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Effect of different organic manures on plant growth and establishment of carambola (*Averrhoa carambola* L) cv. Golden star (Florida)

Senchumbeni R Khuvung, Samir E Topno and Vijay Bahadur

Abstract

The experiment entitled “Effect of Different Organic Manures on Plant Growth and Establishment of Carambola (*Averrhoa carambola* L) cv. Golden Star (Florida)” was carried out during the year 2020-2021. The experiment were laid out in Randomized Block Design comprising of 12 treatments viz., T₁ 5kg FYM + 1.5 kg Vermicompost plant⁻¹, T₂ 6.5kg FYM + 3.5 kg Vermicompost plant⁻¹, T₃ 8.5kg FYM + 2.5 kg Vermicompost plant⁻¹, T₄ 1.5 kg FYM + 1.5 kg Vermicompost plant⁻¹, T₅ 3.5 kg FYM + 3.5 kg Vermicompost plant⁻¹, T₆ 1.5 kg Vermicompost+ 3.5 kg FYM plant⁻¹, T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹, T₈ 3.5 kg Vermicompost+ 5 kg FYM plant⁻¹, T₉ 3.5 kg Vermicompost+ 6.5 kg FYM plant⁻¹, T₁₀ 6.5 kg Vermicompost+ 6 kg FYM plant⁻¹, T₁₁ 10 kg FYM + 5 kg Vermicompost plant⁻¹, T₁₂ 11.5kg FYM + 2 kg Vermicompost plant⁻¹, with three replications. The application of 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹ (T₇) was found to be the best treatment in terms of plant height (105.55), number of branches plant⁻¹ (17.44), number of leaves plant⁻¹ (570.11), stem girth (5.84), plant spread (East – West and North – South) (83.49) and leaf area (9.03 cm²).

Keywords: carambola, FYM, vermicompost, survival (%), mortality (%)

Introduction

Carambola (*Averrhoa carambola* L.), also known as star fruit, is a curious attractive underutilized fruit of warm and sub-tropical areas of the world which belong to the family Oxalidaceae. The fruit has distinctive ridges running down its sides (usually five but can sometimes vary); in cross-section, it resembles a star, hence its name. The original native of *Averrhoa carambola* L. is still unknown today. It is believed that it may have originated from Sri Lanka or Moluccas, Indonesia, but has been cultivated in the Indian Subcontinent and South-East Asian countries for hundreds of years. They are cultivated commercially in Southeast Asia, Southern China, Taiwan and Florida.

There are two main types of carambola: sour (or tart) type and sweet type. The fruit of carambola is a rich source of reducing sugars, ascorbic acid and minerals such as K, Ca, Mg and P (Devadas and Kuriakose, 2005). Ripe fruits of sweet form of carambola contain both oxalic acid (0.16%) and malic acid (0.06%), whereas fruits of sour form contain only oxalic acid in quantities ranging from 1.0% in unripe fruits to 0.51% in ripe ones. Sugars present in both type consist largely of glucose with moderate quantities of fructose and traces of sucrose and vitamin C content is also high (Godage *et al.*, 2013) [8]. Singh *et al.* (2013) stated that the fruits contain several amino acids including serine, glutamic acid and alanine. It is also a potent source of both primary and secondary polyphenolic antioxidants (Rao and Subramanyam, 2009).

Organic matter acts as a reservoir for plant nutrients and prevents leaching loss of nutrients which are vital for plant growth. Organic manure also creates an environment that encourages beneficial soil organisms i.e. earthworms. Organic matter undergoes mineralization with the release of substantial quantities of nitrogen, phosphorus, sulfur and small amount of micronutrients. Farmyard manure is rich in nutrients and improves soil fertility. Application of vermicompost in crop production is an important aspect of organic farming. Vermicompost can be used as effective manure in crop production as well as biofertiliser in maintaining soil health. Vermicompost is a rich nutritive organic fertilizer due to rich in humus, micronutrients, and beneficial soil microbes- nitrogen fixing and phosphorus solubilizing bacteria and actinomycetes and growth hormones auxins, ‘gibberlins and cytokinins.

With these factors, proper combination of organic manures plays a vital role to produce a greater number of shoots and a greater number of leaves that have good impact on the

Vegetative Growth parameters of Carambola. FYM and Vermicompost are most important for vegetative growth parameters, plant growth and to get better survival of Carambola.

Materials and Methods

The experiment was carried out the Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj 2020-2021. The entire organic manures materials were applied as a basal dose. For application organic manures the top soil around the plant (equal to the leaf canopy of the plant) was dug up to 30cm and the manures were uniformly mixed in to the soil, which was then leveled. Well rotten FYM and Vermicompost were applied at the time of plot preparation according to the treatment. Twelve treatment combinations viz. T₁ 5kg FYM + 1.5 kg Vermicompost plant⁻¹, T₂ 6.5kg FYM + 3.5 kg Vermicompost plant⁻¹, T₃ 8.5kg FYM + 2.5 kg Vermicompost plant⁻¹, T₄ 1.5 kg FYM + 1.5 kg Vermicompost plant⁻¹, T₅ 3.5 kg FYM + 3.5 kg Vermicompost plant⁻¹, T₆ 1.5 kg Vermicompost+ 3.5 kg FYM plant⁻¹, T₇ 3.5

kg Vermicompost+ 1.5 kg FYM plant⁻¹, T₈ 3.5 kg Vermicompost+ 5 kg FYM plant⁻¹, T₉ 3.5 kg Vermicompost+ 6.5 kg FYM plant⁻¹, T₁₀ 6.5 kg Vermicompost+ 6 kg FYM plant⁻¹, T₁₁ 10 kg FYM + 5 kg Vermicompost plant⁻¹, T₁₂ 11.5kg FYM + 2 kg Vermicompost plant⁻¹, were applied during the research work on Carambola. The treatment was done at vegetative growth stage. Ten healthy plants were randomly selected from each plot after planting to record the various developmental parameters of the Carambola plant. Observations were recorded on the following parameters: Growth Parameters – Plant height, Number of branches per plant, No of leaves / plant, Stem girth (cm), plant spread, leaf area (cm²), survival (%) and mortality (%). Gap filling was done whenever required during the first two weeks after transplanting. Intercultural operations were conducted on regular basis. Immediately after transplanting a light irrigation was done and later irrigation was done depending upon the moisture requirement of the soil. Pests like thrips and aphids were controlled by spraying imidachloprid @ 1 ml/l, during the period of experimentation.

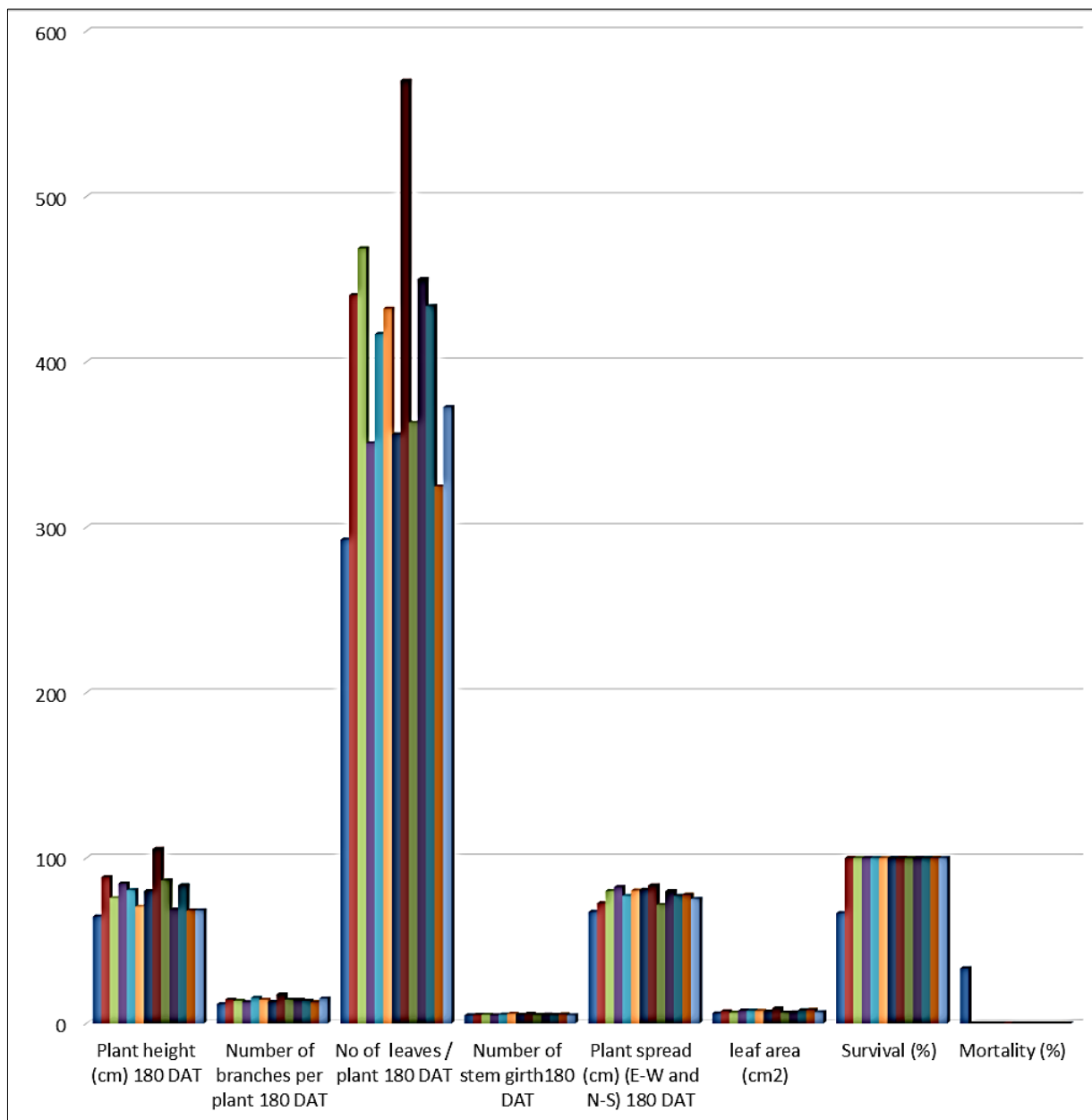


Fig 1: Effect of Different Organic Manures on Plant Growth and Establishment of Carambola

Results and Discussion

Growth parameters

The plant height, number of branches of plant and number of leaves were affected by different levels of organic media over control. However, the maximum plant height (105.55) was recorded in T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹ and the minimum plant height (64.66) was recorded in T₀ Control. The number of branches per plant was found to be maximum (17.44) was recorded in T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹ and the minimum number of branches plant⁻¹ (11.60) was recorded in T₀ Control. The reason for the increase in the plant height and number of branches in the treatment (T₇) may be due to the addition of vermicompost with FYM, which improves soil physical properties by decreasing bulk density and increasing the soil water holding capacity. The better role of vermicompost over FYM could be due to better mobilization and availability of plant nutrients and phytohormones extracted from FYM help the plant to grow more luxuriously. And the minimum plant height (T₀) in control treatment might be due to without application of nutrients and ultimately the supply of insufficient quantity of nutrients needed for the growth of plant.

During the research the progressive increase in number of leaves plant⁻¹ (570.11) was recorded in T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹. Whereas and the minimum number of leaves plant⁻¹ (257.40) was recorded in T₀ Control. Number of leaves is mainly influenced by environmental conditions, nutrients. Since nitrogen in manures affects plant growth, increase in number of leaves of plants can also be due to the availability of nitrogen content in the manures. These results are consistent with the findings of Athani *et al.* (2009), Dhokane *et al.* (2011), Shukla *et al.* (2014), Khan *et al.* (2018).

The stem girth (5.84 cm) was recorded maximum in T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹. Whereas and the minimum stem girth (4.86 cm) was recorded in T₀ Control. Vermicompost is reported to have bioactive principle which is considered to be beneficial for root growth and this has been hypothesized to result in greater root initiation, enhanced growth and development and also balanced composition of nutrients.

At 30, 60, 90, 120, 150, and 180 DAT, as depicted in data, the progressive increase in plant spread (cm) (E-W and N-S) (47.12, 52.88, 58.07, 64.54, 73.89 and 83.49) was recorded in T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹ which were found significantly over all other treatments and the plant spread (cm) (E-W and N-S) was at par with the treatment T₉ 3.5 kg Vermicompost+ 6.5 kg FYM plant⁻¹ T₁₂ 11.5kg FYM + 2 kg Vermicompost plant⁻¹ at 60 and 120 days after transplanting and the minimum plant spread (cm) (E-W and N-S) (25.91, 35.23, 44.89, 52.95, 59.35 and 67.40) was recorded in T₀ Control. The increase in plant spread may be in response to differential treatments indicates manifestation of shoot and leaf vigour by nutrient uptake and accelerated photosynthesis under environmental condition. Manure when decomposed increases both macro and micro nutrients as well as enhances the physico-chemical properties of the soil. The results of present study are almost match with the findings of Uma *et al.* (2002)^[20], Athani and Revanappa (2009), Binopal *et al.* (2013)^[4], Singh *et al.* (2018).

The maximum leaf area (9.03cm²) was found in treatment with T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹ which were found significantly over all other treatments and the leaf area was at par with the treatment T₁ 5kg FYM + 1.5 kg

Vermicompost plant⁻¹, T₃ 8.5kg FYM + 2.5 kg Vermicompost plant⁻¹, T₄ 1.5 kg FYM + 1.5 kg Vermicompost plant⁻¹, T₅ 3.5 kg FYM + 3.5 kg Vermicompost plant⁻¹ and T₆ 1.5 kg Vermicompost+ 3.5 kg FYM plant⁻¹ and the minimum leaf area (6.07cm²) was recorded in T₀ Control.

Survival percentage: After transplanting the seedling the maximum survival (%) (100) was found in treatment with T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹ followed by T₁₂, T₁₁, T₁₀, T₉, T₈, T₇, T₆, T₅, T₄, T₃, T₂ and T₁ and the minimum survival (%) (66.67) was recorded in T₀ Control. Significantly the reason for maximum survival (%) is due to enhanced release of nitrogen from the growth promoting substances produced by the microbes present in vermicompost might have resulted in the induction of leaf area and more leaves. These results closely match with the findings of Uma Shankar *et al.* (2003)^[20], Naik and Rao *et al.* (2007), Agnihotri *et al.* (2013)^[1], Imtiyaz *et al.* (2016) and Kour *et al.* (2019).

Conclusion

On the basis of the investigation it can be concluded that T₇ 3.5 kg Vermicompost+ 1.5 kg FYM plant⁻¹ results as the best treatment combination viz., plant height (105.55), number of branches plant⁻¹ (17.44), number of leaves plant⁻¹ (570.11), stem girth (5.84), plant spread (East – West and North – South) (83.49) and leaf area (9.03 cm²) showed better results in Prayagraj agro climatic condition. And the cost of cultivation was less in control (138540 Rs ha⁻¹).

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