# Effect of Biofertilizers on Growth and Yield of Field pea (*PisumSativum*) Varieties


## ABSTRACT

A field experiment was carried out during *rabi*season of 2022 onField Pea crop atCrop Research Farm, Department of Agronomy, SHUATS, Prayagraj, (U.P.). The soil of theexperimental plot was Sandy loam in texture, with a pH 7.2, that was neutral with EC- 0.26(dS/m), organic carbon (0.72%), available N (178.48kg/ha), available P (27.80kg/ha) andavailable K (233.24kg/ha). The treatments consisted of 3 varieties (Rachana, Aparna and PantC-5)andBiofertilizers(*Rhizobiumsp.*andPSB)andacontrol.Theexperimentwasla idoutin Randomized Block Design (RBD) with 10 treatments and replicated thrice. Application ofRachana + PSB + *Rhizobium sp*. produced higher plant height (98.89 cm), No. of pods/plant(24.04), No. ofseeds/pod(5.39), seedyield(1.73 kg/ha)andstoveryield(3.80 kg/ha).



*Keywords: Biofertilizers, Field pea, PSB, Rhizobium,リゾビウム属はグラム陰性の非芽胞形成好気性桿菌から growth, yield attribute, Rabi.*


## 1. INTRODUCTION

Pea (*Pisumsativum;*エンドウ豆) is an important vegetable crop grown throughout the world. In India, it is grown mainly as a winter vegetable in the plains of North India and as a summer vegetable in the hills. It belongs to the family Fabaceae. Pulses are wonderful gift of nature as they,incombimation with cereals, constitute a balance diet for a predominantly large number of vegetarian Indians. Field pea (PisumSativum) is an important popular pulse crop of India. Among pulses, pea is one of the important pulses having high nutritional quality. Field pea os a cool season legume crop belongs to the family fabaceae (Leguminosae). Peas are native to the Middle East Region, and have been cultivated in Europe several thousands of years. Field pea is as annual herbaceous plant and the stem grow to a length of 2 to 4 ft. A leaf consists of one to three pairs of leaflets with a terminal, branched tendril. Leaves are oale green with a whitish bloom on the surface. At maturity, the plant is a prostrate vine.

India is the second largest producer of pea in the world after Russia. Pea is rich in protein, carbohydrates, vitamin A and C, calcium and phosphorus. Phosphorus is known to play an important role in growth and development of the crop and have direct relation with root proliferation, straw strength, grain formation, crop maturation and crop quality. Enhancing P availability to crop through phosphate-solubilizing bacteria (PSB) holds promise in the present scenario of escalating prices of phosphatic fertilizers in the country and a general

deficiency of P in Indian soils . It increasing availability of nitrogen and phosphorus besides improving biological fixation of atmospheric nitrogen and enhance phosphorus availability to crop. Therefore, introduction of efficient strains of Rhizobium and PSB in soil, which is poor in nitrogen, may help in boosting up production and consequently more nitrogen fixation.

Biofertilizers are the source of microbial inoculation, which have brought hopes for many countries both economically and environmentally. Therefore, in developing countries like India, biofertilizers can solve problems of high cost of fertilizers and thus can save the economy of the country[1]. Application of organic manures and biofertilizers is frequently recommended firstly for improving biological, physical and chemical properties of soil and secondary to get high and clean agricultural yield products free from undesirable high doses of heavy metals and other pollutants.

The Rhizobium as fertilizer in pulses could fix 50-200 kg of N ha/season and is able to meet 80- 90 % of the crop requirement for nitrogen. Inoculation in these crops was found to increase the yield by about 10-15% under on farm conditions [2].

Several Phoshpate Solubilizing Bacteria (PSB) have the consistent capacity to increase the availability of phosphate to plant, not only by mineralizing organic phosphorus compound, but also by rendering inorganic phosphorus compound, more available to plant [3] which increase overall plaant growth resulting in 10 to 15 per cent increase in yield. Several bacteria, particularly, those belonging to genera ***Pseudomonas*** **and** ***Bacillus***possess the ability to bring insoluble phosphate in soil into soluble form by secreting organic acids which lower the pH and bring about dissolution of bound phosphate [4]

The seed inoculation with Rhizobium increases nodulation, influences seed yield and economies the input cost of fertilizers to some extent and protects against chances of soil deterioration and environmental pollution caused by heavy use of chemical fertilizers. The efficient strains of Rhizobium can fix about 90 kg of nitrogen per hectare in one season and enrich soil nitrogen. Introduction of efficient strains of Rhizobium in soils with low nitrogen may help augment nitrogen fixation and there by boost production of crops. Rhizobium inoculation increased the root nodulation through better root development and more nutrient availability, resulting in vigorous plant growth and dry matter production which resulted in better flowering, fruiting and pod formation and ultimately there was beneficial effect on seed yield.

PSB in agricultural practice would not only offset the high cost of manufacturing phosphate fertilizers but would also mobilize insoluble in the fertilizers and soils to which they are applied. Among the whole microbial population in soil, phosphate solubilizing bacteria (PSB) constitute 1 to 50 per cent, while phosphorus solubilizing fungi (PSF) are only 0.1 to 0.5 per cent in P solubilization potential. Positive effects of phosphorein (PSB or PDB) and chemical phosphorus fertilizer on growth, yield, seed yield and quality were found on fiber bean.

## 2. MATERIAL AND METHODS

The experiment was carried out during *Rabi* season of 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) which is located at 25.39”42” N latitude, 81.50”56” E longitude, and 98m altitude above the mean sea level. This area is situated on the right side of the river Yamuna and by the opposite side of Prayagraj City. All the facilities

required for crop cultivation were available. The soil of the experimental field constituting a part of central Gangetic alluvial is neutral and deep. The soil was sandy loam in texture, low in organic carbon and medium in available nitrogen, phosphorus, and low in potassium. Nutrient sources were urea, and Muriate of Potash to fulfil the requirement of Nitrogen and Potassium. The phosphorus was applied in 40, 50, and 60 kg/ha through Single Super Phosphate nutrient source. The crop was sown on 5th November 2022. The experiment was laid out in Randomized Block Design with ten treatments each replicated thrice viz., T1- Rachana + PSB, T2- Rachana + *Rhizobium sp*., T3- Rachana + PSB + *Rhizobium sp*., T4- Aparna + PSB, T5- Aparna + *Rhizobium sp*., T6- Aparna + PSB + *Rhizobium sp*., T7- Pant C-5 + PSB, T8- Pant C-5 + *Rhizobium sp*., T9- Pant C-5 + PSB + *Rhizobium sp*., T10- Control (40-40-50 NPK kg/ha). BiofertilizersPSB at 20g/kg seed, *Rhizobium sp.* 20g/kg seed and PSB + *Rhizobium sp*. at 10:10g/kg seed was applied as soil application along with blanket application of fertilizers before sowing. The growth parameters reading such as plant height (cm), plant dry weight (g) and also, yield parameters such as number of pods/plant, number of seeds/pod, seed yield (kg/ha), and stover yield (kg/ha). The growth parameters were recorded at an intervals of 20, 40, 60, 80, 100 DAS and at harvest stage, from the randomly selected five plants in each treatment. Statistically analysis was done using all the parameters in **one-way Anova**and **means** were compared at 0.05 probability level of significant results.

## 3. RESULTS AND DISCUSSION

### 3.1. Influence of biofertilizers on growth attributes of field pea varieties.

#### 3.1.1. Plant height (cm)

Significantly highest plant height (98.89cm) was observed in treatment 3 (Rachana + PSB + *Rhizobium sp.).* However, treatment 2 (Rachana + *Rhizobium sp.*) was statistically at par with treatment 3. The application of *Rhizobium sp.* + PSB resulted in significantly superior plant height to the rest of the treatments. The increase in plant height may be owing to the improvement in vigour of plants possibly by balanced supply and higher uptake of nitrogen and phosphorus [5].

#### 3.1.2. Dry weight (g/plant)

Significantly maximum dry weight (31.0g) was observed in treatment 3 (Rachana + PSB + *Rhizobium sp*.) However, treatment 2 (Rachana + *Rhizobium sp*.) was statistically at par with treatment 3. The seed inoculation with PSB + *Rhizobium sp*. improved the dry matter accumulation as compared to uninoculated treatment. [6].

**Table1.Influenceofbiofertilizersongrowthattributesoffield pea.**

| S.No. | Treatments | Plantheight (cm) | Dryweight (g/plant) |
|---|---|---|---|
| 1. | Rachana + PSB | 95.25 | 30.1 |
| 2. | Rachana + *Rhizobium sp.* | 97.63 | 30.6 |
| 3. | Rachana + PSB + *Rhizobium sp.* | 98.89 | 31.0 |
| 4. | Aparna + PSB | 97.98 | 23.5 |

| | | | |
|---|---|---|---|
| 5. | Aparna + *Rhizobium sp.* | 79.91 | 23.5 |
| 6. | Aparna + PSB + *Rhizobium sp.* | 79.69 | 23.8 |
| 7. | Pant C-5 + PSB | 79.15 | 22.7 |
| 8. | Pant C-5 + *Rhizobium sp.* | 77.21 | 22.8 |
| 9. | Pant C-5 + PSB + *Rhizobium sp.* | 77.21 | 22.9 |
| 10. | Control(40-40-50NPK kg/ha) | 76.77 | 22.6 |
| | Ftest | S | S |
| | SEm(±) | 0.51 | 0.25 |
| | CD(p=0.05) | 1.52 | 0.76 |

## 3.2. Influence of biofertilizers on yield attributes and yield of field pea varieties

### 3.2.1. Number of pods/plant

Significantly highest number of pods/plant (24.04) was observed in treatment 3 (Rachana + PSB + *Rhizobium sp*.). However, treatment 2 (Rachana + *Rhizobium sp.*) was statistically at par with treatment 3. Different levels of biofertilizers executed their significant influence on number of pods/plant at harvest. Inoculation with Rhizobium sp. + PSB recorded significantly the highest number of pods/plant[7].

### 3.2.2. Number of seeds/pod

Significantly highest number of seeds/pod (5.39) was observed in treatment 3 (Rachana + PSB + *Rhizobium sp*.). However, treatment 2 (Rachana + *Rhizobium sp*.) was statistically at par with treatment 3. Different levels of biofertilizers executed their significant influence on number of seeds per pod at harvest.Inoculation with Rhizobium sp. PSB recorded significantly the highest number of seed pods [7].

### 3.2.3 Seed yield (kg/ha)

Significantly highest seed yield (1730kg/ha) was observed in treatment 3 (Rachana + PSB + *Rhizobium sp.*) However, treatment 2 (Rachana + *Rhizobium sp.*) was statistically at par with treatment 3. Seed inoculation treatments, dual inoculation of Rhizobium + PSB produced significantly higher seed yield than inoculation of Rhizobium and PSB alone, but significantly superior over control[6].

### 3.2.4. Stover yield (kg/ha)

Significantly highest stover yield (3800kg/ha) was observed in treatment 3 (Rachana + PSB + *Rhizobium sp*.). However, treatment 2 (Rachana + *Rhizobium sp*.) was statistically at par with treatment 3. Different levels of biofertlilzers did cause their significant effect on stover yield. Treatment with Rhizobium sp. + PSB gave significantly the maximum stover yield [6].

**Table 2.Influence of biofertilizers on yield attributes and yield of field pea varieties.**

| S.No. | Treatments | No.of pods/plant | No.of seeds/ pod | Seedyield (kg/ha) | Stover yield (kg/ha) |
|---|---|---|---|---|---|
| 1. | Rachana + PSB | 22.33 | 4.79 | 1380 | 3490 |
| 2. | Rachana + *Rhizobium sp.* | 23.29 | 5.19 | 1590 | 3690 |
| 3. | Rachana + PSB + *Rhizobium sp.* | 24.04 | 5.39 | 1730 | 3800 |
| 4. | Aparna + PSB | 17.33 | 4.66 | 1040 | 3670 |
| 5. | Aparna + *Rhizobium sp.* | **17.96** | 4.74 | 1110 | 3470 |
| 6. | Aparna + PSB + *Rhizobium sp.* | 17.92 | 4.92 | 1130 | 3370 |
| 7. | Pant C-5 + PSB | 18.06 | 4.71 | 1080 | 3340 |
| 8. | Pant C-5 + *Rhizobium sp.* | 17.42 | 4.82 | 1080 | 3260 |
| 9. | Pant C-5 + PSB + *Rhizobium sp.* | 17.44 | 4.70 | 1040 | 3150 |
| 10. | Control(40-40-50NPK kg/ha) | 17.30 | 4.63 | 1020 | 3140 |
| | Ftest | S | S | S | S |
| | SEm(±) | 1.18 | 0.19 | 0.05 | 0.07 |
| | CD(p=0.05) | 3.50 | 0.56 | 0.14 | 0.20 |

## 4. CONCLUSION

ItisconcludedthatapplicationofRachana + PSB + *Rhizobium sp.*recordedhighestgrowthattributesand seedyield in field pea crop.

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