RESPONSE OF BLACK GRAM TO DIFFERENT LEVELS AND TIMINGS OF SULPHUR APPLICATION IN VERTISOLS

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Abstract: The field experiment was conducted during *kharif* season of 2008-09 at Research Farm of *Jawahar Lal Nehru Krishi Vishwavidyalaya, Jabalpur,* College of Agriculture, Indore for evaluating the Response of Black gram to different levels and timings of sulphur application in *Vertisols.* Application of sulphur exhibited favorable effect on growth characters and yield attributes of black gram. Consequently higher yield was obtained by the treatment combination of T_2S_2 (50 % basal through Gypsum + 50 % at 20 DAS through sulphur 80% WP: 30 kg S ha^{-1})

Keywords: Black gram, Scheduling, Sulphur levels

INTRODUCTION

Black gram [*Vigna mungo* (L.) Hepper] belongs to Leguminoseae and subfamily Papilionaceae, is being grown as one of the principle crop since ages in Madhya Pradesh as well as in the country. It is one of the major warm season annual pulses grown mostly in *Zaid* and *kharif* as an opportunity crop in rotation with cereals. Sulphur is the key component of balanced nutrient application for crop yields and superior quality produce. It plays very important role in higher protein and oil production. Oilseed crops deficient in S produce low yield and have less oil in the seeds. Sulphur is a part of amino acids cysteine, cystine, and methionine, hence essential for protein production. It involves in various metabolic and enzymatic process including photosynthesis, respiration and legume *Rhizobium* symbiotic nitrogen fixation. Sengupta (2001) studied the effect of sulphur containing fertilizers on productivity of rainfed black gram and found that application of 30 kg S ha^{-1} through single superphosphate gave significantly higher number of branches, leaves effective root nodules and dry matter accumulation per plant as compare to control. Budhar and Tamilselvan (2001) concluded that the number of pods per plant, number of grains per pod, test weight and grain yield (1245 kg ha^{-1}) were increased significantly with 30 kg S ha^{-1} as compared to control but, was at par with 40 and 50 kg S ha^{-1}. Hence the present investigations were under taken to study the response of black gram to different levels and timings of Sulphur application in *Vertisols.*

MATERIAL AND METHODS

Experiment was conducted under Jawahar Lal Nehru Krishi Vishwavidyalaya Research Farm, College of Agriculture, Indore, M.P. during *Kharif* 2008-09. The soil of the experimental field was medium black clay (*Vertisols*) with a uniform topography. The experiment was conducted in factorial randomized block design having combination of (4 sulphur levels): S_0 - 0 kg S/ha, S_1 - 20 kg S/ha, S_2 -30 kg S/ha, S_3 - 40 kg S/ha with (3 scheduling of sulphur levels): T_1 - 100 % basal through Gypsum, T_2 - 50 % basal through Gypsum + 50 % at 20 DAS through sulphur 80% WP, T_3 - 75% as a basal through Gypsum + 12.5% after 20 DAS through sulphur 80 % WP + 12.5% after 40 DAS through sulphur 80 % WP. The treatments were replicated 3 times. Sowing of crop variety IVU – 486 was done on 25 th June 2008, seed rate 25 kg/ha in rows 40 cm apart was maintained and the crop was harvested on 11th September. For analyzing the growth patterns of the crop, five plants of uniform size were selected randomly and tagged from each treatment for recording various observations on growth and development at different stages.

RESULT AND DISCUSSION

Growth attributes

The data presented (Table 1) at 30, 45, 60 DAS and at harvest stage showed significant increase in plant height of black gram. Among the different doses of sulphur 40 kg S ha^{-1} recorded the maximum plant height at different stages of black gram. While the plant height was observed minimum with 0 kg ha^{-1}.The effects of schedule of sulphur application were found non significant. The present findings are in the conformity with the findings of Teotia *et al.* (2001) and Krishna (1995).

The data presented at 45 and 60 DAS stages interval showed significant increase in leaf area (cm^2) while, it was non significant at 30 DAS of black gram. Among the different doses of suphur 30 kg S ha^{-1} recorded the maximum leaf area (cm^2) at different stages of black gram, while the leaf area (cm^2) was observed minimum in 0 kg S ha^{-1}. The effects of schedule of sulphur application were found significant at 45 and 60 DAS and found the maximum leaf area (cm^2) in T3(75% as a basal through Gypsum + 12.5% after 20 DAS through sulphur 80 % WP + 12.5% after 40 DAS through

sulphur 80 % WP). The present findings are in the conformity with the findings of Sengupta (2001).

The increasing dose of sulphur significantly increased the number of root nodules of black gram at 30, 45 and 60 DAS. Among the different doses of sulphur 40 kg S ha^{-1} recorded the maximum number of root nodules at different stages of black gram. The effects of schedule of sulphur application were found significant. Among the schedule of sulphur application T3(75% as a basal through Gypsum + 12.5% after 20 DAS through sulphur 80 % WP + 12.5% after 40 DAS through sulphur 80 % WP) gave the maximum number of root nodule of black gram at 30, 45 and 60 DAS stages crop. The results are in close agreement with the findings of Srinivasan *et al., (*2000) and Teotia *et al.* (2001).

The data is presented at 45 and 60 DAS stages interval which was found significant. Among the different doses of sulphur 30 kg S ha^{-1} recorded the maximum chlorophyll content at different stages of black gram. The effect of schedule of sulphur application were found significant at 45 and 60 DAS and T2 (50 % basal through Gypsum + 50 % at 20 DAS through sulphur 80% WP) gave the highest chlorophyll content. The present findings are the conformity with the findings of Chettri and Mondal (2004).

Effect of yield attributes and yield

The data indicated in Table 2 is that, all the treatments (20, 30 and 40 kg S ha^{-1}) registered higher number of seeds per pod, seeds yield (g) per plant and 100 seed weight (g) as compared to 0 kg S ha^{-1}. Application of 30 kg S ha^{-1}gave the highest number of seeds per pod, seeds per plant and 100 seed weight (g) followed by 40 kg S ha^{-1} and lowest were recorded in 0 kg ha^{-1} sulphur application.

Among the schedule of sulphur application T2(50 % basal through Gypsum + 50 % at 20 DAS through sulphur 80% WP) gave the maximum seed yield g $plant^{-1}$ and 100 seeds weight, which was significantly superior over T1(100 % basal through Gypsum) and T3(75% as a basal through Gypsum + 12.5% after 20 DAS through sulphur 80 % WP + 12.5% after 40 DAS through sulphur 80 % WP), whereas time of sulphur application was found non significant over the number of seeds pod^{-1}. These findings are in agreement with the findings of Singh and Agrawal (1998), Chettri and Mondal (2004), Budhar and Tamilselvan (2001), Srinivasan *et al*. (2000), Srinivasan and Shankaran (2001).

The increasing levels of sulphur significantly increased the seed and straw yield of black gram and maximum were recorded with 30 and 40 kg S ha^{-1} respectively, followed by 20 kg S ha^{-1} and 0 kg S ha^{-1}. Among the schedule of sulphur application T2 (50 % basal through Gypsum + 50 % at 20 DAS through sulphur 80% WP) gave the maximum seed and straw yield of black gram. These findings are in agreement with the findings of Srinivasan *et al*. (2000), Shinde *et al.* (1997) and Singh (2004).The results revealed (Table 2) that there was no effect of sulphur on mean harvest index of black gram.

Table 1: Effect of different levels of sulphur and schedule of sulphur application on mean plant height (cm), leaf area (cm^2), number of root nodules and chlorophyll content of black gram at different stages

Treatments	Plant height (cm)				Leaf area (cm^2)			Number of root nodules			Chlorophyll content(SPAD-502)	
(A)Time of Application	**30 DAS**	**45 DAS**	**60 DAS**	**At harvest**	**30 DAS**	**45 DAS**	**60 DAS**	**30 DAS**	**45 DAS**	**60 DAS**	**45 DAS**	**60 DAS**
T1	31.17	53.86	60.15	66.56	145.56	267.70	303.99	36.87	62.77	62.39	38.51	37.08
T2	32.81	55.36	63.49	69.08	147.09	271.38	309.30	34.48	63.89	67.10	42.11	43.94
T3	31.93	55.80	64.09	69.10	149.09	286.10	325.99	36.82	74.32	71.67	39.22	43.83
SEm (±)	0.47	0.65	1.17	1.19	2.10	3.32	6.08	0.67	1.49	1.83	0.86	1.46
CD at(5%)	NS	NS	NS	NS	NS	9.75	17.83	1.95	4.36	5.37	2.53	4.28
(B) Sulphur												
S0(0 kgha-1)	28.70	51.54	56.23	63.62	144.08	263.61	296.20	30.74	53.55	53.43	38.22	30.21
S1 (20 kgha-1)	31.78	54.29	62.14	66.49	145.68	269.67	307.27	34.62	64.20	66.67	39.13	42.76
S2 (30 kgha-1)	33.09	56.22	64.19	70.67	149.13	284.32	328.72	38.36	74.12	73.61	42.44	46.82
S3 (40 kgha-1)	34.31	57.98	67.26	72.21	147.11	282.63	320.18	40.50	76.10	74.51	39.97	46.68
SEm (±)	0.55	0.75	1.35	1.38	2.42	3.84	7.02	0.77	1.72	2.11	1.0	1.69
CD at(5%)	1.60	2.20	3.97	4.04	NS	11.25	20.59	2.25	5.04	6.20	2.93	4.94

Table 2: Effect of different levels of sulphur and schedule of sulphur application on number of seeds pod^{-1}, seed yield (g plant $^{-1}$), 100 Seed weight (g), seed yield (kgha^{-1}), straw yield (kgha^{-1}) and harvest index (%) of black gram

Treatments	Number of seeds pod^{-1}	Seed yield(g plant^{-1})	100 seed weight (g)	Seed yield (kgha^{-1})	Straw yield (kgha^{-1})	Harvest index (%)
(A)Time of Application						
T1	6.61	6.65	4.56	565.39	2353.88	19.36
T2	6.78	7.45	4.71	620.95	2564.24	19.47
T3	6.73	7.32	4.69	613.43	2528.65	19.72
SEm (±)	0.12	0.21	0.037	15.11	59.04	0.50
CD at(5%)	NS	0.61	0.11	44.33	173.05	NS
(B) Sulphur						
S0(0 kgha-1)	6.35	5.79	4.44	533.18	2106.48	20.22
S1 (20 kgha-1)	6.69	6.98	4.64	581.40	2484.18	18.99
S2 (30 kgha-1)	6.90	8.28	4.79	674.77	2646.99	20.33
S3 (40 kgha-1)	6.87	7.59	4.74	610.34	2691.36	18.52
SEm (±)	0.14	0.24	0.043	17.45	68.17	0.58
CD at(5%)	0.41	0.71	0.13	51.19	199.93	NS

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