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Effect of integrated nutrient management on growth and yield attributing characters of Bael (*Aegle marmelos*) cv. Narendra Bael-9

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Abstract

The present investigation was carried out at Main Experiment Station, Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj Faizabad (U.P.) under sodic soil condition during the years 2014-15 and 2015-16 to evaluate the response of organic manure, inorganic fertilizer and biofertilizer on growth, yield and yield attributing characters. The experiment keeps nine treatments *viz.* T1- 100% NPK, T2-50 Kg FYM, T3-50 Kg FYM + 100% NPK, T4-50 Kg FYM + 75% NPK, T5-50 Kg FYM + 50% NPK, T6-50 Kg FYM + 200g each (*Azotobacter*+ PSB), T7-50 Kg FYM + 100% NPK + 200g each (*Azotobacter*+ PSB), T8-50 Kg FYM + 75% NPK + 200g each (*Azotobacter*+ PSB) and T9-50 Kg FYM + 50% NPK + 200g each (*Azotobacter*+ PSB) and these treatments were replicated four times. The growth character like plant height, plant girth and plant spread (East-West and North-South) flowering and fruiting behaviuor like number of flower per shoot, fruit set, fruit retention, fruit yield were noted maximum with minimum fruit drop by the use of 50 Kg FYM + 100% NPK + 200g each (*Azotobacter*+ PSB) followed by the application of T8-50 Kg FYM + 75% NPK + 200g each (*Azotobacter*+ PSB) and T3-50 Kg FYM + 100% NPK than other treatments. The treatment of T2-50 Kg FYM was recorded the lowest results as comparatively all other treatments.

K**eywords**: Bael, bio-fertilizers, FYM, inorganic fertilizer, NPK, organic manures

Introduction

Bael (*Aegle marmelos*) is one of the medicinal plants of India. It is also known as golden apple or Bengal quince. It is a medium sized deciduous tree belonging to family Rutaceae. Indian peninsula and in Ceylon, Burma, Thailand and Indo-China. The bael tree is indigenous to India and the history of this tree has been made in "Yajurveda". In early Buddhist and Jain literature (8000-325 B.C.), methods of ripening this fruit have been described. It grows wild throughout the low hills of Himachal Pradesh, ascending up to 1000 meters. It is found in plenty in wild forms in the states of Uttar Pradesh, Orissa, West Bengal, and Madhya Pradesh. However, the fruits of the wild trees are considerably smaller than those of the cultivated types grown in the plains.

The fruits are good to taste containing 40 per cent TSS. The Bael tree is one of the most useful medicinal plants of India. All the parts of this tree including stem, bark, root, leaves and fruit at all stages of maturity have medical virtues and have been used in the indigenous medicine for a long time. The ripe fruit is of considerable medical value when it just begins to ripen. The ripe fruit is aromatic, astringent, cooling and laxative. The unripe or half ripe fruit is stomachic, anti-scorbutic, and digestive. Ripe bael fruit is regarded as best of all laxatives. It cleans and tones up the intestines.

Aegle marmelos is one of the most important plants with several medicinal and nutraceutical properties. The unripe or half ripe fruit is perhaps, the most effective food remedy for chronic diarrhea and dysentery. Dried bael or its powder provides the better results. The bael fruit when it is still green, is sliced and dried in the sun. These slices can also be reduced into powder and preserved in air tight bottles. An infusion of bael leaves is regarded as an effective food remedy for peptic ulcer. The bael fruit taken in the form of beverage has also great healing properties because of its mucilage content. This substance forms a coating on the stomach mucosa and thus helps in healing of ulcers.

The continuous applications of huge amount of chemical fertilizers hamper the fruit quality, soil health and generate pollution. The integrated nutrient management paves a way to overcome these problems. Plant nutrient can be supplied from different sources viz., organic manures, crop residues, bio-fertilizers and chemical fertilizers for better utilization of resources and to produce crop with less expenditure, INM is the best approach for sustainable crop production. In this approach all the possible sources of nutrients are applied, based on economic consideration. Organic manures enhance nutrient availability in order to improve the soil health, soil structure and provide environment is conducive for the treatment of soil micro-flora. Potentially of using organic manures along with balanced fertilizers are well established in increasing crop yield and sustained crop production (Nambiar and Abrol, 1992). The

importance of integrated nutrient supply system which involves the combined use of various plant nutrient sources has now assured significance in the field of fruit production. The conjugation use of bio-fertilizers with nitrogenous fertilizers increases the efficiency of nitrogen, improve the soil health and control the soil pollution. It is therefore, necessary to standardize other possible sources of nutrients to a specific soil and agro-climate condition for better plant growth, production and quality of fruits.

Materials and Methods

The present investigation entitled "Effect of Integrated Nutrient Management on Growth and Yeild attributing characters of Bael (*Aegle marmelos*) cv. Narendra Bael-9 in sodic soil condition." was carried out at Main Experimental Station and P.G. Laboratory of the Horticulture, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (UP). Main Experimental Station, Horticulture, N. D. University of Agriculture & Technology is located 45 km away from Ayodhya city on Ayodhya- Rae Bareily Road. The geographically, university is situated at 26.47^0 N latitude, 82.12^0 E longitude and at altitude of 113.0 meter from sea level in the Indo-Gangatic plain of Eastern Uttar Pradesh, India.

The design of the experiment was Randomized Block Design (RBD) where the 27 different accessions are the 9 treatments and 3 replications. The 20 years old plants of the bael cultivars Narendra Bael-9 having uniform vigour was selected randomly. The experiment keeps nine treatments *viz.* T_1-100% NPK, T_2-50 Kg FYM, T_3-50 Kg FYM + 100% NPK, T_4-50 Kg FYM + 75% NPK, T_5-50 Kg FYM + 50% NPK, T_6-50 Kg FYM + 200g each (*Azotobacter*+ PSB), T_7-50 Kg FYM + 100% NPK + 200g each (*Azotobacter*+ PSB), T_8-50 Kg FYM + 75% NPK + 200g each (*Azotobacter*+ PSB) and T_9-50 Kg FYM + 50% NPK +200g each (*Azotobacter*+ PSB). The experiment was conducted under sodic soil condition to evaluate the response of organic manure, inorganic fertilizer and bio-fertilizer on plant height, plant girth and plant spread (East-West and North-South) and fruit yield. The region falls under sub-humid and sub-tropical climate receiving a mean annual rainfall of about 1200 mm out of which about 85 per cent is precipitated from mid June to end of September. The winter months are cold, dry and occasional frost occurs during the period, hot wind starts from the month of April and continue up to onset of monsoon.

Results and Discussion

Growth behaviours

It is clear from the data presented in Table 1 that soil application of organic manure inorganic and bio-fertilizer gave the best result. The maximum (21.56%) per cent increase in plant height was noted by the soil application of T7-50 kg FYM+ 100% NPK+200g each (*Azotobacter*+PSB) followed with 17.34% increase in plant height by the use of T8-50 kg FYM+75% NPK+200g each (*Azotobacter*+PSB) and 17.10 by the use of T3-50 kg FYM+ 100% NPK during the experiment respectively. The treatment T1-100% NPK and T2-50 kg FYM was recorded minimum results as comparison to other treatments. Whereas the maximum (17.57% and 15.45%) per cent increase in plant girth of bael plant was recorded with the use of T7-50 kg FYM+ 100% NPK+200g each (*Azotobacter*+PSB) followed with the use of T8-50 kg FYM+ 75% NPK+200g each (*Azotobacter*+PSB) and T3-50 kg FYM+ 100% NPK during both the years. The lowest result was recorded under the treatment of T2-50 kg FYM. It seems from the Table that plant spread was found better per cent increase in both the direction (East-West and North-South) by the use of Integrated Nutrient Management. The maximum plant spread (E-W and N-S) were noted with the use of T7-50 kg FYM+ 100% NPK+200g each (*Azotobacter*+PSB) which was found at par with the treatment of T8-50 kg FYM+ 75% NPK+200g each (*Azotobacter*+PSB) (East-West and North-South) and T3-50 kg FYM+ 100% NPK (East-West) followed with the use of T9-50 kg FYM+ 50% NPK+200g each (*Azotobacter*+PSB) during the experiment, respectively. Whereas the treatment comprised 50 kg FYM was recorded lowest result than all other treatments during both the years of investigation. It might be due to the fact that plant growth promoting rhizo-bacteria associated with plant rhizosphere presented or multiplied due to application of bio-fertilizers like PSB, *Azotobacter* and FYM may be responsible for growth promotion directly through the synthesis of phytoharmones, N2 fixation, reduction of membrane potential of the roots, synthesis of some enzymes that nodulate the level of plant hormones as well as the solubilization of inorganic phosphate and mineralization of organic phosphate which makes phosphates available to the plants and the application of Farm Yard Manure, *Azotobacter* and Phosphate Solubilizing Bacteria along with inorganic fertilizers may be due to the increase in soil temperature which accelerates the internal physiology of the developing plants to grow profusely and in a speedy way at its maximum level. Results are in close conformity with the finding of Srivastava (2008), with respect to plant height and girth; He reported maximum plant height in papaya with the use of 100% NPK + FYM+ *Azotobacter* + PSB. Similar significant increase in growth parameters due to Vermicompost have been reported by Tripathi*et al.* (2010) and Nawsheen *et al.* (2006) in strawberry cv. 'Chandler', Bakhs*et al.* (2008) in guava and Sahoo*et al.* (2005) strawberry cv. Sweet Charley. Yadav *et al.* (2007) also reported maximum vegetative growth in aonla with the use of 500g N + 250g P + 250g K +100kg FYM + 200 g each(*Azotobacter*+ *Azospirillum*+ PSB) + 25g Sulphur.

Yield and yield attributing characters

The data presented in the Table shows that the integrated nutrient management significantly influenced the number of flower per shoot in bael. The maximum (127.93 and 121.74) number of flowers per shoot was recorded with the use of T7-50 kg FYM+ 100% NPK+200g each (*Azotobacter*+PSB) followed with the soil application of T8-50 kg FYM+ 75%NPK+200g each (*Azotobacter*+PSB). The treatment T2-50kg FYM shows minimum (78.30 and 80.93) number of flower as comparison to other treatments during the

Table 1. Effect of various treatments on plant morphological parameter

Treatments	Plant height per cent increase	Trunk girth per cent increase	Plant spread per cent increase		Fruit yield kg/tree
			NS	EW	
T_1 -100% NPK	3.15	7.25	7.80	7.66	80.93
T_2 -50kg FYM	2.47	5.94	4.67	5.58	78.30
T_3 - 50 kg FYM + 100% NPK	17.10	13.08	18.08	20.40	107.55
T_4 - 50 kg FYM+75% NPK	12.95	10.72	10.92	17.00	101.98
T_5 - 50 kg FYM+50% NPK	6.93	9.03	8.71	10.31	92.14
T_6 - 50 kg FYM+200g each (*Azotobacter* + PSB)	9.38	9.94	9.63	12.76	96.40
T_7 -50kg FYM+100% NPK+200g each (*Azotobacter* + PSB)	21.56	17.57	20.26	23.43	127.93
T_8 -50 kg FYM+75% NPK + 200g each (*Azotobacter* + PSB)	17.34	15.45	19.01	22.33	121.74
T_9 -50 kg FYM+50% NPK + 200g each (*Azotbacter* + PSB)	15.12	11.89	14.23	18.77	105.88
CD at 5%	1.36	0.56	1.21	0.94	5.16

experiment respectively. This might be due to soil application of organic and in-organic fertilizer which increased the photosynthesis efficiency which reflex on vigorous growth of plants and ultimately remitting profuse flowers.

The data recorded in respect to fruit yield also shows that the addition of organic manure and inorganic fertilizer with bio-fertilizer respond better for fruit yield of bael fruit per plant. The maximum (127.93 kg and 121.74) fruit yield per tree was recorded with the use of T7-50 kg FYM+ 100% NPK+200g each (*Azotobacter*+PSB) which were recorded at par with the soil application of T8-50 kg FYM+ 75%NPK+200g each (*Azotobacter*+PSB) followed with the use ofT3-50 kg FYM+ 100% NPK. The treatment T2-50kg FYM recorded minimum (78.30kg a) fruit yield per tree during the experimentation, respectively.

The enhancement in yield by this treatment mainly because of proper supply of nutrients and induction of growth increases in number of fruits and weight due to better root development, better translocation of water, uptake and deposition of nutrients. Farm Yard manure have immobilized microflora, which function in soil to produce useful products and having immobilized enzymes like protease, lipase, amylase and cellulose which keep on their function of bio-degradation of macro-molecular of agricultural residues in the soil and absorb moisture from the air (Edward, 1998). Ghosh *et al.* (2012) also found same result with the application of FYM 20 kg along with N-400, P-100 and K-300g/year in papaya fruit whereas Kumar *et al.* (2012) reported highest yield of lemon fruit by using 50% NPK + 15 kg vermicompost + 5 kg neem cake. Kumar (2016) reported maximum vegetative growth and yield of strawberry with use of Vermi-compost @ 2.5 t/ha + half dose (recommended dose) of NPK.

References

Baksh, H., Yadav, R., Dwivedi, R. 2008. Effect of INM on growth, yield attributing characters and quality of guava cv. Sardar. *Prog. Agri.*, 8(2):141-144.

Edward, S.I. 1998. Effect of organic manure on soil nutrients andgrowth hormones level of soil. *American J. Soil Sci.*, 68(2):130-145.

Ghosh, S.N., Bera, B., Roy, S., Kundu, A. 2012. Integrated nutrient management in pomegranate grown in laterite soil. *Indian J. of Hort.*, 69(3):333-337.

Kumar, D., Pratap, B., Vishwakarma, G. 2016. Studies on integrated nutrient management on vegetative, flowering and yield attributes of Strawberry (*Fragaria x ananassa* Duch) cv. Chandler. *Eco. Env. & Cons.*, 22(2):647-650.

Kumar, V., Singh, M.K., Singh, M., Dev, P., Mohan B. 2012. Influence of integrated nutrient management (INM) on yield and quality of lemon (*Citrus limon* Burn.) cv. Pantlemon-I under western U.P. conditions. *A. of H,* 5(1):137-139.

Nambiar, K.K.M., Abrol, I.P. 1998. Long term fertilizer experiment in India: An overview. *Fertilizer News*, 34(4):11-26.

Sahoo, S.K., Singh, D.B. 2005. Effect of different levels of biofertilizers on growth yield and quality of strawberry (*Fragaria x ananassa* Duch) cv. Sweet Charlie. *Orissa J.of Hort*., 33(2):82-85.

Sharma, B.D., Dhandar, D.G., Bhargava, R. 2003. Response of pomegranate (*Punica granatum* L.) to integration of nutrient sources in sandy soil of acid ecosystem. In: *National Symposium on Organic farming in Horticulture for sustainable production* on held during 29-30 August at CISH, Lucknow. 2003, 33-34.

Singh, Nowsheen, Aroosa, S.R., Masarst Shabeena. 2006. Yield and growth of strawberry cv. Senga management system. *Environment and Ecology*, 245(3):651-654.

Srivastava A. 2008. Integrated nutrient management on papaya (*Carica papaya* L.). Ph.D. Thesis. NDUAT, Kumarganj, Faizabad (U.P.).

Tripathi, V.K., Kumar, N., Shukla, H.S., Mishra, A.N. 2010. Influence of *Azotobacter*, *Azospirillum* and PSB on growth, yield and quality of strawberry cv. Chandler, paper presented in National Symposium on *Conservation Hort*., during March, 21-23, 2010 at Dehradoon, 2010: 198-199.

Yadav, R., Singh, H.K., Yadav, A.L. 2007. Effect of integrated nutrient management on productivity and quality of aonla (*Emblica officinalis* Gaertn). *Plant Archives*,7(2):881-883.