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A Survey of Fruit Quality Properties, Growth, and Yield of Several Melon Varieties (*Cucumis melo* L.) Using Fertigation Approach

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ABSTRACT

Melons, *Cucumis melo* L., belongs to the family Cucurbitaceae. They are popular for their sweet, juicy fruit flesh with pleasant aroma. These melons are packed with numerous essential nutrients for the human body. In this study, the fruit quality properties, growth, and yield of nine different melon varieties were compared via a fertigation approach to deduce the best melon variety to be planted by melon farmers. Quantitative and qualitative traits of all nine melon varieties were collected and compared. As a result, it was discovered that the Japanese Rock Melon F1 Hybrid is an all-rounder best melon variety, with the highest seed germination percentage and fruiting percentage. On the other hand, the Sweet Green Melon F1 can also be considered the second-best choice, but the only downside is that the germination rate is significantly lower compared to others, at merely 37%. Hopefully, this study can serve as a foundation for developing a more comprehensive database for melon varieties to aid melon farmers in decision-making and further improve the industry's yield.

Keywords:*Cucumis melo* L., fertigation, fruit quality, germination rate, melon varieties

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INTRODUCTION

The melons (*Cucumis melo* L.) are family members of Cucurbitaceae. They are known vastly for their edible sweet, juicy and fleshy fruit enriched with a myriad of essential nutrients like magnesium, vitamin A, calcium, fibre, potassium, vitamin C, zinc, omega-3, iron, vitamin B6, and omega-6 (Mehra et al., 2015).

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Melons are cultivated especially in warm regions like India, Malaysia, and Iran. In Malaysia, melon production can yield as much as 5,845.81 metric tons from 313.4 ha plantation area in 2018 (18.65 metrics per ha), which was 4.63 times higher than that of paddy (4.031 metrics per ha) in the same year (Liyana & Pebrian, 2020; Statista Research Department, 2023). One of the most productive ways to cultivate melons is via the fertigation method. It is normally conducted in an open, closed or semi-closed fertigation system, requiring relatively less water consumption per unit area, space, and labour (Muhammad et al., 2017).

Interestingly, these melons come in a myriad of varieties, namely sweet green melon, sweet melon, green netted melon, rock melon, golden melon, and muskmelon (Silva et al., 2022). They share similar characteristics, such as sweet flesh, juicy texture, bright-coloured flesh, and skin with fragrance. Although they can easily be distinguished by their flesh colour, texture, skin colour, and pattern, selecting the most suitable melon variety for optimal growth, yield, and fruit quality remains a critical challenge for farmers. Existing literature does not comprehensively compare various melon varieties using fertigation, which combines irrigation and fertilization. Besides focusing on disease preventive studies on melon varieties, the focus should also be on the characterization of these melons in terms of their fruit quality, growth rate, and yield so that this documentation can facilitate melon farmers in the selection of the best melon variety to cultivate in the future (Jorge et al., 2022). In this study, nine melon varieties were documented based on their properties, and some of the best melon varieties were further deduced accordingly.

Culturing melons (*Cucumis melo* L.) is a vital aspect of the agricultural industry, given their popularity and nutritional significance. However, selecting the most suitable melon variety for optimal growth, yield, and fruit quality remains a critical challenge for farmers. Existing literature does not comprehensively compare various melon varieties using fertigation, which combines irrigation and fertilization. This research addresses this gap by thoroughly investigating the fruit quality properties, growth, and yield of nine different melon varieties, focusing on identifying the most promising variety for cultivation.

MATERIALS AND METHODS

Seedling Management

Nine melon seed types from different cultivar groups (Table 1) were bought from various seed companies. These seeds were germinated in the moistened peat moss-filled germination trays kept away from direct sunlight. The germination percentage was determined by calculating the germinated seedlings against the total planted seed. After these seedlings have expanded their true leaves (at least ten seedlings per melon variety), they are transferred to the greenhouse located at Semongok, and a complete randomized experimental design is adopted. On day 11 post-germination, these seedlings were transplanted into coco peat-filled polybags. They were maintained

carefully in a greenhouse equipped with an automatic fertigation system. The commercial premix AB fertilizers utilized in this study were bought from Lotus Farm Agritech Sdn. Bhd. (Malaysia) with fertilizer contents tabulated in Tables 2 and 3. Fertilizer was prepared by adding 100 L of water to 25 kg of fertilizer A and B separately. The 'TOP CLOUD' application was employed to manipulate the irrigation in an automated manner according to the schedule (Table 4). Foliar was performed every week (Table 5).

Table 1
List of melon varieties

Variety	Descriptive name	Cultivar groups
A	Golden Melon F1 Hybrid L	*cantalupensis*
B	Japanese Rock Melon F1 Hybrid	*reticulatus*
C	Hales Best Muskmelon	*reticulatus*
D	Rock Melon F1 Hybrid ML	*cantalupensis*
E	Sweet Melon F1 Hybrid SL	*cantalupensis*
F	Golden Melon F2 Hybrid L	*cantalupensis*
G	Golden Melon F1 Hybrid B	*cantalupensis*
H	Japanese Green Netted Melon F1 Hybrid	*reticulatus*
I	Sweet Green Melon F1	*reticulatus*

Table 2
The fertilizer contents

	Fertilizer content	Estimated amount (g)
Set A	Calcium nitrate ($CaNO_3$)	4863.2
	Ammonium nitrate (NH_4NO_3)	596.5
	Potassium nitrate (KNO_3)	1831.6
	Iron (Fe) EDTA	78.9
Set B	Monopotassium Phosphate (KH_2PO_4)	2045.5
	Magnesium sulphate ($MgSO_4$)	3578.1
	Manganese (Mn)	9.35
	Sodium borate ($Na_2B_4O_7$)	27.8
	Zinc (Zn) EDTA	8.8
	Copper (Cu) EDTA	2.8
	Ammonium molybdate ($H_8MoN_2O_4$)	0

Table 3
The estimated concentration of elements present in the fertilizers

Elements	Estimated concentration of element in fertilizer (ppm)
N	401.00
P	156.00
K	425.50
Ca	308.00
Mg	114.50
Fe	3.47
Mn	0.41
Zn	0.41
B	1.02
Cu	0.13
Mb	0

Table 4
The irrigation schedule

Day	Growth stage	Daily irrigation time
11	Seedling	8 a.m., 1 p.m., 6 p.m.
35	Flowering	8 a.m., 10 a.m., 1 p.m., 6 p.m.
45	Fruiting	7 a.m., 9 a.m., 11 a.m., 1 p.m., 3 p.m., 6 p.m.
50	Fruiting	7 a.m., 9 a.m., 11 a.m., 1 p.m., 3 p.m., 6 p.m.

Plant Management

The melon plants were given physical support as they were provided with a nylon string tied vertically to each polybag. Hands twined the newly sprouted melon stems onto the nylon strings. The axillary shoots were removed once the plant had grown more than five leaves to concentrate resources and nutrients for main stem development. For pollination purposes, the seventh to eleventh side shoots were untrimmed. Weekly chemical spraying was conducted to minimize fungal and pest manifestations (Table 6). The tallest height was recorded for each melon plant upon the emergence of the 24th leaf.

Pollination, Fruiting, and Harvesting

Manual pollination was performed on plants 35 days old and older, whereby the petals of the male flower were removed to reveal anthers before being introduced to the stigmas of the female flower (axillary shoot). Only a well-developed fruit (with the best morphological characteristics such as evenness, roundness, and plumpness) was selected for each plant, and nylon strings supported it, whereas other fruits were discarded.

Table 5
Weekly foliar application

Day	Foliar
10	Basfoliar® Aktiv SL (1 ml/500 ml)
18	Basfoliar®Avant Natur (20 ml/10 L)
25	Basfoliar® CaBMag (15 ml/10 L) + Basfoliar® Avant Natur (20 ml/10 L) + Fetrilon® Combi 2 (2.5 g/10 L)
32	Basfoliar® CaBMag (15 ml/10 L) + Basfoliar® Avant Natur (20 ml/10 L) + Fetrilon® Combi 2 (2.5 g/10 L)
39	Basfoliar® CaBMag (15 ml/10 L) + Basfoliar® Avant Natur (20 ml/10 L) + Fetrilon® Combi 2 (2.5 g/10 L)
46	Basfoliar® CaBMag (15 ml/10 L) + Basfoliar® Avant Natur (20 ml/10 L) + Fetrilon® Combi 2 (2.5 g/10 L)
53	Basfoliar® 19/19/19 (10 g/10 L)
60	Basfoliar® CaBMag (15 ml/20 L) + Fetrilon® Combi 2 (2.5 g/10 L)
67	Basfoliar® 19/19/19 (10 g/10 L)
74	Basfoliar® K (10 g/10 L)

Note. Brands of Basfoliar® Aktiv SL, Basfoliar®Avant Natur, Basfoliar® CaBMag, Fetrilon® Combi 2, Basfoliar® 19/19/19, and Basfoliar® K = COMPO EXPERT (Germany)

Table 6
Weekly chemical application

Day	Chemical
7	Previcur 840 (1 ml/500 ml) (before transplanting)
16	Fusilier (insecticide) 2.5 ml/10 L + Mancozeb MZ-45 (fungicide) 20 g/10 L
23	Fusilier (insecticide) 2.5 ml/10 L + Mancozeb MZ-45 (fungicide) 20 g/10 L
29	Nativo (2.5 g/10 L)
37	Nativo (2.5 g/10 L)
43	Nativo (2.5 g/10 L)
49	Deltamethrin 25% (2 g/10 L) + Fusilier (insecticide) 2.5 ml/10 L + Abamectin 1.8% w/w (8 ml/10 L)
51	Nativo (5.0 g/10 L)
58	Nativo (5.0 g/10 L)

Note. Previcur 840 (Bayer, Germany); Fusilier (insecticide) (Hextar, Malaysia); Mancozeb MZ-45 (fungicide) (Hextar, Malaysia); Nativo (Bayer, Germany); Deltamethrin 25% (Bayer, Germany), and Abamectin 1.8% w/w (Hextar, Malaysia)

The melon fruits were harvested by performing a T-shape cut (with at least 10 cm stem attached and one leaf attached) to ensure longer shelf life and reduce disease manifestation. Each melon fruit was documented with qualitative and quantitative data, such as weight, transverse circumference, and longitudinal circumference.

Sensory Test and Statistical Analysis

Seven randomly selected participants underwent a sensory test encompassing appearance, texture, juiciness, sweetness, and aromatics. One fruit from each melon variety was sliced and served. Each qualitative trait was graded on a scale of 5 to 1 (most preferred to least preferred).

The statistical tests done in this study include outlier detection, one-way analysis of variance (ANOVA) and Tukey's honestly significant difference (HSD) post hoc tests with IBM® SPSS® Statistics Processor (version 28.0). These tests were performed on parameters such as weight and circumference.

RESULTS AND DISCUSSION

Germination and Fruiting Performance of Melon F1 Hybrid

The melon plant height after the emergence of the 24th leaf, germination, and fruiting percentage were tabulated in Table 7. The germination percentage for the melon variety I (Sweet Green Melon F1) was the lowest. In contrast, the melon variety C (Rock Melon F1 Hybrid ML) had the highest germination percentage, 93.3%. Other melon varieties had germination percentages ranging between 66.7% and 88.9%. As for the plant height, the shortest average height (214 cm) was seen in melon variety B (Japanese Rock Melon F1 Hybrid), while the greatest average height (244 cm) was observed in melon variety I (Sweet Green Melon F1). Looking at the fruiting percentage, melon variety C (Rock Melon F1 Hybrid ML) achieved the lowest fruiting percentage of 16.67%. In contrast, melon variety E (Sweet Melon F1 Hybrid SL) achieved the highest fruiting percentage of 83.33%, followed by melon variety B (Japanese Rock Melon F1 Hybrid) (80.77%). All melon varieties had achieved fruiting percentages greater than 50%, except for C and G (Rock Melon F1 Hybrid ML and Golden Melon F1 Hybrid B).

Table 7
The plant height, germination percentage, and fruiting percentage

Melon variety	Plant height (cm)	Germination percentage (%)	Percentage of melon plants with at least one fruit (%)
A	222	70.70	67.92
B	214	77.60	80.77
C	215	93.30	16.67
D	227	66.70	79.17
E	216	88.90	83.33
F	230	69.40	58.33
G	239	76.50	41.67
H	216	84.60	63.64
I	244	37.00	70.00

Note. A = Golden Melon F1 Hybrid L; B = Japanese Rock Melon F1 Hybrid; C = Hales Best Muskmelon; D = Rock Melon F1 Hybrid ML; E = Sweet Melon F1 Hybrid SL; F = Golden Melon F2 Hybrid L; G = Golden Melon F1 Hybrid B; H = Japanese Green Netted Melon F1 Hybrid; I = Sweet Green Melon F1

Differences in Fruit Weights Across Nine Melon Varieties

The morphology of nine melon varieties is shown in Figure 1. The fruit weight graph across all nine melon varieties is depicted in Figure 2. The melon variety H (Japanese Green Netted Melon F1 Hybrid) scored the highest mean fruit weight (1.637 kg). Upon the one-way ANOVA test, significant differences were found across all melon varieties. Together with the melon varieties B, C, and I (Japanese Rock Melon F1 Hybrid, Hales Best Muskmelon, and Sweet Green Melon F1), the melon variety H (Japanese Green Netted Melon F1 Hybrid) formed a significantly greater weights cluster in contrast with the other melon varieties. Melon variety G (Golden Melon F1 Hybrid B) scored the lowest mean fruit weight, i.e., 0.832 kg. On a side note, the two outliers from melon variety B and one outlier from melon varieties F and G were detected and removed from the analysis. Surprisingly, the mean melon transverse and longitudinal circumferences (Figures 3 and 4) did not show significant differences across all melon varieties.

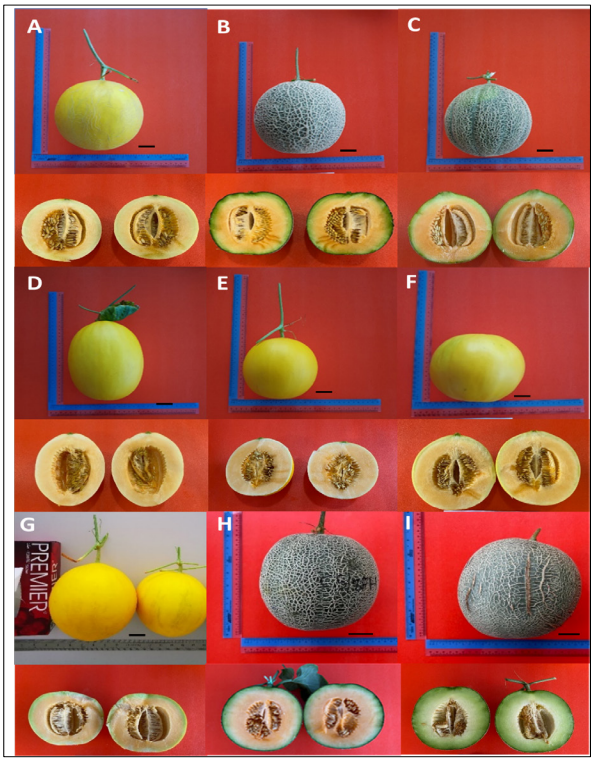

Figure 1. Morphology of nine melon varieties. The upper panel shows the whole fruit while the lower panel shows the transverse section (Scale bar = 2.5 cm measurement)

Note. A = Golden Melon F1 Hybrid L; B = Japanese Rock Melon F1 Hybrid; C = Hales Best Muskmelon; D = Rock Melon F1 Hybrid ML; E = Sweet Melon F1 Hybrid SL; F = Golden Melon F2 Hybrid L; G = Golden Melon F1 Hybrid B; H = Japanese Green Netted Melon F1 Hybrid; I = Sweet Green Melon F1

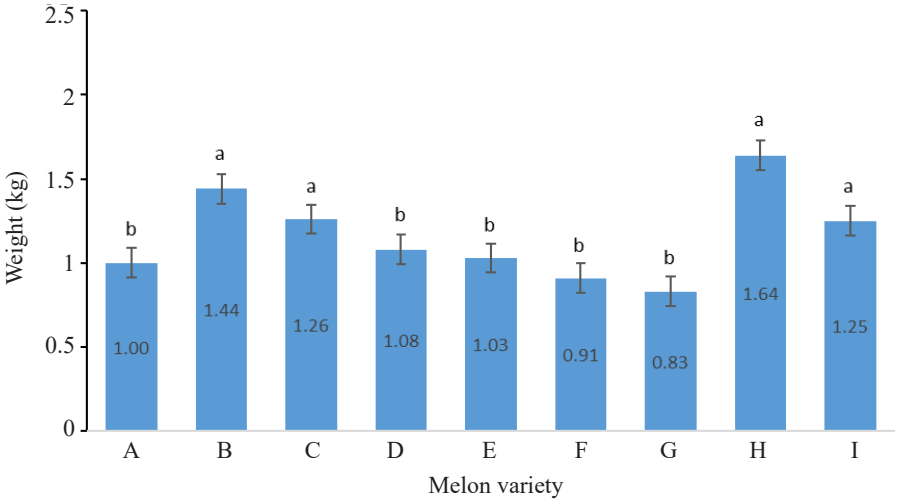

Figure 2. Mean melon fruit weight graph

Note. Significantly different groups were labelled with different lowercase alphabets after one-way analysis of variance and Tukey's honestly significant difference post hoc tests ($p \leq 0.05$); A = Golden Melon F1 Hybrid L; B = Japanese Rock Melon F1 Hybrid; C = Hales Best Muskmelon; D = Rock Melon F1 Hybrid ML; E = Sweet Melon F1 Hybrid SL; F = Golden Melon F2 Hybrid L; G = Golden Melon F1 Hybrid B; H = Japanese Green Netted Melon F1 Hybrid; I = Sweet Green Melon F1

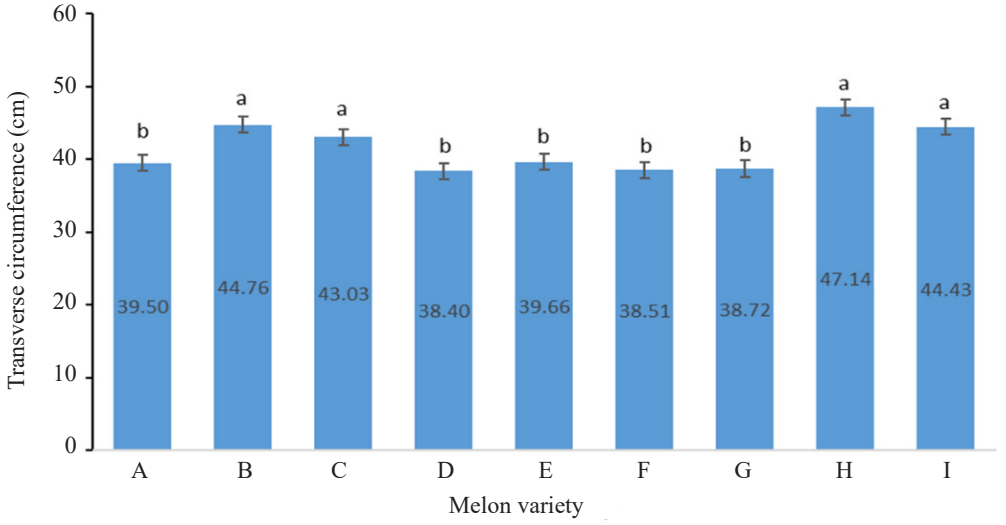

Figure 3. Mean melon transverse circumference graph

Note. Significantly different groups were labelled with different lowercase alphabets after one-way analysis of variance and Tukey's honestly significant difference post hoc tests ($p \leq 0.05$); A = Golden Melon F1 Hybrid L; B = Japanese Rock Melon F1 Hybrid; C = Hales Best Muskmelon; D = Rock Melon F1 Hybrid ML; E = Sweet Melon F1 Hybrid SL; F = Golden Melon F2 Hybrid L; G = Golden Melon F1 Hybrid B; H = Japanese Green Netted Melon F1 Hybrid; I = Sweet Green Melon F1

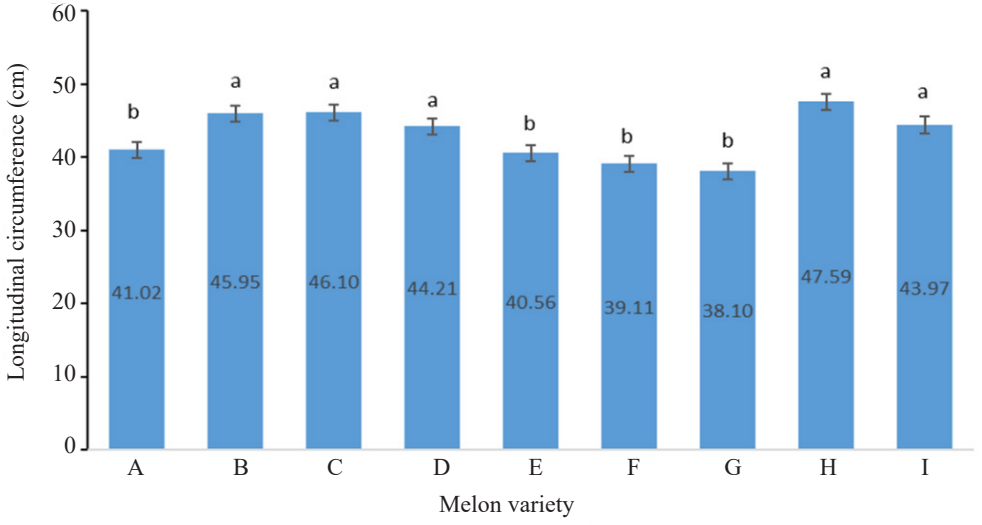

Figure 4. Mean melon longitudinal circumference graph

Note. Significantly different groups were labelled with different lowercase alphabets after one-way analysis of variance and Tukey's honestly significant difference post hoc tests ($p \leq 0.05$); A = Golden Melon F1 Hybrid L; B = Japanese Rock Melon F1 Hybrid; C = Hales Best Muskmelon; D = Rock Melon F1 Hybrid ML; E = Sweet Melon F1 Hybrid SL; F = Golden Melon F2 Hybrid L; G = Golden Melon F1 Hybrid B; H = Japanese Green Netted Melon F1 Hybrid; I = Sweet Green Melon F1

Sensory Tests on Five Qualitative Traits

The sensory tests were conducted with the participation of seven randomly selected individuals across five qualitative traits: fruit flesh texture, sweetness, appearance, juiciness, and aromatics (Figure 5). The melon variety D (Rock Melon F1 Hybrid ML) has the highest mean score of 4.143, whereas melon variety C (Hales Best Muskmelon) has the lowest mean score of 1 for fruit flesh texture. As for sweetness, the melon variety C scored the lowest (1.571), while the melon variety B (Japanese Rock Melon F1 Hybrid) scored the highest of all (4.143). The melon variety F (Golden Melon F2 Hybrid L) scored the lowest in aromatics compared to the melon variety C, which scored the highest (4). Interestingly, the melon variety B was given the highest score (4.714) with respect to appearance, while the melon variety C was voted to be the least attractive (2.571). The juiciest melon variety was voted to be the melon variety C (4.857), contrasting with the 2.4 score given to the melon variety F as the least juicy.

Best Melon Variety

When selecting the best melon variety, the goal to focus on is the consumers' preferences, as they are the endpoint determinant of the melon's price and sales based on its popularity (Bianchi et al., 2016). As such, in this case, the qualitative traits may appear to be much more essential to be taken into consideration when melon farmers are deciding on which melon variety to work on (Bianchi et al., 2016). With that in mind, the sensory tests conducted in

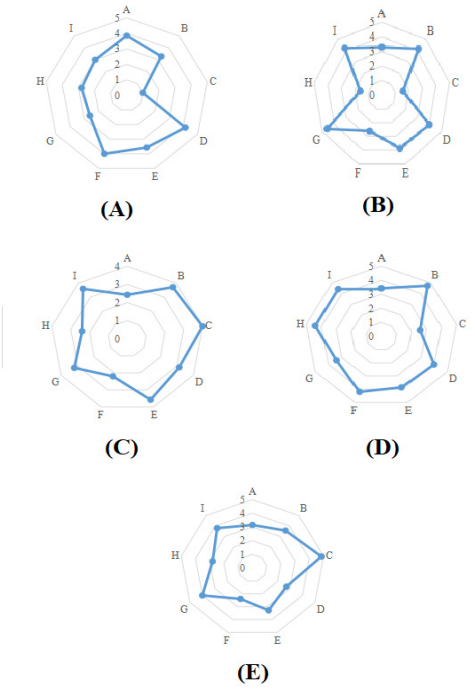

Figure 5. Mean scores for sensory tests qualitative traits: (A) flesh texture, (B) sweetness, (C) aromatics, (D) appearance, and (E) juiciness

this study unearthed two superior melon varieties, i.e., B and C, as both scored the highest in two of the five qualitative traits tested. Melon variety B excelled in sweetness and appearance, whereas melon variety C excelled in aromatics and juiciness.

In comparing the quantitative traits of melon varieties B and C, melon variety C recorded the highest germination rate (93.3%) among all the varieties. In contrast, the germination rate of melon variety B was not so bad either, with a percentage of 77.6%. Both mean plant heights of melon varieties B and C do not differ much (only 1 cm). However, the fruiting percentage of melon variety B (80.77%) far exceeded that of C (16.67%). The fruiting percentage is one of the most vital traits, directly affecting the yield. Since both varieties belong to the group *reticulatus* (i.e., Japanese Rock Melon F1 Hybrid and Hales Best Muskmelon) respectively, the fruit weights of melon varieties B and C are situated at the higher range together with the melon variety H and I, which also belongs to the *reticulatus* varieties (Sharma et al., 2014).

Undeniably, melon variety H scored quite well in most of the quantitative traits tested. However, qualitative traits scored quite low for four sensory traits: flesh texture, sweetness, aromatics and juiciness. I scored quite highly on the melon variety in appearance, juiciness, aromatics, and sweetness. However, the only downside is that the germination rate of melon I is significantly the lowest among all (37%), but the fruiting percentage is considerably good (70%). Utilization of genetic markers to assist in future breeding programs seems viable to allow better identification of the best melon with agronomic and qualitative traits (Flores-León et al., 2021; Luan et al., 2010).

The best all-rounder melon variety in this study would be the melon variety B (Japanese Rock Melon F1 Hybrid), as it possesses above-average quantitative traits and is generally popularly accepted by consumers at the same time. The melon variety I (Sweet Green Melon F1) could also be considered as it is quite positively voted by consumers, except that it has a very low germination rate in the agronomy aspect. Melon farmers could opt for melon variety

B for a better guarantee in terms of yield and quality. The melon variety can also be selected if the price of this melon can be marked up (due to popularity and market demand) to compensate for the downside of the predicaments faced by melon farmers in the low germination rate.

CONCLUSION

When selecting a melon variety to be planted to meet consumer market demand, qualitative traits should be considered ahead of quantitative traits. As such, melon variety B was deemed the all-rounder in almost all quantitative and qualitative traits tested in this study. However, a melon variety should also be considered if there is a markup in price due to popularity and market demand, as it only has one downside: low germination rate.

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REFERENCES

Bianchi, T., Guerrero, L., Gratacós-Cubarsí, M., Claret, A., Argyris, J., Garcia-Mas, J., & Hortós, M. (2016). Textural properties of different melon (*Cucumis melo* L.) fruit types: Sensory and physical-chemical evaluation. *Scientia Horticulturae*, *201*, 46–56. https://doi.org/10.1016/j.scienta.2016.01.028

Flores-León, A., García-Martínez, S., González, V., Garcés-Claver, A., Martí, R., Julián, C., Sifres, A., Pérez-de-Castro, A., Díez, M. J., López, C., Ferriol, M., Gisbert, C., Ruiz, J. J., Cebolla-Cornejo, J., & Picó, B. (2021). Grafting snake melon [*Cucumis melo* L. subsp. melo var. *flexuosus* (L.) Naudin] in organic farming: Effects on agronomic performance; resistance to pathogens; sugar, acid, and VOC profiles; and consumer acceptance. *Frontiers in Plant Science*, *12*, 613845. https://doi.org/10.3389/fpls.2021.613845

Jorge, N., da Silva, A. C., & Veronezi, C. M. (2022). Antioxidant and pharmacological activity of *Cucumis melo* var. cantaloupe. In A. A. Mariod (Ed.), *Multiple biological activities of unconventional seed oils* (pp. 147-170). Academic Press. https://doi.org/10.1016/B978-0-12-824135-6.00001-5

Liyana, N. A., & Pebrian, D. E. (2020). Energy use pattern analysis of rockmelon (*Cucumis melo*) production in Malaysia: A case study. *Food Research*, *4*(Suppl. 5), 34-39. https://doi.org/10.26656/fr.2017.4(S5).014

Luan, F., Sheng, Y., Wang, Y., & Staub, J. E. (2010). Performance of melon hybrids derived from parents of diverse geographic origins. *Euphytica*, *173*, 1-16. https://doi.org/10.1007/s10681-009-0110-6

Mehra, M., Pasricha, V., & Gupta, R. K. (2015). Estimation of nutritional, phytochemical and antioxidant activity of seeds of musk melon (*Cucumis melo*) and watermelon (*Citrullus lanatus*) and nutritional analysis of their respective oils. *Journal of Pharmacognosy and Phytochemistry*, *3*(6), 98-102.

Muhammad, R. M., Masdek, N. R. N. M., Ponari, S. Z., Makup, J. A., & Dardak, R. A. (2017). Technology adoption among melon agropreneurs in Sabah and Sarawak: An analysis using Fuzzy Logic. *Economic and Technology Management Review*, *12*, 19-27.

Sharma, S. P., Leskovar, D. I., Crosby, K. M., Volder, A., & Ibrahim, A. M. H. (2014). Root growth, yield, and fruit quality responses of *reticulatus* and *inodorus* melons (*Cucumis melo* L.) to deficit subsurface drip irrigation. *Agricultural Water Management*, *136*, 75-85. https://doi.org/10.1016/j.agwat.2014.01.008

Silva, M. A., Albuquerque, T. G., Alves, R. C., Oliveira, M. B. P. P., & Costa, H. S. (2022). *Cucumis melo* L. seed oil components and biological activities. In A. A. Mariod (Ed.), *Multiple biological activities of unconventional seed oils* (pp. 125-138). Academic Press. https://doi.org/10.1016/B978-0-12-824135-6.00007-6

Statista Research Department. (2023). *Yield of paddy in Malaysia 2012-2021*. Statista. https://www.statista.com/statistics/795760/yield-ofpaddy-malaysia/