The Pharma Innovation Journal 2022; 11(6): 1681-1684

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(6): 1681-1684

www.thepharmajournal.com
Received: 08-04-2022
Accepted: 29-05-2022

Kalu Singh
M.Sc. Scholar, Department of Agronomy, Mandsaur University, Mandsaur, Madhya Pradesh, India

Dr. Praveen Kumar
Assistant Professor, Department of Agronomy, Mandsaur University, Mandsaur, Madhya Pradesh, India

Dr. Sanjay Singh
Head of Department, Agricultural Sciences, Mandsaur University, Mandsaur, Madhya Pradesh, India

Vishal Sarsaiya
Assistant Professor, Department of Entomology, Mandsaur University, Mandsaur, Madhya Pradesh, India

Corresponding Author:
Kalu Singh
M.Sc. Scholar, Department of Agronomy, Mandsaur University, Mandsaur, Madhya Pradesh, India

Evaluation of sulphur and zinc levels on physiological characters of Indian mustard [*Brassica juncea* (L.) *czern and cosson*] under Malwa region

Kalu Singh, Dr. Praveen Kumar, Dr. Sanjay Singh and Vishal Sarsaiya

Abstract
A field study was studied on the nutrient managements through different inorganic sources of Sulphur and Zinc in order to achieve the maximum crop growth rate, relative growth and absolute growth rate at different duration and at harvest stage. Amongst the different treatments for the different parameters *viz*., maximum crop growth rate, relative growth and absolute growth rate. The findings of present study indicated that growth attributes of crop significantly influence by integrated use of inorganic fertilizers during the period. Significantly at 30, 45 and 60 DAS the maximum crop growth rate, relative growth and absolute growth rate was recorded with Sulphur levels S_4 (60 Kg/ha) in plot T_4. Similarly, for the Zinc at 30, 45 and 60 DAS the best treatments maximum crop growth rate, relative growth and absolute growth rate was recorded with Zinc levels Z_4 (7.5 Kg/ha) in plot T_8.under Malwa region of Madhya Pradesh.

Keywords: Growth, inorganic, mustard, nutrient, physiological, sulphur, zinc

Introduction
Rapeseed-mustard belongs to the *Cruciferae* which is the major oilseed crop of India. The Indian Mustard is considered to be the second highest oil seed crop in India. On its accountability the Mustard is next to the Soyabean in terms of oil seed crops in India. The Indian Mustard is widely grown in Central parts of India. Some of the Indigeneous species of India *viz*., Indian Mustard (*Brassica juncea*), brown Sarson (*Brassica compestris* var. brown Sarson), yellow Sarson (*Brassica compestris* var. yellow Sarson), Toria (*Brassica compestris* var. Toria) and Taramira (*Eruca sativa*). Some of the non-traditional species are Gobhi Sarson (*Brassica napus*), white Sarson (*Brassica alba*) and Ethiopian Sarson (*Brassica carinata*).
Human consumption and sole dependence on mustard seed oil is well documented around north India, as it is generally used in cooking purpose. Mustard seeds is vitally used as condiments, pickles, flavouring agents. Indian mustard is generally grown in *Rabi* season due to its nature of adaptness and suitability in residual moisture conditions (Mukherjee,2010) [5]. Mustard oil cake is used as high nutrition food in animal diet. Since mustard seeds contain a quite higher amount of quality protein. For human diet generally 55g edible mustard oil is essential. Globally, in terms of oil sector India accounts 7% of the total global share production, 12% in terms of consumption and 20% share of the oil imports from India (USDA, 2018) [12] which is after the United States, Brazil, China.
The places where the mustard is easily grown in Madhya Pradesh *viz*., central plateau and Chambal valley region. The district such as Bhind, Morena, Gwalior, Sheopur, Shivpuri. In Madhya Pradesh Mustard is well occupied in regions as stated above and has made significant achievements which indeed is termed as 'Yellow revolution'.
'Morena' district in Madhya Pradesh, shares an area 0.53 mha, production 0.077 mt and productivity of 1453 kg ha^{-1} (SEA,s 2018) [8]. In the last decades 'Morena' district have continued to rule and lead amongst the other states of its territory to take the state production share 27%, b hind 26%, Gwalior 7%, Mandsaur 6% and other remaining districts accounts to state production share 23%.Comparing other states of India 'Rajasthan' have the highest area 2.12 mha, production 2.45mt and productivity of 1155 kg ha^{-1}. Gujarat on the other hands have the highest productivity 1363 kg ha^{-1} in 0.22 mha area with 0.3mt of production annually.
Sulphur is considered to be the most vital nutrients for growth and development for the oil seeds crop particularly in 'Mustard'. Sulphur is known for its physioilogical functioning's such as synthesis of cysteine, methionine, chlorophyll content in oil crops.

Sulphur is regarded to be the key factor for the synthesis of certain vital vitamins *viz*., (B, Biotin and Thiamine) for the metabolism of carbohydrates, protein, and oil formation of flavour in crucifers'.

'Zinc' is well known for the proper growth and development in the plant system and also replenishing the vital requirement of Zinc in the soil. The basic knowledge of 'Zinc' and its dynamics in soil must be clearly understood in order to trace out the deficiency mechanism. Zinc deficiency distribution and factors responsible for the 'Zinc' deficient soil must be treated out very carefully by application of 'Zinc' amendments mainly fertilizers that can hold the recommended nutrients into the soil by increasing the Zinc uptake mechanism.

Materials and Methods

The present investigation conducted at Research farm, Mandsaur, Department of Agronomy, Mandsaur University, Mandsaur (Madhya Pradesh) during *Rabi* season of 2021-2022. Mandsaur (Madhya Pradesh) which is situated at latitude 24^0C 4'36.61''N, longitude $75^0$4'9.46'' E and at an altitude of 442.16 meters above the mean sea level. The experiment was laid out in factorial randomized block design (FRBD) keeping three replications. The gross plot size (4.50×5.10) m^2 with net plot size was (3.60x4.20) m^2. The treatments having different levels were having S_1 (0 Kg/ha) Control, S_2 (20 Kg/ha), S_3 (40 Kg/ha) and S_4 (60 Kg/ha). The zinc in the form of zinc sulphate were as follows Z_1 (0 Kg/ha) Control, Z_2 (2.5 Kg/ha), Z_3 (5.0 Kg/ha) and Z_4 (7.5 Kg/ha). The Mustard variety DRMRIJ-31 (Giriraj) was sown using 5kg seeds $ha^{-1}$and keeping (45row x 15 plant) cm spacing. The crop was grown as per recommended package of practices. The plant growth, yield parameters were recorded in each treatments. The data from the field experiment were subjected analyzed statistically for comparing treatments following Analysis of Variance techniques (ANOVA) for FRBD design and the result were interpreted at 5% level of significance (Gomez and Gomez 1984) [8].

$$\text{Crop growth rate} = \frac{W_2\text{-}W_2}{P(t_2\text{-}t_1)}$$

P = Ground area
W_1=Dry weight of plant/m^2.
t1;t2 = time interval
Expressed in g/m^2/day.

$$\text{Relative growth rate} = \frac{\text{In}W_2\text{- In}W_1}{t_2\text{-}t_1}$$

Where as
In = natural log
W_1=Dry weight of plant/m^2
W_2=Dry weight of plant/m^2

$$\text{Agronomical growth rate} = \frac{h_2 - h1 \text{ cm day}^{-1}}{t_2\text{-}t_1}$$

Results and Discussion

The data based on the parameter crop growth rate as depicted in (Table 1) was significant with different days. Significantly at 0-30 DAS the maximum sulphur levels was recorded 0.778 with supplemented dose of Sulphur S_4 (60 Kg/ha) followed by 5.182 at 30-60 DAS, and 3.438 at 60-90 days of interval. Significantly the minimum was noted control plot T_1 sulphur levels S_1 (0 Kg/ha) at similar days were 0.557, 1.850 and 1.256 at 0-30 DAS, 30-60 DAS and 60-90 DAS for crop growth. Significantly at harvest crop growth rate was highest 4.516 on application of Sulphur S_4 (60 Kg/ha), whereas the minimum was recorded with control plot T_1 at sulphur level S_1 (0 Kg/ha) was recorded 2.707.In context with Zinc in the form of zinc sulphate when applied with recommended doses, the highest value obtained for crop growth rate at 0-30 DAS was 0.566, 30-60 DAS was 4.571 and 60-90 days was 2.245. Significantly at harvest crop growth rate was highest 3.388 on application of Zinc, Z_4 (7.5Kg/ha), whereas the minimum was recorded with control plot T_1 at sulphur level Zinc, Z_4 (0 Kg/ha) was recorded 2.760.Similar observation were also reported by (Baudh and Prasad) [1].

The data based on the parameter relative growth rate as depicted in (Table 2) was significant with different days. Significantly at 0-30 DAS the maximum sulphur levels was 0.026 recorded relative growth rate with supplemented dose of Sulphur S_4 (60 Kg/ha) followed by 0.052 at 30-60 DAS, and 0.033 at 60-90 days of interval. Significantly the minimum was noted in control plot with S_1 (0 Kg/ha) at similar days were 0.008, 0.010 and 0.013 at 0-30 DAS, 30-60 DAS and 60-90 DAS for crop growth. Significantly at harvest relative growth rate was highest 0.075 on application of Sulphur S_4 (60 Kg/ha), whereas the minimum was recorded with control plot T_1 at sulphur level S_1 (0 Kg/ha) was recorded 0.026. Similar observation were also reported by (Dubey *et al.*, 2013) [2]; (Zizala *et al.*, 2008) [14].

In context with Zinc in the form of zinc sulphate when applied with recommended doses, the highest value obtained for relative growth rate at 0-30 DAS was 0.019, 30-60 DAS was 0.033 and 60-90 days was 0.030. Significantly at harvest crop growth rate was highest 0.053 on application of Zinc, Z_4 (7.5Kg/ha), whereas the minimum was recorded with control plot T_1 at sulphur level Zinc, Z_4 (0 Kg/ha) was recorded 0.047. The results are with partial agreements with the study as per (Sipai *et al.*, 2015) [9]; (Upadhyay *et al.*, 2012) [10]; (Upadhyay *et al.*, 2016) [11]; (Verma *et al.*, 2012) [13].

The data based on the parameter absolute growth rate as depicted in (Table 3) was significant with different days. Significantly at 0-30 DAS the maximum sulphur levels was 0.821 recorded relative growth rate with supplemented dose of Sulphur S_4 (60 Kg/ha) followed by 1.545 at 30-60 DAS, and 1.392 at 60-90 days of interval. Significantly the minimum was noted in control plot with S_1 (0 Kg/ha) at similar days were 0.326, 0.412 and 0.584 at 0-30 DAS, 30-60 DAS and 60-90 DAS for crop growth. Significantly at harvest relative growth rate was highest 0.075 on application of Sulphur S_4 (60 Kg/ha), whereas the minimum was recorded with control plot T_1 at sulphur level S_1 (0 Kg/ha) was recorded 0.332. The results are with partial agreements with the study as per (Jat *et al.*, 2013) [4]; (Mukherjee *et al.*, 2013) [5]; (Nayak *et al.*, 2020) [6]; (Pachauri *et al.*, 2012) [7].

In context with Zinc in the form of zinc sulphate when applied with recommended doses, the highest value obtained for relative growth rate at 0-30 DAS was 0.611, 30-60 DAS was 0.576 and 60-90 days was 1.432. Significantly at harvest crop growth rate was highest 0.870 on application of Zinc, Z_4 (7.5Kg/ha), whereas the minimum was recorded with control plot T_1 at sulphur level Zinc, Z_4 (0 Kg/ha) was recorded 0.433. The results are with partial agreements with the study as per (Jat *et al.*, 2013) [4]; (Mukherjee *et al.*, 2013) [5]; (Nayak *et al.* 2020) [6] (Pachauri *et al.* 2012) [7] (Zizala *et al.* 2008) [14].

Table 1: Effect of different levels of Sulphur and Zinc on crop growth rate in Indian Mustard [*Brassica juncea* (L.) *czern and cosson*]

		Crop growth rate (CGR)			
S. No	**Levels of Sulphur**	**0-30 days**	**30-60 days**	**60-90 days**	**At harvest**
T_1	S_1 (0 Kg/ha) Control	0.557	1.850	1.256	2.707
T_2	S_2 (20 Kg/ha)	0.435	2.603	2.268	1.856
T_3	S_3 (40 Kg/ha)	0.294	3.219	1.375	3.235
T_4	S_4 (60 Kg/ha)	0.778	5.182	3.438	4.516
	SE(m)±	0.015	0.028	0.013	0.011
	C.D. (p=0.05)	0.043	0.081	0.038	0.033
	Levels of Zinc sulphate	0-30 days	30-60 days	60-90 days	At harvest
T_5	Z_1 (0 Kg/ha) Control	0.473	1.869	1.901	2.760
T_6	Z_2 (2.5 Kg/ha)	0.523	1.875	1.973	2.795
T_7	Z_3 (5.0 Kg/ha)	0.503	4.540	2.219	3.371
T_8	Z_4 (7.5 Kg/ha)	0.566	4.571	2.245	3.388
	SE(m)±	0.015	0.028	0.013	0.011
	C.D. (p=0.05)	0.043	0.081	0.038	0.033

Table 2: Effect of different levels of Sulphur and Zinc on relative growth rate in Indian Mustard [*Brassica juncea* (L.) *czern and cosson*]

		Relative growth rate (RGR)			
S. No	**Levels of Sulphur**	**0-30 days**	**30-60 days**	**60-90 days**	**At harvest**
T_1	S_1 (0 Kg/ha) Control	0.008	0.010	0.013	0.026
T_2	S_2 (20 Kg/ha)	0.023	0.049	0.028	0.060
T_3	S_3 (40 Kg/ha)	0.014	0.020	0.020	0.044
T_4	S_4 (60 Kg/ha)	0.026	0.052	0.033	0.075
	SE(m)±	0.005	0.007	0.002	0.003
	C.D. (p=0.05)	0.013	0.017	0.005	0.008
	Levels of Zinc sulphate	0-30 days	30-60 days	60-90 days	At harvest
T_5	Z_1 (0 Kg/ha) Control	0.013	0.029	0.012	0.047
T_6	Z_2 (2.5 Kg/ha)	0.018	0.031	0.014	0.050
T_7	Z_3 (5.0 Kg/ha)	0.017	0.031	0.025	0.052
T_8	Z_4 (7.5 Kg/ha)	0.019	0.033	0.030	0.053
	SE(m)±	0.005	0.002	0.002	0.003
	C.D. (p=0.05)	0.013	0.006	0.005	0.008

Table 3: Effect of different levels of Sulphur and Zinc on absolute l growth rate in Indian Mustard [*Brassica juncea* (L.) *czern and cosson*]

		Absolute growth rate (AGR)			
S. No	**Levels of Sulphur**	**0-30 days**	**30-60 days**	**60-90 days**	**At harvest**
T_1	S_1 (0 Kg/ha) Control	0.326	0.412	0.584	0.332
T_2	S_2 (20 Kg/ha)	0.356	0.888	0.909	0.870
T_3	S_3 (40 Kg/ha)	0.614	1.249	1.307	0.384
T_4	S_4 (60 Kg/ha)	0.821	1.545	1.392	1.069
	SE(m)±	0.001	0.003	0.004	0.002
	C.D. (p=0.05)	0.002	0.008	0.010	0.006
	Levels of Zinc sulphate	0-30 days	30-60 days	60-90 days	At harvest
T_5	Z_1 (0 Kg/ha) Control	0.448	1.471	0.668	0.433
T_6	Z_2 (2.5 Kg/ha)	0.449	1.473	0.669	0.721
T_7	Z_3 (5.0 Kg/ha)	0.610	0.573	1.424	0.633
T_8	Z_4 (7.5 Kg/ha)	0.611	0.576	1.432	0.870
	SE(m)±	0.001	0.003	0.004	0.002
	C.D. (p=0.05)	0.002	0.008	0.010	0.006

Conclusion

From the present investigation it may be concluded that for obtaining a higher yields by sustaining soil fertility in terms of available N, P and K. The Mustard variety DRMRIJ-31 (Giriraj) during the *Rabi* season under Malwa region. Amongst the different treatments for the different parameters *viz*., maximum crop growth rate, relative growth and absolute growth rate. The findings of present study indicated that growth attributes of crop significantly influence by integrated use of inorganic fertilizers during the period. It may be concluded that on application at 30, 45 and 60 DAS the maximum crop growth rate, relative growth and absolute growth rate were recorded with Zinc levels Z_4 (7.5 Kg/ha) in plot T_8 and Sulphur levels S_4 (60 Kg/ha) in plot T_4.

Acknowledgements

The authors are grateful to Prof. (Dr.) Sanjay Singh, Head of Department (Agriculture), Mandsaur University for providing necessary assistance for this study and my advisor Dr. Praveen Kumar for guiding me during the entire research.

References

1. Baudh AK, Prasad G. Interaction effect of different dose of sulphur and zinc with nitrogen, phosphorus and organic manure on growth and productivity of mustard (*Brassica compestris*). Indian Journal of Scientific

Research. 2012;3(1):141-144.
2. Dubey SK, Tripathi SK, Singh B. Effect of sulphur and zinc levels on growth, yield and quality of mustard [*Brassica juncea* (L.) Czern & Coss.]. A Journal of Crop Science and Technology. 2013;2(1):2319-3395.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley and Sons. Inc, NY, 1988, 8-20.
4. Jat JS, Rathore BS, Chaudhary MG. 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. 2012;1(1):42-52.
5. Mukherjee D. Productivity, profitability and apparent nutrient balance under different crop sequence in mid hill condition. Indian Journal of Agricultural Sciences. 2010 May 1;80(5):420.
6. Nayak BK, Adhikary S, Pattnaik M, Pal AK. Effect of Sulphur and zinc with combination of FYM on yield and uptake of nutrients in Mustard (*Brassica Juncea* (L.) under Alfisols of Odisha. Journal of Pharmacognosy and Phytochemistry. 2020;9(2):2310-3.
7. Pachauri RK. Effect of sulphur and zinc levels on mustard (*Brassica juncea*). Bhartiya Krishi Anusandhan Patrika. 2012;27(1):5-8.
8. SEA (Solvent Extractors' Association of India): Publishers on March- 2018.
9. Sipai AH, Patel JJ, Patel NI. Effect of sulphur and zinc with and without FYM on yield and yield attributes of mustard [*Brassica juncea* (L.) Czern and Coss] grown on light textured soil of Kachchh. Asian Journal of Soil Science. 2015;10(2):191-200.
10. Upadhyay AK. Effect of sulphur and zinc on yield, uptake of nutrients and quality of mustard. Annals of plant and soil Research. 2012;14(1):42-5.
11. Upadhyay YO, Swaroop NA, Sahu YK, Dhruw SS, Verma PD. Interaction effects of different doses of sulphur and zinc with npk on physic-chemical properties of soil in yellow mustard (*Brassica compestris* L.) Cv. Krishna super Goldi. Int. J Agril. Sci. Res.(IJASR). 2016;6(2):215-20.
12. USDA. Oilseeds: world markets and trade. United Stated of Department of Agriculture, Foreign Agricultural Service. Available at Usdagov psdonline circulars oilseeds, 2018.
13. Verma CK, Prasad K, Yadav DD. Studies on response of sulphur, zinc and boron levels on yield, economics and nutrients uptake of mustard [*Brassica juncea* (L.) czern & coss.]. Crop Research. 2012;44(1and2):75-8.
14. Zizala VJ, Jadav NB, Gorfad PS. Effect of sulphur and zinc on yield, quality and its concentration on mustard. Asian Journal of Soil Science. 2008;3(1):173-7.