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Effect of sulphur and zinc on growth and yield of mustard (*Brassica juncea* L.)

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ABSTRACT : A field experiment was conducted during 2014-15 with mustard (*Brassica* spp. L.) as a test crop under irrigated conditions on sandy clay loam soils with 4 levels of sulphur (0, 15, 30 and 45 kg ha^{-1}) and 3 levels of zinc (0, 2.5 and 5.0 kg ha^{-1}) in Factorial Randomized Block Design with three replications. Seed and stover yield increased significantly upto 30 kg S ha^{-1} and 5.0 kg Zn ha^{-1} application. Maximum seed yield (2011.7 kg ha^{-1}) observed with S_3 x Zn_2 which was significantly higher over rest all the treatment combinations except S_3 x Zn_2 and S_2 x Zn_2 treatments. The maximum net return (Rs. 46475 and 45537) was obtained from S_3 (45 kg S ha^{-1}) x Zn_2 (5.0 kg Zn ha^{-1}) treatments and it was higher than all other treatments. Whereas, maximum B:C ratio (3.71) was obtained from S_2 (30 kg S ha^{-1}) x Zn_2 (5.0 kg Zn ha^{-1}).

KEY WORDS : Growth, Effect, Mustard, Sulphur, Yield, Zinc

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Mustard (*Brassica juncea* L.) is an important *Rabi* season oil seed crops of Madhya Pradesh and is cultivated in 0.82 million hectare with corresponding production of 0.86 million tones with an average productivity of 896 kg ha^{-1}. More than 70 per cent of this area lies in northern Madhya Pradesh, particularly in the districts of Morena, Bhind and Gwalior. (Anonymous, 2016). There are reports of reduction in mustard yield even due to constant use of NPK fertilizers. The reduction in the yield is generally traced due to deficiency of secondary and micronutrients. Sulphur is the fourth most important nutrient after nitrogen, phosphorus and zinc for Indian agriculture. Sulphur deficiency is increasingly being reported from different parts of the country essentially due to increased crop yield coupled with intensive agriculture and a drastic shift from low analysis fertilizers to high analysis fertilizers which contain little or no sulphur. Zinc is one of the essential micronutrient elements and is required by the crop plant in very small amounts. Zinc has specific vital role in growth development and quality of crops. It also plays an important role in biosynthesis of proteins and amino acids in crop plants. It is a component of important enzymes such as dehydrogenase and proteinases etc. The deficiency of S and Zn is increasing due to continuous use of NPK fertilizers and increased cropping intensity with HYV, and is more conspicuous in light textured soils low in organic matter content. The wide-spread deficiency of S and Zn and response of crops to their application are reported from several parts of country. The present study was undertaken to evaluate the effect of sulphur and zinc on growth and yield of mustard.

RESEARCH PROCEDURE

A field experiment was conducted during the *Rabi* seasons of 2014-15 at the experimental farm of School of Agriculture, ITM University Gwalior (Madhya Pradesh), on sandy clay loam soil having 0.38% organic carbon, 213.2 kg ha^{-1} available-N, 14.56 kg available P_2O_5 and 219.5 kg K_2O ha^{-1}, with pH 7.8. The available S and Zn was 10.88 and 0.48 mg kg^{-1}. The treatment consisted of 4 levels of sulphur (0, 15, 30 and 45 kg ha^{-1}) and 3 levels of zinc (0, 2.5 and 5.0 kg ha^{-1}) were laid out in Factorial Randomized Block Design with three replications. Treatments were applied as basal dressing through elemental sulphur and zinc oxide as per treatments. Uniform application of 80 kg N, 40 kg P_2O_5 and 20 kg K_2O per ha. Mustard variety Pusa bold was sown in rows at 30 cm apart using 5 kg seed ha^{-1} on second fortnight of October.

RESEARCH ANALYSIS AND REASONING

The findings of the present study as well as relevant discussion have been presented under following heads :

Effect of sulphur :

Increasing level of sulphur upto 45 kg ha^{-1} significantly increased the plant height and number of branches plant^{-1}. Maximum values were observed with the application of sulphur 45 kg ha^{-1} (S_3) which was significantly higher to control and 15 kg S ha^{-1} but statistically at par with 30 kg S ha^{-1} treatment (Table 1). The yield attributes *viz.*, number of siliquae plant^{-1}, siliquae length, and number of seeds siliquae^{-1}, weed weight plant^{-1} and 1000 seed weight increased due to increasing levels of sulphur. Application of 45 kg S ha^{-1} showed the best results in different yield attributes component but the effect of 30 kg S ha^{-1} was found at par with number of siliquae plant^{-1}, siliqua length, number of seeds siliquae^{-1}. On the other side seed weight plant^{-1} and 1000 seed weight were significantly maximum under 45 kg S ha^{-1} (S_3) which was significantly higher over control, 15 and 30 kg S ha^{-1}. The probable reason may be that adequate supply of all the nutrients, particularly sulphur which resulted in greater accumulation of carbohydrates, amino acids and their translocation to the productive organs, which, in-turn improved in all the growth and yield attributing characters (Singh and Meena, 2004).Increases in siliquae plant^{-1} and seed siliquae^{-1}, were higher under higher rate of sulphur because of the higher translocation of food material for the formation of seeds (Ram Pyare *et al.*, 2008 and Kumar *et al.*, 2011).

The increasing level of sulphur increased the seed and stover yield significantly upto 30 kg ha^{-1}, there was also yield increase but not crossed the levels of significance. Maximum seed yield (1848.0 kg/ha) was observed with the application of 45 kg S ha^{-1} (S_3) which was significantly higher to control and 15 kg S ha^{-1} treatments but statistically at par with 30 kg S ha^{-1} (Table 2).

The positive response of sulphur could be due to increased absorption of sulphur from the soil resulting in improvement in reproductive structure of sink strength thereby increasing production of assimilates to fill the seed and finally the seed yield. The findings confirm the results

Table 1 : Growth and yield attributing character of mustard as influenced by different levels of sulphur and zinc

Treatments	Growth characters		Yield attribute character's				
	Plant height (cm)	No. of branches plant^{-1}	No. of siliquae plant^{-1}	Siliquae length (cm)	No. of seeds siliqua^{-1}	Seed weight plant^{-1} (g)	1000 seed weight (g)
Sulphur levels							
S_0: (Control)	164.82	13.02	135.8	3.31	10.73	5.94	3.86
S_1: 15 kg ha^{-1}	175.98	14.49	155.8	3.63	11.58	7.36	4.02
S_2: 30 kg ha^{-1}	181.89	16.96	198.9	3.87	12.34	10.51	4.28
S_3: 45 kg ha^{-1}	183.78	17.82	206.7	3.91	12.56	11.47	4.43
S.E. ±	2.22	0.24	3.6	0.06	0.11	0.15	0.04
C.D. (P=0.05)	6.51	0.71	10.5	0.17	0.33	0.45	0.12
Zinc levels							
Zn_0: (Control)	166.83	14.60	147.5	3.37	11.38	7.16	4.01
Zn_1 : 2.5 kg ha^{-1}	179.48	15.57	177.9	3.73	11.85	8.95	4.18
Zn_2 : 5.0 kg ha^{-1}	183.54	16.53	197.5	3.94	12.18	10.35	4.25
S.E. ±	1.92	0.21	3.1	0.05	0.10	0.13	0.04
C.D. (P=0.05)	5.64	0.62	9.1	0.14	0.29	0.39	0.11

of Sarangthem *et al.* (2008), increase in stover yield can be ascribed to the over all improvement in plant organs associated with faster and uniform vegetative growth of the crop under the effect of sulphur application. Similar results were reported by Pyare *et al.* (2008).

Effect of zinc :

Application of zinc @ 2.5 and 5.0 kg ha^{-1} recorded significantly higher taller plant and higher number of branches as compared to control (Table 1). Maximum height and number of branches noted with 5.0 kg ha^{-1} treatment but was statistically at par with its lower dose of Zn @ 2.5 kg ha^{-1} at all the observation stages. The yield attributes *viz*., number of siliquae $plant^{-1}$, siliquae length, and number of seeds $siliquae^{-1}$, seed weight $plant^{-1}$ and 1000 seed weight increased due to increasing levels

Table 2 : Effect of different levels of sulphur and zinc on yield parameters of mustard

Treatments	Yield (kg ha^{-1})		Harvest index (%)
	Seed	Stover	
Sulphur levels			
S_0: (Control)	1373.1	3503.4	28.17
S_1: 15 kg ha^{-1}	1604.8	3894.5	29.15
S_2: 30 kg ha^{-1}	1800.7	4320.9	29.33
S_3: 45 kg ha^{-1}	1848.0	4346.3	29.79
S.E. ±	22.9	50.0	0.24
C.D. (P=0.05)	67.3	146.7	0.70
Zinc levels			
Zn_0: (Control)	1456.4	3693.5	28.30
Zn_1 : 2.5 kg ha^{-1}	1718.6	4130.1	29.29
Zn_2 : 5.0 kg ha^{-1}	1794.9	4225.1	29.74
S.E. ±	19.9	43.3	0.21
C.D. (P=0.05)	58.3	127.0	0.60

Table 3 : Economics of different treatments under mustard crop

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B : C ratio
Sulphur levels				
S_0: 0 kg ha^{-1}	16150	47677	31527	2.95
S_1: 15 kg ha^{-1}	16930	55747	38817	3.29
S_2: 30 kg ha^{-1}	17710	63341	45631	3.58-I
S_3: 45 kg ha^{-1}	18490	64965	46475	3.51
Zinc levels				
Zn_0: Control	16150	51067	34917	3.16
Zn_1 : 2.5 kg ha^{-1}	16650	60041	43391	3.61
Zn_2 : 5.0 kg ha^{-1}	17150	62687	45537	3.66-I
S_0Zn_0	16150	42653	26503	2.64
S_0 Zn_1	16650	49216	32566	2.96
S_0 Zn_2	17150	51161	34011	2.98
S_1 Zn_0	16930	51851	34921	3.06
S_1 Zn_1	17430	55869	38439	3.21
S_1 Zn_2	17930	59517	41587	3.32
S_2 Zn_0	17710	54220	36510	3.06
S_2 Zn_1	18210	66343	48133	3.64-II
S_2 Zn_2	18710	69447	50737-II	3.71-I
S_3 Zn_0	18490	55543	37053	3.00
S_3 Zn_1	18990	68731	49741	3.62
S_3 Zn_2	19490	70617	51127-I	3.62

of zinc. Maximum values were observed with 5.0 kg Zn ha^{-1} which was significantly higher to control and 2.5 kg Zn ha^{-1}. The findings confirm the results of Yadav *et al.* (2007) and Zizala *et al.* (2008).

A significant increase in seed and stover yield of mustard upto 5.0 kg Zn ha^{-1} application. Under present study, maximum yield (1794.9 kg ha^{-1}) was observed with 5.0 kg Zn ha^{-1} which was 23.24 and 4.44 per cent significantly higher over to control and 2.5 kg Zn ha^{-1}, respectively. The increase in yield might be due to role of zinc in biosynthesis of indole acetic acid (IAA) and especially due to its role in initiation of primordial for reproductive parts and partitioning of photosynthates towards them, which resulted in better flowering and fruiting. The findings of present investigation are supported by Jat and Mehra (2007).

Economics :

The results (Table 3) revealed the maximum gross and net return obtained under 45 kg S ha^{-1} followed by 30 kg S ha^{-1} whereas, maximum B:C ratio (3.58) was obtained under (30 kg S ha^{-1}) followed by 45 kg S ha^{-1} treatment. This may be because of the difference in yield between 30 and 45 kg S ha^{-1} was at par and cost of cultivation was lesser with 30 kg S ha^{-1}. Similar findings were also reported by Pyare *et al.* (2008) and Kumar and Trivedi (2012). The maximum gross return, net return and B:C ratio obtained under 5.0 kg Zn ha^{-1} followed by 2.5 kg Zn ha^{-1}. This may be because of the difference in yield between 2.5 and 5.0 kg Zn/ha significantly differed from each other and 5.0 kg Zn ha^{-1} produced more seed yield. The maximum net return was obtained from S_3 (45 kg S ha^{-1}) x Zn_2 (5.0 kg Zn ha^{-1}) treatments and it was higher than all other treatments Whereas, maximum B:C ratio (3.71) was obtained from S_2 (30 kg S ha^{-1}) x Zn_{-2} (5.0 kg Zn ha^{-1}) followed by S_2 (30 kg S ha^{-1}) x Zn_1 (2.5 kg Zn ha^{-1}) with 3.64 B:C ratio.

Conclusion :

On the basis of the experimental findings, it is concluded that the application of 30 kg S ha^{-1} and 5.0 kg Zn ha^{-1} can be recommended to harvest the best yield of mustard crop in Gwalior district of Madhya Pradesh.

Literature Cited

Anonymous (2016). Fertiliser statistics. The Fertiliser Association of India, New Delhi.

Jat, J.R. and Mehra, R.K. (2007). Effect of sulphur and zinc on yield, macronutrient content in and uptake by mustard on Haplustepts. *J. Indian Soc. Soil Sci.,* **55** : 190-195.

Kumar, Raman and Trivedi, S.K. (2012). Effect of levels and sources of sulphur on yield, quality and nutrient uptake by mustard (*Brassica juncea*). *Progr. Agric.,* **12** (1) : 69-73.

Kumar, Santosh, Verma, S.K., Singh, T. K. and Singh, Shyambeer (2011) Effect of nitrogen and sulphur on growth, yield and nutrient uptake by Indian mustard (*Brassica juncea*) under rainfed condition. *Indian J. Agric. Sci.,* **81**(2):145-149.

Pyare, Ram, Prasad, Kedar, Dixit, Vivek, Khan, Naushad and Sonker, T.C. (2008). Effect of row spacings and sulphur on growth, yield attributes, yield and economics of mustard [*Brassica juncea* (L.) Czern & Coss]. *Plant Archives*, **8**(2):633-635.

Sarangthem, Indira, Singh, L.S., Singh, N.G. and Sarkar, A.K. (2008). Response of rapeseed on nitrogen and sulphur. *J. Indian Soc. Soil Sci.,* **56** : 222-224.

Singh, Anar and Meena, N.I. (2004). Effect of nitrogen and sulphur on growth, yield attributes and seed yield of mustard (*Brassica juncea*). *Indian J. Agron.,* **49**(3): 186-188.

Yadav, R.B., Singh, R.V., Singh, H.R. and Yadav, H.S.(2007). Effect of different levels of zinc and sulphur on Indian mustard (*Brassica juncea* L.). *Crop Res.* (Hisar), **33**(1/3) : 74-76.

Zizala, V.J., Jadav, N.B. and Gorfad, P.S. (2008). Effect of sulphur and zinc on yield, quality and its concentration on mustard. *Asian J. Soil Sci.,* **3**(1):173-177.