Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8811

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(5), 63-69

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Response of Sulphur Levels and Date of Sowing on Growth, Yield and Quality of Mustard (*Brassica juncea* L.) in Kymore Plateau of Madhya Pradesh

Omkar Prasad[1]* and A. S. Tiwari[2]

[1]M. Sc. (Ag) Student, Department of Agronomy, AKS University, Satna (M.P.)

[2]Teaching Associate, Department of Agronomy, AKS University, Satna (M.P.)

*Corresponding Author E-mail: omkarsahu590@gmail.com

Received: 11.09.2021 | Revised: 17.10.2021 | Accepted: 24.10.2021

ABSTRACT

A field experiment was conducted at student instructional farm, Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during rabi season 2020-21. A set of 12 treatment combinations including four Sulphur levels viz., 0 kg/ha (S0), 15 kg/ha (S1), 25 kg/ha (S2) and 35 kg/ha (S3) with three dates of sowing viz., 7th November (D1), 17th November (D2) and 27th November (D3) were evaluated. Treatments were replicated thrice as per Randomized Block design with Factorial concept. Crop sown with application of Sulphur @ 35 kg/ha with the sowing of mustard variety on November, 7th attained significantly higher growth, yield attributing characters as well as yield of plant. The significantly higher plant height, number branches per plant, number of siliquae per plant, length of siliqua, number of seeds per siliqua, test weight, seed and stover yield per hectare and oil content of mustard at maximum crop growth stage was recorded under the application of Sulphur @ 35 kg/ha with the sowing of mustard variety on November, 7th with the respective values of 141.13 cm, 19.57, 311.93, 7.67 cm, 13.67, 4.50 g, 18.51 q/ha, 61.04 q/ha and 39.75 %, respectively proved significantly superior to rest of the treatments. Result showed that mustard variety when early sown on November, 7th with the application of Sulphur @ 35 kg/ha recorded the maximum and significantly higher values of these parameters.

Keywords: *Mustard, Dates of sowing, Sulphur, Siliqua, Stover yield, Oil content.*

INTRODUCTION

Mustard (*Brassica juncea* L.) is the third important oilseed crop in the world after soybean and palm oil. It is grown in subtropical and tropical countries in the world comprise eight cultivated crops of tribe Brassiceae within the family Cruciferae (Brassicaceae). In India, it is the second most important edible oilseed after groundnut sharing 27.8% in the India's oilseed economy.

Cite this article: Prasad, O., & Tiwari, A. S. (2021). Response of Sulphur Levels and Date of Sowing on Growth, Yield and Quality of Mustard (*Brassica juncea* L.) in Kymore Plateau of Madhya Pradesh, *Ind. J. Pure App. Biosci. 9*(5), 63-69. doi: http://dx.doi.org/10.18782/2582-2845.8811

The estimated area, production and productivity of rapeseed-mustard in the world was 30.74 million ha, 59.93 million tonnes and 1950 kg/ ha, respectively in 2009-10. The area, production and productivity of rapeseed-mustard in India is 6.90 million ha, 8.18 million tonnes and 1185 kg/ ha, respectively during the 2009-10 (Anonymous, 2017).

Madhya Pradesh, occupying 0.75million hectare area with 0.86 million tonnes production accounting 11% and 10% of the national rapeseed and mustard area and production, respectively during 2009–10. The average productivity of rapeseed and mustard in the Madhya Pradesh is 1147 kg/ ha (Anonymous, 2017).

The response of mustard to Sulphur application in alluvial soils of M.P. has been reported (Singh et al., 1998). Mustard has highest requirement of Sulphur with optimum level ranging from 20 to 60 kg S/ ha depending on the soil Sulphur status and yield potential (Sarmah & Debnath, 1999). Indian mustard markedly responded to sulphur fertilization in oilseeds. Sulphur plays a vital role in quality and development of seed. The chemical fertilizers being used for supplementing the major nutrient are generally either deficient or low in sulphur content. The importance of sulphur fertilization for increasing yield and quality of Indian mustard is being increasingly recognized. However, the information regarding optimum level of sulphur as well as source of sulphur and its influences on seed yield and quality of mustard is meager. Probably for these reasons mustard crop needs comparatively higher amount of sulphur for proper growth and development and higher yields. Sulphur levels significantly influenced the seed and Stover yield of mustard (Sharma et al., 2009).

Sulphur is also a constituent of vitamins biotin and thiamine (B1) and also of iron sulphur proteins called ferredoxins. Sulphur is associated with the production of oilseed crops of superior nutritional and market quality. Sulphur deficiencies in India are widespread and scattered. Deficiency of sulphur in Indian soils is on increase due to intensification of agriculture with high yielding varieties and multiple cropping coupled with the use of high analysis sulphur free fertilizers along with the restricted or no use of organic manures have accrued in depletion of the soil sulphur reserve. Crops generally absorb sulphur and phosphorus in similar amounts. On average, the Sulphur absorbed per tonne of grain production is 3-4 kilograms in cereals, 8 kilograms in pulses, and 12 kilograms in oilseeds. Soils, which are deficient in sulphur, cannot on their own provide adequate sulphur to meet crop demand resulting in sulphur deficient crops and sub-optimal yields (Chattopaddhyay et al., 2012).

The crop is mainly grown during the winter season (October-March). The recommended sowing calendar for mustard varies across the major growing regions. Sowing at proper time allows sufficient growth and development of a crop to obtain a satisfactory yield and different sowing dates provide variable environmental conditions within the same location for growth and development of crop and yield stability. If the mustard is sown late, duration is reduced due to the high temperature during the reproductive phase with concomitant reduction in yield (Kumari et al., 2004). In general, it was observed that the mustard crop sown after October 30th resulted in lower yields (Sonani et al., 2002 & Panda et al., 2004b). Understanding of physiological and phenological causes of yield reduction with reference to date of sowing can help to develop strategies for improvement in the seed yield. Further, it will help in the assertion that productivity is constrained by development pattern and process physiology in response to environment.

Crop has different yield potential requiring variable sowing dates. The yield

depends on reaction of different cultivars to environmental conditions such as planting date, cultivars, plant density, types of soil, fertilizer etc. (Meena et al., 2013). Planting date is the agricultural factor which can be effective on enjoyment of the desirable factors and light energy absorbed by plant population and accumulation of dry matter. Therefore, reaction of mustard crop to planting date is different based on change in crop growth rate, net assimilation rate and yield of their grain will be also different. Keeping these points in view, the present investigations were under taken.

MATERIALS AND METHODS

Field experiment was conducted at instructional farm, Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during rabi season 2020- 21. A set of 12 treatment combinations including four Sulphur levels viz., 0 kg/ha (S_0), 15 kg/ha (S1), 25 kg/ha (S2) and 35 kg/ha (S3) with three dates of sowing viz., 7th November (D_1), 17th November (D2) and 27th November (D_3) were evaluated. Treatments were replicated thrice as per Randomized Block design having factorial concept.

The crop was sown in furrows 45.0 cm x 10.0 cm spacing using 6 kg seed rate per hectare. The recommended doses of nitrogen (80 Kg N/ha), phosphorus (40 Kg P_2O_5 /ha) and potassium (40 kg K_2O /ha) along with Sulphur were applied. Sulphur was applied as per treatment. Half dose of nitrogen and full dose of phosphorus and potassium was applied as basal dressing at the time of sowing and remaining half dose of nitrogen was top dressed in two equal split doses each after first and second irrigation. As per treatments, total amount of Sulphur was given at the time of sowing through basal application. Two irrigations were given to mustard crop. First irrigation was done at 30 days after sowing and second irrigation was done at flowering stage of the crop.

RESULTS AND DISCUSSION

GROWTH PARAMETERS

Plant height and number of branches per plant are important growth parameters contributing to grain yield of any crop. Plant height and number of branches per plant represents index of growth and development indicating the infrastructure build-up of plants.

It is evident from the data that plant height and number of branches per plant (Table- 1) increased successively under higher rate of sulphur treatments. Among different level of Sulphur, 35 kg/ha (S_3) produced significantly higher plant height and number of branches per plant (137.31 cm and 18.54) than others. Among different date of sowing, suitable sowing timing (November, 7th) produced significantly higher plant height and number of number of branches per plant as compared to early and delayed sowing (November, 17th and November, 27th) with the respective value of 137.47 cm and 18.49, than others.

Interactions between different levels of Sulphur and date of sowing, application of Sulphur @ 35 kg/ha with the sowing of mustard variety on November, 7th produced significantly highest plant height and number of branches per plant (141.13 cm and 19.57, respectively).

The rate of Sulphur increase in plant height was more at 35 kg S/ ha due to better nutritional environment for plant growth at active vegetative stages as a result of improvement in root growth, cell multiplication, elongation and cell expression in the plant body which ultimately increased the plant height. increase in growth parameters could be ascribed to the overall improvement in plant growth, vigour and production of sufficient photosynthates through increased leaf area index and chlorophyll content of leaves with s fertilization. It may be

attributed to sulphur's essential role for plant growth through its effect on biochemical functioning related to enzyme activation.

The better nutritional environment in plants under application of 35 kg S/ ha seems to have enhanced metabolic activities in plants resulting in higher meristematic activities leading towards increased division, enlargement and elongation of cells which might have helped in attaining higher plant height under its influence. Likewise, these improvement at cellular level might have enhanced root length and branches formation and later on their growth, consequently leads to attainment of higher leaf number by the crop. Higher Sulphur dose was responsible for increased number of leaves and branches causing higher photosynthesis and assimilates, metabolic activities which were responsible for overall improvement in vigour and many growth characters of mustard. Rao et al. (2013) and Jat et al. (2012) also reported an increase in growth of mustard due to s application.

The higher growth characters in optimum sowing time (November, 7^{th}) may be on account of better growth of plants due to favourable growing environment under early sowing. Similar findings had also been reported by Panda et al. (2004a), Bhuiyan et al. (2008) and Kumari et al. (2012) which supports the findings of the present investigation. The decrease in these growth characters under early and delayed sowing could be attributed to temperature gradient. Low temperature during grand growth period in delayed sowing resulted in less production of leaves.

YIELD ATTRIBUTES, YIELD AND QUALITY

It is evident from the data that number of siliquae per plant, length of siliqua, number of seeds per siliqua, test weight, grain yield, stover yield per hectare and oil content (Table- 1) increased successively under different treatments. Among different level of Sulphur, 35 kg/ha (S_3) produced significantly maximum number of siliquae per plant, length of siliqua, number of seeds per siliqua, test weight, grain yield, stover yield per hectare and oil content (282.07, 6.81 cm, 11.89, 4.39 g, 17.04 q/ha, 57.27 q/ha and 38.69 %) than others. Among different date of sowing, suitable sowing timing (November, 7^{th}) exhibited significantly maximum number of siliquae per plant, length of siliqua, number of seeds per siliqua, test weight, grain yield, stover yield per hectare and oil content (282.38, 6.60 cm, 11.98, 4.39 g, 17.21 q/ha, 57.73 q/ha and 38.43 %). Interactions between different levels of Sulphur and date of sowing, application of Sulphur @ 35 kg/ha with the sowing of mustard variety on November, 7th produced significantly maximum number of siliquae per plant, length of siliqua, number of seeds per siliqua, test weight, grain yield, stover yield per hectare and oil content with the respective value of 311.93, 7.67 cm, 13.67, 4.50 g, 18.51 q/ha, 61.04 q/ha and 39.75 %.

The increasing doses of sulphur exhibited the increment in seed yield of mustard up to 35 kg S/ ha. Application of 35 kg S/ ha registered maximum seed yield and showed statistical superiority over 0, 15 and 25 kg S/ ha which exhibited significant differences in seed yield among themselves. Higher Sulphur dose was responsible for increased leaf area and chlorophyll content of leaves causing higher photosynthesis and assimilation, metabolic activities which were responsible for overall improvement in vigour and yield attributes and finally seed yield of mustard. The increase in seed yield might be attributed to number of leaves per plant, number of siliquae per plant and test weight of seeds.

The plant supplied with sulphur are expected to have efficient photosynthetic mechanism and better equipped for efficient translocation site consequently resulting into improved seed yield. Sah et al. (2013) reported that significant

improvement in the number of siliquae per plant, test weight, seed yield and stover yield was recorded with sulfur fertilization as compared to control. Application of 35 kg S/ ha increased all these parameters significantly over 0, 15 and 25 kg kg S/ha. Beneficial effect of application of sulphur on yield attributes might be due to better availability of N, K and S and their translocation which is reflected in terms of increased yield attributes of the crop. The improvement in the yield attributes might be due to the fact that mustard is a short duration crop and being indeterminate in nature and the favourable effect of sulphur in improving nutritional environment extended over a time period. Increase in these parameters might be also ascribed to overall improvement in plant growth and vigour and production of sufficient photosynthates through increased leaf area index and chlorophyll content of leaves with sulphur fertilization that favoured both the grain formation and grain development which resulted into increase in test weight of mustard seed (Mehriya & Khangarot, 2000).

The favourable effect of suitable date of sowing (November, 7th) on sink component could be attributed to better development of the plants in terms of plant height and biomass production leading to increased bearing capacity due to optimum growth on account of favourable temperatures during early vegetative phase. The earlier findings of Singh et al. (2002a), Panda et al. (2004a), Kumari et al. (2012) and Kumar et al. (2021) corroborate these results.

Timely seeded crop accumulated higher proportion of biomass in seed than early or late seeded crop. It may be due to high amount of assimilates produced by more leaves (dry weight) resulting production of number of shoots with larger sink (siliqua). Seed development is a function of rate and duration of seed growth and mainly determined by photosynthates supply. It is also affected by number of environmental factors including sowing dates, water and nitrogen application. Timely and normal sowing may prolong the seed filling duration which ultimately produced healthy and vigorous seed due to more biomass accumulation. A number of experiments conducted earlier gave similar reduction in seed yield, straw yield and harvest index when sowing of mustard was deviated from timely sown condition.

TABLE 1: EFFECT OF SULPHUR LEVELS AND DATE OF SOWING ON GROWTH AND YIELD OF MUSTARD

Treatment	Plant height (cm)	Number of branches/ plant	Number of siliquae per plant	Length of siliqua (cm)	Number of grains per siliqua	Test weight (g)	Seed yield (q/ha)	Stover yield (q/ha)	Oil content (%)
	Effect of Sulphur								
S_0	128.69	16.07	210.60	4.82	8.00	4.13	13.44	0.98	35.54
S_1	134.98	17.89	262.07	6.34	10.69	4.32	16.31	1.13	37.59
S_2	136.38	18.16	272.40	6.66	11.42	4.36	16.71	0.56	38.18
S_3	137.31	18.54	282.07	6.81	11.89	4.39	17.04	0.98	38.69
S. Em±	0.61	0.54	2.04	0.24	0.29	0.04	0.16	1.13	0.48
CD(P=0.05)	1.78	1.59	5.99	0.70	0.85	0.12	0.46	0.56	1.39
	Effect of date of sowing								
D_1	137.47	18.49	282.38	6.60	11.98	4.39	17.21	57.73	38.43
D_2	134.32	17.65	257.77	6.13	10.78	4.30	16.05	55.57	37.58
D_3	131.23	16.85	230.20	5.74	8.73	4.21	14.36	50.21	36.49
S. Em±	0.70	0.62	2.36	0.28	0.33	0.05	0.18	1.13	0.55
CD(P=0.05)	2.05	1.83	6.92	0.81	0.98	0.14	0.53	3.31	1.61
	Interaction effect of Sulphur and sowing dates								
S_0D_1	130.58	16.73	222.93	5.19	8.40	4.16	14.51	49.49	35.65
S_0D_2	138.16	18.67	292.60	6.73	12.67	4.44	17.60	59.56	38.98
S_0D_3	139.99	19.00	302.07	6.83	13.20	4.46	18.19	60.83	39.35
S_1D_1	141.13	19.57	311.93	7.67	13.67	4.50	18.51	61.04	39.75
S_1D_2	128.26	16.13	213.87	4.72	8.27	4.14	13.52	48.78	35.59
S_1D_3	135.45	17.93	261.00	6.51	10.80	4.32	16.51	56.50	37.90
S_2D_1	136.29	18.13	273.87	6.74	11.87	4.36	16.85	57.97	38.22
S_2D_2	137.29	18.40	282.33	6.56	12.20	4.40	17.33	59.05	38.62

S_2D_3	127.24	15.33	195.00	4.55	7.33	4.10	12.29	47.72	35.40
S_3D_1	131.33	17.07	232.60	5.79	8.60	4.20	14.82	49.90	35.90
S_3D_2	132.85	17.33	241.27	6.40	9.20	4.25	15.08	51.53	36.97
S_3D_3	133.51	17.67	251.93	6.22	9.80	4.27	15.27	51.71	37.70
S. Em±	0.35	0.31	1.18	0.14	0.17	0.02	0.09	0.56	0.27
CD(P=0.05)	0.73	0.65	2.45	0.29	0.35	0.05	0.19	1.17	0.57

CONCLUSION

From the results, it was highlighted that under the agro-climatic condition of Satna (M.P.), the sowing of mustard variety with the application of Sulphur @ 35 kg/ha and sown on November, 7th found to be the best for growth and yield attributing characters as well as grain yield.

Acknowledgment

authors are thank to dr.T. Singh Prof and head Agronomy for very kindly providing all the experimental facilities and suggestions for successful conduct of the experiment.

REFERENCES

Anonymous, (2012). Agriculture Statistics at a Glance. Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

Bhuiyan, M. S., Mondol, M. R. I., Rahaman, M. A., Alam, M. S., & Faisal, A. H. M. A. (2008). Yield and yield attributes of rapeseed as influenced by date of planting. *Int. J. Sust. Crop Prod., 3* (3), 25-29.

Chattopaddhyay, S., & Ghosh, G. K. (2012). Response of rapeseed (Brassica juncea L.) to various sources and levels of sulphur in red and lateritic soils of West Bengal, India. *International Journal of Plant, Animal and Environmental Sciences, 2* (4), 50-59.

Jat, J. S., Rathore, B. S., & Chaudhary, M. G. (2012). Effect of sulphur and zinc on growth, chlorophyll content, yield attributes and yields of mustard (Brassica juncea) on clay loam soil of Rajasthan. *AGRES- An International e-Journal, 1* (1), 42-52.

Rajesh, K., Yadav, S. S., Singh, U., & Verma, H. P. (2021). Growth, Yield, Quality and Energetics of Mustard (Brassica juncea (L.) Czern & Coss) as Influenced by Weed Management and Sulphur Fertilization under Semi-Arid Condition of Rajasthan. *International Journal of Bio-resource and Stress Management, 12* (4), 255-263.

Kumari, A., Singh, R. P., & Yeshpal (2012). Productivity, nutrient uptake and economics of mustard hybrid (Brassica juncea) under different planting time and row spacing. *Indian J. Agron., 57* (1), 61-67.

Kumari, Radha, C., Koteswararao, D. S., & Obulamma, U. (2004). Impact of sowing dates and land treatments on Indian mustard (Brassica juncea) in nontraditional areas of Andhra Pradesh. *Madras Agric. J. 91* (7-12), 374-377.

Mehriya, M. L., & Khangarot, S. S. (2000). Response of mustard (Brassica juncea L. Czern and Coss) to sulphur and growth regulators. *Annals of Arid zone, 39* (1), 81-82.

Panda, B. B., Bandyopadhyay, S. K., & Shivay, Y. S. (2004a). Effect of irrigation level, sowing dates and varieties on growth, yield attributes, yield, consumptive water use and water use efficiency of Indian mustard (Brassica juncea). *Indian J. Agric. Sci., 74* (6), 331-342.

Panda, B. B., Shivay, Y. S., & Bandyopadhyay, S. K. (2004b). Growth and development of Indian mustard (Brassica juncea) under different levels of irrigation and date of sowing. *Indian J. Plant. Physiol. 9* (4), 419-425.

Rao, K. T., Rao, A. U., & Sekhar, D. (2013). Effect of sources and levels of sulphur on groundnut. *Journal of Academia and Industrial Research, 2* (5), 268-270.

Sah, D., Sewak, R., Singh, A. K., & Swami, S. (2013). Growth, yield and profitability of Indian mustard (Brassica juncea (L.) Czern & Coss) with different weed control measures and sulphur levels. *Agricultural Science Digest, 33* (1), 15- 20.

Sharma, A., Sharma, P., Brar, M. S., & Dhillion, N. S. (2009). Comparative response to sulphur application in raya (Brassica juncea) and wheat (Triticum aestivum) grown on light textured alluvial soils. *Journal of Indian Society of Soil Science, 57* (1), 62-66.

Raj, S., Rao, V. U. M., Singh, D., & Surakant (2002a). Effect of sowing date and plant density on phonological behaviour, yield and its attributes in oilseed Brassicae. *J. Oilseeds Res. 19* (1), 119-121.

Sonani, V. V., Patel, P. T., & Patel, G. G. (2002). Performance of mustard under different dates of sowing in Bhal and Coastal Agro-climatic zone of Gujarat. *J. Oilseeds Res., 19* (1), 122.

USDA (2010). United States Department of Agriculture-Rapeseed area, yield and production Table No.15. (http://www.fas.usda.gov/psdonline/psd report.Asps).