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Influence of sowing dates and application of zinc on the performance of mustard in South-West semi arid zone of Uttar Pradesh

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ABSTRACT

A field experiment was carried out on typic ustochrepts at Madhurikund Farm, Mathura on mustard (var. VARUNA) in RBD with three dates of sowing (September 25, October 10 and October25) in combination with three levels of Zinc (0,15 and 30kg/ha). The experiment was replicated thrice. All growth parameters yield attributes along with biological, stover and seed yields were found significantly higher under September 25 sowing compared with October10 and October 25. Application of zinc though significantly increased the plant height, number of green leaves, branches and siliquae per plant but failed to show any significant effect on crop maturity and yield attributes like siliquae length, seeds per siliquae and seed yield. However, zinc application recorded higher thousand seed weight and straw yield. Delayed sowing of mustard after September 25 reduced production of oil, oilcake and fuel by 1,4 and 13kg / day / hectare respectively up to October 10 and reduced drastically beyond 10 October at the rate of 8,13 and 42kg / hectare / day oil, oilcake and fuel respectively. Protein content in seed was remained unaffected due to different dates of sowing. However, seed protein content and total sulphur uptakes were significantly increased with the application of zinc. Application of zinc did not influence the seed oil content. September 25 showing recorded maximum (Rs. 12259) and October 25 the least (Rs. 5377) net profit / hectare.

Key words: Mustard, Siliquae, Yield, and Growth parameters, Uptake, zinc.

INTRODUCTION

Establishment of Technology Mission of oilseeds during 1986 though help in boosting oilseeds production of the country during recent years, but it is still remain much lesser to full- fill the needs of growing population of the country. Uttar Pradesh, especially south-west semi arid zone of the state is the major area of rape seed-mustard cultivation in the country. State produces 1.6 million tones of mustard with an average productivity of 10.25 q/ha only,

Which is much lower than the potential, probably due to the cultivation of crop on marginal and sub marginal lands with poor soil fertility. There is an urgent need in increasing production of mustard crop through integrated nutrient management and optimizing sowing time to suit abnormal climate change particularly shorter winter spell with appreciable rise in temperature during the month of February observed during late nineties. Therefore, an experiment was conducted to study the effect of earlier or later sowings and application of zinc on growth, production and quality of mustard with an aim to maximize production and improve quality of produce in south- west semi arid zone of the state.

MATERIALS AND METHODS

The field experiment was conducted with mustard var. *varuna* during three consecutive winter rabi seasons (1999-2000 to 2001-2002) at Madhurikund farm, Mathura. The Experimental soil (Typic ustochrepts) was sandy lome in texture, having pH 7.O, E.C 0.96 dsm^{-1}, organic carbon 0.14%, available N 245kg/ha, available P_20_5 16kg/ha, available Sulphur 7.7ppm, available zinc 0.35ppm and field capacity 18.88%. Nine treatment combinations consisted of three sowing dates (September 25, October 10 and 25) and three levels of .Zn (0,15 and 30 kg. / hectare.) applied through zinc oxide in three replicates in RBD having plot size of 5mx4m. A uniform dose of 80 kg N, 40kg.P_2O_5 40 kg S and 30 kg. K_20 / hectare was applied through Urea, Di-ammonium phosphate, gypsum and Murate of Potash, respectively to all treatments. All the fertilizers were applied at sowing time except N, which was applied in two splits; half as basal and remaining half was top-dressed after first irrigation (30 DAS). Mustard seeds were sown at the rate of 5 kg. / hectare at spacing of 45cm.x20cm. under optimum moisture condition. The uniform crop stand in each plot was ensured by thinning at 25 DAS. The crop was irrigated as when required. The agronomics practices were carried out to keep the crop free from weeds, pests and diseases. Plant growth parameters of mustard crop were recorded at regular intervals. Initial soil samples, seed and straw samples were duly processed and analyzed following standard procedures. The data presented were analyzed statistically on pooled basis for three years following standard method.

RESULTS AND DISCUSSION

Plant Growth Parameters

Earliest sown crop on September 25 produced significantly taller plants than later sowings at all stages (Table-1). The number of green leaves / plant also showed significant variation due to different sowing dates at all the stages of growth which reduced subsequently with each later date of sowing. Number of green leaves / plant seem to be associated with more plant height and higher number of branches / plant, which also behaved in the same manner. More leaf area and leaf area index with earlier sowing of mustard have also been reported by Lad et al (1993). The number of different types of branches / plant and total branches / plant were also significantly higher in early sowing on September 25 and reduced thereafter. The later sowing on October 25 almost failed to produce tertiary branches. The September 25 sowing formed 2.39 and6.60 more number of branches / plant than October 10 and 25 sowings, respectively. Higher branches in early sown crop might be due to optimum weather conditions availed by the experimental crop in early sowing during branching phase of the crop. Similar results have also been reported by Rajput et al (1991), Yadav et al (1994) and Sarma et al (1997). Zinc application significantly influenced plant height that increased with the increase in Zinc doses. Increase in plant height due to 30kgZn/ha was measured 13.28 and 4.66cm higher than control and 15kg.Zn/ha respectively at harvest (Table-1). Similar results have also been reported by Mahrotra et al. (1977) and Samui et al. (1981). On mean basis, 15 and 30 kgZn/ ha enhanced number of green leaves by 0.82 and 1.52 per plant at 60 days stage and 0.47 and 0.90 at 90 days stage, respectively over control. Such increases in number of leaves seem to be associated with number of branches per plant, which also increased with increasing Zinc doses. Influence of zinc did not observed in case of the number of tertiary branches. Flowering and maturity periods also were not influenced significantly by Zinc application.

Yield attributes:

All siliquae characters viz number of siliquae / plant, siliquae length and number of seed / siliquae maximized under early sowing

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on September 25 and reduced thereafter (Table-1). Number of Siliquae / plant in September 25 sowing increased by 13.75 (6.8%) and 44.18 (25.9%), and number of seeds / siliquae by 0.06 and 1.31 than October 10 and 25 sowings respectively. The longer duration of reproductive phase in earlier sown crop might be the main reason for increase in siliquae length and number of siliquae / plant.

(Table-1) were significantly influenced by Zinc application. Application of 30 kg Zn/ha increased number of siliquae by 15.60 and 6.33, and 1000 seed weight by 0.86 and 0.30 g over control and 15 kg Zn/ ha, respectively. Increase in number of siliquae per plant and 1000-seed weight of mustard due to Zinc application had also been reported earlier by Sharma et al. (1990) and Kharbade et al. (1995).

Table 1 : Effect of sowing dates and zinc application on plant growth parameters of mustard crop

Plant growth parameters of mustard crop		Sowing dates				Levels of Zn (kg/ha)			
		September 25th	October 10th	October 25th	CD ± 0.05	0	15	30	CD± 0.05
Plant height (cm.)	30DAS	43.04	41.30	35.58	0.97	38.30	40.15	41.48	0.97
Do	60 DAS	182.93	175.36	150.42	4.15	162.46	170.56	175.62	4.15
Do	Harvest	192.23	179.41	152.21	4.20	167.48	176.10	180.76	4.20
Number of green leaves / plant	30DAS	13.13	12.60	10.75	0.36	11.65	12.16	12.72	0.86
Do	60DAS	20.71	19.77	16.93	0.45	18.36	19.18	19.87	0.45
Do	Harvest	11.83	11.07	9.35	0.29	10.33	10.79	11.12	0.29
Number of branches /plant	Primary	4.52	4.15	3.25	0.22	3.65	4.01	4.26	0.22
	Secondary	12.35	11.11	8.87	0.29	10.39	10.82	11.12	0.29
	Tertiary	2.36	2.08	1.01	0.06	1.86	1.89	1.75	0.06
Number of siliquae /plant		214.67	200.92	170.49	4.76	187.07	196.34	202.67	4.76
Length of siliquae (cm.)		5.56	5.50	4.86	0.18	5.28	5.32	5.31	NS
Number of seeds/siliquae		11.12	11.06	9.81	0.37	10.63	10.75	10.73	NS
Days to 75% flowering		39.81	38.95	35.80	0.39	38.36	38.21	37.98	NS
Days to maturity		129.07	127.49	123.38	0.22	126.60	126.61	126.72	NS
Seed yield /plant (gm.)		13.46	13.05	10.09	0.33	12.02	12.25	12.32	NS
Thousand seed weight (gm.)		4.98	4.88	4.51	0.16	4.31	4.87	5.17	0.15
Harvest index (%)		19.08	18.86	16.79	0.60	18.79	18.08	17.86	0.60

More number of siliquae / plant in earlier sowing seems to be associated with higher number of branches which produced more siliquae / plant. Seed weight / plant was maximum in September 25 sowing and was closely followed by October 10 sowing but reduced significantly in case of October 25 sowing. September 25 sowing produced 0.41g (3.1%) and 3.37g (34.4%) more seed weight / plant than October 10 and 25 sowings, respectively. Improvement in different siliquae characters under early sowing is perhaps responsible for higher seed yield / plant. These results are in close conformity to those of Yadav et. al. (1994), and Sarma et. al. (1997). Early sown crop on September 25 produced bolder size seeds and recorded thousand seed weight higher by 0.10g and 0.47g than October 10 and 25 sowings, respectively. The earlier sown crop enjoyed mild temperature at the time of seed development and maturity which allowed the seeds to develop fully. On the other hand, in delayed sowing, crop subjected to higher temperature at the time of seed development and maturity and thus restricted the development of seeds. Rajput et.al. (1991), Lad et. al. (1993), and Sarma et. al. (1997) have also recorded higher thousand seed weight of mustard in early sowings. The harvest index, which is a ratio between biomass productions and seed yield, was found at per in earlier two sowing dates but significantly higher than October 25 sowing. Reductions in the harvest index are associated with sharp reduction in seed yield due to late sowing. Sowing beyond September 25 caused speedier and greater rate of reduction in seed yield was speedy than. The rate of reduction in biomass production. Significant variation in harvest index of mustard under different sowing times had been also reported by Roy et. al. (1993). Among different yield attributes, the number of siliquae per plant and 1000 seed weight

Yield (seed and straw):

The yield results (Table-2) made it clear that biological, seed and stover yield were significantly higher in earlier sowings than later sowings. September 25 sowing produced 2.8 and 12.40q / ha. more biomass, 0.8 and 4.0q / ha. more seed, 2.0 and 8.40q / ha. more stover than October 10 and 25 sowings, respectively. The maximization of yield in early sown crop are perhaps attributed to better growth parameters, and there additive effects. Khachroo and Kumar (1997) had also reported the additive effect of different yield attributes on seed yield of mustard. Significant variations in mustard yields due to variation in sowing times have also been reported by several workers, which differed under different agro-climatic conditions. Present studies indicated that sowing of mustard should be done at its optimum time (last week of September) for maximization of yield in south- west semi arid zone of U.P. The biological yield was increased significantly up to 15 kg Zn/ha beyond which no significant increase was observed (Table-2). Application of zinc had no significant effect on seed yield. Though number of siliquae per plant increased with zinc application (Table 1) but it failed to increase in seed yield per unit area sufficiently to the level of significance. This result may be supported by the findings of Datta and Bain's (1960) who did not find significant effect of zinc application on seed yield of rapeseed. However, increase in yield of mustard was reported by Misra (2001) with the application of 4 kg Zn/ha, which remain at per with the higher doses.

Seed quality:

The oil content was significantly increased with delayed sow-

Table 2 : Effect of sowing dates and zinc application on yield, quality and uptake of sulphur by mustard crop

Yield, quality and uptake of mustard crop	Sowing dates				Levels of Zn (kg/ha)			
	September 25	October 10	October 25	CD ± 0.05	0	15	30	CD± 0.05
Biological yield (q / ha.)	78.26	75.47	65.87	2.30	70.70	73.76	74.94	2.30
Seed yield (q / ha.)	15.11	14.28	11.11	0.40	13.39	13.83	13.48	NS
Straw yield (q / ha.)	63.15	61.19	54.79	1.92	57.31	60.40	61.46	1.91
Seed: Straw ratio	0.24	0.23	0.20	----	0.23	0.23	0.22	---
Seed protein content (%)	38.91	38.71	38.55	N.S.	38.14	38.96	39.07	0.69
Seed oil content (%)	38.58	39.50	40.03	0.40	39.56	39.53	39.03	NS
Seed sulphur content (%)	0.72	0.77	0.72	0.02	0.74	0.72	0.74	NS
Total sulphur uptake (kg / ha.)	23.35	28.80	19.00	0.68	21.92	22.62	21.98	0.25
Straw sulphur content (%)	0.20	0.21	0.20	N.S.	0.21	0.20	0.20	NS

ing October 25 sowing had1.45 and 0.53% more mean oil content in seed than September 25 and October10 sowings, respectively (Table -2). The reason may be greater utilization of applied nutrients for production of seed yield in shorter time. Increase in toria seed oil content with delayed sowings had also been reported by Gupta and Saini (1982) who recorded 2.69 unit increase in seed oil content with October 1 sowing than September 1 sown crop.

decreased with 30 kg Zn/ha might be due to higher yield. However, Misra (2001) reported, N, P, K, S, and Zn uptake, oil, protein content increased with the lower dose of Zinc (4 kg/ha) application. Seed-straw ratio of mustard did not influenced by the application of Zinc indicating thereby that translocation of photosynthesis by the crop remained unresponsive to Zinc fertilization.

Table 3: Losses in production of mustard incurred due to delayed sowing.

Sowing dates	Oil			Oil cake			Straw (fuel)		
	Production (Kg./ ha)	%	Decrease kg/ha/day	Production (Kg./ha)	%	Decrease (Kg/ha/day)	Production (Kg.)	%	Decrease (Kg./ha./ day)
Sept 25th	583	-	---	928	---	----	6315	----	----
Oct. 10th	564	3.3	1.3	864	6.9	4.3	6119	3.2	13.1
Oct. 25th	445	23.7	7.9	666	28.2	13.1	5479	13.2	42.1

Protein content in seed was not affected significantly by sowing dates. It may be due to the reason that applied nitrogen was taken up by the crop in similar quantity of seed produced in different sowings. Non-significant effect of sowing dates on seed protein content in mustard had also been reported by Ghosh and Chatterjiee (1988). Sulphur content in seed, stover and total uptake by the plant was maximum under October 10 sowing which was significantly higher than October 25 sowing and at per with September 25 sowing. Protein content in seed increased significantly by 0.82% over control with the application of 15 kg Zn/ha but higher dose (30 kg Zn/ha) failed to do so. Oil and sulphur content in seed were not affected by Zinc application (Table-2). Total sulphur uptake by the crop found to be increased significantly with the application of 15 kg Zn/ha but

Losses in production (oil, oilcake and fuel):

Studies on impact of sowing dates on total production of oil, oilcakes and fuel / hectare (Table-3) indicated that delayed sowing of mustard after September 25 reduced production of oil, oilcake and fuel by 1, 4 and 13 kg / hectare / day respectively till October 10. Reduction enhanced considerably 11 October onwards recording oil, oilcake and fuel losses by 8,13 and 42 kg / hectare / day till October 25 .The loss in production found to be eight times higher in case of oil and three times higher in case of oilcake and fuel due to delayed sowing of mustard after October 10.

Net Profit:

Sowing dates had shown clear effect on net income (Table-

Table 4: Economic parameters of mustard cultivation as influenced is sowing dates.

Sowing dates	Cost of cultivation (Rs. /ha	Gross income (Rs./ha	Net profit (Rs./ha	Cost: Benefit Ratio
September 25	14305	26564	12259	1.86
October 10	14565	25967	11402	1.78
October 25	14565	19942	5377	1.37

4). September 25 sowing had earned maximum net profit of Rs. 12259 / hectare which was calculated to be Rs. 857 / hectare (7%) and Rs.6882 / hectare (128%) higher than October 10 and 25 sowing respectively.

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