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RESEARCH PAPER

Effect of vermicompost, diammonium phosphate and zinc sulphate on growth, yield attributes and yield of chickpea (*Cicer arietinum* L.)

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Abstract : To know the effect of vermicompost, diammonium phosphate and zinc sulphate on the growth, yield attributes and yield of chickpea (*Cicer arietinum* L.), the field experiment was carried out during *Rabi* season of the year 2009-10 at the College Agronomy Farm, B. A. College of Agriculture, Anand. Twelve treatment combinations comprising two levels of vermicompost (0 and 1.25 t/ha), three levels of diammonium phosphate (0, 50 and 100 kg/ha) and two levels of zinc sulphate (0 and 25 kg/ha) were tested in a factorial randomized block design with four replications. Application of 1.25 t vermicompost/ha recorded significantly higher seed yield over control. Higher dose of 100 kg DAP /ha gave significantly higher no. of nodules, pods/plant, seed wt. /plant over lower level of 50 kg DAP/ha and 0 kg DAP/ha and being at par with 50 kg DAP/ha, gave significantly higher seed yield over 0 kg DAP/ha. The number of pods/plant were significantly higher in 25 kg $ZnSo_4$/ha but, it did not affect the yield of chickpea. The treatment combination of 1.25 t vermicompost/ha + 100 kg DAP/ha + 25 kg $ZnSo_4$/ha recorded significantly higher seed yield than other treatment combinations, but was at par with treatment combinations $V_1P_1Zn_0$.

Key Words : Vermicompost, Zinc sulphate, Chickpea, Diammonium phosphate

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INTRODUCTION

Pulses have an inherent capacity to fix atmospheric nitrogen and adaptability to a wide range of agro-ecological situations and variable management practices. Pulses are also considered as a vegetarian diet with the cheapest source of protein. As per looking the demand of the crop, there is a possibility of raising the production per unit area by efficient and judicious use of nutrients. Vermicompost, DAP and zinc sulphate are potential nutrient sources, which enhances the macro and micro plant nutrients, growth enhancing substances such as auxins and gibberellins and number of beneficial microorganisms like nitrogen fixing, P-solubilizing and cellulose decomposing organism and also supplies most required nutrients like nitrogen and phosphorus.

MATERIALS AND METHODS

Twelve treatment combinations comprising two levels of vermicompost (0 and 1.25 t/ha), three levels of diammonium phosphate (0,50 and 100 kg/ha) and two levels of zinc sulphate (0 and 25 kg/ha) were tested in a Factorial Randomized Block Design with four replications. The crop was sown at a spacing of 30cm x 10cm on 3rd December, 2009 during *Rabi* season of the year 2009-10 at the College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand having the loamy sand soil in texture, low in organic carbon and nitrogen, medium in available phosphorus, and high in available potassium.

The observation of fresh weight of root nodules/plant (mg) was taken at 45 days after sowing from three randomly selected plants in each net plot. The root nodules were oven

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dried at 70^{0}C till the constant weight of root nodules/plant (mg) was obtained. The growth and yield attributes were recorded from the previously tagged five plants at the time of harvest. The seed yield in kg was recorded per net plot and then calculated on hectare basis (kg/ha), while the dry gotar yield was obtained by deducting the grain yield from the total produce (biological yield).

RESULTS AND DISCUSSION

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

Effect of vermicompost:

Vermicompost treatments had not showed any appreciable influence in respect of growth and yield attributes (Table 1). Though number of branches/plant, number of pods/plant, seed weight/plant and dry gotar yield showed non significant response to different vermicompost treatments, the seed yield was significantly increased by application of 1.25 vermicompost t/ha.

The results revealed that the seed yield was remarkably increased (1356 kg/ha) due to treatment 1.25 t vermicompost/ha as compared to treatment V_0 (1215 kg/ha) and the increment was 11.9 per cent over no application of vermicompost. The constant and optimal supply of nutrients through application of vermicompost resulted in significant positive influence on seed yield. These findings are in accordance with those of Rajkhowa *et al.* (2002), Kumari and Kumari (2002) and Jat and Ahlawat (2002).

Effect of diammonium phosphate:

Number of root nodules/plant, pods/plant, and seed weight/plant were significantly influenced by diammonium phosphate treatments (Table 1). Higher dose of P_2 (100 kg DAP /ha) gave significantly higher no. of root nodules/plant, no. of pods/plant as well as the seed wt./plant over lower levels of P_1 (50 kg DAP/ha) and P_0 (0 kg DAP/ha). Similarly, application of P_2 (100 kg DAP /ha) also gave significantly higher seed yield (1384 kg/ha) than P_0 (0 kg DAP/ha). Application of 50 kg DAP/ ha recorded seed yield of 1297 kg/ha, which was at par with P_0 (0 kg DAP/ha). The significant improvement in growth of chickpea due to increase in diammonium phosphate treatments was probably due to better root growth on account of additional P nutrition as reported by Joseph and Verma (1994). The better root growth facilitated more area for nodule formation. The result pertaining to the number of branches/plant (Table 1) and dry gotar yield (Table 1) showed non-significant response to different diammonium phosphate treatments.

Nitrogen and phosphorous play a vital role in plant nutrition and ultimately concerned with vital functions of plant. The increase in yield due to diammonium phosphate may be also attributed to better growth and development as observed by more number of pods (Table 1). This might be due to its adequate supply resulting in enhanced carbohydrate and protein synthesis and rate of metabolic activities through

Table 1: Effect of different treatment on growth, yield attributes and yield of chickpea

Treatments	Pl. height at harvest (cm)	No. of branches/ plant	No. of pods/ plant	Seed weight/plant (g)	No. of root nodules/ plant	Dry weight of nodules/ plant(mg)	Seed yield (kg/ha)	Gotar yield (kg/ha)
Vermicompost (V)								
V_0:0 t/ha	43.89	18.51	54.70	11.07	40.33	314.5	1215	1260
V_1: 1.25 t/ha	44.73	19.80	55.15	11.33	42.17	322.3	1356	1273
S.E. $\pm$	0.76	0.49	0.56	0.36	0.82	4.1	46	44
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	131	NS
Diammonium phosphate (P)								
P_0: 0 Kg/ha	43.75	18.67	53.78	10.33	39.50	315.1	1174	1244
P_1: 50 Kg/ha	44.81	19.18	54.41	10.60	39.63	316.9	1297	1269
P_2: 100 Kg/ha	44.36	19.62	56.59	12.66	44.63	323.1	1384	1288
S.E. $\pm$	0.93	0.60	0.69	0.44	1.00	5.0	56	54
C.D. (P=0.05)	NS	NS	1.98	1.28	2.88	NS	160	NS
Zinc sulphate (Zn)								
Zn_0 : 0 Kg/ha	44.03	18.91	53.55	10.78	40.54	318.1	1266	1260
Zn_1: 25 Kg/ha	44.58	19.40	56.30	11.61	41.96	318.7	1304	1273
S.E. $\pm$	0.76	0.49	0.56	0.36	0.82	4.1	46	44
C.D. (P=0.05)	NS	NS	1.61	NS	NS	NS	NS	NS

Note: Vermicompost - V_0 =0 t/ha, V_1= 1.25 t /ha; Diammonium phosphate - P_0 = 0 t /ha, P_1 = 50 kg/ ha, P_2 = 100 kg /ha; and Zinc sulphate - Zn_0 = 0 kg/ ha, Zn_1 = 25 kg /ha NS=Non-significant increased leaf area and its efficient utilization in protein synthesis resulting in bold grains. The results are confirmed by the findings of Kumar *et al*. (2002).

Effect of zinc sulphate:

The growth and yield attributes like number of branches/ plant, number of root nodules/plant and dry weight of root nodules/plant were not affected significantly due to zinc sulphate treatments. Likewise the seed and dry gotar yields were also not affected due to zinc sulphate treatments. However, treatment Zn_1 (25 kg $ZnSO_4$/ha) gave significantly higher number of pods/plants (56.30) and the per cent increase in number of pods/plant under treatment Zn_1 was to the tune of 6.30 over Zn_0 (control). This was might be due to large number of new sinks leading to greater activity of zinc attributed its role in metabolic activity mainly in protein synthesis of the plant. This resulted in to higher photosynthetic rate, translocation and accumulation of metabolites in the sink and by reducing flower drop, which ultimately increased number of pods/plant. The similar findings were observed by Ahmed *et al.* (1986).

Interaction effects:

The treatment combination $V_1P_2Zn_1$ (1.25 t vermicompost /ha + 100 kg DAP/ha + 25 kg $ZnSO_4$/ha) recorded significantly higher seed yield (1600 kg/ha) than other treatment combinations (Table 2), but was at par with treatment combination $V_1P_1Zn_0$, which recorded the second highest seed yield (1550 kg/ha) and was also significantly superior than $V_0P_1Zn_0$, $V_0P_0Zn_1$ treatment combinations. The lowest seed yield (988 kg/ha) was recorded under treatment combination $V_0P_0Zn_0$.

Table 2 : Interaction effect of vermicompost x diammonium phosphate x zinc sulphate on seed yield

Treatments	Seed yield (kg/ha)	
	Zn_0	Zn_1
V_0P_0	988	1338
V_0P_1	1113	1288
V_0P_2	1325	1100
V_1P_0	1110	1263
V_1P_1	1550	1238
V_1P_2	1375	1600
S.E. ±	111.59	
C.D. (P=0.05)	321.08	
C. V. %	17.37	

Note: Vermicompost - V_0 =0 t/ha, V_1= 1.25 t /ha;
Diammonium phosphate - P_0 = 0 t /ha, P_1 = 50 kg/ ha, P_2 = 100 kg /ha; and
Zinc sulphate - Zn_0 = 0 kg/ ha, Zn_1 = 25 kg /ha

Thus, it is concluded that for obtaining higher yields with better quality and higher net return, the chickpea should be applied vermicompost @ 1.25 t/ha alongwith diammonium phosphate @ 50 kg/ha in loamy sand soil under middle Gujarat agro-climate conditions.

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