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Short communication

COMPERATIVE RESPONSE OF MUSTARD AND WHEAT TO SULPHUR APPLICATION

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Mustard (*Brassica juncea L.)* is one of the most important oil seed crops with share of 14% in total oil consumption in 2010 In India. The requirement of S for oilseed crop is higher than pulse and cereals. Sulphur plays an important role in growth and development of crops as it is constituents of amino acids like methionine, cystein and cystine; needed for the synthesis of other metabolism, like co-enzyme A, thiamin and glutathione and also required for synthesis of chlorophyll. Owing to continuous use of high analysis S free fertilizers and intensive cropping, S deficiency has been reported as hidden hunger in many crops. In India, soils in more than 200 districts are suffering from some degree of sulphur deficiency meaning thereby that in such areas, S application is needed to obtain high yields (Tandon and Messick, 2002). 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. Wheat being the second largest food crop of India, is growing over an area of around 29.25 mha with the total production of 85.93 mt in 2010-11.Wheat crop is an important rabi crop grown in the Vindhya region of MP. Therefore, an attempt was made to compare the response of wheat and mustard to sulphur application.

Field experiments using mustard and wheat crop as test crop was conducted during rabi season of 2008-09 on farmers' fields at village Semeri,(site I) Bhasuda,(site II) of district Vidisha (MP). The physico-chemical properties of soils of experimental sites are reported in Table 1.The treatments comprised of four levels of sulphur (0, 15, 30, and 60 kg S ha^{-1}) through single superphosphate were tested in randomized block design with five replications. The mustard (Rohini) was sown in second week of October using 5 kg seed ha^{-1} and the wheat crop var. HD 2189 was sown in the month of November keeping a distance of 22.5 cm row spacing. The amount of P applied through single superphosphate was adjusted by diammonium phosphate. A basal dose of 100 kg N and 30 kg P_2O_5 ha^{-1} for mustard crop and 120 kg N and 60 kg P_2O_5 ha^{-1} for 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 content in diacid digest (HNO_3:$HClO_4$, 4:1) was measured turbidimetrically (Chesnin and Yien, 1951). Oil content in seed was determined by soxhlet extraction using petroleum ether as an extractant. The nutrient uptakes by crops were calculated by multiplying per cent content with yield data.

Table1.Physichemical properties of experimental sites

Soil characteristics	Bhasuda (Site I)	Samari (Site II)
pH (1:2)	8.2	8.1
EC (1:2 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

The yield of mustard seed varied from 10.1 to 17.0 q ha^{-1} at different villages due to variation in general fertility status of the soil. However, irrespective of the fertility status, the mustard seed yield increased significantly from 17.8 to 60.3% with application of levels of sulphur at different locations (Table 2). The maximum values of these parameters were obtained at 60 kg S ha^{-1}. Similarly, straw yield of mustard also increased significantly with the application of sulphur. With increasing supply of sulphur the process of tissue differentiation from somatic to reproductive, meristematic activities and development of floral primordial might have increased resulting in more seed yield. These results are in agreement with the findings of Jat and Mehra (2007). Increase in stover yield can be ascribed to the overall improvement in plant organ associated with faster and uniform vegetative growth of the crop under the effect of sulphur application. Similar results were reported by Singh (2005). Highest response of 60.3% at 60 kg S ha^{-1} was observed at site I where as lowest response of 17.8 % was observed at site II with the application of 20 kg S ha^{-1}. There was a significant increase in the yield of wheat with the application of sulphur over control at both the sites. The significant response of wheat to sulphur application might be attributed to its low status in soils. Direct application of sulphur to wheat markedly increased the grain and straw yield. However, direct application of 60 kg S ha^{-1} to wheat recorded significant higher S uptake over no S to wheat. Application of 30 and 60 kg S ha^{-1} significantly increased the grain yield of wheat by 37.9 and 46.1% over no sulphur, respectively. This might be possibly due to continued and balanced supply of nutrients enhancing their availability and with their active involvement in shoot and root growth exhibited better plant growth which consequently translated into higher yield of wheat. The results are in conformity with those of Dewal and Pareek (2004).

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

S levels (kg ha^{-1})	Mustard								Wheat							
	Seed Yield (q ha^{-1})				Stover Yield (q ha^{-1})				Grain Yield (q ha^{-1})				Straw Yield (q ha^{-1})			
	Site I	% response	Site II	% response	Site I	% response	Site II	% response	Site I	% response	Site II	% response	Site I	% response	Site II	% response
0	10.6	-	10.1	-	31.6	-	30.0	-	24.5	-	23.9	-	35.5	-	34.6	-
15	14.3	34.9	11.9	17.8	35.5	12.3	33.2	10.6	32.2	31.4	32.0	33.8	46.6	31.2	45.9	32.6
30	15.8	49.0	12.1	19.8	39.0	23.4	36.7	22.3	33.8	37.9	33.5	40.0	49.0	38.0	46.9	35.5
60	17.0	60.3	14.9	47.5	42.4	34.1	39.4	31.3	35.8	46.1	35.9	50.2	51.9	46.1	49.1	41.9
CD (P=0.05)	**0.65**	-	**0.89**	-	**0.98**	-	**0.82**	-	**0.84**	-	**0.75**	-	**1.2**	-	**1.0**	-
CV	**3.6**	-	**5.9**	-	**2.14**	-	**1.9**	-	**2.1**	-	**1.9**	-	**2.1**	-	**1.9**	-

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}.The increase in oil content with increase in S level was mainly due to increase in glycoside formation (allyisothiocyanate). The sulphur uptake by mustard seed varied from 30 to 77.3 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 both 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 Singh and Singh (2003). Sulphur uptake by wheat grain varied from 19.1 to 61.7 kg ha^{-1} at both sites under different treatments. The sulphur uptake was lowest under control and maximum with 60 kg S ha^{-1}.

Table 3: Effect of applied sulphur on oil content in seeds, content and uptake of S (kg ha^{-1}) by seed and straw of mustard and wheat crop

S levels (kg ha^{-1})	Mustard						Wheat			
	Oil content (%)		S uptake in seed		S uptake in stover		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
0	37.5	37.0	32.3	30.0	28.3	36.0	22.0	19.1	38.8	38.1
15	39.5	38.9	51.1	42.7	58.5	48.1	38.6	39.6	62.8	42.9
30	39.6	39.5	60.9	46.1	68.3	61.5	47.3	46.3	75.4	63.3
60	40.5	40.0	77.3	63.0	82.8	70.9	61.7	54.3	89.0	73.8
CD(P=0.05)	**0.23**	**0.28**	**1.8**	**4.2**	**6.9**	**3.0**	**2.8**	**2.3**	**2.9**	**2.0**
CV	0.48	0.59	2.7	7.6	9.4	4.4	5.4	4.8	3.6	3.0

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.

REFERENCES

Chesnin, L. and Yien, C.H. (1951) Turbidmetric determination of available sulphates. *Soil Science Society of America Proceedings* **15:**149-150.

Dewal, G.S. and Pareek, R.G. (2004) Effect of phosphorus, sulphur and zinc on growth, yield and nutrient uptake of wheat (*Triticum aestuvum*). *Indian Journal of Agronomy* **49**: 160-162.

Jat, J.R. and Mehra, R.K. (2007) Effect of sulphur and zinc on yield, macronutrient content in and uptake by mustard on haplustepts. *Journal of the Indian Society of Soil Science* ***55,**190-195*

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

Singh, V.and Singh, S. (2003) Response of mustard to source and levels of sulphur. *Annals of Plant and Soil Research* **5**: 184-186.

Singh, S.P. and Singh, V. (2005) Effect of nitrogen, sulphur and zinc on Indian mustard (*Brassica Juncea*). *India Journal of Agricultural Science*s **75** (12): 828-830.

Tandon, H.L.S. and Messick, D.L. (2002) *Practical Sulphur Guide*. The sulphur Institute, Washington, USA.