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## Effect of different planting density on growth parameters of moringa (*Moringa oleifera* Lam.)

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**ABSTRACT :** The present study effect of different planting density on growth parameters of moringa for leaf production (*Moringa oleifera* Lam.) was carried out during (Feb.– Dec.) 2016 in the vegetable field unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar. The treatment consisted of five different planting density viz., T<sub>1</sub> (45 x 45cm), T<sub>2</sub> (60 x 60cm), T<sub>3</sub> (75 x 75cm), T<sub>4</sub> (90 x 90cm) and T<sub>5</sub> (120 x 120cm). Among the five different treatments, the treatment T<sub>5</sub> (120 x 120cm) recorded highest value for plant height, number of branches, number of leaves and stem girth.

**KEY WORDS :** Spacing, Plant height, Stem girth, Number of leaves, Number of branches

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*Moringa oleifera* is the most widely cultivated species of the genus *Moringa*, which is the only genus in the family Moringaceae. English common names include: moringa, drumstick tree (from the appearance of the long, slender, triangular seed-pods), horseradish tree (from the taste of the roots, which resembles horseradish), ben oil tree, or benoil tree (from the oil which is derived from the seeds). It is a fast-growing, drought-resistant tree, native to the southern foothills of the Himalayas in North western India, where its young seed pods and leaves are used as vegetables (Anwar *et al.*, 2007). The genus *Moringa* consists of 13 species but the most popular and cultivated type is *Moringa oleifera*, which is spread over in tropical and sub-tropical regions and adapt well in the different soils and adjust well even in marginal conditions. Incredible ability of *Moringa* to survive harsh weather and even drought has made this crop a wider adaptability in varying situations. Besides India, it is grown in Africa, Sri Lanka, Mexico, Malaysia and Philippines (Dillard and German, 2000).

### RESEARCH METHODS

The present investigation on the effect of different planting density on growth parameters of moringa for leaf production (*Moringa oleifera* Lam.) was carried out at the vegetable unit of the Department of Horticulture, Faculty of Agriculture, Annamalai University during 2015-16.

The treatment consisted of five different planting density viz., T<sub>1</sub> (45 x 45cm), T<sub>2</sub> (60 x 60cm), T<sub>3</sub> (75 x 75cm), T<sub>4</sub> (90 x 90cm) and T<sub>5</sub> (120 x 120cm). The experiment was laid out in Randomized Block Design with five treatments and four replications. Observations on growth parameters were recorded on 35 days intervals starting from 70 days after sowing and totally seven harvest were made during the study period. Observations were recorded on plant height, number of leaves per plant, stem girth and number of branches. The statistical analysis of data was done by adopting the standard statistical procedures given by Panse and Sukhatme (1985). The critical difference was worked out for 5 per cent level of significance. The IRRISTAT

software was used for the statistical analysis of data.

## RESEARCH FINDINGS AND DISCUSSION

The data recorded on plant height at eight stages of evaluation (35,70, 105, 140, 175, 210, 245, 280) days after planting are furnished in the Table 1 which showed significant variation for the trait among different treatments. Among the different spacing levels, treatment T<sub>5</sub> (120 x 120cm) recorded the highest plant height of 84.73, 119.00, 138.90, 143.18, 148.70, 150.18, 144.85, 143.85 cm at 35, 70, 105, 140, 175, 210, 245, 280 days after planting, respectively. It was followed by T<sub>4</sub> (90 x 90cm) which recorded 82.70, 114.28, 134.55, 142.10, 144.10, 138.50, 136.83, 136.93 cm at 35, 70, 105, 140, 175, 210, 245, 280 DAP, respectively. T<sub>1</sub> (45 x 45 cm) recorded the least plant height of 71.30, 96.55, 115.13, 118.35, 119.80, 114.05, 115.50, 114.13 cm, respectively over the stages of evaluation. The plant height in different treatments showed an increasing trend over the stages of evaluation.

Regarding number of branches T<sub>5</sub> (120 x 120 cm) recorded the highest number of branches per plant of

2.65, 4.65, 5.98, 7.10, 6.88, 7.20, 7.05, 7.10 at 35, 70, 105, 140, 175, 210, 245, 280 days after planting, respectively. It was followed by T<sub>4</sub> (90 x 90 cm) which recorded 2.10, 4.10, 5.08, 6.55, 6.53, 6.48, 6.53, 6.75 at 35, 70, 105, 140, 175, 210, 245, 280 DAP, respectively. T<sub>1</sub> (45 x 45cm) recorded the least number of branches per plant of 1.18, 2.63, 2.83, 3.73, 3.28, 3.55, 3.25, 3.80, respectively over the stages of evaluation (Table 2). Comparison of the data on vegetative characters such as plant height, number of leaves, number of branches and stem girth revealed that wider spacing of 120 cm was optimum. The higher vegetative growth observed in case of wider spacing can be explained on the basis that plants growing at wider spacing could get more space for their root and shoot development and with the availability of more space in soil, plants acquire more nutrients and water for vegetative growth.

In Moringa, plant height and number of branches plant<sup>-1</sup> are higher under wider spaced plants. These observation are in agreement with the finding of Choudhari and Choudhary (2013) in *Artemisia annua* and Ekwu and Nwokwu (2012) in okra and Maurya

**Table 1 : Effect of various spacing levels on plant height (cm) in moringa cv.PKM-1**

Treatment details (cm)	Plant height (cm)							
	35 DAP	70 DAP	105 DAP	140 DAP	175 DAP	210 DAP	245 DAP	280 DAP
T <sub>1</sub> - 45 x 45	71.30	96.55	115.13	118.35	119.80	114.05	115.50	114.13
T <sub>2</sub> - 60 x 60	74.40	105.63	122.30	128.25	129.05	122.00	123.45	119.20
T <sub>3</sub> - 75 x 75	76.98	110.88	128.98	136.95	135.33	129.28	131.40	127.30
T <sub>4</sub> - 90 x 90	82.70	114.28	134.55	142.10	144.10	138.50	136.83	136.93
T <sub>5</sub> - 120x120	84.73	119.00	138.90	143.18	148.70	150.18	144.85	143.85
Grand mean	78.02	109.27	127.97	133.77	135.40	130.80	130.41	128.28
S.E.±	0.43	0.41	1.29	1.99	1.51	2.04	1.70	1.19
C.D. (P=0.05)	0.94	0.89	2.80	4.33	3.29	4.44	3.69	2.59

**Table 2 : Effect of various spacing levels on number of branches per plant in moringa cv.PKM-1**

Treatment details (cm)	Number of branches per plant							
	35 DAP	70 DAP	105 DAP	140 DAP	175 DAP	210 DAP	245 DAP	280 DAP
T <sub>1</sub> - 45 x 45	1.18	2.63	2.83	3.73	3.28	3.55	3.25	3.80
T <sub>2</sub> - 60 x 60	1.45	3.10	3.23	4.80	4.48	4.58	4.55	4.53
T <sub>3</sub> - 75 x 75	1.70	3.63	4.45	6.03	6.08	5.30	5.50	5.30
T <sub>4</sub> - 90 x 90	2.10	4.10	5.08	6.55	6.53	6.48	6.53	6.75
T <sub>5</sub> - 120 x 120	2.65	4.65	5.98	7.10	6.88	7.20	7.05	7.10
Grand mean	1.82	3.62	4.31	5.64	5.45	5.42	5.38	5.50
S.E.±	0.11	0.08	0.10	0.16	0.09	0.10	0.13	0.11
C.D. (P=0.05)	0.24	0.18	0.21	0.34	0.19	0.23	0.28	0.24

(2013) in okra.

The data on recorded on number of leaves per plant at eight stages of evaluation (35, 70, 105, 140, 175, 210, 245, 280) days after planting are furnished in the Table 3 which showed significant variation for this trait. Among the treatment T<sub>5</sub> (120 x 120 cm) recorded the highest number of leaves per plant of 16.50, 23.17, 30.75, 33.00, 37.56, 36.57, 37.50, 36.47 at 35, 70, 105, 140, 175, 210, 245, 280 days after planting, respectively. Regarding stem girth (Table 4) the treatment T<sub>5</sub> (120 x 120cm) recorded the highest stem girth of 7.80, 8.20, 8.42, 8.98, 9.15, 9.90, 11.70, 12.28 cm at 35, 70, 105, 140, 175, 210, 245, 280 days after planting, respectively. It was followed by T<sub>4</sub> (90 x 90cm) which recorded 7.35, 7.60, 7.73, 8.08, 8.20, 8.28, 9.10, 9.33 cm at 35, 70, 105, 140, 175, 210, 245, 280 days after planting, respectively. T<sub>1</sub> (45 x 45 cm) recorded the least stem girth of 5.43, 5.43, 5.78, 5.83, 5.95, 6.15, 6.43, 6.83 cm, respectively over the stages of evaluation. The stem girth in different treatments showed an increasing trend over the stages of evaluation. Increased number of branches ultimately

increased the number of leaves per plant. These observations are in agreement with the findings of Birbal *et al.* (1995) and Singh (2004) in okra.

The plants under wider spacing are having more number of leaves due to its better utilization of water and nutrients when compared to closer spacing. They have the advantage of better photosynthesis and uptake of nutrients compared to close spaced plants. The above results are similar to reports of Devi and Gopalakrishnan (2004) in oriental pickling melon. Stem girth was higher in wider spaced plants of 120 x 120cm (T<sub>5</sub>) followed by 90 x 90 cm (T<sub>3</sub>) and least stem girth was observed in spacing of 45 x 45 cm (T<sub>1</sub>). The results are in conformity with the findings of Jaffar and Fazal-I-Wahid (2014).

Based on the results of the present investigation, a wider spacing of moringa at 120 x 120 cm recorded maximum value for plant height, number of leaves, number of branches and stem girth. Hence, the spacing of 120 x 120 cm is recommended for harvesting of moringa for leaf purpose.

**Table 3 : Effect of various spacing levels on number of leaves per plant in moringa cv. PKM-1**

Treatment number	Number of leaves per plant							
	35 DAP	70 DAP	105 DAP	140 DAP	175 DAP	210 DAP	245 DAP	280 DAP
T <sub>1</sub> - 45 x 45	10.84	16.86	20.50	25.00	27.24	26.55	26.08	26.67
T <sub>2</sub> - 60 x 60	11.25	17.50	22.00	26.50	29.25	28.74	29.72	28.42
T <sub>3</sub> - 75 x 75	12.75	19.50	24.75	28.25	31.86	30.35	31.63	31.62
T <sub>4</sub> - 90 x 90	14.75	20.50	27.00	31.25	35.64	34.74	35.52	34.47
T <sub>5</sub> - 120x120	16.50	23.17	30.75	33.00	37.56	36.57	37.50	36.47
Grand mean	13.22	19.51	25.00	28.80	32.31	31.39	32.09	31.53
S.E.±	0.51	0.73	0.70	0.64	0.74	0.84	0.52	0.69
C.D. (P=0.05)	1.12	1.60	1.52	1.39	1.61	1.83	1.14	1.50

**Table 4 : Effect of various spacing levels on stem girth (cm) in moringa cv.PKM-1**

Treatment number	Stem girth (cm)							
	35 DAP	70 DAP	105 DAP	140 DAP	175 DAP	210 DAP	245 DAP	280 DAP
T <sub>1</sub> .45 x 45	5.43	5.43	5.78	5.83	5.95	6.15	6.43	6.83
T <sub>2</sub> - 60 x 60	6.20	5.98	6.18	6.83	6.33	6.80	7.13	7.23
T <sub>3</sub> - 75 x 75	6.85	6.80	7.08	7.83	7.18	7.35	7.75	8.50
T <sub>4</sub> - 90 x 90	7.35	7.60	7.73	8.08	8.20	8.28	9.10	9.33
T <sub>5</sub> - 120x120	7.80	8.20	8.42	8.98	9.15	9.90	11.70	12.28
Grand mean	6.73	6.80	7.03	7.51	7.36	7.70	8.42	8.83
S.E.±	0.11	0.02	0.14	0.07	0.14	0.19	0.15	0.15
C.D. (P=0.05)	0.24	0.05	0.29	0.16	0.30	0.41	0.33	0.33

## REFERENCES

- Anwar, F., Latif, S., Ashraf, M. and Gilani, A.H. (2007).** *Moringa oleifera*: a food plant with multiple medicinal uses. *Phytotherapy Res.*, **21**(1):17-25.
- Birbal, B., Nehra, K. and Malik, Y.S. (1995).** Effect of spacing and nitrogen on fruit yield of okra [*Abelmoschus esculentus* (L.) Moench] cv. VARSHA UPHAR. *Haryana Agric. Univ. J. Res.*, **25**(1-2): 47-51.
- Choudhari, R. and Choudhary, R. (2013).** Growth and yield of *Artemisia annua* as affected by different plant geometry. *Adv. Res. J. Crop Improv.*, **4**(1): 31-33.
- Devi, M. J. and Gopalakrishnan, T.R. (2004).** Spacing influences growth and productivity of less spreading and short duration oriental pickling melon (*Cucumis melo* var. *Conomon* mak.) cv. 'SAUBHAGYA' *J. Trop. Agric.*, **42** (2) : 59-61.
- Dillard, C.J. and German, J.B. (2000).** Phytochemicals, Nutraceuticals and human health: A review. *J. Sci. Food Agric.*, **80** (12): 1744–1756.
- Ekwu, L.G. and Nwokwu, G.N. (2012).** Effect of plant spacing and planting date on the growth and yield of okra. *Intl. J. Agri. & Rural Dev.*, **15** (2):1041-1048.
- Jaffar, A. and Fazal-I-Wahid (2014).** Effect of row spacing on growth, yield and yield components of cucumber varieties. *Sci. Lett.*, **2** (1) : 33-38.
- Maurya, R.P. (2013).** Impact of plant spacing and picking interval on the growth, fruit quality and yield of okra [*Abelmoschus esculentus* (L.) Moench]. *American J. Agric. & For.*, **1**(4): 48-54.
- Panse, V.G. and Sukhatme, P.V. (1985).** *Statistical method for agricultural workers*. ICAR, NEW DELHI, INDIA.
- Singh, D. (2004).** Effect of different sowing dates and plant density on seed production of okra variety Parbhani Kranti. *Udyanika*, **10** (1) : 42-46.

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