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Effect of sowing dates on performance of various Mustard cultivars for Southern Telangana Zone

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Abstract

A field experiment was conducted during *rabi*, 2022 at Regional Agricultural Research Station, Palem, Nagarkurnool district, PJTAU, Telangana to study the performance of different mustard varieties in various sowing dates. The experiment was laid out in Factorial RBD with Factor – I: 4 varieties - V₁- Pusa Jagannath, V₂- Pusa Tarak, V₃- NRCHB 101, V₄-DRMRIJ 31; Factor – II 4 dates of sowing D₁- 15th October, D₂- 30th October, D₃ – 15th November, D₄- 30th November and replicated three times. Among the varieties, plant height at harvest was significantly higher in variety DRMRIJ-31 than that of NRCHB 101, Pusa Jagannath & Pusa Tarak and at harvest dry matter production was significantly higher in variety DRMRIJ-31 (4067.3 kg ha⁻¹) than that of NRCHB 101 (3745 kg ha⁻¹), Pusa Jagannath (3457 kg ha⁻¹) and Pusa Tarak (3253 kg ha⁻¹).

The results revealed that plant height at harvest of mustard was significantly higher with crop sown on 15th October (148.36 cm) than that of crop sown on 15th November (132.66 cm) and 30th November (108.47 cm) and was on par with 30th October sown crop (141.1 cm). Dry matter production at harvest was significantly higher with 15th October sown crop (4175.5 kg ha⁻¹) than that of 30th October sown crop (3816 kg ha⁻¹), 15th November sown crop (3542.5 kg ha⁻¹) and 30th November sown crop (277.5 kg ha⁻¹). Among the sowing dates significantly higher yield attributes viz., number of siliqua plant⁻¹ (174), number of seeds siliqua⁻¹ (14), seed yield (1351 kg ha⁻¹), stover yield (3647 kg ha⁻¹) and harvest index (27%) were recorded with crop sown on 15th October followed by 30th October and 15th November.

Keywords: Mustard, date of sowing, variety, dry matter, seed yield

1. Introduction

Indian mustard (*Brassica juncea* L.) 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 includes 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 with a mean increment of 3.68 m.t per annum. Chaudary *et al.* (2015)^[7] Mustard play an important role in the oil seed economy of the country.

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. Rapeseed and mustard are generally sown by the first week of October to the middle of November in north India. The high diurnal temperature during early sown crops resulted in poor germination, improper growth, and development of plants (Alam *et al.*, 2015)^[1]. 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

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sowing dates on commonly grown mustard varieties in north India.

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 Southern Telangana Zone was carried out with the objective of Effect of sowing time and varieties on growth and yield of mustard

2. Materials and Methods

The present field experiment on Mustard was conducted at the Regional Agricultural Research Station (RARS), Palem, Nagarkurnool district PJTAU Telangana during the *rabi* season of 2022-23. The experiment was laid out in Factorial Randomized Block Design (FRBD) four sowing dates i.e., D1-15th October, D2-30th October, D3-15th November and D4-30th November and four Mustard varieties V1-Pusa Jagannath, V2-Pusa Tarak, V3-NRCHB 101, V4-DRMRIJ-31 with three replications.

Crop growth parameters, yield attributes were recorded at 30, 60, 90 DAS and at harvest, Grain and stover yield recorded from the net plot area. The experimental data collected on various characteristics were analysed statistically as described by Gomez and Gomez (1984) [8] for better interpretation of results.

3. Results and Discussion

A. Growth Parameters

a) Plant height (cm)

Plant height was significantly affected by the varieties and dates of sowing. Among the 4 varieties studied taller plants were found in variety DRMRIJ-31 at all the stages, at 30 DAS (11.27 cm), 60 DAS (101.21 cm), 90 DAS (121.22 cm) and at harvest (147.20 cm) followed by the variety NRCHB 101 at 30 DAS ((10.04 cm), 60 DAS (93.61 cm), 90 DAS (114.15 cm) and at

harvest (136.40 cm). However, the plant height of the varieties Pusa Jagannath and Pusa Tarak were found to be on par with each other at all the stages of the plant growth. This height variation may be attributed to the genetic characteristics promoting meristematic activities, resulting in enhanced apical growth in DRMRIJ-31. Similar findings were reported by Somondal *et al.* (2014) [21] and Patel *et al.* (2017) [14].

Among the dates of sowing, it has been observed that, plant height at 15th October sowing had been significantly superior over other dates of sowing at 30 DAS and 60 DAS. While the plant height with 15th October sowing is found to be on par with 30th October sowing at 90 DAS and at harvest. Significantly lowest plant height was observed with 30th November sowing at all the crop growth stages.

b) Dry matter Accumulation (kg ha⁻¹)

At 30 DAS, significantly higher dry matter production was recorded under DRMRIJ -31 variety (279.5 kg ha⁻¹) than that of NRCHB 101 (241 kg ha⁻¹), Pusa Jagannath (211.42 kg ha⁻¹) and Pusa Tarak (201.83 kg ha⁻¹). However, the lowest dry matter production was reported with variety Pusa Tarak (201.83 kg ha⁻¹) and it was on par with Pusa Jagannath variety (211.42 kg ha⁻¹). At 60 DAS significantly higher dry matter production was registered in DRMRIJ-31 (2119.67 kg ha⁻¹) than that of NRCHB 101 (1984.08 kg ha⁻¹), Pusa Jagannath (1676 kg ha⁻¹) and Pusa Tarak (1602.58 kg ha⁻¹). However lowest dry matter production was reported with Pusa Tarak variety.

At 90 DAS and at harvest significantly higher dry matter production was recorded in DRMRIJ - 31 (3936.42 kg ha⁻¹), (4067.33 kg ha⁻¹) respectively than that of NRCHB 101 (3652 kg ha⁻¹), (3754.08 kg ha⁻¹), Pusa Jagannath (3398.25 kg ha⁻¹), (3457.08 kg ha⁻¹) and Pusa Tarak (3213.17 kg ha⁻¹), (3253.25 kg ha⁻¹). However lowest dry matter production was reported with Pusa Tarak variety.

The accumulation of dry matter is directly correlated with plant height, leaf area, and the number of branches per plant. Mustard sown in later planting dates tends to exhibit shorter plants, lower leaf area (LA), and fewer branches, leading to a reduction in dry matter accumulation. Similar observations were documented by Kiran and Shukla (2017) [12], Singh *et al.* (2017) [20] and Patel *et al.* (2017) [14].

Table 1: Growth parameters (plant height and Dry matter accumulation of mustard as influenced by Varieties and dates of sowing

Treatment	Plant height (cm) at				Dry matter (kg ha ⁻¹)			
	30 DAS	60 DAS	90 DAS	Harvest	30 DAS	60 DAS	90 DAS	Harvest
Factor - I: Varieties								
V1: Pusa Jagannath	9.46	87.35	106.38	121.71	211.42	1676.00	3398.25	3457
V2: Pusa Tarak	9.39	85.08	103.26	120.72	201.83	1602.58	3213.17	3253.25
V3: NRCHB 101	10.04	93.61	114.15	136.40	241.00	1984.08	3651.75	3754.08
V4: DRMRIJ - 31	11.27	101.21	121.22	147.20	279.50	2119.67	3936.42	4067.33
SEm ±	0.17	1.67	1.91	2.17	4.77	23.8	59.51	66.27
CD (P=0.05)	0.48	4.84	5.55	6.29	13.85	69.07	172.71	192.33
Factor - II: Dates of Sowing								
D1 -15 October	11.31	104.18	122.8	143.86	275.167	2060.5	4041.83	4175.58
D2 -30 October	10.19	96.64	119.3	141.1	244.5	1929.33	3709.58	3816.08
D3 -15 November	9.57	88.18	112.5	132.66	220.75	1780.08	3458.08	3542.5
D4 - 30 November	9.08	78.25	90.4	108.47	193.33	1612.42	2990.08	2997.58
SEm ±	0.17	1.67	1.91	2.17	4.77	23.8	59.51	66.27
CD (P=0.05)	0.48	4.84	5.44	6.29	13.85	69.07	172.71	192.33
Interaction V X D								
SEm ±	0.35	3.34	3.8	4.34	9.55	47.6	119.02	132.54
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

B) Yield attributes and Yield

a) Number of siliqua plant⁻¹

Number of siliqua plant⁻¹ was significantly influenced by both varieties and dates of sowing. Mustard varieties shown significant effect on number of siliquae per plant. Among different varieties, DRMRIJ-31 had recorded significantly highest number of siliquae plant⁻¹ (166.48) than the variety NRCHB 101(155.13), and Pusa Jaganath (147.60). Number of siliquae plant⁻¹ recorded in varieties NRCHB 101, and Pusa Jaganath were found to be at par.

Also, the number of siliqua plant⁻¹ of varieties Pusa Jaganath and Pusa Tarak were found to be at par with one another. This might be due to the variation in genetic makeup of different varieties which influence number of siliqua plant⁻¹. Similar observations were reported by Mamun *et al.* (2014)^[13].

The mustard crop sown on 15th October exhibited the highest number of siliquae per plant (174.14) followed by 15th November (143.20) and 30th November (127.90) sowings and was on par with 30th October sowing (166.48). This difference could be attributed to favourable weather conditions and increased translocation of photosynthates from source to sink, resulting in a higher number of siliquae in early sowings compared to delayed ones. Similar findings were reported by Chand *et al.* (2000)^[6], Aziz *et al.* (2011)^[2] and Sharif *et al.* (2016)^[19].

b) Number of seeds siliqua⁻¹

The data on the number of seeds per siliqua was influenced by sowing dates and varieties. Among the varieties tested, the variety DRMRIJ-31 had recorded the highest number of seeds per siliqua (13.5), which was comparable to NRCHB 101 (13.1), followed by Pusa Jagannath (12.5). On the other hand, Pusa Tarak had recorded the lowest number of seeds per siliqua (12.3). These findings align with results reported by Biswas *et al.* (2002)^[4].

Among the different sowing dates, the highest number of seeds per siliqua was recorded with the crop sown on 15th October (14.1), which was on par with 30th October (13.5) sowing but more than 15th November (12.6) sown crop. The lowest number of seeds per siliqua (11.3) was recorded with the crop sown on 30th November. Maximum number of seeds per siliqua can be attributed to favourable weather conditions, facilitating the translocation of more photosynthates from source to sink. These findings were concurrence with the results reported by Bhuiyan *et al.* (2008)^[3] Sharif *et al.* (2016)^[19] and Ranabhat *et al.* (2020)^[17].

c) Seed yield (kg ha⁻¹)

Among the different varieties evaluated significantly the highest seed yield was recorded in DRMRIJ-31 (1264 kg ha⁻¹) surpassing NRCHB 101 with 1157 kg ha⁻¹, Pusa Jagannth (997 kg ha⁻¹) and lowest seed yield was recorded with Pusa Tarak (974 kg ha⁻¹). Highest seed yield in DRMRIJ-31 was due to cumulative positive impact of various growth parameters viz., higher number of branches per plant, highest leaf area and dry matter accumulation, siliqua per plant, and seeds per siliqua

when compared to the other evaluated varieties. These findings resonate with similar outcomes reported by Helal *et al.* (2016)^[19] Raghuvanshi *et al.* (2018)^[16], and Biswas *et al.* (2019)^[5]

Among the sowing dates, significantly higher seed yield was recorded with the crop sown on 15th October (1351 kg ha⁻¹), followed by 30th October (1243 kg ha⁻¹), and subsequently, 15th November (1006 kg ha⁻¹). The lowest seed yield was recorded with the crop sown on 30th November (793 kg ha⁻¹). The results clearly indicate that the crop had been sown early had a longer reproductive phase under favourable climatic conditions, allowing it to better utilization of the available resources compared to crop sown on later sowing dates. Conversely, crops from later sowings had experienced a shorter growth phase and grain-filling period, leading to forced maturity due to higher temperatures, resulting in reduced seed yield. These findings are corroborate with results reported by Shivani and Kumar (2002)^[22] Aziz *et al.* (2011)^[2] and Ranabhat *et al.* (2020)^[17]

d) Stover yield (kg ha⁻¹)

Among the varieties evaluated, DRMRIJ-31 had recorded the highest stover yield (3514 kg ha⁻¹), followed by NRCHB 101 (3338 kg ha⁻¹) and Pusa Trak (2973 kg ha⁻¹). The lowest stover yield was recorded with Pusa Jagannath (2960 kg ha⁻¹). These results align with findings reported by Helal *et al.* (2016)^[9] and Raghuvanshi *et al.* (2018)^[16]

Mustard crop sown on 15th October had recorded the highest stover yield (3647 kg ha⁻¹), which was comparable to the yield from 30th October (3502 kg ha⁻¹) sowing followed by the crop sown on 15th November, (3042 kg ha⁻¹). The lowest stover yield was observed with the crop sown on 30th November, amounting to 2593 kg ha⁻¹. Delayed sowing had resulted in a significant reduction in stover yield due to limited time availability to efficiently utilize the available resources, as observed by Singh *et al.* (2017)^[20] Jain and Sandhu (2018)^[10], and Ranabhat *et al.* (2020)^[17].

e) Harvest index (%)

Among the varieties evaluated, the maximum harvest index was recorded with DRMRIJ-31 (26.25%) which was on par with NRCHB 101 (25.28%) followed by Pusa Jaganath with (25.08%). The lowest harvest index was registered in Pusa Tarak (24.50%), but it was on par with Pusa Jaganath and NRCHB 101. The higher growth parameters such as number of branches, leaf area, dry matter production in DRMRIJ-31 contributed to higher harvest index compared to other varieties and in line with the observations reported by Mamun *et al.*, (2014)^[13].

Mustard sown on 15th October had recorded the highest harvest index (27.0%), but on par with the crop sown on 30th October (26.17%), and more than the crop sown on 15th November (24.92%). The lowest harvest index was registered with the crop sown on 30th November (23.33%). The variation in stover yield among different sowing dates can be attributed to the variations in growth parameters under varied weather conditions. Similar findings were reported by Sattar *et al.*, (2013)^[18] and Jiotode *et al.* (2016)^[11].

Table 2: Effect of varieties and dates of sowing on yield attributes and yield of mustard

Treatments	Number of siliqua plant ⁻¹	Number of seeds siliqua ⁻¹	Seed yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)	Harvest Index (%)
V1: Pusa Jaganath	147.60	12.5	997	2960	25.1
V2: Pusa Tarak	142.51	12.3	974	2973	24.5
V3: NRCHB 101	155.13	13.1	1157	3338	25.6
V4: DRMRIJ - 31	166.48	13.5	1264	3514	26.3
SEm ±	2.65	0.2	21	87	0.4
CD (P=0.05)	7.69	0.6	62	253	1.1
D1 -15 October	174.14	14.1	1351	3647	27.00
D2 -30 October	166.48	13.5	1243	3502	26.17
D3 -15 November	143.20	12.6	1006	3042	24.92
D4 - 30 November	127.90	11.3	793	2593	23.33
SEm ±	2.65	0.2	21.3	87.1	0.4
CD (P=0.05)	7.69	0.6	62	253	1.08
Interaction: V X D					
SEm ±	5.30	0.4	42.56	174.28	0.74
CD (P=0.05)	NS	NS	NS	NS	NS

4. Conclusion

Results obtained from the present field experiment reveals that among the different mustard varieties DRMRIJ-31 recorded higher values in terms of growth parameters viz., plant height, dry matter accumulation and yield attributes viz., number of siliqua plant⁻¹, number of seeds siliqua⁻¹ and recorded highest seed yield (1264 kg ha⁻¹) and stover yield (3514 kg ha⁻¹). Among the different dates of sowing, 15th October sown crop had recorded highest values in terms of growth parameters viz., plant height, dry matter accumulation and in yield attributes viz., number of siliqua plant⁻¹, number of seeds siliqua⁻¹ and highest seed yield (1264 kg ha⁻¹), stover yield (3514 kg ha⁻¹). Overall, the results demonstrated that the productivity of mustard would be higher in early sowings than in delayed sowings. Sowing window with 15th October time frame with suitable variety DRMRIJ-31 will give substantially better yields of Mustard for Southern Telangana Zone.

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