



Effect of Different Sowing Dates and Varieties on Mustard Growth and Yield in Prayagraj Conditions

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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

A field experiment was conducted during the winter seasons of 2021-22 at the Research farm of the college of forestry Sam Higginbottom University of Agriculture Technology and Science Prayagraj (U. P) to investigate the effect of different sowing dates and varieties on Mustard growth and yield in Prayagraj conditions Keeping in this view experiment was conducted in Factorial RBD with three replications having two factors. First factor comprised of three dates of sowing 15Oct. 30Oct. and 15Nov. whereas the second factor consists of three Indian mustard varieties viz; Maharaja Mustard, Md Rani Supergold, Kala Sona, Crop sown on 15th November was recorded statistically significant higher seed yield, stover yield, test weight, harvest index and at maturity best consumption of heat units like gdd, htu and ptu as compared to 30th October and 15th October sowing. In the case of plant growth parameters of mustard, maximum was recorded under 15th November as compared to 30th October and 15th October and in case of varieties maximum plant growth like plant height, no of leaves no of branches, no of silique, and optimum use of heat units was recorded with md rani super gold as compared to kala sona and maharaja. The treatment with the date of sowing 15th November and md rani super gold variety proved the most remunerative and economically feasible for the cultivation of Indian mustard under the agro-climatic conditions of Prayagraj U.P.

Keywords: *Plant height; no of leaves; no of branches; heat units; yield; etc.*

1. INTRODUCTION

Mustard (*Brassica juncea* L.) also known by the name of Indian Mustard, belongs to the plant family Brassicaceae (Cruciferae) or the Mustard family. In the trade, it is commonly referred to as Rapeseed-Mustard along with four other closely related cultivated oilseed species viz. *Brassica rapa*, *Brassica napus*, *Brassica carinata* and *Eruca sativa*. Over the past couple of decades, these crops have become one of the most important sources of vegetable oil in the world. Continuous improvement in Rapeseed-Mustard has resulted in nutritionally superior edible oil and meal as an important source of protein in Animal feed Mustard crops are commercially cultivated in more Than 60 countries and major producers include china Canada India Australia and the Czech Republic. In the past, the area under Rapeseed-Mustard globally increased from 6.3 million hectares in 1961 to 34.3 million hectares in 2012 with a mean increment of 0.56 million hectares per annum. Production in the same period increased from 3.68 to 65.1 million tonnes at a mean increment of 3.68 m.t. per annum. Chaudhary et al. (2015) Mustard play an important role in the oil seed economy of the country. Rajasthan is the largest mustard-producing state in the country. Mustard seed production in the state is expected to increase up to 49.50 lakh tonnes during the rabi season of 2021-22 from 35 lakh tonnes in the previous year. In Uttar Pradesh, production is likely to increase from 613.5 lakh tonnes to 17 lakh tonnes. Mustard seed production in Madhya Pradesh is estimated to rise to 12.5 lakh tonnes from 8.5 lakh tonnes. In Punjab and Haryana, mustard seed production is expected 11.50 lakh tonnes, up from 9.5 lakh tonnes in the previous year.

Rapeseed and mustard are generally grown on marginal lands with poor fertility status. Hence, they also suffer from nutrient stress. Sowing time is one of the most important nonmonetary inputs which influences the productivity of seed and oil to a great extent [1]. Rapeseed and mustard are generally sown by the first week of October to the middle of November in north India [2-4]. The high diurnal temperature during early sown crops resulted in poor germination, Improper growth, and development of plants. Besides, pests viz., pointed bug (*Bagrada hilaris*), cutworm (*Agrotis* spp.), sow fly (*Athalia lugens proxima*). Late sown crop on the other hand, suffers from low temperature during its germination and early growth phases and damages due to aphids

(*Lipophis* spp.) during flowering and pod development stage [5,6]. With the development of new varieties of crops and the adoption of multiple cropping systems under irrigated conditions, it has become essential to extend its sowing from October to mid-November or even later. Considering the above facts, field experiments were conducted to study the impact of different sowing dates on two commonly grown mustard varieties of mustard in north India [7-10].

In India, shrinking land resources coupled with an increased population exert huge pressure on the farmers, researchers, and agricultural policymakers to meet the food grain requirement of the nation. This enforces to search for newer vistas. With an optimum change in temperature and rainfall, the optimum time of sowing will also change, and ultimately the crop growth will also be affected. The weather parameters which determined the optimum date of sowing are supposed to be altered to some extent with climate change occurring in that region. Keeping these aspects in view the present study on the Effect of different sowing dates and varieties on mustard growth and yield in prayagraj conditions was carried out with the following objectives

1. Effect of sowing time and varieties on growth and yield of mustard
2. To evaluate agrometeorological indices for Indian mustard

2. MATERIALS AND METHODS

The experiment was conducted at the field collage of the forestry Sam Higginbottom University of Agriculture Technology and Science Prayagraj-2110007 (UP) it is located at 25.45°N 81.84°E in the southern part of Uttar Pradesh at an elevation of 98 meters (322 ft) and stands at the confluence of two, the Ganges and Yamuna. The region was known in antiquity as the Vats country. To its south and southeast is the Bundellkhand region; to its east is middle Ganges valley of North India.

Prayagraj features the typical version of a humid subtropical climate that is common to cities in north-central India. Prayagraj experiences three seasons: hot dry summer, cool dry winter, and warm humid monsoon. The summer season lasts from April to June with the maximum temperatures ranging from 40 °C (104 °F) to 45 °C (113 °F). Monsoon begins in early July and

lasts till September. The winter season lasts from December to February.

Brassica juncea cultivars namely md rani super gold, kala sona, and maharaja mustard were sown during rabi season at 15 days intervals on three dates of sowing beginning 15th October 2021. The field experiment was conducted in an RBD in which three varieties and three sowing dates were replicated three times.

Date	Variety
1. 15 oct.2022	1. maharaja mustard
2. 30 oct.2022	2. md rani super gold
3. 15 nov.2022	3. kala sona mustard

T1 –D1V1 (15-oct.maharaja mustard)
 T2- D1V2 (15-oct. md rani super gold)
 T3- D1V3 (15-oct kala sona)
 T4-D2V1 (30-oct maharaja mustard)
 T5-D2V2 (30-oct.md rani super gold)
 T6-D2V3 (30-oct kala sona)
 T7-D3V1 (15- nov. maharaj mustard)
 T8- D3V2 (15-nov..md rani super gold)
 T9- D3V3 (15- nov. kala sona)

Fertilizers were applied as per recommended agronomic package of practices for the experiment i.e. nitrogen @ 120 kg/ha, P₂O₅ 60 kg/ha and K₂O 40 kg/ha and 20 kg Sulphur. Seeds were sown at the rate of 5 kg seed per hectare in rows spaced 30 cm apart and 3-4 cm deep by a hand-drawn drill. Weeding was carried out manually at about 40 days after seeding and thinning was done to maintain a plant population of about 2,50,000 plants per hectare uniformly in all the plots.

The crop was irrigated during the two most critical growth stages viz. flowering and pod formation stages, as per recommended irrigation package of practices for the crop under prayagraj conditions. Additional irrigations were also given whenever the gravimetric samples showed that the soil moisture had depleted to a value below 50 percent of available water (on a volume basis) in the 15 to 60 cm depth. The purpose of these additional irrigations was to ensure the maintenance of 'not short of water conditions and to retain the soil moisture in the root zone fairly within the available water range.

2.1 Observe Growth, Yield, and Meteorological Parameters

Growth parameters were recorded like- plant height,(at 30,60,90,DAS and at harvest), no of

leaves (at 30,60,90,DAS and at harvest), no of branches (at 30,60,90,DAS and at harvest) and Yield & economical parameters was recorded like- no of silique, grain yield, harvest index and also meteorological indices (GDD,HTU,PTU) was recorded at different phenological stages of plant and at final maturity.

2.2 Statistical Analysis

Analysis of treatment for all the treatments in randomized block design was carried out. Testing the hypothesis, the following ANOVA table was used analysis of variance (ANOVA) as outlined where the 'F' test was significant for comparison of the treatment means, CD values were worked out at 5% probability level. C.D = S.E (d) × 't' error d. f. at 5% level of significance.

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

It may be observed that there is no significant relationship due to date of sowing on plant height observed after 30 days of the crop while after 30 days of sowing of mustard the plant height had a significant effect because of date of sowing was also entered from the table that variety has a significant effect on plant height from 30 DAS to 120 DAS. No significant results were observed for the interaction of date of sowing and variety on the number of leaves Singh et al. [11] also conducted. The maximum plant height at 30, 60, 90, 120, DAS is 20.6, 67.76, 135.3, 189.86 (cm) was found in T₈ (15nov-md rani super gold). However minimum plant height at 30, 60, 90, 120, DAS is 18.7, 61.7, 125.2, 159.5 (cm) was recorded in T₁ (15oct-maharaja).in (Table 1).

From Table 2 may be observed that there is no significant relationship due to date of sowing on the number of leaves observed after 30 days of the crop while after 30 days of sowing of mustard the number of leaves had a significant effect because of the date of sowing it was also entered from the table that variety has a significant effect on some leaves from 30 DAS to 120 DAS. No significant results were observed for the interaction of date of sowing and variety on the number of leaves [12] also conducted. The maximum no. of leaves at 30, 60, 90, 120, DAS is 8.0, 42.8, 59.13, 49.8 (no.) was found in T₈ (15nov-mdrani super gold) However minimum no of leaves at 30, 60, 90, 120, DAS is 5.73, 32.43, 50.76, 44.05 (no.) was recorded in T₁ (15oct-maharaja). In (Table 2).

From Table 3 may be observed that there is no significant relationship due to date of sowing on the number of branches observed after 30 days of the crop while after 30 days of sowing of mustard the number of branches had a significant effect because of the date of sowing it was also entered from the table that variety has a significant effect on the number of branches from 30 DAS to 120 DAS. No significant results were observed for the interaction of date of sowing and variety on the number of leaves Singh et al. [13] also conducted. The maximum no. of branches at 30, 60, 90, 120, DAS is 5.1, 15.0, 20.7, 20.4 (no.) was found in T₈ (15nov-mdrani super gold) However minimum no of branches at 30, 60, 90, 120, DAS is 3.0, 10.4, 16.1, 16 (no.) was recorded in T₁ (15oct-maharaja) (In Table 3).

3.2 Growth Attributes

From Table 4 may be observed that there is a significant relationship due to the date of sowing

on the number of siliques was also entered from the table that variety has a significant effect on the number of siliques. No significant results were observed for the interaction of date of sowing and variety on the number of the silique, may be observed that there is a significant relationship due to the date of sowing on test weight it was also entered from the table that variety has a significant effect on test weight. No significant results were observed for the interaction of date of sowing and variety on test weight also conducted, may be observed that there is a significant relationship due to date of sowing on grain yield it was also entered from the table that variety has a significant effect on grain yield no significant results were observed for the interaction of date of sowing and variety grain yield [14-16]. Singh and Singh [17] also conducted. may be observed that there is a significant relationship due to the date of sowing on harvest index it was also entered from the table that variety has a significant effect on harvest index. No significant results were

Table 1. Plant height as influenced by different dates of sowing and varieties

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
Date of sowing				
15 th Oct 2021	18.967	62.889	125.544	159.589
30 th Oct 2021	19.133	64.522	129.211	177.522
15 th Nov 2021	20.367	67.656	134.689	188.556
SEm±	0.104	0.561	0.316	0.399
CD ($p=0.05$)	0.314	1.2	0.956	1.205
Varieties				
Md rani super gold	18.96	65.61	129.94	175.61
Kala sona	18.8	64.84	129.82	175.24
Maharaja	18.7	64.61	129.67	174.81
SEm±	0.104	0.561	0.316	0.399
CD ($p=0.05$)	NS	1.2	0.956	1.205

Table 2. No of leaves as influenced by different date of sowing and varieties

Treatments	Plant leaves (no)			
	30 DAS	60 DAS	90 DAS	At harvest
Date of sowing				
15 th Oct 2021	5.967	32.911	51.922	45.467
30 th Oct 2021	6.9	37.756	58.211	48.6
15 th Nov 2021	7.7	41.967	59.133	48.678
SEm±	0.253	0.49	0.603	0.417
CD ($p=0.05$)	0.766	1.48	1.82	1.26
Varieties				
Md rani super gold	6.94	37.42	56.83	48.13
Kala sona	6.91	37.82	56.25	47.44
Maharaja	6.71	37.38	56.17	47.16
SEm±	0.253	0.49	0.603	0.417
CD ($p=0.05$)	NS	1.48	1.82	1.26

Table 3. No of branches as influenced by different date of sowing and varieties

Treatments	Branches (no)			
	30 DAS	60 DAS	90 DAS	At harvest
Date of sowing				
15 th Oct 2021	3.131	11.801	16.4	16.333
30 th Oct 2021	4.033	13.578	18	17.944
15 th Nov 2021	4.933	14.6	20.389	20.122
SEm±	0.097	0.116	0.142	0.19
CD ($p=0.05$)	0.92	0.352	0.429	0.576
Varieties				
Md rani super gold	4.11	14.05	18.61	18.45
Kala sona	4.10	13.32	18.33	18.17
Maharaja	3.87	12.60	17.84	17.76
SEm±	0.097	0.116	0.142	0.19
CD ($p=0.05$)	NS	0.352	0.429	0.576

Table 4. Yield parameters as influenced by different date of sowing and varieties

Treatments	Yield parameters			
	No of silique (no)	Grain yield(qt/hac)	Harvest index (%)	Test weight (gm)
Date of sowing				
15 th Oct 2021	165.789	15.876	37.042	3.189
30 th Oct 2021	261.867	18.873	36.5	4.533
15 th Nov 2021	293.245	22.79	38.299	5.133
SEm±	6.70	0.51	0.729	0.045
CD ($p=0.05$)	20.26	1.54	NS	0.135
Varieties				
Md rani super gold	246.81	19.77	38.04	4.46
Kala sona	239.62	19.32	37.27	4.31
Maharaja	234.46	18.44	36.52	4.07
SEm±	6.70	0.51	0.729	0.045
CD ($p=0.05$)	NS	1.54	NS	135

Table 5. Meteorological indices as influenced by different dates of sowing and varieties

Treatment	No. of days	GDD (0 ^c day)	HTU (0 ^c day)	PTU (0 ^c day/hr.)
Date of sowing				
15/10/21	146	1823.6	14132.3	19660.97
30/10/21	143	1812.7	14132	19039.97
15/11/21	132	1675.95	11342.2	17462.53
Sem+_	2.74	196.10	217.56	117.44
CD($p=0.05$)	8.21	277.32	652.26	352.08
Varieties				
Md rani super gold	137	1740	10907.97	17859.12
Kala sona	138	1757	10553.64	16716.57
Maharaja	142	1776	10142.23	16660.17
Sem+_	2.74	196.105	217.56	117.44
CD($p=0.05$)	8.21	277.32	652.26	352.08

observed for the interaction of the date of sowing and the variety of the number of siliques (Singh et al., 2001) [18] also conducted.

The maximum no. of silique (303.4) was found in T₈ (15nov-mdrani super gold). However minimum no of silique (164.5) was recorded in T₁ (15oct-

maharaja). The maximum yield was recorded in T₈ (15nov.-md rani super gold) is 23.36 qtl/ha and minimum yield was recorded in T₁ (15oct.-maharaha) is 15.04 qtl/ha. The maximum harvest index was found in T₈ (15-nov md rani super gold) is 38.38% and minimum harvest index was recorded in T₁ (15oct.-maharaja) 34.5%. The maximum test weight was found in T₈ (15nov.-md rani super gold) is 5.4gm and Minimum test weight was recorded in T₁ (15oct.-maharaja) is 3.16gm. in (Table 4).

Table 5 the maximum heat units (GDD,HTU,PTU). Consumed by 15 oct.. growing crop and minimum GDD,HTU, PTU. Consumed by 15 nov. growing crop and in case of varieties maximum consumed by maharaja mustard and minimum consumed by md rani super gold variety may be observed that there is a significant relationship due to date of sowing on heat unit consumption was also entered from the table that variety has a significant effect on heat units consumption.

4. CONCLUSION

Based on the findings present research work it can be concluded that November 2nd and 3rd week was the most suitable time for the mustard crop because at that time sown crop are consume optimum heat units and change timely phenological stages. Heat units (GDD,HTU, PTU) play the most important role in plant growth and production. 3rd date of sowing (15th Nov. 2021) was found most suitable period for sowing mustard which resulted in maximum growth and yield attributes. & in case of variety md rani super gold is the most suitable variety for the prayagraj region. Based on this study we can recommend farmers around prayagraj to prefer the use of md rani super gold variety and sowing of mustard in the 2nd and 3rd week of November for better results and yield.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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