Plant Archives Vol. 17 No. 2, 2017 pp. 892-894 *ISSN 0972-5210*

INFLUENCE OF SPACING ON THE PERFORMANCE OF SOURSOP (*ANNONA MURICATA* L.) SEEDLINGS FOR LEAF PRODUCTION

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Abstract

An experiment was carried out to standardize the spacing of soursop for leaf production was laid out in Randomized Block Design, replicated five times with five treatments. Six months old soursop seedlings were planted in the field with the following spacings: 1 × 1 m ($\mathbf{T_1}$), 2 × 2 m ($\mathbf{T_2}$), 3 × 3 m ($\mathbf{T_3}$), 4 × 4 m ($\mathbf{T_4}$), 5 × 5 m ($\mathbf{T_5}$). The results of the experiment revealed that, among the various spacings tried, 1 × 1 m ($\mathbf{T_1}$) achieved maximum value for the characters like plant height, stem girth, number of leaves, leaf length, leaf breadth, leaf area and leaf chlorophyll content which was followed by 3 × 3 m ($\mathbf{T_3}$).

Key words : Soursop, spacing, leaf production.

Introduction

Soursop (*Annona muricata* L.), which belongs to Annonaceae family is an evergreen tree species known for its anti-cancer properties, thanks to its annonaceous acetogenins content. It is a native of Central America. It bears the largest fruit among Annonas. It is mostly distributed in tropical and subtropical regions of the world. Soursop grows on a limited scale in Southern India, in states like Tamil Nadu, Karnataka, Andhra Pradesh and Kerala. It also thrives wild throughout the Southern Sub-tropical India. It does not tolerate frost and grows well in well-drained and semi-dry soil upto an elevation of 300 MSL. In India, soursop flowers and fruits during the months of April to October. The soursop is truly tropical. The optimal range of latitude is between 27ºN and 22.5ºS (Nakasone and Paull, 1998). It grows and produces well at 21 to 30ºC, being very sensitive to severe changes in temperature, especially if the limit of 12ºC is reached (Pinto and Silva, 1994). Some popular annonas are the true custard apple, or bullock's heart or Ramphal (*A. reticulata* Linn.), the sugar apple or sweetsop or Sitaphal or Custard apple (*A. squamosa* Linn.) and the cherimoya (*A. cherimola* Mill.). The tree is low-branching and bushy but slender because of its upturned limbs, and reaches a maximum of 7.5-9 m in height (Morton, 1987). The fruit consists of about 67.5% edible white pulp with a pleasing fragrance and flavor. It is a good source of vitamins B and C with some calcium and phosphorus. Some investigators reported the medicinal values of this 'miracle plant' such as anti-cancer (Wang *et al*., 2002), anti-tumor (Kim *et al*., 1998), anti-parasitic (Jaramillo *et al*., 2000), anti-viral (Betancur-Galvis *et al.,* 1999) and antioxidant (Gavamukulya *et al.,* 2014) properties. Tea prepared from soursop leaves and stem has recently been gaining wider popularity and shade dried leaves and stem fetches very premium prices in e-commerce vendors. It is more convenient to store and transport dried leaves and stem as opposed to fruits which are highly perishable and may not ripen properly in fluctuation of storage temperature. Therefore, due to changing market demand, leaf production of soursop would be a lucrative business since the leaves contain annonaceous acetogenins. Moreover, economic returns can be obtained in a short period of time since there is no need to wait for the plants to attain reproductive stage like in the case of fruit production. Hence, an investigation was conducted to evaluate various spacings on the performance of soursop seedlings for leaf production.

Materials and Methods

The experiment was conducted in Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar (Tamil Nadu), India; during 2015-2017. An experiment was conducted in Randomized Block Design with five replications and five treatments. The

treatments were coded as mentioned below: T_1 – 1 × 1 m, T_2 – 2 × 2 m, T_3 – 3 × 3 m, T_4 – 4 × 4 m, T_5 – 5 × 5 m. Six months old soursop (*Annona muricata* L.) seedlings were planted in the field with different spacings. The field was cleared of weeds. Planting pits at the size of 60 cm × 60 cm × 60 cm were dug at different spacing. 20 kg of FYM and recommended fertilizers (40g N, 30g P, 60g K) (Tripathi *et al*., 2014) were applied in each pit. The plants were planted in the pits and watered. Watering was done regularly and plant protection measures were given as and when needed.

Results and Discussion

The data pertaining to plant height, stem girth, number of leaves, leaf area, leaf length, leaf breadth, leaf chlorophyll content of soursop seedlings was recorded and presented in table 1. Significant response among the various spacing treatments was observed in plant height. The highest value for plant height (96.12 cm) was observed in 1 × 1 m spacing (T_1) at 120 days after planting (DAP). It was followed by 3 × 3 m spacing (T_3) (83.50 cm). The least value (75.06 cm) was observed in 4 × 4 m spacing (T_4). The maximum value for stem girth (5.80 cm) was observed in 1 × 1 m spacing (T_1) at 120 DAP. It was followed by 3 × 3 m spacing (T_3) (5.46 cm). The least value (4.00 cm) was observed in 4 × 4 m spacing (T_4). The results agree with the report of Singh *et al*. (2007) also observed the highest plant height and stem girth in the closest spacing in guava. The results are in close conformity with Pandey *et al.* (2015) who observed maximum plant height with a close spacing of 2 × 2 m in *Litchi chinensis* cv. Shahi. Significant response among the various spacing treatments was observed in number of leaves per plant. The highest value for number of leaves (87.55) was observed in 1 × 1 m spacing (T_1) at 120 DAP. It was followed by 3 × 3 m spacing (T_3) (86.17). The least value (70.51) was observed in 4 × 4 m spacing (T_4). The maximum value for leaf length (15.90 cm) was observed in 1 × 1 m spacing (T_1) at 120 DAP. It was followed by 3 × 3 m spacing (T_3) (15.50 cm) which was on par with 2 × 2 m spacing (T_2) (15.36 cm). The least value (14.81 cm) was observed in 4 × 4 m spacing (T_4) which was on par with 5 × 5 m spacing (T_5) (15.02 cm). The maximum value for leaf breadth (6.53 cm) was observed in 1 × 1 m spacing (T_1) at 120 DAP. It was followed by 3 × 3 m spacing (T_3) (6.18 cm) which was on par with 2 × 2 m spacing (T_2) (6.13 cm). The least value (5.72 cm) was observed in 4 × 4 m spacing (T_4) which was on par with 5 × 5 m spacing (T_5) (5.80 cm). The maximum value for leaf area (69.68 cm^2) was observed in 1 × 1 m spacing (T_1) at 120 DAP. It was followed by 3 × 3 m spacing (T_3) (57.02 cm^2). The least value (49.83 cm^2) was observed in 4 × 4 m spacing (T_4). The results are in close conformity with the findings of Abdullahi *et al.* (2013), who reported maximum number of leaves in *Moringa oliefera* at a close spacing of 50cm × 50cm. The maximum value for leaf chlorophyll content (53.58 mg $100g^{-1}$) was observed in 1 × 1 m spacing (T_1) at 120 DAP. It was followed by 3 × 3 m spacing (T_3) (53.52 mg $100g^{-1}$). The least value (52.98 mg $100g^{-1}$) was observed in 4 × 4 m spacing (T_4). These findings are in good harmony with the reports of Basra *et al.* (2015) who observed the highest number of leaf, biomass production and leaf nutritional compositions of *Moringa oleifera* at a close spacing of 15 × 30 cm. Moyin-Jesu and Akinola (2012) also reported the highest stem and leaf biomass in cassava at a close spacing of 50 × 50 cm. The superior result obtained in close spacing of 1 × 1 m spacing might be due to the fact that the suppression of weed growth in close spacing was significantly higher than wide spacing which resulted into utilization of more solar radiation, soil moisture by plant that leads to superior plant growth characteristics *viz.,* plant height, number of leaves, biomass, etc. Close spacing responses highly to the availability of ample amount of macronutrients (NPK) due to lesser weed growth resulted in a better vegetative growth of the crop. The ultra density crop facilitate in maintaining the soil fertility status which leads to proper

Table 1 : Influence of spacing on the performance of soursop seedlings for leaf production.

Treatments	Plant height (cm)	Stem girth (cm)	Number of leaves	Leaf length (cm)	Leaf breadth (cm)	Leaf area (cm^2)	Chlorophyll content (mg $100g^{-1}$)
T_1 – 1 x 1 m	96.12	5.80	87.55	15.90	6.53	69.68	53.58
T_2 – 2 x 2 m	83.02	4.67	83.48	15.36	6.13	54.74	53.37
T_3 – 3 x 3 m	83.50	5.46	86.17	15.50	6.18	57.02	53.52
T_4 – 4 x 4 m	75.06	4.00	70.51	14.81	5.72	49.83	52.98
T_5 – 5 x 5 m	79.15	4.32	77.26	15.02	5.80	51.55	53.12
S.Ed	0.16	0.14	0.31	0.14	0.14	0.21	0.02
CD (P=0.05)	0.34	0.31	0.67	0.31	0.30	0.45	0.04

growth and development of crop with producing higher number of branches resulted into maximum number of leaves per plant, height and spread. Leaves as the site for photosynthesis accumulates more carbohydrates to further increase their numbers (Ughade and Mahadkar, 2015). Talukder *et al.* (2003), Makinde and Macarthy (2006) opined that in nature the competition effect may be completely absent until population density reaches some threshold at which resources become limited. Further, increase in plant height in closer spacing might be due to competition for light because of insufficient space (Pandey *et al.*, 2015). This improved growth might be due to the fact that the plants are at young stage. As the plants continue to grow and spread competition among the plants may hinder growth. So, the next best spacing of 3 × 3 m or 2.5 × 2.5m may be recommended for long term soursop leaf production.

Acknowledgement

Authors are thankful to Department of Horticulture, Faculty of Agriculture, Annamalai University in Chidambaram for providing facilities.

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