Madras Agric. J., 100 (4-6): 339-341, June 2013
https://doi.org/10.29321/MAJ.10.001305

Influence of Organic Manures and Chemical Fertilizer on Nutrient uptake, Yield and Profitability of Mungbean [*Vigna radiata* (L.) Wilczek]

H.R. Choudhary*, O.P. Sharma, R.K. Singh, Kanchan Singh, Rakesh Kumar and Lalji Yadav

SKN College of Agriculture, Jobner,
Swami Keshwan and Rajasthan Agricultural University,
Bikaner (Rajasthan) 303329

Field experiment was conducted during *kharif* 2008 to assess the response of Mungbean to different organic manure, fertilizers and bio-fertilizers [*Rhizobium* (B_1) and PSB (B_2) seed inoculation]. Yield attributes and seed yield of mungbean were significantly higher under vermicompost @ 0.7 t/ha + 50% RDF and was at par with poultry manure @ 0.85 t/ha + 50% RDF. N, P and K concentration in seed and straw and their uptake, protein content in seed and net returns were higher in vermicompost @ 0.7 t/ha + 50% RDF.

Key words : Mungbean, rhizobium, PSB, vermicompost, poultry manure , RDF.

Mungbean [*Vigna radiata* (L.)Wilczek] is an excellent source of high quality protein and contains about 25 per cent protein. India grows nearly 23 m ha of pulses with an annual production of 14 million tonnes with an average productivity of 617 kg/ha (Anonymous,2009) . In Rajasthan, the total area under mungban is 1.06 million hectares with an annual production of 0.42 mt and productivity of 396 kg/ha which is very low as compared to its yield (658 kg/ha) obtained under National Demonstration Projects (Anonymous,2007). Moreover, chemical fertilizers are becoming costlier input in agriculture. Therefore, it is necessary to evaluate the feasibility and efficiency of organic wastes not only for improving and building up of soil fertility but also to increase efficiency of chemical fertilizer. Integrated use of chemical fertilizer with organic manure has been found to be quite promising not only in maintaining higher productivity but also in greater stability to crop production (Nambiar and Abrol, 1992). FYM also acts as a source of energy for the growth of soil microbes. Improvement in physical properties of soil, organic carbon and available nitrogen, phosphorus and potassium due to long term application of FYM and fertilizer has been well documented by Babulkar *et al.* (2000). Vermi compost is a sustainable bio-fertilizer regenerated from organic wastes using earthworms. Vermi compost is a rich source of N, P, K and micronutrients. Bio-fertilizers are other organic source which play an important role in meeting the nutrient requirement of crops through biological nitrogen fixation (BNF). Inoculation of seeds with phosphate solubilizing bacteria increases nodulation , crop growth, nutrient availability, their uptake and crop yield of field pea (Srivastava and Ahlawat, 1993). The need of the hour is to evolve an integrated plant nutrient supply system comprising of balanced use of chemical fertilizers, organic manures and bio-fertilizers.

Materials and Methods

A field experiment was conducted during *kharif* 2008 at the Agronomy farm, SKN College of Agriculture, Jobner. Rajasthan in a factorial randomized block design with three replications. The soil was loamy sand in texture, alkaline in reaction (pH 8.4), low in organic carbon (0.31%), available nitrogen (124.4 kg/ha),available phosphorus (15.7 kg $P_2 0_5$/ha) and medium in potassium (152.3 kg $K_2 0$/ha). The treatments were RDF @ 20 kg N + 40 kg $P_2 0_5$/ha (F_1), FYM @ 4 t/ha (F_2) , FYM @ 2 t/ha + 50 % RDF (F_3), poultry manure @ 1.7 t/ha (F_4), poultry manure @ 0.85 t/ha + 50% RDF (F_5), vermicompost @ 1.4 t/ha (F_6) and vermicompost @ 0.7 t/ha + 50% RDF (F_7), 2 bio fertilizers [*Rhizobium* (B_1) @ 20 g /kg and PSB (B_2) @ 20 g/ kg seed inoculation] and an absolute control. Recommended dose of fertilizer viz., 20 kg N and 40 kg $P_2 0_5$/ha were applied as per treatment through Diammonium phosphate (DAP) and urea as a basal dose. FYM, poultry manure and vermicompost alone or with fertilizer were applied as basal. The mungbean cv.RMG- 268 was sown at a spacing of 30 cm x 10 cm using 20 kg/ha seed. The uptake of N,P and K at harvest in seed and straw was estimated.The per cent crude protein content in seed was calculated by multiplying per cent nitrogen of seed with a factor 6.25 (AOAC, 1960). The produce obtained under each treatment was multiplied with the prevailing market price of seed and straw to compute economics. N,P, K content of manures were estimated as FYM (0.5, 0.25, 0.5%), poultry manure (1.2, 1.15, 0.75%) and vermicompost (1.4, 0.9, 1.03%).

*Corresponding author email: hariram.agrian@gmail.com

Results and Discussion

Nutrient uptake and crude protein yield

Nitrogen, phosphorus and potassium concentration in seed, straw and their uptake, protein content and protein yield (Table 1) were significantly higher with vermicompost @ 0.7 t/ha + 50 % RDF (F_7), but was at par with poultry manure @ 0.85 t/ha + 50% RDF (F_5). However, in respect of protein content in seed, RDF @ 20 kg N + 40 kg $P_2 0_5$ (F_1) was also on par with the above treatments. The favourable conditions for microbial as well as chemical activities due to addition of above manures in conjunction with fertilizers augmented the mineralization of nutrients and ultimately the available nutrient pool of the soil led to higher uptake of nutrients by plants. Significant increase in protein concentration due to vermicompost @ 0.7 t/ha + 50% RDF or poultry manure @ 0.85 t/ha + 50 % RDF might be due to increased availability of nitrogen to plants. Application of nutrients through organic and inorganic sources in combination also

Table 1. Effect of organic manures, fertilizers and bio-fertilizers on nutrient content & uptake, protein content (%) and protein yield (kg/ha) of mungbean

Treatment	N concentration(%)		Total N uptake	Protein content	P concentration (%)		Total P uptake	K. concentration(%)		Total K uptake	Protein yield
	Seed	Straw	(kg/ha)	(%)	Seed	Straw	(kg/ha)	Seed	Straw	(kg/ha)	(kg/ha)
Control V/s rest											
Absolute control	2.723	0.830	36.69	17.02	0.151	0.112	3.61	0.900	1.050	36.50	133.24
Rest	3.328	1.163	67.53	20.80	0.278	0.169	7.42	1.242	1.756	57.65	244.03
SE m+	0.095	0.041	3.11	0.59	0.015	0.007	0.57	0.107	0.140	4.24	14.72
CD (P=0.05)	2.273	0.119	8.99	1.71	0.044	0.022	1.64	0.308	0.405	12.24	42.49
Fertility levels											
F1- RDF (20 kg N+ 40 kg $P_2 0_5$/ha)	3.365	1.164	68.70	21.03	0.291	0.170	7.65	1.185	1.749	57.38	249.10
F2- FYM @ 4 t/ha	3.074	0.980	53.26	19.21	0.211	0.143	5.37	1.153	1.491	45.48	193.24
F3-FYM @ 2 t/ha+ 50% RDF	3.302	1.146	66.87	20.64	0.284	0.163	7.34	1.182	1.725	56.36	241.30
F4- Poultry manure @ 1.7 t/ha	3.157	1.059	59.02	19.73	0.252	0.152	6.26	1.163	1.627	50.12	216.92
F5- Poultry manure @ 0.85 t/ha + 50% RDF	3.504	1.328	75.93	21.90	0.320	0.194	8.74	1.398	1.975	66.26	268.99
F6- Vermicompost @ 1.4 t/ha	3.123	1.071	62.71	20.08	0.254	0.160	6.79	1.175	1.637	53.50	228.61
F7- Vermicompost @ 0.7 t/ha + 50% RDF	3.678	1.390	86.23	22.99	0.332	0.203	9.82	1.435	2.091	74.43	310.07
SE m+	0.067	0.029	2.20	0.42	0.011	0.005	0.40	0.075	0.099	3.00	10.41
CD (P=0.05)	0.193	0.084	6.36	1.21	0.031	0.015	1.16	0.218	0.286	8.65	30.05
Bio- fertilizers											
B1- Rhizobium	3.328	1.178	69.26	20.80	0.270	0.161	7.18	1.280	1.809	59.83	244.42
B2- PSB	3.328	1.147	65.81	20.80	0.286	0.178	7.67	1.203	1.704	55.46	243.64
SE m+	0.036	0.016	1.18	0.22	0.006	0.003	0.21	0.040	0.053	1.60	5.56
CD (P= 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

recorded significantly higher NPK uptake over the control. Similar results were also obtained by Devi and Agarwal (1999) in sunflower.

Both the bio-fertilizers being at par with each other significantly (Table 1) enhanced the N, P and K concentration in seed and straw, their uptake by crop, protein content of seed and protein yield over absolute control. This may be due to more nitrogen fixation by bacteria which in turn helped in better absorption and utilization of all the plant nutrients, thus resulting in more N and P content in seed and straw and protein content in seed. Similar results have also been reported by Singh and Kumari (1990). The seed inoculation with PSB helped in realizing P from native as well as protecting fixation of added phosphate and rendered more available P for the plants leading to increased nutrient content of the plant. It is in accordance with the findings of Gaind and Gaur (1991). Since protein content of seed is essentially a manifestation of N content, increased N content due to seed inoculation with *Rhizobium* or PSB resulted in higher protein content because of their beneficial role in enhancing N content in seed. The findings of Maiti *et al.* (1998) also support the present finding.

Yield and Economics

Application of various nutrients through different sources either alone or in combination significantly increased the seed and straw yield of mungbean (Table 2). Application of vermicompost @ 0.7 t/ha + 50% RDF recorded significantly higher seed yield (1351 kg/ha) and straw yield (2633 kg/ha) indicating an increase of 58.0 and 70.3 per cent over absolute control, respectively. This treatment was also found on par with F_5 (poultry manure @ 0.85 t/ha + 50 % RDF). Application of manures with chemical fertilizer was found more effective as compared to sole application of either FYM, poultry manure or vermicompost. Moreover, manures contain high amount of organic matter which increase the moisture retention of the soil and improves dissolutions of nutrients particularly phosphorus. It is in close conformity with the findings of Munirathnam *et al.* (2004) in foxtail millet. Cost of cultivation, was lower in 100 % RDF (20 kg N + 40 kg $P_2 0_5$/ha) Highest B:C ratio was found under RDF (20 kg N + 40 kg $P_2 0_5$ /ha).(Table 2). Vermicompost @ 0.7 t/ha + 50% RDF (F_7) brought out the maximum gross returns (Rs 73399), net returns (Rs 57372 / ha), production efficiency (20.4 kg/day/ha) and net profitability (Rs. 869.2 /day/ha). Similar results were also obtained by Yadav (2001) in cowpea.

Based on the results of this study, it may be inferred that conjunctive application of vermicompost @ 0.7 t/ha + 50% RDF or poultry manure @ 0.85 t/ha + 50% RDF and seed inoculation with *Rhizobium*

Table 2. Effect of organic manure, fertilizers and bio-fertilizers on Yield (kg/ha) and Profitability of mungbean

Treatment	Yield (kg/ha)		Cost of cultivation	Gross returns	Net returns	B:C ratio	Production efficiency
	Seed	Straw	(Rs.)	(Rs/ha)	(Rs/ha)		(kg/day/ha)
Control V/s rest							
Absolute control	784	1852	15471	45613	30169	1.95	11.88
Rest	1167	2441	14861	63057	48150	3.24	17.69
SE m+	62	74	-	-	-	-	0.94
CD (P=0.05)	179	214	-	-	-	-	2.71
Fertility levels							
F1- RDF (20 kg N+ 40 kg $P_2 0_5$/ha)	1184	2479	13474	63361	49854	3.70	17.93
F2- FYM @ 4 t/ha	1007	2278	14649	54516	39847	2.72	15.26
F3-FYM @ 2t/ha+ 50% RDF	1169	2467	14889	63554	48690	3.27	17.70
F4- Poultry manure @ 1.7 t/ha	1097	2296	14814	59276	44442	3.00	16.62
F5- Poultry manure @ 0.85 t/ha + 50% RDF	1226	2486	14794	66451	51632	3.49	18.58
F6- Vermicompost @ 1.4 t/ha	1139	2450	15537	60839	45215	2.91	17.25
F7- Vermicompost @ 0.7 t/ha + 50% RDF	1351	2633	15981	73399	57372	3.59	20.47
SE m+	44	52	-	-	-	-	0.66
CD(P=0.05)	126	151	-	-	-	-	1.92
Bio- fertilizers							
B1- Rhizobium	1170	2465	14692	63049	48337	3.29	17.73
B2- PSB	1165	2418	15035	63064	47964	3.19	17.65
SE m+	23	28	-	-	-	-	-
CD (P= 0.05)	NS	NS	-	-	-	-	-

or PSB were found to be the most promising treatments as compared to sole application of either manure or chemical fertilizer and no inoculation.

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Received: August 22, 2012; Accepted: March 21, 2013