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EFFECT OF NPK AND BIOFERTILIZERS ON PIGEON PEA (*CAJANAS CAJAN* L. *MILL* SP.)

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ABSTRACT

Field trials were conducted in cotton black soil during the season 2001-02 and 2002-03. Response of Pigeon pea cultivar (Maroti var. IPCL-87119) to inoculation with Rhizobial strains was studied. Wild strains of *Rhizobium* sp.from Pigeon pea and *Azotobacter chroococcum, Pseudomonas striata* (Regional centre for organic farming, Nagpur) and its mix culture T4, $T_5$and T6 was performed significantly well in improving plant height, number of branches, and grains (seeds) yield of higher cost benefits and more additional net income as compared to NPK controls. It was further reported that T5 performed well with Pigeon pea cultivar (Maroti var. IPCL-87119) indicating its specificity.

INTRODUCTION

Pigeonpea (*Cajanas cajan* Linn. *Milli* sp.) is popularly grown pulse crop in India during kharif. About 90% world area is contributed by India. It has acquired 3.82, 3.52 million hectare area with the total production of 2.93 and 2.69 metric tones throughout the world and Asia respectively (Anonymous, 2003). Pigeon pea (*Cajanus cajan* (L.) Mill sp.) ranks second amongst pulses in terms of area and production in India. Legume crop possess the root nodules and fix atmospheric nitrogen enriching soil fertility (Mareckova, 1979). It is a good practice to give *Rhizobium* sp. treatment to legume seedlings. This is achieved by symbiotic nitrogen fixing bacteria

Rhizobium sp. and *Azotobacter chroococcum*. Phosphorus can be made soluble in soil by phosphate solubalizing bacteria (*Pseudomonas striata*). They possess ability to bring insoluble phosphate in to soluble form by secreting organic acids. NPK is most important elements in controlling the normal growth and yield of crops including Pigeon pea. Generally the crops need recommended doses of 25kg N: 50kg P: 50 kgK/ha and to get the 1.2 tonnes/ha yield, the crop plant requires 8.5, 8.0 and 16kg NPK/ha respectively, Aulakh *et al.,* (1985). The variability in the studies on inoculations of *Rhizobium* sp., *Pseudomonas striata* and *Azotobacter chroococcum* singly and on combination of 2-3 strains alone and in combination with NPK fertilizers are noticed (Katsuyuki Katayama *et al.,* 1990). A less information was available on Pigeon pea. Considering the advantage of biofertilizers and NPK,,the studies were undertaken to investigate the effect of Rhizobial, Pseudomonial and Azotobacterial inoculation on Pigeon pea as well as to find out the combination of these strains over recommended doses of NPK fertilizers on biochemical and yield contributing parameters.

MATERIALS AND METHODS

The experiment was conducted under the field conditions of the Department of Botany, P.G.T.D, RTM, Nagpur University, Nagpur, for two years during the rainy seasons (Kharif) of 2001-02 and 2002-03 in a factorial randomized block design with three applications. Total seventeen treatment, comprising of 5-treatments with dual inoculation of *Rhizobium* sp., and *Pseudomonas striata with 5-levels of NPK. 5- treatments with* dual inoculation of *Rhizobium* sp. and *Azotobacter* chroococcum with 5-levels of NPK, and 5-treatmenrs with triple inoculation of *Rhizobial* + *Pseudomonas* + *Azotobacter* with 5-levels of NPK and one treatment of uninoculated (control) were tested in black cotton soil. The 15-days old seedling was fertilized with 1mL of inocula of *Rhizobia* sp., *Pseudomonas striata* and *Azotobacter chroococcum* respectively. These strains were obtained from regional centres of organic farming and composting, Nagpur region, Nagpur. The seeds sown at 30 x 30cm spacing in plots. The basal dose of 12.5N:25P_2O_5: 25K_2O kg/ha was applied to all treatments plots. Observations on plant height, number of shoots (branches) per plant, seed yield contributing character in terms of treatment with biofertilizers in combination with NPK fertilizers were recorded at harvest stage. The data were pooled for two years and analysed. The minimization of NPK fertilizers due to fertilization of plant with biofertilizers were also recorded.

RESULTS AND DISCUSSION

Data in respect of plant height (cms), number of branches per plant and mean yield (t/ha) are given in Table 1. In chemical treatment T_3, it is observed that the plant height and branches per plant are significant over treatment T_0, T_1, and T_2, however, in treatment $T_{3.1}$, yield factor and plant height is slightly higher but if we consider the cost factor of NPK, treatment $T_{3.1}$ is non significant over T_3. Similarly the impact of higher doses, influences adverse effect on yield and other factors i.e. non significant ($T_{3.2}$). Mahalakshmi,P.A, and Vijayalakshmi (2001) Recorded that application of sago waste and pressmud @ 12.5 t/ha each increased growth parameters of green gram. Inoculation with NPK (15:30:30 kg/ha) T_3 and dual strain of *Rhizobium sp.* and *Pseudomonas* (T_4) were non significant over T_3 and NPK (15:30:30 kg/ha) with dual strain of *Rhizobium* and *Azotobacter* (T_5). Similar findings were noted by Borde *et al.,* (1993) also reported that application of 50 kg P2O5 through SSP + 25 kg P2O5 through pressmud cake in green gram increased number of branches from 2.9 to 4.3.

Table 1: Mean grain yield (t/ha), plant height (cms) and number of branches. Control and NPK treatment. (Pooled data of two years 2001-02 and 2002-03)

Treatments	Grain yieldt/ha	Plant height (cms)	No. of branches per plant
Control(T_0)	1.03	108.75	5.0
NPK(Kg/ha)5: 10:10(T_1)	2.68	211.0	7.0
10:20:20(T_2)	3.12	216.0	10.0
15:30:30(T_3)	3.48	225.0	12.0
20:40:40($T_{3.1}$)	3.50	227.0	12.0
25:50:50($_{3.2}$)	3.29	224.0	11.0

Table 2: Grain yield (t/ha), plant height (cms) and number of branches. Control and selected NPK treatment T_3 with dual combination of *Rhizobium* sp.+ *Pseudomonas striata* T_4, T_3 *with dual combination of Rhizobium* sp.+ *Azotobacter chroococcumc* and T_3 with triple inoculation of Rhizobium sp.+ *Azotobacter chroococcumc*,+ *Pseudomonas striata* (Pooled data of two years 2001-02 and 2002-03)

Treatments	Grain yield t/ha.	Plant height (cms).	No. of Branches per plant
Control T_0	1.03	108.75	5.0
Selected NPK(kg/ha) 15:30:30(T_3)	3.48	225.0	12.0
15:30:30+*Rhizobium* +*Pseudomonas*(T_4)	3.62	229.0	13.0
15:30:30+*Rhizobium*+ *Azotobacter*(T_5)	3.57	230.0	13.5
15:30:30+*Rhizobium*+ *Pseudomonas*+*Azotobacter*(T_6)	3.64	242.5	13.5

Data in respect of plant height, number of branches, and mean yield (t/ha) are given in table-2. It is observed that the inoculation with T_6 *i.e.* NPK (15:30:30 kg/ha) and triple inoculation of *Rhizobium* sp. + *Azotobacter chroococcumc*+ *Pseudomonas striata* showed more effectiveness over T_5 and T_4. Inoculation with T_4 showed higher seed weight (3.62 t/ha) over T_3 (3.48 t/ha) but inoculation with T_5 (3.57 t/ha) showed lower yield over T_4 (3.62 t/ha) and T_3 (3.48 t/ha). Inoculation with T_6 showed highest seed weight (*i.e.* 3.64 t/ha) over T_3 (3.48 t/ha), T_4 (3.62 t/ha) and T_5 (3.57 t/ha). Increase in grain yield per hectare might be a impact of increased dry matter content at maturity. The seed development might be attributed to the mobilization of reserved food material to developing seed, which acts as a sink for carbohydrates present in plant. Similar type of findings was reported by Rewari *et al.,* (1980); Singh *et al.,* (1979). The results reported by Gibson, (1980); Khurana and Phutela, (1980); Lie, (1981); Mareckova, (1979); Wange, (1990) and Singh *et al.,* (1979) are in line with present findings.

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