DA ReportTemplate

Satya Prakash Sharma

1. INTRODUCTION

1.1 Project Overview

This project, titled "Plant Growth Insights Dashboard", is focused on analyzing how different environmental and management factors influence plant growth stages. Using Power BI, we've built an interactive dashboard that allows users to explore the relationships between variables such as soil type, sunlight hours, water frequency, fertilizer type, temperature, and humidity with plant development.

The primary goal is to assist agriculture-based companies in identifying optimal conditions that lead to healthy and consistent plant growth. This project brings data-driven decision-making into agriculture, offering valuable insights that help improve productivity and sustainability in farming.

1.2 Objectives

- To identify the key environmental and management factors affecting plant growth.
- To build an interactive dashboard using Power BI for better visual analysis.
- To help agriculture companies standardize optimal growing conditions.
- To improve crop yield and plant health through data-based decisions.
- To simplify complex data using visualizations like decomposition trees, bar charts, pie charts, and scatter plots.

2. Project Initialization and Planning Phase

2.1 Define Problem Statement

Inconsistent plant growth across different locations and farming setups creates challenges for agriculture companies. Factors like soil type, temperature, watering patterns, and fertilizer usage can vary, affecting the overall health and yield of plants. Without proper analysis, it's difficult to know which conditions lead to better growth. This project aims to solve this by using data analytics to find patterns and identify the best combinations of environmental and management factors for healthy plant development.

2.2 Project Proposal (Proposed Solution)

The proposed solution is to develop a Power BI dashboard that visualizes plant growth patterns based on collected environmental and management data. By analyzing this data, the dashboard will provide clear insights into what factors contribute positively or negatively to plant growth. The solution includes using calculated columns, decomposition trees, and various chart types to make the data easy to understand and explore.

2.3 Initial Project Planning

- Tool Chosen: **Power BI Desktop**
- Dataset Provided: Environmental and plant growth data (CSV format)
- Target Users: Agriculture-based companies (e.g., ABC Greenhouses, GreenEarth Farms)

- Key Visuals Planned: Decomposition Tree, Clustered Bar Chart, Pie Chart, Scatter Plot, KPI Cards
- Timeline:
  - o Week 1: Understanding data and planning
  - o Week 2: Building visuals and layout
  - o Week 3: Finalizing dashboard and insights
  - o Week 4: Report preparation and submission

3. Data Collection and Preprocessing Phase

3.1 Data Collection Plan and Raw Data Sources Identified

The dataset was provided in CSV format and contains plant-related observations including:

- Soil Type
- Temperature
- Humidity
- Fertilizer Type
- Watering Frequency
- Sunlight Hours
- Plant Growth Stage

This data represents real-world farming conditions and was used as the base for all visualizations. It was loaded into Power BI Desktop for analysis and transformation.

3.2 Data Quality Report

After loading the dataset, the following data quality checks were performed:

- Checked for missing or blank values
- Verified data types (numeric, text, categorical)
- Removed unnecessary columns like ID (if not used)
- Created new calculated columns such as:
    - **Temperature_Range** (e.g., Low, Medium, High)
    - **Humidity_Level** (e.g., Low, Medium, High)

The dataset was clean and did not contain any critical issues that would affect the accuracy of visualizations.

3.3 Data Exploration and Preprocessing

Using Power BI's **Power Query Editor**, the following preprocessing steps were done:

- Removed columns not contributing to visual insights
- Created calculated columns using **DAX** (Data Analysis Expressions)
- Renamed fields for better readability in visuals
- Grouped numerical values into meaningful categories (like temperature range)
- Ensured consistent formatting and filtered out any invalid entries

4. Data Visualization

4.1 Framing Business Questions

Before building the dashboard, the following business questions were framed to guide the analysis:

What environmental conditions lead to the best plant growth?

Which soil type, fertilizer, and watering pattern give the highest growth milestones?

How does temperature and humidity affect plant development?

Can we identify ideal combinations of conditions for organic or smart farming?

Which areas need improvement in current farming practices?

These questions helped in deciding the type of visualizations to include and which fields to analyze deeper using decomposition trees and measures.

4.2 Developing Visualizations

Based on the questions and dataset, the following visualizations were developed using Power BI:

Decomposition Tree

To drill down into growth milestone counts by factors like soil type, water frequency, and sunlight hours.

Clustered Bar Charts

Used to compare how different ranges of temperature and humidity affect plant growth stages.

Pie Chart

Shows the distribution of different soil types in the dataset.

Scatter Plot

Displays the relationship between sunlight hours and plant growth milestones.

KPI Cards

Displayed overall insights such as total plant records, most frequent growth stage, and average growth under specific conditions.

All visuals were customized using a clean layout, with a light background and dark green blocks for better contrast and readability. Filters and slicers were also added to make the dashboard interactive.

5. Dashboard

5.1 Dashboard Design File

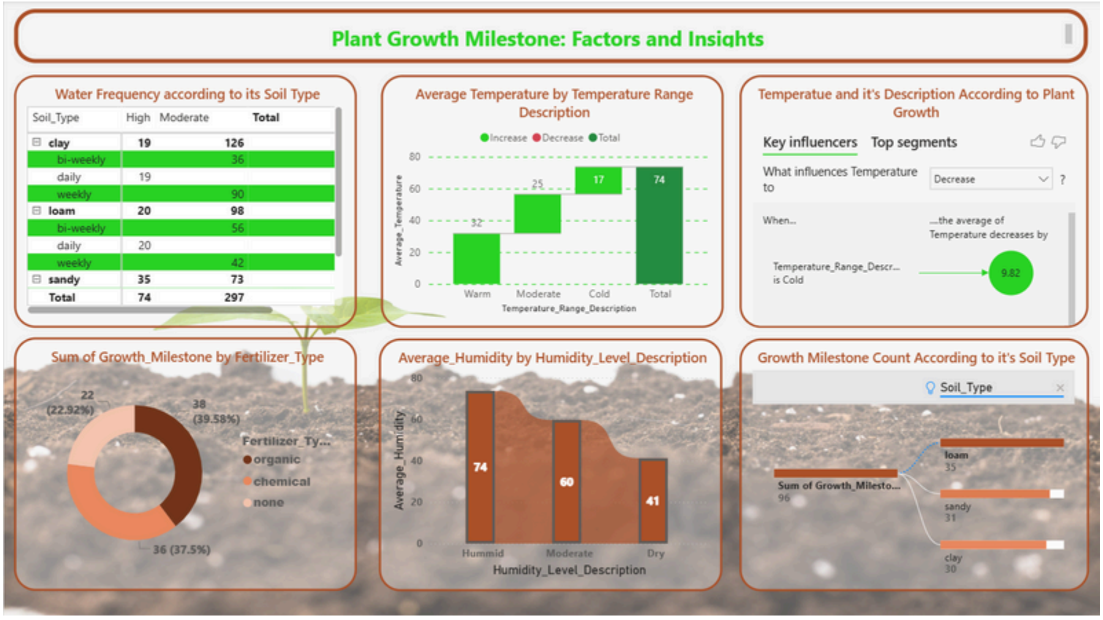
The final dashboard was designed using Power BI with a focus on clarity, simplicity, and user interaction. The layout follows a structured format where key visualizations are arranged in logical sections, allowing users to easily interpret the data.

The key design elements include:

- **Theme:** Light background with dark green visual blocks for a clean and eco-friendly appearance.
- **Title Box:** Clearly displayed at the top as *"Plant Growth Insights Dashboard"*, center-aligned with proper formatting to grab attention.
- **Visual Placement:** Cards, bar charts, pie charts, and decomposition trees were spaced uniformly to maintain a clean and symmetrical layout.
- **Filters and Slicers:** Enabled interactive filtering by soil type, temperature range, humidity level, and other key variables.
- **Consistency:** Font size, colors, and grid lines were adjusted across all visuals for a uniform and professional look.
- **Calculated Fields:** DAX-based columns such as Temperature Range and Humidity Level were created to simplify complex data and group values.

The final dashboard is fully interactive, easy to navigate, and highlights the most important insights regarding plant growth under various environmental and management conditions.

Below is a screenshot of final power bi dashboard design:



6. Insights Derived

Based on the Power BI dashboard and data analysis, the following insights were derived:

6.1 Optimal Growth Conditions

- Loam soil showed the highest growth milestone (35), followed closely by sandy (31) and clay (30).
- Moderate temperature (around 25°C) is linked with better plant growth across all soil types.
- Daily watering with organic fertilizers consistently leads to higher growth milestones.

6.2 Fertilizer Effectiveness

• Organic fertilizers contributed the most to plant growth milestones.

• Chemical fertilizers performed slightly better than no fertilizer but less effective than organic ones.

6.3 Water Frequency Trends

• Daily watering had the highest impact on plant growth.

• Bi-weekly watering showedmoderate results, while weekly watering was least effective overall.

6.4water frequency and Fertilizer Combinations

• Loam soil + Organic fertilizer + Daily watering emerged as the most successful combination.

• Sandy soil with chemical fertilizers also performed well, though not as high as organic treatments.

6.5 Growth Efficiency

- The overall growth efficiency (milestone per temperature unit) was found to be **0.07**, indicating scope for optimization.
- The dashboard helps isolate low-performing conditions for better decision-making.

These insights support actionable decisions for improving agricultural practices, especially in organic farming and smart irrigation techniques.

7. Performance Testing

7.1 Utilization of Data Filters

To improve user interaction and dynamic analysis, multiple filters and slicers were added in the Power BI dashboard. These filters help segment the data across various factors affecting plant growth. The following filters were utilized:

- **Soil Type** – to compare growth across clay, sandy, and loam soils
- **Fertilizer Type** – to analyze performance of organic, chemical, and no fertilizer
- **Water Frequency** – daily, weekly, and bi-weekly options

- **Temperature Range** – grouped into low, moderate, and high
- **Humidity Level** – low, moderate, and high

These filters allow users to drill down into specific scenarios and combinations to better understand their effect on plant growth.

7.2 No. of Calculation Fields

To support deeper analysis and meaningful categorization, the following calculated columns and measures were created using DAX:

- **Temperature_Range** – categorized temperature values into Low, Moderate, and High
- **Humidity_Level** – categorized humidity values similarly
- **Average Growth Milestone** – created using a measure to analyze performance under different groupings

In total, **3 calculated fields** were created to enhance data insights and simplify visuals.

7.3 No. of Visualizations

The final dashboard includes **a total of 6 visualizations**, carefully selected to present different aspects of plant growth:

- 1 Decomposition Tree
- 1 Clustered Column Chart
- 1 Pie Chart
- 1 Scatter Plot
- 2 KPI Cards

These visuals were arranged with appropriate spacing, background contrast, and formatting to ensure clarity and usability.

8.Conclusion / Observation

The Power BI dashboard built for the analysis of plant growth stages effectively highlighted how different environmental and management factors influence plant development. Through the use ofinteractive visuals and filters, the project provided clear answers to keybusiness questions such as:

•Which soil types promote better growth?
•What fertilizer and water combinations yield the best results?
•How do temperature and humidity ranges affect overall performance?

The decomposition tree helped identify the best-performing combinations, and the categorized fields (like Temperature_Range andHumidity_Level) simplified data understanding.

Overall, the dashboard serves as a useful tool for decision-making in agriculture, especially for companies working with organic farming or smart irrigation systems. It helps stakeholders focus on the right growing conditions to boost yield, optimize resource use, and maintain consistency across greenhouse operations.

9. Future Scope

This Power BI project lays the foundation for further exploration in data-driven agriculture. In the future, several improvements and enhancements can be implemented to make the dashboard even more powerful and practical.

Possible future developments include:

• Integration with IoT Devices – Smart sensors for real-time monitoring of soil moisture, temperature, and humidity can feed live data into the dashboard.

• Predictive Analytics – Machine learning models can be used to forecast plant growth stages based on current conditions.

• Weather API Integration – External APIs can be linked to provide dynamic environmental data like rainfall or sunlight forecasts.

• Mobile Accessibility – The dashboard can be optimized for tablets or mobile devices to help field-level users.

• Scalability – The model can be extended to cover multiple crops, regions, or seasons for larger agricultural enterprises.

With these enhancements, the system can become a full-fledged smart agriculture solution, assisting in real-time decisions and resource planning.

10. Appendix

10.1 Source Code (if any)

Since the project was built using Power BI, most of the work involved no traditional programming. However, **DAX formulas** were used for creating calculated columns and measures such as Temperature_Range and Humidity_Level. These formulas helped in grouping data and enhancing insights.

The .pbix Power BI dashboard file contains all the visuals, filters, and logic used in the project. The source file will be made available via GitHub.

10.2 GitHub & Project Demo Link

The full project, including the Power BI dashboard file and this report documentation, will be uploaded to GitHub for future access.