E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(8): 676-678
Received: 20-05-2024
Accepted: 26-06-2024

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Effect of cultivars and dates of transplanting on quality parameters of mustard (*Brassica juncea* L.) in Northern Telangana Zone (NTZ)

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DOI: https://doi.org/10.33545/2618060X.2024.v7.i8Si.1348

Abstract
The field experiment entitled "Effect of cultivars and dates of transplanting on quality parameters of mustard (*Brassica juncea* L.) in Northern Zone of Telangana (NTZ)" was conducted at College Farm, Agricultural College, Polasa, Jagtial in *Rabi*, 2023-24. The experiment was laid out in Split plot design with twelve treatment combinations by replicating thrice. The treatment includes 3 transplanting dates i.e, D_1- 44th Standard week, D_2- 46th Standard week and D_3-48th Standard week as main plot treatments and four sub plot treatments varieties S_1-Sitara Sringar, S_2-Black gold, S_3- Pusa mustard and S_4-NRCHB 101 as sub plot design treatments in sandy clay loam soil. Results revealed that all the quality parameters were increased significantly under 44th Standard week transplanted. The quality parameters like, oil content and oil yield (kg ha^{-1}), protein content and protein yield (kg ha^{-1}) of mustard crop were significantly higher with variety Sitara sringar. 44th Standard week transplanting with Sitara sringar variety proved the most remunerative and economically feasible for cultivation of Indian mustard under the agro climatic conditions of Northern Telangana Zone (NTZ).

Keywords: Mustard, cultivars, dates of transplanting, quality parameters

Introduction
Mustard is one of the most important oil seed crops of the world with a production of 72.42 million tonnes hectare-1. It is the second most important edible oilseed crop after groundnut in India. In India, it is cultivated in an area of 8.8 million hectares with an average production of 12.6 million tonnes and productivity of 1428 kg ha^{-1} (Indiastat, 2023) [5]. Rajasthan is the leading producer of mustard followed by Uttar Pradesh. In Telangana, mustard is grown over an area of 1000 hectares with a production of 1.00 million tonnes and productivity of 1316 kg ha^{-1} (Indiastat, 2022) [4]. As a Rabi crop, mustard is grown mostly in the districts of Jagtial, Nizamabad, Nirmal and Kamareddy located in Northern Telangana Zone (Department of Agriculture, 2022) [3].

The plant population and date of sowing affect the yield to a greater extent. Due to the delayed cessation of the monsoon, farmers are forced to sow the crop late, resulting in low yields due to the negative influence of the monsoon on plant growth, flowering duration, seed production, and productivity (Bali *et al*., 2000) [1]. Transplanting the crop rather than normal drilling may be a costlier method of crop establishment; however, the labour requirement for sowing followed by thinning the crop, to remove extra plants, may be costlier. Hence, transplanted crop has the exact plant population with mathematical precision, and there is also some time benefit after harvest of the rainy (kharif) season crops. Through transplanting, the full potentiality of individual plants can be realized and yield more than drilling of seeds. The late sowing of Indian mustard cultivars results in yield losses and thus affects the supply-chain of the oil in the market. The forceful late sowing conditions of the crop are mainly because of delayed harvesting of the kharif crops. In order to accommodate multiple cropping systems on scarcely available land, transplanting of seedlings rather than direct seeding of rapeseed-mustard shall be more advantageous.

Materials and Methods

The experiment was carried out at the College Farm, Agricultural College, Polasa, Jagtial, Professor Jayashankar Telangana State Agricultural University. The experimental site was located between 18º 50' 58" N latitude and 78º 56' 97" E longitude at an altitude of 243.4 meters above mean sea level (MSL). It is assigned to the Northern Telangana Zone of Telangana. The soil was sandy clay loam, low in nitrogen (179.2), phosphorous (13.8) and high in potassium (310) with pH (7.53).

The seedlings were raised on a nursery bed of size 3m ×1m × 15 cm. the soil was made friable and mixed well with 15 kg vermicompost, 5 kg farmyard manure, 2 kg red soil and 2 kg sand. The seeds were treated with captan @ 4g/kg of seed. After sowing was done nursery bed is covered with straw for mulching purpose. Frequent irrigation was given after the emergence of the seedlings based on the visual symptoms; the 25 days aged seedlings were transplanted as one seedling per one hill on different dates of transplanting by 15 days interval for each transplanting. To retain optimum plant, stand gap filling was taken up in the field at 10 DAS. A recommended dose of fertilizer for mustard was Nitrogen @ 60 kg ha^{-1}, Phosphorous @ 40 kg ha^{-1} and Potassium @ 40 kg ha^{-1}. The N, P and K fertilizers were applied as urea (46% N), single super phosphate (16% P_2O_5) and muriate of potash (60% K_2O), respectively. Crop growth parameters recorded were Plant height (cm), no. of primary and secondary branches $plant^{-1}$ and drymatter accumulation. Yield attributes recorded were no. of siliqua $plant^{-1}$ and no. of seeds $siliquae^{-1}$.

Results and Discussion

Oil content and Oil yield (kg ha^{-1})

Mustard transplanted during the 44th Standard Week (1st November) achieved the highest oil content at 32.4% and the highest oil yield at 601.1 kg ha^{-1}. This was followed by crops transplanted in the 46th Standard Week (15th November), which recorded an oil content of 29.9% and an oil yield of 385.6 kg ha^{-1}. The lowest oil content and oil yield were observed in crops transplanted during the 48th Standard Week (December), with values of 27.1% and 269.2 kg ha^{-1}, respectively.

This significant decrease in oil yield might be due to low seed yield and less oil content (%) under delayed planting, since the oil yield is product of seed yield and the oil content (%). This behavior could be ascribed to improper seed development and oil synthesis in seeds under delayed transplanting, owing to restricted growth of plants and the rise in temperature during the seed development phase. Similar findings were observed by Singh *et al*. (2019) [7].

Highest oil content and oil yield has recorded in variety Sitara Sringar (31.3%, 565.9 kg ha^{-1}) in turn followed by Black gold (30.2% ,444.9 kg ha^{-1}), followed by Pusa mustard 28 (29.4%, 360.7 kg ha^{-1}). Lowest oil content and oil yield was obtained in variety NRCHB 101 (28.2%, 303.1 kg ha^{-1}). The differences in oil content among different varieties could be attributed to their genetic constitution. The varietal difference in oil content was also earlier reported by Patel *et al*. (2015) [6].

Interaction between dates of transplanting and varieties was found significant on oil yield. Maximum interaction was found with treatment combination of 44th standard week i.e on 1st November transplanted crop and the cultivar Sitara Sringar (D1S1). The lowest interaction effect was observed with the treatment combination of 48th Standard week transplanted crop and the cultivar NRCHB 101 (D3S4).

Protein content and Protein yield (kg ha^{-1})

Mustard transplanted during the 44th Standard Week (1st November) exhibited the highest protein content at 15.2% and the highest protein yield at 286.6 kg ha^{-1}. This was followed by crops transplanted in the 46th Standard Week (15th November), which had a protein content of 15.1% and a protein yield of 191.4 kg ha^{-1}. The lowest protein content and protein yield were recorded in crops transplanted during the 48th Standard Week (1st December), with values of 15.1% and 144.2 kg ha^{-1}, respectively. These findings are consistent with those reported by Tripathi *et al*. (2020) [8].

The highest protein content and protein yield were observed in the variety Sitara Sringar, with values of 15.6% and 273.4 kg ha^{-1}, respectively. This was statistically comparable to Black Gold, which had a protein content of 15.3% and a protein yield of 221.3 kg ha^{-1}. Pusa Mustard 28 followed with a protein content of 14.95% and a protein yield of 178.8 kg ha^{-1}. The lowest protein content and protein yield were recorded in NRCHB 101, with values of 14.7% and 156.0 kg ha^{-1}, respectively. The observed differences in protein content among the varieties are likely attributed to their genetic constitution. These findings are consistent with those reported by Chauhan *et al*. (2007) [2].

Interaction between dates of transplanting and cultivars for protein content and protein yield was found to be non-significant at all stages.

Table 1: Effect of cultivars and dates of transplanting on quality parameters of mustard

Treatments	Oil content (%)	Oil yield (kg ha^{-1})	Protein content	Protein yield (kg ha^{-1})
D_1- 44th Standard week	32.4	601.1	15.2	286.6
D_2- 46th Standard week	29.9	385.6	15.1	191.4
D_3- 48th Standard week	27.1	269.2	15.1	144.2
SEm±	0.5	5.2	0.3	5.0
CD(P=0.05)	1.9	20.6	NS	19.7
S_1-Sitara sringar	31.3	565.9	15.6	273.4
S_2 – Black gold	30.2	444.9	15.3	221.3
S_3 - Pusa mustard 28	29.4	360.7	14.9	178.8
S_4-NRCHB101	28.2	303.1	14.7	156.0
SEm±	0.5	7.1	1.0	13.4
CD(P=0.05)	1.6	21.2	NS	37.7
SEm±(MxS)	0.9	12.4	1.8	23.2
CD(P=0.05)	NS	36.8	NS	NS
SEm±(SxM)	0.9	11.9	1.6	20.7
CD(P=0.05)	NS	37.7	NS	NS

Table 2: Interaction between dates of transplanting and cultivars on Oil yield ((Kgha^{-1})

Main plots (dates of transplanting)	Sub plots (cultivars)				
	S1- Sitara sringar	S2-Black gold	S3- Pusa mustard	S4- NRCHB 101	Mean
D1-44th Standard week	833.8	634.5	492.7	443.4	601.1
D2-46th Standard week	529.2	425.7	339.4	248.1	385.6
D3-48th Standard week	334.5	274.3	249.9	217.8	269.1
Mean	565.9	444.85	360.7	303.1	
(M × S)	SEm±		12.4		
	CD(P=0.05)		36.8		
(S × M)	SEm±		11.9		
	CD(P=0.05)		37.7		

Conclusion

From the above results transplanting on 44th Standard week along with Sitara sringar recorded higher values of quality parameter. Finally it can be concluded that transplanting on 44th Standard week seedlings with Sitara sringar is more suitable for Northern Telangana Zone (NTZ).

Acknowledgement

I deem it as a great pleasure to express my heartfelt gratitude and respect to the chairperson of my advisory committee, Dr. O. Sampath, Assistant Professor, Agricultural College, Jagtial for suggesting one of his novel thoughts having blend of scientists and farmers vision as my research work. I wish to offer my genuine thanks to Dr. N. Mahesh, Assistant Professor, Department of Agronomy, Jagtial as a member of my advisory committee for his esteemed stewardship, enabling guidance, cherishable counseling and personal affection for which I am greatly indebted to him. I avail this opportunity expressing my sincere thanks to member of my advisory committee, Dr. R. Sai Kumar, Assistant Professor, Department of Soil Science and Agricultural Chemistry, Jagtial for their guidelines in every moment of work and academics. I deeply convey my thanks for their valuable suggestions.

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