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Effect of Phosphorus, Sulphur and Zinc on Plant height, Green leaves, Pod per plant, Grain yield per plant and Straw yield per plant of Black gram

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Abstract

The experiment was conducted in Kharif season (July- October) at Agriculture research farm of Raja Balwant Singh College Bichpuri, Agra (Uttar Pradesh) to assess the effect of phosphorus, sulphur and zinc on plant height , green leaves, pod per plant yield and straw yield per plant of Black gram. The treatment resulted in increased plant height, green leaves, Number of pod per plant, per plant grain and straw yield up to 40 kg sulphur and 60 kg phosphorus per hectare and superiority maintained as compared to control plot. The present experiment was conducted in split plot design with three replication, three levels of phosphorus 0 kg, 30 kg, 60 kg per hectare; three levels of sulphur 0 kg, 20 kg 40 kg per hectare and three levels of zinc 0 kg, 5 kg, 10 kg per hectare, 27 treatment combinations and 81 plots were used to conduct this study.

Keywards: Black gram; Plant yield; Zinc; Sulphur; Phosphorus; Control plot

Introduction

Black gram is important grain legume crop of rainfed agriculture in the semi-arid tropic. Legumes are rich source of protein common masses especially vegetarian. In complete both grains and stalk of legumes contain good amount of protein and minerals which are essential for the growth and development of human and animal body. India produced 22.09 million tonnes pulse during 2008-09. Important states producing black gram are Maharashtra, Uttar Pradesh, Andhra Pradesh, Orrisa, Tamil Nadu, Rajasthan, Chhattisgarh and Madhya Pradesh. Fluctuation in area, Production and productivity of black gram was observed in the past few years due variation in market rates, rainfall, Poor nutrient management and other factors. Sulphur is one at the sixteen nutrient elements which all plants must have for normal growth and development. Plants deficient in an essential nutrient have poor growth, give low yield and the produce is also inferior quality. The sulphur application in to increasing the yield of crop. Improved the quality of produce and phosphorus play a very vital role in crop production in black gram (Pulses).

Productivity per hectare increased of Black gram crop, it can only possible by providing all necessary inputs at optimum of the crop. Out of these inputs sowing of crop at optimum time and proper nutrient managements are much importance keeping above aspects in mind, an experiment was conducted to study the effect of phosphorus, sulphur and zinc on plant height, green leaves, pod per plant grain yield per plant and straw yield per plant of black gram.

Materials and Methods

A field experiment was conducted at agriculture research farm of Raja Balwant Singh College Bichpuri Agra (Uttar Pradesh) which is situated above 11km to the south west of Agra city on Agra Bharatpur road. Field experiment was carried out for two consecutive years to assess the effect of phosphorus, sulphur and zinc on plant height, green leaves, pod per plant, grain yield per plant and straw yield per plant of Black gram

Table 1: Mechanical Analysis of the soil

Component	Content		Methods of determination
	02-03	03-04	
Sand %	60.19	60.99	International pipette methods(piper, 1966
Silt %	21.98	21.23	Do
Clay %	17.83	17.78	Do

experiment was conducted in Kharif season on that field whose soil was sandy loam in texture, the pH value of the soil 0-25 cm, depth was found to be 8.10 in both year.

The value of organic carbon, available Nitrogen, available phosphorus, available potash, available sulphur Kg per ha in the soil was found to be 0.42, 171.30 kg ha^{-1}, 18.90 kg ha^{-1}, 212.20 kg ha^{-1},8.10 kg ha^{-1}, respectively in the first year. Then after in the second year of experimentation the value of organic carbon, available nitrogen, available phosphorus, available potash, available sulphur in the soil was found 0.44, 174.40 kg ha^{-1}, 19.40 kg ha^{-1}, 220.70 kg ha^{-1}, 8.30 kg ha^{-1}.

The experiment was conducted in split plot design with three replication three levels of phosphorus, three levels of sulphur three levels of zinc, 27 treatment combination and 81 plots were used to conduct this study. Full doses of phosphorus, sulphur and zinc as per treatments were supplied through, DAP, elementary sulphur and zinc oxide respectively at the time of sowing and recommended dose of nitrogen and potash through urea and Murat of potash.

Results and discussion

(i) Plant Height

The data given in the table clearly show that with the addition of phosphorus, there was considerable increase in the plant height at all the stages of observation in both year, application of 60 kg P_2O_5 ha increased plant height significantly at all the growth stages except at 30 days after sowing and application for sulphur and zinc at either rate had beneficial effect on plant height over no sulphur and zinc application. The response of sulphur and zinc application was observed upto 40 kg ha^{-1} sulphur and 10 kg ha^{-1} zinc results supported by Singh et al. (2008) and Mir et al. (2009).

(ii) Green leaves per plant

The black gram crop showed favorable response to phosphorus application with regard to green leaves plant. It is obvious from table 3 that the significant response of phosphorus application was noted with every increase in the level up to 60 kg P_2O_5 ha^{-1}, in both the years at both the stages. Thus, on an average application of 60 kg P_2O_5 ha^{-1}, may be considered better so for as the number of green leaves $plant^{-1}$ is considered and application of sulphur and zinc either rate had beneficial effect on increased the number of leaves per plant. Observed 40 kg sulphur and 10 kg zinc per hectare results supported by Singh et al. (2008).

(iii) Number of Pods per plants

The data presented in table 3 clearly shows that black gram crop responded significantly to phosphorus application with regard to number f pods plant during both the yeas of experimentation. It is observed that phosphorus application at 60 kg P_2O_5 ha^{-1} (P_2) produced significantly more number at pods $plants^{-1}$ that response of phosphorus on mean basis was noticed upto 60 kg P_2O_5 which produced 23.05 and 10.28 per cent more number of pods $plant^{-1}$ over 0 and 30 kg P_2O_5 ha^{-1} respectively and application of 40 kg S ha^{-1} produced averaged in both year 24.09 and 8.46 per

Table 2: Plant height (cm) green leaves $plant^{-1}$ at successive stages of crop effect by various treatments

Treatments	Plant height (cm) Days after sowing				Number of green leaves days after sowing					
	30 Days		60 Days		At harvest		30 Days		60 Days	
	Ist year	IInd year	Ist year	IInd year	Ist year	IInd year	Ist year	IInd year	Ist year	IInd year
Phosphorus levels										
P_0	20.47	21.78	55.25	59.34	68.50	72.91	23.22	24.89	65.18	69.37
P_1	21.88	23.39	56.93	61.16	72.40	76.58	27.01	28.88	70.08	74.39
P_2	22.40	23.98	58.64	62.91	75.02	79.65	29.72	31.71	73.90	78.32
CD at 5%	0.1212	0.123	1.136	1.217	2.376	2.419	1.378	1.476	2.869	4.019
Sulphur levels										
S_0	21.22	22.53	54.50	58.67	68.30	72.77	23.94	25.65	63.80	67.97
S_1	21.61	23.09	57.20	61.39	71.30	75.81	27.06	28.92	70.82	75.11
S_2	21.92	23.53	59.15	63.44	73.42	80.56	27.09	30.91	74.53	79.00
CD at 5%	0.116	0.121	1.129	1.215	2.368	2.415	1.373	1.471	2.864	4.010
Zinc levels										
Zn_0	21.48	22.90	56.71	60.88	71.70	76.19	26.19	27.91	68.71	72.91
Zn_1	21.60	23.03	56.98	61.19	72.02	76.36	26.68	28.55	69.76	74.19
Zn_2	21.68	23.22	57.16	61.43	72.31	76.59	27.09	29.02	70.68	74.98
CD at 5%	0.116	0.121	1.129	1.215	2.368	2.415	NS	NS	NS	NS

Table 3: Seed yield (g), straw yield (g) and Number of pods per plants as affected by various treatments

Treatments	Seed yield plant -1 (g)		Straw yield plant -1 (g)		Number of pods per plants	
	Ist year	IInd year	Ist year	IInd year	Ist year	IInd year
Phosphorus levels						
P_0	10.42	11.02	16.21	17.33	40.97	43.55
P_1	12.39	13.25	20.06	20.57	45.69	48.62
P_2	13.78	14.74	23.01	24.61	50.34	53.66
CD at 5%	1.299	1.317	1.978	1.993	6.279	6.407
Sulphur levels						
S_0	10.14	10.83	15.00	16.04	40.62	43.73
S_1	12.37	13.11	19.91	21.30	46.63	49.86
S_2	14.17	15.16	21.97	25.94	50.65	53.99
CD at 5%	1.294	1.314	1.973	1.988	6.069	6.402
Zinc levels						
Zn_0	11.98	12.82	19.47	20.82	44.46	47.63
Zn_1	12.25	13.09	19.82	21.20	46.08	49.29
Zn_2	12.46	13.32	20.10	21.29	47.36	50.59
CD at 5%	NS	NS	NS	NS	NS	NS

cent more number of pods over 0 and 20 kg ha^{-1} result supported by Singh et al. (2008), Hussain et al. (2011) and Deshbharatar et al. (2010).

(iv) Straw yield per plant

It is clear from data given in table that application of phosphorus increased the straw yield significantly application of 60 kg P_2O_5 ha^{-1} produced highest straw yield per plant result supported by Hussain et al. (2011) and Mir et al. (2009) and sulphur application was useful from the point of view of straw yield the straw per plant was increased significantly with every increase level of sulphur application upto highest level result supported by Deshbhratar et al. (2010) and zinc applied did not showed any significant effect but however numerically increase was noted with increasing levels Zn_2 both the year.

(v) Seed yield per plant

The production figures under varying levels of phosphorus in both years indicated a significant response with every increase in the levels of phosphorus from 0 to 60 kg P_2O_5 ha^{-1} on an average application of 60 kg P_2O_5 ha^{-1} accretion 33.02 and 11.23 percent more seed yield per plant over 0 and 30 kg P_2O_5 ha^{-1} result support by Hussain et al (2011) and Mir et al. (2009) and it is concluded from the table 3, that sulphur fertilization increased the seed yield per plant numerically and statistically maximum seed yield per plant was noted under S_2 followed by S_1 and S_0 respectively in both year result support by Deshbhratar et al. (2010) and Mir (2009), and zinc application did not increase seed yield per plant significantly. However increasing trend was noted with increasingly level of the zinc.

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