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RESEARCH PAPER

Effect of vermicompost and zinc on yield attributes, yield and quality of green gram [*Vigna radiata* var. *aureus* (L.) wilczek] in arid western Rajasthan

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Abstract : A field experiment was conducted during *Kharif* season to find out the Response of green gram [*Vigna radiata* var. *aureus* (L.) wilczek] to vermicompost and zinc application in arid western Rajasthan. The treatments comprised of five organic manure (Control, FYM @ 10 tha^{-1}, vermicompost @ 5 tha^{-1}, vermicompost @ 7.5 tha^{-1} and vermicompost @10 tha^{-1}) and four spray of zinc sulphate (control, at initiation of branching, at initiation of flowering and at initiation of branching as well as flowering) were laid out in randomized block design. Application of increasing levels of vermicompost from 5 to 7.5 t ha^{-1} significantly enhanced the pods per plant, pod length, grains per pod, test weight, grain yield, straw yield, biological yield, harvest index, NPK and Zn, content in seed and straw and protein content in seed of green gram. Further an application of foliar spray of zinc at both branching and flowering stage in green gram significantly increased the pods per plant, pod length, grains per pod, test weight, grain yield, straw yield, biological yield, harvest index, NPK and Zn, content in seed and straw and protein content in seed of green gram as compared to single application of foliar spray of zinc at branching as well as flowering and control.

Key Words : Green gram, Organic manure, Zinc, Yield attributes, Yield, Quality

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INTRODUCTION

Green gram [*Vigna radiate* (L.) wilczek var. aureus] commonly known as Moong is an important pulse crop of India. Green gram seeds contain about 25 per cent protein of high digestibility and better quality. Sprouted seeds synthesize vitamin-C in them. It is also a good source of riboflavin and thiamin. The pulses are the chief sources of protein in a balanced diet in Indian conditions and contribute about 15 per cent of diet (Kumar and Ali, 2001).

The world's arable land resources are finite and there is not much scope for significantly expending the area of land under cultivation. Hence, most of the increase in agricultural production will have to be obtained through increased productivity from the existing agricultural land. This can be achieved by improved management practices in general and fertilizer management in practices in particular. Amongst various factors that limit the yield of green gram are poor soil fertility and its management has been recognized as one of the important constraint in green gram production. Since, the soils of North- Western Rajasthan are very low in organic matter as well as major and micro nutrients essential for healthy crop growth.

The effect of environment on plant root rhizosphere is in the focus these days. Today, use of organic matter in soil is being promoted at various forums for maintaining soil quality and crop yield sustainability. Vermicompost is dropping of earthworms after the intestinal digestion of organic matter; these dropping are high in nutritive value. Since vermicompost helps in enhancing the activity of micro-organisms in soils which further enhance solubility of nutrients and their consequent availability to plants is known to be altered by micro- organisms by reducing soil pH at micro sites, chelating action of organic acids producing by

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them and intraphyl mobility in fungal filaments (Chhonkar, 2002). Thus, in organic carbon deficient arid and semi arid soils, vermicompost would not only increase organic carbon status of soil but also increase the soil water holding capacity, soil flocculation and crop production sustainable one (Rajkhowa *et al.*, 2000).

Further, zinc application in field crops is an important as that of major nutrients in present day agriculture. Increasing cultivation of higher fertilizer responsive genotypes, lack of use of organic manures and high cropping intensity have been affecting the zinc status in soils, therefore, zinc deficiency become one of the major constraints for crop productivity. Thereafter, the present investigation was undertaken to find out the effect of vermicompost and zinc on growth attributes of green gram.

MATERIAL AND METHODS

The experiment was conducted at College of Agriculture, Bikaner during summer season. The soil was loamy sand and low in organic matter. The soil pH was 8.3. It was low in organic carbon (0.07 %), available nitrogen (65.48 kg ha^{-1}) and available phosphorus (9.56 kg ha^{-1}) and medium in potassium (160.22 kg ha^{-1}). The treatments comprised of five organic matter (Control, FYM @ 10 tha^{-1}, vermicompost @ 5 tha^{-1}, vermicompost @ 7.5 tha^{-1} and vermicompost @10 tha^{-1}) and four spray zinc sulphate (control, at initiation of branching, at initiation of flowering and at initiation of branching as well as flowering) were laid out in randomized block design with three replications. Vermicompost and well decomposed FYM were applied as per treatment at the time of sowing and were thoroughly incorporated in soil with the help of spade. The calculated quantity of zinc sulphate spray was applied as per treatment at initiation of branching and flowering stage. Green gram variety RMG-62 was sown at 15 kg ha^{-1}in line spaced at 30 cm at a depth of 5 cm by "Kera" method in open furrow.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of organic manure:

Data (Table 1 and 2) reveled that application of organic manure improved the yield parameter and nutrient content of the green gram as compared to control. Application of increasing levels of vermicompost from 5 to 7.5 t ha^{-1} significantly enhanced the pods per plant, pod length, grains per pod, test weight, grain, straw and biological yield, harvest index, nitrogen, phosphorus, potassium, zinc content in grain and straw and protein content in grain. Further increase of vermicompost up to 10 tha^{-1} the effect was found to be at par with vermicompost at 7.5 t ha^{-1}. The effect of FYM 10 t ha^{-1} at par with the vermicompost at 5 tha^{-1} was also significantly increased yield parameter and nutrient content in green gram as compare to control.

The magnitude of increase under vermicompost 7.5 t ha^{-1} were 46.50, 10.51 and 8.18 per cent in pods per plant, 60.41, 11.81 and 5.08, per cent in pod length, 71.53, 13.45 and 10.65 per cent in grains per pod, 11.90, 1.39 and 0.18 per cent in test weight, 91.75, 10.20 and 8.03 per cent in grain yield, 20.95, 17.81 and 7.38 per cent in straw yield, 38.62, 9.40 and 7.60 per cent in biological yield, 38.36, 0.73 and 0.41 per cent in harvest index, 29.84, 8.90 and 7.46 per cent in nitrogen content in grain, 28.37, 8.76 and 7.23 per cent in nitrogen content in straw, 33.42, 9.60 and 7.91 per

Table 1: Effect of vermicompost and foliar spray of zinc on yield attributes and yield of green gram

Treatments	Pods/ plant	Pod length (cm)	Grains/ pod	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
Organic manure								
Control	14.00	4.90	4.18	30.01	4.00	12.03	16.03	24.95
FYM@ 10tha^{-1}	18.56	7.03	6.32	33.12	6.96	12.35	20.31	34.27
Vermicompost @ 5tha^{-1}	18.96	7.48	6.48	33.64	7.10	13.55	20.65	34.38
Vermicompost @ 7.5tha^{-1}	20.51	7.86	7.17	33.58	7.67	14.55	22.22	34.52
Vermicompost @10tha^{-1}	20.87	7.98	7.25	33.95	7.78	14.65	22.43	34.86
S.E..±	0.34	0.19	0.14	0.66	0.16	0.34	0.51	0.81
C.D. (P=0.05)	0.99	0.55	0.40	1.91	0.47	0.97	1.47	2.33
Foliar spray of $ZnSO_4$ (0.5%)								
Control	15.05	5.12	4.70	31.54	4.60	11.74	16.34	28.10
At initiation of branching	19.16	7.44	6.62	33.35	7.12	13.80	20.92	33.97
At initiation of flowering	19.22	7.50	6.65	33.92	7.18	13.85	21.03	34.07
At initiation of branching + flowering	20.89	8.14	7.14	35.83	7.91	15.11	23.02	34.26
S.E..±	0.30	0.17	0.12	0.59	0.14	0.13	0.45	0.72
C.D. (P=0.05)	0.89	0.49	0.36	1.70	0.42	0.87	1.31	2.00

cent in phosphorus content in grain, 34.21, 10.39 and 7.59 per cent in phosphorus content in straw, 33.96, 10.12 and 8.01 per cent in potassium content in grain, 33.79, 10.19 and 8.04 per cent in potassium content in straw, 33.29, 10.31 and 7.94 per cent in zinc content in grain, 33.67, 10.36 and 7.98 per cent in zinc content in straw, 19.12, 7.13 and 5.03 per cent in protein content in grain over control, FYM 10 t ha^{-1} and vermicompost at 5tha^{-1}, respectively.

It is established fact that vermicompost improve the physical, chemical and biological properties of the soil including supply of almost all the essential plant nutrients for the growth and development of plant. Humic acid in vermicompost enhances the availability of both native and added micro- nutrients in soil and thus plant growth, yield attributes and yield increased. Similar results were also observed by Rajkhowa *et al.* (2000).

Effect of zinc application:

Further an application of foliar spray of zinc at both branching and flowering stage in green gram significantly increased the pods per plant, pod length, grains per pod, test weight, grain, straw and biological yield, harvest index, nitrogen, phosphorus, potassium, zinc content in grain and straw and protein content in grain of green gram as compare to single application of foliar spray of zinc at branching as well as flowering and control. However, single application of foliar spray of zinc at branching as well as flowering also enhanced the yield attributes and nutrient content of green gram over control (Table 1 and 2).

The significant increase due to application of foliar spray of zinc at branching, foliar spray of zinc at flowering and foliar spray of zinc at both branching + flowering, was 27.31, 27.71 and 38.80 per cent in pods per plant, 45.31, 46.48 and 58.98 per cent in pod length, 40.85, 41.49 and 51.91 per cent in grains per pod, 5.74, 7.55 and 13.60 per cent in test weight, 54.78, 56.09 and 71.96 per cent in grain yield, 17.55, 17.97 and 28.71 per cent in straw yield, 28.03, 28.70 and 40.88 per cent in biological yield, 20.89, 21.25 and 21.92 per cent in harvest index, 16.80, 17.88 and 28.20 per cent in nitrogen content in grain, 17.04, 17.28 and 26.41 per cent in nitrogen content in straw, 20.90, 23.54 and 35.45 per cent in phosphorus content in grain, 19.70, 20.71 and

Table 2 : Effect of vermicompost and foliar spray of zinc on N, P, K, Zn and protein content of green gram

Treatments	Nitrogen content (%)		Phosphorus content (%)		Potassium content (%)		Zinc content (ppm)		Protein content in seed (%)
	Seed	Straw	Seed	Straw	Seed	Straw	Seed	Straw	
Organic manure									
Control	2.761	1.664	0.368	0.190	1.007	1.326	23.04	13.87	18.04
FYM@ 10tha^{-1}	3.292	1.964	0.448	0.231	1.225	1.610	27.84	16.80	20.06
Vermicompost @ 5tha^{-1}	3.336	1.992	0.455	0.237	1.249	1.642	28.45	17.17	20.46
Vermicompost @ 7.5tha^{-1}	3.585	2.136	0.491	0.255	1.349	1.774	30.71	18.54	21.49
Vermicompost @10tha^{-1}	3.626	2.144	0.498	0.262	1.370	1.798	30.96	18.87	21.55
S.E..±	0.084	0.049	0.009	0.0058	0.0259	0.347	0.656	0.393	0.328
C.D. (P=0.05)	0.242	0.140	0.027	0.0168	0.074	0.099	1.88	1.12	0.94
Foliar spray of $ZnSO_4$ (0.5%)									
Control	2.869	1.719	0.378	0.198	1.053	1.385	24.06	14.48	19.46
At initiation of branching	3.351	2.012	0.457	0.237	1.253	1.647	28.49	17.19	20.55
At initiation of flowering	3.382	2.016	0.467	0.239	1.263	1.660	28.78	17.40	20.56
At initiation of branching + flowering	3.678	2.173	0.512	0.266	1.391	1.828	31.67	19.13	20.71
S.E..±	0.075	0.044	0.008	0.0052	0.0232	0.031	0.587	0.351	0.293
C.D. (P=0.05)	0.216	0.126	0.024	0.0151	0.066	0.089	1.68	1.00	0.84

Table 3 : Interaction effect of vermicompost and foliar spray of zinc on grain yield of green gram

Treatments	Grain yield (q ha^{-1})			
	Zn_0	Zn_b	Zn_f	Zn_{b+f}
Control	2.80	4.33	4.37	4.49
FYM @ 10 tha^{-1}	4.87	7.39	7.68	7.89
Vermicompost @ 5 tha^{-1}	4.97	7.54	7.61	8.28
Vermicompost @ 7.5 tha^{-1}	5.37	8.07	8.22	9.03
Vermicompost @10 tha^{-1}	4.99	8.26	8.03	9.86
S.E.±	0.33			
C.D. (P = 0.05)	0.95			

34.34 per cent in phosphorus content in straw, 18.99, 19.94 and 32.10 per cent in potassium content in grain, 18.92, 19.86 and 31.99 per cent in potassium content in straw, 18.41, 19.62 and 31.63 per cent in zinc content in grain, 18.72, 20.17 and 32.11 per cent in zinc content in straw, 5.60, 5.65 and 6.42 per cent in protein content in grain of green gram, respectively, over control.

This might be due to quick supply of adequate amount available zinc to meet out the demand of growing plant as the DTPA extractable zinc content of the experimental soil was low (0.36 ppm). Zinc plays a vital role in plant nutrition, which is clear from its involment in process of photosynthesis and sugar translocation. The increase in seed and straw yields due to foliar application of zinc might be due to the concomitant increase in number of pods per plant, number of seeds per pod and test weight, which is clear from positive correlation between yield and yield attributing characters. These results are in conformity to those of Rizk and Abdo (2001) and Mali *et al.*(2001).

Interaction effect of organic manure and foliar spray of zinc on grain yield:

Interaction between vermicompost and foliar spray of zinc (Table 3) clearly indicate that foliar spray of zinc at initiation of branching resulted into positive interaction with increasing doses of vermicompost increased grain yield by 1.53 to 3.27 q ha^{-1} over control. Application of vermicompost at 7.5 t ha^{-1}resulted in to higher grain yield when it was applied with foliar spray of zinc (Zn_{b+f}) as compared to earlier Zn_b or Zn_f. But it is further evident from data that foliar spray of zinc gave the highest yield (9.86 q ha^{-1}) when applied at both stages (at initiation of branching+ at initiation of flowering) with the highest doses of vermicompost (10 t ha^{-1}).

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