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EFFECT OF VERMICOMPOST AND BIOFERTILIZERS ON YIELD AND SOIL NUTRIENT STATUS AFTER HARVEST OF COWPEA [*VIGNA UNGUICULATA* (L.) W.]

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ABSTRACT

A field experiment was conducted during *kharif* season of 2012 on loamy sand soil to study the effect of vermicompost and biofertilizers on yield and soil nutrient status after harvest of cowpea. Results indicated that application of 6.0 t/ha significantly increased straw yield, biological yield, grain yield, organic carbon, available nitrogen, available phosphorus, available potassium and which was at par with treatment of vermicompost @ of 4.0 t/ha than the other levels of vermicompost. However, application of vermicompost @ 6/ha significantly increased in case of seed yield over control. Results further indicated that seed inoculation with the *Rhizobium* and PSB significantly increased in seed, straw and biological yield, organic carbon, available nitrogen, available phosphorus and available potassium over control.

Keywords:
Cowpea, PSB, Rhizobium, Vermicompost

INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) W.] 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. It has considerable promise as an alternative pulse crop in dry land farming. Vermicompost has been advocated as good organic manure for use in the field crops. Use of vermicompost as a organic fertilizer and substitute for chemical fertilizer is advised by pioneers of organic farming. Earthworm processed organic waste, often referred to as vermicompost are finely divided peat like materials with high porosity, aeration, drain ability and water holding capacity. Vermicompost contains nutrients in the readily available form to the plants such as nitrate, exchangeable, soluble potassium, calcium and magnesium (Edwards and Burrows, 1988). It also contains biologically active substance such as plant growth regulators (Tomatic *et al*., 1987). Biofertilizers a component of integrated nutrient management are considered to be eco-friendly, having low cost of plant nutrient supplementing chemical fertilizers in sustainable agriculture system in India. Their role assumes a special significance in present context of very high costs of chemical fertilizers. Use of biofertilizers 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 aim to increase efficient rhizospheric microorganisms that enhance nutrient availability with plant growth promoting activities.

MATERIALS AND METHODS

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 (2.3 g/kg), available nitrogen (123.4 kg/ha), available phosphorus (15.8 kg/ha) and medium in available potassium (151.2 kg/ha) content. The experiment consisted of four levels of vermicompost (Control, 2.0, 4.0 and 6.0 t/ha) and four levels of biofertilizers (Control, *Rhizobium*, PSB and *Rhizobium* + PSB) thereby, making sixteen treatment combinations. Recommend dose of fertilizer was 20 kg N and 40 kg P_2O_5/ha. The cowpea cv. RC-19 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.

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RESULTS AND DISCUSSION

Effect of vermicompost levels

The application vermicompost levels up to 6.0 t/ha significantly increased straw yield (24.75 q/ha), biological yield (39.00 q/ha), organic carbon (0.27%), available nitrogen (149.68 kg/ha), available phosphorus (21.10 kg/ha), available potassium (179.11 kg/ha) and remained at par with the application of vermicompost @ of 4.0 t/ha over lower vermicompost levels (Table 1). However, application of vermicompost @ 6/ha significantly increased seed yield (14.25 q/ha) over control. This may be attributed primarily to the beneficial effect of vermicompost on overall physical condition of the soil. Since, the vermicompost being a store house of almost all the plant nutrient required for proper growth and development of plants, its addition in soil enhanced availability of these nutrients. The significant increase in organic carbon, available nitrogen, phosphorus and potassium content of the soil at harvest of crop may be ascribed to the beneficial role of vermicompost in mineralization of native as well as its own nutrient content which enhanced the available nutrient pool of the soil. As a matter of fact, all the available nutrients are not taken up by the plant and the rest remains in the soil which improves the available nutrient status of soil after harvest of crop. The favorable conditions for microbial as well as chemical activity due to addition of vermicompost integrated with other nutrient augmented the mineralization of nutrient and ultimately increased the available nutrient status of the soil. These results are in agreement with those of Ghanshyam *et al*. (2010) and Ramawtar *et al*. (2013).

Effect of biofertilizers

The result reveals that the seed inoculation with *Rhizobium* + PSB significantly increased seed (13.65 q/ha), straw (23.78 q/ha) and biological yield (37.43 q/ha), organic carbon (0.27%), available nitrogen (155.67 kg/ha), phosphorus (20.89 kg/ha) and potassium (179.54 kg/ha) content in soil after harvest of the cowpea over the control (Table 1). The combined inoculation of *Rhizobium* + PSB proved significantly superior to PSB and no inoculation and slightly superior to *Rhizobium* alone in terms of yield. *Rhizobium* + PSB might have improved both nitrogen and available phosphorus in *Rhizophere* as they are symbiotic nitrogen fixers and phosphorus solubilize, respectively. Thus, the increased availability of nitrogen due to *Rhizobium* coupled with phosphors due to PSB might open the door for increased utilization of others nutrient also and have resulted in more increase in yield in comparison to *Rhizobium* and PSB alone inoculations similar finding was also reported by (Yadav, 2001) in cowpea. Biofertilizers can make a significant contribution in maintaining soil health and soil fertility have, thus an important role in improving nutrient supplies to soil and also have long term impact without any adverse effects (Sardana, 1997). Biofertilizers can fix atmospheric nitrogen through the process of biological nitrogen fixation. Inoculation of seed with nitrogen fixers might have increased the concentration of an efficient and healthy strain of *Rhizobium* bacteria in the root nodules which in turn might have resulted in greater fixation of atmosphere N consequently having higher accumulation of nitrogen in the soil. The micro-organism are also responsible for providing favourable physical properties which help in the mineralization of soil nutrient leading to higher available phosphorus and potassium. The beneficial effect of micro-organism on potassium availability includes minimization of the losses from leaching through the action of organic acids, released during decomposition and also minimizing losses due to fixation (Dhaksinamoorthy *et al.,* 2000).

Table 1 Effect of vermicompost and biofertilizers on yield of cowpea and nutrient status of post harvested soil.

Treatments	Seed yield q/ha	Straw yield q/ha	Organic carbon (%)	Available Nitrogen kg/ha	Available Phosphorus kg/ha	Available Potassium kg/ha
Vermicompost levels						
V_0 : Control	8.87	15.81	0.239	120.79	15.95	149.64
V1 : 2.0 t/ha	11.54	20.40	0.251	132.05	18.85	162.54
V2 : 4.0 t/ha	13.57	23.70	0.262	141.24	20.55	172.72
V3 : 6.0 t/ha	14.25	24.75	0.269	149.68	21.10	179.11
S.Em. ±	0.34	0.65	0.003	3.20	0.34	2.53
CD (*P*=0.05)	0.98	1.84	0.009	9.13	0.96	7.22
Biofertilizers						
No inoculation (Control)	10.50	18.55	0.245	121.53	15.86	150.26
Rhizobium	12.15	21.33	0.256	135.42	19.80	169.53
PSB	11.93	21.01	0.253	131.14	19.90	164.70
Rhizobium + PSB	13.65	23.78	0.267	155.67	20.89	179.54
S.Em. ±	0.34	0.65	0.003	3.20	0.34	2.53
CD (*P*=0.05)	0.98	1.84	0.009	9.13	0.96	7.22

CONCLUSION

Based on the results of the experiment, it could be concluded that the application of vermicompost @ 6 t/ha and biofertilizers (*Rhizobium*+PSB) had also significant effect in yield and improving the fertility status of soil in comparison treatments of cowpea.

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