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INTERACTION EFFECT OF DIFFERENT DOSE OF SULPHUR AND ZINC WITH NITROGEN, PHOSPHORUS AND ORGANIC MANURE ON GROWTH AND PRODUCTIVITY OF MUSTARD (*Brassica compestris*)

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ABSTRACT

The interaction effect of different dose of sulphur and zinc with optimum dose of N, P and different dose of organic manure on growth and productivity of mustard (*Brassica compestris*) were studied during October 2006 to March 2008. The level of S and Zn were employed at 0, 20, 40 and 60 kg S/ha^{-1}, 0.50, 1.0, 2.0 kg Zn/ha^{-1} and 0, 10, 15, 20 Q/ha^{-1} organic manure respectively. The result indicated that growth and productivity increase with increasing level of S and Zn. Application of the S and Zn were highly influenced with the application of 60 kg S/ha^{-1} in the combination. The root length, shoot length, number of leaf/plant, number of branch/plant and crop growth rate was much influenced on these combination. The productivity such as biomass production, number of capsule, seed output and reproductive capacity with grain biological yield also increased with increasing level of S and Zn at S_3 and Zn_3 levels.

KEY WORDS: *Brassica compestris*, Sulphur, Zinc, Nitrogen, Phosphorus, organic manure

Inadequate supply of S, Zn and other nutrient containing fertilizer's in one hand lead to low S and Zn contents in soil on the other hand. Deplection of soil fertilizer creating a serious constant to higher crop production in Azamgarh district. The farmers use general tradition and no fertilizer is used for the production of the mustard *Brassica compestris* one of the traditional oil seed crop. Mustard contains about 36 to 44% protein with a well balanced amino acid composition, physic acid 1.5%. and sinapine contain approximation 1.0 to 1.5% until recently. The feeding value of mustard meet has been limited due to the presence of sulphur compound called glucosinolates. The vegetative tissue of mustard plant contain one are more of 90 know glucosinolates (Ankineedu et al., 2002). Mustard occupied a great importance among oil seed to its various uses and special quality. Sulphur thought a major nutrient nobody thought of its application of crop production a few year back. Limited work has been performed in combined dose of sulphur and zinc with organic manure on mustard crop. Therefore the present work has been undertaken.

MATERIALS AND METHODS

The experiment was conducted during October-March 2006-2008 at the experimental farm of the S.D.J.P.G. College, Chandeshwar, Azamgarh. The agro soil of the Black clay and loam in texture, slightly alkaline with a pH 6.5 to 7.0 in the experimental field. The fertilizer treatment

in the soil was given in full optimum dose of N 80 kg/ha^{-1}, phosphorus 60 kg/ha^{-1}. The dose of the sulphur in S_0 = 0 kg/ha^{-1}, S_1 = 20 kg/ha^{-1}, S_2 = 40 kg/ha^{-1}, S_3 = 60 kg/ha^{-1} in 6 x 6 m plot. In the same way zinc Zn_0 = 0 kg/ha^{-1}, Zn_1 = 0.5 kg/ha^{-1}, Zn_2 = 1.0 kg/ha^{-1}, Zn_3 = 1.5 kg/ ha^{-1}, respectively. The basal dose of N, P, S and Zn were given in the form of superphasphate, element sulphur and chealate Zn. The different dose of organic manure 10 q/ha^{-1}, 15 q/ha^{-1} and 20 q/ha^{-1} in the form of yard organic manure were given. The optimum dose of N was applied 50% as basal and 50% at top dressing at 30 DAS age of crop. While optimum dose of phosphorus and zinc in different combination dose was given uniformly as basal application in every treatment. The higher cultivated variety "Varuna" was selected having about 210 to 220 cm in height with average yield range from 20 q/ha^{-1}. Seed were sown at the rate of 30 q/ha^{-1}, uniformly in all the treatment set. The seed were sown on 25 October, 2006 and 26 October, 2007 whereas harvested on March 18, 2007 and March 20, 2008, respectively. The mustard plant was purely grown in rainfed condition without application of irrigation, it received natural rain fall two times during crop period in the both year. For the systemic study of different parameter of test plant 60 cm from all the side of

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field area left as border area and in the center field of 2 x 7 m (4.00 m^2) area was set aside as harvest for study of final yield observation. The remaining excluding border and harvest area were used for the recording growth and yield observation. The observation was recorded at an interval of 30 DAS after showing up to harvest. The total crop growth rate, leaf area index, reproductive capacity, seed out put etc. were calculated by using appropriate formula.

RESULTS AND DISCUSSION

Growth

The result showed that the growth parameter such as root length of the test plant was much affected due to increasing combined dose of sulphur and zinc. The average root length treated of plant at 30, 60 and 90 DAS increased 55.2%, 19.25% and 6.95%, respectively, from control to highest dose of sulphur and zinc application in the first season and the same pattern has been also seen in the second season. The shoot length of the test plant increased progressively with the advancement in the plant age due to effect of S and Zn application. But beyond the level up to 1.0 kg Zn/ ha^{-1} show toxic effect on test plant. Number of leaves did not much increase due to increasing trent of fertilizer but the thickness of leaf and darkened colour of leaves was much effect (Pathak, 1998).

There was no much effect of combination of fertilizers on the number of branches per plant however the application of nitrogen, phosphorus and sulphur significantly increased the average number of branches in both season of observation. The crop growth rate of the test plant increased considerably with the period of increasing leaf area index but decreased gradually later due to advancement of plant age. Application of 60 kg S/ha^{-1} attained appreciable more crop growth rate than 20 to 40 kg S ha^{-1} probably due to efficient photosynthetic activity leading to improved plant vigour and increased crop growth of test plant (Table- 1).

Productivity

During observation period it was found that significant and enhancement of biomass production was due to treatment of sulphur and zinc in combination form. Maximum biomass production has been recorded at highest combined dose S_1 Zn_3 level at different stage of crop age at both season. Biomass increased almost linearly up to 120 DAS plant maximum between 60 DAS to 110 DAS.

The number of capsules/plant was found to be highly influenced due to highest level of S_1 Zn_3 while above to this level the different was non-significant. The interaction effect of N. P. also found significant (Chaubey et al. ,1992). The response of mustard to N. P. K. fertilizers beside the number of capsules size and colour was also change due to interaction of Zn treatment. The significant increasing trend level up to N_2 : P_2 : S_3 : Zn_3 combination beyond that different were not significant. The reproduction capacity of the test plant was much sensitive to the sulphur and zinc interaction. Sterility progressively decreased due to the increasing level of S and Zn (Kumar and Singh ,2003). It was found that 60 kg S/ha^{-1} and 1.5 kg Zn/ha^{-1} was best and unique optimum dose that produce that lowest sterility percentage and high reproductive capacity of seed/pods. The individual application of N, P and S significantly increased the grain and biological yield of test plant. The present interaction study of S and Zn also show much significant response in test plant. The data revealed that magnitude increasing in order N > P > S > Zn also reported by (Kumar et al., 1992). The rest weight 1000 seed have also significantly increasing with different dose of Zn in both season. Dry matter yield increasing with the age of plant and the increased was accelerated between 45 and 90 DAS. This might be due to quick growth of plant increased in leaves number, plant height and increase in level of S and Zn. Similar finding was obtained by Hemantrajan and Triwedi ,2004 who reported that dry matter production was higher with increase S and Zn application. In constant zinc showed at significant effect on dry matter yield at all the growth stage expect of S and Zn on dry matter yield was not significant at all the growth stage expect 90 DAS (Aulakh et al. ,1980). Result reveals that interaction effect of S and Zn on dry matter was not significant at all the grow stage except 90 DAS (Table- 2).

Table 1:Interaction Effect of S and Zn with Organic Manure on Growth in *Brassica compestris* at 30, 60 and 90 DAS (2006-2008)

	Root Length (cm)			Shoot Length (cm)		
Treatment	**30**	**60**	**90**	**30**	**60**	**90**
Control	10.10	20.00	30.00	20.00	80.00	140.20
S_1Zn_1 Om_1	12.18	26.16	36.28	28.40	110.60	165.40
S_2Zn_2 Om_2	16.58	34.26	40.46	35.40	132.20	180.40
S_3Zn_3 Om_3	18.40	36.60	43.00	40.20	150.80	210.85

Treatment	**Number of Leaves/Plant**			**Number of Branch/Plant**		**Crop Growth Rate g $Plant^{-1}$/Day**		
	30	**60**	**90**	Flowering Stage	Harvesting stage	**30**	**60**	**90**
Control	16.20	120.80	170.20	4.00	8.40	0.30	1.90	1.58
S_1Zn_1 Om_1	22.80	10.80	195.80	4.80	8.90	0.348	2.86	1.88
S_2Zn_2 Om_2	26.20	146.20	200.60	5.80	8.70	0.398	2.88	1.92
S_3Zn_3 Om_3	30.80	145.20	215.20	6.04	9.80	0.486	2.96	1.82

Table 2:Interaction of S and Zn with Organic Manure on Productivity in *Brassica compestris* at Harvesting Stage (2006-2007) and (2007-2008)

Treatment	**Year**	**Biomass Production g/$Plant^{-1}$**	**Number of Pod/Plant**	**Seed Out Put/Pods**
Control	2006-2007	12.05	315	7.0
	2007-2008	12.45	325	7.0
S_1Zn_1 Om_1	2006-2007	12.40	433	9.0
	2007-2008	12.00	430	9.0
S_2Zn_2 Om_2	2006-2007	13.20	585	11.0
	2007-2008	13.40	580	11.0
S_3Zn_3 Om_3	2006-2007	13.90	645	13.0
	2007-2008	13.10	640	13.0

Treatment	Year	Sterility %	Grain Yield q/ha^{-1}	Weight g/1000 seed^{-1}
Control	2006-2007	16.12	10.30	8.68
	2007-2008	15.90	10.40	8.40
$S_1 Zn_1 Om_1$	2006-2007	15.98	12.05	8.90
	2007-2008	15.90	12.90	9.06
$S_2 Zn_2 Om_2$	2006-2007	13.30	14.05	9.25
	2007-2008	12.10	14.05	9.88
$S_3 Zn_3 Om_3$	2006-2007	12.40	15.28	10.20
	2007-2008	12.00	16.30	10.78

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