Original Research Article

Influence of Sulphur and Micronutrients on growth and yield of Mustard (*Brassica juncea* L.)

AUTHORS

Abstract

A field experiment was conducted during rabi 2023-2024 at the Department of Agronomy, Sam Higginbottom University of Agriculture, Technology And Sciences (SHUATS), Prayagraj Effect of Sulphur and Micronutrient on growth and yield of Mustard (*Brassica juncea* L.) with ten treatments combination Sulphur 10ppm + Mg 30 kg/ha, Sulphur 10ppm + B 5 kg/ha, Sulphur 10ppm + Ca 5 kg/ha, Sulphur 15ppm + Mg 30 kg/ha, Sulphur 15ppm + B 5 kg/ha, Sulphur 15ppm + Ca 5 kg/ha, Sulphur 20ppm + Mg 30 kg/ha, Sulphur 20ppm + B 5 kg/ha, Sulphur 20ppm + Ca 5 kg/ha and Control (RDF) 80:40:40 kg/ha (NPK)in randomized block design with three replications. Application of Sulphur 20ppm + B 5 kg/ha (Treatment 8) recorded maximum plant height (214.20), dry weight (g) per plant (31.61), Seed yield (t/ ha) (2.69) and stover yield (t/ha) (4.33)

Keywords: Sulphur, Micronutrients, Growth, Yield, Mustard

Introduction

Mustard is the major rabi oilseed crop of India and the world. It occupies a prominent place being next to groundnut both in the area and production in India. It belongs to the family Cruciferae. It is known by different common names Rai, Raya, and Laha in India. India is the 4th largest oil seed-producing economy in the world after the USA, China, and Brazil, which contributes about 10% of the world's oilseeds production, 6-7% of the global production of vegetable oil, and nearly 7% of protein meal. Although India has 20.8% of the world's area under oilseed crops, it accounts for about 10% of global production. This is because of the low productivity of oilseed crops and year-to-year fluctuations in production in India. This is because of the low productivity of oilseed crops and year-to-year fluctuations in production in India. Currently, India accounts for about 13% of the world's oilseeds area, 7% of the world's oilseeds output and 10% of the world's edible oil consumption. Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% of the total

oilseeds production and ranks second after groundnut sharing 27.8% in ~~the~~ India's oilseed economy **Yanthan and Singh (2021).**

The deficiency of soil S in ~~the~~ agriculture soils has been reported frequently in mustard crops **Mansoori (2011)** found a significant interaction between N and S on the height of the plant, number of pods per plant, number of seeds per pod, 1000 seed weight, seed yield and oil percentage. **Amanullahjan *et al*., (2002)** reported that grain yield was significantly higher at the highest levels of both the nutrients applied while oil contents decreased with an increase in the level of Sulphur to 90 kg/ha (43/19%) and nitrogen to the level of 120 kg/ha (42%). Boron is one of the essential micronutrients required for the normal growth of most of the plants. Boron plays an important role in cell differentiation and development, regulating membrane permeability, tissue differentiation, carbohydrates, and protein metabolism **Sharma *et al*., (2020).**

Magnesium is also an important nutrient required by plants as it is a major constituent of the cell wall. It is a constituent of the chlorophyll molecule and an enzyme activator for several energy transfer reactions. It plays a vital role in the process of photosynthesis and is therefore important for the life of the plant. It acts as a cofactor and activator for many enzymes and substrate transfer reactions. Even slight magnesium deficiency may affect biomass formation and plant susceptibility to environmental stresses by diminishing several biochemical and physiological processes. The foliar spraying of magnesium provides a means of addressing the increasing occurrence of magnesium deficiency in crops. Foliar nutrient application can be a good strategy to increase crop yield, help in soil supplementation, and generate response in a short period **(Fageria *et al*., 2009).**

Materials and Methods

The experiment was conducted during the Rabi season 2023, at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.) which is located at 25^{o} 39' 42''N latitude, 81^{o} 67' 56" E longitude and 98 m altitude above the mean sea level (MSL). This area is situated on the right side of the Yamuna River by the side of Prayagraj - Rewa road about 12 km from the city. The experiment was laid out in Randomized Block Design Which consisting of ten treatments with T_1 – Sulphur 10ppm + Mg 30 kg/ha, T_2 – Sulphur 10ppm + B 5 kg/ha, T_3 – Sulphur 10ppm + Ca 5 kg/ha, T_4 - Sulphur 15ppm + Mg 30 kg/ha, T_5 - Sulphur 15ppm + B 5 kg/ha, T_6 - Sulphur 15ppm + Ca 5 kg/ha, T_7 - Sulphur 20ppm + Mg 30 kg/ha, T_8 - Sulphur 20ppm + B 5 kg/ha, T_9- Sulphur 20ppm + Ca 5 kg/ha,

T_{10} - Control (RDF 80-40-40). Data recorded on different aspects of the crop, *viz.*, growth, and yield attributes were subjected to statistical analysis by analysis of variance method (**Gomez and Gomez, 1976)** and economic data analysis by a mathematical method using MS Excel.

Results and Discussion

Growth parameters

There are different types of growth parameters included as Plant height (cm) and Plant dry weight (g).

Plant height (cm)

At 80 DAS, the maximum plant height (214.20) was recorded with the application of Sulphur 20ppm + B 5 kg/ha whereas the minimum plant height (203.00) was recorded with Control (RDF) 80:40:40 kg/ha (NPK). There was no significant difference between different treatment combinations. However, Sulphur 20ppm + Ca 5 kg/ha and Sulphur 10ppm + Ca 5 kg/ha are found statistically at par with Sulphur 20ppm + B 5 kg/ha. The interaction effect of sulphur and boron was non-significant. Similar results were reported by **Ranjan *et al.*, (2018)** and **Lucy and Lalrinengi (2022).**

Plant dry weight (g)

At 80 DAS, the maximum dry weight (g) per plant (31.61) was recorded with the application of Sulphur 20ppm + B 5 kg/ha whereas the minimum dry weight (g) per plant (23.63) was recorded with Control (RDF) 80:40:40 kg/ha (NPK). There was a significant difference between different treatment combinations. However, Sulphur 20ppm + Mg 30 kg/ha and Sulphur 20ppm + Ca 5 kg/ha Are found statistically at par to Sulphur 20ppm + B 5 kg/ha (Table 1). The interaction effect of sulphur and boron was non-significant. Similar results were reported by **Ranjan *et al.*, (2018)** and **Lucy and Lalrinengi (2022).**

Yield Parameters

There are several types of yield parameters included as Seed yield (t/ha) and Stover yield (t/ha) (Table 1).

Seed yield (t/ha)

The highest Seed yield (t/ha) (2.69) was observed in treatment Sulphur 20ppm + B 5 kg/ha, whereas the lowest Seed yield (t/ha) (2.56) was found in treatment Control (RDF) 80:40:40 kg/ha (NPK). However, Sulphur 20ppm + Ca 5 kg/ha is found statistically at par with Sulphur 20ppm + B 5 kg/ha. There was a significant difference between different

treatment combinations. Significant responses were noticed due to S x B. Similar results were reported by **Bamboriya *et al*., (2017)** and **Lucy and Lalrinengi (2022).**

Stover yield (t/ha)

The highest stover yield (t ha^{-1}) (4.33) was observed in treatment Sulphur 20ppm + B 5 kg/ha, whereas the lowest stover yield (t ha^{-1}) (2.58) was found in treatment Control (RDF) 80:40:40 kg/ha (NPK). However, Sulphur 20ppm + Ca 5 kg/ha (4.21) is found statistically at par with Sulphur 20ppm + B 5 kg/ha. There was a significant difference between different treatment combinations. Significant responses were noticed due to S x B. Similar results were reported by **Bamboriya *et al*., (2017)** and **Lucy and Lalrinengi (2022).**

Conclusions

The present study concluded that the effect of Sulphur and Micronutrients perform effective improvement to the growth as well as in yield of *rabi* mustard. The application of Sulphur 20ppm + B 5 kg/ha (Treatment 8) recorded maximum growth and yield of mustard.

Table 1. Influence of Sulphur and Micronutrients on growth and yield of Mustard

S. No.	Treatment combinations	Plant height (cm) (80 DAS)	Plant dry weight (g) (80 DAS)	Seed Yield (t/ha)	Stover Yield (t/ha)
1	Sulphur 10ppm + Mg 30 kg/ha	203.00	23.65	1.77	2.81
2	Sulphur 10ppm + B 5 kg/ha	204.60	24.25	1.85	2.92
3	Sulphur 10ppm + Ca 5 kg/ha	205.40	24.41	1.92	3.07
4	Sulphur 15ppm + Mg 30 kg/ha	199.40	26.01	2.00	3.30
5	Sulphur 15ppm + B 5 kg/ha	210.87	26.66	2.06	3.66
6	Sulphur 15ppm + Ca 5 kg/ha	211.80	24.70	2.10	3.77
7	Sulphur 30ppm + Mg 30 kg/ha	214.00	25.33	2.25	3.91
8	Sulphur 30ppm + B 5 kg/ha	214.20	31.61	2.69	4.33
9	Sulphur 30ppm + Ca 5 kg/ha	204.87	30.01	2.56	4.21
10	Control (RDF)	195.73	22.3	1.45	2.58
	F-test	**S**	**NS**	**S**	**S**
	SEm(±)	3.20	1.87	0.05	0.07

CD (p=0.05)	9.50	-	0.21	0.22

References

1. Amanullah Jan, Khan Noorullah, Khan Naeem, Khan Ijaz Ahmad, Khattak Baharullah (2002). Chemical composition of canola is affected by nitrogen and sulphur. *Asian Journal of Plant Science*. **1**(5):579-521.
2. Bamboriya, S. D., Bana, R. S., Pooniya, V., Rana, K. S., & Singh, Y. V. (2017). Planting density and nitrogen management effects on productivity, quality, and water-use efficiency of rainfed pearlmillet (*Pennisetum glaucum*) under conservation agriculture. *Indian Journal of Agronomy.* **62**(3), 363-366.
3. Fageria, N. K., Barbosa-Filho, M. P., Moreira, A. and Guimaraes, C. M. (2009). Foliar fertilization of crop plants. *Journal of Plant Nutrition.* **32**: 1044-1064.
4. Gomez, K. A. and Gomez, A. A. (1976). Statistical procedures for agriculture Research, 2nd Edition, John Wiley and Son, New York, 680p.
5. Lucy Taki and Lalrinengi (2022). Effect of phosphorus and magnesium on growth and yield characteristics of Indian mustard (*Brassica juncea* L.) in Kanpur. *The Pharma Innovation Journal.* **11**(6): 291-293
6. Mansouri Irandokht (2011). Response of canola to nitrogen and sulphur fertilizers. *International Journal of Agriculture and Crop Sciences*. **4**(1):28-33.
7. Ranjan R, Dimree S, Pathak RK, Awasthi UD, Verma Amar Kant (2018). Productivity, Water Use Efficiency and Economics of Indian Mustard (*Brassica juncea* L.) as Influenced by Integrated Nutrient Management. *International Journal of Current Microbiology and Applied Sciences*. **7**(11):2027-2034.
8. Sharma Simta, Chaudhray Shikha and Singh Rupinder (2020). Effect of boron and sulphur on growth, yield and nutrient uptake of mustard (*Brassica juncea* L.) *International Journal of Chemical Studies*. **8**(4): 1998-2001.
9. Yanthan Mhonthung R and Singh Rajesh (2021). Effect and boron and zinc level on growth, yield, and yield parameters of Mustard (*Brassica campestris* L.). *The Pharma Innovation Journal.* **10**(11): 474-476.