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Effect of sowing time and plant spacing on flowering and earliness of muskmelon variety Arka Siri

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Abstract
The present research entitled "Effect of different sowing time and plant spacing on growth, yield and quality of muskmelon (*Cucumis melo* L.) variety Arka Siri under Southern Telangana conditions" was carried out at the PG Research Farm, College of Horticulture, SKLTSHU, Rajendranagar, during *Summer*-2024. The experiment was laid in Factorial Randomized Block Design with two factors *i.e.* 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) with three replications. The experiment was executed with objectives to study the effect of sowing time on flowering and yield. Among the different sowing time number of male flowers per plant (130.71), early node at which first male flower appeared (2.79) early node at which first female flower appeared (7.99), minimum sex ratio (10.05) days taken for first flowering (29.23), days taken to first fruit harvest (70.46), days taken from flowering to fruit maturity (26.05) was seen in 15th February. the maximum number of female flowers per plant (10.42) in 1st January sowing date. Among the different plant spacing number of male flowers per plant (120.23), number of female flowers per plant (9.44), minimum sex ratio (12.77), early node at which first male and female flower appeared (2.72, 8.36) the minimum number of days taken for first flowering (36.81), days taken to fruit harvest (77.63), days taken from flowering to fruit maturity (28.66) were significantly recorded in 100 cm × 50 cm The interaction effect was found to be non-significant on both earliness and flowering parameters. Based on the results we can conclude that D_2S_3 can be recommended as it coincides with optimum temperature for flowering and yield parameters and fetch higher yield with good returns to farmers.

Keywords: Muskmelon, sowing time, plant spacing, flowering, earliness, male and female flowers, significant

Introduction
Muskmelon (*Cucumis melo* L.) is an important vegetable crop belongs to the Cucurbitaceae family, commonly referred to as cucurbits (2n=2x=24) (Schaefer *et al.*, 2009) [14] and is composed of two varieties *Cucumis melo* var. *reticulatus* and *Cucumis melo* var. *cantaloupensis* It is also referred as cantaloupe, melon, casba and winter melon. Muskmelon is a spherical, yellow-tan fruit having low fat content by nature and is a rich source of minerals. Due to its higher content of carotene, nutritional fiber, folic acid, ascorbic acid, potassium and bioactive components, muskmelon is preferred by consumers.

In India, muskmelon is cultivated in an area of 65,900 hectares with an average production of 14,96,100 metric tons (2022-23 Second advance estimates by India Stats, Ministry of Agriculture and Farmers Welfare, Government of India). In India, major muskmelon producing states are Uttar Pradesh, Andhra Pradesh, Punjab, Madhya Pradesh, Karnataka, Tamil Nadu and Chhattisgarh.

Vines are monoecious or andro-monoecious Musk melon is monoecious with male and female flowers present on same plant. Calyx has 5 lobes which are 6-8 mm long. The petals are free, round, 2 cm long, with three stamens. Seeds are whitish or buff, flat, smooth, 5-15 mm long. Fruits are variable in size, shape and rind. The outer skin can be smooth, ribbed, furrowed, gray-brown, purple, fleshy or pink. Ripe musk melon fruit is almost purple, yellowish white, and rough in texture. An immature musk melon is green with a smooth rind, and depending on the cultivar, may have shallow grooves. Most fruits are seeded (Dhami 2021) [5].

India is a vast country with diverse agro-climatic conditions. The winter temperatures range from 4 °C to 15 °C, while in the summer it reaches 45 °C in many areas, most notably the plains of North India. Warm-season crops, such as muskmelon, can be grown during spring and summer in tropical and subtropical climates. Low humidity, high temperatures, and minimal precipitation are the best growth conditions for muskmelon. Sowing time affects the growth cycle of muskmelon by aligning the plant's development stages with favorable environmental conditions, such as temperature, light, and humidity. Appropriate sowing ensures optimal vegetative growth, timely flowering, and fruit development, leading to higher yields and better fruit quality. Similarly, plant spacing regulates competition for resources such as nutrients, water, and light, which significantly influences plant vigor, flowering time, and earliness. This research aims to evaluate how these factors influence the performance of Arka Siri, providing insights that can help optimize production strategies and improve both the quantity and quality of the yield.

Materials and Methods

The experiment was conducted at College of Horticulture, Hyderabad, located at latitude of 17019' N, longitude of 79023' E and altitude of 542.3 m above mean sea level, during the crop period from January to May.

A factorial randomized block design (FRBD) was employed to evaluate the effect of sowing time and plant spacing on flowering and earliness of muskmelon variety Arka Siri. The experiment consisted of 12 treatments, formed by the combination of 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). These combinations resulted in 12 distinct treatments each replicated three times to ensure the reliability of the results. The seeds were sown directly on the bed by placing 2 -3 seedling per hill and light irrigation is given after sowing. Thinning operation was down after 20 days retaining only on seedling per hill. The fruits are harvested at fill slip stage when they true orange yellow color with musky aroma. The experimental plots size measuring is 8 m x 1 m. The data collected were subjected to analysis of variance (ANOVA) using a factorial RBD design. The significance of the treatment effects was tested at a 5% probability level, and mean comparisons were performed using the least significant difference (LSD) test where applicable.

Results and Discussion

Effect of sowing time on flowering and earliness

The sowing time have shown significant difference with respect to flowering parameters. Significantly the more number of male flowers were found in treatment D_4: 15th February (130.71) which was followed by treatment D_3: 1st February (118.78). Similar findings were observed by Desai and Patil (1985) [4]. Significantly more number of female flowers per plant were found in treatment D_1: 1st January (10.42) which was followed by treatment D_2: 15th January (9.88). Similar findings were observed by Mohanty *et al.* 2023 in zucchini and Soubeih (2016) [16] in bottle gourd. The minimum sex ratio (10.61) was examined in treatment D_1: 1st January sowing time which was followed by treatment D_2: 15th January sowing time with 11.40. Comparable results were achieved by Nwofia *et al.* (2015) [11] in cucumber. The early node at which male flower appeared was observed in treatment D_4: 15th February with 2.79 and was statistically on par with treatment D_3: 1st February (2.88) and was followed by treatment D_1: 15th January (2.94). The early node at which first female flower appeared was found in treatment D_1: 1st January (7.99) which was statistically on par with treatment D_2: 15th January with 8.24 and was followed by treatment D_3: 1st February with 8.67. Similar results were obtained by Longjam and Devi (2017) [8] in cucumber. The earliness parameters have also differed significantly the minimum number of days taken to first flowering, minimum number of days taken from flowering to fruit maturity, days taken to first fruit harvest were found in treatment D_4: 15th February with 29.23,26.05,70.46.

Table 1: Effect of sowing time and plant spacing on flowering parameters of muskmelon variety Arka Siri

Sowing time	Number of male flowers per plant				Number of female flowers per plant				Sex ratio (m/f)			
	Plant spacing				Plant spacing				Plant spacing			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
D_1	98.13	101.72	106.26	**102.04^c**	10.07	10.33	10.87	**10.42^a**	9.69	10.15	10.29	**10.05^a**
D_2	107.28	115.06	118.11	**113.48^b**	9.67	9.83	10.15	**9.88^b**	10.77	11.56	11.87	**11.40^b**
D_3	116.07	118.38	121.90	**118.78^b**	7.86	8.29	8.99	**8.38^c**	13.40	13.90	14.40	**13.90^c**
D_4	124.00	133.45	134.67	**130.71^a**	7.09	7.48	7.74	**7.44^d**	17.20	17.68	17.94	**17.61^d**
Mean	**111.37^b**	**117.15^{ab}**	**120.23^a**		**8.67^b**	**8.98^b**	**9.44^a**		**12.77^a**	**13.32^{ab}**	**13.62^b**	
Factors	C.D. at 5%		S.E.m±		C.D. at 5%		S.E.m±		C.D. at 5%		S.E.m±	
D	7.07		2.41		0.36		0.12		0.69		0.23	
S	6.12		2.08		0.31		0.11		0.59		0.20	
D×S	NS		4.17		NS		0.21		NS		0.41	

Effect of plant spacing on flowering and earliness

There was significant difference observed on flowering and earliness parameters with respect to plant spacing. Among the plant spacing the treatment S_3: 100 cm × 50 cm spacing with 120.23 recorded maximum number of male flowers per plant which was statistically on par with treatment S_2: 100 cm × 40 cm with 117.15. The maximum number of female flowers per plant was seen in treatment S_3: 100 cm × 50 cm spacing with 9.44 which was statistically on par with treatment S_2: 100 cm × 40 cm with 8.98, Similar findings were observed in treatment Bakhtouri *et al.* (2017) [3] in pumpkin; Uga and Umekwe (2016) [12] in water melon; the minimum sex ratio (12.77) was recorded

in treatment S_1: 100 cm × 30 cm which was statistically on par with treatment S_2: 100 cm × 40 cm with 13.32. The results were consistent with findings of Narke *et al.* (2015) [10] in zucchini and Agbaje *et al.* (2012) [2] in pumpkin. The node at which first male flower appeared, was found statistically at lower node in S_3: 100 cm × 50 cm with 2.72 which was followed by S_2: 100 cm × 40 cm with 2.87. The node at which first female flower appeared was found statistically at early node in treatment S_3: 100 cm × 50 cm with 8.36 which was statistically on par with treatment S_2: 100 cm × 40 cm with 8.73, similar results were obtained by Sawale *et al.* (2022) [13] in zucchini, Maraga *et al.* (2018) [9] in bitter gourd and Sharma *et al.* (2005) [15] in cucumber.

Table 2: Effect of sowing time and plant spacing on earliness parameters of muskmelon variety Arka Siri

Sowing time	Days to first flowering				Days taken from flowering to fruit maturity				Days taken to first fruit harvest			
	Plant spacing				Plant spacing				Plant spacing			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
D_1	49.04	47.67	45.99	**47.57^{d}**	34.18	33.00	31.60	**32.93^{d}**	90.22	87.59	86.38	**88.06^{d}**
D_2	44.36	42.67	41.24	**42.76^{c}**	31.07	30.93	29.93	**30.65^{c}**	84.56	83.98	81.65	**83.40^{c}**
D_3	35.45	33.58	31.73	**33.59^{b}**	29.47	29.40	27.93	**28.93^{b}**	78.93	76.77	75.89	**77.21^{b}**
D_4	30.26	29.13	28.29	**29.23^{a}**	26.93	26.06	25.16	**26.05^{a}**	74.86	69.92	66.59	**70.46^{a}**
Mean	**39.78^{b}**	**38.26^{ab}**	**36.81^{a}**		**30.41^{b}**	**29.85^{ab}**	**28.66^{a}**		**82.14^{b}**	**79.57^{ab}**	**77.63^{a}**	
Factors	C.D. at 5%		S.E.m±		C.D. at 5%		S.E.m±		C.D. at 5%		S.E.m±	
D	1.91		0.65		1.52		0.51		3.13		1.06	
S	1.66		0.56		1.31		0.44		2.71		0.92	
D×S	NS		1.13		NS		0.89		NS		1.85	

Significant difference was observed by plant spacing with respect to number of days taken to first flowering which was found statistically minimum in treatment S_3: 100 cm × 50 cm with 36.81 and was statistically on par with treatment S_2: 100 cm × 40 cm with 38.26. The maximum days taken to first flowering were observed in treatment S_1: 100 cm × 30 cm with 39.78. The effect of plant spacing has shown significant difference with respect to number of days taken from flowering to fruit maturity which was found statistically maximum in treatment S_1: 100 cm × 30 cm with 28.66 and was statistically on par with treatment S_2: 100 cm × 40 cm with 29.85. The minimum number of days taken were observed in treatment S_3: 100 cm × 50 cm with 30.41. The impact of plant spacing was significant in relation to number of days taken to first fruit harvest which was found minimum in treatment S_3: 100 cm × 50 cm with 77.63 which was statistically on par with treatment S_2: 100 cm × 40 cm with 79.57. The maximum number of days taken to first fruit harvest were observed in treatment S_1: 100 cm × 30 cm.

Table 3: Effect of sowing time and plant spacing on flowering of muskmelon variety Arka Siri

Sowing time	**Node at which first male flower appeared**				**Node at which first female flower appeared**			
	Plant spacing				**Plant spacing**			
	S_1	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**
D_1	3.30	2.96	2.80	**3.02^{c}**	8.33	7.92	7.72	**7.99^{a}**
D_2	3.15	2.90	2.78	**2.94^{bc}**	8.36	8.31	8.04	**8.24^{b}**
D_3	3.12	2.81	2.69	**2.88^{ab}**	9.05	8.72	8.23	**8.67^{c}**
D_4	2.99	2.79	2.59	**2.79^{a}**	10.55	9.98	9.44	**9.99^{d}**
Mean	**3.14^{c}**	**2.87^{b}**	**2.72^{a}**		**9.07^{b}**	**8.73^{ab}**	**8.36^{a}**	
Factors	**C.D. at 5%**		**S.E.m±**		**C.D. at 5%**		**S.E.m±**	
D	0.11		0.04		0.43		0.14	
S	0.1		0.03		0.37		0.12	
D×S	NS		0.07		NS		0.25	

Combined effect of sowing time and plant spacing

Interaction effect of sowing time and plant spacing have non-significant effect on flowering and earliness parameters.

Discussion

The increase in number of male flowers per plant might be due to enhanced temperature prevailing at later sowing times and due to more adequate space for the plants to be exposed to light and nutrients for optimum growth and development which favors production of more male flowers. The increase in sex ratio at later sowing times possibly due to high temperature and long days which augments male flower development and limits female flowers. The decrease in nodal position of first male flower at later sowing time could be due to warmer temperature which cause faster growth and more reproductive development. The increase in node at which first male flower appeared at wider plant spacing might be due to increase in completion for nutrients, water, sunlight so in order to overcome it plant goes into reproductive phase The decline in number of days taken for earliness parameters at later sowing days and at wider plant spacing might be due to cooler temperature prevailing at earlier sowing time, more competition at narrow plant spacing which resulted in longer time to maturity.

Conclusion

Based on the above results we can conclude that treatment combination of D_2S_3 *i.e.* T_6 (15^{th} January,100 cm × 50 cm) can be recommended for growers aiming to optimize yield and harvest time.as the flowering and earliness parameters coincide with optimum temperature conditions required for growth of muskmelon.

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