Project Assignment

Morphological Attributes of Plants Under Different Treatments

Treatment	Fruit Weight (g)	Fruit Diameter (cm)	Fruit Length (cm)	Yield per Plant (g)
T1	38.7±0.0577e	3.3±0.0577f	14.5±0.0577e	220.7±0.0577c
T2	42.1±0.0577c	3.9±0.0577b	14.9±0.0577d	198.7±0.0577e
T3	36.2±0.0577h	3.5±0.0577e	13.4±0.0577f	186.9±0.0577g
T4	29.1±0.0577j	2.8±0.0577h	12.1±0.0577h	120.6±0.0577k
T5	44.5±0.0577b	3.7±0.0577cd	15.6±0.0577b	229.8±0.0577b
T6	37.5±0.0577g	3.6±0.0577de	15.4±0.0577c	219.5±0.0577d
T7	47.8±0.0577a	4.5±0.0577a	16.4±0.0577a	243.8±0.0577a
T8	39.8±0.0577d	3.7±0.0577cd	14.8±0.0577d	195.8±0.0577f
T9	37.9±0.0577f	3.8±0.0577bc	15.4±0.0577c	180.6±0.0577h
T10	32.5±0.0577i	3.1±0.0577g	13.5±0.0577f	167.5±0.0577i
T11	27.8±0.0577k	2.8±0.0577h	12.7±0.0577g	131.2±0.0577j
T12	26.1±0.0577l	2.1±0.0577i	11.8±0.0577i	110.5±0.0577l

Table 1. The table summarizes the impacts of various treatments on plant morphological traits, including Fruit Weight (g), Fruit Diameter (cm), Fruit Length (cm), and Yield per Plant (g). The treatments are listed alongside their corresponding mean values ± standard error (SE), highlighting significant differences. Treatment T1 serves as the control and consists of 500 ppm saline without salicylic acid. Treatment T2 incorporates 100 ppm salicylic acid, while T3 involves 500 ppm saline alone. Treatments T4, T5, and T6 represent saline levels of 2500 ppm, 5000 ppm, and 7500 ppm, respectively. Combination treatments include T7 (500 ppm saline + 50 ppm salicylic acid), T8 (2500 ppm saline + 50 ppm salicylic acid), T9 (5000 ppm saline + 50 ppm salicylic acid), and T10 (7500 ppm saline + 50 ppm salicylic acid). Further combinations include T11 (2500 ppm saline + 100 ppm salicylic acid) and T12 (7500 ppm saline + 100 ppm salicylic acid). Mean values ± SE for each trait are presented, with significant groupings determined via ANOVA analysis.

Results & Discussion

The data in Table 1 reveal varied responses of plant morphological traits—specifically Fruit Weight, Fruit Diameter, Fruit Length, and Yield per Plant—across treatments T1 to T12. Treatment T7, consisting of 500 ppm saline combined with 50 ppm salicylic acid, exhibited the best performance in all measured parameters, achieving the highest values: Fruit Weight (47.8 g), Fruit Diameter (4.5 cm), Fruit Length (16.4 cm), and Yield per Plant (243.8 g). These results, classified under statistical grouping 'a,' were significantly superior to those of other treatments. Conversely, Treatment T12, which involved the highest saline concentration (7500 ppm) paired with 100 ppm salicylic acid, produced the lowest values across all traits: Fruit Weight (26.1 g), Fruit Diameter (2.1 cm), Fruit Length (11.8 cm), and Yield per Plant (110.5 g). These outcomes, categorized in statistical grouping 'l,' highlight the severe stress and notable reduction in plant growth and productivity.

The intermediate treatments showed varied effects, with the control treatment (T1) yielding moderate values but outperforming certain treatments with higher saline or salicylic acid levels, such as T2 and T6, in terms of yield. Interestingly, the inclusion of salicylic acid at moderate saline concentrations (as observed in T5 and T7) appeared to mitigate the adverse effects of salinity, indicating a protective role of salicylic acid in alleviating salt stress. The data reveal a complex interplay between salicylic acid and saline concentrations, suggesting that specific salicylic acid levels can enhance tolerance to salinity, thereby improving plant morphology and yield. These findings validate the hypothesis that salicylic acid strengthens plant resilience against abiotic stresses and offers valuable implications for agricultural practices in saline environments. Overall, the study highlights the need to optimize salicylic acid and saline concentrations to maximize plant growth and productivity, demonstrating the potential of strategic agronomic interventions to enhance crop performance under challenging conditions.

PCA, Dendogram & Correleation plot of the Treatment of the Project Dataset

PCA- Biplot

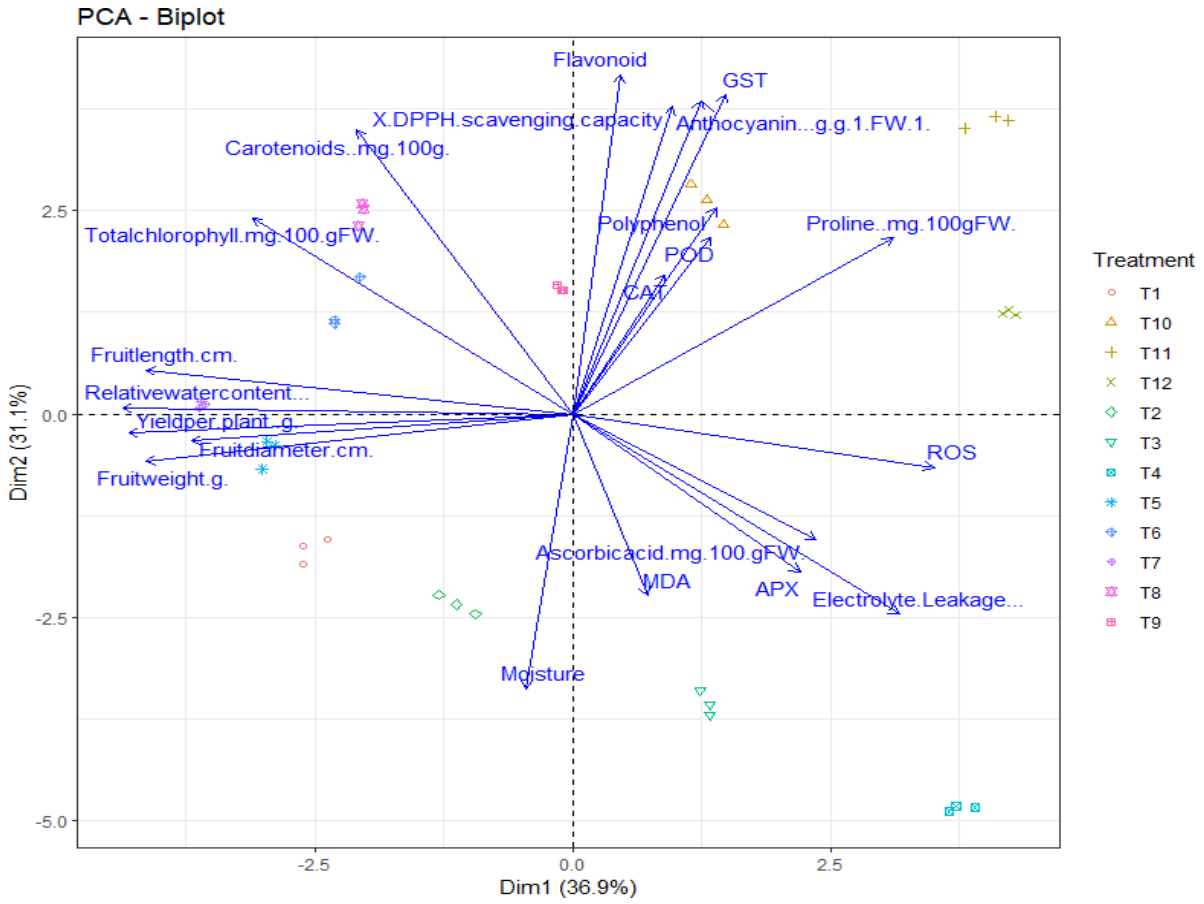

Figure 1. The Principal Component Analysis (PCA) biplot depicts the distribution of treatments and their corresponding trait responses. PC1 and PC2 explain 36.9% and 31.1% of the total variance, respectively. Traits such as flavonoid content, GST activity, and anthocyanin levels are strongly associated with treatments featuring higher salicylic acid and salinity concentrations. Conversely, yield-related traits, including yield per plant and fruit weight, are more closely associated with treatments involving lower salinity levels. This visualization highlights the influence of salinity and salicylic acid on plant traits, showing distinct clustering patterns among the treatments.

2. Correlation (Pearson)

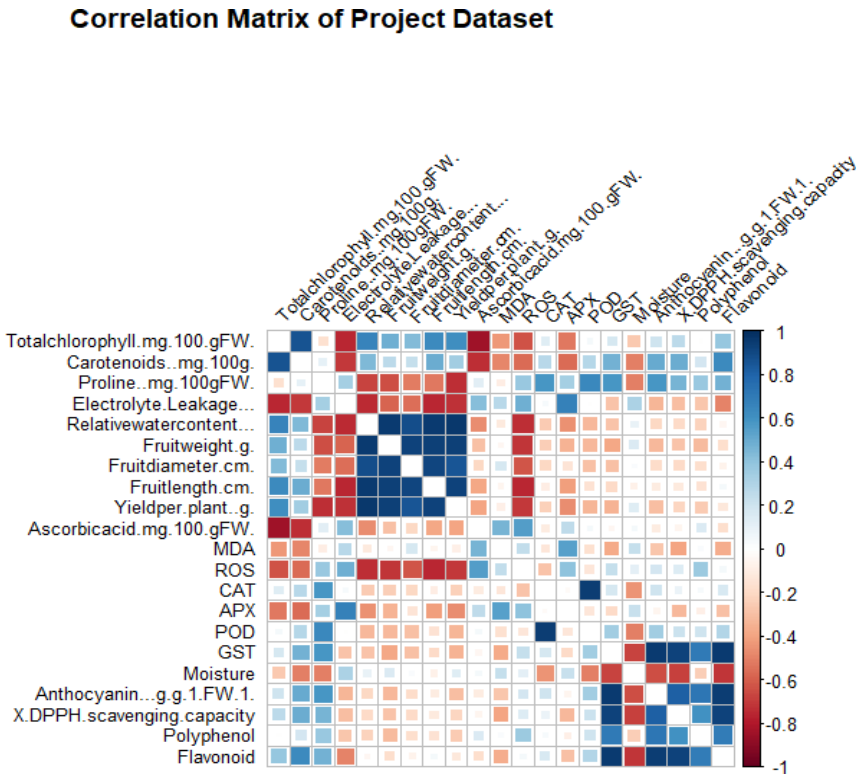

Figure 2. The correlation matrix for the dataset depicts the relationships between various plant traits across different treatments. Positive correlations are represented in shades of blue, while negative correlations appear in shades of red, with deeper colors signifying stronger correlation strengths. Distinct clusters are evident, showing strong positive correlations among traits related to fruit characteristics (e.g., fruit weight and fruit diameter) and biochemical components such as polyphenol and flavonoid levels. This matrix provides valuable insights into the interactions between physiological and biochemical traits influenced by saline and salicylic acid treatments.

3. Dendrogram

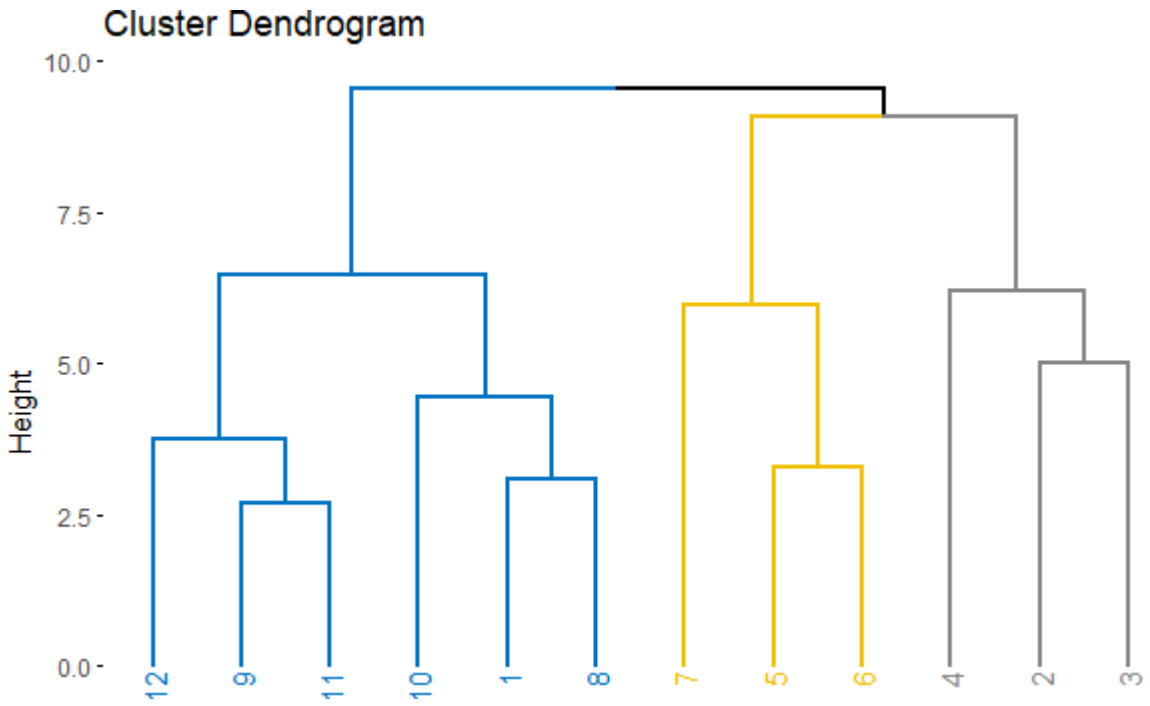

Figure 3. The hierarchical cluster dendrogram classifies treatments based on similarities in physiological and biochemical traits, grouping them according to their response profiles. Treatments such as T12, T9, T11, T10, and T8 are grouped, reflecting similar stress responses under high salinity and/or salicylic acid conditions. In contrast, treatments with lower salinity levels, including T3, T2, and T4, form distinct clusters, indicating different adaptation patterns. This dendrogram provides insights into the effects of varying salinity and salicylic acid levels, highlighting treatments with comparable stress response mechanisms.