

Original Research Article

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Effect of Integrated Nutrient Management on Flowering, Fruit Yield and Quality of Aonla (*Emblica officinalis* Gaertn) cv. Chakaiya

Balram Pusam* and Deepansu Masih

Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj, India

*Corresponding author

ABSTRACT

Keywords

INM, Flowering yield, Quality and Aonla

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The investigation entitled “Effect of integrated nutrient management on flowering, fruit and quality of Aonla (*Emblica officinalis* Gaertn) cv. Chakaiya” was conducted during 2019-2020 at the Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The experiment was laid out in Randomized Block Design (RBD), replicated thrice with the 11 treatment combination. The observation was recorded on flowering, fruiting and quality. The maximum flowering duration (20.54), Fruit set (%) (74.71), Number of fruit per shoots (76.42), Number of shoots per tree (12.80), fruit weight (g) (46.43), Yield per tree (kg) (84.66), total soluble solids (13.58 °Brix), Acidity (2.21%), Ascorbic acid (mg/100g of flesh pulp) (473.66%), Total sugar (5.39) and Juice (%) (68.76) was recorded with the application of T₆ 600:200:800g NPK + 50g PSB + 40 g Azotobacter per plant.

Introduction

Aonla or Indian gooseberry (*Emblica officinalis* Gaertn.) is indigenous to Indian sub-continent, belongs to the family Euphorbiaceae. It is the richest source of vitamin C (400-1300 mg/100 g from pulp) among the fruits next to Barbados cherry (Mandal *et al.*, 2013). Owing to its hardy nature, suitability to various wastelands, high productivity, nutritive and therapeutic values, aonla has become an important fruit. Alternate land use systems, particularly agri-horti systems with the inclusion of aonla (*Emblica officinalis* Gaertn.) on marginal, less productive soils, has a tremendous potential in

Bundelkhand region (Pathak and Bhatt, 2001). The edible fruit is highly nutritious and is the richest source of vitamin –C (400-1300mg 100-1 g fruit pulp) among the fruits next to Barbados cherry (Asenjo, 1953). Soil type, fertility and nutrient management play important roles in obtaining higher growth and yields of aonla. Its fruit is a tonic for diuretic, laxative, antioxidant and act as cooling refrigerant. It is the richest source of vitamin “C” (600mg /100g) among all fruit, except Barbados cherry and fruit contain 89-94% pulp, 0.8, 2.0 % Fibre, 10-14% TSS, 1.4-2.4, acidity 2.4-3.1% protein and 2.0-3.05 Phenols (Singh *et al.*, 1993). In India aonla is widely distribution in the Himalaya region,

Chhota Nagpur, Bihar, Orissa, West Bengal Decan and Karnataka. The total cultivated area under aonal in India is 93, 000 ha with and annual production of 10,77,000 MT (NHB, 2017-2018). The forest of M. P. has a rich diversity of aonla, Major aonla producing areas in Madhya Pradesh are Sheopur, Betul, Balaghat, Satna, Sidhi, Ratlam, Mandasaur and Neemuch district.

Materials and Methods

The investigation entitled “Effect of integrated nutrient management on flowering, fruit and quality of Aonla (*Emblica officinalis* Gaertn) cv. Chakaiya” was conducted during 2019-2020 at the Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The experiment was laid out in Randomized Block Design (RBD), replicated thrice with the 11 treatment with combination of T₀ control, T₁:800:400:800g NPK per plant, T₂: 400:200:400g NPK +10kg FYM per plant, T₃: 400:200:400g NPK + 10 kg Vermicompost per plant, T₄: 800:200:400g NPK + 50g PSB per plant, T₅: 600:400:800 g NPK + 400 g Azotobacter per plant, T₆: 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant, T₇:: 400:0:400g NPK +10kg FYM + 50g PSB per plant, T₈: 400:0:400g NPK +10kg Vermicompost + 50g PSB per plant and T₉: 200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant and T₁₀:200:0:400g NPK + 10 kg Vermicompost + 50g PSB + 40g Azotobacter per plant.

The observation were recorded on flowering, fruiting and quality *viz.*, duration of flower, fruit set (%), number of fruit per shoots, number of shoots per tree, fruit weight (g), yield per tree (kg), total soluble solids (^obrix), acidity (%), ascorbic acid (mg/100g of flesh pulp), total sugar and juice (%).The data recorded during the course of investigation

were subjected to statistical analysis as per method of analysis of variance (Fisher, 1936).

Results and Discussion

The data on flowering, fruiting and quality influenced by different treatments are presented in table 1 and graphically delineated in figure 1. It is vivid from the table that there was significant effect of integrated nutrient management various treatments on duration of flowers. However, the minimum duration (20.54) of flowers was recorded in T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₈ 200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant, T₃ 800:200:400g NPK + 50g PSB per plant and T₁ 400:200:400g NPK + 10kg FYM per plant. The minimum duration (30.01) of flowers was recorded in T₀ similiar findings were reported by mahantesh kamatyanatti *et al.*, (2019) in plum cv. Kala the maximum Fruit set (%) (74.71) was recorded in T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₈ 200:0:400g NPK + 10 kg FYM + 50g PSB + 40g Azotobacter per plant, T₇ 400:0:400g NPK + 10kg Vermicompost + 50g PSB per plant and T₉ 200:0:400g NPK + 10 kg Vermicompost+50g PSB+40g Azotobacter per plant. The minimum fruit set (52.25) of flower per cluster was recorded in T₀ Control similiar findings were reported by (Mandal *et al.*, 2013) in Aonla and (Mitra *et al.*, 2010) in Aonla.

The maximum Number of fruit per shoots (76.42) was recorded in T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₇ 400:0:400g NPK + 10kg Vermicompost + 50g PSB per plant, T₈200:0:400g NPK + 10 kg FYM + 50g PSB+40g Azotobacter per plant, T₃800:200:400g NPK + 50g PSB per plant and T₉ 200:0:400g NPK + 10 kg Vermicompost + 50g PSB + 40g Azotobacter

per plant. The minimum Number of fruit per shoots (28.42) was recorded in T₀ Control. similiar findings were reported by Ranjeet Jamra *et al.*, (2020) in Aonla mahantesh kamatyanatti *et al.*, (2019) in plum cv. Kala the maximum Number of shoots per tree (12.80) was recorded in T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₇ 400:0:400g NPK +10kg Vermicompost + 50g PSB per plant, T₈200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant, T₃800:200:400g NPK + 50g PSB per plant and T₉ 200:0:400g NPK + 10 kg Vermicompost + 50g PSB + 40g Azotobacter per plant.

The minimum Number of fruit per shoots (7.26) was recorded in T₀ Control. similiar findings were reported by Ranjeet Jamra *et all.*,(2020) in Aonla the maximum fruit weight (g) (46.43) was recorded in T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed byT₁400:200:400g NPK + 10kg FYM per plant, T₂400:200:400g NPK + 10 kg Vermicompost per plant, T₉ 200:0:400g NPK + 10 kg Vermicompost+50g PSB+40g Azotobacter per plant, T₈200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant and T₃800:200:400g NPK+50g PSB per plant.

The minimum fruit weight (g) (17.57) was recorded in T₀ Control similiar findings were reported by Darpeet kaur *et all.*,(2019) in Aonla, Chandra *et al.*,(2015) in Aonla & Dinesh *et al.*,(2014) in Aonla. Ranjeet Jamra *et all.*,(2020) in Aonla the maximum Yield per tree (kg) (84.66) was recorded in T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₈ 200:0:400g NPK + 10 kg FYM+50g PSB + 40g Azotobacter per plant, T₉ 200:0:400g NPK + 10 kg Vermicompost+50g PSB+40g Azotobacter per plant, T₂ 400:200:400g NPK

+ 10 kg Vermicompost per plant and T₃ 800:200:400g NPK+50g PSB per plant. The minimum Yield per tree (kg) (38.63) was recorded in T₀ Control similar findings were reported by (Mandal *et al.*, 2013) in aonla. Govind vishwakarma *et al.*, (2017) in bael., Darpreet Kaur *et al.*, (2019) in Aonla. Ranjeet Jamra *et al.*, (2020) in Aonla

The maximum total soluble solids (13.58⁰Brix) was recorded with T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₇400:0:400g NPK +10kg Vermicompost + 50g PSB per plant, T₈200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant, T₂400:200:400g NPK + 10 kg Vermicompost per plant, T₄600:400:800 g NPK + 400 g Azotobacter per plant and T₅600:200:800g NPK+50g PSB + 40 g Azotobacter per plant and minimum total soluble solid (10.17) was found in T₀ Control.

The maximum total soluble solids (⁰Brix) in T₆ may be due to the fact that there was more supplement of nutrients to the plants similiar findings were reported by Ram *et al.*, (2007) in Aonla & Singh *et al.*, (2018) in Aonla & Darpreet kaur *et al.*, (2019) in Aonla.

The maximum Acidity (2.21%) was recorded with T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₅600:200:800g NPK+50g PSB + 40 g Azotobacter per plant, T₇400:0:400g NPK +10kg Vermicompost + 50g PSB per plant, T₈200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant and T₁400:200:400g NPK + 10kg FYM per plant and minimum Acidity (%) (1.66) was found in T₀ Control (Fig. 2 and Table 2).

The maximum Acidity (%) in T₆ may be due to the fact that there was more supplement of nutrients to the plants similar findings were reported by Barath *et al.*, (2019) in Aonla.

Table.1 Effect of integrated nutrient management on flowering, fruiting and yield of Aonla (*Emblica officinalis Gaertn*) cv. Chakaiya

| Treatments No. | Duration of flower | Fruit set (%) | Number of fruit per shoots | Number of shoots per tree | Fruit weight (g) | Yield per tree (kg) |
|-----------------|--------------------|---------------|----------------------------|---------------------------|------------------|---------------------|
| T ₀ | 30.01 | 52.25 | 28.42 | 7.26 | 17.57 | 38.63 |
| T ₁ | 23.9 | 63.35 | 32.58 | 8.94 | 41.54 | 55.55 |
| T ₂ | 25.65 | 58.46 | 48.57 | 10.43 | 38.52 | 72.59 |
| T ₃ | 22.27 | 54.56 | 60.79 | 11.25 | 32.5 | 71.6 |
| T ₄ | 26.37 | 56.27 | 52.47 | 8.78 | 29.49 | 68.52 |
| T ₅ | 26.47 | 55.42 | 54.54 | 8.67 | 24.62 | 65.77 |
| T ₆ | 20.54 | 74.71 | 76.42 | 12.8 | 46.43 | 84.66 |
| T ₇ | 26.25 | 71.49 | 65.78 | 10.39 | 21.49 | 81.64 |
| T ₈ | 21.53 | 72.23 | 62.79 | 10.23 | 30.38 | 82.57 |
| T ₉ | 28.5 | 68.41 | 59.78 | 11.44 | 32.84 | 81.41 |
| T ₁₀ | 27.21 | 67.98 | 55.26 | 9.68 | 35.57 | 80.14 |
| F-Test | S | S | S | S | S | S |
| C. D. at 0.5% | 0.942 | 1.551 | 1.564 | 1.124 | 1.558 | 0.76 |
| S.Ed. | 0.452 | 0.744 | 0.75 | 0.539 | 0.747 | 0.364 |

Table.2 Effect of integrated nutrient management on quality of Aonla (*Emblica officinalis Gaertn*) cv. Chakaiya

| Treatments No. | Total soluble solids (^o Brix) | Acidity (%) | Ascorbic acid (mg/100g of flesh pulp) | Total sugar | Juice (%) |
|-----------------|---|--------------|---------------------------------------|--------------|--------------|
| T ₀ | 10.17 | 1.66 | 436.72 | 4.29 | 42.78 |
| T ₁ | 11.58 | 1.97 | 442.31 | 4.44 | 44.7 |
| T ₂ | 12.59 | 1.87 | 438.33 | 4.54 | 45.78 |
| T ₃ | 11.65 | 1.84 | 441.54 | 4.56 | 48.63 |
| T ₄ | 12.51 | 1.91 | 448.55 | 4.79 | 53.52 |
| T ₅ | 12.16 | 2.02 | 442.46 | 4.75 | 67.76 |
| T ₆ | 13.58 | 2.21 | 473.66 | 5.39 | 68.76 |
| T ₇ | 13.33 | 1.95 | 471.67 | 4.88 | 50.55 |
| T ₈ | 13.43 | 1.93 | 469.21 | 4.54 | 53.8 |
| T ₉ | 10.57 | 1.73 | 470.93 | 4.49 | 62.39 |
| T ₁₀ | 10.68 | 1.74 | 463.87 | 4.54 | 61.5 |
| F-Test | S | S | S | S | S |
| C. D. at 0.5% | 0.364 | 0.246 | 3.17 | 0.172 | 0.504 |
| S.Ed. | 0.175 | 0.118 | 1.519 | 0.083 | 0.242 |

Fig.1 Effect of integrated nutrient management on flowering, fruiting and yield of Aonla (*Emblica officinalis Gaertn*) cv. Chakaiya

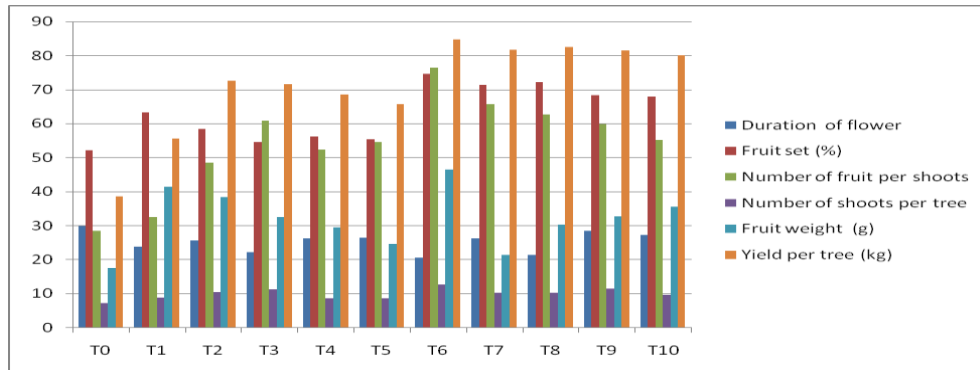
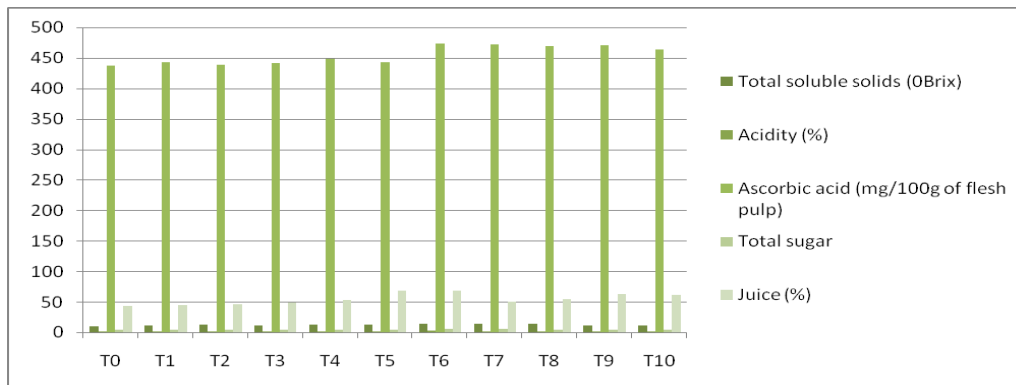


Fig.2 Effect of integrated nutrient management on quality of Aonla (*Emblica officinalis Gaertn*) cv. Chakaiya



The maximum Ascorbic acid (mg/100g of flesh pulp) (473.66%) was recorded with T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₇ 400:0:400g NPK + 10kg Vermicompost + 50g PSB per plant, T₉200:0:400g NPK + 10 kg Vermicompost+ 50g PSB + 40g Azotobacter per plant and T₈200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant and minimum Ascorbic acid (mg/100g of flesh pulp) (436.72) was found in T₀ Control. The maximum Ascorbic acid (mg/100g of flesh pulp) in T₆ may be due to the fact that there was more supplement of nutrients to the plants similar findings were reported by Pankaj and Raj (2008) in Guava and Maity *et al.*, (2006) in Guava &(A. O.A.C., 1980).

The maximum Total sugar (5.39) was recorded with T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by T₄ 600:400:800 g NPK + 400 g Azotobacter per plant, T₅ 600:200:800g NPK + 50g PSB + 40 g Azotobacter per plant and T₇ 400:0:400g NPK +10kg Vermicompost + 50g PSB per plant and minimum Total sugar (4.29) was found in T₀ Control. The maximum Total sugar in T₆ may be due to the fact that there was more supplement of nutrients to the plants similar findings were reported by Ranjan (2006) in mosambi and Ram *et al.*, in(mango).

The maximum Juice (%) (68.76) was recorded with T₆ 600:200:800g NPK+50g PSB + 40 g Azotobacter per plant followed by

T₅600:200:800g NPK+50g PSB + 40 g Azotobacter per plant, T₉200:0:400g NPK + 10 kg Vermicompost+50g PSB+40g Azotobacter per plant, T₈200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant and T₄600:400:800 g NPK + 400 g Azotobacter per plant and minimum Juice (%) (42.78) was found in T₀ Control. The maximum Juice (%) in T₆ may be due to the fact that there was more supplement of nutrients to the plants similar findings were reported by DINESH MEENA, RAJESH TIWARI* AND O.P. SINGH (2014) in Aonla

In conclusion the results of present experiment for the 20 years old Aonla cv. Chakaiya variety showed that the treatment T₆ (600:200:800 g NPK + 50 g PSB + 40 g Azotobacter per plant) has been found most appropriate integrated nutrient dose followed by, T₈ (400:0:400g NPK +10kg Vermicompost + 50g PSB per plant) , T₇(400:0:400g NPK +10kg FYM + 50g PSB per plant) and T₉ (200:0:400g NPK + 10 kg FYM+50g PSB+40g Azotobacter per plant) under agro-climatic conditions of paryagraj for obtaining maximum vegetative growth and yield for improving the reproductive parameters, physical characteristics and quality of the fruit and also which is economic with a benefits cost ratio of (1: 5.50).

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