Original Research Article

Agronomic evaluation of mustard (*brassica juncea* l.) hybrids under agro-climatic conditions of prayagraj (u.p), India : Experimental Investigation

ABSTRACT

A field experiment was carried out at the Crop Research Farm, Department of Agronomy, Sam HigginbottomUniversityofAgriculture,TechnologyandSciences,Prayagraj during *Rabi*season 2022 on Mustard crop. The experiment was laid out in randomized block design with ten treatments and three replications. The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36%), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The maximum plant height (175.97 cm), primary branches (8.85), secondary branches (18.85/plant), plant dry weight (40.97 g/plant) at 100 DAS in hybrid M-155 was recorded. Maximum Crop growth rate (CGR) recorded at 60-80 DAS (10.24 g/m^2 /day), number of siliqua/plant (466.27), number of seeds/siliqua (13.63), test weight (5.40 g) and seed yield (2.40 t/ha) were observed in hybrid M-155. In terms of economics, highest gross returns (Rs 130905.7/ha), net returns (Rs81592.73/ha) and B:C ratio (1.65) were observed in hybrid M-155.

Keywords:Agronomic evaluation, Economics, Growth, Mustard hybrids, Yield.

1. INTRODUCTION

Mustard (*Brassica juncea* L.) is important oilseed crop of family Cruciferae and occupies a prominent place among oilseed crops being next to groundnut in important. Nine oilseeds currently have an area, production, and yield in India of about 26.48 m/ha, 30.94 mt, and 1168 kg/ha, respectively. Rapeseed mustard has an area of 6.36 m/ha and a production in India of 8.03 mt(**Directorate of Economics and Statistics,Department of Agriculture and Cooperation, 2012–13**). "India's average productivity for rapeseed mustard is 1262 kg/ha. In order to ensure that India is self-sufficient in edible oil, the average productivity of rapeseed-mustard in the country must be increased to 2562 kg/ha by 2030. Currently, it is only 1145 kg/ha.The country shares about 23% of the world production of rapeseed and mustard. These crops are of particular significance of Rajasthan and Uttar Pradesh, which shares about 80% of area and production of entire country" [Vasudha et al.2021].

"The simple fact that these crops are grown in 28 states across the nation in a variety of agro-ecological conditions across an area of 6.51 million hectares and yield 8.18 million tonnes of vegetable oil attests to their significance in the national vegetable oil market. Rapeseed-mustard output made for 20–22% of the nation's total oilseed production, although Haryana accounted for 10.2% of that total. It is grown on 6.70 million hectares in India, with a productivity of 1188 kg/ha and a production of 7.96 mt in 2013–14. Haryana is one of the top states for rapeseed and mustard production, and in 2013–14, the crop produced 8.8 lakh tonnes on 5.4 lakh ha, with an average yield of 1639 kg/ha" (**Pattam*et al.*, 2017**).

"Following a conventional package of practises, growing rapeseed-mustard as a second crop in a rice-based system could result in an increased net revenue of Rs. 23,127/- per hectare per year" (**Singh *et al.*, 2010**). Because mustard thrives in a dry, chilly atmosphere and is grown in a subtropical region, it is typically planted during the rabi season. It is raised in regions with annual rainfall ranging from 625 to 1000 mm. This

crop needs a clear sky and no frost because it cannot survive frost. It may be cultivated in many different types of soil, including light and thick loamy soils. The optimum soils for growing mustard are medium to deep and well-drained. For mustard, the optimal soil pH range is 6.0 to 7.5. Despite the high quality of oil and meal and also itswide adaptability for varied agro- climatic conditions, the area, production and yield of rapeseed –mustard in India have been fluctuating due to various biotic and abiotic stresses coupled with India's domestic price support program.Nevertheless, the crop has potential to ensure nutritional security and contribute to livelihood security. In Uttar Pradesh rapeseed and mustard is one of the major grown crop occupying 0.56 million ha of area with production and productivity of 0.699 million tons and 1,248 kg/ha, respectively. The seed and oil of mustard have a peculiar pungency due to presence of glucosinolate and its hydrolysis products such as AllylIsothiocynate (0.30-0.35%). The productivity of the crop in the state (1,066 kg/ha) is quite lower than developed countries mainly due to cultivation of age- old varieties having low yield potentialKeeping above facts in view, the present experiment entitled "Agronomic evaluation of mustard (brassica juncea l.) hybrids under agro-climatic conditions of prayagraj (u.p), India : Experimental Investigation".

2. MATERIALSANDMETHODS

During the *Rabi* season of 2022, a field experiment was conducted in alluvial soil at the Crop Research Farm of the Department of Agronomy, SHUATS, Prayagraj, U.P. The soil of experimental plot was sandy loam, having a nearly neutral soil reaction (pH 7.1), electrical conductivity (0.365 ds/m), medium in available Nitrogen (173.4 kg/ha) and available potassium (213.9 kg/ha), and low in available phosphorous (11.63 kg/ha). The crop was sown on November 5th2022 using hybrids. TheexperimentwasconductedinaRandomizedBlock Design consisting of 14 treatment combinations and 3 replications *viz.*T1 (M10), T2 (M30), T3 (M45),T4 (M85), T5 (M101), T6 (M105), T7 (M110), T8 (M155), T9 (M170), T10 (M210), T11 (M307), T12 (M320), T13 (M360), T14 (M414). The nutrient sources were Urea, Single Super Phosphate (SSP) and

Muriateof Potash (MOP), applied as per the recommended dose of 60-30-30 kg NPK/ha. Plant growth parameters, such asplant height (cm), dry weight (g/plant) were measured at a regular intervals from germination till harvest and yield and yield attributes, such as Days to 50% flowering, Number of primary branches/plant, No. of secondary branches/plant,Siliqua/plant, Seeds/Siliqua, seed index (g), seed yield (t/ha), stoveryield (t/ha),harvest index(%) and oil content(%) were measured at harvest. The observed data were statistically analysed using analysis of variance (ANOVA) as applicable to randomized block design (Gomez and Gomez, 1984).

3. RESULTSAND DISCUSSIONS

3.1 Growthparameter

The data pertaining to growth attributes presented in Table 1.At 100 DAS, maximum plant height was recorded in hybrid M 155 (175.97 cm). Hybrids M 45 (172.97 cm), M-210 (172.50 cm) and M-360 (170.17 cm) were statistically at par with hybrid M 155. The hybrid attained maximum plant height at all the stages of crop growth and tallest plant of hybrid was mainly due to the varietal characteristics. The above findings are supported by **Kumari*et al.*, 2009.**At 100 DAS, significantly maximum dry matter was recorded in hybrid M- 155 (40.97 g/plant). Hybrid M 30 (38.49 g/plant) and M 360 (39.30 g/plant) were found to be statistically at par with M 155. At maturity total dry matter per plant was significant which may be due to the longer duration of crop growth and higher LAI during later stages of its growth which was true indicative of photosynthates production.At 40-60 DAS, significantly maximum crop growth rate was recorded in hybrid M-110 (22.37 g/m2 /day). However, M-85 (21.63 g/m2 /day), M-101 (20.04 g/m2 /day) and M 155 (22.13 g/m2 /day) were found to be statistically at par with M-110**.**Due to differences in dry matter accumulation, the crop growth rate was higher at maturity due to higher dry matter production at respective stages of crop growth. CGR and RGR are two physiological growth indicators that differ greatly. These findings are supported by **Singh 1989**

and Raquibullah*et.al* 2006.The number of branches/plants recorded at maturity. The data shows that there was a significant effect of different hybrids on the number of branches/plant. Among variety, M 155 (8.85/plant) produced significantly highest number of primary branches per plant. However, M 170 recorded 7.65 which was statistically at par with M-155. The highest number of secondary branches (18.85/plant) in hybrid M 155. Hybrid M 30 (17.90/plant), M 110 (18.12/plant) and M 360 (18.60/plant) were found to be statistically at par with hybrid M 155. "The higher number primary and secondary of branches during maturity was primarily because of higher LAI which increases the total energy available for formation of branches there by higher dry matter accumulation". (**Singh 1989 and Raquiballah*et al.*, 2006).**The significantly lower fifty percent of flowering was achieved (43.33 DAS) by the hybrid M-307. However, M 45 (42.66 DAS), M-320 (42.33 DAS) and M 105 (41.66 DAS) were statistically at par with M 307. "Different varieties of mustard had significant influence on floweringcharacters at productive part flowering development stages which might be due to different crop growth maturity pattern in complete life cycle growth period". (**Kumar *et al*., 2017).**

3.2 Yieldattributes

The data of yield attributes and yield Table 2 showed that the amount of siliqua/plant of mustard maximum number of siliqua/plant was recorded significantly higher in hybrid M-155 (466.27/plant). However, M 10 (449.80 siliqua/plant), M-307 (451.80 siliqua/plant) and M 414 (432.17 siliqua/plant) were statistically at par with M 155. The length of the siliqua of was recorded significantly higher in hybrid M-105 (5.91 cm). However, M 45 (5.84 cm), M-155 (4.93 cm), M-307 (5.46 cm) and M 210 (5.02 cm) were statistically at par with M 105. The number of seeds/siliquas of mustard was significantly maximum in hybrid M 155 (13.63). However, hybrid M-101 (12.62 seeds/siliqua), M 210 (12.79 seeds/siliqua) and M 307 (12.99 seeds/siliqua) were found to be statistically at par with M 155. Larger the siliqua more the grains per siliquaand

higher test weight were recorded in main shoot followed by primary and secondary branches.The maximum test weight of mustard was recorded in hybrid M-155 (5.40 g). The highest test weight was recorded in hybrid which was primarily due to higher number ofbranches and siliqua per plant. The varietal differences of yield attributes has also been reported by **Singh *et al*., 2007 and Razzaque*et al*., 2007**.The maximum seed yield of mustard was recorded in hybrid M-155 (2.40 t/ha). However, M 10 (2.25 t/ha), M-170 (2.38 t/ha), M-307 (2.14 t/ha) and M 360 (2.09 t/ha). The hybrid which recorded significantly highest seed yield might be due to higher number of branches, siliqua and highest seed weight per plant. The significantly maximum stover yield of mustard was recorded in hybrid M-360 (5.14 t/ha). However, M-10 (4.52 t/ha), M 155 (5.09 t/ha), M-170 (4.70 t/ha) and M 307 (4.78 t/ha) were statistically at par with M-85. The stover yield was highest due to higher dry matter accumulation in that hybrid. The maximum harvest index of mustard was recorded in hybrid M-170 (39.09%). However, M 10 (37.06 %), M-155 (37.60 %) and M-307 (36.18 %) were statistically at par with M-170 The varietal differences in yield has also been reported by**Razzaque*et al*., 2007 and Dehghani*et al*., 2008.**

3.3 Economics

The data pertaining to the economics of different treatments presented in Table 3 showed that themaximum gross return (130905.7 INR/ha), net return (87347.93 INR/ha), and benefit-cost ratio (1.65) were recorded in M155, and the minimum gross return (97286.32 INR/ha), net return (47973.32 INR/ha), and lowest benefit-cost ratio (0.97) were recorded in M110.

4. CONCLUSION

From the results of the experiment,the results were concluded that the hybrid M-155 performs positively and has higher growth and yield

parameters in mustard.

COMPETING INTERESTS

Authors have declared that no competing interest exist

REFERENCES

Dehghani, H., Omidi, H. and Sabaghania, N. (2008).Graphic analysis of trait relations of rapeseed using the biplot method.*Agron. J*., **100**(5): 1443-1449.

Gomez KA, Gomez AA (1984). Three or more factor expects. In statistical Procedure for Agricultural Research.2: 139-141.

Kumar, A., Mahapatra, B.S., Singh, V.P., Shukla, A., Negi, M.S., Yadav, A.S., Singh, P., Gaurendra, G.and Singh, M. 2017. Effect of nutrient levels on yield, nutrient uptakeand economics of Indianmustard (*Brassica juncea*) in tarai region of Uttarakhand.*Indian Journal of Agronomy***62**(3): 378-381.

Kumari, A. 2009.Evaluation of hybrid varieties of mustard (*Brassica juncea* L.) under different sowing time and spacing (Doctoral dissertation, GB Pant University of Agriculture and Technology, Pantnagar- 263 145 (Uttarakhand).

Pattam, K., Pannu, R.K., Dhaka, A.K. and Sharma, K.D. 2017.Effect of dates of sowing and nitrogen levels on growth and yield of Indian mustard.*Intl J Current MicrobiolApplSci***6**: 1029-1036.

Razzaque, M. and Karim, M. (2007). Effect of varing concentrations of certain salts on germination and seedling vigor of two rape (*Bassicanapus*L.) varoties.). *Mesopotamia Journal of Agriculture*.**14**(2): 25-40.

Singh, R.K. 1989. Effect of different levels of nitrogen on promising varieties of mustard (Brassica juncea L.) M. Sc. Ag., Thesis G.B. Pant

Univ. of Agric. & Tech.,Pantnagar.

Singh, R.K., Singh, Y., Singh, A.K., Kumar, R. and Rakesh, V.K. 2010.Productivity and economics of mustard (Brassica juncea) varieties as influenced by different fertility levels under late sown condition.*Indian Journal of Soil Conservation***38**(2): 121- 124.

Singh, S. and Singh, V. Effect of sources and levels of sulphur on yield, quality and nutrient uptake by linseed (Linumusitatissimum).*Indian Journal of Agronomy***52** (2): 158-159, 2007.

Vasudha KS, Singh V, Tiwari D. Agronomic evaluation of mustard (Brassica juncea L.) hybrids under agro-climatic conditions of Prayagraj (UP).The Pharma Innovation Journal 2021; 10(10): 852-855

Table 1. Growth parameter ofdifferentmustardhybrids

Hybrids	Plant height (cm) 100 DAS	Dry weight (g/plant) 100DAS	Crop Growth Rate ($g/cm^2/day$) During 40-60 DAS	Primary Branches	Secondary Branches	50% Flowering
M-10	132.37	37.27	17.51	6.2	16.2	35.33
M-30	147.97	38.49	19.55	5.9	17.9	38.33
M-45	172.97	37.33	18.03	5.8	15.8	42.66
M-85	130.23	35.60	21.63	8.2	16.4	38.66
M-101	144.73	36.33	20.04	7.4	17.4	38.33
M-105	159.23	35.83	17.1	6.8	16.8	41.66
M-110	151.29	34.37	22.37	8.12	18.12	35.33
M-155	175.97	40.97	22.13	8.85	18.85	36.33
M-170	156.37	35.97	15.54	7.65	17.65	37.66
M-210	172.50	37.77	18.55	7.19	17.19	38.33
M-307	167.25	34.15	17.74	5.82	15.82	43.33
M-320	137.33	37.25	18.75	6.88	16.88	42.33
M-360	170.17	39.3	16.66	6.4	18.6	37.66
M-414	154.47	34.92	15.64	6.46	16.46	38.33
F-test	S	S	S	S	S	S
SEm(±)	2.14	0.97	0.75	0.39	0.32	0.70
CD (P=0.05)	6.43	2.95	2.33	1.2	1.02	2.13

Table 2. Yield and yield attributes parameter ofdifferentmustardhybrids

	Yield and Yield attributes						
Hybrids	**Numberofsiliqua/plant**	**Length of siliqua/plant (cm)**	**Numberofseeds/siliqua**	**Testweight(g)**	**Seed yield (t/ha)**	**StoverYield(t/ha)**	**HarvestIndex(%)**
M-10	449.80	4.46	10.99	4.93	2.25	4.52	37.06
M-30	360.59	4.43	12.32	5.13	1.92	3.80	33.53
M-45	393.47	5.84	10.92	5.10	2.02	3.53	35.09
M-85	403.76	4.48	9.39	4.83	2.01	3.82	34.47
M-101	355.13	4.82	12.62	4.96	1.98	3.70	34.80
M-105	305.76	5.91	12.26	4.53	1.80	3.80	32.22
M-110	314.89	4.42	11.19	4.23	1.79	3.60	33.15
M-155	466.27	4.93	13.63	5.40	2.40	5.09	37.60
M-170	355.13	4.35	10.62	5.27	2.38	4.70	39.09
M-210	361.27	4.21	12.79	4.53	1.85	3.75	33.01
M-307	451.80	5.46	12.99	4.54	2.14	4.78	36.18
M-320	354.59	4.70	12.56	5.02	1.87	3.77	33.13
M-360	383.47	5.02	10.87	5.34	2.09	5.14	35.21
M-414	432.17	4.90	9.49	4.76	1.90	4.10	33.31
F-test	S	S	S	NS	S	S	S
SEm±	15.22	0.31	0.30	0.89	0.11	0.22	1.20
CD(P =0.05)	45.73	1.01	1.03	-	0.35	0.75	3.63

Table 3.Economics of mustard hybrid

Hybrids	Economic		
	Grossreturns (INR/ha)	Net returns (INR/ha)	B:C
M-10	122683.3	73370.32	1.49
M-30	116869.8	67556.8	1.37
M-45	109984.8	60671.82	1.23
M-85	109421.3	60108.29	1.22
M-101	107641.3	58328.32	1.18
M-105	98339.8	49026.8	0.99
M-110	97286.32	47973.32	0.97
M-155	130905.7	81592.73	1.65
M-170	129441.3	80128.32	1.62
M-210	100701.3	51388.29	1.04
M-307	104490.1	55177.13	1.12
M-320	101656.1	52343.13	1.06
M-360	103323.8	54010.83	1.10
M-414	113776.9	64463.93	1.31