www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(6): 985-988

www.thepharmajournal.com
Received: 02-04-2021
Accepted: 10-05-2021

YV Harireddy
M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Joy Dawson
Professor, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Corresponding Author:
YV Harireddy
M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Effect of biofertilizers and levels of vermicompost on growth and yield of cowpea (*Vigna unguiculata* L.)

YV Harireddy and Joy Dawson

Abstract
A field experiment was conducted during kharif 2020 at SMOF (SHIATS Model Organic farm), Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the experimental field is sandy loam in texture, nearly neutral in soil reaction (pH 7.4). The treatments consisted of Biofertilizers *viz*., Azospirillum (seed inoculation @ 25 g/kg), Rhizobium (seed inoculation @ 25 g/kg), Azospirillum + Rhizobium (seed inoculation @ 25 g/kg) and vermicompost *viz*., vermicompost (3 t/ha), vermicompost (6 t/ha), vermicompost (9 t/ha) whose effect is observed in cowpea (Gomathi). The experiment was laid out in Randomized Block Design with ten treatments replicated thrice. The treatment with application of vermicompost (6 t/ha) + Rhizobium + Azospirillum also recorded significantly higher in plant height (40.20 cm), number of branches (8.79), and plant dry weight (88.93g). The treatment with application of vermicompost (6 t/ha) + Rhizobium + Azospirillum also recorded significantly higher in Number pobs per plant (33.72), and Number of grains/pod (9.57) and crop growth rate (0.94 g/g^2/day) and straw yield (2926.87 kg/ha). The maximum gross return (96521.2 INR/ha), net return (61526.2 INR/ha) and B:C ratio (1.76) is recorded in treatment with application of vermicompost 6t/ha + Rhizobium + Azospirillum.

Keywords: Cowpea, vermicompost, azospirillum, rhizobium

Introduction
Cowpea [*Vigna unguiculata* (L.) Walp] commonly known in India as labia is one of the important *kharif* pulse crops grown for vegetable, grain, forage and green manuring. Pulse crops leave behind reasonable quantity of nitrogen in soil to the extent of 30 kg/ha. Cowpea is an important legume vegetable crop grown commercially in summer season and rainy season. In India pulses are grown nearly in 25.43 m ha with an annual production of 17.28 m t and an average productivity of 679 kg/ha (Anonymous, 2012) [1]. In Rajasthan the area under pulses is 47.54 lakh ha with an annual production of 32.54 lakh m t and an average productivity of 684 kg/ha and the area under Cowpea is 1.02 lakh ha with the production of 0.64 lakh tonnes and productivity of 529 kg/ha (Anonymous, 2011). The per capita availability of pulses in India is 35.5 g/day as against the minimum requirement of 70 g/day/capita as advocated by Indian Council of Medical Research (Anonymous, 2009).

Bio-fertilizers, a component of integrated nutrient management are considered to be cost effective, eco-friendly and renewable source of non-bulky, low cost of plant nutrient supplementing chemical fertilizers in sustainable agriculture system in India. Their role assumes a special significance in present context of high costs of chemical fertilizers.

Vermicompost is ecofriendly low cost effective and an effective way to recycle agricultural and kitchen waste. Vermicompost is a recent innovation in composting technology. It is a mixture of earthworm's castings, organic materials humus and other organisms. Agricultural residues, animal wastes, dairy and poultry wastes, food industry wastes, sludge can all be recycled to give vermicomposting. In recent years, use of Vermicompost has been advocated in integrated nutrient management system in field crops (Shroff and Devathali, 1992) [5]. In Rajasthan, large quantities of crop residues are left after the harvest of wheat, sorghum, maize, cotton etc. where vermicomposting may be efficiently used.

Indian soils are poor to medium status in available nitrogen and available phosphorus. The seed of pulses is 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. The inoculation of seeds with suitable Rhizobium culture increased the green pod yield over uninoculated control (Vaisya *et al*., 1983).

The association of Rhizobium and pulse plants helps in improving fertility of soil and is a cost effective method of nitrogen fertilization in legumes.

Materials And Methods

A field experiment was conducted during *Kharif* season of 2020 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) which is located at 25 degree 39' 42"N latitude, 81 degree 67'56" E longitude and 98 m altitude above the mean sea level, during *Kharif* season 2020 on sandy loam soil. Treatments comprised of T_1 – Control plot, T_2 - Vermicompost (3t/ha) + Azospirillum, T_3 - Vermicompost (3t/ha) + Rhizobium, T_4 - Vermicompost (3t/ha) + Rhizobium + Azospirillum, T_5 - Vermicompost (6t/ha) + Azospirillum, T_6 - Vermicompost (6t/ha) + Rhizobium, T_7 - Vermicompost (6t/ha) + Rhizobium + Azospirillum, T_8 - Vermicompost (9t/ha) + Azospirillum, T_9 - Vermicompost (9t/ha) + Rhizobium, T_{10} - Vermicompost (9t/ha) + Rhizobium + Azospirillum. These were replicated thrice in Randomized Block Design.

Statistical analysis

The data recorded were different characteristics were subjected to statistical analysis by adopting Fishers the method of analysis of varianc (ANOVA) as described by Gomez (2010). Critical difference (CD) values were calculated the 'F' test was found significant at 5% level.

Results and Discussion

Plant height (cm)

At harvest, treatment with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum was recorded maximum (40.20 cm) plant height Which was superior over other treatments, whereas treatment with application of Vermicompost (3t/ha) + Rhizobium + Azospirillum and Vermicompost (6t/ha) + Azospirillum were at par with highest treatment. It might be due to the plant height was significantly differed due to different treatments. Application of Vermicompost (6t/ha) + Rhizobium + Azospirillum) produced significantly higher plant height (40.2 cm). The factors which are responsible for growth plant height was augmented significantly due to increased supply of nutrients from integrated nutrient use of organic manures along with biofertilizers (Singh *et al*., 2014) [7]. The interaction due to manure with biofertilizers for fresh weight per plant at maturity stage was found more significant. Ramawtar *et al.* (2013) observed that the application of vermicompost increased growth parameters over control treatment. Similar results were observed by Tiwari D, *et al.*(2008), Singh *et al*., (2011), Das *et al*., (2002)

Number of Branches per plant

At harvest, treatment with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum was recorded maximum number of branches (8.79) which was superior over other treatments, whereas treatment with application of Vermicompost (3t/ha) + Rhizobium + Azospirillum and Vermicompost (6t/ha) + Azospirillum were at par with highest treatment. It might be due to the Significant impact of branching was recorded with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum which was superior over all the treatment. The factors which are responsible for growth (branches per plant, plant height, leaf area, and seed yield) were augmented significantly due to increased supply of nutrients from integrated nutrient use of organic manures along with biofertilizers (Singh *et al*., 2014) [7].

Plant dry weight (g/plant)

At harvest, treatment with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum was recorded maximum plant dry weight (88.93 g/m^2) Which was superior over other treatments, whereas treatment with application of Vermicompost (6t/ha) + Azospirillum was at par with highest treatment. It might be due to the improvement in soil environment of encouraged proliferation of plant roots, which helped to draw more water and nutrients from larger area and deeper layers and thus owing to higher availability of nutrients, synthesis of more carbohydrates and their translocation to different plant parts resulted increased vegetative growth including the reproductive structures. These results corroborate with the finding of Sharma (2001) [10]. due to Rhizobium might open the door for increased utilization of others nutrient also and have resulted in more increase in growth, yield attributes and ultimately the yield in comparison to Rhizobium and PSB inoculations similar finding also reported by Yadav (2001) [12] in cowpea and Kumawat *et al*., (2010) in green gram.

Table 1: Effect of Biofertilizer and levels of Vermicompost on growth attributes of cowpea

Treatments	Plant height (cm)				No. of Branches per plant			Plant dry weight (g/plant)			
	15 DAS	30 DAS	45 DAS	At harvest	30 DAS	45 DAS	At harvest	15 DAS	30 DAS	45 DAS	At harvest
1. Control plot [No biofertilizer]	3.60	12.59	35.66	37.08	3.02	7.11	7.82	12.16	31.40	38.56	73.67
2. VC (3t/ha) + Azospirillum	3.22	12.74	35.66	37.18	2.94	6.62	8.02	12.01	32.38	40.26	76.60
3. VC (3t/ha) + Rhizobium	3.18	13.03	35.81	37.54	2.97	6.89	8.15	12.06	32.85	36.28	69.01
4. VC (3t/ha) + Rhizobium + Azospirillum	3.43	13.43	36.40	39.05	3.47	7.62	8.59	13.03	33.24	44.85	82.88
5. VC (6t/ha) + Azospirillum	3.35	12.78	35.60	39.14	3.52	7.32	8.65	13.58	36.39	45.14	82.32
6. VC (6t/ha) + Rhizobium	3.52	12.73	36.08	37.27	3.66	7.05	8.10	13.08	33.12	35.40	73.73
7. VC (6t/ha) + Rhizobium + Azospirillum	3.60	13.34	36.03	40.20	2.99	7.67	8.79	14.30	39.18	48.36	88.93
8. VC (9t/ha) + Azospirillum	3.51	13.28	37.02	38.33	3.81	7.03	8.17	12.11	31.79	38.79	67.48
9. VC (9t/ha)+ Rhizobium	3.52	13.22	36.54	37.84	3.27	6.68	8.05	11.86	32.76	41.18	78.78
10. VC (9t/ha) + Rhizobium +Azospirillum	2.88	12.09	34.14	36.66	2.86	6.97	8.18	12.63	35.35	41.95	79.29
SEm (±)	0.321	0.363	0.634	0.446	0.2447	0.2204	0.1322	0.66	1.17	1.70	2.73
CD (0.05%)	--	--	--	1.325	--	0.6548	0.3928	--	3.49	5.05	8.14

Table 2: Effect of biofertilizer and levels of vermicompost on yield attributes, yield and economics of cowpea

Treatments	Yield attributes			Yield			Economics	
	No. of pods/ plant	No. of grains/pod	Test weight(g)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)	Net return (INR/ha)	B:C ratio
1. Control plot [No biofertilizer]	28.07	7.69	29.79	0.83	2.66	23.76	37510.80	1.32
2. VC (3t/ha) + Azospirillum	27.41	7.56	29.09	1.06	2.75	27.77	48438.70	1.53
3. VC (3t/ha) + Rhizobium	26.05	7.10	30.51	0.91	2.73	25.05	39437.30	1.24
4. VC (3t/ha) + Rhizobium + Azospirillum	32.56	8.86	28.84	1.25	2.81	30.82	60268.60	1.88
5. VC (6t/ha) + Azospirillum	30.98	9.38	30.83	1.20	2.87	29.60	55110.90	1.59
6. VC (6t/ha) + Rhizobium	28.33	7.34	30.32	0.99	2.59	27.73	40594.90	1.17
7. VC (6t/ha) + Rhizobium + Azospirillum	33.72	9.57	30.99	1.31	2.92	31.02	61526.20	1.76
8. VC (9t/ha) + Azospirillum	25.30	7.87	29.74	0.89	2.72	24.79	32442.30	0.86
9. VC (9t/ha)+ Rhizobium	26.27	6.77	29.71	0.94	2.71	25.88	35315.10	0.94
10. VC (9t/ha) + Rhizobium +Azospirillum	27.68	7.35	30.74	0.91	2.73	25.01	33405	0.88
S.Em(±)	1.406	0.37	0.6425	0.06	0.058	1.25		
CD (p=0.05)	4.177	1.10	--	0.18	0.174	3.72		

Yield attributes and Yield

In number of pods per plant, treatment with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum was recorded maximum number of pods/ plant (33.72) Which was superior over other treatments, whereas treatment with application of Vermicompost (3t/ha) + Rhizobium + Azospirillum and Vermicompost (6t/ha) + Azospirillum were at par with highest treatment.In number of grains/pod, treatment with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum was recorded maximum number of pods/ plant (9.57) Which was superior over other treatments, whereas treatment with application of Vermicompost (3t/ha) + Rhizobium + Azospirillum and Vermicompost (6t/ha) + Azospirillum were at par with highest treatment.In Test weight, Treatment with application of Vermicompost(6t/ha) + Rhizobium + Azospirillum was recorded maximum (30.99 g) test weight and Treatment with application of Vermicompost (3t/ha) + Rhizobium + Azospirillum recorded minimum (28.84 g) test weight(g) as compared to other treatments. The significantly highest number of pod per plant was (33.72), number of seed per pod (9.57) and test weight of seed (28.84 g) were recorded in treatment Vermicompost (6t/ha) + Rhizobium + Azospirillum. It might be due to Increase in yield attributes in combination of organic manures and biofertilizer (Vermicompost (6t/ha Rajkhowa *et al*., (2003) [4, 14] in green gram, Khandelwal *et al*., (2012) [15, 16] and Balachandran *et al*., (2005) [17] Rhizobium + Azospirillum) over control may. The increased seed yield was obtained in organic manures combination with biofertilizers application (Rhizobium and PSB) could be attributed to the effect of growth hormones like IAA and cytokinin's produced by Rhizobium which stimulated root morphology. This in turn, would have improved assimilation of nutrients and thus seed yield. The phosphate solubilizing bacteria increase the availability of phosphorus to the plants and its greater uptake. The present results are in collaboration with the findings of Rajkhowa *et al*., (2003) [4, 14] in green gram, Khandelwal *et al.*, (2012) [15, 16] and Balachandran *et al.*, (2005) [17]. In Grain yield (t/ha), treatment with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum was recorded maximum grain yield (1.31 t/ha) Which was superior over other treatments, whereas treatment with application of Vermicompost (3t/ha) + Rhizobium + Azospirillum and Vermicompost (6t/ha) + Azospirillum were at par with highest treatment. In Stover yield (t/ha), treatment with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum was recorded maximum stover yield (2.92 t/ha) Which was superior over other treatments, whereas treatment with application of Vermicompost (3t/ha) + Rhizobium + Azospirillum and Vermicompost (6t/ha) + Azospirillum were at par with highest treatment. In Harvest index (%), treatment with application of Vermicompost (6t/ha) + Rhizobium + Azospirillum was recorded maximum harvest index (31.02%) Which was superior over other treatments, whereas treatment with application of Vermicompost (3t/ha) + Azospirillum, Vermicompost (3t/ha) + Rhizobium + Azospirillum, Vermicompost (6t/ha) + Rhizobium and Vermicompost (6t/ha) + Azospirillum were at par with highest treatment. It might be due to Mehta *et al*., (2011) reported that addition of vermicompost @ 6 t/ha to soil improved the supply of available nutrient to the plant and brought about favorable soil environment which ultimately increased nutrient and water holding capacity of soil for longer period and that resulted in better growth, yield attributes and yield of Pigeon pea. The beneficial effect of FYM and vermicompost on crop yields and soil productivity is the result of their usefulness as a store-house of plant nutrients. These organic sources of nutrients improved soil aeration, root development and increase microbial and biological activities in the rhizosphere. As reported by Shukla *et al*., (2013), Chatterjee *et al*., (2014). Gupta and Sharma (2006) [3].

References

1. Anonymous. Economic survey of India, ministry of finance (economic division) GOI, New Delhi 2012, 17-22
2. Balachandram S, Deotale RD, Hatmode CN, Titare PS, Thorat AW. Effect of bio-fertilizers (Pressmud, Rhizobium and PSB) and nutrients (NPK) on morphophysioogical parameters of greengram. Journal of soils and crops 2005;15:442-447.
3. Gupta A, Sharma VK. Studies on the effect of bio-fertilizer and phosphorous levels on yield and economics of Urdbean (Vigna mungo L. Hepper). Legume Research. 2006;29:278-281.
4. Rajkhowa DJ, Saikia M, Rajkhowa KM. effect of vermicompost and levels of fetilizer on greengram. Legume research 2003;26:63-65.
5. Shorff VN, Devathali S. Earthworm farming scope and limitation. Proceeding national seminar an natural farming (Ed.). L.L. Somani, K.L, Totawat and B.L., Baser. 1992, 126-142.
6. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research. edn 2, John Wiley & Sons, New York 1984.
7. Singh Dashrath, Singh RP. Effect of integrated nutrient management on growth, physiological parameters and

productivity of lentil (*Lens culinaris Medik*.). Internat. J agric. Sci 2014;10(1):175-178.
8. Singh B, Pareek RG. Effect of phosphorus and biofertilizers on growth and yield of mungbean. Indian Journal of Pulses Research 2003;16:31-33.
9. Tiwari D, Kumar K. Effect of biofertilizer and phosphorus levels on growth, nodulation and yield of mung bean. (In) International Conference on Grain Legumes: Quality Improvement, Value Addition and Trade held during 14-16 February, at Indian Institute of Pulses Research, Kanpur 2009
10. Sharma SR. Effect of organic manure nutrients on symbiotic efficiency in cowpea. Indian J. Pulses Res. 2001;15:156-160.
11. Yadav BK, Tarafdar JC. Studies on phosphatase activity and cluster bean production as influenced by the P mobilizing organism *Emmericella Rugulosa*. Legume Research 2010;33:118-220.
12. Yadav BL, Jakhar SR. Effect of tillage and phosphorus fertilization on yield and water expense efficiency of rainfed mungbean. J. Indian Soc. Soil Sci 2001;49:193-1.
13. Kumar S, Singh RC, Kadian VS. Performance of mung bean as influenced by seed inoculation with Rhizobium and levels of inorganic sources of nutrients. Indian Journal of Pulses Research 2003;16:67-68.
14. Rajkhowa DJ, Saikia M, Rajkhowa KM. Effect of vermicompost and levels of fertilizer on green gram. Legume Research 2003;26:63-65.
15. Khandelwal R, Choudhary SK, Khangarot SS, Jat MK, Singh P. Effect of inorganic and bio-fertilizers on productivity and nutrients uptake in Cowpea [*Vigna unguiculata* (L.) *walp*]. Legume Research 2012;35(3):235-238.
16. Khandelwal R. Response of cowpea [*Vigna unguiculate* (L.) *Walp*] to nitrogen and phosphorus fertilizers and seed inoculations. Legume Research 2012;35:235-238.
17. Balachandran S, Deotale RD, Hatmode CN, Titare PS, Thorat AW. Effect of bio-fertilizers (Pressmud, Rhizobium and PSB) and nutrients (NPK) on morphophysiological parameters of greengram. Journal of Soils and Crops 2005;15:442- 447.
18. Gupta SC, Ganagwar S. Effect of molybdenum iron and mineral inoculation. Journal of Food Legume 2012;25:45-49.