INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

www.ijabpt.com ISSN : 0976-4550

Volume-6, Issue-3, July-Sept-2015 Coden IJABFP-CAS-USA Copyrights@2015

Received: 4th June-2015 *Revised: 10th July -2015* *Accepted: 10th July-2015*

Research article

INFLUENCE OF BIOFERTILIZERS, VERMICOMPOST AND CHEMICAL FERTILIZRS ON GROWTH, NODULATION, NUTRIENT UPTAKE, SEED YIELD AND ECONOMICS OF BLACK GRAM

Harish Kumar Mehta, R. Subhash Reddy. P. Jayamma and R. Naveen Kumar

Department of Agricultural Microbiology and Bioenergy, College of Agriculture, Rajendranagar, Hyderabad-30.

ABSTRACT: The experiment was conducted during rabi season in medium black soil at College Farm, College of Agriculture, Rajendranagar, ANGRAU, Hyderabad, Andhra Pradesh to study the influence of biofertilizers, vermicompost and chemical fertilizers on growth, nodulation, nutrient uptake, seed yield and economics of Black gram. From the data, it was observed that 50%RDF + Vermicompost + Rhizobium + Pseudomonas significantly increased the plant height, root length, leaf area index and leaf chlorophyll content at 25 and 50 DAS over the other treatments including control. The same treatment recorded highest seed yield (707 kg ha^{-1}) and haulm yield (7067 kg ha^{-1}) as compared to the control. Nutrient uptake recorded significantly highest in the treatment supplied with biofertilizers along with Vermicompost and 50%RDF. Treatment supplied with 50%RDF + Vermicompost + Rhizobium + Pseudomonas recorded highest net return (17784 Rs ha^{-1}) but highest B: C ratio (2.11) was recorded in the treatment supplied with 50%RDF + Rhizobium + Pseudomonas.

Key words: Biofertilizers, vermicompost, chemical fertilizers, economics, black gram.

INTRODUCTION

Urdbean [*Vigna mungo* (L.) Hepper] is an important kharif food legume, generally grown under marginal lands by resource poor farmers in India. India is the leading country in pulse cultivation area and contributes 25 to 27% of the world production and consumption respectively but also the largest importer of pulses with the contribution of 34% of the global food use (Faostat 2008). India shares 70% of the total world black gram and green gram(*Vigna radiata*) production in which black gram constitutes 1.65 MT with the share of 12.4% (Elzebroek and Wind 2008). Being grown mainly on the soils poor in fertility, use of biofertilizer along with vermicompost is necessary to realize good yields (Biswas *et al.* 2009).The inoculation of seeds with *Rhizobium leguminosarum bv. phaseoli* (RHL) is known to increase nodulation, nutrient uptake, growth and yield response of crop plants (Roy *et al.* 2006). The phosphate solubilising bacteria (PSB) – *Pseudomonas fluorescence* (PSF) also improves grain yield and soil nutrients besides suppressing soil borne pathogens (Balakrishnan *et al.* 2007). Co-inoculation of RHL and PSB and their combination with FYM improved plant biomass production, grain yield (Rudresh *et al.* 2005; Gomma and Mohamed 2007). In the present investigation the influence of mixing of biofertilizers with vermicompost on the growth, nodulation, nutrient uptake, seed yield and economics of Black gram is studied and result discussed.

MATERIALS AND METHODS

The experiment was conducted during *rabi* season in medium black soil at College Farm, College of Agriculture, Rajendranagar, ANGRAU, Hyderabad, Andhra Pradesh. The field experiment was conducted following randomized block design with 11 treatments replicated thrice. Treatment consisted of T_1 (100%RDF), T_2 (100%RDF+ *Rhizobium* + *Pseudomonas*), T_3 (Vermicompost), T_4 (Vermicompost + *Rhizobium*), T_5 (Vermicompost + *Pseudomonas*), T_6 (Vermicompost + *Rhizobium* + *Pseudomonas*), T_7 (50%RDF), T_8 (50%RDF+ *Rhizobium* + *Pseudomonas*), T_9 (50%RDF + Vermicompost + *Rhizobium*), T_{10} (50%RDF + Vermicompost + *Pseudomonas*) and T_{11} (50%RDF + Vermicompost + *Rhizobium* + *Pseudomonas*). The growth parameters *viz.*, plant height, root length, leaf area index, chlorophyll content nodule no. $plant^{-1}$, nodule wt. (g $plant^{-1}$), dry matter accumulation (g $plant^{-1}$), were recorded at different crop growth stages. Likewise observation on yield attributes *viz.*, number of seeds pod^{-1}, weight of 100 Seeds, seed yield and haulm yield were taken at harvest.The net return and benefit: cost ratio was calcuated. The protein % in seed was determined by multiplying N content by 6.25. (Sadasivam and Manickam, 1996). Available nitrogen, phosphorus and potassium were estimated by alkaline permanganate method (Subbiah and Asija 1956), by Olsen's method (Jackson (1973) and by flame photometer method respectively.

RESULTS AND DISCUSSION

At 25 DAS and 50 DAS, treatment supplied with 50%RDF + Vermicompost + *Rhizobium* + *Pseudomonas* recorded significantly higher plant height, root length, leaf area index and chlorophyll content as compared to the remaining treatment as well as control.

At flowering stage treatment T_{11} (50%RDF + Vermicompost + *Rhizobium* + *Pseudomonas*) recorded significantly higher number of root nodule (28.17) and nodule dry weight (0.19 g). Prasad *et al.* (2002) reported significantly higher nodulation in black gram crop due to seed inoculation with *Rhizobium* + phosphate solubilizing bacteria + plant growth promoting rhizobacteria than *Rhizobium* applied either alone or in combination with phosphate solubilizing bacteria.The highest protein content (21.56) was recorded in the treatment T_{11} which might be due to the combined effect of 50 % RDF, vermicompost, *Rhizobium* and *Pseudomonas*.

The combined application of 50 % RDF, vermicompost and biofertilizers were recorded highest seed yield (707 kg ha^{-1}) and haulm yield (7067 kg ha^{-1}) as compared to the control. Hussian *et al.* (2011) reported the slight increase in seed yield of black gram crop with addition of *Rhizobium* + phosphate solubilizing bacteria could be attributed to the increase in the growth parameters and yield contributing characters.

Table 1: Effect of biofertilizers, vermicompost and chemical fertilizers on plant height, root length, leaf area index, chlorophyll content, nodulation (Flowering stage), dry matter and seed protein content (harvest stage)of black gram crop.

Treatments	Plant height (cm)		Root length (cm)		Leaf area index		Chlorophyll conetent		No. of nodule $plant^{-1}$	Wt. of nodule (g $plant^{-1}$)	Dry matter (g $plant^{-1}$)	Seed protein (%)
	25 DAS	50 DAS	25 DAS	50 DAS	25 DAS	50 DAS	25 DAS	50 DAS				
T_1	11.85	23.1	6.20	9.90	0.11	0.61	32.86	33.80	13.83	0.04	1.03	18.27
T_2	12.77	26.8	7.53	13.13	0.15	0.76	35.27	38.17	24.73	0.11	1.24	21.55
T_3	11.80	22.27	6.40	9.60	0.12	0.60	32.65	33.60	16.27	0.07	1.01	16.82
T_4	12.07	24.13	6.87	11.80	0.11	0.66	33.85	36.32	18.53	0.07	1.11	20.02
T_5	11.83	24.33	6.80	11.87	0.11	0.62	34.31	36.45	17.77	0.07	1.07	19.63
T_6	12.33	24.13	6.93	12.33	0.12	0.68	34.66	37.11	21.50	0.08	1.35	20.73
T_7	11.58	22.75	6.40	9.17	0.11	0.61	33.85	34.93	13.57	0.05	0.98	17.80
T_8	12.60	25.20	7.40	13.00	0.14	0.72	35.13	38.18	22.17	0.09	1.67	21.25
T_9	12.57	24.13	7.20	11.27	0.13	0.67	34.33	36.77	19.63	0.09	1.18	20.65
T_{10}	12.50	23.97	7.00	11.33	0.12	0.65	34.35	36.56	20.07	0.08	1.29	20.52
T_{11}	13.88	27.28	8.50	14.03	0.18	0.90	37.23	41.05	28.17	0.19	2.20	21.56
SEm+/-	0.21	0.60	0.22	0.28	0.005	0.018	0.42	0.29	0.43	0.01	0.10	0.73
CD (P=0.05)	0.40	1.78	0.64	0.82	0.02	0.05	1.25	0.87	1.28	0.03	0.32	2.15

T_1- 100%RDF, T_2-100%RDF + *Rhizobium* + *Pseudomonas*, T_3- Vermicompost T_4- Vermicompost + *Rhizobium*, T_5- Vermicompost + *Pseudomonas* T_6- Vermicompost + *Rhizobium* + *Pseudomonas*, T_7-50%RDF T_8-50%RDF + *Rhizobium* + *Pseudomonas*, T_9- 50%RDF + Vermicompost + *Rhizobium* T_{10}-50%RDF + Vermicompost + *Pseudomonas*, T_{11}-50%RDF + Vermicompost + *Rhizobium* + *Pseudomonas*

CD (P=0.05): Critical difference at 5% level of significance

Table 2: Effect of biofertilizers, vermicompost and chemical fertilizers on yield attributes, yield, nutrient uptake, available soil nutrient at harvest and economics of black gram crop.

Treatments	No. of seed pod^{-1}	100 seed wt.(g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Total Nutrient uptake (kg ha^{-1})			Available nutrient at harvest (kg h^{-1})			Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	B:C ratio
					N	P	K	N	P	K				
T_1	5.53	5.19	490	3472	73.79	13.79	77.59	200.90	20.56	211.97	19642	10276	9366	1.10
T_2	6.57	5.46	605	6172	111.41	25.80	98.79	265.35	45.73	250.29	26137	16631	9506	1.75
T_3	5.77	4.64	480	3333	63.97	10.33	77.29	218.09	25.74	216.93	19192	8132	11060	0.74
T_4	6.00	5.32	531	4250	80.73	15.02	82.84	237.62	33.17	233.11	21758	10628	11130	0.95
T_5	6.20	5.23	582	4143	77.49	13.39	81.00	232.10	38.38	236.41	23348	12218	11130	1.10
T_6	6.53	5.43	600	4444	86.02	17.25	85.97	246.03	40.25	242.87	24244	13044	11200	1.16
T_7	5.30	5.14	457	3611	71.06	13.07	81.51	182.64	18.95	199.01	18681	10718	7963	1.35
T_8	6.53	5.41	601	5361	109.7	24.73	95.28	260.32	50.61	246.28	25198	17095	8103	2.11
T_9	6.43	5.33	587	4444	100.10	19.46	93.70	239.52	25.63	222.56	23823	11290	12533	0.90
T_{10}	6.33	5.30	571	4306	90.43	17.88	90.00	227.09	37.16	226.60	23152	10619	12533	0.85
T_{11}	7.30	6.30	707	7067	114.51	17.88	101.43	270.41	55.37	271.59	30387	17784	12603	1.41
SEm+/-	0.14	0.14	23	311	0.76	0.95	0.70	1.51	1.07	0.87	-	-	-	--
CD (P=0.05)	0.40	0.41	70	916	2.25	2.80	2.53	4.44	3.16	2.58	-	-	-	-

T_1- 100%RDF, T_2-100%RDF + *Rhizobium* + *Pseudomonas*, T_3- Vermicompost, T_4- Vermicompost + *Rhizobium*, T_5- Vermicompost + *Pseudomonas*, T_6- Vermicompost + *Rhizobium* + *Pseudomonas*, T_7-50%RDF, T_8-50%RDF + *Rhizobium* + *Pseudomonas* , T_9- 50%RDF + Vermicompost + *Rhizobium* , T_{10}-50%RDF + Vermicompost + *Pseudomonas* , T_{11}-50%RDF + Vermicompost + *Rhizobium* + *Pseudomonas*

CD (P=0.05): Critical difference at 5 % level of significance

Highest nitrogen, phosphorus and potassium uptake as well as highest available nitrogen, phosphorus and potassium in the soil was observed with the combined inoculation of *Rhizobium* + *Pseudomonas* along with 50% RDF and vermicompost which was significantly better than single inoculation with *Rhizobium*, *Pseudomonas* along with 100% RDF or 50% RDF or vermicompost. Treatment supplied with 50%RDF + Vermicompost + *Rhizobium* + *Pseudomonas* recorded highest net return (17784 Rs ha^{-1}) but highest B: C ratio (2.11) was recorded in the treatment supplied with 50%RDF + *Rhizobium* + *Pseudomonas*. This is due to the additional cost of vermicompost (3000 Rs. t ha^{-1}) applied in this treatment. If the vermicompost is produced on farm by the farmer from the crop wastes, the treatment 50%RDF + Vermicompost + *Rhizobium* + *Pseudomonas* would more beneficial to the farmer in view of highest net return and also due to the improvement in the benefit cost ratio also.

REFERENCES

Balakrishnan, V, Venkatesan, K and Ravindran, K.C. (2007). The influence of halophytic compost, farmyard manure and phosphobacteria on soil microflora and enzyme activities. Plant and Soil Environment. 53: 186-192.

Biswas, P. K, Bhowmick, M.K and Bhattacharyya, A. (2009). Effect of molybdenum and seed inoculation on nodulation, growth and yield in Urdbean (*Vigna mungo L.Hepper)*. Journal of Crop and Weed. 5:147-150.

Elzebroek, T and Wind, K. (2008). *Guide to Cultivated Plants*. CAB International, United Kingdom. 262.

Faostat. (2008). *Food and Agriculture Organization United Nations*. 15.02.2009 http:// faostat.fao.org/ site/339/ default.aspx (accessed on)

Gomma, A.M and Mohamed, M.H. (2007). Application of bio-organic agriculture and its effect on Guar (*Cyamopsis tetragonoloba L.*) root nodules, forage, seed yield and yield quality. World Journal of Agriculture Science. 3: 91-96.

Hussain, N, Hassan, B, Habib, R., Chand, L. Ali, A and Anwar, H. (2011). Response of biofertilizers on growth and yield attributes of blackgram (*Vigna mungo* L.). International Journal of Current Research.2: 148-150.

Jackson, M. L., (1973). *Soil Chemical Analysis*. Prentice- Hall of India private limited, New Delhi.

Olsen, S.R., Cole, C.V., Watanabe, F.S and Dean, L.A. (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. Circ US Dept. Agricultuture. 939.

Prasad, H, Chandra, R, Pareek, R.P and Kumar, N. (2002). Synergism among phosphate solubilizing bacteria, rhizobacteria and *Rhizobium* in urdbean. Indian Journal of Pulses Research.15:131-135.

Roy, R.N., Finck, A., Blair, G.J and Tandon, H.L.S. (2006). Plant nutrition for food security -A guide for integrated nutrient management, *FAO*. Fertilizer and Plant Nutrition Bulletin. 16.

Rudresh, D.L, Shivaprakash, M.K and Prasad, R.D. (2005). Effect of combined application of *Rhizobium*, phosphate solubilizing bacterium and *Trichoderma spp.* on growth, nutrient uptake and yield of chickpea *(Cicer aritenium* L.*).* Applied Soil Ecology. 28: 139-146.

Sadasivam, S and Manickam, A. (1996). *Biochemical methods*. New Age International, Pvt.Ltd.New Delhi.

Subbaiah, B.V and Asija, G.L. (1956). A rapid procedure for estimation of available nitrogen in soils. Current Science. 25: 259–260

ISSN : 0976-4550

INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

Email : ijabpt@gmail.com

Website: www.ijabpt.com