E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; 7(10): 115-118
Received: 28-07-2024
Accepted: 03-09-2024

Bathula Nithya Sri
MSc. Scholar, Department of Vegetable Science, SKLTSHU, Mulugu, Siddipet, Telangana, India

K Nirosha
Assistant Professor, Department of Vegetable Science, College of Horticulture, Rajendranagar, SKLTSHU, Telangana, India

Dr. S Mallesh
Assistant Professor, Dept. of Vegetable Science, PGIHS, SKLTSHU, Mulugu, Siddipet, Telangana, India

A Mamatha
Assistant Professor, Department of Vegetable Science, College of Horticulture, Rajendranagar, SKLTSHU, Telangana, India

Dr. B Naveen Kumar
Vice Principal, Department of soil science, Horticultural Polytechnic, Ramgirikhilla, Telangana, India

Corresponding Author:
Dr. Tushar B Patil
Associate Professor, ACPM Medical College, Dhule, Maharashtra, India

Study of sowing time and plant spacing effects on biochemical constituents in muskmelon variety Arka Siri

Bathula Nithya Sri, K Nirosha, Dr. S Mallesh, A Mamatha and Dr. B Naveen Kumar

DOI: https://doi.org/10.33545/2618060X.2024.v7.i10b.1712

Abstract
The study investigates the effect of sowing time and plant spacing on the biochemical constituents of muskmelon (*Cucumis melo L.*) variety Arka Siri. A field experiment was conducted using a Factorial Randomized Block Design (FRBD) with two factors: sowing time (1st January, 15th January, 1st February, 15th February) and plant spacing (100 cm × 30 cm, 100 cm × 40 cm, 100 cm × 50 cm), each replicated thrice. The biochemical constituents analyzed include Total Soluble Solids (TSS), shelf life, ascorbic acid content, and carotenoid levels. The results revealed significant effect on sowing time and plant spacing on these biochemical parameters. With respect to sowing time D_4: 15th February was found maximum in TSS, ascorbic acid and carotenoids whereas shelf life was maximum in D_1: 1st January. Among, the plant spacing wider plant spacing S_3: 100 cm × 50 cm was found maximum on biochemical constituents and shelf life have shown non-significant effect. The combined effect of sowing time and plant spacing have shown non-significant effect on shelf life and carotenoids, it was significantly maximum in the treatment T_{12}: 15th February, 100 cm × 50 cm. Hence, based on the results we can conclude that T_{12}: 15th February, 100 cm × 50 cm was best for improved nutritional quality. However, trails should be repeated for few more seasons for precision of the experiment.

Keywords: Muskmelon, sowing time, plant spacing, Total Soluble Solids (TSS), Ascorbic acid, carotenoids, shelf life

Introduction
Musk melon (*Cucumis melo* L.) is a widely cultivated and economically important vegetable crop known for its rich nutritional content and refreshing flavor. It is being considered as wonder crop because of its medicinal properties. The sweetness of the fruit *i.e.* sugar content, flavor or aroma, texture and phytonutrients are the most important traits which determines consumer preference (Lester and Hodges, 2008) [10]. It is a rich source of polyphenols and flavonoids, including cryptoxanthin, zea-xanthin, Cucurbitacin-E, Cucurbitacin-B and two terpenoids with anti-inflammatory properties. In India muskmelon is being cultivated in an area of 65,900 hectares with an average production of 14,96,100 metric tons and the major muskmelon producing states include Uttar Pradesh, Andhra Pradesh, Punjab, Madhya Pradesh and Karnataka (2022-23 Second advance estimates by India Stats, Ministry of Agriculture and Farmers Welfare, Government of India).

Among the various factors influencing the quality of musk melon, sowing time and plant spacing play crucial roles in determining the biochemical composition of the fruit. These factors directly impact the plant's growth environment, affecting its physiological processes and consequently, the synthesis and accumulation of key biochemical constituents such as sugars, vitamins, and antioxidants.

The variety Arka Siri, developed by the Indian Institute of Horticultural Research, has gained popularity due to its superior fruit quality *viz.*, TSS was retained well and pulp color was more yellowish orange (low Hue angle) and carotenoids were high (https://iihr.res.in/muskmelon-high-yielding-variety-arka-siri) and adaptability to different agro-climatic conditions. However, optimizing its cultivation practices to enhance its biochemical constituents is essential to

maximize its nutritional and commercial value. This study aims to investigate the effect of different sowing times and plant spacing on the biochemical composition of the musk melon variety Arka Siri. By understanding how these agronomic practices influence the biochemical profile of the fruit, growers can make informed decisions to improve both yield and quality, thereby meeting consumer demands and increasing profitability.

Materials and Methods

A field experiment was conducted from January 2024 to May 2024 during the summer season at the College of Horticulture PG Research Farm at Hyderabad, situated in the sub-tropical zone at 17°19' N latitude, 79°23' E longitude, and an altitude of 542.3 meters above sea level. The experimental site featured sandy loam soil with good drainage and low water retention capacity. The experiment covered a total area of 480 square meters, with each plot measuring 8 × 1 square meters. The study was designed using a Factorial Randomized Block Design (FRBD), incorporating two factors: sowing dates (1st January, 15th January, 1st February, 15th February) and plant spacing (100 cm × 30 cm, 100 cm × 40 cm, 100 cm × 50 cm) with three replications. In total, 12 treatments were applied within each replication. Thinning and gap filling were carried out 20 days after sowing, ensuring one seedling per hill. The crop was harvested at the full-slip stage when the fruits had fully matured and reached optimal size. The data was analyzed statistically using analysis of variance (ANOVA) techniques appropriate for FRBD, as outlined by Panse and Sukhatme (1967) [12]. Analysis of bio chemical components was done by following methods:

Total Soluble Solids (°Brix)

It was determined by using ERMA Hand Refractometer. About 2-3 drops of juice was placed on the prism of refractometer and reading was observed on scale and averages were expressed in °Brix.

Carotenoids (mg/100 g)

Fruit sample of muskmelon 5 gm were taken and grinded with acetone by using pestle and mortal the extract is decanted in to a conical flask continue the extraction till the residue is colorless transfer into a separating funnel and added 10-15 ml of petroleum ether also added 25 ml of 5% anhydrous sodium sulphate shake it gently keep it for some time and yellow pigment is transferred into the petroleum ether layer collected supernatant in volumetric flask make up the volume with petroleum ether and measure the OD 452 nm in spectrophotometer expressed in mg/100 g.

Ascorbic acid content (mg/100 g)

The method suggested by AOAC (1990) involving the usage of 2, 6-dicholorophenol indophenol dye was used for the determination of Ascorbic acid.

Reagents

- **Metaphosphoric acid (HPO_3) 3%:** PREPARED by dissolving 3 grams of pellets in 100 ml of distilled water.
- **Ascorbic acid standard:** 100 mg of ascorbic acid was dissolved in 3% metaphosphoric acid and volume made up to 100 ml.
- **Dye solution:** 50 mg of the sodium salt of 2, 6-dichlorophenol-indophenol was dissolved in 150 ml of hot distilled water containing 42 mg of sodium bicarbonate and then cooled and diluted with distilled water up to 200 ml, stored in a refrigerator.

Procedure

- 10 ml meta phosphoric acid was added in it and titrated against the dye solution (V_1 ml). End point was the appearance of pink color which persists for a few minutes. The amount of the dye consumed was equivalent to the amount of ascorbic acid.

$$\beta\text{-Carotene (mg /100g)} = \frac{\text{O.D. of sample x } 13.9 \text{ x } 10^4 \text{ x } 10}{\text{Weight of sample x } 560 \text{ x} 1000}$$

- 2 g of fruit sample was crushed and extracted in 3 per cent meta phosphoric acid. Volume was made up to 100ml and centrifuged for 20 minutes.
- 5 ml of this supernatant was pipetted out and added into the 10 ml of 3 per cent meta phosphoric acid.
- It was titrated against the dye (V_2 ml)

Calculation

$$\text{Ascorbic acid} = \frac{0.5 \text{ mg}}{V_1 \text{ ml}} \times \frac{V_2 \text{ ml}}{5 \text{ ml}} \times \frac{100 \text{ ml}}{\text{Weight of sample taken for estimation}} \times 100$$

Results and Discussion

Effect of sowing time and plant spacing on Total Soluble Solids TSS (°Brix)

Sowing time and plant spacing have significant effect on TSS. The maximum TSS content was examined in treatment D_4: 15th February sowing time with 12.16 °Brix While, the minimum was noted in treatment D_1: 1st January with 9.13 °Brix. Among the plant spacing the maximum was observed in treatment S_3: 100 cm × 50 cm with 11.00 °Brix and the minimum was detected in treatment S_1: 100 cm × 30 cm with 10.33 °Brix. The treatment T_{12}: 15th February, 100 cm × 50 cm with 12.42 °Brix has maximum TSS which was statistically on par with treatments T_9: 1st February, 100 cm × 50 cm, T_{11}: 15th February, 100 cm × 40 cm, T_{10}: 15th February, 100 cm × 30 cm with 12.22 °Brix, 12.13 °Brix, 11.93 °Brix respectively and the minimum was observed in treatment T_1: 1st January, 100 cm × 30 cm with 9.08 °Brix. An increase in TSS is associated with accelerated ripening, due to which starch gets converted to sugars and at wider plant spacing due to higher sunlight penetration which enhances photosynthesis, sugars production. This was closely aligning with the results obtained by Wee *et al.* (2018) [13] in rock melon; Ahmad *et al.* (2021) [2] in muskmelon.

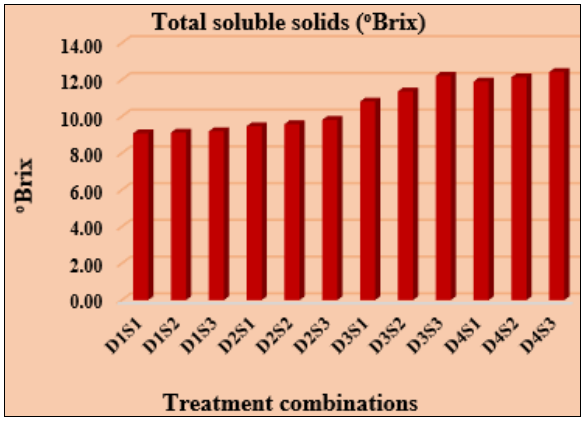

Fig 1: Effect of sowing time and plant spacing on TSS(°Brix) of muskmelon variety Arka Siri

Shelf Life

Time of sowing have shown significant differences on shelf life. The shelf life was maximum from fruits taken in treatment D_1: 1st January with 8.98 which was followed by treatment D_2: 15th January with 7.99. While, the minimum was observed in treatment D_4: 15th February with 4.38. The plant spacing and interaction effect have shown non-significant effect on shelf life. The decrease in shelf life might be due to high temperature prevailing at later sowing times. The results were in accordance with Ezzat *et al.* (2002) [6] in cantaloupe and Garg *et al.* (2008) [7] in tomato.

Table 1: Effect of sowing time and plant spacing on TSS (°Brix) and shelf life of muskmelon variety Arka Siri

Sowing time	Total Soluble Solids (°Brix)				Shelf life			
	Plant spacing				Plant spacing			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
D_1	9.08^{f}	9.12^{ef}	9.19^{ef}	9.13^{d}	8.80	8.93	9.20	8.98^{a}
D_2	9.47^{ef}	9.58^{de}	9.81^{d}	9.62^{c}	7.94	8.00	8.03	7.99^{b}
D_3	10.84^{c}	11.36^{bc}	12.22^{a}	11.47^{b}	6.52	6.57	6.60	6.56^{c}
D_4	11.93^{ab}	12.13^{a}	12.42^{a}	12.16^{a}	4.36	4.38	4.40	4.38^{d}
Mean	10.33^{c}	10.55^{b}	11.00^{a}		6.91	6.97	7.06	
Factors	C.D. at 5%		S.E.m±		C.D. at 5%		S.E.m±	
D	0.34		0.11		0.15		0.05	
S	0.29		0.10		NS		0.04	
D×S	0.58		0.20		NS		0.09	

Ascorbic acid (mg/100 g)

The sowing time and plant spacing have shown significant effect on ascorbic acid content. The maximum ascorbic acid content was observed in treatment D_4: 15th February sowing time with 43.93 mg/100 g and least was seen in D_1: 1st January with 38.96 mg/100 g. The treatment S_3: 100 cm ×50 cm with 42.42 mg/100 g recorded maximum ascorbic acid content which was statistically on par with treatment S_2: 100 cm × 40 cm with 41.96 mg/100 g and the lease was seen in S_1: 100 cm × 30 cm. The interaction effect of plant spacing and sowing times have significant effect in connection with ascorbic acid content the maximum was examined in treatment T_{12}: 15th February, 100 cm × 50 cm with 44.72 mg/100 g which was statistically on par with treatment T_{11}: 15th February, 100 cm × 40 cm with 43.87 mg/100 g and the least was seen in T_1: 1st January, 100 cm × 30 cm with 37.91 mg/100 g.

The rise in ascorbic acid at later sowing time and at wider plant spacing might be because of increase in sugars and due to less interplant completion which indirectly increase photosynthesis, production of sugars resulting in high ascorbic acid content (Kaushal and Sharma 2018) [9] in tomato. Related results have been cited by Anusha *et al.* (2021) [3].

Table 2: Effect of sowing time and plant spacing on ascorbic acid and carotenoids on muskmelon variety Arka Siri

Sowing time	Ascorbic acid (mg/100 g)				Carotenoids (mg/100 g)			
	Plant spacing				Plant spacing			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
D_1	37.91^{f}	39.76^{e}	40.20^{e}	38.96^{d}	3.43	3.82	3.92	3.72^{d}
D_2	41.19^{d}	41.26^{d}	41.67^{d}	41.38^{c}	3.98	4.01	4.09	4.03^{c}
D_3	41.70^{d}	42.95^{c}	43.07^{bc}	42.58^{b}	4.14	4.23	4.33	4.23^{b}
D_4	43.20^{bc}	43.87^{ab}	44.72^{a}	43.93^{a}	4.20	4.31	4.54	4.35^{a}
Mean	40.75^{b}	41.96^{a}	42.42^{a}		3.94^{c}	4.09^{b}	4.22^{a}	
Factors	C.D. at 5%		S.E.m±		C.D. at 5%		S.E.m±	
D	0.53		0.45		0.11		0.04	
S	0.46		0.39		0.09		0.03	
D×S	0.92		0.79		NS		0.06	

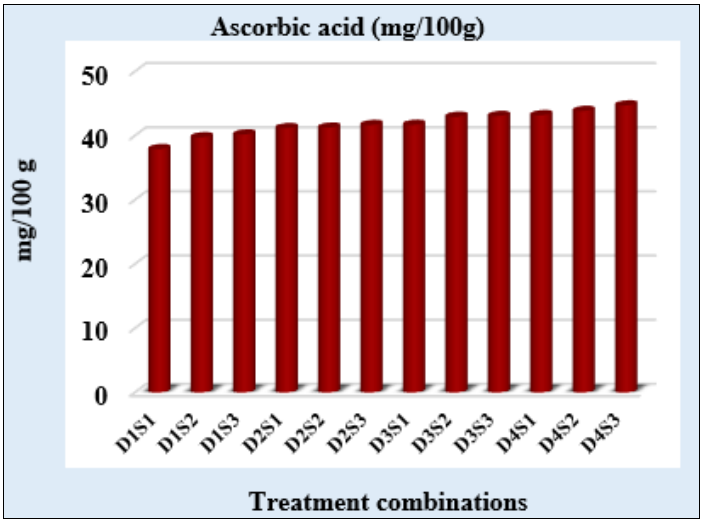

Fig 2: Effect of sowing time and plant spacing on ascorbic acid (mg/100 g) of muskmelon variety Arka Siri

Carotenoids (mg/100 g)

The maximum carotenoid content was observed in treatment D_4: 15th February sowing time with 4.35 mg/100 g and least was observed in D_1: 1st January with 3.72 mg/100 g. Significantly maximum carotenoid content was noted in treatment S_3: 100 cm × 50 cm with 4.22 mg/100 g which was statistically on par with treatment S_2: 100 cm × 40 cm with 4.09 mg/100 g and least was recorded in treatm ent S_1: 100 cm × 30 cm with 3.94 mg/100 g. The combined effect of sowing time and plant spacing have non-significant effect with regard to carotenoids content.

The increase in carotenoids at later sowing times and at wider plant spacing might be due to the impact of light in determining the yellow color and the carotenoid content in muskmelon. The variations in carotenoid accumulation are caused by variations in the response of genes linked to carotenoid biosynthesis, which are influenced by temperature, light intensity, and harvesting time (Bhattacharjee *et al.*, 2023) [5]. Similar results were found in Mohanty *et al.* (2023) [11] in zucchini.

Conclusion

From the above results we can conclude that T_{12}: 15th February, 100 cm × 50 cm was best with regard to biochemical constituents. Therefore, for growers aiming to maximize the biochemical benefits of muskmelon, adopting the 15th February sowing date with 100 cm × 50 cm plant spacing is recommended.

Acknowledgement

The author extends gratitude to the Post Graduate Institute of Horticultural Sciences, Sri Konda Laxman Telangana State Horticultural University, Mulugu, Siddipet, for facilitating the research and providing financial support.

References

1. India Stats. 2022-23 Second Advance Estimates. Ministry of Agriculture and Farmer's Welfare, Government of India. Available from: https://www.indiastat.com/table/agriculture/area-production-muskmelon-india-2012-2013-2022-2023/962312. [Accessed 22 November 2023].
2. Ahmad E, Nabi G, Imtiaz M, Ali Z, Ali MY, Khan AA. Effect of sowing times on the growth, yield and quality of muskmelon (*Cucumis melo* L.) varieties. Fresenius Environ Bull. 2021;30(4):3408-3412.

3. Anusha KR, Singh K, Sardana V, Sharma SP, Singh R. Influence of planting time on yield and quality of direct sown muskmelon (*Cucumis melo* L.) under low tunnel. Veg Sci. 2021;48(2):150-155.
4. Association of Official Agricultural Chemists, Horwitz W. Official methods of analysis of the Association of Official Analytical Chemists. Washington, DC: Association of Official Analytical Chemists; c1975 .p. 222.
5. Bhattacharjee D, Phookan DB, Chamuah S, Nath MK, Gogoi S, Das S, Debnath. Influence of planting time and spacing on quality of zucchini (*Cucurbita pepo*) under naturally ventilated polyhouse. Emerg Life Sci Res. 2023;9(2):43-50.
6. Ezzat M. Effect of cultivar and planting date on yielding ability, fruit characteristics and storage ability of some cantaloupe cultivars under Lower Egypt conditions. J Plant Prod. 2002;27(3):1783-1799.
7. Garg N, Cheema DS, Dhatt AS. Genetics of yield, quality and shelf life characteristics in tomato under normal and late planting conditions. Euphytica. 2008;159:275-88.
8. Indian Institute of Horticultural Research. Arka Siri muskmelon variety. Available from: https://iihr.res.in/muskmelon-high-yielding-variety-arka-siri. [Accessed 20 December 2023].
9. Kaushal S, Sharma V. Effect of date of transplanting, spacing and training system on quality characters of tomato (*Solanum lycopersicum* Mill) under naturally ventilated polyhouse. Indian J Hill Farming. 2018, 31(1).
10. Lester GE, Hodges DM. Antioxidants associated with fruit senescence and human health: novel orange-fleshed non-netted honeydew melon genotype comparisons following different seasonal productions and cold storage durations. Postharvest Biol Technol. 2008;48(3):347-54.
11. Mohanty M, Kachari M, Borbora PD, Borah N. Quality of zucchini (*Cucurbita pepo*) influenced by planting time and fertilizers. The Pharma Innovation J. 2023;12:3888-91.
12. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: Indian Council of Agricultural Research; c1967. p. 152-61.
13. Wee WC, Lai KS, Kong CL, Yap WS. Impact of within-row plant spacing and fixed fruit setting on yield and quality of rockmelon fruit cultivated by drip irrigation in a greenhouse. Horticult Sci Technol. 2018;36(2):172-82.