

GROWTH, YIELD AND NUTRIENT CONTENT OF MUNGBEAN (*VIGNA RADIATA* L.) IN RESPONSE TO INM IN EASTERN UTTAR PRADESH, INDIA

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Abstract

Significant improvement in LAI, number of trifoliolate, SPAD value of green leaf chlorophyll, dry matter accumulation, yield, harvest index (%) and nutrient content of mungbean were recorded due to application of 75% RDF + 2.5 t/ha vermicompost (VC) + *Rhizobium* (*Rh*) + phosphorus solubilizing bacteria (PSB), followed by 100% RDF + 2.5 t/ha VC and 100% RDF + *Rh* + PSB. The highest seed yield of mungbean was obtained with the application of 75% RDF + 2.5 t/ha VC + *Rh* + PSB (12.34 q/ha) followed by 100% RDF + 2.5 t/ha VC (12.05 q/ha) and 100% RDF + *Rh* + PSB (11.95 q/ha).

In Asian agriculture, during green revolution era cultivation of HYVs of crops and use of huge amount of agrochemicals has led to severe depletion of nutrients from the soil. Normally, farmers use imbalanced chemical fertilizers for individual crop without considering integrated nutrient management approach. As a result, productivity and soil biodiversity has been affected. Recently growth and yield of mungbean have been affected by poor management and low soil fertility (Bradl 2004). Nutrient elements are needed in relatively very small quantities for adequate plant morphology and production, their deficiency may cause great disturbance in the physiological and metabolic processes involved in the plant (Babaeian *et al.* 2011, Meena *et al.* 2013). A bio-fertilizer is a natural product carrying living microorganism derived from the root or cultivated soil helps in atmospheric N₂ fixation, phosphorous solubilisation and stimulate growth hormones providing better plant morphology, chlorophyll and increased nutrient content of crop (Mohamed *et al.* 2012, Ram Swaroop and Ramawatar 2012). Vermicompost is nutrient rich products of a non-thermophilic biodegradation of organic materials through interactions between earthworms and microorganisms (Aira *et al.* 2002, Sallaku *et al.* 2009). However, the information on integrated use of organic manures, chemical fertilizers and bio-fertilizers on plant morphology and productivity of mungbean are meager (Meena 2013, Meena and Sharma 2013). The present study reports the effect of manures and such fertilizers on the productivity of mungbean in eastern Uttar Pradesh, India.

A field experiment was conducted during rainy (*kharif*) season of 2013 at Agronomy Farm, Institute of Agricultural Sciences, BHU, Varanasi (UP). The soil was sandy clay loam with pH 7.32, available N 160.13 kg/ha (Subbiah and Asija 1956), P 22.64 kg/ha (Olsen *et al.* 1954), K 211.41 kg/ha (Stanford and English 1949) and 0.36% organic carbon (Jackson 1973). The 12 treatments comprised of control, three levels of RDF (75, 50 and 100% NPK) and other eight in combination *viz.*, 50% RDF+ *Rh* + PSB, 50% RDF + 2.5 t/ha VC, 50% RDF + 2.5 t/ha VC/ha + *Rh* + PSB, 75% RDF+ *Rh* + PSB, 75% RDF + 2.5 t/ha VC, 75% RDF + 2.5 t/ha VC + *Rh* + PSB, 100% RDF + *Rh* + PSB and 100% RDF + 2.5 t/ha VC were laid out in randomized block design

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with three replications. Recommended dose of fertilizer 20: 40: 20 kg/ha (N₂: P₂O₅ : K₂O) and vermicompost were applied as per treatments as basal dose at the time of sowing in furrows at 30 cm apart in at the depth of 10 cm. The required quantity of *Rhizobium* cultures, *i.e.* @ 200 g culture per 10 kg seed was mixed to 10% sugar solution to form slurry. The culture of PSB 200 g per 12 kg fine soil was well mixed and then applied. Vermicompost was applied thoroughly as per treatment before sowing in 15 cm top soil layer. Green gram variety HUM 12 (Maliviya Jenchetna) was sown at the rate of 15 kg/ha in line at 30 cm apart at the depth of 5 cm on 6 August.

The data showed (Table 1) that source of nutrient like, 75% RDF + VC + bio-fertilizers (*Rh* and PSB) caused significant increase in LAI, number of trifoliolate, SPAD value of chlorophyll, dry matter accumulation, yield, harvest index and nutrient content compared to other treatments followed by 100% RDF + 2.5 t/ha VC and 100% RDF + *Rh* + PSB. Significantly higher leaf area index, trifoliolate leaves/plant and SPAD value of chlorophyll were recorded on 45 DAS with the various integrated nutrient management up to 75% RDF + 2.5 t/ha VC + *Rh* + PSB, followed by 100% RDF + 2.5 t/ha VC and 100% RDF + *Rh* + PSB. It is clear from data that crop dry matter accumulation was significantly influenced by integrated nutrient management, in combination of 75% RDF + 2.5 t/ha VC + *Rh* + PSB recorded the maximum.

Table 1. Effect of integrated nutrient management on plant growth parameters of mungbean.

Treatment	Leaf area index (LAI)		No. of trifoliolate leaves at 45 DAS	Chlorophyll contain at 45 DAS (SPAD value)*	Dry matter per plant (g) at harvest
	45 DAS	At harvest			
Control	2.05	1.85	6.77	39.62	11.27
50% RDF	2.90	2.34	8.63	42.94	12.53
75% RDF	2.98	2.61	10.31	44.63	14.22
100% RDF	3.04	2.80	11.03	45.68	15.27
50% RDF + <i>Rh</i> + PSB	2.87	2.33	9.68	44.23	13.82
50% RDF + 2.5 t/ha VC	2.68	2.46	10.15	44.44	14.03
50% RDF + 2.5t/haVC + <i>Rh</i> + PSB	3.36	2.91	11.59	46.23	15.62
75% RDF + <i>Rh</i> + PSB	3.16	2.81	11.09	45.83	15.42
75% RDF + 2.5t/ha VC	3.30	2.85	11.39	46.16	15.52
75% RDF + 2.5t/ha VC + <i>Rh</i> + PSB	3.89	3.33	12.53	46.72	16.31
100% RDF + <i>Rh</i> + PSB	3.40	2.93	11.73	46.33	15.92
100% RDF + 2.5 t/ha VC	3.57	3.00	12.06	46.43	16.02
S.E.	0.27	0.179	0.565	0.45	0.368
CD (p 0.05)	0.80	1.85	1.658	1.32	1.080

RDF: Recommended dose of fertilizer, VC: Vermicompost, Rh: Rhizobium, PSB: Phosphorus solubilizing bacteria, DAS: Days after sowing, NS: Non significant. *Per unit fresh weight of leaf tissue (nmol/mg).

Integrated nutrient management *viz.*, 75% RDF + 2.5 t/ha VC + *Rh* + PSB significantly improved seed, straw, biological yield harvest index and nutrient content (Table 2) of mungbean followed by 100% RDF + 2.5 t/ha VC and 100% RDF + *Rh* + PSB. The highest seed yield of mungbean was obtained with the application of recommended dose of 75% RDF + 2.5 t/ha VC + *Rh* + PSB (12.34 q /ha) followed by treatments 100% RDF + 2.5 t/ha VC (12.05 q /ha) and 100% RDF + *Rh* + PSB (11.95 q /ha). The combined application of NPK increased availability of major nutrients to plant due to enhanced early root growth and cell multiplication leading to more absorption of other nutrients from deeper layers of soil ultimately resulting in increased plant growth attributes and finally increased yield. Further, the translocation and accumulation of

photosynthates in the economic sinks, resulted in increased grain, straw and biological yields. Increased yield attributes and yield by various workers have been reported at different places with INM practices Rajkhowa *et al.* (2003), Patel *et al.* (2003). The synergistic effect of *Rhizobium* and PSB as discussed above might have increased the growth, yield attributes and ultimately the yield in present investigation due to increased nitrogenous activity and available phosphorus status of soil. Similar finding was reported by Yadav *et al.* (2007), Meena and Sharma 2012.

Table 2 Effect of integrated nutrient management on yields, harvest index and nutrient content of mungbean.

Treatment	Yield (q /ha)			Harvest index (%)	N (%)		P (%)		P (%)	
	Seed	Straw	Biological		Seed	Straw	Seed	Straw	Seed	Straw
Control	7.29	24.74	32.04	22.74	3.27	1.22	0.350	0.141	0.860	1.108
50% RDF	8.55	27.09	35.64	23.99	3.46	1.54	0.368	0.169	1.043	1.184
75% RDF	10.25	28.78	39.03	26.25	3.69	1.77	0.373	0.187	1.267	1.205
100% RDF	11.30	29.83	41.13	27.45	3.85	1.89	0.419	0.212	1.432	1.213
50% RDF + <i>Rh</i> + PSB	9.85	28.38	38.23	25.76	3.66	1.75	0.385	0.198	1.243	1.197
50% RDF + 2.5 t/ha VC	10.05	28.59	38.64	26.02	3.73	1.81	0.356	0.188	1.308	1.228
50% RDF + 2.5t/ha VC + <i>Rh</i> + PSB	11.65	30.40	42.05	27.70	3.92	1.96	0.428	0.227	1.485	1.270
75%RDF + <i>Rh</i> + PSB	11.45	29.98	41.43	27.63	3.87	1.89	0.422	0.215	1.447	1.217
75% RDF + 2.5t/ha VC	11.55	30.23	41.78	27.63	3.91	1.92	0.425	0.220	1.475	1.252
75% RDF + 2.5t/ha VC + <i>Rh</i> + PSB	12.34	31.15	43.49	28.32	3.96	2.00	0.483	0.284	1.534	1.307
100% RDF + <i>Rh</i> + PSB	11.95	30.48	42.43	28.16	3.92	1.97	0.442	0.239	1.511	1.276
100% RDF+2.5 t/ha VC	12.05	30.58	42.63	28.26	3.94	1.99	0.454	0.242	1.519	1.303
S. E. ±	0.37	0.40	0.73	0.54	0.039	0.080	0.026	0.016	0.036	0.0266
CD (p = 0.05)	1.09	1.16	2.13	1.60	0.114	0.236	0.075	0.047	0.105	0.0780

RDF: Recommended dose of fertilizer, VC: Vermicompost, *Rh*: *Rhizobium*, PSB: Phosphorus solubilizing bacteria.

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