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Performance of different composts and biofertilizer on yield and quality of green gram (*Vigna radiata* L.)

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ABSTRACT : A field experiment was conducted at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, to study the performance of different composts and bio-fertilizers on growth, yield attributes and yield of green gram (*Vigna radiata* L.) under middle Gujarat conditions during *Kharif* season of the year 2010 on loamy sand soil. The results revealed that application of 100 per cent RDN from vermicompost (T_5) treatment significantly influenced the growth and yield attributes *viz.,* plant height, number of branches plant^{-1}, number of pods plant^{1}, test weight, seed and stover yield as well as protein content (%) over control. Application of 50 per cent RDN from vermicompost along with bio-fertilizers significantly increased root nodules over control.

Key Words : Green gram, Vermicompost, Composts, *Rhizobium*

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For sustainable agriculture emphasis should be given for using more organic manure and curtail use of chemical fertilizers. Under dwindling supply of traditional organic manures like FYM, composts and bio-fertilizers can have appreciable contribution to substitute FYM and can be an excellent option for chemical fertilizers too, particularly in the crops like pulses whose nutrient requirement is low. Among the pulses green gram (*Vigna radiata* L.) is one of the most important and extensively cultivated pulse crops, whose nutrient requirement is very low. In India, green gram is cultivated in about 3.44 million ha with production and productivity of 1.20 million tones and 351 kg ha^{-1}, respectively (Anonymous, 2011). In Gujarat, it is an important pulse crop grown throughout the state in an area of about 1.70 lakh ha with 5.97 lakh tones of production and 361 kg ha^{-1} productivity (Anonymous, 2010).

Composting of agricultural waste materials in conjunction with bio-fertilizers play an important role in improving the organic matter content of the soil and thereby improving soil productivity and yield along with partial replacement of mineral fertilizers (Sutaria *et al.,* 2010).

Green gram being a leguminous crop, meets its nitrogen requirements through symbiotic nitrogen fixation. Nodule formation can fix about 35 kg ha^{-1} atmospheric nitrogen through *Rhizobium* bacteria (Yadav, 1992). Similarly, phosphorus solubilizing bacteria (PSB) plays an important role in supplementing phosphorus to the plants. Since no study has been carried out for determining the performance of composts prepared by different methods and their effects along with biofertilizer like *Rhizobium* and PSB on *Kharif* green gram; this experiment was taken up.

RESEARCH PROCEDURE

A field experiment was conducted during *Kharif* season of the year 2010 at College Agronomy Farm, B. A. College of Agriculture, AAU, Anand, Gujarat. NADEP compost and Indore compost were prepared by using raw material of maize straw and cattle dung in the ratio of 75:25 whereas vermicompost was prepared by using the same raw material in the ratio of 25:75. The nutrient status of soil and different composts were determined. The soil of experimental area was sandy loam in texture, low in available nitrogen, medium in available phosphorus, high in potash and low in O.C content in soil with pH 7.8. The highest per cent of N (0.97%), P_2O_5 (0.93%) and O.C (3.17%) were recorded in the vermicompost, whereas K_2O content of vermicompost and FYM found the same (0.53%). The experiment laid out in Randomized Block Design with ten treatments and four replications was comprising of absolute Control (T_1), 100 per cent RDF (20-40-00 N-P-K kg ha^{-1})(T_2), 100 per cent RDN from compost prepared by NADEP technique(T_3), 100 per cent RDN from composts prepared by INDORE

technique (T_4), 100 per cent RDN from vermicompost (T_5), 100 per cent RDN from FYM (T_6), 50 per cent RDN from NADEP technique + biofertilizer (T_7), 50 per cent RDN from INDORE technique+ biofertilizer(T_8), 50 per cent RDN from vermicompost technique + biofertilizer (T_9) and 50 per cent RDN from FYM + biofertilizer (T_{10}). At the time of sowing seeds were inoculated with liquid *Rhizobium* culture @ 5 ml kg^{-1} of seeds; whereas PSB culture was applied in the soil @ 1 l ha^{-1} for the treatments T_7 to T_{10}. Phosphorus was applied through SSP in treatments T_2 to T_{10}. For the treatments T_3 to T_{10} phosphorus was adjusted according to the quantity of organic material applied and the rest of phosphorus was compensated through SSP. Green gram variety GM-4 was sown by drilling at a spacing of 30 ×10 cm under dry condition, followed by light irrigation with recommended seed rate 20 kg ha^{-1}.

RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation have been duscussed below:

Growth and yield attributes:

Results pertaining to all growth and yield attributing characters are presented in Table 1. Growth attributes such as plant height, number of branches $plant^{-1}$ and number of root nodules $plant^{-1}$ were recorded significant differences when composts prepared by different techniques were applied with and without bio-fertilizers as compared to control. Treatment T_5 (100 % RDN from vermicompost) ranked first followed by treatment T_9 (50 % vermicompost along with biofertilizer) and treatment T_2 (100 % RDF from chemical fertilizer) for the parameters like plant height (66.98 cm) and number of branches $plant^{-1}$ (9.70). However, significantly higher number of root nodules $plant^{-1}$ was recorded under treatment T_9 which was followed by T_5 (100 % RDN from vermicompost). Significant differences were also observed for yield attributing characters *viz*., number of pods $plant^{-1}$ (24.60) and test weight (44.24 g) of green gram when different composts were applied with and without bio-fertilizers. The trend remained unchanged as in case of growth attributes and treatment T_5 remained statistically superior over other treatments; however, treatment T_9 recorded significantly higher root nodules $plant^{-1}$(17.88).

Yield attributing characters like pod length, number of seeds pod^{-1} and harvest index were not influenced significantly due to different composting techniques with and without bio-fertilizers treatments. This might be due to the reason that high microbial mass from vermicompost might contribute to plant growth by supplying various plant growth regulating substances and hormones (Frankenberger and Arshad, 1995). Furthermore, higher availability of organic carbon from vermicompost might lead to multiplication of micro organisms which in turn might influence soil physical and chemical properties leading to improved nutrient availability for a longer period of time resulting in maximum growth and yield attributes of plant. Similar trends were also observed by Rajkhowa *et al*. (2002) and Kumar and Uppar (2007).

Nitrogen content in seed and protein content were also significantly affected due to different composting techniques with and without biofertilizer treatment and T_5(100% RDN from vermicompost) recorded the highest nitrogen content in seed and protein content along with T_9 and T_2. Higher protein content in 100 per cent RDN from vermicompost (T_5) may be due to root enlargement; better microbial activities resulted in more availability and uptake of nitrogen and increased protein content in seed. These results are in agreement with those of Parthasarathi *et al*. (2008).

Table 1 : Effect of different composts and biofertilizer on yield attributes and quality of *Kharif* green gram

Treatments	Plant height (cm) at harvest	No. of branches $plant^{-1}$	No. of root nodules $plant^{-1}$	No. of pods $plant^{-1}$	No. of seeds pod^{-1}	Pods length (cm)	Number of seeds pod^{-1}	1000 test weight (g)	Seed nitrogen content (%)	Protein content %
T_1	52.88	7.95	11.50	17.35	9.25	7.15	9.25	37.77	3.18	19.86
T_2	61.35	9.30	13.60	21.00	10.40	7.46	10.40	41.15	3.59	22.43
T_3	57.95	8.65	12.55	19.35	9.60	7.35	9.60	38.56	3.33	20.82
T_4	59.15	8.70	12.58	18.85	9.65	7.32	9.65	39.34	3.44	21.49
T_5	66.98	9.70	15.20	24.60	10.65	7.77	10.65	44.24	4.21	26.29
T_6	58.80	8.70	12.83	19.85	9.85	7.34	9.85	39.24	3.37	21.01
T_7	57.70	8.75	14.50	19.80	9.90	7.32	9.90	38.76	3.52	22.00
T_8	58.35	8.65	14.05	20.10	9.95	7.39	9.95	38.75	3.36	21.01
T_9	61.43	9.45	17.88	21.48	10.30	7.50	10.30	41.91	3.79	23.71
T_{10}	58.90	8.75	15.00	19.90	10.05	7.42	10.05	39.32	3.54	22.14
S.E. (±)	2.37	0.31	0.98	1.25	0.29	0.19	0.29	1.28	0.17	1.05
C.D. (P=0.05)	6.88	0.91	2.85	3.63	NS	NS	NS	3.71	0.49	3.03

NS=Non-significant

Table 2 : Effect of different composts and biofertilizer on yield and economics of *Kharif* green gram

Treatments	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Income (`. ha^{-1})		Gross income (`. ha^{-1})	Gross expenditure (`. ha^{-1})	Net realization (`. ha^{-1})	BCR
			Seed	Stover				
T_1	658	2797	29610	2377	31987	11933	20054	1: 2.68
T_2	828	3303	37260	2808	40068	13424	26644	1:2.98
T_3	715	3032	32175	2577	34752	17934	16818	1:1.94
T_4	723	3085	32535	2622	35157	25509	9648	1:1.38
T_5	868	3660	39060	3111	42171	16624	25547	1:2.54
T_6	723	3078	32535	2616	35151	19665	15486	1: 1.79
T_7	735	3161	33075	2687	35762	15099	20663	1: 2.37
T_8	738	3159	33210	2685	35895	18887	17008	1: 1.90
T_9	830	3379	37350	2872	40222	14443	25779	1: 2.78
T_{10}	740	3103	33300	2638	35938	15964	19974	1: 2.25
S.E. (±)	40.44	152.27	-	-	-	-	-	-
C.D. (P=0.05)	117.34	441.85	-	-	-	-	-	-

Note : Seed @ `. 45 $^{-1}$, Stover @ `. 0.85 kg^{-1}

Yield:

The seed yield and stover yield remarkably influenced due to different composting techniques. It was revealed from the data (Table 2) that application of 100 per cent RDN from vermicompost (T_5) recorded significantly higher seed yield of 868 kg ha^{-1} and stover yield of 3660 kg ha^{-1} which remained at par with treatment T_9 and T_2. Application of 100 per cent RDN from vermicompost (T_5) showed 24.1 per cent and 23.5 per cent higher seed yield and stover yield over control, respectively. This might be due to the reason that prolong availability of nutrients might increase number of branches and number of pods plant^{-1}, plant height, number of nodules plant^{-1} and test weight which were important growth and yield attributes having significant correlation and augmenting the seed and stover yield. Furthermore, because of prolonged availability of moisture due to organic manure might be resulted into increased uptake of nutrients, release of phytohormones and organic acids which provided food for the beneficial bacteria. The higher availability of N and P might have contributed to higher yield by the application of vermicompost. Besides this, slow release of nutrients from decomposed organic matter, loosening of soil due to organic matter application and significant nitrogen fixation might be the probable reasons for the maximum plant growth and grain yield. These results are in agreement with those of Abraham and Lal (2003), Kumar and Uppar (2007) and Saha *et al*. (2008).

Economics:

Data on economics presented in Table 2 indicated that recommended dose of fertilizers (T_2) gave the maximum net realization of Rs. 26644 ha^{-1} followed by T_9 *i.e.* 50 per cent RDN from vermicompost along with biofertilizer (Rs. 25779 ha^{-1}) and T_5 *i.e.* 100 per cent RDN from vermicompost (Rs. 25547 ha^{-1}) which were to the tune of about 25 per cent, 22 per cent and 21 per cent over control (T_1), respectively. This was because of the lower fertilizers requirement of green gram and higher rate of composts.

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