Original Research Article

Pre-Sowing Seed treatment of selected Botanical extracts and Biofertilizers on Growth,Yield and Yield attributing traits of Mustard (*Brassica juncea*.L)

Abstract

The present investigation was carried out for **"Pre-sowing seed treatments of selected botanicals extract and biofertilizers on growth, yield and yield attributing traits of Mustard (*Brassica juncea* L.)".** For this purpose, 13 priming treatments including control on Mustard seeds variety were used to study under filed conditions during rabi, 2021-22. Field experiment was laid out in Randomized Block Design (RBD) with four and three replications respectively during Rabi 2021-22. Analysis for the data in field experiment revealed significance mean sum of squares due to seed priming treatments for all the characters under study. In order to standerized method of seed priming to specific mustard crop and they were evaluated by screeming a range of duration and concentration *Viz* T0- Control, T_1 Neem Leaf Extract 5% (6Hrs), T_2 Neem Leaf Extract 10%(6Hrs), T_3 Moringa Leaf Extract 5% (6Hrs), T_4 Moringa Leaf Extract(10%Hrs), T_5 *Trichoderma viridae* 0.1%(6Hrs), T_6 *Trichoderma viridae* 0.3%(6Hrs), T_7 Azosprillum 0.1%(6Hrs), T_8 Azosprillum 0.3%(6Hrs), T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs, T_{10} Trichoderma viridae + Azosprillum (0.1%+0.1%), T_{10} Trichoderma viridae + Azosprillum (0.1%+0.1%), T_{11} Neem Leaf Extract + Trichoderma viridae (3% +0.1%), T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%)To find out Influence of different seed treatment on growth , yield and seed quality parameters of mustard showed that significant treatment Field emergence (%), Plant height (30,60,90 DAS), Days to 50% flowering, Number of branches per plant, Number of silique per plant, Number of seeds per silique, Seed yield per plant (g),Seed yield per plot (g),Biological yield (g),Harvest index. The study helps to improve the quality to improve of seed with help of seed different Leaf extracts and Biofertilizers priming treatment which are cost effective and economic, non- toxic, ecofriendly sources. Pre-sowing treatment with It is concluded from the present study that the seeds of Mustard (Variety - sonalika) were treated with T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs enhanced the Field emergence percentage, Plant height (cm), Number of branches per plant, Number of silique per plant, Number of seeds per silique, Seed yield per plant, Seed yield per plot, Biological yield, Harvest index followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) and T4 Moringa Leaf Extract(10%Hrs) as compared to control (untreated) seeds

Key words: Mustard seed, Priming, Seed treatment, Leaf Extracts, Biofertilizers, RBD (Randomized Block Design)

1. Introduction

Mustard is an annual, cool-season specialty cash crop that has a short growing season and is commonly grown in rotation with small grains. Mustard is the name given to two closely related species in the Brassica family. Yellow mustard, *Sinapis alba* L. (also identified as *Brassica hirita* L.) and Indian, oriental or brown mustard, Brassica juncea L. Mustard is native to temperate regions of Europe and has its historic base there. Production and cultivation of *Brassica juncea* (L.) the estimated area, production and yield of rapeseed-mustard in the world was 36.59 million hectares (mha), 72.37 million tonnes (mt) and 1980 kg / ha, respectively, during 2018-19. Globally, India account for 19.8 % and 9.8% of the total acreage and production (USDA). During the last eight years, there has been a considerable increase in productivity from 1840 kg/ha in 2010-11 to 1980 kg/ha in 2018-19 and production has also increased from 61.64 m t in 2010-11 to 72.42 m t in 2018-19.

2. Materials and methods

The present investigation was carried out Pre-sowing seed treatments of selected Botanical extracts and Biofertilizers on Growth,Yield and Yield attributing traits of Mustard (*Brassica junce*a L.) at the central research field of Seed science and Technology in the Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture, Technology and Science, Naini Agriculture Institute, Prayagraj(U.P). Field experiment was laid out in Randomized Block Design (RBD) with treatment material consists of 12 treatments and untreated (control) seed of mustard and three replications respectively during Rabi 2021-22. viz., T0- Control, T1 Neem Leaf Extract 5% (6Hrs), T2 Neem Leaf Extract 10%(6Hrs), T3 Moringa Leaf Extract 5% (6Hrs), T4 Moringa Leaf Extract(10%Hrs), T5 *Trichoderma viridae* 0.1%(6Hrs), T6 *Trichoderma viridae* 0.3%(6Hrs), T7 Azosprillum 0.1%(6Hrs), T8 Azosprillum 0.3%(6Hrs), T9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs, T10 *Trichoderma viridae* + Azosprillum (0.1%+0.1%), T10 *Trichoderma viridae* + Azosprillum (0.1%+0.1%), T11 Neem Leaf Extract + *Trichoderma viridae* (3% +0.1%), T12 Moringa Leaf Extract + Azosprillum(3% +0.1%) with the soaking durations of 6hrs along with water. The unfortified seed served as control. The soaked seeds were surface dried for one day and were evaluated for the seed quality parameters viz., Maximum field emergence,percentage at4DAS,7DAS,10DAS plant height (30,60,90DAS), number of branches per plant, days to 50% flowering,days to maturity, number of silique per plant, number of seeds per silique, seed yield per plant(g), seed yield per plot(g), biological yield (g), harvest index(%)among this five superior plants randomly were selected in each replication and find the best treatment results was observed superior result of mustard variety (sonalika).

3. Results and discussion

An investigation was carried out “Pre-sowing seed treatments of selected botanicals extract and biofertilizers on growth, yield and yield attributing traits of Mustard (*Brassica juncea* L.)” Growth and yield parameters include field emergence percentage, days to 50% flowering,days to maturity, plant height, number of branches per plant, number of silique per plant, number of seeds per silique, seed yield per plant, seed yield per plot, biological yield and harvest index, The mean performance of field emergence ranged from 72.22% to 84.72 % with mean value of 82.78 %.Significantly maximum highest percentage of field emer-

gence (84.72%) was recorded T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) (84.72 %), T_5 - Moringa Leaf Extract 5% (6Hrs) (83.33%) and T_8 Azosprillum 0.3%(6Hrs) (83.33%). Minimum field emergence was recorded by T0 – Control (72.22%). The mean performance of field emergence ranged from 72.22% to 84.72 % with mean value of 82.78 %.Significantly maximum highest percentage of field emergence (94.44%) was recorded T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) (88.88 %), T_4 Moringa Leaf Extract(10%Hrs) (87.5) and T_8 Azosprillum 0.3%(6Hrs) (83.33%). Minimum field emergence was recorded by T0 – Control (79.16 %). The mean performance of field emergence ranged from 81.94% to 98.61 % with mean value of 88.08 %.Significantly maximum highest percentage of field emergence (98.61%) was recorded T_9 Neem Leaf Extract + Moringa Leaf Extract(5%+3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) (93.06 %), T_4 Moringa Leaf Extract(10%Hrs) (6Hrs) (90.28 %) and T_6 *Trichoderma viridae* 0.3%(6Hrs) (88.89%). Minimum field emergence was recorded by T0 – Control (81.94%). The mean performance of plant height ranged from 68.03 cm to 84.03 cm with mean value of 71.18 cm. Significantly, maximum height of plant (cm) 30DAS (84.03 cm) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) (75.39 cm), T_1 Neem Leaf Extract 5% (6Hrs) (74.59 cm) and T_2 Neem Leaf Extract 10%(6Hrs) (72.49cm). Minimum plant height was recorded by T0– Control (68.03 cm). The mean performance of plant height ranged from 92.67 cm to 120.13 cm with mean value of 110.53 cm. Significantly, maximum height of plant (123.40 cm) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%)(120.13), T_4 Moringa Leaf Extract(10%Hrs (118.40 cm) and T_7 Azosprillum 0.1%(6Hrs) (116.33 cm). Minimum plant height was recorded by T0– Control (92.67 cm). The mean performance of plant height ranged from 136.60 cm to 152.13 cm with mean value of 143.63 cm. Significantly, maximum height of plant (152.13 cm) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) (148.67 cm), T_4 Moringa Leaf Extract(10%Hrs) (148.33cm) and T_{10} Trichoderma viridae + Azosprillum (0.1%+0.1% (147.47cm). Minimum plant height was recorded by T0– Control (136.60 cm). The mean performance of number of branches per plant ranged from 8.20 to 11.87 with mean value of 10.26 Significantly, maximum number of branches (11.87) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T12 Moringa Leaf Extract + Azosprillum(3% +0.1%) (11.07), T4 Moringa Leaf Extract(10%Hrs)) (11.0) , T3 Moringa Leaf Extract 5% (6Hrs). Minimum number of branches was recorded by T0– Control (8.20). The mean performance of Days to 50% flowering per plant ranged from 41.78 to 48.69 with mean value of 44.35 Significantly, maximum days to 50% flowering (48.69) was recorded by T0-Control and it was followed by T12 Moringa Leaf Extract + Azosprillum(3% +0.1%) (47.78), T7 Azosprillum 0.1%(6Hrs) (44.24) and Minimum was recorded by T9

Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs (42.83). The mean performance of Days to Maturity ranged from 41.78 to 48.69 with mean value of 44.35 Significantly, maximum days to 50% flowering (48.69) was recorded by T0-Control and it was followed by T12 Moringa Leaf Extract + Azosprillum(3% +0.1%) (47.78), T7 Azosprillum 0.1%(6Hrs) (44.24) and Minimum was recorded by T9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs (42.83). The mean performance of number of silique per plant ranged from 40.33to 54.27 with mean value of47.0. Significantly, maximum number of silique (54.27) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs (54.27)and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) (49.73), T4 Moringa Leaf Extract(10%Hrs) (6Hrs) (48.87), T8 Azosprillum 0.3%(6Hrs) (47.87). T7 Azosprillum 0.1%(6Hrs) (47.67) and Minimum number of silique per plant was recorded by T0– Control (40.33). The mean performance of number of seeds per silique ranged from 8.00 to 16.87 with mean value of 10.47. Significantly maximum number of seeds per silique (16.87) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%)(16.53) 6hrs and it was followed by , T_{12} Moringa Leaf Extract + Azosprillum (3% +0.1%) (10.87), T4 Moringa Leaf Extract(10%Hrs) (10.87), T_{12} - Azosprillum 0.5% (6Hrs)(10.20), T7 Azosprillum 0.1%(6Hrs) (10.53) and Minimum number of seeds per silique was recorded by T0– Control (8.00). The mean performance of seed yield per plant ranged from 9.73 g to 14.30 g with mean value of 11.51 g. Significantly, maximum seed yield per plant (4.75 g) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs (14.30) and it was followed by T12 Moringa Leaf Extract + Azosprillum(3% +0.1%) (13.66), T4 Moringa Leaf Extract(10%Hrs) (12.50g), T6 Trichoderma viridae 0.3%(6Hrs) (12.46 g) and T_3 - Neem Leaf Extract 5% (6Hrs) (11.49 g). Minimum seed yield per plant was recorded by T0– Control (9.73 g). The mean performance of seed yield per plot ranged from 37.53 g to 59.16 g with mean value of 43.93g. Significantly, maximum seed yield per plot (59.16g) was recorded by T9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T12 Moringa Leaf Extract + Azosprillum(3% +0.1%) (48.41g), T4 Moringa Leaf Extract(10%Hrs) (46.65g) and T3 Moringa Leaf Extract 5% (6Hrs) (46.55g). Minimum seed yield per plot was recorded by T0– Control (37.53g). The mean performance of biological yield ranged from 175.50 g to 246.97 g with mean value of 175.07 g. Significantly, maximum biological yield (246.97 g) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1% (202.57), T_4 Moringa Leaf Extract(10%Hrs) (192.17 g), T5 Trichoderma viridae 0.1%(6Hr) (185.17 g), and T3 Moringa Leaf Extract 5% (6Hrs) (181.73 g). Minimum biological yield was recorded by T0(175.50). The mean performance of harvest index ranged from 5.57% to 8.47% with mean value of 6.48%. Significantly, maximum harvest index (8.47%) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs (8.47%)and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) (7.81%), T4 Moringa Leaf Extract(10%Hrs) (7.49%), T8 Azosprillum 0.3%(6Hrs) (7.25%), Minimum harvest index was recorded by T0– Control (5.57%).This was might be due to better water imbibition

due to hydro priming and priming with Moringa leaf extract (MLE), because soybean seeds have a thick outer coat and they might take more time to start germination if sown unprimed because water imbibition is the first step of germination and insufficient moisture level hampers the germination process**.** These results are in agreement with those obtained by Iqbal [2014] and Iqbal *et al*. [2014], who recorded positive effects of Moringa leaf extract (MLE) on growth of plants The significantly higher final germination given by Moringa leaf extract was might be due to zeatin which is complete confirmation with those of Phiri and Mbewe [2010], who observed more germination and seedling growth triggered by zeatin. These results are in agreement with those obtained by Muhammad Aamir Iqbal [2014] who recorded positive effects of Moringa leaf extract (MLE) on growth of plants, These findings are also supported by the findings of Lee *et al*. [1988] who reported that *Moringa oleifera* leaf extract accelerate the growth of young plants, strengthen plants, improve resistance to pests and diseases, increase leaf area duration, increase number of roots. These findings are in line with **Ella and Zapata *et al.*,[1991],** who reported more seed production due to vigorous vegetative growth of crops as a result of exogenous application of phytohormones. This was probably due to the presence of growth promoting hormones as well as other macro and micro nutrient which increased the cell devision and there was more root and shoot length. These results are in line with **Akinbode and Ikuton** [**2008**], **Makkar and Becker *et al.*, [1996]** and **Ella *et al*. [1991],** who described more physiological growth and development with the application if moringa leaf extract. the highest number of leaves and roots were produced by plants that were treated with 5% moringa leaf extract (MLE) and the minimum values were given by control treatment. This was probably due the growth promoting effect of various nutrients present in moringa leaf extract. These findings are in agreement with **Ambler *et al*. [1992]. Bashir *et al.* (2014**) revealed that moringa leaf extract significantly increased the average plant height, leaves number, number of branches and yield of tomato plant. **Oluwagbenga and Odeghe (2015)** mentioned that sweet bell pepper plant height; number of leaves, fruit weight and yield were significantly influenced by the application of moringa leaf extract. **Aluko (2016)** reported that the highest values of pepper plant growth and yield parameters were obtained with MLE foliar application at concentration of (1:20). These results are in accordance with the findings of **Lakra *et al.* (2018).** However, plant height, number of seeds/siliqua, length ofsiliqua and test weights remained unaffected due to planting geometry. These findings are in positive assurance with the earlier findings of **Jarman Gadi *et al.*, (2020), Lekhraj Jat *et al.*, (2019), Yared Semahegn Belete *et al.*, (2012).** The results of present study were also supported by the earlier findings of **Alam *et al.*, (2015)** in mustard. However, mustard grown at 30 × 10 cm and 45 × 15 cm remained statistically at par with each other but maintained their significant superiority over the rest of the wider spacing treatments in respect of seed yield. These findings were in conformity with those of **Khajuria *et al.*, (2017)** and **Lakra *et al.*, (2018).** These finding are in agreement with **Phiri and Mbewe (2010]** and **Qayyum *et al.* [2007],** who reported more yield and harvest index of a variety of oil seed and other cereal crops with exogenous application of phytohormones especially zeatin and brassinosteroids

Conclusion

Pre-sowing treatment with It is concluded from the present study that the seeds of Mustard (Variety - sonalika) were treated with T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs enhanced the Field emergence percentage, Plant height (cm), Number of branches per plant, Number of silique per plant, Number of seeds per silique, Seed yield per plant, Seed yield per plot, Biological yield, Harvest index followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%) and T4 Moringa Leaf Extract(10%Hrs) as compared to control (untreated) seeds . These conclusions are based on the results of six months investigation and therefore further investigation is needed to arrive at valid recommendation.

Table no -01 ANOVA for effect of treatments on growth and yield parameters in Mustard

Sr. No	**Characters**	**Mean Sum of Squares**		
		Treatment Df(12)	**Replication Df(2)**	**Error Df(24)**
1.	FIELD EMERGENCE (%) at 4DAS	37.40*	42.00	25.56
2	FIELD EMERGENCE (%) at 7th DAS	54.012	119.3	12.724
3	FIELD EMERGENCE (%) at 10th DAS	56.46*	123.31	25.41
4	PLANT HEIGHT (30DAYS)	51.73*	58.70	10.44
5	PLANT HEIGHT (60DAYS)	249.69*	17.33	19.44
6	PLANT HEIGHT (90DAYS)	73.84*	303.54	104.77
7	NUMBER OF BRANCHES / PLANTS AT 30DAS	31.62*	8.18	2.35
8	DAYS TO 50% FLOWERING	12.60*	0.94	0.27
9	DAYS TO MATURITY	34.70	33.25	11.95
10	NO OF SILIQUA PER PLANT	29.49*	35.50	13.12
11	NO OF SEEDS PER SILIQUA	13.57*	4.42	1.63
12	SEED YIELD PER PLANT	6.35*	6.65	1.29
13	SEED YIELD PER PLOT	90.79*	4.60	3.70
14	BIOLOGICAL YIELD	2222.27*	1265.27	864.26
15	HARVEST INDEX	46.86*	71.56	53.48
	*Significant at 5% level of significance			

Table -02.Pre harvest observation mean performance of Mustard for growth and yield parameters

Sl.no	Treat-ment	Field Emer-gence 4DAS %	Field Emer-gence 7DAS %	Field Emergence 10DAS %	Plant Height			Number of branch-es/plant at 60das	Days to 50% flower-ing	Day to Ma-turity	Num-ber. of siliqua / plant	Num-ber. of seeds /silique
					30DAS (cm)	60DAS (cm)	90DAS(cm)					
1.	T_0	72	79	81	68.03	92.67	136.6	8.20	48.69	125.33	40.33	8
2.	T_1	80	83	86	74.59	103.33	141.73	10.93	42.93	130.33	46.33	8.8
3.	T_2	81	86	86	72.49	115.02	136.93	9.8	42.43	130.33	45.33	9.53
4.	T_3	79	83	83	71.95	113.47	146.13	10.47	42.98	128.67	46.73	9.4
5.	T_4	83	87	90	72.11	118.4	148.33	10.47	41.78	134	48.87	10.87
6.	T_5	80	84	88	71.01	102.27	144.93	10.4	44.16	127.33	45.13	10.8
7.	T_6	83	87	88	70.85	110.53	140.67	11	42.83	129.33	46.07	10.27
8	T_7	81	86	87	69.09	116.33	140.33	9.07	44.24	126.33	47.67	10.53
9.	T_8	83	84	84	70.16	107.87	145.33	9.8	47.26	128.33	47.87	10.8
10	T_9	84	94	98	84.03	123.4	152.13	11.87	43.41	136.67	54.27	16.87
11	T_{10}	80	84	86	69.31	99	147.47	10.33	44.09	131.33	46.4	9.13
12	T_{11}	81	86	88	69.37	116.67	137.93	9.93	43.93	129	46.27	10.2
13	T_{12}	84	88	93	75.39	120.13	148.67	11.07	47.78	135.33	49.73	10.87
Grand Mean		**81**	**85**	**88**	**72.18**	**110.70**	**143.63**	**10.26**	**44.35**	**130.18**	**47.0**	**S**
F TEST		**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
SE(m)		**2.05**	**2.05**	**2.91**	**1.87**	**2.55**	**5.91**	**0.18**	**0.30**	**1.99**	**2.09**	**0.74**
CV		**4.35**	**4.13**	**5.73**	**4.48**	**3.98**	**7.13**	**3.05**	**1.19**	**2.65**	**7.71**	**12.21**
C.D		**6.01**	**6.00**	**8.49**	**5.44**	**7.43**	**17.25**	**0.53**	**0.88**	**5.82**	**6.10**	**2.15**

Table -03. Post harvesting observation mean performance of Mustard for growth and yield parameters

Sl.no	Treatment	Seed yield per plant(g)	Seed yield per plot(g)	Biological yield(g)	Harvest index
1	T_0	9.73	37.53	175.5	5.57
2	T_1	10.43	43.54	174.97	6.53
3	T_2	10.46	42.11	144.4	5.17
4	T_3	11.49	46.55	181.73	6.34
5	T_4	12.5	46.65	192.17	7.49
6	T_5	11.34	43.28	185.17	6.11
7	T_6	12.46	41.27	147.67	5.79
8	T_7	10.62	42.18	183.9	5.79
9	T_8	12.4	40.19	165.73	7.25
10	T_9	14.3	59.16	246.97	8.47
11	T_{1o}	10.26	40.35	163.23	6.29
12	T_{11}	9.94	40.03	175.2	5.67
13	T_{12}	13.66	48.41	202.57	7.81
Grand Mean		**11.51**	**43.94**	**175.07**	**7.66**
F TEST		**S**	**S**	**S**	**S**
SE(m)		**0.66**	**1.11**	**16.67**	**4.22**
CV		**9.88**	**4.38**	**16.79**	**95.47**
C.D		**1.92**	**3.24**	**49.53**	**12.32**

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