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Effect of Seed Treatment with Chemicals and Plant Growth Regulators on Growth and Yield Attributing Traits of Indian Mustard (*Brassica juncea* L.) Variety: Pusa Bold

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The Experiment was conducted in the field of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) during Rabi season 2020-2021, in order to standardize the suitable pre- sowing seed treatment for Mustard. Different pre- sowing seed treatments with control (Unhardened) were evaluated viz., T0– Control,T1- Mg(No3)2 @ 0.1%,T2- Mg(No3)2 @ 0.3%,T3- Mg(No3)2 @ 0.5%,T4- Ca(No3)2 @ 0.1%,T5- KNO3 @ 0.5%,T6- Mg(So4)2 @ 0.1%,T7- Mg(So4)2 @ 0.3%,T8- Mg(So4)2 @ 0.5%,T9- GA3 @ 25ppm,T10- GA3 @ 50ppm,T11- GA3 @ 75ppm,T12- PEG6000 @ 25ppm. It was found that the all pre-sowing seed treatments showed significance difference with control. Seed treatment with KNO3 @ 0.5% found to be highest in field emergence and yield attributes of Mustard and it was followed by GA3 @ 25ppm and Mg(No3)2 @ 0.1%. Pre- sowing seed treatment with KNO3 @ 0.5% and GA3 @ 25 ppm showed maximum increase yield of mustard seeds and found to be lowest in control seeds. Pre-sowing seed treatments of the mustard seeds in which KNO3 @ 0.5%

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gave best result to enhanced germinability, seed vigour, seed yield and yielding attributes. These conclusions are based on the results of six months investigation and therefore further investigation is needed to arrive at valid recommendations.

Keywords: Mustard seeds; halo priming seed treatment; KNO3; GA3; Mg(No3)2 and RBD(Randomized Block Design); Among various oilseed crops grown in India; rapeseed-mustard group of crops.

1. INTRODUCTION

Mustard (*Brassica juncea* L. Czern and Coss) is an important oilseed crop belonging to family cruciferous (Syn. brassicacae). Indian mustard or brown mustard is natural amphidiploids having chromosome no (2n=36). It is self-pollinated but certain amount (2-15 %) pollination occur due to insects and other factors. The origin place of mustard is China, north eastern India from where it has extended up to Afghanistan via Punjab (Vaughan, 1997).

(*Brassica spp*., Family *Brassicaceae*) comprising Indian rape (toria), Indian mustard (rye), oilseed rape (gobhi sarsen), Ethiopian mustard (African sarsen), yellow sarsen, brown sarsen and taramira, are next to soybean in terms of area and production. Cultivation of these crops in 28 states of the country under diverse agro-ecological situations over an area of 6.51 million hectares to produce 8.18 million tons signifies its importance in vegetable oil scenario of the country [1].

Edible oils are the concentrated sources of energy, contain essential fatty acids (linoleic and linolenic), carriers of fat-soluble vitamins (A, D, E and K) and contribute to taste, flavor, palatability and satiety of food. These crops also serve as raw material for various industrial products. Protein rich oilseed meal obtained after oil extraction is used as animal feed. The current production of edible oilseeds in the country meets only about 50 per cent of the requirement. During 2011-12, 8.43 million tons of edible oil worth `46,242 crores was imported against domestic production of 8.68 million tons [2]. With increasing population and improving purchasing power of the consumers, the demand of edible oil is further increasing at the rate of 4-6 per cent [3] (Rao 2009).

India is a paradise of oilseed crops. They play a key role in Indian agriculture. In fact, they are next to food crops in importance and occupy a sizable share (13%) of the country's gross crop production. Their net value (10%) of all agricultural products is also substantial. As far as their contribution to the gross national production is concerned, oilseeds have 5% share, and an annual turnover of Rs 60,000 crores [4]. India has the largest number of commercial varieties of oilseeds as she has vast tracts of arable land and diverse agro-climatic conditions. The major oilseeds include castor, coconut, groundnut, linseed, Niger, rapeseed- mustard, safflower, sesame, soybean and sunflower [5,4].

Rapeseed-mustard group of crops occupies 22.4 per cent of total cultivated area under oilseeds (27.2 mha) and contributes 22.6 percent to total production of oilseeds (32.5 mt) in the country [6]. India ranks second in area after China and third in production after Canada and China contributing about 21.7 per cent of the total area and 13.4 per cent of the total production of rapeseed- mustard in the world [7]. However, the present productivity of rapeseed- mustard in India (1257 kg/ha) is below its average productivity in the world (1856 kg/ha). Among these *Brassica* species, Indian mustard (*Brassica juncea* L. Czern & Coss) with a share of about 80 per cent in area and production, occupies prominent position in India.

These concerns prompted an intensive breeding program by researchers, as mustard had become a major oil seed crop. Oil of the Indian mustard varieties exhibits quite high content of erucic acid High amount of erucic acid in edible oils was reported to impair myocardial conductance, causes lipidosis in children and increases blood cholesterol with applications in the lubricants industry. Nowadays edible oils are also being utilized as a biofuel substitute for the traditional fossil diesel fuel with the potential to reduce greenhouse gas emissions. Because of the adverse effects of high erucic acid content in oil of Indian mustard varieties, the varietal improvement program in India aims at reducing erucic acid level up to internationally accepted norms, which necessitates non-destructive screening of a large number of samples with limited seed availability especially in the potential germplasm. High fibre content (12– 13%) in the seed meal reflects lower value of the metabolizable energy and it may negatively

influence the protein digestibility and bioavailability of minerals such as manganese and zinc [8]. This information on the nutritional and anti-nutritional make-up of mustard oil would be quite useful for the breeders in the quality improvement program.

2. MATERIALS AND METHODS

The present investigation was carried out at the Laboratory and field of Seed science and Technology in the Department of Genetics and Plant Breeding, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Science, Naini Agriculture Institute, Prayagraj (U.P) located in the South-East part of Uttar Pradesh, India. The site of experiment is located at 25.57º N latitude, 81.51º E longitude and 98 meter above the sea level. The experimental material consists of 13 treatments with 4 replication analyzed through Randomized Block Design(RBD) and seed of mustard, which were provided by Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). Details of the treatments with its code, concentration and duration (hrs) viz., T0– Control, T1- Mg(No3)2 @0.1%,T2- Mg(No3)2 @ 0.3%,T3- Mg(No3)2 @ 0.5%,T4- Ca(No3)2 @

0.1%,T5- KNO3 @ 0.5%,T6- Mg(So4)2 @
0.1%,T7- Mg(So4)2 @ 0.3%,T8- Mg(So4)2 @ 0.5%,T9- GA3 @ 25ppm,T10- GA3 @ 50ppm,T11-

GA3 @ 75ppm,T12- PEG6000 @ 25ppm. In this experiment Field emergence percentage for 15Days, Plant height (30,60,90 DAS), Days to 50% flowering, Number of branches per plant, Number of siliquae per plant, Number of seeds per siliquae, Seed yield per plant /sq. mts(g), Seed yield per plot /sq. mts (g), Biological yield (g) and Harvest index are the observations recorded.

3. RESULTS AND DISCUSSIONS

The data presented in Table 1 shows mean performance of 13 treatments for 10 growth and yield parameters (Quantative). The grand mean for all the traits is also depicted in Table 1.

3.1 Field Emergence (%)

Field emergence percentage recorded high in case of primed seeds than that of unprimed seeds in this experiment. Among different pre-sowing seed treatments, KNO3 @ 0.5% found to be highest and control found to be lowest among all the treatments. In case of different pre-sowing seed treatment, field emergence percentage was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and Mg(NO3)2 @ 0.3% when compared with control. When the data regarding the field emergence percentage found best in KNO3 @ 0.5% among all the treatments. Similar results of field emergence percentage were observed by Ghassemi-Golezani et al., [9].

3.2 Plant Height (cm) 30,60,90 DAS

Pre-sowing seed treatment plant height 30DAS was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and Ca(No3)2

@ 0.1% when compared with control. When the data regarding the plant height found best in KNO3 @ 0.5% among all the treatments. Similar results of plant height were observed by Hossain et al., [10].

Pre-sowing seed treatment plant height 60DAS was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and Mg(So4) @ 0.5% when compared with control. When the data regarding the plant height found best in KNO3 @ 0.5% among all the treatments. Similar results of plant height were observed by Vazirimehr et al., [11].

Plant height recorded high in case of primed seeds than that of unprimed seeds in this experiment. Among different pre-sowing seed treatments, KNO3 @ 0.5% found to be highest and control found to be lowest among all the treatments. In case of different pre-sowing seed treatment, plant height was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and Mg(No3)2 @ 0.5% when compared with control. Similar results of plant height were observed by Sarkar and Pal [12].

3.3 Number of Branches Per Plant

In case of different pre-sowing seed treatment, number of branches per plant was found significantly higher in KNO3 @ 0.5% seeds followed by T9- GA3 @ 25ppm and T8- Mg(So4)2 @ 0.5%, when compared with control. When the data regarding the number of branches

Table 1. Effect of treatments on mean performance of mustard for growth and yield parameters

S. No	Treatment	Field Emergence (%)	Plant Height (cm) 30DAS	60DAS	90DAS	Number of branches/plant	50% days to flowering	No of silique per plant	Seed per silique	Seed yield per plant (gm)	Seed Yield/ plot (gm)	Biological Yield (gm)	Harvest index (%)
1.	T_o	73	24.33	87.73	126.13	3.44	48.69	44.33	9.00	1.33	34.81	185.11	18.80
2.	T_1	85.53	27.33	101.76	123.4	3.91	47.26	52.67	11.00	2.03	39.08	189.58	20.61
3.	T_2	77.5	31.66	88.53	129.6	4.34	42.93	58.00	11.00	2.24	40.75	203.09	20.05
4.	T_3	81	29.33	102.13	130.1	4.84	42.43	62.67	12.33	2.42	41.41	208.53	19.85
5.	T_4	84.5	32.0	95.0	123.43	4.75	42.98	60.33	12.00	2.15	40.49	200.80	20.17
6.	T_5	87.03	33.0	116.33	138.46	6.22	40.19	82.67	15.33	4.12	53.72	237.04	22.66
7.	T_6	81.66	27.0	94.43	128.53	4.88	44.16	70.33	12.20	2.82	43.45	212.46	20.10
8	T_7	80.7	31.0	97.4	129.9	4.68	42.83	69.67	13.00	2.90	50.03	229.08	21.83
9.	T_8	79.33	33.0	110.33	122.43	5.17	47.28	73.33	12.33	2.81	40.73	212.42	19.17
10	T_9	86.26	32.66	113.0	134.43	5.91	41.78	78.00	15.00	4.00	52.13	235.12	22.16
11	T_{10}	81.033	30.0	108.66	138.46	4.80	43.41	75.33	12.00	3.06	39.26	199.82	19.68
12	T_{11}	81.04	26.66	100.4	126.7	4.32	44.09	72.00	11.33	2.77	49.13	230.43	21.32
13	T12	77.8	29.33	104.46	130.63	5.03	43.93	73.67	10.67	2.52	49.47	230.18	21.49
Avg Mean		81.29	29.36	101.55	101.55	4.79	43.76	43.93	12.10	2.70	44.19	213.66	20.61
F Test		S	S	S	NS	S	S	S	S	S	S	S	S
SE(m)		2.3	1.3	4.5	4.5	0.36	0.29	1.45	0.72	0.09	0.97	2.52	0.39
CV		4.9	7.91	7.7	6.0	13.09	0.84	0.29	10.28	5.79	3.78	2.04	3.28
C.D(5%)		6.7	3.9	13.1	13.1	1.06	1.16	1.16	2.10	0.26	2.83	7.34	1.14

per plant found best in KNO3 @ 0.5% among all the treatments. Similar results of number of branches per plant was observed by Hossain et al., [10].

3.4 Days to 50% Flowering

In case of different pre-sowing seed treatment, number of branches per plant was KNO3 @ 0.5% found significantly higher in seeds followed by GA3 @ 25ppm and Mg(No3)2 @ 0.5% when compared with control. When the data regarding the number of branches per plant found best KNO3 @ 0.5% in among all the treatments. Similar finding was observed by Demir and Oztolcar [13].

3.5 Number of Siliquae Per Plant

In case of different pre-sowing seed treatment, number of siliquae per plant was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and GA3 @ 50ppm when compared with control. When the data regarding the number of siliquae per plant found best in KNO3 @ 0.5% among all the treatments. Similar results of number of siliquae per plant was observed by Shehzad et al., [14].

3.6 Number of Seeds Per Siliquae

In case of different pre-sowing seed treatment, number of seeds per siliquae was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and Mg(So4)2 @ 0.3% . when compared with control. When the data regarding the number of seeds per siliquae found best in KNO3 @ 0.5% among all the treatments. Similar results of number of seeds per siliquae was observed by Demir and Oztolcar [13].

3.7 Seed Yield Per Plant (gm)

Seed yield per plant recorded high in case of primed seeds than that of unprimed seeds in this experiment. Among different pre-sowing seed treatments, KNO3 @ 0.5% found to be highest and control found to be lowest among all the treatments. In case of different pre-sowing seed treatment, seed yield per plant was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and GA3 @ 50ppm when compared with control. Similar finding was observed by Sarkar et al., [15].

3.8 Seed Yield Per Plot (gm)

In case of different pre-sowing seed treatment, seed yield per plot was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and Mg(So4)2 @ 0.3% when compared with control. When the data regarding the seed yield per plot found best in KNO3 @ 0.5% among all the treatments. Similar results of seed yield per plot was observed by Golezani et al., [16].

3.9 Biological Yield (gm)

In case of different pre-sowing seed treatment, biological yield was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and GA3 @ 75ppm. when compared with control. When the data regarding the biological yield found best in KNO3 @ 0.5% among all the treatments. Similar results of biological yield was observed by Toklu et al., [17].

3.10 Harvest Index (%)

Harvest index recorded high in case of primed seeds than that of unprimed seeds in this experiment. Among different pre-sowing seed treatments, KNO3 @ 0.5% found to be highest and control found to be lowest among all the treatments. In case of different pre-sowing seed treatment, harvest index was found significantly higher in KNO3 @ 0.5% seeds followed by GA3 @ 25ppm and Mg(So4)2 @ 0.3% when compared with control. When the data regarding the harvest index found best in KNO3 @ 0.5% among all the treatments. Similar findings was observed by Hoseini et al., [10]; Galhaut et al., [18].

4. CONCLUSION

The present study was undertaken to evaluate the effect of pre-sowing seed treatments with chemicals and plant growth regulators on growth and yield attributing traits of Indian Mustard (*Brassica juncea* L.)". From the present experiment it can be concluded that the all the parameters studied showed significant variation for growth, yield and yield attributes. Pre-sowing seed treatments of the mustard seeds for which T5-KNO3 0.5% gave best result to enhanced germinability, plant height, seed yield and yielding attributes of Mustard.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. Food and Agricultural Organization of the United Nations; 2012.
   Available:http://www.faostat.org.
2. Anonymous. India"s import of agricultural products. Director general of commercial intelligence and statistics. Ministry of Commerce, Kolkata; 2013.
   Available:http://www.agricoop.nic.in
3. Hegde DM. Can India achieve self-reliance in vegetable oils? In: Proc National Symposium on Vegetable Oils Scenario: Approaches to Meet the Growing Demands. Indian Society of Oilseeds Research, Directorate of Oilseeds Research, Hyderabad. 2009;29-31:1-10.
4. Hegde DM. Measures to turn self-reliant. The Hindu Survey of Indian Agric. 2002;71-74.
5. Shukla RK, Singh HB, Jaggi S. Trends in oilseed production in India and strategies to meet future challenges. In: Rapeseed-mustard at the Doorstep of the New Millennium. 2000;21-26.
   Bhatnagar AK, Shukla RK, Singh HB. Mustard research and promotion consortium, New Delhi.
6. Anonymous. Area, production and yield of principal crops. Directorate of Economics and Statistics, Department of. 2011;85-136.
7. Kumar A, Yadava DK, Rana DS. Rapeseed-mustard in India: Present scenario, future projections and R & D issues. Indian Farm. 2012;62(8): 14-21.
8. Chauhan YS, Bhargava MK, Jain VK. Weed management in Indian mustard (*Brassica juncea*). Indian Journal of Agronomy. 2002;50(2):149-151.
9. Ghasemi-Golezani K, Aliloo AA, Valizadeh M, Moghaddam M. Effects of different priming techniques on seed invigoration and seedling establishment of lentil (*Lens culinaris* Medik.). J Food Agric Environ. 2008;6:222-226.
10. Haq MZ, Hossain MM, Huda MS, Zamal SS, Karim MR. Response of foliar application of GA3 in different plant ages for seed production in black cumin. Eco-friendly Agril. J. 2013;6 (08): 150-155.
11. Vazirimehr MR, Ganjali HR, Rigi K, and Keshtehgar A. Effect of seed priming on quantitative traits corn. International Journal of Plant Sciences. 2014;4:134-140.
12. Sarkar RK, Pal PK. Effect of pre- sowing seed treatment and foliar spray of nitrate salts on growth and yield of wheat (*Triticum aestivum*). Indian Journal of Agricultural Research. 2006;76:62-65.
13. Demir I, Oztokar C. Effect of salt priming on germination and seedling growth at low temperature in watermelon seed during development. Seed science and technology. 2003;31:765-770.
14. Shehzad M, Ayub M, Ahmad AHU, Yaseen M. Influence of priming techniques on emergence and seedling growth of forage sorghum (*Sorghum bicolor* L.). Journal of Animal and Plant Sciences. 2012;22:154-158.
15. Sarkar RK, Deb N, Parya MK. Effect of seed treatment and foliar nutrition on growth and productivity of spring sunflower (*Helianthus annuus*). Indian Journal of Agricultural Sciences. 2007;77(3):191-194.
16. Golezani KG, Jafari SF, Kolvanagh JS. Seed priming and field performance of soybean (Glycine max L.) in response to water limitation. Notulae Botanica Horti Agrobotanici Cluj-Napoca. 2011;39:186-189.
17. Toklu F. Effects of different priming treatments on seed germination properties, yield components and grain yield of lentil (*Lens culinaris* Medik.) Notule Botanicae Horti Agrobotanici. 2015;43(1):153-158.

18. Galhaut L, Lespinay A, Walker DJ, Bernal MP, Correal E, Lutts S. Seed priming of Trifolium repens L. improved germination and early seedling growth on heavy metal-contaminated soil, Water Air Soil Pollution. 2014;225:1-15.

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