

Nutrient management with organic, inorganic and biofertilizers for yield attributes of soursop (*Annona muricata* L.)

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ABSTRACT

A field experiment was carried out to study the effect of organic, inorganic and biofertilizers in soursop (*Annona muricata* L.) at Department of Horticulture, Faculty of Agriculture, Annamalai University during 2017-2019. Two years old soursop plants were used for this study. The experiment was conducted in a Randomized Block Design with eight treatments in four replications. The treatments include chemical fertilizers (80:60:40 g of N:P:K; 60:45:30 g of NPK and 40:30:20 g of NPK), organic nutrients viz., vermicompost @ 500 g, Biofertilizers (*Azospirillum* and *Phosphobacteria*) @ 50 g were applied per plant in the respective treatments. Humic acid @ 0.2 % spray was applied through foliar means once in 3 months. Totally 4 sprays were given starting from 2 years after planting in the respective treatments. The results revealed that among the various treatments tried, application of 80:60:40 g NPK/plant + Biofertilizer (50 g/plant) + Vermicompost (1/2 kg/plant) + Humic Acid (0.2 % spray) resulted in improving the yield attributes like minimum days taken for flowering, number of flowers per plant, minimum days taken for fruit set, number of fruits per plant, per cent fruit set (%), fruit length (cm), fruit width (cm), fruit weight (g). This was closely followed by the application of 60:45:30 g NPK/plant + Vermicompost (1/2 kg/plant) + Biofertilizer (50 g/plant) + Humic Acid (0.2 % spray).

Key words: Soursop, organic manures, biofertilizers, humic Acid

Soursop (*Annona muricata* L.) which belongs to Annonaceae family is an evergreen tree species and it has annonaceous acetogenins content. Soursop is known for its anti-cancer properties. Origin of this crop is Central America. It bears the largest fruit among Annonas. Annonaceous acetogenins content of soursop leaves exhibited significant inhibitory effects against six human cancer cell lines: lung, breast, colon, pancreatic, kidney carcinoma (Vieira *et al.*, 2010).

Soursop Leaves Crude Extract (AMCE) exhibited cytotoxicity towards breast cancer cell lines and reduced the tumor's size and weight in lab mice. Thus it is proved to be a promising candidate for cancer treatment especially in breast cancer as an alternative to conventional drugs (Najmuddin *et al.*, 2016). Such an amazing gift of nature should be utilized and commercialized for cultivation. Since it is an underutilized fruit crop, agro techniques are yet to be standardized. Hence a field experiment was conducted to study the effect of organic, inorganic and biofertilizers on the yield attributes of soursop.

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MATERIALS AND METHODS

A field experiment was carried out to study the effect of organic, inorganic and biofertilizers in soursop at Department of Horticulture, Faculty of Agriculture, Annamalai University during the year 2017. Two years old soursop plants were used for this study. The experiment was conducted in a Randomized Block Design with eight treatments in four replications. The treatments included chemical fertilizers (80:60:40 g of NPK; 60:45:30 g of NPK and 40:30:20 g of NPK), organic nutrients viz., vermicompost @ 500 g, Biofertilizers (*Azospirillum* and *Phosphobacteria*) @ 50 g were applied per plant in the respective treatments. Accordingly total eight treatments were there viz., 80:60:40 g NPK/ plant (T₁); 80:60:40 g NPK/ plant + Biofertilizer (50 g/ plant) (T₂); 80:60:40 g NPK/ plant + Vermicompost (1/2 kg/ plant) (T₃); 80:60:40 g NPK/ plant + Humic Acid @ 0.2 % spray (4 spray once in 3 month) (T₄); 80:60:40 g NPK/ plant + Biofertilizer (50 g/ plant) + Vermicompost (1/2 Kg/ plant) + Humic Acid (0.2 % spray) (T₅); 40:30:20 g NPK/ plant + Vermicompost (1/2 Kg/ plant) + Biofertilizer (50g/ plant) + Humic acid (0.2 % spray) (T₆); 60:45:30 g NPK/ plant + Vermicompost (1/2 Kg/ plant) + Biofertilizer (50 g/ plant) + Humic Acid (0.2 % spray) (T₇); Control (T₈). The chemical fertilizers were applied in the form of urea, single super phosphate and muriate of potash as per treatments by forming a trench around the tree at 30 cm away from the trunk. 80:60:40 g; 60:45:30 g and 40:30:20 g of NPK were applied in the respective treatments. Phosphorous and potash were applied as basal. Nitrogen was applied in two split doses at 3 months interval. Humic acid @ 0.2 % spray was applied through foliar means once in 3 months during the months of July, October, January and April, 2017. Totally 4 sprays were given starting from 2 years after planting in the respective treatments. Irrigations

were given through basin method. Observations recorded were, number of days for flowering, number of days for fruit set, number of fruits, fruit set (%), fruit length (cm), fruit breadth (cm) and fruit weight (g).

RESULT AND DISCUSSION

The results revealed that among the various treatments tried, application of 80:60:40 g NPK/ plant + Biofertilizer (50 g/ plant) + Vermicompost (1/2 kg/ plant) + Humic Acid (0.2 % spray) (T₅) resulted improving the yield attributes like minimum days taken for flowering, minimum days taken for fruit set, maximum number of flowers per plant, maximum number of fruits per plant, per cent fruit set (%), fruit length (cm), fruit width (cm), fruit weight (g). This was closely followed by application of 60:45:30 g NPK/ plant + Vermicompost (1/2 kg/ plant) + Biofertilizer (50 g/ plant) + Humic Acid (0.2 % spray) (T₇).

The reproductive growth in terms of number of flowers, number of fruits and per cent fruit set was also significantly influenced due to the application of 100% of NPK, biofertilizers, vermicompost and humic acid. The maximum number of flowers per tree, maximum number of fruits per tree (Table 1) and per cent fruit set were recorded in the treatment T₅ (80:60:40 g NPK/ plant + Biofertilizer (50 g/ plant) + Vermicompost (1/2 Kg/ plant) + Humic acid (0.2 % spray). Minimum days required for flowering, fruit set, and High fruit set %, maximum value for fruit length, fruit breadth, and fruit weight were recorded in the same treatment. The results are in agreement with the findings of Suresh Kumar *et al.* (2017) in custard apple, who reported the enhanced growth characters of custard apple due to the integrated nutrient practices. The effect of integrated nutrient management on yield parameters of soursop viz., days taken for flowering, percent fruit set, was evident that it

might be due to the altered C: N ratio which helped in balanced management of vegetative and reproductive stages and induce early flowering.

It is clear from the results, that 100 % NPK, vermicompost, biofertilizer and humic acid recorded significantly the maximum number of flowers per plant as compared to control. The increased number of flowers per plant might be due to increased continuous supply of nutrients and growth promoting substance from vermicompost and biofertilizers. The fact that increased number of fruits set percent was obtained with the same treatment might be due to supply of all the nutrients in balanced proportion right from starting of the experimentation to the harvesting of the crop, which induced the more flowering and fruits set due to production and supply of photosynthates at critical requirement. These results are in accordance with the findings of Singh and Mithra(2017) in bael.

The results revealed that 100 % of N, P and K with organic nutrients significantly increased the number of fruits per tree and this was similar to the results of Suresh Kumar *et al.*(2011) in custard apple.

The increase in fruit length, fruit breadth and fruit weight (Table 2) might be attributed to elongation of individual cells. This might be possible through better translocation of soluble ions under optimum level of nutrients. Fruit weight and fruit size are highly correlated with biomass and balanced level of hormones. Improved fruit quality might be due to the fact that, organic manures and microbial fertilizers enhance the nutrient availability by enhancing the capacity of the plant. The above findings are in accordance with Meena (2016) in sapota. Application of vermicompost provides adequate supply of macro and micronutrients to the metabolic activities of plants. Indirectly, it increases the photosynthetic activities of plants and ultimately increased the fruit length and fruit girth. Moreover vermicompost are rich in microbial activity and plant growth stimulants, and possessing pest

repellence attributes as reported by Gandhi *et al.*, (1997). Better fruit quality with respect to fruit length, diameter, and fruit weight might be due to fact that chemical fertilizers along with biofertilizers application caused accumulation of more food reserves in the trees and lead to an efficient utilization of the food materials for development of fruit. The marked effect of nitrogen on various characters of fruits showed that, it increased the efficiency of metabolic processes of the tree in various parts of the plant which might have resulted in high rate of photosynthesis and in higher carbohydrate accumulation in fruits thereby increasing in fruit length, diameter and weight. As the application of NPK significantly enhanced the plant growth and through its beneficial effects, which in turn resulted in increased fruit size as reported by Athani *et al.* (2007) in Guava. Humic acid also influenced the increase in number of fruits. This might be due to enhanced uptake of mineral nutrients and increase of cation exchange in soil as well as growth hormone like activity of humic acid. Similar results were also reported by Ngullie *et al.* (2014) in mango.

Organic manures and biofertilizers have direct role in nitrogen fixation, production of growth hormones like substances and more uptake of nutrients hence enhanced the fruit quality. These observations are in agreement with the findings Sharma and Bhatnagar (2014) in custard apple. Experimental findings stated that integration of organic, inorganic nutrients and biofertilizers studies will increase the productivity of crops by providing balanced nutrients in optimum quantity.

CONCLUSION

Based on the above observations, it could be concluded that among the various treatments, application of 80:60:40 g NPK/plant + biofertilizer (50 g /plant) + vermicompost (1/2 kg/plant) + humic acid (0.2 % spray) (T₅) was adjudged as the best treatment for enhancing the various yield parameters of soursop.

Table 1 Effect of Integrated nutrient management on yield parameters of soursop

Treatments	Number of days for flowering	Number of flowers	Number of days for fruit set	Number of fruits
T ₁ - 80:60:40 g NPK/ plant	233.25	15.25	71.25	10.15
T ₂ - 80:60:40 g NPK/ plant + Biofertilizer (50 g/ plant)	238.25	13.25	67.45	8.25
T ₃ - 80:60:40 g NPK/ plant + Vermicompost (1/2 kg/ plant)	218.35	21.25	59.35	16.15
T ₄ - 80:60:40 g NPK/plant + Humic Acid @ 0.2 % spray (4 spray once in 3 month)	228.15	18.15	64.25	12.58
T ₅ - 80:60:40 g NPK/plant + Biofertilizer (50 g/plant) + Vermicompost (1/2 Kg/plant) + Humic Acid (0.2 % spray)	200.00	31.35	48.00	27.35
T ₆ - 40:30:20 g NPK/plant + Vermicompost (1/2 Kg/plant) + Biofertilizer (50g/plant) + Humic acid (0.2 % spray)	212.25	24.25	55.25	19.25
T ₇ - 60:45:30 g NPK/plant + Vermicompost (1/2 Kg/plant) + Biofertilizer (50 g/plant) + Humic Acid (0.2 % spray)	206.05	27.35	51.05	22.76
T ₈ - Control	251.42	12.25	75.64	6.55
S.Ed	1.63	0.58	0.82	1.45
C.D(P=0.05)	3.26	1.16	1.64	2.90

Table 2 Effect of Integrated nutrient management on fruit characters of soursop

Treatments	Fruit set (%)	Fruit length(cm)	Fruit breadth(cm)	Fruit weight (g)
T ₁ - 80:60:40 g NPK/ plant	66.55	23.53	16.52	449.66
T ₂ - 80:60:40 g NPK/ plant + Biofertilizer (50 g/ plant)	62.26	24.55	17.55	464.22
T ₃ - 80:60:40 g NPK/ plant + Vermicompost (1/2 kg/ plant)	76.00	25.06	18.05	476.52
T ₄ - 80:60:40 g NPK/plant + Humic Acid @ 0.2 % spray (4 spray once in 3 month)	69.31	24.05	17.05	456.22
T ₅ - 80:60:40 g NPK/plant + Biofertilizer (50 g/plant) + Vermicompost (1/2 Kg/plant) + Humic Acid (0.2 % spray)	87.24	26.54	19.53	500.00
T ₆ - 40:30:20 g NPK/plant + Vermicompost (1/2 Kg/plant) + Biofertilizer (50g/plant) + Humic acid (0.2 % spray)	79.38	25.55	18.55	484.32
T ₇ - 60:45:30 g NPK/plant + Vermicompost (1/2 Kg/plant) + Biofertilizer (50 g/plant) + Humic Acid (0.2 % spray)	83.21	26.05	19.05	490.32
T ₈ - Control	53.46	23.05	16.03	443.22
S.Ed	1.08	0.13	0.13	2.60
C.D(P=0.05)	2.17	0.27	0.26	5.20

Soursop fruit



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