International Journal of Forestry and Crop Improvement
December, 2011 | Volume 2 | Issue 2 | 114-117

*Research Article*

# Influence of *Rhizobium* seed inoculation, nitrogen and phosphorus levels on growth, seed yield and quality of cowpea cv. PUSA PHALGUNI

**D.K. JADHAV, B.N. PATEL AND S.T. KAD**

***Abstract :*** A field experiment was conducted during the summer season of 2005 at Agricultural Experimental Station, Paria to study the influence of *Rhizobium* seed inoculation and nitrogen and phosphorus levels on cowpea (*Vigna unguiculata* Walp). Combined application of 20 kg N/ha + 40 kg $P_2O_5$/ha with seed inoculation significantly increased growth, seed yield and quality of cowpea.

***Key Words :*** *Rhizobium*, Cowpea, Nitrogen, Phosphorus, Seed yield and quality

***How to cite this Article:*** Jadhav, D.K., Patel, B.N. and Kad, S.T. (2011). Influence of *Rhizobium* seed inoculation, nitrogen and phosphorus levels on growth, seed yield and quality of cowpea (*Vigna unguiculata* Walp) cv. PUSA PHALGUNI, *Internat. J. Forestry & Crop Improv.,* **2** (2) : 114-117.

***Article Chronical :*** **Received :** *06.06.2011;* **Revised :** *14.07.2011;* **Accepted :** *24.09.2011*

## INTRODUCTION

Cowpea (*Vigna unguiculata* Walp) is an important leguminous vegetable crop grown in summer as well as *Kharif* season in Gujarat for its long green tender pods and also for seeds.

It is nutritive vegetable, which supplies protein, phosphorus and vitamins like A, B and C (Smartt, 1976). Being a nutritious vegetabe, it plays an important role in maintaining soil fertility. But, average productivity of the crop is far below the yield levels recorded at research stations. Major hurdles in increasing the productivity are poor soil in which crop is grown and improper fertilization. Hence, there is need for increasing crop productivity by improving soil fertility. In addition to nitrogen which is fixed in the soil from the atmosphere by the crop specific *Rhizobium* found in root nodules of this crop. Phosphorus is another important element which inter-alia enhances the nitrogen fixation capacity of the crop. In addition to biologically fixed nitrogen, crop also required N through fertilization to meet its initial requirement. Information on the combined effect of fertilizer nutrient and seed inoculation with *Rhizobium* culture in affecting the productivity of the crop is meagre. In light of above, the present investigation was conducted.

**MEMBERS OF RESEARCH FORUM**

**Author of the Correspondence :**
**D.K. JADHAV,** Department of Crop Science, College of Agricultural Biotechnology, Loni, Rahata, AHMEDNAGAR (M.S.) INDIA

**Address of the Coopted Authors :**
**B.N. PATEL AND S.T. KAD,** Department of Crop Science, College of Agricultural Biotechnology, Loni, Rahata, AHMEDNAGAR (M.S.) INDIA

## EXPERIMENTAL METHODS

A field experiment was conducted in summer season of 2005 at Agricultural Experimental Station, Paria. The soil was clayey in texture having pH 8.15 and available N, $P_2O_5$ 235.2 kg and 41.65 kg/ha, respectively. The treatment comprised of three levels of nitrogen *viz.*, 0, 10 and 20 kg N/ha. Three levels of phosphorus *i.e.* 0, 20 and 40 kg/ha with and without *Rhizobium* seed inoculation. Full dose of phosphorus and half dose of N were applied at the time of sowing along with FYM @ 15 q/ha and remaining half dose of N was applied at 30 DAS. The experiment was laid out in Randomized Block Deisgn with three replications. Seeds of cowpea 'Pusa Phalguni' were treated with *Rhizobium* culture

prior to sowing by slurry method and dried under shade. Seeds were dibbled at spacing of 45 cm apart and 15 cm within rows in bed on last week of Feb. 2005. The crop was irrigated as per requirement. The plots were kept weed free by manual weeding till grain filling.

## EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present study have been presented under following heads :

**Growth :**

Data on morphological components of cowpea as influenced by *Rhizobium*, nitrogen and phosphorus are presented in Table 1. Results showed that the tallest plants (50.77 cm, 55.03 cm and 52.27 cm), which produced maximum branches and nodules per plant were found from an application of N @ 20 kg/ha + 40 kg $P_2O_5$ /ha with *Rhizobium* inoculation. The similar observations were recorded by Rajput (1994) and Mishra and Baboo (1999).

**Yield parameters:**

The yield components as number of clusters per plant, pods per clusters, pods/ plant, seeds per pod, seed yield per plant and seed yield per ha were significantly influenced by *Rhizobium* seed inoculation (Table 2). Similar results were also recorded at application of 20 kg/ha. The additional supply of nitrogen by nitrogen fixing bacteria appeared to have increased the number of leaves and thereby, greater supply of food materials through increased photosynthesis, which ultimately gave significant increase in yield parameters. Similar results were reported by Mishra and Solanki (1996).

All the above yield parameters and seed yield per ha of cowpea responded well to phosphorus application by showing maximum values with 40 kg $P_2O_5$/ha. The results are in conformity with those reported by Mishra (1999) and Thapa and Maity (2004). Phosphorus, being one of the most important constituents of RNA and DNA, appears to have influenced the plant metabolic activity gainfully in the present investigations.

**Quality parameters:**

Different quality parameters (Table 3) such as test weight, nitrogen content (%) and protein content (%) were significantly influenced by *Rhizobium* seed inoculation. It might be due to physiological influence of *Rhizobium* on the activity of enzymes along with inorganic nutrients could have altered the contents to desired level. These results are in close conformity with Desai *et al.* (2001), Mishra (1999)

**Table 1 : Effect of nitrogen, phosphorus and *Rhizobium* on growth, nodulation and branching of cowpea cv. PUSA PHALGUNI**

| Treatments | Plant height (cm) | Nodules/ plant 15 DAS | Branches/ plant |
|---|---|---|---|
| ***Rhizobium* treatment (R)** | | | |
| $R_1$ : Untreated | 49.10 | 5.75 | 4.33 |
| $R_2$ : Treated | 50.77 | 6.52 | 4.51 |
| S.E.± | 0.52 | 0.08 | 0.08 |
| C.D. (P=0.05) | 1.57 | 0.25 | NS |
| **Levels of nitrogen (N)** | | | |
| $N_0$ : Control | 45.63 | 6.01 | 4.15 |
| $N_1$ : 10 kg N /ha | 49.15 | 6.97 | 4.41 |
| $N_2$ : 20 kg N /ha | 55.03 | 5.43 | 4.80 |
| S.E.± | 0.64 | 0.10 | 0.10 |
| C.D. (P=0.05) | 1.86 | 0.30 | 0.29 |
| **Levels of phosphorus (P)** | | | |
| $P_0$ : Control | 47.81 | 5.91 | 4.23 |
| $P_1$ : 20 kg $P_2O_5$ /ha | 49.72 | 6. 36 | 4.46 |
| $P_2$ : 40 kg $P_2O_5$ /ha | 52.27 | 6. 15 | 4.67 |
| S.E.± | 0.64 | 0.10 | 0.102 |
| C.D. (P=0.05) | 1.86 | 0.30 | 0.29 |
| **Interaction** | | | |
| R x N | NS | NS | NS |
| R x P | NS | NS | NS |
| N x P | NS | NS | NS |
| R x N x P | NS | NS | NS |

NS=Non-significant S=Significant

**Table 2 : Effect of *Rhizobium* seed inoculation, nitrogen and phosphorus on yield parameters and seed yield of cowpea**

| Treatments | Pods/cluster | Cluster /plant | Pods/plant | Seeds /pod | Seed yield/plant | Seed yield (q/ha) |
|---|---|---|---|---|---|---|
| ***Rhizobium* treatment (R)** | | | | | | |
| $R_1$: Untreated | 3.18 | 9.66 | 31.24 | 12.26 | 14.26 | 23.77 |
| $R_2$ : Treated | 3.38 | 10.05 | 32.89 | 12.64 | 16.10 | 26.83 |
| S.E. ± | 0.07 | 0.12 | 0.53 | 0.12 | 0.23 | 0.39 |
| C.D. (P=0.05) | 0.20 | 0.36 | 1.53 | 0.36 | 0.67 | 1.12 |
| **Levels of nitrogen (N)** | | | | | | |
| $N_0$ : Control | 3.08 | 8.41 | 28.32 | 12.01 | 12.66 | 21.11 |
| $N_1$ : 10 kg N /ha | 3.32 | 9.98 | 33.03 | 12.34 | 15.55 | 25.91 |
| $N_2$ : 20 kg N /ha | 3.44 | 11.18 | 34.84 | 13.00 | 17.33 | 28.89 |
| S.E. ± | 0.09 | 0.15 | 0.65 | 0.15 | 0.28 | 0.47 |
| C.D. (P=0.05) | 0.24 | 0.44 | 1.87 | 0.45 | 0.82 | 1.37 |
| **Levels of phosphorus (P)** | | | | | | |
| $P_0$ : Control | 3.12 | 9.39 | 30.96 | 11.79 | 13.70 | 22.83 |
| $P_1$ : 20 kg $P_2O_5$ /ha | 3.25 | 9.76 | 31.90 | 12.32 | 14.90 | 24.83 |
| $P_2$ : 40 kg $P_2O_5$ /ha | 3.46 | 10.41 | 33.33 | 13.24 | 16.94 | 28.24 |
| S.E. ± | 0.09 | 0.15 | 0.65 | 0.15 | 0.28 | 0.47 |
| C.D. (P=0.05) | 0.24 | 0.44 | 1.87 | 0.45 | 0.82 | 1.37 |
| Interaction | | | | | | |
| R x N | NS | NS | NS | NS | NS | NS |
| R x P | NS | NS | NS | S | S | S |
| N x P | NS | NS | NS | NS | NS | NS |
| R x N x P | NS | NS | NS | NS | NS | NS |

NS=Non-significant S=Significant

**Table 3 : Effect of *Rhizobium* seed inoculation, nitrogen and phosphorus on quality parameters of cowpea**

| Treatments | Test weight | Nitrogen content | Protein content | Germination percentage |
|---|---|---|---|---|
| **Rhizobium treatment (R)** | | | | |
| $R_1$: Untreated | 7.61 | 2.98 | 18.44 | 88.92 |
| $R_2$ : Treated | 8.01 | 3.11 | 19.18 | 89.49 |
| S.E.± | 0.11 | 0.04 | 0.24 | 0.97 |
| C.D. (P=0.05) | 0.33 | 0.12 | 0.70 | NS |
| **Levels of nitrogen (N)** | | | | |
| $N_0$ : Control | 7.57 | 2.92 | 18.26 | 87.10 |
| $N_1$ : 10 kg N /ha | 7.75 | 3.05 | 18.46 | 90.10 |
| $N_2$ : 20 kg N /ha | 8.12 | 3.17 | 19.70 | 90.40 |
| S.E.± | 0.14 | 0.05 | 0.30 | 1.19 |
| C.D. (P=0.05) | 0.40 | 0.14 | 0.86 | NS |
| **Levels of phosphorus (P)** | | | | |
| $P_0$ : Control | 7.58 | 2.92 | 18.24 | 87.10 |
| $P_1$ : 20 kg $P_2O_5$ /ha | 7.74 | 3.02 | 18.62 | 88.53 |
| $P_2$ : 40 kg $P_2O_5$ /ha | 8.12 | 3.20 | 19.57 | 91.97 |
| S.E.± | 0.14 | 0.05 | 0.30 | 1.19 |
| C.D. (P=0.05) | 0.40 | 0.14 | 0.86 | 3.42 |
| **Interaction** | | | | |
| R x N | NS | NS | NS | NS |
| R x P | NS | NS | NS | NS |
| N x P | NS | NS | NS | NS |
| R x N x P | NS | NS | NS | NS |

NS=Non-significant

**Table 4 : Interaction effect of R x P on seed yield (q/ha) of cowpea cv. PUSA PHALGUNI**

| Treatments (Phosphorus levels ) | *Rhizobium* levels | |
|---|---|---|
| | $R_1$ | $R_2$ |
| $P_0$ | 21.79 | 23.88 |
| $P_1$ | 23.87 | 25.79 |
| $P_2$ | 25.66 | 30.83 |
| S.E. ± | 0.67 | |
| C.D. (P=0.05) | 1.93 | |

and Singh *et al.* (1989). While, germination percentage remained unaffected by *Rhizobium* treatment.

All the quality parameters discussed above differed significantly by nitrogen levels except germination percentage. However, maximum test weight (8.12 g), N content (3.17%) and protein content (19.70%) were recorded by 20 kg N/ha. Similar trend was observed by Sajjan *et al.* (2004), Narayana (2003) and Sharma and Singh (2003).

All the characters as test weight, N content, protein content and germination percentage was significantly affected by phosphorus levels. However, maximum values were recorded by 40 kg $P_2O_5$/ha. It might be due to role of phosphorus in many metabolic process of plants and its involvement in photosynthetic reaction and tended to increase grain formation. Also it increased utilization of nitrogen and increased $N_2$ content and protein content. Also phosphorus is directly involved in seed germination phenomenon. The similar trend was observed by Yadav *et al.* (2004) and Singh *et al.* (1989).

**Interaction effect of R x P:**

The data on R x P interaction are presented in Table 4. The treatment combination $R_2P_2$ recorded the highest seed yield of (30.83 q/ha) while, the lowest seed yield was recorded at $R_1P_0$ (21.79 q/ha).

**Conclusion:**

From the foregoing discussions it can be concluded that combined application of 20 kg N/ha + 40 kg $P_2O_5$/ha with *Rhizobium* seed inoculation significantly increased growth, seed yield and quality of cowpea

## REFERENCES


Desai, D.T., Khistria, M.K. and Akbari, K.N. (2001). Effect of NP fertilization and bio-fertilizers on yield, quality and nutrient uptake of cowpea. *Adv. Pl. Sci.,* **14** (2): 571-575.

Mishra, S.K. (1999). Effect of nitrogen, phosphorus and seed inoculation on vegetable cowpea (*Vigna sinensis* Savi). *Ann. Agric. Res*., **20** (3): 308-312.

Mishra, S.K. and Baboo, R. (1999). Effect of nitrogen, phosphorus and seed inoculation on cowpea (*Vigna unguiculata*). *Indian J. Agron.,* **44** (2): 373-376.

Mishra, S.K. and Solanki, R.B. (1996). Effect of *Rhizobium* inoculation, nitrogen and phosphorus on growth and seed yield of cowpea (*Vigna sinesis* Savi). *Indian J. Hort.,* **53** (3): 220-224.

Narayana, E. (2003). Yield and economics of soybean as influenced by nitrogen and phosphorus. *Andhra Agric. J*., **50** (1-2): 18-19.

Rajput, A.L. (1994). Response of cowpea (*Vigna unguiculata*) to *Rhizobium* inoculation, date of sowing and phosphorus. *Indian J. Agron.,* **39** (4): 584-587.

Sajjan, A.S., Shekaragouda, M. and Biradar, B.D. (2004). Effect of sowing dates, spacing and nitrogen levels on seed yield and quality of okra [*Abelmoschus esculentus* (L.) Moench]. *Seed Res.,* **32** (2): 118-121.

Sharma,S.K. and Singh, H. (2003). Effect of seed rate and fertilizer doses on growth, yield and seed quality of pea (*Pisum sativum*) cv. ARKEL. *Seed Res*., **31** (1): 43-46.

Singh,T., Singh, S.B., Awashti, C.P., Singh, B.N. and Srivastava, S.K. (1989). Effect of *Rhizobium* and phosphorus on pod yield and chemical constituents of cowpea [*Vigna unguiculata* (L.) Walp.]. *Veg. Sci.,* **16** (2): 125-131.

Smart,J. (1976). *Tropical pulse.* Longman group limited, London, 82.

Thapa,U. and Maity, T.K. (2004). Influence of nitrogen, phosphorus and number of cutting on seed yield of fenugreek (*Trigonella foenum graecum*). *Seed Res*., **32** (1): 33-35.

Yadav, G.L., Kumavat, P.D. and Babel, A.L. (2004). Effect of nitrogen, phosphorus and *Rhizobium* inoculation on mothbean. *Indian J. Pulses Res*., **17** (1): 95-96.


********