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EVALUATION OF CLIMATE-SMART MUSTARD (*Brassica juncea* L.) VARIETIES UNDER THE SOUTHERN TELANGANA ZONE

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ABSTRACT

Mustard (*Brassica juncea* L.) is recognized as a climate-smart oilseed crop because of its adaptability to diverse agro-climatic conditions, low water requirement, and tolerance to moisture stress. The crop also serves as a suitable alternative in areas affected by wildlife interference as its pungent nature and glucosinolate content make it less susceptible to damage by wild animals. A field experiment was conducted during the *rabi* season of 2022–23 in a forest-fringe village of Nagarkurnool district, Southern Telangana to evaluate the performance of different mustard varieties under local agro-climatic conditions. Nine mustard varieties i.e., PM 25, PM 27, Pusa Tarak, Pusa Jagannath, Pusa Mehak, NRCHD 101, Pusa agrani, NRCDR 2 and Blackgold were evaluated in a randomized block design with three replications. Observations on growth parameters, yield attributes and yield were recorded and analyzed statistically. Significant variation was observed among the tested varieties for growth and yield characteristics. Among the varieties, Pusa Tarak recorded the highest plant height, number of siliquae per plant, siliqua length, seed yield, straw yield, and harvest index. The superior performance of Pusa Tarak indicated its better adaptability and productivity under the prevailing environmental conditions. The study demonstrated the potential of mustard cultivation as a climate-smart option for forest-fringe areas of Southern Telangana. Based on overall performance, Pusa Tarak was found to be the most promising variety for achieving higher productivity and improving farm income under conditions where crop damage by wild animals is a major concern.

Keywords: Mustard, climate-smart crop, forest-fringe ecosystem, varietal evaluation, yield attributes, Southern Telangana.

India is one among the largest importers of edible oils globally and relies heavily on imports to meet its domestic consumption requirements. During 2025–26, the country's edible oil imports were estimated at approximately 16.7 million tonnes, whereas domestic production was only about 9.6 million tonnes, highlighting a significant dependence on imports for edible oil requirements (Annonymous[a], 2025). The production of oilseeds and edible oils in India has not kept pace with the rapidly increasing domestic demand, resulting in a widening demand-supply gap and necessitating substantial imports of edible oils. Rapeseed-mustard oil constitutes about 36 % of India's total edible oil production, making it the leading contributor to the nation's oil basket (DES & MAFW, GOI, 2023). Mustard (*Brassica juncea* L.) is one of the most important oilseed crops cultivated in India and contributes significantly to the country's edible oil production. The crop is valued for its adaptability to diverse agro-climatic conditions, relatively low input requirements, and ability to perform well under limited moisture availability. These characteristics make mustard a suitable crop for resource-constrained farming systems and areas prone to climatic variability. India ranks as the third-largest producer of rapeseed–mustard in the world, contributing more than 13 per cent to global production from 2020-21 to 2024–25. In the year 2025-26, rape seed and mustard crop was cultivated in 9.15 m ha in India and produced 13.3 m tonnes (India stat, 2026). Despite this significant contribution, the average productivity of rapeseed–mustard in India during 2025–26 was only 1456 kg ha^{-1}, which is more than 60 per cent lower than the global average productivity of 2070 kg ha^{-1} (Kumar *et al.,* 2025). In recent years, crop cultivation in forest-fringe villages has been increasingly challenged by the incidenceof wild animal damage. Crop losses caused by wild boar, deer, peafowl, and other animals adversely affect farm productivity and discourage cultivation of several field crops (Arunachalam *et al.,* 2022 and Thakur *et al*., 2022). Consequently, there is a need to identify alternative crops that are both economically viable and less attractive to wildlife. Mustard has emerged as a potential solution to this problem because its characteristic pungency and the presence of

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glucosinolates and other sulphur-containing compounds act as natural deterrents to many wild animals (Rathi *et al*., 2020). As a result, mustard cultivation may reduce crop losses while providing a profitable oilseed crop option for farmers residing in vulnerable forest-adjacent regions.

The Southern Telangana Zone possesses suitable climatic conditions for mustard cultivation during the rabi season. However, information on the performance of different mustard varieties under forest-fringe ecosystems of the region is limited. Identification of high-yielding and adaptable varieties is essential for improving productivity and promoting the crop as a climate-smart alternative in these areas. Therefore, the present investigation was undertaken to evaluate different mustard varieties under field conditions in the Southern Telangana Zone and to identify suitable varieties based on their growth performance, yield attributes, and productivity.

MATERIAL AND METHODS

The field experiment was conducted during the *rabi* season of 2022–23 at Madhavanpalli village in Nagarkurnool district of the Southern Telangana Zone. The study area represents a typical forest-fringe ecosystem where crop cultivation is frequently affected by wildlife intrusion it was located at an average altitude of 576 m above mean sea level (MSL). The region falls under the semi-arid tropical agro-climatic zone and is characterized by hot summers, mild winters and erratic rainfall distribution. The soil of experimental site was sandy clay loam with pH 6.9, electrical conductivity 0.36 dSm^{-1}, low organic carbon (0.57%), low available nitrogen (214.8 kg ha^{-1}) and medium phosphorus (14.9 kg ha^{-1}) and high in potassium (298.7 kg ha^{-1}). The experiment was laid out in a Randomized Block Design (RBD) with three replications. Nine mustard varieties were evaluated under farmers' field conditions. The varieties included are Pusa Mehak, PM-27, NRCDR-2, Black Gold, Pusa Agrani, PM-25, NRCHB-101, Pusa Jagannath and Pusa Tarak. The crop was raised following the recommended agronomic practices for mustard cultivation under the prevailing agro-climatic conditions of the region. Mustard crop sown with seed rate of 5-6 kg ha^{-1} with 45 cm spacing between the rows and 15 cm between the plants of same row. Crop was ensured with recommended dose of fertilizers *i.e.,* 60-40-40 of NPK kg ha^{-1} in which, 30 kg N and entire P_2O_5 and K_2O were applied as basal and remaining 30 kg N applied at 55-60 days after sowing. Irrigation water was provided for this crop nearly 200 to 250 mm scheduled in 3 to 4 irrigations during critical periods of crop growth like germination, 30 Days after germination, flowering and seed filling stage. Weed management was carried out through intercultivation by hoeing between the crop rows at regular intervals to minimize weed competition and maintain proper soil aeration for better crop growth and development. Necessary cultural operations were carried out uniformly across all treatments to ensure proper crop establishment and growth. Observations were recorded on important growth and yield parameters, including: Plant height (cm), Number of siliquae per plant, Length of siliqua (cm), Seed yield (kg ha^{-1}), Straw yield (kg ha^{-1}), Harvest index (%) and Test weight (g). The recorded data were subjected to statistical analysis using the analysis of variance (ANOVA) procedure appropriate for a Randomized Block Design. Treatment means were compared to determine the significance of varietal differences for the observed parameters.

RESULTS AND DISCUSSION

The performance of mustard varieties differed significantly with respect to growth, yield attributes, and yield parameters under the agro-climatic conditions of the Southern Telangana Zone. The observed variations indicate the influence of varietal characteristics on crop growth and productivity.

Plant Height

Plant height is an important growth parameter that reflects the overall vigour and adaptability of a variety to the prevailing environmental conditions. Significant differences were observed among the tested mustard varieties. Significantly highest plant height was recorded by Pusa Tarak (157.2 cm), followed by NRCHB-101 (156.0 cm) and Pusa Jagannath (155.4 cm), Pusa Agrani (153.4 cm) and PM 25 (152.2 cm) which were at par with each other. In contrast, Pusa Mehak recorded the lowest plant height (111.1 cm). The superior plant height observed in Pusa Tarak may be attributed to its greater vegetative growth and better utilization of available resources. Increased plant height is often associated with enhanced photosynthetic capacity

and biomass accumulation, which contribute positively to crop productivity. (Madhukar *et al.,* 2025).

Number of Siliquae per Plant

The number of siliquae per plant is one of the major yield contributing characters in mustard. Significant variation was observed among the varieties for this trait. Pusa Tarak recorded the highest number of siliquae per plant (172.5), which was closely followed by NRCHB-101 (172.1) and Pusa Jagannath (163.7) which were at par with each other. The lowest number of siliquae per plant was observed in NRCDR-2 (58.9). The higher siliquae production in Pusa Tarak and NRCHB-101 indicates their superior reproductive efficiency and greater sink capacity, which ultimately contributed to improved seed yield. (Sharma *et al*., 2019 and Kumar *et al.* 2020)

Length of Siliqua

Siliqua length showed considerable variation among the evaluated varieties. The longest siliqua was recorded in Pusa Tarak (5.8 cm), followed by NRCHB-101 (5.3 cm) and Pusa Agrani (5.2 cm). The shortest siliqua length was observed in PM-25 (4.3 cm) and PM-27 (4.2 cm). Longer siliquae generally accommodate a greater number of seeds, thereby contributing to higher yield potential. The superior siliqua length recorded by Pusa Tarak further strengthened its overall yield advantage over the other varieties. (Kumar *et al*., 2017 and Rana *et al*., 2019)

Seed Yield

Seed yield is the ultimate expression of the combined effect of growth and yield contributing characters. Significant differences were observed among the mustard varieties with respect to seed yield. Among all the varieties, Pusa Tarak recorded significantly highest seed yield (971 kg ha^{-1}), followed by Pusa Jagannath (833 kg ha^{-1}), NRCHB-101 (801 kg ha^{-1}), and Pusa Agrani (789 kg ha^{-1}). The lowest seed yield was recorded in Black Gold (505 kg ha^{-1}). The superior seed yield obtained with Pusa Tarak may be attributed to its greater plant height, higher number of siliquae per plant, longer siliqua length, and efficient partitioning of assimilates towards reproductive structures. These favourable characteristics collectively enhanced the yield potential of the variety under field conditions. Similar findings have been reported by Kumari *et al*. (2012), Ray *et al.* (2014), Dinda *et al.* (2015), Kumar *et al*. (2024) and Keerthi *et al*. (2026).

Straw Yield

Significant variation was also observed in straw yield among the tested varieties. Pusa Tarak produced the highest straw yield (1820 kg ha^{-1}), followed by NRCHB-101 (1659 kg ha^{-1}), Pusa Jagannath (1593 kg ha^{-1}), and PM-27 (1590 kg ha^{-1}). The lowest straw yield was recorded in Pusa Mehak (1351 kg ha^{-1}). The higher straw yield in Pusa Tarak reflected its vigorous vegetative growth and greater biomass accumulation. Enhanced biomass production is indicative of better adaptation to local environmental conditions and efficient utilization of available resources. (Maurya *et al*., 2022 and Keerthi *et al*., 2026)

Harvest Index

Harvest index represents the efficiency with which a plant converts total biomass into economic yield. Significant differences were observed among the mustard varieties. Pusa Tarak recorded the highest harvest index (0.35), followed by Pusa Agrani and Pusa Jagannath (0.34 each). The lowest harvest index was recorded in Black Gold (0.27). The higher harvest index of Pusa Tarak indicates its superior ability to allocate assimilates towards seed production, thereby resulting in higher economic yield. (Keerthi *et al*., 2026)

Test Weight

Test weight is an important quality parameter and reflects the size and density of seeds. The highest test weight was recorded in Pusa Tarak (5.2 g), followed by Pusa Agrani, NRCHB-101, and Pusa Jagannath (5.1 g each). The lowest test weight was observed in PM-27 and NRCDR-2 (4.0 g). The higher test weight recorded by Pusa Tarak indicates better seed development and grain filling, which contributed to its superior yield performance. (Kumar *et al*., 2024)

CONCLUSION

The present investigation demonstrated the suitability of mustard as a climate-smart crop for cultivation in forest-fringe ecosystems of the Southern Telangana Zone. Significant variation was observed among the tested varieties for growth, yield attributes,

Table. 1. Growth, yield Attributes and yield of different mustard varieties under Southern Telangana during *rabi* 2022-23

varieties	Plant height (Cm)	Siliquae Plant^{-1}	Siliqua Length (Cm)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest Index	Test weight (g)
Pusa Mehak	111.1	115.3	4.6	558	1351	0.29	4.1
PM-27	122.8	99.6	4.2	636	1590	0.29	4.0
NRCDR-2	132.3	58.9	4.9	596	1493	0.29	4.0
Black Gold	135.1	94.8	5.1	505	1354	0.27	4.6
Pusa Agrani	153.4	99.3	5.2	789	1515	0.34	5.1
PM-25	152.2	135.7	4.3	597	1397	0.30	4.1
NRCHB-101	156.0	172.1	5.3	801	1659	0.33	5.1
Pusa Jagannath	155.4	163.7	5.1	833	1593	0.34	5.1
Pusa Tarak	157.2	172.5	5.8	971	1820	0.35	5.2

and yield parameters. Among the evaluated varieties, Pusa Tarak consistently exhibited superior performance with respect to plant height, number of siliquae per plant, siliqua length, seed yield, straw yield, harvest index, and test weight. The variety produced the highest seed yield and showed better adaptability to the prevailing environmental conditions.

Based on the overall performance, Pusa Tarak may be recommended as a promising mustard variety for cultivation in forest-fringe areas of Southern Telangana, where crop damage due to wildlife interference poses a major challenge to agricultural production.

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