

RESEARCH NOTE

Effect of vermicompost and biofertilizer on symbiotic efficiency and yield of cowpea in arid zone of Rajasthan

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A field experiment was conducted during *Kharif* season of 2012 on loamy sand soil to study the effect of vermicompost and biofertilizers on growth, yield and quality of cowpea. The experiment consisted of four treatments of vermicompost (control, 2.0, 4.0 and 6.0 t/ha) and four treatments of biofertilizer (control, *Rhizobium*, PSB and *Rhizobium*+PSB) thereby making sixteen treatment combinations tested in Randomized Block Design with four replications. The results indicated the application of vermicompost 4.0 t/ha gave maximum and significantly higher the net returns over other treatments and remained at par with 6.0 t/ha of vermicompost. Whereas, seed yield, straw yield, biological yield, total root nodules and leghaemoglobin content significantly increased upto 6.0 t/ha and remained at par with 4.0 t/ha of vermicompost over other treatments. But, protein content in seed and effective root nodules significantly higher upto 6.0 t/ha of vermicompost over other treatments. The nitrogen fixation capacity unchanged under different levels of vermicompost. Results further indicated that combined seed inoculation with the *Rhizobium* + PSB significantly increased the seed yield, straw yield, biological yield, protein content in seed, total root nodules, effective root nodule, leghaemoglobin content, nitrogen capacity and net returns over control and other treatments.

Key words : Biofertilizer, Cowpea, Vermicompost, Yield

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Cowpea [*Vigna unguiculata* (L.) Walp] commonly known as *Lobia* is one of the important *Kharif* pulse crop grown for grain, forage and green manuring in Rajasthan. The crop gives such a heavy vegetative growth and covers the ground so well that it checks the soil erosion in problem areas and can later be ploughed down for green manure. Vermicompost has been advocated as good organic manure for use in the field crops. Vermicompost contain nutrients in the readily available form to the plants such as nitrate, exchangeable, soluble potassium, calcium and magnesium. It also contains biologically active substance

such as plant growth regulators. Biofertilizer role assumes a special significance in present context of very high costs of chemical fertilizers. Use of biofertilizer can have a greater importance in increasing fertilizer use efficiency. Indian soils are poor to medium status in available nitrogen and available phosphorus. The seeds of pulses were inoculated with *Rhizobium* with an objective of increasing their number in the rhizosphere so that there is substantial increase in the microbiologically fixed nitrogen for the plant growth and development. Most of soils are poor in available phosphorus supply and low in organic matter. Seeds of

pulses when inoculated with phosphate solubilizing bacteria they secrete acidic substances which solubilize otherwise unavailable soil phosphorus. The inoculation with phosphate solubilizing bacteria, may increase yield of crops by 10-30 per cent (Tilak and Annapurna, 1993).

A field experiment was conducted during *Kharif* season of 2012 at the Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) in Randomized Block Design with four replications. The soil was loamy sand in texture, alkaline in reaction (pH 8.2), low in organic carbon (0.23 %), available nitrogen (123.4 kg/ha), available phosphorus (15.8 kg P₂O₅/ha) and medium in potassium (151.2 kg K₂O/ha) content. The experiment consisted of four levels of vermicompost (control, 2.0, 4.0 and 6.0 t/ha) and four treatments of biofertilizer (control, *Rhizobium*, PSB and *Rhizobium*+PSB) thereby, making sixteen treatment combinations. Recommended dose of fertilizer was 20 kg N and 40 kg P₂O₅/ha. The cowpea cv. RC-19 was sown on 27th July, 2012 using seed rate 20 kg/ha with a row spacing of 30 cm. The crop was harvested on 1st October, 2012.

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of vermicompost levels :

The results indicated application of vermicompost 4.0 t/ha showed significantly higher net returns in cowpea

as compared to other treatments and being at par with 6.0 t/ha of vermicompost. Application of vermicompost recorded the maximum and significantly higher net returns (Rs. 39816/ha) over other treatments (Table 1). The application of vermicompost 6.0 t/ha recorded significantly higher seed yield (14.25 q/ha), straw yield (24.75), biological yield (39.00 q/ha), total root nodules and leghaemoglobin content being at par with 4.0 t/ha of vermicompost. Progressive increase in vermicompost levels upto 6.0 t/ha gave significantly higher the protein content in seed and effective root nodules over the lower vermicompost levels (Table 1). The nitrogen fixation capacity unchanged under different levels of vermicompost. Legumes are known to have symbiotic association with *Rhizobium* bacteria which the application of vermicompost might have enhanced the population of desired microbes in the root zone during the early stage of infection by improving the physical, chemical and biological properties of soil. Higher population of the desired organisms will always have greater possibilities of infection and consequently formation of more healthy and effective root nodules having higher amount of leghaemoglobin. These results are in agreement with finding of Karmegam *et al.* (1999) and Sharma and Bhandari (2002).

Effect of biofertilizers :

The progressive increase in biofertilizer as combined

Treatments	Yield (q/ha)			Protein content (%)	Total root nodules	Effective root nodules	Leghaemoglobin content (per mg)	Nitrogen fixation capacity (%)	Net returns (Rs./ha)
	Seed	Straw	Biological						
Vermicompost levels									
V ₀ : Control	8.87	15.81	24.68	21.39	12.65	9.43	1.25	9.36	28106
V ₁ : 2.0 t/ha	11.54	20.40	31.94	23.11	13.90	10.75	1.47	9.50	35420
V ₂ : 4.0 t/ha	13.57	23.70	37.27	24.05	15.35	12.12	1.72	9.55	39816
V ₃ : 6.0 t/ha	14.25	24.75	39.00	24.62	16.56	13.30	1.90	9.56	38676
S.E. ±	0.34	0.65	0.98	0.19	0.48	0.49	0.07	0.12	1437
C.D. (P=0.05)	0.98	1.84	2.78	0.54	1.36	1.11	0.21	NS	4094
Biofertilizers									
No inoculation (Control)	10.50	18.55	29.05	21.56	12.86	8.90	1.28	–	28848
<i>Rhizobium</i>	12.15	21.33	33.48	23.75	15.10	12.05	1.55	11.70	35956
PSB	11.93	21.01	32.94	23.42	13.90	11.10	1.51	10.26	34994
<i>Rhizobium</i> + PSB	13.65	23.78	37.43	24.44	16.60	13.55	1.99	16.01	42220
S.E. ±	0.34	0.65	0.98	0.19	0.48	0.49	0.07	0.12	1437
C.D. (P=0.05)	0.98	1.84	2.78	0.54	1.36	1.11	0.21	0.34	4094

NS=Non-significant

seed inoculation with *Rhizobium* + PSB gave significantly higher the seed yield, straw yield, biological yield, protein content in seed, total root nodules, effective root nodules, leghaemoglobin, nitrogen fixation capacity and net returns over control, *Rhizobium* and PSB (Table 1). The combined seed inoculation with *Rhizobium* + PSB recorded the maximum and significantly higher net returns (Rs. 42220/ha) over other treatments. The increase in net returns might be due to higher seed yield (13.65 q/ha) and straw yield (23.78 q/ha) obtained under this treatment as compared to cost involved under this treatment. The combined inoculation of *Rhizobium* and PSB proved one of the most efficient inoculations in increasing total and effective number of root nodules per plant, leghaemoglobin content in root nodules and nitrogen fixation capacity (Chattopadhyay and Dutta, 2003 and Mukherjee and Sarkar, 2007). The increased nodulation under combined inoculation of *Rhizobium* + PSB might be due to close association of both the microbial population and their activities resulting in

substantially more nodulation as compared to *Rhizobium* and PSB alone. Similar results have been reported by Bansal (2009) in greengram and Rana *et al.* (2006), in rajmesh.

Conclusion :

Based on the results of the experiment, it could be concluded that the application of vermicompost 4.0 t/ha and combined seed inoculation with *Rhizobium* + PSB significantly increased seed yield, straw yield, biological yield, protein content in seed and symbiotic efficiency and higher net returns was found in this treatment over other treatments.

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