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# **Database Management System (IT615)**

## **Project Final Report for Sustainable Agriculture Resource Management**

**Group Number: 02**  
**Aarushi Goel (202412002)**  
**Jayesh Chauhan (202412012)**

**Dhirubhai Ambani  
Institute of Information & Communication Technology  
(DA-IICT)**

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## Chapter 1: Software Requirements Specification (SRS)

### 1. Problem Description

The primary aim of this study is to analyse and assess the current level of farmers' knowledge regarding **Sustainable Agriculture Resource Management** and its various aspects. The study seeks to evaluate farmers' understanding of sustainable farming practices, including resource conservation, soil health, water management, and eco-friendly crop cultivation techniques. Additionally, the study aims to explore how these sustainable agricultural activities are being applied on farms and to identify the challenges and opportunities farmers face in adopting them.

- Detailed explanation of the case study:
  - **Historical Context:**
    - In ancient India, farming was characterized by sustainable practices such as crop rotation, organic fertilizers, and efficient irrigation systems.
    - Agricultural activities were deeply connected to community traditions and rituals, contributing to stable food supplies and resilient economies.
  - **Modern Challenges:**
    - Despite technological advancements in mechanized equipment, genetically modified crops, and irrigation techniques, modern
      - Indian agriculture faces significant difficulties:  
Environmental Degradation: Excessive use of chemical fertilizers and pesticides is leading to soil depletion and contamination.
      - Water Scarcity:  
Advanced irrigation systems have not fully solved the problem of water overuse, especially in water-stressed regions.
      - Soil Health Decline:  
Intensive farming practices have degraded soil quality, reducing fertility and making it harder to maintain high yields.
      - Financial Instability:  
Small-scale farmers, who form a large portion of the agricultural community, often face limited access to resources, leading to economic struggles and debt.

Ranking number	Specification	Farm size, ha		Farmers age, yr		Education	
		13–45	46–150	20–45	46–67	basic	basic plus
1	soil survey	19	9	12	16	12	16
2	fertilization plan (balance)	6	10	11	5	2	14
3	identifying hotspots for leaching (i.e. farm-walk)	7	7	8	6	3	11
4	farm-gate nutrient balance (FGB)	1	5	3	3	1	5

### Farmer's experiences regarding the use of sustainable nutrient management tools

Source:

[https://www.researchgate.net/publication/324178764\\_Sustainable\\_agriculture\\_The\\_study\\_on\\_farmers'\\_perception\\_and\\_practices\\_regarding\\_nutrient\\_management\\_and\\_limiting\\_losses](https://www.researchgate.net/publication/324178764_Sustainable_agriculture_The_study_on_farmers'_perception_and_practices_regarding_nutrient_management_and_limiting_losses)

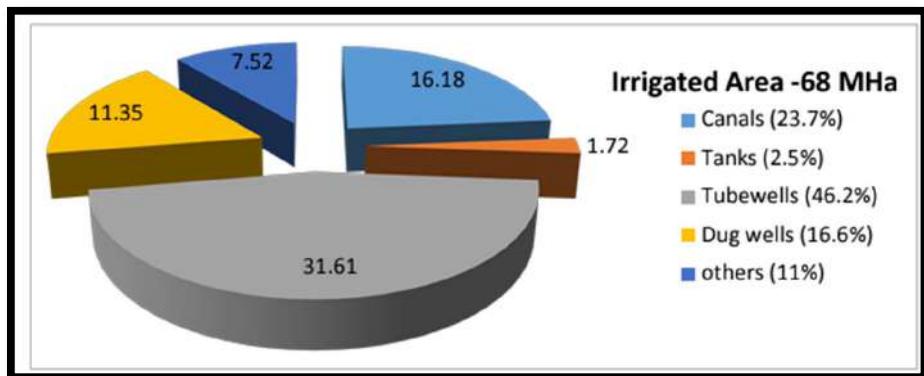
- The table presents a comparison of agricultural practices among farmers, focusing on factors like farm size, farmers' age, and education level. Four specific agricultural activities are ranked: soil surveys, fertilization plans (balance), identifying hotspots for leaching through farm-walks, and farm-gate nutrient balance (FGB).
- Farmers are divided by two ranges of farm size: 13–45 hectares and 46–150 hectares. The data shows that a higher number of farmers with larger farms (46–150 ha) engage in soil surveys (9 farmers) and fertilization plans (10 farmers), compared to smaller farms (13–45 ha) where 19 farmers conduct soil surveys and 6 engage in fertilization planning.
- Age is another key factor, with farmers split into two age groups: 20–45 years and 46–67 years. The table shows that older farmers (46–67 years) tend to be more involved in soil surveys (16 farmers) compared to their younger counterparts (12 farmers). However, younger farmers (20–45 years) show higher participation in fertilization plans (11 farmers) than the older group (5 farmers).
- Finally, the education levels of the farmers are categorized as "basic" and "basic plus" (likely indicating additional or higher education). Farmers with "basic plus" education are more engaged in practices like fertilization planning (14 farmers) and soil surveys (16 farmers) compared to those with only basic education (2 farmers for fertilization plans and 12 for soil surveys).
- In summary, the data suggests that larger farms, older farmers, and those with higher education are more likely to adopt critical agricultural practices like soil surveys and fertilization plans, indicating that these factors might influence the implementation of advanced farming techniques.

- **Key Problems:**

- **Lack of Sustainable Practices:**

The shift away from traditional methods has led to unsustainable farming practices, impacting long-term productivity.

- **Resource Management Issues:**  
Farmers lack tools to efficiently track and manage critical resources such as soil health, water usage, and weather patterns.
- **Balancing Productivity and Conservation:**  
While technology has increased yields, it has also intensified the challenge of balancing high productivity with sustainability.
- **Inadequate Access to Real-time Data:**  
Farmers often do not have access to crucial real-time information, such as weather forecasts or crop growth metrics, which could help optimize their decisions.
- **Knowledge Gaps:**  
Many farmers have limited access to training and information about modern sustainable practices, resulting in a reliance on outdated methods.
- **Impact of Climate Change:**  
Unpredictable weather patterns, such as droughts or floods, severely disrupt farming cycles and strain water resources. Farmers face difficulties in adapting their practices without real-time data or technologies to manage the effects
- **Water Mismanagement:**  
The mismanagement of irrigation systems, compounded by water scarcity, leads to inefficient water use and stress on water resources, particularly in drought-prone areas. Traditional irrigation practices are often not optimized for modern water conservation needs.
- **Technological Access:**  
The lack of precision farming tools, such as sensors for soil monitoring or automated irrigation systems, makes it difficult for farmers to adopt efficient resource management strategies.



**Extent and sources of irrigation in Agriculture**

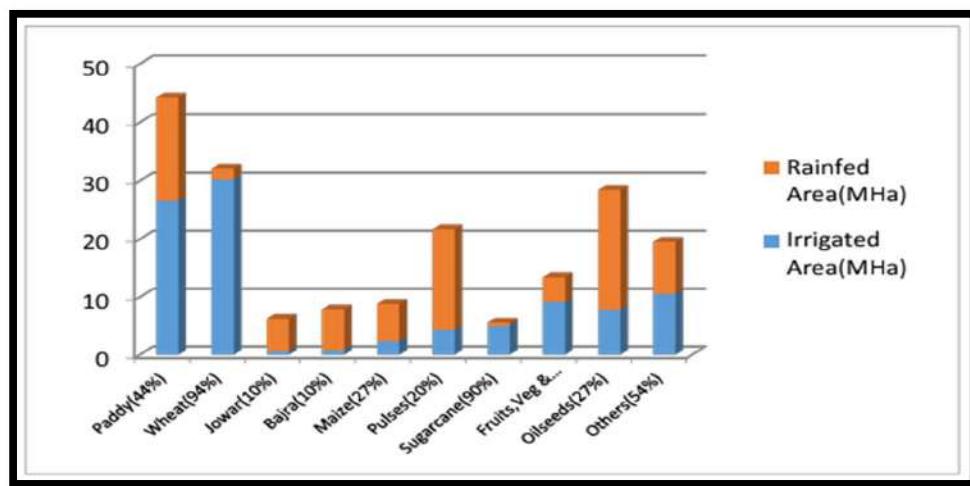
**Source:**

<https://agriwelfare.gov.in/Documents/DFI%20Volume%207.pdf>

- The pie chart illustrates the distribution of irrigated areas across different water sources in a total of 68 million hectares (MHa). Most of the irrigation comes from tubewells, which account for 46.2% of the irrigated area, indicating a heavy reliance on groundwater. Canals are the

second most significant source, contributing to 23.7% of the irrigated land, followed by dug wells with 16.6%.

- Tanks and other sources make up smaller proportions, at 2.5% and 11%, respectively. This highlights that while tubewells dominate irrigation, there is also a need to diversify and improve water management strategies, especially in light of water scarcity issues in many regions. The over-reliance on groundwater for irrigation through tubewells may also raise concerns about groundwater depletion in the long term.
- Tubewells account for 46.2% of the total irrigated area, highlighting a strong reliance on groundwater as the primary irrigation source. This dependence raises concerns about the long-term sustainability of groundwater reserves, particularly in regions facing water scarcity.

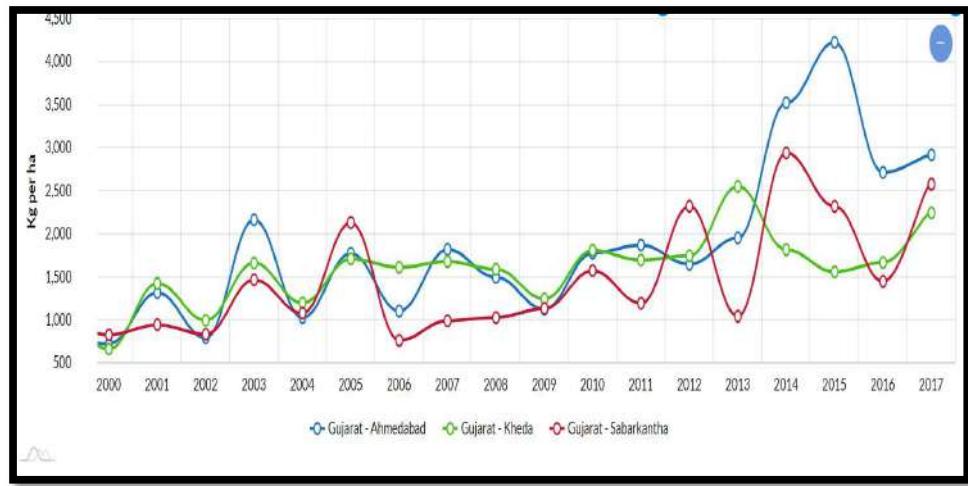


**Crop-wise ratio of rainfed and irrigated area**

**Source:**

<https://agriwelfare.gov.in/Documents/DFI%20Volume%207.pdf>

- It shows issue of water dependency in agriculture is a critical challenge that significantly impacts Sustainable Agriculture Resource Management (SARM). The reliance on irrigation for high-demand crops such as wheat, paddy, and sugarcane places immense pressure on water resources, leading to potential over-extraction from rivers, aquifers, and lakes. This over-reliance not only jeopardizes the sustainability of these water sources but also raises concerns about long-term soil health, crop productivity, and ecological balance.
- Conversely, the continued dependence on rainfed conditions for crops like jowar and bajra emphasizes the vulnerability of agricultural systems to climate variability and unpredictable weather patterns. In regions where rainfall is erratic, farmers face heightened risks of crop failure and reduced yields, exacerbating food insecurity and economic instability. This scenario highlights the necessity for effective water management strategies that integrate both irrigation and rainfed agriculture.



Source:

<http://data.icrisat.org/dld/>

- The graph illustrates the trend in crop production, likely cotton, across three districts in Gujarat from 2000 to 2017, measured in kilograms per hectare (Kg/ha).
- **District-wise Analysis:**
  - Ahmedabad experienced fluctuations with peaks in 2002, 2004, 2013, and 2015, resulting in a slight overall increase.
  - Kheda showed a similar pattern with peaks in 2003, 2013, and 2017, though the upward trend is less pronounced than Ahmedabad.
  - Sabarkantha saw a significant rise from 2000 to 2013, peaking in 2013 but declining sharply thereafter, indicating concerns about the sustainability of its growth.
- **Comparison:** Sabarkantha recorded the most dramatic increase, followed by Ahmedabad and Kheda, but its recent decline raises questions about future productivity.
- **Possible Factors Influencing Trends:** These include weather patterns, agricultural practices, government policies, and market dynamics.

## 2. Requirement Collection

- Background Reading
- **Description of each reading done**
  - **Doubling Farmers' Income: Report by the Committee on Doubling Farmers' Income.**  
**Government of India, 2018.**  
<https://agriwelfare.gov.in/Documents/DFI%20Volume%207.pdf>
  - The "Doubling Farmers' Income" report stresses a holistic strategy to boost farmers' incomes by enhancing agricultural productivity, diversifying income streams, and improving value addition. It addresses environmental degradation, water scarcity, and soil health, emphasizing the need for infrastructure, market access, and supportive policies.
  - The report calls for investments in research, capacity building, and sustainable farming practices. It outlines that to achieve the goal, a comprehensive approach integrating modern technology, education, and better resource management is crucial for long-term agricultural sustainability and economic upliftment.

- **Sustainable Agriculture in India: Socioeconomic and Environmental Issues.**  
**Journal of Rural Development, Vol. 37, No. 1, 2018**  
<https://www.ceew.in/sites/default/files/CEEW-FOLU-Sustainable-Agriculture-in-India-2021-20Apr21.pdf>
  - The report "Sustainable Agriculture in India: Socioeconomic and Environmental Issues" discusses the challenges and opportunities in promoting sustainable agricultural practices. It highlights the environmental impacts of traditional farming, such as soil degradation and water scarcity, while exploring the socioeconomic factors that influence farmers' decisions. The report emphasizes the need for policies that support eco-friendly methods, technological innovations, and economic incentives to encourage sustainability in agriculture. It also stresses the importance of balancing productivity with environmental conservation.
- **Sustainable agriculture: The study on farmers' perception and practices regarding nutrient management and limiting losses**  
[https://www.researchgate.net/publication/324178764\\_Sustainable\\_agriculture\\_The\\_study\\_on\\_farmers'\\_perception\\_and\\_practices\\_regarding\\_nutrient\\_management\\_and\\_limiting\\_losses](https://www.researchgate.net/publication/324178764_Sustainable_agriculture_The_study_on_farmers'_perception_and_practices_regarding_nutrient_management_and_limiting_losses)
  - The study on "Sustainable Agriculture: Farmers' Perception and Practices Regarding Nutrient Management and Limiting Losses" investigates farmers' awareness and adoption of sustainable nutrient management practices. It explores how farmers manage soil health, reduce nutrient losses, and implement eco-friendly farming techniques. The research highlights the challenges faced by farmers in adopting sustainable practices and provides insights into their perceptions of nutrient use, crop productivity, and environmental impact.
- **Sustainable Agriculture Research & Education Program**  
<https://sarep.ucdavis.edu/sustainable-ag>
  - The Sustainable Agriculture Research & Education Program at UC Davis helps farmers improve their agricultural practices while protecting the environment. It focuses on sustainable farming techniques such as improving soil health, efficient water use, and pest management. The program provides research-based resources and educational outreach to support farmers in reducing their environmental impact, increasing productivity, and achieving long-term farm sustainability.
- **Sustainable Agriculture Practices & Their Management**  
<https://eos.com/blog/sustainable-agriculture/>
  - The article provides an overview of eco-friendly farming methods designed to balance agricultural productivity with environmental conservation. It discusses practices like crop rotation, cover cropping, agroforestry, and reduced tillage, all aimed at improving soil health, conserving water, and reducing chemical use. The article highlights how these methods promote long-term sustainability, increase biodiversity, and help farmers adapt to climate change.
- **Sustainable agriculture**  
<https://krishi.icar.gov.in/jspui/bitstream/123456789/2852/1/Sustainable%20Agriculture%20-%20ISA%20article%20-%20DM%20Hegde%20&%20SNS%20Babu%20July%2030%202016.pdf>
  - The article on "Sustainable Agriculture" explores practices that aim to balance productivity with environmental conservation. It highlights techniques like organic farming, soil management, crop diversification, and water-efficient irrigation methods. The focus is on

reducing the use of chemical inputs, improving soil health, and addressing the socioeconomic challenges faced by farmers. The article also emphasizes the importance of research and government policies in promoting sustainable agricultural systems.

- **What is Sustainable Agriculture? - TNAU Agritech Portal**

<https://agritech.tnau.ac.in/pdf/sustainableagriculture.pdf>

- The document "What is Sustainable Agriculture?" from the TNAU Agritech Portal defines sustainable agriculture as farming that meets current food needs while conserving natural resources for future generations. It focuses on practices like organic farming, crop rotation, integrated pest management, and water conservation. The goal is to enhance soil health, biodiversity, and farm productivity while minimizing environmental impact. It also highlights the role of education, technology, and policy in promoting sustainable agriculture.
- Summary of domain research, including resources (books, journals, documents, websites).

- **Lack of Sustainable Practices**

1. Sustainable Practices Database:

- The system shall include a comprehensive repository of sustainable farming practices, including details on their implementation, benefits, and case studies.
- The database shall provide guidelines on transitioning from traditional methods to sustainable practices, highlighting their long-term benefits.

2. Best Practices Repository:

- The database shall catalog both traditional and innovative farming techniques, with documentation on best practices for improving sustainability.
- The system shall offer resources and educational materials to facilitate the adoption of sustainable methods.

- **Resource Management Issues**

1. Resource Tracking Database:

- The system shall integrate with sensors and IoT devices to track and record data on soil health, water usage, and other critical resources.
- The database shall provide historical and real-time data on resource status, allowing farmers to monitor and manage resources effectively.

2. Soil and Water Health Records:

- The database shall maintain detailed records of soil and water quality, including historical data and trends.
- The system shall support data analysis and reporting to aid in resource management and early detection of potential issues.

- **Balancing Productivity and Conservation**

1. Productivity vs. Conservation Data:

- The system shall include a model that analyzes the impact of various practices on productivity and conservation.
  - The database shall provide insights and recommendations on achieving an optimal balance between high yields and environmental sustainability.
2. Decision Support System:
- The system shall incorporate a decision support tool that offers recommendations based on historical data and current conditions.
  - The tool shall assist farmers in making informed decisions that consider both productivity and conservation goals.

- **Inadequate Access to Real-time Data**

1. Real-time Data Integration:
    - The system shall integrate real-time data sources, including weather forecasts, crop growth metrics, and other relevant information.
    - The database shall provide a centralized platform for accessing and managing this data.
  2. Dashboard and Alerts:
    - The system shall feature a user-friendly dashboard that presents real-time data in an accessible format.
    - The database shall include alert functionalities to notify users of critical conditions, such as adverse weather or potential crop diseases, enabling prompt responses.
- Interviews
- **Purpose of Interview:**

The purpose of the interview is to understand the challenges farmers face in sustainable agricultural practices, gather insights on modern farming techniques, and evaluate potential solutions for improving resource management. Additionally, it aims to share practical experiences and explore how research can support farmers in adopting sustainable methods.
  - **Agenda**
    1. Farmer's Views on Sustainability:

Gather insights on how farmers perceive sustainability, including their beliefs about its importance and impact on long-term agricultural practices.
    2. Current Resource Management Techniques:

Assess the methods farmers currently use for managing water, soil health, and crop rotation, identifying best practices and areas for improvement.
    3. Challenges in Adopting Sustainable Methods:

Identify the barriers farmers face in implementing sustainable practices, such as financial constraints, lack of training, and limited access to technology.
    4. Technology Integration in Farming:

Explore the extent to which farmers are incorporating modern technologies into their operations, including tools for precision farming, data analytics, and resource monitoring.

- **Questionnaire for Farmers:**

1. How do you define sustainable agriculture?
2. Are you aware of new agricultural technologies? If yes, how did you learn about them? If no, do you want to learn?
3. Do you wish to pass down your agricultural knowledge to your children? Are they interested in continuing farming?
4. Are you familiar with crop rotation? If yes, how did you learn about it, and where are you practicing it?
5. How do you currently manage resources like water, land, and technology?
6. Would you benefit from more awareness about crop diseases and guidance on using technology for weather forecasting?

- **Questionnaire for Researcher:**

1. How do you define sustainable agriculture?
2. Are there any emerging innovations with the potential to revolutionize sustainable agriculture management?
3. What are the pros and cons of genetically modified crops in the context of sustainable agriculture?

- **Summary of Key Points:**

1. Farmers need increased awareness and training on sustainable practices and new agricultural technologies.
  - A table can store details on sustainable practices, including session records and completion status for each farmer.
2. Farmers seek better access to tools like weather forecasting, soil health monitoring, and disease management systems.
  - Integrate real-time data for weather forecasting, soil health reports, and disease tracking into a table. These records would be regularly updated for decision-making.
3. Programs to encourage youth to continue farming and adopt sustainable methods.
  - A table can track involvement in training programs and farming initiatives, monitoring their progress and interest in sustainable methods.
4. There is a need for improved water conservation techniques and irrigation systems.
  - A table can store irrigation schedules, water usage statistics, and recommended conservation techniques based on local conditions.

5. Education on crop rotation and diversified farming for better productivity and sustainability.
  - A table would record crops, timing, and fields used, optimizing yield and sustainability. It would link with the table for more effective recommendations.
6. Cost-effective technological solutions for small-scale farmers to integrate into their practices.
  - A table can track which farmers have integrated affordable technologies, like smart irrigation systems or mobile apps, and how effectively they are using them.
7. Researchers stress the need for more clarity and education on sustainable farming, focusing on long-term resource conservation and ecosystem health.
  - A table could monitor usage of natural resources, tracking trends in water, soil, and crop data over time, ensuring long-term sustainability.
8. Both farmers and researchers agree on the need for new technologies like precision farming and smart irrigation systems to enhance sustainability and productivity.
  - A table would store sensor data and provide detailed recommendations for optimal water, fertilizer, and pesticide usage based on real-time metrics.
9. While crops can boost yields, careful management is required to avoid environmental risks.
  - A table could track the use and performance of genetically modified seeds, recording pros/cons like yield improvement versus any environmental concerns.
10. Improved techniques for soil and water conservation are needed for more efficient farming.
  - Separate tables for Soil and Water would log practices adopted by each farmer, linking them to the outcomes in the Farmers table for evaluation.
11. Follow up
  - Prepare a detailed survey to assess farmers' awareness and needs regarding sustainable agriculture resource management, focusing on their current practices, technology usage, and training requirements.
12. next step
  - Prepare a detailed survey to collect data from the people about the awareness and need for sustainable agriculture resource management.
    - Questionnaires/Surveys
      - Summary of questions asked, common issues identified, and responses received.
      - Evaluates farmers' understanding of sustainable agriculture and hybrid crop benefits and risks.
      - Investigates the extent to which farmers utilize modern technologies, such as weather forecasting and soil monitoring.
      - Identifies where farmers primarily gain knowledge about new farming techniques (e.g., online platforms, government programs, or farmer communities).
      - Assesses adoption levels of sustainable methods, including crop rotation and modern or traditional water management practices.

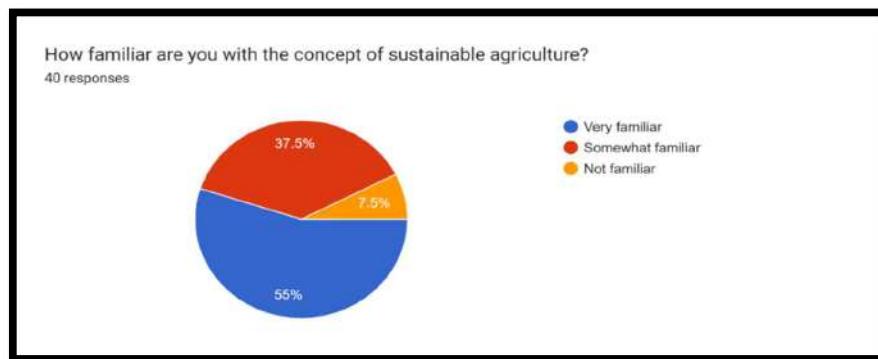
- Gauges perceptions of how prepared young farmers are to continue sustainable farming practices.
- Identifies primary obstacles to adopting sustainable practices (e.g., lack of awareness, resources, or high technology costs) and the support (e.g., training, technology access, financial aid) that could facilitate adoption.
- Explores additional difficulties farmers face with essential resources like water, soil, and crop health.
- Collects farmers' insights on what measures could effectively promote sustainable agriculture in their regions.

- **Common Issues Identified**

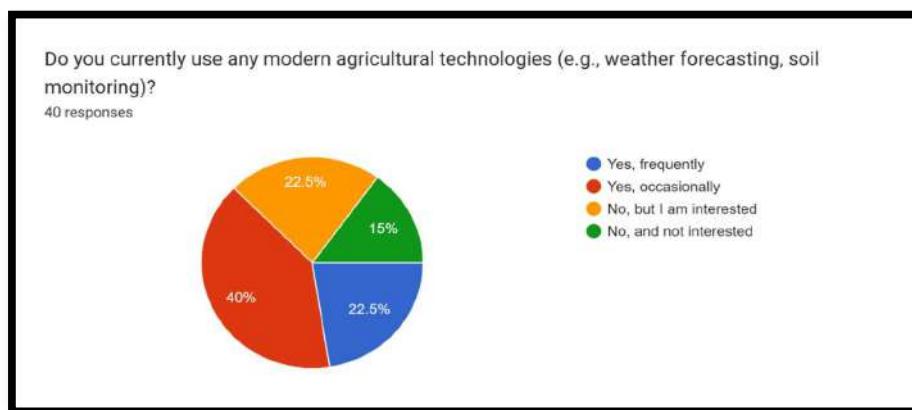
1. Increased awareness and education on sustainable practices:
  - Create a centralized database system that stores and organizes educational resources, including articles, tutorials, case studies, and best practices related to sustainable agriculture and hybrid crops. Users can access and search this repository to enhance their knowledge.
2. Enhanced access to modern agricultural technologies:
  - Develop a database to catalog available modern technologies, such as irrigation systems, soil sensors, and weather forecasting tools. This database can include details on technology providers, costs, benefits, and user reviews to help farmers make informed decisions.
3. Support for technology adoption and addressing the high cost of technology:
  - Implement a database system to manage and track financial aid, grants, and subsidies available for sustainable agriculture technologies. The system can also include information on resource availability and application processes for financial assistance.
4. Training programs and support for young farmers:
  - Create a database to manage training programs, workshops, and support initiatives. This system can track participant registration, program content, and feedback. It can also help in scheduling and promoting these programs to ensure wide participation.
5. Encouragement of crop rotation and modern water management practices:
  - Develop a database to track and analyze crop rotation practices and water management strategies. This system can provide recommendations based on historical data, user inputs, and best practices, helping farmers optimize their crop rotation and water usage.
6. Water Resource Management:
  - Create a database to manage information on water resource management practices, including modern irrigation systems, traditional methods, and reliance on rainfall. This can help identify trends and provide recommendations for improving water resource management
7. Preparation of Young Farmers:

- Develop a database to assess and track the preparedness of young farmers for sustainable practices. This system can help in identifying areas where additional support or training is needed.

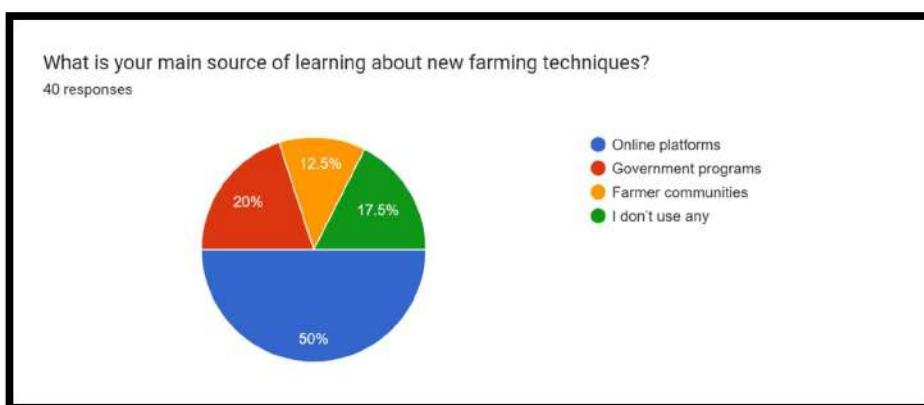
- **Responses Received:**



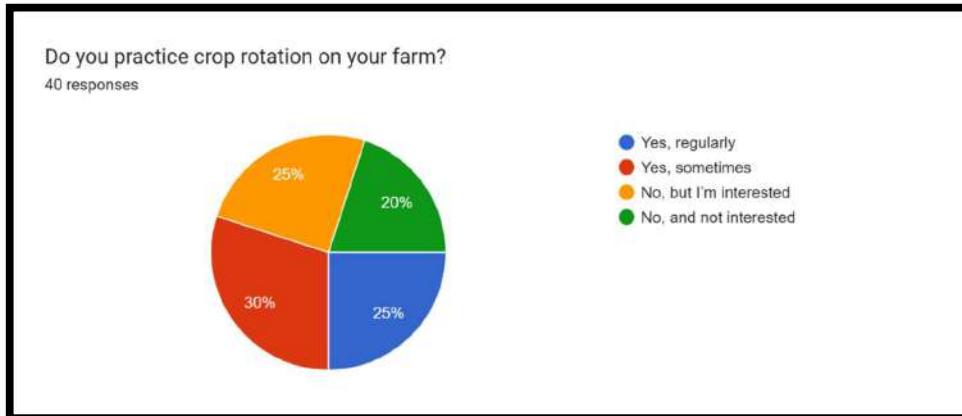
- Most respondents are very familiar with sustainable agriculture, which indicates a good foundational knowledge among the surveyed group.



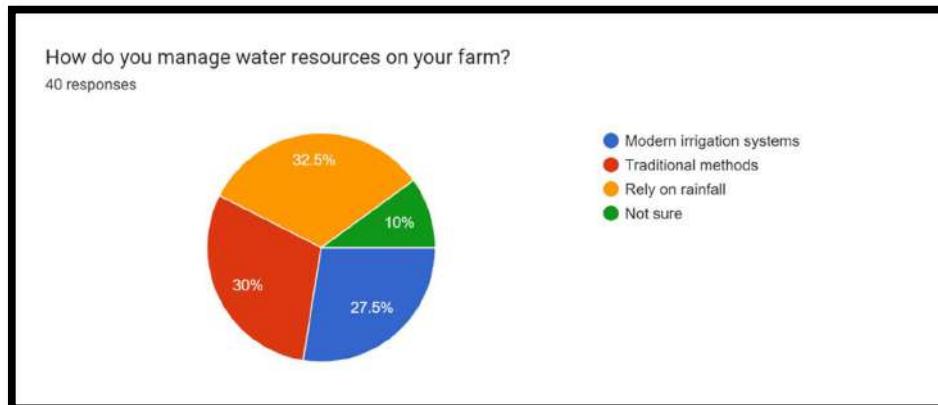
- A significant portion of respondents uses modern technologies occasionally and expresses interest in adopting them more. This suggests a gap in frequent usage but an openness to technology.



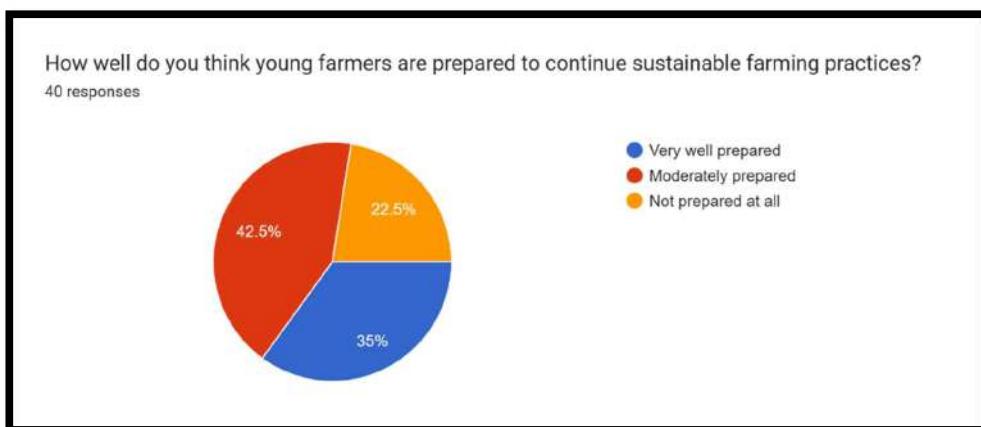
- Online platforms are the primary source of learning for most respondents, indicating that digital resources are key to their knowledge acquisition.



- While a quarter of respondents practice crop rotation regularly, there's notable interest from those who do not yet practice it, suggesting a potential area for education and adoption.



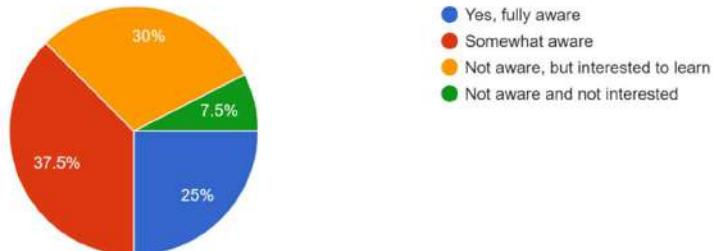
- Many respondents rely on rainfall or traditional methods, indicating a need for more modern water management solutions.



- There is a mixed view on the preparedness of young farmers, with a moderate level of confidence and some concerns about their readiness.

Are you familiar with hybrid crops and their potential benefits/risks?

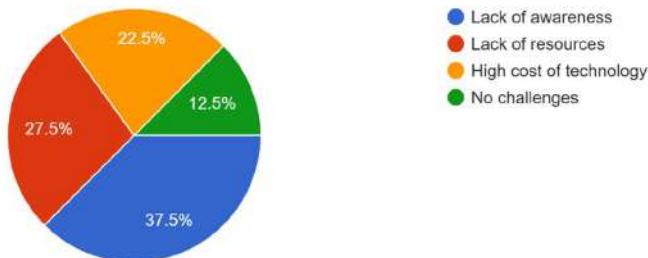
40 responses



- There is a strong interest in learning about hybrid crops, suggesting that education on this topic could be valuable.

What is your biggest challenge in adopting sustainable practices?

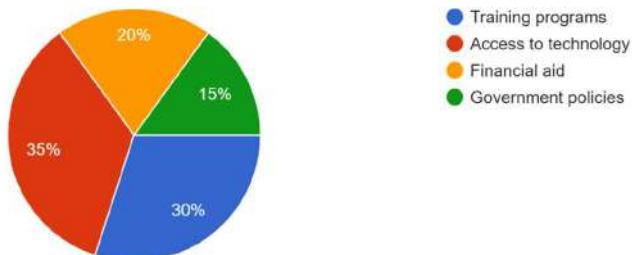
40 responses



- The major challenges are lack of awareness and resources, with a notable concern about the cost of technology.

What type of support would help you most in adopting sustainable methods?

40 responses



- Access to technology and training programs are seen as the most critical supports needed, with financial aid and government policies also being relevant.

- Observation
  - Real-world observations of processes in the domain.
- 1. Strong Foundational Knowledge:
  - Most respondents have a solid understanding of sustainable agriculture.
- 2. Interest in Technology Adoption:
  - Many respondents occasionally use modern technologies and express interest in adopting them more frequently.
- 3. Dependence on Digital Resources:
  - Online platforms are the primary source of learning for most respondents, highlighting the need for accessible educational resources.
- 4. Crop Rotation and Water Management Practices:
  - About 25% regularly practice crop rotation, with others showing interest in adopting it.
  - Many respondents rely on rainfall or traditional water management methods, indicating a need for modern solutions.
- 5. Preparedness of Young Farmers:
  - Mixed opinions on the readiness of young farmers for sustainable practices suggest a need for targeted training and support.
- 6. Challenges in Technology Access and Financial Constraints:
  - Key challenges include lack of awareness and high costs of modern agricultural technologies.
  - Respondents see financial aid, subsidies, and better resource access as critical for overcoming these barriers.
- 7. Interest in Hybrid Crops:
  - Strong interest in learning about hybrid crops indicates potential for valuable educational efforts in this area.
- 8. Importance of Training and Financial Aid:
  - Increased access to training programs and financial aid is essential for promoting the adoption of sustainable practices.
  - In conclusion, while young farmers are knowledgeable about sustainable agriculture, they encounter significant barriers related to technology access, financial constraints, and a lack of training opportunities. To empower this demographic, it is essential to enhance access to affordable sustainable technologies, increase funding for training programs and low-interest loans, and foster mentorship connections with experienced farmers. By addressing these challenges, we can support young farmers in successfully adopting sustainable practices, ultimately leading to a more resilient and sustainable agricultural community.

### 3. Fact-Finding Chart

- Table/chart of findings from the above requirement collection techniques.

Objective	Technique	Subject(s)	Time Commitment
Analyse farmers' knowledge of sustainable agriculture	Background Reading	Farmers, Researchers, Students, Agricultural	1 hour 30 minutes
Assess current resource management practices	Interview	Aarushi Goel (Role play as Interviewer)  Jayesh Chauhan (Role play as Farmer/Researcher)	45 minutes (10/09/2024)
Evaluate integration of modern technologies	Document Sampling	Researchers, Students	1.5 hours
Explore impact of new technologies on sustainability	Interview and Observation	Farmers' and researchers' perspectives on new technologies	1.5 hours
Prepare for follow-up and detailed survey	Google form	Farmers, Researchers, Students, Agricultural	2 hours

#### **4. Requirements List**

- Consolidated list of overall requirements identified for the domain.
- Farmers need increased awareness and training on sustainable practices and new agricultural technologies.
- Farmers seek better access to tools like weather forecasting, soil health monitoring, and disease management systems.
- Programs to encourage youth to continue farming and adopt sustainable methods.
- There is a need for improved water conservation techniques and irrigation systems.
- Education on crop rotation and diversified farming for better productivity and sustainability.
- Cost-effective technological solutions for small-scale farmers to integrate into their practices.
- Researchers stress the need for more clarity and education on sustainable farming, focusing on long-term resource conservation and ecosystem health.
- Both farmers and researchers agree on the need for new technologies like precision farming and smart irrigation systems to enhance sustainability and productivity.
- While crops can boost yields, careful management is required to avoid environmental risks.
- Improved techniques for soil and water conservation are needed for more efficient farming.
- Increased awareness and education on sustainable practices.
- Enhanced access to modern agricultural technologies.
- Support for technology adoption and addressing the high cost of technology:
- Training programs and support for young farmers:
- Encouragement of crop rotation and modern water management practices
- While young farmers are knowledgeable about sustainable agriculture, they encounter significant barriers related to technology access, financial constraints, and a lack of training opportunities. To empower this demographic, it is essential to enhance access to affordable sustainable technologies, increase funding for training programs and low-interest loans, and foster mentorship connections with experienced farmers.
- Queries could identify geographic areas with high young farmer populations but low access to funding and training programs. Relationships between young farmers and their mentors

could be tracked to measure the impact of mentorship on adoption of sustainable practices. By using data to understand the barriers and target support, we can create more opportunities for young farmers to thrive in sustainable agriculture

- The shift away from traditional methods has led to unsustainable farming practices, impacting long-term productivity.
- Farmers lack tools to efficiently track and manage critical resources such as soil health, water usage, and weather patterns.
- While technology has increased yields, it has also intensified the challenge of balancing high productivity with sustainability.
- Farmers often do not have access to crucial real-time information, such as weather forecasts or crop growth metrics, which could help optimize their decisions.
- Many farmers have limited access to training and information about modern sustainable practices, resulting in a reliance on outdated methods.
- Unpredictable weather patterns, such as droughts or floods, severely disrupt farming cycles and strain water resources.
- Farmers face difficulties in adapting their practices without real time data or technologies to manage the effects
- The mismanagement of irrigation systems, compounded by water scarcity, leads to inefficient water use and stress on water resources, particularly in drought-prone areas.
- Traditional irrigation practices are often not optimized for modern water conservation needs.
- The lack of precision farming tools, such as sensors for soil monitoring or automated irrigation systems, makes it difficult for farmers to adopt efficient resource management strategies.
- Farmers relying on a single crop year after year are depleting the soil and reducing biodiversity, leading to long-term negative impacts on ecosystem health.
- Many farmers lack access to subsidies or financial aid for implementing sustainable practices, creating a barrier to adopting new technologies.
- The high upfront cost of tools such as soil sensors, automated irrigation, and precision farming equipment discourages many small-scale farmers.
- Farmers often lack access to research findings or innovative agricultural techniques developed by academic institutions and agricultural organizations.

- There is a slow uptake of research-based farming practices due to the difficulty of communicating these findings effectively to farmers.
- Farmers are not fully equipped with strategies to deal with climate-related challenges such as droughts, floods, and erratic rainfall patterns.
- Local farmers' networks could be stronger, allowing more peer-to-peer learning and dissemination of sustainable practices.
- Policy support for sustainable agriculture, such as incentives for organic farming or penalties for unsustainable practices, is often weak or insufficient.
- Farmers' reliance on chemical fertilizers and pesticides is leading to long-term soil degradation and water contamination.
- Unstable market prices prevent farmers from making long-term investments in sustainable practices.
- Farmers find it difficult to access premium markets for sustainably grown crops due to a lack of certification or infrastructure.
- Many farmers lack exposure to international examples of successful sustainable agriculture, making it hard for them to implement globally tested solutions.

## 5. User Privileges

- Description of different user roles and privileges within the system.
1. Farmer Access
    - Data Access:
      - View information on crops, sustainable practices, soil, weather updates, and irrigation techniques.
    - Personalized Recommendations:
      - Receive tailored crop rotation and hybrid crop suggestions. Information on Crop diseases and crop rotation.
    - Community Interaction:
      - Participate in forums and connect with mentors, join training programs.
    - Monitoring and Alerts:
      - Get notifications for critical weather events and planting reminders.
    - Educational Resources:
      - Access training programs, tutorials, and webinars focused on sustainable practices.
    - Record Keeping:
      - Log farming activities, monitor soil health, and manage crop disease information.
  2. Researcher Access
    - Focused Data Access:
      - Analyze soil data, crop disease information, and technologies used by farmers.

- Data Contribution:
  - Share research findings and insights on sustainable practices.
- Resource Sharing:
  - Upload educational materials, research reports, and best practices for farmer training.

### 3. Admin Access

- User Management:
  - Manage user accounts and set access privileges.
- Content Management:
  - Curate training content and ensure the accuracy of shared information.
- Data Oversight:
  - Monitor data submissions from farmers and researchers for reliability.

## Chapter 2: Database Design

### 1. Noun Analysis

- Identification of entities and relationships for ER Diagram design.

- **Noun & Verb Analysis**

Nouns	Verbs
Student	Needs
Farmer	Boost
Young Farmers	Provides
Researcher	Tracks
Educational resources	Monitors
Technology	Conserves
Crops	Stress
Crop diseases	Encourage
Weather Forecasting	Support
Soil	Adopt
Policy	Provide
Training programs	Encourages
Machinery	Affects
Fertilizer	Seeks
Crop rotation	Improve
Irrigation	Tracks
Water manages	Monitors
Disease Manages	Health
Subsidies	Optimizes
Sustainable Practices	Detects
Farming Tools	Study
Markets	Adopt
Climate	Provide
Financial	Encourage
Farmers	Detect

Awareness	Address
Training	Access
Technologies	Challenges
Tools	Supports
Weather	Adopts
Forecasting	Rotate
Ecosystem	Informs
Health	Depletes
Monitoring	Manages
Disease	Analysis
Management	Learn
Programs	Educate
Youth	Implement
Practices	Optimize
Water	Review
Conservation	Manage
Techniques	Assists
Irrigation	Grows
Education	Diversify
Crop	Enhances
Rotation	Affects
Sustainability	Improves
Solutions	Mismanages
Research	Monitor
Resource	Participate
Productivity	Enhance
Equipment	Certify
Sensors	Impacts
Data	Addresses
Challenges	Grow
Funding	Provides
Support	Face
Networks	Fund
Policies	Conserve
Chemicals	Track
Fertilizers	Disrupts
Pests	Conserves
Certification	Yield
Investment	Helps
Biodiversity	Implements
Information	Support
Patterns	Help
Aid	Educes
Drought	Impact
Flood	Reduce
	Degrades
	Seek

	Assist
	Affect
	Lacks
	Search
	Prepare
	Train
	Faces
	Deplete
	Accesses
	Recommend
	Analysis
	Relies
	Reviews
	Uses

- Candidate entity and attributes set

Candidate Entity	Candidate Attributes
Student	Student ID, Name, Major, Year of Study, Contact Info
Farmer	Farmer ID, Name, Farm Size, Crop Types, Contact Info
Researcher	Researcher ID, Name, Area of Research, Publications, Contact Info
Educational Resource	Resource ID, Title, Type (e.g., article, video), Subject, URL
Technology	Technology ID, Name, Type, Purpose, Manufacturer
Crop	Crop ID, Name, Type, Growth Period, Yield
Crop Disease	Disease ID, Name, Affected Crops, Symptoms, Treatment
Weather	Weather ID, Date, Temperature, Precipitation, Conditions
Soil	Soil ID, Type, Nutrient Content, pH Level, Moisture Level
Policy	Policy ID, Name, Type, Scope, Implementation Date
Fertilizer	Fertilizer ID, Name, Type, Nutrient Content, Application Method
Irrigation	Irrigation ID, Type, Coverage Area, Efficiency, Installation Date
Crop Rotation	Rotation ID, Crop Sequence, Duration, Benefits
Farming Tool	Tool ID, Name, Type, Usage, Manufacturer
Training Program	Program ID, Title, Duration, Target Audience, Content
Sustainable Practice	Practice ID, Name, Description, Benefits, Implementation Level
Investment	Investment ID, Amount, Purpose, Beneficiary, Date
Aid	Aid ID, Type, Amount, Beneficiary, Date
Drought	Drought ID, Region, Duration, Severity, Impact
Flood	Flood ID, Region, Duration, Severity, Impact

- Candidate Relationship set

Relationship	Entities Involved	Description
Enrols	Student, Training Program	A student enrols in a training program.
Owns	Farmer, Crop	A farmer grows a specific crop.
Conducts	Researcher, Crop Disease	A researcher studies crop disease.
Uses	Farmer, Technology	A farmer utilizes technology for farming.

Affects	Weather, Crop	Weather conditions impact crop growth.
Composed Of	Crop Rotation, Crop	A crop rotation consists of multiple crops.
Implements	Farmer, Sustainable Practice	A farmer implements sustainable practices in farming.
Requires	Crop, Fertilizer	A specific crop requires certain fertilizers.
Affects	Crop Disease, Crop	A crop disease affects specific crops.
Involves	Policy, Irrigation	A policy may regulate irrigation practices.
Uses	Farmer, Farming Tool	A farmer uses various farming tools.
Provides	Investment, Farmer	An investment provides funds to a farmer.
Allocates	Aid, Farmer	Aid is allocated to farmers in need.
Occurs In	Drought, Region	A drought occurs in a specific region.
Occurs In	Flood, Region	A flood occurs in a specific region.
Monitors	Researcher, Weather	A researcher monitors weather patterns.

- **Rejected Noun & Verbs list**

Noun	Reason for Rejection
Young Farmers	Too specific; lacks broader context or categories.
Technology	Overly broad; needs specificity related to agriculture.
Machinery	Generic; needs context on types or relevance to farming.
Water manages	Vague; unclear what specific aspect of water management refers to.
Disease Manages	Lacks clarity; needs to specify what aspect of disease management is being discussed.
Subsidies	Broad term; needs context related to agriculture.
Sustainable Practices	Too vague; needs specifics on which practices are sustainable.
Markets	Generic; lacks context on which markets are relevant.
Climate	Too broad; lacks specific relevance to farming practices.
Financial	Generic; needs to specify what financial aspects are relevant.
Farmers	Overly broad; can refer to various types without specificity.

Awareness	Vague; lacks context on what awareness is being referenced.
Training Access	Needs specificity on what type of training is being accessed.
Technologies Challenges	Too vague; needs clarification on which challenges are relevant.
Tools Supports	Generic; lacks specificity on which tools or supports are being referenced.
Weather Adopts	Unclear; needs context on how weather is being adopted or its implications.
Forecasting Rotate	Lacks clarity; needs to specify what is being forecasted or rotated.
Ecosystem Informs	Vague; lacks specificity on how ecosystems inform farming.
Monitoring Manages	Unclear; needs context on what is being monitored and managed.
Disease Analysis	Needs specificity on which diseases or methods of analysis are being referenced.
Management Learn	Vague; lacks clarity on what is being learned in management.
Programs Educate	Generic; needs detail on which programs are being referred to.
Youth Implement	Lacks specificity on what youth are implementing.
Practices Optimize	Too vague; needs context on which practices are being optimized.
Water Review	Generic; lacks context on what is being reviewed regarding water.
Conservation Manage	Vague; unclear what aspect of conservation management is being referred to.
Techniques Assists	Needs specificity on which techniques are being referenced.
Irrigation Grows	Lacks clarity; needs context on how irrigation is growing or its implications.
Education Diversify	Vague; needs specifics on how education is diversifying.
Crop Enhances	Needs context on what crop is being enhanced or how.

Rotation Affects	Unclear; needs detail on what is being rotated and its effects.
Sustainability Improves	Vague; lacks specifics on what sustainability is improving.
Solutions Mismanages	Unclear; needs context on what solutions are mismanaged.
Research Monitor	Lacks specificity; needs context on what is being monitored in research.
Resource Participate	Vague; lacks clarity on what resources are participating in.
Productivity Enhance	Needs context on what productivity is being enhanced and how.
Equipment Certify	Unclear; needs detail on which equipment is being certified.
Sensors Impacts	Vague; lacks specifics on what sensors are being discussed.
Data Addresses	Needs context on what data is being addressed and how.
Challenges Grow	Generic; lacks specificity on which challenges are being referred to.
Provides	Too vague; lacks context on what is being provided.
Support Face	Unclear; needs context on what support is facing which challenges.
Networks Fund	Vague; lacks clarity on what networks and what they are funding.
Policies Conserve	Needs specificity on which policies are being referenced.
Chemicals Track	Unclear; needs detail on what chemicals are being tracked and why.
Fertilizers Disrupts	Vague; lacks clarity on how fertilizers disrupt practices.
Certification Yield	Needs context on what is being certified and how it relates to yield.
Implements	Too vague; lacks clarity on what is being implemented.
Information Support	Generic; lacks specifics on what information is being supported.
Patterns Help	Unclear; needs detail on which patterns are helping and how.

Educes	Vague; lacks specificity on who or what is being educated.
Drought	Needs context on its specific impact on farming practices.
Flood	Lacks specifics on how flooding affects agriculture.

- Candidate Entity set and Candidate Attribute set

Candidate Entity	Candidate Attributes
Student	Student ID, Name, Major, Year of Study, Contact Info
Farmer	Farmer ID, Name, Farm Size, Crop Types, Contact Info
Researcher	Researcher ID, Name, Area of Research, Publications, Contact Info
Educational Resource	Resource ID, Title, Type (e.g., article, video), Subject, URL
Technology	Technology ID, Name, Type, Purpose, Manufacturer
Crop	Crop ID, Name, Type, Growth Period, Yield
Crop Disease	Disease ID, Name, Affected Crops, Symptoms, Treatment
Weather	Weather ID, Date, Temperature, Precipitation, Conditions
Soil	Soil ID, Type, Nutrient Content, pH Level, Moisture Level
Policy	Policy ID, Name, Type, Scope, Implementation Date
Fertilizer	Fertilizer ID, Name, Type, Nutrient Content, Application Method
Irrigation	Irrigation ID, Type, Coverage Area, Efficiency, Installation Date
Crop Rotation	Rotation ID, Crop Sequence, Duration, Benefits
Farming Tool	Tool ID, Name, Type, Usage, Manufacturer
Training Program	Program ID, Title, Duration, Target Audience, Content
Sustainable Practice	Practice ID, Name, Description, Benefits, Implementation Level
Investment	Investment ID, Amount, Purpose, Beneficiary, Date
Aid	Aid ID, Type, Amount, Beneficiary, Date

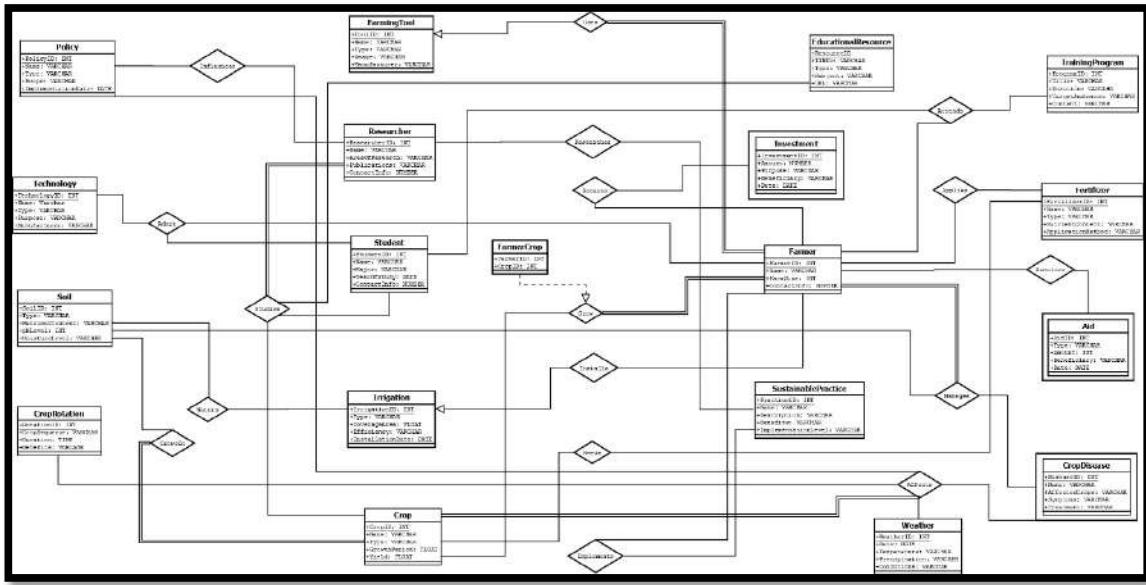
- Candidate Relationship set

Relationship	Entities Involved	Description
Enrols	Student, Training Program	A student enrols in a training program.
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Conducts	Researcher, Crop Disease	A researcher studies crop disease.
Uses	Farmer, Technology	A farmer utilizes technology for farming.
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Composed Of	Crop Rotation, Crop	A crop rotation consists of multiple crops.
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Requires	Crop, Fertilizer	A specific crop requires certain fertilizers.
Affects	Crop Disease, Crop	A crop disease affects specific crops.

Involves	Policy, Irrigation	A policy may regulate irrigation practices.
Uses	Farmer, Farming Tool	A farmer uses various farming tools.
Provides	Investment, Farmer	An investment provides funds to a farmer.
Allocates	Aid, Farmer	Aid is allocated to farmers in need.
Monitors	Researcher, Weather	A researcher monitors weather patterns.

## 2. Schema and ER Diagram Design

1. Farmer(FarmerID, Name, FarmSize, CropTypes, ContactInfo)
2. Visitor(VisitorID, Name, Role, ContactInfo)
3. Technology(TechnologyID, Name, Type, Purpose, Manufacturer)
4. Crop(CropID, Name, Type, GrowthPeriod, Yield)
5. CropDisease(DiseaseID, Name, AffectedCrops, Symptoms, Treatment)
6. Weather(WeatherID, Date, Temperature, Precipitation, Conditions)
7. Soil(SoilID, Type, NutrientContent, pHLevel, MoistureLevel)
8. Policy(PolicyID, Name, Type, Scope, ImplementationDate)
9. Fertilizer(FertilizerID, Name, Type, NutrientContent, ApplicationMethod)
10. Irrigation(IrrigationID, Type, CoverageArea, Efficiency, InstallationDate)
11. CropRotation(RotationID, CropSequence, Duration, Benefits)
12. FarmingTool(ToolID, Name, Type, Usage, Manufacturer)
13. TrainingProgram(ProgramID, Title, Duration, TargetAudience, Content)
14. SustainablePractice(PracticeID, Name, Description, Benefits, ImplementationLevel)
15. Investment(InvestmentID, Amount, Purpose, Beneficiary, Date)
16. Aid(AidID, Type, Amount, Beneficiary, Date)



### 3. ER Diagram Improvement

- Identify Entity Types

#### A. Weak entity set/s

- Aid
- Investment
- Crop Disease

#### B. Type of relationships using natural associations appearing in problem description (Hierarchy, Aggregation, Recursive, Simple Association Link)

1. Farmer – Crop (Many-to-Many)
  - Relationship: Grow
  - Type: Simple Association
  - Reason: Farmers and crops are distinct entities linked by a simple association where the farmer grows the crop.
2. Farmer – Technology (Many-to-Many)
  - Relationship: Adopt
  - Type: Simple Association
  - Reason: The relationship between a farmer adopting technology is a straightforward association, as each entity retains independence.
3. Farmer – FarmingTool (One-to-Many)
  - Relationship: Uses
  - Type: Simple Association
  - Reason: The farmer uses farming tools, and there's a direct association between them.
4. Farmer – Irrigation (One-to-Many)

- Relationship: Installs
  - Type: Simple Association
  - Reason: This is a simple association where farmers install and manage irrigation systems.
5. Farmer – Soil (Many-to-Many)
- Relationship: Manages
  - Type: Simple Association
  - Reason: Farmers manage the soil on their land, forming a direct, simple relationship.
6. Farmer – Fertilizer (Many-to-Many)
- Relationship: Applies
  - Type: Simple Association
  - Reason: The farmer applies fertilizer to crops, representing a direct association between the two entities.
7. Farmer – TrainingProgram (Many-to-Many)
- Relationship: Attends
  - Type: Simple Association
  - Reason: This is a direct association where farmers attend training programs.
8. Crop – Fertilizer (Many-to-Many)
- Relationship: Needs
  - Type: Simple Association
  - Reason: Crops require fertilizers, and the relationship between them is direct.
9. Crop – CropDisease (Many-to-Many)
- Relationship: Affects
  - Type: Simple Association
  - Reason: Crop diseases affect crops, forming a direct association.
10. Farmer – Aid (Many-to-Many)
- Relationship: Receives
  - Type: Simple Association
  - Reason: Farmers receive aid in a direct relationship.
11. Farmer – Investment (Many-to-Many)
- Relationship: Secures
  - Type: Simple Association
  - Reason: The farmer secures investments, forming a direct association between the two entities.
12. Irrigation – Soil (Many-to-Many)
- Relationship: Waters
  - Type: Aggregation
  - Reason: Irrigation waters the soil, forming an aggregation where irrigation is part of soil management.
13. Crop – Soil (Many-to-Many)
-

- Relationship: GrowsIn
- Type: Aggregation
- Reason: The crop grows in the soil, and this can be seen as an aggregation where the crop's growth is dependent on the soil.

14. Weather – Crop (Many-to-Many)

- Relationship: Affects
- Type: Aggregation
- Reason: Weather affects crops, forming an aggregation where weather is a component of crop growth.

15. Farmer – SustainablePractice (Many-to-Many)

- Relationship: Implements
- Type: Aggregation
- Reason: Farmers implement sustainable practices as part of their overall farming operation, forming an aggregation where the sustainable practices contribute to the larger farming system.

○ Identify Relationship Types

#### A. Entity vs. Attribute vs. Relationships

1. Farmer\_Crop

- New Table: Farmer\_Crop (FarmerID, CropID)
- Input Tables: Farmer (FarmerID, Name, FarmSize, ContactInfo), Crop (CropID, Name, Type, GrowthPeriod, Yield)
- Description: The Farmer\_Crop table manages the many-to-many relationship between farmers and the crops they cultivate.

2. Farmer\_Tech

- New Table: Farmer\_Tech (FarmerID, TechnologyID, TimeofUsage)
- Input Tables: Farmer (FarmerID, Name, FarmSize, ContactInfo), Technology (TechnologyID, Name, Type, Purpose)
- Description: The Farmer\_Tech table represents the relationship between farmers and the technologies they use, along with the usage time.

3. FarmingTool

- New Table: FarmingTool (ToolID, Name, Type, Usage, Manufacturer, FarmerID)
- Input Tables: None (new entity)
- Description: The FarmingTool table tracks the tools used by farmers, including details about each tool and its manufacturer.

4. Irrigation

- New Table: Irrigation (IrrigationID, Type, CoverageArea, Efficiency, InstallationDate, FarmerID)
- Input Tables: None (new entity)
- Description: The Irrigation table stores information about irrigation systems used by farmers, including coverage and efficiency metrics.

5. Farmer\_Soil
  - New Table: Farmer\_Soil (FarmerID, SoilID)
  - Input Tables: Farmer (FarmerID, Name, FarmSize, ContactInfo), Soil (SoilID, Type, NutrientContent, pHLevel, MoistureLevel)
  - Description: The Farmer\_Soil table manages the relationship between farmers and the soil types they utilize.
6. Farmer\_Fertilizer
  - New Table: Farmer\_Fertilizer (FarmerID, FertilizerID, Quantity)
  - Input Tables: Farmer (FarmerID, Name, FarmSize, ContactInfo), Fertilizer (FertilizerID, Name, Type, NutrientContent, ApplicationMethod)
  - Description: The Farmer\_Fertilizer table tracks the fertilizers used by farmers and the quantities applied.
7. Farmer\_TrainingProgram
  - New Table: Farmer\_TrainingProgram (FarmerID, ProgramID)
  - Input Tables: Farmer (FarmerID, Name, FarmSize, ContactInfo), TrainingProgram (ProgramID, Title, Duration, TargetAudience, Content)
  - Description: The Farmer\_TrainingProgram table represents the training programs attended by farmers.
8. Crop\_Fertilizer
  - New Table: Crop\_Fertilizer (CropID, FertilizerID, FertilizerQuantity)
  - Input Tables: Crop (CropID, Name, Type, GrowthPeriod, Yield), Fertilizer (FertilizerID, Name, Type, NutrientContent, ApplicationMethod)
  - Description: The Crop\_Fertilizer table manages the relationship between crops and the fertilizers used, along with quantities.
9. Crop\_Disease
  - New Table: Crop\_Disease (CropID, DiseaseID)
  - Input Tables: Crop (CropID, Name, Type, GrowthPeriod, Yield), CropDisease (DiseaseID, Name, AffectedCrops, Symptoms, Treatment)
  - Description: The Crop\_Disease table tracks diseases affecting specific crops.
10. Farmer\_Aid
  - New Table: Farmer\_Aid (FarmerID, AidID)
  - Input Tables: Farmer (FarmerID, Name, FarmSize, ContactInfo), Aid (AidID, Type, Amount, Beneficiary, Date)
  - Description: The Farmer\_Aid table manages the aid received by farmers.
11. Farmer\_Investment
  - New Table: Farmer\_Investment (FarmerID, InvestmentID)
  - Input Tables: Farmer (FarmerID, Name, FarmSize, ContactInfo), Investment (InvestmentID, Amount, Purpose, Beneficiary, Date)
  - Description: The Farmer\_Investment table tracks investments made by farmers.
12. Irrigation\_Soil

- New Table: Irrigation\_Soil (IrrigationID, SoilID)
- Input Tables: Irrigation (IrrigationID, Type, CoverageArea, Efficiency, InstallationDate, FarmerID), Soil (SoilID, Type, NutrientContent, pHLevel, MoistureLevel)
- Description: The Irrigation\_Soil table manages the relationship between irrigation systems and soil types.

#### 13. Crop\_Soil

- New Table: Crop\_Soil (CropID, SoilID)
- Input Tables: Crop (CropID, Name, Type, GrowthPeriod, Yield), Soil (SoilID, Type, NutrientContent, pHLevel, MoistureLevel)
- Description: The Crop\_Soil table tracks the types of soil used for different crops.

#### 14. Crop\_Weather

- New Table: Crop\_Weather (CropID, WeatherID)
- Input Tables: Crop (CropID, Name, Type, GrowthPeriod, Yield), Weather (WeatherID, Date, Temperature, Precipitation, Conditions)
- Description: The Crop\_Weather table manages the relationship between crops and weather conditions.

#### 15. Farmer\_SustainablePractice

- New Table: Farmer\_SustainablePractice (FarmerID, PracticeID)
- Input Tables: Farmer (FarmerID, Name, FarmSize, ContactInfo), SustainablePractice (PracticeID, Name, Description, Benefits, ImplementationLevel)
- Description: The Farmer\_SustainablePractice table tracks sustainable practices adopted by farmers.

## B. Binary vs. Ternary Relationships

### 1. Farmer and Crop

- Type: Binary
- Description: A farmer can grow multiple crops, and a crop can be grown by multiple farmers.

### 2. Farmer and FarmingTool

- Type: Binary
- Description: A farmer uses various farming tools, and a tool can be used by multiple farmers.

### 3. Crop and CropDisease

- Type: Binary
- Description: A crop can be affected by multiple diseases, and a disease can affect multiple crops.

### 4. Policy and TrainingProgram

- Type: Binary
- Description: Policies may be linked to multiple training programs aimed at implementing them.

### 5. Weather and Soil

- Type: Binary
  - Description: Different weather conditions affect soil types, but this might not need a direct relationship in the schema unless you want to analyze effects on crop growth.
6. Irrigation and Crop
- Type: Binary
  - Description: Different irrigation systems may be used for different crops.
7. Investment and Farmer/Researcher
- Type: Binary
  - Description: Investments can be made towards specific farmers or researchers.
8. SustainablePractice and Farmer
- Type: Binary
  - Description: Farmers may adopt multiple sustainable practices, while a practice can be adopted by multiple farmers.
9. Drought and Crop
- Type: Binary
  - Description: Drought affects multiple crops, and crops can be impacted by different drought events.
10. Flood and Crop
- Type: Binary
  - Description: Flood impacts various crops, and crops can be affected by multiple flood events.

### C. Aggregation vs. Ternary Relationship

- TrainingProgram for Farmers using Technology:
- Assume there's a training program that trains Farmers on using specific Technology. You could model this using a ternary relationship between TrainingProgram, Farmer, and Technology.
- However, if you wanted to associate multiple factors (e.g., trainers, durations, or locations), you could aggregate this relationship into a higher-level entity such as TrainingEvent.
- TrainingProgram → TrainingEvent (aggregated relationship) → Farmer, Technology, Trainer

### D. Total participation

Entity	Related Entity	Relationship	Total Participation
Crop	CropDisease	Affected	Yes
Crop	Soil	Grown In	Yes
Farmer	Crop	Grow	Yes
Farmer	Soil	Manages	Yes
Farmer	Fertilizer	Uses	Yes

## Explanation:

- **Entity:** The primary entity being examined.
  - **Related Entity:** The entity it relates to.
  - **Relationship:** Describes how the entities relate.
  - **Total Participation:** Indicates if every instance of the primary entity must be associated with an instance of the related entity.
- [ER Diagram Analysis](#)
- Entities Removed:
    - The updated diagram has removed entities such as Researcher, Student, EducationalResource.
  - Relationships Removed:
    - Relationships involving removed entities, such as Uses (Researcher with Technology), Creates (Researcher with EducationalResource), and other associations with Researcher and Student, have been eliminated.
  - Simplified Connections:
    - The relationships in the updated ER diagram are more streamlined, reducing complexity by focusing on essential associations related to the Farmer entity.
  - Core Entities and Relationships Retained:
    - Core entities such as Farmer, Crop, Soil, Fertilizer, Technology, Weather, TrainingProgram, Investment, and SustainablePractice are retained, with key relationships like Adopts, Uses, and Applies.
      - [Additional refinements and corrections in the ER Diagram based on analysis.](#)
1. Entity Removal and Simplification
    - The entities Researcher, Student, and EducationalResource were removed to streamline the ER diagram. This change reflects a more focused approach by concentrating on core relationships primarily associated with the Farmer entity.
    - The removal of these entities also simplifies relationships, reducing redundancy and unnecessary complexity in the diagram.
  2. Introduction of Visitor Entity
    - A new entity, Visitor, was introduced to replace Researcher and Student. This entity captures essential details, with attributes such as:
      - VisitorID (Primary Key)
      - Name (Visitor's Full Name)
      - Role (Defines whether the visitor is a researcher, student, or other types)
      - ContactInfo (Visitor's contact details)
    - This adjustment ensures that the ER diagram remains comprehensive by allowing for the representation of individuals who interact with the system, while focusing on their general role without adding specific research-based relationships.

3. Core Entity and Attribute Mapping
  - Essential entities and attributes are retained, including Farmer, Crop, Soil, Technology, Fertilizer, TrainingProgram, Policy, Aid, CropDisease, CropRotation, Investment, Weather, and SustainablePractice.
  - Each entity is defined with primary attributes that provide a foundational structure, enabling the storage of essential information directly related to sustainable agricultural practices.
  
4. Relationship Refinement
  - Relationships associated with Researcher and Student have been removed, such as Uses (Researcher with Technology) and Creates (Researcher with EducationalResource).
  - Simplified, essential relationships have been maintained around the Farmer entity to ensure clarity. Key relationships retained include:
    - Farmer\_Crop (Links Farmer with specific Crops)
    - Farmer\_Tech (Tracks Technology usage by Farmers)
    - Farmer\_TrainingProgram (Maps Farmer participation in Training Programs)
    - Farmer\_Soil and Farmer\_Fertilizer (Associations for soil and fertilizer management)
    - Farmer\_Aid and Farmer\_Investment (Tracks financial aids and investments for farmers)
  - This focused approach reduces diagram complexity while retaining functionality for managing critical information related to sustainable farming.
  
5. Simplified Relationship Structure
  - By focusing relationships primarily on the Farmer entity, the ER diagram is streamlined, enhancing readability and maintainability.
  - Relationships such as Farmer\_SustainablePractice are retained, ensuring that essential connections between Farmers and their sustainable practices remain a focal point for analysis.
  
6. Comprehensive Data Modeling
  - The ER diagram continues to encompass core data interactions, ensuring that relevant entities, relationships, and data attributes required for a robust analysis of sustainable agricultural practices are well-represented.
  - The addition of the Visitor entity, alongside the refined Farmer-centric relationships, supports both simplicity and functionality, allowing for straightforward updates and future extensions as needed.

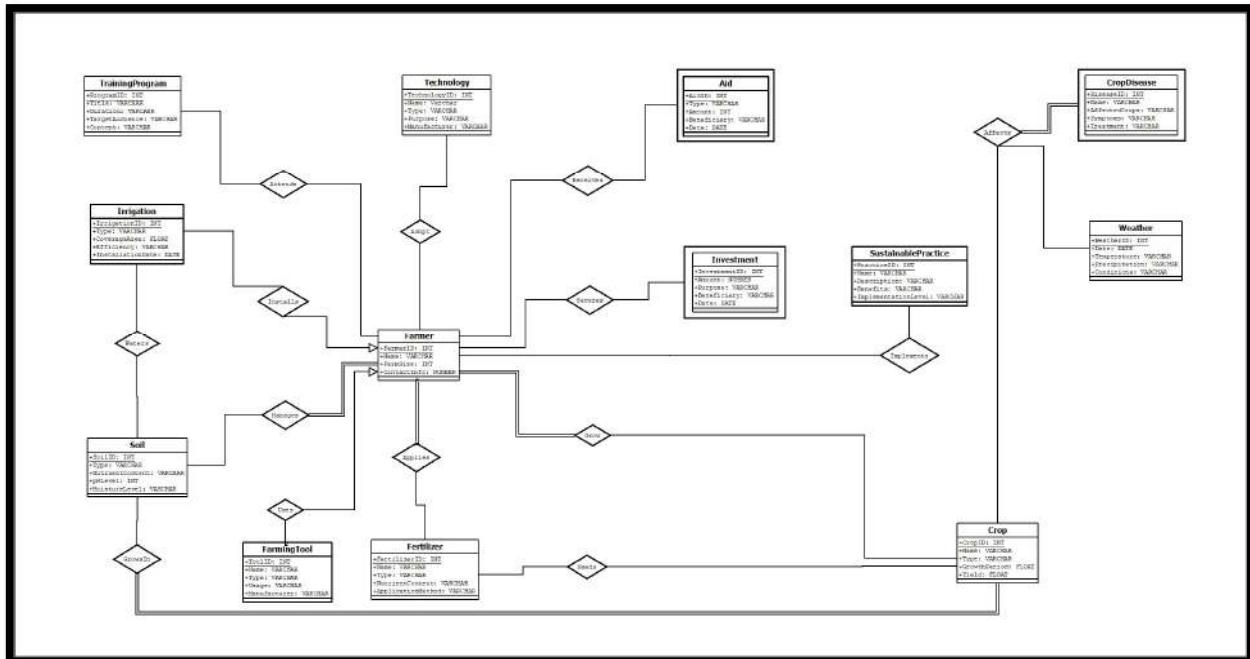
## 4. Mapping ER Model to Relational Model

- Entities Mapping
  1. Farmer(FarmerID, Name, FarmSize, ContactInfo)
  2. Crop(CropID, Name, Type, GrowthPeriod, Yield)
  3. Technology(TechnologyID, Name, Type, Purpose)
  4. Soil(SoilID, Type, NutrientContent, pHLevel, MoistureLevel)
  5. Fertilizer(FertilizerID, Name, Type, NutrientContent, ApplicationMethod)

6. TrainingProgram(ProgramID, Title, Duration, TargetAudience, Content)
7. Visitor(VisitorID, Name, Role, ContactInfo)
8. Policy(PolicyID, Name, Type, ImplementationDate)
9. Aid(AidID, Type, Amount, Beneficiary, Date)
10. CropDisease(DiseaseID, Name, AffectedCrops, Symptoms, Treatment)
11. CropRotation(RotationID, CropSequence, Duration, Benefits)
12. Investment(InvestmentID, Amount, Purpose, Beneficiary, Date)
13. Weather(WeatherID, Date, Temperature, Precipitation, Conditions)
14. SustainablePractice(PracticeID, Name, Description, Benefits, ImplementationLevel)

- Relationships Mapping

1. Farmer\_Crop(FarmerID, CropID)
2. Farmer\_Tech(FarmerID, TechnologyID, TimeofUsage)
3. FarmingTool(ToolID, Name, Type, Usage, Manufacturer, FarmerID)
4. Irrigation(IrrigationID, Type, CoverageArea, Efficiency, InstallationDate, FarmerID)
5. Farmer\_Soil(FarmerID, SoilID)
6. Farmer\_Fertilizer(FarmerID, FertilizerID, Quantity)
7. Farmer\_TrainingProgram(FarmerID, ProgramID)
8. Crop\_Fertilizer(CropID, FertilizerID, FertilizerQuantity)
9. Crop\_Disease(CropID, DiseaseID)
10. Farmer\_Aid(FarmerID, AidID)
11. Farmer\_Investment(FarmerID, InvestmentID)
12. Irrigation\_Soil(IrrigationID, SoilID)
13. Crop\_Soil(CropID, SoilID)
14. Crop\_Weather(CropID, WeatherID)
15. Farmer\_SustainablePractice(FarmerID, PracticeID)



## 5. Create DDL Scripts

### 1. Farmer

```
CREATE TABLE Farmer (
    FarmerID INT PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    FarmSize DECIMAL(10, 2) CHECK (FarmSize > 0),
    ContactInfo VARCHAR(100)
);
```

### 2. Crop

```
CREATE TABLE Crop (
    CropID INT PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    Type VARCHAR(50),
    GrowthPeriod INT CHECK (GrowthPeriod >= 0),
    Yield DECIMAL(10, 2) CHECK (Yield >= 0)
);
```

### 3. Technology

```
CREATE TABLE Technology (
    TechnologyID INT PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    Type VARCHAR(50),
    Purpose VARCHAR(100)
);
```

### 4. Soil

```
CREATE TABLE Soil (
    SoilID INT PRIMARY KEY,
    Type VARCHAR(50),
    NutrientContent VARCHAR(100),
    pHLevel DECIMAL(3, 2) CHECK (pHLevel >= 0 AND pHLevel <= 14),
    MoistureLevel DECIMAL(5, 2) CHECK (MoistureLevel >= 0)
);
```

### 5. Fertilizer

```
CREATE TABLE Fertilizer (
    FertilizerID INT PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    Type VARCHAR(50),
    NutrientContent VARCHAR(100),
    ApplicationMethod VARCHAR(100)
);
```

### 6. Training Program

```
CREATE TABLE TrainingProgram (
    ProgramID INT PRIMARY KEY,
    Title VARCHAR(100) NOT NULL,
```

```
Duration INT CHECK (Duration > 0),
TargetAudience VARCHAR(100),
Content VARCHAR(100)
);
```

## **7. Visitor**

```
CREATE TABLE Visitor (
    VisitorID INT PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    Role VARCHAR(50),
    ContactInfo VARCHAR(100)
);
```

## **8. Policy**

```
CREATE TABLE Policy (
    PolicyID INT PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    Type VARCHAR(50),
    ImplementationDate DATE
);
```

## **9. Aid**

```
CREATE TABLE Aid (
    AidID INT PRIMARY KEY,
    Type VARCHAR(50),
    Amount DECIMAL(10, 2) CHECK (Amount > 0),
    Beneficiary VARCHAR(100),
    Date DATE
);
```

## **10. Crop Disease**

```
CREATE TABLE CropDisease (
    DiseaseID INT PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    AffectedCrops VARCHAR(100),
    Symptoms VARCHAR(100),
    Treatment VARCHAR(100)
);
```

## **11. Crop Rotation**

```
CREATE TABLE CropRotation (
    RotationID INT PRIMARY KEY,
    CropSequence VARCHAR(100) NOT NULL,
    Duration INT CHECK (Duration > 0),
    Benefits VARCHAR(100)
);
```

## **12. Investment**

```
CREATE TABLE Investment (
    InvestmentID INT PRIMARY KEY,
    Amount DECIMAL(10, 2) CHECK (Amount > 0),
    Purpose VARCHAR(100),
    Beneficiary VARCHAR(100),
    Date DATE
);
```

### **13. Weather**

```
CREATE TABLE Weather (
    WeatherID INT PRIMARY KEY,
    Date DATE NOT NULL,
    Temperature DECIMAL(5, 2),
    Precipitation DECIMAL(5, 2),
    Conditions VARCHAR(100)
);
```

### **14. Sustainable Practice**

```
CREATE TABLE SustainablePractice (
    PracticeID INT PRIMARY KEY,
    Name VARCHAR(100) NOT NULL,
    Description VARCHAR(100),
    Benefits VARCHAR(100),
    ImplementationLevel VARCHAR(50)
);
```

### **15. Farmer\_Crop**

```
CREATE TABLE Farmer_Crop (
    FarmerID INT,
    CropID INT,
    PRIMARY KEY (FarmerID, CropID),
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE,
    FOREIGN KEY (CropID) REFERENCES Crop(CropID) ON DELETE CASCADE
);
```

### **16. Farmer\_Tech**

```
CREATE TABLE Farmer_Tech (
    FarmerID INT,
    TechnologyID INT,
    TimeofUsage DATE,
    PRIMARY KEY (FarmerID, TechnologyID),
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE,
    FOREIGN KEY (TechnologyID) REFERENCES Technology(TechnologyID) ON DELETE
    CASCADE
);
```

### **17. FarmingTool**

```
CREATE TABLE FarmingTool (
```

```
ToolID INT PRIMARY KEY,  
Name VARCHAR(100) NOT NULL,  
Type VARCHAR(50),  
Usage TEXT,  
Manufacturer VARCHAR(100),  
FarmerID INT,  
FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE  
);
```

## **18. Irrigation**

```
CREATE TABLE Irrigation (  
    IrrigationID INT PRIMARY KEY,  
    Type VARCHAR(50),  
    CoverageArea DECIMAL(10, 2) CHECK (CoverageArea > 0),  
    Efficiency DECIMAL(5, 2) CHECK (Efficiency >= 0 AND Efficiency <= 100),  
    InstallationDate DATE,  
    FarmerID INT,  
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE  
);
```

## **19. Farmer\_Soil**

```
CREATE TABLE Farmer_Soil (  
    FarmerID INT,  
    SoilID INT,  
    PRIMARY KEY (FarmerID, SoilID),  
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE,  
    FOREIGN KEY (SoilID) REFERENCES Soil(SoilID) ON DELETE CASCADE  
);
```

## **20. Farmer\_Fertilizer**

```
CREATE TABLE Farmer_Fertilizer (  
    FarmerID INT,  
    FertilizerID INT,  
    Quantity DECIMAL(10, 2) CHECK (Quantity >= 0),  
    PRIMARY KEY (FarmerID, FertilizerID),  
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE,  
    FOREIGN KEY (FertilizerID) REFERENCES Fertilizer(FertilizerID) ON DELETE  
    CASCADE  
);
```

## **21. Farmer\_TrainingProgram**

```
CREATE TABLE Farmer_TrainingProgram (  
    FarmerID INT,  
    ProgramID INT,  
    PRIMARY KEY (FarmerID, ProgramID),  
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE,  
    FOREIGN KEY (ProgramID) REFERENCES TrainingProgram(ProgramID) ON DELETE  
    CASCADE
```

);

## **22. Crop\_Fertilizer**

```
CREATE TABLE Crop_Fertilizer (
    CropID INT,
    FertilizerID INT,
    FertilizerQuantity DECIMAL(10, 2) CHECK (FertilizerQuantity >= 0),
    PRIMARY KEY (CropID, FertilizerID),
    FOREIGN KEY (CropID) REFERENCES Crop(CropID) ON DELETE CASCADE,
    FOREIGN KEY (FertilizerID) REFERENCES Fertilizer(FertilizerID) ON DELETE
    CASCADE
);
```

## **23. Crop\_Disease**

```
CREATE TABLE Crop_Disease (
    CropID INT,
    DiseaseID INT,
    PRIMARY KEY (CropID, DiseaseID),
    FOREIGN KEY (CropID) REFERENCES Crop(CropID) ON DELETE CASCADE,
    FOREIGN KEY (DiseaseID) REFERENCES CropDisease(DiseaseID) ON DELETE
    CASCADE
);
```

## **24. Farmer\_Aid**

```
CREATE TABLE Farmer_Aid (
    FarmerID INT,
    AidID INT,
    PRIMARY KEY (FarmerID, AidID),
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE,
    FOREIGN KEY (AidID) REFERENCES Aid(AidID) ON DELETE CASCADE
);
```

## **25. Farmer\_Investment**

```
CREATE TABLE Farmer_Investment (
    FarmerID INT,
    InvestmentID INT,
    PRIMARY KEY (FarmerID, InvestmentID),
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE,
    FOREIGN KEY (InvestmentID) REFERENCES Investment(InvestmentID) ON DELETE
    CASCADE
);
```

## **26. Irrigation\_Soil**

```
CREATE TABLE Irrigation_Soil (
    IrrigationID INT,
    SoilID INT,
    PRIMARY KEY (IrrigationID, SoilID),
```

```

    FOREIGN KEY (IrrigationID) REFERENCES Irrigation(IrrigationID) ON DELETE
CASCADE,
    FOREIGN KEY (SoilID) REFERENCES Soil(SoilID) ON DELETE CASCADE
);

```

## **27. Crop\_Soil**

```

CREATE TABLE Crop_Soil (
    CropID INT,
    SoilID INT,
    PRIMARY KEY (CropID, SoilID),
    FOREIGN KEY (CropID) REFERENCES Crop(CropID) ON DELETE CASCADE,
    FOREIGN KEY (SoilID) REFERENCES Soil(SoilID) ON DELETE CASCADE
);

```

## **28. Crop\_Weather**

```

CREATE TABLE Crop_Weather (
    CropID INT,
    WeatherID INT,
    PRIMARY KEY (CropID, WeatherID),
    FOREIGN KEY (CropID) REFERENCES Crop(CropID) ON DELETE CASCADE,
    FOREIGN KEY (WeatherID) REFERENCES Weather(WeatherID) ON DELETE CASCADE
);

```

## **29. Farmer\_SustainablePractice**

```

CREATE TABLE Farmer_SustainablePractice (
    FarmerID INT,
    PracticeID INT,
    PRIMARY KEY (FarmerID, PracticeID),
    FOREIGN KEY (FarmerID) REFERENCES Farmer(FarmerID) ON DELETE CASCADE,
    FOREIGN KEY (PracticeID) REFERENCES SustainablePractice(PracticeID) ON DELETE
CASCADE
);

```

## **Chapter 3: Normalization of Database**

### **1. Normalization and Schema Refinement**

- o Original Design of Database
  1. Farmer(FarmerID, Name, FarmSize, ContactInfo)
  2. Crop(CropID, Name, Type, GrowthPeriod, Yield)
  3. Technology(TechnologyID, Name, Type, Purpose)
  4. Soil(SoilID, Type, NutrientContent, pHLevel, MoistureLevel)
  5. Fertilizer(FertilizerID, Name, Type, NutrientContent, ApplicationMethod)
  6. TrainingProgram(ProgramID, Title, Duration, TargetAudience, Content)
  7. Visitor(VisitorID, Name, Role, ContactInfo)
  8. Policy(PolicyID, Name, Type, ImplementationDate)
  9. Aid(AidID, Type, Amount, Beneficiary, Date)
  10. CropDisease(DiseaseID, Name, Symptoms, Treatment)

11. CropRotation(RotationID, CropSequence, Duration, Benefits)
12. Investment(InvestmentID, Amount, Purpose, Beneficiary, Date)
13. Weather(WeatherID, Date, Temperature, Precipitation, Conditions)
14. SustainablePractice(PracticeID, Name, Description, Benefits, ImplementationLevel)
  
15. Farmer\_Crop(FarmerID, CropID)
16. Farmer\_Tech(FarmerID, TechnologyID, TimeofUsage)
17. FarmingTool(ToolID, Name, Type, Usage, Manufacturer, FarmerID)
18. Irrigation(IrrigationID, Type, CoverageArea, Efficiency, InstallationDate, FarmerID)
19. Farmer\_Soil(FarmerID, SoilID)
20. Farmer\_Fertilizer(FarmerID, FertilizerID, Quantity)
21. Farmer\_TrainingProgram(FarmerID, ProgramID)
22. Crop\_Fertilizer(CropID, FertilizerID, FertilizerQuantity)
23. Crop\_Disease(CropID, DiseaseID)
24. Farmer\_Aid(FarmerID, AidID)
25. Farmer\_Investment(FarmerID, InvestmentID)
26. Irrigation\_Soil(IrrigationID, SoilID)
27. Crop\_Soil(CropID, SoilID)
28. Crop\_Weather(CropID, WeatherID)
29. Farmer\_SustainablePractice(FarmerID, PracticeID)

- o Dependency Analysis

- Identification of primary keys, foreign keys, and functional dependencies.

1. Farmer (FarmerID, Name, FarmSize, ContactInfo)  
Primary Key (PK): FarmerID  
Functional Dependencies (FDs):  
FarmerID -> Name, FarmSize, ContactInfo
  
2. Crop (CropID, Name, Type, GrowthPeriod, Yield)  
Primary Key (PK): CropID  
Functional Dependencies (FDs):  
CropID -> Name, Type, GrowthPeriod, Yield
  
3. Technology (TechnologyID, Name, Type, Purpose)  
Primary Key (PK): TechnologyID  
Functional Dependencies (FDs):  
TechnologyID -> Name, Type, Purpose
  
4. Soil (SoilID, Type, NutrientContent, pHLevel, MoistureLevel)  
Primary Key (PK): SoilID  
Functional Dependencies (FDs):  
SoilID -> Type, NutrientContent, pHLevel, MoistureLevel
  
5. Fertilizer (FertilizerID, Name, Type, NutrientContent, ApplicationMethod)  
Primary Key (PK): FertilizerID  
Functional Dependencies (FDs):  
FertilizerID -> Name, Type, NutrientContent, ApplicationMethod

6. TrainingProgram (ProgramID, Title, Duration, TargetAudience, Content)  
Primary Key (PK): ProgramID  
Functional Dependencies (FDs):  
ProgramID -> Title, Duration, TargetAudience, Content
7. Visitor (VisitorID, Name, Role, ContactInfo)  
Primary Key (PK): VisitorID  
Functional Dependencies (FDs):  
VisitorID -> Name, Role, ContactInfo
8. Policy (PolicyID, Name, Type, ImplementationDate)  
Primary Key (PK): PolicyID  
Functional Dependencies (FDs):  
PolicyID -> Name, Type, ImplementationDate
9. Aid (AidID, Type, Amount, Beneficiary, Date)  
Primary Key (PK): AidID  
Functional Dependencies (FDs):  
AidID -> Type, Amount, Beneficiary, Date
10. CropDisease (DiseaseID, Name, AffectedCrops, Symptoms, Treatment)  
Primary Key (PK): DiseaseID  
Functional Dependencies (FDs):  
DiseaseID -> Name, AffectedCrops, Symptoms, Treatment
11. CropRotation (RotationID, CropSequence, Duration, Benefits)  
Primary Key (PK): RotationID  
Functional Dependencies (FDs):  
RotationID -> CropSequence, Duration, Benefits
12. Investment (InvestmentID, Amount, Purpose, Beneficiary, Date)  
Primary Key (PK): InvestmentID  
Functional Dependencies (FDs):  
InvestmentID -> Amount, Purpose, Beneficiary, Date
13. Weather (WeatherID, Date, Temperature, Precipitation, Conditions)  
Primary Key (PK): WeatherID  
Functional Dependencies (FDs):  
WeatherID -> Date, Temperature, Precipitation, Conditions
14. SustainablePractice (PracticeID, Name, Description, Benefits, ImplementationLevel)  
Primary Key (PK): PracticeID  
Functional Dependencies (FDs):  
PracticeID -> Name, Description, Benefits, ImplementationLevel
15. Farmer\_Crop (FarmerID, CropID)  
Primary Keys (PK): FarmerID, CropID (Composite Key)

Foreign Keys (FK):  
FarmerID → Farmer(FarmerID)  
CropID → Crop(CropID)

16. Farmer\_Tech (FarmerID, TechnologyID, TimeofUsage)  
Primary Keys (PK): FarmerID, TechnologyID (Composite Key)  
Foreign Keys (FK):  
FarmerID → Farmer(FarmerID)  
TechnologyID → Technology(TechnologyID)
17. FarmingTool (ToolID, Name, Type, Usage, Manufacturer, FarmerID)  
Primary Key (PK): ToolID  
Foreign Key (FK):  
FarmerID → Farmer(FarmerID)  
Functional Dependencies (FDs):  
ToolID → Name, Type, Usage, Manufacturer
18. Irrigation (IrrigationID, Type, CoverageArea, Efficiency, InstallationDate, FarmerID)  
Primary Key (PK): IrrigationID  
Foreign Key (FK):  
FarmerID → Farmer(FarmerID)  
Functional Dependencies (FDs):  
IrrigationID → Type, CoverageArea, Efficiency, InstallationDate
19. Farmer\_Soil (FarmerID, SoilID)  
Primary Keys (PK): FarmerID, SoilID (Composite Key)  
Foreign Keys (FK):  
FarmerID → Farmer(FarmerID)  
SoilID → Soil(SoilID)
20. Farmer\_Fertilizer (FarmerID, FertilizerID, Quantity)  
Primary Keys (PK): FarmerID, FertilizerID (Composite Key)  
Foreign Keys (FK):  
FarmerID → Farmer(FarmerID)  
FertilizerID → Fertilizer(FertilizerID)  
Functional Dependencies (FDs):  
FarmerID, FertilizerID → Quantity
21. Farmer\_TrainingProgram (FarmerID, ProgramID)  
Primary Keys (PK): FarmerID, ProgramID (Composite Key)  
Foreign Keys (FK):  
FarmerID → Farmer(FarmerID)  
ProgramID → TrainingProgram(ProgramID)
22. Crop\_Fertilizer (CropID, FertilizerID, FertilizerQuantity)  
Primary Keys (PK): CropID, FertilizerID (Composite Key)  
Foreign Keys (FK):  
CropID → Crop(CropID)

FertilizerID → Fertilizer(FertilizerID)  
Functional Dependencies (FDs):  
CropID, FertilizerID → FertilizerQuantity

23. Crop\_Disease (CropID, DiseaseID)  
Primary Keys (PK): CropID, DiseaseID (Composite Key)  
Foreign Keys (FK):  
CropID → Crop(CropID)  
DiseaseID → CropDisease(DiseaseID)
24. Farmer\_Aid (FarmerID, AidID)  
Primary Keys (PK): FarmerID, AidID (Composite Key)  
Foreign Keys (FK):  
FarmerID → Farmer(FarmerID)  
AidID → Aid(AidID)
25. Farmer\_Investment (FarmerID, InvestmentID)  
Primary Keys (PK): FarmerID, InvestmentID (Composite Key)  
Foreign Keys (FK):  
FarmerID → Farmer(FarmerID)  
InvestmentID → Investment(InvestmentID)
26. Irrigation\_Soil (IrrigationID, SoilID)  
Primary Keys (PK): IrrigationID, SoilID (Composite Key)  
Foreign Keys (FK):  
IrrigationID → Irrigation(IrrigationID)  
SoilID → Soil(SoilID)
27. Crop\_Soil (CropID, SoilID)  
Primary Keys (PK): CropID, SoilID (Composite Key)  
Foreign Keys (FK):  
CropID → Crop(CropID)  
SoilID → Soil(SoilID)
28. Crop\_Weather (CropID, WeatherID)  
Primary Keys (PK): CropID, WeatherID (Composite Key)  
Foreign Keys (FK):  
CropID → Crop(CropID)  
WeatherID → Weather(WeatherID)
29. Farmer\_SustainablePractice (FarmerID, PracticeID)  
Primary Keys (PK): FarmerID, PracticeID (Composite Key)  
Foreign Keys (FK):  
FarmerID → Farmer(FarmerID)  
PracticeID → SustainablePractice(PracticeID)

## 2. Redundancy and Anomalies Documentation

---

- Redundancies
  - List existing redundancies for each schema.

<b>Schema</b>	<b>Redundancies</b>
Farmer	ContactInfo could be redundant if multiple farmers share the same contact details (e.g., family members working on the same farm).  If a farmer is involved in multiple activities or crops, repeating Name and FarmSize across different related tables could result in redundancy.
Crop	Type, GrowthPeriod, and Yield might be redundant if the same crop is recorded multiple times (e.g., in crop-rotation cycles). This would lead to repeated data across different records.
Technology	Repetition of Type and Purpose across records of the same technology can create redundancy, especially if the same technology is used by multiple farmers or in multiple locations.
Soil	If multiple records refer to the same Soil Type, the attributes like NutrientContent, pHLevel, and MoistureLevel might be repeated unnecessarily.
Fertilizer	Repeating NutrientContent and ApplicationMethod for the same type of fertilizer in multiple records can create redundancy.
TrainingProgram	Repetition of TargetAudience and Content in multiple records of the same program may result in redundancy.
Visitor	ContactInfo could be redundant if multiple visitors share the same role or contact information (e.g., a group of people with the same representative contact).
Policy	Repeated Type or ImplementationDate for multiple policies of the same name could result in redundancy.
Aid	If the same Type of aid is repeatedly provided, the Amount and Date might be redundant across multiple records.
CropDisease	Repetition of Symptoms and Treatment for diseases affecting multiple crops could result in redundancy.

CropRotation	Duration and Benefits might be redundant if the same crop sequence is repeated in multiple records.
Investment	Repeated Purpose and Amount for the same type of investment might result in redundancy.
Weather	Temperature and Precipitation might be redundant if recorded repeatedly for the same Date across different areas.
SustainablePractice	Repetition of Benefits and ImplementationLevel for the same practice might result in redundancy.
FarmingTool	FarmerID may appear multiple times if different farmers use the same tool.
Irrigation	Type may be repeated if multiple farmers use the same irrigation type.

- Anomalies
  - Document update, delete, and insert anomalies.

Schema	Anomalies		
	Update	Delete	Insert
Farmer	If a farmer's contact information changes, it needs to be updated in every record where the farmer is involved. Failure to update all records leads to inconsistencies.	If a farmer is deleted and this table contains important information like farm size, deleting the farmer might result in the loss of crucial data about their farm.	If a new farmer is added without full details (e.g., missing contact info), the database would reject the insert or leave partial information
Crop	If the growth period of a particular crop changes, all records for that crop must be updated. Failing to do so will lead to inconsistencies.	If a crop is deleted, relevant data on its yield and growth characteristics might be lost.	If a new crop is added with missing yield or growth period data, the insert may fail or lead to incomplete records.

Technology	If the purpose or type of a technology is updated, all related records must be updated. Otherwise, inconsistent technology information may exist in the database.	Deleting a technology record could result in the loss of valuable information on how and why that technology was used.	If a new technology is inserted without its purpose or type, the entry might be incomplete, leading to a less useful record.
Soil	If the soil's nutrient content or moisture level changes, it needs to be updated across multiple records. Failure to update all records causes inconsistencies.	If a soil type is deleted, critical data about its composition and suitability for farming might be lost.	Missing values for key attributes like nutrient content could prevent the insertion of a complete soil record.
Fertilizer	If the application method for a specific fertilizer changes, every related record needs to be updated to avoid inconsistencies.	Deleting a fertilizer entry may lead to the loss of important data on its usage and nutrient composition.	Inserting a new fertilizer record without specifying its type or application method could result in an incomplete entry.
TrainingProgram	If the duration or content of a program changes, all records for that program need to be updated, which can lead to inconsistencies if not handled properly.	Deleting a program could result in the loss of valuable information regarding its content and target audience.	If a new training program is inserted without specifying the target audience or content, the record would be incomplete.
Visitor	If a visitor's contact information changes, all related records need to be updated. Failure to do so will lead to inconsistencies.	Deleting a visitor might lead to the loss of information about their role or contact info.	Inserting a visitor without contact info may result in incomplete records.

Policy	If the implementation date of a policy is updated, it must be updated in all related records, or inconsistencies may occur.	Deleting a policy could result in losing valuable information about its type and implementation date.	Inserting a policy without providing the implementation date may lead to an incomplete record.
Aid	If the aid amount or date is changed, all related records must be updated to avoid inconsistencies.	Deleting an aid record might lead to the loss of important data regarding the beneficiary and the aid provided.	Inserting a record without specifying the aid amount or beneficiary might lead to incomplete data.
CropDisease	If the symptoms or treatment for a disease are updated, all related records must be updated. Otherwise, inconsistencies will arise.	Deleting a disease record might result in the loss of critical information about its symptoms and treatment.	Inserting a new disease without providing its symptoms or treatment may result in an incomplete record.
CropRotation	If the benefits or duration of a rotation scheme are updated, all related records must be updated to avoid inconsistencies.	Deleting a rotation entry could result in the loss of information about its benefits and duration.	Inserting a new rotation record without specifying the benefits could result in an incomplete entry.
Investment	If the purpose or amount of an investment is updated, all related records must be updated to avoid inconsistencies.	Deleting an investment record could lead to the loss of important data about the beneficiary and the purpose of the investment.	Inserting a new investment without specifying the beneficiary or amount could lead to an incomplete record.

Weather	If the temperature or precipitation for a specific date changes, all related records must be updated.	Deleting a weather record could result in the loss of important weatherrelated data.	Inserting a new weather record without providing key information like temperature or conditions could lead to an incomplete record.
SustainablePractice	If the benefits or implementation level of a sustainable practice changes, all related records need to be updated to maintain consistency.	Deleting a practice could lead to the loss of valuable information about its benefits and implementation details.	If a new practice is inserted without specifying its benefits, it may lead to an incomplete record.
FarmingTool	Updating a tool's details needs to be done for all records using that tool.	Deleting a tool may inadvertently lose information about its usage by various farmers.	Incomplete data entries, such as missing tool usage or manufacturer details, could occur.
Irrigation	If irrigation type or efficiency changes, all relevant records must be updated.	Deleting an irrigation record may lead to the loss of data relevant to that system's performance.	Missing details about coverage area or efficiency in new records could lead to incomplete datasets.

### 3. Normalization Process

- o 1NF – Enforcing scalar values.

Schema	Atomic values	Status
1. Farmer(FarmerID, Name, FarmSize, ContactInfo)	TRUE	1NF
2. Crop(CropID, Name, Type, GrowthPeriod, Yield)	TRUE	1NF
3. Technology(TechnologyID, Name, Type, Purpose)	TRUE	1NF
4. Soil(SoilID, Type, NutrientContent, pHLevel, MoistureLevel)	TRUE	1NF

5. Fertilizer(FertilizerID, Name, Type, NutrientContent, ApplicationMethod)	<b>TRUE</b>	<b>1NF</b>
6. TrainingProgram(ProgramID, Title, Duration, TargetAudience, Content)	<b>TRUE</b>	<b>1NF</b>
7. Visitor(VisitorID, Name, Role, ContactInfo)	<b>TRUE</b>	<b>1NF</b>
8. Policy(PolicyID, Name, Type, ImplementationDate)	<b>TRUE</b>	<b>1NF</b>
9. Aid(AidID, Type, Amount, Beneficiary, Date)	<b>TRUE</b>	<b>1NF</b>
10. CropDisease(DiseaseID, Name, Symptoms, Treatment)	<b>TRUE</b>	<b>1NF</b>
11. CropRotation(RotationID, CropSequence, Duration, Benefits)	<b>TRUE</b>	<b>1NF</b>
12. Investment(InvestmentID, Amount, Purpose, Beneficiary, Date)	<b>TRUE</b>	<b>1NF</b>
13. Weather(WeatherID, Date, Temperature, Precipitation, Conditions)	<b>TRUE</b>	<b>1NF</b>
14. SustainablePractice(PracticeID, Name, Description, Benefits, ImplementationLevel)	<b>TRUE</b>	<b>1NF</b>
15. Farmer_Crop(FarmerID, CropID)	<b>TRUE</b>	<b>1NF</b>
16. Farmer_Tech(FarmerID, TechnologyID, TimeofUsage)	<b>TRUE</b>	<b>1NF</b>
17. FarmingTool(ToolID, Name, Type, Usage, Manufacturer, FarmerID)	<b>TRUE</b>	<b>1NF</b>
18. Irrigation(IrrigationID, Type, CoverageArea, Efficiency, InstallationDate, FarmerID)	<b>TRUE</b>	<b>1NF</b>
19. Farmer_Soil(FarmerID, SoilID)	<b>TRUE</b>	<b>1NF</b>
20. Farmer_Fertilizer(FarmerID, FertilizerID, Quantity)	<b>TRUE</b>	<b>1NF</b>
21. Farmer_TrainingProgram(FarmerID, ProgramID)	<b>TRUE</b>	<b>1NF</b>
22. Crop_Fertilizer(CropID, FertilizerID, FertilizerQuantity)	<b>TRUE</b>	<b>1NF</b>
23. Crop_Disease(CropID, DiseaseID)	<b>TRUE</b>	<b>1NF</b>
24. Farmer_Aid(FarmerID, AidID)	<b>TRUE</b>	<b>1NF</b>
25. Farmer_Investment(FarmerID, InvestmentID)	<b>TRUE</b>	<b>1NF</b>
26. Irrigation_Soil(IrrigationID, SoilID)	<b>TRUE</b>	<b>1NF</b>
27. Crop_Soil(CropID, SoilID)	<b>TRUE</b>	<b>1NF</b>
28. Crop_Weather(CropID, WeatherID)	<b>TRUE</b>	<b>1NF</b>
29. Farmer_SustainablePractice(FarmerID, PracticeID)	<b>TRUE</b>	<b>1NF</b>

- 2NF – Eliminating partial dependencies.
- Redundancy Analysis for 2NF
  - Document any redundancies in 2NF.

Schema	Partial Dependencies	Status
1. Farmer(FarmerID, Name, FarmSize, ContactInfo)	<b>None</b>	<b>2NF</b>
2. Crop(CropID, Name, Type, GrowthPeriod, Yield)	<b>None</b>	<b>2NF</b>
3. Technology(TechnologyID, Name, Type, Purpose)	<b>None</b>	<b>2NF</b>

4. Soil(SoilID, Type, NutrientContent, pHLevel, MoistureLevel)	<b>None</b>	<b>2NF</b>
5. Fertilizer(FertilizerID, Name, Type, NutrientContent, ApplicationMethod)	<b>None</b>	<b>2NF</b>
6. TrainingProgram(ProgramID, Title, Duration, TargetAudience, Content)	<b>None</b>	<b>2NF</b>
7. Visitor(VisitorID, Name, Role, ContactInfo)	<b>None</b>	<b>2NF</b>
8. Policy(PolicyID, Name, Type, ImplementationDate)	<b>None</b>	<b>2NF</b>
9. Aid(AidID, Type, Amount, Beneficiary, Date)	<b>None</b>	<b>2NF</b>
10. CropDisease(DiseaseID, Name, Symptoms, Treatment)	<b>None</b>	<b>2NF</b>
11. CropRotation(RotationID, CropSequence, Duration, Benefits)	<b>None</b>	<b>2NF</b>
12. Investment(InvestmentID, Amount, Purpose, Beneficiary, Date)	<b>None</b>	<b>2NF</b>
13. Weather(WeatherID, Date, Temperature, Precipitation, Conditions)	<b>None</b>	<b>2NF</b>
14. SustainablePractice(PracticeID, Name, Description, Benefits, ImplementationLevel)	<b>None</b>	<b>2NF</b>
15. Farmer_Crop(FarmerID, CropID)	<b>None</b>	<b>2NF</b>
16. Farmer_Tech(FarmerID, TechnologyID, TimeofUsage)	<b>None</b>	<b>2NF</b>
17. FarmingTool(ToolID, Name, Type, Usage, Manufacturer, FarmerID)	<b>None</b>	<b>2NF</b>
18. Irrigation(IrrigationID, Type, CoverageArea, Efficiency, InstallationDate, FarmerID)	<b>None</b>	<b>2NF</b>
19. Farmer_Soil(FarmerID, SoilID)	<b>None</b>	<b>2NF</b>
20. Farmer_Fertilizer(FarmerID, FertilizerID, Quantity)	<b>None</b>	<b>2NF</b>
21. Farmer_TrainingProgram(FarmerID, ProgramID)	<b>None</b>	<b>2NF</b>
22. Crop_Fertilizer(CropID, FertilizerID, FertilizerQuantity)	<b>None</b>	<b>2NF</b>
23. Crop_Disease(CropID, DiseaseID)	<b>None</b>	<b>2NF</b>
24. Farmer_Aid(FarmerID, AidID)	<b>None</b>	<b>2NF</b>
25. Farmer_Investment(FarmerID, InvestmentID)	<b>None</b>	<b>2NF</b>
26. Irrigation_Soil(IrrigationID, SoilID)	<b>None</b>	<b>2NF</b>
27. Crop_Soil(CropID, SoilID)	<b>None</b>	<b>2NF</b>
28. Crop_Weather(CropID, WeatherID)	<b>None</b>	<b>2NF</b>
29. Farmer_SustainablePractice(FarmerID, PracticeID)	<b>None</b>	<b>2NF</b>

- 3NF/BCNF – Removing transitive dependencies.

<b>Schema</b>	<b>Transitive dependencies</b>	<b>Normalized Schema</b>		<b>Status</b>
		<b>Schema</b>	<b>New Schema</b>	
1. Farmer(FarmerID, Name, FarmSize, ContactInfo)	<b>Not present</b>	-	-	<b>3NF</b>

2. Crop(CropID, Name, Type, GrowthPeriod, Yield)	Present	Crop(CropID, Name, GrowthPeriod, Yield,TypeID)	CropType(TypeID, Type, AdditionalInfo)	3NF
3. Technology(TechnologyID, Name, Type, Purpose)	Present	Technology(TechnologyID, Name, Purpose,TypeID)	TechnologyType(TypeID, Type, AdditionalInfo)	3NF
4. Soil(SoilID, Type, NutrientContent, pHLevel, MoistureLevel)	Present	Soil(SoilID, NutrientContent, pHLevel, MoistureLevel,TypeID)	SoilType(TypeID, Type, AdditionalProperties)	3NF
5. Fertilizer(FertilizerID, Name, Type, NutrientContent, ApplicationMethod)	Present	Fertilizer(FertilizerID, Name, NutrientContent, ApplicationMethod,TypeID)	FertilizerType(TypeID, Type, AdditionalInfo)	3NF
6. TrainingProgram(ProgramID, Title, Duration, TargetAudience, Content)	Present	TrainingProgram(ProgramID, Title, Duration, Content, AudienceID)	TrainingAudience(AudienceID, AudienceType, Description)	3NF
7. Visitor(VisitorID, Name, Role, ContactInfo)	Not Present	-	-	3NF
8. Policy(PolicyID, Name, Type, ImplementationDate)	Present	Policy(PolicyID, Name, ImplementationDate,TypeID)	PolicyType(TypeID, Type, Description)	3NF
9. Aid(AidID, Type, Amount, Beneficiary, Date)	Present	Aid(AidID, Amount, Beneficiary, Date,TypeID)	AidType(TypeID, Type, Description)	3NF
10. CropDisease(DiseaseID, Name, Symptoms, Treatment)	Not present	-	-	3NF
11. CropRotation(RotationID, CropSequence, Duration, Benefits)	Present	CropRotation(RotationID, CropSequence, Duration)	CropBenefits(BenefitID, RotationID, Benefit)	3NF

12. Investment(InvestmentID, Amount, Purpose, Beneficiary, Date)	Present	Investment(InvestmentID, Amount, Beneficiary, Date, PurposeID)	InvestmentPurpose(PurposeID, Purpose, Description)	3NF
13. Weather(WeatherID, Date, Temperature, Precipitation, Conditions)	Not present	-	-	3NF
14. SustainablePractice(PracticeID, Name, Description, Benefits, ImplementationLevel)	Present	SustainablePractice(PracticeID, Name, Description, ImplementationLevel, BenefitID)	PracticeBenefits(BenefitID, PracticeID, Benefit)	3NF
15. Farmer_Crop(FarmerID, CropID)	Not present	-	-	3NF
16. Farmer_Tech(FarmerID, TechnologyID, TimeofUsage)	Not present	-	-	3NF
17. FarmingTool(ToolID, Name, Type, Usage, Manufacturer, FarmerID)	Present	FarmingTool(ToolID, Name, Usage, Manufacturer, FarmerID,TypeID)	ToolType(TypeID, Type, Description)	3NF
18. Irrigation(IrrigationID, Type, CoverageArea, Efficiency, InstallationDate, FarmerID)	Present	Irrigation(IrrigationID, CoverageArea, Efficiency, InstallationDate, FarmerID,TypeID)	IrrigationType(TypeID, Type, Description)	3NF
19. Farmer_Soil(FarmerID, SoilID)	Not present	-	-	3NF
20. Farmer_Fertilizer(FarmerID, FertilizerID, Quantity)	Not present	-	-	3NF
21. Farmer_TrainingProgram(FarmerID, ProgramID)	Not present	-	-	3NF
22. Crop_Fertilizer(CropID, FertilizerID, FertilizerQuantity)	Not present	-	-	3NF
23. Crop_Disease(CropID, DiseaseID)	Not present	-	-	3NF

24. Farmer_Aid(FarmerID, AidID)	<b>Not present</b>	-	-	<b>3NF</b>
25. Farmer_Investment(FarmerID, InvestmentID)	<b>Not present</b>	-	-	<b>3NF</b>
26. Irrigation_Soil(IrrigationID, SoilID)	<b>Not present</b>	-	-	<b>3NF</b>
27. Crop_Soil(CropID, SoilID)	<b>Not present</b>	-	-	<b>3NF</b>
28. Crop_Weather(CropID, WeatherID)	<b>Not present</b>	-	-	<b>3NF</b>
29. Farmer_SustainablePractice(FarmerID, PracticeID)	<b>Not present</b>	-	-	<b>3NF</b>

## Chapter 4: Implementation of Database

### 1. Revised DDL Scripts

- Updated scripts accommodating the normalized database design (3NF/BCNF).
- Ensure domain, primary key, foreign key, and referential integrity constraints.

#### 1. Farmer

```
CREATE TABLE "G2SARM".Farmer (
    FarmerID INT PRIMARY KEY,
    Name VARCHAR(255) NOT NULL, -- Domain Constraint: Name must be provided
    FarmSize DECIMAL(10, 2) CHECK (FarmSize >= 0), -- Domain Constraint: FarmSize
    must be non-negative
    ContactInfo VARCHAR(255)
);
```

#### 2. CropType Table

```
CREATE TABLE CropType (
    TypeID INT PRIMARY KEY, -- Primary Key
    Type VARCHAR(255) NOT NULL, -- Domain Constraint: Type must be provided
    AdditionalInfo TEXT -- Additional information can be specified
);
```

#### 3. Crop Table

```
CREATE TABLE Crop (
    CropID INT PRIMARY KEY, -- Primary Key
    Name VARCHAR(255) NOT NULL, -- Domain Constraint: Name must be provided
    GrowthPeriod INT CHECK (GrowthPeriod > 0), -- Domain Constraint: GrowthPeriod
    must be positive
    Yield DECIMAL(10, 2) CHECK (Yield >= 0), -- Domain Constraint: Yield must be non-
    negative
    TypeID INT, -- Foreign Key Reference to CropType
```

```
    FOREIGN KEY (TypeID) REFERENCES CropType(TypeID) ON DELETE SET NULL  
-- Referential Integrity with ON DELETE SET NULL  
);
```

#### 4. TechnologyType

```
CREATE TABLE TechnologyType (  
    TypeID INT PRIMARY KEY,  
    Type VARCHAR(255) NOT NULL,  
    AdditionalInfo TEXT  
);
```

#### 5. Technology

```
CREATE TABLE Technology (  
    TechnologyID INT PRIMARY KEY,  
    Name VARCHAR(255) NOT NULL,  
    Purpose TEXT,  
    TypeID INT,  
    FOREIGN KEY (TypeID) REFERENCES TechnologyType(TypeID) ON DELETE SET  
    NULL  
);
```

#### 6. SoilType

```
CREATE TABLE SoilType (  
    TypeID INT PRIMARY KEY,  
    Type VARCHAR(255) NOT NULL,  
    AdditionalProperties TEXT  
);
```

#### 7. Soil

```
CREATE TABLE Soil (  
    SoilID INT PRIMARY KEY,  
    NutrientContent TEXT,  
    pHLevel DECIMAL(3, 2),  
    MoistureLevel DECIMAL(5, 2),  
    TypeID INT,  
    FOREIGN KEY (TypeID) REFERENCES SoilType(TypeID) ON DELETE SET NULL  
);
```

#### 8. FertilizerType

```
CREATE TABLE FertilizerType (  
    TypeID INT PRIMARY KEY,  
    Type VARCHAR(255) NOT NULL,  
    AdditionalInfo TEXT  
);
```

#### 9. Fertilizer

```
CREATE TABLE Fertilizer (
```

```
FertilizerID INT PRIMARY KEY,  
Name VARCHAR(255) NOT NULL,  
NutrientContent TEXT,  
ApplicationMethod TEXT,  
TypeID INT,  
FOREIGN KEY (TypeID) REFERENCES FertilizerType(TypeID) ON DELETE SET  
NULL  
);
```

## 10. TrainingAudience

```
CREATE TABLE TrainingAudience (  
    AudienceID INT PRIMARY KEY,  
    AudienceType VARCHAR(255) NOT NULL,  
    Description TEXT  
);
```

## 11. TrainingProgram

```
CREATE TABLE TrainingProgram (  
    ProgramID INT PRIMARY KEY,  
    Title VARCHAR(255) NOT NULL,  
    Duration INT,  
    Content TEXT,  
    AudienceID INT,  
    FOREIGN KEY (AudienceID) REFERENCES TrainingAudience(AudienceID) ON  
    DELETE SET NULL  
);
```

## 12. Visitor

```
CREATE TABLE "G2SARM".Visitor (  
    VisitorID INT PRIMARY KEY,  
    Name VARCHAR(255) NOT NULL,  
    Role VARCHAR(255),  
    ContactInfo VARCHAR(255)  
);
```

## 13. PolicyType

```
CREATE TABLE PolicyType (  
    TypeID INT PRIMARY KEY,  
    Type VARCHAR(255) NOT NULL,  
    Description TEXT  
);
```

## 14. Policy

```
CREATE TABLE Policy (  
    PolicyID INT PRIMARY KEY,  
    Name VARCHAR(255) NOT NULL,  
    ImplementationDate DATE,
```

```
TypeID INT,  
FOREIGN KEY (TypeID) REFERENCES PolicyType(TypeID) ON DELETE SET NULL  
);
```

#### **15. AidType**

```
CREATE TABLE AidType (  
    TypeID INT PRIMARY KEY,  
    Type VARCHAR(255) NOT NULL,  
    Description TEXT  
);
```

#### **16. Aid**

```
CREATE TABLE Aid (  
    AidID INT PRIMARY KEY,  
    Amount DECIMAL(10, 2),  
    Beneficiary VARCHAR(255),  
    Date DATE,  
    TypeID INT,  
    FOREIGN KEY (TypeID) REFERENCES AidType(TypeID) ON DELETE SET NULL  
);
```

#### **17. CropDisease**

```
CREATE TABLE "G2SARM".CropDisease (  
    DiseaseID INT PRIMARY KEY,  
    Name VARCHAR(255) NOT NULL,  
    Symptoms TEXT,  
    Treatment TEXT  
);
```

#### **18. CropRotation**

```
CREATE TABLE CropRotation (  
    RotationID INT PRIMARY KEY,  
    CropSequence TEXT,  
    Duration INT  
);
```

#### **19. CropBenefits**

```
CREATE TABLE CropBenefits (  
    BenefitID INT PRIMARY KEY,  
    RotationID INT,  
    Benefit TEXT,  
    FOREIGN KEY (RotationID) REFERENCES CropRotation(RotationID) ON DELETE  
    CASCADE  
);
```

#### **20. InvestmentPurpose**

```
CREATE TABLE InvestmentPurpose (
```

```
PurposeID INT PRIMARY KEY,  
Purpose VARCHAR(255) NOT NULL,  
Description TEXT  
);
```

## **21. Investment**

```
CREATE TABLE Investment (  
    InvestmentID INT PRIMARY KEY,  
    Amount DECIMAL(10, 2),  
    Beneficiary VARCHAR(255),  
    Date DATE,  
    PurposeID INT,  
    FOREIGN KEY (PurposeID) REFERENCES InvestmentPurpose(PurposeID) ON  
    DELETE SET NULL  
);
```

## **22. Weather**

```
CREATE TABLE "G2SARM".Weather (  
    WeatherID INT PRIMARY KEY,  
    Date DATE NOT NULL,  
    Temperature DECIMAL(5, 2),  
    Precipitation DECIMAL(5, 2),  
    Conditions VARCHAR(255)  
);
```

## **23. SustainablePractice**

```
CREATE TABLE SustainablePractice (  
    PracticeID INT PRIMARY KEY,  
    Name VARCHAR(255) NOT NULL,  
    Description TEXT,  
    ImplementationLevel VARCHAR(255)  
);
```

## **24. PracticeBenefits**

```
CREATE TABLE PracticeBenefits (  
    BenefitID INT PRIMARY KEY,  
    PracticeID INT,  
    Benefit TEXT,  
    FOREIGN KEY (PracticeID) REFERENCES SustainablePractice(PracticeID) ON  
    DELETE CASCADE  
);
```

## **25. Farmer\_Crop**

```
CREATE TABLE "G2SARM".Farmer_Crop (  
    FarmerID INT,  
    CropID INT,  
    PRIMARY KEY (FarmerID, CropID),
```

```

    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
    DELETE CASCADE,
    FOREIGN KEY (CropID) REFERENCES "G2SARM".Crop(CropID) ON DELETE
    CASCADE
);

```

## **26. Farmer\_Tech**

```

CREATE TABLE "G2SARM".Farmer_Tech (
    FarmerID INT,
    TechnologyID INT,
    TimeofUsage DATE NOT NULL,
    PRIMARY KEY (FarmerID, TechnologyID),
    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
    DELETE CASCADE,
    FOREIGN KEY (TechnologyID) REFERENCES
    "G2SARM".Technology(TechnologyID) ON DELETE CASCADE
);

```

## **27. FarmingTool**

```

CREATE TABLE "G2SARM".FarmingTool (
    ToolID INT PRIMARY KEY, -- Primary Key
    Name VARCHAR(255) NOT NULL, -- Domain Constraint: Name must be provided
    Usage VARCHAR(255) NOT NULL, -- Domain Constraint: Usage must be provided
    Manufacturer VARCHAR(255), -- Domain Constraint: Manufacturer can be specified
    FarmerID INT, -- Foreign Key Reference
    TypeID INT, -- Foreign Key Reference
    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
    DELETE SET NULL,
    FOREIGN KEY (TypeID) REFERENCES "G2SARM".ToolType(TypeID) ON DELETE
    SET NULL
);

```

## **28. ToolType**

```

CREATE TABLE "G2SARM".ToolType (
    TypeID INT PRIMARY KEY, -- Primary Key
    Type VARCHAR(255) NOT NULL, -- Domain Constraint: Type must be provided
    Description TEXT -- Domain Constraint: Description can be specified
);

```

## **29. Irrigation**

```

CREATE TABLE "G2SARM".Irrigation (
    IrrigationID INT PRIMARY KEY, -- Primary Key
    CoverageArea DECIMAL(10, 2) CHECK (CoverageArea >= 0), -- Domain Constraint:
    Coverage Area must be non-negative
    Efficiency DECIMAL(5, 2) CHECK (Efficiency BETWEEN 0 AND 100), -- Domain
    Constraint: Efficiency should be between 0 and 100
)

```

```
InstallationDate DATE NOT NULL, -- Domain Constraint: Installation Date must be
provided
    FarmerID INT, -- Foreign Key Reference
   TypeID INT, -- Foreign Key Reference
        FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
DELETE SET NULL,
        FOREIGN KEY (TypeID) REFERENCES "G2SARM".IrrigationType(TypeID) ON
DELETE SET NULL
);
```

### **30. IrrigationType**

```
CREATE TABLE "G2SARM".IrrigationType (
    TypeID INT PRIMARY KEY, -- Primary Key
    Type VARCHAR(255) NOT NULL, -- Domain Constraint: Type must be provided
    Description TEXT -- Domain Constraint: Description can be specified
);
```

### **31. Farmer\_Soil**

```
CREATE TABLE "G2SARM".Farmer_Soil (
    FarmerID INT,
    SoilID INT,
    PRIMARY KEY (FarmerID, SoilID),
    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
DELETE CASCADE,
    FOREIGN KEY (SoilID) REFERENCES "G2SARM".Soil(SoilID) ON DELETE
CASCADE
);
```

### **32. Farmer\_Fertilizer**

```
CREATE TABLE "G2SARM".Farmer_Fertilizer (
    FarmerID INT,
    FertilizerID INT,
    Quantity DECIMAL(10, 2) CHECK (Quantity >= 0),
    PRIMARY KEY (FarmerID, FertilizerID),
    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
DELETE CASCADE,
    FOREIGN KEY (FertilizerID) REFERENCES "G2SARM".Fertilizer(FertilizerID) ON
DELETE CASCADE
);
```

### **33. Farmer\_TrainingProgram**

```
CREATE TABLE "G2SARM".Farmer_TrainingProgram (
    FarmerID INT,
    ProgramID INT,
    PRIMARY KEY (FarmerID, ProgramID),
    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
DELETE CASCADE,
```

```
    FOREIGN KEY (ProgramID) REFERENCES "G2SARM".TrainingProgram(ProgramID)
    ON DELETE CASCADE
);
```

#### **34. Crop\_Fertilizer**

```
CREATE TABLE "G2SARM".Crop_Fertilizer (
    CropID INT,
    FertilizerID INT,
    FertilizerQuantity DECIMAL(10, 2) CHECK (FertilizerQuantity >= 0),
    PRIMARY KEY (CropID, FertilizerID),
    FOREIGN KEY (CropID) REFERENCES "G2SARM".Crop(CropID) ON DELETE
    CASCADE,
    FOREIGN KEY (FertilizerID) REFERENCES "G2SARM".Fertilizer(FertilizerID) ON
    DELETE CASCADE
);
```

#### **35. Crop\_Disease**

```
CREATE TABLE "G2SARM".Crop_Disease (
    CropID INT,
    DiseaseID INT,
    PRIMARY KEY (CropID, DiseaseID),
    FOREIGN KEY (CropID) REFERENCES "G2SARM".Crop(CropID) ON DELETE
    CASCADE,
    FOREIGN KEY (DiseaseID) REFERENCES "G2SARM".CropDisease(DiseaseID) ON
    DELETE CASCADE
);
```

#### **36. Farmer\_Aid**

```
CREATE TABLE "G2SARM".Farmer_Aid (
    FarmerID INT,
    AidID INT,
    PRIMARY KEY (FarmerID, AidID),
    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
    DELETE CASCADE,
    FOREIGN KEY (AidID) REFERENCES "G2SARM".Aid(AidID) ON DELETE
    CASCADE
);
```

#### **37. Farmer\_Investment**

```
CREATE TABLE "G2SARM".Farmer_Investment (
    FarmerID INT,
    InvestmentID INT,
    PRIMARY KEY (FarmerID, InvestmentID),
    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
    DELETE CASCADE,
    FOREIGN KEY (InvestmentID) REFERENCES "G2SARM".Investment(InvestmentID)
    ON DELETE CASCADE
)
```

);

### **38. Irrigation\_Soil**

```
CREATE TABLE "G2SARM".Irrigation_Soil (
    IrrigationID INT,
    SoilID INT,
    PRIMARY KEY (IrrigationID, SoilID),
    FOREIGN KEY (IrrigationID) REFERENCES "G2SARM".Irrigation(IrrigationID) ON
    DELETE CASCADE,
    FOREIGN KEY (SoilID) REFERENCES "G2SARM".Soil(SoilID) ON DELETE
    CASCADE
);
```

### **39. Crop\_Soil**

```
CREATE TABLE "G2SARM".Crop_Soil (
    CropID INT,
    SoilID INT,
    PRIMARY KEY (CropID, SoilID),
    FOREIGN KEY (CropID) REFERENCES "G2SARM".Crop(CropID) ON DELETE
    CASCADE,
    FOREIGN KEY (SoilID) REFERENCES "G2SARM".Soil(SoilID) ON DELETE
    CASCADE
);
```

### **40. Crop\_Weather**

```
CREATE TABLE "G2SARM".Crop_Weather (
    CropID INT,
    WeatherID INT,
    PRIMARY KEY (CropID, WeatherID),
    FOREIGN KEY (CropID) REFERENCES "G2SARM".Crop(CropID) ON DELETE
    CASCADE,
    FOREIGN KEY (WeatherID) REFERENCES "G2SARM".Weather(WeatherID) ON
    DELETE CASCADE
);
```

### **41. Farmer\_SustainablePractice**

```
CREATE TABLE "G2SARM".Farmer_SustainablePractice (
    FarmerID INT,
    PracticeID INT,
    PRIMARY KEY (FarmerID, PracticeID),
    FOREIGN KEY (FarmerID) REFERENCES "G2SARM".Farmer(FarmerID) ON
    DELETE CASCADE,
    FOREIGN KEY (PracticeID) REFERENCES
    "G2SARM".SustainablePractice(PracticeID) ON DELETE CASCADE
);
```

- o **Final Schema**

1. Farmer(FarmerID, Name, FarmSize, ContactInfo)
2. Crop(CropID, Name, GrowthPeriod, Yield,TypeID)
3. CropType(TypeID, Type, AdditionalInfo)
4. Technology(TechnologyID, Name, Purpose,TypeID)
5. TechnologyType(TypeID, Type, AdditionalInfo)
6. Soil(SoilID, NutrientContent, pHLevel, MoistureLevel,TypeID)
7. SoilType(TypeID, Type, AdditionalProperties)
8. Fertilizer(FertilizerID, Name, NutrientContent, ApplicationMethod,TypeID)
9. FertilizerType(TypeID, Type, AdditionalInfo)
10. TrainingProgram(ProgramID, Title, Duration, Content, AudienceID)
11. TrainingAudience(AudienceID, AudienceType, Description)
12. Visitor(VisitorID, Name, Role, ContactInfo)
13. Policy(PolicyID, Name, ImplementationDate,TypeID)
14. PolicyType(TypeID, Type, Description)
15. Aid(AidID, Amount, Beneficiary, Date,TypeID)
16. AidType(TypeID, Type, Description)
17. CropDisease(DiseaseID, Name, Symptoms, Treatment)
18. CropRotation(RotationID, CropSequence, Duration)
19. CropBenefits(BenefitID, RotationID, Benefit)
20. Investment(InvestmentID, Amount, Beneficiary, Date, PurposeID)
21. InvestmentPurpose(PurposeID, Purpose, Description)
22. Weather(WeatherID, Date, Temperature, Precipitation, Conditions)
23. SustainablePractice(PracticeID, Name, Description, ImplementationLevel, BenefitID)

24. PracticeBenefits(BenefitID, PracticeID, Benefit)
25. Farmer\_Crop(FarmerID, CropID)
26. Farmer\_Tech(FarmerID, TechnologyID, TimeofUsage)
27. FarmingTool(ToolID, Name, Usage, Manufacturer, FarmerID,TypeID)
28. ToolType(TypeID, Type, Description)
29. Irrigation(IrrigationID, CoverageArea, Efficiency, InstallationDate, FarmerID,TypeID)
30. IrrigationType(TypeID, Type, Description)
31. Farmer\_Soil(FarmerID, SoilID)
32. Farmer\_Fertilizer(FarmerID, FertilizerID, Quantity)
33. Farmer\_TrainingProgram(FarmerID, ProgramID)
34. Crop\_Fertilizer(CropID, FertilizerID, FertilizerQuantity)
35. Crop\_Disease(CropID, DiseaseID)
36. Farmer\_Aid(FarmerID, AidID)
37. Farmer\_Investment(FarmerID, InvestmentID)
38. Irrigation\_Soil(IrrigationID, SoilID)
39. Crop\_Soil(CropID, SoilID)
40. Crop\_Weather(CropID, WeatherID)
41. Farmer\_SustainablePractice(FarmerID, PracticeID)

## **2. Database Population**

- o INSERT Statements
  - Populate tables with at least 80-100 tuples per table.

1. Farmer(FarmerID, Name, FarmSize, ContactInfo)

```

SELECT * FROM "G2SARM".farmer;

```

farmerid	name	farmsize	contactinfo
1	Mariav Singh	20.50	mariav.singh@example.com
2	Veer Sharma	61.00	veer.sharma@example.com
3	Kumar Gupta	15.50	kumar.gupta@example.com
4	Aamir Patel	30.00	aamir.patel@example.com
5	Karma Verma	74.25	karma.verma@example.com
6	Ronak Joshi	50.00	ronak.joshi@example.com
7	Noel Mehta	30.00	noel.mehta@example.com
8	Raj Rao	11.00	raj.rao@example.com
9	Shiraz Desai	27.00	shiraz.desai@example.com
10	Kausal Reddy	80.00	kaushal.reddy@example.com
11	Aarav Singh	22.50	aarav.singh@example.com
12	Vikram Sharma	65.00	vikram.sharma@example.com
13	Rahul Gupta	10.50	rahul.gupta@example.com
14	Arjun Patel	33.00	arjun.patel@example.com
15	Karan Verma	77.25	karan.verma@example.com
16	Rohit Joshi	55.00	rohit.joshi@example.com
17	Nikhil Mehta	40.00	nikhil.mehta@example.com
18	Rajesh Rao	12.00	rajesh.rao@example.com
19	Siddharth Desai	27.00	siddharth.desai@example.com

Total rows: 95    Query complete 00:00:00.076    Ln 1, Col 31

✓ Successfully run. Total query runtime: 76 msec. 95 rows affected.

```

INSERT INTO Farmer (FarmerID, Name, FarmSize, ContactInfo) VALUES
(11, 'Aarav Singh', 22.50, 'aarav.singh@example.com'),
(12, 'Vikram Sharma', 65.00, 'vikram.sharma@example.com'),
(13, 'Rahul Gupta', 10.50, 'rahul.gupta@example.com'),
(14, 'Arjun Patel', 33.00, 'arjun.patel@example.com'),
(15, 'Karan Verma', 77.25, 'karan.verma@example.com'),
(16, 'Rohit Joshi', 55.00, 'rohit.joshi@example.com'),
(17, 'Nikhil Mehta', 40.00, 'nikhil.mehta@example.com'),
(18, 'Rajesh Rao', 12.00, 'rajesh.rao@example.com'),
(19, 'Siddharth Desai', 27.00, 'siddharth.desai@example.com'),
(20, 'Kunal Reddy', 18.00, 'kunal.reddy@example.com'),
(21, 'Varun Nair', 35.50, 'varun.nair@example.com'),
(22, 'Aniket Iyer', 60.00, 'aniket.iyer@example.com'),
(23, 'Manoj Bhatia', 20.75, 'manoj.bhatia@example.com'),
(24, 'Deepak Kumar', 48.50, 'deepak.kumar@example.com'),
(25, 'Vishal Choudhury', 31.00, 'vishal.choudhury@example.com'),
(26, 'Ajay Singh', 75.00, 'ajay.singh@example.com'),
(27, 'Ravi Sharma', 29.50, 'ravi.sharma@example.com'),
(28, 'Sameer Joshi', 54.00, 'sameer.joshi@example.com'),
(29, 'Suresh Reddy', 14.50, 'suresh.reddy@example.com'),
(30, 'Akash Verma', 41.00, 'akash.verma@example.com'),
(31, 'Sandeep Iyer', 67.00, 'sandeep.iyer@example.com'),
(32, 'Rahul Patil', 38.00, 'rahul.patil@example.com'),
(33, 'Ravi Gupta', 26.75, 'ravi.gupta@example.com'),
(34, 'Mohit Singh', 71.00, 'mohit.singh@example.com'),
(35, 'Kartik Sharma', 39.50, 'kartik.sharma@example.com'),
(36, 'Neeraj Kumar', 33.25, 'neeraj.kumar@example.com'),
(37, 'Gaurav Saini', 49.00, 'gaurav.saini@example.com'),
(38, 'Yash Patil', 63.50, 'yash.patil@example.com'),
(39, 'Nitin Mehta', 46.25, 'nitin.mehta@example.com'),

```

(40, 'Vivek Bhatia', 37.75, 'vivek.bhatia@example.com'),  
(41, 'Praveen Joshi', 52.00, 'praveen.joshi@example.com'),  
(42, 'Rajesh Nair', 19.25, 'rajesh.nair@example.com'),  
(43, 'Raghav Singh', 32.50, 'raghav.singh@example.com'),  
(44, 'Vikram Reddy', 28.00, 'vikram.reddy@example.com'),  
(45, 'Shubham Gupta', 24.00, 'shubham.gupta@example.com'),  
(46, 'Anurag Saini', 34.50, 'anurag.saini@example.com'),  
(47, 'Sahil Patel', 68.00, 'sahil.patel@example.com'),  
(48, 'Kartik Reddy', 42.75, 'kartik.reddy@example.com'),  
(49, 'Rakesh Mehta', 53.50, 'rakesh.mehta@example.com'),  
(50, 'Chirag Singh', 78.25, 'chirag.singh@example.com'),  
(51, 'Rohan Sharma', 15.50, 'rohan.sharma@example.com'),  
(52, 'Siddharth Rao', 61.00, 'siddharth.rao@example.com'),  
(53, 'Anish Verma', 29.75, 'anish.verma@example.com'),  
(54, 'Pratik Joshi', 18.50, 'pratik.joshi@example.com'),  
(55, 'Gaurav Patel', 44.00, 'gaurav.patel@example.com'),  
(56, 'Manish Reddy', 39.25, 'manish.reddy@example.com'),  
(57, 'Niranjan Bhatia', 22.00, 'niranjan.bhatia@example.com'),  
(58, 'Ajit Singh', 34.75, 'ajit.singh@example.com'),  
(59, 'Arvind Kumar', 27.50, 'arvind.kumar@example.com'),  
(60, 'Dinesh Sharma', 66.00, 'dinesh.sharma@example.com'),  
(61, 'Amit Desai', 16.25, 'amit.desai@example.com'),  
(62, 'Vineet Gupta', 48.75, 'vineet.gupta@example.com'),  
(63, 'Keshav Reddy', 55.25, 'keshav.reddy@example.com'),  
(64, 'Suraj Mehta', 39.00, 'suraj.mehta@example.com'),  
(65, 'Devendra Patel', 62.50, 'devendra.patel@example.com'),  
(66, 'Shivam Iyer', 43.50, 'shivam.iyer@example.com'),  
(67, 'Ritvik Singh', 30.25, 'ritvik.singh@example.com'),  
(68, 'Vinay Bhatia', 23.00, 'vinay.bhatia@example.com'),  
(69, 'Tarun Sharma', 57.00, 'tarun.sharma@example.com'),  
(70, 'Raghav Joshi', 36.25, 'raghav.joshi@example.com'),  
(71, 'Aditya Gupta', 45.50, 'aditya.gupta@example.com'),  
(72, 'Kiran Patel', 19.75, 'kiran.patel@example.com'),  
(73, 'Suryansh Reddy', 50.00, 'suryansh.reddy@example.com'),  
(74, 'Dev Bhatia', 29.00, 'dev.bhatia@example.com'),  
(75, 'Raj Kumar', 70.00, 'raj.kumar@example.com'),  
(76, 'Kunal Singh', 11.25, 'kunal.singh@example.com'),  
(77, 'Ishaan Mehta', 77.75, 'ishaan.mehta@example.com'),  
(78, 'Vishal Verma', 26.50, 'vishal.verma@example.com'),  
(79, 'Siddhant Sharma', 38.00, 'siddhant.sharma@example.com'),  
(80, 'Samir Gupta', 55.75, 'samir.gupta@example.com'),  
(81, 'Parth Rao', 41.50, 'parth.rao@example.com'),  
(82, 'Ritesh Reddy', 68.50, 'ritesh.reddy@example.com'),  
(83, 'Shreyas Bhatia', 16.75, 'shreyas.bhatia@example.com'),  
(84, 'Arnav Singh', 49.25, 'arnav.singh@example.com'),  
(85, 'Nitin Gupta', 33.50, 'nitin.gupta@example.com'),  
(86, 'Vikrant Reddy', 58.25, 'vikrant.reddy@example.com'),

```
(87, 'Suryansh Patel', 24.75, 'suryansh.patel@example.com'),
(88, 'Aakash Singh', 60.50, 'akash.singh@example.com'),
(89, 'Bharat Kumar', 14.00, 'bharat.kumar@example.com'),
(90, 'Yogesh Sharma', 35.75, 'yogesh.sharma@example.com'),
(91, 'Hitesh Reddy', 48.00, 'hitesh.reddy@example.com'),
(92, 'Vikram Verma', 40.25, 'vikram.verma@example.com'),
(93, 'Ajay Mehta', 73.50, 'ajay.mehta@example.com'),
(94, 'Rajan Singh', 22.25, 'rajan.singh@example.com'),
(95, 'Vinod Patel', 31.75, 'vinod.patel@example.com');
```

## 2. Crop(CropID, Name, GrowthPeriod, Yield)

The screenshot shows the Object Explorer pane on the left with the 'Tables (41)' node expanded, revealing various tables like 'aid', 'aidtype', 'crop', etc. The main pane displays a query results grid for the 'CROP' table. The table has columns: cropid [PK] integer, name character varying (255), growthperiod integer, yield numeric (10,2), and typeid integer. The data grid shows 19 rows of crop information. A status bar at the bottom indicates 'Successfully run. Total query runtime: 108 msec. 90 rows affected.' and 'Ln 1, Col 28'.

cropid	name	growthperiod	yield	typeid
1	Wheat	120	3.50	1
2	Rice	150	4.00	1
3	Barley	90	3.00	1
4	Oats	100	2.80	1
5	Corn	90	4.20	1
6	Soybean	100	2.75	2
7	Chickpeas	110	1.50	2
8	Lentil	80	1.80	2
9	Pea	70	1.20	2
10	Black Bean	90	1.40	2
11	Carrot	90	1.50	3
12	Tomato	80	2.00	3
13	Lettuce	30	0.80	3
14	Potato	120	4.00	3
15	Onion	120	2.50	3
16	Apple	180	5.00	4
17	Banana	365	8.00	4
18	Orange	365	7.50	4
19	Strawberry	120	2.00	4

INSERT INTO Crop (CropID, Name, GrowthPeriod, Yield) VALUES

```
(1, 'Wheat', 120, 3.50),
(2, 'Rice', 150, 4.00),
(3, 'Corn', 90, 5.00),
(4, 'Barley', 100, 3.20),
(5, 'Oats', 85, 2.80),
(6, 'Soybean', 120, 3.75),
(7, 'Potato', 90, 5.50),
(8, 'Tomato', 75, 4.20),
(9, 'Carrot', 80, 3.10),
(10, 'Onion', 90, 4.50),
(11, 'Garlic', 80, 3.30),
(12, 'Cabbage', 75, 3.80),
(13, 'Spinach', 60, 2.50),
(14, 'Lettuce', 50, 2.00),
(15, 'Bell Pepper', 70, 4.00),
(16, 'Cucumber', 60, 3.20),
(17, 'Pumpkin', 120, 4.10),
(18, 'Zucchini', 50, 2.90),
```

(19, 'Eggplant', 90, 3.50),  
(20, 'Peas', 70, 2.80),  
(21, 'Chickpeas', 90, 3.40),  
(22, 'Lentils', 85, 2.60),  
(23, 'Mung Bean', 60, 3.00),  
(24, 'Canola', 120, 4.80),  
(25, 'Sorghum', 120, 3.60),  
(26, 'Rye', 100, 3.70),  
(27, 'Millet', 90, 2.40),  
(28, 'Flaxseed', 100, 2.70),  
(29, 'Almond', 180, 1.20),  
(30, 'Walnut', 180, 1.50),  
(31, 'Peach', 120, 4.30),  
(32, 'Apple', 150, 3.50),  
(33, 'Orange', 180, 3.80),  
(34, 'Grape', 150, 5.00),  
(35, 'Strawberry', 90, 2.60),  
(36, 'Blueberry', 100, 2.90),  
(37, 'Raspberry', 80, 2.40),  
(38, 'Cranberry', 90, 3.10),  
(39, 'Blackberry', 90, 2.70),  
(40, 'Kiwi', 120, 3.00),  
(41, 'Pineapple', 240, 2.80),  
(42, 'Mango', 150, 3.90),  
(43, 'Papaya', 180, 3.20),  
(44, 'Avocado', 180, 2.70),  
(45, 'Coconut', 360, 1.80),  
(46, 'Date Palm', 300, 1.50),  
(47, 'Guava', 150, 4.00),  
(48, 'Lychee', 120, 3.30),  
(49, 'Dragon Fruit', 150, 2.50),  
(50, 'Passion Fruit', 90, 3.60),  
(51, 'Pomegranate', 150, 3.80),  
(52, 'Taro', 180, 3.00),  
(53, 'Yam', 180, 4.20),  
(54, 'Sweet Potato', 150, 4.10),  
(55, 'Cassava', 180, 5.00),  
(56, 'Chili Pepper', 75, 3.50),  
(57, 'Radish', 40, 2.00),  
(58, 'Turnip', 60, 2.20),  
(59, 'Fennel', 70, 2.80),  
(60, 'Basil', 60, 3.40),  
(61, 'Parsley', 50, 2.10),  
(62, 'Mint', 30, 1.80),  
(63, 'Sage', 60, 3.20),  
(64, 'Rosemary', 70, 3.50),  
(65, 'Thyme', 50, 2.70),

---

```
(66, 'Cilantro', 50, 2.30),
(67, 'Chives', 30, 1.50),
(68, 'Oregano', 40, 2.40),
(69, 'Marjoram', 50, 2.60),
(70, 'Dill', 40, 2.20),
(71, 'Cardamom', 150, 3.80),
(72, 'Coriander', 50, 2.50),
(73, 'Fenugreek', 60, 3.00),
(74, 'Mustard', 70, 2.90),
(75, 'Sesame', 100, 2.70),
(76, 'Cacao', 300, 1.10),
(77, 'Coffee', 240, 1.20),
(78, 'Tea', 180, 1.50),
(79, 'Hops', 180, 2.00),
(80, 'Barley Grass', 60, 1.80),
(81, 'Alfalfa', 70, 2.40),
(82, 'Kale', 70, 3.20),
(83, 'Swiss Chard', 60, 2.90),
(84, 'Broccoli', 70, 3.70),
(85, 'Cauliflower', 70, 3.60),
(86, 'Brussels Sprouts', 90, 2.90),
(87, 'Asparagus', 120, 3.00),
(88, 'Artichoke', 120, 3.50),
(89, 'Leek', 70, 2.70),
(90, 'Parsnip', 80, 2.40);
```

### 3. CropType(TypeID, Type, AdditionalInfo)

typeid	Type	AdditionalInfo
1	Cereal	Includes grains such as wheat, rice, and corn.
2	Legume	Includes beans, peas, lentils, and peanuts.
3	Vegetable	Includes leafy greens, root vegetables, and tubers.
4	Fruit	Includes apples, bananas, berries, and citrus.
5	Kets	Includes culinary herbs like basil, parsley, and cilantro.
6	Oilsseed	Includes crops like canola, sunflower, and soybeans.
7	Tubers	Includes potatoes, sweet potatoes, and yams.
8	PseudoCereal	Includes quinoa, amaranth, and buckwheat.
9	Spice	Includes crops like black pepper, vanilla, and cinnamon.
10	Nut	Includes almonds, walnuts, cashews, and pecans.
11	Berries	Includes strawberries, blueberries, and raspberries.
12	Fungi	Includes mushrooms and truffles.
13	Aquatic Plants	Includes watercress, lotus, and algae.
14	Citrus	Includes oranges, lemons, limes, and grapefruits.
15	Drapes	Includes peaches, cherries, and plums.
16	Melons	Includes watermelons and cantaloupes.
17	Root Crops	Includes carrots, beets, and turnips.
18	Green Manure	Includes cover crops used to improve soil.
19	Fiber	Includes cotton, jute, and hemp.

Successfully run. Total query runtime: 119 msec. 90 rows affected.

```
INSERT INTO CropType (TypeID, Type, AdditionalInfo) VALUES
(1, 'Cereal', 'Includes grains like wheat, rice, and corn, which are staple foods.'),
(2, 'Legume', 'Plants such as beans, lentils, and peas that fix nitrogen in the soil.'),
```

- (3, 'Root Vegetable', 'Vegetables that grow underground, such as carrots and potatoes.'),  
(4, 'Leafy Green', 'Includes spinach, lettuce, and kale, known for their high nutritional value.'),  
(5, 'Fruiting Vegetable', 'Vegetables that bear fruits, such as tomatoes, peppers, and cucumbers.'),  
(6, 'Herbs', 'Plants used for flavoring, garnishing, or medicinal purposes, like basil and mint.'),  
(7, 'Oilseed', 'Plants grown primarily for their oil, such as soybeans and sunflower.'),  
(8, 'Tubers', 'Underground storage organs like sweet potatoes and yams.'),  
(9, 'Nuts', 'Hard-shelled fruits that are typically edible, such as almonds and walnuts.'),  
(10, 'Berries', 'Small, juicy fruits like strawberries, blueberries, and raspberries.'),  
(11, 'Fruits', 'Includes a wide variety of sweet or sour edible parts of flowering plants.'),  
(12, 'Grasses', 'Includes forage grasses used for livestock grazing, such as ryegrass and fescue.'),  
(13, 'Citrus', 'Fruits like oranges, lemons, and limes that thrive in warmer climates.'),  
(14, 'Tropical Fruit', 'Includes fruits such as mangoes, bananas, and papayas from tropical regions.'),  
(15, 'Cruciferous Vegetables', 'Includes broccoli, cauliflower, and cabbage, known for their health benefits.'),  
(16, 'Mushrooms', 'Fungi used in culinary dishes, such as shiitake and portobello.'),  
(17, 'Spices', 'Plant-derived substances used for flavoring and preserving food, like pepper and turmeric.'),  
(18, 'Cover Crops', 'Crops planted to prevent soil erosion and improve soil health, like clover.'),  
(19, 'Forage Crops', 'Plants grown for livestock feed, such as alfalfa and clover.'),  
(20, 'Fiber Crops', 'Plants cultivated for their fiber, like cotton and flax.'),  
(21, 'Sugarcane', 'Tall perennial grass used for sugar production and biofuel.'),  
(22, 'Tobacco', 'Cultivated for its leaves, which are used in tobacco products.'),  
(23, 'Wine Grapes', 'Grapes specifically cultivated for winemaking.'),  
(24, 'Coffee', 'A popular beverage crop cultivated for its beans.'),  
(25, 'Tea', 'Cultivated for its leaves used to make tea.'),  
(26, 'Medicinal Plants', 'Plants grown for their therapeutic properties, like aloe vera.'),  
(27, 'Drought-resistant Crops', 'Crops bred to withstand dry conditions, such as millet and sorghum.'),  
(28, 'Salad Greens', 'Includes various greens like arugula, mixed salad greens, and endive.'),  
(29, 'Pumpkin', 'A large fruit that can be used in both sweet and savory dishes.'),  
(30, 'Peppers', 'Includes bell peppers, chili peppers, and jalapeños, used in many cuisines.'),  
(31, 'Squash', 'Includes varieties like zucchini and butternut squash, often used in cooking.'),  
(32, 'Melons', 'Fruits like watermelon and cantaloupe that are refreshing and hydrating.'),  
(33, 'Fennel', 'An aromatic plant with a thick bulb used in cooking and salads.'),  
(34, 'Asparagus', 'A perennial vegetable known for its tender shoots.'),  
(35, 'Rhubarb', 'A vegetable often used in desserts, known for its tart flavor.'),  
(36, 'Celery', 'A crunchy vegetable commonly used in salads and soups.'),  
(37, 'Artichoke', 'A thistle-like vegetable prized for its edible buds.'),  
(38, 'Radish', 'A root vegetable known for its spicy flavor and crisp texture.'),  
(39, 'Brussels Sprouts', 'Small, leafy green vegetables that grow along a stalk.'),  
(40, 'Kohlrabi', 'A bulbous vegetable that can be eaten raw or cooked.'),  
(41, 'Swiss Chard', 'A leafy green with colorful stems, often used in salads and cooking.'),  
(42, 'Eggplant', 'A purple fruit often used in savory dishes, also known as aubergine.'),  
(43, 'Cabbage', 'A leafy green vegetable that can be eaten raw or cooked.'),  
(44, 'Onion', 'A bulb vegetable used as a base for many dishes.'),  
(45, 'Garlic', 'A pungent bulb used to enhance flavor in cooking.'),  
(46, 'Shallot', 'A mild onion variety often used in gourmet cooking.'),  
(47, 'Leek', 'A vegetable similar to onion, used in soups and stews.'),

(48, 'Carrot', 'A root vegetable known for its sweetness and crunch.'),  
(49, 'Turnip', 'A root vegetable that can be eaten raw or cooked.'),  
(50, 'Beet', 'A root vegetable known for its earthy flavor and color.'),  
(51, 'Chard', 'A leafy green often used in Mediterranean cooking.'),  
(52, 'Chili', 'Spicy fruits that can be used fresh or dried.'),  
(53, 'Zucchini', 'A summer squash that can be eaten raw or cooked.'),  
(54, 'Cauliflower', 'A white flowering vegetable, used in many dishes.'),  
(55, 'Broccoli', 'A nutrient-rich vegetable known for its florets.'),  
(56, 'Sweet Corn', 'A variety of maize that is harvested when immature.'),  
(57, 'Popcorn', 'A special type of maize known for its popping ability.'),  
(58, 'Barley', 'A cereal grain often used for animal feed and brewing.'),  
(59, 'Rye', 'A cereal grain used for flour and animal feed.'),  
(60, 'Oats', 'A cereal grain commonly used for breakfast cereals and animal feed.'),  
(61, 'Millet', 'A small-seeded grass widely cultivated as cereal crops.'),  
(62, 'Sorghum', 'A drought-resistant grain used for food and animal feed.'),  
(63, 'Quinoa', 'A high-protein grain that is gluten-free and nutritious.'),  
(64, 'Teff', 'A tiny grain known for its nutritional content, used in Ethiopian cuisine.'),  
(65, 'Fava Bean', 'A broad bean variety, often used in Mediterranean dishes.'),  
(66, 'Chickpea', 'A legume used in many cuisines, known for its high protein content.'),  
(67, 'Pea', 'A legume consumed fresh or dried.'),  
(68, 'Black Bean', 'A common legume used in various cuisines, rich in protein.'),  
(69, 'Kidney Bean', 'A common bean variety used in soups and chili.'),  
(70, 'Pinto Bean', 'A versatile legume often used in Mexican cuisine.'),  
(71, 'Soybean', 'A legume cultivated for oil, food, and animal feed.'),  
(72, 'Flax', 'Cultivated for its seeds and fiber, known for health benefits.'),  
(73, 'Hemp', 'Cultivated for its fibers, seeds, and oil, used in various products.'),  
(74, 'Cotton', 'Grown for its fibers used in textiles.'),  
(75, 'Safflower', 'A plant cultivated for its seeds used for oil.'),  
(76, 'Sunflower', 'Cultivated for its seeds and oil, known for its bright flowers.'),  
(77, 'Sesame', 'Cultivated for its seeds used for oil and flavoring.'),  
(78, 'Bamboo', 'A fast-growing grass used for construction and crafts.'),  
(79, 'Cacao', 'Cultivated for its beans, used to produce chocolate.'),  
(80, 'Vanilla', 'Cultivated for its aromatic pods, used in flavoring.');

#### 4. Technology(TechnologyID, Name, Purpose)

The screenshot shows the pgAdmin interface with the Object Explorer on the left displaying a tree structure of database objects. The main area shows a query results grid for the 'Technology' table.

technologyid	name	purpose	typeid
1	Drip Irrigation	Efficient water management in agriculture	1
2	Sprinkler System	Uniform distribution of water to crops	1
3	Soil Sensors	Monitoring soil moisture and nutrient levels	2
4	Weather Forecasting Tools	Predicting weather conditions for better planning	3
5	Precision Farming Software	Optimizing field variability	4
6	Drones for Crop Monitoring	Aerial surveillance of crop health	3
7	Automated Irrigation Systems	Automating irrigation based on weather and soil conditions	1
8	Crop Rotation Software	Planning crop rotation to enhance soil health	7
9	Pest Control Drones	Targeted pest management using drones	5
10	Soil Testing Kits	Analyzing soil properties for better crop choices	2
11	Greenhouse Technology	Controlling climate for optimal plant growth	6
12	Hydroponic Systems	Growing plants without soil	6
13	Aquaponics Systems	Combining aquaculture with hydroponics	6
14	Plant Disease Diagnosis Apps	Identifying diseases through image recognition	5
15	Mobile Farming Apps	Managing farming tasks and schedules on mobile devices	4
16	Crop Yield Prediction Models	Forecasting crop yields based on various factors	4
17	Automated Harvesters	Mechanizing the harvesting process	9
18	Robotic Weeders	Weeding crops using robotics	3
19	Nutrient Management Software	Managing nutrient application for crops	

Total rows: 90 of 90    Query complete 00:00:00.070    Successfully run. Total query runtime: 70 msec. 90 rows affected.    Ln 1, Col 34

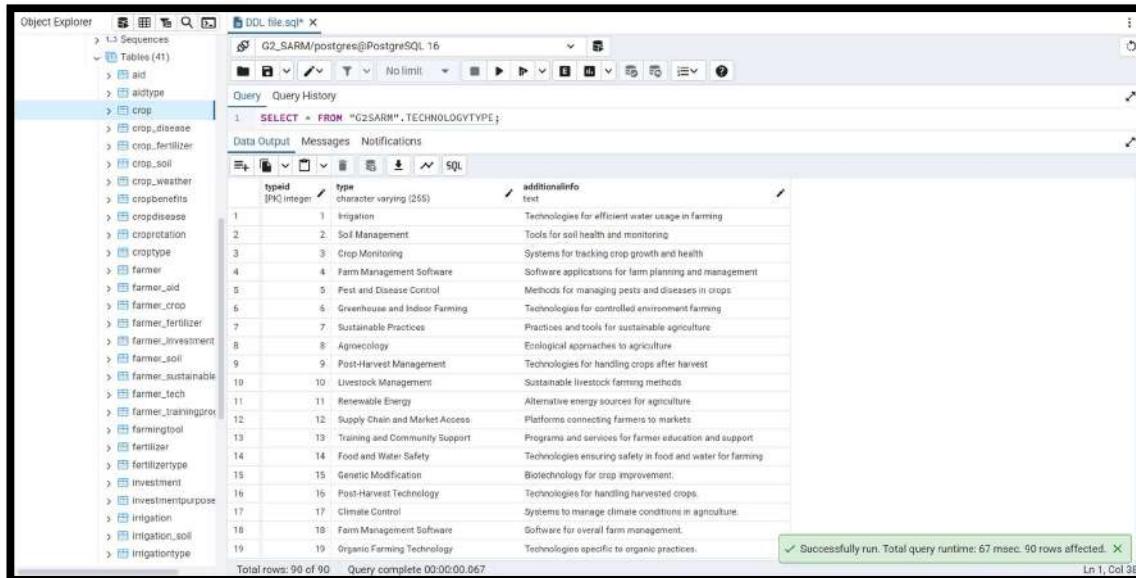
INSERT INTO Technology (TechnologyID, Name, Purpose) VALUES

- (1, 'Drip Irrigation', 'Efficient water management in agriculture'),
- (2, 'Sprinkler System', 'Uniform distribution of water to crops'),
- (3, 'Soil Sensors', 'Monitoring soil moisture and nutrient levels'),
- (4, 'Weather Forecasting Tools', 'Predicting weather conditions for better planning'),
- (5, 'Precision Farming Software', 'Optimizing field variability'),
- (6, 'Drones for Crop Monitoring', 'Aerial surveillance of crop health'),
- (7, 'Automated Irrigation Systems', 'Automating irrigation based on weather and soil conditions'),
- (8, 'Crop Rotation Software', 'Planning crop rotation to enhance soil health'),
- (9, 'Pest Control Drones', 'Targeted pest management using drones'),
- (10, 'Soil Testing Kits', 'Analyzing soil properties for better crop choices'),
- (11, 'Greenhouse Technology', 'Controlling climate for optimal plant growth'),
- (12, 'Hydroponic Systems', 'Growing plants without soil'),
- (13, 'Aquaponics Systems', 'Combining aquaculture with hydroponics'),
- (14, 'Plant Disease Diagnosis Apps', 'Identifying diseases through image recognition'),
- (15, 'Mobile Farming Apps', 'Managing farming tasks and schedules on mobile devices'),
- (16, 'Crop Yield Prediction Models', 'Forecasting crop yields based on various factors'),
- (17, 'Automated Harvesters', 'Mechanizing the harvesting process'),
- (18, 'Robotic Weeders', 'Weeding crops using robotics'),
- (19, 'Nutrient Management Software', 'Managing nutrient application for crops'),
- (20, 'Biopesticides', 'Natural pest control methods'),
- (21, 'Organic Fertilizers', 'Sustainable alternatives to chemical fertilizers'),
- (22, 'Cover Cropping Techniques', 'Improving soil health with cover crops'),
- (23, 'Companion Planting Guides', 'Optimizing plant growth through strategic planting'),
- (24, 'Soil Conservation Techniques', 'Preventing soil erosion and degradation'),
- (25, 'Sustainable Pest Management', 'Balancing pests and benefits in agriculture'),
- (26, 'Mobile Soil Testing Services', 'On-site soil analysis using mobile labs'),
- (27, 'Climate Smart Agriculture Tools', 'Adapting to climate change in farming'),
- (28, 'Vertical Farming Technology', 'Maximizing space for growing crops vertically'),
- (29, 'Organic Farming Techniques', 'Practices that promote biodiversity and soil health'),

- (30, 'Fertigation Systems', 'Combining irrigation with fertilizer application'),
- (31, 'Integrated Pest Management (IPM)', 'Combining biological, cultural, and chemical practices'),
- (32, 'Traceability Systems', 'Tracking crop production and supply chain'),
- (33, 'Biodynamic Farming Techniques', 'Holistic approach to farming'),
- (34, 'Seed Treatment Technologies', 'Protecting seeds before planting'),
- (35, 'Mulching Techniques', 'Reducing soil moisture loss and controlling weeds'),
- (36, 'Crop Breeding Technologies', 'Developing new crop varieties for better yields'),
- (37, 'Data Analytics for Agriculture', 'Using data to improve farming decisions'),
- (38, 'Farm Management Software', 'Streamlining farming operations'),
- (39, 'Irrigation Scheduling Software', 'Planning irrigation based on plant needs'),
- (40, 'Farming Simulators', 'Training farmers in a virtual environment'),
- (41, 'Plant Growth Regulators', 'Influencing plant growth and development'),
- (42, 'Farming Networks', 'Connecting farmers for knowledge sharing'),
- (43, 'Market Access Platforms', 'Linking farmers to buyers directly'),
- (44, 'Community Supported Agriculture (CSA)', 'Connecting farmers with consumers'),
- (45, 'Solar-Powered Irrigation', 'Using renewable energy for irrigation'),
- (46, 'Composting Technologies', 'Turning waste into nutrient-rich soil amendments'),
- (47, 'Green Manure Practices', 'Using cover crops to enrich soil'),
- (48, 'Water Conservation Techniques', 'Minimizing water use in agriculture'),
- (49, 'Post-Harvest Management Tools', 'Improving storage and handling of crops'),
- (50, 'Food Safety Technologies', 'Ensuring food safety in the supply chain'),
- (51, 'Agroforestry Practices', 'Integrating trees into agricultural systems'),
- (52, 'Sustainable Livestock Management', 'Practices for responsible animal farming'),
- (53, 'Genetic Modification Techniques', 'Altering crops for desired traits'),
- (54, 'Aquaculture Technologies', 'Innovative practices in fish farming'),
- (55, 'Community Training Programs', 'Educating farmers on best practices'),
- (56, 'Extension Services', 'Providing research-based assistance to farmers'),
- (57, 'Agroecological Approaches', 'Sustainable farming practices based on ecology'),
- (58, 'Remote Sensing Technologies', 'Using satellite data for crop monitoring'),
- (59, 'Bioengineering Methods', 'Using biology for agricultural advancements'),
- (60, 'Natural Resource Management', 'Sustainable use of natural resources'),
- (61, 'Farm to Fork Initiatives', 'Promoting local food systems'),
- (62, 'Food Waste Reduction Technologies', 'Minimizing food loss at various stages'),
- (63, 'Nutrient Recycling Techniques', 'Recovering nutrients from waste'),
- (64, 'Carbon Farming Practices', 'Sequestering carbon in agricultural systems'),
- (65, 'Cultural Practices', 'Traditional farming techniques passed down through generations'),
- (66, 'Farm Diversification Strategies', 'Increasing resilience through varied crops'),
- (67, 'Smallholder Support Programs', 'Empowering small-scale farmers'),
- (68, 'Youth Engagement in Agriculture', 'Involving youth in farming initiatives'),
- (69, 'Women Empowerment in Farming', 'Supporting women in agriculture'),
- (70, 'Agricultural Policy Advocacy', 'Promoting policies for sustainable agriculture'),
- (71, 'Agricultural Cooperatives', 'Collective farming efforts for better market access'),
- (72, 'Digital Platforms for Farmers', 'Online tools for farm management'),
- (73, 'Health and Safety Standards', 'Ensuring safe farming practices'),
- (74, 'Food Sovereignty Movements', 'Promoting local control over food systems'),
- (75, 'Sustainable Forestry Practices', 'Responsible management of forest resources'),
- (76, 'Indigenous Farming Practices', 'Traditional knowledge in agriculture'),

(77, 'Regenerative Agriculture Techniques', 'Restoring and enhancing ecosystem health'),  
 (78, 'Climate Resilient Crops', 'Developing crops that withstand climate change'),  
 (79, 'Alternative Energy in Farming', 'Using renewable energy sources'),  
 (80, 'Local Food Systems', 'Strengthening regional food networks'),  
 (81, 'Integrated Crop-Livestock Systems', 'Combining crops and livestock for efficiency'),  
 (82, 'Agro-tourism', 'Combining agriculture and tourism for income'),  
 (83, 'Food Processing Technologies', 'Enhancing the value of agricultural products'),  
 (84, 'Rural Development Programs', 'Supporting rural communities through agriculture'),  
 (85, 'Water Quality Management', 'Ensuring safe water for agricultural use'),  
 (86, 'Soil Health Initiatives', 'Promoting practices that improve soil quality'),  
 (87, 'Pollinator Habitat Restoration', 'Creating environments for pollinators'),  
 (88, 'Sustainable Packaging Solutions', 'Reducing waste in food packaging'),  
 (89, 'Fair Trade Practices', 'Ensuring fair compensation for farmers'),  
 (90, 'Agricultural Research Institutions', 'Promoting scientific research in agriculture');

## 5. TechnologyType(TypeID, Type, AdditionalInfo)



The screenshot shows the pgAdmin interface with the Object Explorer on the left and a query editor on the right. The query editor displays a SELECT statement from the 'TechnologyType' table:

```
SELECT * FROM "G2_SARM", TECHNOLOGYTYPE;
```

The results show 19 rows of data:

typeid	type	additionalinfo
1	Irrigation	Technologies for efficient water usage in farming
2	Soil Management	Tools for soil health and monitoring
3	Crop Monitoring	Systems for tracking crop growth and health
4	Farm Management Software	Software applications for farm planning and management
5	Pest and Disease Control	Methods for managing pests and diseases in crops
6	Greenhouse and Indoor Farming	Technologies for controlled environment farming
7	Sustainable Practices	Practices and tools for sustainable agriculture
8	Agronomy	Ecological approaches to agriculture
9	Post-Harvest Management	Technologies for handling crops after harvest
10	Livestock Management	Sustainable livestock farming methods
11	Renewable Energy	Alternative energy sources for agriculture
12	Supply Chain and Market Access	Platforms connecting farmers to markets
13	Training and Community Support	Programs and services for farmer education and support
14	Food and Water Safety	Technologies ensuring safety in food and water for farming
15	Genetic Modification	Biotechnology for crop improvement
16	Post-Harvest Technology	Technologies for handling harvested crops
17	Climate Control	Systems to manage climate conditions in agriculture
18	Farm Management Software	Software for overall farm management
19	Organic Farming Technology	Technologies specific to organic practices

Below the table, a message indicates the query was successfully run with a runtime of 67 msec and 90 rows affected.

## INSERT INTO TechnologyType (TypeID, Type, AdditionalInfo) VALUES

(1, 'Precision Agriculture', 'Use of technology to monitor and manage field variability.'),  
 (2, 'Drones', 'Unmanned aerial vehicles for crop monitoring and surveying.'),  
 (3, 'Soil Sensors', 'Devices used to measure soil moisture and nutrient levels.'),  
 (4, 'Weather Stations', 'Automated systems for real-time weather data collection.'),  
 (5, 'Irrigation Management Systems', 'Technologies to optimize water usage in agriculture.'),  
 (6, 'Farm Management Software', 'Applications for planning, monitoring, and analyzing all activities on a farm.'),  
 (7, 'Geographic Information Systems (GIS)', 'Tools for mapping and analyzing spatial data.'),  
 (8, 'Yield Mapping Technology', 'Used to analyze crop yield data for better decision-making.'),  
 (9, 'Remote Sensing', 'Techniques to gather information about crops from a distance.'),  
 (10, 'Biotechnology', 'Genetic modification and other biotechnological advancements in crop production.'),  
 (11, 'Integrated Pest Management (IPM)', 'Sustainable pest control strategies combining different management approaches.'),

- (12, 'Artificial Intelligence (AI)', 'Use of algorithms and machine learning in farming operations.'),  
(13, 'Big Data Analytics', 'Analyzing large data sets for informed agricultural decisions.'),  
(14, 'Blockchain Technology', 'Used for tracking the supply chain of agricultural products.'),  
(15, 'Mobile Applications', 'Apps for farmers to access information and manage operations.'),  
(16, 'Smart Irrigation', 'Automated systems that adjust water supply based on plant needs.'),  
(17, 'Hydroponics', 'Growing plants without soil, using mineral nutrient solutions.'),  
(18, 'Aeroponics', 'Growing plants in an air or mist environment without soil.'),  
(19, 'Vertical Farming', 'Practice of growing crops in stacked layers to optimize space.'),  
(20, 'Aquaponics', 'Combination of aquaculture and hydroponics in a symbiotic environment.'),  
(21, 'Crop Rotation Software', 'Tools for planning crop rotation schedules.'),  
(22, 'Fertility Management Tools', 'Technologies to optimize soil fertility and nutrient applications.'),  
(23, 'Smart Greenhouses', 'Greenhouses equipped with automated systems for climate control.'),  
(24, 'Livestock Monitoring Systems', 'Technology for tracking and managing livestock health and behavior.'),  
(25, 'Feed Management Software', 'Applications for optimizing animal feed usage and nutrition.'),  
(26, 'Supply Chain Management Tools', 'Technologies for improving the efficiency of agricultural supply chains.'),  
(27, 'Robotics in Agriculture', 'Use of robots for tasks like planting, harvesting, and weeding.'),  
(28, 'Climate Smart Technologies', 'Tools designed to improve resilience to climate change in agriculture.'),  
(29, 'Nutrient Management Software', 'Tools for managing fertilizer applications and soil health.'),  
(30, 'Remote Weather Sensors', 'Sensors used to collect weather data from remote locations.'),  
(31, 'Data Visualization Tools', 'Software for presenting agricultural data in graphical formats.'),  
(32, 'Sustainable Farming Technologies', 'Innovations aimed at promoting sustainable agricultural practices.'),  
(33, 'Pesticide Application Drones', 'Drones specifically designed for the targeted application of pesticides.'),  
(34, 'Crop Disease Detection Systems', 'Technologies for early identification of crop diseases.'),  
(35, 'Smart Farming Equipment', 'Machinery equipped with sensors and connectivity features.'),  
(36, 'Mobile Market Access Platforms', 'Apps connecting farmers directly to buyers and markets.'),  
(37, 'Genomic Tools', 'Technologies used for plant breeding and improvement.'),  
(38, 'Soil Health Monitoring Tools', 'Technologies to assess soil health and its properties.'),  
(39, 'Integrated Water Management Systems', 'Technologies for comprehensive water resource management.'),  
(40, 'Thermal Imaging Cameras', 'Used for assessing crop health based on temperature variations.'),  
(41, 'Planting Automation Technologies', 'Mechanisms that automate the planting process.'),  
(42, 'Robotic Harvesters', 'Automated machines designed to harvest crops.'),  
(43, 'Aquaculture Technologies', 'Innovations in farming fish and other aquatic organisms.'),  
(44, 'Blockchain in Supply Chain', 'Using blockchain to enhance transparency in the food supply chain.'),  
(45, 'Farm Safety Technologies', 'Tools aimed at improving safety in agricultural operations.'),  
(46, 'Carbon Footprint Analysis Tools', 'Software for assessing the environmental impact of farming practices.'),  
(47, 'Crop Breeding Software', 'Tools for enhancing crop varieties through breeding techniques.'),  
(48, 'Smart Fertilizers', 'Fertilizers that release nutrients at controlled rates.'),  
(49, 'Digital Marketplaces', 'Online platforms for buying and selling agricultural products.'),  
(50, 'Cold Chain Management', 'Technologies for maintaining the quality of perishable products.'),

- (51, 'Sustainable Pest Control Technologies', 'Innovations aimed at reducing pesticide use.'),  
(52, 'Farming Simulation Software', 'Programs for simulating agricultural scenarios and outcomes.'),  
(53, 'Vertical Farming Technologies', 'Tools designed for urban agriculture and space optimization.'),  
(54, 'Soil Remediation Technologies', 'Innovations for improving soil quality and health.'),  
(55, 'Organic Farming Technologies', 'Tools and practices that support organic agriculture.'),  
(56, 'Genetic Resistance Technologies', 'Methods to develop crops resistant to pests and diseases.'),  
(57, 'Community Supported Agriculture (CSA) Platforms', 'Models for connecting local farmers with consumers.'),  
(58, 'Data Management Systems', 'Tools for managing agricultural data effectively.'),  
(59, 'Automated Weeding Technologies', 'Systems that remove weeds without harming crops.'),  
(60, 'Drone Surveillance Systems', 'Using drones for surveillance and monitoring of agricultural lands.'),  
(61, 'Precision Livestock Farming', 'Technologies aimed at monitoring and managing livestock production.'),  
(62, 'Crop Simulation Models', 'Models used to predict crop performance under different conditions.'),  
(63, 'Sustainable Irrigation Technologies', 'Innovations to conserve water in irrigation practices.'),  
(64, 'Water Quality Monitoring Tools', 'Technologies for assessing the quality of water used in farming.'),  
(65, 'Renewable Energy in Agriculture', 'Technologies utilizing renewable energy sources for farming.'),  
(66, 'E-commerce for Agricultural Products', 'Online platforms for selling farm produce directly to consumers.'),  
(67, 'Local Food Networks', 'Systems connecting local farmers to their communities.'),  
(68, 'Digital Field Mapping', 'Technologies for creating digital maps of agricultural fields.'),  
(69, 'Insect Monitoring Systems', 'Technologies for monitoring pest populations in crops.'),  
(70, 'Biosecurity Measures', 'Technologies and practices aimed at preventing the introduction of diseases.'),  
(71, 'Nutrient Recycling Technologies', 'Methods for recycling nutrients from agricultural waste.'),  
(72, 'Robotic Soil Tilling', 'Automated machines for soil preparation and tilling.'),  
(73, 'Weather Forecasting Tools', 'Technologies for predicting weather conditions impacting agriculture.'),  
(74, 'Farm Equipment Monitoring Systems', 'Technologies to monitor the condition and usage of farm equipment.'),  
(75, 'Climate Change Mitigation Technologies', 'Tools aimed at reducing agriculture's carbon footprint.'),  
(76, 'Value-Added Processing Technologies', 'Innovations to process raw agricultural products into finished goods.'),  
(77, 'Rural Broadband Solutions', 'Technologies improving internet access for rural farmers.'),  
(78, 'Supply Chain Analytics', 'Tools for analyzing agricultural supply chain efficiency.'),  
(79, 'Post-Harvest Management Technologies', 'Technologies focused on the handling of crops after harvest.'),  
(80, 'Drought Resilient Crop Technologies', 'Methods to breed or cultivate crops that can withstand drought.'),  
(81, 'Food Safety Technologies', 'Innovations ensuring the safety of food products.'),  
(82, 'Innovative Fertilizer Application Methods', 'Techniques that enhance fertilizer efficiency.'),  
(83, 'Participatory Breeding Platforms', 'Tools that engage farmers in the crop breeding process.'),  
(84, 'Sustainable Certification Programs', 'Certifications that promote sustainable farming practices.'),  
(85, 'Agroecology Practices', 'Sustainable farming methods integrating ecological principles.');

## 6. Soil(SoilID, NutrientContent, pHLevel, MoistureLevel)

The screenshot shows the pgAdmin 4 interface. In the Object Explorer, the 'Tables (41)' section is expanded, showing various tables such as 'aid', 'autotype', 'crop', 'crop\_disease', 'crop\_fertilizer', 'crop\_soil', 'crop\_weather', 'cropbenefits', 'cropdisease', 'cropertilizer', 'cropstype', 'farmer', 'farmer\_aid', 'farmer\_crop', 'farmer\_fertilizer', 'farmer\_investment', 'farmer\_soil', 'farmer\_sustainable', 'farmer\_tech', 'farmer\_trainingprior', 'farmingtool', 'fertilizer', 'fertilizertype', 'investment', 'investmentpurpose', 'irrigation', 'irrigation\_soil', and 'irrigationtype'. The 'SOIL' table is selected in the query editor.

The query editor contains the following SQL code:

```
1  SELECT * FROM "G2SARM".SOIL;
```

The results grid shows the following data:

soilid	nutrientcontent	pHlevel	moisturelevel	typeid
1	High Nitrogen	6.50	25.00	1
2	Low Phosphorus	7.00	30.00	2
3	Balanced Nutrients	6.80	22.50	3
4	High Potassium	5.80	20.00	4
5	Organic Matter Rich	6.30	45.00	5
6	Sandy Soil	7.20	10.00	6
7	Clayey Soil	5.50	35.00	7
8	Loamy Soil	6.40	28.00	8
9	Peaty Soil	5.90	50.00	9
10	Saline Soil	8.00	5.00	10
11	Acidic Soil	4.80	60.00	11
12	Alkaline Soil	8.20	15.00	12
13	Nutrient Deficient	6.00	32.00	13
14	Fertile Soil	6.70	40.00	14
15	Silty Soil	6.90	35.00	15
16	Heavy Clay	5.70	20.00	7
17	Light Sand	7.50	12.00	6
18	Moderately Acidic	5.60	55.00	11
19	Highly Saline	9.00	2.00	10

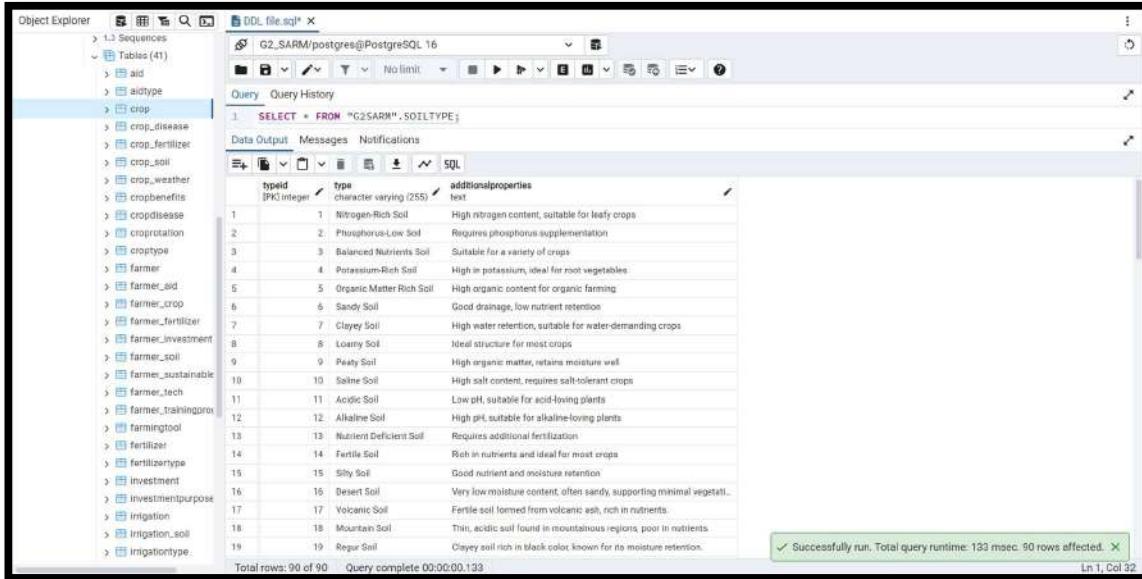
Message bar: Successfully run. Total query runtime: 66 msec. 90 rows affected. Lr 1, Col 2g

```
INSERT INTO Soil (SoilID, NutrientContent, pHLevel, MoistureLevel) VALUES
(1, 'High Nitrogen', 6.50, 25.00),
(2, 'Low Phosphorus', 7.00, 30.00),
(3, 'Balanced Nutrients', 6.80, 22.50),
(4, 'High Potassium', 5.80, 20.00),
(5, 'Organic Matter Rich', 6.30, 45.00),
(6, 'Sandy Soil', 7.20, 10.00),
(7, 'Clayey Soil', 5.50, 35.00),
(8, 'Loamy Soil', 6.40, 28.00),
(9, 'Peaty Soil', 5.90, 50.00),
(10, 'Saline Soil', 8.00, 5.00),
(11, 'Acidic Soil', 4.80, 60.00),
(12, 'Alkaline Soil', 8.20, 15.00),
(13, 'Nutrient Deficient', 6.00, 32.00),
(14, 'Fertile Soil', 6.70, 40.00),
(15, 'Silty Soil', 6.90, 35.00),
(16, 'Heavy Clay', 5.70, 20.00),
(17, 'Light Sand', 7.50, 12.00),
(18, 'Moderately Acidic', 5.60, 55.00),
(19, 'Highly Saline', 9.00, 2.00),
(20, 'Humic Soil', 6.10, 45.00),
(21, 'Calcareous Soil', 7.10, 18.00),
(22, 'Nutrient-Rich Clay', 6.30, 30.00),
(23, 'Peat Soil', 5.50, 70.00),
(24, 'Rocky Soil', 6.00, 8.00),
(25, 'Very Moist Soil', 5.90, 95.00),
(26, 'Low Organic Matter', 7.00, 20.00),
(27, 'Fertile Sandy Loam', 6.80, 25.00),
(28, 'Moderate Moisture', 6.60, 50.00),
```

(29, 'Poor Drainage', 5.80, 80.00),  
(30, 'Well-Drained', 6.70, 15.00),  
(31, 'Eroded Soil', 6.20, 30.00),  
(32, 'Nutrient-Rich Loam', 6.50, 35.00),  
(33, 'Wetland Soil', 6.40, 90.00),  
(34, 'Desert Soil', 8.50, 3.00),  
(35, 'Floodplain Soil', 6.10, 75.00),  
(36, 'Silt Loam', 6.90, 25.00),  
(37, 'Clay Loam', 5.60, 40.00),  
(38, 'Dry Soil', 7.20, 10.00),  
(39, 'Loamy Sand', 6.70, 20.00),  
(40, 'Organic Soil', 6.80, 55.00),  
(41, 'Nutrient Poor', 5.50, 30.00),  
(42, 'Soil with Heavy Metals', 6.10, 15.00),  
(43, 'Hydric Soil', 5.90, 80.00),  
(44, 'Upland Soil', 6.60, 20.00),  
(45, 'Bottomland Soil', 6.30, 40.00),  
(46, 'Volcanic Soil', 5.80, 35.00),  
(47, 'Mountain Soil', 6.70, 30.00),  
(48, 'Tropical Soil', 6.50, 45.00),  
(49, 'Temperate Soil', 6.80, 25.00),  
(50, 'Cold Climate Soil', 5.90, 20.00),  
(51, 'Salty Soil', 8.10, 10.00),  
(52, 'Nutrient-Rich Peat', 6.40, 60.00),  
(53, 'Industrial Soil', 5.70, 15.00),  
(54, 'Brick Soil', 6.00, 20.00),  
(55, 'Cliff Soil', 5.90, 30.00),  
(56, 'Pine Forest Soil', 6.30, 45.00),  
(57, 'Scrub Soil', 6.20, 25.00),  
(58, 'Wet Soil', 5.80, 80.00),  
(59, 'Silt Soil', 6.40, 30.00),  
(60, 'Surface Soil', 6.60, 15.00),  
(61, 'Subsoil', 5.70, 20.00),  
(62, 'High Organic Content', 6.90, 45.00),  
(63, 'Low Organic Content', 7.10, 20.00),  
(64, 'Arable Soil', 6.50, 30.00),  
(65, 'Forest Floor Soil', 6.80, 60.00),  
(66, 'Cultivated Soil', 5.90, 25.00),  
(67, 'Compacted Soil', 6.10, 20.00),  
(68, 'Nutrient-Rich Sand', 6.70, 30.00),  
(69, 'Underdeveloped Soil', 5.60, 10.00),  
(70, 'Reclaimed Soil', 6.30, 35.00),  
(71, 'Restored Soil', 6.40, 45.00),  
(72, 'Native Soil', 6.80, 25.00),  
(73, 'Biochar Soil', 6.60, 30.00),  
(74, 'Urban Soil', 5.80, 20.00),  
(75, 'Silt Clay', 6.50, 15.00),

(76, 'Dirt', 5.40, 5.00),  
 (77, 'Polluted Soil', 4.90, 10.00),  
 (78, 'Waste Land Soil', 5.30, 8.00),  
 (79, 'Plantation Soil', 6.20, 40.00),  
 (80, 'Alpine Soil', 6.90, 50.00),  
 (81, 'Clayey Silt', 5.80, 60.00),  
 (82, 'Muddy Soil', 6.10, 70.00),  
 (83, 'Acid Sulfate Soil', 5.00, 20.00),  
 (84, 'Fertile Alluvial Soil', 6.30, 40.00),  
 (85, 'Lowland Soil', 5.60, 30.00);

## 7. SoilType(TypeID, Type, AdditionalProperties)



The screenshot shows the pgAdmin interface with the Object Explorer on the left and a SQL editor on the right.

**Object Explorer:** Shows the database schema with tables like aid, aitype, crop, crop\_disease, crop\_fertilizer, crop\_soil, crop\_weather, cropbenefits, cropdisease, croprotation, cropstype, farmer, farmer\_sid, farmer\_crop, farmer\_fertilizer, farmer\_investment, farmer\_soil, farmer\_sustainable, farmer\_tech, farmer\_trainingprox, farmingtool, fertilizer, fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype.

**SQL Editor:**

```

CREATE TABLE "SOILTYPE"
(
    typeid integer NOT NULL,
    type character varying(255),
    additionalproperties text
)

```

**Data Output:** Displays the inserted data:

typeid	type	additionalproperties
1	Nitrogen-Rich Soil	High nitrogen content, suitable for leafy crops
2	Phosphorus-Low Soil	Requires phosphorus supplementation
3	Balanced Nutrients Soil	Suitable for a variety of crops
4	Potassium-Rich Soil	High in potassium, ideal for root vegetables
5	Organic Matter Rich Soil	High organic content for organic farming
6	Sandy Soil	Good drainage, low nutrient retention
7	Clayey Soil	High water retention, suitable for water-demanding crops
8	Loamy Soil	Ideal structure for most crops
9	Peaty Soil	High organic matter, retains moisture well
10	Saline Soil	High salt content, requires salt-tolerant crops
11	Acidic Soil	Low pH, suitable for acid-loving plants
12	Alkaline Soil	High pH, suitable for alkaline-loving plants
13	Nutrient Deficient Soil	Requires additional fertilization
14	Fertile Soil	Rich in nutrients and ideal for most crops
15	Silty Soil	Good nutrient and moisture retention
16	Desert Soil	Very low moisture content, often sandy, supporting minimal vegetation
17	Volcanic Soil	Fertile soil formed from volcanic ash, rich in nutrients
18	Mountain Soil	Thin, acidic soil found in mountainous regions, poor in nutrients
19	Peat Soil	Clayey soil rich in black color, known for its moisture retention

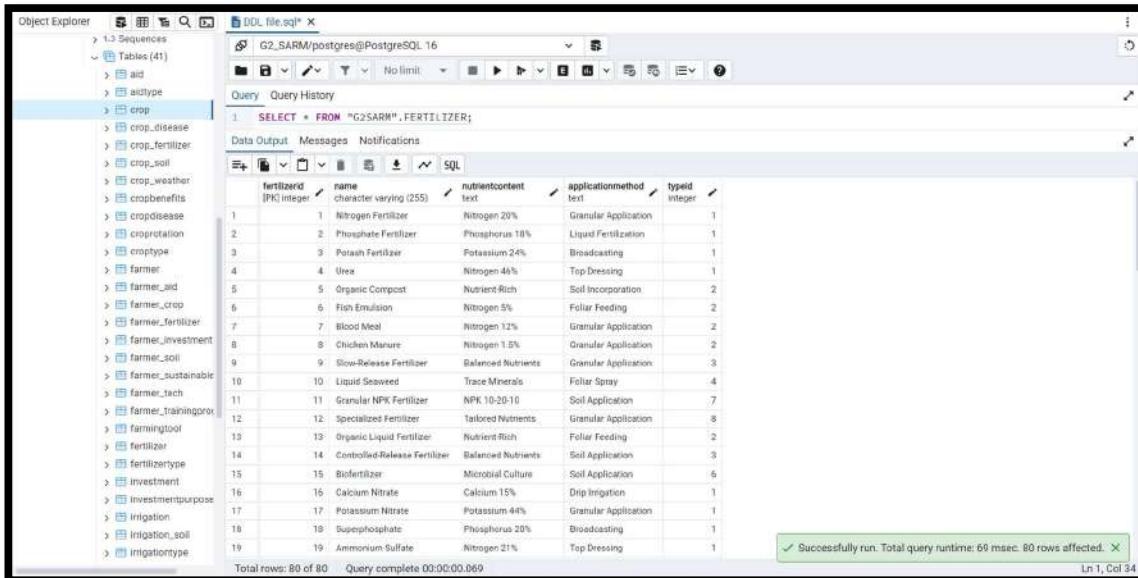
Message bar: Successfully run. Total query runtime: 133 msec. 90 rows affected.

INSERT INTO SoilType (TypeID, Type, AdditionalProperties) VALUES  
 (1, 'Clay', 'High plasticity, retains moisture, poor drainage.'),  
 (2, 'Sandy', 'Well-drained, low nutrient content, warms quickly.'),  
 (3, 'Silty', 'Rich in nutrients, good moisture retention, prone to erosion.'),  
 (4, 'Loamy', 'Balanced mixture of sand, silt, and clay, ideal for agriculture.'),  
 (5, 'Peaty', 'High organic matter, retains moisture, acidic pH.'),  
 (6, 'Saline', 'High salt content, can be toxic to plants, poor fertility.'),  
 (7, 'Chalky', 'Alkaline, drains well, high calcium carbonate content.'),  
 (8, 'Silty Clay', 'Good fertility, retains moisture, can become compacted.'),  
 (9, 'Clay Loam', 'Combines clay and loam properties, good for crops.'),  
 (10, 'Sandy Loam', 'Well-drained, good nutrient-holding capacity.'),  
 (11, 'Rocky', 'Contains large rocks, poor for agriculture, but can support certain crops.'),  
 (12, 'Muck', 'High organic content, dark color, excellent fertility.'),  
 (13, 'Brown Earth', 'Rich in organic matter, supports diverse vegetation.'),  
 (14, 'Podzol', 'Acidic, poor nutrient retention, typically found in coniferous forests.'),  
 (15, 'Laterite', 'High in iron and aluminum, hardens when dry, found in tropical areas.'),  
 (16, 'Vertisol', 'High clay content, expands and contracts with moisture, can be fertile.'),  
 (17, 'Andosol', 'Volcanic soil, rich in minerals, very fertile.'),

- (18, 'Regosol', 'Young soil, low profile development, variable texture.'),  
(19, 'Gleysol', 'Waterlogged soils, poor drainage, often found in wetlands.'),  
(20, 'Histosol', 'Organic soils, formed in wetlands, rich in decomposed material.'),  
(21, 'Arenosol', 'Sandy soils, low fertility, easily eroded.'),  
(22, 'Calcisol', 'High calcium content, often found in arid regions.'),  
(23, 'Ferralsol', 'Highly weathered soils, rich in iron oxides, low fertility.'),  
(24, 'Cambisol', 'Well-developed soils, variable texture, supports agriculture.'),  
(25, 'Nitisol', 'Deep, fertile soils, good for crops, often found in tropical areas.'),  
(26, 'Phaeozem', 'Dark, fertile soils, rich in organic matter, great for farming.'),  
(27, 'Podzolic', 'Leached soils, typically acidic, found under coniferous forests.'),  
(28, 'Chroma', 'Variety of color in soil layers, indicating mineral presence.'),  
(29, 'Oxisol', 'Highly weathered, low nutrient content, but high in minerals.'),  
(30, 'Gelisol', 'Permafrost present, moisture retained, often found in cold regions.'),  
(31, 'Alfisols', 'Moderately leached soils, good fertility, found in temperate zones.'),  
(32, 'Ultisols', 'Highly weathered, acidic, low nutrient content, common in humid areas.'),  
(33, 'Histosolic', 'Organic-rich soils, high moisture retention, found in wetlands.'),  
(34, 'Solonetz', 'High clay content, sodium-rich, often found in arid regions.'),  
(35, 'Aridisols', 'Soils found in arid regions, low organic matter, often saline.'),  
(36, 'Biodiverse', 'Soils supporting diverse flora and fauna, high organic content.'),  
(37, 'Hydromorphic', 'Soils affected by waterlogging, often poor for agriculture.'),  
(38, 'Terra Rossa', 'Red clayey soil, found in Mediterranean regions, good for olives.'),  
(39, 'Colloid', 'Soils with high surface area, great for retaining nutrients.'),  
(40, 'Cryosol', 'Cold region soils, contain permafrost, moisture retention.'),  
(41, 'Nitrogen-rich', 'Soils high in nitrogen, promote plant growth, good for crops.'),  
(42, 'Sulphur-rich', 'High in sulfur content, important for specific crops.'),  
(43, 'Organic', 'High organic matter, excellent for retaining moisture and nutrients.'),  
(44, 'Alkaline', 'Soils with high pH, can affect nutrient availability.'),  
(45, 'Acidic', 'Soils with low pH, may limit certain crops growth.'),  
(46, 'Decomposed', 'Soils rich in decomposed plant matter, high fertility.'),  
(47, 'Sandstone', 'Soils formed from sandstone, typically well-drained.'),  
(48, 'Basalt', 'Soils formed from basalt rock, rich in minerals, good fertility.'),  
(49, 'Gravelly', 'Well-drained soils with high gravel content, low fertility.'),  
(50, 'Clayey Sand', 'Combination of clay and sand, variable properties.'),  
(51, 'Fluvial', 'Soils deposited by rivers, often fertile and well-drained.'),  
(52, 'Marine', 'Soils formed from ocean deposits, can be saline.'),  
(53, 'Anthrosols', 'Soils significantly influenced by human activity.'),  
(54, 'Stagnosol', 'Waterlogged soils, poor drainage, typically rich in organic material.'),  
(55, 'Fluvic', 'Soils with significant water retention, supports wetland vegetation.'),  
(56, 'Coluvium', 'Soils formed by gravitational processes, often unstable.'),  
(57, 'Lithosol', 'Thin soils on rocky surfaces, low fertility.'),  
(58, 'Terrarossa', 'Red earth soils, fertile, often found in temperate regions.'),  
(59, 'Polypedon', 'Complex of soil types in a particular area, rich in biodiversity.'),  
(60, 'Tropical', 'Soils rich in organic material, found in tropical regions.'),  
(61, 'Mountain', 'Soils found in mountainous regions, variable fertility.'),  
(62, 'Coastal', 'Soils near coastlines, can be saline, variable fertility.'),  
(63, 'Volcanic Ash', 'Light, nutrient-rich soils, excellent for agriculture.'),  
(64, 'Loess', 'Windblown silt soils, fertile, found in various regions.'),

(65, 'Regressive', 'Soils that have lost nutrients due to erosion.'),  
 (66, 'Sedimentary', 'Soils formed from sedimentary rock, variable properties.'),  
 (67, 'Podzolic', 'Leached soils with a grayish color, poor nutrient retention.'),  
 (68, 'Terra Firma', 'Well-drained soils, good for agriculture, found in varied climates.'),  
 (69, 'Zonal', 'Soils developed under specific climate conditions.'),  
 (70, 'Systemic', 'Soils that support complex ecosystems, rich in nutrients.'),  
 (71, 'Pragmatic', 'Soils with practical uses for various crops.'),  
 (72, 'Eutrophic', 'High nutrient content, often supports diverse plant life.'),  
 (73, 'Aneutrophic', 'Low nutrient content, often supports specialized flora.'),  
 (74, 'Mesotrophic', 'Moderate nutrient levels, supports diverse ecosystems.'),  
 (75, 'Biodynamic', 'Soils managed using biodynamic farming methods, high fertility.'),  
 (76, 'Zen Soil', 'Soils with balanced nutrient profiles, ideal for diverse crops.'),  
 (77, 'Silty Clay Loam', 'Combination of silty, clay, and loamy properties, fertile.'),  
 (78, 'Hydric', 'Wet soils, often found in marshy areas, rich in organic matter.'),  
 (79, 'Dystrophic', 'Acidic soils with low nutrient content, can limit plant growth.'),  
 (80, 'Fertile Ridge', 'Soils found on ridges, often rich in nutrients, good drainage.'),  
 (81, 'Sandstone-derived', 'Soils developed from sandstone, typically well-drained.'),  
 (82, 'Carbonaceous', 'High organic carbon content, excellent for agriculture.'),  
 (83, 'Quartzite', 'Soils formed from quartzite rock, often well-drained.'),  
 (84, 'Cryogenic', 'Soils with permafrost, moisture retention in cold climates.'),  
 (85, 'Cultivated', 'Soils actively managed for agricultural production.');

## 8. Fertilizer(FertilizerID, Name, NutrientContent, ApplicationMethod)



The screenshot shows the pgAdmin 4 interface. In the Object Explorer, the 'Tables' node is expanded, showing 41 tables including 'aid', 'aidtype', 'crop', 'crop\_disease', 'crop\_fertilizer', 'crop\_soil', 'crop\_weather', 'cropbenefits', 'cropdisease', 'croptreatment', 'cropstype', 'farmer', 'farmer\_aid', 'farmer\_crop', 'farmer\_fertilizer', 'farmer\_investment', 'farmer\_soil', 'farmer\_sustainable', 'farmer\_tech', 'farmer\_trainingprior', 'farmingtool', 'fertilizer', 'fertilertype', 'investment', 'investmentpurpose', 'irrigation', 'irrigation\_soil', and 'irrigationtype'. The 'crop' table is currently selected.

In the main query editor window, the following SQL code is displayed:

```
1  SELECT * FROM "G2SARM".FERTILIZER;
```

The results of this query are shown in a table:

fertilizerid	[PK]	name	nutrientcontent	applicationmethod	typeid
1	1	Nitrogen Fertilizer	Nitrogen 20%	Granular Application	1
2	2	Phosphate Fertilizer	Phosphorus 18%	Liquid Fertilization	1
3	3	Potash Fertilizer	Potassium 24%	Broadcasting	1
4	4	Urea	Nitrogen 46%	Top Dressing	1
5	5	Organic Compost	Nutrient-Rich	Soil Incorporation	2
6	6	Fish Emulsion	Nitrogen 5%	Foliar Feeding	2
7	7	Blood Meal	Nitrogen 12%	Granular Application	2
8	8	Chicken Manure	Nitrogen 1.5%	Granular Application	2
9	9	Slow-Release Fertilizer	Balanced Nutrients	Granular Application	3
10	10	Liquid Seaweed	Trace Minerals	Foliar Spray	4
11	11	Granular NPK Fertilizer	NPK 10-20-10	Soil Application	7
12	12	Specialized Fertilizer	Tailored Nutrients	Granular Application	8
13	13	Organic Liquid Fertilizer	Nutrient-Rich	Foliar Feeding	2
14	14	Controlled-Release Fertilizer	Balanced Nutrients	Soil Application	3
15	15	Biofertilizer	Microbial Culture	Soil Application	6
16	16	Calcium Nitrate	Calcium 15%	Drip Irrigation	1
17	17	Potassium Nitrate	Potassium 44%	Granular Application	1
18	18	Superphosphate	Phosphorus 20%	Broadcasting	1
19	19	Ammonium Sulfate	Nitrogen 21%	Top Dressing	1

Below the table, a message indicates: 'Successfully run. Total query runtime: 69 msec. 80 rows affected.'

INSERT INTO Fertilizer (FertilizerID, Name, NutrientContent, ApplicationMethod) VALUES  
 (1, 'Nitrogen Fertilizer', 'Nitrogen 20%', 'Granular Application'),  
 (2, 'Phosphate Fertilizer', 'Phosphorus 18%', 'Liquid Fertilization'),  
 (3, 'Potash Fertilizer', 'Potassium 24%', 'Broadcasting'),  
 (4, 'Urea', 'Nitrogen 46%', 'Top Dressing'),  
 (5, 'Triple Super Phosphate', 'Phosphorus 45%', 'Incorporation'),  
 (6, 'Ammonium Nitrate', 'Nitrogen 34%', 'Soil Injection'),

- (7, 'Calcium Nitrate', 'Calcium 15%', 'Foliar Spray'),  
(8, 'Gypsum', 'Calcium 18%', 'Soil Amendment'),  
(9, 'Organic Compost', 'Nutrient-Rich', 'Soil Incorporation'),  
(10, 'Fish Emulsion', 'Nitrogen 5%', 'Foliar Feeding'),  
(11, 'Blood Meal', 'Nitrogen 12%', 'Granular Application'),  
(12, 'Bone Meal', 'Phosphorus 12%', 'Soil Incorporation'),  
(13, 'Kelp Meal', 'Trace Minerals', 'Foliar Spray'),  
(14, 'Chicken Manure', 'Nitrogen 1.5%', 'Granular Application'),  
(15, 'Cottonseed Meal', 'Nitrogen 7%', 'Soil Amendment'),  
(16, 'Alfalfa Meal', 'Nutrient-Rich', 'Top Dressing'),  
(17, 'Compost Tea', 'Nutrient-Rich', 'Foliar Feeding'),  
(18, 'Liquid Seaweed', 'Trace Minerals', 'Foliar Spray'),  
(19, 'Sulfate of Potash', 'Potassium 50%', 'Granular Application'),  
(20, 'Rock Phosphate', 'Phosphorus 30%', 'Soil Incorporation'),  
(21, 'Green Manure', 'Nutrient-Rich', 'Soil Incorporation'),  
(22, 'Muriate of Potash', 'Potassium 60%', 'Broadcasting'),  
(23, 'Fertilizer Pellets', 'Balanced Nutrients', 'Granular Application'),  
(24, 'Slow-Release Fertilizer', 'Balanced Nutrients', 'Granular Application'),  
(25, 'Controlled-Release Fertilizer', 'Balanced Nutrients', 'Soil Application'),  
(26, 'Organic Liquid Fertilizer', 'Nutrient-Rich', 'Foliar Feeding'),  
(27, 'Synthetic Fertilizer', 'Balanced Nutrients', 'Granular Application'),  
(28, 'NPK Fertilizer', 'Nitrogen, Phosphorus, Potassium', 'Granular Application'),  
(29, 'Nitrate of Soda', 'Sodium 15%', 'Broadcasting'),  
(30, 'Superphosphate', 'Phosphorus 20%', 'Soil Incorporation'),  
(31, 'Ammonium Sulfate', 'Nitrogen 21%', 'Top Dressing'),  
(32, 'Calcium Sulfate', 'Calcium 18%', 'Soil Amendment'),  
(33, 'Humic Acid', 'Organic Matter', 'Soil Application'),  
(34, 'Iron Chelate', 'Iron 6%', 'Foliar Feeding'),  
(35, 'Zinc Sulfate', 'Zinc 35%', 'Soil Injection'),  
(36, 'Boric Acid', 'Boron 17%', 'Soil Application'),  
(37, 'Manganese Sulfate', 'Manganese 30%', 'Soil Incorporation'),  
(38, 'Copper Sulfate', 'Copper 25%', 'Soil Injection'),  
(39, 'Lithovit', 'Calcium Carbonate', 'Soil Application'),  
(40, 'Epsom Salt', 'Magnesium 10%', 'Foliar Spray'),  
(41, 'Liquid Iron', 'Iron 10%', 'Foliar Feeding'),  
(42, 'Liquid Nitrogen', 'Nitrogen 30%', 'Soil Injection'),  
(43, 'Natural Phosphate', 'Phosphorus 22%', 'Soil Incorporation'),  
(44, 'Sodium Nitrate', 'Sodium 15%', 'Granular Application'),  
(45, 'Potassium Sulfate', 'Potassium 40%', 'Broadcasting'),  
(46, 'Liquid Kelp', 'Trace Nutrients', 'Foliar Feeding'),  
(47, 'Organic Bone Meal', 'Phosphorus 10%', 'Soil Incorporation'),  
(48, 'Organic Fish Fertilizer', 'Nitrogen 5%', 'Granular Application'),  
(49, 'Organic Blood Meal', 'Nitrogen 12%', 'Top Dressing'),  
(50, 'Organic Cottonseed Meal', 'Nitrogen 7%', 'Soil Amendment'),  
(51, 'Organic Alfalfa Meal', 'Nutrient-Rich', 'Top Dressing'),  
(52, 'Organic Chicken Manure', 'Nitrogen 1.5%', 'Granular Application'),  
(53, 'Organic Compost Tea', 'Nutrient-Rich', 'Foliar Feeding'),

(54, 'Organic Liquid Fertilizer', 'Nutrient-Rich', 'Foliar Feeding'),  
(55, 'Organic Slow-Release Fertilizer', 'Balanced Nutrients', 'Granular Application'),  
(56, 'Organic Controlled-Release Fertilizer', 'Balanced Nutrients', 'Soil Application'),  
(57, 'Organic NPK Fertilizer', 'Nitrogen, Phosphorus, Potassium', 'Granular Application'),  
(58, 'Organic Muriate of Potash', 'Potassium 60%', 'Broadcasting'),  
(59, 'Organic Rock Phosphate', 'Phosphorus 30%', 'Soil Incorporation'),  
(60, 'Organic Green Manure', 'Nutrient-Rich', 'Soil Incorporation'),  
(61, 'Organic Fertilizer Pellets', 'Balanced Nutrients', 'Granular Application'),  
(62, 'Organic Fertilizer Granules', 'Balanced Nutrients', 'Granular Application'),  
(63, 'Organic Fertilizer Blend', 'Balanced Nutrients', 'Granular Application'),  
(64, 'Organic Soil Booster', 'Nutrient-Rich', 'Soil Application'),  
(65, 'Organic Soil Conditioner', 'Nutrient-Rich', 'Soil Application'),  
(66, 'Organic Nutrient Mix', 'Balanced Nutrients', 'Granular Application'),  
(67, 'Organic Amendment', 'Nutrient-Rich', 'Soil Application'),  
(68, 'Organic Base Fertilizer', 'Nutrient-Rich', 'Granular Application'),  
(69, 'Organic Microbial Fertilizer', 'Microbial Culture', 'Soil Application'),  
(70, 'Organic Fertilizer Mix', 'Balanced Nutrients', 'Granular Application'),  
(71, 'Liquid Organic Fertilizer', 'Balanced Nutrients', 'Foliar Feeding'),  
(72, 'Fertilizer Tablets', 'Balanced Nutrients', 'Soil Application'),  
(73, 'Fertilizer Sticks', 'Balanced Nutrients', 'Soil Application'),  
(74, 'Fertilizer Powders', 'Balanced Nutrients', 'Soil Application'),  
(75, 'Organic Fertilizer Mix', 'Balanced Nutrients', 'Granular Application'),  
(76, 'Fertilizer Sprays', 'Balanced Nutrients', 'Foliar Spray'),  
(77, 'Fertilizer Granules', 'Balanced Nutrients', 'Granular Application'),  
(78, 'Nutrient-Rich Fertilizer', 'Nutrient-Rich', 'Soil Application'),  
(79, 'Balanced Fertilizer', 'Balanced Nutrients', 'Soil Application'),  
(80, 'Premium Fertilizer', 'Premium Nutrients', 'Soil Application'),  
(81, 'Value-Added Fertilizer', 'Value Nutrients', 'Soil Application'),  
(82, 'Customized Fertilizer', 'Customized Nutrients', 'Granular Application'),  
(83, 'Specialized Fertilizer', 'Specialized Nutrients', 'Soil Application'),  
(84, 'Targeted Fertilizer', 'Targeted Nutrients', 'Soil Application'),  
(85, 'Seasonal Fertilizer', 'Seasonal Nutrients', 'Soil Application'),  
(86, 'Eco-Friendly Fertilizer', 'Eco-Friendly Nutrients', 'Soil Application'),  
(87, 'Sustainable Fertilizer', 'Sustainable Nutrients', 'Soil Application'),  
(88, 'Conventional Fertilizer', 'Conventional Nutrients', 'Soil Application'),  
(89, 'Innovative Fertilizer', 'Innovative Nutrients', 'Granular Application'),  
(90, 'Advanced Fertilizer', 'Advanced Nutrients', 'Soil Application'),  
(91, 'High-Performance Fertilizer', 'High-Performance Nutrients', 'Granular Application'),  
(92, 'Quick-Release Fertilizer', 'Quick-Release Nutrients', 'Granular Application'),  
(93, 'Instant Fertilizer', 'Instant Nutrients', 'Granular Application'),  
(94, 'Long-Lasting Fertilizer', 'Long-Lasting Nutrients', 'Soil Application'),  
(95, 'All-Purpose Fertilizer', 'All-Purpose Nutrients', 'Soil Application');

9 FertilizerType(TypeID, Type, AdditionalInfo)

```

SELECT * FROM "G2SARM",FERTILIZERTYPE;

```

typeid	type	additionalinfo
1	Synthetic	Chemically manufactured fertilizers
2	Organic	Derived from natural sources
3	Slow-Release	Nutrients released gradually over time
4	Liquid	Dissolved in water for quick absorption
5	Granular	Solid particles for direct application
6	Biofertilizer	Contains living microorganisms
7	NPK	Contains Nitrogen, Phosphorus, and Potassium
8	Specialty	Tailored for specific crops or conditions
9	Compost	Decomposed organic matter used to enrich soil
10	Manure	Animal waste used as a fertilizer, rich in nutrients
11	Fish Emulsion	Liquid fertilizer made from fish byproducts, high in nitrogen
12	Bone Meal	Ground animal bones, high in phosphorus
13	Blood Meal	Dried animal blood, high in nitrogen
14	Kelp Meal	Seaweed-based fertilizer, rich in trace minerals
15	Green Manure	Crops grown to be plowed back into the soil for nutrients
16	Mulch	Layer of organic material spread over soil to retain moisture
17	Superphosphate	Highly soluble phosphorus fertilizer
18	Triple Superphosphate	Concentrated form of superphosphate with high phosphorus content
19	Ammonium Nitrate	Quick-release nitrogen fertilizer

Total rows: 90 of 90    Query complete 00:00:00.072    Ln 1, Col 3B

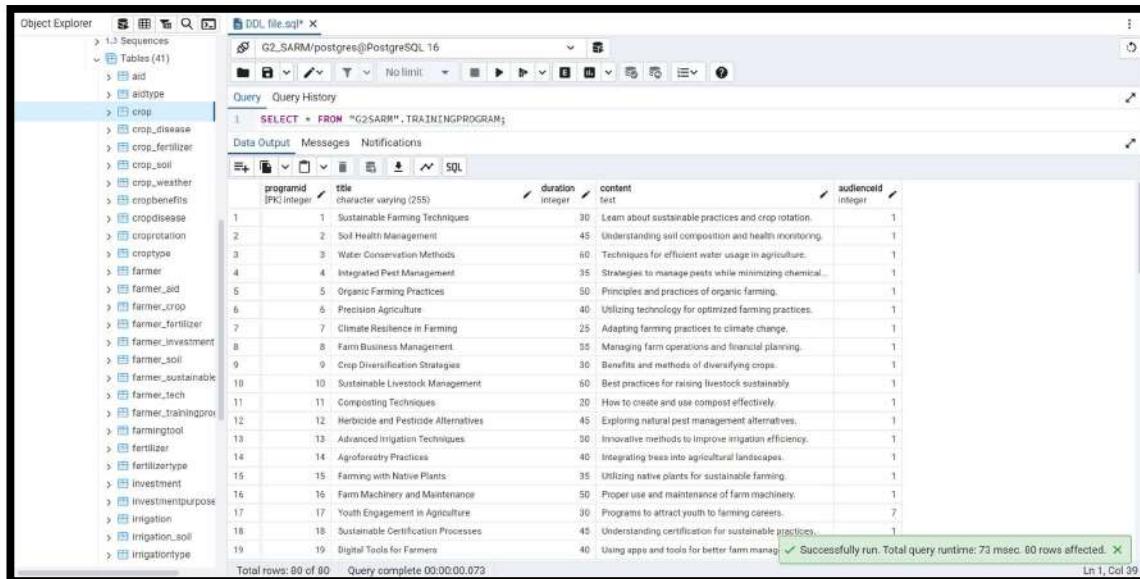
INSERT INTO FertilizerType (TypeID, Type, AdditionalInfo) VALUES

- (1, 'Nitrogen Fertilizer', 'Promotes vegetative growth, essential for leaf development.'),
- (2, 'Phosphorus Fertilizer', 'Enhances root development and flowering.'),
- (3, 'Potassium Fertilizer', 'Improves drought resistance and overall plant health.'),
- (4, 'Organic Fertilizer', 'Made from natural sources, improves soil structure and fertility.'),
- (5, 'Synthetic Fertilizer', 'Chemically manufactured, quick-release nutrients for fast growth.'),
- (6, 'Slow-Release Fertilizer', 'Gradually releases nutrients over time, reducing leaching.'),
- (7, 'Liquid Fertilizer', 'Easily absorbed by plants, allows for quick nutrient uptake.'),
- (8, 'Granular Fertilizer', 'Solid form, easy to apply, and can be used for slow nutrient release.'),
- (9, 'Compost', 'Decomposed organic material, enriches soil, improves moisture retention.'),
- (10, 'Manure', 'Animal waste, rich in nutrients, improves soil fertility and structure.'),
- (11, 'Bone Meal', 'Phosphate-rich fertilizer from ground animal bones, promotes root growth.'),
- (12, 'Blood Meal', 'High nitrogen content, boosts green growth and vitality.'),
- (13, 'Fish Emulsion', 'Liquid fertilizer derived from fish, provides micronutrients.'),
- (14, 'Kelp Meal', 'Seaweed-based, rich in micronutrients and growth hormones.'),
- (15, 'Rock Phosphate', 'Natural mineral source of phosphorus, slow to release nutrients.'),
- (16, 'Wood Ash', 'Alkaline, provides potassium and trace minerals, improves pH balance.'),
- (17, 'Epsom Salt', 'Provides magnesium and sulfur, essential for chlorophyll production.'),
- (18, 'Gypsum', 'Calcium sulfate, improves soil structure and drainage, provides calcium.'),
- (19, 'Sulfur Fertilizer', 'Reduces soil pH, aids in nutrient availability in alkaline soils.'),
- (20, 'Chelated Micronutrients', 'Minerals in an organic complex, improves availability to plants.'),
- (21, 'NPK Fertilizer', 'Balanced fertilizer with nitrogen, phosphorus, and potassium.'),
- (22, 'Urea', 'High nitrogen content, fast-acting, commonly used in agriculture.'),
- (23, 'Ammonium Nitrate', 'Quickly supplies nitrogen, highly soluble.'),
- (24, 'Calcium Nitrate', 'Provides both calcium and nitrogen, helps in fruit and vegetable development.'),
- (25, 'Superphosphate', 'Highly available phosphorus source, enhances root development.'),
- (26, 'Triple Superphosphate', 'Concentrated form of superphosphate, boosts phosphorus levels.'),
- (27, 'Potassium Chloride', 'Commonly used potassium source, enhances overall plant health.'),
- (28, 'Potassium Sulfate', 'Provides potassium and sulfur, suitable for sensitive crops.'),
- (29, 'Ammonium Sulfate', 'Source of nitrogen and sulfur, lowers soil pH.'),

- (30, 'Calcium Sulfate', 'Improves soil structure and drainage, provides calcium.'),  
(31, 'Fertilizer Pellets', 'Controlled-release formulations, reduces nutrient loss.'),  
(32, 'Fertigation', 'Application of fertilizers through irrigation systems.'),  
(33, 'Micronutrient Mix', 'Blend of essential trace elements, supports overall plant health.'),  
(34, 'Green Manure', 'Cover crops grown to enhance soil fertility when tilled under.'),  
(35, 'Fish Meal', 'High in nitrogen and phosphorus, improves soil microbiota.'),  
(36, 'Sodium Nitrate', 'Provides nitrogen, often used in arid regions.'),  
(37, 'Potassium Nitrate', 'Supplies potassium and nitrogen, good for fruiting crops.'),  
(38, 'Sulfate of Potash', 'Provides potassium and sulfur, promotes flower and fruit development.'),  
(39, 'Organic Liquid Fertilizer', 'Contains nutrients from organic sources, easy application.'),  
(40, 'Sustained Release Fertilizer', 'Releases nutrients over an extended period for continuous feeding.'),  
(41, 'Molasses', 'Source of carbohydrates, encourages microbial activity in the soil.'),  
(42, 'Sewage Sludge', 'Nutrient-rich organic matter from wastewater treatment, improves soil structure.'),  
(43, 'Seaweed Extract', 'Concentrated seaweed, provides micronutrients and promotes growth.'),  
(44, 'Boric Acid', 'Micronutrient, essential for plant growth, especially in fruiting stages.'),  
(45, 'Potash', 'Natural potassium source, improves crop yields and quality.'),  
(46, 'Calcium Carbonate', 'Used to correct soil acidity, provides calcium.'),  
(47, 'Perlite', 'Lightweight volcanic rock, improves aeration and drainage in soil.'),  
(48, 'Vermicompost', 'Produced by worms, rich in nutrients and beneficial microbes.'),  
(49, 'Peat Moss', 'Organic material that improves soil structure and water retention.'),  
(50, 'Liquid Seaweed', 'Enhances nutrient uptake and root growth, provides trace elements.'),  
(51, 'Zinc Sulfate', 'Source of zinc, important for enzyme activity and chlorophyll formation.'),  
(52, 'Iron Chelate', 'Provides iron in an available form, important for chlorosis prevention.'),  
(53, 'Copper Sulfate', 'Micronutrient that aids in plant health, prevents deficiencies.'),  
(54, 'Manganese Sulfate', 'Source of manganese, essential for photosynthesis.'),  
(55, 'Borax', 'Source of boron, important for flower and fruit development.'),  
(56, 'Nitro-chalk', 'Combines nitrogen and calcium, improves soil structure.'),  
(57, 'Fertilizer Tablets', 'Convenient, slow-release tablets for easy application.'),  
(58, 'Hydrolyzed Fish', 'Liquid fertilizer from fish, provides nutrients and amino acids.'),  
(59, 'Organic Fertilizer Blends', 'Combines various organic materials for balanced nutrition.'),  
(60, 'Sustainable Fertilizer', 'Eco-friendly options made from renewable resources.'),  
(61, 'Chick Starter Feed', 'High in protein, suitable for young plants and seedlings.'),  
(62, 'Crushed Shells', 'Calcium-rich material, improves soil structure.'),  
(63, 'Agricultural Lime', 'Raises soil pH, provides calcium and magnesium.'),  
(64, 'Kelp Fertilizer', 'Promotes root growth and overall health using seaweed extracts.'),  
(65, 'Green Tea Fertilizer', 'Nutrient-rich liquid from steeped plant materials, improves soil life.'),  
(66, 'Soybean Meal', 'High nitrogen content, improves soil health and fertility.'),  
(67, 'Horticultural Grade Fertilizer', 'Special formulations designed for specific plant types.'),  
(68, 'Sulfur-coated Urea', 'Controlled-release nitrogen fertilizer, reduces leaching.'),  
(69, 'Organic Bone Meal', 'Slow-release phosphorus source from animal bones, enhances root development.'),  
(70, 'Organic Nitrogen Sources', 'Natural materials like alfalfa and clover that provide nitrogen.'),  
(71, 'Kelp and Fish Mix', 'Combination of seaweed and fish nutrients, promotes plant health.'),  
(72, 'Slow-Release Granules', 'Granular fertilizers that release nutrients over time.'),  
(73, 'Topsoil Mix', 'Nutrient-rich soil mix, often used for planting and gardening.'),  
(74, 'Nutrient Film Technique Fertilizer', 'Used in hydroponics, provides nutrients in a thin film of water.'),

(75, 'Natural Mineral Fertilizers', 'Fertilizers sourced from natural minerals, often sustainable.'),  
 (76, 'Coconut Coir', 'Organic material that enhances moisture retention and aeration.'),  
 (77, 'Natural Rock Phosphate', 'Slow-release phosphorus source from natural deposits.'),  
 (78, 'Hydroponic Fertilizer', 'Specially formulated for plants grown in nutrient solutions.'),  
 (79, 'Bamboo Charcoal', 'Improves soil aeration and nutrient retention, rich in minerals.'),  
 (80, 'Wood Chips', 'Organic material that improves soil structure as it decomposes.'),  
 (81, 'Peat-based Fertilizer', 'Made from peat moss, improves moisture retention and nutrient content.'),  
 (82, 'Kona Coffee Pulp', 'High in nitrogen, can be used as a mulch or fertilizer.'),  
 (83, 'Spent Mushroom Substrate', 'Organic waste from mushroom farming, rich in nutrients.'),  
 (84, 'Biochar', 'Charcoal used to enhance soil fertility and carbon sequestration.'),  
 (85, 'Earthworm Castings', 'Rich organic fertilizer produced by earthworms, improves soil health.');

## 10. TrainingProgram(ProgramID, Title, Duration, Content)



```

SELECT * FROM "G2_SARM"."TRAININGPROGRAM";

```

programid	title	duration	content	audienceid
1	Sustainable Farming Techniques	30	Learn about sustainable practices and crop rotation.	1
2	Soil Health Management	45	Understanding soil composition and health monitoring.	1
3	Water Conservation Methods	60	Techniques for efficient water usage in agriculture.	1
4	Integrated Pest Management	35	Strategies to manage pests while minimizing chemical use.	1
5	Organic Farming Practices	50	Principles and practices of organic farming.	1
6	Precision Agriculture	40	Utilizing technology for optimized farming practices.	1
7	Climate Resilience in Farming	25	Adapting farming practices to climate change.	1
8	Farm Business Management	55	Managing farm operations and financial planning.	1
9	Crop Diversification Strategies	30	Benefits and methods of diversifying crops.	1
10	Sustainable Livestock Management	60	Best practices for raising livestock sustainably.	1
11	Composting Techniques	20	How to create and use compost effectively.	1
12	Herbicide and Pesticide Alternatives	45	Exploring natural pest management alternatives.	1
13	Advanced Irrigation Techniques	50	Innovative methods to improve irrigation efficiency.	1
14	Agroforestry Practices	40	Integrating trees into agricultural landscapes.	1
15	Farming with Native Plants	35	Utilizing native plants for sustainable farming.	1
16	Farm Machinery and Maintenance	50	Proper use and maintenance of farm machinery.	1
17	Youth Engagement in Agriculture	30	Programs to attract youth to farming careers.	7
18	Sustainable Certification Processes	45	Understanding certification for sustainable practices.	1
19	Digital Tools for Farmers	40	Using apps and tools for better farm management.	1

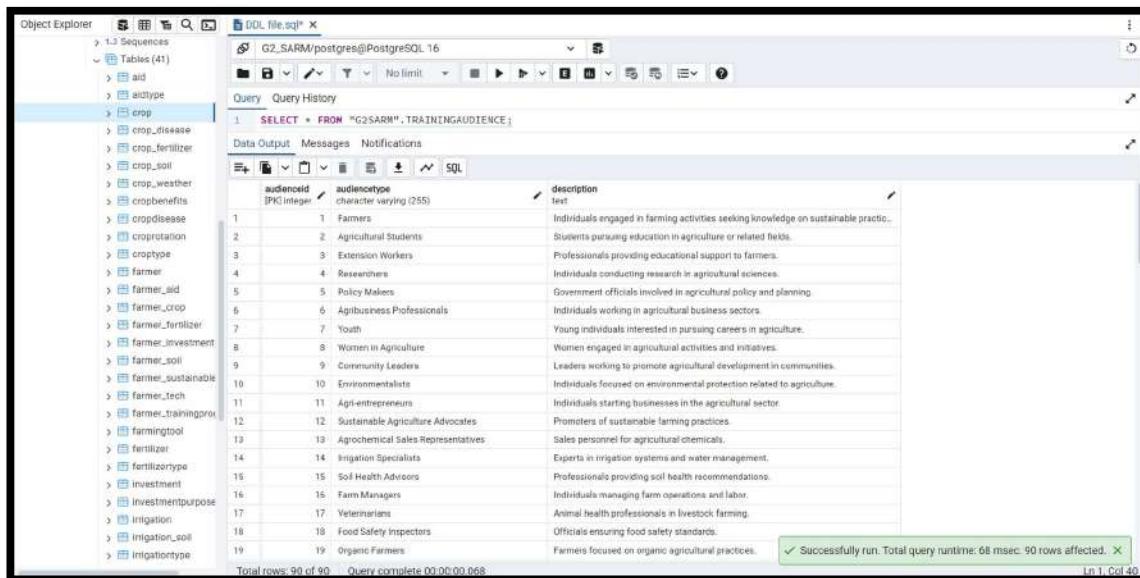
INSERT INTO TrainingProgram (ProgramID, Title, Duration, Content) VALUES

(1, 'Sustainable Farming Techniques', 30, 'Learn about sustainable practices and crop rotation.'),  
 (2, 'Soil Health Management', 45, 'Understanding soil composition and health monitoring.'),  
 (3, 'Water Conservation Methods', 60, 'Techniques for efficient water usage in agriculture.'),  
 (4, 'Integrated Pest Management', 35, 'Strategies to manage pests while minimizing chemical use.'),  
 (5, 'Organic Farming Practices', 50, 'Principles and practices of organic farming.'),  
 (6, 'Precision Agriculture', 40, 'Utilizing technology for optimized farming practices.'),  
 (7, 'Climate Resilience in Farming', 25, 'Adapting farming practices to climate change.'),  
 (8, 'Farm Business Management', 55, 'Managing farm operations and financial planning.'),  
 (9, 'Crop Diversification Strategies', 30, 'Benefits and methods of diversifying crops.'),  
 (10, 'Sustainable Livestock Management', 60, 'Best practices for raising livestock sustainably.'),  
 (11, 'Composting Techniques', 20, 'How to create and use compost effectively.'),  
 (12, 'Herbicide and Pesticide Alternatives', 45, 'Exploring natural pest management alternatives.'),  
 (13, 'Advanced Irrigation Techniques', 50, 'Innovative methods to improve irrigation efficiency.'),  
 (14, 'Agroforestry Practices', 40, 'Integrating trees into agricultural landscapes.'),  
 (15, 'Farming with Native Plants', 35, 'Utilizing native plants for sustainable farming.'),  
 (16, 'Farm Machinery and Maintenance', 50, 'Proper use and maintenance of farm machinery.'),

- (17, 'Youth Engagement in Agriculture', 30, 'Programs to attract youth to farming careers.'),  
(18, 'Sustainable Certification Processes', 45, 'Understanding certification for sustainable practices.'),  
(19, 'Digital Tools for Farmers', 40, 'Using apps and tools for better farm management.'),  
(20, 'Nutrition Management in Crops', 55, 'Best practices for managing nutrient levels in crops.'),  
(21, 'Seed Selection and Treatment', 30, 'Choosing the right seeds and treating them properly.'),  
(22, 'Biological Pest Control', 40, 'Using biological agents for pest management.'),  
(23, 'Climate-Smart Agriculture', 45, 'Practices that enhance resilience to climate impacts.'),  
(24, 'Financial Support for Farmers', 30, 'Information on grants, loans, and subsidies available.'),  
(25, 'Organic Certification Requirements', 55, 'Guidelines to achieve organic certification.'),  
(26, 'Community Supported Agriculture', 35, 'Benefits of joining CSA programs.'),  
(27, 'Regenerative Agriculture Practices', 40, 'Techniques to restore soil health and biodiversity.'),  
(28, 'Biodynamic Farming Methods', 30, 'Principles of biodynamic agriculture.'),  
(29, 'Ecosystem Services in Agriculture', 45, 'Understanding and enhancing ecosystem services.'),  
(30, 'Sustainable Crop Production Systems', 50, 'Methods for sustainable crop production.'),  
(31, 'Farm Safety and Risk Management', 30, 'Ensuring safety on the farm and managing risks.'),  
(32, 'Food Safety Practices', 40, 'Ensuring food safety from farm to table.'),  
(33, 'Using Technology for Record Keeping', 25, 'Implementing digital records for farm management.'),  
(34, 'Organic Pest Management Strategies', 45, 'Managing pests without synthetic chemicals.'),  
(35, 'Soil Fertility Management', 60, 'Understanding and improving soil fertility.'),  
(36, 'Innovative Crop Rotation', 30, 'Advanced techniques for crop rotation.'),  
(37, 'Agricultural Policy and Advocacy', 50, 'Understanding policies affecting agriculture.'),  
(38, 'Marketing for Farmers', 40, 'Strategies for marketing farm products effectively.'),  
(39, 'Rural Entrepreneurship', 35, 'Starting and managing a rural business.'),  
(40, 'Farm-to-Table Initiatives', 30, 'Connecting farmers directly to consumers.'),  
(41, 'Sustainable Packaging Solutions', 45, 'Eco-friendly packaging methods for farm products.'),  
(42, 'Renewable Energy in Agriculture', 50, 'Utilizing renewable energy sources on the farm.'),  
(43, 'Soil Erosion Control Techniques', 35, 'Methods to prevent soil erosion on farmland.'),  
(44, 'Traditional Farming Practices', 30, 'Learning from traditional agricultural methods.'),  
(45, 'Farmer Cooperatives and Networks', 30, 'The benefits of joining cooperatives.'),  
(46, 'Environmental Impact Assessment', 55, 'Understanding the environmental impacts of farming.'),  
(47, 'Sustainable Aquaculture Practices', 60, 'Best practices for sustainable fish farming.'),  
(48, 'Crop Disease Management', 40, 'Identifying and managing crop diseases.'),  
(49, 'Organic Fertilizers and Their Uses', 45, 'Exploring different organic fertilizers.'),  
(50, 'Farming and Biodiversity', 35, 'The importance of biodiversity in agriculture.'),  
(51, 'Agri-Tourism Development', 50, 'Creating tourism opportunities on farms.'),  
(52, 'Urban Agriculture Initiatives', 30, 'Implementing farming in urban settings.'),  
(53, 'Nutritional Education for Farmers', 25, 'Understanding nutrition for better crop choices.'),  
(54, 'Cold Chain Management in Agriculture', 40, 'Maintaining quality in perishable goods.'),  
(55, 'Heritage Crop Preservation', 35, 'The importance of preserving heritage crops.'),  
(56, 'Alternative Livelihood Strategies', 50, 'Diversifying income sources for farmers.'),  
(57, 'Mobile Apps for Farm Management', 30, 'Using technology for better farm efficiency.'),  
(58, 'Agri-Finance and Investment', 60, 'Understanding financial options for farmers.'),  
(59, 'Effective Communication for Farmers', 25, 'Improving communication skills for better networking.'),  
(60, 'Climate Change and Agriculture', 40, 'Understanding the impact of climate change on farming.'),  
(61, 'Youth in Agriculture', 30, 'Engaging young people in farming careers.'),  
(62, 'Crop Insurance Essentials', 50, 'Understanding crop insurance and its benefits.'),

- (63, 'Water Management Strategies', 45, 'Efficient use of water resources in farming.'),  
 (64, 'Resilient Farming Techniques', 50, 'Techniques to enhance resilience against climate shocks.'),  
 (65, 'Sustainable Weeding Techniques', 35, 'Weeding methods that promote sustainability.'),  
 (66, 'Research and Development in Agriculture', 40, 'Promoting R&D for improved farming practices.'),  
 (67, 'Women in Agriculture', 30, 'Empowering women in the agricultural sector.'),  
 (68, 'Farmer Field Schools', 40, 'Participatory education for farmers.'),  
 (69, 'Value Addition in Agriculture', 50, 'Increasing the value of agricultural products.'),  
 (70, 'Soil and Water Conservation Techniques', 45, 'Methods to conserve soil and water resources.'),  
 (71, 'Digital Marketing for Farmers', 35, 'Using digital platforms to market farm produce.'),  
 (72, 'Crop Rotation and Soil Health', 30, 'How crop rotation affects soil health.'),  
 (73, 'Understanding Agricultural Subsidies', 40, 'Navigating subsidy programs for farmers.'),  
 (74, 'Participatory Rural Appraisal', 45, 'Community engagement techniques for development.'),  
 (75, 'Land Use Planning for Farmers', 50, 'Strategies for effective land management.'),  
 (76, 'Empowering Local Communities', 35, 'Strengthening community ties through agriculture.'),  
 (77, 'Sustainable Beekeeping Practices', 60, 'Best practices for keeping bees sustainably.'),  
 (78, 'Post-Harvest Management', 30, 'Techniques for managing crops after harvest.'),  
 (79, 'Diversifying Farm Income', 40, 'Strategies to diversify income sources.'),  
 (80, 'Food Sovereignty and Security', 50, 'Understanding food systems and community resilience.');

## 11 TrainingAudience(AudienceID, AudienceType, Description)



The screenshot shows the pgAdmin 4 interface with a query editor window. The query is:

```
1 SELECT * FROM "G2SARM", TRAININGAUDIENCE;
```

The results table has three columns: audienceid, audiencetype, and description. The data is as follows:

audienceid	audiencetype	description
1	Farmers	Individuals engaged in farming activities seeking knowledge on sustainable practices.
2	Agricultural Students	Students pursuing education in agriculture or related fields.
3	Extension Workers	Professionals providing educational support to farmers.
4	Researchers	Individuals conducting research in agricultural sciences.
5	Policy Makers	Government officials involved in agricultural policy and planning.
6	Agriculture Professionals	Individuals working in agricultural business sectors.
7	Youth	Young individuals interested in pursuing careers in agriculture.
8	Women in Agriculture	Women engaged in agricultural activities and initiatives.
9	Community Leaders	Leaders working to promote agricultural development in communities.
10	Environmentalists	Individuals focused on environmental protection related to agriculture.
11	Ag-entrepreneurs	Individuals starting businesses in the agricultural sector.
12	Sustainable Agriculture Advocates	Promoters of sustainable farming practices.
13	Agrochemical Sales Representatives	Sales personnel for agricultural chemicals.
14	Irrigation Specialists	Experts in irrigation systems and water management.
15	Soil Health Advisors	Professionals providing soil health recommendations.
16	Farm Managers	Individuals managing farm operations and labor.
17	Veterinarians	Animal health professionals in livestock farming.
18	Food Safety Inspectors	Officials ensuring food safety standards.
19	Organic Farmers	Farmers focused on organic agricultural practices.

Message bar: Successfully run. Total query runtime: 68 msec. 90 rows affected.

INSERT INTO TrainingAudience (AudienceID, AudienceType, Description) VALUES

- (1, 'Smallholder Farmers', 'Farmers with limited land who practice subsistence agriculture.'),  
 (2, 'Commercial Farmers', 'Farmers engaged in large-scale agricultural production for sale.'),  
 (3, 'Young Farmers', 'Individuals under 30 years who are starting their farming careers.'),  
 (4, 'Women Farmers', 'Female farmers involved in agricultural activities and decision-making.'),  
 (5, 'Cooperative Groups', 'Groups of farmers who collaborate for shared benefits and resources.'),  
 (6, 'Agricultural Extension Workers', 'Professionals providing training and resources to farmers.'),  
 (7, 'Agronomy Students', 'Students studying agronomy and related agricultural sciences.'),  
 (8, 'Researchers', 'Individuals conducting studies related to agriculture and sustainability.'),  
 (9, 'Government Officials', 'Policy makers involved in agricultural development and support.'),  
 (10, 'NGO Representatives', 'Staff from non-governmental organizations working in agriculture.'),

- (11, 'Agricultural Technicians', 'Technicians providing support and expertise in agricultural practices.'),  
(12, 'Farm Supply Vendors', 'Sellers of agricultural inputs such as seeds, fertilizers, and equipment.'),  
(13, 'Irrigation Specialists', 'Experts focused on irrigation practices and water management.'),  
(14, 'Soil Scientists', 'Scientists studying soil properties and management techniques.'),  
(15, 'Crop Consultants', 'Advisors specializing in crop management and production.'),  
(16, 'Environmentalists', 'Individuals focused on sustainable practices and ecological impacts.'),  
(17, 'Rural Development Workers', 'Professionals enhancing rural livelihoods through agriculture.'),  
(18, 'Policy Analysts', 'Experts analyzing agricultural policies and their impacts.'),  
(19, 'Agroecologists', 'Researchers focusing on sustainable farming systems and ecology.'),  
(20, 'Veterinarians', 'Animal health professionals involved in livestock management.'),  
(21, 'Food Scientists', 'Experts studying food production, preservation, and safety.'),  
(22, 'Community Leaders', 'Local leaders influencing agricultural practices and community growth.'),  
(23, 'Students of Sustainable Agriculture', 'Students interested in sustainable farming practices.'),  
(24, 'Agricultural Entrepreneurs', 'Individuals starting new businesses in agriculture.'),  
(25, 'Farm Workers', 'Laborers working on farms, often responsible for daily operations.'),  
(26, 'Agricultural Journalists', 'Reporters focusing on agricultural news and information dissemination.'),  
(27, 'Nutritionists', 'Experts promoting nutritional practices linked to agriculture.'),  
(28, 'Civic Organizations', 'Groups advocating for agricultural and rural community interests.'),  
(29, 'Local Business Owners', 'Businesses that support or are supported by the agricultural sector.'),  
(30, 'Seed Savers', 'Farmers preserving heirloom seeds and traditional farming techniques.'),  
(31, 'Organic Farmers', 'Farmers practicing organic agriculture without synthetic inputs.'),  
(32, 'Permaculture Practitioners', 'Individuals applying permaculture principles to farming.'),  
(33, 'Irrigation Farmers', 'Farmers specializing in irrigated agriculture.'),  
(34, 'Biodynamic Farmers', 'Practitioners of biodynamic farming based on holistic principles.'),  
(35, 'Agroforestry Farmers', 'Farmers integrating trees into their agricultural practices.'),  
(36, 'Greenhouse Growers', 'Farmers cultivating crops in controlled greenhouse environments.'),  
(37, 'Aquaponics Farmers', 'Farmers utilizing aquaponics systems for sustainable food production.'),  
(38, 'Vertical Farmers', 'Practitioners of vertical farming methods to optimize space.'),  
(39, 'Livestock Producers', 'Farmers raising animals for food and other products.'),  
(40, 'Fishermen', 'Individuals involved in fishing as a source of livelihood.'),  
(41, 'Beekeepers', 'Farmers raising bees for honey production and pollination.'),  
(42, 'Craft Farmers', 'Farmers producing artisanal products, such as cheese or preserves.'),  
(43, 'Herbalists', 'Farmers growing medicinal herbs for health applications.'),  
(44, 'Agri-business Owners', 'Owners of businesses related to agricultural production and supply.'),  
(45, 'Urban Farmers', 'Individuals growing food in urban settings and communities.'),  
(46, 'Farmers' Market Vendors', 'Sellers at local markets focusing on fresh produce.'),  
(47, 'Food Processors', 'Businesses transforming raw agricultural products into consumables.'),  
(48, 'Agro-tourism Operators', 'Individuals promoting tourism in agricultural settings.'),  
(49, 'Agri-Tech Innovators', 'Entrepreneurs developing technology solutions for agriculture.'),  
(50, 'Farmers' Union Members', 'Members of unions advocating for farmers' rights and interests.'),  
(51, 'Sustainable Agriculture Advocates', 'Individuals promoting sustainable farming practices.'),  
(52, 'Food Security Experts', 'Professionals addressing food availability and access issues.'),  
(53, 'Traditional Farmers', 'Farmers practicing traditional and cultural farming methods.'),  
(54, 'Community Supported Agriculture (CSA) Participants', 'Consumers supporting local farmers through subscriptions.'),  
(55, 'Seed Companies', 'Businesses producing and selling seeds to farmers.'),  
(56, 'Agricultural Cooperatives', 'Cooperatives that provide support and resources to farmers.'),

(57, 'Agri-Environmentalists', 'Individuals focused on the intersection of agriculture and the environment.'),  
(58, 'Organic Certification Bodies', 'Organizations certifying organic farming practices.'),  
(59, 'Agricultural Educators', 'Teachers and trainers in agricultural education programs.'),  
(60, 'Local Agricultural Clubs', 'Community groups focused on local agricultural interests.'),  
(61, 'Non-profit Organizations', 'Groups working to support sustainable agricultural practices.'),  
(62, 'Veterinary Technicians', 'Assistants providing care for livestock health.'),  
(63, 'Food Safety Inspectors', 'Inspectors ensuring safety and quality in food production.'),  
(64, 'Sustainable Development Experts', 'Professionals working towards sustainable agricultural practices.'),  
(65, 'Land Use Planners', 'Experts planning land use for sustainable agricultural practices.'),  
(66, 'Agri-Finance Advisors', 'Financial experts guiding farmers on funding and investments.'),  
(67, 'Climate Change Researchers', 'Scientists studying the impact of climate on agriculture.'),  
(68, 'Elder Farmers', 'Experienced farmers providing mentorship to new farmers.'),  
(69, 'Agro-business Analysts', 'Analysts studying the agricultural business sector.'),  
(70, 'Wildlife Conservationists', 'Individuals promoting biodiversity in agricultural landscapes.'),  
(71, 'Pollination Specialists', 'Experts focused on pollination and its impact on crops.'),  
(72, 'Agroecological Farmers', 'Farmers employing agroecological principles for sustainability.'),  
(73, 'Social Entrepreneurs', 'Individuals combining business and social impact in agriculture.'),  
(74, 'Health Educators', 'Educators promoting the link between health and agriculture.'),  
(75, 'Food Sovereignty Activists', 'Advocates for local control over food systems and production.'),  
(76, 'Market Research Analysts', 'Analysts studying consumer preferences in agriculture.'),  
(77, 'Sustainable Land Managers', 'Managers promoting sustainable land use in farming.'),  
(78, 'Pollinator Gardeners', 'Individuals creating habitats for pollinators within farms.'),  
(79, 'Agroforestry Trainers', 'Trainers educating on the benefits of agroforestry.'),  
(80, 'Farming Cooperatives', 'Groups of farmers working together for mutual benefit.'),  
(81, 'Consumer Groups', 'Groups advocating for consumer interests in agriculture.'),  
(82, 'Rural Youth Organizations', 'Organizations supporting youth involvement in agriculture.'),  
(83, 'Farm Equipment Manufacturers', 'Companies producing machinery and tools for agriculture.'),  
(84, 'Plant Breeders', 'Scientists developing new crop varieties for better yields.'),  
(85, 'Agrochemical Representatives', 'Sales representatives for agricultural chemical products.');

12. Visitor(VisitorID, Name, Role, ContactInfo)

The screenshot shows the pgAdmin interface with the following details:

- Object Explorer:** Shows the database structure with 1.3 Sequences and 41 Tables.
- Query Editor:** Contains the SQL query: `SELECT * FROM "G2SARM".VISITOR;`
- Data Output:** Displays the results of the query, showing 100 rows of data.
- Messages:** Shows a success message: "Successfully run. Total query runtime: 67 msec. 100 rows affected."

visitorid	name	role	contactinfo
1	Aarav Patel	Researcher	aarav.patel@example.com
2	Vivaan Sharma	Student	vivaan.sharma@example.com
3	Aditya Mehta	Researcher	aditya.mehta@example.com
4	Vihaan Joshi	Student	vihaan.joshi@example.com
5	Reyansh Singh	Researcher	reyansh.singh@example.com
6	Rohan Kapoor	Student	rohan.kapoor@example.com
7	Krishna Nair	Researcher	krishna.nair@example.com
8	Lakshya Gupta	Student	lakshya.gupta@example.com
9	Kunal Verma	Researcher	kunal.verma@example.com
10	Samarth Iyer	Student	samarth.ye@example.com
11	Aryan Choudhury	Researcher	aryan.choudhury@example.com
12	Aniket Rao	Student	aniket.rao@example.com
13	Yash Bansal	Researcher	yash.bansal@example.com
14	Aditya Jain	Student	aditya.jain@example.com
15	Ayaan Reddy	Researcher	ayaan.reddy@example.com
16	Dev Agarwal	Student	dev.agarwal@example.com
17	Siddharth Malhotra	Researcher	siddharth.malhotra@example.com
18	Manish Ghosh	Student	manish.ghosh@example.com
19	Harsh Desai	Researcher	harsh.desai@example.com

INSERT INTO Visitor (VisitorID, Name, Role, ContactInfo) VALUES  
 (1, 'Aarav Sharma', 'Researcher', 'aarav.sharma@example.com'),  
 (2, 'Vivaan Patel', 'Farmer', 'vivaan.patel@example.com'),  
 (3, 'Aditya Verma', 'Agronomist', 'aditya.verma@example.com'),  
 (4, 'Vihaan Singh', 'Policy Maker', 'vihaan.singh@example.com'),  
 (5, 'Reyansh Gupta', 'Consultant', 'reyansh.gupta@example.com'),  
 (6, 'Ayaan Kumar', 'Researcher', 'ayaan.kumar@example.com'),  
 (7, 'Krishna Rao', 'Farmer', 'krishna.rao@example.com'),  
 (8, 'Sai Mehta', 'Agricultural Scientist', 'sai.mehta@example.com'),  
 (9, 'Karan Joshi', 'Extension Officer', 'karan.joshi@example.com'),  
 (10, 'Rohan Nair', 'Educator', 'rohan.nair@example.com'),  
 (11, 'Arjun Reddy', 'Researcher', 'arjun.reddy@example.com'),  
 (12, 'Niranjan Iyer', 'Farmer', 'niranjan.iyer@example.com'),  
 (13, 'Rajesh Choudhary', 'Agronomist', 'rajesh.choudhary@example.com'),  
 (14, 'Siddharth Sethi', 'Policy Maker', 'siddharth.sethi@example.com'),  
 (15, 'Dev Sharma', 'Consultant', 'dev.sharma@example.com'),  
 (16, 'Yash Bansal', 'Researcher', 'yash.bansal@example.com'),  
 (17, 'Anirudh Tiwari', 'Farmer', 'anirudh.tiwari@example.com'),  
 (18, 'Harsh Mehta', 'Agricultural Scientist', 'harsh.mehta@example.com'),  
 (19, 'Kunal Saxena', 'Extension Officer', 'kunal.saxena@example.com'),  
 (20, 'Pranav Agarwal', 'Educator', 'pranav.agarwal@example.com'),  
 (21, 'Raghav Joshi', 'Researcher', 'raghav.joshi@example.com'),  
 (22, 'Shivam Kumar', 'Farmer', 'shivam.kumar@example.com'),  
 (23, 'Vikram Patel', 'Agronomist', 'vikram.patel@example.com'),  
 (24, 'Manish Yadav', 'Policy Maker', 'manish.yadav@example.com'),  
 (25, 'Ashish Bhatia', 'Consultant', 'ashish.bhatia@example.com'),  
 (26, 'Sumit Singh', 'Researcher', 'sumit.singh@example.com'),  
 (27, 'Ritesh Roy', 'Farmer', 'ritesh.roy@example.com'),  
 (28, 'Suresh Khanna', 'Agricultural Scientist', 'suresh.khanna@example.com'),  
 (29, 'Abhishek Verma', 'Extension Officer', 'abhishek.verma@example.com'),

- (30, 'Tarun Saxena', 'Educator', 'tarun.saxena@example.com'),  
(31, 'Nikhil Mehta', 'Researcher', 'nikhil.mehta@example.com'),  
(32, 'Deepak Tiwari', 'Farmer', 'deepak.tiwari@example.com'),  
(33, 'Kartik Iyer', 'Agronomist', 'kartik.iyer@example.com'),  
(34, 'Suresh Kumar', 'Policy Maker', 'suresh.kumar@example.com'),  
(35, 'Rahul Sharma', 'Consultant', 'rahul.sharma@example.com'),  
(36, 'Vishal Reddy', 'Researcher', 'vishal.reddy@example.com'),  
(37, 'Manoj Gupta', 'Farmer', 'manoj.gupta@example.com'),  
(38, 'Vinay Soni', 'Agricultural Scientist', 'vinay.soni@example.com'),  
(39, 'Pankaj Singh', 'Extension Officer', 'pankaj.singh@example.com'),  
(40, 'Sandeep Kumar', 'Educator', 'sandeep.kumar@example.com'),  
(41, 'Kishore Ranjan', 'Researcher', 'kishore.ranjan@example.com'),  
(42, 'Ramesh Bhatt', 'Farmer', 'ramesh.bhatt@example.com'),  
(43, 'Rajiv Jain', 'Agronomist', 'rajiv.jain@example.com'),  
(44, 'Shankar Desai', 'Policy Maker', 'shankar.desai@example.com'),  
(45, 'Arvind Mehta', 'Consultant', 'arvind.mehta@example.com'),  
(46, 'Vikas Kumar', 'Researcher', 'vikas.kumar@example.com'),  
(47, 'Gaurav Singh', 'Farmer', 'gaurav.singh@example.com'),  
(48, 'Nitin Rao', 'Agricultural Scientist', 'nitin.rao@example.com'),  
(49, 'Ajay Kapoor', 'Extension Officer', 'ajay.kapoor@example.com'),  
(50, 'Karan Nair', 'Educator', 'karan.nair@example.com'),  
(51, 'Ravi Sharma', 'Researcher', 'ravi.sharma@example.com'),  
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(54, 'Mohit Verma', 'Policy Maker', 'mohit.verma@example.com'),  
(55, 'Ritesh Iyer', 'Consultant', 'riteshi.iyer@example.com'),  
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(70, 'Devendra Singh', 'Educator', 'devendra.singh@example.com'),  
(71, 'Amit Reddy', 'Researcher', 'amit.reddy@example.com'),  
(72, 'Vivek Joshi', 'Farmer', 'vivek.joshi@example.com'),  
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(76, 'Vivek Verma', 'Researcher', 'vivek.verma@example.com'),

(77, 'Raj Kumar', 'Farmer', 'raj.kumar@example.com'),  
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 (88, 'Bikram Singh', 'Agricultural Scientist', 'bikram.singh@example.com'),  
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 (91, 'Rajesh Bansal', 'Researcher')

### 13. Policy(PolicyID, Name, ImplementationDate)

policyid	name	implementationdate	typeid
1	National Agriculture Policy	2020-01-15	2
2	Soil Health Management Program	2020-02-20	1
3	Integrated Pest Management Policy	2020-03-25	1
4	Water Conservation Initiative	2020-04-10	11
5	Climate Resilient Agriculture Program	2020-05-05	13
6	Organic Farming Promotion Scheme	2020-05-15	14
7	Fertilizer Subsidy Policy	2020-07-01	8
8	Rural Employment Generation Scheme	2020-08-12	3
9	Precision Farming Policy	2020-09-18	4
10	Sustainable Livestock Development Policy	2020-10-30	2
11	National Agroforestry Policy	2020-11-15	1
12	Digital Agriculture Initiative	2020-12-01	4
13	Crop Insurance Scheme	2021-01-10	8
14	Women in Agriculture Program	2021-02-14	3
15	Food Security Policy	2021-03-16	10
16	Agric-Startup Policy	2021-04-20	2
17	National Dairy Development Policy	2021-05-25	2
18	National Fisheries Policy	2021-09-30	2
19	National Seed Policy	2021-07-18	1

INSERT INTO Policy (PolicyID, Name, ImplementationDate) VALUES

(1, 'National Agriculture Policy', '2020-01-15'),  
 (2, 'Soil Health Management Program', '2020-02-20'),  
 (3, 'Integrated Pest Management Policy', '2020-03-25'),  
 (4, 'Water Conservation Initiative', '2020-04-10'),  
 (5, 'Climate Resilient Agriculture Program', '2020-05-05'),  
 (6, 'Organic Farming Promotion Scheme', '2020-06-15'),  
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 (9, 'Agroforestry Development Policy', '2020-08-10'),  
 (10, 'Micro Irrigation Scheme', '2020-09-01'),  
 (11, 'National Food Security Act', '2020-09-15'),  
 (12, 'Pradhan Mantri Krishi Sinchai Yojana', '2020-10-05'),

- (13, 'Agricultural Technology Management Agency', '2020-10-20'),
- (14, 'National Livestock Policy', '2020-11-01'),
- (15, 'Integrated Watershed Management Program', '2020-11-15'),
- (16, 'Pradhan Mantri Fasal Bima Yojana', '2020-12-05'),
- (17, 'National Policy on Organic Farming', '2021-01-10'),
- (18, 'Agri-Export Policy', '2021-02-15'),
- (19, 'Skill Development in Agriculture', '2021-03-01'),
- (20, 'National Fisheries Policy', '2021-03-15'),
- (21, 'Sustainable Agriculture Practices Initiative', '2021-04-10'),
- (22, 'Soil Conservation Policy', '2021-04-25'),
- (23, 'Pradhan Mantri Kisan Samman Nidhi', '2021-05-05'),
- (24, 'National Bamboo Mission', '2021-06-15'),
- (25, 'Cooperative Development Policy', '2021-07-01'),
- (26, 'National Agroforestry Policy', '2021-07-20'),
- (27, 'Agri-Startups Initiative', '2021-08-10'),
- (28, 'National Renewable Energy Policy', '2021-09-01'),
- (29, 'State Livelihoods Mission', '2021-09-15'),
- (30, 'Rural Infrastructure Development Fund', '2021-10-05'),
- (31, 'Digital Agriculture Initiative', '2021-10-20'),
- (32, 'Climate Change Adaptation Program', '2021-11-01'),
- (33, 'Integrated Farming System Policy', '2021-11-15'),
- (34, 'Pest Control Management Policy', '2021-12-05'),
- (35, 'Dairy Development Policy', '2022-01-10'),
- (36, 'Agricultural Credit Policy', '2022-02-15'),
- (37, 'Food Processing Policy', '2022-03-01'),
- (38, 'Farmers' Market Promotion Scheme', '2022-03-15'),
- (39, 'Research and Development in Agriculture', '2022-04-10'),
- (40, 'National Policy for Sustainable Agriculture', '2022-04-25'),
- (41, 'Farm Mechanization Policy', '2022-05-05'),
- (42, 'Water Resources Management Policy', '2022-06-15'),
- (43, 'Integrated Animal Husbandry Policy', '2022-07-01'),
- (44, 'National Agro-Climate Action Plan', '2022-07-20'),
- (45, 'Promotion of Farm Cooperatives', '2022-08-10'),
- (46, 'Agroecology Initiative', '2022-09-01'),
- (47, 'Sustainable Livestock Production Policy', '2022-09-15'),
- (48, 'Climate Smart Agriculture Strategy', '2022-10-05'),
- (49, 'State Agricultural Policy', '2022-10-20'),
- (50, 'National Green Mission', '2022-11-01'),
- (51, 'Biodiversity Conservation Policy', '2022-11-15'),
- (52, 'Research and Extension in Agriculture', '2022-12-05'),
- (53, 'National Agroforestry Development Plan', '2023-01-10'),
- (54, 'Paddy Procurement Policy', '2023-02-15'),
- (55, 'Integrated Crop Management Policy', '2023-03-01'),
- (56, 'Sustainable Fisheries Development Policy', '2023-03-15'),
- (57, 'Promotion of Heritage Crops', '2023-04-10'),
- (58, 'Soil Fertility Management Policy', '2023-04-25'),
- (59, 'Smart Farming Policy', '2023-05-05'),

(60, 'Urban Agriculture Policy', '2023-06-15'),  
(61, 'National Food Processing Mission', '2023-07-01'),  
(62, 'Agri-Input Management Policy', '2023-07-20'),  
(63, 'National Fisheries Development Program', '2023-08-10'),  
(64, 'Agri-Tech Adoption Policy', '2023-09-01'),  
(65, 'Promotion of Nutri-Cereals', '2023-09-15'),  
(66, 'Rainfed Farming Policy', '2023-10-05'),  
(67, 'National Agricultural Policy Review', '2023-10-20'),  
(68, 'Promotion of Climate Resilient Varieties', '2023-11-01'),  
(69, 'Agro-Processing Policy', '2023-11-15'),  
(70, 'Land Use Policy', '2023-12-05'),  
(71, 'Smallholder Farmer Support Program', '2024-01-10'),  
(72, 'Promotion of Sustainable Practices in Dairy', '2024-02-15'),  
(73, 'Policy for Digital Platforms in Agriculture', '2024-03-01'),  
(74, 'Sustainable Practices for Vegetable Production', '2024-03-15'),  
(75, 'Policy for Farmer Producer Organizations', '2024-04-10'),  
(76, 'Soil Organic Matter Improvement Program', '2024-04-25'),  
(77, 'Integrated Pest Management for Sustainable Crops', '2024-05-05'),  
(78, 'Promotion of Sustainable Aquaculture', '2024-06-15'),  
(79, 'Policy for Disaster Risk Management in Agriculture', '2024-07-01'),  
(80, 'Promotion of Indigenous Crop Varieties', '2024-07-20'),  
(81, 'Climate Resilience and Food Security Policy', '2024-08-10'),  
(82, 'National Rural Livelihoods Mission', '2024-09-01'),  
(83, 'Policy for Improved Access to Agricultural Credit', '2024-09-15'),  
(84, 'Policy for Women in Agriculture', '2024-10-05'),  
(85, 'Agricultural Biodiversity Conservation Policy', '2024-10-20'),  
(86, 'National Organic Farming Certification Scheme', '2024-11-01'),  
(87, 'Promotion of Agro-Biodiversity', '2024-11-15'),  
(88, 'National Policy for Climate-Smart Fisheries', '2024-12-05'),  
(89, 'Soil Restoration Policy', '2025-01-10'),  
(90, 'Policy for Green Energy in Agriculture', '2025-02-15');

#### 14. PolicyType(TypeID, Type, Description)

	typeID	type	description
1	1	Environmental	Policies aimed at promoting sustainable environmental practices.
2	2	Economic	Policies that support economic growth and stability in agriculture.
3	3	Social	Policies focused on social equity and community development in agriculture.
4	4	Technological	Policies that encourage the adoption of innovative agricultural technologies.
5	5	Regulatory	Policies designed to regulate agricultural practices for sustainability.
6	6	Research	Policies that promote agricultural research and development.
7	7	Education	Policies aimed at improving agricultural education and training.
8	8	Financial	Policies that provide financial support and incentives for farmers.
9	9	Market Access	Policies that facilitate access to markets for agricultural products.
10	10	Food Security	Policies that ensure food security and nutrition for all.
11	11	Water Management	Policies that promote sustainable water management practices.
12	12	Land Use	Policies focusing on the sustainable use of land resources.
13	13	Climate Adaptation	Policies that help farmers adapt to climate change impacts.
14	14	Organic Farming	Policies that promote organic farming practices.
15	15	Biodiversity	Policies aimed at conserving agricultural biodiversity.
16	16	Agroecology Policy	Policies promoting ecological approaches to agriculture.
17	17	Farming Technology Policy	Support for the adoption of agricultural technologies.
18	18	Renewable Energy Policy	Regulations encouraging the use of renewable energy in agriculture.
19	19	Youth Engagement Policy	Initiatives to engage young people in agriculture.

Successfully run. Total query runtime: 283 msec. 90 rows affected. Ln 1, Col 34

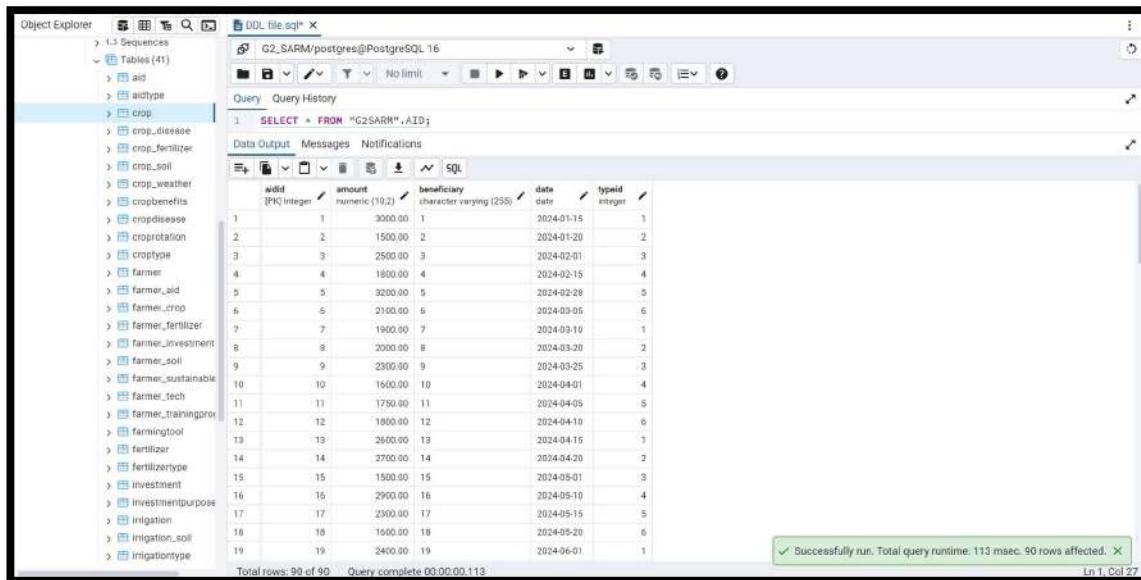
INSERT INTO PolicyType (TypeID, Type, Description) VALUES

- (1, 'Subsidy Policy', 'Policies providing financial assistance to farmers for inputs and production.'),
- (2, 'Sustainability Policy', 'Policies promoting sustainable farming practices and resource conservation.'),
- (3, 'Crop Insurance Policy', 'Insurance schemes to protect farmers against crop failures and losses.'),
- (4, 'Water Management Policy', 'Regulations and guidelines for sustainable water use in agriculture.'),
- (5, 'Soil Conservation Policy', 'Policies aimed at preventing soil erosion and promoting soil health.'),
- (6, 'Market Access Policy', 'Policies facilitating farmers' access to markets and fair pricing.'),
- (7, 'Research and Development Policy', 'Support for agricultural research and innovation initiatives.'),
- (8, 'Rural Development Policy', 'Programs aimed at improving infrastructure and livelihoods in rural areas.'),
- (9, 'Climate Change Policy', 'Strategies to mitigate and adapt to the impacts of climate change in agriculture.'),
- (10, 'Organic Farming Policy', 'Regulations supporting organic farming practices and certification.'),
- (11, 'Biodiversity Policy', 'Policies aimed at preserving agricultural biodiversity and ecosystems.'),
- (12, 'Fisheries Management Policy', 'Regulations governing sustainable fishing practices and aquaculture.'),
- (13, 'Livestock Management Policy', 'Guidelines for sustainable livestock production and welfare.'),
- (14, 'Food Safety Policy', 'Standards ensuring the safety and quality of agricultural products.'),
- (15, 'Pesticide Management Policy', 'Regulations for the use and management of agricultural chemicals.'),
- (16, 'Agricultural Education Policy', 'Support for education and training programs in agriculture.'),
- (17, 'Youth Engagement Policy', 'Programs encouraging youth involvement in agriculture and farming.'),
- (18, 'Gender Equality Policy', 'Promoting gender equality in agricultural practices and decision-making.'),
- (19, 'Fertilizer Regulation Policy', 'Guidelines for the use of fertilizers to promote sustainable practices.'),
- (20, 'Export Policy', 'Policies governing the export of agricultural products to international markets.'),
- (21, 'Land Tenure Policy', 'Regulations addressing land ownership and usage rights for farmers.'),
- (22, 'Community Support Policy', 'Policies fostering community collaboration and support for farmers.'),
- (23, 'Food Security Policy', 'Strategies to ensure access to sufficient, safe, and nutritious food.'),
- (24, 'Agroecology Policy', 'Support for agroecological practices and sustainable farming methods.'),

- (25, 'Plant Variety Protection Policy', 'Regulations for the protection of new plant varieties.'),  
(26, 'Agricultural Cooperatives Policy', 'Support for the formation and operation of farming cooperatives.'),  
(27, 'Infrastructure Development Policy', 'Policies aimed at improving rural infrastructure for farmers.'),  
(28, 'Consumer Protection Policy', 'Regulations safeguarding consumer rights in agricultural markets.'),  
(29, 'Technology Transfer Policy', 'Facilitating the transfer of agricultural technologies to farmers.'),  
(30, 'Ecosystem Services Policy', 'Policies recognizing and promoting ecosystem services from agriculture.'),  
(31, 'Public Procurement Policy', 'Guidelines for government purchases of agricultural products.'),  
(32, 'Rural Employment Policy', 'Initiatives to enhance employment opportunities in rural areas.'),  
(33, 'Carbon Farming Policy', 'Incentives for practices that sequester carbon in agriculture.'),  
(34, 'Agro-tourism Policy', 'Regulations promoting tourism activities on farms.'),  
(35, 'Food Waste Reduction Policy', 'Strategies to minimize food waste in the agricultural supply chain.'),  
(36, 'Veterinary Health Policy', 'Guidelines for livestock health and veterinary services.'),  
(37, 'National Agricultural Policy', 'Comprehensive strategies guiding national agricultural development.'),  
(38, 'Innovation Policy', 'Support for innovative practices and technologies in agriculture.'),  
(39, 'Farming Technology Policy', 'Promoting the adoption of modern farming technologies.'),  
(40, 'Food Processing Policy', 'Regulations supporting food processing industries and practices.'),  
(41, 'Research Funding Policy', 'Providing financial support for agricultural research initiatives.'),  
(42, 'Wildlife Conservation Policy', 'Policies integrating agriculture with wildlife conservation efforts.'),  
(43, 'Participatory Policy Development', 'Encouraging stakeholder involvement in policy formulation.'),  
(44, 'Nutritional Policy', 'Policies promoting healthy diets and nutrition linked to agriculture.'),  
(45, 'Climate Resilience Policy', 'Strategies to enhance resilience against climate-related impacts.'),  
(46, 'Sustainable Land Use Policy', 'Guidelines for responsible land use in agricultural practices.'),  
(47, 'Indigenous Rights Policy', 'Respecting the rights of indigenous communities in agriculture.'),  
(48, 'Agroforestry Policy', 'Support for integrating trees into agricultural systems.'),  
(49, 'Seed Policy', 'Regulations governing the production and distribution of seeds.'),  
(50, 'Traceability Policy', 'Requirements for tracking agricultural products from farm to table.'),  
(51, 'Integrated Pest Management Policy', 'Guidelines for sustainable pest management practices.'),  
(52, 'Food System Resilience Policy', 'Strategies to enhance the resilience of food systems.'),  
(53, 'Animal Welfare Policy', 'Regulations ensuring humane treatment of livestock.'),  
(54, 'Agro-industrial Policy', 'Policies supporting the agro-industrial sector.'),  
(55, 'Rural Health Policy', 'Improving health services in rural agricultural communities.'),  
(56, 'Supply Chain Policy', 'Regulations governing agricultural supply chains for efficiency.'),  
(57, 'Environmental Impact Policy', 'Assessing environmental impacts of agricultural practices.'),  
(58, 'Gender-Inclusive Policy', 'Strategies to include women in agricultural development processes.'),  
(59, 'Digital Agriculture Policy', 'Promoting the use of digital technologies in farming.'),  
(60, 'Resilience Building Policy', 'Policies supporting community resilience in agriculture.'),  
(61, 'Local Food Systems Policy', 'Promoting local food production and consumption practices.'),  
(62, 'Integrated Water Resource Management Policy', 'Guidelines for holistic water management in agriculture.'),  
(63, 'Drought Management Policy', 'Strategies to mitigate the effects of drought on agriculture.'),  
(64, 'Soil Health Policy', 'Regulations promoting the health and fertility of soils.'),  
(65, 'Agrochemical Policy', 'Guidelines for the responsible use of agrochemicals.'),  
(66, 'Harvest Management Policy', 'Strategies for effective and sustainable harvest practices.'),

(67, 'Market Regulation Policy', 'Policies regulating agricultural market activities and practices.'),  
 (68, 'Stakeholder Engagement Policy', 'Encouraging stakeholder involvement in agricultural development.'),  
 (69, 'Farming Input Subsidy Policy', 'Subsidies for inputs such as seeds, fertilizers, and equipment.'),  
 (70, 'Rural Connectivity Policy', 'Improving connectivity in rural areas for farmers and communities.'),  
 (71, 'National Food Policy', 'A comprehensive policy framework addressing national food issues.'),  
 (72, 'Invasive Species Policy', 'Regulations managing invasive species affecting agriculture.'),  
 (73, 'Public Health Policy', 'Policies addressing health issues related to agriculture.'),  
 (74, 'Land Restoration Policy', 'Strategies for restoring degraded agricultural land.'),  
 (75, 'Sustainable Fisheries Policy', 'Policies promoting responsible and sustainable fishing practices.'),  
 (76, 'Energy Efficiency Policy', 'Strategies for improving energy use in agricultural practices.'),  
 (77, 'Access to Finance Policy', 'Policies enhancing access to financial resources for farmers.'),  
 (78, 'Cross-sectoral Policy', 'Integrating agriculture with other sectors for holistic development.'),  
 (79, 'Agricultural Export Promotion Policy', 'Supporting farmers in accessing international markets.'),  
 (80, 'Crisis Management Policy', 'Strategies for managing agricultural crises and emergencies.');

## 15. Aid(AidID, Amount, Beneficiary, Date)



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SELECT * FROM "G2SARM".AID;

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3	2500.00	3	2024-02-01	3
4	1800.00	4	2024-02-15	4
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6	2100.00	6	2024-03-05	6
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9	2300.00	9	2024-03-25	3
10	1600.00	10	2024-04-01	4
11	1750.00	11	2024-04-05	5
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INSERT INTO Aid (AidID, Amount, Beneficiary, Date) VALUES

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(71, 1900.00, 71, '2027-01-10'),
(72, 2000.00, 72, '2027-02-15'),
(73, 2100.00, 73, '2027-03-01'),
(74, 2200.00, 74, '2027-03-15'),
(75, 2300.00, 75, '2027-04-10'),
(76, 2400.00, 76, '2027-04-25'),
(77, 1500.00, 77, '2027-05-05'),
(78, 1600.00, 78, '2027-06-15'),
(79, 1700.00, 79, '2027-07-01'),
(80, 1800.00, 80, '2027-07-20'),
(81, 1900.00, 81, '2027-08-10'),
(82, 2000.00, 82, '2027-09-01'),
(83, 2100.00, 83, '2027-09-15'),
(84, 2200.00, 84, '2027-10-05'),
(85, 2300.00, 85, '2027-10-20');
```

## 16. AidType(TypeID, Type, Description)

The screenshot shows the pgAdmin 4 interface. The left pane is the Object Explorer, displaying the database schema with tables like aid, aidtype, crop, etc. The right pane is a query editor window titled 'DDL file.sql'.

```

CREATE TABLE "G2SARM".AIDTYPE
(
    typeid integer NOT NULL,
    type character varying(255),
    description text
)
WITH (
    OIDS=FALSE
);
ALTER TABLE "G2SARM".AIDTYPE
OWNER TO G2SARM;
GRANT ALL ON "G2SARM".AIDTYPE TO PUBLIC;

```

The query editor also contains the following data insertion script:

```

INSERT INTO "G2SARM".AIDTYPE
VALUES
(1, 'Financial Aid', 'Monetary support for various needs'),
(2, 'Food Aid', 'Provision of food to those in need'),
(3, 'Educational Aid', 'Support for educational purposes'),
(4, 'Medical Aid', 'Health-related assistance and resources'),
(5, 'Technical Assistance', 'Support for technical projects and initiatives'),
(6, 'Emergency Aid', 'Immediate help during crises or disasters'),
(7, 'Crop Insurance', 'Financial protection against crop losses due to unforeseen events'),
(8, 'Market Access Programs', 'Programs designed to help farmers reach markets'),
(9, 'Research Grants', 'Funding for agricultural research projects'),
(10, 'Training Programs', 'Educational programs for farmers on best practices'),
(11, 'Soil Health Initiatives', 'Programs aimed at improving soil quality and health'),
(12, 'Pest Management Support', 'Assistance with integrated pest management strategies'),
(13, 'Water Conservation Programs', 'Initiatives promoting efficient water use in agriculture'),
(14, 'Youth Empowerment Initiatives', 'Programs aimed at engaging and empowering young farmers'),
(15, 'Women in Agriculture Support', 'Support programs focused on women farmers'),
(16, 'Sustainable Farming Grants', 'Grants for projects promoting sustainable farming practices'),
(17, 'Organic Farming Support', 'Assistance for transitioning to organic farming methods'),
(18, 'Community Development Aid', 'Support for rural community development initiatives'),
(19, 'Food Security Programs', 'Programs aimed at improving food security for vulnerable populations');

```

The status bar at the bottom of the query editor indicates: 'Successfully run. Total query runtime: 109 msec. 80 rows affected.'

INSERT INTO AidType (TypeID, Type, Description) VALUES  
(1, 'Financial Aid', 'Monetary assistance provided to support farmers and agricultural projects.'),

- (2, 'Technical Assistance', 'Support in the form of expertise and training to improve farming practices.'),  
(3, 'Material Support', 'Provision of physical goods such as seeds, fertilizers, and equipment.'),  
(4, 'Advisory Services', 'Consultation services to guide farmers on best practices and technology.'),  
(5, 'Capacity Building', 'Programs designed to enhance the skills and knowledge of farmers.'),  
(6, 'Emergency Relief', 'Aid provided during crises such as natural disasters or food shortages.'),  
(7, 'Research Grants', 'Funding for agricultural research projects and innovations.'),  
(8, 'Training Workshops', 'Educational sessions focused on specific agricultural skills and practices.'),  
(9, 'Subsidized Loans', 'Loans offered at reduced interest rates to support agricultural investments.'),  
(10, 'Market Access Programs', 'Initiatives facilitating farmers' access to markets and buyers.'),  
(11, 'Insurance Schemes', 'Financial protection against crop losses and unforeseen events.'),  
(12, 'Community Development Projects', 'Aid aimed at improving rural infrastructure and community resources.'),  
(13, 'Sustainable Farming Initiatives', 'Programs promoting environmentally friendly farming practices.'),  
(14, 'Youth Engagement Programs', 'Support aimed at involving young people in agriculture.'),  
(15, 'Gender Equality Initiatives', 'Programs focused on empowering women in agriculture.'),  
(16, 'Health and Nutrition Aid', 'Support for improving food security and nutritional outcomes.'),  
(17, 'Agricultural Policy Advocacy', 'Efforts to influence policies that benefit the agricultural sector.'),  
(18, 'Crisis Management Aid', 'Support for farmers in managing agricultural crises.'),  
(19, 'Organic Certification Support', 'Assistance in obtaining organic farming certifications.'),  
(20, 'Climate Resilience Programs', 'Initiatives aimed at enhancing resilience to climate change.'),  
(21, 'Food Safety Training', 'Programs educating farmers on safe food production practices.'),  
(22, 'Innovation Grants', 'Funding to encourage innovative agricultural technologies and practices.'),  
(23, 'Infrastructure Development Aid', 'Support for building and improving agricultural infrastructure.'),  
(24, 'Soil Health Improvement Programs', 'Initiatives focused on enhancing soil quality and fertility.'),  
(25, 'Water Conservation Projects', 'Programs promoting efficient water use in agriculture.'),  
(26, 'Biodiversity Conservation Aid', 'Support for preserving agricultural biodiversity and ecosystems.'),  
(27, 'Technology Transfer Programs', 'Initiatives facilitating the adoption of new technologies.'),  
(28, 'Local Food System Support', 'Aid focused on promoting local food production and consumption.'),  
(29, 'Pest and Disease Management Training', 'Education on managing agricultural pests and diseases.'),  
(30, 'Agroecology Support', 'Programs promoting agroecological farming practices.'),  
(31, 'Market Research Support', 'Assistance in conducting market research for agricultural products.'),  
(32, 'Crop Diversification Aid', 'Support for farmers to diversify their crops for resilience.'),  
(33, 'Livestock Health Programs', 'Aid focused on improving livestock health and management.'),  
(34, 'Ecosystem Services Programs', 'Support for recognizing and promoting ecosystem services.'),  
(35, 'Community Supported Agriculture', 'Programs connecting consumers directly with local farmers.'),  
(36, 'Food Processing Aid', 'Support for improving food processing techniques and facilities.'),  
(37, 'Seed Distribution Programs', 'Initiatives providing quality seeds to farmers.'),  
(38, 'Fisheries Support', 'Aid focused on sustainable fishing practices and aquaculture.'),  
(39, 'Agroforestry Support', 'Programs promoting the integration of trees into agricultural systems.'),  
(40, 'Training for Sustainable Practices', 'Workshops focused on teaching sustainable farming methods.'),  
(41, 'Integrated Pest Management Aid', 'Support for implementing integrated pest management practices.'),  
(42, 'Soil Erosion Prevention Programs', 'Initiatives to prevent soil erosion and degradation.'),  
(43, 'Public Awareness Campaigns', 'Efforts to raise awareness about sustainable agriculture.'),  
(44, 'Carbon Credit Programs', 'Support for practices that sequester carbon in agriculture.'),  
(45, 'Animal Welfare Programs', 'Aid focused on promoting humane treatment of livestock.'),

- (46, 'Urban Agriculture Support', 'Programs encouraging agricultural practices in urban areas.'),
- (47, 'Research Collaborations', 'Support for partnerships in agricultural research and development.'),
- (48, 'Crop Insurance Education', 'Training on the benefits and use of crop insurance.'),
- (49, 'Market Access Training', 'Workshops to help farmers understand market dynamics.'),
- (50, 'Agri-tourism Support', 'Aid for promoting tourism related to agriculture.'),
- (51, 'Disaster Preparedness Training', 'Programs educating farmers on disaster risk management.'),
- (52, 'Water Resource Management Aid', 'Support for effective water management practices.'),
- (53, 'Rural Youth Development Programs', 'Initiatives focusing on youth development in rural areas.'),
- (54, 'Invasive Species Management Aid', 'Support for managing invasive species in agriculture.'),
- (55, 'Food Security Initiatives', 'Programs aimed at ensuring access to nutritious food.'),
- (56, 'Health Services for Farmers', 'Access to healthcare services for farming communities.'),
- (57, 'Consumer Education Programs', 'Informing consumers about sustainable food practices.'),
- (58, 'Local Seed Bank Support', 'Aid for establishing local seed banks for crop diversity.'),
- (59, 'Elderly Farmer Support Programs', 'Assistance for older farmers in continuing agricultural practices.'),
- (60, 'Pesticide Management Training', 'Education on safe and effective pesticide use.'),
- (61, 'Agri-business Training', 'Workshops on managing agricultural enterprises effectively.'),
- (62, 'Rural Electrification Programs', 'Support for providing electricity to rural farming areas.'),
- (63, 'Pollinator Protection Initiatives', 'Programs aimed at protecting pollinator species.'),
- (64, 'Animal Breeding Programs', 'Support for improving livestock breeds and genetics.'),
- (65, 'Agri-tech Competitions', 'Competitions encouraging innovation in agricultural technologies.'),
- (66, 'Sustainable Water Use Programs', 'Initiatives promoting efficient water use practices.'),
- (67, 'Community Resilience Training', 'Education on building resilient communities in agriculture.'),
- (68, 'Soil Testing Services', 'Support for soil testing to guide agricultural practices.'),
- (69, 'Public-Private Partnerships', 'Collaborations between public and private sectors for agriculture.'),
- (70, 'Food Donation Programs', 'Initiatives to reduce food waste through donations.'),
- (71, 'Education for Sustainable Development', 'Programs integrating sustainability into educational curricula.'),
- (72, 'Gender-Sensitive Training', 'Training programs addressing the specific needs of women farmers.'),
- (73, 'Integrated Farming Support', 'Aid promoting integrated farming systems.'),
- (74, 'Mobile Technology Aid', 'Support for using mobile technology in agricultural practices.'),
- (75, 'Sustainable Fishing Aid', 'Support for practices promoting sustainable fishing.'),
- (76, 'Economic Development Programs', 'Programs focused on enhancing the economic status of farmers.'),
- (77, 'Resource Management Workshops', 'Training on managing agricultural resources effectively.'),
- (78, 'Peer Learning Networks', 'Facilitating networks for farmers to learn from each other.'),
- (79, 'Conservation Agriculture Training', 'Education on practices that conserve natural resources.'),
- (80, 'Advocacy for Farmers\' Rights', 'Programs supporting the rights and interests of farmers.');

## 17. CropDisease(DiseaseID, Name, Symptoms, Treatment)

The screenshot shows the pgAdmin 4 interface. In the Object Explorer, the 'Tables (41)' section is expanded, showing various tables like 'aid', 'airtype', 'crop', 'crop\_disease', etc. The 'Query' tab is selected, displaying the SQL query: 'SELECT \* FROM "G2\_SARM"."CROPDISEASE";'. The results grid shows 90 rows of data with columns: diseaseid, name, symptoms, and treatment. The last row of the results grid has a note: 'Successfully run. Total query runtime: 68 msec. 90 rows affected.' and 'Ln 1, Col 34'.

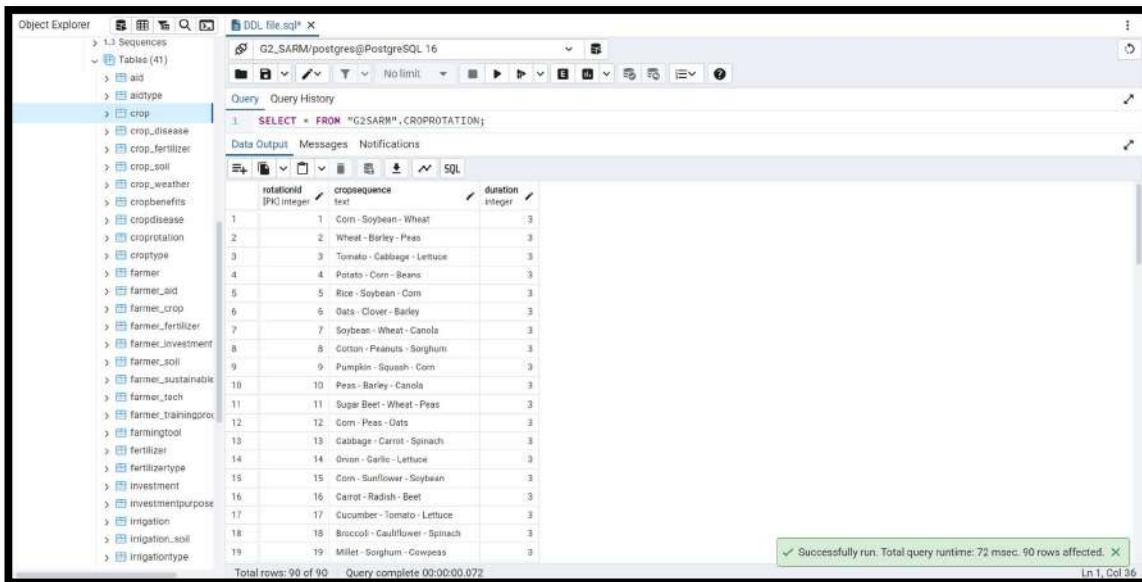
diseaseid	name	symptoms	treatment
1	1 Downy Mildew	Yellowing of leaves, mold on underside.	Fungicides, good air circulation.
2	2 Powdery Mildew	White powdery spots on leaves.	Fungicides, sulfur-based treatments.
3	3 Bacterial Blight	Water-soaked spots on leaves.	Copper-based bactericides.
4	4 Leaf Spot	Brown or black spots on leaves.	Remove infected leaves, fungicides.
5	5 Rust	Orange or rust-colored spots on leaves.	Fungicides, crop rotation.
6	6 Blight	Wilting, brown stems, and leaves.	Fungicides, proper sanitation.
7	7 Crown Rot	Wilting and darkening of plant base.	Improve drainage, fungicides.
8	8 Fusarium Wilt	Yellowing and wilting of leaves.	Soil sterilization, resistant varieties.
9	9 Anthracnose	Dark, sunken lesions on fruits.	Fungicides, crop rotation.
10	10 Sclerotinia	White mold on infected tissues.	Fungicides, good air circulation.
11	11 Root Rot	Yellowing and wilting of plants.	Improve drainage, remove infected plants.
12	12 Powdery Scab	Powdery spots on tubers.	Crop rotation, resistant varieties.
13	13 Leaf Curl	Curling and distortion of leaves.	Pesticides, proper pruning.
14	14 Viruses	Stunted growth, mottled leaves.	Use virus-free seeds, insect control.
15	15 Gray Mold	Soft, brown rot on fruits and flowers.	Fungicides, reduce humidity.
16	16 Black Rot	Dark lesions on stems and leaves.	Remove infected plants, fungicides.
17	17 White Rust	White pustules on leaves.	Fungicides, resistant varieties.
18	18 Nematodes	Root galls, stunted growth.	Crop rotation, nematode-resistant varieties.
19	19 Flea Beetle	Tiny holes in leaves.	Insecticides, row covers.

INSERT INTO CropDisease (DiseaseID, Name, Symptoms, Treatment) VALUES  
(1, 'Downy Mildew', 'Yellowing of leaves, mold on underside.', 'Fungicides, good air circulation.'),  
(2, 'Powdery Mildew', 'White powdery spots on leaves.', 'Fungicides, sulfur-based treatments.'),  
(3, 'Bacterial Blight', 'Water-soaked spots on leaves.', 'Copper-based bactericides.'),  
(4, 'Leaf Spot', 'Brown or black spots on leaves.', 'Remove infected leaves, fungicides.'),  
(5, 'Rust', 'Orange or rust-colored spots on leaves.', 'Fungicides, crop rotation.'),  
(6, 'Blight', 'Wilting, brown stems, and leaves.', 'Fungicides, proper sanitation.'),  
(7, 'Crown Rot', 'Wilting and darkening of plant base.', 'Improve drainage, fungicides.'),  
(8, 'Fusarium Wilt', 'Yellowing and wilting of leaves.', 'Soil sterilization, resistant varieties.'),  
(9, 'Anthracnose', 'Dark, sunken lesions on fruits.', 'Fungicides, crop rotation.'),  
(10, 'Sclerotinia', 'White mold on infected tissues.', 'Fungicides, good air circulation.'),  
(11, 'Root Rot', 'Yellowing and wilting of plants.', 'Improve drainage, remove infected plants.'),  
(12, 'Powdery Scab', 'Powdery spots on tubers.', 'Crop rotation, resistant varieties.'),  
(13, 'Leaf Curl', 'Curling and distortion of leaves.', 'Pesticides, proper pruning.'),  
(14, 'Viruses', 'Stunted growth, mottled leaves.', 'Use virus-free seeds, insect control.'),  
(15, 'Gray Mold', 'Soft, brown rot on fruits and flowers.', 'Fungicides, reduce humidity.'),  
(16, 'Black Rot', 'Dark lesions on stems and leaves.', 'Remove infected plants, fungicides.'),  
(17, 'White Rust', 'White pustules on leaves.', 'Fungicides, resistant varieties.'),  
(18, 'Nematodes', 'Root galls, stunted growth.', 'Crop rotation, nematode-resistant varieties.'),  
(19, 'Flea Beetle', 'Tiny holes in leaves.', 'Insecticides, row covers.'),  
(20, 'Aphids', 'Curling leaves, sticky residue.', 'Insecticidal soap, ladybugs.'),  
(21, 'Spider Mites', 'Fine webbing on leaves.', 'Miticides, increase humidity.'),  
(22, 'Cabbage Worm', 'Chewed holes in leaves.', 'Bacillus thuringiensis, handpicking.'),  
(23, 'Cutworms', 'Plants cut off at the base.', 'Collars around seedlings, insecticides.'),  
(24, 'Thrips', 'Silver streaks on leaves.', 'Insecticides, sticky traps.'),  
(25, 'Leafhoppers', 'Yellowing leaves, stunted growth.', 'Insecticides, reflective mulch.'),  
(26, 'Corn Smut', 'Tumors on corn ears.', 'Remove infected plants, fungicides.'),  
(27, 'Tobacco Mosaic Virus', 'Mottling on leaves.', 'Use virus-free seeds, control aphids.'),  
(28, 'Late Blight', 'Black lesions on leaves and stems.', 'Fungicides, resistant varieties.'),  
(29, 'Early Blight', 'Dark spots on lower leaves.', 'Fungicides, crop rotation.'),

- (30, 'Pea Weevil', 'Holes in pea pods.', 'Insecticides, sanitation.'),  
(31, 'Soybean Cyst Nematode', 'Stunted growth, yellowing.', 'Resistant varieties, crop rotation.'),  
(32, 'Cercospora Leaf Spot', 'Grayish-brown spots on leaves.', 'Fungicides, remove debris.'),  
(33, 'Septoria Leaf Spot', 'Small dark spots on leaves.', 'Fungicides, crop rotation.'),  
(34, 'Zucchini Yellow Mosaic Virus', 'Mottling on zucchini leaves.', 'Use virus-free seeds.'),  
(35, 'Bacterial Soft Rot', 'Soft, water-soaked tissues.', 'Reduce moisture, remove infected plants.'),  
(36, 'Blossom End Rot', 'Dark, sunken spots on fruits.', 'Calcium supplements, proper watering.'),  
(37, 'Tomato Mosaic Virus', 'Mottled leaves, poor growth.', 'Control aphids, use virus-free seeds.'),  
(38, 'Aspergillus Rot', 'Dark, sunken spots on fruits.', 'Fungicides, proper sanitation.'),  
(39, 'Rhizoctonia Root Rot', 'Brown lesions on roots.', 'Improve drainage, fungicides.'),  
(40, 'Scab', 'Rough, raised areas on fruits.', 'Fungicides, resistant varieties.'),  
(41, 'Soft Rot', 'Brown, mushy tissue.', 'Reduce humidity, improve drainage.'),  
(42, 'Crown Gall', 'Tumors on stems and roots.', 'Prune infected parts, soil sterilization.'),  
(43, 'Charcoal Rot', 'Black, sunken lesions on stems.', 'Crop rotation, good sanitation.'),  
(44, 'Sooty Mold', 'Black sooty fungus on leaves.', 'Control insect pests, remove affected leaves.'),  
(45, 'Tomato Spotted Wilt Virus', 'Spots on leaves and fruit.', 'Control thrips, use resistant varieties.'),  
(46, 'Bacterial Wilt', 'Sudden wilting of plants.', 'Use resistant varieties, crop rotation.'),  
(47, 'Curly Top Virus', 'Leaf curling and yellowing.', 'Control leafhoppers, resistant varieties.'),  
(48, 'Yellow Mosaic Virus', 'Yellow mottling on leaves.', 'Use virus-free seeds, control aphids.'),  
(49, 'Damping Off', 'Seedlings collapse at soil level.', 'Improve drainage, sterilize soil.'),  
(50, 'Cucumber Mosaic Virus', 'Mottled, yellowing leaves.', 'Use virus-free seeds, control aphids.'),  
(51, 'Fusarium Root Rot', 'Brown roots, stunted growth.', 'Improve drainage, resistant varieties.'),  
(52, 'Verticillium Wilt', 'Wilting of leaves, yellowing.', 'Resistant varieties, good crop rotation.'),  
(53, 'Bacterial Leaf Spot', 'Water-soaked spots, yellowing.', 'Copper-based bactericides.'),  
(54, 'Sooty Blotch', 'Dark spots on fruit skins.', 'Improve airflow, fungicides.'),  
(55, 'Target Spot', 'Dark, circular spots on leaves.', 'Fungicides, crop rotation.'),  
(56, 'Tansy Ragwort', 'Yellow flowers, stunted growth.', 'Manual removal, herbicides.'),  
(57, 'Aster Yellows', 'Yellowing and stunted growth.', 'Control leafhoppers, resistant varieties.'),  
(58, 'Pea Powdery Mildew', 'White powder on leaves.', 'Fungicides, resistant varieties.'),  
(59, 'Late Summer Blight', 'Brown patches on leaves.', 'Fungicides, good air circulation.'),  
(60, 'Leaf Drop', 'Premature dropping of leaves.', 'Monitor watering, reduce humidity.'),  
(61, 'Bacterial Canker', 'Dark, sunken spots on stems.', 'Prune infected branches, copper fungicides.'),  
(62, 'Anthracnose Fruit Rot', 'Dark lesions on ripe fruit.', 'Fungicides, crop rotation.'),  
(63, 'Crown Disease', 'Wilting, darkened roots.', 'Crop rotation, resistant varieties.'),  
(64, 'Leaf Mold', 'Dark, fuzzy mold on leaves.', 'Increase air circulation, fungicides.'),  
(65, 'Damping Off Disease', 'Seedlings collapse at soil level.', 'Sterilize soil, improve drainage.'),  
(66, 'Phytophthora Blight', 'Water-soaked lesions, wilting.', 'Fungicides, proper spacing.'),  
(67, 'Sweet Potato Weevil', 'Holes in sweet potato.', 'Insecticides, crop rotation.'),  
(68, 'Nutrient Deficiency', 'Yellowing leaves, poor growth.', 'Fertilizer application, soil testing.'),  
(69, 'Tomato Wilt Virus', 'Yellowing and wilting leaves.', 'Control nematodes, resistant varieties.'),  
(70, 'Cotton Leaf Curl Virus', 'Curled leaves, stunted growth.', 'Control whiteflies, resistant varieties.'),  
(71, 'Bacterial Leaf Blight', 'Brown lesions on leaf tips.', 'Fungicides, remove infected leaves.'),  
(72, 'Red Root Rot', 'Red discoloration of roots.', 'Improve drainage, resistant varieties.'),  
(73, 'Fungal Leaf Spot', 'Dark spots on leaves.', 'Fungicides, proper sanitation.'),  
(74, 'Black Leg', 'Dark lesions on stems.', 'Fungicides, crop rotation.'),  
(75, 'Leaf Scald', 'Brown edges on leaves.', 'Fungicides, improve air circulation.'),  
(76, 'Tomato Hornworm', 'Chewed leaves, large green caterpillars.', 'Manual removal, insecticides.'),

(77, 'Whiteflies', 'Sticky leaves, wilting.', 'Insecticides, yellow sticky traps.'),  
 (78, 'Bacterial Blight of Beans', 'Water-soaked spots on leaves.', 'Copper-based treatments, crop rotation.'),  
 (79, 'Botrytis Blight', 'Gray mold on flowers and fruits.', 'Fungicides, reduce humidity.'),  
 (80, 'Scab Disease', 'Rough spots on fruits.', 'Fungicides, resistant varieties.'),  
 (81, 'Sclerotinia Stem Rot', 'White mold on stems.', 'Fungicides, improve drainage.'),  
 (82, 'Fusarium Head Blight', 'Rotting heads in grains.', 'Fungicides, crop rotation.'),  
 (83, 'Ring Spot Virus', 'Circular spots on leaves.', 'Use virus-free seeds, control insect vectors.'),  
 (84, 'Black Mold', 'Dark mold on leaves and fruits.', 'Fungicides, improve ventilation.'),  
 (85, 'Chickpea Wilt', 'Stunted growth, yellowing leaves.', 'Resistant varieties, crop rotation.'),  
 (86, 'Olive Knot', 'Knots on branches and stems.', 'Prune infected areas, disinfect tools.'),  
 (87, 'Vine Decline', 'Wilting and yellowing of vines.', 'Control pests, improve soil health.'),  
 (88, 'Citrus Greening', 'Yellowing leaves, lopsided fruit.', 'Control psyllids, remove infected trees.'),  
 (89, 'Raspberry Leaf Curl', 'Curling and discoloration of leaves.', 'Remove infected plants, control aphids.'),  
 (90, 'Sweet Corn Smut', 'Tumors on ears and kernels.', 'Remove infected plants, resistant varieties.');

## 18. CropRotation(RotationID, CropSequence, Duration)



The screenshot shows the pgAdmin 4 interface. The left pane is the Object Explorer, displaying a tree view of the database schema with various tables like aid, airtype, crop, and croprotation. The right pane is the Query Editor, showing a SQL query and its results.

```

SELECT * FROM "G2_SARM".CROPROTATION;
  
```

rotationid	cropsequence	duration
1	Corn - Soybean - Wheat	3
2	Wheat - Barley - Peas	3
3	Tomato - Cabbage - Lettuce	3
4	Potato - Corn - Beans	3
5	Rice - Soybean - Corn	3
6	Oats - Clover - Barley	3
7	Soybean - Wheat - Canola	3
8	Cotton - Peanuts - Sorghum	3
9	Pumpkin - Squash - Corn	3
10	Peas - Barley - Canola	3
11	Sugar Beet - Wheat - Peas	3
12	Corn - Peas - Oats	3
13	Cabbage - Carrot - Spinach	3
14	Onion - Garlic - Lettuce	3
15	Corn - Sunflower - Soybean	3
16	Carrot - Radish - Beef	3
17	Cucumber - Tomato - Lettuce	3
18	Broccoli - Cauliflower - Spinach	3
19	Millet - Sorghum - Cowpeas	3

Total rows: 90 of 90    Query complete 00:00:00.072    ✓ Successfully run. Total query runtime: 72 msec. 90 rows affected. X

INSERT INTO CropRotation (RotationID, CropSequence, Duration) VALUES

(1, 'Corn - Soybean - Wheat', 3),  
 (2, 'Wheat - Barley - Peas', 3),  
 (3, 'Tomato - Cabbage - Lettuce', 3),  
 (4, 'Potato - Corn - Beans', 3),  
 (5, 'Rice - Soybean - Corn', 3),  
 (6, 'Oats - Clover - Barley', 3),  
 (7, 'Soybean - Wheat - Canola', 3),  
 (8, 'Cotton - Peanuts - Sorghum', 3),  
 (9, 'Pumpkin - Squash - Corn', 3),  
 (10, 'Peas - Barley - Canola', 3),  
 (11, 'Sugar Beet - Wheat - Peas', 3),  
 (12, 'Corn - Peas - Oats', 3),

- (13, 'Cabbage - Carrot - Spinach', 3),
- (14, 'Onion - Garlic - Lettuce', 3),
- (15, 'Corn - Sunflower - Soybean', 3),
- (16, 'Carrot - Radish - Beet', 3),
- (17, 'Cucumber - Tomato - Lettuce', 3),
- (18, 'Broccoli - Cauliflower - Spinach', 3),
- (19, 'Millet - Sorghum - Cowpeas', 3),
- (20, 'Alfalfa - Wheat - Oats', 3),
- (21, 'Barley - Rye - Clover', 3),
- (22, 'Sweet Potato - Corn - Beans', 3),
- (23, 'Cabbage - Potatoes - Peas', 3),
- (24, 'Pumpkin - Beans - Corn', 3),
- (25, 'Faba Beans - Wheat - Barley', 3),
- (26, 'Sorghum - Peas - Sunflower', 3),
- (27, 'Tomato - Pepper - Eggplant', 3),
- (28, 'Brussels Sprouts - Kale - Cabbage', 3),
- (29, 'Rice - Wheat - Sesame', 3),
- (30, 'Sesame - Millet - Sorghum', 3),
- (31, 'Squash - Beans - Corn', 3),
- (32, 'Peas - Potato - Carrot', 3),
- (33, 'Garlic - Onion - Shallots', 3),
- (34, 'Spinach - Kale - Chard', 3),
- (35, 'Cotton - Soybean - Wheat', 3),
- (36, 'Soybean - Corn - Wheat', 3),
- (37, 'Peas - Barley - Rye', 3),
- (38, 'Barley - Faba Beans - Oats', 3),
- (39, 'Wheat - Beans - Clover', 3),
- (40, 'Triticale - Corn - Soybean', 3),
- (41, 'Millet - Barley - Cowpeas', 3),
- (42, 'Chickpeas - Wheat - Mustard', 3),
- (43, 'Lentils - Barley - Peas', 3),
- (44, 'Potatoes - Corn - Beans', 3),
- (45, 'Sugar Beets - Soybean - Peas', 3),
- (46, 'Cabbage - Broccoli - Cauliflower', 3),
- (47, 'Spinach - Lettuce - Chard', 3),
- (48, 'Carrot - Beet - Parsnip', 3),
- (49, 'Tomato - Corn - Cucumber', 3),
- (50, 'Brassicicas - Legumes - Grains', 3),
- (51, 'Sweet Corn - Beans - Squash', 3),
- (52, 'Rye - Clover - Oats', 3),
- (53, 'Barley - Potatoes - Beans', 3),
- (54, 'Canola - Corn - Wheat', 3),
- (55, 'Cabbage - Peas - Carrots', 3),
- (56, 'Peas - Potatoes - Spinach', 3),
- (57, 'Corn - Oats - Soybean', 3),
- (58, 'Wheat - Canola - Faba Beans', 3),
- (59, 'Pumpkin - Corn - Beans', 3),

(60, 'Garlic - Peas - Carrots', 3),  
(61, 'Radishes - Carrots - Onions', 3),  
(62, 'Onion - Garlic - Shallots', 3),  
(63, 'Tomato - Lettuce - Spinach', 3),  
(64, 'Potato - Squash - Beans', 3),  
(65, 'Oats - Rye - Peas', 3),  
(66, 'Corn - Cotton - Peas', 3),  
(67, 'Barley - Soybean - Peas', 3),  
(68, 'Peas - Faba Beans - Oats', 3),  
(69, 'Sesame - Wheat - Rye', 3),  
(70, 'Rice - Corn - Soybean', 3),  
(71, 'Cucumber - Beans - Peas', 3),  
(72, 'Sunflower - Corn - Beans', 3),  
(73, 'Squash - Corn - Beans', 3),  
(74, 'Potato - Corn - Wheat', 3),  
(75, 'Tomato - Bean - Squash', 3),  
(76, 'Soybean - Wheat - Peas', 3),  
(77, 'Barley - Corn - Soybean', 3),  
(78, 'Cotton - Wheat - Barley', 3),  
(79, 'Oats - Sunflower - Peas', 3),  
(80, 'Millet - Soybean - Corn', 3),  
(81, 'Tomato - Potato - Lettuce', 3),  
(82, 'Cabbage - Carrot - Onion', 3),  
(83, 'Garlic - Tomato - Spinach', 3),  
(84, 'Peas - Corn - Squash', 3),  
(85, 'Soybean - Peas - Wheat', 3),  
(86, 'Cotton - Peas - Wheat', 3),  
(87, 'Chickpeas - Lentils - Wheat', 3),  
(88, 'Barley - Cabbage - Lettuce', 3),  
(89, 'Potato - Squash - Beans', 3),  
(90, 'Corn - Soybean - Oats', 3);

19. CropBenefits(BenefitID, RotationID, Benefit)

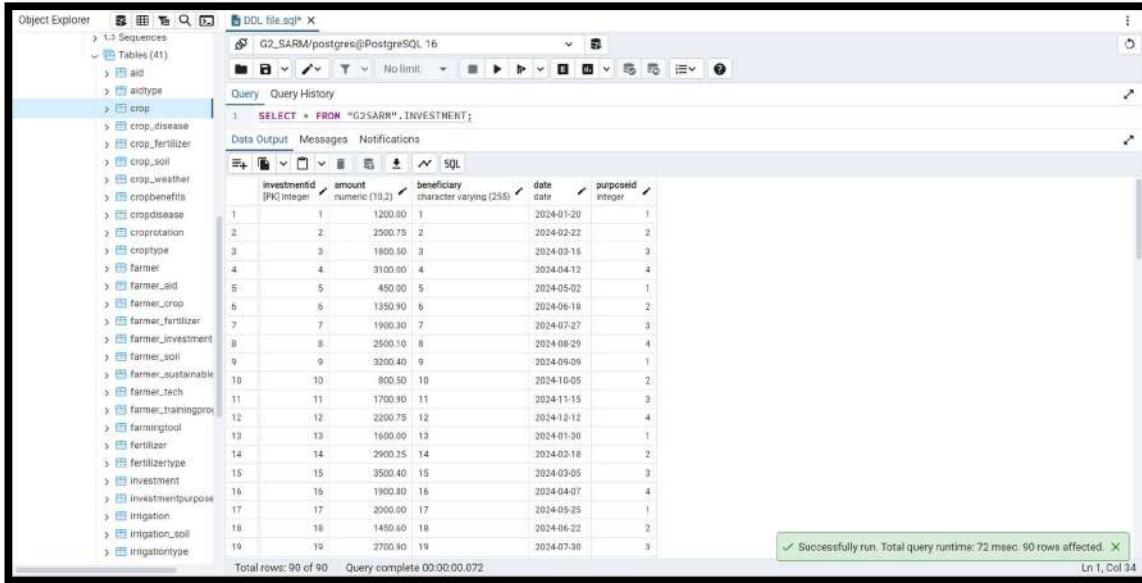
benefitid	rotationid	benefit
1	1	1. Improves soil fertility through nitrogen fixation
2	2	1. Reduces pest populations
3	3	1. Enhances biodiversity
4	4	2. Increases yields by improving soil structure
5	5	2. Prevents disease buildup
6	6	3. Promotes healthy growth and increases yield
7	7	3. Improves soil structure and fertility
8	8	4. Diversifies crop production
9	9	4. Helps in weed management
10	10	5. Reduces dependency on chemical fertilizers
11	11	5. Improves pest management
12	12	6. Enhances soil health
13	13	6. Reduces erosion
14	14	7. Increases nutrient cycling
15	15	7. Improves water retention
16	16	8. Boosts overall farm resilience
17	17	8. Increases profits by diversifying crops
18	18	9. Improves nutrient availability
19	19	9. Reduces environmental impact

INSERT INTO CropBenefits (BenefitID, RotationID, Benefit) VALUES  
(1, 1, 'Improves soil fertility by alternating crops.'),  
(2, 1, 'Reduces pest and disease cycles.'),  
(3, 1, 'Enhances biodiversity in the farming system.'),  
(4, 1, 'Improves crop yield and quality.'),  
(5, 1, 'Increases resilience to climate change.'),  
(6, 1, 'Reduces soil erosion through diverse root structures.'),  
(7, 1, 'Promotes better water retention in the soil.'),  
(8, 1, 'Helps in managing weeds more effectively.'),  
(9, 1, 'Increases nutrient cycling and availability.'),  
(10, 1, 'Enhances the overall ecosystem health.'),  
(11, 2, 'Improves nutrient availability for subsequent crops.'),  
(12, 2, 'Breaks cycles of pests and diseases.'),  
(13, 2, 'Provides habitat for beneficial organisms.'),  
(14, 2, 'Promotes better water use efficiency.'),  
(15, 2, 'Improves the resilience of the farming system.'),  
(16, 2, 'Facilitates better organic matter decomposition.'),  
(17, 2, 'Enhances soil structure and aeration.'),  
(18, 2, 'Increases overall farm profitability.'),  
(19, 2, 'Encourages crop diversity and resilience.'),  
(20, 2, 'Supports sustainable land management practices.'),  
(21, 3, 'Contributes to carbon sequestration in soils.'),  
(22, 3, 'Enhances crop rotation effectiveness.'),  
(23, 3, 'Reduces reliance on chemical inputs.'),  
(24, 3, 'Improves soil health through diverse crop residues.'),  
(25, 3, 'Mitigates the impact of soil degradation.'),  
(26, 3, 'Enhances overall ecosystem services.'),  
(27, 3, 'Reduces the need for irrigation through improved soil structure.'),  
(28, 3, 'Increases the profitability of mixed cropping systems.'),  
(29, 3, 'Encourages community engagement in sustainable practices.'),

- (30, 3, 'Facilitates knowledge sharing among farmers.'),  
(31, 4, 'Reduces fertilizer runoff into water bodies.'),  
(32, 4, 'Improves the resilience of crops to environmental stressors.'),  
(33, 4, 'Enhances crop rotation productivity.'),  
(34, 4, 'Encourages sustainable agricultural practices.'),  
(35, 4, 'Improves overall farm sustainability.'),  
(36, 4, 'Strengthens soil microbial activity and diversity.'),  
(37, 4, 'Promotes agro-ecological practices.'),  
(38, 4, 'Facilitates market access for diverse crops.'),  
(39, 4, 'Supports local food systems and communities.'),  
(40, 4, 'Encourages adaptive management strategies.'),  
(41, 5, 'Improves resilience to extreme weather events.'),  
(42, 5, 'Enhances soil moisture retention.'),  
(43, 5, 'Promotes effective nutrient management.'),  
(44, 5, 'Encourages farmer education and training.'),  
(45, 5, 'Facilitates research and development in agriculture.'),  
(46, 5, 'Encourages investment in sustainable practices.'),  
(47, 5, 'Enhances economic viability of crop rotations.'),  
(48, 5, 'Increases land use efficiency.'),  
(49, 5, 'Supports biodiversity conservation efforts.'),  
(50, 5, 'Improves the quality of local produce.'),  
(51, 6, 'Enhances the effectiveness of integrated pest management.'),  
(52, 6, 'Encourages local partnerships in agriculture.'),  
(53, 6, 'Reduces production costs through sustainable practices.'),  
(54, 6, 'Promotes healthier diets through diverse crops.'),  
(55, 6, 'Facilitates access to eco-friendly farming resources.'),  
(56, 6, 'Encourages farmers to adopt modern technologies.'),  
(57, 6, 'Supports rural development initiatives.'),  
(58, 6, 'Facilitates environmental conservation efforts.'),  
(59, 6, 'Improves overall health of farming ecosystems.'),  
(60, 6, 'Encourages resilience in agricultural systems.'),  
(61, 7, 'Promotes soil health and fertility.'),  
(62, 7, 'Facilitates crop yield stability.'),  
(63, 7, 'Encourages sustainable pest control methods.'),  
(64, 7, 'Increases access to organic markets.'),  
(65, 7, 'Supports traditional farming practices.'),  
(66, 7, 'Enhances farm-level climate change mitigation.'),  
(67, 7, 'Improves knowledge transfer between generations.'),  
(68, 7, 'Encourages crop insurance participation.'),  
(69, 7, 'Enhances community resilience against economic shocks.'),  
(70, 7, 'Facilitates sustainable agricultural education.'),  
(71, 8, 'Improves crop productivity through diversification.'),  
(72, 8, 'Encourages participatory research approaches.'),  
(73, 8, 'Increases efficiency of resource use.'),  
(74, 8, 'Supports agro-biodiversity conservation.'),  
(75, 8, 'Facilitates sustainable rural livelihoods.'),  
(76, 8, 'Promotes the use of green manure crops.'),

(77, 8, 'Enhances resilience to market fluctuations.'),  
 (78, 8, 'Encourages cooperative farming initiatives.'),  
 (79, 8, 'Improves social equity in agricultural practices.'),  
 (80, 8, 'Increases farmer adaptability to climate variability.'),  
 (81, 9, 'Reduces soil salinization and compaction.'),  
 (82, 9, 'Encourages improved livestock management practices.'),  
 (83, 9, 'Enhances the profitability of farming systems.'),  
 (84, 9, 'Facilitates better pest and weed control.'),  
 (85, 9, 'Promotes water quality improvement initiatives.'),  
 (86, 9, 'Encourages local sourcing of agricultural inputs.'),  
 (87, 9, 'Supports family farming and community resilience.'),  
 (88, 9, 'Enhances public health through improved food systems.'),  
 (89, 9, 'Promotes ethical sourcing of agricultural products.'),  
 (90, 9, 'Facilitates training and support for new farmers.');

## 20. Investment(InvestmentID, Amount, Beneficiary, Date)



The screenshot shows the pgAdmin interface with the Object Explorer on the left and a query results grid on the right.

**Object Explorer:** Shows the database structure with tables like aid, aidtype, crop, crop\_disease, crop\_fertilizer, crop\_soil, crop\_weather, cropbenefits, cropdisease, croprotation, cropstype, farmer, farmer\_aid, farmer\_crop, farmer\_fertilizer, farmer\_investment, farmer\_sustainable, farmer\_tech, farmer\_trainingproj, farmingtool, fertilizer, fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype.

**Query Grid:** The current query is "SELECT \* FROM \"G2\_SARM\".INVESTMENT;". The results show 90 rows of data with columns: investmentid [PK] integer, amount numeric (10,2), beneficiary character varying (255), date date, purposeid integer.

investmentid [PK] integer	amount numeric (10,2)	beneficiary character varying (255)	date date	purposeid integer
1	1200.00	1	2024-01-20	1
2	2500.75	2	2024-02-22	2
3	1800.50	3	2024-03-15	3
4	3100.00	4	2024-04-12	4
5	450.00	5	2024-05-02	1
6	1350.90	6	2024-06-18	2
7	1900.30	7	2024-07-27	3
8	2500.10	8	2024-08-29	4
9	3200.40	9	2024-09-09	1
10	800.50	10	2024-10-05	2
11	1700.90	11	2024-11-15	3
12	2200.75	12	2024-12-12	4
13	1600.00	13	2025-01-30	1
14	2900.25	14	2025-02-18	2
15	3500.40	15	2025-03-05	3
16	1900.80	16	2025-04-07	4
17	2000.00	17	2025-05-25	1
18	1450.60	18	2025-06-22	2
19	2700.80	19	2025-07-30	3

Total rows: 90 of 90    Query complete 00:00:00.072    Successfully run. Total query runtime: 72 msec. 90 rows affected.    Ln 1, Col 34

INSERT INTO Investment (InvestmentID, Amount, Beneficiary, Date) VALUES

(1, 1000.00, 1, '2024-01-15'),  
 (2, 2000.50, 2, '2024-02-20'),  
 (3, 1500.75, 3, '2024-03-25'),  
 (4, 3000.00, 4, '2024-04-10'),  
 (5, 500.25, 5, '2024-05-05'),  
 (6, 1250.80, 6, '2024-06-15'),  
 (7, 1750.40, 7, '2024-07-25'),  
 (8, 2200.00, 8, '2024-08-30'),  
 (9, 3000.50, 9, '2024-09-05'),  
 (10, 900.99, 10, '2024-10-01'),  
 (11, 2500.25, 11, '2024-11-12'),  
 (12, 600.60, 12, '2024-12-22'),  
 (13, 800.80, 13, '2024-01-10'),

(14, 1200.00, 14, '2024-02-18'),  
(15, 2100.90, 15, '2024-03-27'),  
(16, 500.00, 16, '2024-04-07'),  
(17, 1500.00, 17, '2024-05-15'),  
(18, 950.45, 18, '2024-06-20'),  
(19, 2700.55, 19, '2024-07-19'),  
(20, 1800.75, 20, '2024-08-24'),  
(21, 2200.00, 21, '2024-09-15'),  
(22, 1100.00, 22, '2024-10-30'),  
(23, 700.50, 23, '2024-11-08'),  
(24, 1350.00, 24, '2024-12-14'),  
(25, 1600.80, 25, '2024-01-05'),  
(26, 2400.20, 26, '2024-02-02'),  
(27, 300.00, 27, '2024-03-17'),  
(28, 1800.00, 28, '2024-04-23'),  
(29, 1500.45, 29, '2024-05-30'),  
(30, 1300.00, 30, '2024-06-19'),  
(31, 700.70, 31, '2024-07-10'),  
(32, 900.90, 32, '2024-08-15'),  
(33, 1100.00, 33, '2024-09-20'),  
(34, 1400.25, 34, '2024-10-03'),  
(35, 800.00, 35, '2024-11-12'),  
(36, 2300.00, 36, '2024-12-01'),  
(37, 1700.40, 37, '2024-01-22'),  
(38, 2600.00, 38, '2024-02-28'),  
(39, 900.30, 39, '2024-03-15'),  
(40, 1500.90, 40, '2024-04-18'),  
(41, 500.75, 41, '2024-05-25'),  
(42, 1200.60, 42, '2024-06-08'),  
(43, 3000.20, 43, '2024-07-01'),  
(44, 2000.10, 44, '2024-08-05'),  
(45, 800.80, 45, '2024-09-07'),  
(46, 1800.20, 46, '2024-10-12'),  
(47, 950.00, 47, '2024-11-20'),  
(48, 700.40, 48, '2024-12-18'),  
(49, 3000.00, 49, '2024-01-09'),  
(50, 2400.90, 50, '2024-02-15'),  
(51, 1500.00, 51, '2024-03-27'),  
(52, 1250.75, 52, '2024-04-11'),  
(53, 2000.50, 53, '2024-05-30'),  
(54, 1300.00, 54, '2024-06-14'),  
(55, 800.00, 55, '2024-07-22'),  
(56, 300.30, 56, '2024-08-19'),  
(57, 900.50, 57, '2024-09-24'),  
(58, 2500.00, 58, '2024-10-15'),  
(59, 700.80, 59, '2024-11-30'),  
(60, 950.75, 60, '2024-12-08'),

```
(61, 1200.00, 61, '2024-01-12'),
(62, 2000.40, 62, '2024-02-20'),
(63, 1400.20, 63, '2024-03-02'),
(64, 1100.50, 64, '2024-04-23'),
(65, 300.00, 65, '2024-05-30'),
(66, 1800.80, 66, '2024-06-17'),
(67, 2700.90, 67, '2024-07-14'),
(68, 1500.00, 68, '2024-08-21'),
(69, 2200.00, 69, '2024-09-28'),
(70, 600.10, 70, '2024-10-10'),
(71, 3000.00, 71, '2024-11-06'),
(72, 950.90, 72, '2024-12-03'),
(73, 1800.00, 73, '2024-01-15'),
(74, 1250.00, 74, '2024-02-12'),
(75, 1100.25, 75, '2024-03-22'),
(76, 300.00, 76, '2024-04-29'),
(77, 1500.90, 77, '2024-05-26'),
(78, 2200.00, 78, '2024-06-08'),
(79, 800.40, 79, '2024-07-01'),
(80, 3000.00, 80, '2024-08-18');
```

## 21. InvestmentPurpose(PurposeID, Purpose, Description)

purposeid	purpose	description
1	Education	Funding for educational programs and resources.
2	Infrastructure	Investment in agricultural infrastructure improvements.
3	Research	Financial support for agricultural research initiatives.
4	Sustainability	Funding for projects aimed at sustainable farming practices.
5	Equipment	Investment in modern farming equipment and technology.
6	Training	Funding for training programs and workshops for farmers.
7	Community Development	Investing in community-driven agricultural projects.
8	Market Access	Supporting farmers in accessing larger markets.
9	Resource Management	Funding for water and soil conservation practices.
10	Policy Advocacy	Supporting initiatives for better agricultural policies.
11	Organic Farming	Investment in organic farming practices and certifications.
12	Research Facilities	Building and maintaining agricultural research facilities.
13	Extension Services	Funding for agricultural extension services and outreach.
14	Pest Management	Investment in integrated pest management strategies.
15	Seed Development	Funding for the development of improved seed varieties.
16	Technology Integration	Support for integrating new technologies in farming.
17	Biodiversity Projects	Funding initiatives that promote agricultural biodiversity.
18	Water Conservation	Investment in water-saving irrigation technologies.
19	Youth Programs	Funding programs aimed at engaging youth in agriculture.

Total rows: 99 of 99    Query complete 00:00:00.093    Ln 1, Col 41

INSERT INTO InvestmentPurpose (PurposeID, Purpose, Description) VALUES  
(1, 'Infrastructure Development', 'Funding for building essential agricultural infrastructure such as roads, storage facilities, and irrigation systems.'),  
(2, 'Technology Adoption', 'Investment in modern technologies to enhance agricultural productivity and sustainability.'),  
(3, 'Research and Development', 'Funding research projects focused on improving crop yields, pest resistance, and sustainable practices.'),  
(4, 'Training Programs', 'Financial support for training initiatives aimed at educating farmers on best practices and new technologies.'),

- (5, 'Market Access', 'Investment aimed at improving access to local and international markets for farmers.'),  
(6, 'Environmental Conservation', 'Funding initiatives that promote sustainable farming practices to protect natural resources.'),  
(7, 'Financial Assistance', 'Provision of loans and grants to farmers for purchasing inputs and equipment.'),  
(8, 'Crop Insurance', 'Investing in crop insurance programs to protect farmers against losses due to natural disasters.'),  
(9, 'Youth Engagement', 'Support for programs targeting youth involvement in agriculture to foster new generations of farmers.'),  
(10, 'Water Management', 'Investment in systems to improve water conservation and management in farming practices.'),  
(11, 'Soil Health Improvement', 'Funding for programs aimed at enhancing soil fertility and health.'),  
(12, 'Organic Farming Support', 'Investment in initiatives that promote organic farming practices and certification.'),  
(13, 'Diversification Strategies', 'Financial support for farmers to diversify their crop production for better risk management.'),  
(14, 'Community Development', 'Investing in local community projects to strengthen rural economies.'),  
(15, 'Pest and Disease Management', 'Funding for the development of pest and disease management programs.'),  
(16, 'Renewable Energy Initiatives', 'Investment in renewable energy solutions for farms to reduce carbon footprints.'),  
(17, 'Sustainable Livestock Practices', 'Financial support for practices that improve the sustainability of livestock farming.'),  
(18, 'Extension Services', 'Investment in agricultural extension services to provide farmers with vital information and support.'),  
(19, 'Climate Change Mitigation', 'Funding for practices that help farmers adapt to climate change impacts.'),  
(20, 'Input Supply Chain Development', 'Investment in improving supply chains for agricultural inputs.'),  
(21, 'Local Seed Production', 'Funding for programs to encourage local seed production and use.'),  
(22, 'Value-Added Processing', 'Investment in facilities and training for value-added agricultural processing.'),  
(23, 'Agroforestry Practices', 'Financial support for implementing agroforestry systems in farming.'),  
(24, 'Soil Erosion Control', 'Funding for initiatives aimed at controlling soil erosion on agricultural lands.'),  
(25, 'Smart Irrigation Systems', 'Investment in modern irrigation technologies to improve efficiency.'),  
(26, 'Food Safety Initiatives', 'Financial support for programs ensuring food safety and quality.'),  
(27, 'Nutrition Awareness', 'Investment in educational campaigns promoting nutrition and healthy eating.'),  
(28, 'Cooperative Development', 'Funding for the establishment of agricultural cooperatives for better resource sharing.'),  
(29, 'Rural Infrastructure', 'Investment in rural infrastructure to support agricultural activities.'),  
(30, 'Crisis Response Programs', 'Funding for emergency response initiatives during agricultural crises.'),  
(31, 'Certification Programs', 'Investment in training for farmers to obtain organic and sustainable certifications.'),

- (32, 'Intercropping Research', 'Funding for research into intercropping systems for improved yields.'),  
(33, 'Precision Agriculture', 'Investment in technologies that promote precision farming techniques.'),  
(34, 'Agroecology Promotion', 'Financial support for promoting agroecological farming practices.'),  
(35, 'Market Information Systems', 'Investment in systems providing farmers with market data and prices.'),  
(36, 'Transport Solutions', 'Funding for improving transport solutions for agricultural products.'),  
(37, 'E-commerce Platforms', 'Investment in online platforms to facilitate the sale of agricultural products.'),  
(38, 'Cultural Heritage Conservation', 'Funding for preserving traditional agricultural practices and knowledge.'),  
(39, 'Disaster Risk Reduction', 'Investment in programs to minimize disaster risks in agriculture.'),  
(40, 'Holistic Farm Management', 'Financial support for holistic approaches to farm management.'),  
(41, 'Promoting Indigenous Practices', 'Investment in initiatives that support indigenous farming methods.'),  
(42, 'Urban Agriculture', 'Funding for promoting agricultural practices within urban settings.'),  
(43, 'Community Supported Agriculture', 'Investment in community-supported agriculture initiatives.'),  
(44, 'Animal Welfare Practices', 'Funding for improving animal welfare standards in farming.'),  
(45, 'Sustainable Aquaculture', 'Investment in sustainable practices in aquaculture.'),  
(46, 'Agri-tourism Development', 'Financial support for developing agri-tourism as an income source.'),  
(47, 'Digital Literacy Programs', 'Investment in programs that enhance digital literacy among farmers.'),  
(48, 'Local Market Development', 'Funding for initiatives that support local market development for farmers.'),  
(49, 'Agro-climatic Research', 'Investment in research on agro-climatic conditions and their impact on farming.'),  
(50, 'Farming Equipment Loans', 'Financial assistance for loans on farming equipment purchases.'),  
(51, 'Community Training Workshops', 'Funding for workshops that educate communities on sustainable practices.'),  
(52, 'Soil Fertility Research', 'Investment in research on improving soil fertility through various practices.'),  
(53, 'Traditional Crop Promotion', 'Funding for programs promoting traditional crops and their cultivation.'),  
(54, 'Financial Literacy Training', 'Investment in training farmers on financial management skills.'),  
(55, 'Sustainable Water Practices', 'Funding for initiatives that promote sustainable water use in agriculture.'),  
(56, 'Gender Equality Initiatives', 'Investment in programs promoting gender equality in farming.'),  
(57, 'Smallholder Support Programs', 'Financial support aimed at assisting smallholder farmers.'),  
(58, 'Food Processing Technology', 'Investment in technologies for improving food processing methods.'),  
(59, 'Pesticide Management Training', 'Funding for training on safe and effective pesticide use.'),  
(60, 'Agro-input Subsidies', 'Investment in subsidies for agricultural inputs like seeds and fertilizers.'),  
(61, 'Sustainable Crop Rotation', 'Funding for promoting sustainable crop rotation practices.'),  
(62, 'Soil Remediation Projects', 'Investment in projects aimed at soil remediation and health improvement.'),  
(63, 'Local Food Systems', 'Funding for initiatives supporting local food systems.'),  
(64, 'Integrated Farming Systems', 'Investment in promoting integrated farming systems for sustainability.'),  
(65, 'Market Linkages', 'Funding to create linkages between farmers and markets.'),

- (66, 'Green Technology Adoption', 'Investment in green technologies for sustainable agriculture.'),
- (67, 'Soil Testing Services', 'Funding for services that provide soil testing for farmers.'),
- (68, 'Cultural Education Programs', 'Investment in educational programs focusing on agricultural culture and history.'),
- (69, 'Water Harvesting Techniques', 'Funding for training on effective water harvesting methods.'),
- (70, 'Participatory Research', 'Investment in participatory research approaches involving farmers.'),
- (71, 'Seed Saving Programs', 'Funding for programs that encourage seed saving and sharing.'),
- (72, 'Public-Private Partnerships', 'Investment in partnerships between public and private sectors for agriculture.'),
- (73, 'Agricultural Shows and Exhibitions', 'Funding for showcasing agricultural innovations and products.'),
- (74, 'Research Dissemination', 'Investment in methods to disseminate research findings to farmers.'),
- (75, 'Soil Conservation Programs', 'Funding for soil conservation initiatives to prevent erosion.'),
- (76, 'Collaborative Farming Initiatives', 'Investment in programs that promote collaborative farming efforts.'),
- (77, 'Sustainable Forestry Practices', 'Funding for sustainable practices in forestry related to agriculture.'),
- (78, 'Farm-to-Table Initiatives', 'Investment in programs connecting farmers directly to consumers.'),
- (79, 'Health and Safety Training', 'Funding for training on health and safety standards in agriculture.'),
- (80, 'Technology Transfer', 'Investment in programs that facilitate technology transfer to farmers.'),
- (81, 'Food Sovereignty Initiatives', 'Funding for promoting food sovereignty among local communities.'),
- (82, 'Social Media Marketing', 'Investment in training farmers on using social media for marketing.'),
- (83, 'Improved Seed Varieties', 'Funding for the development and distribution of improved seed varieties.'),
- (84, 'Rural Livelihood Programs', 'Investment in programs enhancing rural livelihoods through agriculture.'),
- (85, 'Ecosystem Services Promotion', 'Funding for promoting ecosystem services through sustainable practices.'),
- (86, 'Crop Diversification Training', 'Investment in training programs focused on crop diversification.'),
- (87, 'Sustainable Urban Planning', 'Funding for integrating agriculture into urban planning.'),
- (88, 'Carbon Credit Programs', 'Investment in programs facilitating participation in carbon credit markets.'),
- (89, 'Knowledge Exchange Programs', 'Funding for initiatives promoting knowledge exchange between farmers.'),
- (90, 'Research Capacity Building', 'Investment in building research capacity in agricultural sectors.');

## 22. Weather(WeatherID, Date, Temperature, Precipitation, Conditions)

The screenshot shows the pgAdmin 4 interface. In the Object Explorer, under the 'Tables' section, there is a table named 'weather'. A query is run against this table:

```
1. SELECT * FROM "G2SARM".WEATHER;
```

The results are displayed in a grid:

weatherid	date	temperature	precipitation	conditions
1	2024-01-01	25.00	0.00	Sunny
2	2024-01-02	22.50	0.00	Clear
3	2024-01-03	20.00	5.00	Rainy
4	2024-01-04	18.00	10.00	Cloudy
5	2024-01-05	21.00	2.00	Partly Cloudy
6	2024-01-06	24.00	0.00	Sunny
7	2024-01-07	23.50	0.50	Clear
8	2024-01-08	19.00	8.00	Rainy
9	2024-01-09	20.50	3.00	Cloudy
10	2024-01-10	22.00	0.00	Sunny
11	2024-01-11	26.00	0.00	Sunny
12	2024-01-12	27.50	0.00	Clear
13	2024-01-13	29.00	0.00	Clear
14	2024-01-14	24.00	1.00	Cloudy
15	2024-01-15	22.00	5.00	Rainy
16	2024-01-16	23.00	0.00	Sunny
17	2024-01-17	25.00	0.00	Sunny
18	2024-01-18	26.50	0.00	Clear
19	2024-01-19	27.00	0.00	Clear

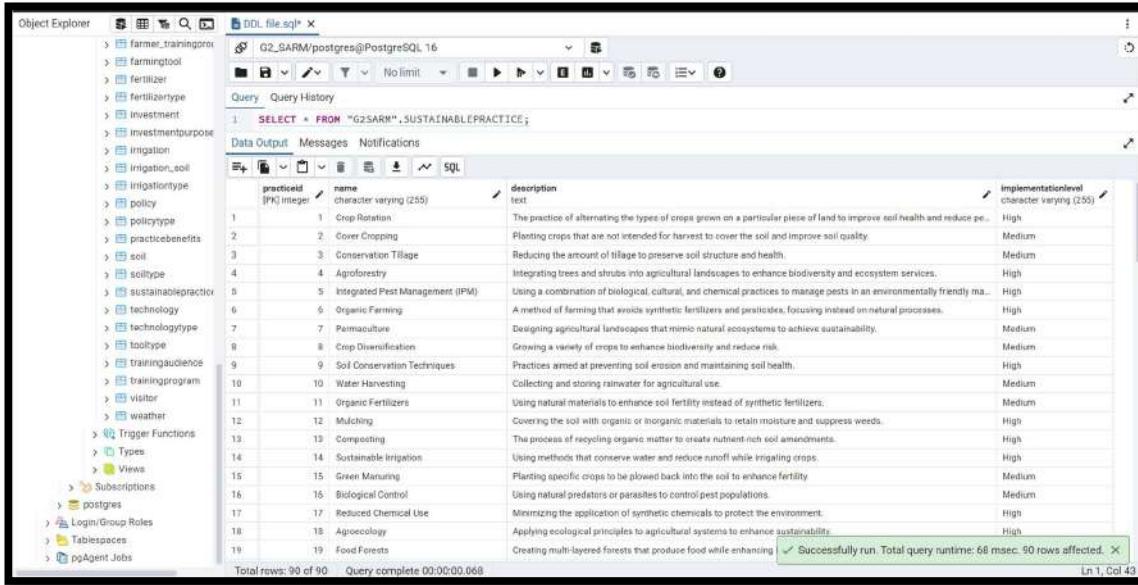
Total rows: 19 | Query complete 00:00:00.080

```
INSERT INTO Weather (WeatherID, Date, Temperature, Precipitation, Conditions) VALUES
(1, '2024-01-01', 25.00, 0.00, 'Sunny'),
(2, '2024-01-02', 22.50, 0.00, 'Clear'),
(3, '2024-01-03', 20.00, 5.00, 'Rainy'),
(4, '2024-01-04', 18.00, 10.00, 'Cloudy'),
(5, '2024-01-05', 21.00, 2.00, 'Partly Cloudy'),
(6, '2024-01-06', 24.00, 0.00, 'Sunny'),
(7, '2024-01-07', 23.50, 0.50, 'Clear'),
(8, '2024-01-08', 19.00, 8.00, 'Rainy'),
(9, '2024-01-09', 20.50, 3.00, 'Cloudy'),
(10, '2024-01-10', 22.00, 0.00, 'Sunny'),
(11, '2024-01-11', 26.00, 0.00, 'Sunny'),
(12, '2024-01-12', 27.50, 0.00, 'Clear'),
(13, '2024-01-13', 29.00, 0.00, 'Clear'),
(14, '2024-01-14', 24.00, 1.00, 'Cloudy'),
(15, '2024-01-15', 22.00, 5.00, 'Rainy'),
(16, '2024-01-16', 23.00, 0.00, 'Sunny'),
(17, '2024-01-17', 25.00, 0.00, 'Sunny'),
(18, '2024-01-18', 26.50, 0.00, 'Clear'),
(19, '2024-01-19', 27.00, 0.00, 'Clear'),
(20, '2024-01-20', 23.50, 2.00, 'Partly Cloudy'),
(21, '2024-01-21', 22.00, 3.00, 'Cloudy'),
(22, '2024-01-22', 21.00, 7.00, 'Rainy'),
(23, '2024-01-23', 19.50, 10.00, 'Rainy'),
(24, '2024-01-24', 18.00, 5.00, 'Cloudy'),
(25, '2024-01-25', 20.00, 2.00, 'Partly Cloudy'),
(26, '2024-01-26', 21.50, 0.00, 'Sunny'),
(27, '2024-01-27', 22.50, 0.00, 'Sunny'),
(28, '2024-01-28', 24.00, 0.00, 'Clear'),
(29, '2024-01-29', 23.00, 1.00, 'Cloudy'),
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(31, '2024-01-31', 18.50, 10.00, 'Rainy'),  
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(33, '2024-02-02', 24.00, 0.00, 'Sunny'),  
(34, '2024-02-03', 22.00, 2.00, 'Partly Cloudy'),  
(35, '2024-02-04', 21.00, 3.00, 'Cloudy'),  
(36, '2024-02-05', 20.50, 8.00, 'Rainy'),  
(37, '2024-02-06', 19.00, 0.00, 'Clear'),  
(38, '2024-02-07', 27.00, 0.00, 'Clear'),  
(39, '2024-02-08', 29.00, 0.00, 'Clear'),  
(40, '2024-02-09', 24.50, 2.00, 'Partly Cloudy'),  
(41, '2024-02-10', 22.00, 4.00, 'Cloudy'),  
(42, '2024-02-11', 21.00, 3.00, 'Rainy'),  
(43, '2024-02-12', 20.00, 10.00, 'Rainy'),  
(44, '2024-02-13', 23.00, 0.00, 'Sunny'),  
(45, '2024-02-14', 25.00, 0.00, 'Sunny'),  
(46, '2024-02-15', 22.50, 0.00, 'Clear'),  
(47, '2024-02-16', 24.00, 0.00, 'Clear'),  
(48, '2024-02-17', 27.00, 1.00, 'Cloudy'),  
(49, '2024-02-18', 26.00, 2.00, 'Partly Cloudy'),  
(50, '2024-02-19', 20.00, 5.00, 'Rainy'),  
(51, '2024-02-20', 21.50, 4.00, 'Cloudy'),  
(52, '2024-02-21', 23.00, 0.00, 'Sunny'),  
(53, '2024-02-22', 19.50, 6.00, 'Rainy'),  
(54, '2024-02-23', 22.00, 0.00, 'Sunny'),  
(55, '2024-02-24', 20.00, 2.00, 'Partly Cloudy'),  
(56, '2024-02-25', 18.00, 10.00, 'Cloudy'),  
(57, '2024-02-26', 24.00, 0.00, 'Sunny'),  
(58, '2024-02-27', 25.00, 0.00, 'Clear'),  
(59, '2024-02-28', 22.50, 1.00, 'Partly Cloudy'),  
(60, '2024-03-01', 20.50, 0.00, 'Sunny'),  
(61, '2024-03-02', 21.00, 0.00, 'Clear'),  
(62, '2024-03-03', 19.50, 3.00, 'Cloudy'),  
(63, '2024-03-04', 23.00, 5.00, 'Rainy'),  
(64, '2024-03-05', 24.50, 0.00, 'Sunny'),  
(65, '2024-03-06', 26.00, 0.00, 'Clear'),  
(66, '2024-03-07', 22.00, 2.00, 'Partly Cloudy'),  
(67, '2024-03-08', 20.00, 4.00, 'Cloudy'),  
(68, '2024-03-09', 21.50, 0.00, 'Sunny'),  
(69, '2024-03-10', 25.00, 0.00, 'Sunny'),  
(70, '2024-03-11', 22.50, 1.00, 'Partly Cloudy'),  
(71, '2024-03-12', 21.00, 0.00, 'Clear'),  
(72, '2024-03-13', 23.00, 0.00, 'Sunny'),  
(73, '2024-03-14', 24.50, 0.00, 'Clear'),  
(74, '2024-03-15', 22.00, 3.00, 'Cloudy'),  
(75, '2024-03-16', 20.50, 5.00, 'Rainy'),  
(76, '2024-03-17', 19.00, 2.00, 'Partly Cloudy'),

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(77, '2024-03-18', 25.00, 0.00, 'Sunny'),
(78, '2024-03-19', 24.00, 0.00, 'Clear'),
(79, '2024-03-20', 26.50, 0.00, 'Clear'),
(80, '2024-03-21', 22.50, 1.00, 'Partly Cloudy'),
(81, '2024-03-22', 23.00, 0.00, 'Sunny'),
(82, '2024-03-23', 19.00, 7.00, 'Rainy'),
(83, '2024-03-24', 20.50, 0.00, 'Clear'),
(84, '2024-03-25', 22.00, 3.00, 'Cloudy'),
(85, '2024-03-26', 21.00, 1.00, 'Partly Cloudy');
```

### 23. SustainablePractice(PracticeID, Name, Description, ImplementationLevel)



The screenshot shows the pgAdmin 4 interface with the following details:

- Object Explorer:** On the left, it lists various database objects including tables like farmer\_trainingprogram, farmingtool, fertilizer, fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype, policy, politytype, practicebenefits, soil, scilttype, sustainablepractice, technology, technologype, tooltype, trainingaudience, trainingprogram, visitor, weather, Trigger Functions, Types, Views, Subscriptions, and PostgreSQL.
- Query Editor:** The main window contains a query in the SQL tab:
 

```
1. SELECT * FROM "G2SARM".SUSTAINABLEPRACTICE;
```
- Data Output:** Below the query editor, the results are displayed in a table format. The columns are:
 

practiceid [PK] integer	name character varying (255)	description text	implementationlevel character varying (255)
1	1 Crop Rotation	The practice of alternating the types of crops grown on a particular piece of land to improve soil health and reduce pests.	High
2	2 Cover Cropping	Planting crops that are not intended for harvest to cover the soil and improve soil quality.	Medium
3	3 Conservation Tillage	Reducing the amount of tillage to preserve soil structure and health.	Medium
4	4 Agroforestry	Integrating trees and shrubs into agricultural landscapes to enhance biodiversity and ecosystem services.	High
5	5 Integrated Pest Management (IPM)	Using a combination of biological, cultural, and chemical practices to manage pests in an environmentally friendly manner.	High
6	6 Organic Farming	A method of farming that avoids synthetic fertilizers and pesticides, focusing instead on natural processes.	High
7	7 Permaculture	Designing agricultural landscapes that mimic natural ecosystems to achieve sustainability.	Medium
8	8 Crop Diversification	Growing a variety of crops to enhance biodiversity and reduce risk.	Medium
9	9 Soil Conservation Techniques	Practices aimed at preventing soil erosion and maintaining soil health.	High
10	10 Water Harvesting	Collecting and storing rainwater for agricultural use.	Medium
11	11 Organic Fertilizers	Using natural materials to enhance soil fertility instead of synthetic fertilizers.	Medium
12	12 Mulching	Covering the soil with organic or inorganic materials to retain moisture and suppress weeds.	High
13	13 Composting	The process of recycling organic matter to create nutrient-rich soil amendments.	High
14	14 Sustainable Irrigation	Using methods that conserve water and reduce runoff while irrigating crops.	High
15	15 Green Manuring	Planting specific crops to be plowed back into the soil to enhance fertility.	Medium
16	16 Biological Control	Using natural predators or parasites to control pest populations.	Medium
17	17 Reduced Chemical Use	Minimizing the application of synthetic chemicals to protect the environment.	High
18	18 Agroecology	Applying ecological principles to agricultural systems to enhance sustainability.	High
19	19 Food Forests	Creating multi-layered forests that produce food while enhancing	High
- Messages:** A green message at the bottom right indicates the query was successfully run: "Successfully run. Total query runtime: 68 msec. 90 rows affected."
- Status Bar:** At the bottom right, it shows "Ln 1, Col 43".

INSERT INTO SustainablePractice (PracticeID, Name, Description, ImplementationLevel) VALUES

(1, 'Crop Rotation', 'The practice of alternating the types of crops grown on a particular piece of land to improve soil health and reduce pests.', 'High'),  
 (2, 'Cover Cropping', 'Planting crops that are not intended for harvest to cover the soil and improve soil quality.', 'Medium'),  
 (3, 'Conservation Tillage', 'Reducing the amount of tillage to preserve soil structure and health.', 'Medium'),  
 (4, 'Agroforestry', 'Integrating trees and shrubs into agricultural landscapes to enhance biodiversity and ecosystem services.', 'High'),  
 (5, 'Integrated Pest Management (IPM)', 'Using a combination of biological, cultural, and chemical practices to manage pests in an environmentally friendly manner.', 'High'),  
 (6, 'Organic Farming', 'A method of farming that avoids synthetic fertilizers and pesticides, focusing instead on natural processes.', 'High'),  
 (7, 'Permaculture', 'Designing agricultural landscapes that mimic natural ecosystems to achieve sustainability.', 'Medium'),  
 (8, 'Crop Diversification', 'Growing a variety of crops to enhance biodiversity and reduce risk.', 'Medium'),  
 (9, 'Soil Conservation Techniques', 'Practices aimed at preventing soil erosion and maintaining soil health.', 'High'),  
 (10, 'Water Harvesting', 'Collecting and storing rainwater for agricultural use.', 'Medium'),

- (11, 'Organic Fertilizers', 'Using natural materials to enhance soil fertility instead of synthetic fertilizers.', 'Medium'),
- (12, 'Mulching', 'Covering the soil with organic or inorganic materials to retain moisture and suppress weeds.', 'High'),
- (13, 'Composting', 'The process of recycling organic matter to create nutrient-rich soil amendments.', 'High'),
- (14, 'Sustainable Irrigation', 'Using methods that conserve water and reduce runoff while irrigating crops.', 'High'),
- (15, 'Green Manuring', 'Planting specific crops to be plowed back into the soil to enhance fertility.', 'Medium'),
- (16, 'Biological Control', 'Using natural predators or parasites to control pest populations.', 'Medium'),
- (17, 'Reduced Chemical Use', 'Minimizing the application of synthetic chemicals to protect the environment.', 'High'),
- (18, 'Agroecology', 'Applying ecological principles to agricultural systems to enhance sustainability.', 'High'),
- (19, 'Food Forests', 'Creating multi-layered forests that produce food while enhancing biodiversity.', 'Medium'),
- (20, 'Precision Agriculture', 'Using technology to monitor and manage field variability in crops.', 'High'),
- (21, 'Drought-resistant Crops', 'Developing and planting crops that require less water.', 'Medium'),
- (22, 'Shade-grown Coffee', 'Cultivating coffee under tree cover to promote biodiversity and reduce erosion.', 'High'),
- (23, 'Intercropping', 'Growing two or more crops in close proximity for increased productivity.', 'Medium'),
- (24, 'Restoration of Degraded Lands', 'Implementing practices to restore the health of damaged ecosystems.', 'High'),
- (25, 'Integrated Crop-Livestock Systems', 'Combining crop and livestock farming to enhance resource use efficiency.', 'Medium'),
- (26, 'Biodynamic Farming', 'A holistic approach to farming that emphasizes ecological and ethical considerations.', 'Medium'),
- (27, 'Heirloom Seed Preservation', 'Saving traditional seed varieties to maintain genetic diversity.', 'High'),
- (28, 'Wetland Restoration', 'Rehabilitating wetlands to improve water quality and provide habitat.', 'High'),
- (29, 'Wildlife Habitat Conservation', 'Creating and maintaining habitats to support wildlife populations.', 'High'),
- (30, 'Nutrient Management', 'Balancing the nutrient input and output in agricultural systems for sustainability.', 'Medium'),
- (31, 'Sustainable Animal Husbandry', 'Practices that ensure the well-being of livestock while minimizing environmental impact.', 'High'),
- (32, 'Alternative Energy Use', 'Incorporating renewable energy sources in agricultural practices.', 'Medium'),
- (33, 'Local Food Systems', 'Encouraging local production and consumption to reduce transportation emissions.', 'High'),
- (34, 'Value-added Products', 'Processing agricultural products to increase their market value.', 'Medium'),
- (35, 'Sustainable Forestry', 'Practicing responsible forest management to protect ecosystems and resources.', 'High'),
- (36, 'Community Supported Agriculture (CSA)', 'Creating a direct relationship between farmers and consumers to promote local produce.', 'Medium'),

- (37, 'Soil Fertility Management', 'Practices aimed at maintaining and enhancing soil fertility sustainably.', 'High'),
- (38, 'Grassland Restoration', 'Rehabilitating grassland ecosystems for improved biodiversity and productivity.', 'Medium'),
- (39, 'Aquaponics', 'Combining aquaculture and hydroponics to create a sustainable food system.', 'High'),
- (40, 'Green Infrastructure', 'Using natural systems to manage water and enhance urban agriculture.', 'Medium'),
- (41, 'Sustainable Fisheries', 'Practicing responsible fishing to maintain fish populations and ecosystems.', 'High'),
- (42, 'Urban Agriculture', 'Cultivating food in urban environments to enhance local food security.', 'Medium'),
- (43, 'Agri-tourism', 'Combining agriculture and tourism to promote sustainable practices and generate income.', 'Medium'),
- (44, 'Carbon Sequestration Practices', 'Implementing methods to capture and store atmospheric carbon in soil.', 'High'),
- (45, 'Sustainable Packaging', 'Using environmentally friendly materials for packaging agricultural products.', 'Medium'),
- (46, 'Farm to School Programs', 'Connecting schools with local farms to promote healthy eating and local agriculture.', 'High'),
- (47, 'Soil Health Assessment', 'Regularly assessing soil health to inform management practices.', 'Medium'),
- (48, 'Water Quality Monitoring', 'Regularly monitoring water quality to prevent pollution and enhance ecosystem health.', 'High'),
- (49, 'Integrated Farming Systems', 'Combining various agricultural practices to optimize productivity and sustainability.', 'Medium'),
- (50, 'Community Gardens', 'Creating shared gardens to promote local food production and community involvement.', 'High'),
- (51, 'Crop Residue Management', 'Properly managing crop leftovers to maintain soil health.', 'Medium'),
- (52, 'Agrochemical Reduction', 'Minimizing the use of chemicals to protect human health and the environment.', 'High'),
- (53, 'Participatory Research', 'Involving farmers in the research process to ensure relevance and practicality.', 'Medium'),
- (54, 'Organic Certification', 'Obtaining certification for organic practices to promote sustainable products.', 'High'),
- (55, 'Pesticide Alternatives', 'Exploring natural alternatives to synthetic pesticides for pest control.', 'Medium'),
- (56, 'Resource-efficient Farming', 'Practices aimed at maximizing resource use efficiency in agriculture.', 'High'),
- (57, 'Soil Moisture Conservation', 'Implementing practices to retain soil moisture during dry periods.', 'Medium'),
- (58, 'Sustainable Crop Selection', 'Choosing crop varieties that are suited for local environmental conditions.', 'High'),
- (59, 'Land Restoration', 'Improving the health of degraded lands to enhance productivity and ecosystem services.', 'High'),
- (60, 'Pond-based Aquaculture', 'Raising fish in controlled pond environments to promote sustainable fish farming.', 'Medium'),

- (61, 'Farming Cooperatives', 'Farmers joining together to share resources and market products collectively.', 'High'),
- (62, 'Traceability Systems', 'Implementing systems to track products from farm to consumer to ensure quality and sustainability.', 'Medium'),
- (63, 'Wetland Agriculture', 'Practicing agriculture in wetland areas to promote biodiversity and resource use efficiency.', 'Medium'),
- (64, 'Crop Insurance Programs', 'Providing insurance options for farmers to mitigate risk and encourage sustainable practices.', 'High'),
- (65, 'Biodiversity Hotspots Preservation', 'Protecting areas with high levels of biodiversity from agricultural expansion.', 'High'),
- (66, 'Land Use Planning', 'Strategically planning land use to balance agriculture with conservation.', 'Medium'),
- (67, 'Rainwater Management', 'Implementing systems to manage and utilize rainwater efficiently.', 'Medium'),
- (68, 'Nutrient Recycling', 'Recycling nutrients from waste to improve soil health and reduce chemical use.', 'High'),
- (69, 'Perennial Crop Cultivation', 'Growing perennial crops that do not require annual replanting for sustainability.', 'Medium'),
- (70, 'Smallholder Support Programs', 'Supporting smallholder farmers to enhance productivity and sustainability.', 'High'),
- (71, 'Soil Erosion Control', 'Implementing measures to prevent soil erosion and maintain soil quality.', 'Medium'),
- (72, 'Sustainable Harvesting Practices', 'Practices aimed at harvesting natural resources in a way that maintains their availability.', 'High'),
- (73, 'Ecological Restoration', 'Restoring ecosystems to improve biodiversity and environmental health.', 'Medium'),
- (74, 'Seed Bank Establishment', 'Creating seed banks to preserve genetic diversity in crops.', 'High'),
- (75, 'Food Security Programs', 'Initiatives aimed at improving food security through sustainable practices.', 'High'),
- (76, 'Holistic Management', 'Using a systems approach to manage land and livestock sustainably.', 'Medium'),
- (77, 'Climate-smart Agriculture', 'Practices that increase productivity while reducing greenhouse gas emissions.', 'High'),
- (78, 'Beekeeping', 'Incorporating beekeeping into farming for pollination and honey production.', 'Medium'),
- (79, 'Mobile Apps for Farmers', 'Developing apps to provide farmers with information and resources for sustainable practices.', 'Medium'),
- (80, 'Sustainable Development Goals Awareness', 'Promoting awareness of the Sustainable Development Goals in agricultural practices.', 'High');

#### 24. PracticeBenefits(BenefitID, PracticeID, Benefit)

```

SELECT * FROM "G2SARM".PRACTICEBENEFITS;

```

benefitid	practiceid	benefit
1	1	1 Improves soil fertility and reduces pest infestations.
2	2	2 Enhances soil quality and prevents erosion.
3	3	3 Preserves soil structure and minimizes erosion.
4	4	4 Increases biodiversity and improves ecosystem services.
5	5	5 Reduces chemical use and promotes ecological balance.
6	6	6 Enhances soil health and reduces chemical dependency.
7	7	7 Promotes sustainable land use and biodiversity.
8	8	8 Increases resilience to pests and market fluctuations.
9	9	9 Protects soil from erosion and maintains fertility.
10	10	10 Conserves water and improves crop yield.
11	11	11 Improves soil structure and nutrient content.
12	12	12 Helps retain soil moisture and suppresses weeds.
13	13	13 Recycles nutrients and improves soil health.
14	14	14 Improves water efficiency and reduces waste.
15	15	15 Enhances soil fertility and prevents erosion.
16	16	16 Reduces pest populations naturally and sustainably.
17	17	17 Minimizes environmental harm and promotes health.
18	18	18 Enhances sustainability and ecosystem resilience.
19	19	19 Provides diverse food sources and habitat.

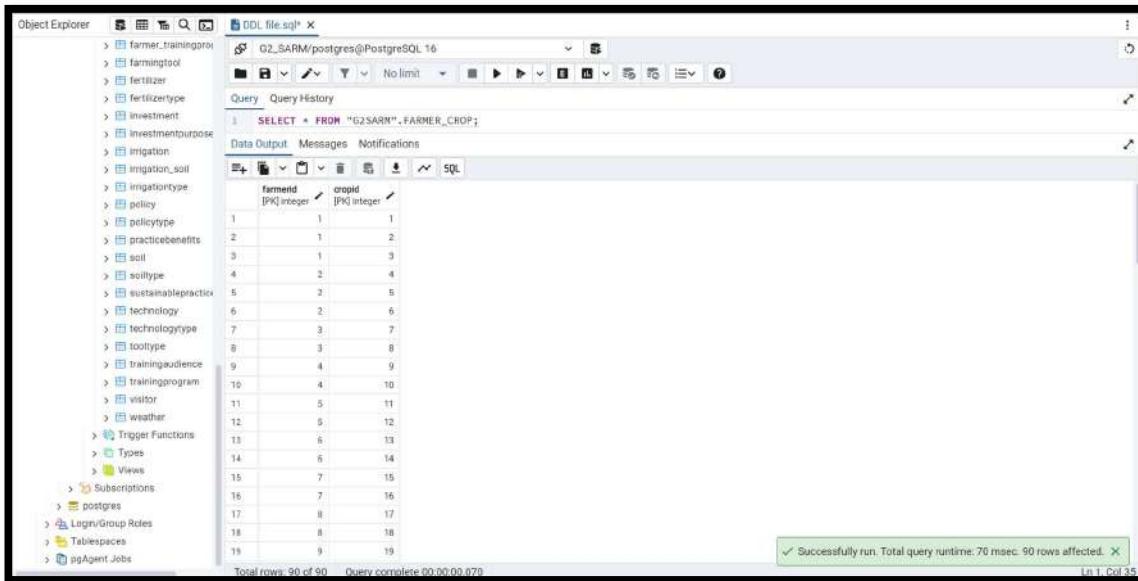
Successfully run. Total query runtime: 146 msec. 90 rows affected. Ln 1, Col 24

INSERT INTO PracticeBenefits (BenefitID, PracticeID, Benefit) VALUES  
(1, 1, 'Improved soil health through organic matter enhancement.'),  
(2, 1, 'Increased crop yields due to better nutrient availability.'),  
(3, 1, 'Enhanced water retention in soil, reducing irrigation needs.'),  
(4, 1, 'Reduction in chemical fertilizer usage, leading to cost savings.'),  
(5, 1, 'Promotion of biodiversity by encouraging diverse soil organisms.'),  
(6, 1, 'Reduced erosion due to better soil structure and coverage.'),  
(7, 1, 'Higher resilience to pests and diseases due to healthy soils.'),  
(8, 2, 'Lower water usage with drip irrigation systems.'),  
(9, 2, 'Minimized weed growth, reducing labor and herbicide costs.'),  
(10, 2, 'Enhanced crop quality with more consistent moisture levels.'),  
(11, 2, 'Improved efficiency of nutrient delivery to plants.'),  
(12, 2, 'Increased adaptability to climate variability.'),  
(13, 3, 'Higher resilience of crops to drought conditions.'),  
(14, 3, 'Reduced risk of crop failure through diversified planting.'),  
(15, 3, 'Increased farmer income through higher market prices for diverse crops.'),  
(16, 3, 'Lower pest pressure due to crop rotation.'),  
(17, 4, 'Reduced reliance on chemical pesticides, leading to safer food.'),  
(18, 4, 'Improved pollinator health, enhancing crop production.'),  
(19, 4, 'Increased customer demand for sustainably grown produce.'),  
(20, 4, 'Enhanced ecosystem services, such as natural pest control.'),  
(21, 5, 'Greater nutrient cycling, leading to reduced fertilizer needs.'),  
(22, 5, 'Improved soil structure promoting root growth and stability.'),  
(23, 5, 'Increased soil carbon sequestration, helping mitigate climate change.'),  
(24, 5, 'Better moisture retention, reducing irrigation frequency.'),  
(25, 6, 'Enhanced community engagement in local agriculture.'),  
(26, 6, 'Increased availability of locally sourced food.'),  
(27, 6, 'Strengthened local economies through direct sales.'),  
(28, 6, 'Promotion of traditional knowledge and practices.'),  
(29, 7, 'Improved understanding of sustainable farming principles.'),

- (30, 7, 'Increased farmer collaboration and knowledge sharing.'),  
(31, 7, 'Empowerment of farmers through education and training.'),  
(32, 8, 'Higher nutritional value of crops through diversified production.'),  
(33, 8, 'Enhanced resilience to market fluctuations through diversity.'),  
(34, 8, 'Better pest and disease management through biodiversity.'),  
(35, 8, 'Reduced dependence on monoculture practices.'),  
(36, 9, 'Improved land conservation through integrated management practices.'),  
(37, 9, 'Increased awareness of environmental impacts of farming.'),  
(38, 9, 'Stronger community ties through cooperative farming initiatives.'),  
(39, 10, 'Higher marketability of sustainably produced products.'),  
(40, 10, 'Increased access to premium markets due to certification.'),  
(41, 11, 'Enhanced soil fertility through cover cropping.'),  
(42, 11, 'Improved microbial activity in the soil.'),  
(43, 11, 'Better crop resilience to environmental stresses.'),  
(44, 11, 'Reduced soil compaction and enhanced aeration.'),  
(45, 12, 'Promotion of agroforestry practices benefiting biodiversity.'),  
(46, 12, 'Higher income through multiple revenue streams.'),  
(47, 12, 'Improved microclimate conditions for crops.'),  
(48, 12, 'Enhanced landscape stability reducing erosion.'),  
(49, 13, 'Increased farmer confidence in adopting new technologies.'),  
(50, 13, 'Better risk management through diversified production.'),  
(51, 13, 'Improved water quality through reduced runoff.'),  
(52, 14, 'Lower input costs leading to higher profit margins.'),  
(53, 14, 'Greater adaptability to changing market demands.'),  
(54, 14, 'Enhanced understanding of ecosystem dynamics.'),  
(55, 15, 'Stronger resistance to climate-related challenges.'),  
(56, 15, 'Better pest management through biological controls.'),  
(57, 15, 'Higher quality produce due to improved farming practices.'),  
(58, 16, 'Increased farmer networks and partnerships.'),  
(59, 16, 'Greater awareness of global agricultural trends.'),  
(60, 16, 'Empowered communities through participatory practices.'),  
(61, 17, 'Improved public perception of farming practices.'),  
(62, 17, 'Enhanced policy support for sustainable practices.'),  
(63, 17, 'Reduced environmental impact of farming activities.'),  
(64, 18, 'Increased resilience of farming systems to shocks.'),  
(65, 18, 'Better financial management through diversified income sources.'),  
(66, 19, 'Enhanced community food security through local production.'),  
(67, 19, 'Higher consumer trust in locally sourced food.'),  
(68, 19, 'Reduced transportation costs and emissions.'),  
(69, 20, 'Improved adaptability to changing climate conditions.'),  
(70, 20, 'Enhanced cultural heritage through traditional practices.'),  
(71, 21, 'Greater investment in sustainable agriculture.'),  
(72, 21, 'Improved access to resources for farmers.'),  
(73, 21, 'Strengthened partnerships between stakeholders.'),  
(74, 22, 'Enhanced nutrient cycling within ecosystems.'),  
(75, 22, 'Better understanding of soil health dynamics.'),  
(76, 22, 'Increased farmer innovation through experimentation.'),

(77, 23, 'Improved agricultural education and literacy.'),  
 (78, 23, 'Greater collaboration among farming communities.'),  
 (79, 24, 'Increased awareness of sustainable practices among consumers.'),  
 (80, 24, 'Strengthened agricultural policy frameworks for sustainability.');

## 25. Farmer\_Crop(FarmerID, CropID)



```
Object Explorer   DDL file.sql*   G2_SARM/postgres@PostgreSQL 16
farmer_trainingprogram
farmingtool
fertilizer
fertilizertype
investment
investmentpurpose
irrigation
irrigationsoil
irrigationtype
policy
policytype
practicebenefits
soil
soiltype
sustainablepractices
technology
technologytype
tootype
trainingaudience
trainingprogram
visitor
weather
Trigger Functions
Types
Views
Subscriptions
postres
Login/Group Roles
Tablespaces
pgAgent Jobs

Query Query History
SELECT * FROM "G2SARM".FARMER_CROP;

Data Output Messages Notifications
farmerid [PK] integer
cropid [PK] integer
1 1 1
2 1 2
3 1 3
4 2 4
5 2 5
6 2 6
7 3 7
8 3 8
9 4 9
10 4 10
11 5 11
12 5 12
13 6 13
14 6 14
15 7 15
16 7 16
17 8 17
18 8 18
19 9 19

Total rows: 90 of 90  Query complete 00:00:00.070  ✓ Successfully run. Total query runtime: 70 msec. 90 rows affected. Line 1, Col 35
```

INSERT INTO "G2SARM".Farmer\_Crop (FarmerID, CropID) VALUES

```
(1, 1),
(1, 2),
(1, 3),
(2, 4),
(2, 5),
(2, 6),
(3, 7),
(3, 8),
(4, 9),
(4, 10),
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(7, 15),
(7, 16),
(8, 17),
(8, 18),
(9, 19),
(9, 20),
(10, 21),
(10, 22),
(1, 23),
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(7, 69),  
(8, 70),

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```
(9, 71),
(10, 72),
(1, 73),
(2, 74),
(3, 75),
(4, 76),
(5, 77),
(6, 78),
(7, 79),
(8, 80),
(9, 81),
(10, 82),
(1, 83),
(2, 84),
(3, 85),
(4, 86),
(5, 87),
(6, 88),
(7, 89),
(8, 90);
```

## 26. Farmer\_Tech(FarmerID, TechnologyID, TimeofUsage)

farmerid	technologyid	timeofusage	date
1	1	1	2023-01-15
2	1	2	2023-02-20
3	1	3	2023-03-10
4	2	4	2023-01-25
5	2	5	2023-04-15
6	2	6	2023-05-05
7	3	7	2023-06-30
8	3	8	2023-07-18
9	4	9	2023-08-22
10	4	10	2023-09-15
11	5	11	2023-10-20
12	5	12	2023-11-05
13	6	13	2023-01-30
14	6	14	2023-05-15
15	7	15	2023-05-28
16	7	16	2023-04-12
17	8	17	2023-05-23
18	8	18	2023-06-14
19	9	19	2023-07-30

Total rows: 90 of 90    Query complete 00:00:00.114    L1, Col 36

Successfully run. Total query runtime: 114 msec. 90 rows affected.

```
INSERT INTO "G2SARM".Farmer_Tech (FarmerID, TechnologyID, TimeofUsage) VALUES
(1, 1, '2023-01-15'),
(1, 2, '2023-02-20'),
(1, 3, '2023-03-10'),
(2, 4, '2023-01-25'),
(2, 5, '2023-04-15'),
(2, 6, '2023-05-05'),
(3, 7, '2023-06-30'),
```

(3, 8, '2023-07-18'),  
(4, 9, '2023-08-22'),  
(4, 10, '2023-09-15'),  
(5, 11, '2023-10-20'),  
(5, 12, '2023-11-05'),  
(6, 13, '2023-01-30'),  
(6, 14, '2023-02-15'),  
(7, 15, '2023-03-28'),  
(7, 16, '2023-04-12'),  
(8, 17, '2023-05-23'),  
(8, 18, '2023-06-14'),  
(9, 19, '2023-07-30'),  
(9, 20, '2023-08-16'),  
(10, 21, '2023-09-10'),  
(10, 22, '2023-10-05'),  
(1, 23, '2023-11-01'),  
(2, 24, '2023-01-05'),  
(3, 25, '2023-02-12'),  
(4, 26, '2023-03-25'),  
(5, 27, '2023-04-08'),  
(6, 28, '2023-05-02'),  
(7, 29, '2023-06-26'),  
(8, 30, '2023-07-19'),  
(9, 31, '2023-08-13'),  
(10, 32, '2023-09-20'),  
(1, 33, '2023-10-30'),  
(2, 34, '2023-01-22'),  
(3, 35, '2023-02-18'),  
(4, 36, '2023-03-09'),  
(5, 37, '2023-04-25'),  
(6, 38, '2023-05-18'),  
(7, 39, '2023-06-08'),  
(8, 40, '2023-07-15'),  
(9, 41, '2023-08-28'),  
(10, 42, '2023-09-14'),  
(1, 43, '2023-10-22'),  
(2, 44, '2023-01-12'),  
(3, 45, '2023-02-05'),  
(4, 46, '2023-03-29'),  
(5, 47, '2023-04-19'),  
(6, 48, '2023-05-27'),  
(7, 49, '2023-06-20'),  
(8, 50, '2023-07-02'),  
(9, 51, '2023-08-21'),  
(10, 52, '2023-09-18'),  
(1, 53, '2023-10-15'),  
(2, 54, '2023-01-28'),

---

(3, 55, '2023-02-14'),  
(4, 56, '2023-03-07'),  
(5, 57, '2023-04-30'),  
(6, 58, '2023-05-21'),  
(7, 59, '2023-06-15'),  
(8, 60, '2023-07-24'),  
(9, 61, '2023-08-05'),  
(10, 62, '2023-09-22'),  
(1, 63, '2023-10-10'),  
(2, 64, '2023-01-19'),  
(3, 65, '2023-02-29'),  
(4, 66, '2023-03-12'),  
(5, 67, '2023-04-23'),  
(6, 68, '2023-05-06'),  
(7, 69, '2023-06-09'),  
(8, 70, '2023-07-17'),  
(9, 71, '2023-08-11'),  
(10, 72, '2023-09-30'),  
(1, 73, '2023-10-25'),  
(2, 74, '2023-01-10'),  
(3, 75, '2023-02-16'),  
(4, 76, '2023-03-24'),  
(5, 77, '2023-04-05'),  
(6, 78, '2023-05-30'),  
(7, 79, '2023-06-11'),  
(8, 80, '2023-07-27'),  
(9, 81, '2023-08-02'),  
(10, 82, '2023-09-12'),  
(1, 83, '2023-10-02'),  
(2, 84, '2023-01-27'),  
(3, 85, '2023-02-04'),  
(4, 86, '2023-03-11'),  
(5, 87, '2023-04-18'),  
(6, 88, '2023-05-13'),  
(7, 89, '2023-06-22'),  
(8, 90, '2023-07-29');

27. FarmingTool(ToolID, Name, Usage, Manufacturer, FarmerID,TypeID)

The screenshot shows the pgAdmin 4 interface. The Object Explorer on the left lists various database objects like tables, functions, and types. The main window contains a query editor with the following SQL command:

```
1. SELECT * FROM "G2SARM".FARMINGTOOL;
```

The results grid shows the following data:

toolID	name	usage	manufacturer	farmerID	typeID
1	Basic Hammer	Used for driving nails into wood	Craftsman	1	1
2	Cordless Drill	Used for drilling holes in various materials	DeWalt	2	2
3	Garden Spade	Used for digging and turning soil	Fiskars	1	3
4	Drip Irrigation Kit	Used for efficient watering of plants	Rain Bird	3	4
5	Soil pH Meter	Measures the acidity or alkalinity of the soil	Hanna Instruments	4	5
6	Seed Drill	Used for planting seeds in rows	John Deere	2	6
7	Fertilizer Spreader	Distributes fertilizers evenly across fields	Agri-Fab	5	7
8	Rotary Tiller	Tills the soil to prepare for planting	Husqvarna	6	8
9	Sickle	Used for harvesting crops	Ego	7	9
10	Weeder	Removes weeds from gardens and fields	Garden Weasel	8	10
11	Hand Cultivator	Breaks up and aerates the soil	Bosch	9	11
12	Backpack Sprayer	For applying pesticides and herbicides	Chapin	10	12
13	Tractor	Heavy machinery for various farming tasks	Case IH	1	13
14	Subsoiler	Used to break up compacted soil layers	Kinze	2	14
15	Mulching Mower	Cuts and chops grass, returning nutrients to the soil	Honda	3	15
16	Portable Greenhouse	Provides a controlled environment for plants	Palram	4	16
17	Irrigation Timer	Automates watering schedules	Orbit	5	17
18	Compost Bin	For composting organic materials	Envirocycle	6	18
19	Drone Sprayer	Drones used for crop spraying	DJI		

Total rows: 90 of 90    Query complete 00:00:00.110    Ln 1, Col 35

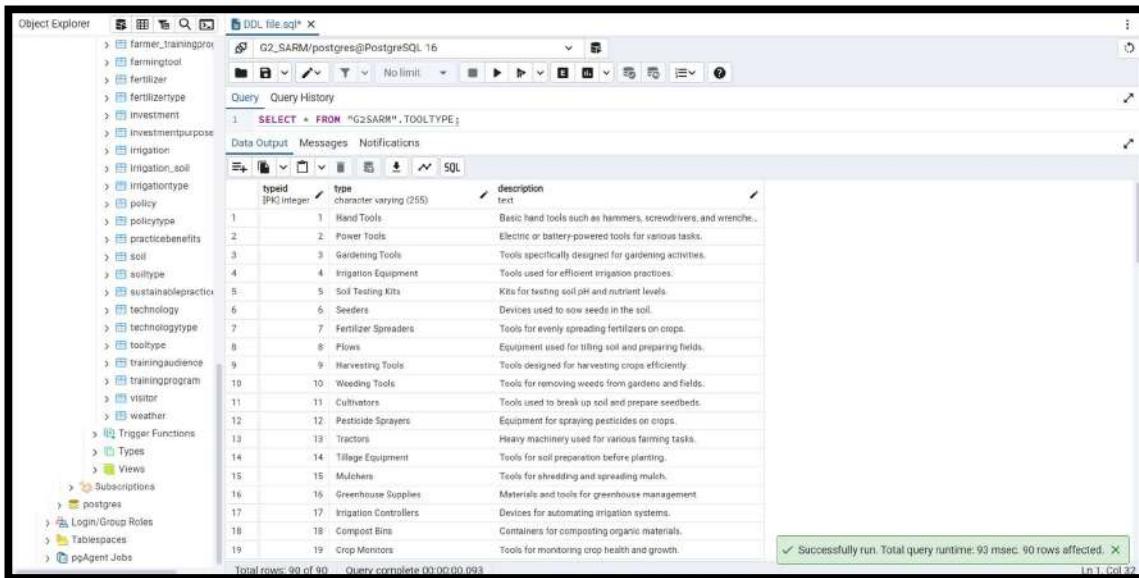
INSERT INTO "G2SARM".FarmingTool (ToolID, Name, Usage, Manufacturer, FarmerID, TypeID)  
VALUES

- (1, 'Basic Hammer', 'Used for driving nails into wood', 'Craftsman', 1, 1),
- (2, 'Cordless Drill', 'Used for drilling holes in various materials', 'DeWalt', 2, 2),
- (3, 'Garden Spade', 'Used for digging and turning soil', 'Fiskars', 1, 3),
- (4, 'Drip Irrigation Kit', 'Used for efficient watering of plants', 'Rain Bird', 3, 4),
- (5, 'Soil pH Meter', 'Measures the acidity or alkalinity of the soil', 'Hanna Instruments', 4, 5),
- (6, 'Seed Drill', 'Used for planting seeds in rows', 'John Deere', 2, 6),
- (7, 'Fertilizer Spreader', 'Distributes fertilizers evenly across fields', 'Agri-Fab', 5, 7),
- (8, 'Rotary Tiller', 'Tills the soil to prepare for planting', 'Husqvarna', 6, 8),
- (9, 'Sickle', 'Used for harvesting crops', 'Ego', 7, 9),
- (10, 'Weeder', 'Removes weeds from gardens and fields', 'Garden Weasel', 8, 10),
- (11, 'Hand Cultivator', 'Breaks up and aerates the soil', 'Bosch', 9, 11),
- (12, 'Backpack Sprayer', 'For applying pesticides and herbicides', 'Chapin', 10, 12),
- (13, 'Tractor', 'Heavy machinery for various farming tasks', 'Case IH', 1, 13),
- (14, 'Subsoiler', 'Used to break up compacted soil layers', 'Kinze', 2, 14),
- (15, 'Mulching Mower', 'Cuts and chops grass, returning nutrients to the soil', 'Honda', 3, 15),
- (16, 'Portable Greenhouse', 'Provides a controlled environment for plants', 'Palram', 4, 16),
- (17, 'Irrigation Timer', 'Automates watering schedules', 'Orbit', 5, 17),
- (18, 'Compost Bin', 'For composting organic materials', 'Envirocycle', 6, 18),
- (19, 'Drone Sprayer', 'Drones used for crop spraying', 'DJI', 7, 19),
- (20, 'Feed Trough', 'For feeding livestock', 'Little Giant', 8, 20),
- (21, 'Thermometer', 'Measures temperature for livestock health', 'Taylor', 9, 21),
- (22, 'Safety Gloves', 'Protective gloves for handling tools', 'Mechanix Wear', 10, 22),
- (23, 'Tool Shed', 'Storage for farming tools', 'Suncast', 1, 23),
- (24, 'Rain Gauge', 'Measures rainfall amounts', 'AcuRite', 2, 24),
- (25, 'Soil Moisture Meter', 'Checks moisture levels in soil', 'GROVE', 3, 25),
- (26, 'Automatic Feed Mixer', 'Mixes livestock feed', 'RotoMix', 4, 26),
- (27, 'Bale Wrapper', 'Wraps bales for preservation', 'Agri-Tech', 5, 27),
- (28, 'Pruning Shears', 'Cuts branches and plants', 'Felco', 6, 28),

- (29, 'Greenhouse Ventilation System', 'Controls airflow in greenhouses', 'HydroFarm', 7, 29),  
(30, 'Rotary Cutter', 'Cuts grass and crop residues', 'Bush Hog', 8, 30),  
(31, 'Seedling Transplanter', 'Helps in transplanting seedlings', 'EarthWay', 9, 31),  
(32, 'Hydroponics Setup', 'Soil-less growing system for plants', 'Nutrient Film Technique', 10, 32),  
(33, 'Farm Management App', 'Software for managing farm operations', 'FarmLogs', 1, 33),  
(34, 'Fertilizer Injector', 'Injects fertilizers into irrigation systems', 'Netafim', 2, 34),  
(35, 'Organic Fertilizer', 'Natural fertilizer for crops', 'Miracle-Gro', 3, 35),  
(36, 'Herbicide Sprayer', 'Sprays herbicides to control weeds', 'Solo', 4, 36),  
(37, 'Crop Monitoring Software', 'Monitors crop health and growth', 'AgriWebb', 5, 37),  
(38, 'Windbreak Nets', 'Protects crops from wind damage', 'Agri-Fab', 6, 38),  
(39, 'Watering Can', 'For manual watering of plants', 'Orbit', 7, 39),  
(40, 'Soil Amendment Mixer', 'Mixes soil amendments for application', 'Soil Mix', 8, 40),  
(41, 'Livestock Health Tracker', 'Monitors health metrics for livestock', 'Zoetis', 9, 41),  
(42, 'Biochar Application Tool', 'Applies biochar to improve soil', 'TerraPreta', 10, 42),  
(43, 'Grain Bin', 'Storage for grains', 'Behlen', 1, 43),  
(44, 'Animal Transport Crate', 'Transports animals safely', 'Petmate', 2, 44),  
(45, 'Rotary Hoe', 'Breaks up soil crusts', 'John Deere', 3, 45),  
(46, 'Field Marker', 'Marks rows in the field', 'Sundown', 4, 46),  
(47, 'Hose Reel', 'Stores and manages hoses', 'Gilmour', 5, 47),  
(48, 'Soil Probe', 'Takes samples of soil', 'Ames', 6, 48),  
(49, 'Flail Mower', 'Used for mowing thick grass', 'Troy-Bilt', 7, 49),  
(50, 'Post Hole Digger', 'Creates holes for fence posts', 'Earthquake', 8, 50),  
(51, 'Poultry Feeder', 'Automatically feeds poultry', 'Little Giant', 9, 51),  
(52, 'Cattle Chute', 'For safely handling cattle', 'Priefert', 10, 52),  
(53, 'Silage Bagger', 'Bags silage for preservation', 'Penta', 1, 53),  
(54, 'Spray Rig', 'For applying chemicals to crops', 'Hagie', 2, 54),  
(55, 'Fencing Tool', 'Tools for installing and repairing fences', 'RanchEx', 3, 55),  
(56, 'Beekeeping Suit', 'Protective suit for beekeeping', 'Mann Lake', 4, 56),  
(57, 'Water Wheel', 'For irrigation in wetland areas', 'Gator', 5, 57),  
(58, 'Compost Turner', 'Turns compost piles for aeration', 'EZ Compost', 6, 58),  
(59, 'Drip Tape', 'For efficient irrigation of rows', 'Netafim', 7, 59),  
(60, 'Silos for Grain Storage', 'Stores grains in bulk', 'BinMaster', 8, 60),  
(61, 'Calf Puller', 'Assists in birthing calves', 'Ritchie', 9, 61),  
(62, 'Sprout Tray', 'For growing sprouts indoors', 'Hydrofarm', 10, 62),  
(63, 'Handheld Sprayer', 'Sprays liquid fertilizers or pesticides', 'Chapman', 1, 63),  
(64, 'Cow Milking Machine', 'For efficient milking of cows', 'Delaval', 2, 64),  
(65, 'Hog Feeder', 'Feeds hogs automatically', 'Little Giant', 3, 65),  
(66, 'Sheep Shearing Equipment', 'Tools for shearing sheep', 'Havahart', 4, 66),  
(67, 'Aquaculture Tank', 'For raising fish', 'Aquafarm', 5, 67),  
(68, 'Garden Hose', 'Used for watering plants', 'Flexzilla', 6, 68),  
(69, 'Greenhouse Heater', 'Maintains temperature in greenhouses', 'BioGreen', 7, 69),  
(70, 'Portable Generator', 'Provides power for farm equipment', 'Honda', 8, 70),  
(71, 'Fruit Washer', 'Washes fruits before packaging', 'Laveo', 9, 71),  
(72, 'Grain Elevator', 'Elevates grains for storage', 'Walinga', 10, 72),  
(73, 'Peat Moss', 'Enhances soil structure and moisture retention', 'Miracle-Gro', 1, 73),  
(74, 'Raised Garden Bed', 'Elevates garden plants for better growth', 'Garden Trends', 2, 74),  
(75, 'Garden Fork', 'Used for loosening soil', 'Fiskars', 3, 75),

(76, 'Spray Drone', 'Drone for applying fertilizers', 'DJI', 4, 76),  
 (77, 'Cold Frame', 'Protects plants from cold weather', 'Gardener's Supply', 5, 77),  
 (78, 'Tomato Cage', 'Supports tomato plants', 'Gardener's Supply', 6, 78),  
 (79, 'Trimming Knife', 'Used for trimming plants', 'Fiskars', 7, 79),  
 (80, 'Outdoor Compost Bin', 'For composting yard waste', 'Envirocycle', 8, 80),  
 (81, 'Hydraulic Jack', 'Lifts heavy equipment', 'Powerbuilt', 9, 81),  
 (82, 'Pesticide Sprayer', 'Applies pesticides to crops', 'Solo', 10, 82),  
 (83, 'Berry Picking Tool', 'For harvesting berries', 'E-Z Pick', 1, 83),  
 (84, 'Garden Kneeler', 'Sits on while working in gardens', 'Garden Kneeler', 2, 84),  
 (85, 'Weed Torch', 'Uses flame to kill weeds', 'ECO Garden', 3, 85),  
 (86, 'Straw Baler', 'Bales straw after harvest', 'Case IH', 4, 86),  
 (87, 'Electric Fence Charger', 'Powers electric fences', 'Zareba', 5, 87),  
 (88, 'Crop Cover', 'Protects plants from frost and pests', 'FarmTek', 6, 88),  
 (89, 'Soil Cultivator', 'Breaks up soil for planting', 'Husqvarna', 7, 89),  
 (90, 'Farming Handbook', 'Guide to modern farming techniques', 'Farmers' Almanac', 8, 90);

## 28. ToolType(TypeID, Type, Description)



The screenshot shows the SSMS interface with the following details:

- Object Explorer:** Shows various database objects like farmer\_trainingprogram, farmingtool, fertilizer, fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype, policy, pollicytype, practicebenefits, soil, soiltype, sustainablepractices, technology, technologype, tooltype, trainingaudience, trainingprogram, visitor, weather, Trigger Functions, Types, Views, Subscriptions, postres, Login/Group Roles, Tablespace, and pgAgent Jobs.
- Query Editor:** A query is running against the "G2\_SARM" database:
 

```
1  SELECT * FROM "G2SARM".TOOLTYPE;
```
- Results Grid:** The results show 19 rows of data:
 

	typeid	type	description
1	1	Hand Tools	Basic hand tools such as hammers, screwdrivers, and wrenches.
2	2	Power Tools	Electric or battery-powered tools for various tasks.
3	3	Gardening Tools	Tools specifically designed for gardening activities.
4	4	Irrigation Equipment	Tools used for efficient irrigation practices.
5	5	Soil Testing Kits	Kits for testing soil pH and nutrient levels.
6	6	Seeders	Devices used to sow seeds in the soil.
7	7	Fertilizer Spreaders	Tools for evenly spreading fertilizers on crops.
8	8	Plows	Equipment used for tilling soil and preparing fields.
9	9	Harvesting Tools	Tools designed for harvesting crops efficiently.
10	10	Weeding Tools	Tools for removing weeds from gardens and fields.
11	11	Cultivators	Tools used to break up soil and prepare seedbeds.
12	12	Pesticide Sprayers	Equipment for spraying pesticides on crops.
13	13	Tractors	Heavy machinery used for various farming tasks.
14	14	Tillage Equipment	Tools for soil preparation before planting.
15	15	Mulchers	Tools for shredding and spreading mulch.
16	16	Greenhouse Supplies	Materials and tools for greenhouse management.
17	17	Irrigation Controllers	Devices for automating irrigation systems.
18	18	Compost Bins	Containers for composting organic materials.
19	19	Crop Monitors	Tools for monitoring crop health and growth.
- Status Bar:** Shows "Successfully run. Total query runtime: 93 msec. 90 rows affected."

INSERT INTO "G2SARM".ToolType (TypeID, Type, Description) VALUES

(1, 'Hand Tools', 'Basic hand tools such as hammers, screwdrivers, and wrenches.'),  
 (2, 'Power Tools', 'Electric or battery-powered tools for various tasks.'),  
 (3, 'Gardening Tools', 'Tools specifically designed for gardening activities.'),  
 (4, 'Irrigation Equipment', 'Tools used for efficient irrigation practices.'),  
 (5, 'Soil Testing Kits', 'Kits for testing soil pH and nutrient levels.'),  
 (6, 'Seeders', 'Devices used to sow seeds in the soil.'),  
 (7, 'Fertilizer Spreaders', 'Tools for evenly spreading fertilizers on crops.'),  
 (8, 'Plows', 'Equipment used for tilling soil and preparing fields.'),  
 (9, 'Harvesting Tools', 'Tools designed for harvesting crops efficiently.'),  
 (10, 'Weeding Tools', 'Tools for removing weeds from gardens and fields.'),  
 (11, 'Cultivators', 'Tools used to break up soil and prepare seedbeds.'),  
 (12, 'Pesticide Sprayers', 'Equipment for spraying pesticides on crops.'),  
 (13, 'Tractors', 'Heavy machinery used for various farming tasks.'),

- (14, 'Tillage Equipment', 'Tools for soil preparation before planting.'),
- (15, 'Mulchers', 'Tools for shredding and spreading mulch.'),
- (16, 'Greenhouse Supplies', 'Materials and tools for greenhouse management.'),
- (17, 'Irrigation Controllers', 'Devices for automating irrigation systems.'),
- (18, 'Compost Bins', 'Containers for composting organic materials.'),
- (19, 'Crop Monitors', 'Tools for monitoring crop health and growth.'),
- (20, 'Drone Technology', 'Drones used for surveying and monitoring fields.'),
- (21, 'Livestock Feeders', 'Equipment for feeding livestock efficiently.'),
- (22, 'Animal Health Supplies', 'Tools and supplies for animal health care.'),
- (23, 'Safety Gear', 'Protective equipment for farm workers.'),
- (24, 'Storage Containers', 'Containers for storing tools and supplies.'),
- (25, 'Fencing Supplies', 'Materials used for building fences around farms.'),
- (26, 'Weather Stations', 'Devices for monitoring weather conditions on farms.'),
- (27, 'Soil Moisture Sensors', 'Sensors for measuring soil moisture levels.'),
- (28, 'Tillage Tractors', 'Tractors specifically designed for tillage.'),
- (29, 'Seedling Trays', 'Trays for starting seedlings before transplanting.'),
- (30, 'Row Covers', 'Materials for protecting plants from pests and weather.'),
- (31, 'Farm Management Software', 'Software for managing farm operations.'),
- (32, 'Nutrient Injectors', 'Tools for injecting nutrients into irrigation systems.'),
- (33, 'Organic Fertilizers', 'Natural fertilizers for sustainable farming.'),
- (34, 'Bio-pesticides', 'Environmentally friendly pesticides.'),
- (35, 'Planting Equipment', 'Tools for planting seeds and seedlings.'),
- (36, 'Composting Equipment', 'Tools for efficient composting.'),
- (37, 'Green Manure Tools', 'Tools for managing green manure crops.'),
- (38, 'Windbreak Materials', 'Materials for creating windbreaks on farms.'),
- (39, 'Water Storage Tanks', 'Tanks for storing irrigation water.'),
- (40, 'Pump Systems', 'Pumps for distributing water for irrigation.'),
- (41, 'Precision Agriculture Tools', 'Tools for precision farming techniques.'),
- (42, 'Field Mapping Tools', 'Tools for mapping fields for better management.'),
- (43, 'Baling Equipment', 'Tools for baling hay and straw.'),
- (44, 'Crop Rotation Tools', 'Tools for managing crop rotation practices.'),
- (45, 'Soil Erosion Control Tools', 'Tools for preventing soil erosion.'),
- (46, 'Field Drains', 'Drainage systems for managing water in fields.'),
- (47, 'Cover Crop Seeds', 'Seeds for planting cover crops.'),
- (48, 'Fruit Picking Tools', 'Tools designed for picking fruits efficiently.'),
- (49, 'Vegetable Harvesters', 'Machinery for harvesting vegetables.'),
- (50, 'Fertilizer Injectors', 'Tools for injecting fertilizers into the soil.'),
- (51, 'Hay Equipment', 'Tools specifically for hay production.'),
- (52, 'Aerial Spraying Equipment', 'Equipment for aerial application of chemicals.'),
- (53, 'Silo Systems', 'Systems for storing grains and feeds.'),
- (54, 'Feed Mixing Equipment', 'Tools for mixing animal feed.'),
- (55, 'Land Levelers', 'Tools for leveling land for planting.'),
- (56, 'Rotary Cutters', 'Tools for cutting grass and crops.'),
- (57, 'Crop Rotation Planning Tools', 'Software for planning crop rotations.'),
- (58, 'Bee Keeping Equipment', 'Tools and supplies for beekeeping.'),
- (59, 'Biochar Equipment', 'Tools for producing biochar for soil improvement.'),
- (60, 'Soil Amendments', 'Materials added to soil to improve its quality.'),

(61, 'Pond Liners', 'Linings for creating ponds on farms.'),  
(62, 'Livestock Trailers', 'Trailers for transporting livestock.'),  
(63, 'Solar Pumps', 'Solar-powered water pumps for irrigation.'),  
(64, 'Organic Herbicides', 'Natural herbicides for weed control.'),  
(65, 'Pesticide Application Equipment', 'Tools for applying pesticides.'),  
(66, 'Livestock Health Monitoring Systems', 'Systems for monitoring livestock health.'),  
(67, 'Post-Harvest Equipment', 'Tools for processing crops after harvest.'),  
(68, 'Soil Compaction Equipment', 'Tools for measuring soil compaction.'),  
(69, 'Field Cultivators', 'Tools for cultivating and aerating soil.'),  
(70, 'Chemical Storage Containers', 'Containers for safely storing chemicals.'),  
(71, 'Aquaponics Systems', 'Systems combining aquaculture and hydroponics.'),  
(72, 'Vertical Farming Equipment', 'Tools for vertical farming setups.'),  
(73, 'Cold Storage Units', 'Units for storing perishable products.'),  
(74, 'Farm Vehicles', 'Vehicles used for transportation on farms.'),  
(75, 'Irrigation Pipes', 'Pipes for transporting water in irrigation systems.'),  
(76, 'Soil Tillage Tools', 'Tools for tilling and turning soil.'),  
(77, 'Hydroponic Systems', 'Soil-less growing systems for plants.'),  
(78, 'Biosolids', 'Nutrient-rich organic materials for soil.'),  
(79, 'Wind Turbines', 'Renewable energy systems for farms.'),  
(80, 'Organic Soil Amendments', 'Natural materials added to improve soil.'),  
(81, 'Water Conservation Systems', 'Systems designed to conserve water on farms.'),  
(82, 'Integrated Pest Management Tools', 'Tools for managing pests sustainably.'),  
(83, 'Plasticulture Supplies', 'Materials for plasticulture farming.'),  
(84, 'Tree Pruning Tools', 'Tools for pruning trees and shrubs.'),  
(85, 'Grafting Tools', 'Tools for grafting plants.'),  
(86, 'Solar Panels', 'Solar energy systems for powering farms.'),  
(87, 'Climate Control Systems', 'Systems for controlling climate in greenhouses.'),  
(88, 'Organic Mulch', 'Natural mulch materials for soil health.'),  
(89, 'Cage Systems for Fish', 'Systems for aquaculture operations.'),  
(90, 'Thermal Cameras', 'Cameras for monitoring plant health and moisture.');

29. Irrigation(IrrigationID, CoverageArea, Efficiency, InstallationDate, FarmerID)

```

INSERT INTO "G2SARM".Irrigation (IrrigationID, CoverageArea, Efficiency, InstallationDate,
FarmerID,TypeID) VALUES
(1, 1000.00, 85.00, '2023-01-15', 1, 1),
(2, 1500.50, 90.00, '2023-02-20', 2, 2),
(3, 750.25, 78.50, '2023-03-05', 3, 3),
(4, 1200.00, 88.00, '2023-04-10', 4, 4),
(5, 900.75, 82.00, '2023-05-14', 5, 5),
(6, 1100.00, 80.00, '2023-06-01', 6, 6),
(7, 1600.20, 95.00, '2023-06-15', 7, 7),
(8, 2000.00, 91.50, '2023-07-22', 8, 8),
(9, 500.00, 76.00, '2023-08-03', 9, 9),
(10, 800.00, 83.50, '2023-08-30', 10, 10),
(11, 1300.50, 89.00, '2023-09-15', 11, 11),
(12, 950.00, 81.00, '2023-10-10', 12, 12),
(13, 1750.25, 92.00, '2023-11-01', 13, 13),
(14, 2200.00, 93.50, '2023-11-05', 14, 14),
(15, 1350.50, 87.00, '2023-12-12', 15, 15),
(16, 1250.00, 90.00, '2023-01-11', 16, 16),
(17, 800.50, 79.50, '2023-02-25', 17, 17),
(18, 670.75, 82.00, '2023-03-15', 18, 18),
(19, 980.00, 84.50, '2023-04-20', 19, 19),
(20, 560.00, 76.50, '2023-05-01', 20, 20),
(21, 1700.00, 92.00, '2023-05-30', 21, 21),
(22, 1900.50, 88.00, '2023-06-18', 22, 22),
(23, 1100.00, 85.00, '2023-07-08', 23, 23),
(24, 1400.25, 90.50, '2023-08-01', 24, 24),
(25, 1000.00, 78.50, '2023-09-15', 25, 25),
(26, 1500.00, 94.00, '2023-10-12', 26, 26),
(27, 900.75, 82.00, '2023-11-07', 27, 27),
(28, 1200.00, 88.50, '2023-12-01', 28, 28),
(29, 1300.00, 84.00, '2024-01-22', 29, 29),

```

(30, 1100.50, 91.00, '2024-02-18', 30, 30),  
(31, 750.00, 77.50, '2024-03-02', 31, 31),  
(32, 850.25, 89.00, '2024-04-09', 32, 32),  
(33, 1600.50, 90.00, '2024-05-15', 33, 33),  
(34, 1400.00, 81.50, '2024-06-12', 34, 34),  
(35, 1300.75, 92.50, '2024-07-21', 35, 35),  
(36, 1900.00, 86.00, '2024-08-15', 36, 36),  
(37, 1700.00, 94.50, '2024-09-03', 37, 37),  
(38, 1500.25, 88.00, '2024-10-10', 38, 38),  
(39, 800.00, 78.00, '2024-11-12', 39, 39),  
(40, 1200.50, 82.00, '2024-12-05', 40, 40),  
(41, 1100.00, 90.00, '2023-01-15', 41, 41),  
(42, 950.75, 84.00, '2023-02-20', 42, 42),  
(43, 800.00, 79.50, '2023-03-05', 43, 43),  
(44, 600.50, 86.50, '2023-04-10', 44, 44),  
(45, 1500.00, 90.00, '2023-05-14', 45, 45),  
(46, 1100.00, 93.00, '2023-06-01', 46, 46),  
(47, 950.25, 81.00, '2023-06-15', 47, 47),  
(48, 1350.50, 88.50, '2023-07-22', 48, 48),  
(49, 1450.00, 90.00, '2023-08-03', 49, 49),  
(50, 800.50, 82.00, '2023-08-30', 50, 50),  
(51, 1200.00, 85.00, '2023-09-15', 51, 51),  
(52, 670.00, 79.50, '2023-10-10', 52, 52),  
(53, 1700.25, 93.00, '2023-11-01', 53, 53),  
(54, 1300.50, 87.00, '2023-11-05', 54, 54),  
(55, 2000.00, 91.00, '2023-12-12', 55, 55),  
(56, 1750.00, 84.50, '2024-01-11', 56, 56),  
(57, 1600.00, 90.50, '2024-02-25', 57, 57),  
(58, 1800.00, 89.00, '2024-03-15', 58, 58),  
(59, 800.25, 88.00, '2024-04-20', 59, 59),  
(60, 950.00, 92.50, '2024-05-01', 60, 60),  
(61, 700.00, 80.00, '2024-05-30', 61, 61),  
(62, 1200.50, 85.00, '2024-06-18', 62, 62),  
(63, 1300.00, 87.00, '2024-07-08', 63, 63),  
(64, 1400.50, 90.00, '2024-08-01', 64, 64),  
(65, 1500.00, 93.00, '2024-09-15', 65, 65),  
(66, 1750.00, 91.50, '2024-10-12', 66, 66),  
(67, 800.25, 82.00, '2024-11-07', 67, 67),  
(68, 1200.00, 88.50, '2024-12-01', 68, 68),  
(69, 850.50, 90.00, '2023-01-22', 69, 69),  
(70, 950.75, 85.00, '2023-02-18', 70, 70),  
(71, 1100.00, 76.50, '2023-03-02', 71, 71),  
(72, 670.25, 82.00, '2023-04-09', 72, 72),  
(73, 850.50, 89.50, '2023-05-15', 73, 73),  
(74, 1200.00, 84.00, '2023-06-12', 74, 74),  
(75, 1800.00, 93.00, '2023-07-21', 75, 75),  
(76, 1400.00, 87.50, '2023-08-15', 76, 76),

```
(77, 1750.50, 90.00, '2023-09-03', 77, 77),
(78, 1000.00, 88.00, '2023-10-10', 78, 78),
(79, 1250.00, 91.00, '2023-11-12', 79, 79),
(80, 1350.00, 84.50, '2023-12-05', 80, 80),
(81, 950.25, 89.00, '2024-01-18', 81, 81),
(82, 1150.50, 92.00, '2024-02-20', 82, 82),
(83, 1500.00, 80.00, '2024-03-15', 83, 83),
(84, 1200.00, 87.00, '2024-04-22', 84, 84),
(85, 1000.50, 78.00, '2024-05-30', 85, 85),
(86, 800.00, 90.50, '2024-06-10', 86, 86),
(87, 900.25, 84.00, '2024-07-15', 87, 87),
(88, 1200.00, 92.00, '2024-08-05', 88, 88),
(89, 950.75, 83.50, '2024-09-03', 89, 89),
(90, 1400.00, 86.50, '2024-10-01', 90, 90);
```

### 30. IrrigationType(TypeID, Type, Description)

The screenshot shows the pgAdmin 4 interface. The Object Explorer on the left lists various database objects like tables, triggers, and functions. The main window shows a query editor with the following SQL code:

```
SELECT * FROM "G2SARM".IRRIGATIONTYPE;
```

The results pane displays the data from the 'IRRIGATIONTYPE' table:

TypeID	Type	Description
1	Drip Irrigation	Delivers water directly to the root zone of plants through a network of tubing and emitters.
2	Sprinkler Irrigation	Uses a system of pipes and pumps to spray water onto crops in the form of droplets.
3	Surface Irrigation	Water is applied directly to the soil surface and allowed to flow over the field by gravity.
4	Subsurface Irrigation	Water is delivered below the surface of the soil to maintain moisture levels.
5	Flood Irrigation	Entire fields are flooded with water, allowing it to infiltrate the soil.
6	Basin Irrigation	Water is applied in basins that are bounded by dikes to control water flow.
7	Furrow Irrigation	Water is applied in furrows between rows of crops, allowing it to infiltrate the soil.
8	Center Pivot Irrigation	A rotating sprinkler system that waters circular areas of farmland.
9	Line Source Irrigation	Water is delivered through a line of emitters along the crop rows.
10	Surface Drip Irrigation	A hybrid method that combines surface irrigation techniques with drip systems.
11	Spray Irrigation	Water is sprayed over crops using a series of nozzles or spray heads.
12	Micro Irrigation	Utilizes small-scale irrigation systems to water individual plants or small areas.
13	Portable Sprinkler System	Easily movable sprinkler system for different sections of a field.
14	Flooding with Water Harvesting	Collects and uses rainwater for irrigating crops by flooding fields.
15	Overhead Irrigation	Water is distributed from above using overhead sprinklers or nozzles.
16	Manual Irrigation	Watering is done manually using watering cans or hoses.
17	Soaker Hose Irrigation	Uses porous hoses that allow water to seep out slowly along their length.
18	Rainwater Harvesting	Collects rainwater for irrigation purposes through various collection systems.
19	Green Roof Irrigation	Utilizes irrigation systems specifically designed for rooftop gardens.

Total rows: 90 of 90    Query complete 00:00:00.086    Successfully run. Total query runtime: 86 msec. 90 rows affected.

INSERT INTO "G2SARM".IrrigationType (TypeID, Type, Description) VALUES

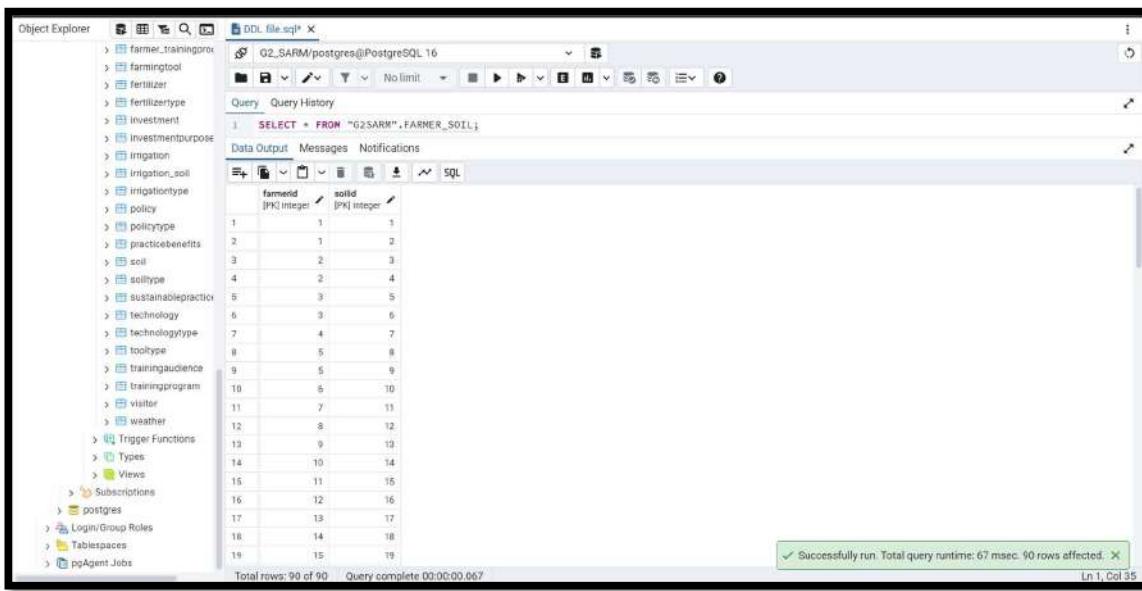
- (1, 'Drip Irrigation', 'Delivers water directly to the root zone of plants through a network of tubing and emitters.'),
- (2, 'Sprinkler Irrigation', 'Uses a system of pipes and pumps to spray water onto crops in the form of droplets.'),
- (3, 'Surface Irrigation', 'Water is applied directly to the soil surface and allowed to flow over the field by gravity.'),
- (4, 'Subsurface Irrigation', 'Water is delivered below the surface of the soil to maintain moisture levels.'),
- (5, 'Flood Irrigation', 'Entire fields are flooded with water, allowing it to infiltrate the soil.'),
- (6, 'Basin Irrigation', 'Water is applied in basins that are bounded by dikes to control water flow.'),
- (7, 'Furrow Irrigation', 'Water is applied in furrows between rows of crops, allowing it to infiltrate the soil.'),
- (8, 'Center Pivot Irrigation', 'A rotating sprinkler system that waters circular areas of farmland.'),
- (9, 'Line Source Irrigation', 'Water is delivered through a line of emitters along the crop rows.'),

- (10, 'Surface Drip Irrigation', 'A hybrid method that combines surface irrigation techniques with drip systems.'),  
(11, 'Spray Irrigation', 'Water is sprayed over crops using a series of nozzles or spray heads.'),  
(12, 'Micro Irrigation', 'Utilizes small-scale irrigation systems to water individual plants or small areas.'),  
(13, 'Portable Sprinkler System', 'Easily movable sprinkler system for different sections of a field.'),  
(14, 'Flooding with Water Harvesting', 'Collects and uses rainwater for irrigating crops by flooding fields.'),  
(15, 'Overhead Irrigation', 'Water is distributed from above using overhead sprinklers or nozzles.'),  
(16, 'Manual Irrigation', 'Watering is done manually using watering cans or hoses.'),  
(17, 'Soaker Hose Irrigation', 'Uses porous hoses that allow water to seep out slowly along their length.'),  
(18, 'Rainwater Harvesting', 'Collects rainwater for irrigation purposes through various collection systems.'),  
(19, 'Green Roof Irrigation', 'Utilizes irrigation systems specifically designed for rooftop gardens and green roofs.'),  
(20, 'Aquaponic Irrigation', 'Combines aquaculture and hydroponics where fish waste provides nutrients for plants.'),  
(21, 'Hydroponic Irrigation', 'Growing plants in nutrient-rich water without soil.'),  
(22, 'Aeroponic Irrigation', 'Plants are grown in an air/mist environment with no soil or aggregate medium.'),  
(23, 'Controlled Environment Agriculture', 'Utilizes technology to control environmental factors for optimal growth.'),  
(24, 'Capillary Irrigation', 'Water is drawn up through a porous medium to the plants.'),  
(25, 'Gravity Fed Irrigation', 'Uses gravity to move water from a higher source to lower areas.'),  
(26, 'Drip Line Irrigation', 'A continuous line of drip emitters for uniform water distribution.'),  
(27, 'Pulsating Sprinkler System', 'Sprinklers that deliver water in pulses for efficiency.'),  
(28, 'Drip Tape Irrigation', 'A flat tape with emitters for irrigation, suitable for row crops.'),  
(29, 'Wet Wall Irrigation', 'Utilizes wet walls to create humidity in greenhouse settings.'),  
(30, 'Perforated Pipe Irrigation', 'Pipes with holes for water to seep out slowly into the surrounding soil.'),  
(31, 'Rain Gun Irrigation', 'A rotating sprinkler that can cover large areas with a powerful jet of water.'),  
(32, 'Subirrigation', 'Watering system that delivers water to the root zone through capillary action.'),  
(33, 'Flood and Furrow Irrigation', 'Combination of flooding and furrow systems for enhanced efficiency.'),  
(34, 'Field Ditch Irrigation', 'Uses ditches to convey water across fields.'),  
(35, 'Contour Irrigation', 'Irrigation along the contour lines of sloped land to reduce runoff.'),  
(36, 'Permanent Bed System', 'Allows for year-round growing with permanent beds and controlled irrigation.'),  
(37, 'Zai Pits Irrigation', 'Involves digging pits to concentrate water and improve soil moisture retention.'),  
(38, 'Mulch Irrigation', 'Uses mulch to retain soil moisture and improve irrigation efficiency.'),  
(39, 'Nutrient Film Technique (NFT)', 'Thin film of nutrient-rich water flows over plant roots.'),  
(40, 'Subsurface Drainage Irrigation', 'Combines drainage and irrigation below the soil surface.'),  
(41, 'Dual-Purpose Irrigation', 'Systems designed for both irrigation and drainage.'),  
(42, 'Solar-Powered Irrigation', 'Uses solar panels to power irrigation systems.'),  
(43, 'Biochar Soil Amendment Irrigation', 'Uses biochar to enhance soil moisture retention in irrigation.'),

- (44, 'Evapotranspiration-based Irrigation', 'Irrigation schedules based on weather data and plant water use.'),  
(45, 'Seasonal Flood Irrigation', 'Floods fields during specific seasons for crop growth.'),  
(46, 'Spray Drift Control Irrigation', 'Minimizes drift in aerial spraying applications.'),  
(47, 'Soil Moisture Sensor Irrigation', 'Uses sensors to optimize watering based on soil moisture levels.'),  
(48, 'Reservoir Irrigation', 'Uses water stored in reservoirs for irrigation purposes.'),  
(49, 'Intermittent Irrigation', 'Allows soil to dry out between watering sessions for crop health.'),  
(50, 'Bubbler Irrigation', 'Water is delivered through small holes or emitters that bubble water.'),  
(51, 'Ridge and Furrow Irrigation', 'Combines ridge planting with furrows for improved water distribution.'),  
(52, 'In-Line Drip Irrigation', 'Drip emitters are placed directly in the irrigation line for efficiency.'),  
(53, 'Frost Protection Irrigation', 'Irrigation used to protect crops from frost damage.'),  
(54, 'Bioengineering Irrigation', 'Uses natural materials for erosion control and irrigation.'),  
(55, 'Aquifer Recharge Irrigation', 'Uses irrigation to replenish groundwater aquifers.'),  
(56, 'Windbreak Irrigation', 'Combines windbreaks with irrigation strategies to conserve moisture.'),  
(57, 'Pressure Regulated Irrigation', 'Maintains consistent water pressure throughout the system.'),  
(58, 'Flood Irrigation with Erosion Control', 'Floods fields while managing soil erosion risks.'),  
(59, 'Wetland Irrigation', 'Uses wetland areas for natural filtration and irrigation.'),  
(60, 'Hydraulic Ram Pump Irrigation', 'Uses hydraulic pressure to pump water without electricity.'),  
(61, 'Surface Flow Irrigation', 'Surface water flows directly over the soil to irrigate crops.'),  
(62, 'Water Recycling Irrigation', 'Uses treated wastewater for irrigation to conserve fresh water.'),  
(63, 'Aerobic Treatment Irrigation', 'Uses aerobic processes to treat water before irrigation.'),  
(64, 'Seasonal Storage Irrigation', 'Holds water for seasonal use in irrigation systems.'),  
(65, 'Ditch Irrigation', 'Water flows through ditches dug into the soil for irrigation.'),  
(66, 'Recycled Water Irrigation', 'Uses treated wastewater for agricultural irrigation.'),  
(67, 'Smart Irrigation Systems', 'Automated systems that adjust watering based on weather conditions.'),  
(68, 'Flooded Rice Field Irrigation', 'Specialized irrigation for rice paddies that require flooding.'),  
(69, 'Water-Conserving Irrigation', 'Techniques focused on minimizing water use while maintaining crop health.'),  
(70, 'High-Volume Irrigation', 'Delivers large volumes of water for specific crop types.'),  
(71, 'Soil Compaction Irrigation', 'Irrigation techniques that address soil compaction issues.'),  
(72, 'Seepage Irrigation', 'Water seeps through the soil layer from underground sources.'),  
(73, 'Water Table Management Irrigation', 'Manages water tables to optimize irrigation practices.'),  
(74, 'Irrigation Pits', 'Pits that collect water for localized irrigation systems.'),  
(75, 'Hydraulic Sprinkler System', 'Uses hydraulic principles for efficient sprinkler irrigation.'),  
(76, 'Basin Irrigation with Conservation', 'Combines basin irrigation with conservation practices.'),  
(77, 'Wetland Restoration Irrigation', 'Uses irrigation techniques to restore wetland areas.'),  
(78, 'Vertical Garden Irrigation', 'Specialized irrigation for vertical gardening systems.'),  
(79, 'Rain-activated Irrigation', 'Automatically activates irrigation based on rainfall levels.'),  
(80, 'Sustainable Irrigation Practices', 'Irrigation methods focused on environmental sustainability.'),  
(81, 'Trench Irrigation', 'Water is delivered through trenches dug alongside crops.'),  
(82, 'Catchment Area Irrigation', 'Uses catchment areas to collect rainwater for irrigation.'),  
(83, 'Pipe Irrigation', 'Water is delivered through a network of pipes.'),  
(84, 'Sub-surface Drainage Irrigation', 'Combination of drainage and irrigation below the surface.'),  
(85, 'Percolation Irrigation', 'Water percolates through the soil to reach plant roots.'),  
(86, 'Infiltration Irrigation', 'Water is applied and infiltrates the soil surface.'),  
(87, 'Flood Irrigation with Nutrient Addition', 'Flooding method that also adds nutrients to the soil.'),

(88, 'Sprinkler Irrigation with Rain Sensors', 'Sprinklers that adjust based on rainfall data.'),  
 (89, 'Underground Irrigation', 'Irrigation systems located below the soil surface.'),  
 (90, 'Natural Resource Irrigation', 'Uses natural resources efficiently for irrigation.');

### 31. Farmer\_Soil(FarmerID, SoilID)



The screenshot shows the pgAdmin 4 interface. The left pane is the Object Explorer, displaying various database objects like tables, functions, and types. The right pane is the Query Editor, which has run a SQL command:

```
SELECT * FROM "G2SARM".FARMER_SOIL;
```

The results are displayed in a Data Output grid:

	farmerid	soilid
1	1	1
2	1	2
3	2	3
4	2	4
5	3	5
6	3	6
7	4	7
8	5	8
9	5	9
10	6	10
11	7	11
12	8	12
13	9	13
14	10	14
15	11	15
16	12	16
17	13	17
18	14	18
19	15	19

Below the grid, a message bar indicates: "Successfully run. Total query runtime: 67 msec. 90 rows affected." and "Ln 1, Col 35".

```
INSERT INTO "G2SARM".Farmer_Soil (FarmerID, SoilID) VALUES
(1, 1),
(1, 2),
(2, 3),
(2, 4),
(3, 5),
(3, 6),
(4, 7),
(5, 8),
(5, 9),
(6, 10),
(7, 11),
(8, 12),
(9, 13),
(10, 14),
(11, 15),
(12, 16),
(13, 17),
(14, 18),
(15, 19),
(16, 20),
(17, 21),
(18, 22),
(19, 23),
(20, 24),
```

(21, 25),  
(22, 26),  
(23, 27),  
(24, 28),  
(25, 29),  
(26, 30),  
(27, 31),  
(28, 32),  
(29, 33),  
(30, 34),  
(31, 35),  
(32, 36),  
(33, 37),  
(34, 38),  
(35, 39),  
(36, 40),  
(37, 41),  
(38, 42),  
(39, 43),  
(40, 44),  
(41, 45),  
(42, 46),  
(43, 47),  
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(46, 50),  
(47, 51),  
(48, 52),  
(49, 53),  
(50, 54),  
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(54, 58),  
(55, 59),  
(56, 60),  
(57, 61),  
(58, 62),  
(59, 63),  
(60, 64),  
(61, 65),  
(62, 66),  
(63, 67),  
(64, 68),  
(65, 69),  
(66, 70),  
(67, 71),

---

```
(68, 72),
(69, 73),
(70, 74),
(71, 75),
(72, 76),
(73, 77),
(74, 78),
(75, 79),
(76, 80),
(77, 81),
(78, 82),
(79, 83),
(80, 84),
(81, 85),
(82, 86),
(83, 87),
(84, 88),
(85, 89),
(86, 90);
```

### 32. Farmer\_Fertilizer(FarmerID, FertilizerID, Quantity)

The screenshot shows the pgAdmin 4 interface with the following details:

- Object Explorer:** Shows the database schema with tables like farmer\_trainingprog, farmingtool, fertilizer, fertilertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype, policy, polictype, practicebenefits, soil, solitype, sustainablepractice, technology, technologytype, tooltype, trainingaudience, trainingprogram, visitor, weather.
- Query Editor:** Contains the SQL command: `SELECT * FROM "G2SARM".FARMER_FERTILIZER;`
- Data Output:** Displays the results of the query in a grid format. The columns are FarmerID, FertilizerID, and quantity. The data consists of 80 rows.
- Status Bar:** Shows a green message: "Successfully run. Total query runtime: 115 msec. 80 rows affected." and "Ln 1, Col 41".

farmerid	fertilizerid	quantity
1	1	100.00
2	1	200.00
3	2	150.50
4	2	300.00
5	3	250.00
6	3	400.00
7	4	500.00
8	5	600.00
9	5	50.00
10	6	75.00
11	7	120.00
12	8	180.00
13	9	90.00
14	10	300.50
15	11	200.00
16	12	250.00
17	13	80.00
18	14	70.00
19	15	65.00

```
INSERT INTO "G2SARM".Farmer_Fertilizer (FarmerID, FertilizerID, Quantity) VALUES
(1, 1, 100.00),
(1, 2, 200.00),
(2, 3, 150.50),
(2, 4, 300.00),
(3, 5, 250.00),
(3, 6, 400.00),
(4, 7, 500.00),
(5, 8, 600.00),
```

(5, 9, 50.00),  
(6, 10, 75.00),  
(7, 11, 120.00),  
(8, 12, 180.00),  
(9, 13, 90.00),  
(10, 14, 300.50),  
(11, 15, 200.00),  
(12, 16, 250.00),  
(13, 17, 80.00),  
(14, 18, 70.00),  
(15, 19, 95.00),  
(16, 20, 130.00),  
(17, 21, 175.00),  
(18, 22, 220.00),  
(19, 23, 85.00),  
(20, 24, 150.00),  
(21, 25, 55.00),  
(22, 26, 65.00),  
(23, 27, 40.00),  
(24, 28, 600.00),  
(25, 29, 70.00),  
(26, 30, 50.00),  
(27, 31, 110.00),  
(28, 32, 190.00),  
(29, 33, 130.00),  
(30, 34, 160.00),  
(31, 35, 200.00),  
(32, 36, 300.00),  
(33, 37, 75.00),  
(34, 38, 80.00),  
(35, 39, 90.00),  
(36, 40, 150.00),  
(37, 41, 220.00),  
(38, 42, 135.00),  
(39, 43, 190.00),  
(40, 44, 200.00),  
(41, 45, 175.00),  
(42, 46, 100.00),  
(43, 47, 125.00),  
(44, 48, 50.00),  
(45, 49, 80.00),  
(46, 50, 300.00),  
(47, 51, 90.00),  
(48, 52, 120.00),  
(49, 53, 70.00),  
(50, 54, 60.00),  
(51, 55, 110.00),

---

```
(52, 56, 180.00),
(53, 57, 200.00),
(54, 58, 230.00),
(55, 59, 260.00),
(56, 60, 190.00),
(57, 61, 75.00),
(58, 62, 85.00),
(59, 63, 95.00),
(60, 64, 150.00),
(61, 65, 225.00),
(62, 66, 105.00),
(63, 67, 195.00),
(64, 68, 110.00),
(65, 69, 120.00),
(66, 70, 130.00),
(67, 71, 140.00),
(68, 72, 150.00),
(69, 73, 160.00),
(70, 74, 170.00),
(71, 75, 180.00),
(72, 76, 90.00),
(73, 77, 50.00),
(74, 78, 60.00),
(75, 79, 100.00),
(76, 80, 150.00);
```

### 33. Farmer\_TrainingProgram(FarmerID, ProgramID)

The screenshot shows the pgAdmin 4 interface. The left pane is the Object Explorer, displaying a tree view of database objects including tables like farmer\_trainingprogram, farmingtool, fertilizer, fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype, policy, politytype, practicebenefits, soil, solitype, sustainablepractor, technology, technologytype, tooltype, trainingaudience, trainingprogram, visitor, weather, and various system categories like Trigger Functions, Types, Views, Subscriptions, and PostgreSQL roles. The right pane is the Query Editor, showing a query window with the following content:

```
SELECT * FROM "G2SARM".FARMER_TRAININGPROGRAM;
```

The results grid displays the following data:

	farmerid	programid
1	1	1
2	1	2
3	2	3
4	2	4
5	3	5
6	3	6
7	4	7
8	5	8
9	5	9
10	6	10
11	7	11
12	8	12
13	9	13
14	10	14
15	11	15
16	12	16
17	13	17
18	14	18
19	15	19

At the bottom of the Query Editor, a status bar indicates: Total rows: 00 of 00 | Query complete 00:00:00.070 | ✓ Successfully run. Total query runtime: 70 msec. 00 rows affected. | Ln 1, Col 46.

```
INSERT INTO "G2SARM".Farmer_TrainingProgram (FarmerID, ProgramID) VALUES
(1, 1),
(1, 2),
```

(2, 3),  
(2, 4),  
(3, 5),  
(3, 6),  
(4, 7),  
(5, 8),  
(5, 9),  
(6, 10),  
(7, 11),  
(8, 12),  
(9, 13),  
(10, 14),  
(11, 15),  
(12, 16),  
(13, 17),  
(14, 18),  
(15, 19),  
(16, 20),  
(17, 21),  
(18, 22),  
(19, 23),  
(20, 24),  
(21, 25),  
(22, 26),  
(23, 27),  
(24, 28),  
(25, 29),  
(26, 30),  
(27, 31),  
(28, 32),  
(29, 33),  
(30, 34),  
(31, 35),  
(32, 36),  
(33, 37),  
(34, 38),  
(35, 39),  
(36, 40),  
(37, 41),  
(38, 42),  
(39, 43),  
(40, 44),  
(41, 45),  
(42, 46),  
(43, 47),  
(44, 48),  
(45, 49),

---

(46, 50),  
(47, 51),  
(48, 52),  
(49, 53),  
(50, 54),  
(51, 55),  
(52, 56),  
(53, 57),  
(54, 58),  
(55, 59),  
(56, 60),  
(57, 61),  
(58, 62),  
(59, 63),  
(60, 64),  
(61, 65),  
(62, 66),  
(63, 67),  
(64, 68),  
(65, 69),  
(66, 70),  
(67, 71),  
(68, 72),  
(69, 73),  
(70, 74),  
(71, 75),  
(72, 76),  
(73, 77),  
(74, 78),  
(75, 79),  
(76, 80);

34. Crop\_Fertilizer(CropID, FertilizerID, FertilizerQuantity)

The screenshot shows the pgAdmin 4 interface with the following details:

- Object Explorer:** On the left, it lists various database objects including tables like farmer\_training, farmtool, fertilizer, fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype, policy, politytype, practicebenefits, soil, soiltype, sustainablepractices, technology, technologytype, tooltype, trainingaudience, trainingprogram, visitor, weather, and several system-related items.
- Query Editor:** The main area contains the SQL command: `SELECT * FROM "G2SARM".CROP_FERTILIZER;`. Below the command is a results grid with the following schema and data:

	cropid	fertilizerid	fertilizerquantity
1	1	1	50.00
2	2	1	30.00
3	3	2	40.00
4	4	2	20.00
5	5	3	60.00
6	6	3	25.00
7	7	4	45.00
8	8	5	55.00
9	9	6	70.00
10	10	7	35.00
11	11	8	50.00
12	12	9	80.00
13	13	10	30.00
14	14	11	90.00
15	15	12	45.00
16	16	13	60.00
17	17	14	75.00
18	18	15	30.00
19	19	16	40.00

- Status Bar:** At the bottom right, it says "Successfully run. Total query runtime: 66 msec. 83 rows affected." and "Ln 1 Col 39".

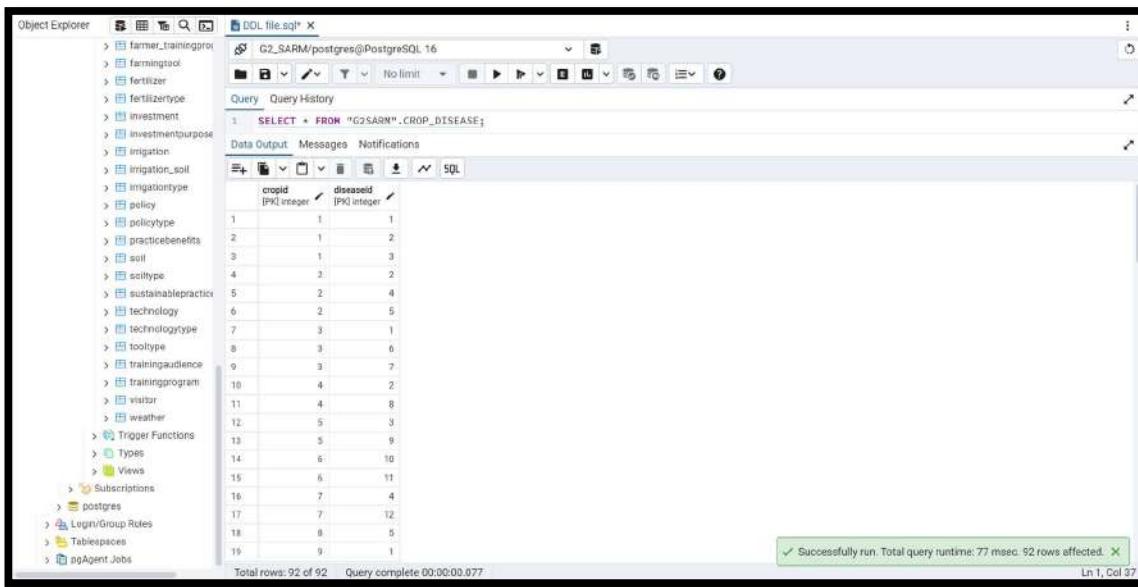
```
INSERT INTO "G2SARM".Crop_Fertilizer (CropID, FertilizerID, FertilizerQuantity) VALUES
(1, 1, 50.00),
(1, 2, 30.00),
(2, 3, 40.00),
(2, 4, 20.00),
(3, 5, 60.00),
(3, 6, 25.00),
(4, 7, 45.00),
(5, 8, 55.00),
(6, 9, 70.00),
(7, 10, 35.00),
(8, 11, 50.00),
(9, 12, 80.00),
(10, 13, 30.00),
(11, 14, 90.00),
(12, 15, 45.00),
(13, 16, 60.00),
(14, 17, 75.00),
(15, 18, 30.00),
(16, 19, 40.00),
(17, 20, 55.00),
(18, 21, 65.00),
(19, 22, 50.00),
(20, 23, 85.00),
(21, 24, 90.00),
(22, 25, 75.00),
(23, 26, 100.00),
(24, 27, 95.00),
(25, 28, 110.00),
(26, 29, 105.00),
(27, 30, 45.00),
```

(28, 31, 55.00),  
(29, 32, 35.00),  
(30, 33, 60.00),  
(31, 34, 25.00),  
(32, 35, 40.00),  
(33, 36, 80.00),  
(34, 37, 50.00),  
(35, 38, 70.00),  
(36, 39, 90.00),  
(37, 40, 20.00),  
(38, 41, 25.00),  
(39, 42, 35.00),  
(40, 43, 50.00),  
(41, 44, 60.00),  
(42, 45, 70.00),  
(43, 46, 80.00),  
(44, 47, 90.00),  
(45, 48, 100.00),  
(46, 49, 50.00),  
(47, 50, 60.00),  
(48, 51, 70.00),  
(49, 52, 80.00),  
(50, 53, 30.00),  
(51, 54, 50.00),  
(52, 55, 75.00),  
(53, 56, 65.00),  
(54, 57, 85.00),  
(55, 58, 95.00),  
(56, 59, 55.00),  
(57, 60, 65.00),  
(58, 61, 50.00),  
(59, 62, 70.00),  
(60, 63, 60.00),  
(61, 64, 40.00),  
(62, 65, 30.00),  
(63, 66, 50.00),  
(64, 67, 20.00),  
(65, 68, 35.00),  
(66, 69, 60.00),  
(67, 70, 40.00),  
(68, 71, 25.00),  
(69, 72, 55.00),  
(70, 73, 90.00),  
(71, 74, 75.00),  
(72, 75, 100.00),  
(73, 76, 60.00),  
(74, 77, 70.00),

---

```
(75, 78, 80.00),
(76, 79, 30.00),
(77, 80, 50.00),
(78, 1, 40.00),
(79, 2, 70.00),
(80, 3, 60.00);
```

### 35. Crop\_Disease(CropID, DiseaseID)



cropid [PK] integer	diseased [PK] integer
1	1
2	1
3	1
4	2
5	2
6	2
7	3
8	3
9	3
10	4
11	4
12	5
13	5
14	6
15	6
16	7
17	7
18	8
19	9

Total rows: 92 of 92    Query complete 00:00:00.077    ✓ Successfully run. Total query runtime: 77 msec. 92 rows affected.    Ln 1, Col 37

```
INSERT INTO "G2SARM".Crop_Disease (CropID, DiseaseID) VALUES
```

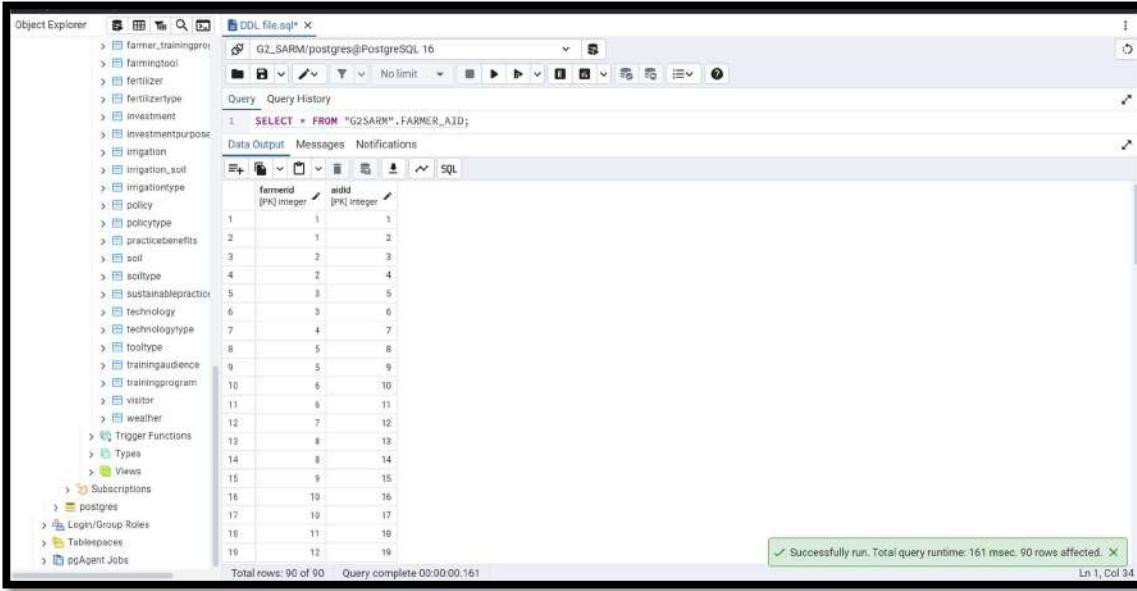
```
(1, 1),
(1, 2),
(1, 3),
(2, 2),
(2, 4),
(2, 5),
(3, 1),
(3, 6),
(3, 7),
(4, 2),
(4, 8),
(5, 3),
(5, 9),
(6, 10),
(6, 11),
(7, 4),
(7, 12),
(8, 5),
(9, 1),
(9, 2),
(10, 6),
```

(11, 7),  
(11, 8),  
(12, 9),  
(13, 3),  
(14, 10),  
(15, 11),  
(16, 12),  
(17, 4),  
(18, 5),  
(19, 2),  
(20, 1),  
(21, 3),  
(22, 6),  
(23, 8),  
(24, 10),  
(25, 11),  
(26, 12),  
(27, 1),  
(28, 2),  
(29, 4),  
(30, 3),  
(31, 5),  
(32, 6),  
(33, 7),  
(34, 9),  
(35, 10),  
(36, 11),  
(37, 12),  
(38, 3),  
(39, 4),  
(40, 5),  
(41, 6),  
(42, 7),  
(43, 8),  
(44, 9),  
(45, 10),  
(46, 11),  
(47, 1),  
(48, 2),  
(49, 3),  
(50, 4),  
(51, 5),  
(52, 6),  
(53, 7),  
(54, 8),  
(55, 9),  
(56, 10),

---

```
(57, 11),
(58, 12),
(59, 1),
(60, 2),
(61, 3),
(62, 4),
(63, 5),
(64, 6),
(65, 7),
(66, 8),
(67, 9),
(68, 10),
(69, 11),
(70, 12),
(71, 1),
(72, 2),
(73, 3),
(74, 4),
(75, 5),
(76, 6),
(77, 7),
(78, 8),
(79, 9),
(80, 10);
```

### 36. Farmer\_Aid(FarmerID, AidID)



The screenshot shows a PostgreSQL client interface with the following details:

- Object Explorer:** On the left, it lists various database objects including tables like farmer\_trainingprogram, farmingtool, fertilizer, Fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype, policy, politytype, practicebenefits, soil, sciltype, sustainablepractice, technology, technologytype, tooltype, trainingaudience, trainingprogram, visitor, weather, and Views.
- Query Editor:** The main area contains a query window titled "G2SARM/postgres@PostgreSQL\_16". The query is:
 

```
1  SELECT * FROM "G2SARM".FARMER_AID;
```
- Data Output:** Below the query window, the results of the SELECT query are displayed in a table:
 

	farmerid	aidid
1	1	1
2	1	2
3	2	3
4	2	4
5	3	5
6	3	6
7	4	7
8	5	8
9	5	9
10	6	10
11	6	11
12	7	12
13	8	13
14	8	14
15	9	15
16	10	16
17	10	17
18	11	18
19	12	19
- Status Bar:** At the bottom, it shows "Total rows: 90 of 90" and "Query complete 00:00:00.161". A green message bar indicates "Successfully run. Total query runtime: 161 msec. 90 rows affected." at "Ln 1, Col 34".

```
INSERT INTO "G2SARM".Farmer_Aid (FarmerID, AidID) VALUES
```

```
(1, 1),
(1, 2),
(2, 3),
```

(2, 4),  
(3, 5),  
(3, 6),  
(4, 7),  
(5, 8),  
(5, 9),  
(6, 10),  
(6, 11),  
(7, 12),  
(8, 13),  
(8, 14),  
(9, 15),  
(10, 16),  
(10, 17),  
(11, 18),  
(12, 19),  
(12, 20),  
(13, 21),  
(14, 22),  
(14, 23),  
(15, 24),  
(16, 25),  
(17, 26),  
(17, 27),  
(18, 28),  
(19, 29),  
(19, 30),  
(20, 31),  
(21, 32),  
(22, 33),  
(22, 34),  
(23, 35),  
(24, 36),  
(25, 37),  
(25, 38),  
(26, 39),  
(27, 40),  
(27, 41),  
(28, 42),  
(29, 43),  
(29, 44),  
(30, 45),  
(31, 46),  
(31, 47),  
(32, 48),  
(33, 49),  
(33, 50),

---

(34, 51),  
(35, 52),  
(36, 53),  
(37, 54),  
(38, 55),  
(39, 56),  
(39, 57),  
(40, 58),  
(41, 59),  
(41, 60),  
(42, 61),  
(43, 62),  
(43, 63),  
(44, 64),  
(45, 65),  
(46, 66),  
(47, 67),  
(48, 68),  
(49, 69),  
(50, 70),  
(51, 71),  
(52, 72),  
(53, 73),  
(54, 74),  
(55, 75),  
(56, 76),  
(57, 77),  
(58, 78),  
(59, 79),  
(60, 80),  
(61, 81),  
(62, 82),  
(63, 83),  
(64, 84),  
(65, 85),  
(66, 86),  
(67, 87),  
(68, 88),  
(69, 89),  
(70, 90);

37. Farmer\_Investment(FarmerID, InvestmentID)

```

Object Explorer   DDL file.sql*   G2_SARM/postgres@PostgreSQL 16
farmer_trainingor
farmington
fertilizer
fertilizertype
investment
investmentpurpose
irrigation
Irrigation_soil
irrigationtype
policy
policytype
practicebenefits
soil
soiltype
sustainablepractices
technology
technologytype
tooltype
trainingaudience
trainingprogram
visitor
weather
Trigger Functions
Types
Views
Subscriptions
postgres
Login/Group Roles
Tablespaces
pgAgent Jobs

```

Query History

```

1. SELECT * FROM "G2SARM".FARMER_INVESTMENT;

```

Data Output Messages Notifications

farmerid	investmentid
1	1
2	1
3	2
4	2
5	3
6	3
7	4
8	5
9	5
10	6
11	6
12	7
13	8
14	8
15	9
16	10
17	10
18	11
19	12

Total rows: 90 of 90    Query complete 00:00:00.065    In 1. Col 42

✓ Successfully run. Total query runtime: 65 msec. 90 rows affected.

INSERT INTO "G2SARM".Farmer\_Investment (FarmerID, InvestmentID) VALUES

```

(1, 1),
(1, 2),
(2, 3),
(2, 4),
(3, 5),
(3, 6),
(4, 7),
(5, 8),
(5, 9),
(6, 10),
(6, 11),
(7, 12),
(8, 13),
(8, 14),
(9, 15),
(10, 16),
(10, 17),
(11, 18),
(12, 19),
(12, 20),
(13, 21),
(14, 22),
(14, 23),
(15, 24),
(16, 25),
(17, 26),
(17, 27),
(18, 28),
(19, 29),

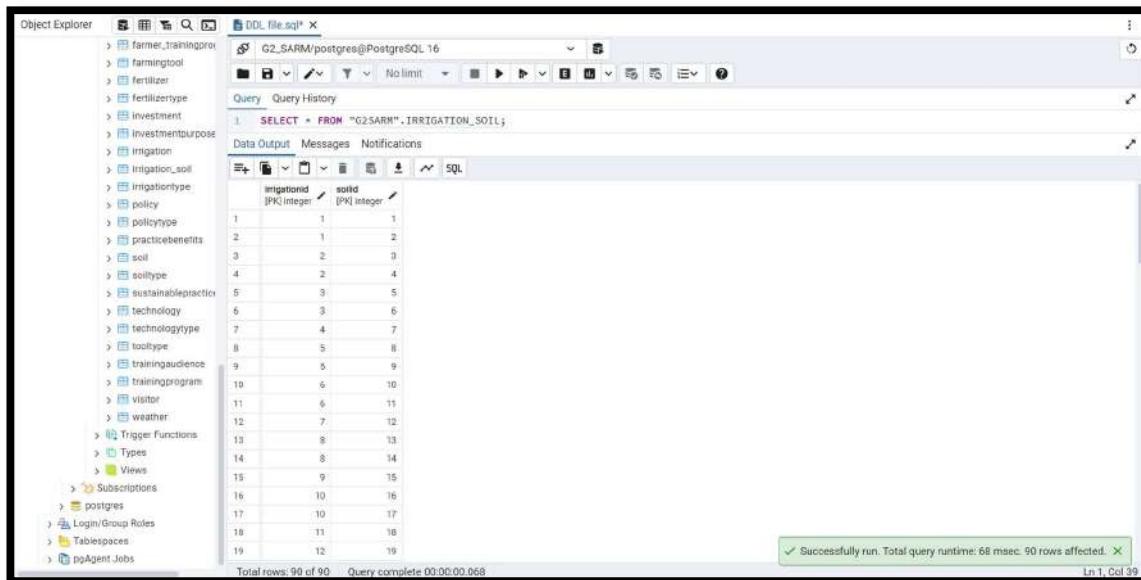
```

(19, 30),  
(20, 31),  
(21, 32),  
(22, 33),  
(22, 34),  
(23, 35),  
(24, 36),  
(25, 37),  
(25, 38),  
(26, 39),  
(27, 40),  
(27, 41),  
(28, 42),  
(29, 43),  
(29, 44),  
(30, 45),  
(31, 46),  
(31, 47),  
(32, 48),  
(33, 49),  
(33, 50),  
(34, 51),  
(35, 52),  
(36, 53),  
(37, 54),  
(38, 55),  
(39, 56),  
(39, 57),  
(40, 58),  
(41, 59),  
(41, 60),  
(42, 61),  
(43, 62),  
(43, 63),  
(44, 64),  
(45, 65),  
(46, 66),  
(47, 67),  
(48, 68),  
(49, 69),  
(50, 70),  
(51, 71),  
(52, 72),  
(53, 73),  
(54, 74),  
(55, 75),  
(56, 76),

---

(57, 77),  
 (58, 78),  
 (59, 79),  
 (60, 80),  
 (61, 81),  
 (62, 82),  
 (63, 83),  
 (64, 84),  
 (65, 85),  
 (66, 86),  
 (67, 87),  
 (68, 88),  
 (69, 89),  
 (70, 90);

### 38. Irrigation\_Soil(IrrigationID, SoilID)



The screenshot shows a PostgreSQL database interface with the following details:

- Object Explorer:** On the left, it lists various database objects including tables like farmer\_trainingprogr, farmingtool, fertilizer, fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype, policy, politype, practicebenefits, soil, soiltype, sustainablepractice, technology, technologype, tooltype, trainingaudience, trainingprogram, visitor, weather, and several system-related items.
- Query Editor:** The main area contains a SQL query window with the following content:
 

```
SELECT * FROM "G2SARM".IRRIGATION_SOIL;
```
- Data Output:** Below the query window, there is a table preview showing the data from the Irrigation\_Soil table. The table has two columns: IrrigationID and SoilID. The data is as follows:

IrrigationID	SoilID
1	1
2	1
3	2
4	2
5	3
6	3
7	4
8	5
9	5
10	6
11	6
12	7
13	8
14	8
15	9
16	10
17	10
18	11
19	12

Below the table, a message indicates: "Successfully run. Total query runtime: 68 msec. 90 rows affected." and "Ln 1, Col 39".

INSERT INTO "G2SARM".Irrigation\_Soil (IrrigationID, SoilID) VALUES

(1, 1),  
 (1, 2),  
 (2, 3),  
 (2, 4),  
 (3, 5),  
 (3, 6),  
 (4, 7),  
 (5, 8),  
 (5, 9),  
 (6, 10),  
 (6, 11),  
 (7, 12),  
 (8, 13),

(8, 14),  
(9, 15),  
(10, 16),  
(10, 17),  
(11, 18),  
(12, 19),  
(12, 20),  
(13, 21),  
(14, 22),  
(14, 23),  
(15, 24),  
(16, 25),  
(17, 26),  
(17, 27),  
(18, 28),  
(19, 29),  
(19, 30),  
(20, 31),  
(21, 32),  
(22, 33),  
(22, 34),  
(23, 35),  
(24, 36),  
(25, 37),  
(25, 38),  
(26, 39),  
(27, 40),  
(27, 41),  
(28, 42),  
(29, 43),  
(29, 44),  
(30, 45),  
(31, 46),  
(31, 47),  
(32, 48),  
(33, 49),  
(33, 50),  
(34, 51),  
(35, 52),  
(36, 53),  
(37, 54),  
(38, 55),  
(39, 56),  
(39, 57),  
(40, 58),  
(41, 59),  
(41, 60),

---

(42, 61),  
(43, 62),  
(43, 63),  
(44, 64),  
(45, 65),  
(46, 66),  
(47, 67),  
(48, 68),  
(49, 69),  
(50, 70),  
(51, 71),  
(52, 72),  
(53, 73),  
(54, 74),  
(55, 75),  
(56, 76),  
(57, 77),  
(58, 78),  
(59, 79),  
(60, 80),  
(61, 81),  
(62, 82),  
(63, 83),  
(64, 84),  
(65, 85),  
(66, 86),  
(67, 87),  
(68, 88),  
(69, 89),  
(70, 90);

39. Crop\_Soil(CropID, SoilID)

```

SELECT * FROM "G2SARM".CROP_SOIL;

```

cropid	soilid
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19

INSERT INTO "G2SARM".Crop\_Soil (CropID, SoilID) VALUES

```

(1, 1),
(1, 2),
(2, 3),
(2, 4),
(3, 5),
(3, 6),
(4, 7),
(5, 8),
(5, 9),
(6, 10),
(6, 11),
(7, 12),
(8, 13),
(8, 14),
(9, 15),
(10, 16),
(10, 17),
(11, 18),
(12, 19),
(12, 20),
(13, 21),
(14, 22),
(14, 23),
(15, 24),
(16, 25),
(17, 26),
(17, 27),
(18, 28),
(19, 29),
(19, 30),

```

(20, 31),  
(21, 32),  
(22, 33),  
(22, 34),  
(23, 35),  
(24, 36),  
(25, 37),  
(25, 38),  
(26, 39),  
(27, 40),  
(27, 41),  
(28, 42),  
(29, 43),  
(29, 44),  
(30, 45),  
(31, 46),  
(31, 47),  
(32, 48),  
(33, 49),  
(33, 50),  
(34, 51),  
(35, 52),  
(36, 53),  
(37, 54),  
(38, 55),  
(39, 56),  
(39, 57),  
(40, 58),  
(41, 59),  
(41, 60),  
(42, 61),  
(43, 62),  
(43, 63),  
(44, 64),  
(45, 65),  
(46, 66),  
(47, 67),  
(48, 68),  
(49, 69),  
(50, 70),  
(51, 71),  
(52, 72),  
(53, 73),  
(54, 74),  
(55, 75),  
(56, 76),  
(57, 77),

---

```
(58, 78),
(59, 79),
(60, 80),
(61, 81),
(62, 82),
(63, 83),
(64, 84),
(65, 85),
(66, 86),
(67, 87),
(68, 88),
(69, 89),
(70, 90);
```

#### 40. Crop\_Weather(CropID, WeatherID)

The screenshot shows the pgAdmin 4 interface with the following details:

- Object Explorer:** Shows the database schema with tables like farmer\_traininggoal, farmingtool, fertilizer, fertilizertype, investment, investmentpurpose, irrigation, irrigation\_soil, irrigationtype, policy, politytype, practicebenefits, soil, solitype, sustainablepractices, technology, technologytype, tooltype, trainingaudience, trainingprogram, visitor, and weather.
- Query Editor:** Contains the SQL command: `SELECT * FROM "G2SARM".CROP_WEATHER;`
- Data Output:** Displays the results of the query as a table with two columns: `cropid` and `weatherid`. The data is as follows:

cropid	weatherid
1	1
2	1
3	1
4	2
5	2
6	2
7	3
8	3
9	3
10	4
11	4
12	4
13	5
14	5
15	5
16	5
17	6
18	7
19	7

- Messages:** A green message bar at the bottom right indicates: "Successfully run. Total query runtime: 70 msec. 90 rows affected." and "Ln 1, Col 37".

```
INSERT INTO "G2SARM".Crop_Weather (CropID, WeatherID) VALUES
```

```
(1, 1),
(1, 2),
(1, 3),
(2, 4),
(2, 5),
(2, 6),
(3, 7),
(3, 8),
(3, 9),
(4, 10),
(4, 11),
(4, 12),
(5, 13),
(5, 14),
```

(5, 15),  
(6, 16),  
(6, 17),  
(7, 18),  
(7, 19),  
(8, 20),  
(8, 21),  
(9, 22),  
(9, 23),  
(10, 24),  
(10, 25),  
(11, 26),  
(11, 27),  
(12, 28),  
(12, 29),  
(13, 30),  
(14, 31),  
(14, 32),  
(15, 33),  
(15, 34),  
(16, 35),  
(17, 36),  
(17, 37),  
(18, 38),  
(19, 39),  
(19, 40),  
(20, 41),  
(20, 42),  
(21, 43),  
(22, 44),  
(22, 45),  
(23, 46),  
(24, 47),  
(24, 48),  
(25, 49),  
(25, 50),  
(26, 51),  
(27, 52),  
(27, 53),  
(28, 54),  
(29, 55),  
(30, 56),  
(31, 57),  
(32, 58),  
(33, 59),  
(34, 60),  
(34, 61),

---

(35, 62),  
(36, 63),  
(37, 64),  
(38, 65),  
(39, 66),  
(40, 67),  
(41, 68),  
(42, 69),  
(43, 70),  
(44, 71),  
(45, 72),  
(46, 73),  
(47, 74),  
(48, 75),  
(49, 76),  
(50, 77),  
(51, 78),  
(52, 79),  
(53, 80),  
(54, 81),  
(55, 82),  
(56, 83),  
(57, 84),  
(58, 85),  
(59, 86),  
(60, 87),  
(61, 88),  
(62, 89),  
(63, 90);

41. Farmer\_SustainablePractice(FarmerID, PracticeID)

```

SELECT * FROM "G2SARM".FARMER_SUSTAINABLEPRACTICE;

```

farmerid	practiceid
1	1
2	1
3	2
4	3
5	4
6	5
7	6
8	7
9	8
10	9
11	10
12	11
13	12
14	13
15	14
16	15
17	16
18	17
19	18

Total rows: 90 of 90    Query complete 00:00:00.119    Ln 1, Col 50

Successfully run. Total query runtime: 119 msec. 90 rows affected.

INSERT INTO "G2SARM".Farmer\_SustainablePractice (FarmerID, PracticeID) VALUES

```

(1, 1),
(1, 2),
(2, 3),
(3, 4),
(4, 5),
(5, 6),
(6, 7),
(7, 8),
(8, 9),
(9, 10),
(10, 11),
(11, 12),
(12, 13),
(13, 14),
(14, 15),
(15, 16),
(16, 17),
(17, 18),
(18, 19),
(19, 20),
(20, 21),
(21, 22),
(22, 23),
(23, 24),
(24, 25),
(25, 26),
(26, 27),
(27, 28),
(28, 29),

```

(29, 30),  
(30, 31),  
(31, 32),  
(32, 33),  
(33, 34),  
(34, 35),  
(35, 36),  
(36, 37),  
(37, 38),  
(38, 39),  
(39, 40),  
(40, 41),  
(41, 42),  
(42, 43),  
(43, 44),  
(44, 45),  
(45, 46),  
(46, 47),  
(47, 48),  
(48, 49),  
(49, 50),  
(50, 51),  
(51, 52),  
(52, 53),  
(53, 54),  
(54, 55),  
(55, 56),  
(56, 57),  
(57, 58),  
(58, 59),  
(59, 60),  
(60, 61),  
(61, 62),  
(62, 63),  
(63, 64),  
(64, 65),  
(65, 66),  
(66, 67),  
(67, 68),  
(68, 69),  
(69, 70),  
(70, 71),  
(71, 72),  
(72, 73),  
(73, 74),  
(74, 75),  
(75, 76),

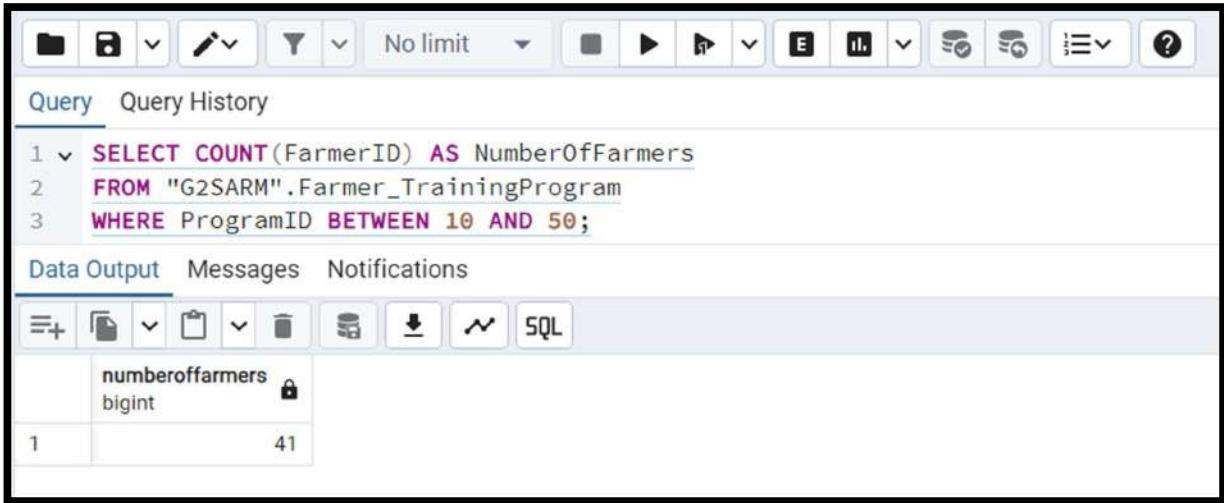
---

```
(76, 77),  
(77, 78),  
(78, 79),  
(79, 80),  
(80, 81),  
(81, 82),  
(82, 83),  
(83, 84),  
(84, 85),  
(85, 86),  
(86, 87),  
(87, 88),  
(88, 89),  
(89, 90);
```

### 3. SQL Queries

- o Query List
  - Simple queries (no joins):

1. SELECT COUNT(FarmerID) AS NumberOfFarmers  
FROM "G2SARM".Farmer\_TrainingProgram  
WHERE ProgramID BETWEEN 10 AND 50;



The screenshot shows a SQL query editor interface. At the top, there's a toolbar with various icons. Below it, a tab bar with 'Query' selected and 'Query History' as an option. The main area contains the following SQL code:

```
1 ▾ SELECT COUNT(FarmerID) AS NumberOfFarmers  
2 FROM "G2SARM".Farmer_TrainingProgram  
3 WHERE ProgramID BETWEEN 10 AND 50;
```

Below the code, there are tabs for 'Data Output', 'Messages', and 'Notifications'. Under 'Data Output', there's a table with one row:

	numberoffarmers
1	41

This query counts the number of farmers who have participated in training programs with ProgramID between 10 and 50.

2. SELECT COUNT(FertilizerID) AS TotalFertilizers FROM "G2SARM".Fertilizer;

The screenshot shows a MySQL Workbench interface. The query window contains the SQL statement: `SELECT COUNT(FertilizerID) AS TotalFertilizers FROM "G2SARM".Fertilizer;`. The results pane displays a single row with the column name `totalfertilizers` and the value `80`.

totalfertilizers	bigint
1	80

This query counts the Number of Different Fertilizers.

3. SELECT SUM(Quantity) AS TotalFertilizerUsed  
FROM "G2SARM".Farmer\_Fertilizer  
WHERE FertilizerID = 5;

The screenshot shows a MySQL Workbench interface. The query window contains the SQL statement: `SELECT SUM(Quantity) AS TotalFertilizerUsed FROM "G2SARM".Farmer_Fertilizer WHERE FertilizerID = 5;`. The results pane displays a single row with the column name `totalfertilizerused` and the value `250.00`.

totalfertilizerused	numeric
1	250.00

This query calculates the total quantity of fertilizer (with FertilizerID 5) used by all farmers.

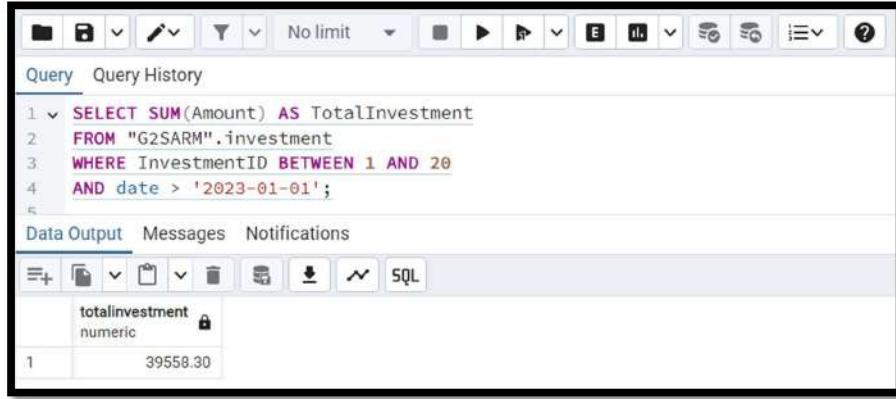
4. SELECT AVG(yield) AS AverageYield  
FROM "G2SARM".Crop  
WHERE growthperiod > 150;

The screenshot shows a MySQL Workbench interface. The query window contains the SQL statement: `SELECT AVG(yield) AS AverageYield FROM "G2SARM".Crop WHERE growthperiod > 150;`. The results pane displays a single row with the column name `averageyield` and the value `4.166666666666667`.

averageyield	numeric
1	4.166666666666667

This query calculates the average yield for all crops which have growth period is greater than 150;

5. `SELECT SUM(Amount) AS TotalInvestment  
FROM "G2SARM".investment  
WHERE InvestmentID BETWEEN 1 AND 20  
AND date > '2023-01-01';`



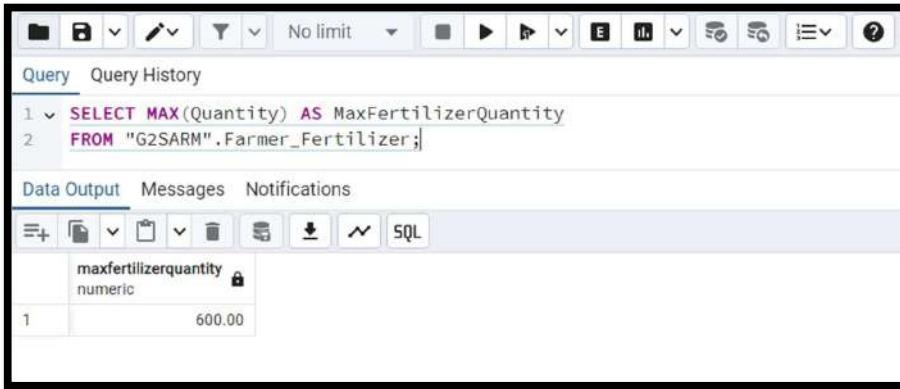
The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```
1 v SELECT SUM(Amount) AS TotalInvestment
2   FROM "G2SARM".investment
3   WHERE InvestmentID BETWEEN 1 AND 20
4   AND date > '2023-01-01';
5
```

The results pane shows a single row with the column name `totalinvestment` and the value `39558.30`.

This query calculates the total investment amount for investments with IDs between 1 and 20, made after January 1, 2023.

6. `SELECT MAX(Quantity) AS MaxFertilizerQuantity  
FROM "G2SARM".Farmer_Fertilizer;`



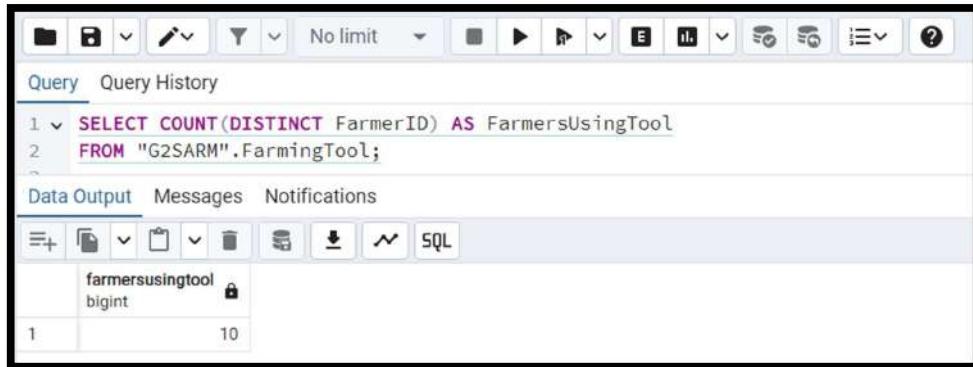
The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```
1 v SELECT MAX(Quantity) AS MaxFertilizerQuantity
2   FROM "G2SARM".Farmer_Fertilizer;
```

The results pane shows a single row with the column name `maxfertilizerquantity` and the value `600.00`.

This query finds the highest fertilizer quantity used by any single farmer.

7. `SELECT COUNT(DISTINCT FarmerID) AS FarmersUsingTool  
FROM "G2SARM".FarmingTool;`



The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```
1 v SELECT COUNT(DISTINCT FarmerID) AS FarmersUsingTool
2   FROM "G2SARM".FarmingTool;
```

The results pane shows a single row with the column name `farmersusingtool` and the value `10`.

This query counts the number of distinct farmers who are using any farming tool.

8. SELECT COUNT(DISTINCT FarmerID) AS NumberOfFarmers  
FROM "G2SARM".Farmer\_Tech  
WHERE TimeofUsage BETWEEN '2018-01-01' AND '2022-12-31';



The screenshot shows a SQL query editor interface. The top bar has various icons for file operations, search, and help. Below it, a toolbar with icons for new query, save, copy, and execute. The main area is divided into two tabs: 'Query' (selected) and 'Query History'. The 'Query' tab contains the following SQL code:

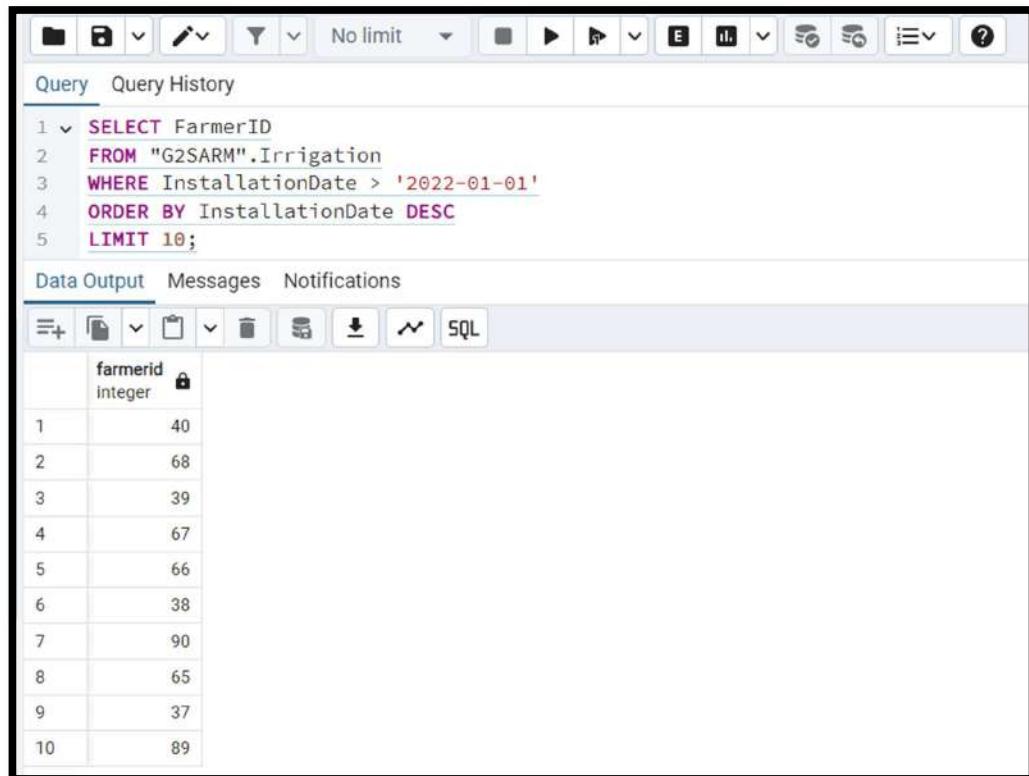
```
1 v SELECT COUNT(DISTINCT FarmerID) AS NumberOfFarmers
2   FROM "G2SARM".Farmer_Tech
3 WHERE TimeofUsage BETWEEN '2018-01-01' AND '2022-12-31';
4
```

The 'Data Output' tab is selected, showing a single row of results:

	numberoffarmers
1	0

This query counts the number of unique farmers who have used technology between the years 2018 and 2022.

9. SELECT FarmerID  
FROM "G2SARM".Irrigation  
WHERE InstallationDate > '2022-01-01'  
ORDER BY InstallationDate DESC  
LIMIT 10;



The screenshot shows a SQL query editor interface. The top bar has various icons for file operations, search, and help. Below it, a toolbar with icons for new query, save, copy, and execute. The main area is divided into two tabs: 'Query' (selected) and 'Query History'. The 'Query' tab contains the following SQL code:

```
1 v SELECT FarmerID
2   FROM "G2SARM".Irrigation
3 WHERE InstallationDate > '2022-01-01'
4 ORDER BY InstallationDate DESC
5 LIMIT 10;
```

The 'Data Output' tab is selected, showing 10 rows of results:

	farmerid
1	40
2	68
3	39
4	67
5	66
6	38
7	90
8	65
9	37
10	89

This query retrieves the IDs of farmers who installed irrigation systems after January 1, 2022, ordered by installation date, limited to the top 10 results.

```

10. SELECT FarmerID, Name
   FROM "G2SARM".Farmer
   WHERE FarmerID NOT IN (
   SELECT DISTINCT FarmerID
   FROM "G2SARM".Farmer_Fertilizer
   );

```

The screenshot shows a SQL query editor with the following details:

- Query History:** Shows the executed SQL code.
- Data Output:** Shows the results of the query in a table format.
- Table Structure:** The table has two columns: **farmerid** [PK] integer and **name** character varying (255).
- Table Data:** The table contains 19 rows of data, each with a unique ID and a corresponding name.
- Total Rows:** Total rows: 19 of 19
- Query Time:** Query complete 00:00:00.081

	farmerid	name
1	77	Ishaan Mehta
2	78	Vishal Verma
3	79	Siddhant Sharma
4	80	Samir Gupta
5	81	Parth Rao
6	82	Ritesh Reddy
7	83	Shreyas Bhatia
8	84	Arnav Singh
9	85	Nitin Gupta
10	86	Vikrant Reddy
11	87	Suryansh Patel
12	88	Aakash Singh
13	89	Bharat Kumar
14	90	Yogesh Sharma
15	91	Hitesh Reddy

This query retrieves the IDs and name of farmers who have not used any fertilizer, by checking the absence of their FarmerID in the Farmer\_Fertilizer table.

```

11. SELECT AVG(Efficiency) AS AverageEfficiency
   FROM "G2SARM".Irrigation
   WHERE TypeID = 1
   AND InstallationDate BETWEEN '2020-01-01' AND '2023-12-31';

```

```

1 ✓ SELECT AVG(Efficiency) AS AverageEfficiency
2   FROM "G2SARM".Irrigation
3   WHERE TypeID = 1
4   AND InstallationDate BETWEEN '2020-01-01' AND '2023-12-31';

```

The screenshot shows a SQL query editor interface. The query window contains the provided SQL code. The results window shows a single row with the column name 'averageefficiency' and the value '85.00000000000000'. The interface includes various toolbar icons and tabs for Data Output, Messages, and Notifications.

This query calculates the average efficiency of irrigation systems of type 1, installed between 2020 and 2023.

12. SELECT CropID  
FROM "G2SARM".Crop  
WHERE Yield > 5  
AND CropID < 50;

```

1 ✓ SELECT CropID
2   FROM "G2SARM".Crop
3   WHERE Yield > 5
4   AND CropID < 50;

```

The screenshot shows a SQL query editor interface. The query window contains the provided SQL code. The results window shows three rows with the column name 'cropid' and values 17, 18, and 49. The interface includes various toolbar icons and tabs for Data Output, Messages, and Notifications.

This query retrieves the CropID for crops with a yield greater than 5, specifically for CropID less than 50.

13. SELECT ProgramID  
FROM "G2SARM".TrainingProgram  
WHERE duration =  
(  
SELECT MAX(duration)  
FROM "G2SARM".TrainingProgram  
);

```

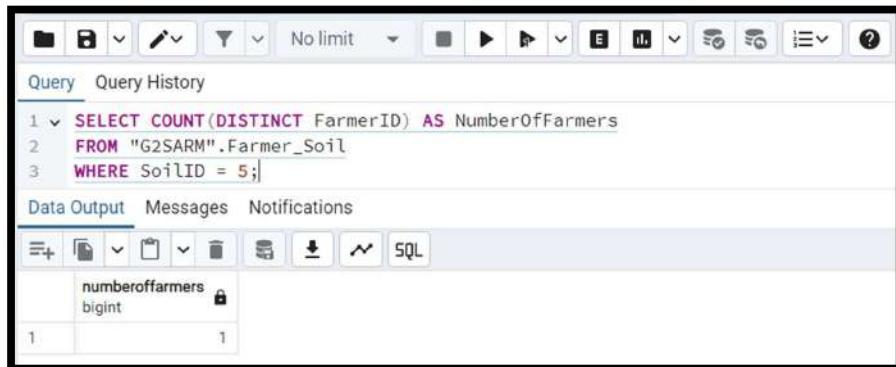
1 ✓ SELECT ProgramID
2   FROM "G2SARM".TrainingProgram
3   WHERE duration = (
4     SELECT MAX(duration)
5     FROM "G2SARM".TrainingProgram
6   );

```

The screenshot shows a SQL query editor interface. The query window contains the provided SQL code. The results window shows six rows with the column name 'programid' and values 3, 10, 35, 47, 58, and 73. The interface includes various toolbar icons and tabs for Data Output, Messages, and Notifications.

This query retrieves the ProgramID of the training program with the longest duration.

14. SELECT COUNT(DISTINCT FarmerID) AS NumberOfFarmers  
FROM "G2SARM".Farmer\_Soil  
WHERE SoilID = 5;



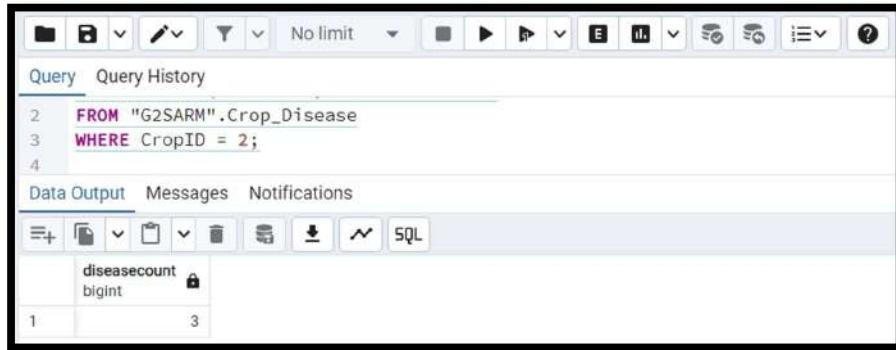
The screenshot shows a SQL query editor interface. The query window contains the following code:

```
1 v SELECT COUNT(DISTINCT FarmerID) AS NumberOfFarmers
2   FROM "G2SARM".Farmer_Soil
3 WHERE SoilID = 5;
```

The results pane shows a single row with the column name 'numberoffarmers' and the value '1'.

This query counts the number of farmers using a specific soil type (SoilID 5).

15. SELECT COUNT(DiseaseID) AS DiseaseCount  
FROM "G2SARM".Crop\_Disease  
WHERE CropID = 2;



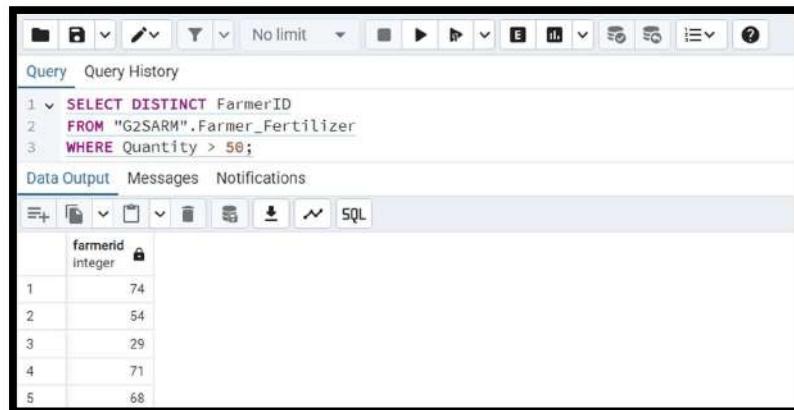
The screenshot shows a SQL query editor interface. The query window contains the following code:

```
2   FROM "G2SARM".Crop_Disease
3 WHERE CropID = 2;
4
```

The results pane shows a single row with the column name 'diseasecount' and the value '3'.

This query counts the number of diseases affecting CropID 2.

16. SELECT DISTINCT FarmerID  
FROM "G2SARM".Farmer\_Fertilizer  
WHERE Quantity > 50;



The screenshot shows a SQL query editor interface. The query window contains the following code:

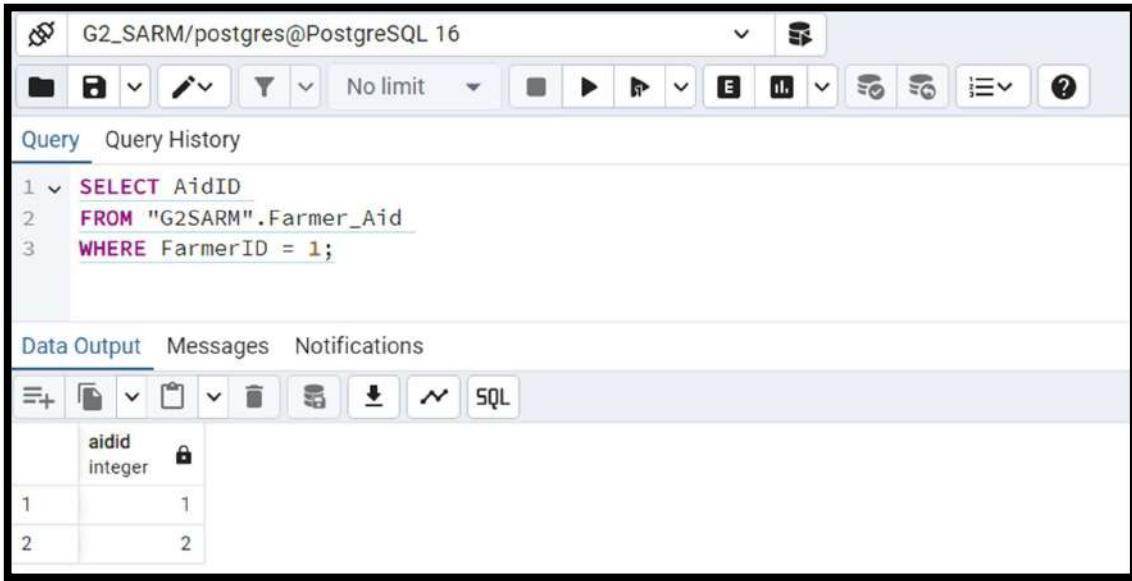
```
1 v SELECT DISTINCT FarmerID
2   FROM "G2SARM".Farmer_Fertilizer
3 WHERE Quantity > 50;
```

The results pane shows a list of farmer IDs:

farmerid	integer
1	74
2	54
3	29
4	71
5	68

This query retrieves the list of farmers who have used more than 50 units of fertilizer.

17. SELECT AidID  
FROM "G2SARM".Farmer\_Aid  
WHERE FarmerID = 1;



The screenshot shows the pgAdmin 4 interface with a query editor window titled 'G2\_SARM/postgres@PostgreSQL 16'. The query is:

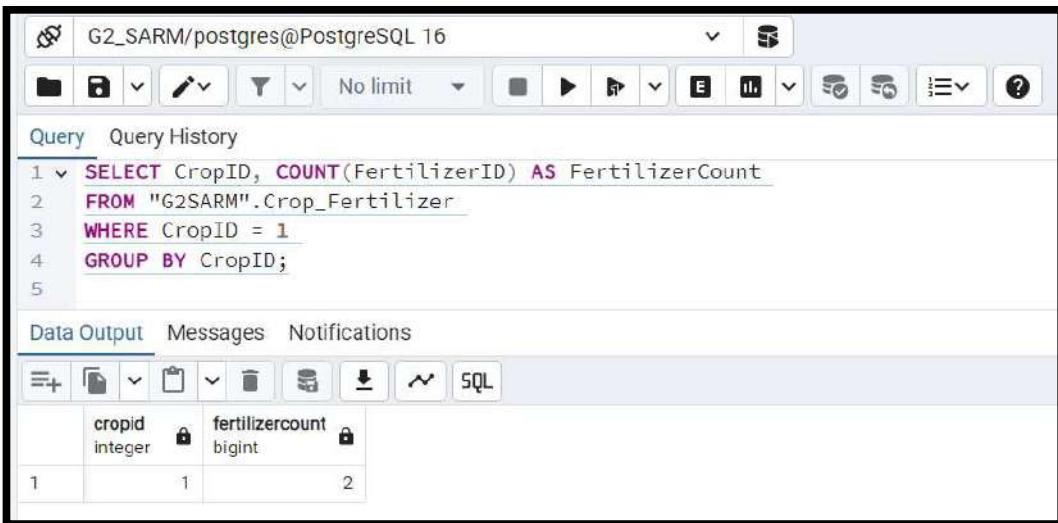
```
1 v SELECT AidID
2   FROM "G2SARM".Farmer_Aid
3 WHERE FarmerID = 1;
```

The results pane shows a table with one column 'aidid' and two rows:

aidid
1
2

This query retrieves the AidID(s) associated with FarmerID 1 from the Farmer\_Aid table.

18. SELECT CropID, COUNT(FertilizerID) AS FertilizerCount  
FROM "G2SARM".Crop\_Fertilizer  
WHERE CropID = 1  
GROUP BY CropID;



The screenshot shows the pgAdmin 4 interface with a query editor window titled 'G2\_SARM/postgres@PostgreSQL 16'. The query is:

```
1 v SELECT CropID, COUNT(FertilizerID) AS FertilizerCount
2   FROM "G2SARM".Crop_Fertilizer
3 WHERE CropID = 1
4 GROUP BY CropID;
5
```

The results pane shows a table with two columns: 'cropid' and 'fertilizercount'. There is one row with values 1 and 2 respectively:

cropid	fertilizercount
1	2

19. This query counts the number of fertilizers used for CropID 1 and groups the result by CropID.  
SELECT FarmerID  
FROM "G2SARM".Farmer\_Aid  
WHERE AidID BETWEEN 8 AND 15;

The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```

1 SELECT FarmerID
2 FROM "G2SARM".Farmer_Aid
3 WHERE AidID BETWEEN 8 AND 15;

```

The results window displays a table with one column, 'farmerid', containing integer values from 1 to 8.

farmerid	integer
1	5
2	5
3	6
4	6
5	7
6	8
7	8
8	9

This query retrieves the FarmerID(s) associated with AidID values between 8 and 15 from the Farmer\_Aid table.

20. SELECT Name, Contactinfo FROM "G2SARM".Visitor WHERE Role='Student';

The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```

1 SELECT Name, Contactinfo FROM "G2SARM".Visitor WHERE Role='Student';

```

The results window displays a table with two columns, 'name' and 'contactinfo'. The 'name' column lists 19 student names, and the 'contactinfo' column lists their corresponding email addresses.

name	contactinfo
Vivaan Sharma	vivaan.sharma@example.com
Vihan Joshi	vihan.joshi@example.com
Rohan Kapoor	rohan.kapoor@example.com
Lakshya Gupta	lakshya.gupta@example.com
Samarth Iyer	samarth.iyer@example.com
Aniket Rao	aniket.rao@example.com
Advik Jain	advik.jain@example.com
Dev Agarwal	dev.agarwal@example.com
Nishant Ghosh	nishant.ghosh@example.com
Kartik Sethi	kartik.sethi@example.com
Rudra Kumar	rudra.kumar@example.com
Manan Roy	manan.roy@example.com
Arjun Pillai	arjun.pillai@example.com
Tanay Singh	tanay.singh@example.com
Harit Rawat	harit.rawat@example.com
Vikas Singh	vikas.singh@example.com
Rahul Kapoor	rahul.kapoor@example.com
Keshav Dubey	keshav.dubey@example.com
Uday Patil	uday.patil@example.com

Total rows: 50 of 50    Query complete 00:00:00.089

This query retrieves the Name and Contactinfo of visitors who have the role of 'Student' from the Visitor table.

- Complex queries (multiple joins, sub-queries)
1. SELECT f.FarmerID, COALESCE(SUM(a.Amount), 0) AS TotalAid, COALESCE(SUM(i.Amount), 0) AS TotalInvestment  
FROM "G2SARM".Farmer f  
LEFT JOIN "G2SARM".Farmer\_Aid fa ON f.FarmerID = fa.FarmerID

```

LEFT JOIN "G2SARM".Aid a ON fa.AidID = a.AidID
LEFT JOIN "G2SARM".Farmer_Investment fi ON f.FarmerID = fi.FarmerID
LEFT JOIN "G2SARM".Investment i ON fi.InvestmentID = i.InvestmentID
GROUP BY f.FarmerID
ORDER BY TotalAid DESC, TotalInvestment DESC;

```

The screenshot shows a SQL query editor with the following details:

- Toolbar:** Includes icons for file operations, search, and various database functions.
- Query History:** Shows the executed SQL code:

```

1 SELECT f.FarmerID, COALESCE(SUM(a.Amount), 0) AS TotalAid, COALESCE(SUM(i.Amount), 0) AS TotalInvestment
2 FROM "G2SARM".Farmer f
3 LEFT JOIN "G2SARM".Farmer_Aid fa ON f.FarmerID = fa.FarmerID
4 LEFT JOIN "G2SARM".Aid a ON fa.AidID = a.AidID
5 LEFT JOIN "G2SARM".Farmer_Investment fi ON f.FarmerID = fi.FarmerID
6 LEFT JOIN "G2SARM".Investment i ON fi.InvestmentID = i.InvestmentID
7 GROUP BY f.FarmerID
8 ORDER BY TotalAid DESC, TotalInvestment DESC;

```

- Data Output:** Displays the results in a table format:

farmerid	totalaid	totalinvestment
1	10600.00	9000.50
2	10600.00	3601.80
3	10400.00	7801.60
4	10400.00	7002.30
5	10200.00	9201.00
6	9800.00	8001.00
7	9800.00	6201.80
8	9600.00	9503.00
9	9600.00	8401.70
10	9200.00	10200.80
11	9000.00	7401.50
12	8800.00	8502.80
13	8600.00	11401.00
14	0.00	0.00

Total rows: 95 of 95    Query complete 00:00:00.162

This query calculates the total aid and investment amounts for each farmer, sorting the results by aid and investment amounts in descending order.

2. 

```

SELECT s.SoilId, AVG(c.Yield) AS AverageYield
FROM "G2SARM".Soil s
JOIN "G2SARM".Crop_Soil cs ON s.SoilID = cs.SoilID
JOIN "G2SARM".Crop c ON cs.CropID = c.CropID
GROUP BY s.SoilId
ORDER BY AverageYield DESC;
```

The screenshot shows a SQL query editor with the following details:

- Toolbar:** Includes icons for file operations (New, Open, Save, Print), search, filters, and various database management functions.
- Query History:** Shows "No limit" for the number of queries stored.
- Query:** The SQL code is:
 

```

1 v  SELECT s.SoilId, AVG(c.Yield) AS AverageYield
2   FROM "G2SARM".Soil s
3   JOIN "G2SARM".Crop_Soil cs ON s.SoilID = cs.SoilID
4   JOIN "G2SARM".Crop c ON cs.CropID = c.CropID
5   GROUP BY s.SoilId
6   ORDER BY AverageYield DESC;
    
```
- Data Output:** The results are displayed in a table with two columns: "soilid" and "averageyield".
- Table Data:**

	soilid [PK] integer	averageyield numeric
1	27	8.0000000000000000
2	26	8.0000000000000000
3	28	7.5000000000000000
4	69	6.0000000000000000
5	67	5.0000000000000000
6	53	5.0000000000000000
7	25	5.0000000000000000
8	31	4.5000000000000000
9	68	4.5000000000000000
10	56	4.2000000000000000
11	57	4.2000000000000000
12	9	4.2000000000000000
13	8	4.2000000000000000
14	22	4.0000000000000000
15	3	4.0000000000000000
- Message Bar:** Shows "Total rows: 90 of 90" and "Query complete 00:00:00.085".

This query calculates the average yield of crops grown on different soil types.

3. 

```

SELECT DISTINCT f.FarmerID, f.Name
FROM "G2SARM".Farmer f
JOIN "G2SARM".Farmer_SustainablePractice fp ON f.FarmerID = fp.FarmerID
JOIN "G2SARM".Farmer_Aid fa ON f.FarmerID = fa.FarmerID
WHERE fp.PracticeID IN (SELECT PracticeID FROM "G2SARM".SustainablePractice
WHERE Description LIKE '%organic%');
    
```

```

1 v SELECT DISTINCT f.FarmerID, f.Name
2   FROM "G2SARM".Farmer f
3   JOIN "G2SARM".Farmer_SustainablePractice fp ON f.FarmerID = fp.FarmerID
4   JOIN "G2SARM".Farmer_Aid fa ON f.FarmerID = fa.FarmerID
5 WHERE fp.PracticeID IN (SELECT PracticeID FROM "G2SARM".SustainablePractice WHERE Description LIKE '%organic%');

```

Data Output Messages Notifications

farmerid	name
11	Aarav Singh
12	Vikram Sharma
53	Anish Verma

This query finds farmers who practice sustainable methods (such as "organic" practices) and have received aid.

4. 

```

SELECT f.FarmerID, f.Name, c.Name
FROM "G2SARM".Farmer_Crop fc
JOIN "G2SARM".Farmer f ON fc.FarmerID = f.FarmerID
JOIN "G2SARM".Crop c ON fc.CropID = c.CropID
JOIN "G2SARM".Crop_Weather cw ON c.CropID = cw.CropID
JOIN "G2SARM".Weather w ON cw.WeatherID = w.WeatherID
WHERE w.conditions = 'Clear';

```

```

1 v SELECT f.FarmerID, f.Name, c.Name
2   FROM "G2SARM".Farmer_Crop fc
3   JOIN "G2SARM".Farmer f ON fc.FarmerID = f.FarmerID
4   JOIN "G2SARM".Crop c ON fc.CropID = c.CropID
5   JOIN "G2SARM".Crop_Weather cw ON c.CropID = cw.CropID
6   JOIN "G2SARM".Weather w ON cw.WeatherID = w.WeatherID
7 WHERE w.conditions = 'Clear';

```

Data Output Messages Notifications

farmerid	name	name
1	Manav Singh	Wheat
2	Manav Singh	Barley
3	Veer Sharma	Oats
4	Veer Sharma	Corn
5	Kumar Gupta	Chickpea
6	Kumar Gupta	Chickpea
7	Karma Verma	Tomato
8	Raj Rao	Banana
9	Raj Rao	Orange
10	Shiraz Desai	Strawberry
11	Manav Singh	Parsley
12	Veer Sharma	Sunflower
13	Kaushal Reddy	Buckwheat
14	Veer Sharma	Black Pepper

Total rows: 22 of 22    Query complete 00:00:00.065

This query retrieves information about farmers who grow crops suited to clear weather conditions.

- ```
5. SELECT CropID, COUNT(DiseaseID) AS DiseaseCount  
FROM "G2SARM".Crop_Disease  
GROUP BY CropID  
HAVING COUNT(DiseaseID) > 1  
ORDER BY DiseaseCount DESC;
```

The screenshot shows a PostgreSQL database client interface. The top bar contains various icons for file operations, search, and navigation. Below the bar, the title "Query Query History" is displayed. The main area contains a SQL query and its results.

```
1 SELECT CropID, COUNT(DiseaseID) AS DiseaseCount
2 FROM "G2SARM".Crop_Disease
3 GROUP BY CropID
4 HAVING COUNT(DiseaseID) > 1
5 ORDER BY DiseaseCount DESC;
```

The results of the query are displayed in a table:

|   | cropid | diseasecount |
|---|--------|--------------|
| 1 | 3      | 3            |
| 2 | 1      | 3            |
| 3 | 2      | 3            |
| 4 | 9      | 2            |
| 5 | 7      | 2            |
| 6 | 4      | 2            |
| 7 | 5      | 2            |
| 8 | 6      | 2            |
| 9 | 11     | 2            |

This query identifies crops affected by more than one disease, sorted by the number of diseases.

6. SELECT DISTINCT f.FarmerID, f.Name  
FROM "G2SARM".Farmer f  
WHERE EXISTS (SELECT 1 FROM "G2SARM".Farmer\_Fertilizer ff WHERE ff.FarmerID = f.FarmerID)  
AND EXISTS (SELECT 1 FROM "G2SARM".Farmer\_SustainablePractice sp WHERE  
sp.FarmerID = f.FarmerID);

Query    Query History

```

1. v  SELECT DISTINCT f.FarmerID, f.Name
2.   FROM "G2SARM".Farmer f
3. WHERE EXISTS (SELECT 1 FROM "G2SARM".Farmer_Fertilizer ff WHERE ff.FarmerID = f.FarmerID)
4. AND EXISTS (SELECT 1 FROM "G2SARM".Farmer_SustainablePractice sp WHERE sp.FarmerID = f.FarmerID);

```

Data Output    Messages    Notifications

|    | farmerid | name          |
|----|----------|---------------|
| 1  | 46       | Anurag Saini  |
| 2  | 71       | Aditya Gupta  |
| 3  | 1        | Manav Singh   |
| 4  | 30       | Akash Verma   |
| 5  | 24       | Deepak Kumar  |
| 6  | 47       | Sahil Patel   |
| 7  | 17       | Nikhil Mehta  |
| 8  | 60       | Dinesh Sharma |
| 9  | 51       | Rohan Sharma  |
| 10 | 43       | Raghav Singh  |
| 11 | 8        | Raj Rao       |
| 12 | 54       | Pratik Joshi  |
| 13 | 53       | Anish Verma   |
| 14 | 9        | Shiraz Desai  |
| 15 | 22       | Aniket Iyer   |
| 16 | 13       | Rahul Gupta   |
| 17 | 39       | Nitin Mehta   |

Total rows: 76 of 76    Query complete 00:00:00.098

This query finds farmers who are using both fertilizers and sustainable practices.

7. `SELECT FarmerID, COUNT(DISTINCT CropID) AS CropVarietyCount  
FROM "G2SARM".Farmer_Crop  
GROUP BY FarmerID  
ORDER BY CropVarietyCount DESC  
LIMIT 5;`

Query    Query History

```

1. v  SELECT FarmerID, COUNT(DISTINCT CropID) AS CropVarietyCount
2.   FROM "G2SARM".Farmer_Crop
3. GROUP BY FarmerID
4. ORDER BY CropVarietyCount DESC
5. LIMIT 5;

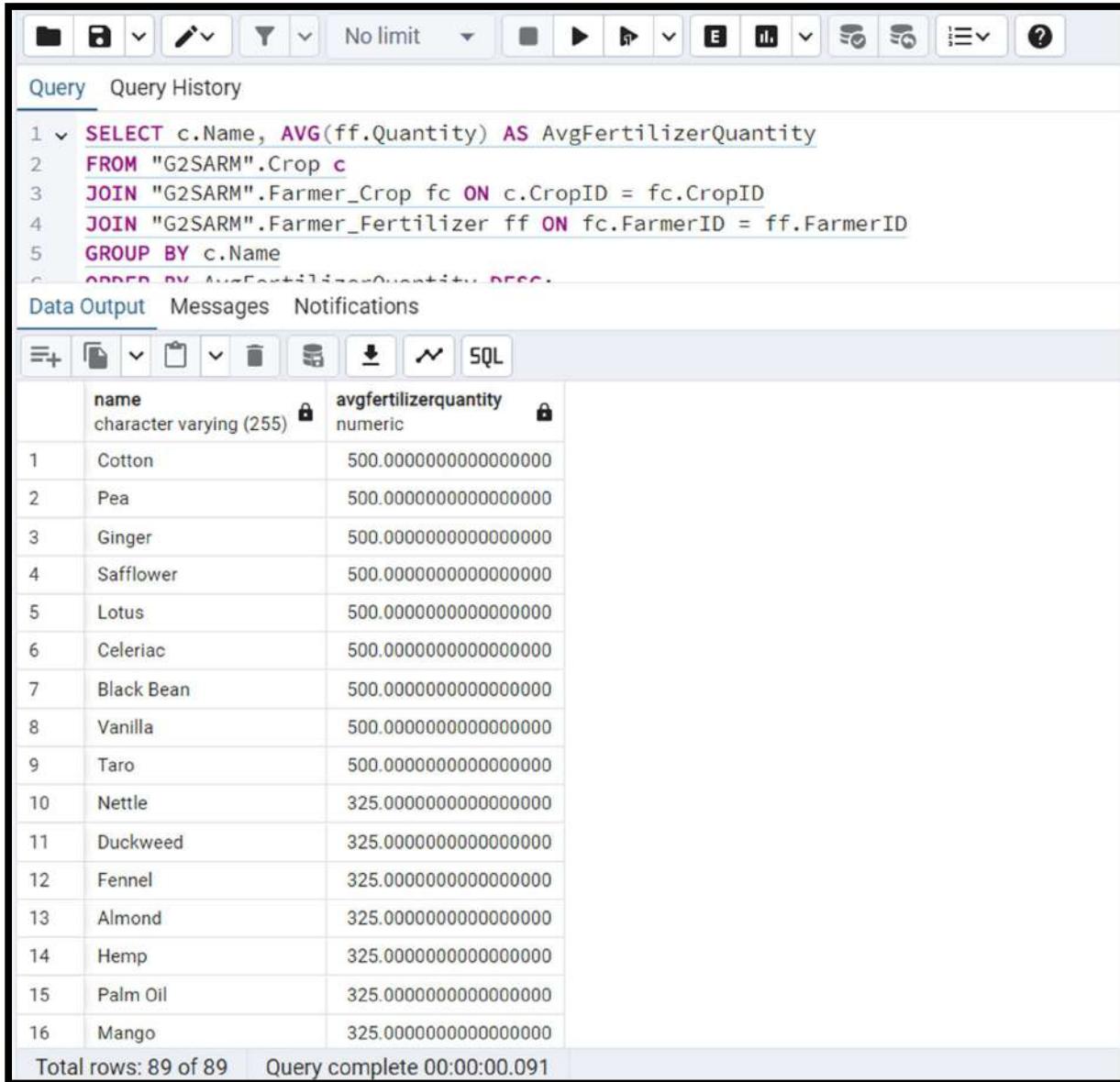
```

Data Output    Messages    Notifications

|   | farmerid | cropvarietycount |
|---|----------|------------------|
| 1 | 1        | 10               |
| 2 | 2        | 10               |
| 3 | 3        | 9                |
| 4 | 4        | 9                |
| 5 | 5        | 9                |

This query identifies the top 5 farmers who grow the most diverse range of crops.

8. SELECT c.Name, AVG(ff.Quantity) AS AvgFertilizerQuantity  
 FROM "G2SARM".Crop c  
 JOIN "G2SARM".Farmer\_Crop fc ON c.CropID = fc.CropID  
 JOIN "G2SARM".Farmer\_Fertilizer ff ON fc.FarmerID = ff.FarmerID  
 GROUP BY c.Name  
 ORDER BY AvgFertilizerQuantity DESC;



|    | name<br>character varying (255) | avgfertilizerquantity<br>numeric |
|----|---------------------------------|----------------------------------|
| 1  | Cotton                          | 500.000000000000000000           |
| 2  | Pea                             | 500.000000000000000000           |
| 3  | Ginger                          | 500.000000000000000000           |
| 4  | Safflower                       | 500.000000000000000000           |
| 5  | Lotus                           | 500.000000000000000000           |
| 6  | Celeriac                        | 500.000000000000000000           |
| 7  | Black Bean                      | 500.000000000000000000           |
| 8  | Vanilla                         | 500.000000000000000000           |
| 9  | Taro                            | 500.000000000000000000           |
| 10 | Nettle                          | 325.000000000000000000           |
| 11 | Duckweed                        | 325.000000000000000000           |
| 12 | Fennel                          | 325.000000000000000000           |
| 13 | Almond                          | 325.000000000000000000           |
| 14 | Hemp                            | 325.000000000000000000           |
| 15 | Palm Oil                        | 325.000000000000000000           |
| 16 | Mango                           | 325.000000000000000000           |

Total rows: 89 of 89    Query complete 00:00:00.091

This query calculates the average fertilizer quantity used for each crop type.

9. SELECT f.FarmerID, f.Name  
 FROM "G2SARM".Farmer\_Aid fa  
 JOIN "G2SARM".Farmer f ON fa.FarmerID = f.FarmerID  
 JOIN "G2SARM".Farmer\_Fertilizer ff ON f.FarmerID = ff.FarmerID  
 WHERE ff.FertilizerID = 2;

The screenshot shows a SQL query editor interface. At the top, there's a toolbar with various icons. Below it is a "Query History" section where a query has been run. The query itself is:

```

1. SELECT f.FarmerID, f.Name
2. FROM "G2SARM".Farmer_Aid fa
3. JOIN "G2SARM".Farmer f ON fa.FarmerID = f.FarmerID
4. JOIN "G2SARM".Farmer_Fertilizer ff ON f.FarmerID = ff.FarmerID
5. WHERE ff.FertilizerID = 2;

```

Below the query history is a "Data Output" section which displays the results of the query. The results are shown in a table:

|   | farmerid<br>[PK] integer | name<br>character varying (255) |
|---|--------------------------|---------------------------------|
| 1 | 1                        | Manav Singh                     |
| 2 | 1                        | Manav Singh                     |

This query retrieves farmers who have received aid and use a specific fertilizer with FertilizerID = 2.

10. `SELECT sp.PracticeID, sp.Description, COUNT(fp.FarmerID) AS FarmerCount  
FROM "G2SARM".SustainablePractice sp  
LEFT JOIN "G2SARM".Farmer_SustainablePractice fp ON  
sp.PracticeID = fp.PracticeID  
GROUP BY sp.PracticeID, sp.Description  
ORDER BY FarmerCount DESC;`

The screenshot shows a SQL query editor interface. At the top, there's a toolbar with various icons. Below it is a "Query History" section where a query has been run. The query itself is:

```

1. SELECT sp.PracticeID, sp.Description, COUNT(fp.FarmerID) AS FarmerCount
2. FROM "G2SARM".SustainablePractice sp
3. LEFT JOIN "G2SARM".Farmer_SustainablePractice fp ON sp.PracticeID = fp.PracticeID
4. GROUP BY sp.PracticeID, sp.Description
5. ORDER BY FarmerCount DESC;

```

Below the query history is a "Data Output" section which displays the results of the query. The results are shown in a table:

|    | practiceid<br>[PK] integer | description<br>text                                                                                       | farmercount<br>bigint |
|----|----------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------|
| 1  | 55                         | Exploring natural alternatives to synthetic pesticides for pest control.                                  | 1                     |
| 2  | 27                         | Saving traditional seed varieties to maintain genetic diversity.                                          | 1                     |
| 3  | 23                         | Growing two or more crops in close proximity for increased productivity.                                  | 1                     |
| 4  | 56                         | Practices aimed at maximizing resource use efficiency in agriculture.                                     | 1                     |
| 5  | 58                         | Choosing crop varieties that are suited for local environmental conditions.                               | 1                     |
| 6  | 8                          | Growing a variety of crops to enhance biodiversity and reduce risk.                                       | 1                     |
| 7  | 87                         | Using biodegradable or recyclable materials for agricultural product packaging.                           | 1                     |
| 8  | 74                         | Creating seed banks to preserve genetic diversity in crops.                                               | 1                     |
| 9  | 54                         | Obtaining certification for organic practices to promote sustainable products.                            | 1                     |
| 10 | 29                         | Creating and maintaining habitats to support wildlife populations.                                        | 1                     |
| 11 | 71                         | Implementing measures to prevent soil erosion and maintain soil quality.                                  | 1                     |
| 12 | 68                         | Recycling nutrients from waste to improve soil health and reduce chemical use.                            | 1                     |
| 13 | 4                          | Integrating trees and shrubs into agricultural landscapes to enhance biodiversity and ecosystem services. | 1                     |
| 14 | 34                         | Processing agricultural products to increase their market value.                                          | 1                     |
| 15 | 51                         | Properly managing crop leftovers to maintain soil health.                                                 | 1                     |
| 16 | 80                         | Implementing practices to optimize water use in agriculture.                                              | 1                     |

Total rows: 90 of 90      Query complete 00:00:00.078

This query calculates the number of farmers who are practicing each sustainable method.

```

11. SELECT DISTINCT f.FarmerID, f.Name
   FROM "G2SARM".Farmer f
   JOIN "G2SARM".Farmer_Crop fc ON f.FarmerID = fc.FarmerID
   JOIN "G2SARM".Crop_Weather cw ON fc.CropID = cw.CropID
   JOIN "G2SARM".Weather w ON cw.WeatherID = w.WeatherID
   WHERE w.conditions IN ('Sunny', 'Rainy')
   GROUP BY f.FarmerID
   HAVING COUNT(DISTINCT w.WeatherId) > 2;

```

The screenshot shows a SQL interface with the following details:

- Query Bar:** Contains various icons for file operations, search, and navigation.
- Query Tab:** Labeled "Query" and "Query History". It displays the executed SQL code.
- Data Output Tab:** Labeled "Data Output" and "Messages". It shows the results of the query in a table format.
- Table Data:** The table has two columns: "farmerid" and "name". The data is as follows:

|   | farmerid | name          |
|---|----------|---------------|
| 1 | 5        | Karma Verma   |
| 2 | 1        | Manav Singh   |
| 3 | 10       | Kaushal Reddy |
| 4 | 4        | Aamir Patel   |
| 5 | 9        | Shiraz Desai  |
| 6 | 6        | Ronak Joshi   |
| 7 | 3        | Kumar Gupta   |
| 8 | 2        | Veer Sharma   |

This query retrieves farmers growing crops suited to both sunny and rainy rainfall conditions.

```

12. SELECT f.FarmerID, f.Name, SUM(i.Amount) AS TotalInvestment
   FROM "G2SARM".Farmer f
   JOIN "G2SARM".Farmer_Investment fi ON f.FarmerID = fi.FarmerID
   JOIN "G2SARM".Investment i ON fi.InvestmentID = i.InvestmentID
   GROUP BY f.FarmerID, f.Name
   ORDER BY TotalInvestment DESC
   LIMIT 5;

```

The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```

1 v SELECT f.FarmerID, f.Name, SUM(i.Amount) AS TotalInvestment
2 FROM "G2SARM".Farmer f
3 JOIN "G2SARM".Farmer_Investment fi ON f.FarmerID = fi.FarmerID
4 JOIN "G2SARM".Investment i ON fi.InvestmentID = i.InvestmentID
5 GROUP BY f.FarmerID, f.Name
6 ORDER BY TotalInvestment DESC
7 LIMIT 5;

```

The results window displays a table with three columns: farmerid, name, and totalinvestment. The data is as follows:

|   | farmerid<br>[PK] integer | name<br>character varying (255) | totalinvestment<br>numeric |
|---|--------------------------|---------------------------------|----------------------------|
| 1 | 5                        | Karma Verma                     | 5700.50                    |
| 2 | 29                       | Suresh Reddy                    | 5100.40                    |
| 3 | 31                       | Sandeep Iyer                    | 4901.20                    |
| 4 | 2                        | Veer Sharma                     | 4900.50                    |
| 5 | 14                       | Arjun Patel                     | 4800.50                    |

This query finds the top 5 farmers with the highest total investment.

13. `SELECT f.FarmerID, f.Name  
FROM "G2SARM".Farmer f  
WHERE NOT EXISTS (  
SELECT 1  
FROM "G2SARM".Farmer_SustainablePractice fp  
JOIN "G2SARM".SustainablePractice sp ON fp.PracticeID = sp.PracticeID  
WHERE fp.FarmerID = f.FarmerID AND sp.Description NOT LIKE '%Organic%'  
);`

The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```

1 v SELECT f.FarmerID, f.Name
2 FROM "G2SARM".Farmer f
3 WHERE NOT EXISTS (
4   SELECT 1
5   FROM "G2SARM".Farmer_SustainablePractice fp
6   JOIN "G2SARM".SustainablePractice sp ON fp.PracticeID = sp.PracticeID
7   WHERE fp.FarmerID = f.FarmerID AND sp.Description NOT LIKE '%Organic%'

```

The results window displays a table with two columns: farmerid and name. The data is as follows:

|   | farmerid<br>[PK] Integer | name<br>character varying (255) |
|---|--------------------------|---------------------------------|
| 1 | 90                       | Yogesh Sharma                   |
| 2 | 91                       | Hitesh Reddy                    |
| 3 | 92                       | Vikram Verma                    |
| 4 | 93                       | Ajay Mehta                      |
| 5 | 94                       | Rajan Singh                     |
| 6 | 95                       | Vinod Patel                     |

This query lists farmers who exclusively use organic sustainable practices.

```

14. SELECT f.Name, COUNT(ff.FarmerID) AS FarmerCount
   FROM "G2SARM".Fertilizer f
   LEFT JOIN "G2SARM".Farmer_Fertilizer ff ON f.FertilizerID = ff.FertilizerID
   GROUP BY f.Name
   ORDER BY FarmerCount DESC;

```

|    | name                          | farmercount |
|----|-------------------------------|-------------|
| 1  | Peat Moss                     | 1           |
| 2  | Organic NPK 8-4-4             | 1           |
| 3  | Controlled-Release Fertilizer | 1           |
| 4  | Synthetic NPK 15-15-15        | 1           |
| 5  | Sodium Bicarbonate            | 1           |
| 6  | Organic NPK 10-5-5            | 1           |
| 7  | Organic Fertilizer 15-15-15   | 1           |
| 8  | Synthetic NPK 10-10-10        | 1           |
| 9  | Organic NPK Fertilizer        | 1           |
| 10 | Manganese Sulfate             | 1           |
| 11 | Calcium Nitrate               | 1           |
| 12 | NPK 20-20-20                  | 1           |
| 13 | Organic Fertilizer 10-10-10   | 1           |
| 14 | Biofertilizer                 | 1           |
| 15 | Organic Fertilizer 6-3-3      | 1           |
| 16 | Organic 3-1-1 Fertilizer      | 1           |

Total rows: 80 of 80    Query complete 00:00:00.077

This query shows how many farmers are using each type of fertilizer, ordered by the number of users per fertilizer.

```

15. SELECT AVG(a.Amount) AS AvgAid
   FROM "G2SARM".Farmer f
   JOIN "G2SARM".Farmer_Aid fa ON f.FarmerID = fa.FarmerID
   JOIN "G2SARM".Aid a ON fa.AidID = a.AidID
   WHERE EXISTS (
   SELECT 1
   FROM "G2SARM".Farmer_SustainablePractice fp
   WHERE fp.FarmerID = f.FarmerID
   );

```

The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```

1 v SELECT AVG(a.Amount) AS AvgAid
2   FROM "G2SARM".Farmer f
3   JOIN "G2SARM".Farmer_Aid fa ON f.FarmerID = fa.FarmerID
4   JOIN "G2SARM".Aid a ON fa.AidID = a.AidID
5 WHERE EXISTS (
6   SELECT 1
7     FROM "G2SARM".Farmer_SustainablePractice fp
8    WHERE fp.FarmerID = f.FarmerID
9 );

```

The data output window shows a single row with the value 2271.6666666666666667.

This query calculates the average aid amount received by farmers who are engaged in sustainable practices.

16. `SELECT DISTINCT f.FarmerID, f.name, d.name  
FROM "G2SARM".Farmer f  
JOIN "G2SARM".Farmer_Crop fc ON f.FarmerID = fc.FarmerID  
JOIN "G2SARM".Crop_Disease cd ON fc.CropID = cd.CropID  
JOIN "G2SARM".cropdisease d ON cd.DiseaseID = d.DiseaseID  
WHERE d.name = 'Blight';`

The screenshot shows a SQL query editor interface. The query window contains the following SQL code:

```

1 v SELECT DISTINCT f.FarmerID, f.name, d.name
2   FROM "G2SARM".Farmer f
3   JOIN "G2SARM".Farmer_Crop fc ON f.FarmerID = fc.FarmerID
4   JOIN "G2SARM".Crop_Disease cd ON fc.CropID = cd.CropID
5   JOIN "G2SARM".cropdisease d ON cd.DiseaseID = d.DiseaseID
6 WHERE d.name = 'Blight';

```

The data output window shows a table with the following data:

|   | farmerid | name          | name   |
|---|----------|---------------|--------|
| 1 | 1        | Manav Singh   | Blight |
| 2 | 2        | Veer Sharma   | Blight |
| 3 | 4        | Aamir Patel   | Blight |
| 4 | 9        | Shiraz Desai  | Blight |
| 5 | 10       | Kaushal Reddy | Blight |

This query finds farmers who grow crops resistant to a specific disease, in this case, "Blight."

```

17. SELECT f.FarmerID, f.Name, SUM(i.Amount) AS TotalInvestment
   FROM "G2SARM".Farmer f
   JOIN "G2SARM".Farmer_Investment fi ON f.FarmerID = fi.FarmerID
   JOIN "G2SARM".Investment i ON fi.InvestmentID = i.InvestmentID
   GROUP BY f.FarmerID, f.Name
   ORDER BY TotalInvestment DESC;

```

The screenshot shows a database interface with a toolbar at the top, followed by a 'Query History' section containing the executed SQL code, and a 'Data Output' section displaying the resulting table.

```

1 v  SELECT f.FarmerID, f.Name, SUM(i.Amount) AS TotalInvestment
2   FROM "G2SARM".Farmer f
3   JOIN "G2SARM".Farmer_Investment fi ON f.FarmerID = fi.FarmerID
4   JOIN "G2SARM".Investment i ON fi.InvestmentID = i.InvestmentID
5   GROUP BY f.FarmerID, f.Name
6   ORDER BY TotalInvestment DESC;
7

```

|    | farmerid<br>[PK] integer | name<br>character varying (255) | totalinvestment<br>numeric |
|----|--------------------------|---------------------------------|----------------------------|
| 1  | 5                        | Karma Verma                     | 5700.50                    |
| 2  | 29                       | Suresh Reddy                    | 5100.40                    |
| 3  | 31                       | Sandeep Iyer                    | 4901.20                    |
| 4  | 2                        | Veer Sharma                     | 4900.50                    |
| 5  | 14                       | Arjun Patel                     | 4800.50                    |
| 6  | 41                       | Praveen Joshi                   | 4751.50                    |
| 7  | 39                       | Nitin Mehta                     | 4600.50                    |
| 8  | 8                        | Raj Rao                         | 4500.25                    |
| 9  | 43                       | Raghav Singh                    | 4251.40                    |
| 10 | 33                       | Ravi Gupta                      | 4200.85                    |
| 11 | 27                       | Ravi Sharma                     | 4000.50                    |
| 12 | 48                       | Kartik Reddy                    | 4000.00                    |
| 13 | 24                       | Deepak Kumar                    | 4000.00                    |
| 14 | 10                       | Kaushal Reddy                   | 3900.80                    |
| 15 | 25                       | Vishal Choudhury                | 3900.25                    |

Total rows: 70 of 70    Query complete 00:00:00.099

This query provides the total investment amount received by each farmer, sorted in descending order.

```

18. SELECT f.FarmerID, f.Name, s.SoilId
   FROM "G2SARM".Farmer f
   JOIN "G2SARM".Farmer_Crop fc ON f.FarmerID = fc.FarmerID
   JOIN "G2SARM".Crop_Soil cs ON fc.CropID = cs.CropID
   JOIN "G2SARM".Soil s ON cs.SoilID = s.SoilID
   WHERE s.phlevel > 7;

```

Query    Query History

```

1 v SELECT f.FarmerID, f.Name, s.SoilID
2   FROM "G2SARM".Farmer f
3   JOIN "G2SARM".Farmer_Crop fc ON f.FarmerID = fc.FarmerID
4   JOIN "G2SARM".Crop_Soil cs ON fc.CropID = cs.CropID
5   JOIN "G2SARM".Soil s ON cs.SoilID = s.SoilID
6 WHERE s.phlevel > 7;

```

Data Output    Messages    Notifications

|    | farmerid | name        | soilid |
|----|----------|-------------|--------|
| 1  | 1        | Manav Singh | 6      |
| 2  | 1        | Manav Singh | 83     |
| 3  | 1        | Manav Singh | 73     |
| 4  | 2        | Veer Sharma | 64     |
| 5  | 2        | Veer Sharma | 10     |
| 6  | 3        | Kumar Gupta | 38     |
| 7  | 3        | Kumar Gupta | 12     |
| 8  | 3        | Kumar Gupta | 65     |
| 9  | 4        | Aamir Patel | 17     |
| 10 | 5        | Karma Verma | 77     |
| 11 | 5        | Karma Verma | 19     |
| 12 | 6        | Ronak Joshi | 88     |
| 13 | 6        | Ronak Joshi | 21     |
| 14 | 6        | Ronak Joshi | 55     |
| 15 | 7        | Neel Mehta  | 57     |

Total rows: 17 of 17    Query complete 00:00:00.091

This query lists farmers who grow crops which have a phlevel of soil greater than 7.

19. `SELECT f.FarmerID, f.Name, SUM(a.Amount) AS TotalAid  
FROM "G2SARM".Farmer f  
JOIN "G2SARM".Farmer_Aid fa ON f.FarmerID = fa.FarmerID  
JOIN "G2SARM".Aid a ON fa.AidID = a.AidID  
GROUP BY f.FarmerID, f.Name  
HAVING SUM(a.Amount) > 5000;`

Query    Query History

```

1 v SELECT f.FarmerID, f.Name, SUM(a.Amount) AS TotalAid
2   FROM "G2SARM".Farmer f
3   JOIN "G2SARM".Farmer_Aid fa ON f.FarmerID = fa.FarmerID
4   JOIN "G2SARM".Aid a ON fa.AidID = a.AidID
5   GROUP BY f.FarmerID, f.Name
6   HAVING SUM(a.Amount) > 5000;

```

Data Output    Messages    Notifications

|   | farmerid | name          | totalaid |
|---|----------|---------------|----------|
| 1 | 10       | Kaushal Reddy | 5200.00  |
| 2 | 39       | Nitin Mehta   | 5100.00  |
| 3 | 12       | Vikram Sharma | 5200.00  |
| 4 | 3        | Kumar Gupta   | 5300.00  |
| 5 | 8        | Raj Rao       | 5300.00  |

This query finds farmers who have received aid exceeding a specified threshold of more than 5000.

```

20. SELECT f.FarmerID, f.Name
   FROM "G2SARM".Farmer f
   WHERE NOT EXISTS (
   SELECT 1 FROM "G2SARM".Farmer_Aid fa WHERE fa.FarmerID = f.FarmerID
);

```

The screenshot shows a SQL query editor with the following details:

- Toolbar:** Includes various icons for file operations, search, and navigation.
- Query Tab:** Shows the executed SQL code:
 

```

1 ✓ SELECT f.FarmerID, f.Name
2   FROM "G2SARM".Farmer f
3   WHERE NOT EXISTS (
4       SELECT 1 FROM "G2SARM".Farmer_Aid fa WHERE fa.FarmerID = f.FarmerID
5   );
6

```
- Data Output Tab:** Displays the results of the query in a table format. The table has two columns: **farmerid** and **name**.
 

|    | farmerid | name            |
|----|----------|-----------------|
| 1  | 71       | Aditya Gupta    |
| 2  | 72       | Kiran Patel     |
| 3  | 73       | Suryansh Reddy  |
| 4  | 74       | Dev Bhatia      |
| 5  | 75       | Raj Kumar       |
| 6  | 76       | Kunal Singh     |
| 7  | 77       | Ishaan Mehta    |
| 8  | 78       | Vishal Verma    |
| 9  | 79       | Siddhant Sharma |
| 10 | 80       | Samir Gupta     |
| 11 | 81       | Parth Rao       |
| 12 | 82       | Ritesh Reddy    |
| 13 | 83       | Shreyas Bhatia  |
| 14 | 84       | Arnav Singh     |
| 15 | 85       | Nitin Gupta     |
- Bottom Status Bar:** Shows "Total rows: 25 of 25" and "Query complete 00:00:00.068".

This query finds farmers who have not received any aid.

## Chapter 5: Interface Implementation

### 1. Setup JDBC and Basic GUI

- **Driver Setup and Connection Configuration:**
  - Driver Setup:
    - Ensure the correct JDBC driver (PostgreSQL) is added to the project. For ease of use, add the driver as a library in your IDE or manage it as a Maven dependency if using a Maven project.
  - Database URL, Username, Password:
    - Store database credentials securely, either directly in DatabaseManager.java in a configuration file or environment variables for security.
  - Connection Method:
    - Implement a connect() method in DatabaseManager.java to establish and return a database connection. Use Connection pooling if needed for better performance.
- **CRUD Operations for Each Table:**
  - Create separate methods in DatabaseManager.java for CRUD operations (Create, Read, Update, Delete) for Crop, CropType, Technology, and TechnologyType tables.
  - Use prepared statements in each method to prevent SQL injection and ensure performance efficiency.
- **Basic GUI Setup Requirements for Each GUI File:**

For CropGUI.java, CropTypeGUI.java, TechnologyGUI.java, and TechnologyTypeGUI.java:

  - GUI Components:
    - Design a user-friendly GUI with JTextFields for input, JButtons for actions (e.g., Add, Update, Delete, Load), and JTable for displaying data.
    - Use appropriate layout managers to structure the GUI components.
  - Action Listeners for CRUD Operations:
    - Each button (Add, Update, Delete, Load) should have an action listener that calls the corresponding method in DatabaseManager.java to perform the operation.
    - JTable should be used to display records from the database, with data loading on button click.
  - Documentation of JDBC setup and basic graphical user interface.
- **Project Prerequisites:**
  - This project requires Java Development Kit (JDK) version 8 or later and an Integrated Development Environment (IDE) such as IntelliJ IDEA or Eclipse.
  - The JDBC driver for your specific database (e.g., MySQL JDBC Connector if using MySQL) must be added to the project. In an IDE, add the JDBC driver as a library dependency or manage it via Maven if you are using a Maven project structure.
- **DatabaseManager.java Overview:**

- DatabaseManager.java serves as the core component for handling all database interactions, including connecting to the database and performing CRUD (Create, Read, Update, Delete) operations.
  - Each CRUD method within DatabaseManager.java is designed to interact with specific database tables such as Crop, CropType, Technology, and TechnologyType.
- **Database Connection Setup:**
- To set up the database connection in DatabaseManager.java:
    - Database URL Format:
      - Include the correct database URL format (e.g., jdbc:mysql://localhost:5432/G2\_SARM) and ensure the port number matches your database configuration.
    - Database Credentials:
      - Set up variables to securely store and access the database's username and password.
- **File Overview:**
- Each GUI file serves as an interface for interacting with a particular table in the database.
  - CropGUI.java - Manages crop data
  - CropTypeGUI.java - Manages crop type data
  - TechnologyGUI.java - Manages technology data
  - TechnologyTypeGUI.java - Manages technology type data
  - Each file allows users to perform CRUD operations via intuitive, dedicated input fields and buttons.
- **GUI Layout and Components:**
- The graphical layout should be designed using Swing components such as JTextField for input, JButton for actions (e.g., Add, Update, Delete, Load), and JTable for displaying data.
  - Use appropriate layout managers (GridLayout for input fields, BorderLayout for the main panel) to ensure a structured and responsive design.
- **CRUD Operations and Event Handling:**
- Each CRUD operation should be assigned to a specific button (e.g., "Add" for inserting a new record, "Update" for modifying an existing record).
  - Implement action listeners for each button. When clicked, the listener should call the relevant method in DatabaseManager.java to perform the operation.
  - For example, clicking the "Add" button in CropGUI.java triggers a call to the addCrop() method in DatabaseManager, with input from JTextField components provided as parameters.
- **Sample Usage Instructions:**
- Adding Records: Fill in the relevant fields in the GUI, then click "Add." The system will notify the user of a successful addition or alert them to errors.
  - Updating Records: Select a record from the JTable, modify the values in the fields, and click "Update" to save changes.
  - Deleting Records: Select a record from the table and click "Delete" to remove it from the database.

- Loading Records: Click "Load" to fetch and display the data in JTable from the database.
- Screenshots: Adding screenshots for each operation can help users understand the GUI layout and data flow.

## 2. CRUD Operations in GUI

- Explanation and demonstration of:
  - Create, Read, Update, Delete operations using GUI.

### 1. Farmer(FarmerID, Name, FarmSize, ContactInfo)

The screenshot shows a Java Swing application titled "Farmer Management". The window has a title bar with standard minimize, maximize, and close buttons. On the left side, there is a vertical stack of four text input fields labeled "Farmer ID:", "Name:", "Farm Size:", and "Contact Info:". To the right of these fields is a JTable with four columns: "Farmer ID", "Name", "Farm Size", and "Contact Info". The table currently contains no data. At the bottom of the window are four buttons: "Add", "Update", "Delete", and "Load".

Initial stage of Farmer Management prompt

## Load Operation

 Farmer Management

Farmer ID:  
Name:  
Farm Size:  
Contact Info:

| Farmer ID | Name          | Farm Size | Contact Info               |
|-----------|---------------|-----------|----------------------------|
| 1         | Manav Singh   | 20.5      | manav.singh@example.c...   |
| 2         | Veer Sharma   | 61.0      | veer.sharma@example.c...   |
| 3         | Kumar Gupta   | 15.5      | kumar.gupta@example.c...   |
| 4         | Aamir Patel   | 30.0      | aamir.patel@example.co...  |
| 5         | Karma Verma   | 74.25     | karma.verma@example....    |
| 6         | Ronak Joshi   | 50.0      | ronak.joshi@example.com    |
| 7         | Neel Mehta    | 30.0      | neel.mehta@example.co...   |
| 8         | Raj Rao       | 11.0      | raj.rao@example.com        |
| 9         | Shiraz Desai  | 27.0      | shiraz.desai@example.co... |
| 10        | Kaushal Reddy | 80.0      | kaushal.reddy@example...   |
| 11        | Aarav Singh   | 22.5      | aarav.singh@example.co...  |
| 12        | Vikram Sharma | 65.0      | vikram.sharma@example...   |
| 13        | Rahul Gupta   | 10.5      | rahul.gupta@example.co...  |

**Add** **Update** **Delete** **Load**

Query History

```
1 select * from "G2SARM".farmer;
```

Data Output Messages Notifications

SQL

|    | farmerid<br>[PK] integer | name<br>character varying (255) | farmsize<br>numeric (10,2) | contactinfo<br>character varying (255) |
|----|--------------------------|---------------------------------|----------------------------|----------------------------------------|
| 75 | 75                       | Raj Kumar                       | 70.00                      | raj.kumar@example.com                  |
| 76 | 76                       | Kunal Singh                     | 11.25                      | kunal.singh@example.com                |
| 77 | 77                       | Ishaan Mehta                    | 77.75                      | ishaan.mehta@example.com               |
| 78 | 78                       | Vishal Verma                    | 26.50                      | vishal.verma@example.com               |
| 79 | 79                       | Siddhant Sharma                 | 38.00                      | siddhant.sharma@example.com            |
| 80 | 80                       | Samir Gupta                     | 55.75                      | samir.gupta@example.com                |
| 81 | 81                       | Parth Rao                       | 41.50                      | parth.rao@example.com                  |
| 82 | 82                       | Ritesh Reddy                    | 68.50                      | ritesh.reddy@example.com               |
| 83 | 83                       | Shreyas Bhatia                  | 16.75                      | shreyas.bhatia@example.com             |
| 84 | 84                       | Arnav Singh                     | 49.25                      | arnav.singh@example.com                |
| 85 | 85                       | Nitin Gupta                     | 33.50                      | nitin.gupta@example.com                |
| 86 | 86                       | Vikrant Reddy                   | 58.25                      | vikrant.reddy@example.com              |
| 87 | 87                       | Suryansh Patel                  | 24.75                      | suryansh.patel@example.com             |
| 88 | 88                       | Aakash Singh                    | 60.50                      | aakash.singh@example.com               |
| 89 | 89                       | Bharat Kumar                    | 14.00                      | bharat.kumar@example.com               |
| 90 | 91                       | Hitesh Reddy                    | 48.00                      | hitesh.reddy@example.com               |
| 91 | 92                       | Vikram Verma                    | 40.25                      | vikram.verma@example.com               |
| 92 | 93                       | Ajay Mehta                      | 73.50                      | ajay.mehta@example.com                 |
| 93 | 94                       | Rajan Singh                     | 22.25                      | rajan.singh@example.com                |

Total rows: 93 of 93    Query complete 00:00:00.282

SELECT \* FROM farmer;

## Add Operation

**Farmer Management**

|                      |                    |
|----------------------|--------------------|
| <b>Farmer ID:</b>    | 96                 |
| <b>Name:</b>         | Jayesh Chauhan     |
| <b>Farm Size:</b>    | 30.10              |
| <b>Contact Info:</b> | jayesh@example.com |

| Farmer ID | Name           | Farm Size | Contact Info              |
|-----------|----------------|-----------|---------------------------|
| 82        | Ritesh Reddy   | 68.5      | ritesh.reddy@example.co.. |
| 83        | Shreyas Bhatia | 16.75     | shreyas.bhatia@example..  |
| 84        | Arnav Singh    | 49.25     | arnav.singh@example.co..  |
| 85        | Nitin Gupta    | 33.5      | nitin.gupta@example.com   |
| 86        | Vikrant Reddy  | 58.25     | vikrant.reddy@example.c.. |
| 87        | Suryansh Patel | 24.75     | suryansh.patel@example..  |
| 88        | Aakash Singh   | 60.5      | aakash.singh@example.c..  |
| 89        | Bharat Kumar   | 14.0      | bharat.kumar@example.c..  |
| 91        | Hitesh Reddy   | 48.0      | hitesh.reddy@example.co.. |
| 92        | Vikram Verma   | 40.25     | vikram.verma@example....  |
| 93        | Ajay Mehta     | 73.5      | ajay.mehta@example.com    |
| 94        | Rajan Singh    | 22.25     | rajan.singh@example.com   |
| 96        | Jayesh Chauhan | 30.1      | jayesh@example.com        |

**Add**   **Update**   **Delete**   **Load**

INSERT INTO Farmer (FarmerID, Name, FarmSize, ContactInfo)  
VALUES (96, 'Jayesh Chauhan', 30.10, 'jayesh@example.com');

**Farmer Management**

|                      |                       |
|----------------------|-----------------------|
| <b>Farmer ID:</b>    | 97                    |
| <b>Name:</b>         | Sahil Shah            |
| <b>Farm Size:</b>    | 35.15                 |
| <b>Contact Info:</b> | sahilshah@example.com |

| Farmer ID | Name           | Farm Size | Contact Info              |
|-----------|----------------|-----------|---------------------------|
| 83        | Shreyas Bhatia | 16.75     | shreyas.bhatia@example..  |
| 84        | Arnav Singh    | 49.25     | arnav.singh@example.co..  |
| 85        | Nitin Gupta    | 33.5      | nitin.gupta@example.com   |
| 86        | Vikrant Reddy  | 58.25     | vikrant.reddy@example.c.. |
| 87        | Suryansh Patel | 24.75     | suryansh.patel@example..  |
| 88        | Aakash Singh   | 60.5      | aakash.singh@example.c..  |
| 89        | Bharat Kumar   | 14.0      | bharat.kumar@example.c..  |
| 91        | Hitesh Reddy   | 48.0      | hitesh.reddy@example.co.. |
| 92        | Vikram Verma   | 40.25     | vikram.verma@example....  |
| 93        | Ajay Mehta     | 73.5      | ajay.mehta@example.com    |
| 94        | Rajan Singh    | 22.25     | rajan.singh@example.com   |
| 96        | Jayesh Chauhan | 30.1      | jayesh@example.com        |
| 97        | Sahil Shah     | 35.15     | sahilshah@example.com     |

**Add**   **Update**   **Delete**   **Load**

INSERT INTO Farmer (FarmerID, Name, FarmSize, ContactInfo)  
VALUES (97, 'Sahil Shah', 35.15, 'sahilshah@example.com');

A screenshot of a database management system interface. The top bar includes various icons for file operations, search, and navigation. Below the bar, the title "Query History" is visible. The main area shows a SQL query and its results.
   
**Query:**

```
1 select * from "G2SARM".farmer;
```

  
**Data Output** (selected) | **Messages** | **Notifications**
  
 The results are displayed in a table with the following columns:
 

|    | <b>farmerid</b><br>[PK] integer | <b>name</b><br>character varying (255) | <b>farmsize</b><br>numeric (10,2) | <b>contactinfo</b><br>character varying (255) |
|----|---------------------------------|----------------------------------------|-----------------------------------|-----------------------------------------------|
| 77 | 77                              | Ishaan Mehta                           | 77.75                             | ishaan.mehta@example.com                      |
| 78 | 78                              | Vishal Verma                           | 26.50                             | vishal.verma@example.com                      |
| 79 | 79                              | Siddhant Sharma                        | 38.00                             | siddhant.sharma@example.com                   |
| 80 | 80                              | Samir Gupta                            | 55.75                             | samir.gupta@example.com                       |
| 81 | 81                              | Parth Rao                              | 41.50                             | parth.rao@example.com                         |
| 82 | 82                              | Ritesh Reddy                           | 68.50                             | ritesh.reddy@example.com                      |
| 83 | 83                              | Shreyas Bhatia                         | 16.75                             | shreyas.bhatia@example.com                    |
| 84 | 84                              | Arnav Singh                            | 49.25                             | arnav.singh@example.com                       |
| 85 | 85                              | Nitin Gupta                            | 33.50                             | nitin.gupta@example.com                       |
| 86 | 86                              | Vikrant Reddy                          | 58.25                             | vikrant.reddy@example.com                     |
| 87 | 87                              | Suryansh Patel                         | 24.75                             | suryansh.patel@example.com                    |
| 88 | 88                              | Aakash Singh                           | 60.50                             | aakash.singh@example.com                      |
| 89 | 89                              | Bharat Kumar                           | 14.00                             | bharat.kumar@example.com                      |
| 90 | 91                              | Hitesh Reddy                           | 48.00                             | hitesh.reddy@example.com                      |
| 91 | 92                              | Vikram Verma                           | 40.25                             | vikram.verma@example.com                      |
| 92 | 93                              | Ajay Mehta                             | 73.50                             | ajay.mehta@example.com                        |
| 93 | 94                              | Rajan Singh                            | 22.25                             | rajan.singh@example.com                       |
| 94 | 96                              | Jayesh Chauhan                         | 30.10                             | jayesh@example.com                            |
| 95 | 97                              | Sahil Shah                             | 35.15                             | sahilshah@example.com                         |

Total rows: 95 of 95 | Query complete 00:00:00.137

## Update Operation

**Farmer Management**

|               |                  |
|---------------|------------------|
| Farmer ID:    | 96               |
| Name:         | Meet Jha         |
| Farm Size:    | 20               |
| Contact Info: | meet@example.com |

| Farmer ID | Name           | Farm Size | Contact Info               |
|-----------|----------------|-----------|----------------------------|
| 83        | Shreyas Bhatia | 16.75     | shreyas.bhatia@example.com |
| 84        | Arnav Singh    | 49.25     | arnav.singh@example.com    |
| 85        | Nitin Gupta    | 33.5      | nitin.gupta@example.com    |
| 86        | Vikrant Reddy  | 58.25     | vikrant.reddy@example.com  |
| 87        | Suryansh Patel | 24.75     | suryansh.patel@example.com |
| 88        | Aakash Singh   | 60.5      | aakash.singh@example.com   |
| 89        | Bharat Kumar   | 14.0      | bharat.kumar@example.com   |
| 91        | Hitesh Reddy   | 48.0      | hitesh.reddy@example.com   |
| 92        | Vikram Verma   | 40.25     | vikram.verma@example.com   |
| 93        | Ajay Mehta     | 73.5      | ajay.mehta@example.com     |
| 94        | Rajan Singh    | 22.25     | rajan.singh@example.com    |
| 97        | Sahil Shah     | 35.15     | sahilshah@example.com      |
| 96        | Meet Jha       | 20.0      | meet@example.com           |

Add    Update    Delete    Load

UPDATE Farmer SET Name = 'Meet Jha', FarmSize = 20.0, ContactInfo = 'meet@example.com'  
WHERE FarmerID = 96;

**Farmer Management**

|               |                    |
|---------------|--------------------|
| Farmer ID:    | 97                 |
| Name:         | Malhar Oza         |
| Farm Size:    | 25                 |
| Contact Info: | malhar@example.com |

| Farmer ID | Name           | Farm Size | Contact Info               |
|-----------|----------------|-----------|----------------------------|
| 83        | Shreyas Bhatia | 16.75     | shreyas.bhatia@example.com |
| 84        | Arnav Singh    | 49.25     | arnav.singh@example.com    |
| 85        | Nitin Gupta    | 33.5      | nitin.gupta@example.com    |
| 86        | Vikrant Reddy  | 58.25     | vikrant.reddy@example.com  |
| 87        | Suryansh Patel | 24.75     | suryansh.patel@example.com |
| 88        | Aakash Singh   | 60.5      | aakash.singh@example.com   |
| 89        | Bharat Kumar   | 14.0      | bharat.kumar@example.com   |
| 91        | Hitesh Reddy   | 48.0      | hitesh.reddy@example.com   |
| 92        | Vikram Verma   | 40.25     | vikram.verma@example.com   |
| 93        | Ajay Mehta     | 73.5      | ajay.mehta@example.com     |
| 94        | Rajan Singh    | 22.25     | rajan.singh@example.com    |
| 96        | Meet Jha       | 20.0      | meet@example.com           |
| 97        | Malhar Oza     | 25.0      | malhar@example.com         |

Add    Update    Delete    Load

UPDATE Farmer SET Name = 'Malhar Oza', FarmSize = 25.0, ContactInfo = 'malhar@example.com'  
WHERE FarmerID = 97;

Query    Query History

```
1  select * from "G2SARM".farmer;
```

Data Output    Messages    Notifications

**SQL**

|    | farmerid<br>[PK] integer | name<br>character varying (255) | farmsize<br>numeric (10,2) | contactinfo<br>character varying (255) |
|----|--------------------------|---------------------------------|----------------------------|----------------------------------------|
| 77 | 77                       | Ishaan Mehta                    | 77.75                      | ishaan.mehta@example.com               |
| 78 | 78                       | Vishal Verma                    | 26.50                      | vishal.verma@example.com               |
| 79 | 79                       | Siddhant Sharma                 | 38.00                      | siddhant.sharma@example.com            |
| 80 | 80                       | Samir Gupta                     | 55.75                      | samir.gupta@example.com                |
| 81 | 81                       | Parth Rao                       | 41.50                      | parth.rao@example.com                  |
| 82 | 82                       | Ritesh Reddy                    | 68.50                      | ritesh.reddy@example.com               |
| 83 | 83                       | Shreyas Bhatia                  | 16.75                      | shreyas.bhatia@example.com             |
| 84 | 84                       | Arnav Singh                     | 49.25                      | arnav.singh@example.com                |
| 85 | 85                       | Nitin Gupta                     | 33.50                      | nitin.gupta@example.com                |
| 86 | 86                       | Vikrant Reddy                   | 58.25                      | vikrant.reddy@example.com              |
| 87 | 87                       | Suryansh Patel                  | 24.75                      | suryansh.patel@example.com             |
| 88 | 88                       | Aakash Singh                    | 60.50                      | aakash.singh@example.com               |
| 89 | 89                       | Bharat Kumar                    | 14.00                      | bharat.kumar@example.com               |
| 90 | 91                       | Hitesh Reddy                    | 48.00                      | hitesh.reddy@example.com               |
| 91 | 92                       | Vikram Verma                    | 40.25                      | vikram.verma@example.com               |
| 92 | 93                       | Ajay Mehta                      | 73.50                      | ajay.mehta@example.com                 |
| 93 | 94                       | Rajan Singh                     | 22.25                      | rajan.singh@example.com                |
| 94 | 96                       | Meet Jha                        | 20.00                      | meet@example.com                       |
| 95 | 97                       | Malhar Oza                      | 25.00                      | malhar@example.com                     |

Total rows: 95 of 95    Query complete 00:00:00.128

## Delete Operation

 Farmer Management

|               |    |
|---------------|----|
| Farmer ID:    | 97 |
| Name:         |    |
| Farm Size:    |    |
| Contact Info: |    |

| Farmer ID | Name           | Farm Size | Contact Info               |
|-----------|----------------|-----------|----------------------------|
| 82        | Ritesh Reddy   | 68.5      | ritesh.reddy@example.co... |
| 83        | Shreyas Bhatia | 16.75     | shreyas.bhatia@example...  |
| 84        | Arnav Singh    | 49.25     | arnav.singh@example.co...  |
| 85        | Nitin Gupta    | 33.5      | nitin.gupta@example.com    |
| 86        | Vikrant Reddy  | 58.25     | vikrant.reddy@example.c... |
| 87        | Suryansh Patel | 24.75     | suryansh.patel@example...  |
| 88        | Aakash Singh   | 60.5      | aakash.singh@example.c...  |
| 89        | Bharat Kumar   | 14.0      | bharat.kumar@example.c...  |
| 91        | Hitesh Reddy   | 48.0      | hitesh.reddy@example.co... |
| 92        | Vikram Verma   | 40.25     | vikram.verma@example....   |
| 93        | Ajay Mehta     | 73.5      | ajay.mehta@example.com     |
| 94        | Rajan Singh    | 22.25     | rajan.singh@example.com    |
| 96        | Meet Jha       | 20.0      | meet@example.com           |

**Add**   **Update**   **Delete**   **Load**

DELETE FROM Farmer WHERE FarmerID = 97;

 Farmer Management

|               |    |
|---------------|----|
| Farmer ID:    | 96 |
| Name:         |    |
| Farm Size:    |    |
| Contact Info: |    |

| Farmer ID | Name           | Farm Size | Contact Info               |
|-----------|----------------|-----------|----------------------------|
| 81        | Parth Rao      | 41.5      | parth.rao@example.com      |
| 82        | Ritesh Reddy   | 68.5      | ritesh.reddy@example.co... |
| 83        | Shreyas Bhatia | 16.75     | shreyas.bhatia@example...  |
| 84        | Arnav Singh    | 49.25     | arnav.singh@example.co...  |
| 85        | Nitin Gupta    | 33.5      | nitin.gupta@example.com    |
| 86        | Vikrant Reddy  | 58.25     | vikrant.reddy@example.c... |
| 87        | Suryansh Patel | 24.75     | suryansh.patel@example...  |
| 88        | Aakash Singh   | 60.5      | aakash.singh@example.c...  |
| 89        | Bharat Kumar   | 14.0      | bharat.kumar@example.c...  |
| 91        | Hitesh Reddy   | 48.0      | hitesh.reddy@example.co... |
| 92        | Vikram Verma   | 40.25     | vikram.verma@example....   |
| 93        | Ajay Mehta     | 73.5      | ajay.mehta@example.com     |
| 94        | Rajan Singh    | 22.25     | rajan.singh@example.com    |

**Add**   **Update**   **Delete**   **Load**

DELETE FROM Farmer WHERE FarmerID = 96;

A screenshot of a database management system interface. The top bar has various icons for file operations, search, and navigation. Below the bar, the title "Query" is underlined, followed by "Query History". A single SQL query is listed:
 

```
1 select * from "G2SARM".farmer;
```

 Below the query, tabs for "Data Output", "Messages", and "Notifications" are visible. The main area shows a table with the following data:
 

|    | farmerid<br>[PK] integer | name<br>character varying (255) | farmsize<br>numeric (10,2) | contactinfo<br>character varying (255) |
|----|--------------------------|---------------------------------|----------------------------|----------------------------------------|
| 75 | 75                       | Raj Kumar                       | 70.00                      | raj.kumar@example.com                  |
| 76 | 76                       | Kunal Singh                     | 11.25                      | kunal.singh@example.com                |
| 77 | 77                       | Ishaan Mehta                    | 77.75                      | ishaan.mehta@example.com               |
| 78 | 78                       | Vishal Verma                    | 26.50                      | vishal.verma@example.com               |
| 79 | 79                       | Siddhant Sharma                 | 38.00                      | siddhant.sharma@example.com            |
| 80 | 80                       | Samir Gupta                     | 55.75                      | samir.gupta@example.com                |
| 81 | 81                       | Parth Rao                       | 41.50                      | parth.rao@example.com                  |
| 82 | 82                       | Ritesh Reddy                    | 68.50                      | ritesh.reddy@example.com               |
| 83 | 83                       | Shreyas Bhatia                  | 16.75                      | shreyas.bhatia@example.com             |
| 84 | 84                       | Arnav Singh                     | 49.25                      | arnav.singh@example.com                |
| 85 | 85                       | Nitin Gupta                     | 33.50                      | nitin.gupta@example.com                |
| 86 | 86                       | Vikrant Reddy                   | 58.25                      | vikrant.reddy@example.com              |
| 87 | 87                       | Suryansh Patel                  | 24.75                      | suryansh.patel@example.com             |
| 88 | 88                       | Aakash Singh                    | 60.50                      | aakash.singh@example.com               |
| 89 | 89                       | Bharat Kumar                    | 14.00                      | bharat.kumar@example.com               |
| 90 | 91                       | Hitesh Reddy                    | 48.00                      | hitesh.reddy@example.com               |
| 91 | 92                       | Vikram Verma                    | 40.25                      | vikram.verma@example.com               |
| 92 | 93                       | Ajay Mehta                      | 73.50                      | ajay.mehta@example.com                 |
| 93 | 94                       | Rajan Singh                     | 22.25                      | rajan.singh@example.com                |

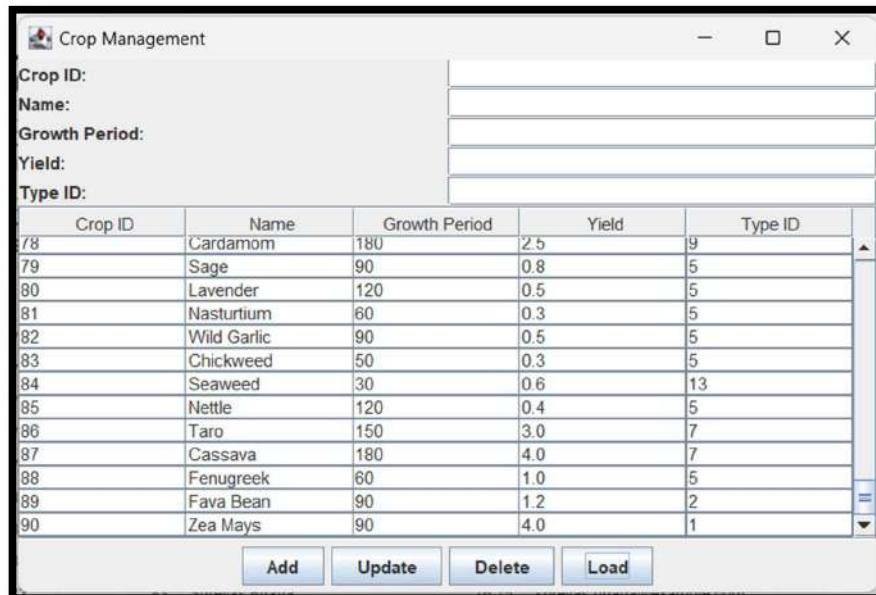
 At the bottom, a status bar indicates "Total rows: 93 of 93" and "Query complete 00:00:00.069".

## 2. Crop(CropID, Name, GrowthPeriod, Yield,TypeID)

The screenshot shows a Windows-style application window titled "Crop Management". On the left side, there are five input fields labeled "Crop ID:", "Name:", "Growth Period:", "Yield:", and "Type ID:". To the right of these fields is a vertical stack of five empty text boxes. Below these fields is a horizontal table with five columns, each containing a header label: "Crop ID", "Name", "Growth Period", "Yield", and "TypeID". At the bottom of the window are four buttons: "Add", "Update", "Delete", and "Load".

Initial stage of Crop Management prompt

## Load Operation



The screenshot shows a SQL query interface with a toolbar at the top and a results grid below. The toolbar includes icons for file operations, search, and navigation. The results grid displays the same 22 rows of crop data as the application window above. At the bottom of the interface, it says "Total rows: 90 of 90" and "Query complete 00:00:00.082".

| cropid | name        | growthperiod | yield | typeid |
|--------|-------------|--------------|-------|--------|
| 72     | Tarragon    | 70           | 0.30  | 5      |
| 73     | Thyme       | 60           | 0.50  | 5      |
| 74     | Chives      | 30           | 0.20  | 5      |
| 75     | Jicama      | 150          | 1.30  | 3      |
| 76     | Celeriac    | 150          | 1.50  | 3      |
| 77     | Fennel      | 100          | 1.00  | 3      |
| 78     | Cardamom    | 180          | 2.50  | 9      |
| 79     | Sage        | 90           | 0.80  | 5      |
| 80     | Lavender    | 120          | 0.50  | 5      |
| 81     | Nasturtium  | 60           | 0.30  | 5      |
| 82     | Wild Garlic | 90           | 0.50  | 5      |
| 83     | Chickweed   | 50           | 0.30  | 5      |
| 84     | Seaweed     | 30           | 0.60  | 13     |
| 85     | Nettle      | 120          | 0.40  | 5      |
| 86     | Taro        | 150          | 3.00  | 7      |
| 87     | Cassava     | 180          | 4.00  | 7      |
| 88     | Fenugreek   | 60           | 1.00  | 5      |
| 89     | Fava Bean   | 90           | 1.20  | 2      |
| 90     | Zea Mays    | 90           | 4.00  | 1      |

SELECT \* FROM crop;

## Add Operation

| Crop ID | Name       | Growth Period | Yield | Type ID |
|---------|------------|---------------|-------|---------|
| 1       | Wheat      | 120           | 3.5   | 1       |
| 2       | Rice       | 150           | 4.0   | 1       |
| 3       | Barley     | 90            | 3.0   | 1       |
| 4       | Oats       | 100           | 2.8   | 1       |
| 5       | Corn       | 90            | 4.2   | 1       |
| 6       | Soybean    | 100           | 2.75  | 2       |
| 7       | Chickpea   | 110           | 1.5   | 2       |
| 8       | Lentil     | 80            | 1.8   | 2       |
| 9       | Pea        | 70            | 1.2   | 2       |
| 10      | Black Bean | 90            | 1.4   | 2       |
| 11      | Carrot     | 90            | 1.5   | 3       |
| 12      | Tomato     | 80            | 2.0   | 3       |
| 13      | Lettuce    | 30            | 0.8   | 3       |

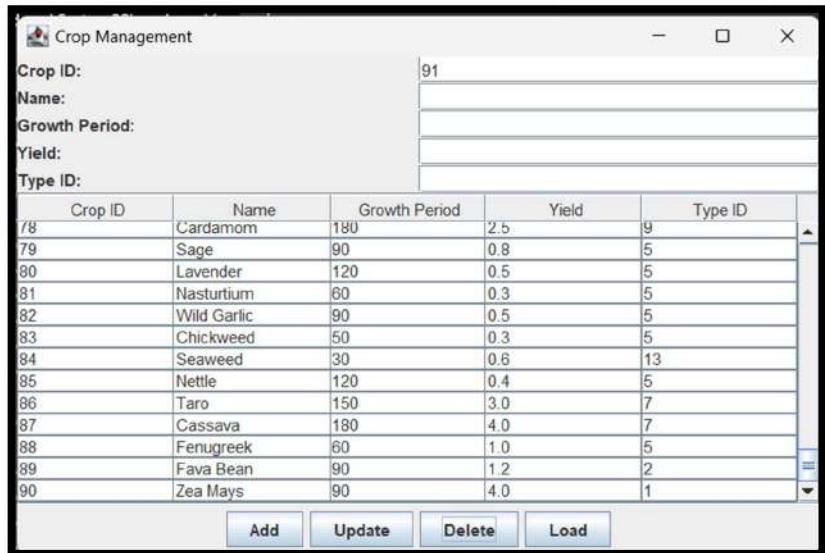
```
INSERT INTO Crop (CropID, Name, GrowthPeriod, Yield,TypeID)
VALUES (91, 'Fodder', 120, 5.0, 3);
```

## Update Operation

| Crop ID | Name       | Growth Period | Yield | Type ID |
|---------|------------|---------------|-------|---------|
| 1       | Wheat      | 120           | 3.5   | 1       |
| 2       | Rice       | 150           | 4.0   | 1       |
| 3       | Barley     | 90            | 3.0   | 1       |
| 4       | Oats       | 100           | 2.8   | 1       |
| 5       | Corn       | 90            | 4.2   | 1       |
| 6       | Soybean    | 100           | 2.75  | 2       |
| 7       | Chickpea   | 110           | 1.5   | 2       |
| 8       | Lentil     | 80            | 1.8   | 2       |
| 9       | Pea        | 70            | 1.2   | 2       |
| 10      | Black Bean | 90            | 1.4   | 2       |
| 11      | Carrot     | 90            | 1.5   | 3       |
| 12      | Tomato     | 80            | 2.0   | 3       |
| 13      | Lettuce    | 30            | 0.8   | 3       |

```
UPDATE Crop SET Name = 'Kharif', GrowthPeriod = 80, Yield = 4.2, TypeID = 5
WHERE CropID = 91;
```

## Delete Operation



DELETE FROM Crop WHERE CropID = 91;

The screenshot shows a SQL query interface with a toolbar at the top and a table below. The table has columns: cropid [PK] integer, name character varying (255), growthperiod integer, yield numeric (10,2), and typeid integer. The data shows 19 rows of crop information.

| cropid [PK] integer | name character varying (255) | growthperiod integer | yield numeric (10,2) | typeid integer |
|---------------------|------------------------------|----------------------|----------------------|----------------|
| 1                   | Wheat                        | 120                  | 3.50                 | 1              |
| 2                   | Rice                         | 150                  | 4.00                 | 1              |
| 3                   | Barley                       | 90                   | 3.00                 | 1              |
| 4                   | Oats                         | 100                  | 2.80                 | 1              |
| 5                   | Corn                         | 90                   | 4.20                 | 1              |
| 6                   | Soybean                      | 100                  | 2.75                 | 2              |
| 7                   | Chickpea                     | 110                  | 1.50                 | 2              |
| 8                   | Lentil                       | 80                   | 1.80                 | 2              |
| 9                   | Pea                          | 70                   | 1.20                 | 2              |
| 10                  | Black Bean                   | 90                   | 1.40                 | 2              |
| 11                  | Carrot                       | 90                   | 1.50                 | 3              |
| 12                  | Tomato                       | 80                   | 2.00                 | 3              |
| 13                  | Lettuce                      | 30                   | 0.80                 | 3              |
| 14                  | Potato                       | 120                  | 4.00                 | 3              |
| 15                  | Onion                        | 120                  | 2.50                 | 3              |
| 16                  | Apple                        | 180                  | 5.00                 | 4              |
| 17                  | Banana                       | 365                  | 8.00                 | 4              |
| 18                  | Orange                       | 365                  | 7.50                 | 4              |
| 19                  | Strawberry                   | 120                  | 2.00                 | 4              |

Total rows: 90 of 90    Query complete 00:00:00.097

### 3. CropType(TypeID, Type, AdditionalInfo)

The screenshot shows a Windows application window titled "Crop Type Management". The window has a standard title bar with minimize, maximize, and close buttons. Inside, there are three input fields labeled "Type ID:", "Type:", and "Additional Info:". Below these is a table with three columns: "Type ID", "Type", and "Additional Info". At the bottom of the window are four buttons: "Add", "Update", "Delete", and "Load".

Initial stage of Crop Type Management prompt

## Load Operation

Crop Type Management

| Type ID:         |                         |                                                       |
|------------------|-------------------------|-------------------------------------------------------|
| Type:            |                         |                                                       |
| Additional Info: |                         |                                                       |
| Type ID          | Type                    | Additional Info                                       |
| 76               | Urban Agriculture Crops | Includes crops suited for city gardens.               |
| 77               | Perennial Crops         | Includes crops that grow back year after year.        |
| 78               | Cover Crops             | Used to cover soil between main crops.                |
| 79               | Annual Flowers          | Flowers that complete their life cycle in one season. |
| 80               | Plant-Based Proteins    | Includes lentils, beans, and peas.                    |
| 81               | Carbon Farming Crops    | Includes plants that help sequester carbon.           |
| 82               | Floral Crops            | Includes crops grown for their flowers.               |
| 83               | Low-Input Crops         | Crops that require fewer resources to grow.           |
| 84               | Grazing Crops           | Crops suitable for grazing animals.                   |
| 85               | Germplasm Conservation  | Includes plants preserved for future use.             |
| 86               | Non-Traditional Grains  | Includes teff and fonio.                              |
| 87               | Hybrid Varieties        | Crossbred varieties for enhanced traits.              |
| 88               | Experimental Crops      | Crops being trialed for potential benefits.           |
| 89               | Indigenous Crops        | Crops traditional to specific cultures.               |
| 90               | Sustainable Seafood     | Aquatic plants used in sustainable fishing.           |

Add    Update    Delete    Load

Query    Query History

```
1 select * from "G2SARM".CropType;
```

Data Output    Messages    Notifications

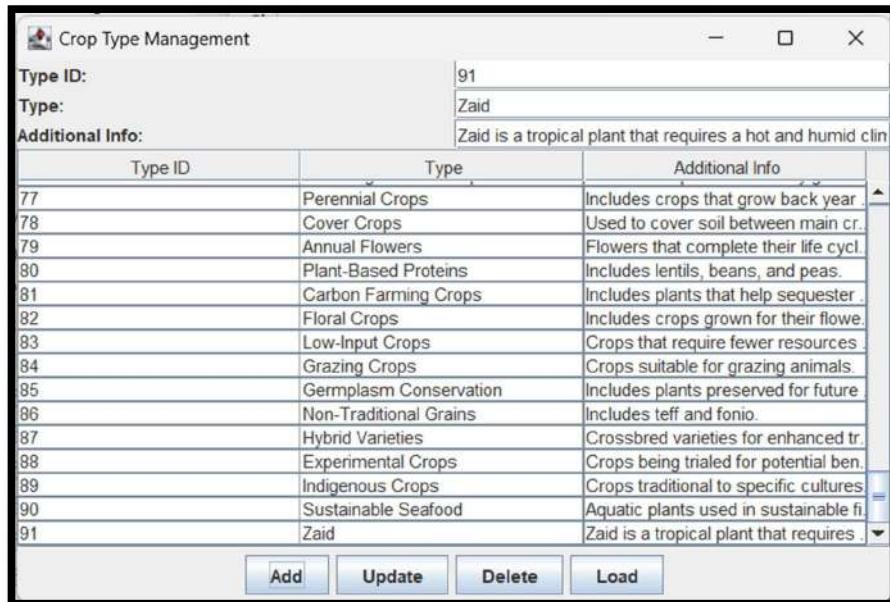
SQL

| typeid<br>[PK] integer | type<br>character varying (255) | additionalinfo<br>text                                |
|------------------------|---------------------------------|-------------------------------------------------------|
| 72                     | 72 Genetically Modified Crops   | Crops altered for specific traits.                    |
| 73                     | 73 Organic Crops                | Crops grown without synthetic chemicals.              |
| 74                     | 74 Native Plants                | Includes plants indigenous to a specific region.      |
| 75                     | 75 Climate-Smart Crops          | Includes crops resilient to climate change.           |
| 76                     | 76 Urban Agriculture Crops      | Includes crops suited for city gardening.             |
| 77                     | 77 Perennial Crops              | Includes crops that grow back year after year.        |
| 78                     | 78 Cover Crops                  | Used to cover soil between main crops.                |
| 79                     | 79 Annual Flowers               | Flowers that complete their life cycle in one season. |
| 80                     | 80 Plant-Based Proteins         | Includes lentils, beans, and peas.                    |
| 81                     | 81 Carbon Farming Crops         | Includes plants that help sequester carbon.           |
| 82                     | 82 Floral Crops                 | Includes crops grown for their flowers.               |
| 83                     | 83 Low-Input Crops              | Crops that require fewer resources to grow.           |
| 84                     | 84 Grazing Crops                | Crops suitable for grazing animals.                   |
| 85                     | 85 Germplasm Conservation       | Includes plants preserved for future use.             |
| 86                     | 86 Non-Traditional Grains       | Includes teff and fonio.                              |
| 87                     | 87 Hybrid Varieties             | Crossbred varieties for enhanced traits.              |
| 88                     | 88 Experimental Crops           | Crops being trialed for potential benefits.           |
| 89                     | 89 Indigenous Crops             | Crops traditional to specific cultures.               |
| 90                     | 90 Sustainable Seafood          | Aquatic plants used in sustainable fishing.           |

Total rows: 90 of 90    Query complete 00:00:00.081

SELECT \* FROM CropType;

## Add Operation

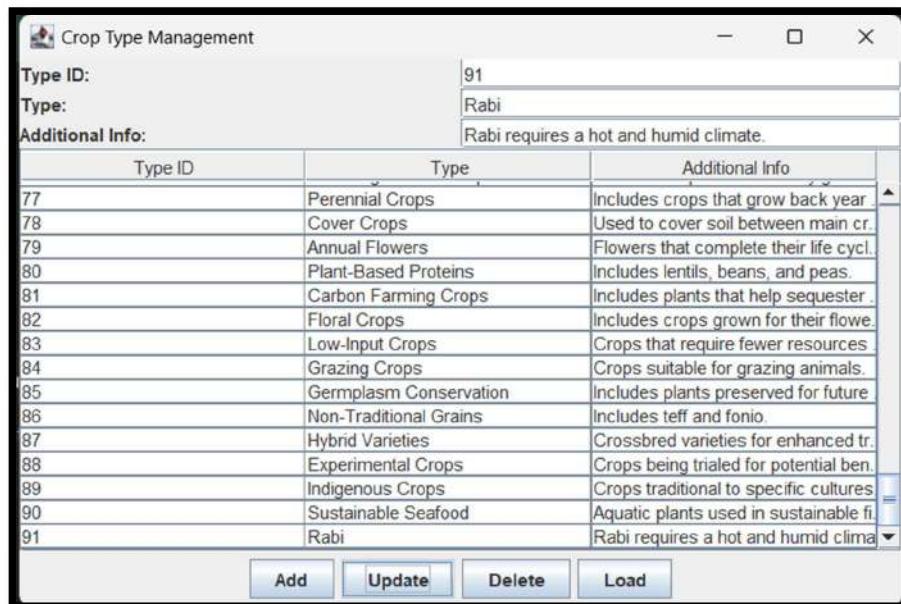


```
INSERT INTO CropType (TypeID, Type, AdditionalInfo)
VALUES (91, 'Zaid', 'Zaid is a tropical plant that requires a hot and humid climate.');
```

| typeid | type                    | additionalinfo                                                  |
|--------|-------------------------|-----------------------------------------------------------------|
| 73     | Organic Crops           | Crops grown without synthetic chemicals.                        |
| 74     | Native Plants           | Includes plants indigenous to a specific region.                |
| 75     | Climate-Smart Crops     | Includes crops resilient to climate change.                     |
| 76     | Urban Agriculture Crops | Includes crops suited for city gardening.                       |
| 77     | Perennial Crops         | Includes crops that grow back year after year.                  |
| 78     | Cover Crops             | Used to cover soil between main crops.                          |
| 79     | Annual Flowers          | Flowers that complete their life cycle in one season.           |
| 80     | Plant-Based Proteins    | Includes lentils, beans, and peas.                              |
| 81     | Carbon Farming Crops    | Includes plants that help sequester carbon.                     |
| 82     | Floral Crops            | Includes crops grown for their flowers.                         |
| 83     | Low-Input Crops         | Crops that require fewer resources to grow.                     |
| 84     | Grazing Crops           | Crops suitable for grazing animals.                             |
| 85     | Germplasm Conservation  | Includes plants preserved for future use.                       |
| 86     | Non-Traditional Grains  | Includes teff and fonio.                                        |
| 87     | Hybrid Varieties        | Crossbred varieties for enhanced traits.                        |
| 88     | Experimental Crops      | Crops being trialed for potential benefits.                     |
| 89     | Indigenous Crops        | Crops traditional to specific cultures.                         |
| 90     | Sustainable Seafood     | Aquatic plants used in sustainable fishing.                     |
| 91     | Zaid                    | Zaid is a tropical plant that requires a hot and humid climate. |

Total rows: 91 of 91    Query complete 00:00:00.152

## Update Operation

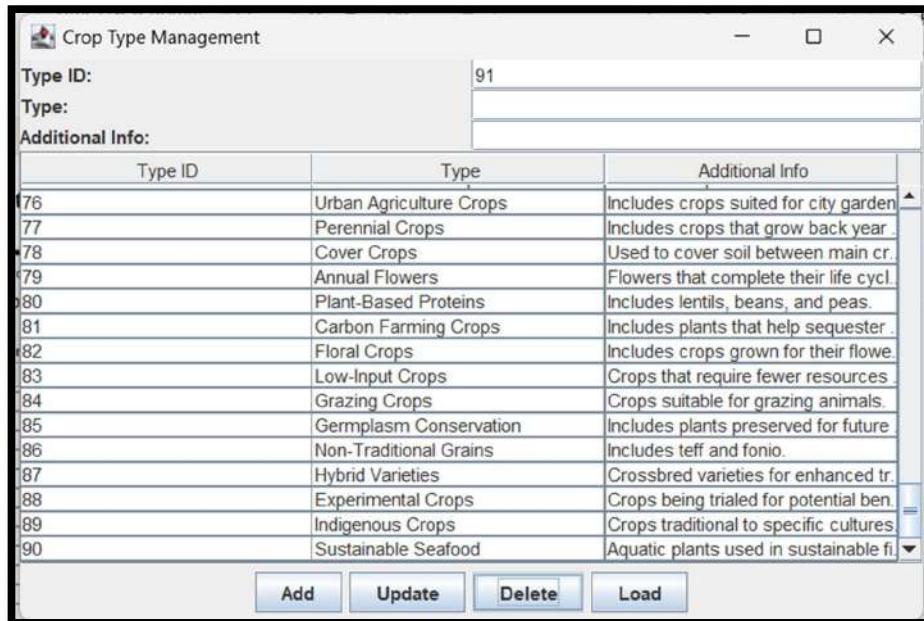


UPDATE CropType SET Type = 'Rabi', AdditionalInfo = 'Rabi requires a hot and humid climate.' WHERE TypeID = 91;

| typeid | type                    | additionalinfo                                        |
|--------|-------------------------|-------------------------------------------------------|
| 73     | Organic Crops           | Crops grown without synthetic chemicals.              |
| 74     | Native Plants           | Includes plants indigenous to a specific region.      |
| 75     | Climate-Smart Crops     | Includes crops resilient to climate change.           |
| 76     | Urban Agriculture Crops | Includes crops suited for city gardening.             |
| 77     | Perennial Crops         | Includes crops that grow back year after year.        |
| 78     | Cover Crops             | Used to cover soil between main crops.                |
| 79     | Annual Flowers          | Flowers that complete their life cycle in one season. |
| 80     | Plant-Based Proteins    | Includes lentils, beans, and peas.                    |
| 81     | Carbon Farming Crops    | Includes plants that help sequester carbon.           |
| 82     | Floral Crops            | Includes crops grown for their flowers.               |
| 83     | Low-Input Crops         | Crops that require fewer resources to grow.           |
| 84     | Grazing Crops           | Crops suitable for grazing animals.                   |
| 85     | Germplasm Conservation  | Includes plants preserved for future use.             |
| 86     | Non-Traditional Grains  | Includes teff and fonio.                              |
| 87     | Hybrid Varieties        | Crossbred varieties for enhanced traits.              |
| 88     | Experimental Crops      | Crops being trialed for potential benefits.           |
| 89     | Indigenous Crops        | Crops traditional to specific cultures.               |
| 90     | Sustainable Seafood     | Aquatic plants used in sustainable fishing.           |
| 91     | Rabi                    | Rabi requires a hot and humid climate.                |

Total rows: 91 of 91    Query complete 00:00:00.082

## Delete Operation



DELETE FROM CropType WHERE TypeID = 91;

| typeid | type                       | additionalinfo                                        |
|--------|----------------------------|-------------------------------------------------------|
| 72     | Genetically Modified Crops | Crops altered for specific traits.                    |
| 73     | Organic Crops              | Crops grown without synthetic chemicals.              |
| 74     | Native Plants              | Includes plants indigenous to a specific region.      |
| 75     | Climate-Smart Crops        | Includes crops resilient to climate change.           |
| 76     | Urban Agriculture Crops    | Includes crops suited for city gardening.             |
| 77     | Perennial Crops            | Includes crops that grow back year after year.        |
| 78     | Cover Crops                | Used to cover soil between main crops.                |
| 79     | Annual Flowers             | Flowers that complete their life cycle in one season. |
| 80     | Plant-Based Proteins       | Includes lentils, beans, and peas.                    |
| 81     | Carbon Farming Crops       | Includes plants that help sequester carbon.           |
| 82     | Floral Crops               | Includes crops grown for their flowers.               |
| 83     | Low-Input Crops            | Crops that require fewer resources to grow.           |
| 84     | Grazing Crops              | Crops suitable for grazing animals.                   |
| 85     | Germplasm Conservation     | Includes plants preserved for future use.             |
| 86     | Non-Traditional Grains     | Includes teff and fonio.                              |
| 87     | Hybrid Varieties           | Crossbred varieties for enhanced traits.              |
| 88     | Experimental Crops         | Crops being trialed for potential benefits.           |
| 89     | Indigenous Crops           | Crops traditional to specific cultures.               |
| 90     | Sustainable Seafood        | Aquatic plants used in sustainable fishing.           |

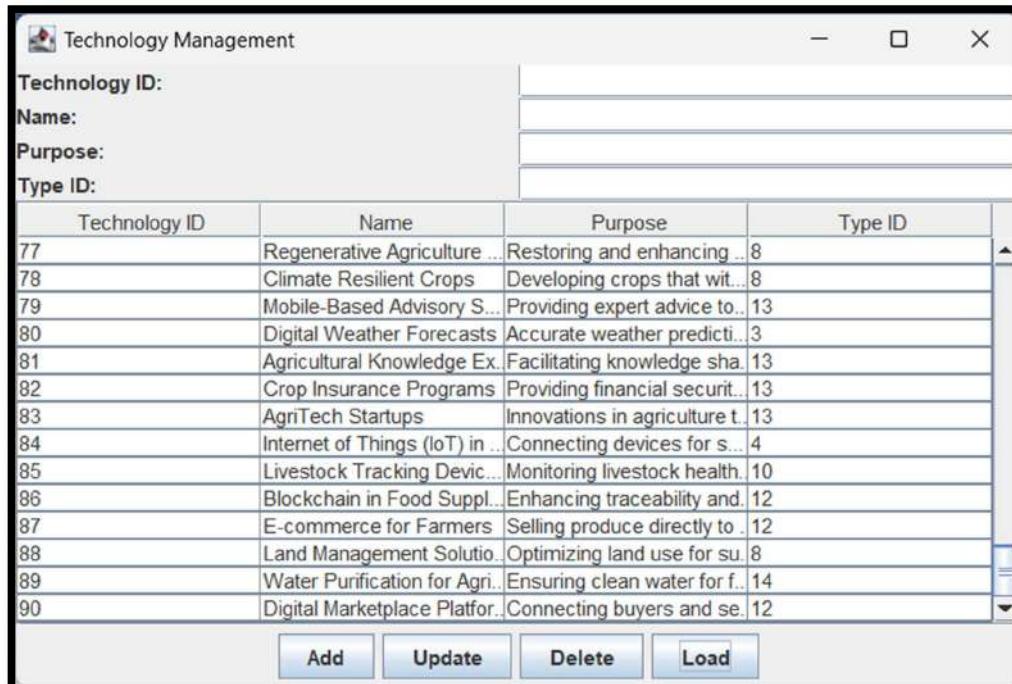
Total rows: 90 of 90    Query complete 00:00:00.114

#### 4. Technology(TechnologyID, Name, Purpose,TypeID)

The screenshot shows a Windows-style application window titled "Technology Management". The window has a standard title bar with minimize, maximize, and close buttons. On the left side, there are four input fields labeled "Technology ID:", "Name:", "Purpose:", and "TypeID:". To the right of these fields is a vertical scrollable list area. Below this area is a table with four columns: "Technology ID", "Name", "Purpose", and "TypeID". At the bottom of the window are four buttons: "Add", "Update", "Delete", and "Load".

Initial stage of Technology Management prompt

## Load Operation



| Query History                |                                           |                                                      |                   |  |
|------------------------------|-------------------------------------------|------------------------------------------------------|-------------------|--|
| No limit                     |                                           |                                                      |                   |  |
| Data Output                  |                                           |                                                      |                   |  |
| technologyid<br>[PK] integer | name<br>character varying (255)           | purpose<br>text                                      | typeid<br>integer |  |
| 72                           | Digital Platforms for Farmers             | Online tools for farm management                     | 4                 |  |
| 73                           | Health and Safety Standards               | Ensuring safe farming practices                      | 14                |  |
| 74                           | Food Sovereignty Movements                | Promoting local control over food systems            | 12                |  |
| 75                           | Sustainable Forestry Practices            | Responsible management of forest resources           | 8                 |  |
| 76                           | Indigenous Farming Practices              | Traditional knowledge in agriculture                 | 8                 |  |
| 77                           | Regenerative Agriculture Techniques       | Restoring and enhancing ecosystem health             | 8                 |  |
| 78                           | Climate Resilient Crops                   | Developing crops that withstand climate change       | 8                 |  |
| 79                           | Mobile-Based Advisory Services            | Providing expert advice to farmers on mobile devices | 13                |  |
| 80                           | Digital Weather Forecasts                 | Accurate weather predictions for rural areas         | 3                 |  |
| 81                           | Agricultural Knowledge Exchange Platforms | Facilitating knowledge sharing among farmers         | 13                |  |
| 82                           | Crop Insurance Programs                   | Providing financial security against crop losses     | 13                |  |
| 83                           | AgriTech Startups                         | Innovations in agriculture technology                | 13                |  |
| 84                           | Internet of Things (IoT) in Agriculture   | Connecting devices for smarter farming               | 4                 |  |
| 85                           | Livestock Tracking Devices                | Monitoring livestock health and location             | 10                |  |
| 86                           | Blockchain in Food Supply Chain           | Enhancing traceability and transparency              | 12                |  |
| 87                           | E-commerce for Farmers                    | Selling produce directly to consumers online         | 12                |  |
| 88                           | Land Management Solutions                 | Optimizing land use for sustainability               | 8                 |  |
| 89                           | Water Purification for Agriculture        | Ensuring clean water for farming                     | 14                |  |
| 90                           | Digital Marketplace Platforms             | Connecting buyers and sellers of agricultural goods  | 12                |  |

Total rows: 90 of 90    Query complete 00:00:00.069

SELECT \* FROM Technology;

## Add Operation

Technology Management

| Technology ID:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 91                                                       |                                                          |         |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|---------|---------|---------|----|-------------------------|------------------------------------------------|---|----|--------------------------------|----------------------------------------------|----|----|---------------------------|----------------------------------------------|---|----|-------------------------------------------|----------------------------------------------|----|----|-------------------------|--------------------------------------------------|----|----|-------------------|---------------------------------------|----|----|-----------------------------------------|----------------------------------------|---|----|----------------------------|------------------------------------------|----|----|---------------------------------|-----------------------------------------|----|----|------------------------|----------------------------------------------|----|----|---------------------------|----------------------------------------|---|----|------------------------------------|----------------------------------|----|----|-------------------------------|-----------------------------------------------------|----|----|--------------------|----------------------------------------------------------|----|
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Robotic Technology                                       |                                                          |         |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| Purpose:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | It can do monotonous tasks without sacrificing accuracy. |                                                          |         |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| Type ID:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 15                                                       |                                                          |         |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| <table border="1"> <thead> <tr> <th>Technology ID</th> <th>Name</th> <th>Purpose</th> <th>Type ID</th> </tr> </thead> <tbody> <tr><td>78</td><td>Climate Resilient Crops</td><td>Developing crops that withstand climate change</td><td>8</td></tr> <tr><td>79</td><td>Mobile-Based Advisory Services</td><td>Providing expert advice to farmers on mobile</td><td>13</td></tr> <tr><td>80</td><td>Digital Weather Forecasts</td><td>Accurate weather predictions for rural areas</td><td>3</td></tr> <tr><td>81</td><td>Agricultural Knowledge Exchange Platforms</td><td>Facilitating knowledge sharing among farmers</td><td>13</td></tr> <tr><td>82</td><td>Crop Insurance Programs</td><td>Providing financial security against crop losses</td><td>13</td></tr> <tr><td>83</td><td>AgriTech Startups</td><td>Innovations in agriculture technology</td><td>13</td></tr> <tr><td>84</td><td>Internet of Things (IoT) in Agriculture</td><td>Connecting devices for smarter farming</td><td>4</td></tr> <tr><td>85</td><td>Livestock Tracking Devices</td><td>Monitoring livestock health and location</td><td>10</td></tr> <tr><td>86</td><td>Blockchain in Food Supply Chain</td><td>Enhancing traceability and transparency</td><td>12</td></tr> <tr><td>87</td><td>E-commerce for Farmers</td><td>Selling produce directly to consumers online</td><td>12</td></tr> <tr><td>88</td><td>Land Management Solutions</td><td>Optimizing land use for sustainability</td><td>8</td></tr> <tr><td>89</td><td>Water Purification for Agriculture</td><td>Ensuring clean water for farming</td><td>14</td></tr> <tr><td>90</td><td>Digital Marketplace Platforms</td><td>Connecting buyers and sellers of agricultural goods</td><td>12</td></tr> <tr><td>91</td><td>Robotic Technology</td><td>It can do monotonous tasks without sacrificing accuracy.</td><td>15</td></tr> </tbody> </table> |                                                          | Technology ID                                            | Name    | Purpose | Type ID | 78 | Climate Resilient Crops | Developing crops that withstand climate change | 8 | 79 | Mobile-Based Advisory Services | Providing expert advice to farmers on mobile | 13 | 80 | Digital Weather Forecasts | Accurate weather predictions for rural areas | 3 | 81 | Agricultural Knowledge Exchange Platforms | Facilitating knowledge sharing among farmers | 13 | 82 | Crop Insurance Programs | Providing financial security against crop losses | 13 | 83 | AgriTech Startups | Innovations in agriculture technology | 13 | 84 | Internet of Things (IoT) in Agriculture | Connecting devices for smarter farming | 4 | 85 | Livestock Tracking Devices | Monitoring livestock health and location | 10 | 86 | Blockchain in Food Supply Chain | Enhancing traceability and transparency | 12 | 87 | E-commerce for Farmers | Selling produce directly to consumers online | 12 | 88 | Land Management Solutions | Optimizing land use for sustainability | 8 | 89 | Water Purification for Agriculture | Ensuring clean water for farming | 14 | 90 | Digital Marketplace Platforms | Connecting buyers and sellers of agricultural goods | 12 | 91 | Robotic Technology | It can do monotonous tasks without sacrificing accuracy. | 15 |
| Technology ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Name                                                     | Purpose                                                  | Type ID |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 78                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Climate Resilient Crops                                  | Developing crops that withstand climate change           | 8       |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 79                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Mobile-Based Advisory Services                           | Providing expert advice to farmers on mobile             | 13      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 80                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Digital Weather Forecasts                                | Accurate weather predictions for rural areas             | 3       |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 81                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Agricultural Knowledge Exchange Platforms                | Facilitating knowledge sharing among farmers             | 13      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 82                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Crop Insurance Programs                                  | Providing financial security against crop losses         | 13      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 83                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | AgriTech Startups                                        | Innovations in agriculture technology                    | 13      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 84                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Internet of Things (IoT) in Agriculture                  | Connecting devices for smarter farming                   | 4       |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 85                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Livestock Tracking Devices                               | Monitoring livestock health and location                 | 10      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 86                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Blockchain in Food Supply Chain                          | Enhancing traceability and transparency                  | 12      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 87                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | E-commerce for Farmers                                   | Selling produce directly to consumers online             | 12      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 88                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Land Management Solutions                                | Optimizing land use for sustainability                   | 8       |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 89                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Water Purification for Agriculture                       | Ensuring clean water for farming                         | 14      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 90                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Digital Marketplace Platforms                            | Connecting buyers and sellers of agricultural goods      | 12      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| 91                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Robotic Technology                                       | It can do monotonous tasks without sacrificing accuracy. | 15      |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |
| <input type="button" value="Add"/> <input type="button" value="Update"/> <input type="button" value="Delete"/> <input type="button" value="Load"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                                                          |         |         |         |    |                         |                                                |   |    |                                |                                              |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                    |                                                          |    |

INSERT INTO Technology (TechnologyID, Name, Purpose, TypeID)  
VALUES (91, 'Robotic Technology', 'It can do monotonous tasks without sacrificing accuracy.', 15);

Query History

```
1 select * from "G2SARM".Technology;
```

Data Output Notifications

| technologyid [PK] integer | name character varying (255)              | purpose text                                             | typeid integer |
|---------------------------|-------------------------------------------|----------------------------------------------------------|----------------|
| 73                        | Health and Safety Standards               | Ensuring safe farming practices                          | 14             |
| 74                        | Food Sovereignty Movements                | Promoting local control over food systems                | 12             |
| 75                        | Sustainable Forestry Practices            | Responsible management of forest resources               | 8              |
| 76                        | Indigenous Farming Practices              | Traditional knowledge in agriculture                     | 8              |
| 77                        | Regenerative Agriculture Techniques       | Restoring and enhancing ecosystem health                 | 8              |
| 78                        | Climate Resilient Crops                   | Developing crops that withstand climate change           | 8              |
| 79                        | Mobile-Based Advisory Services            | Providing expert advice to farmers on mobile             | 13             |
| 80                        | Digital Weather Forecasts                 | Accurate weather predictions for rural areas             | 3              |
| 81                        | Agricultural Knowledge Exchange Platforms | Facilitating knowledge sharing among farmers             | 13             |
| 82                        | Crop Insurance Programs                   | Providing financial security against crop losses         | 13             |
| 83                        | AgriTech Startups                         | Innovations in agriculture technology                    | 13             |
| 84                        | Internet of Things (IoT) in Agriculture   | Connecting devices for smarter farming                   | 4              |
| 85                        | Livestock Tracking Devices                | Monitoring livestock health and location                 | 10             |
| 86                        | Blockchain in Food Supply Chain           | Enhancing traceability and transparency                  | 12             |
| 87                        | E-commerce for Farmers                    | Selling produce directly to consumers online             | 12             |
| 88                        | Land Management Solutions                 | Optimizing land use for sustainability                   | 8              |
| 89                        | Water Purification for Agriculture        | Ensuring clean water for farming                         | 14             |
| 90                        | Digital Marketplace Platforms             | Connecting buyers and sellers of agricultural goods      | 12             |
| 91                        | Robotic Technology                        | It can do monotonous tasks without sacrificing accuracy. | 15             |

Total rows: 91 of 91 Query complete 00:00:00.078 ✓ Successfully run. Total time: 00:00:00.078

## Update Operation

Technology Management

| <b>Technology ID:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 91                                        |                                                      |         |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|------------------------------------------------------|---------|---------|---------|----|-------------------------|------------------------------------------------|---|----|--------------------------------|------------------------------------------------------|----|----|---------------------------|----------------------------------------------|---|----|-------------------------------------------|----------------------------------------------|----|----|-------------------------|--------------------------------------------------|----|----|-------------------|---------------------------------------|----|----|-----------------------------------------|----------------------------------------|---|----|----------------------------|------------------------------------------|----|----|---------------------------------|-----------------------------------------|----|----|------------------------|----------------------------------------------|----|----|---------------------------|----------------------------------------|---|----|------------------------------------|----------------------------------|----|----|-------------------------------|-----------------------------------------------------|----|----|---------------------------|---------------------------------------|----|
| <b>Name:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Smart Agriculture Sensors                 |                                                      |         |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| <b>Purpose:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | help of agriculture sensor technology     |                                                      |         |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| <b>Type ID:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 25                                        |                                                      |         |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
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| Technology ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Name                                      | Purpose                                              | Type ID |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 78                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Climate Resilient Crops                   | Developing crops that withstand climate change       | 8       |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 79                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Mobile-Based Advisory Services            | Providing expert advice to farmers on mobile devices | 13      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 80                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Digital Weather Forecasts                 | Accurate weather predictions for rural areas         | 3       |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 81                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Agricultural Knowledge Exchange Platforms | Facilitating knowledge sharing among farmers         | 13      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 82                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Crop Insurance Programs                   | Providing financial security against crop losses     | 13      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 83                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | AgriTech Startups                         | Innovations in agriculture technology                | 13      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 84                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Internet of Things (IoT) in Agriculture   | Connecting devices for smarter farming               | 4       |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 85                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Livestock Tracking Devices                | Monitoring livestock health and location             | 10      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 86                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Blockchain in Food Supply Chain           | Enhancing traceability and transparency              | 12      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 87                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | E-commerce for Farmers                    | Selling produce directly to consumers online         | 12      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 88                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Land Management Solutions                 | Optimizing land use for sustainability               | 8       |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 89                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Water Purification for Agriculture        | Ensuring clean water for farming                     | 14      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 90                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Digital Marketplace Platforms             | Connecting buyers and sellers of agricultural goods  | 12      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| 91                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Smart Agriculture Sensors                 | help of agriculture sensor technology                | 25      |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |
| <input type="button" value="Add"/> <input type="button" value="Update"/> <input type="button" value="Delete"/> <input type="button" value="Load"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                           |                                                      |         |         |         |    |                         |                                                |   |    |                                |                                                      |    |    |                           |                                              |   |    |                                           |                                              |    |    |                         |                                                  |    |    |                   |                                       |    |    |                                         |                                        |   |    |                            |                                          |    |    |                                 |                                         |    |    |                        |                                              |    |    |                           |                                        |   |    |                                    |                                  |    |    |                               |                                                     |    |    |                           |                                       |    |

UPDATE Technology SET Name = 'Smart Agriculture Sensors', Purpose = 'help of agriculture sensor technology.', TypeID = 25 WHERE TechnologyID = 91;

Query History

```
1 select * from "G2SARM".Technology;
```

Data Output Messages Notifications

SQL

|    | technologyid<br>[PK] integer | name<br>character varying (255)           | purpose<br>text                                      | typeid<br>integer |
|----|------------------------------|-------------------------------------------|------------------------------------------------------|-------------------|
| 73 | 73                           | Health and Safety Standards               | Ensuring safe farming practices                      | 14                |
| 74 | 74                           | Food Sovereignty Movements                | Promoting local control over food systems            | 12                |
| 75 | 75                           | Sustainable Forestry Practices            | Responsible management of forest resources           | 8                 |
| 76 | 76                           | Indigenous Farming Practices              | Traditional knowledge in agriculture                 | 8                 |
| 77 | 77                           | Regenerative Agriculture Techniques       | Restoring and enhancing ecosystem health             | 8                 |
| 78 | 78                           | Climate Resilient Crops                   | Developing crops that withstand climate change       | 8                 |
| 79 | 79                           | Mobile-Based Advisory Services            | Providing expert advice to farmers on mobile devices | 13                |
| 80 | 80                           | Digital Weather Forecasts                 | Accurate weather predictions for rural areas         | 3                 |
| 81 | 81                           | Agricultural Knowledge Exchange Platforms | Facilitating knowledge sharing among farmers         | 13                |
| 82 | 82                           | Crop Insurance Programs                   | Providing financial security against crop losses     | 13                |
| 83 | 83                           | AgriTech Startups                         | Innovations in agriculture technology                | 13                |
| 84 | 84                           | Internet of Things (IoT) in Agriculture   | Connecting devices for smarter farming               | 4                 |
| 85 | 85                           | Livestock Tracking Devices                | Monitoring livestock health and location             | 10                |
| 86 | 86                           | Blockchain in Food Supply Chain           | Enhancing traceability and transparency              | 12                |
| 87 | 87                           | E-commerce for Farmers                    | Selling produce directly to consumers online         | 12                |
| 88 | 88                           | Land Management Solutions                 | Optimizing land use for sustainability               | 8                 |
| 89 | 89                           | Water Purification for Agriculture        | Ensuring clean water for farming                     | 14                |
| 90 | 90                           | Digital Marketplace Platforms             | Connecting buyers and sellers of agricultural goods  | 12                |
| 91 | 91                           | Smart Agriculture Sensors                 | help of agriculture sensor technology                | 25                |

Total rows: 91 of 91    Query complete 00:00:00.084

## Delete Operation

Technology Management

| Technology ID:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 91                              |                                 |         |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------|---------|---------|----|------------------------------|-----------------------------|---|----|-------------------------|------------------------------|---|----|----------------------------|-------------------------------|----|----|---------------------------|------------------------------|---|----|------------------------------|-------------------------------|----|----|-------------------------|--------------------------------|----|----|-------------------|---------------------------------|----|----|---------------------------------|-----------------------------|---|----|-----------------------------|------------------------------|----|----|-----------------------------|-------------------------------|----|----|------------------------|--------------------------------|----|----|----------------------------|-------------------------------|---|----|--------------------------------|-------------------------------|----|----|--------------------------------|-----------------------------|----|
| Name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                 |                                 |         |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| Purpose:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                 |                                 |         |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| Type ID:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                 |                                 |         |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| <table border="1"> <thead> <tr> <th>Technology ID</th> <th>Name</th> <th>Purpose</th> <th>Type ID</th> </tr> </thead> <tbody> <tr><td>77</td><td>Regenerative Agriculture ...</td><td>Restoring and enhancing ...</td><td>8</td></tr> <tr><td>78</td><td>Climate Resilient Crops</td><td>Developing crops that wit...</td><td>8</td></tr> <tr><td>79</td><td>Mobile-Based Advisory S...</td><td>Providing expert advice to...</td><td>13</td></tr> <tr><td>80</td><td>Digital Weather Forecasts</td><td>Accurate weather predicti...</td><td>3</td></tr> <tr><td>81</td><td>Agricultural Knowledge Ex...</td><td>Facilitating knowledge sha...</td><td>13</td></tr> <tr><td>82</td><td>Crop Insurance Programs</td><td>Providing financial securit...</td><td>13</td></tr> <tr><td>83</td><td>AgriTech Startups</td><td>Innovations in agriculture t...</td><td>13</td></tr> <tr><td>84</td><td>Internet of Things (IoT) in ...</td><td>Connecting devices for s...</td><td>4</td></tr> <tr><td>85</td><td>Livestock Tracking Devic...</td><td>Monitoring livestock health.</td><td>10</td></tr> <tr><td>86</td><td>Blockchain in Food Suppl...</td><td>Enhancing traceability and...</td><td>12</td></tr> <tr><td>87</td><td>E-commerce for Farmers</td><td>Selling produce directly to...</td><td>12</td></tr> <tr><td>88</td><td>Land Management Solutio...</td><td>Optimizing land use for su...</td><td>8</td></tr> <tr><td>89</td><td>Water Purification for Agri...</td><td>Ensuring clean water for f...</td><td>14</td></tr> <tr><td>90</td><td>Digital Marketplace Platfor...</td><td>Connecting buyers and se...</td><td>12</td></tr> </tbody> </table> |                                 | Technology ID                   | Name    | Purpose | Type ID | 77 | Regenerative Agriculture ... | Restoring and enhancing ... | 8 | 78 | Climate Resilient Crops | Developing crops that wit... | 8 | 79 | Mobile-Based Advisory S... | Providing expert advice to... | 13 | 80 | Digital Weather Forecasts | Accurate weather predicti... | 3 | 81 | Agricultural Knowledge Ex... | Facilitating knowledge sha... | 13 | 82 | Crop Insurance Programs | Providing financial securit... | 13 | 83 | AgriTech Startups | Innovations in agriculture t... | 13 | 84 | Internet of Things (IoT) in ... | Connecting devices for s... | 4 | 85 | Livestock Tracking Devic... | Monitoring livestock health. | 10 | 86 | Blockchain in Food Suppl... | Enhancing traceability and... | 12 | 87 | E-commerce for Farmers | Selling produce directly to... | 12 | 88 | Land Management Solutio... | Optimizing land use for su... | 8 | 89 | Water Purification for Agri... | Ensuring clean water for f... | 14 | 90 | Digital Marketplace Platfor... | Connecting buyers and se... | 12 |
| Technology ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Name                            | Purpose                         | Type ID |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 77                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Regenerative Agriculture ...    | Restoring and enhancing ...     | 8       |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 78                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Climate Resilient Crops         | Developing crops that wit...    | 8       |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 79                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Mobile-Based Advisory S...      | Providing expert advice to...   | 13      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 80                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Digital Weather Forecasts       | Accurate weather predicti...    | 3       |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 81                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Agricultural Knowledge Ex...    | Facilitating knowledge sha...   | 13      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 82                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Crop Insurance Programs         | Providing financial securit...  | 13      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 83                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | AgriTech Startups               | Innovations in agriculture t... | 13      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 84                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Internet of Things (IoT) in ... | Connecting devices for s...     | 4       |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 85                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Livestock Tracking Devic...     | Monitoring livestock health.    | 10      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 86                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Blockchain in Food Suppl...     | Enhancing traceability and...   | 12      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 87                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | E-commerce for Farmers          | Selling produce directly to...  | 12      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 88                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Land Management Solutio...      | Optimizing land use for su...   | 8       |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 89                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Water Purification for Agri...  | Ensuring clean water for f...   | 14      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| 90                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Digital Marketplace Platfor...  | Connecting buyers and se...     | 12      |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |
| <input type="button" value="Add"/> <input type="button" value="Update"/> <input type="button" value="Delete"/> <input type="button" value="Load"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                 |                                 |         |         |         |    |                              |                             |   |    |                         |                              |   |    |                            |                               |    |    |                           |                              |   |    |                              |                               |    |    |                         |                                |    |    |                   |                                 |    |    |                                 |                             |   |    |                             |                              |    |    |                             |                               |    |    |                        |                                |    |    |                            |                               |   |    |                                |                               |    |    |                                |                             |    |

DELETE FROM Technology WHERE TechnologyID = 91;

Query History

```
1 select * from "G2SARM".Technology;
```

Data Output Messages Notifications

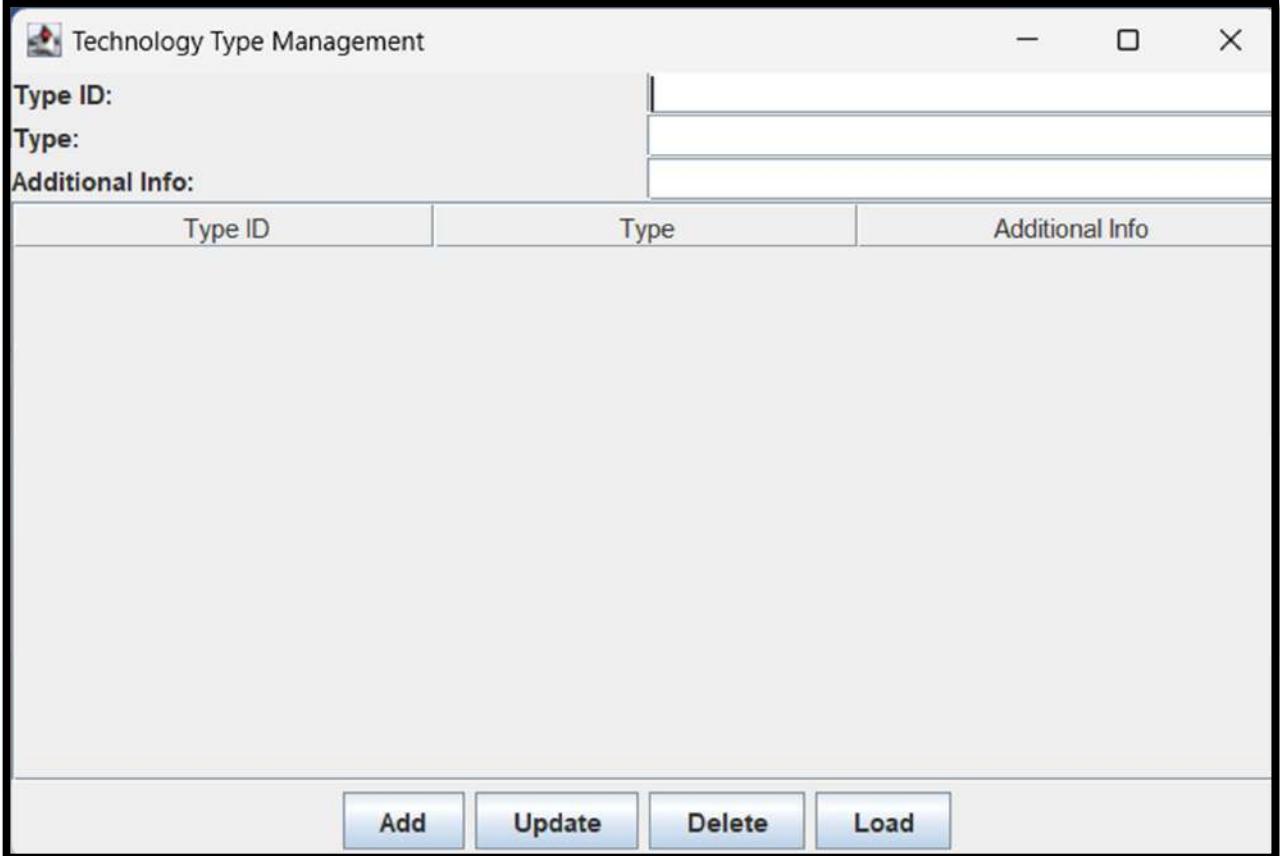
SQL

| technologyid<br>[PK] integer | name<br>character varying (255)              | purpose<br>text                                     | typeid<br>integer |
|------------------------------|----------------------------------------------|-----------------------------------------------------|-------------------|
| 72                           | 72 Digital Platforms for Farmers             | Online tools for farm management                    | 4                 |
| 73                           | 73 Health and Safety Standards               | Ensuring safe farming practices                     | 14                |
| 74                           | 74 Food Sovereignty Movements                | Promoting local control over food systems           | 12                |
| 75                           | 75 Sustainable Forestry Practices            | Responsible management of forest resources          | 8                 |
| 76                           | 76 Indigenous Farming Practices              | Traditional knowledge in agriculture                | 8                 |
| 77                           | 77 Regenerative Agriculture Techniques       | Restoring and enhancing ecosystem health            | 8                 |
| 78                           | 78 Climate Resilient Crops                   | Developing crops that withstand climate change      | 8                 |
| 79                           | 79 Mobile-Based Advisory Services            | Providing expert advice to farmers on mobile        | 13                |
| 80                           | 80 Digital Weather Forecasts                 | Accurate weather predictions for rural areas        | 3                 |
| 81                           | 81 Agricultural Knowledge Exchange Platforms | Facilitating knowledge sharing among farmers        | 13                |
| 82                           | 82 Crop Insurance Programs                   | Providing financial security against crop losses    | 13                |
| 83                           | 83 AgriTech Startups                         | Innovations in agriculture technology               | 13                |
| 84                           | 84 Internet of Things (IoT) in Agriculture   | Connecting devices for smarter farming              | 4                 |
| 85                           | 85 Livestock Tracking Devices                | Monitoring livestock health and location            | 10                |
| 86                           | 86 Blockchain In Food Supply Chain           | Enhancing traceability and transparency             | 12                |
| 87                           | 87 E-commerce for Farmers                    | Selling produce directly to consumers online        | 12                |
| 88                           | 88 Land Management Solutions                 | Optimizing land use for sustainability              | 8                 |
| 89                           | 89 Water Purification for Agriculture        | Ensuring clean water for farming                    | 14                |
| 90                           | 90 Digital Marketplace Platforms             | Connecting buyers and sellers of agricultural goods |                   |

Successfully run

Total rows: 90 of 90 Query complete 00:00:00.090

## 5. TechnologyType(TypeID, Type, AdditionalInfo)



The screenshot shows a Windows application window titled "Technology Type Management". The window has a standard title bar with minimize, maximize, and close buttons. Inside, there are three text input fields labeled "Type ID:", "Type:", and "Additional Info:". Below these is a table with three columns: "Type ID", "Type", and "Additional Info". At the bottom of the window are four buttons: "Add", "Update", "Delete", and "Load".

Initial stage of Technology Type Management prompt

## Load Operation

**Technology Type Management**

| Type ID: | Type:                                    | Additional Info:                                         |
|----------|------------------------------------------|----------------------------------------------------------|
| 76       | Rural Innovation Hubs                    | Centers for fostering agricultural innovation.           |
| 77       | Interactive Farming Simulations          | Simulating farming scenarios for training and education. |
| 78       | Artificial Intelligence in Crop Breeding | Using AI for crop breeding processes.                    |
| 79       | Agroforestry Practices                   | Integrating trees into agricultural landscapes.          |
| 80       | Organic Certification Technologies       | Systems for certifying organic products.                 |
| 81       | Local Food Networks                      | Connecting local farmers with consumers.                 |
| 82       | Alternative Protein Sources              | Innovations in producing alternative proteins.           |
| 83       | Carbon Footprint Tracking                | Tools to measure and manage carbon footprints.           |
| 84       | Soil Nutrient Testing Kits               | Tools for on-site soil nutrient testing.                 |
| 85       | Youth Engagement Programs in Agriculture | Programs to engage youth in farming.                     |
| 86       | Resource-Efficient Farming Techniques    | Practices minimizing resource use.                       |
| 87       | Smart Logistics for Agriculture          | Optimizing supply chain logistics for agriculture.       |
| 88       | Collaborative Farming Technologies       | Platforms for collaborative agricultural practices.      |
| 89       | Biodegradable Mulches                    | Environmentally friendly mulching options for crops.     |
| 90       | Circular Economy in Agriculture          | Implementing circular economy principles in farming.     |

**Action Buttons:** Add, Update, Delete, Load

**Query History**

```
1 select * from "G2SARM".TechnologyType;
```

**Data Output**

| typeid [PK] integer | type character varying (255)             | additionalinfo text                                           |
|---------------------|------------------------------------------|---------------------------------------------------------------|
| 72                  | Integrated Pest Management Solutions     | Comprehensive systems for pest management.                    |
| 73                  | Remote Sensing Technologies              | Using satellite imagery for crop monitoring.                  |
| 74                  | Climate Adaptation Tools                 | Technologies to help adapt to climate change impacts.         |
| 75                  | Hydrological Modeling                    | Models to analyze water resources for agriculture.            |
| 76                  | Rural Innovation Hubs                    | Centers for fostering agricultural innovation in rural areas. |
| 77                  | Interactive Farming Simulations          | Simulating farming scenarios for training and education.      |
| 78                  | Artificial Intelligence in Crop Breeding | Using AI for crop breeding processes.                         |
| 79                  | Agroforestry Practices                   | Integrating trees into agricultural landscapes.               |
| 80                  | Organic Certification Technologies       | Systems for certifying organic products.                      |
| 81                  | Local Food Networks                      | Connecting local farmers with consumers.                      |
| 82                  | Alternative Protein Sources              | Innovations in producing alternative proteins.                |
| 83                  | Carbon Footprint Tracking                | Tools to measure and manage carbon footprints in agriculture. |
| 84                  | Soil Nutrient Testing Kits               | Tools for on-site soil nutrient testing.                      |
| 85                  | Youth Engagement Programs in Agriculture | Programs to engage youth in farming.                          |
| 86                  | Resource-Efficient Farming Techniques    | Practices minimizing resource use.                            |
| 87                  | Smart Logistics for Agriculture          | Optimizing supply chain logistics for agriculture.            |
| 88                  | Collaborative Farming Technologies       | Platforms for collaborative agricultural practices.           |
| 89                  | Biodegradable Mulches                    | Environmentally friendly mulching options for crops.          |
| 90                  | Circular Economy in Agriculture          | Implementing circular economy principles in farming.          |

Total rows: 90 of 90    Query complete 00:00:00.106

SELECT \* FROM TechnologyType;

## Add Operation

Technology Type Management

|                  |                                                                                                                                            |                                                                                                                                            |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Type ID:         | 91                                                                                                                                         |                                                                                                                                            |
| Type:            | Irrigation Technology                                                                                                                      |                                                                                                                                            |
| Additional Info: | Technologies used to optimize water usage in agriculture, including systems like drip irrigation, sprinkler systems, and smart irrigation. |                                                                                                                                            |
| Type ID          | Type                                                                                                                                       | Additional Info                                                                                                                            |
| 77               | Interactive Farming Simulations                                                                                                            | Simulating farming scenarios for training and education.                                                                                   |
| 78               | Artificial Intelligence in Crop Breeding                                                                                                   | Using AI for crop breeding processes.                                                                                                      |
| 79               | Agroforestry Practices                                                                                                                     | Integrating trees into agricultural landscapes.                                                                                            |
| 80               | Organic Certification Technologies                                                                                                         | Systems for certifying organic products.                                                                                                   |
| 81               | Local Food Networks                                                                                                                        | Connecting local farmers with consumers.                                                                                                   |
| 82               | Alternative Protein Sources                                                                                                                | Innovations in producing alternative protein sources.                                                                                      |
| 83               | Carbon Footprint Tracking                                                                                                                  | Tools to measure and manage carbon footprints.                                                                                             |
| 84               | Soil Nutrient Testing Kits                                                                                                                 | Tools for on-site soil nutrient testing.                                                                                                   |
| 85               | Youth Engagement Programs in Agriculture                                                                                                   | Programs to engage youth in farming.                                                                                                       |
| 86               | Resource-Efficient Farming Techniques                                                                                                      | Practices minimizing resource use.                                                                                                         |
| 87               | Smart Logistics for Agriculture                                                                                                            | Optimizing supply chain logistics for agriculture.                                                                                         |
| 88               | Collaborative Farming Technologies                                                                                                         | Platforms for collaborative agricultural practices.                                                                                        |
| 89               | Biodegradable Mulches                                                                                                                      | Environmentally friendly mulching options for crops.                                                                                       |
| 90               | Circular Economy in Agriculture                                                                                                            | Implementing circular economy principles in farming.                                                                                       |
| 91               | Irrigation Technology                                                                                                                      | Technologies used to optimize water usage in agriculture, including systems like drip irrigation, sprinkler systems, and smart irrigation. |

**Add** **Update** **Delete** **Load**

```
INSERT INTO TechnologyType (TypeID, Type, AdditionalInfo)VALUES (91, 'Irrigation Technology', 'Technologies used to optimize water usage in agriculture, including systems like drip irrigation, sprinkler systems, and smart irrigation.');
```

Query History

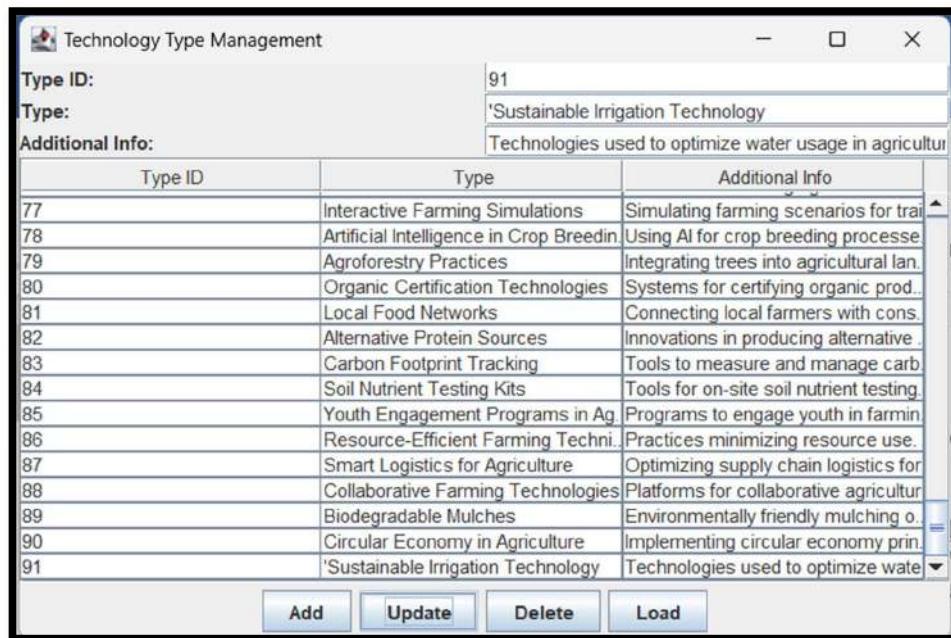
```
1 select * from "G2SARM".TechnologyType;
```

Data Output Messages Notifications

| typeid       | type                                     | additionalinfo                                                                                                                             |
|--------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| [PK] Integer | character varying (255)                  | text                                                                                                                                       |
| 73           | Remote Sensing Technologies              | Using satellite imagery for crop monitoring.                                                                                               |
| 74           | Climate Adaptation Tools                 | Technologies to help adapt to climate change impacts.                                                                                      |
| 75           | Hydrological Modeling                    | Models to analyze water resources for agriculture.                                                                                         |
| 76           | Rural Innovation Hubs                    | Centers for fostering agricultural innovation in rural areas.                                                                              |
| 77           | Interactive Farming Simulations          | Simulating farming scenarios for training and education.                                                                                   |
| 78           | Artificial Intelligence in Crop Breeding | Using AI for crop breeding processes.                                                                                                      |
| 79           | Agroforestry Practices                   | Integrating trees into agricultural landscapes.                                                                                            |
| 80           | Organic Certification Technologies       | Systems for certifying organic products.                                                                                                   |
| 81           | Local Food Networks                      | Connecting local farmers with consumers.                                                                                                   |
| 82           | Alternative Protein Sources              | Innovations in producing alternative proteins.                                                                                             |
| 83           | Carbon Footprint Tracking                | Tools to measure and manage carbon footprints in agriculture.                                                                              |
| 84           | Soil Nutrient Testing Kits               | Tools for on-site soil nutrient testing.                                                                                                   |
| 85           | Youth Engagement Programs in Agriculture | Programs to engage youth in farming.                                                                                                       |
| 86           | Resource-Efficient Farming Techniques    | Practices minimizing resource use.                                                                                                         |
| 87           | Smart Logistics for Agriculture          | Optimizing supply chain logistics for agriculture.                                                                                         |
| 88           | Collaborative Farming Technologies       | Platforms for collaborative agricultural practices.                                                                                        |
| 89           | Biodegradable Mulches                    | Environmentally friendly mulching options for crops.                                                                                       |
| 90           | Circular Economy in Agriculture          | Implementing circular economy principles in farming.                                                                                       |
| 91           | Irrigation Technology                    | Technologies used to optimize water usage in agriculture, including systems like drip irrigation, sprinkler systems, and smart irrigation. |

Total rows: 91 of 91 Query complete 00:00:00.099

## Update Operation



UPDATE TechnologyType SET Type = 'Sustainable Irrigation Technology', AdditionalInfo = 'Technologies focused on sustainable water usage, including smart irrigation systems, rainwater harvesting, and water-efficient drip systems.' WHERE TypeID = 91;

| typeid | type                                     | additionalinfo                                                           |
|--------|------------------------------------------|--------------------------------------------------------------------------|
| 73     | Remote Sensing Technologies              | Using satellite imagery for crop monitoring.                             |
| 74     | Climate Adaptation Tools                 | Technologies to help adapt to climate change impacts.                    |
| 75     | Hydrological Modeling                    | Models to analyze water resources for agriculture.                       |
| 76     | Rural Innovation Hubs                    | Centers for fostering agricultural innovation in rural areas.            |
| 77     | Interactive Farming Simulations          | Simulating farming scenarios for training and education.                 |
| 78     | Artificial Intelligence in Crop Breeding | Using AI for crop breeding processes.                                    |
| 79     | Agroforestry Practices                   | Integrating trees into agricultural landscapes.                          |
| 80     | Organic Certification Technologies       | Systems for certifying organic products.                                 |
| 81     | Local Food Networks                      | Connecting local farmers with consumers.                                 |
| 82     | Alternative Protein Sources              | Innovations in producing alternative proteins.                           |
| 83     | Carbon Footprint Tracking                | Tools to measure and manage carbon footprints in agriculture.            |
| 84     | Soil Nutrient Testing Kits               | Tools for on-site soil nutrient testing.                                 |
| 85     | Youth Engagement Programs in Agriculture | Programs to engage youth in farming.                                     |
| 86     | Resource-Efficient Farming Techniques    | Practices minimizing resource use.                                       |
| 87     | Smart Logistics for Agriculture          | Optimizing supply chain logistics for agriculture.                       |
| 88     | Collaborative Farming Technologies       | Platforms for collaborative agricultural practices.                      |
| 89     | Biodegradable Mulches                    | Environmentally friendly mulching options for crops.                     |
| 90     | Circular Economy in Agriculture          | Implementing circular economy principles in farming.                     |
| 91     | 'Sustainable Irrigation Technology'      | Technologies used to optimize water usage in agriculture, incl ✓ Success |

Total rows: 91 of 91    Query complete 00:00:00.169

## Delete Operation

Technology Type Management

| Type ID:         | 91                                       |                                                          |
|------------------|------------------------------------------|----------------------------------------------------------|
| Type:            |                                          |                                                          |
| Additional Info: |                                          |                                                          |
| Type ID          | Type                                     | Additional Info                                          |
| 76               | Rural Innovation Hubs                    | Centers for fostering agricultural innovation.           |
| 77               | Interactive Farming Simulations          | Simulating farming scenarios for training and education. |
| 78               | Artificial Intelligence in Crop Breeding | Using AI for crop breeding processes.                    |
| 79               | Agroforestry Practices                   | Integrating trees into agricultural landscapes.          |
| 80               | Organic Certification Technologies       | Systems for certifying organic products.                 |
| 81               | Local Food Networks                      | Connecting local farmers with consumers.                 |
| 82               | Alternative Protein Sources              | Innovations in producing alternative protein sources.    |
| 83               | Carbon Footprint Tracking                | Tools to measure and manage carbon footprints.           |
| 84               | Soil Nutrient Testing Kits               | Tools for on-site soil nutrient testing.                 |
| 85               | Youth Engagement Programs in Agriculture | Programs to engage youth in farming.                     |
| 86               | Resource-Efficient Farming Techniques    | Practices minimizing resource use.                       |
| 87               | Smart Logistics for Agriculture          | Optimizing supply chain logistics for agriculture.       |
| 88               | Collaborative Farming Technologies       | Platforms for collaborative agricultural practices.      |
| 89               | Biodegradable Mulches                    | Environmentally friendly mulching options for crops.     |
| 90               | Circular Economy in Agriculture          | Implementing circular economy principles in farming.     |

Add    Update    Delete    Load

DELETE FROM TechnologyType WHERE TypeID = 91;

Query    Query History

```
1 select * from "G2SARM".TechnologyType;
```

Data Output    Messages    Notifications

| typeid [PK] integer | type character varying (255)             | additionalinfo text                                           |
|---------------------|------------------------------------------|---------------------------------------------------------------|
| 72                  | Integrated Pest Management Solutions     | Comprehensive systems for pest management.                    |
| 73                  | Remote Sensing Technologies              | Using satellite imagery for crop monitoring.                  |
| 74                  | Climate Adaptation Tools                 | Technologies to help adapt to climate change impacts.         |
| 75                  | Hydrological Modeling                    | Models to analyze water resources for agriculture.            |
| 76                  | Rural Innovation Hubs                    | Centers for fostering agricultural innovation in rural areas. |
| 77                  | Interactive Farming Simulations          | Simulating farming scenarios for training and education.      |
| 78                  | Artificial Intelligence in Crop Breeding | Using AI for crop breeding processes.                         |
| 79                  | Agroforestry Practices                   | Integrating trees into agricultural landscapes.               |
| 80                  | Organic Certification Technologies       | Systems for certifying organic products.                      |
| 81                  | Local Food Networks                      | Connecting local farmers with consumers.                      |
| 82                  | Alternative Protein Sources              | Innovations in producing alternative proteins.                |
| 83                  | Carbon Footprint Tracking                | Tools to measure and manage carbon footprints in agriculture. |
| 84                  | Soil Nutrient Testing Kits               | Tools for on-site soil nutrient testing.                      |
| 85                  | Youth Engagement Programs in Agriculture | Programs to engage youth in farming.                          |
| 86                  | Resource-Efficient Farming Techniques    | Practices minimizing resource use.                            |
| 87                  | Smart Logistics for Agriculture          | Optimizing supply chain logistics for agriculture.            |
| 88                  | Collaborative Farming Technologies       | Platforms for collaborative agricultural practices.           |
| 89                  | Biodegradable Mulches                    | Environmentally friendly mulching options for crops.          |
| 90                  | Circular Economy in Agriculture          | Implementing circular economy principles in farming.          |

Total rows: 90 of 90    Query complete 00:00:00.140    ✓ Success

## Chapter 6: Technical Issues and Solution

### 1. Technical Issues

#### **Issue 1: Database Connection and Configuration**

- Description: Setting up a stable JDBC connection in DatabaseManager.java was challenging due to configuration complexities with the database URL, driver, and credentials. Configuring the environment to ensure a secure and stable connection also required attention to prevent connection leaks and to manage resources effectively.
- Impact: Misconfigured connections led to frequent SQLException errors, causing interruptions during data retrieval and updating operations. It was particularly challenging as any connection failure would halt GUI operations in Crop, CropType, Technology, and TechnologyType GUIs, impeding overall user experience.

#### **Issue 2: GUI Table Population and Synchronization with Database**

- Description: Displaying data from the database in the GUIs (CropGUI, CropTypeGUI, TechnologyGUI, and TechnologyTypeGUI) and keeping the data synchronized with the database proved complex. Each GUI required a method to load data into JTable components accurately, as well as mechanisms to refresh and update the data in real-time whenever changes were made.
- Impact: Data inconsistencies would arise when the displayed data in the GUI did not match the actual database content. This caused confusion and required a strategy to regularly refresh the displayed information without overwhelming the database with requests.

#### **Issue 3: Error Handling and Data Validation**

- Description: Each GUI interface had various input fields (e.g., crop yield, growth period) where users could input incorrect or incompatible data types, such as entering text instead of numbers. This needed validation to prevent database errors during CRUD (Create, Read, Update, Delete) operations.
- Impact: Incorrect data entries caused NumberFormatException and SQLException errors, disrupting the workflow. Validation errors slowed down user interaction and required frequent exception handling in each GUI class.

#### **Issue 4: Dependency Management and UI Responsiveness**

- Description: Managing dependencies across DatabaseManager and each GUI class while ensuring responsive UI interactions became challenging. Dependencies between classes required clear method calls and efficient database queries to avoid UI lag, especially when dealing with larger datasets.
- Impact: High dependency on database queries to update GUI elements led to performance lags, impacting user interaction quality and causing the interface to feel unresponsive during data retrieval and update tasks.

## 2. Solution

### Solution 1: Configuring and Optimizing JDBC Connection

- Approach: For JDBC configuration, specific steps were taken to secure and optimize the connection. Configuration included setting up a connection pool and fine-tuning the database URL, driver, and user credentials.
- Steps Taken:
- Created a singleton instance for DatabaseManager to reuse a single database connection, reducing connection time.
- Applied try-with-resources to ensure connections are closed automatically after each operation, preventing memory leaks.
- Configured connection pooling for high efficiency, reusing connections across requests.
- Alternative Solutions: Initially considered creating separate connections for each request, but connection pooling was chosen for efficiency and scalability.

### Solution 2: Implementing Data Loading and Refresh Mechanisms

- Approach: Developed loadData methods in each GUI class to populate JTable components, with scheduled reload functions to ensure synchronization.
- Steps Taken:
- Created a loadData function in each GUI that pulls data from DatabaseManager and populates the table model for display.
- Added listeners to buttons (Add, Update, Delete) that trigger table reloads on each CRUD operation to maintain current data in the GUI.
- Alternative Solutions: Considered using SwingWorker threads to load data in the background, but direct table model reloads were chosen for simplicity.

### Solution 3: Error Handling and Input Validation

- Approach: Integrated input validation checks and error handling at the GUI level to prevent invalid data from reaching the database.
- Steps Taken:
- Applied try-catch blocks in the GUI action listeners to catch and handle NumberFormatException and SQLException for invalid inputs.
- Added regex checks on text fields to ensure only valid numeric entries (for numeric fields) and text (for string fields).
- Displayed error messages using JOptionPane dialogs to inform users about incorrect input formats before they can proceed.
- Alternative Solutions: Initially considered server-side validation only, but opted for both server and client-side validation to enhance data accuracy.

### Solution 4: Reducing Dependencies and Improving UI Responsiveness

- Approach: Decoupled the GUI components from direct database operations by introducing intermediate methods and refactoring for more modular code.
- Steps Taken:
- Introduced helper methods in DatabaseManager for common queries to reduce redundant code in GUI classes.
- Used SwingUtilities.invokeLater to run data-loading tasks in the background to maintain UI responsiveness.

- Refactored code in GUI classes to handle only UI tasks, delegating all data logic to DatabaseManager.
- Alternative Solutions: Explored a Model-View-Controller (MVC) approach but opted for direct refactoring for simplicity and improved readability.