



Leaf characteristics of 'Harumanis' mango (*Mangifera indica* L.) trees planted under open-area and greenhouse conditions

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ABSTRACT

Leaf characteristic is a significant element in most plant physiological studies, especially fruit trees. Therefore, to improve our understanding of this aspect, the characteristics of the leaves of Harumanis mango trees that have been planted under two different conditions (i.e. open-area and greenhouse) were evaluated. Leaf characteristics such as leaf area (cm²), leaf width (cm), leaf length (cm) as well as their fresh (g) and dry weight (g), including leaf moisture content (%) were measured and compared between the trees growing under greenhouse and open area. Statistical analyses indicate that the leaf area, leaf length and moisture content of leaves show significantly different ($P < 0.05$) between growing condition but not for leaf width, the fresh and dry weights. Our results, therefore, suggest that different growing conditions may have affected the characteristics of tree organs such as leaves that may contribute to the environmental adaptation and tree productivity of this high-value mango crop.

INTRODUCTION & AIM OF STUDY

- Mango (*Mangifera indica* L.) fruits ranks among the most significant and widely consumed tropical fruits globally. In Malaysia, the Harumanis cultivar, designated as MA 128, is extensively cultivated, especially in the Northern States of Malaysia [1].
- This mango cultivar has a substantial economic important due to its exceptional flavour, high vitamin content, appealing appearance, and widespread consumer preference in Malaysia.
- The economic significance of this cultivar has prompted local growers to engage in large-scale cultivation; however, there remains a scarcity of information regarding the physiological characteristics of this fruit crop, particularly concerning the development of its organ such as leaves.
- In order to improve our understanding of the plant's physiological processes in tropical mango crops, an evaluation of the leaf morphological characteristics of Harumanis mango cultivar was conducted, comparing those grown under two distinct conditions: greenhouse and open area.

MATERIALS AND METHOD

- The research was carried out at the Institute of Sustainable Agro-Technology (INSAT) University Malaysia Perlis (UniMAP), Malaysia (6°6'5"34.0" N, 100°26'0.83" E) during the growing season of 2021 to 2022.
- A range of leaf sizes from the selected trees, which were cultivated under both greenhouse and open field conditions, were randomly collected using a staggered grid sampling method ($n=100$ for each growing condition).
- The Leaf Area Meter (LI-3100, LI-COR, Nebraska, USA) was used to determine the surface area (cm²) of the collected leaves, with each leaf being measured three times to ensure accuracy. Leaf characteristics, including width (cm) and length (cm), were manually measured using a flexible tape (Figure 1).
- The fresh and dry weights (g) of the leaves were recorded using a digital balance (Satorius, ELT6000). For the determination of dry weight, the leaves were placed in an oven at 80°C for a duration of 48 hours.
- The moisture content of the leaves (%) was calculated using the formula: [(fresh weight - dry weight) / fresh weight] x 100%. Since the data was not normally distributed even after transformation, the data analysis was performed using the non-parametric ANOVA (Wilcoxon Mann-Whitney U-test).

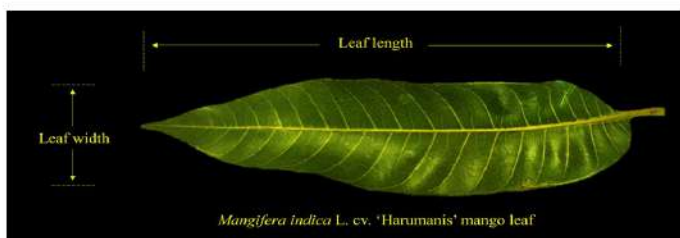


Figure 1. The morphology of *Mangifera indica* L. cv. 'Harumanis' mango leaf. The point of length (cm) and width (cm) measurement on the leaf.

RESULTS AND DISCUSSION

Table 1. Growth analysis on the leaf characteristics (leaf area, length, width, fresh and dry weight, and moisture content) of the 'Harumanis' mango planted under greenhouse and open area.

Leaf characteristics	Growth condition	Mean	P-value*
Leaf area (cm ²)	Greenhouse	76.23	P=0.03
	Open area	63.07	
Leaf length (cm)	Greenhouse	18.50	P=0.02
	Open area	16.78	
Leaf width (cm)	Greenhouse	5.38	ns
	Open area	5.05	
Leaf fresh weight (g)	Greenhouse	2.41	ns
	Open area	2.09	
Leaf dry weight (g)	Greenhouse	0.99	ns
	Open area	0.85	
Leaf moisture content (%)	Greenhouse	58.52	P=0.02
	Open area	59.57	

* Significant or not significant (ns) at $P < 0.05$ (respectively) according to the Non-Parametric Statistic (Wilcoxon Mann-Whitney U-test).

- Leaves in the greenhouse exhibited significantly larger leaf area (76.23 cm² vs. 63.07 cm², $P=0.03$) and longer leaf length (18.50 cm vs. 16.78 cm, $P=0.02$) compared to the open area. However, leaf width, fresh weight, and dry weight showed no significant differences.
- Interestingly, the leaf moisture content was slightly lower in the greenhouse (58.52%) than in the open area (59.57%), but the difference was statistically significant ($P=0.02$).
- Our results suggest that environmental factors in the greenhouse may influence certain growth aspects of the Harumanis mango, particularly leaf size and moisture retention [2, 3 & 4].

CONCLUSION & REFERENCES

- The findings of this study suggest that varying growth conditions can significantly impact the leaf morphological characteristics of the Harumanis mango. We found significant differences in leaf area, leaf length, and leaf moisture content of Harumanis mango between two different growing conditions.
- It is posited that any changes in the tree's organs, particularly the leaves, could have implications for the future productivity of Harumanis mangoes. The outcomes of this research may serve as a foundation for further assessments in the crop production strategies for the Harumanis mango cultivar.

References

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