

Original Research Article

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Efficiency of Sulphur and Row Spacing on Growth and Yield Attributes of Mustard (*Brassica campestris*)

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ABSTRACT

Keywords

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A field experiment was carried out at Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, SHUATS, Prayagraj (U. P) in *rabi* 2019 to determine the effect of different levels of sulphur on various row spacings on growth, yield and its attributes of mustard. The experiment was laid out in Randomized Block Design with 12 treatments, each replicated thrice treatment comprises of different levels of sulphur; S₁ (1% @ 30 DAS), S₂ (2% @ 35 DAS) and S₃ (3% @ 40 DAS) and three levels of row spacings R₁ (30 cm), R₂ (40 cm) and R₃ (50 cm) respectively. Results revealed that application of sulphur at various row spacings showed significant variation for growth and yield parameters. Among all the treatments, application of 3% sulphur @ 40 DAS with 40 cm row spacing recorded the maximum of 249.91 silique per plant, 14.09 seeds per silique and 3.84 g test weight whereas application of 3% sulphur @ 40 DAS with 30 cm row spacing recorded seed yield of 1946.9 Kg/ha, stover yield of 4882.9 Kg/ha and 28.5 % of harvest index respectively.

Introduction

Oilseeds have prestigious place in Indian agriculture next to cereals. India is the largest rapeseed-mustard growing country in the world, occupying the first position in area and second in production after China.

Indian mustard (*Brassica campestris*) is a winter season crop that requires relatively cool temperature, a fair supply of soil moisture during the growing season and a dry harvest period. It needs well-drained sandy loam soil and has a low water requirement of (240–400 mm) which fits well in the rain-fed

cropping system. Time of sowing stands as a constant factor in determining the yield and oilseed content in the mustard seeds, unless the drastic reduction in the yield remains imminent (Kumari and Singh, 2012). Most critical stages are observed as emergence, flowering, silique formation and grain developmental stages (Vimala *et al.*, 2010).

As the crop productivity is the summation of the moisture effect at different growth stages scheduling irrigation at the most critical stage helps to boost the plant production and productivity efficiencies (Shukla *et al.*, 2002).

Mustard seeds have 28- 36% protein content with a high nutritive value. It is considered to be an important constituent of Indian diet and its oil is used as main cooking medium especially in northern India. Both the seeds and oil are used as condiment in the preparation of pickles and flavoring curries and vegetables (Banerjee *et al.*, 2010). The cake obtained after the oil extraction is mostly used for cattle feed and manure. Mustard seeds are excellent source of minerals such as magnesium, calcium, potassium and phosphorus. It is a great source of dietary foliate and Vitamin- A (Tripathi *et al.*, 2010). Mustard leaves or greens are a great source of essential minerals such as calcium, potassium and phosphorus. It is a great source of dietary fiber and magnesium (Pandey *et al.*, 2013).

The role of S in plants is to help in the formation of plant proteins, and it is essential for the formation of chlorophyll and improves root growth. It is involved in the formation of vitamins and enzymes required for the plant to conduct its biochemical processes (Scherer *et al.*, 2008). Sulphur deficiency symptoms firstly appear on the seedlings; on the colour of younger leaves, followed by chlorosis later the leaf lamina is restricted, leaves show cupping owing to the curling of the leaf margins and arresting of the growing points.

Plant density is an important cultural practice that determines number of pods, number of siliquae and other growth attributes of Mustard. Improved varieties of mustard or hybrids are capable of higher yields when grown under optimum row spacing and fertility level. The seed yield and maturity of mustard plants are greatly influenced by environmental conditions regardless of proper row spacing. Mustard seeds when planted at higher densities are susceptible to lodging and show heavy incidence of Downey mildew without the benefit of any yield increase. Therefore, the present study was carried out

to find the optimum dosage and duration of sulphur application with proper row spacing that must be maintained for higher production.

Materials and Methods

The experiment was carried out during the *Rabi* season of 2019 at Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, SHUATS, Prayagraj (U. P). The soil of the experimental plot was sandy loamy in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.58%), medium I available nitrogen (238 Kg/ha), high in available P (32.10 Kg/ha) and low in available K (189 Kg/ha). The treatment consisted of three levels of sulphur through Ammonium sulphate; S₁ (1% @ 30 DAS), S₂ (2% @ 35 DAS) and S₃ (3% @ 40 DAS) and three levels of row spacings R₁ (30 cm), R₂ (40 cm) and R₃ (50 cm). There are nine treatments each replicated thrice. The experiment was laid out in Randomized Block Design. Date of sowing was on 7th December 2019 with the seed rate of 4-5kg/ha. Recommended doses of fertilizer dosage N:P:K (80: 60: 40) were applied.

Results and Discussion

Response of Mustard to sulphur application and different row spacing showed significant result for growth, yield and yield parameters.

Growth attributes

Plant height (cm)

Application of 3% sulphur @ 40 DAS with 40 cm row spacing recorded the maximum plant height of 161.10 cm at 90 DAS (Table 1). Sulphur is the fourth major essential element after N, P and K to mustard; it helps in formation of proteins, enzymes, vitamins which has a crucial role in plant metabolic

activities. Kumar and Trivedi (2012) observed the increased plant height to the control with application of sulphur in mustard.

Increase in plant height due to foliar of Ammonium sulphate might be attributed to

the supply of Sulphur is more readily available than other sources. This would be increase the metabolic process and promotes the meristematic activities caused apical growth and resulted in increased plant height (Intodia and Tomar, 1997).

Table.1 Efficiency of Sulphur and row spacing on growth of mustard at 90 DAS

Treatments	Plant height at 90 DAS (cm)	No of Branches at 90 DAS	Dry weight at 90 DAS (g/plant)
1% Sulphur + 30 cm Row spacing	143.76	7.82	28.21
1% Sulphur + 40 cm Row spacing	144.80	7.87	28.78
1% Sulphur + 50 cm Row spacing	138.43	7.78	29.45
2% Sulphur + 30 cm Row spacing	148.20	7.72	29.00
2% Sulphur + 40 cm Row spacing	151.66	7.84	29.53
2% Sulphur + 50 cm Row spacing	145.20	7.70	28.79
3% Sulphur + 30 cm Row spacing	157.80	7.87	29.68
3% Sulphur + 40 cm Row spacing	161.10	7.92	30.26
3% Sulphur + 50 cm Row spacing	156.57	7.82	28.81
SEm ₊	2.54	0.03	0.29
CD (p=0.05)	10.52	0.11	0.89

Table.2 Efficiency of Sulphur and row spacing on yield of mustard

Treatments	Test weight (g)	Seed yield (Kg/ha)	Stover yield (Kg/ha)
1% Sulphur + 30 cm Row spacing	3.46	1572.17	3954.2
1% Sulphur + 40 cm Row spacing	3.51	1544.4	3950.46
1% Sulphur + 50 cm Row spacing	3.46	1365.3	3814.33
2% Sulphur + 30 cm Row spacing	3.68	1715.00	4627.76
2% Sulphur + 40 cm Row spacing	3.71	1659.16	4691.46
2% Sulphur + 50 cm Row spacing	3.65	1538.25	3992.6
3% Sulphur + 30 cm Row spacing	3.78	1946.9	4882.9
3% Sulphur + 40 cm Row spacing	3.84	1892.83	4819.16
3% Sulphur + 50 cm Row spacing	3.78	1699.36	4703.9
SEm ₊	0.07	20.39	26.84
CD (p=0.05)	0.23	61.14	80.47

Number of branches/plant

At 90 DAS, Maximum number of branches/plant of 7.92 was observed with

application of 3% sulphur @ 40 DAS with 40 cm row spacing (Table 1). Singh *et al.*, (2017) reported the maximum number of branches with application of sulphur@ 40 Kg/ha.

The increased number of branches due to ammonium sulphate might be attributed to the supply of sulphur which enhances cell division and tissue development and also increases plant height and Leaf area index (Intondia and Tomar, 1997).

Dry weight (g)

Among all the treatments, Maximum dry weight of 30.26 g at 90 DAS was recorded with the application of 3% sulphur @ 40 DAS with 40 cm row spacing (Table 1). Sulphur application to oilseeds increases root growth, nutrient uptake capacity, number of leaves per plant, dry weight, protein and oil contents (Rana *et al.*, 2016).

The increase in total dry matter application of Sulphur could be due to release of sulphur ions immediately I to the soil resulting in the better availability and absorption of sulphur and also resulted in vigorous growth rate and high dry matter of plant (Vishwanath *et al.*, 2006).

Yield attributes

Among all the treatments, application of 3% sulphur @ 40 DAS with 40 cm row spacing recorded the maximum of 249.91 siliqua per plant, 14.09 seeds per siliquae and 3.84 g test weight respectively.

Application of 3% sulphur @ 40 DAS with 30 cm row spacing recorded seed yield of 1946.9 Kg/ha, stover yield of 4882.9 Kg/ha and 28.50556 % of harvest index respectively; which was found to be maximum among all the treatment combinations (Table 2).

Higher sulphur dose was responsible for increased photosynthesis, assimilation and metabolic activities which directly effects yield attributes of Mustard (Rana and Rana, 2003). Sulphur enhances the rate of

reproductive growth, reproductive tissue and stimulates flowering and seed formation in siliqua (Prasad *et al.*, 2002).

Increasing sulphur levels of Sulphur which resulted in greater accumulation of carbohydrates, protein and their translocations to the productive organs which further results more seed yield and stover yield (Kumar and Yadav 2007).

It can be concluded from the above study that treatment with 3% sulphur with 30cm spacing rerecorded higher yields and was found to be economically profitable; var. VARUNA can be recommended to farmers.

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