

**“AGRONOMIC EVALUATION OF MUSTARD (*Brassica juncea* L.)
HYBRIDS UNDER
AGRO-CLIMATIC CONDITIONS OF PRAYAGRAJ(U.P)”**

Abstract

Field experimentation was conducted during Rabi 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). 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 hybrids were sown. The research was laid out in Randomized Block Design with ten treatments each replicated three times. In that study the experiment recorded significant effect in M8 for Plant height (173.97), Plant dry weight (38.97), Number of secondary branches /plant (18.87), Number of siliqua/plant (475.27), Number of seeds/siliqua (13.64), Seed Yield (2507.54), Stover Yield (3686.24), Test weight (5.80), Seed size (2.75). However, Number of primary branches/plant (8.1) in M5, length of siliqua /plant (5.65 cm) in M6. Crop Growth Rate (22.08) in M7, Relative Growth Rate (0.17) in M-7, Days taken for 50% flowering in M2 (32.78) and Harvest Index (42.17) in M9 were observed.

At the same time higher gross returns (Rs162990.1/ha), net return (Rs113677.1/ha) and benefit cost ratio (2.305) was obtained in M8 hybrid.

Key Words:, Agronomic evaluation, Economics, Growth, Yield, Mustard, Hybrids

1. INTRODUCTION

Mustard (*Brassica spp.*) is the third important oilseed crop in the world after soybean and groundnut, respectively. In India, mustard is the second important edible oil seed after groundnut. Rapeseed and mustard are the major oilseed crops. It is traditionally grown everywhere in the country due to its high adaptability in

conventional farming systems. The oil obtained is the main cooking medium in northern India cannot be easily replaced by any other edible oil. The oilcake is mostly used as a cattle feed. The leaves of young plants are used as a green vegetable. The use of mustard oil for industrial purposes is rather limited on account of its high cost.

Mustard has primary center of its origin in central Asia with secondary centers in central and western China, Eastern India, Burma and through Iran to near East cultivated for centuries in many parts of Eurasia. However, the principle growing countries are Bangladesh, Central Africa, China, India, Japan, Nepal, and Pakistan as well as Southern Russia in north of the Caspian Sea (Kumar *et al.*, 2016). Plant based edible oils are indispensable in the human diet and also an important ingredient of several industrial uses. Under the name's rapeseed and mustard, several oilseeds are belonging to the *cruciferae* are grown in India. They are generally divided into four groups: Brown mustard, Sarson, Toria and Taramira. In trade sarson, toria and taramira are known as rapeseed, and rai as mustard. India is among the largest vegetable oil economies in the world next only to USA, China and Brazil. *Brassica juncea* L. originally introduced from China into northeast India, from it has extended into Afghanistan via the Punjab. Eastern Afghanistan, together with the adjoining northwestern India, is one of the independent centers of origin of Brown sarson (*Brassica campestris* var. brown sarson). In India, the Brassica crops occupy the second largest position after groundnut, with 3.5 million hectares, production about 2 million tonnes of seed annually The oilseed sector constitutes an important determinant of agricultural economy in the country. The increasing population couples with rise in income led to higher demand of edible oils. Rapeseed-mustard after China and Canada, accounting for 16% of the global production. Quality breeding of rapeseed has been oriented largely by nutritional concerns of consumers and food industries.

Most mustard was prepared in the early days by pounding the seeds in a mortar and moistening them with vinegar. Today there are countless mustard varieties available throughout the world, each reflecting local, regional and national cuisine. Three types of mustard seeds are popularly used as condiments: pale yellow or white (*Brassica alba*), brown or oriental mustard (*Brassica juncea*) and black or dark brown mustard (*Brassica nigra*). A part from their use as spice mustards are widely used as green vegetables as a salad crop, as an important oil

seed crop (particularly in India where rape seed mustard is the largest vegetable oil next to groundnut), green manure or as fodder crop and for industrial oil purposes.

The production of rapeseed in India is around 16.2 million tones which accounts for about 18 per cent of the total oil seed production of the country. Indian mustard, brown and yellow Sarson, raya and toria crops are included in mustard rapeseed groups. These are grown mainly in Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana and Gujarat and in some areas of south like Andhra Pradesh, Karnataka and Tamil Nadu. Yellow Sarson is considered as *Rabi* crop in Assam, Bihar, Orissa and West Bengal whereas in Punjab, Haryana, Uttar Pradesh and Himachal Pradesh it is a catch crop. Earlier Brown Sarson was cultivated in most of the areas but now its area under cultivation is getting decreased and replaced by Indian Mustard. Brown Sarson has two ecotypes Lotni and Toria. Toria is short duration crop sown under irrigated condition.

Growing rapeseed-mustard as a second crop in rice-based system could bring an additional net income of Rs. 23,127/- per hectare per annum following standard package of practice (Singh *et al.*, 2010). Mustard is grown in sub-tropical climate it thrives well in dry n cool climate therefore mustard mostly grown as *rabi* season crop. It is grown in the areas receiving 625 – 1000mm yearly rainfall. This crop does not tolerate frost, so it requires clear sky with free frost conditions. It can be grown in wide varieties of soil that ranges from light to heavy loamy soils. Medium to deep soils with good drainage is best suitable for mustard cultivation. Soil ideal pH range for mustard is 6.0 to 7.5.

Despite the high quality of oil and meal and also its wide 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 programme. 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 tonnes 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 Allyl Isothiocyanate (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 potential (De *et al.*, 2014, Directorate of agriculture, 2014-15).

Keeping this points in view, the present investigation entitled “**Evaluation of mustard (*Brassica juncea* L.) Hybrids under climatic condition of Prayagraj**” was conducted at Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during *rabi* season of 2020.

Objectives

1. To study the growth and yield of mustard varieties.
2. To evaluate the economics of different mustard varieties.

2.MATERIALS AND METHODS

The experiment was carried out during rabi season of 2021 at he CRF (Crop Research farm), Department of Agronomy, Sam Higginbottom University of Agriculture Technology and Sciences Prayagraj (U.P.) . The Crop Research Farm is Situated at 25.75 0 N latitude, 87.19 E longitude at an altitude of 98 meter above mean sea level. This area is situated on the Right Side of the River Yamuna and by the Opposite side of Prayagraj City.

All the facilities Required for crop cultivation were available. The experimental plot was Sandy loam in Texture, nearly Neutral in Soil reaction (pH) 7.1. low in organic carbon (0.112%), Available N –173.4 (kg/ha)available P 10.8 kg /ha and available K 206.4kg/Ha The Crop was sown on November 4th 2021using Hybrids .The experiment was laid out in Randomized Block Design comprised of 3 replications and total 10 treatments viz. T1 (M1), T2 (M2), T3 (M3),T4 (M4),T5(M5), T6 (M6), T7 (M7), T8 (M8) , T9 (M9) and T10 (M10)All nutrients were applied into the soil in the form of Urea, Single super phosphate (SSP) and Muriate of potash (MOP).The recommended Dose of Fertilizer is 80:40:40 Entire dose of P and K was applied basal for respective plots, half dose of N (as urea) was applied as basal, one-fourth at 30 days after sowing and remaining one-fourth at the time of flowering. The growth parameters were recorded at periodical intervals of 20,40,60,80,100 DAS and at harvest stagefrom the randomly selected five plants in each treatment. Statistically analysis was done using. (for example SPSS) for all the parameters in one-way Anova and means were compared at 5% probability level of significant results.

3.RESULTS AND DISCUSSION

The findings of the present experiment entitled, “Agronomic Evaluation of Mustard (*Brassica juncea* L.) Hybrids Under Agro-climatic Conditions of Prayagraj (U.P.)”, are being presented and discussed in the following pages under appropriate headings. Data on pre-harvest and post-harvest observations were analyzed and discussion on experimental findings in the light of scientific reasoning has been stated.

Pre-harvest observations

3.1 Plant height (cm) of different hybrids mustard

The plant height of mustard was recorded at 20, 40, 60 80 and 100 days after sowing (DAS).

At 20 DAS, significantly higher maximum plant height was recorded in hybrid M3 (22.23 cm).

At 40 DAS, significantly higher maximum plant height was recorded in hybrid M9 (54.12 cm) which was found to be statistically at par with hybrid M10 (51.77), M8 (51.77), M5 (51.37) and M6 (50.23 cm).

At 60 DAS, significantly taller plant height was recorded in hybrids M6 (119.53 cm), which was found to be statistically at par with hybrid M8(117.97 cm).

At 80 DAS, significantly maximum plant height was recorded in hybrid M8 (150.23 cm) which was found to be statistically at par with hybrid M6 (148.83 cm) and M10 (146.78 cm).

At 100 DAS, maximum plant height was recorded in hybrid M8 (173.97 cm) which was found to be statistically at par with hybrid M10 (170.97 cm).

The hybrid M8 attained maximum plant height at all the stages of crop growth and tallest plant of hybrid M8 followed by M10 was mainly due to the varietal characteristics. The above findings are supported by **Kumari et al., 2009.**

3.2 Number of branches per plants

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.

Primary Branches

Among variety, M5 (8.10/plant) produced the significantly highest number of primary branches per plant.

Secondary Branches

Whereas the highest number of secondary branches (18.87/plant) in hybrid M8 which was found to be statistically at par with hybrid M3 (18.57/plant)

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. These findings are supported by **Singh** 1989 and **Raquiballah et al.**, 2006

3.3 Days taken to 50% flowering

The significantly lower fifty percent of flowering was achieved (32.78 DAS) by the hybrid M-2 which was statistically at par with M4 (34.98 DAS), M3 (35.34 DAS) and M7 (35.54 DAS), M9 (35.58 DAS) and M1 (36.56 DAS).

Different varieties of mustard had significant influence on flowering characters at productive part flowering development stages which might be due to different crop growth maturity pattern in complete life cycle growth period. These findings are supported by **Kumar et al.**, 2017.

3.4 Dry weight of mustard hybrids

The dry weight of mustard was recorded at 20, 40, 60, 80 and 100 days after sowing (DAS).

At 20 DAS, maximum dry matter was recorded in hybrid M-6 (0.38 g/plant) and minimum was recorded in M3 (0.15 g/plant).

At 40 DAS, significantly maximum dry matter was recorded in M5 (8.93 g/plant) which was found to be statistically at par with hybrid M4 (8.04 g/plant) and M10 (7.87 g/plant).

At 60 DAS, significantly maximum dry matter was recorded in hybrid M-8 (29.57 g/plant) which was found to be statistically at par with hybrid M4 (28.33 g/plant).

At 80 DAS, significantly maximum dry matter was recorded in hybrid M-8 (35.67 g/plant) which was found to be statistically at par with hybrid M10 (35.33 g/plant).

At 100 DAS, significantly maximum dry matter was recorded in hybrid M-8 (38.97 g/plant) which was found to be statistically at par with hybrid M-4 (37.30 g/plant) and M2 (36.49 g/plant).

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

3.5 Crop growth rate (g/m²/day) of mustard hybrids

Crop growth rate (g/m²/day) was recorded periodically recorded at 20-40, 40-60 60-80 and 80- 100 DAS. There was consistent increase crop growth rate up to maturity (Table 1).

At 0-20 DAS, higher crop growth rate was recorded in hybrid M-6 (0.87 g/m²/day) and lower was recorded in hybrid M-4 (0.27

g/m²/day).

At 20-40 DAS, higher crop growth rate was recorded in hybrid M-4 (8.84 g/m²/day) and lower was recorded in hybrid M-2 (4.09 g/m²/day).

At 40-60 DAS, significantly maximum crop growth rate was recorded in hybrid M-7 (22.08 g/m²/day) which was found to be statistically at par with M-8 (21.84 g/m²/day), M4 (21.34 g/m²/day) and M-9 (21.25 g/m²/day).

At 60-80 DAS, significantly maximum crop growth rate was recorded in hybrid M-8 (9.74 g/m²/day) which was found to be statistically at par with M-1 (9.44 g/m²/day), M-7 (9.15 g/m²/day) and M-3 (8.93 g/m²/day).

At 80-100 DAS, significantly maximum crop growth rate was recorded in hybrid M-8 (2.26 g/m²/day) which was found to be statistically at par with M-5 (2.33 g/m²/day), and M-1 (2.04 g/m²/day).

At maturity the crop growth rate was higher in hybrid UMR-5 followed by hybrid UMR-4 which was due to higher dry matter production at respective stages of crop growth due to difference in dry matter accumulation. The physiological growth parameters like CGR and RGR differ significantly. These findings are supported by Singh 1989 and Raquibullah *et.al* 2006.

3.6 Relative growth rate (g/g/day) of mustard hybrids

Relative growth rate (g/g/day) was recorded periodically recorded at 20-40, 40-60, 60-80 DAS and 80-100 DAS. There was consistent decrease relative growth rate (g/g/day) up to maturity (Table. 2).

At 20-40 DAS, highest relative growth rate was recorded in variety M-7 (0.17 g/g/day) and lowest was recorded in variety M-5 (0.12 g/g/day)

At 40-60 DAS, highest relative growth rate was recorded in hybrid M-8 (0.16 g/g/day) and lowest with hybrid M-4, M-6 and M-10 (0.06 g/g/day).

At 60-80 DAS, highest relative growth rate was recorded in hybrid M-7 (0.012 g/g/day) and lowest with hybrid M-8 (0.009 g/g/day).

At 80-100 DAS, highest relative growth rate was recorded in hybrid M-1 (0.02 g/g/day)

Post-harvest observations

3.7 Number of siliqua/plant

The number of siliqua/plant of mustard maximum number of siliqua/plant was recorded significantly higher in hybrid M-8 (475.27/plant).

The number of siliqua/ plant were highest due to higher dry matter production.

3.8 Length of siliqua

The length of the siliqua of was recorded significantly higher in hybrid M-6 (5.65 cm).

3.9 Number of grains/siliqua

The number of seeds/siliqua of mustard was significantly maximum in hybrid M 8 (13.64) which was found to be statistically at par with hybrid M-10 (13.40), M 5 (13.23), M2 (12.93) and M-6 (12.87).

Larger the siliqua more the grains per siliqua and higher test weight were recorded in main shoot followed by primary and secondary branches.

3.10 Test weight

The maximum test weight of mustard was recorded in hybrid M-8 (5.80 g) which was found to be statistically at par with hybrid M-9 (5.67 g), M-2 (5.53), M3 (5.20 g) and M-5 (5.06 g).

The highest test weight was recorded in hybrid which was primarily due to higher number of branches and siliqua per plant.

3.11 Seed size

The hybrid M-8 recorded significantly higher seed size of mustard grain (2.75 mm) which was found to be statistically at par with hybrid M-4 (2.65 mm).

The varietal differences of yield attributes has also been reported by **Prakash et al.**,2000, **Roy et al.**, 2005, **Singh et al.**, 2006 and **Razzaque et al.**, 2007.

3.12 Seed yield

The maximum seed yield of mustard was recorded in hybrid M-8 (2507.54 kg/ha) which was statistically at par with M9 (2480.67 kg/ha) and M 1 (2356.67 kg/ha).

The hybrid URM-1 recorded significantly highest seed yield this might be due to higher number of branches, siliqua, and highest seed weight per plant. The varietal differences in seed yield have also been reported by **Singh et al.**, 2001, **Raquibullah et al.**, 2006, **Razzaque et al.**, 2007 and **Dehghani et al.**, 2008.

3.13 Stover yield

The significantly maximum stover yield of mustard was recorded in hybrid M-8 (3687.24 kg/ha) which was statistically at par with M 4 (3516.20 kg/ha) and M 6 (3496.67 kg/ha).

The stover yield was highest due to higher dry matter accumulation in that hybrid.

3.14 Harvest index

The maximum harvest index of mustard was recorded in hybrid M-9 (42.17 %) which was statistically at par with M 8 (40.48 %), M1 (40.10 %), M3 (39.46 %) and M2 (39.24 %).

C. Economics of mustard hybrids

3.15 Cost of cultivation (INR/ha)

The cost of cultivation of hybrid rice is presented in the table 3 Cost of cultivation (Rs 49313.00/ha) was calculated taking into consideration all the cost incurred during cultivation.

3.16 Gross Returns (INR /ha)

The gross return of hybrid rice has been presented in table 3. Maximum gross return (Rs 162990.00/ha) was obtained from treatment M 8. Lowest was recorded in M 7 (Rs 122893.6 /ha).

3.17 Net Returns (INR /ha)

The net return of hybrid rice has been presented in table 3 The treatment M-8 recorded the highest net return (Rs 113677.10 /ha) lowest in M7 (Rs 73580.55)

3.18 Benefit Cost Ratio

Maximum benefit cost ratio of 2.30 was recorded in the treatment M-8 because of higher net return and lowest in M6 (Rs 1.51). This result

is supported by **Fayez *et al.* (2015)**.

UNDER PEER REVIEW

S.No.	Hybrids	Plant Height (cm)	Number of primary branches/plant	Number of secondary branches/plant	Number of primary branches/plant /day)	Number of secondary branches/plant /day)	CGR (g/m ² /day)	RG (g/g)	Days taken to 50% flowering	Dry Weight (g/plant)
1	-1	30.37	5.0	14.	17	22	17.07	0.	3	3
2	-2	45.97	5.4	15.	23	26	19.09	0.	3	3
3	-3	42.73	4.9	18.	57	74	20.08	0.	3	3
4	-4	28.23	5.0	13.	33	34	21.06	0.	3	3
5	-5	35.33	8.1	13.	33	75	20.09	0.	3	3
6	-6	57.23	4.9	14.	77	81	16.06	0.	4	3
7	-7	49.29	5.4	16.	77	08	22.07	0.	3	3
8	-8	73.97	5.3	18.	87	84	21.16	0.	4	3
9			6.8	14.			21.	0.	3	3

	-9	54.37	7	17	25	08	5.58	3.97	
			1	5.4	15.	18.	0.	4	3
10	-10	70.97		23	26	06	1.37	5.77	
			S	S	S	S	N	S	S
F test						S			
			2.	0.4	0.6	0.3	0.	1	1.
Sem(±)		57		9	6	013	.99	18	
CD			7.	1.2	2.1	1.2		4	2.

Table:1. Performance of mustard hybrids on growth attributes at harvest

Table:2. Performance of mustard hybrids on yield attributes

S.No.	Hybrids	Number of Siliqua/Plant	Length of Siliqua/Plant (cm)	Number of seeds/Siliqua	Seed Yield (kg/ha)	Stover Yield (kg/ha)	Seed Size(mm)	Test Weight(g)	Harvest Index (%)
1	M-1	458.80	5.21	11.60	2356.67	3523.33	2.20	5.03	40.10
2	M-2	369.53	4.45	12.93	2250.00	3483.33	2.21	5.53	39.24
3	M-3	302.47	4.77	11.53	2123.67	3433.33	2.03	5.20	39.46

4	M-4	441.17	4.23	10.00	2113.33	3516.20	2.65	4.93	38.23
5	M-5	364.13	4.67	13.23	2080.67	3400.00	1.93	5.06	37.41
6	M-6	314.00	5.65	12.87	1910.00	3496.67	1.93	4.63	35.32
7	M-7	223.00	4.15	11.80	1890.67	3300.00	2.03	4.33	36.39
8	M-8	475.27	4.65	13.64	2507.54	3686.24	2.75	5.80	40.48
9	M-9	364.13	4.67	11.23	2480.67	3400.54	1.95	5.67	42.17
10	M10	370.27	5.17	13.40	1953.33	3450.00	2.03	4.63	36.13
F test		S	S	S	S	S	S	S	S
Sem(±)		29.69	0.10	0.27	62.87	45.95	0.16	0.28	1.085
CD (0.05)		90.07	0.31	0.82	190.69	139.38	0.50	0.75	3.29

Table 3. Performance of Mustard hybrids on economics.

S.No.	Hybrids	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1	M-1	49313.00	153183.60	103870.60	2.106
2	M-2	49313.00	146250.00	96937.00	1.965
3	M-3	49313.00	138038.60	88725.55	1.799
4	M-4	49313.00	137366.50	88053.45	1.785
5	M-5	49313.00	135243.60	85930.55	1.742
6	M-6	49313.00	124150.00	74837.00	1.517
7	M-7	49313.00	122893.60	73580.55	1.492
8	M-8	49313.00	162990.10	113677.10	2.305
9	M-9	49313.00	161243.60	111930.60	2.269
10	M-10	49313.00	126966.50	77653.45	1.574

CONCLUSION

The results were concluded that based on experimentation the hybrid M-8 performs positively and has higher growth and yield parameters in mustard.

The conclusion drawn are based on one season data only which requires further confirmation for recommendation.

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