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

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**Abstract**
The field experiment entitled "Effect of cultivars and dates of transplanting on growth and productivity 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, $D_1$- 44$^{th}$ Standard week, $D_2$- 46$^{th}$ 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 growth and yield attributes were increased significantly under 44$^{th}$ Standard week transplanted. The agronomical parameters like, plant height (cm), leaf area index, dry matter accumulation (g plant-1) and yield attributes like number of siliquae plant-1, number of seed siliqua-1 of mustard crop were significantly higher with variety Sitara sringar. 44$^{th}$ 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, growth and productivity

## Introduction
Mustard is one of the most important oil seed crops of the world with a production of 72.42 million tonnes hectare-1 (Statista Research Department, 2021). 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. 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) [13]. 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).

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) [6]. 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 18° 50' 58" N latitude and 78° 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

### Plant height

Plant height is an imperative morphological growth parameter. It exhibits the vigour of the plant. It has a significant role in capture of light and sun-oriented radiation. Plant height increased with advance in duration of mustard crop. Plant height was affected significantly by dates of transplanting and cultivars at all stages of sampling. At branching initiation, there was no significant difference in plant height at different dates of transplanting. The crop transplanted on 44th Standard week recorded highest plant height (32.1cm) which was on par with 46th Standard week and 48th Standard week. Crop transplanted on 44th Standard week recorded significantly highest plant height (147.2, 166.3, 168.3 cm) which was on par with 46th Standard week flowering, siliqua initiation and harvest. The lowest plant height was recorded on 48th Standard week (131.0, 148.1, 150.3 cm)

The significant plant height might be due to longer crop duration and favourable agrometeorological conditions. The findings of the present study also confirmed by Alam *et al*. (2015) [2], Bazzaz *et al*. (2020) [7] and De *et al*. (2021) [10].

Among the cultivars,at branching initiation there was no significant difference in plant height. But the highest plant height was obtained with variety Sitara sringar (30.9 cm) which was on par with Black gold which was in turn on par with Pusa mustard 28 and NRCHB101 (28.0cm). At flowering stage, siliqua initiation and harvest, significantly highest plant height was observed in Sitara sringar (148.9, 168.2, 170.6 cm) which was on par with Black gold which inturn on par with Pusa mustard 28 and significantly lowest plant height was recorded in NRCHB 101 (129.4, 146.3, 148.3 cm). This might be due to genetic character rof promoted meristematic activities resulting in higher apical growth in Sitara sringar. Similar findings were observed by Somondal *et al.* (2014) [28] and Patel *et al*. (2017) [22].

### Dry matter accumulation

Dry matter is the accretion of photosynthates after respiration and anabolic process. The results illustrated that there is a steady increase in the dry matter accumulation in every stage of crop growth until harvest. Among the dates of transplanting, significantly highest dry matter accumulation was recorded on 44th Standard week (526.1, 1331.8, 3026.1, 4077 kg $ha^{-1}$) followed by 46th Standard week and 48th Standard week kg $ha^{-1}$) at branching, flowering stage, siliqua initiation and at harvest stage. Lowest value has been observed on 48th Standard week of transplanted date at all the crop growth stages.

Dry matter accumulation is directly related to their plant height, leaf area index and number of branches $plant^{-1}$. Mustard transplanted on later stages resulted in shorter plant, low LAI, less number of branches $plant^{-1}$ which in turn resulted in low dry matter accumulation. Similar results were reported by Keerthi *et al*. (2017) [14] and Bazzaz *et al*. (2020) [7].

Among the cultivars, Sitara sringar significantly exhibited highest dry matter production throughout the crop growth period at branching stage (538.0 $kgha^{-1}$), flowering stage (1360.3$kgha^{-1}$), siliqua initiation (3022.5 kg $ha^{-1}$) and at harvest (4102.5 kg $ha^{-1}$). It was on par with Black gold followed by Pusa mustard 28 at branching initiation, flowering stage,siliqua initiation and at harvest respectively. Lowest dry matter accumulation was reported by NRCHB 101 (436.7,1117.8, 2563.8, and 3502.4 $kgha^{-1}$). The variety Sitara sringar has higher capacity to utilize photosynthates more efficiently results in rapid formation of branches, higher leaf area index and ultimately the dry matter production. Similar findings were observed by Raghuvanshi *et al.* (2018) [23] and Lal *et al.* (2020) [19].

Its probable reason might be attributed to genetic characters of Sitara sringar which has higher capacity to utilize the photosynthates more efficiently for maximum leaf area index, number of primary and secondary branches $plant^{-1}$ and ultimately the dry matter accumulation. Similar findings observed by Kumar *et al*. (2024) [15].

### Number of primary branches $plant^{-1}$

Among dates of transplanting, 44th Standard week transplanted crop attained significantly higher number of primary branches $plant^{1}$ (5.0, 7.0, 7.3 and 7.5) which was on par with 46th Standard week (4.6, 6.5, 6.8 and 6.9) at branching initiation stage, flowering, siliqua and maturity stage. Lowest number of primary branches $plant^{1}$ recorded in 48th Standard week (3.4, 6.1, 6.4 and 6.5) branching initiation stage, flowering stage, siliqua development stage and at maturity stage. Delayed transplanting recorded a lesser number of branches. This might be due to late sown crops faced high-temperature stress that ultimately decreased stand established and growth of the plant finally reduced the branches. Afroz *et al*. (2011) [1] and Bazzaz *et al*. (2020) [7] also reported similar findings.

### Number of secondary branches $plant^{-1}$

Among the cultivars, Sitara sringar recorded higher number of primary branches $plant^{-1}$(5.0, 7.0, 7.4 and 7.6) at branching initiation stage, flowering stage, Siliqua initiation and maturity stage, followed by Black gold and Pusa mustard. Lower number of primary branches $plant^{-1}$ were noted with NRCHB 101(3.5, 6.1, 6.4 and 6.5) at branching initiation stage, flowering stage, which were on par with Pusa mustard 28. these results are in accordance with the findings of Chaudhary *et al.* (2016), Sannathimaappa *et al.* (2020) [25] and Sowjanya *et al* (2021) [29].

A perusal of the data revealed that number of secondary branches per plant followed the same trend as primary branches. Significantly highest number of secondary branches plant$^{-1}$ was observed in 44$^{th}$ standard week transplanted crop (12.6, 18.1, 20.2) at flowering stage, siliqua development stage and maturity stage which was on par with 46$^{th}$ Standard week transplanted crop (17.2) at siliqua development stage. Less number of secondary branches per plant recorded in 48$^{th}$ standard week transplanted crop (11.1,15.4 and 17.4) at flowering stage, siliqua development stage and at maturity stage respectively.

Delayed transplanting recorded a smaller number of branches, which might be due to late sown crops faced high-temperature stress that ultimately decreased stand established and growth of the plant finally reduced the branches. Afroz *et al*. (2011) [1] and Bazzaz *et al*. (2020) [7] also reported similar findings.

Among the cultivars, Sitara sringar obtained higher number of secondary branches plant$^{-1}$(12.7, 18.5, 20.4) at flowering stage, siliqua initiation, maturity whichwason par with Black gold and Pusa mustard 28. Lower number of secondary branches plant$^{1}$ were noted with NRCHB 101(10.9, 14.7, 17.0) at flowering stage, siliqua initiation and maturity stage. These results are in accordance with the findings of Satpathy (2007), Chaudhary *et al.* (2016), Ashok and Sajjan (2018) [3] and Sannathimaappa *et al.* (2020) [25].

**Number of siliqua plant$^{-1}$**

Significantly highest number of siliqua plant$^{-1}$ was recorded with 44$^{th}$ standard week transplanted crop (510.5) which was followed by 46$^{th}$ Standard week transplanted crop. As a result of better partitioning of photosynthates from source to sink and less competition for resources, development of yield attributes was better under optimum date of transplanting with suitable cultivar. Higher value might be due to early crop establishment, better biomass production and longer crop duration. These results agree with the findings of Aziz *et al*. (2011) [5] and Gawariya *et al*. (2015). The lowest number of siliquae plant$^{-1}$ was noticed in 48$^{th}$ Standard week (272.4). Among the cultivars, Sitara sringar obtained highest number of siliqua plant$^{-1}$ (496.1) whichwasfollowed by Black gold and Pusa mustard 28. Lower number of siliqua plant$^{1}$ were noted with NRCHB 101(312.5) at flowering stage, siliqua initiation and maturity stage. This might be due to the variation in genetic makeup of different varieties which influence number of siliqua plant. Similar observations were reported by Mamun *et al*. (2014) [20], Kumar *et al*. (2016) [16] and Sowjanya *et al*. (2021) [29].

The interaction effect of dates of transplanting and cultivars for no. of siliqua plant$^{-1}$ was found to be significant (Table 1). Maximum interaction was found with treatment combination of 44$^{th}$ standard week transplanted crop and the cultivar Sitara sringar ($D_1S_1$). The lowest interaction effect was observed with the treatment combination of 48$^{th}$ Standard week transplanted crop and the cultivar NRCHB 101 ($D_3S_4$).

**Number of seeds siliqua$^{-1}$**

Since seeds are generated as storage organs, the number of filled seeds is thought to be a significant component that directly contributes to utilizing potential yield recovery in oilseed crops. It appears that the number of seeds per siliqua is larger sink allowing for the storage of more materials.

Among the dates of transplanting, 44$^{th}$ Standard week transplanted crop (13.1) has recorded significantly higher number of seeds siliqua$^{-1}$ which was followed by 46$^{th}$ Standard week and the lowest filled seeds siliqua$^{1}$was seen in 48$^{th}$ standard week (10.9). Maximum number of seeds siliqua$^{-1}$ was due to favourable climatic conditions which results in translocation of more photosynthates from source to sink which was in agreement with the findings of Bhuiyan *et al*. (2008) [8], Sharif *et al*. (2016) [27] and Ranabhat *et al*. (2020) [24].

Among the cultivars, Sitara sringar recorded higher number of seeds siliqua$^{-1}$(12.7) which was followed by Black gold (12.1) and Pusa mustard 28 (11.6). Lower number of seeds siliqua$^{-1}$ were noted with NRCHB 101(11.4). This might be due to the variation in genetic makeup of different varieties which influence number of seeds siliqua$^{-1}$. Similar observations were reported by Mamun *et al*. (2014) [20] and Kumar *et al*. (2016) [16] and Sowjanya *et al*. (2021) [29].

**Table 1:** Effect of cultivars and dates of transplanting on yield attributes of mustard

| Treatment | Yield Attributes | | | | | |
|---|---|---|---|---|---|---|
| | Plant Height (cm) | Dry matter accumulation (kgha$^{-1}$) | No. of Primary branches | No. of secondary branches | No of siliqua plant$^{-1}$ | No. of seed siliqua$^{-1}$ |
| **Main plot (dates of transplanting)** | | | | | | |
| $D_1$- 44thStandard week | 168.3 | 4077.0 | 7.5 | 20.2 | 510.5 | 13.1 |
| $D_2$- 46thStandard week | 158.4 | 3863.4 | 6.9 | 18.3 | 393.3 | 11.8 |
| $D_3$- 48thStandard week | 150.3 | 3557.0 | 6.5 | 17.4 | 272.4 | 10.9 |
| SEm ± | 3.4 | 80.7 | 0.2 | 0.4 | 11.9 | 0.2 |
| CD(P=0.05) | 13.3 | 316.9 | 0.6 | 1.8 | 46.9 | 1.0 |
| **Subplot (cultivars)** | | | | | | |
| $S_1$-Sitara Shringar | 170.6 | 4102.5 | 7.6 | 20.4 | 496.1 | 12.7 |
| $S_2$ – Black gold | 162.2 | 3952.6 | 7.1 | 19.1 | 411.5 | 12.1 |
| $S_3$ - Pusa mustard 28 | 154.8 | 3772.3 | 6.8 | 18.1 | 348.4 | 11.6 |
| $S_4$-NRCHB101 | 148.3 | 3502.4 | 6.5 | 17.0 | 312.5 | 11.4 |
| SEm± | 4.8 | 101.2 | 0.2 | 0.6 | 15.5 | 0.2 |
| CD(P=0.05) | 14.1 | 300.8 | 0.5 | 1.7 | 45.9 | 0.7 |
| **Interaction** | | | | | | |
| Sem ± (MxS) | 8.2 | 175.3 | 0.26 | 1.0 | 27.0 | 0.4 |
| CD(P=0.05) | NS | NS | NS | NS | 79.5 | NS |
| Sem ± (SxM) | 7.9 | 172.0 | 0.27 | 1.0 | 26.1 | 0.4 |
| CD(P=0.05) | NS | NS | NS | NS | 82.7 | NS |

**Conclusion**

From the above results transplanting on 44$^{th}$ Standard week along with Sitara sringar recorded higher values of plant growth parameters plant height and dry matter accumulation and yield attributes.Finally it can be concluded that transplanting on 44$^{th}$ Standard week seedlings with Sitara sringar is more suitable for

Northern Telangana Zone (NTZ).

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