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Effect of Levels of Phosphorus and Molybdenum on Growth and Yield Attributes of Mustard (*Brassica juncea* L.)

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ABSTRACT

Keywords

Mustard, Phosphorus, Molybdenum, Soil application, Foliar application

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A field experiment was conducted at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj, on the Mustard in *Rabi* 2019, with 9 treatments which were replicated thrice and laid out in Randomized Block Design. The experiment consisted of three levels of Phosphorus *viz*., (P_1: 40, P_2: 50, P_3: 60 Kg/ha) were applied at the time of sowing and three levels of Molybdenum *viz*., (M_1: 0kg/ha, M_2:2 kg/ha, $M_{3:}$ 2kg/ha+5ppm) as basal at the time of sowing and foliar application of (5ppm) before flowering stage. Among the treatments, 60Kg/ha of Phosphorus along with basal application & foliar spray of molybdenum i.e., 2Kg/ha + 5ppm was recorded higher in plant height (204.93cm), number of branches(11.13/plant), dry weight(112.83g/plant), number of siliqua/plant (253.22), number of seeds/siliqua (16.11), test weight (4.33g) were recorded higher in treatment combination 60Kg/ha P_2O_5 + 2Kg/ha+5ppm Mo.

Introduction

Mustard (*Brassica juncea*.L) is an important *Rabi* season oil seed crop growing mainly in Rajasthan, Haryana, Uttar Pradesh, Maharashtra, Karnataka, Madhya Pradesh, and West Bengal, Tamilnadu., occupying a prominent place being next in importance to groundnut, both in area and production. It is also called as rai, raya or laha. The oil content of mustard seed ranges from 30 - 47 % and 20 - 40 % protein. Present production of oilseeds in India is around 32.3 million tons from 25.5 million hectare with average productivity 1265 Kg/ha. In India, mustard is cultivated over an area of 6.2 million hectare with production of 9.3 million tons of seeds.

The average yield of mustard in country is 1499 Kg/ha. In India, Rajasthan ranks first in production 4.08 million tons and Haryana State have the second highest production of 1.25 million tons of mustard. In U.P. mustard is grown with production of 1.12 million tons and percent share of production to all India 11.96 (Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare. 2018-2019)

There may be a number of factors responsible for low yield of mustard in India but poor soil fertility status and sub optimal use of fertilizer nutrients, particularly, phosphorus appears to be most important (Premi and Kumar, 2004). Phosphorous plays a vital role as a structural component of cell constituent and metabolically active compounds i.e. chloroplasts, mitochondria, phyton, nucleic acid, protein, flavin nucleotides and several enzymes. phosphorus influences the vigour of plants and root growth. It also encourages the development of nitrogen fixing bacteria, pod formation and hastens the maturity of pods (Tisdale *et al.,* 1984).

Molybdenum is one of the most recognized nutrient elements considered to be essential for the growth of plant also playing important role in structural building of cell wall and cell membrane and synthesis of protein. Mustard is very susceptible to molybdenum deficiency. Growth is markedly reduced and plants develop foliar symptoms like cupping, marginal scorching and loss of lamina. Molybdenum is an essential micronutrient for plants, bacteria, and animals. Mo-deficient plants exhibit poor growth and low chlorophyll and ascorbic acid content (Marschner, 1995).

Materials and Methods

The experiment was carried out during *Rabi* season of 2019 at the Crop Research Farm (CRF) Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh. The soil of the experimental area was sandy loam. Soil sample was taken before and after sowing with soil auger and analysed. The effectiveness of levels of phosphorus and Molybdenum was evaluated through a field experiment in mustard crop. The experiment was laid out in Randomized Block Design with three replications with a plot size of 3 x 3 m. T-59 (Varuna) mustard variety was grown with a spacing of 40 x 15 cm Three levels of phosphorus (P_1: 40, P_2: 50, P_3: 60 Kg/ha)and molybdenum(M_1: 0kg/ha, M_2: 2 kg/ha, M_3: 2kg/ha+5ppm) were applied in the respective plots according to the treatments just before sowing of the seed in a line, and the quantity was based on the requirement of crop. Observations such as average plant height, number of branches, dry weight, number of siliqua, were recorded by taking average of 5 plants and treatment-wise. Seed yield was recorded per plot and converted into Kg/ha. Data generated from the field experiments were subjected to the statistical analysis of variance appropriate to the experimental design.

Results and Discussion

Growth attributes

Plant height (cm)

The data pertaining to plant height is presented in Table 1. At 120 DAS, the plant height was found to be significantly higher in treatment T_9 (60 Kg ha P_2O_5 along with 2Kg ha+ 5ppm Mo) (204.93 cm) whereas treatment T_6 (60 Kg/ha P_2 O_5+ 0 Kg/ha Mo), T_7 (60 Kg/ha P_2 O_5 + 2 Kg/ha Mo) were found to be statistically at par with treatment T_9. The increase in plant height was probably due to increased efficiency of metabolism by P and Mo supply and formation of structural carbohydrates in mustard (Ghosh and Gulati, 2001).

The concentration of available P in the soil solution is normally insufficient to support the plant growth, continual replacement of soluble P from inorganic and organic sources is necessary to meet the P requirements of crop by (Tisdale *et al.,* 2002).

Table.1 Effect of phosphorus and molybdenum levels on growth of mustard

Treatment combinations	Plant height (cm) at 120 DAS	No. of branches /plant at 120 DAS	Dry weight (g) at 120 DAS	Crop growth rate (g/m^2/day) at 100-120 DAS	Relative growth rate (g/g/day) at 100-120 DAS
T_1: 40 Kg/ha P_2 O_5 + 0 Kg/ha Mo	186.81	10.33	81.40	10.09	0.020
T_2: 40 Kg/ha P_2 O_5+ 2 Kg/ha Mo	177.18	10.20	105.23	10.00	0.015
T_3: 40 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo	197.79	10.17	94.70	10.99	0.019
T_4:50 Kg/ha P_2 O_5+ 0 Kg/ha Mo	197.81	9.93	100.86	12.16	0.020
T_5: 50 Kg/ha P_2 O_5+ 2 Kg/ha Mo	191.59	10.00	98.76	10.86	0.018
T_6: 50 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo	189.96	10.47	103.70	10.86	0.017
T_7: 60 Kg/ha P_2 O_5+ 0 Kg/ha Mo	198.78	10.47	93.56	11.54	0.020
T_8: 60 Kg/ha P_2 O_5 + 2 Kg/ha Mo	196.81	10.53	109.93	12.50	0.018
T_9: 60 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo	204.93	11.13	112.83	10.49	0.014
F- test	S	S	S	S	S
SEm±	4.01	0.22	3.55	0.44	0.001
CD(P=0.05)	12.03	0.66	10.64	1.33	0.004

Table.2 Effect of phosphorus and molybdenum levels on yield attributes of mustard

Treatment combinations	Siliqua/plant	Seeds/siliqua	Test weight (g)
T_1:40 Kg/ha P_2 O_5 + 0 Kg/ha Mo	181.56	15.11	3.91
T_2:40 Kg/ha P_2 O_5+ 2 Kg/ha Mo	161.22	14.67	4.11
T_3:40 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo	149.89	15.67	4.11
T_4:50 Kg/ha P_2 O_5+ 0 Kg/ha Mo	150.78	15.56	4.04
T_5:50 Kg/ha P_2 O_5+ 2 Kg/ha Mo	203.67	15.56	4.19
T_6:50 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo	160.33	14.78	4.27
T_7:60 Kg/ha P_2 O_5+ 0 Kg/ha Mo	204.22	15.67	4.11
T_8:60 Kg/ha P_2 O_5 + 2 Kg/ha Mo	244.67	14.56	4.21
T_9:60 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo	253.22	16.11	4.33
F- test	S	S	S
SEm±	14.91	0.32	0.08
CD(P=0.05)	44.69	0.97	0.24

No. of branches per plant

The data related to No of branches per plant is presented in Table 1 which revealed that, at 120 DAS the no. of branches per plant was found to be significantly higher in treatment T_9 (60 Kg ha P_2O_5 along with 2Kg ha+ 5ppm Mo) (11.13) whereas treatment T_6 (50 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo) and treatment T_7 (60 Kg/ha P_2 O_5+ 0 Kg/ha Mo) were found to be statistically at par with treatment T_9..

Phosphorous plays a vital role as a structural component of cell constituent and metabolically active compounds i.e. chloroplasts, mitochondria, phyton, nucleic acid, protein, flavin nucleotides and several enzymes. phosphorus influences the vigor of plants and root growth. It also encourages the development of nitrogen fixing bacteria, pod formation and hastens the maturity of pods (Tisdale *et al.,* 1984).

Dry weight (g)

The data related to Dry weight is presented in Table 1. At 120 DAS, the dry weight was found to be significantly higher in treatment T_9 (60Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm M) (112.83 g/plant) whereas treatment T_8 (60Kg/ha P_2 O_5 + 2 Kg/ha Mo) was found to be statistically at par with treatment T_9. Dry matter accumulation per plant of mustard was noted the application of higher dose of phosphorus 60 Kg/ha was produced significantly more dry matter accumulation with the application of 60 Kg P_2O_5/ha. (Tripathi *et al.,* 2010).

Crop growth rate (g/m^2/day)

The data related to Crop growth rate is presented in the Table 1 at 100-120 DAS Crop growth rate was found to be significantly higher in treatment T_8 (60 Kg/ha P_2 O_5+ 2 Kg/ha Mo) (12.50) whereas treatment T_4 (50 Kg/ha P_2 O_5+ 0 Kg/ha Mo) and treatment T_7 (60 Kg/ha P_2 O_5+ 0 Kg/ha Mo) were found to be statistically at par with treatment T_8.Molybdenum was required for normal plant growth, reduction supply with molybdenum to the growth medium decreased activities of nitrate reductase and glutamine synthetase involved at initial steps of nitrate assimilation (Hristozkova *et al.,* 2006).

Relative Growth Rate (g/g/day)

The data related to Relative Growth Rate was presented in Table 1. At 100-120 DAS it was found to be highest in treatment T_1 (40 Kg/ha P_2 O_5 + 0 Kg/ha Mo)(0.020), whereas treatments T_4 (50 Kg/ha P_2 O_5+ 0 Kg/ha Mo) &T_7 (60Kg/ha P_2 O_5+ 0 Kg/ha Mo) found to be statistically at with T_1. The supply of phosphorus to soil might have accelerated cell division and enlargement, carbohydrate, fat metabolism and respiration in mustard plant by (Rana *et al.,* 2005).

Yield attributes:

Siliqua per plant

The data related to siliqua per plant is presented in Table 2. Which revealed that the siliqua per plant (253.22/plant) was found to be significantly higher with the treatment T_9 (60 Kg/ha P_2 O_5 + 2 Kg/ha + 5ppm Mo) whereas treatmentT_8 (60 Kg/ha P_2 O_5 + 2 Kg/ha Mo) found to be statistically at par with treatment T_9.

The Phosphorus uptake leads to increased net CO_2 fixations with increased rate of photosynthesis and thereby more photosynthates to develop more no. of pods per plants in mustard (Badsra and Chaudhary 2001). Phosphorus application significantly increased the number of siliquae/plants in mustard (Premi and Kumar 2004).

Seeds per siliqua

The data pertaining to seeds per siliqua is presented in Table 2. which revealed that the seeds per siliqua (16.11) was found to be significantly higher with the treatment T_9 (60 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo) whereas treatments T_3, T_4, T_5 & $T_7$are statistically at par to T9. The Phosphorus levels leads to synthesis and deposition of seeds reserves (starch, lipid, protein and phytin) that ultimately produce higher no. of seeds/siliqua (Jat *et al.*, 2000).

Test weight (g)

The data related to test weight is presented in Table 2, which revealed that the test weight (4.33) was found to be significantly higher with the treatment T_9 (60 Kg/ha P_2 O_5+ 2 Kg/ha + 5ppm Mo) whereas treatments T_8, T_7, T_6, T_5, T_3& $T_2$are statistically at par to T_9.The results indicated that increasing levels of phosphorus up to 60 Kg phosphorus resulted in significant increase in dry matter accumulation, phosphorus uptake, yield attributes like pods per plant, seed per pod and 1000 seed weight) and seed yield, (Kumar and Sharma, 2005)

Based on the findings of this experiment it can be concluded that application of 60 Kg/ha along with 2Kg/ha + 5ppm Mo was found to be economically profitable for farmers.

References

Badsra, S. R. and Chaudhary, L. (2001). Association of yield and its components in Indian mustard (Brassica juncea L. Czern and Coss). *Agriculture Science Digest*. 21(2): 83-86.

Directorate of Economics & Statistics, Department of Agriculture, Co-operation & Farmers Welfare. (2018-2019).

Ghosh, S. K. and Gulati, S. C. (2001). Genetic variability and association of yield component in Indian mustard (*Brassica juncea* L.). *Crop Research*. 21(3): 345-49.

Hristozkova, M., M. Geneva and I. Stanch Eva, 2006. Response of pea plants (*Pisum sativum* L.) to reduced Supply with Molybdenum and Copper. International Journal of Agriculture and Biology, 8(2): 218-220.

Jat, R. S., Kanhangarot, S. S. and Rathore, S. S. (2000). Effect of different fertility levels on growth and yield of mustard (*Brassica juncea L. Czern and Coss*). *Annals of Agriculture Research.* 21(3): 421-23.

Kumar and Sharma M, (2005). Effect of phosphorus and Molybdenum on yield and nutrient uptake chickpea (*Cicer arietineum* L). *Advances in plant science*18:869-873.

Kundu, S., and Dhaka, R. P. S. (1996). Protein, oil and glucosinolate contents in some elite genotypes on Indian mustard (*Brassica juncea L. Czern and Coss). J. Oilseeds* Research. 13(1): 149-5

Marschner H., (1995). Mineral nutrition of higher plants. 2nd edition. London: Academic Press.

Premi, O. P. and Kumar, M. (2004). Response of Indian mustard (Brassica juncea) to different levels of nitrogen and phosphorus under irrigated condition. Indian J. Agriculture Research, 38(2): 151 - 153.

Rana, K.S., Rana, D.S., Gautam, R.C. 2005. Influence of phosphorus, sulphur and boron on growth, yield, nutrient uptake and economics of Indian mustard (*Brassica juncea*) under rainfed conditions. Indian Journal of Agronomy; 50 (4):314-316.

S.L. Tisdale, W.L. Nelson, J.D. Beaten. (1984). Zinc in Soil Fertility and

Fertilizers (Fourth ed.), Macmillan Publishing Company, New York pp. 382–391.

Solanki, R.L., Sharma, M., Sharma, S.K., Sharma, F.L. and Jain, H.K. (2016) Effect of phosphorus, sulphur and phosphate solubilizing bacteria on yield and micronutrient cation uptake of mustard (*Brassica Juncea* L.) on a Haplustept. *Indian Journal of fertilisers*, 12, 36-41.

Tisdale Samuel, L., Nelson Werner, L., Beaton James, D. and Havlin John, L. (2002). Soil and fertilizer phosphorus from soil fertility and fertilizers. Asoke K. Ghosh, Prentice- HallOf India Pvt. Ltd., New Delhi (India).

Tripathi, M.L., Trivedi, S.K. (2010). Yield and quality of Indian mustard (*Brassica juncea* L.) as influenced by irrigation and nutrient levels. *Indian Journal of Agronomy*, 55 (1): 56-59.

Tuncturk, R. and Tuncturk, M. (2006). Effect of different phosphorus levels on the yield and quality components of cumin (*Cuminum cyminum* L.). *Res. J. Agril. Biol. Sci*. 2(6): 336-340.

Yadav, R.P.; Tripathi, M.L.; Trivedi, S.K. (2010). Yield and quality of Indian mustard (*Brassica juncea* L.) as influenced by irrigation and nutrient levels. *Indian Journal of Agronomy*,55 (1): 56-59.

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