SMARTBRIDGE EXTERNSHIP DATA ANALYTICS GUIDED PROJECT

MAXIMIZING CROP POTENTIAL: EMPOWERING FARMERS WITH ACTIONABLE INSIGHTS THROUGH ANALYTICS

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1. INTRODUCTION

1.1 Overview

Maximizing crop potential and empowering farmers with actionable insights through data analytics has revolutionized the agricultural industry. With the abundance of data available from various sources, farmers can now make informed decisions to optimize their farming practices, increase productivity, and reduce risks. This approach combines the power of data collection, integration, preprocessing, descriptive analytics, predictive analytics, and prescriptive analytics to transform agriculture.

Data collection is the first step in this process, where farmers gather information about soil conditions, weather patterns, crop health indicators, and farm management practices.
Data integration brings together diverse datasets, allowing farmers to have a comprehensive view of their farming operations.Data preprocessing ensures that the collected data is reliable and accurate. Descriptive analytics focuses on exploring and summarizing the collected data.
Predictive analytics takes the analysis a step further by using historical data and statistical models to make predictions about future crop performance.Prescriptive analytics builds upon predictive analytics by providing recommendations and actionable insights.

1.2 Purpose

The use of data analytics in agriculture has transformed the way farmers approach crop production. By leveraging data collection, integration, preprocessing, descriptive analytics, predictive analytics, and prescriptive analytics, farmers can make data-driven decisions and optimize their farming practices. This empowers them to maximize crop potential, increase productivity, and mitigate risks, ultimately leading to a more sustainable and efficient agricultural industry.

2. LITERATURE SURVEY

2.1 Existing problem

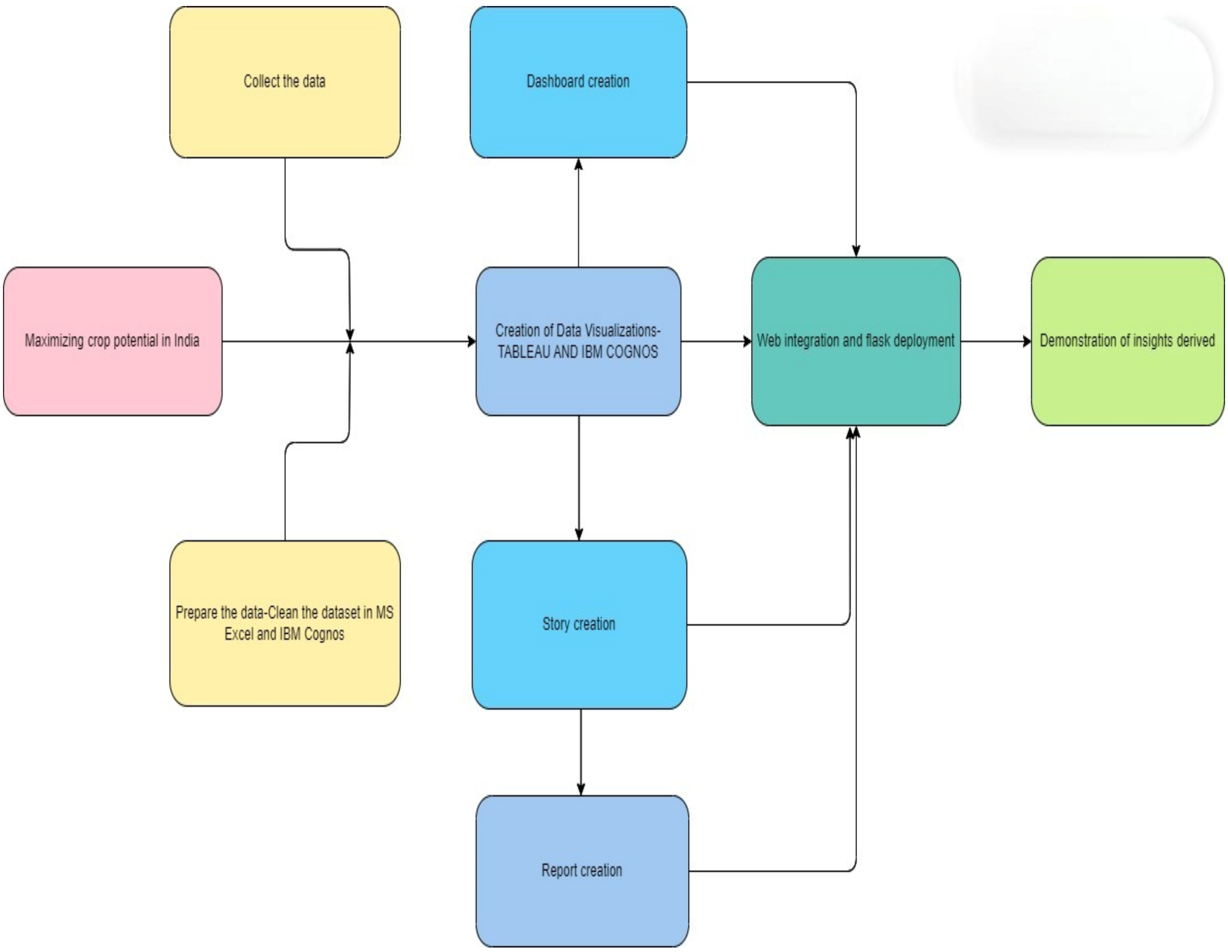
India has difficulty producing crops because of a number of issues that affect agricultural productivity and yield. Crop cycles are impacted by climate variability, which includes irregular monsoons, intense weather, and water scarcity. Limited pest management techniques make yield losses caused by pests, illnesses, and weed infestations worse. Productivity is hampered by outdated farming practises, poor infrastructure, and restricted access to cutting-edge tools and market information. Additional difficulties are posed by soil erosion, land degradation, and decreased soil fertility. Small landholdings, restricted access to credit, and limited access to education are socioeconomic variables that exacerbate the problems.

2.2 Proposed solution

To enhance crop production and provide support to farmers, it is crucial to analyse the crop production and yield trends across states, districts of India, and seasons, gaining insights into patterns, yields, and production trends. By leveraging the capabilities of Tableau, we will conduct a comprehensive analysis to identify key findings, such as states with favourable crop production, seasons that yield better results, and other relevant factors. These findings will empower farmers and the government to make informed decisions, implement targeted interventions, and allocate resources effectively to maximize crop productivity and support the agricultural sector.

3.THEORETICAL ANALYSIS

3.1 Block diagram



4. EXPERIMENTAL INVESTIGATIONS

In this project, we performed seven types of analysis using Tableau to create visualizations, dashboards, and stories in order to gain insights and references from the visualizations. The analyses we performed are as follows:

4.1. Total yield and production generated:

-We conducted a district-wise analysis of total production and the running sum of yield in Tableau using a stacked bar chart.

4.2. States and total yield comparison:

-We analysed the state-wise yield using a horizontal bar chart in Tableau.

4.3. Total area and production analysis by state:

-We conducted total area and production analysis per state using a bubble chart in Tableau.

4.4. Yield analysis as per state using a map:

-We performed yield analysis by state using a map in Tableau.

4.5. Time series analysis for total yield:

-We conducted a time series analysis for total yield using a line chart in Tableau.

4.6. Yield analysis of crop type based on season:

-We performed a yield analysis of crop types based on the season using a stacked bar chart in Tableau.

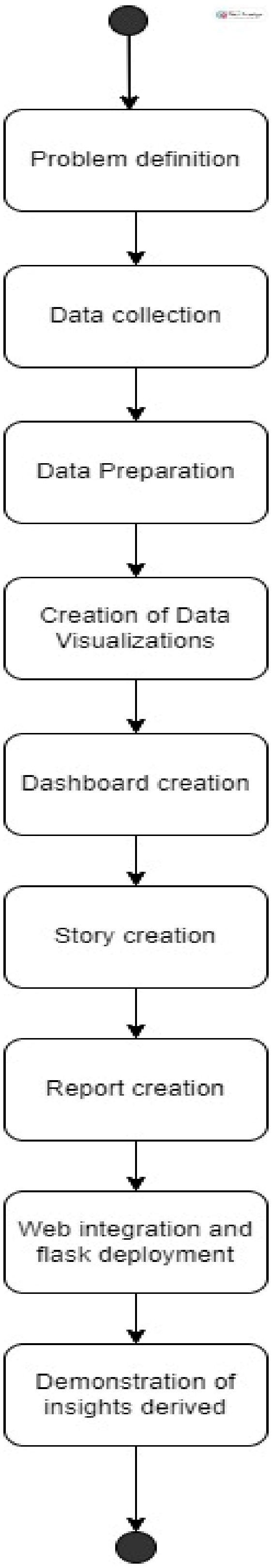
4.7. Total yield analysis by state:

-We performed total yield analysis by state using a tree map in Tableau

Finally, we created two dashboards in Tableau. Dashboards are interactive visual displays that consolidate multiple views and visualizations on a single screen. They provide a comprehensive overview of data, allowing users to analyse and explore different aspects of the data in real-time. Dashboards are used to monitor key metrics, identify trends, and gain insights quickly.

Additionally, we created a story in Tableau. Stories are used to weave a narrative around the data and provide a structured and interactive way to communicate insights. They serve as powerful storytelling mechanisms to communicate insights, guide data exploration, support decision-making, and facilitate collaboration among stakeholders.

5. FLOWCHART


Problem definition
Data collection
Data Preparation
Creation of Data Visualizations
Dashboard creation
Story creation
Report creation
Web integration and flask deployment
Demonstration of insights derived

6. RESULT

We derived the following observations from our analysis

1. The net yield across all states is 27.4 million. The total production is 326 billion.

2.The yield ranges from over 0.4 in Ladakh to over 5.6 million in Tamil Nadu.Tamil Nadu has the highest total yield with a value of 5,617,809,16, followed by West Bengal, Karnataka, and Assam. The sum of their respective yield values adds up to over 23 million or 83.9% of the total yield.

3.Southern states and eastern states have a higher total yield compared to the northern, and western states. Further research must be done to understand why the other parts of India have lower total yield as compared to the southern and eastern states.

4.Yield ranges from over 1,321 in 2020-21 to nearly 1.6 million in 2011-12.It is necessary to study and understand the cause for a drastic decline in yield

5.Yield is most unusual in 1997-98, 1998-99, 1999-00, and 2020-21. The most significant values of Year for yield are 2011-12, 2019-20, 2018-19, 2017-18, and 2009-10. The yield values add up to over 7.6 million or 27.8% of the total yield.

6.The crop with the highest significant yield is coconut (throughout the year and during the Kharif season).Karnataka has the highest total yield of coconut, followed by Assam, Andhra Pradesh, and Kerala

7.Season-wise crop analysis shows that-
A. During the **Kharif season**, **sugarcane** produces the highest yield
B.During **Rabi** season, **potato** produces the highest yield.
C.Throughout the **year**, **coconut** has the highest yield
D**.Summer** season, **banana** produces the highest yield.
E. In **winter**, **sugarcane** produces the highest yield
F. During **autumn, maize** produces the highest yield.

8.Sugarcane and coconut are the only crops grown throughout the year. Other crops are grown in specific seasons.

9.The sum of the production area across all states is nearly 3.3 billion.

10.Across all states, the sum of production is approximately 109 billion. Production ranges from nearly 545 million in Bihar to approximately 64 billion in Karnataka.

11.The area ranges from over 162 million in Punjab to nearly 543 million in Uttar Pradesh. The area in Uttar Pradesh is unusually high.

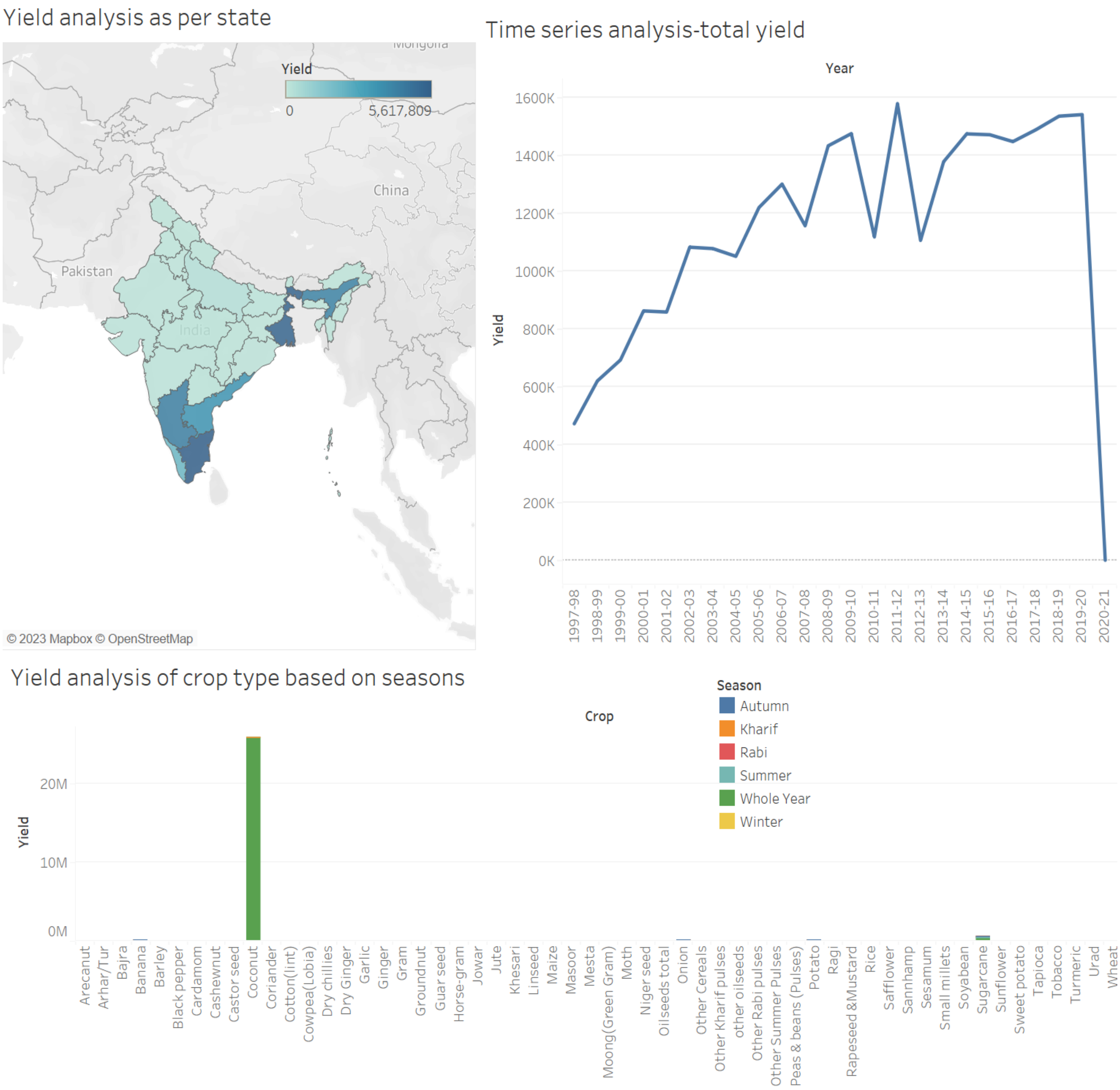
12.Uttar Pradesh has the highest crop production area, followed by Madhya Pradesh, Rajasthan, and Maharashtra. The sum of their respective area values adds up to almost 2.0 billion or 60.6% of the total.

13. Kozhikode district has the highest total production out of all districts, followed by Malappuram, Tumkur, and Coimbatore.

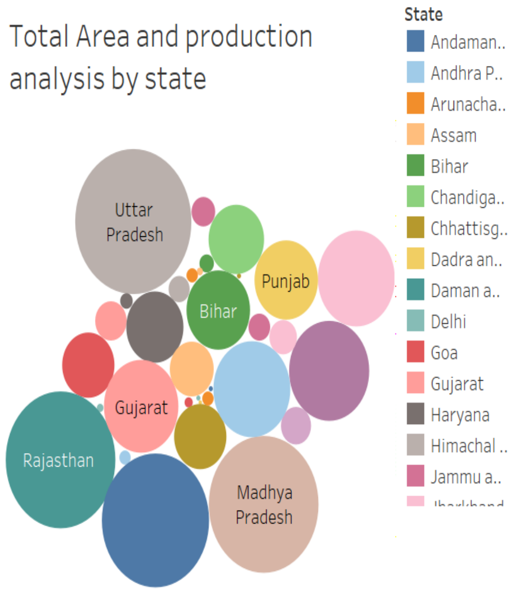
14.The 24 Paraganas South district in West Bengal has the lowest running sum of crop yield. The Tirupur district in Tamil Nadu has the highest running sum of crop yield**.**

Screen Shots:

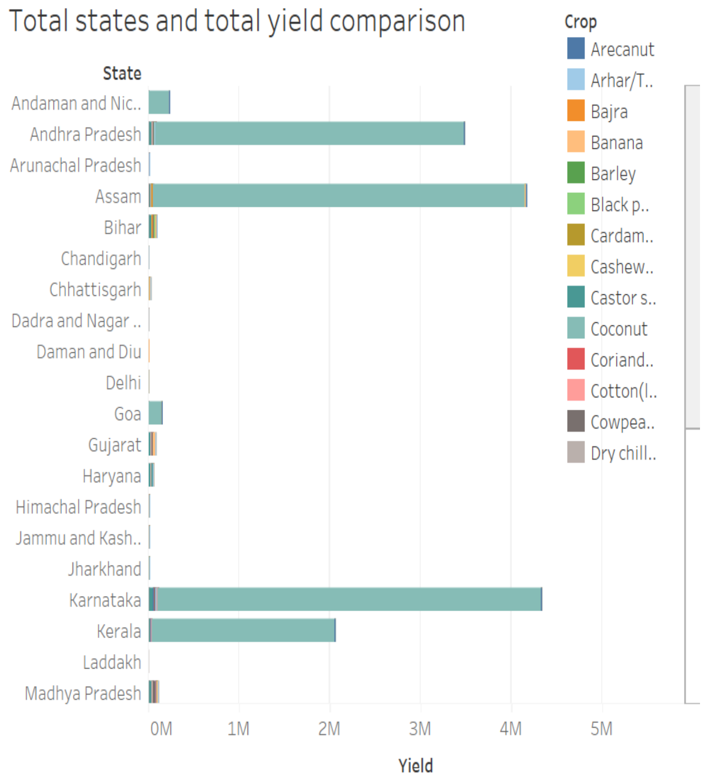
Dashboard 1



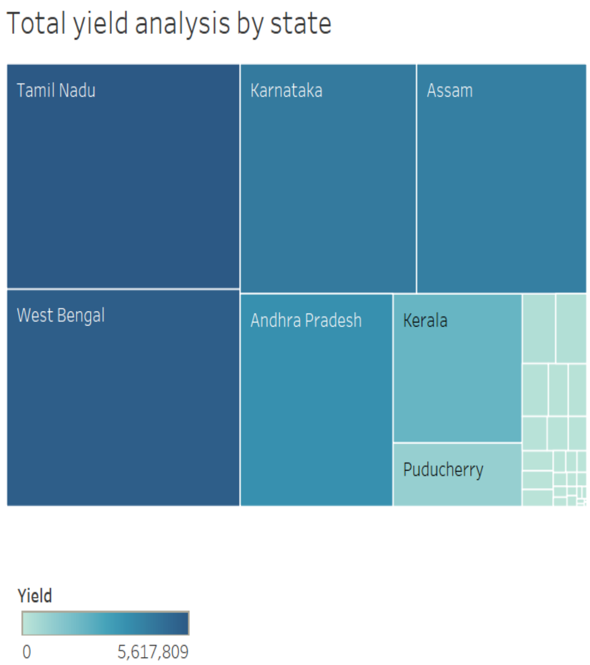
DASHBOARD 2:



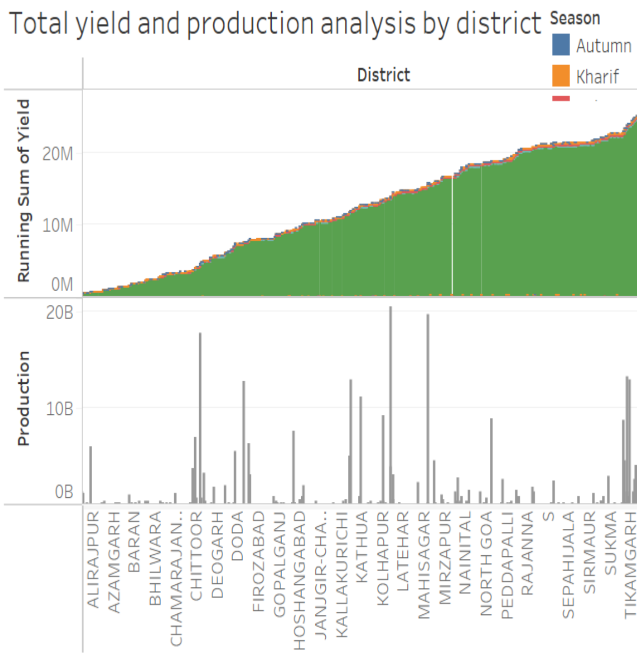
Total Area and production analysis by state
State
Andaman..
Andhra P..
Arunacha..
Assam
Bihar
Chandiga..
Chhattisg..
Dadra an..
Daman a..
Delhi
Goa
Gujarat
Haryana
Himachal ..
Jammu a..
Uttar Pradesh
Punjab
Bihar
Gujarat
Rajasthan
Madhya Pradesh



Total states and total yield comparison
State
Andaman and Nic..
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chandigarh
Chhattisgarh
Dadra and Nagar ..
Daman and Diu
Delhi
Goa
Gujarat
Haryana
Himachal Pradesh
Jammu and Kash..
Jharkhand
Karnataka
Kerala
Laddakh
Madhya Pradesh
0M
1M
2M
3M
4M
5M
Yield
Crop
Arecanut
Arhar/T..
Bajra
Banana
Barley
Black p..
Cardam..
Cashew..
Castor s..
Coconut
Coriand..
Cotton(l..
Cowpea..
Dry chill..



Total yield analysis by state
Tamil Nadu
Karnataka
Assam
West Bengal
Andhra Pradesh
Kerala
Puducherry
Yield
0
5,617,809



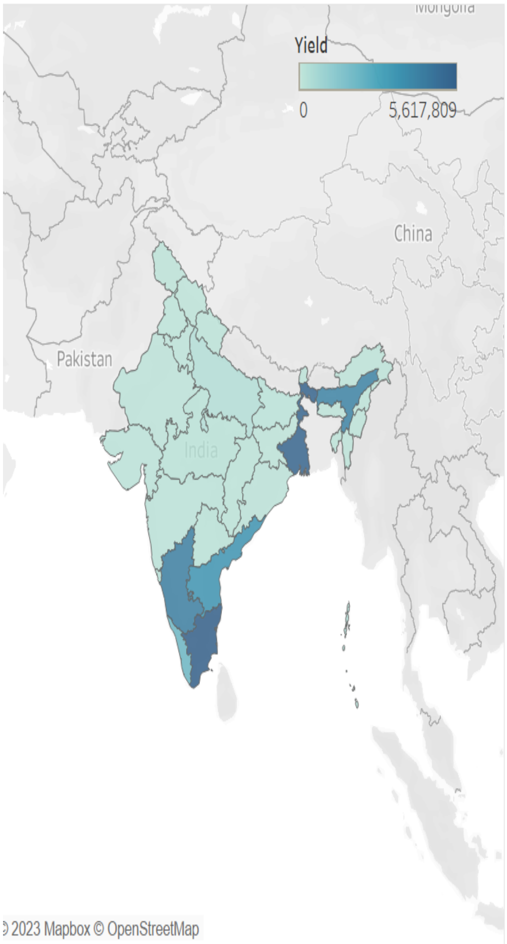
Total yield and production analysis by district
Season
Autumn
Kharif
District
Running Sum of Yield
20M
10M
0M
Production
20B
10B
0B
ALIRAJPUR
AZAMGARH
BARAN
BHILWARA
CHAMARAJAN..
CHITTOOR
DEOGARH
DODA
FIROZABAD
GOPALGANJ
HOSHANGABAD
JANJGIR-CHA..
KALLAKURICHI
KATHUA
KOLHAPUR
LATEHAR
MAHISAGAR
MIRZAPUR
NAINITAL
NORTH GOA
PEDDAPALLI
RAJANNA
S
SEPAHIJALA
SIRMAUR
SUKMA
TIKAMGARH

Story

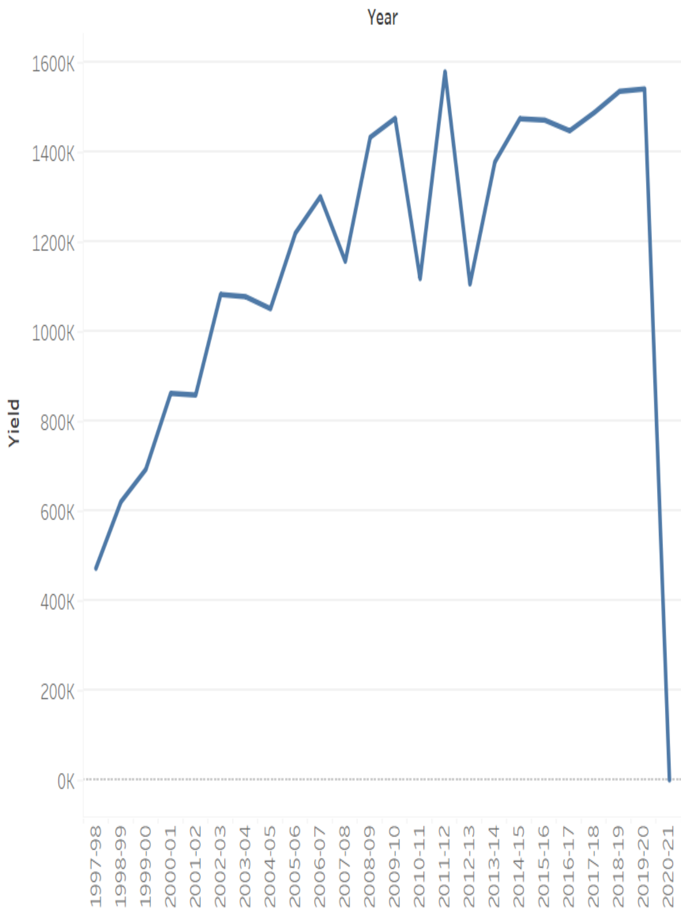
-Tamil nadu has highest total yield followed by West bengal,Karnataka and Assam.
-Yield ranges from over 0,4 in Laddakh to over 5.6 million in Tamil Nadu
-Southern and eastern states have a higher total yield as compared to the northern and western states
-The year 2011-2012 witnessed the highest total crop yield
-The year 2020-2021 witnessed the lowest total crop yield
-The crop with the highest significant yield is coconut(whole year and Kharif season)
-Sugarcane and coconut are the only crops that grow the entire year.Other crops grown in specific seasons

-Uttar Pradesh has the highest area of crop production followed by Madhya Pradesh,Rajasthan and Maharashtra
-Karnataka has the highest total yield of coconut followed by Assam,Andhra Pradesh and kerala
-Tamil nadu has highest total yield followed by West bengal,Karnataka and Assam.
-Laddakh has a yield value of 0
-Kozhikode district has the highest total production out of all districts followed by Malappuram,Tumkur and Coimbatore
-24 Paraganas South district in West Bengal has the lowest running sum of crop yield
-Tirupur district in Tamil nadu has the highest running sum of crop yield.

'ield analysis as per state



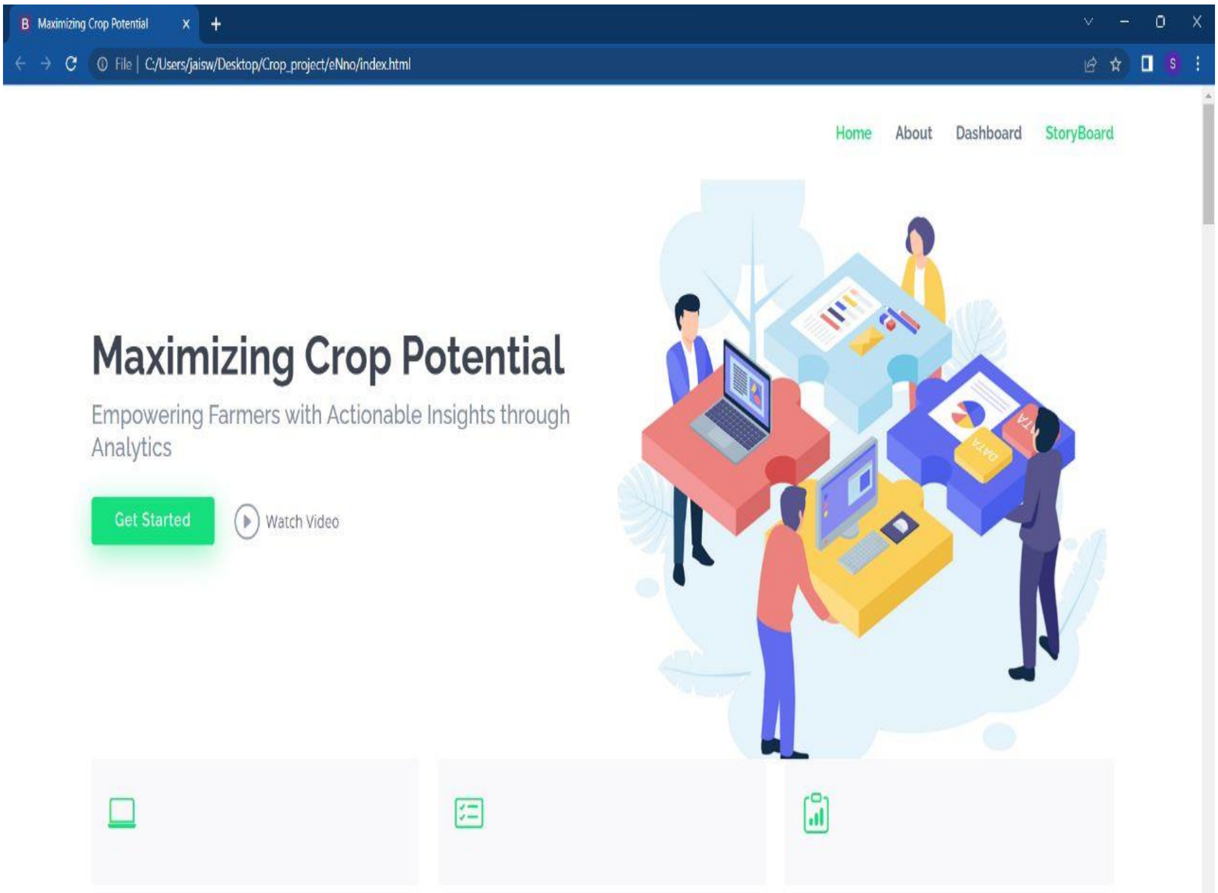
Time series analysis-total yield

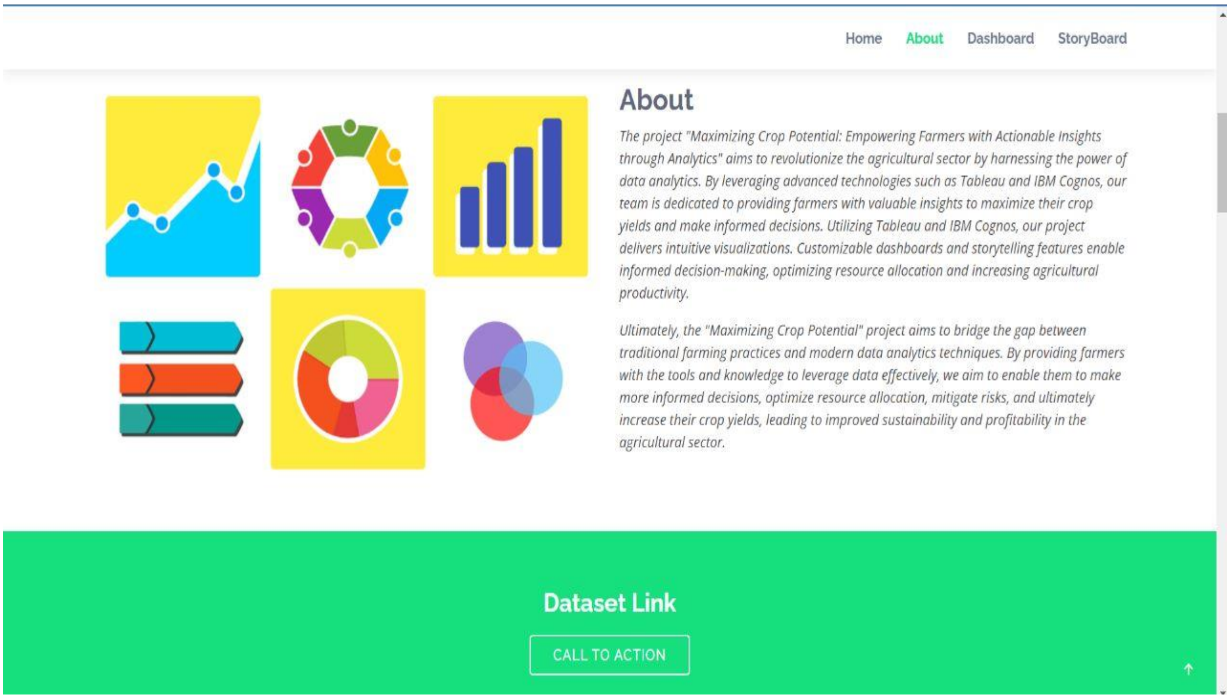


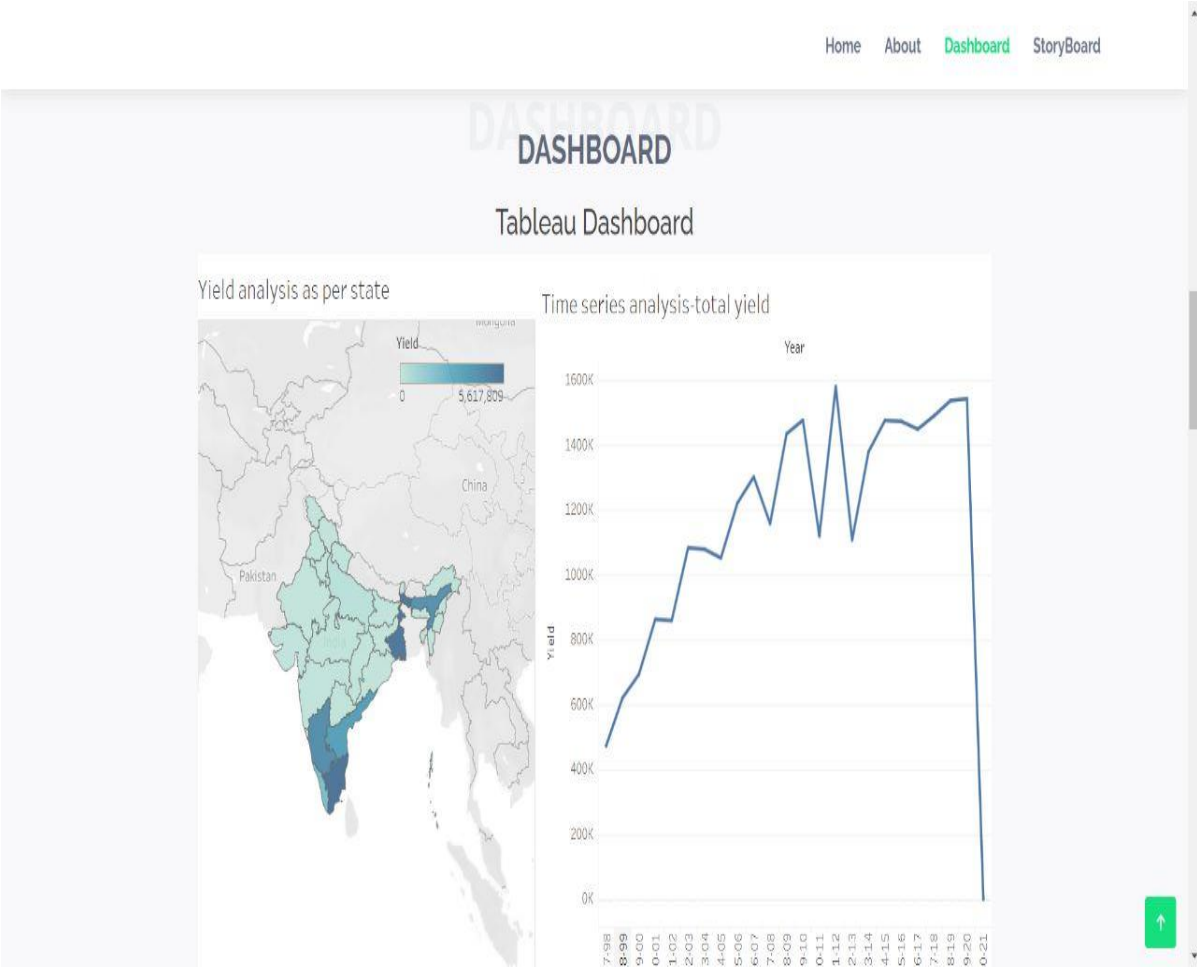
Yield analysis of crop type based on seasons

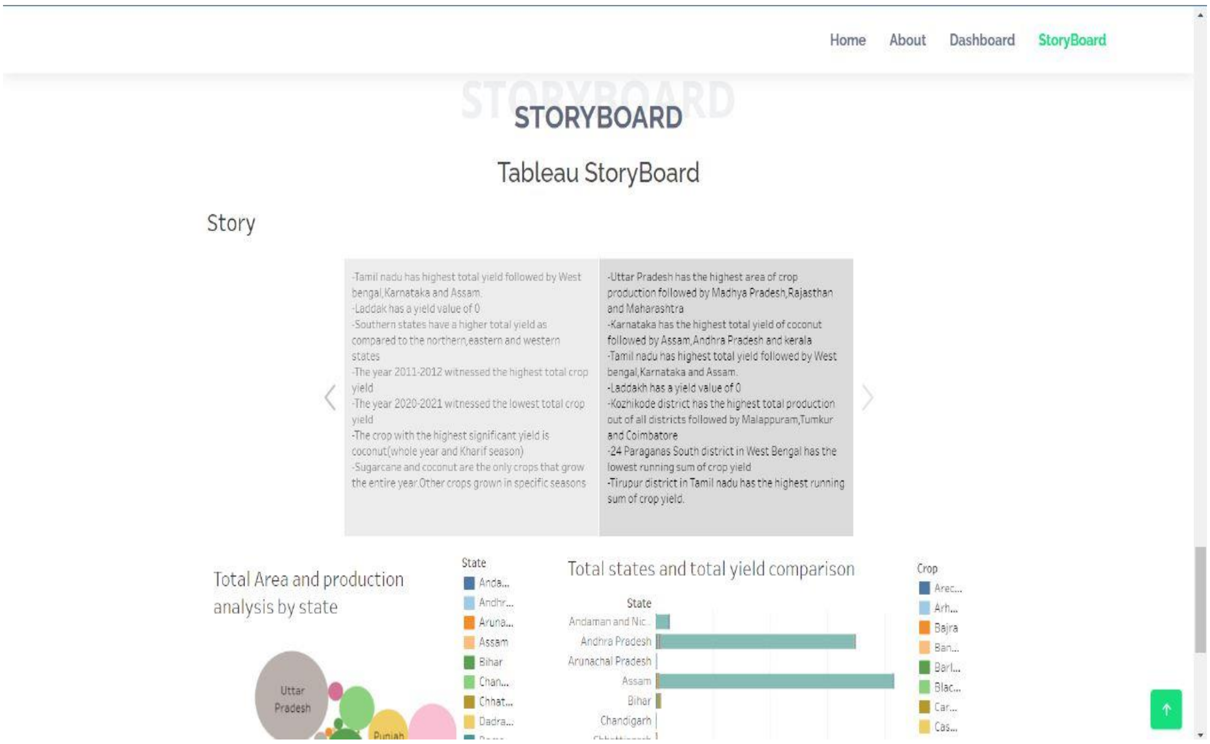
Season

WEB UI


Maximizing Crop Potential
File | C:/Users/jaisw/Desktop/Crop_project/eNno/index.html
Home
About
Dashboard
StoryBoard
Maximizing Crop Potential
Empowering Farmers with Actionable Insights through Analytics
Get Started
Watch Video


Home
About
Dashboard
StoryBoard
About
The project "Maximizing Crop Potential: Empowering Farmers with Actionable Insights through Analytics" aims to revolutionize the agricultural sector by harnessing the power of data analytics. By leveraging advanced technologies such as Tableau and IBM Cognos, our team is dedicated to providing farmers with valuable insights to maximize their crop yields and make informed decisions. Utilizing Tableau and IBM Cognos, our project delivers intuitive visualizations. Customizable dashboards and storytelling features enable informed decision-making, optimizing resource allocation and increasing agricultural productivity.
Ultimately, the "Maximizing Crop Potential" project aims to bridge the gap between traditional farming practices and modern data analytics techniques. By providing farmers with the tools and knowledge to leverage data effectively, we aim to enable them to make more informed decisions, optimize resource allocation, mitigate risks, and ultimately increase their crop yields, leading to improved sustainability and profitability in the agricultural sector.
Dataset Link
CALL TO ACTION


Home
About
Dashboard
StoryBoard
DASHBOARD
Tableau Dashboard
Yield analysis as per state
Yield
0
5,617,809
China
Pakistan
Time series analysis-total yield
Year
1600K
1400K
1200K
1000K
800K
600K
400K
200K
0K
Yield


Home
About
Dashboard
StoryBoard
STORYBOARD
Tableau StoryBoard
Story
-Tamil nadu has highest total yield followed by West bengal,Karnataka and Assam.
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-Tirupur district in Tamil nadu has the highest running sum of crop yield.
Total Area and production analysis by state
State
Anda...
Andhr...
Aruna...
Assam
Bihar
Chan...
Chhat...
Dadra...
Uttar Pradesh
Punjab
Total states and total yield comparison
State
Andaman and Nic..
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chandigarh
Crop
Arec...
Arh...
Bajra
Ban...
Barl...
Blac...
Car...
Cas...

7. ADVANTAGES

Maximizing crop potential has several benefits for individual farms as well as the larger agricultural industry. Here are several major advantages:

1) **Increased Yield**: By implementing practices that optimize crop potential, farmers can achieve higher yields. This translates into more produce per unit of land, leading to increased profitability and food availability.

2**) Enhanced Profitability**: Maximizing crop potential often results in higher revenues for farmers. Increased yields, coupled with efficient resource management, can improve profitability by reducing production costs and maximizing returns on investment.

3) **Food Security**: With a growing global population, maximizing crop potential is crucial for ensuring food security. By increasing yields, farmers can produce more food, helping to meet the rising demand and reduce the risk of food shortages.

4) **Environmental Sustainability**: Maximizing crop potential can be achieved through sustainable farming practices. Implementing strategies such as crop rotation, integrated pest management, and efficient water and nutrient management reduces the reliance on chemical inputs and minimizes the environmental impact of agriculture.

5) **Resource Efficiency**: Optimizing crop potential involves efficient utilization of resources like water, fertilizers, and energy. By employing precision agriculture techniques, farmers can apply these resources more effectively, reducing waste and minimizing the overall environmental footprint of farming operations.

Overall, It benefits farmers, consumers, and the environment by increasing yields, enhancing profitability, ensuring food security, and promoting sustainable and resilient farming systems.

DISADVANTAGES

While maximizing crop potential brings numerous benefits, there are also some potential disadvantages to consider. These disadvantages can arise if crop optimization is pursued without careful consideration of ecological, social, and economic factors. Here are a few possible disadvantages:

1) Environmental Impact: Overemphasis on maximizing crop potential can lead to increased use of agrochemicals, such as fertilizers and pesticides, which may have negative impacts on soil health, water quality, and biodiversity. Excessive use of resources like water can also strain local water sources, leading to water scarcity and ecological imbalances.

2) Soil Degradation: Intensive farming practices focused solely on maximizing crop yields can deplete soil fertility over time. Continuous monoculture, excessive tillage, and inadequate soil management practices can lead to soil erosion, reduced organic matter content, and degradation of soil structure and health.

3) Loss of Biodiversity: Simplifying agricultural landscapes for the purpose of maximizing crop yields can lead to a loss of biodiversity. The removal of natural habitats, reduction in plant

diversity, and disruption of ecological balance can negatively impact pollinators, beneficial insects, and other wildlife species.

It's important to strike a balance between maximizing crop potential and promoting sustainable agricultural practices that consider environmental, social, and economic factors. Implementing sustainable farming techniques, diversifying crop rotations, and adopting precision agriculture can help mitigate these potential disadvantages while still achieving high productivity.

8. APPLICATIONS

Visualization can play a significant role in maximizing crop potential by providing valuable insights, aiding decision-making, and improving overall farm management. Here are some key applications of visualization in crop optimization:

1) Field Mapping and Planning: Visualization tools can be used to create digital maps of fields, capturing key features such as topography, soil types, and drainage patterns. By visually analyzing these maps, farmers can identify areas with different soil conditions and plan crop rotations, irrigation systems, and nutrient management strategies accordingly.

2) Crop Monitoring and Health Assessment: Remote sensing technologies, such as satellite imagery and drones, can capture high-resolution data on crop health, growth, and nutrient status. Through visualization techniques like normalized difference vegetation index (NDVI) mapping, farmers can identify areas of low or high crop vigor, detect early signs of pest or disease infestations, and make informed decisions on targeted interventions.

3)Weather and Climate Analysis: Visualization tools can help farmers understand weather patterns and climate data more effectively. By visualizing historical and real-time weather information, such as temperature, rainfall, and wind patterns, farmers can make better-informed decisions on irrigation scheduling, planting dates, and crop protection strategies.

4) Yield Mapping and Analysis: Yield data collected during harvest can be processed and visualized to generate yield maps. These maps allow farmers to visualize spatial variations in crop performance, identify areas of high or low yields, and investigate underlying factors that contribute to these variations. This information can guide future management decisions and precision farming practices.

9. CONCLUSION

In conclusion, maximizing crop potential benefits farmers, the agricultural industry, and society at large in a number of ways. We can raise production, improve profitability, guarantee food security, and save the environment by putting sustainable agriculture practices into practice.

Increasing agricultural potential offers benefits like higher yields, increased profitability, and more food availability. We can lessen agriculture's negative environmental effects, increase resource efficiency, and protect biodiversity by implementing sustainable farming techniques. Improved nutrition results, rural development, and economic growth are all benefits of maximizing agricultural potential.

It's crucial to consider any potential drawbacks, though. A focus on increasing crop potential at the expense of ecological, social, and economic considerations can result in biodiversity loss, soil deterioration, and environmental degradation. Additionally, it might ignore societal repercussions, present financial dangers, and jeopardize the nutritional value of food.

We must embrace precision agriculture, digital farming platforms, big data analytics, and climate-smart agriculture in order to overcome these obstacles and take advantage of the opportunities presented by the future. Increased production and efficiency will result from the integration of biotechnology, robotics, and automation. To maximise crop potential while balancing productivity, profitability, and environmental stewardship, collaboration, knowledge sharing, and sustainable practises are essential.

We can create a future with optimised crop potential that supports global food security, economic prosperity, and environmental sustainability by using technology, data, and sustainable farming practises.

10. FUTURE SCOPE

The future scope of maximizing crop potential is promising, with advancements in technology, data analytics, and sustainable agriculture practices. Here are some key areas that hold potential for further development and innovation:

1) Precision Agriculture: The adoption of precision agriculture techniques is expected to grow, enabling farmers to optimize crop potential by precisely managing resources and tailoring interventions at the individual plant or field level. Advancements in sensors, drones, robotics, and artificial intelligence will further enhance the accuracy and efficiency of precision agriculture systems.

2) Digital Farming Platforms: Integrated digital platforms that combine data collection, analytics, and decision support tools will become more prevalent. These platforms will provide farmers with real-time insights, personalized recommendations, and the ability to monitor and manage their crops remotely. Such platforms will facilitate better decision-making and promote sustainable farming practices.

3) Big Data Analytics: The increasing availability of data from various sources, such as remote sensing, weather stations, and farm management systems, will create opportunities for advanced data analytics. Machine learning and predictive modeling techniques will help identify patterns, optimize crop management strategies, and provide early warnings for pest outbreaks, diseases, or extreme weather events.

4) Climate-Smart Agriculture: With the need to adapt to changing climatic conditions, the future of crop optimization lies in climate-smart agriculture. This approach integrates innovative practices that enhance productivity, build resilience, and reduce greenhouse gas emissions. Developing climate-resistant crop varieties, implementing agroforestry systems, and utilizing precision irrigation technologies are among the areas of focus.

11. REFERENCES

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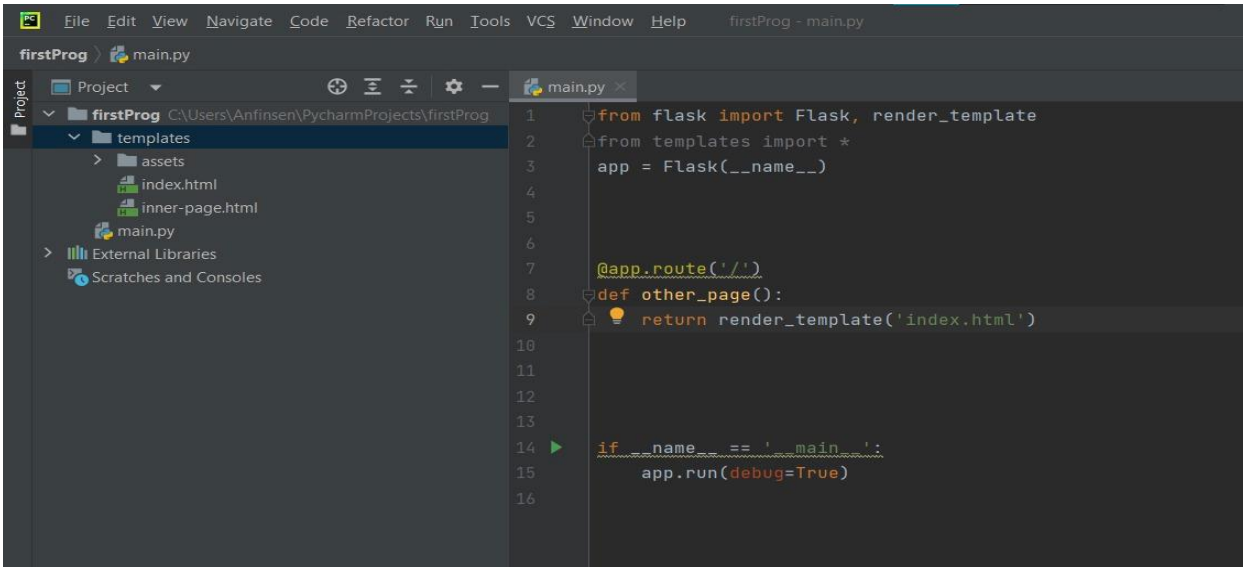
[5] Heins, R. D., Liu, B., & Runkle, E. S. (1998, August). Regulation of crop growth and development based on environmental factors. In *XXV International Horticultural Congress, Part 3: Culture Techniques with Special Emphasis on Environmental Implications, 513* (pp. 17-28).

12. APPENDIX

A. Source code



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Press CTRL+C to quit
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