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EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON GROWTH AND YIELD IN GUAVA OF BEGUSARAI, BIHAR.

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ABSTRACT

A field trail was conducted from 2012 to 2014 at farmer's field at Begusarai to know the effect of *Azotobacter* enriched in FYM, Vermi compost, Poultry manure with full and half dose of recommended fertilizer on five years old guava plants of cv. Allahabad safeda. Trees grown with half dose of recommended fertilizers(250gN:150gP:250gK) + 5 kg Vermicompost and 20 kg Poultry manure found most effective to increase the plant height(0.28m), trunk diameter(2.78cm), shoot length(11.78cm), fruit yield(9131.27kgha^{-1}) which was at par with the application of half dose of recommended fertilizer + Poultry manure 20 Kg + *Azotobacter*. Leaf minerals (N, P and K) were also affected by application of different organic manures and *Azotobacter* with maximum nitrogen(2.43 %), P(0.24%) and K(1.48%) obtained from HRDF + Poulty manure(20 kg) + Vermi compost(5kg). Amongst the various organic amendments application of 20 kg Poultry manure was found the best which was at par with the application of Vermi compost 5kg.

INTRODUCTION

Guava (*Psidium guajava* L.) is an important commercial fruit crop of tropical and sub-tropical regions of India and is known for its high nutritive value. It is rich in vitamin c, pectin and is available at affordable price and its cultivation, too, requires little care and minimum inputs. That is why, guava's called as "poor man's apple'. In Bihar State, it is cultivated in 29960 ha area with an annual production of 238620 tonnes (Anonymous, 2015) and Begusarai is one of the district wherein the fruit crop is grown. Balanced nutrition ensures efficient use of all nutrients by the plant. Imbalanced nutrition results in low yield, low fertilizer- use efficiency and low farmer profit, besides depletion of the deficient nutrients of the soil. There is a need for reduced consumptions of chemical fertilizers and increased use of organic manures and biofertilizer for sustainability. *Azotobacter* is known to add nitrogen to soil through biological nitrogen fixation, which plays significant role in crop production(Trivedi *et al*., 2012). The growth and fruiting of a plant depends on nutrient status of the leaf (Goswami *et al*.,2012). It is estimated that in the year 2025, India will need at least 45 million tonnes of nutrients, but only 35 tonnes will be met through, chemical fertilizers and the remaining 10 tonnes through organic manures, crop residues and biofertilizers(Singh and Singh, 2014). In order to meet balanced nutrient supply in guava, integrated nutrient management is the important alternative source, which is not beneficial to maintain the soil health but also to sustain the fruit production(Sharma *et al*., 2013). However, so far, information about the use of organic manures alone or in combination with inorganic fertilizers to fulfill the nutrient need of guava trees grown in the soils in Begusarai is very scarce. Thus, the present investigation was undertaken to find out the effect of farmyard manure (FYM), Vermicompost and Poultry manure in combination with chemical fertilizers on growth, leaf nutrient status and yield of guava cv. Allahabad safeda.

MATERIALS AND METHODS

The present investigation was carried out at farmer's field at Begusarai from 2012 to 2014 on five years old guava trees (cv. Allahabad safeda). The plant were uniform in growth and vigour. The experiment was conducted on a very slightly alkaline sandy loam soil and laid out in Randomized Block design (Panse and Sukhatme, 2000) with eleven treatments replicated thrice with two trees per replication. The treatment combinations consisting of T_1 recommended dose of fertilizer (RDF) (500 g:300g: 500g NPK tree^{-1}), T_2 (T_1 + FYM 25 kg tree^{-1}), T_3 (T_1 + Poultry manure 20kg tree^{-1}), T_4 (T_1 + Vermi compost 5kg tree^{-1}), T_5 (T_1 + *Azotobacter* 200g tree^{-1}), T_6 Half of the recommended dose of fertilizers (HRDF) (250gN:150gP: 250gK + FYM 25 kg + Poultry manure 20kg tree^{-1}), T_7 (HRDF 250gN: 150gP: 250 gK + FYM (25kg) + Vermi compost (5kg) tree^{-1}), T_8 (HRDF 250gN:150gP:250gK + FYM (25kg) + *Azotobacter*(200g)tree^{-1}), T_9 (HRDF 250gN :150gP :250gK + Poultry manure (20kg) + Vermi compost (5kg) tree^{-1}), T_{10} (HRDF 250gN :150gP :250gK :+ Poultry manure (20kg) + *Azotobacter* (200g) tree^{-1} and T_{11} (HRDF 250gN:150gP:250gK + Vermi compost (5kg) + *Azotobacter* (200g) tree^{-1}. The chemical content of different organic manures is given in Table 1. The organic manures were applied on dry weight basis. *Azotobacter* culture was enriched with organic manures and its single application mixed with soil. The dose of fertilizers (500-300-500 g tree^{-1}) was applied as

per the recommendation made by Rajendra Agricultural University, Pusa, Samastipur(Bihar) after pruning of the trees. Other recommendations at cultural practices and plant protection measures were adopted as and when required. The samples were decontaminated and dried. The dried powder of leaves was preserved and used for analyzing total nitrogen (by microKjeldhal method), phosphorus (by vanado-molybdo-phosphoric yellow colour method) and potassium (by flame photo-meter) as described by Jackson (1973). Plant height, increase in girth of the trunk, shoot length and yield were recorded for two years.

RESULTS AND DISCUSSION

It is evident from Table 2 that the pooled analysis of various growth attributes and fruit yield in two years showed maximum tree height (0.28m), girth (2.78cm), annual increase in shoot lenth (11.78cm) and fruit yield (9131.27 kg ha^{-1}) with treatment HRDF + Poultry manure 20 kg + Vermicompost 5 kg tree^{-1} year^{-1}. The maximum values of plant height were recorded with application of Poultry manure + Vermicompost, which was at par with Poultry manure + enriched with *Azotobacter,* Vermicompost + *Azotobacter* and FYM + Poultry manure and superior to the rest of all the treatments. The significant differences were not observed in trunk girth, however, numerical increased over the previous year. The pooled analysis of shoot length in two years were found statistically at par with Poultry manure + *Azotobacter*(T_{10}) and other treatments were found superior over the RDF(T_1). The pooled analysis of yield in two years showed maximum fruit yield (9131.27 kg ha^{-1}) significantly increased with T_9 but found statistically at par with T_6, T_7, T_8, T_{10} and T_{11} and significantly superior to the rest of all other treatments. The increased fruit yield might be attributed to fertilizer use efficiency in the presence of poultry manure than that of other organic sources. Vermicompost being a bulky organic source, release soil compaction and improves soil aeration in addition to the supply of essential plant nutrients and organic matter, thereby increasing the soil's biological activities and application of *Azotobacter*, enhanced biological nitrogen fixation, better development of root systems and possible higher synthesis of plant growth hormones. Similar results were also observed by Trivedi *et al.*(2012). Increase in all the parameters of plant due to application of fertilizer either alone or in combination with organic manures and *Azotobacter* were recorded.The combination of organic manure and biofertilizer stimulate the multiplication of rhizobia and was found conducive for the development of motile forms of root nodule bacteria, which are essentially required to migrate through the soil towards the root system (Gaur,1990; Kumar and Yadav,2003). Between the organic manures the performance of poultry manure was better than Vermicompost with regard to yield and other data recorded applied with full and half doses of fertilizer. Amount and type of the added organic material might have affected the soil properties differently. The results of the study are also in agreement with the finding of Das *et al.*(2015), who reported that the use of Vermicompost @ 5 kg plant $^{-1}$ + FYM@20 kg plant^{-1} proved most effective in production of guava.

Nutrient content was also influence by the application of organic manure. The pooled analysis of leaf nutrient status

Table 1 : Nutrient content (%) of organic manures

Manures	Year	N	P_2O_5	K_20
Vermicompost	2012	1.17	0.83	0.87
	2013	1.12	0.86	0.81
Farmyard manure	2012	1.02	0.26	0.54
	2013	1.03	0.26	0.66
Poultry manure	2012	1.19	0.96	1.26
	2013	1.07	0.85	1.27

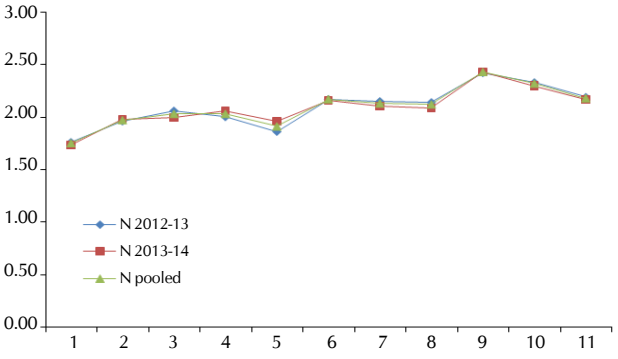

Figure 1 : Effect of various treatments on Leaf nitrogen status of guava

Table 2 : Effect of various treatments on annual increase in height, trunk diameter, shoot length and yield in guava cv. Allahabad safeda.

Treatments	Annual increase in plant height (m)			Annual increase in trunk diameter (cm)			Increase in shootlength (cm)			Yield (kg ha $^{-1}$)		
	2012-13	2013-14	Pooled	2012-13	2013-14	Pooled	2012-13	2013-14	Pooled	2012-13	2013-14	Pooled
T_1	0.14	0.16	0.15	2.01	2.09	2.05	2.19	3.42	2.81	4916.30	5534.46	5225.38
T_2	0.17	0.18	0.18	2.19	2.37	2.28	3.47	4.64	4.10	7316.00	7575.01	7445.50
T_3	0.18	0.19	0.19	2.32	2.47	2.40	5.74	7.47	6.61	7707.00	8123.66	7915.33
T_4	0.18	0.20	0.19	2.20	2.39	2.30	3.96	5.65	4.81	7405.60	7969.29	7687.45
T_5	0.17	0.19	0.18	2.07	2.16	2.12	2.92	4.46	3.69	5849.50	6312.83	6081.16
T_6	0.22	0.23	0.23	2.54	2.69	2.62	8.68	9.66	9.17	8146.60	8672.00	8409.30
T_7	0.20	0.19	0.20	2.52	2.64	2.58	7.36	9.54	8.45	8105.00	8506.00	8305.50
T_8	0.19	0.19	0.19	2.50	2.62	2.56	6.67	8.36	7.52	8012.00	8432.00	8222.00
T_9	0.27	0.29	0.28	2.70	2.86	2.78	10.66	12.89	11.78	8996.00	9266.54	9131.27
T_{10}	0.25	0.26	0.26	2.56	2.70	2.63	9.54	11.42	10.48	8604.00	9105.30	8854.65
T_{11}	0.24	0.25	0.25	2.49	2.66	2.58	9.01	10.51	9.76	8479.20	8968.00	8723.60
CD (p = 0.05)	0.05	0.07	0.04	NS	0.40	NS	1.60	1.60	1.47	1834.86	1109.74	956.66

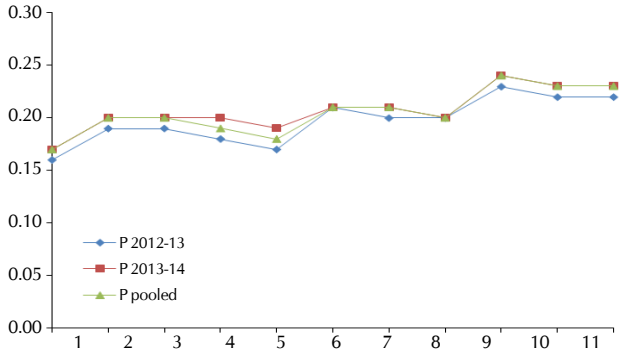

Figure 2: Effect of various treatments on Leaf phosphorus status of guava

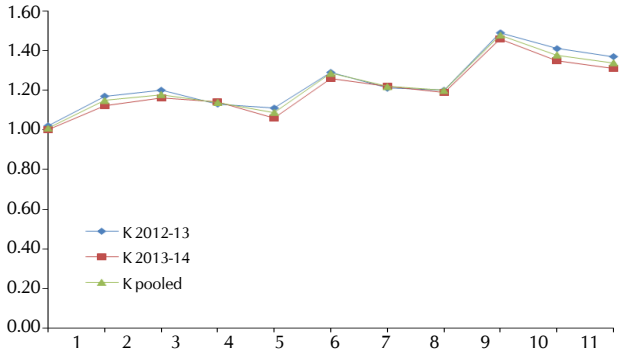

Figure 3: Effect of various treatments on Leaf potassium status of guava

indicated that leaf nitrogen (2.43%) (Fig. 1), phosphorus (0.24%) (Fig. 2) and potassium (1.48%) (Fig. 3) contents was more in plots treated with HRDF + Poultry manure + Vermicompost(T_9). However, the significantly higher uptake of potassium was noted and which was at par with those in treatments T_{10} and T_{11}. In all the treatments RDF(T_1) recorded the minimum (leaf N, P and K content as 1.75%, 0.17% and 1.01% respectively). Hayworth *et al.*(1996), who reported that the application of together organic manures improve the physical, chemical and biological properties of the soil such as high porosity, aeration, drainage, water holding capacity and diverse microbial activity.

The increase in growth attributes and fruit yield could be attributed to the stimulating effect of micro-flora in the rhizosphere leading to increased nutrient availability and hence vigorous plant growth(Singh *et al.*,2000; Aseri and Tarafdar,2006). It seems that manures and *Azotobacter* culture hastened the vegetative growth by virtue of their nutrient supplying and other properties. Improvement in soil aeration and better soil moisture retention in root zone probably increased microbial nitrogen fixation and thus improved the availability of leaf nutrient status(Morselli *et al.*, 2004). Nutrients applied without organic manure were less effective in improving the guava productivity even at higher dose and more effective when applied with organic manure (Das *et al.*,2015). It is concluded that, application of 20kg Poultry manure alongwith 5kg Vermicompost tree^{-1} with half doses of recommended chemical fertilizers improved the growth attributes and fruit yield of guava. Balance fertilization supports sustained and enhanced productivity of guava in Begusarai district of Bihar.

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