Original Research Article

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

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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)

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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. (al- so identified as *Brassica hirita* L.) and In- dian, oriental or brown mustard, Brassica juncea L. Mustard is native to temperate re- gions of Europe and has its historic base there. Production and cultivation of *Brassicajuncea* (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, Indiaaccount for 19.8 % and 9.8% of the total acreage and production (USDA). During the last eight years, there has been a considera- ble increase in productivity from 1840 kg/ha in 2010-11 to 1980 kg/ha in 2018-19 andproduction has also increased from 61.64 m tin 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 (*Bras- sica junce*a L.) at the central research field of Seed science and Technology in the Depart- ment of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture, Tech- nology and Science, Naini Agriculture Insti- tute, Prayagraj(U.P). Field experiment was laid out in Randomized Block Design (RBD) with treatment material consists of 12 treat- ments and untreated (control) seed of mustard and three replications respectively during Ra- bi 2021-22. viz., T0- Control, T1 Neem Leaf Extract 5% (6Hrs), T2 Neem Leaf Extract 10%(6Hrs), T3 Moringa Leaf Extract 5%

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(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% flower- ing,days to maturity, number of silique perplant, 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 mus- tard variety (sonalika).

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As the duration of soaking in all the treatment is uniform, so it should not be mentioned in each treatment.

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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 fieldemergence percentage, days to 50% flower- ing,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-

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gence (84.72%) was recorded …T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was followed by T_{12} Moringa LeafExtract + 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 per- centage of field emergence (94.44%) was rec-orded 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 Ex- tract(10%Hrs) (87.5) and T_8 Azosprillum 0.3%(6Hrs) (83.33%). Minimum field emer- gence was recorded by T0 – Control (79.16
%). The mean performance of field emer- gence ranged from 81.94% to 98.61 % with mean value of 88.08 %.Significantly maxi-mum 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 valueof 71.18 cm. Significantly, maximum height of plant (cm) 30DAS (84.03 cm) was recordedby T_9 Neem Leaf Extract + Moringa Leaf Ex- tract(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 heightwas recorded by T0– Control (68.03 cm). The

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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 Ex- tract(5% +3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3% +0.1%)(120.13), T_4 Moringa Leaf Ex- tract(10%Hrs (118.40 cm) and T_7 Azospril- lum 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, max-imum height of plant (152.13 cm) was rec- orded by T_9 Neem Leaf Extract + Moringa Leaf Extract(5% +3%) 6hrs and it was fol- lowed 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, max- imum number of branches (11.87) was record-ed 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 Ex- tract(10%Hrs)) (11.0) , T3 Moringa Leaf Ex- tract 5% (6Hrs). Minimum number of branch-es 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

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Neem Leaf Extract + Moringa Leaf Ex- tract(5% +3%) 6hrs (42.83). The mean per- formance of Days to Maturity ranged from
41.78 to 48.69 with mean value of 44.35 Sig- nificantly, 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), T7Azosprillum 0.1%(6Hrs) (44.24) and Mini- mum 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, maxi- mum number of silique (54.27) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Ex- tract(5% +3%) 6hrs (54.27)and it was fol- lowed 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 Mini- mum number of silique per plant was record- ed by T0– Control (40.33). The mean perfor- mance 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 Ex- tract(5% +3%)(16.53) 6hrs and it was fol- lowed 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 Mini- mum number of seeds per silique was record- ed by T0– Control (8.00). The mean perfor- mance 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 Ex- tract + 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 Ex- tract(5% +3%) 6hrs and it was followed by T12 Moringa Leaf Extract + Azosprillum(3%
+0.1%) (48.41g), T4 Moringa Leaf Ex- tract(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, maxi- mum biological yield (246.97 g) was recorded by T_9 Neem Leaf Extract + Moringa Leaf Ex- tract(5% +3%) 6hrs and it was followed by T_{12} Moringa Leaf Extract + Azosprillum(3%
+0.1% (202.57), T_4 Moringa Leaf Ex- tract(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 har- vest 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 Ex- tract(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 ex- tract (MLE) on growth of plants The signifi- cantly higher final germination given by Moringa leaf extract was might be due to zea- tin which is complete confirmation with those of Phiri and Mbewe [2010], who observed more germination and seedling growth trig- gered by zeatin. These results are in agree- ment 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 sup- ported by the findings of Lee *et al*. [1988] who reported that *Moringa oleifera* leaf ex- tract accelerate the growth of young plants, strengthen plants, improve resistance to pests and diseases, increase leaf area duration, in- crease number of roots. These findings are in line with **Ella and Zapata *et al.*,[1991],** who reported more seed production due to vigor- ous 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 anddevelopment with the application if moringa leaf extract. the highest number of leaves and roots were produced by plants that were treat- ed with 5% moringa leaf extract (MLE) and the minimum values were given by control

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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 geome- try. 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 mus-tard. However, mustard grown at 30 × 10 cm and 45 × 15 cm remained statistically at par with each other but maintained their signifi- cant 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 phyto-hormones especially zeatin and brassinoster- oids

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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			

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Comment [N37]: Why six months? If further investigation is needed, go for another year of study and come to an valid conclusion.

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

Sl.no	Treatment	Field Emer-gence 4DAS %	Field Emer-gence 7DAS %	Field Emergence 10DAS %	Plant Height 30DAS (cm)	Plant Height 60DAS (cm)	Plant Height 90DAS(cm)	Number of branches/plant at 60das	Days to 50% flowering	Day to Maturity	Number. of siliqua / plant	Number. of seeds /silique
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**

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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 in-dex
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_{10}	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**

Comment [N53]: Table 3

Comment [N54]: mention the yield per ha

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4. Bibliography

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