

Effect of Different Levels of Inorganic Fertilizer and Bio-Fertilizer for Soil Amelioration Growth and Yield of Field Pea (*Pisum Sativum L.*)

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Abstract—A field experiment was conducted during Rabi season (November- April) 2015-2016 to study the “Effect of bio-fertilizer and different levels of inorganic fertilizers for soil amelioration growth and yield of field pea (*Pisum sativum L.*)” at the Research Farm of Department of Soil Science, Sam Higginbottom Institute of Agriculture, Technology & Science, Allahabad. The experiment was laid out in randomized block design with three levels of NPK (0%, 50%, 100%, RDF) kg ha^{-1} and three levels of Bio-fertilizer (PSB, Rhizobium and PSB + Rhizobium $75\% \text{ t ha}^{-1}$). The treatments combinations were replicated three times and were allocated at random in each replication. The treatment combination T_6 [Rhizobium + 100% RDF [N (25 kg ha^{-1}), P(60 kg ha^{-1}), K(20 kg ha^{-1})] gave the best result with the respect to plant height (82.02cm), number of branches plant^{-1} (16.93), Number of leaves plant^{-1} (81.33), number of nodules plant^{-1} (13.27), fresh weight of plant (g) (114.93), dry weight of plant (g) 22.73 it gave highest number of pods plant^{-1} 18.27, number of seeds pod^{-1} 6.73, length of pod (cm) 7.00 and test weight 253.07g. Combined use of inorganic fertilizer and bio-fertilizers resulted in significant increase on enrichment of soil fertility status. The treatment T_6 resulted in a slight decrease in soil pH 7.00 and significantly increases EC 0.277 dSm^{-1} , bulk density 1.34 g cm^{-3} , particle density 2.67 g cm^{-3} , soil pore space 49.69%, % organic carbon 0.81%, available N 330.59 Kg ha^{-1} , P 32.37 Kg ha^{-1} , K 197.85 Kg ha^{-1} in the soil. From the economical point of view, the same treatment gave the maximum profit of Rs 64,413 with C:B ratio of 1: 2.34.

Keywords—RDF, Bio-fertilizer, Field Pea, Growth and Yield.

I. INTRODUCTION

Pea provides a variety of vegetarian dishes and hence it is liked throughout the world. There are two types of cultivated pea the garden pea commonly grown in India. The Field pea (*Pisum sativum* var. hortense) is a green coloured, wrinkled seeded, sweet in taste, used for table

and canning purposes. Young green pods are plucked and sold in the market which gives an attractive price.

Another type of pea is used for pulse and popularly known as field pea (*Pisum sativum* var. arvense). The seeds are round or little angular, hard and whitish in colour. The plants are very hard and resistant to drought and frost. The sweet pea is another type of pea which has ornamental properties. The plants are tall, twining and bear very fragrant flowers. This type has little or no economic value. Agriculture has been and continues to be the lifeline of the Indian economy. India is a major pulse growing country of the world. According to a survey India occupies one third of the total world's crop area under pulses and fourth of total production. As the largest private sector in India, agriculture contribute nearly 17.22% of the national GDP, sustain livelihood of about 70% of population and is the backbone of agro-based industry.

Pea is a popular pulse crop of India. Pea is one of the fifth most important vegetable crops of India. The crop is usually grown for its green pods which contain immature seeds. Pea being rich in protein is considered a valuable component in vegetarian diet. Field pea (*Pisum sativum L.*) is a cool season legume crop belongs to leguminosae family. Peas are native to the Middle East region, and have been cultivated in Europe several thousands of years. The seed is rich in protein (contains 20-25% crude protein), and it is mostly consumed as a food product. The seed and the biomass of the plant are also used as a concentrate or forage for livestock. Field pea production in Western Canada has been increasing since 1997. In 2006 Alberta grew 18% of the total field-pea area in Canada and produced 586,100 tonnes of field-pea seeds. Field -pea plant has a tap root, vine, weak stem, and shallow root system. It is susceptible to drought and heat and grows best on well-drained loamy and clayey soils. However, the competitiveness of the field pea crop against weeds is low. This suggests the development of integrated weed control strategies, especially as there are very few herbicides registered for the crop. Which raise

concerns over the development of resistance to herbicides in some weeds. The production of pulses has grown to 29 million tonnes from 475 to 580 kg/ha. Pulses may an important role in agriculture economy, apart from being very rich and valuable protein source. Pulses have the ability to fix atmospheric Nitrogen symbiotic association with bacteria *Rhizobium*. As we know that, Indian population predominantly vegetarian and as such people use pulses to fulfil their requirement.

II. MATERIALS AND METHODS

The experiment was conducted at research Farm of Soil Science at Sam Higginbottom Institute of Agriculture Technology and Sciences, Deemed to be University, Allahabad. The area is situated on the south of Allahabad on the right side of the river Yamuna on the South of Rewa Road at a distance of about 6 Km from Allahabad city. It is situated at 25°24'23" N latitude, 81°50'38" E longitude and at the altitude of 98 meter above the sea level.

Table.1: Treatment combination

S. No.	Symbol	Treatment combination
1.	T ₁ (B ₀ I ₀)	PSB@200gm + 0% RDF
2.	T ₂ (B ₀ I ₁)	PSB@200gm + 50% RDF [N(12.5 kg ha ⁻¹), P(30 kg ha ⁻¹), K(10 kg ha ⁻¹)]
3.	T ₃ (B ₀ I ₂)	PSB@200gm + 100% RDF [N(25 kg ha ⁻¹), P(60 kg ha ⁻¹), K(20 kg ha ⁻¹)]
4.	T ₄ (B ₁ I ₀)	<i>Rhizobium</i> @200gm + 0% RDF
5.	T ₅ (B ₁ I ₁)	<i>Rhizobium</i> @200gm + 50% RDF [N(12.5 kg ha ⁻¹), P(30 kg ha ⁻¹), K(10 kg ha ⁻¹)]
6.	T ₆ (B ₁ I ₂)	<i>Rhizobium</i> + 100% RDF [N(25 kg ha ⁻¹), P(60 kg ha ⁻¹), K(20 kg ha ⁻¹)]
7.	T ₇ (B ₂ I ₀)	PSB + <i>Rhizobium</i> @ 200gm + 0% RDF
8.	T ₈ (B ₂ I ₁)	PSB + <i>Rhizobium</i> @ 200gm+ 50% RDF [N(12.5 kg ha ⁻¹), P(30 kg ha ⁻¹), K(10 kg ha ⁻¹)]
9.	T ₉ (B ₂ I ₂)	PSB + <i>Rhizobium</i> @ 200gm+ 100% RDF [N(25 kg ha ⁻¹), P(60 kg ha ⁻¹), K(20 kg ha ⁻¹)]

III. RESULT AND DISCUSSION

This results of the present investigation topic entitle "Effect of Different levels of Inorganic fertilizer and Bio – Fertilizers for Soil Amelioration Growth and Yields

attributes of Field Pea (*Pisum sativum* L.)", is summarized below in this chapter.

1. With increase level of inorganic fertilizer 100% RDF (Recommended Doses of Fertilizer) there was significant increase in vegetative growth (Plant height, no. of branches, no. of leaves); yield attributes and nutrient uptake. 100% RDF result a slight decreases in pH and EC but increase nutrient status of soil.
2. The bio-fertilizer *Rhizobium* @ 200g there was significant increase in vegetable growth (Plant height, no. of branches, no. of leaves.), nodulation, and yield attributes (number of pods plant⁻¹, number of seeds pod⁻¹, length of pod (cm), test weight (1000-seed weight (g) and nutrient uptake. At this level there was slight decrease in pH and EC but increase in nutrient status of soil **Manjunatha and Naik (2011)**.
3. The interaction effect of inorganic fertilizer with rhizobium increased all the growth parameters and nutrient uptake in plant with the terms of treatment T₆ (i.e. *Rhizobium* + 100% RDF [N (25 kg ha⁻¹), P(60 kg ha⁻¹), K(20 kg ha⁻¹)]) The yield attributes and nutrient uptake in plant and seed increased with the treatment T₆ (i.e. *Rhizobium* + 100% RDF [N (25 kg ha⁻¹), P(60 kg ha⁻¹), K(20 kg ha⁻¹)]) was also highest in this combination **Maya et al. (2012)**.
4. Treatment combination T₆ (i.e. *Rhizobium* + 100% RDF [N (25 kg ha⁻¹), P (60 kg ha⁻¹), K(20 kg ha⁻¹)]) was found to be the best combination. Highest Net Return and Benefit / Cost Ratio were also recorded in this treatment combination **Keram et al. (2012)**.

IV. CONCLUSION

From the finding of present investigation, it is concluded that inorganic fertilizers and bio-fertilizers has significantly influenced the physical and chemical properties of soil. The application of *Rhizobium* and RDF in terms of treatment number T₆ (*Rhizobium* + 100% RDF [N (25 kg ha⁻¹), P(60 kg ha⁻¹), K(20 kg ha⁻¹)]) gave the best results in terms of pod yield (q ha⁻¹) (89.05 q ha⁻¹) of pea and highest net profit (Rs. 64,413) with cost benefit ratio 1: 2.34.

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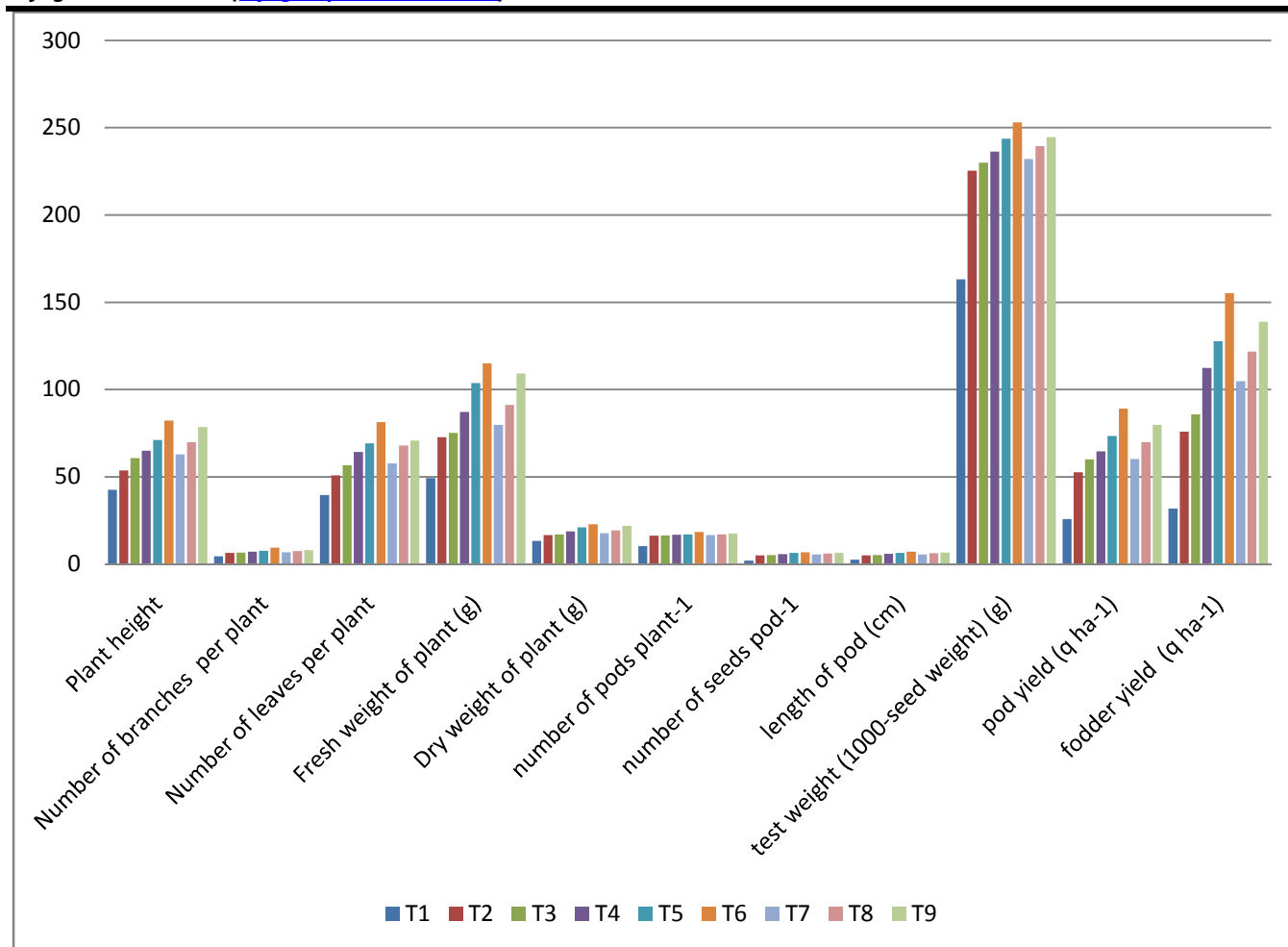
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Table.2: Effect of Different Levels of Inorganic Fertilizer and Bio-Fertilizer for Soil Amelioration Growth and Yield of Field Pea (*Pisum Sativum* L.)

Treatme nt No.	Plant height	Numb er of branc hes per plant	Numb er of leaves per plant	Fresh weight of plant (g)	Dry weight of plant (g)	numb er of pods plant- 1	numb er of seeds pod-1	length of pod (cm)	test weight (1000- seed weight) (g)	pod yield (q ha-1)	fodde r yield (q ha- 1)
T ₁	42.47	4.47	39.47	49.27	13.20	10.20	1.93	2.47	163.19	25.79	31.68
T ₂	53.67	6.27	50.73	72.67	16.60	16.20	4.87	4.87	225.40	52.55	75.90
T ₃	60.67	6.47	56.60	75.07	16.93	16.47	5.07	5.13	229.93	59.94	85.80
T ₄	64.93	7.13	64.13	87.14	18.73	16.80	5.73	5.80	236.33	64.47	112.3 4
T ₅	71.00	7.60	69.07	103.67	21.07	17.00	6.27	6.27	243.80	73.30	127.7 3
T ₆	82.20	9.26	81.33	114.93	22.73	18.27	6.73	7.00	253.07	89.05	155.1 3
T ₇	62.87	6.73	57.67	79.67	17.60	16.63	5.40	5.53	232.07	60.10	104.7 3
T ₈	69.80	7.33	67.93	91.13	19.27	16.93	5.93	6.13	239.47	69.83	121.6 7
T ₉	78.47	7.93	70.73	109.13	21.87	17.40	6.33	6.53	244.67	79.65	138.8 2
F- test	S	S	S	S	S	S	S	S	S	S	S
S. Ed. (±)	0.89	0.11	0.52	1.86	0.24	0.06	0.09	0.12	0.96	1.54	3.47
C. D. (P = 0.05)	1.90	0.24	1.11	3.95	0.52	0.12	0.19	0.26	2.03	0.26	7.35

Table.2 Effect of Different Levels of Inorganic Fertilizer and Bio -Fertilizer for Soil Amelioration Growth and Yield of Field Pea (*Pisum Sativum* L.)



T6

