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Effect of sulphur levels and row spacing on yield attributes of mustard varieties (*Brassica Juncea* L. Var. Varuna and Rohini) under Bundelkhand region in U.P.

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Abstract
Field experiment was conducted during winter (Rabi) 2015–16 and 2016-17 at the Research Farm of Brahmanand Post Graduate College, Rath (Hamirpur) U.P. to evaluate the impact of sulphur levels, row spacing and varieties on the yield attributes of mustard (*B. Juncea* L.) There were four sulphur levels *viz.* control, 20, 40. And 60 kg S ha-1 four row spacing as control (Broadcasting) 15, 30 and 45 cm and two mustard varieties were arranged in split plot design with three replications. Amongst the sulphur levels, the 60 Kg S ha^{-1}, row spacings, the 45 cm widely spaced rows were found to produce higher values of yield attributes as the number of siliquae plant-1. Number of seeds $siliquae^{-1}$ weight of siliquae $plant^{-1}$ and test weight. The mustard variety Rohini was found to produce significantly higher number of siliqua $plant^{-1}$ and weight of Siliqua $plant^{-1}$ only as compared to mustard variety Varuna.

Keywords: *Brassica juncea*, var. Varuna, Rohini, row spacing, sulphur levels

Introduction

Mustard (*Brassica juncea* L. Czern and Cross) is an important and predominant oilseed crop in rabi (winter) season of northern India. It is known by different names as Rai, Raya or Laha. The leaves of young plants are used as a green vegetable which is locally known as sagg. It has high nutritive value because it supplies enough sulphur and minerals in the human diet. Among various sulphur containing amino acids, cystein (26%) and methionine (21%) are present in abundant amounts in oilseed of mustard and these aminocids have a pivotal role in human metabolism due to their essentiality. These Sulphur containing amino acids are the building unit of high quality proteins. Sulphur is also a chief constituent of vitamins viz., thiamine and biotin which is found to be necessary to prevent the different disorders of human beings. Tondon (1991) [6] reported that 120 districts in India are sulphur deficient. In Uttar Pradesh the soils of 11 districts, among oilseed crops mustard has the highest S requirement of 16 kg per tonne of seed yield, whereas it is 7.9, 8.8, 11.7, 11.7 and 5.6 kg in case of groundnut, soybean, sesame, sunflower and linseed respectively. Sulphur fertilization in deficient soil is known to increase seed yield of irrigate) mustard by 12 to 48 per cent and rainfed mustard by 17-124 percent (Aulakh and Pasricha, 1988) [2] Crop productivity depends on the performance of in a community subjected to forces of population dynamics. Optimum plant populating levels is decided by competition or co-oprection among, individual plants in the community. The extent to which plant density can be increased without affeciting the classical yield component is an important aspect to be explored for and in a given set of agro climatic situation.

Materials and Methods

A field experiment was conducted during winter (Rabi) of 2015 – 16 and 2016- 17 at the Research Farm of Brahmanand Post Graduate College, Rath (Hamirpur) U.P. The soil of the field was Parwa (Silty loan) a type for Bundelkhand soil having silt loam texture with slightly alkaline in reaction (pH7.6). It was low in phosphorus and high in available potassium. The electrical conductively and calcium carbonate content of the soil was 0.4dsm'! and 4.8 percent receptively. Varieties Varuna and Rohini were grown in a split plot design with four sulphur level *viz*. Control 20, 40 and 60 kg, S ha^{-1} and in sub- plot four row spacings as control (Broad casting), 15 30 and 45 cm. in main plot with three replications.

The crop was fertilized with recommended dose of fertilizers (100:60:40 kg NPK ha") Full doses of phosphorus and potassium and half dose of nitrogen were applied as basal and half dose of nitrogen was applied as top dressing afer I" irrigation at 30 DAS, In the present experiment elemental Sulphur was used as source of sulphur in basal application.

Results and Discussion: Effect of row spacing

The results of data for two years (table 1) reveal that number of seed siliqua, seed weight plant^{-1} and test weight were significantly influenced due to row spacings. The highest number of siliquae (197.54 and 202.92) plant^{-1}, siliquae weight (15.74 and 14.76g) plant^{-1}, number of seeds (12.07 and 11.07) seed weight (9.25 and 9.23 g,) plant^{-1} and test weight (4.27 and 4.26g,) were recorded in wider rows spaced at 45 cm. which was higher over the rest narrow spaced rows. These findings are in agreement with Thakuia and Gogoi (1996). Row spacings pushed up the removal of nutmeats and water from soil by the crop which might have enhanced the photosynthesis and translocation of assimilates from source (leaves and stem) to sink (siliqua and seed).

Table 1: Effect of sulphur levels and row spacing on yield attributing characters of mustard Varieties.

Treatment	No. of Siliqua		Siliqua weight plant-1 (g)		No. of seed siliqua^{-1}		Seed weight plant^{-1} (g)		Test weight (g)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Effect of row spacing										
R_0	113.62	119.29	7.00	6.47	8.07	8.11	3.43	3.42	3.72	3.79
R_1	119.16	119.04	7.24	6.43	8.17	8.15	3.61	3.58	3.69	3.76
R_2	166.54	166.58	11.69	10.77	10.40	10.38	7.05	7.01	4.08	4.07
R_3	197.54	202.92	15.74	14.76	12.07	11.07	9.27	9.23	4.27	4.26
S.E. m±	0.102	0.690	0.015	0.013	0.025	0.014	0.0015	0.032	0.036	0.004
CD at 5%	0.249	1.690	0.038	0.032	0.062	0.034	0.0037	0.079	0.090	0.009
Effect of Variety										
T-59	148.75	151.71	10.40	9.60	9.67	9.42	5.80	5.78	3.92	3.95
Rohini	149.68	152.21	10.44	9.62	9.68	9.43	5.87	5.83	3.92	3.97
SE m±	0.051	0.205	0.014	0.005	-	-	0.0013	-	-	0.006
CD at 5%	0.117	0.473	0.032	0.012	N.S.	N.S.	0.0029	N.S.	N.S.	0.014
Effect of levels										
S_0	144.37	145.71	9.95	9.16	9.53	9.32	5.28	5.26	3.78	3.78
S_1	147.25	149.95	10.29	9.48	9.58	9.36	5.72	5.68	3.89	3.95
S_2	152.08	155.37	10.62	9.80	9.78	9.50	6.13	6.10	4.03	4.05
S_3	153.17	156.79	10.81	9.99	9.84	9.54	6.22	6.21	4.05	4.06
SE m ±	0.074	0.652	0.012	0.016	0.008	0.013	0.015	0.34	0.29	0.007
CD at 5%	0.149	11.311	0.024	0.032	0.017	0.026	0.029	0.069	0.059	0.015

Effect of varieties

Yield attributing characters are the resultant of vegetative developement which determine yield. All the yield contributing characters of variety Rohini were found higher than that of Varuna during both the years. The mustard variety Rohini was found to produce significantly higher number of siliqua plant^{-1} as compared to mustard variety Varuna. The probable reason may be attributed to better growth and developement of plant as evident from the growth components Better developement of plant resulting information of more number of siliqua plant^{-1} which ultimately resulted in higher seed yield plant^{-1}. and test weight. The findings are in close conformity with Bora (1997) [3].

Effect of sulphur

Sulphur exhibited favorable effect on yield attributing characters such as siliqua weight plant^{-1}, seed siliqua^{-1}, number of siliqua plant^{-1}, seed weight plant^{-1} and test weight Apposition of 60 kg S ha^{-1} gave significantly higher yield attributes except test weight which was statistically at par with 40 kg S ha^{-1} during both the years. Sulphur levels. Increased the process of tissues differentiation from somatic to reproductive and development of floral primoradia which enhanced the production of grater number of flowers and siliquae. High sulphur levels induced grater translocation of photosynthates for prolonged period from leaves and stem to sink, i.e. siliquae and Seed. The findings are in agreement with the result reported by Ali et al. (1996), Sharma and Dabnath (1999) [4].

Table 2: interaction effect of sulphur levels and a·ow spacing on yield attributes.

Treatments	No. of Siliqua Plant^{-1}		No. of Siliqua Plant^{-1} (g)		No. of seed siliqua^{-1}		Seed weight plant^{-1} (g)		Test weight (g)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
R_0 S_0	8.00	8.11	6.80	6.30	110.00	115.7	3.22	3.25	3.70	3.70
R_0 S_1	8.00	8.10	6.93	6.40	112.5	118.5	3.34	3.32	3.70	3.69
R_0 S_2	8.10	8.10	7.05	6.53	115.66	121.0	3.53	3.56	3.74	3.80
R_0 S_3	8.20	8.10	7.12	6.63	116.33	122.0	3.57	3.56	3.76	3.80
R_1 S_0	8.10	8.10	7.00	6.20	115.16	115.5	3.45	3.45	3.71	3.71
R_1 S_1	8.10	8.10	7.20	6.40	118.10	118.7	3.55	3.56	3.55	3.77
R_1 S_2	8.20	8.20	7.30	6.50	120.50	120.0	3.69	3.55	3.75	3.78
R_1 S_3	8.30	8.20	7.42	6.63	122.33	122.0	3.76	3.77	3.76	3.78
R_2 S_0	10.00	10.10	11.00	10.07	160.16	159.7	6.07	6.08	3.83	3.80
R_2 S_1	10.20	10.20	11.50	10.62	162.5	167.7	6.57	6.58	4.03	4.02
R_2 S_2	10.70	10.60	12.02	11.10	171.16	169.0	7.51	7.60	4.22	4.22
R_2 S_3	10.80	10.70	12.20	11.30	172.33	170.0	7.75	7.77	4.25	4.25
R_3 S_0	12.00	11.00	15.00	14.00	192.33	192.0	8.29	8.25	3.92	3.90
R_3 S_1	12.00	11.00	15.50	14.50	195.50	195.0	9.22	9.25	4.30	4.33
R_3 S_2	12.10	11.10	16.05	15.07	200.83	211.5	9.77	9.69	4.21	4.42
R_3 S_3	12.10	11.20	16.42	15.42	201.00	213.2	9.82	9.73	4.44	4.42
SE m $\pm$	0.02	0.02	0.02	0.03	0.032	1.30	0.30	0.069	0.060	0.015
CD at 5%	0.03	0.03	0.04	0.06	0.65	2.62	0.59	0.138	0.12	0.031

Sulphur levels X row spacings (Interaction)

Data on interaction effect of sulphur level and row spacing are presented in table 2. Varying sulphur levels interact significantly with row spacing in respect of number of siliquae weight plant^{-1}, number of seed siliqua^{-1}, seed weight plant^{-1} and test weight during both the years. All yield attributing characters significantly increased from 0-60 kg sulphur and control 45 cm row spacing. The treatment combination R_3 S_3 (45 cm, row spacing along with 60 kg S ha^{-1}) was found to produce all the yield attributes significantly higher over remaining treatment combinations in both the years.

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