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EFFECT OF *BIOFERTILIZERS* AND NP LEVELS ON GROWTH PARAMETERS OF GREENGRAM UNDER CUSTARD APPLE BASED AGRI-HORTI SYSTEM

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ABSTRACT

A field experiment was conducted during *kharif* season of 2012-13 to find out the effect of *biofertilizers*, nitrogen and phosphorus levels on greengram (*Vigna radiata* L. Wilczek.) under custard apple (*Annona squamosa* L.) based agri- horti system. The experiment was conducted in randomized block design with seven treatments of *biofertilizers* and 20 kg N, 40 kg P_2O_5 level in four replications, seed of greengram inoculated by strain *Rhizobium (*MOR-1*)* and Phosphate Solubilizing Bacteria (*Bacillus subtilis*). Results showed that growth parameters of greengram were affected by biofertilizers (*Rhizobium* + PSB), nitrogen and phosphorus application. Seed inoculation with *Rhizobium* and PSB+20 kg N, 40 kg P_2O_5 application recorded significantly higher growth parameters *viz*., plant height (cm), number nodules/plant, dry matter accumulation/plant, number of trifoliate leaves/plant of greengram as compared to uninoculation of biofertilizer and control treatments.

Keywords:
Custard apple,
Dry matter,
Greengram,
Growth parameters

INTRODUCTION

Short duration cultivars/crops are found favourable with the environments in rainfed areas. Short duration crops may be intercropped to make the best use of resources in an agri- horti based system in which perennial fruit trees and crops as an annual grown together. Besides the efficient resource use, the techniques used for crop production in agri-hoticultural trees also share benefits. For instance, interculture, weed control, tillage, mulching *etc*. applied to the crop also benefits the trees in agroforestry system (Kang and Gutteridge, 2013). *Annona squamosa* L. the plant of Annonaceae family, also known as custard apple, is commonly found in deciduous forests, also cultivated in wild in various parts of India, is an edible fruit which has been reported to possess various medicinal properties. Young leaves of *Annona squamosa* contain steroids, alkaloids, saponins, terpenes, tannins, phenolic substances, carbohydrates, volatile oil, mucilage (Kokate, 1994; Harborne, 1998; Kumar *et al.*, 2013).

Mungbean [*Vigna radiata* (L.) Wilczek] is one of the most ancient and extensively grown leguminous crops of India. It contains about 25 per cent protein. It also contains high quality of lysine (4600 mg/ g N) and tryptophan (60 mg/ g N) and consumed as whole grain or as well as in the form of Dal for table purposes. The sprouted seeds of mungbean are rich in ascorbic acid (vitamin C), riboflavin and thiamine (Choudhary, 2010). Mungbean being a legume crop does not require much nitrogen except in small quantities in the beginning of its life cycle. Nitrogen plays an important role in various processes of the plant and it is a constituent of chloroplast. Nitrogen is an essential constituent of compounds like amino acid, protein, nucleic acid, prophyrin, flavine, pyridines, nucleotides, enzymes, coenzymes and alkaloids (Malik *et al*., 2003). The study of phosphorus to legume is more important than the nitrogen because later is fixed by symbiosis with *Rhizobium* bacteria. Phosphorus plays a very significant role in the formation of energy rich phosphate bond, nuclear protein, phospholipids and is also essential for growth of root system. (Chaudhary *et al*., 2003). Keeping all these factors in mind, the present experiment was conducted to find out the effect of *biofertilizers*, nitrogen and phosphorus levels on greengram under custard apple based agri- horti system

MATERIALS AND METHODS

A field experiment was conducted during *kharif* season of 2012-13 at Agronomy farm of Rajiv Gandhi South Campus Banaras Hindu University, Barkachha, Mirzapur, Uttar Pradesh, Which is situated in *Vindhyan* region of Mirzapur district (25^0 10' latitude, 82^0 37' longitude and altitude of 147 meters above mean sea level. The soil of the experimental site was sandy loam and having 183.33 kg/ha alkaline permanganate oxidizable N (Subbiah and Asija, 1956), 15.55 kg/ha available P (Olsen *et al*., 1954), 122.0 kg/ha 1 *N* ammonium acetate exchangeable K (Stanford and English, 1949) and 0.27% organic carbon (Jackson, 1973). The pH of soil was 5.4 (1:2.5 soil and water ratio). The experiment was

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conducted in randomized block design having two levels of N + P and seed inoculated by strain *Rhizobium (*MOR-1*)* and phosphate solubilizing bacteria (*Bacillus subtilis*) of greengram with four replications. Five years old custard apple trees were planted in august 2007 at the spacing of 5 x 5 meter. Greengram was sown as an alley crop under custard apple based agri-horti system. All the data obtained from trail was statistically analyzed using the *F*-test (Gomez and Gomez 1984). Critical difference (CD) values at *P*=0.05 were used for determine the significance of differences between mean values of treatments.

RESULTS AND DISCUSSION

Results of the experiment were revealed that growth parameters of green gram (Table 1) showed marked variation due to *biofertilizer* and fertility levels. The dual inoculation *Rhizobium* and PSB along with 20 kg N, 40 kg P_2O_5/ha were recorded significantly higher growth parameters *viz*., plant height (cm), number nodules/plant, dry matter accumulation/plant, number of trifoliate leaves/plant of greengram as compared to uninoculation of *biofertilizer* and control treatment. The increased growth parameters may be attributed to increased cell division due to sufficient supply of nitrogen and phosphorus by dual inoculation of *Rhizobium* and PSB culture. The number of root nodules/plant was observed significantly enhanced with the medium of higher fertility levels under dual inoculation of *Rhizobium* and PSB as compared to their uninoculation and control during all observation period. The results were in close conformity with the observation recorded by Tarafdar *et al.* (1992). Dry matter accumulation increased markedly with dual inoculation of *Rhizobium* and PSB under the higher level of fertility. Such influence of treatment may be attributed to higher microbial population favoring more N contents (%) and its association with increased chlorophyll formation due to *Rhizobium* inoculation and increased phosphatase activity and the beneficial effects of production of growth regulators due to PSB inoculation. The similar reasons were also proposed by Prasad and Ram (1984) and Tarafdar *et al.* (1992).The higher dry matter accumulation at the higher level fertility could be possible by the result of peak growth period and role of available nitrogen and phosphorus to the plants through its direct application. Incorporation of 20 kg N, 40 kg P_2O_5 + *Rhizobium* + PSB treatment contrary to this control, 20 kg N, 0 kg P_2O_5, treatment recorded poor growth parameters near to custard apple tree plant due to competition of light, moisture and nutrient. Noticeable variation on trifoliate leaves/plant under dual inoculation of *Rhizobium* and PSB with 20 kg N, 40 kg P_2O_5 was recorded and this extra ordinary response may be ascribed to penetration of roots to deeper depths, resulting in more absorption of water and nutrients from the plots where treatments was applied. Similar findings were reported by Singh and Pareek (2003) and also reported that *Rhizobium* along with PSB inoculation in green gram which significantly improved growth parameters. Similar results were also reported by Vijila and Jebaraj (2008) and Hussain *et al.* (2011).

Table1 Effect of *Rhizobium*, PSB culture, nitrogen and phosphorus levels on growth parameters of greengram under custard apple based agri-horti system

Treatment	Plant height/ plant (cm)			Root nodules /plant (No.)		Dry matter accumulation/ plant (g)			Primary branches/ plant (No.)		Secondary branches/plant (No.)		Trifoliate leaves /plant (No.)		
	20 DAS	40 DAS	At harvest	20 DAS	40 DAS	20 DAS	40 DAS	At harvest	40 DAS	At harvest	40 DAS	At harvest	20 DAS	40 DAS	At harvest
Control	16.70	32.18	34.08	4.43	8.87	0.90	3.87	2.93	5.26	5.47	1.53	3.53	4.10	6.70	4.37
N 20kg / ha	20.31	35.43	37.16	5.60	11.20	1.60	5.30	4.37	6.28	6.38	2.43	4.47	5.13	7.87	5.53
P_2O_5 40 kg /ha	23.43	38.69	41.10	6.63	13.27	2.13	6.43	5.50	7.54	7.65	3.13	5.17	6.20	8.70	6.73
N 20 kg + P_2O_5 40 kg/ ha	25.45	42.95	44.30	7.53	15.07	2.73	7.63	6.70	9.33	9.37	4.07	6.10	8.27	11.10	9.27
Rhizobium + PSB+ N 20 kg / ha	23.00	38.57	41.13	7.67	15.33	2.20	6.50	5.67	8.50	8.60	3.37	5.40	6.27	9.30	7.07
Rhizobium + PSB+ P_2O_5 40 kg/ ha	25.15	42.83	44.80	8.63	17.27	2.80	7.67	6.73	9.50	9.57	4.27	6.30	7.63	10.87	8.43
Rhizobium+ PSB + N 20 kg + P_2O_5 40 kg/ ha	29.53	45.87	47.97	9.80	19.60	3.27	8.87	7.97	11.58	11.70	6.20	8.23	10.27	13.87	11.20
CD (*P*=0.05)	1.96	2.62	2.98	0.80	1.60	0.51	0.89	0.94	0.65	0.45	0.78	0.78	0.43	0.73	1.46

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