

COMPARATIVE RESPONSE TO SULPHUR APPLICATION IN MUSTARD (*BRASSICA JUNCEA L*) AND WHEAT (*TRITICUM AESTIVUM*)

JAGA P.K.

Department of Soil Science and Agricultural Chemistry, JNKVV, College of Agriculture, GanjBasoda, Vidisha (MP)-464 221,
Email: praveen_jaga@yahoo.co.in

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ABSTRACT

Field experiments were conducted on sulphur-deficient or nearly deficient soil, to evaluate the comparative response to sulphur application in mustard and wheat crop at two different village of Vidisha districts. The mustard seed yield increased significantly by 17.8 to 60. % over control with the application of sulphur at different villages but the yield increase in wheat was not significant. Sulphur content in and uptake by plants increased with the application of sulphur-fertilizer to the soil. The oil content in mustard increased with the application of sulphur.

Keywords: Sulphur, Mustard (*Brassica Juncea L.*, wheat).

INTRODUCTION

Mustard (*Brassica Juncea L.*) is one of the most important oil seed crops of winter season contributing 28.4% of the total oil production in India. Sulphur deficiency in soils is on the increase with intensification of agriculture. The continuous use of major plant nutrients such as NPK through chemical fertilizers has resulted in the depletion of soils of their secondary and micronutrient reserves. There are instances where application of adequate amounts of N, P and K failed to give optimum yields until the deficiency of sulphur was corrected. The sulphur fertility status of soils in oilseed growing regions is poor and wide spread sulphur deficiency has been observed in crops and soils in 120 district of India irrespective of soil texture and cropping pattern.(Tandon1991). Wheat crops are the important Rabi crop grown in the Vindhya region MP. It has been reported that removal of sulphur per tonne of grain is 3 kg in cereals against 12 kg in oil seeds (Tandon 1995). The irrigation requirements of both crops are different. The present study was, therefore, undertaken to compare the response in wheat (cereal) and mustard (oilseed crop) to sulphur application.

MATERIALS AND METHODS

Simultaneously field experiments on mustard crop was conducted during 2008-09 on farmers' fields at village Semeri,(site I) Bhasuda,(site II) tehsil GanjBasoda district Vidisha (MP). The physicochemical properties of soil like pH, EC OC, sand silt clay, available N ,Olsen P available K and available sulphur of experimental sites were estimated and reported in Table 1.The treatments at each site comprised of four levels of sulphur (0, 15, 30, and 60 kg S ha⁻¹) through single superphosphate. The treatments imposed 6m x 5m plots were replicated five times following randomized block design. The levels of S were adjusted by the application of single superphosphate (SSP) and P and N was adjusted by using diammonium phosphate (DAP) and urea. A basal dose of 100 N and 30 kg P₂O₅ ha⁻¹ to mustard crop and 120 kg N and 60 kg P₂O₅ ha⁻¹ to the wheat crop was applied. Two irrigations were applied to mustard crop and four to wheat crop. At maturity the grain and straw yields were recorded. Sulphur was applied as per treatment through sulphur powder. The concentration of NPK in grain and straw were determined by standard procedures, Sulphur content in diacid digest (HNO₃:HClO₄:1) was measured turbidmetrically. The necessary plant protection and weed control practices were followed during crop growth .

RESULTS AND DISCUSSION

Response to applied sulphur

The yield of mustard in control plots varied from 10.1 to 17.1 q ha⁻¹ at different village due to variation in general fertility status of the soil. The organic carbon content at Bhasuda (site I) village was highest than other location so was highest the yield of mustard. However, irrespective of the fertility status, the mustard seed yield increased significantly from 17 to 60% with application of different levels of applied sulphur at different locations (Table 2).Similarly, straw yield of mustard also increased significantly with the application of sulphur. Highest response of 60% to the application of 60 kg S ha⁻¹ was observed at this site (site I) where as lowest response of 17 % was observed at site II with the application of 20 kg S ha⁻¹. There was some increase in the yield of wheat with the application of sulphur but the increase was statistically non-significant. The significant response of mustard to sulphur application might attributed to its deficiency in the site and indicates the differential behavior of two crops with respect to their sulphur requirement.

Oil content, S content and uptake by Mustard

The oil content of mustard varied from 37 to 40 % with the application of different levels of applied S and the maximum oil content of 40.5% was obtained with the application of 60 kg S ha⁻¹. On an average, oil content increased from 37% to 40.5% with the increase in level of S application from 0 to 60% kg S ha⁻¹. Oil content increased significantly with the application of sulphur it may be attributed to increase in glycosides. Kumar et al. (2006) reported similar results. The significant increase in S content in mustard seed with the application of S to crop was observed at all the sites. Maximum S content (40%) in mustard was obtained at the highest (60 kg S ha⁻¹) level of applied S. The sulphur uptake by mustard seed varied from 32 to 77 kg ha⁻¹ by the application of different levels of S, normally the uptake of S was higher by seeds as compared to straw (Table 3) The sulphur uptake was higher at sites where yields were higher. At all site sulphur uptake increased with increase in levels of applied S. Increase in S uptake by the application of sulphur has also been observed by Jaggi and Sharma(1999) and Saraswat ,B.L. and Singh, B.P (2007) Singh ,V and Singh, S(2003). Aulakh et al. (1985) reported that the quantity of S removal from soil highest by oilseed crops followed by pulses.

Sulphur Content and uptake by wheat

Generally, the S content in wheat increased with the increase in the level of applied S but the increase was non-significant (Table 3). The S content in wheat grain varied from 0.09 to 0.17% and in wheat straw it varied from 0.29 to 0.36% with the increase in levels of S application from 0 to 60 kg S ha⁻¹. Sulphur uptake by wheat grain varied from 19.1 to 61.7 kg ha⁻¹ at different sites under different treatments. The sulphur uptake was lowest under control and

increased with increase in levels of applied sulphur. Contrary to mustard, the sulphur uptake by wheat straw was more than that by grains. Jaggi (1994) reported that the requirement of S by mustard (as an oilseed crop) was much higher than the wheat crop.

On the basis of results it can be concluded that mustard crop is more responsive to sulphur application as compared to wheat crop. The application of sulphur to mustard crop is highly beneficial to the farmers.

Table1. Physicochemical properties of experimental sites

Soil characteristics	Bhasuda (Site I)	Samari (Site II)
pH (1:2 soil water ratio)	8.2	8.1
EC (1:2 soil water ratio, dS m ⁻¹)	0.1	0.2
Organic carbon (g kg ⁻¹)	4.2	3.9
Sand (%)	65	70
Silt (%)	15	20
Clay (%)	20	10
Texture	Sandy clay loam	Sandy loam
Available N (kg ha ⁻¹)	163.0	161.5
Available P (kg ha ⁻¹)	9.5	9.0
Available K (kg ha ⁻¹)	240	237
Available S (kg ha ⁻¹)	11.1	9.5

Table 2: Cooperative effect of S application on yields of mustard and wheat crop

S levels (kg ha ⁻¹)	Mustard				Wheat			
	Seed Yields (q ha ⁻¹)		Grain Yields (q ha ⁻¹)		Seed Yields (q ha ⁻¹)		Grain Yields (q ha ⁻¹)	
	Site I	% response	Site II	% response	Site I	% response	Site II	% response
0	10.6	-	10.1	-	24.5	-	23.9	-
15	14.3	34.9	11.9	17.8	32.2	31.4	32.4	35.5
30	15.8	49.0	12.1	19.8	33.8	37.9	33.0	38.0
60	17.0	60.3	14.9	47.5	35.8	46.1	33.9	41.8
CD(P=0.05)	0.65		0.89		0.84		0.75	
CV	3.6		5.9		2.1		1.9	
S levels (kg ha ⁻¹)	Mustard				Wheat			
	Straw Yields (q ha ⁻¹)		Straw Yields (q ha ⁻¹)		Straw Yields (q ha ⁻¹)		Straw Yields (q ha ⁻¹)	
	Site I	% response	Site II	% response	Site I	% response	Site II	% response
0	31.6	-	30.0	-	30.9	-	30.5	-
15	35.5	12.3	33.2	10.6	32.4	4.8	33.0	8.1
30	39.0	23.4	36.7	22.3	34.0	10.0	33.2	8.8
60	42.4	34.1	39.4	31.3	36.3	17.4	35.6	16.7
CD(P=0.05)	0.98		0.82		0.27		.52	
CV	2.14		1.9		1.4		1.29	

Table3: Effect of applied sulphur on oil content in seeds, content and uptake of S (kg/ha) by seed and straw of mustard and wheat crop

S levels (kg ha ⁻¹)	Mustard								Wheat									
	oil content		S content in seed		S content in straw		S uptake in seed		S uptake in straw		S content in grain		S content in straw		S uptake in grain		S uptake in straw	
	Site I	Site II	Site I	Site II	Site I	Site II	Site I	Site II	Site I	Site II	Site I	Site II	Site I	Site II	Site I	Site II	Site I	Site II
0	37.5	37.0	0.30	0.29	0.09	0.12	32.3	30.0	28.3	36.0	0.09	0.08	0.29	0.44	0.29	0.28	0.21	0.21
15	39.5	38.9	0.35	0.35	0.16	0.14	51.1	42.7	58.5	48.1	0.12	0.12	0.31	0.31	0.31	0.31	0.23	0.23
30	39.6	39.5	0.38	0.38	0.17	0.16	60.9	46.1	68.3	61.5	0.14	0.14	0.33	0.33	0.33	0.33	0.26	0.26
60	40.5	40.0	.45	0.42	0.19	0.18	77.3	63.0	82.8	70.9	0.17	0.16	0.36	0.34	0.36	0.34	0.28	0.28
CD (P=0.05)	0.23	0.28	0.01	0.009	0.02	0.006	1.84	4.2	6.9	3.0	0.007	0.005	0.007	NS	0.007	0.005	0.008	0.12
CV	0.48	0.59	2.7	2.1	10.7	3.2	2.7	7.6	9.4	4.4	4.9	3.7	1.9	26.6	1.9	26.6	2.8	44.6

REFERENCES

- Aulakh, M.S., Sindhu, B.S., Arora, B.R. and Singh, B. (1985) Content and uptake of nutrients by pulse and oilseed crops. Indian Journal of Ecology 22: 238-242.
- Chesnin, L. and Yien, C.H. (1950) Turbidimetric determination of available sulphates. Soil Science Society of America Proceedings 15:149-150.
- Jaggi, R.C. and Sharma, R.K. (1999) sulphur-phosphorus interaction in raya (Brassica juncea var. Varuna) in acid Alfisols of western Himalaya. Tropical Agriculture 76: 157-163.
- Jaggi, R.C. (1994) Response of raya (Brassica juncea) to sulphur through different sources in an acid Alfisols. Journal of the Indian Society of Soil Science 42: 281-283.
- Kumar, N., Singh, S. and Singh, V. (2006) Effect of iron and sulphur levels on yield, oil content and their uptake by Indian mustard (Brassica juncea). Indian Journal of Agronomy 51:63-64
- Saraswat, B.L. and Singh, B.P. (2007) Effect of bio-fertilizers, sulphur and nitrogen on growth and yield of mustard. Annals of Plant and Soil Research 9:69-71.
- Singh, V. and Singh, S. (2003) Response of mustard to source and levels of sulphur. Annals of Plant and Soil Research 5: 184-186.

8. Tandon,H.L.S(1991) Sulphur in soils and areas of sulphur deficiency. In Sulphur Research agricultural Production in India, 3rd Edition, pp18-36. Fertilizer Development and consultation Organization, New Delhi
9. Tandon,H.L.S. (199) Sulphur Fertilizers for Indian Agriculture- A Guide Book .
10. Fertilizer Development and consultation Organization, New Delhi.