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Coinoculation effect of endophytic PGPR and *Rhizobium* for Pigeonpea yield performance

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Abstract
To assess the effect of endophytic PGPR and *Rhizobium* on yield of Pigeonpea, a trial was laid out at National Pulse Research Centre using different strains *viz.*, received from various AICRP centres. A total of nine treatments comprising of *Rhizobium* (Local best), *Rhizobium*+ V4RB1 *Pseudomonas marginalis* (Ludhiana), *Rhizobium* + V4RB3 *Serratialiquefaciens* (Ludhiana), *Rhizobium* + PPR-46 *Pantoea sp*. (Kanpur), *Rhizobium* + PPR-57C *Burkholderia sp*. (Kanpur), *Rhizobium* + KP-3(Kalaburagi), *Rhizobium* + KP- 1(Kalaburagi), N asper RDF and control. PGPR promotes plant growth through nutrient mobilization, growth hormone secretion and protects the plants from pest/diseases. Pigeonpea seeds were treated with all the PGPR along with the local best *Rhizobium* BMBS 47 strains. Observations were recorded at 45^{th} DAS to assess their effect on plant growth parameters *viz.*, number of nodules /plants, root length and shoot length and nodule dry weight and yield parameters at harvest. Among the multifunctional rhizobacteria *Rhizobium* + PPR-46 *Pantoea sp*. (Kanpur) recorded a greater number of nodules/plant (18.66/plant) and nodule dry weight (18.16 g/plant) which is higher than other rhizobacteria. This was followed by *Rhizobium* + PPR-57C *Burkholderia sp*. (Kanpur) which recorded 17.00 nodules /plant. Uninoculated control recorded the least nodulation as 09.66 plant which is significantly lesser than all the other treatments. Crop was harvested at 65 DAS and yield parameters *viz.*, number of pods per plant, plant dry weight and yield were recorded and tabulated (Table 4). The *Rhizobium* + PPR-46*Pantoea sp*. (Kanpur) treatments recorded higher values for number of pods/plant (99 pods/plant) and plant dry weight (156.66 g/plant) when compared to the uninoculated control. Among the different rhizobacteria *Rhizobium* + PPR-46*Pantoea sp*. (Kanpur) inoculated treatment recorded the highest yield of 1064 kg/ha followed by *Rhizobium* + PPR-57C*Burkholderia sp*. (Kanpur).

Keywords: Pigeonpea, PGPR, *Rhizobium*, Nodules, Yield

Introduction
Pigeonpea (Cajanus cajan L. Millsp.) is the fifth prominent pulse crop in the world and second in India after chickpea. Being a pulse, it plays an important role for improving the soil fertility and consequently the productivity of succeeding crops. To meet the demands of pulse crops of ever-increasing population of our country, it is necessary to improve the production and productivity of pulse crops. In order to increase the production further there is no other option except to increase productivity by using available resources most efficiently. Fertilizers use continued to play a key role in augmenting higher crop productivity but reckless use of it deteriorates soil health, energy conserving ecosystem and economics. It has been realized that not only chemical fertilizers but also organic manures in conjunction with biofertilizers will sustain and maintain the productivity of soil. Therefore, it is needed to compare various organic as well as biological sources of nutrients with chemical fertilizers in order to find out most effective combination. Keeping this objective in view, the present investigation was conducted to study the co-inoculation of PGPR with *Rhizobium* strains on growth, nodulation and dry matter yield of pigeonpea.

Materials and Methods
To assess the effect of multifunctional rhizobacteria on yield of pigeonpea, a trial was laid out using different multifunctional rhizobacteria received from various AICRP centres. The variety chosen for experiment was VBN 3 in Randomized Block design with nine treatments in three replicates. The details of the experiment is given below.

Treatment details

1. *Rhizobium* (Local best).
2. *Rhizobium* + V4RB1 *Pseudomonas marginalis* (Ludhiana).
3. *Rhizobium* +V4RB3 *Serratialiquefaciens* (Ludhiana).
4. *Rhizobium* + PPR-46 *Pantoea sp*. (Kanpur).
5. *Rhizobium* + PPR-57C *Burkholderia sp*. (Kanpur).
6. *Rhizobium* + KP-3 (Kalaburagi).
7. *Rhizobium* + KP-1 (Kalaburagi).
8. N as per RDF.
9. Control.

Experimental field

Pigeon pea seeds were treated with all the PGPR along with the local best *Rhizobium* BMBS 47 strains. Observations were recorded at 45th DAS to assess their effect on plant growth parameters *viz.,* number of nodules /plants, root length and shoot length and nodule dry weight and yield parameters at harvest.

Results and Discussion

Seed inoculation with biofertilizers significantly increased the growth parameters *viz*., plant height and number of branches per plant at harvest and number of root nodules at 30, 60 and 90 DAS as well as yield attributes *viz*., number of pods per plant, number of grains per pod, grain yield per plant and test weight of pigeon pea crop as compared to control.

Among the multifunctional rhizobacteria *Rhizobium* + PPR – 46 *Pantoea sp*. (Kanpur) recorded a greater number of nodules/plant (18.66/plant) and nodule dry weight (18.16 g/plant) which is higher than other rhizobacteria. This was followed by *Rhizobium* + PPR-57C *Burkholderia sp*. (Kanpur) which recorded 17.00 nodules /plant. Uninoculated control recorded the least nodulation as 09.66 plant which is significantly lesser than all the other treatments.

Table 1: Effect of coinoculation of *Rhizobium* and PGPR on the growth and nodulation of pigeon pea

S. No.	Treatments	Root length (cm)	Shoot length (cm	Nodule number (No. / plant)	Nodule dry weight (g/plant))
1	*Rhizobium (local best)*	16.43	67.00	12.00	11.16
2	*Rhizobium* + V4RB1 *Pseudomonas marginalis* (Ludhiana)	15.90	66.00	11.30	10.16
3	*Rhizobium* +V4RB3 *Serratialiquefaciens* (Ludhiana)	16.83	69.33	13.66	12.00
4	*Rhizobium* + PPR-46*Pantoea sp.* (Kanpur)	19.10	84.00	18.66	18.16
5	*Rhizobium* + PPR-57C*Burkholderia sp.* (Kanpur)	18.76	80.30	17.00	16.16
6	*Rhizobium* + KP-3(Kalaburagi)	18.10	78.00	15.33	14.00
7	*Rhizobium* + KP-1(Kalaburagi)	17.53	72.00	14.30	13.16
8	N asper RDF	14.90	63.30	10.66	09.66
9	Control	13.90	60.00	09.66	09.00
	SE(d)	0.4834	3.4305	1.9476	1.8481
	CD (@ 5%)	1.0248	7.2725	4.1288	3.9178

Among the multifunctional rhizobacteria *Rhizobium* + PPR - 46 *Pantoea sp*. (Kanpur) recorded more number of nodules/plant (18.66/plant) and nodule dry weight (18.16 g/plant) which is higher than other rhizobacteria. This was followed by *Rhizobium* + PPR-57C *Burkholderia sp*. (Kanpur) which recorded 17.00 nodules /plant. Uninoculated control recorded the least nodulation as 09.66 plant which is significantly lesser than all the other treatments (Table 1). Those results agreed with the findings of A.B. Patil* and D.R. Padmani,2007 and showed that the biofertilizers inoculation resulted in greater nodulation resulted in increased availability of fixed as well as applied nitrogen and phosphorus to the plants, which in turn encourage cell formation, division and multiplication. The beneficial effect of these inoculations on yield attributes seem to be due to better availability of nutrient and their translocation, which reflect in terms of increased yield attributes of pigeonpea. Also similar findings agreed with the result of Podile (1995) [2], suggested that increasing nodulation in pigeonpea (18-24%) by the inoculation of seeds with *Bacillus subtilis* over control. This may be due to produce many plant growth promoting substance like IAA, gibberellic acids and vitamins etc., which help in the synthesis of nodular tissue.

Table 2: Effect of coinoculation of *Rhizobium* and PGPR on the yield of pigeonpea

S. No.	Treatments	Pods per plant (no/plant)	Plant dry weight (g/plant)	Yield (kg/ha)
1	*Rhizobium* (Local best)	75.33	161.66	879.30
2	*Rhizobium* + V4RB1 *Pseudomonas marginalis* (Ludhiana)	71.0	154.00	838.00
3	*Rhizobium* +V4RB3 *Serratia liquefaciens* (Ludhiana)	77.33	166.66	900.60
4	*Rhizobium* + PPR-46 *Pantoea sp.* (Kanpur)	99.00	186.66	1064.6
5	*Rhizobium* + PPR-57C *Burkholderia sp.* (Kanpur)	95.00	180.33	1031.00
6	*Rhizobium* + KP-3(Kalaburagi)	92.66	115.00	956.00
7	*Rhizobium* + KP-1(Kalaburagi)	88.00	170.30	930.66
8	N asper RDF	67.66	138.00	803.30
9	Control	64.66	122.00	730.00
	SE(d)	6.2321	17.8434	58.937
	CD (@ 5%)	13.2117	37.8268	124.943

Crop was harvested at 65 DAS and yield parameters *viz.*, number of pods per plant, plant dry weight and yield were recorded and tabulated (Table 4). The *Rhizobium* + PPR-46*Pantoea sp*. (Kanpur) treatments recorded higher values for number of pods/plant (99 pods/plant) and plant dry weight (156.66g/plant) when compared to the uninoculated control. Among the different rhizobacteria *Rhizobium* + PPR-46*Pantoea sp*. (Kanpur) inoculated treatment recorded the highest yield of 1064 kg/ha followed by *Rhizobium* + PPR-57C*Burkholderia sp*. (Kanpur) (Table 2).

Appreciable increase in number of pods per plant and grains per pod (Table 1) as a result of fertilizer application might have reflected in increased grain yield whereas, improvement in growth parameters *viz*., plant height and number of branches per plant (Table 1) due to fertilizer application might have resulted in higher stover yield.

The increase in grain yield may be attributed to the reason that chemical fertilizers along with FYM possibly increased the concentrations of N, P and K ions of soil solution and ultimately affected the formation of more nodules, vigrous root development, better N fixation and better development of plant growth leading to higher photosynthetic activity and translocation of photosynthates to the sink which in turn resulted in better development of yield attributes and finally in higher grain yield. The results are substantiated with the studies conducted by Rao *et al*. (1983) and Thakur *et al*. (1988) [3, 4].

Conclusion

Biofertilizers are cheaper, eco-friendly and based on renewable energy sources has gained momentum to supplement the parts of chemical fertilizer (Meena *et al*., 2015a). Inoculation with an effective and persistent PGPR and *Rhizobium* strains has numerous benefits, which increase the pod yield due to increased nodulation. The results agreed with the same findings showed that inoculation of PSB strains increased the yield of pigeonpea (Podile, 1995) [2]. The use of farm derived source such as FYM has extensively been used in various crops. These organic additives can be used to promote the development of beneficial organisms in the soil, water holding capacity and cation exchange capacity (Singh *et al*., 2008) [5]. Organic amendment also increases the efficiency of biofertilizers

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Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical Issues: None.

References

1. Patil AB, Padmani DR. Effect of integrated nutrient management on growth and yield of pigeonpea (Cajanus cajan L. Millsp.). Int J Agric Sci. 2007;3(2):49-51.
2. Podile AR. Seed bacterization with Bacillus subtilis AF1 enhances seedling emergence, growth and nodulation of pigeonpea. Indian J Microbiol. 1995;35:199-204.
3. Rao YY, Reddy G, Ramasubba C, Ramaseshaish K. Response of rabi red gram to different levels of fertility. Andhra Agric J. 1983;30:196-199.
4. Thakur HS, Raghuwanshi RKS, Verma RS, Verma GP. Effect of fertilizer doses and plant density on yield of pigeonpea. Adv Crops Monit Environ Process Ecol. 1988;10:373-377.
5. Singh A, Singh VK, Rana NS, Kumar S, Panwar GS, Kumar Y. Response of urdbean to farmyard manure and phosphorus application under urdbean-wheat cropping sequence. J Food Legumes. 2008;21:119-121.