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Sulphur management in blackgram and its effect on yield and economics

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Abstract: Field trials were conducted during *kharif* and *rabi* seasons of 1995 and 1996 to study the effect of sources and levels of sulphur on the growth, yield and economics of irrigated blackgram. Three different sources of sulphur *viz.* Gypsum, Elemental sulphur, and Pyrite were tried at five levels of sulphur *viz.* 0,10,20,30 and 40 kg ha^{-1}. The results proved that gypsum was the superior sulphur source which was evident from the yield increase due to gypsum application. Elemental sulphur and pyrite were on par in their effect. Among the levels 30 kg S/ha was best, but this was on par with 40 kg S/ha. Highest benefit cost ratio was also realised from gypsum source and at levels of 30 and 40 kg S/ha. *(Key Words: Sulphur, Gypsum, Elemental sulphur, Pyrite, Blackgram).*

Pulses are recognised as the cheapest and main source of dietary vegetarian protein of majority of Indian. They have the inherent ability to enrich soil through root nodules. The production scenario of pulses in our country has remained stagnant over decades. Blackgram is the most favoured pulse crop of South India, especially in Tamil Nadu, because it is frequently used in the commonly cooked day to day dishes. In the modern dynamic multi component system approach, a major factor of increasing importance is equal to that of nitrogen and in terms of crop uptake it exceeds that of even phosphorus (Tandon, 1995). During the recent years, due to intensive agriculture and use of sulphur free high analysis fertilizers, there has been a steady decline in the sulphur status of soil leading to its deficiency (Rajagopalan, 1985). Application of sulphur has to be deliberately built into a balanced fertilizer programme for achieving sustainable yield in blackgram. Hence this trial was formulated to find the best sulphur source and level for blackgram.

Materials and Methods

Field experiments were conducted at National Pulses Research Centre, Vamban, Padukottai district, during *kharif* and *rabi* seasons of 1995 and 1996, under irrigated conditions, to find out the effect of sulphur application on the growth and yield of blackgram. The soil of the experimental field was red soil with sandy clay loam texture. The fertility status of the soil was classified as low in available N, low in available P and medium in available K. The sulphur content of the soil was below the critical limit value of 10 ppm. Blackgram variety Vamban-1 was taken for the study. The trial was laid out in a factorial

Table 1. Effect of sources and levels of sulphur on yield and economics of blackgram (1995)

Treatment	Plant height (cm)			No.of pods/plant			Grain yield/(kg ha^{-1})			Benefit cost ratio		
	Kharif	*Rabi*	Mean	*Kharif*	*Rabi*	Mean	*Kharif*	*Rabi*	Mean	*Kharif*	*Rabi*	Mean
S - sources												
Elemental S	39.3	32.5	35.9	22.3	16.2	19.3	946	826	886	2.24	1.83	2.04
Gypsum	55.5	42.6	49.1	28.7	20.9	24.8	1245	979	1112	3.34	2.43	2.89
Pyrite	41.1	33.7	37.4	23.4	16.9	20.2	1009	855	932	2.52	2.64	2.58
SEd	0.9	0.8	-	0.9	0.5	-	32	27	-	-	-	-
CD (5%)	2.1	1.7	-	1.9	1.0	-	66	55	-	-	-	-
S - levels (kg ha^{-1})												
0	29.5	24.4	26.9	18.7	11.8	15.3	832	704	768	1.94	1.48	1.71
10	36.9	28.1	32.4	21.4	13.5	17.4	920	756	838	2.22	1.65	1.94
20	40.9	32.9	36.9	23.6	16.9	20.3	1002	843	922	2.48	1.93	2.21
30	48.9	38.4	43.6	26.1	19.6	22.8	1120	938	1029	2.86	2.23	2.55
40	54.7	45.6	50.1	28.4	22.0	25.3	1225	1010	1117	3.00	2.31	2.66
SEd	1.6	0.9	-	1.2	1.2	-	37	30	-	-	-	-
CD (5%)	2.4	2.0	-	2.4	2.5	-	76	63	-	-	-	-

Table 2. Effect of sources and levels of sulphur on yield and economics of blackgram (1996)

Treatment	Plant height (cm)			No.of pods/plant			Grain yield/(kg ha^{-1})			Benefit cost ratio		
	Kharif	*Rabi*	Mean	*Kharif*	*Rabi*	Mean	*Kharif*	*Rabi*	Mean	*Kharif*	*Rabi*	Mean
S- sources												
Elemental S	35.3	34.6	34.9	22.1	18.0	20.1	974	874	924	2.35	2.11	2.23
Gypsum	58.7	48.9	53.8	27.1	22.7	24.9	1209	1023	1116	3.40	3.52	3.46
Pyrite	36.1	36.7	36.4	23.5	18.6	21.1	999	901	950	2.48	2.34	2.41
SEd	1.2	1.3	-	0.8	0.6	-	27	20	-	-	-	-
CD (5%)	2.5	2.6	-	1.7	1.3	-	56	42	-	-	-	-
S – levels *(kg ha^{-1})*												
0	30.8	26.3	28.6	17.9	13.5	15.7	814	754	784	1.85	1.70	1.78
10	33.7	30.8	32.3	20.1	15.7	17.9	879	810	845	2.01	1.92	1.96
20	39.6	25.9	37.8	22.7	18.6	20.7	1006	894	950	2.30	2.25	2.28
30	47.8	43.4	45.6	26.4	21.9	23.2	1102	973	1038	2.64	2.50	2.57
40	52.3	50.1	51.2	28.7	23.9	26.3	1254	1053	1154	2.67	2.53	2.60
SEd	1.5	1.4	-	1.2	1.0	-	32	24	-	-	-	-
CD (5%)	3.0	2.9	-	2.4	2.1	-	65	49	-	-	-	-

randomised block design with three replications. Various sulphur sources *viz.* elemental sulphur (90% S), gypsum (15% S) and iron pyrite (20% S) constituted one factor, while various levels of sulphur *viz.* 0,10,20,30 and 40 kg S/ha formed the other factor. A uniform dose of 25:50:20 kg NPK /ha was applied basally to all the plots. The crop was sown at a spacing of 30 x 10 cm and biometric observations were recorded and statistically analysed.

Results and Discussion

The results obtained during the *kharif* and *rabi* seasons of 1995 and 1996 are presented in tables 1 and 2 respectively.

Plant height

Significant difference in crop height was noticed during both the seasons and both the years. Gypsum application produced the tallest crops as compared to pyrite and elemental sulphur. Pyrite and elemental sulphur were similar in their effect. The superiority of gypsum in increasing the crop height might be attributed to the readily available form of sulphate in gypsum which was easily taken up by the crop and metabolised easily which in turn might have induced the growth (Praveen kumar *et al.* 1985).

Among the sulphur levels, sulphur at 40 kg ha^{-1} produced significantly taller crops. Progressive increase in crop height was observed with every incremental dose of sulphur.

No. of pods/plant

Sources and levels of S significantly influenced the pod number per plant. Among the sources, gypsum produced the highest number of pods per plant during both the seasons. Pyrite and elemental S produced more or less the same number of pods/plant during both the seasons. The increased number of pods/plant in gypsum might be due to balanced source sink relationship, maintained by sulphur application. There was progressive increase in the number of pods/plant with every increment dose of sulphur and this beneficial effect was seen during all the seasons. Sulphur at 40kg ha^{-1} exhibited its superiority by registering the highest number of pods/plant which was on par with 30 kg ha^{-1}. The same trend was observed during both the seasons and both the years.

Grain yield

There are significant effect of sources and levels of S on grain yield of blackgram during both the seasons. Gypsum yielded 1245 kg ha^{-1} and 979 kg ha^{-1} of grain during *kharif* and *rabi* seasons of 1995 while it was 1209 and 1023 kg ha^{-1} during 1996 respectively. The grain yield varied only marginally between pyrite and elemental S and they were comparable with each other. Positive response to gypsum application might be due to easily available sulphate sulphur in gypsum and due to its higher solubility. Similar findings were reported by Biswas *et al.* (1986) and Hariram and Dwivedi (1992). The poor response to elemental S and pyrite might be due to low oxidation rate of sulphide to sulphate (Arora *et al.* 1991). Among the levels of sulphur, 40 kg S/ha produced significantly higher yield which was on par with 30 kg S/ha. The same trend was noticed during both the seasons and both the years. Progressive yield increase observed due to the cumulative favourable effect of sulphur on growth attributes, yield components and uptake of nutrients.

Economics

Sources and levels of sulphur were found to alter the benefit cost ratio (BCR). Sulphur nutrition through gypsum was more effective in increasing the monetary returns. Gypsum gave the highest BCR of 3.33 and 2.43 during *kharif* and *rabi* seasons of 1995 while it was 3.40 and 3.52 for 1996. Among the levels, 40 kg S/ha produced the highest BCR which was comparable with the BCR produced by 30 kg S/ha. The reason could be attributed for lower input cost and higher returns in the respective treatments.

Application of 30 kg S/ha in the form of gypsum proved to be the best sulphur management practice for irrigated blackgram.

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