Eco. Env. & Cons. 28 (4) : 2022; pp. (1773-1777)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i04.015

Effect of Fertilizers on yield attributes of Green gram [*Vigna radiata* (L.) Wilczek] under Guava (*Psidium guajava* L.) based Agri-horti system in Vindhyan region of Eastern Uttar Pradesh, India

Rashav Chahal[1], S.K. Verma[1] and Alok Kumar Singh[2*]

[1]Department of Agroforestry, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya 224 229, U.P., India
[2*]Department of Silviculture and Agroforestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173 230, H.P, India

(Received 9 March, 2022; Accepted 18 May, 2022)

ABSTRACTS

A field experiment was conducted in Factorial Randomized Block Design during kharif 2018 farm, Rajiv Gandhi South Campus, Barkachha, Mirzapur (RGSC), Banaras Hindu University (U.P.) to effect of fertilizer and biofertilizer on growth and yield attributes in green gram (*V. radiata* L.) under guava (*P. guvajava* L.) based agri-horti system. The twelve year old guava (*P. guvajava* L.) orchard was planted in August 2006 as spacing of 7m x 7m. Seven treatment combinations *viz.*, control, Rhizobium culture, phosphorus solubilizing bacteria, press mud, Rhizobium culture plus fertilizer, phosphorus solubilizing bacteria plus fertilizer, press mud plus fertilizer. Application of press mud plus fertilizer performed better by recording number of pod per plant (35.6), length of pod (11 cm) and test weight (35.1 g) yield attributes viz., grain yield (1090.25 kg ha^{-1}) and Stover yield (2808.01 kg ha^{-1}) However, significantly superior to the rest of the treatment over the control.

Key words : *Agri-horti system, Biofertilizer, Fertilizer, Green gram, Guava*

Introduction

Agroforestry plays a vital role in the Indian economy by way of tangible and intangible benefits (Singh *et al*., 2020). It has helped in rehabilitation of degraded lands on one hand and has increased farm productivity on the other. At present agroforestry meets almost half of the demand of fuel wood, 2/3 of the small timber, 70-80 per cent wood for plywood, 60 per cent raw material for paper pulp and 9-11 per cent of the greenfodder requirement of livestock, besides meeting the subsistence needs of households for food, fruit, fibre, medicine etc. Agroforestry is also playing the greatest role in maintaining the resource base and increasing overall productivity in the rainfed areas in general and the arid and semi-arid regions in particular (Annon, 2013). Agri-horti framework is ordinarily favored agricultural yields based agro ranger service framework in vindhyan area of India (Minz *et al.*, 2021). The natural product tree species developed in relationship with harvests in this area are aonla, ber, cit-

(*Ph.D. Research Scholar)

rus, custard apple, guava, bael etc. Agri-horti framework is an improved arrangement of intercropping in which agronomical harvests are developed in the middle of the horticultural trees with goals of greatest usage of regular assets to expand the arrival per unit region per unit time. Ranchers understand the issue of no monetary returns in the underlying phase of natural product tree plantations till the tree begins heading organic products. There is plentiful extension to use the space between organic product trees amid the underlying 5 to 6 years by developing arable harvests (Bisaria *et al.,* 1995).

Guava (*P. guvajava* L.) is distributed throughout the tropics and is predominantly a desert fruit, with appreciable vitamin C content (35-42 mg/100 g). The nutrient value of thiamine, potassium and dietary fiber is also significant. Guava is a good source of firewood. Green fruits, seeds and leaves have effective vermicides and insecticide properties. It has been reported that leaves, shoots, bark and root have medicinal properties (Morton, 1987). The unripe fruit is astringent, and a drastic purgative is the root. It can be planted as a shade tree and can also be grown with arable crops of short duration.Green gram (*V. radiata* (L.) Wilczek) is a critical conventional harvest developed everywhere throughout the world. It is of brief length, requires low venture, yields higher salary, and fills in as an astounding protein source as seed or grow. The region under development of this yield keeps on expanding in light of its development as a decrepit or revolution crop after rice and groundnut in ordinary soils (Srinives, 1990). Around 100 g of developed green gram seeds contains 1,453 kJ of vitality, 62.62 g of starches, 6.60 g of sugar, 16.3 g of dietary fiber, 1.15 g of fat, 23.9 g of protein, 4.8 mg of nutrient C, 132 mg of calcium, 189 mg of magnesium, 367 mg of phosphorus, 1246 mg of potassium and 15 mg of sodium, 6.7 mg of Fe, 2.7 mg of Zn, 2.3 mg of niacin (Annon, 2004).

Materials and Methods

The experiment was conducted on kharif (rainy) season at the Agronomy Farm of Rajiv Gandhi South Campus, Banaras Hindu University (BHU), Barkachha, Mirzapur, Uttar Pradesh on 2018 located in the Vindhyan region (25° 10' latitude, 82° 37 'longitude and an altitude of 147 meters above mean sea level) occupying over an area of more than 1000 ha of land. Mirzapur district on the north and northeast it is bounded by the Varanasi district, on the south bounded by Sonbhadra district, on the northwest by Prayagraj district. The shape to the north and west is totally irregular.

Mirzapur falls in a belt of semi-arid to sub-humid climate. The normal period for the onset of monsoon in this region is the third week of June and lasts up to the end of September or sometimes extends to the first week of October. Winter showers are often experienced in between the month of December to mid of February. However, March to May is generally dry. On an average, out of the total annual rainfall major fraction (75 %) is received from June to September. The coldest and hottest months are January and May, respectively. The temperature begins to rise from the month of February and reaches its maximum in May.

The twelve year old guava orchard which was planted in August, 2006 at a spacing of 7m × 7m. Experiment was laid on randomized block design (RBD) with three replications and seven repeat treatment combination consisted T_1 control, T_2 Rhizobium culture, T_3 Phosphorus solubilizing bacteria, T_4Pressmud, T_5NPK+Rhizobium culture, T_6 NPK+phosphorus solubilizing bacteria and T_7 NPK+pressmud.

The observation recorded during the investigation was tabulated and statistically analyzed to draw a valid conclusion. The data were analyzed according to the standard procedure "Analysis of Variance" (ANOVA) as described by Gomez and Gomez (1976). The significance of treatment was tested by 'F' test (Variance ratio). Standard error of mean was computed in all cases. The results thus obtained were presented using suitable diagram wherever needed.

The difference in the treatment mean were tested by using critical difference in the treatment where 'F' test showed significant difference (CD) at 5% level of probability by the following formula:

$$5F.585Z.\pm = \sqrt{\frac{EMS}{n}}$$

C.D. at 5% = SEm.± × √2 × t value at 5% of error (a) degree of freedom.

Results and Discussion

Among Guava based agri-horti system the application of press mud along with recommended dose of fertilizers showed significantly increased in number

of pods plant^{-1}, number of grains pod^{-1}, test weight, grain and straw yield and harvest index over the control (Table 1 and 2). It was due to closeness guava tree canopy resulting increase competition among components for light, nutrient and moisture. However, straw yield significantly increased with increasing rate of application of press mud along with recommended doses of fertilizers (Table 1). This might be due to the fact that the better root development and more nutrient availability, resulting in vigorous plant growth and dry matter accumulation which resulted in better flowering, fruiting and pod formation.

Enhanced vegetative growth in term of dry matter production and branches plant^{-1} provided more sites for the translocation of photosynthates and ultimately resulted inincreased number of pods plant^{-1}, grains pod, pod length and test weight which significantly benefitted with the availability of nutrients through application of press mud along with recommended dose of fertilizers duringcrop growing season, which ultimately contributed higher yield. The grains pod^{-1} and test weight were also improved due to press mud along recommended dose of fertilizer with grain. The maximum number of pods plant^{-1}, strawyield and 1000 grains weight were recorded in treatment T_7 application of press mud along with recommended dose of fertilizer in agri-horti system. This could be attributed to bettersupply of nitrogen and phosphorus with the help of biofertilizers resulting in higher branch and podand there by higher yield. It is an established fact that phosphorus plays an important role inthe formation of new shoots thereby; increase in the number of branches plant^{-1} was observed. In addition, itregulates the photosynthetic and carbohydrate metabolism which can be considered to be oneof the major limiting factors particularly growth during the reproductive phase. As stated earlier, the adequate supply of nitrogen and phosphorus play a vital role in metabolic process of photosynthesis that resulted in increased flowering and fruiting thereby improved number of pods plant^{-1}, grains pod^{-1}and test weight. The increase in above parameters with

Table 1. Effect of fertilizer and biofertilizer on Number of grain pod^{-1} and test weight (g) of green gram [*V.radiata* (L.) Wilczek] under guava (*P.gujava* L.) based Agri-horti system''

Treatment	Length of pod plant^{-1} (cm)	Number of grain pod^{-1}	1000 grain weight (g)
Control	3.4	6.8	23.6
Rhizobium culture	4.6	7.7	25.3
Phosphorus solubilizing bacteria	5.2	8.1	27.1
Press mud	5.4	9.2	27.9
Rhizobium culture + Required dose of fertilizer (20:40:10 kg NPK)	5.5	9.6	28.0
Phosphorus solubilizing bacteria + Required dose of fertilizer (20:40:10 kg NPK)	6.1	10.0	31.3
Press mud + Required dose of fertilizer (20:40:10 kg NPK)	6.6	12.0	35.1
SEm±	0.27	0.37	1.24
CD (P=0.05)	0.86	1.14	3.83

Table 2. Effect of fertilizer and bio fertilizer on yield and harvest index of green gram [*V.radiata* (L.) Wilczek] under guava (*P. gujava* L.) based Agri-horti system''

Treatment	Yield (kg/ha^{-1})		Harvest index %
	Grain	Straw	
Control	490.12	1725.09	22.75
Rhizobium culture	560.67	1958.50	25.30
Phosphorus solubilizing bacteria	690.42	2049.68	26.60
Press mud	810.36	2375.16	26.90
Rhizobium culture + Required dose of fertilizer	880.36	2592.01	27.40
Phosphorus solubilizing bacteria + Required dose of fertilizer	980.34	2698.06	27.81
Press mud + Required dose of fertilizer	1090.25	2808.01	28.20
SEM±	20.20	48.40	
CD (P=0.05)	58.10	143.4	

the application of nitrogen and phosphorus in appropriate level might be due to its favourable effect on growth parameters. The significant increase in test weight due to the application of medium level of fertility might be on account of better removal and translocation of nutrients, especially phosphorus, resulting in bold seed formation by increasing the size and weight of grains. The results are in close accordance with findings of Kumar (2003).

The better growth of plant in terms of height and dry matter accumulation might have helped in improving yield parameters and yield of green gram through better translocation of food reserves to sink. The levels of phosphorus during this period regulate the starch/sucrose ratio in the source leaves and the reproductive organs. It also influences the stomatal resistance and activity of ribilose bi-phosphate carboxylase. Thus, the stimulatory effect of nitrogen and phosphorus on growth and partitioning of photosynthates to sink development has led to increase in the number of pods plant^{-1}, grains pod^{-1}and test weight. The corresponding lower values of these parameters at lower doses further lend support to the above statement.

The analysed data on grain and straw yields revealed that application of press mud along with recommended doses of fertilizers showed significant improvement as compared to control. The application of nitrogen appears to be cumulative effect of dry matter accumulation and greater removal of nitrogen during reproductive and grain filling stages. This was also due to the beneficial effect of phosphorus, which brought about stimulating effect of phosphorus on plant processes, *viz*., cell division and root elongation in meristemic tissues and constitute of ADP and ATP in plant, which plays an important role in energy storage. Similarly press mud application increase number of pod^{-1}, number of filled pod and grain yield in black gram (Shanmughan, 1996).

With increased dry matter and photosynthetic products, coupled with efficient translocation, plant produced more pods plant^{-1}with more number of grains pod^{-1}and higher test weight. The significant increase in grain and straw yields appeared to be on account of the beneficial effects of nitrogen, phosphorus and potassium under press mud on growth and yield attributes which finally reflected in higher yield of green gram. Similarly, press mud application gave increase yield 20 to 30% observed in green gram Borde *et al*. (1984)

Relative economics

The economic analysis includes the cost of cultivation, gross return, net return and benefit: cost ratio for different treatments, combinations, and data in respect of economics have been summarized in Table 3. The common cost of cultivation of different treatment combinations were worked out, considering all operations from land preparation to harvesting input used. The cost of treatment was calculated separately and it was combined with common cost of cultivation to find out the total cost of cultivation. Data showed in table revealed that the cost of cultivation was minimum (Rs28580 ha^{-1}) under the control treatment. However, the total cost of cultivation was maximum (Rs 32817.76 ha^{-1}) under the application of press mud along with recommended dose of fertilizer. It is evident from the data that press mud plus dose of fertilizer recorded maximum gross return of Rs. 98353 ha^{-1} under the control treatment. The minimum gross return of Rs. 54178 ha^{-1} was recorded in agri-horti system under with control. The net return was markedly influenced due to different cost incurred and yield (grain and straw) obtained under various treatments. The maximum net return of Rs. 65535 ha^{-1} was recorded under the application press mud plus fertilizer. However, the minimum net return of Rs 25598 ha^{-1} was obtained under control.

Table 3. Effect of fertilizer and biofertilizer in combination on relative economics in ha^{-1}

S. No.	Treatment	Cost of cultivation	Gross return (Rs.)				Net return	Benefit : Cost ratio
			Grain	Straw	Guava (Fruit)	Total		
1.	T_1	28580	34308.4	3450.18	16420	54178	25598	1.89
2.	T_2	28830	39246.9	3917	16420	59583	30753	2.06
3.	T_3	28730	48329.4	4099.36	16420	68848	40118	2.39
4.	T_4	30680	56725.2	4750.32	16420	77895	47215	2.53
5.	T_5	30947.76	61625.2	5184.02	16420	83229	52281	2.68
6.	T_6	30847.76	68623.8	5396.12	16420	90439	59591	2.93
7.	T_7	32817.76	76317.5	5616.02	16420	98353	65535	3.01

Conclusion

Based on the above finding, it is concluded that the application of press mud along with recommended dose of fertilizer (20:40:10 NPK) to green gram proved significantly superior in respect of grain yield, net return and benefit: cost ratio under guava based agri-horti system in Vindhyan region of Mirzapur.

Conflict of Interest

All the authors hereby declare that there is no conflict of interest regarding the publication of this article.

References

Anonymous, 2004. United States Department of Agriculture Report. 1: 40-42.

Anonymous 2013. Vision 2050. National Research Centre for Agroforestry (NRCAF), Jhansi (UP). p.30

Bisaria, A.K., Gill, A.S., Lal, B., Handa, A.K. and Ajit, 1995. Agri-silvicultural studies: establishment, growth and production of multipurpose trees and their effect on the growth and production of crops and vice-versa, Annual Report, 1995-96 NRCAF, Jhansi, UP, 10-22.

Borde, Achin Kumar and Satendra Kumar, 1994. Effect of biofertilizer and P-levels on yield, nutrient content, uptake physico-chemical properties of soil under Black gram. 6: 1243-1251.

Gomez, K.A. and Gomez, A.A. 1976. Statistical Procedures for Agricultural Research (2 ed.). John wiley and sons, NewYork, 680p.

Kumar Surendra 2003. Effect of different spacing and fertilizer levels on yield parameters of mungbean under guava based agri-horti system. *J. Progressive Agric.* 4(2).

Minz, S.D., Singh, A.K., Kumar, N.M. and Singh, B.K. 2021. Effect of crop geometry and nitrogen management on growth attributes of pearl millet (*Pennisetum glaucum* L.) under guava based agri-horti system. *The PharmaInnov. J.* 10(9) : 2191-2195.

Morton, A.K., Mishra, D. and Ganyat, B.P. 1987. Effect of association of tree species on grain production of intercrops, In Agroforestry in 21st century, 1: 90-92.

Shanmughan, D.G. 1996. Agroforestry effects of associated tree species on grain production of arable crops. *J. Maharashtra Agric. Univ.* 15 (3): 356-357.

Singh, A.K., Aisha, S., Singh, B.K. and Minz, S.D. 2020. Economic transformation through agroforestry in global scenario. In : Rao R K. (Ed), Agriculture development and economic transformation in global scenario, Pp. 19-26. Mahima Research Foundation and Social Welfare, Varanasi.

Srinives, B.B. 1990. Effect of nutrient on the yield of Mungbean. *Ind. J. Agric. Sci.* 57: 193-205.