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Assessing Mungbean Productivity under Organic Management

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ABSTRACT

Background: Now a day's demand for organic food has increased. Being leguminous, requirement of nitrogen for mung is low. Soil organic matter could affect the soil microbial community and increase the crop growth and yield. In mungbean, roots have symbiotic rhizobia bacteria, which help in fixing atmospheric nitrogen into the soil. Nitrogen plays a major role in synthesis of protein, chlorophyll and plant enzymes of legume. The chemical fertilizers is used in huge quantity which hazards the soil and environment. Synthetic fertilizers have mainly macronutrients in large quantities and cemented the soil for worsening the soil and also the negative impact on crops, livestock and human being. The application of organic sources of nutrients improves the soil physical-chemical condition by adding macro and micronutrients both

Methods: A field experiment in *Kharif* season was conducted at Agronomy field of CCSHAU, Hisar, Haryana, to study the yield, quality and physiological parameters of mungbean under different organic sources. The experiment was conducted with nine treatments *viz*., T_1- RDF, T_2-FYM @ 5 t/ha, T_3-Vermicompost@ 2.5 t/ha, T_4-FYM @ 5t/ha + Rhizobium, T_5-Vermicompost @ 2.5 t/ha + Rhizobium, T_6-Green manuring +FYM @ 5 t/ha, T_7- Green manuring + Vermicompost @ 2.5 t/ha, T_8-Green manuring + FYM @ 5t/ha + Rhizobium and T_9-Green manuring + Vermi-compost @ 2.5 t/ha + Rhizobium in RBD replicated thrice.

Result: Application of recommended dose of fertilizer produced 6.93 and 4.04 percent higher yield as compared to green manuring + FYM @ 5t/ha + Rhizobium and green manuring + vermicompost @ 2.5 t/ha, respectively. The data revealed that the SPAD value of chlorophyll, RWC and LWP was higher with the application of various organic sources over to recommended dose of fertilizer.

Key words: FYM, Mungbean, Rhizobium, Vermicompost, Yield.

INTRODUCTION

Mungbean is one of the most important and hardiest crops among the pulses. It is a supplement of protein for vegetarian's people in the world. It has 25-26% protein, 3% vitamins and 51% carbohydrates (Mondal *et al*., 2012). It is widely grown as a short duration *Kharif* crop.

The requirement of fertilizer for the mungbean crop is not too high as it is a leguminous crop. In mungbean roots have symbiotic rhizobia bacteria which help in fixing atmospheric nitrogen into the soil (Anjum *et al*., 2006). For increasing the growth and yield of mungbean initial application of fertilizer is essential. Nitrogen plays a major role in synthesis of protein, chlorophyll and plant enzymes of legume. For enhancing vegetative growth, plant canopy and ultimately grain yield nitrogen nutrition is very necessary. The chemical fertilizers are used in huge quantity which hazards the soil and environment. Synthetic fertilizers have mainly macronutrients in large quantities and cemented the soil for worsening the soil and also the negative impact on crops, livestock and human being (Moller, 2009). For sustainable agriculture, emphasis should be on the use of organic fertilizer for growing crops (Tejada *et al*., 2009). The application of organic sources of nutrients improves the soil physical-chemical condition by adding macro and micronutrients both (Choudhry, 2005). Organic manures contain both macro and micronutrients and enhance soil fertility, soil porosity, infiltration rate, total carbon, water holding capacity, cation exchange capacity, reducing bulk density, check soil erosion and lead to the increasing availability of plant nutrients through mineralization. Green manuring of dhaincha (125 kg/ha nitrogen) provides an additional benefit to the succeeding crops as well as subsequent crops.

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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). So keeping these points in mind a field experiment was conducted to study the performance of mungbean under different organic sources.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* season of 2016 and 2017 at agronomy research field, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, to study the yield, quality and physiological parameters of mungbean under different organic sources. The experiment comprising with nine treatments *viz*., T_1- Recommended fertilizer dose, T_2- FYM 5 t/ha, T_3- Vermi-compost 2.5 t/ha,

T_4 - FYM 5t/ha + *Rhizobium*, T_5 - Vermicompost 2.5 t/ha + *Rhizobium*, T_6 - Green manuring + FYM 5 t/ha, T_7 - Green manuring + Vermicompost 2.5 t/ha, T_8 - Green manuring + FYM 5 t/ha + *Rhizobium* and T_9 - Green manuring + Vermicompost 2.5 t/ha + *Rhizobium* in RBD with three replications. The soil of the experimental fields was sandy loam in texture and slightly saline in reaction. The field is situated at 29°10′N latitude and 75° 46′ E longitudes at an elevation of 215.2 m above mean sea level. The soil (0-30 cm layer) had pH 8.1 (1:2.5 soil and water ratio), SOC 0.34%, available N 191.54 kg/ha, P 17.25 kg/ha and K 287 kg/ha.

The field was ploughed with disk harrow followed by rotavator and cultivator. Mungbean variety MH-421 was sown after pre-sowing irrigation using 18 kg/ha seed rate. A basal dose of 20 kg N as urea and 40 kg P_2O_5 as DAP was applied per hectare in case of recommended dose of fertilizer (T_1). FYM and vermicompost were applied in the field 15 days before sowing and mixed in soil. As per the treatments seeds were treated with *Rhizobium.* Mungbean phenological development was recorded on visual basis. The observations on plant height and dry matter accumulations were made at harvest, sun dried for 2 days and kept in an oven at 7±5°C for 48 h for recording dry weight. The crop was harvested manually, threshed for yield record.

RESULTS AND DISCUSSION

Effect on yield and yield attributes

The data revealed from Table 1 that source of organic nutrient have significant effect on number of seeds/pod, number of primary branches/plant 100-seed weight, grain and biological yield. Number of seeds/pod was significantly higher under green manuring + FYM 5 t/ha + Rhizobium and on par with FYM 5 t/ha +Rhizobium, green manuring + vermi compost 2.5 t/ha+ Rhizobium followed by green manuring + vermi compost 2.5 t/ha and recommended fertilizer dose during first year, while during second year green manuring + FYM 5 t/ha + Rhizobium produced significantly higher number of seeds/pod and found on par with FYM 5 t/ha +Rhizobium. Recommended fertilizer dose was on par with green manuring + vermicompost 2.5 t/ha, vermicompost 2.5 t/ha + Rhizobium. During first year, significantly higher grain yield was recorded under FYM 5 t/ha + Rhizobium and remained on par with vermicompost 2.5 t/ha. During first year, significantly lower gain yield was observed under green manuring + vermicompost 2.5 t/ha and green manuring + FYM 5 t/ha than other treatments. While during second year, green manuring + FYM 5 t/ha + Rhizobium produced significantly higher grain yield and it was on par with green manuring + vermicompost 2.5 t/ha over other treatments (Table 1). Recommended fertilizer treatment produced 6.93 and 4.04 per cent lower yield over green manuring + FYM 5t/ha + Rhizobium and green manuring + vermicompost 2.5 t/ha, respectively. This might be due to more primary branches, pods per plant and dry matter accumulation and translocation of nutrients and photosynthesis to reproductive parts leads to more yield. During second year similar pattern was followed for biological yield. These results are in conformity with those reported by Birla *et al*. (2018), Dhakal *et al*. (2015), Neelam *et al*., (2015) Bahadur and Tiwari (2014) and Wagadre *et al*. (2010).

Effect on physiological parameters and soil nutrients

From the study it is revealed that dry matter was non-significantly affected by the treatments during study at harvest. These finding was also in line with those reported by Rohit *et al*. (2013) and Sepehya *et al*. (2012).

Physiological parameters were significantly affected by organic nutrients during the study. The data revealed that SPAD value of chlorophyll, RWC and LWP were more under organic sources over the recommended fertilizer dose. Green manuring along with organic manure have more effect on SPAD value of chlorophyll and relative water content, this might be due to higher photosynthesis rate. Similar finding was also reported by Menon *et al*. (2010), Sharma

Table 1: Effect of organic nutrients on yield and yield attributes of mungbean crop.

Treatment	No. of seeds/pod		No. of primary branches/plant		100-seed weight (g)		Grain yield (kg/ha)		Biological yield (kg/ha)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Recommended fertilizer dose	8.5	8.7	2.8	2.7	5.03	4.81	493.78	433.78	4825	4254
FYM 5 t/ha	7.9	8.0	2.1	2.2	4.56	4.63	453.51	318.34	4079	3246
Vermicompost 2.5 t/ha	7.8	8.0	2.8	2.5	5.01	5.17	537.64	370.62	4605	3772
FYM5 t/ha + Rhizobium	8.9	9.1	3.1	2.4	4.93	5.21	545.79	358.77	4123	3684
Vermicompost 2.5 t/ha + Rhizobium	8.0	8.9	3.0	2.4	4.87	4.73	503.64	349.56	3377	3728
Green manuring + FYM 5 t/ha	8.1	8.3	2.3	2.2	4.60	4.56	425.79	327.20	3290.	3465
Green manuring + Vermicompost 2.5 t/ha	8.6	8.7	2.3	3.2	4.93	4.83	425.88	451.32	3947	4474
Green manuring + FYM 5 t/ha + Rhizobium	9.1	9.4	2.1	3.2	5.13	4.92	466.98	463.82	4474	4693
Green manuring + Vermicompost 2.5 t/ha + Rhizobium	8.7	8.0	3.1	2.7	4.86	4.52	509.13	431.14	4693	4298
CD (P0.05)	0.4	0.4	0.5	0.4	0.20	0.26	18.24	17.06	221	195

Table 2: Effect of organic nutrients on physiological parameters of mungbean crop.

Treatments	SPAD		RWC (%)		LWP		Plant height (cm)		DM at Harvest (g/m²)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Recommended fertilizer dose	27.08	23.73	67.52	59.39	16.33	28.3	74.17	71.5	15.38	15.9
FYM 5 t/ha	29.71	26.10	68.65	61.24	16.33	27.0	67.27	78.0	14.48	16.3
Vermicompost 2.5 t/ha	34.05	30.73	72.44	61.48	12.00	23.3	71.87	72.3	15.15	15.8
FYM5 t/ha + Rhizobium	30.88	31.08	75.39	61.35	12.33	22.0	70.47	67.8	15.02	15.0
Vermicompost 2.5 t/ha + Rhizobium	31.38	34.34	71.83	61.59	14.00	22.3	69.80	71.6	14.99	15.8
Green manuring + FYM 5 t/ha	34.68	38.08	75.19	64.24	11.33	18.3	68.13	70.9	14.86	15.1
Green manuring + Vermicompost 2.5 t/ha	33.78	38.28	74.32	67.56	12.67	17.0	72.77	74.3	15.25	15.7
Green manuring + FYM 5 t/ha + Rhizobium	39.47	40.10	75.12	68.05	12.67	16.7	76.00	77.0	15.48	15.4
Green manuring + Vermicompost 2.5 t/ha + Rhizobium	38.38	36.13	81.11	73.10	11.00	15.7	77.10	77.5	15.96	15.2
CD (P0.05)	1.87	1.24	2.81	3.01	0.84	0.79	4.6	3.7	NS	NS

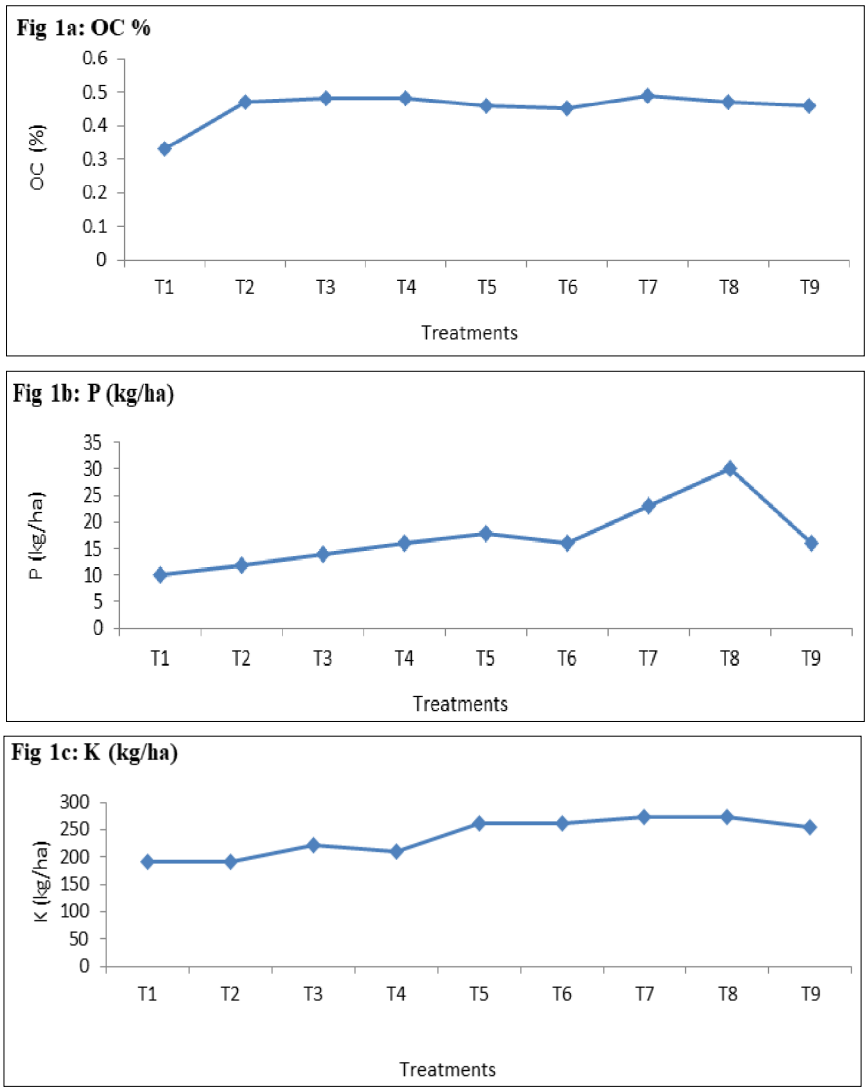


Fig 1: Study of organic carbon **(a)**, P kg/ha **(b)** and K kg/ha **(c)** status under different organic treatments (CD at 5% NS).

et al. (2014) and Birla *et al*. (2018). Leaf water potential has negative relation with SPAD and relative water content and the highest value of LWP were recorded under recommended fertilizer dose (Table 2).

Organic carbon content was affected by organic treatments and Fig 1a revealed that minimum organic carbon content was recorded under recommended fertilizer dose and higher organic carbon content was registered under green manuring + vermicompost 2.5 t/ha. The effect of organic treatments was also observed on available P and available K (Fig 1b and 1c). Minimum value of available P and available K (kg/ha) were observed under recommended dose of fertilizer (10 and 190.8 kg/ha, respectively) and maximum under green manuring + FYM 5 t/ha + Rhizobium (30 and 273.8 kg/ha). This might be due to incorporation of green manuring, which have high nitrogen and organic carbon and increase nutrient status of soil.

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