Final Project Report: Plant Growth Milestone Analysis

1. Introduction

    1.1. Project Overview

The project focused on building a "Plant Growth Milestone: Factors and Insights" dashboard in Power BI. The goal was to provide visual correlations between key environmental and management factors (Temperature, Humidity, Soil Type, Watering Frequency, Fertilizer Type) and the resulting Growth

Milestone Count.

    1.2. Objectives

To define the optimal combination of Soil Type and Watering Frequency for maximizing growth milestones.

To quantify the differential impact of segmented Temperature and Humidity levels on the overall Growth Milestone Count.

To centralize complex environmental and management data into an intuitive and interactive dashboard for researchers.

2. Project Initialization and Planning Phase

    2.1. Define Problem Statement

PS-1 (Researcher Perspective): A researcher is trying to quickly determine optimal Soil/Watering combinations, but lacks a centralized visualization tool to cross-reference these factors, which makes them feel inefficient and frustrated.

2.2. Project Proposal (Proposed Solution)

Approach: Utilized Data Segmentation (creating levels like 'Cold,' 'Humid') and Visualization (Cross-Tabulation, Waterfall, Key Influencers charts) to link management decisions to growth outcomes.

Key Features: Environmental KPIs (Average Sunlight, Humidity, Temp), a Cross-Tabulated Table for management analysis, and a Key Influencers visual for temperature factor analysis.

2.3. Initial Project Planning

High Priority Tasks (Sprint-1/2 focus): Creating measures for Average_Sunlighthours,

Average_Humidity, Average_Temperature, and developing the Cross-Tabulated Table showing Soil Type vs. Watering Frequency.

3. Data Collection and Preprocessing Phase

3.1. Data Collection Plan and Raw Data Sources Identified

Data was collected from Historical Sensor Logs (for continuous environmental data) and Management Log Sheets (for categorical labels like Soil Type and the Growth Milestone Count outcome).

3.2. Data Quality Report

Issue & Resolution: Missing sensor values were resolved using Last Observation Carried Forward (LOCF) or Averaging techniques for small gaps.

3.3. Data Exploration and Preprocessing

Transformation: Defined categorical segmentation for continuous variables, such as Temperature_level_description and Humidity_level_description.

Data Modeling: A unified data model was created, and core DAX measures were implemented to display overall averages (e.g., Average_Humidity: 58.10).

4. Data Visualization

4.1. Framing Business Questions

The dashboard was built to answer questions like: "What is the total growth count across all factors?" and "What is the contribution of each Fertilizer Type?".

4.2. Developing Visualizations

The visualizations developed directly support the required insights:

Waterfall Chart: Visually represents the change in Average Temperature across segmented levels (Warm, Moderate, Cold).

Area Chart: Displays the Growth_milestone_count by Humidity_level_description, clearly showing the peak performance at the Moderate level.

5. Dashboard

5.1. Dashboard Design File

The dashboard features an overall Total Growth Milestone Count of 96. Key visuals:

Table: Cross-references Soil Type (clay, loam, sandy) against watering frequency (bi-weekly, daily, weekly) with a total growth count of 11,213.09.

Doughnut Chart: Illustrates that Chemical fertilizer contributes the largest percentage of milestones at 39.58% (38 milestones).

6. Report

6.1. Story Design File

The narrative is built around comparative performance:

Optimal Watering Protocol: Weekly watering (1,827.24 clay+808.54 loam+3,722.31 sandy=6,358.09 total) is the most efficient and successful schedule, contributing equally to 38 milestones alongside Daily watering.

7. Performance Testing

7.1. Utilization of Data filters

Data filters allow users to isolate performance. For example, filtering the sandy soil row shows that weekly watering yields the highest growth count in that soil type at 3,722.31.

7.2. No of Calculation Field

The dashboard relies on key calculated measures (e.g., Average_Temperature,

Growth_milestone_count) and at least 5 segmentation fields (Soil_Type, Watering_Frequency, Fertilizer_Type, Temp_level_description, Humidity_level_description).

7.3. No of Visualization

The dashboard utilizes 7 distinct visualizations to convey insights (3 KPIs, 1 Table, 1 Doughnut, 1 Waterfall/Bar Chart, 1 Key Influencers/Scatter Plot).

8. Conclusion/Observation

The analysis provides actionable, quantitative evidence for managing plant growth:

Humidity Threshold: Performance peaks in Moderate humidity; the Humid level, despite its high average of 74.02, has a lower milestone count.

Temperature Control: The Key Influencers visual precisely quantifies the effect of the Cold segment, showing it decreases the average temperature by 9.7.

Best Soil: Clay soil is the most effective at absorbing or retaining light (Average Sunlighthours: 7.27).

9. Future Scope

Integrate Time-Series Analysis to identify seasonal trends in growth milestones.

Develop a Predictive Model (ML) to forecast the Growth Milestone Count based on planned management inputs (Soil/Water/Fertilizer).

10. Appendix

Project Demo Link : https://drive.google.com/file/d/12PZ15uJzTr-FHAjgzNRBeNg7ecN7pC4s/view?usp=drive_link

Github Link:

https://github.com/Swaraj-001/Predicting-Plant-Growth-Stages-with-Environmental-and-Management-Data-Using-Power-BI.git