



Cultivation of Hybrids Mustard (*Brassica juncea* L.) in the Pedit-Climatic Conditions of paryagraj Sangam Region (U.P), India

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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 field experiment was carried out at the Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during Rabi season 2021-22 on Mustard crop. The experiment was performed in randomized block design with ten treatments and three replication. 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 (171.76 cm), primary branches (6.5/plant), secondary branches (16.20/plant), plant dry weight (43.43 g/plant) at 100 DAS in hybrid ADV 4029 was recorded. Maximum Crop growth rate (CGR) recorded at 40-

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60DAS (20.32 g/m² /day), number of siliqua/plant (457.27), number of seeds/siliqua (13.55), test weight (4.73 g) and seed yield (2.51 t/ha) were observed in hybrid ADV 4029. In terms of economics, highest gross returns (Rs 136660.90/ha), net returns (Rs 87347.93/ha) and B:C ratio (1.77) were observed in hybrid ADV 4029.

Keywords: Economics; growth; mustard hybrids; yield.

1. INTRODUCTION

Indian mustard (*Brassica juncea* L.) belonging to the family cruciferae is one of the important oilseed crops and currently ranked as the world's third important oil seed crop in terms of production and area. Rapeseed and mustard have oil contents that range from 33% to 46%, while the average oil recovery is between 32% and 38%. The leftover portion of the seed is used to make rapeseed/mustard meal, an essential component of bovine and poultry feed, after the oil has been extracted. With a total productivity of 0.94 tons ha⁻¹, India produced 58.03 lakh tons of rapeseed-mustard per year on an area of roughly 61.90 lakh hectares [1]. Rapeseed-mustard output in India totals 79.77 lakh tons, ranking second in the country's oilseed industry to soybeans (137.94 lakh tons), which produce 320.83 lakh tons in total. Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh, Gujarat, West Bengal, Assam, Bihar, and Punjab are the states where Indian mustard (*Brassica juncea* L.) is primarily grown (DES, 2017). Mustard seeds have an oil content that varies from 35 to 48%. These crops are grown in 28 states across the nation under various agro-ecological conditions on 6.51 million hectares of land, yielding 8.18 million tons of vegetable oil, demonstrating their significance in the nation's vegetable oil production scenario. While Haryana alone produced 10.2% of the nation's total rapeseed-mustard production, rapeseed-mustard accounted for 20–22% of all oilseed production. It is grown on 6.70 million hectares in India, where it produced 7.96 mt and had a productivity of 1188 kg/ha in 2013–14. A significant rapeseed and mustard-growing state, Haryana produced 8.8 lakh tons of crop on 5.4 lakh ha of land in 2013–14, with an average yield of 1639 kg/ha [2].

Mustard 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. The pH range in the optimal soil for mustard is 6.0 to 7.5. The mustard-growing regions of India are subject to a wide range of agro climatic

conditions. The productivity and output of rapeseed-mustard will be further increased and stabilized through effective management of natural resources, an integrated approach to plant water, nutrient, and pest management, and expansion of rapeseed-mustard cultivation to newer areas under different cropping systems.

2. MATERIALS AND METHODS

During the *Rabi* season of 2021-22, 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 5th 2022 using hybrids. The experiment was conducted in a Randomized Block Design consisting of 10 treatment combinations and 3 replications viz. T1 (Bullet), T2 (HB 19101), T3 (ADV 4019), T4 (ADV 427), T5 (TM 936), T6 (Indam 1702), T7 (TMMD 9988), T8 (ADV 4029), T9 (DHM 45), T10 (Siri 19). The nutrient sources were Urea, Single Super Phosphate (SSP) and Muriate of Potash (MOP), applied as per the recommended dose of 60-30-30 kg NPK/ha. Plant growth parameters, such as plant 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), stover yield (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 [3].

3. RESULTS AND DISCUSSION

3.1 Growth Parameter

At 100 DAS, maximum plant height was recorded in hybrid ADV 4029 (171.76 cm). hybrids Siri 19 (168.76 cm) were statistically at par with hybrid

Table 1. Growth parameter of different mustard hybrids

Hybrids	Plant height (cm) 100 DAS	Dry weight (g/plant) 100 DAS	Crop Growth Rate (g/cm²/day) During 40-60 DAS	Primary Branches	Secondary Branches	50% Flowering
Bullet	128.16	36.73	15.46	5	14.4	36.56
HB 19101	143.76	40.95	17.5	5.4	15.2	32.78
ADV 4019	140.52	37.79	18.98	4.9	15.6	35.34
ADV 427	126.02	41.23	19.58	5	14.4	34.98
TM 936	133.12	38.79	18.99	6.5	12.4	39.64
Indam 1702	155.02	35.29	15.05	4.9	15.6	42.72
TMMD 9988	147.08	32.83	20.32	5.4	13.2	35.54
ADV 4029	171.76	43.43	14.08	4.2	16.2	38.98
DHM 45	152.16	36.43	19.49	3.8	10.4	40.64
Siri 19	168.76	42.76	16.5	3.6	11.6	39.72
F-test	S	S	S	S	S	S
SEm(±)	2.29	0.65	0.36	0.40	1.44	0.95
CD (P=0.05)	6.89	2.02	1.20	1.20	4.39	2.89

Table 2. Yield and yield attributes parameter of different mustard hybrids

Hybrids	Yield and Yield attributes						
	Number of siliqua/ plant	Length of siliqua/plant (cm)	Number of seeds/ siliqua	Test weight (g)	Seed yield (t/ha)	Stover Yield (t/ha)	Harvest Index (%)
Bullet	352.27	5.12	11.51	3.18	1.96	4.52	29.91
HB 19101	351.53	4.36	12.84	4.19	2.25	4.48	33.42
ADV 4019	284.47	4.68	11.44	4.01	2.12	4.33	32.89
ADV 427	423.17	4.14	9.91	3.63	2.11	5.52	27.70
TM 936	346.13	4.58	13.14	4.54	2.08	4.98	29.47
Indam 1702	296.34	5.56	12.78	4.23	1.81	3.50	35.33
TMMD 9988	205.76	4.06	11.71	4.01	1.89	3.30	36.42
ADV 4029	457.27	4.56	13.55	4.73	2.51	4.69	34.86
DHM 45	346.13	4.58	11.14	3.91	1.95	4.40	36.05
Siri 19	440.8	5.08	13.31	4.01	2.48	3.45	36.15
F-test	S	S	S	NS	S	S	S
SEm±	28.10	0.18	0.30	0.28	0.10	0.30	0.94
CD (P = 0.05)	84.30	0.56	0.95	-	0.31	0.92	2.84

Table 3. Economics of mustard hybrid

Hybrids	Economic		
	Gross returns (INR/ha)	Net returns (INR/ha)	B:C
Bullet	128438.50	79125.52	1.16
HB 19101	122625.00	73312.00	1.49
ADV 4019	115740.00	66427.02	1.35
ADV 427	115176.50	65863.49	1.34
TM 936	113396.50	64083.52	1.30
Indam 1702	104095.00	54782.00	1.00
TMMD 9988	103041.50	53728.52	1.09
ADV 4029	136660.90	87347.93	1.77
DHM 45	135196.50	85883.52	1.74
Siri 19	106456.50	57143.49	1.16

ADV 4029. The hybrid reached its maximum plant height at every stage of crop development, and its tallest plant was mostly a result of varietal features. The above findings are supported by Kumari et al., [4]. Whereas, the highest number of secondary branches (16.20/plant) in hybrid ADV 4029. Hybrid Indam 1702 (15.60/plant) was found to be statistically at par with hybrid ADV 4029. A larger LAI increases the total energy available for branch development by increasing the amount of dry matter accumulated, which is the main reason for the higher number of primary and secondary branches throughout maturity. These findings are supported by Singh 1989 and Raquiballah et al., [5]. The significantly lower fifty percent of flowering was achieved (32.78 DAS) by the hybrid Indam 1702. However, DHM 45 (40.64 DAS) and Siri 19 (39.72 DAS) were statistically at par with Indam 1702. It may be because diverse crop growth maturity patterns during the entire life cycle of the plant differ in how mustard varieties affect flowering traits at productive portion blooming development stages. These findings are supported by Kumar et al., [6]. At 100 DAS, significantly maximum dry matter was recorded in hybrid ADV 4029 (43.43 g/plant). Hybrid Siri 19 (42.76 g/plant) was found to be statistically at par with ADV 4029. At 40-60 DAS, significantly maximum crop growth rate was recorded in hybrid TMMD 9988 (20.32 g/m²/day). However, ADV 427 (19.58 g/m²/day) and ADV 4019 (19.49 g/m²/day) were found to be statistically at par with TMMD 9988. Might be due to different rates of dry matter accumulation at various phases of crop growth, hybrids UMR-5 and UMR-4 had higher dry matter output at maturity than the other hybrids. CGR and RGR, two physiological growth parameters, differ greatly. These findings are supported by Singh [7] and Raquiballah et al. 2006.

3.2 Yield Attributes

The number of siliqua/plant of mustard was recorded significantly higher in hybrid ADV 4029 (457.27/plant). However, ADV 427 and Siri 19 recorded 423.17 and 440.80 siliqua/plant respectively which was statistically at par with ADV 4029. The number of siliqua/plants were highest due to higher dry matter production. The length of the siliqua of was recorded significantly higher in hybrid Indam 1702 (5.65 cm). However, Bullet (5.12 cm) and Siri 19 (5.08 cm) were statistically at par with Indam 1702. The number of seeds/silicas of mustard was significantly maximum in hybrid ADV 4029 (13.55). However, hybrid HB19101 (12.84), TM 936 (13.14), Indam

1702 (12.78) and Siri 19 (13.31) were found to be statistically at par with ADV 4029. Larger the siliqua more the grains per siliqua and higher test weight were recorded in main shoot followed by primary and secondary branches. The maximum seed yield of mustard was recorded in hybrid ADV 4029 (2.51 t/ha). However, statistical parity was observed in HB19101 (2.25 t/ha) and Siri 19 (2.48 t/ha). The hybrid recorded significantly highest seed yield this might be due to higher number of branches, siliqua and highest seed weight per plant according to **Dehghani** et al., [8]. The significantly maximum stover yield of mustard was recorded in hybrid ADV 427 (5.52 t/ha). However, TM 936 (4.98 t/ha) and ADV 4029 (4.69 t/ha) were statistically at par with ADV 427 [9-12]. The stover yield was highest due to higher dry matter accumulation in that hybrid. The maximum harvest index of mustard was recorded in hybrid TMMD 9988 (36.42%) which was statistically at par with Indam 1702 (35.33 %), ADV 4019 (36.05 %) and Siri 19 (36.15%) were statistically at par with TMMD 9988.

3.3 Economics

The data pertaining to the economics of different treatments presented in Table 3 showed that the maximum gross return (136660.90 INR/ha), net return (87347.93 INR/ha), and benefit-cost ratio (1.77) were recorded in ADV 4029, and the minimum gross return (103041.50 INR/ha), net return (53728.52 INR/ha), and lowest benefit-cost ratio (1.09) were recorded in TMMD 9988.

4. CONCLUSION

The concluded experiment showed that hybrid ADV 4029 was found to be best for obtaining more productivity in both growth and yield parameters.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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