*Environment & Ecology* 29 (1A) : 263—265, 2011
 *ISSN 0970-0420*

# Effect of Fertilization and *Rhizobium* Inoculation on Productivity of Pigeonpea (*Cajanus cajan*)

U. K. SINGH, J. K. LAL[1], D. K. PRASAD[2] AND R. KUMAR[2]

*Krishi Vigyan Kendra, Bokaro (BAU, Ranchi)*
*KVK, Bokaro, Jharkhand*
*[1]KVK, Giridih, Jharkhand*
*[2]Department of Agronomy, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India*
*E-mail : udaysingh72@gmail.com*

**Abstract**

A field trail was conducted in the farmer's field of Bokaro district of Jharkhand for two consecutive years during 2006-08 to study the effect of chemical fertilizer and rhizobium inoculation on the productivity of pigeonpea. The experiment comprised three treatments i. e. farmer practice (no fertilization and seed treatment), recommended PK (40 kg P205 + 20 kg K20) + seed treatment with rhizobium inoculation and $T_3$ recommended NPK (20 : 40 : 20 kg NPK) + rhizobium inoculation. The experiment was laid out in randomized block design with replicated at 10 sites. Results revealed that maximum grain yield of pigeonpea (19.0 q/ha) with the recommend NPK along with rhizobium inoculation following by application of recommended PK along with rhizobium inoculation recorded grain yield 15.2 q/ha.

**Key words : Pigeonpea, *Rhizobium* inoculation, Fertilizer application.**

Pigeonpea in general grown in the farmers field as sole crop and mixed crop without fertilization and rhizobium inoculation in *kharif* season under rainfed condition. One of the important factors responsible for its low productivity is no or inadequate use of plant nutrient particularly phosphorus and potassium (1). Being a pulse crop, pigeonpea can meets its nitrogen requirement by symbiotic fixation of atmosphere nitrogen. However, as starter dose of nitrogen increases the grain yield of pulse and the crude protein content significantly. *Rhizobium* inoculation is a low cost input and its combination used with fertilizer may bring the stability in yield and improves the productivity . However, the study on the combined effect of fertilization and rhizobium inoculation simultaneously has not largely been studied particularly in this agro-ecological zone of the state. The present experiment was therefore planned in the farmers field to demonstrate the effect of fertilization and rhizobium inoculation on productivity of pigeonpea (*Cajanus cajan*).

## Methods

A field experiment was conducted around Krishi Vigyan Kendra, Bokaro during the *kharif* season of 2006-07 and 2007-08 of farmers field in the village Bundu under Peterwar block of Bokaro district, to demonstrate the effect of application of plant nutrient and biofertilizer on productivity of pigeonpea. The soil of the experimental area was sandy loam pH 5.5 low in organic carbon (0.30—0.38) available nitrogen 190.0 kg/ha. Phosphorus 8—10 kg/ha and available potassium 90—110 kg/ha. Treatment comprised three treatments i.e. $T_1$, farmer practice (no fertilization and no seed treatment with rhizobium inoculation); $T_2$ recommended dose of phosphorus and potassium with rhizobium inoculation; and $T_3$ recommended dose of NPK (20 : 40 : 20 kg/ha) with rhizobium inoculation. The experiment was laid out in randomized block design replicated on 10 farmers field considering each as a replication. Pigeonpea (var Bahar) with a spacing of 75 cm apart at 20 kg/ha seed rate was sown during first week of July in both the years. Nitrogen was applied as urea, phosphorus as single super phosphate and potassium as muriate of potash. Full dose of fertilizer were applied as basal application. Seeds were treated with rhizobium culture before sowing with recommended method. At harvest, data on plant height, pods/plant, test weight and grain yield (q/ha) were recorded.The data were subjected to statistical analysis (2).

**Table 1.** Effect of fertilizer and *Rhizobium* inoculation on growth, yield attributes of pigeonpea (Pooled data of 2 years).

| Technology | Plant height (cm) | No. of branches/ plant | Leaf area index | Pods/ plant | Seeds/ pod | Test weight (g) |
|---|---|---|---|---|---|---|
| $T_1$ = Farmer's practice (no.use of fertilizer) | 168.60 | 12.2 | 1.61 | 78.4 | 2.62 | 71.2 |
| $T_2$ =P:K::40 : 20 kg/ha + Seed treatment with *Rhizobium* culture | 193.80 | 14.3 | 1.69 | 107.0 | 2.89 | 79.10 |
| $T_3$ = N:P:K:: :40:20kg/ ha + treatment with *Rhizobium* culture | 198.50 | 15.8 | 1.86 | 129.8 | 3.40 | 85.5 |
| CD | 11.2 | 0.8 | 0.12 | 19.7 | 0.26 | 3.72 |

## Results and Discussion

### *Growth and Yield Attributes*

Data on growth and yield attributes presented in Table 1 indicate that plant height, no. of branches/ plant, leaf area index, pods/plant, seeds/pod and test weight increased significantly by application of either recommended dose of phosphate and potash (40 and 20 kg/ha) with rhizobium inoculation or recommended dose of NPK i.e. 20 : 40 : 20 kg/ha with rhizobium inoculation. Application of only recommended dose of P and K along with seed treatment with rhizobium culture was significantly better than farmers practice in term of plant height, no. of branches/plant and leaf area index. Pigeonpea fertilized with either recommended dose of P and K or recommended dose of NPK with rhizobium inoculation resulted in significant increase in yield attributes viz. pods/plant, seeds/ pod and test weight over farmers practices where no fertilizer were applied.

The overall improvement in crop growth and yield attributes might be due to application of P resulted in early formation of root and increased microbial activity in the root nodules. This might have improved the effective utilization of applied and native soil nutrient and greater biological N-fixation.

**Table 2.** Effect of fertilizer and *Rhizobium* inoculation on yield and economics of pigeonpea (Pooled data of 2 years).

| Technology | Seed yield (q/ha) | Stalk yield (q/ha) | Gross income (Rs/ha) | Net return (Rs/ha) | B : C ratio |
|---|---|---|---|---|---|
| $T_1$ = Farmer's practice (no. use of fertilizer) | 9.8 | 29.7 | 16660 | 8160 | 1.96 |
| $T_2$ = P : K :: 40 : 20 kg/ha + Seed treatment with *Rhizobium* culture | 15.2 | 48.4 | 25500 | 12900 | 2.65 |
| $T_3$ = N : P : K :: : 40 : 20 kg/ha + treatment with *Rhizobium* culture | 19.0 | 56.3 | 32300 | 22500 | 3.29 |
| CD | 1.3 | | | | |

### *Yield and Economics*

Data on yield and economics of cultivation of pigeonpea presented in Table 2 reveal that application of recommended dose of PK along with rhizobium inoculation recorded the heighest grain yield (19.0 q/ha), the increase over farmer practice being 93.87% and over recommended dose of PK along with rhizobium inoculation being 26.67%. A starter dose of nitrogen significantly increased grain yield of pulses (3). This might be due to better root establishment by nodulation, nitrogen fixation from the atmosphere resulting better yield attribute and grain yield of pigeonpea. The lowest grain yield (9.8 q/ha) of pigeonpea was recorded under farmer practice. The heighst net return (Rs 22,500/ha) and benefit cost ratio (3.29) were obtained with fertilization of recommended NPK along with rhizobium inoculation followed by fertilization with recommended PK along with rhizobium inoculation. Farmer practice recorded minimum net return (Rs 8,160/ha) with benefit cost ratio of 1.96.

Thus it can be inferred that the productivity of pigeonpea can be increased in the area under study adopting appropriate nutrient management programme and pigeonpea cultivation could be profitable also.

### References

1. Shivran P. L., I. P. S. Ahlawat and D. R. Shivran. 2000. Effect of phosphorus and sulfur on pigeon pea (*Cajanas cajan*) and succeeding wheat (*Triticum*

*aestivum*) in pigeonpea-wheat cropping system. *Ind. J. Agron.* 45 : 25—30.

2. Snedecor G. W. and W. G. Cochran. 1967. *Statistical methods.* Oxford and IBH Publ. Co., Calcutta, India.

3. Solaiappan U. and S. Ramaih. 1990. Effect of seed treatment soil and folier fertilization on N and P and yield and yield attributes of pigeonpea grown under rainfed condition. *Ind. J. Agron*. 35 : 234—237.