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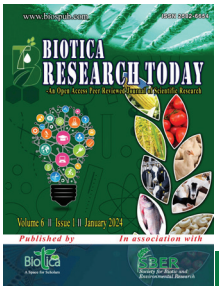

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Melon (*Cucumis melo* L.): A Horticultural Delicacy Endowing Nutritional Benefits

Koku K. Tara*, Neha Sharma and R. Vishal

Division of Vegetable Science, ICAR-Indian Agricultural Research Institute, New Delhi (110 012), India

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Corresponding Author

Koku K. Tara

: kokuktara428@gmail.com

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Abstract

The Cucurbitaceae family, encompassing about 118 genera and 825 species, is economically, culturally, aesthetically, horticulturally and medicinally significant. Among its cultivated species, melon (*Cucumis melo* L.) stands out for its immense diversity, with distinct groups based on horticultural usage. This article explores the morphological characteristics, nutritional value and uses of melon, emphasizing its potential health benefits. Melon, a warm-season crop, requires specific climate and soil conditions for optimal growth. Breeding objectives focus on medium-sized fruits with high sugar content, while cultivation practices address disease resistance and efficient water management. The nutritional composition of melon and its various uses, both fresh and processed, contribute to its popularity as a dessert and a health-promoting food. Overall, melons offer a rich source of essential nutrients and their diverse attributes make them valuable for enhancing human health.

Keywords: Health benefits, Horticultural usage, Melon (*Cucumis melo* L.), Nutritional composition

Introduction

The Cucurbitaceae is remarkable or notable plant family, deserving of major attention due its economic, cultural, aesthetic, horticulturally and medicinal importance. The family consists of about 118 genera and 825 species, distributed across tropical and subtropical regions of the world (Kumar, 2016). Many of these species are cultivated, including two economically significant vegetables within the *Cucumis* genus, namely, melon (*Cucumis melo* L.; 2n=24) and cucumber (*Cucumis sativus* L.; 2n=14). The term 'musk' originates from a Persian term signifying a 'type of fragrance,' whereas 'melon' is derived from the French term '*melo pepo*,' which refers to an 'apple-shaped melon'. The country's cultivation area with respect to melon spans approximately 0.54 million hectares, with a production of about 1.23 million tonnes. Uttar Pradesh, Andhra Pradesh, Madhya Pradesh and Punjab are the leading states in the cultivation of melon. Owing to its huge diversity and morphological traits, six melon groups were deduced according to their horticultural usage, *i.e.*, cantaloupe and muskmelon (*cantalupensis* group), winter melon (*inodorous* group), snap melon (*momordica* group), oriental melon (*conomon* group), snake melon (*flexuosus* group) and pomegranate melon (*dudaim* group). Considering its substantial economic advantages, cultivation on riverbanks during winter and spring is practiced for off-season or diara land cultivation.

Morphological Characteristics

Melon is a large, sprawling annual plant characterized by a medium to long tap root system with branched stems and nodes (Figure 1). Tendrils on the axils of leaves are simple and both stem and lobed pubescent leaves. The plant is primarily cultivated for its edible fruit, commonly known as 'pepo' due to its hard rind when fully matures (Kumar, 2016). The flowers, which are solitary and large, appear in the leaf axils, featuring bright yellow, showy petals. The plant is highly cross-pollinated, with honey bees and bumblebees serving as the primary sources for natural pollination. A wide range of sex forms like monoecious andromonoecious and hermaphrodite are most commonly observed in melon. The colour of the fruit rind can vary from green, cream, black or variegated, with or without sutures and netting. Similarly, the flesh of the fruit may display variation color, ranging from green to cream and brown. Fruits shape varies from

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round, flat round, oblong and cylindrical and fruit weight varies according to the subspecies and local agronomic practices.

a) Vines b) Fruits

Figure 1: *Cucumis melo* L. (Melon) vines and fruits

Nutritional Value and Uses

The edible parts of the fruit are the internal segments known as the endocarp and mesocarp. The fruit is extensively enjoyed as a dessert due to its enticing aromatic flavor, naturally soft texture and abundant supply of essential vitamins and minerals. Furthermore, it is low in both calorie and cholesterol content. The matured fruits of improved cultivars offer sweet and juicy pulp, typically consumed fresh or in refreshing drinks while discarding the epicarp and some mesocarp (tough rind). Conversely, the desi types (phut) are primarily utilized in various culinary preparations. Nonetheless, for the fresh consumption of the indigenous type, the pulp is blended with water and sugar or jaggery and milk, creating a refreshing beverage. Salmon-orange flesh contain carotenoid pigment, green-fleshed varieties contain chlorophyll, while the white fleshed types lack these pigments. Varieties with orange flesh exhibit higher levels of carotene compared to green and white-fleshed types. Owing to their substantial β-carotene content, melons are considered highly beneficial in preventing carcinogenesis. Additionally, their high potassium content makes them potentially beneficial for individuals with high blood pressure. They are also believed to be advantageous for heart patients as they contain an anticoagulant named adenosine (Dhaliwal, 2017). Seeds contain vitamin E and omega-3 fatty acids which act as anti-oxidant and anti-inflammatory. The peel extract demonstrated the highest scavenging activity for radicals and showed greater polyphenolic content compared to the seed extract. Melons utilized as vegetables contain flavonoids, alkaloids and bitter principles, enhancing their health benefits for humans. The activities of antioxidant enzymes, such as peroxidase and polyphenol oxidase, gradually increase during the ripening process, reaching their maximum levels at the ripe and pre-ripened stages, respectively (Menon and Ramana Rao, 2012). In China, various parts of melon plants are employed in local medicine to lower hypertension, with leaves and seeds used for treating hematomas (Robinson and Decker-Walters, 1997) The nutritional composition of melon (muskmelon) fruits is presented in table 1 (USDA, 2019).

Breeding Objectives in Melon

Successful melon breeding relies on having a higher proportion of medium-sized fruits rather than large ones, combined with a high sugar content (TSS), a round fruit shape, thick flesh, salmon-orange flesh color and a pleasant aroma. Medium-sized fruits offer various advantages in terms of packaging, transportation and consumer preference. Since cantaloupe and muskmelon are climacteric fruits with very short shelf-life, it leads to significant post-harvest losses, therefore, it is crucial to introduce and breed winter melons (*inodorous* group) that are non-climacteric, as this can significantly extend their shelf life. Melon improvement efforts should also focus on developing resistance to common diseases like *Fusarium* wilt, downy mildew, powdery mildew and various viruses.

Table 1: The nutritional content (per 100 g edible pulp) of melon fruit

Parameters	Quantity
Water (g)	90.2
Energy (kcal)	38
Protein (g)	0.82
Fat (g)	0.18
CHO (g)	8.69
Fibre (g)	0.8
Sugar	7.88
Calcium (mg)	9
Magnesium (mg)	13
Phosphorus (mg)	17
Potassium (mg)	157
Sodium (mg)	30
Iron (mg)	0.38
Zinc (mg)	0.44
Vitamin A (µg)	232
Vitamin C (mg)	10.9

Cultivation Practices for Melon

Climate

Melon is a warm-season crop primarily cultivated in sub-tropical and hot-arid regions. It thrives in regions with long daylight hours, dry weather and ample sunshine, being extremely sensitive to even mild frost. The ideal temperature for seed germination ranges between 23-25 °C. For optimal growth and fruit development, the temperature should remain relatively high, within the range of 20-32 °C. Irregular and unexpected rainfall during the fruit development stage can lead to fruit cracking and hinder further fruit maturation. The ideal conditions for melon growth involve cool nights and warm days, facilitating the accumulation of sugars in the fruits. Excessive humidity encourages the onset and spread of various diseases such as downy mildew, anthracnose, viruses and pests like the fruit fly.

Soil

Soil preferences for melon cultivation include well-drained loamy soil, as it does not thrive well in heavy clay or peat

soils. Moderately fertile soil with a good organic matter content is ideal. Melon exhibits slight tolerance to acidic soils and shows better growth when the soil pH ranges from 6.0 to 7.0.

Sowing, Seed Rate and Nutrient Management

Sowing of melon is typically scheduled during the summer season to ensure that fruit development and maturation coincide with dry and warm weather. The seeds can be directly sown at a rate of 2-3 seeds hole^{-1}, or transplanted after sowing in plug trays approximately 30-35 days after raising them in the nursery. Due to its long taproot system, melon cultivation is suitable for riverbed cultivation. For direct sowing, 1.5 to 2 kg of seeds are sufficient for 1 hectare, while for the transplanting method, 0.5 kg of seeds is adequate for the same area. The optimal sowing time varies from November to March, with February being the preferred month for sowing in the North Indian plains.

The application of manures and fertilizers should be based on the nutrient status of the soil and the crop's performance. For achieving optimum yields, it is recommended to apply farm yard manure (FYM) at a rate of 15-20 tonnes hectare^{-1} during the field preparation.

Irrigation

Pre-planting and post-planting watering are essential to ensure seed germination, seedling emergence and establishment. Delaying the first irrigation for directly sown crops is feasible under appropriate soil moisture conditions, while transplanted crops require immediate watering post-transplanting. Subsequent irrigations should be administered at weekly intervals. During fruit set, light irrigation at weekly intervals is recommended, ceasing 7 to 10 days before harvesting.

Weed Control

Weed control measures involve the use of tractor-driven disc ploughs between beds, with hand hoeing and weed pulling between plants carried out regularly. Alternatively, plastic mulching can be employed to manage weeds. Typically, 2-3 weeding operations are necessary, with the first weeding conducted 20-25 days after sowing and subsequent weeding every month.

Plant Protection Measures

Melon is susceptible to various diseases such as damping off, fusarium wilt, gummy stem blight, downy mildew and viruses. Early plant growth stages are vulnerable to attacks by red pumpkin beetles, while fruit flies lay eggs on developing fruits, leading to a rotting smell and hampered fruit development. Implementing integrated disease/ pest management (IDM and IPM) practices is crucial for effective disease and pest control.

Harvesting, Yield and Storage

Melon fruits reach marketable maturity around 30-40 days after pollination and 60-80 days after sowing. Harvesting is typically carried out during the cool morning hours to preserve fruit quality and the harvested fruits are promptly moved to shaded areas before temperatures rise. For climacteric fruits like cantaloupe and muskmelon such as Pusa Madhuras, Hara Madhu and Kashi Madhu, possess a strong musky flavor, with the peduncle slipping upon ripening. Therefore, these melons are harvested at the half-slip stage for local markets and at the mature green stage for distant markets. The indigenous variety, known as 'phut' found locally most in North-western India is characterized by its high acidity, non-sweet and mealy pulp, which tends to crack upon ripening its fruits and the maturity can be judged through changes in fruit color from green to brown or black depending upon the variety/ landraces. Winter melons, on the other hand, are harvested when the skin changes from green to yellow and the vines have dried up. In contrast, the *inodorous* melon type, also referred to as winter melon (Pusa Sarda, Pusa Sunehari, Honey Dew), do not slip upon ripening and their maturity is judged by drying and yellowing of leaves/ vines and changes in fruit color from green to yellow. These varieties have an extended shelf life of 15-20 days at room temperature.

Depending on the cultivated melon types and variety and environmental conditions, melon yield ranges from 150 to 300 quintals hectare^{-1}. Given its reliance on cross-pollination, introducing 6-7 beehive colonies hectare^{-1} significantly enhances fruit yield. Muskmelon fruits are highly perishable and can be stored for 2-4 days at room temperature, while cold storage at 2-4 °C and 85-90% relative humidity can extend storage to 2-3 weeks.

Conclusion

The wide diversity of melons serves as a valuable reservoir of essential nutrients, featuring a high concentration of beneficial elements for human consumption. Notably rich in potassium and low in sodium, melons possess medicinal properties that hold promise for improving healthcare management. The peel extracts, exhibiting substantial antioxidant activity, open up possibilities for applications in the nutraceutical and healthcare industries. The noteworthy qualities of melons and their by-products underscore their potential in promoting various health benefits.

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