

Evaluation of Fruit Quality Traits in Muskmelon (*Cucumis melo* L.) For Commercial Prospects

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ABSTRACT

Thirty three newly developed muskmelon (*Cucumis melo* L.) hybrids were evaluated for key qualitative and quantitative traits to identify promising entries for commercial cultivation. Significant phenotypic variability was observed across all measured parameters. Fruit length ranged from 16.83 cm (MUMH61) to 24.97 cm (MUMH624), while fruit weight significantly varied between 545.87 g (MUMH61) and 1531 g (MUMH624). The maximum fruit diameter was recorded in MUMH56 (15.20 cm), whereas MUMH820 exhibited the minimum (10.00 cm). Flesh thickness, a key determinant of edible portion, varied from 2.46 cm (MUMH510) to 4.12 cm (MUMH822). Rind thickness ranged from 0.3 cm (MUMH820) to 0.58 cm (MUMH92 & MUMH97), influencing storage and postharvest durability. TSS (°Brix) also exhibited substantial variation, with MUMH623 (13.6 °Brix), MUMH82 (13.4 °Brix), MUMH510 (12.9 °Brix) and MUMH91 (12.83 °Brix) showing superior sweetness. Moreover, a wide spectrum of variation was recorded in fruit external and internal quality traits, including fruit and flesh colour, fruit shape, flavour intensity, netting density, and peduncle adherence. Through the integrated evaluation of quality-related attributes, several hybrids exhibited strong commercial prospects.

Keywords: Muskmelon, Hybrid, Trait, Fruit quality.

I. INTRODUCTION

Muskmelon (*Cucumis melo* L., $2n = 2x = 24$) is a prominent warm-season crop known for its pleasant flavour, aroma, nutritional richness, and diverse quality traits. These attributes contribute to its rising consumer preference and expanding cultivation

worldwide. India is one of the leading producers of muskmelon, with major cultivation concentrated in Uttar Pradesh, Haryana, Punjab, Rajasthan, and Madhya Pradesh [1]. Globally, muskmelon production is estimated at approximately 1,495 million tonnes. Within India, the crop occupies nearly 66,000 hectares. In Maharashtra alone, muskmelon is

cultivated on about 1,220 hectares, contributing an annual production of 21.10 million tonnes [2]. The fruit is nutritionally valuable, containing significant levels of ascorbic acid, carotene, folic acid, potassium, phenolics, flavonoids, and tocopherols, which boost its antioxidant capacity [10], [7]. Additionally, muskmelon provides vitamin A, vitamin C, β -carotene, sugars, carbohydrates, proteins, and small amounts of vitamin K and B-complex vitamins [9]. Its short crop duration, high yield potential, nutritional profile, and adaptability for cultivation under protected conditions make it an appealing commercial crop. The fruit thrives best in warm, sunny environments, especially in sandy and sandy loam soils, and is often grown in fields and along riverbanks in India [13].

Genetic diversity centers for muskmelon are located in Iran, Uzbekistan, Afghanistan, China, and India [14]. A broad genetic base for traits related to quality exists, offering opportunities for precise enhancement [8]. As a cross pollinated species with considerable morphological variation, muskmelon exhibits diversity in fruit size, shape, rind pattern, pulp texture, colour, aroma, and sweetness [3], [11], [15].

Genetic improvement in muskmelon primarily relies on exploiting germplasm variability through systematic selection and hybridisation. The identification of superior parental lines is crucial for developing hybrids with enhanced yield, fruit quality, and resistance to major [16]. Modern hybrid breeding programs emphasise traits such as high productivity, uniform fruit shape and size, and extended shelf life, as these attributes significantly influence market value and consumer preference. Incorporating these desirable traits into new genotypes is essential for strengthening domestic supply chains and maintaining the crop's competitiveness in export markets [12].

Despite advances in breeding and post-harvest handling, it remains difficult to consistently preserve and enhance muskmelon fruit quality from the farm to the market. Therefore, a comprehensive assessment of key quality traits, including sweetness (TSS), aroma,

colour, and shelf life, is crucial for developing superior muskmelon hybrids with greater commercial value and consumer acceptance. This study aimed to evaluate these fruit quality traits in new muskmelon F1 hybrids to determine their commercial potential and guide future breeding efforts.

II. MATERIAL AND METHODS:

A. Experimental Site and Geographical Location

The experiment was conducted during the summer 2025 season at the Research and Development (R&D) of Ellora Natural Seeds Pvt. Ltd., Chhatrapati Sambhajnagar, Maharashtra, India. The altitude of the location is 568 meter above mean sea level and situated 19.80648° N of latitude and 75.263971°E of longitude.

B. Agro-climate conditions

The region has a subtropical climate, and the experimental field soil was a black loam with a pH of 6.8 and the area typically experiences high temperatures during the summer season, with March to May being the hottest months.

C. Plant Material

A total of 13 (MUM1, MUM2, MUM5, MUM6, MUM7, MUM8, MUM9, MUM11, MUM20, MUM21, MUM22, MUM23, MUM24) diverse parental lines were initially selected based on extensive screening for key fruit quality attributes, including fruit size, TSS, flesh and rind thickness, netting intensity, plant vigour, and overall horticultural performance. These parents were further assessed for their combining ability to identify promising male and female lines for hybrid development. Controlled, randomised crosses were performed among the selected parental lines to maximise genetic variability and generate a broad spectrum of F1 combinations. Standard hand-pollination techniques were employed to ensure genetic purity and prevent unwanted pollen contamination. Each pollinated flower was tagged and

monitored until fruit maturity. Mature fruits from each cross were harvested individually, and seeds were extracted, cleaned, and stored separately. Using this structured hybridisation approach, 33 distinct F1 hybrids were successfully developed and subsequently evaluated under field conditions for morphological and fruit-quality traits.

D. Experimental Design

The field trial of these newly developed F1 hybrids was arranged in a Randomised Block Design (RBD) with three replications. Made 1.5 m raised beds and positioned the lateral tubes in the center of each bed. Irrigation was carried out in the beds by continuously running the drip system for 8-12 hours. Each hybrid was planted in a plot of 1,755 m² with a spacing of 1.5 m × 0.5 m. All recommended agronomic practices, irrigation schedules, and plant protection measures were applied consistently.

E. Data Collection

Observations were taken on 10 randomly selected plants from each plot. Observations were recorded at physiological fruit maturity on representative samples from each hybrid for both qualitative and quantitative

traits. Quantitative measurements included fruit length (cm), fruit weight (g), fruit circumference (cm), fruit diameter (cm), cavity length (cm), flesh thickness (cm), rind thickness (cm), and total soluble solids (TSS, °Brix). Fruit length, circumference, and cavity length were measured using a graduated measuring tape. In contrast, fruit diameter, flesh thickness, and rind thickness were recorded using a digital vernier calliper for improved precision. Fruit weight was determined using a calibrated digital weighing balance. TSS was measured from fresh juice extracts using a hand-held digital refractometer, and values were expressed in degrees Brix (°Brix). Qualitative traits such as fruit shape, external colour, flesh colour, surface netting pattern, fruit flavour and peduncle adherence were assessed visually following standard muskmelon DUS guidelines to ensure uniformity in scoring.

F. Statistical Analysis

The data collected underwent an ANOVA test, and the least significant difference tests were used to detect any significant differences ($P \leq 0.05$) among the samples. The Agricolae package in RStudio software [6] was used for data analysis.

III.RESULT AND DISCUSSION:

Table 1: Quantitative trait analysis in fruits of muskmelon F1 hybrids.

Sr. No.	F1 Hybrid	Fruit length (cm)	Fruit weight (gm)	fruit circumference (cm)	Fruit diameter (cm)	Cavity length (cm)	Flesh thickness (cm)	Rind thickness (cm)	TSS %
1	MUMH624	24.97 ^a	1531.01 ^a	45.37 ^a	14.77 ^b	6.25 ^{de}	3.35 ^{hii}	0.50 ^{bcd}	9.40 ^{qr}
2	MUMH811	23.55 ^b	1143.00 ^d	41.05 ^{cde}	12.15 ^{klm}	4.65 ^{mn}	4.00 ^b	0.40 ^{ghi}	11.40 ^h
3	MUMH822	23.40 ^{bc}	1230.40 ^c	41.54 ^{cde}	12.43 ^{jk}	5.27 ^j	4.13 ^a	0.44 ^{efg}	7.63 ^z
4	MUMH823	23.10 ^c	1222.00 ^c	39.40 ^c	12.65 ^{ij}	5.15 ^{jk}	3.45 ^{fg}	0.35 ^{hij}	6.80 ^B
5	MUMH623	22.71 ^d	1302.87 ^b	42.33 ^{bc}	13.25 ^{def}	5.75 ^{gh}	3.27 ^{ijk}	0.55 ^{abc}	13.60 ^a
6	MUMH121	22.65 ^d	1247.01 ^c	42.50 ^b	13.26 ^{def}	5.08 ^{jk}	3.38 ^{gh}	0.33 ^{ij}	7.52 ^A
7	MUMH821	22.61 ^d	1010.33 ^e	41.55 ^{cde}	11.73 ^{nop}	4.67 ^m	3.55 ^{de}	0.43 ^{efg}	8.00 ^y
8	MUMH622	22.27 ^e	1114.44 ^d	41.20 ^{cde}	13.07 ^{efg}	5.52 ⁱ	3.82 ^c	0.40 ^{ghi}	12.30 ^g
9	MUMH87	22.16 ^c	1102.00 ^d	40.53 ^{de}	13.28 ^{de}	6.57 ^{bc}	3.83 ^c	0.46 ^{defg}	9.92 ^p
10	MUMH721	21.95 ^{ef}	1360.28 ^b	43.40 ^b	13.92 ^c	5.83 ^{gh}	3.97 ^b	0.47 ^{defg}	10.32 ^m

Sr. No.	F1 Hybrid	Fruit length (cm)	Fruit weight (gm)	fruit circumference (cm)	Fruit diameter (cm)	Cavity length (cm)	Flesh thickness (cm)	Rind thickness (cm)	TSS %
11	MUMH620	21.82 ^f	1008.41 ^c	37.57 ^{fg}	11.97 ^{lmno}	10.17 ^a	3.27 ^{ijk}	0.42 ^{fgh}	9.43 ^φ
12	MUMH720	21.82 ^f	1121.93 ^d	43.47 ^b	12.83 ^{ghi}	5.92 ^{fg}	3.50 ^{ef}	0.47 ^{defg}	8.48 ^w
13	MUMH97	21.65 ^f	1262.57 ^c	43.70 ^b	13.53 ^{cd}	5.70 ^{ghi}	3.60 ^d	0.58 ^a	9.35 ^{rs}
14	MUMH21	21.63 ^f	1012.92 ^e	40.23 ^{de}	12.16 ^{klm}	5.77 ^{gh}	3.08 ^{nop}	0.41 ^{fgh}	11.37 ^h
15	MUMH26	21.41 ^{fg}	993.07 ^c	40.32 ^{de}	12.67 ^{hij}	6.30 ^{de}	3.06 ^{op}	0.50 ^{bcde}	12.48 ^c
16	MUMH72	21.27 ^{fg}	1046.29 ^e	43.74 ^b	13.05 ^{efgh}	6.42 ^{cd}	3.09 ^{no}	0.50 ^{bcde}	8.17 ^x
17	MUMH68	21.18 ^{fg}	993.59 ^c	30.79 ⁱ	11.80 ^{lmno}	4.43 ⁿ	3.62 ^d	0.40 ^{ghi}	10.25 ⁿ
18	MUMH91	21.10 ^{fg}	1006.39 ^c	39.85 ^c	12.12 ^{klmn}	4.63 ^{mn}	3.18 ^{klm}	0.48 ^{cdef}	12.83 ^d
19	MUMH92	20.51 ^g	775.83 ^f	37.10 ^g	11.77 ^{mnop}	5.75 ^{gh}	2.70 ^t	0.58 ^a	11.00 ^j
20	MUMH710	20.40 ^g	910.39 ^f	41.40 ^{cde}	12.40 ^{jk}	6.28 ^{de}	3.13 ^{mno}	0.46 ^{defg}	10.45 ^l
21	MUMH81	20.37 ^g	861.63 ^f	36.05 ^{gh}	11.08 ^φ	4.57 ^{mn}	3.09 ^{no}	0.56 ^{ab}	9.02 ^u
22	MUMH82	20.31 ^g	842.10 ^f	37.06 ^g	11.13 ^φ	4.93 ^{kl}	3.31 ^{hij}	0.46 ^{defg}	13.40 ^b
23	MUMH78	20.26 ^g	972.19 ^c	36.30 ^{gh}	11.72 ^{op}	5.27 ^j	3.23 ^{kl}	0.47 ^{defg}	10.18 ^o
24	MUMH65	20.21 ^g	955.73 ^c	39.26 ^c	12.17 ^{kl}	5.68 ^{hi}	3.12 ^{mno}	0.43 ^{efg}	9.33 ^s
25	MUMH27	20.03 ^g	940.93 ^c	40.71 ^{de}	12.88 ^{fghi}	6.12 ^{ef}	3.17 ^{lmn}	0.42 ^{fgh}	10.27 ^{mn}
26	MUMH51	19.75 ^h	795.67 ^f	38.11 ^f	11.78 ^{lmnop}	5.75 ^{gh}	2.84 ^{rs}	0.41 ^{fgh}	8.88 ^v
27	MUMH56	19.31 ^h	843.82 ^f	37.00 ^g	15.20 ^a	6.47 ^{cd}	2.90 ^r	0.45 ^{efg}	11.13 ⁱ
28	MUMH820	19.10 ^h	612.99 ^g	31.09 ⁱ	10.00 ^r	4.20 ^o	3.00 ^{pφ}	0.30 ^j	9.20 ^t
29	MUMH510	18.82 ^h	724.27 ^g	37.00 ^g	13.00 ^{efghi}	6.72 ^b	2.46 ^u	0.53 ^{abcd}	12.90 ^c
30	MUMH71	18.47 ^h	748.18 ^g	36.97 ^g	11.82 ^{lmno}	5.22 ^j	2.92 ^{φr}	0.47 ^{defg}	11.10 ⁱ
31	MUMH57	17.88 ⁱ	626.16 ^g	39.58 ^c	11.40 ^{pφ}	5.70 ^{ghi}	2.78 st	0.42 ^{fgh}	10.62 ^k
32	MUMH52	17.34 ⁱ	768.62 ^g	33.90 ^h	11.60 ^{op}	6.13 ^{ef}	2.86 ^{rs}	0.46 ^{defg}	10.17 ^o
33	MUMH61	16.83 ^j	545.87 ^g	31.23 ⁱ	10.23 ^r	4.78 ^{lm}	2.53 ^u	0.42 ^{fgh}	12.37 ^f
	Mean	20.9	988.9	39.0	12.3	5.7	3.2	0.5	10.3
	CV (%)	1.0	2.9	1.7	7.2	2.5	5.3	22.1	1.0
	LSD	0.3	46.7	1.1	1.4	0.2	0.3	0.2	0.2

A comprehensive quantitative assessment of 33 muskmelon F₁ hybrids revealed substantial variability across all measured fruit morphological and quality traits (Table 1). ANOVA followed by LSD ($P \leq 0.05$) confirmed statistically significant differences among the hybrids, highlighting the presence of considerable genetic diversity with strong commercial potential. The analysis showed highly significant variation for fruit length, fruit circumference, fruit diameter, fruit weight, cavity length, flesh thickness, rind thickness and TSS, as reflected by their respective p-values.

Fruits were considered marketable if they were full-sized, well-netted, showed normal rind colour, and were free from cracks, damage, or disease [17]. Among the 33 F₁ hybrids evaluated, a wide range of variability was observed in fruit quantitative traits, including fruit length, weight, circumference, diameter, cavity length, flesh thickness, rind thickness, and TSS. This clear phenotypic variation indicates significant underlying genetic diversity, which provides valuable opportunities for selection and improvement in commercial muskmelon breeding

programs. Fruit length ranged from 16.83 cm (MUMH61) to 24.97 cm (MUMH624), indicating a shift from medium to long-fruited types. A wide variation was observed for fruit weight, ranging from 545.87 g (MUMH61) to 1531.01 g (MUMH624), further supports the presence of high genetic variability in yield components. Hybrids such as MUMH624 (1531.01 g), MUMH623 (1302.87 g), MUMH721 (1360.28 g), MUMH97 (1262.57 g), MUMH121 (1247.01 g), MUMH822 (1230.40 g), MUMH823 (1222 g), MUMH720 (1121.93 g), and MUMH622 (1114.44 g), recorded significantly higher fruit weights, marking their suitability for yield enhancement and hybrid development targeting commercial cultivation. Similarly, fruit circumference varied from 30.79 cm (MUMH68) to 45.37 cm (MUMH624). Hybrids like MUMH624, MUMH721, MUMH720, MUMH97, MUMH72, recorded significantly higher values for fruit circumference, highlighting their potential to produce larger, market-preferred fruit types. Fruit diameter ranged from 10.0 cm (MUMH820) to 15.20 cm (MUMH56), showing considerable diversity in fruit roundness and shape. MUMH56, MUMH624, MUMH721, MUMH97 showed higher diameter values contributing to overall fruit volume. The highest cavity length (10.17 cm) was noted in MUMH620 while lowest (4.20 cm) in MUMH820. Whereas most of the hybrids shows optimal cavity length. Flesh thickness is a crucial quality attribute affecting edible portion and consumer acceptance. The maximum flesh thickness was recorded in MUMH822 (4.13 cm) and MUMH811 (4.00 cm). Hybrids like MUMH721 (3.97 cm), MUMH87 (3.83 cm), MUMH622 (3.82cm), MUMH97

(3.60cm), MUMH821 (3.55 cm) and, MUMH720 (3.50 cm) also showed statistically higher values. The mean thickness was 3.2 cm, indicating overall good fruit quality across the evaluated hybrids. Rind thickness ranged narrowly from 0.30 cm (MUMH820) to 0.58 cm (MUMH92 and MUMH97). Hybrids such as MUMH92, MUMH97, MUMH81, MUMH623, MUMH510, MUMH78, and MUMH811 demonstrated better postharvest durability, making them suitable for long-distance transport and storage due to their thicker rind. Fruit length, Fruit diameter, Flesh thickness, rind thickness and TSS are key determinants of muskmelon fruit quality and marketability are governed by a combination of additive and non-additive (dominance) gene effects [5], [4], [18]. TSS exhibited considerable variability, ranging from 6.80 °Brix (MUMH823) to 13.60 °Brix (MUMH623). Hybrids viz., MUMH623 (13.60 °Brix), MUMH82 (13.40 °Brix), MUMH510 (12.90 °Brix), MUMH26 (12.48 °Brix), and MUMH61 (12.36 °Brix) showed considerably higher TSS content, indicating superior sweetness and quality. Whereas, MUMH811 (11.40 °Brix), MUMH21 (11.30 °Brix), MUMH56 (11.13 °Brix), MUMH71 (11.10 °Brix), MUMH92 (11.00 °Brix) exhibited moderate TSS. As TSS is a critical determinant of flavour and consumer preference, these hybrids have strong potential to develop dessert-type muskmelons. The wide variability recorded for all morphometric and quality traits indicates the presence of substantial and exploitable genetic diversity among the parental lines, which has been effectively expressed in their derived hybrids.

Table 2: Qualitative trait analysis in fruit of Muskmelon F1 hybrids.

Sr. No.	F1 Hybrid	Fruit colour	Fruit peduncle at maturity	Fruit shape in longitudinal section	Fruit shape at peduncle end	Fruit shape at blossom end	Fruit surface netting	Flesh colour	Fruit flavour
1	MUMH121	Pale	Non-	Round	Truncate	Truncate	Dense	Light	Mild

Sr. No.	F1 Hybrid	Fruit colour	Fruit peduncle at maturity	Fruit shape in longitudinal section	Fruit shape at peduncle end	Fruit shape at blossom end	Fruit surface netting	Flesh colour	Fruit flavour
		Yellow	Slippable					Orange	
2	MUMH21	Yellow	Slippable	Round	Truncate	Truncate	Dense	Orange	Strong
3	MUMH26	Light Yellow	Slippable	Round	Truncate	Truncate	Dense	Orange	Medium
4	MUMH27	Pale yellow	Slippable	Flat Round	Truncate	Truncate	Moderate	Light orange	Medium
5	MUMH51	Creamy White	Slippable	Flat Round	Rounded	Rounded	Moderate	Light Orange	Medium
6	MUMH52	Creamy Yellow	Slippable	Round	Truncate	Rounded	Dense	Orange	Strong
7	MUMH56	Pale Yellow	Slippable	Round	Rounded	Rounded	Dense	Orange	Strong
8	MUMH57	Yellowish tan	Non-slippable	Flat round	Truncate	Truncate	Moderate	Orange	Medium
9	MUMH510	Yellow	Non-slippable	Round	Truncate	Truncate	Dense	Light Orange	Mild
10	MUMH61	Bright Yellow	Slippable	Round	Truncate	Truncate	Dense	Orange	Medium
11	MUMH65	Creamy White	Slippable	Round	Rounded	Truncate	Dense	Light Orange	Strong
12	MUMH68	Pale Yellow	Non-slippable	Oval	Rounded	Rounded	Moderate	Orange	Medium
13	MUMH620	Golden Yellow	Non-slippable	Oval	Rounded	Rounded	Moderate	Orange	Mild
14	MUMH622	Whitish Yellow	Non-slippable	Elongated globe	Rounded	Rounded	Dense	Orange	Strong
15	MUMH623	Creamy Yellow	Non-slippable	Round	Rounded	Rounded	Dense	Light Orange	Medium
16	MUMH624	Creamy Yellow	Non-slippable	Elongated globe	Rounded	Rounded	Dense	Orange	Medium
17	MUMH71	Yellow	Non-slippable	Round	Truncate	Truncate	Moderate	Light Orange	Medium
18	MUMH72	Creamy White	Slippable	Flat Round	Truncate	Truncate	Moderate	Light Orange	Mild
19	MUMH78	Golden Yellow	Non-slippable	Round	Truncate	Truncate	Low	Orange	Mild

Sr. No.	F1 Hybrid	Fruit colour	Fruit peduncle at maturity	Fruit shape in longitudinal section	Fruit shape at peduncle end	Fruit shape at blossom end	Fruit surface netting	Flesh colour	Fruit flavour
20	MUMH710	Pale Yellow	Non-slippable	Flat Round	Truncate	Rounded	Moderate	Light Orange	Mild
21	MUMH720	Yellow	Non-slippable	Flat Round	Truncate	Rounded	Moderate	Orange	Mild
22	MUMH721	Pale yellow	Non-slippable	Round	Rounded	Rounded	Dense	Light Orange	Mild
23	MUMH81	Yellowish beige	Slippable	Round	Rounded	Rounded	Moderate	Orange	Mild
24	MUMH82	Yellow	Non-slippable	Oval	Rounded	Pointed	Moderate	Orange	Mild
25	MUMH87	Golden Yellow	Non-slippable	Round	Rounded	Pointed	Low	Orange	Mild
26	MUMH811	Yellow	Non-slippable	Oval	Rounded	Rounded	Dense	Orange	Mild
27	MUMH820	Yellow	Non-slippable	Oval	Rounded	Rounded	Low	Light Orange	Mild
28	MUMH821	Creamy Yellow	Non-slippable	Oval	Rounded	Rounded	Dense	Orange	Mild
29	MUMH822	Creamy Yellow	Non-slippable	Oval	Rounded	Rounded	Moderate	Light Orange	Mild
30	MUMH823	Golden Yellow	Non-slippable	Oval	Rounded	Intermediate	Absent	Light Orange	Mild
31	MUMH91	Golden Yellow	Non-slippable	Oval	Rounded	Rounded	Moderate	Light Orange	Medium
32	MUMH92	Pale Yellow	Non-slippable	Round	Rounded	Rounded	Dense	Orange	Medium
33	MUMH97	Pale Yellow	Non-slippable	Round	Rounded	Rounded	Dense	Light Orange	Medium

A wide range of qualitative traits was observed among the 33 muskmelon hybrids, indicating extensive genetic diversity and reflecting the diverse parental combinations used in the hybridisation program. These traits are essential for assessing consumer acceptance, market compatibility, and post-harvest handling efficiency. Fruit colour showed wide variation, ranging from pale yellow, light yellow,

bright yellow, golden yellow, creamy yellow, creamy white, to yellowish-beige. Several hybrids such as MUMH21, MUMH57, MUMH61, MUMH71, MUMH78, MUMH81, MUMH87, MUMH92, MUMH97, MUMH510 and MUMH720, highlighting the prevalence of yellow pigmentation in the breeding material. Creamy or whitish fruits, as seen in MUMH51, MUMH52, and MUMH623, contribute to

niche diversification. Golden-yellow fruits were observed in hybrids such as MUMH620, MUMH823, and MUMH91, enhancing visual appeal and potential consumer interest. The hybrids exhibit slippable and non-slippable peduncle appearances. Slippable peduncles, which naturally detach at physiological maturity, facilitate harvesting and serve as reliable indicators of ripeness. These were recorded in hybrids such as MUMH21, MUMH26, MUMH27, MUMH51, MUMH52, MUMH56, MUMH61, MUMH65, MUMH72, and MUMH81. These hybrids offer easier harvesting and reliable visual cues of maturity. Conversely, a larger proportion of hybrids displayed non-slippable peduncles, including MUMH121, MUMH57, MUMH510, MUMH68, MUMH720, and several other hybrids in the set. Non-slippable peduncles provide firmer fruit attachment, potentially increasing resistance to mechanical damage and enhancing post-harvest shelf life. However, such fruits require more precise maturity assessment during harvest. This variation in peduncle behaviour is significant for agronomy, as it allows breeders and producers to select hybrids based on preferred harvest convenience, firmness, and post-harvest handling characteristics. A wide variety of fruit shapes was observed among the evaluated hybrids, indicating significant morphological diversity. Round-shaped fruits were the most common, found in seventeen hybrids, including MUMH121, MUMH21, MUMH26, MUMH52, MUMH56, MUMH510, MUMH61, MUMH62, MUMH623, MUMH71, MUMH78, MUMH721, MUMH81, MUMH87, MUMH92, and MUMH97. Flat-round fruits appeared in six hybrids, such as MUMH27, MUMH51, MUMH57, MUMH72, MUMH710, and MUMH720, contributing to variation in the fruit length-diameter ratio. Nine hybrids exhibited oval-shaped fruits, including MUMH68, MUMH620, MUMH82, MUMH811, MUMH820, MUMH821, MUMH822, MUMH823, and MUMH91, a shape often preferred in specific consumer and export markets for its compact and uniform appearance. Additionally, elongated globe-shaped

fruits were observed in two hybrids, MUMH622 and MUMH624, offering distinct fruit types suited to specialised commercial segments. Substantial morphological diversity in fruit shape was also observed at the peduncle and blossom ends. Hybrids showed truncate, rounded, intermediate, and pointed tip shapes. These differences reflect the influence of genetically diverse parental lines and suggest multiple developmental pathways controlling apex and pedicel-end formation. Netting density varied from absent to dense among the hybrids. Dense netting was observed in several commercially desirable hybrids, including MUMH121, MUMH21, MUMH26, MUMH52, MUMH56, MUMH510, MUMH61, MUMH65, MUMH622, MUMH623, MUMH624, MUMH721, MUMH821, MUMH92, and MUMH97, which enhanced shelf life and surface durability. Moderate netting was common in hybrids such as MUMH27, MUMH51, MUMH57, MUMH68, MUMH620, MUMH71, MUMH72, MUMH710, MUMH720, MUMH81, MUMH82, MUMH811, MUMH822, and MUMH91. Hybrids MUMH78, MUMH87, and MUMH820 exhibited the lowest netting intensity, characterised by sparse and discontinuous net formation. In contrast, hybrid MUMH823 showed a complete absence of netting, indicating a smooth-skinned phenotype. Across the hybrids, orange flesh was the most common, recorded in 18 hybrids. The remaining 15 hybrids showed Light Orange flesh. The high frequency of orange pigmentation suggests the presence of genotypes with increased carotenoid accumulation, especially β -carotene, which produces deeper orange hues and is linked to higher nutritional value. Hybrids consistently showing orange flesh (e.g., MUMH21, MUMH52, MUMH56, MUMH61, MUMH622, MUMH71, MUMH720, and MUMH82) indicate strong genetic control over pigment deposition, likely due to dominant alleles regulating carotenoid biosynthesis pathways. The appearance of light orange in hybrids such as MUMH121, MUMH27, MUMH57, MUMH65, MUMH72, MUMH78, MUMH823, and

MUMH97 suggests moderate carotenoid levels, possibly influenced by partial dominance or polygenic inheritance. The fruit flavour varied significantly among the hybrids tested, with levels from mild to strong, depending on aromatic compounds and sugar-acid balance differences. Hybrids like MUMH21, MUMH52, MUMH56, and MUMH622 showed strong flavour, while 11 hybrids had medium intensity, indicating a balanced aroma that appeals to the general market. The remaining hybrids, mainly yellow and creamy-yellow types, exhibited mild flavour.

IV. CONCLUSION

The evaluation of newly developed muskmelon hybrids revealed significant variability in fruit quality, morphological traits, and commercial potential. Hybrids such as MUMH623, MUMH82, MUMH510, MUMH91, MUMH26, MUMH61, and MUMH622 emerged as promising due to their high TSS, optimal fruit weight, and desirable market traits. Additionally, Hybrids exhibiting greater rind thickness such as MUMH92, MUMH97, MUMH81, MUMH623, MUMH510, MUMH78, and MUMH811 showed enhanced postharvest sturdiness, indicating their suitability for long-distance transportation and extended storage (Figure 1). The study highlights the importance of fruit shape, surface netting, and peduncle adherence in determining market acceptability and ease of handling. These findings offer valuable insights for breeders and farmers in selecting high-yielding, resilient muskmelon hybrids for commercial cultivation and sustainable agriculture. Further research will focus on enhancing disease resistance, climate adaptability, and postharvest longevity to improve the economic viability of muskmelon production.



Figure 1: Identified Elite Muskmelon (*Cucumis melo* L.) F₁ Hybrids.

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