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GROWTH AND YIELD RESPONSE OF BROCCOLI (*Brassica oleracea* var. *Italica* L.) VARIETIES TO DIFFERENT PLANTING DATES UNDER TELANGANA CONDITIONS

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ABSTRACT

The present investigation entitled “Growth and yield response of broccoli (*Brassica oleracea* var. *italica* L.) varieties to different planting dates under Telangana conditions” was conducted during Rabi 2025–2026 at PGIHS, SKLTGHU, Mulugu, Telangana, to evaluate the performance of four broccoli varieties under different planting dates. The experiment was laid out in a Factorial Randomized Block Design (FRBD) comprising sixteen treatment combinations involving four varieties and four planting dates, with three replications. The treatments consisted of Palam Samridhi, Palam Vichitra, Pusa Purple Broccoli-1 and Saki transplanted on 15 September, 30 September, 15 October and 30 October 2025. Significant variation was observed for harvest index and total head yield per plot. Palam Vichitra recorded the highest harvest index (19.8%) and total head yield per plot (10.7 kg), while transplanting on 30 September recorded the highest mean harvest index (16.3%) and total head yield per plot (9.9 kg). The interaction between variety and planting date was significant, with Palam Vichitra transplanted on 30 September (V_2D_2) recording the highest harvest index (26.2%) and total head yield per plot (13.4 kg). The findings indicate that the performance of broccoli under Central Telangana conditions was influenced by the interaction between genotype and transplanting date, with Palam Vichitra transplanted on 30 September showing superior performance for the measured yield-related parameters.

Key words : Broccoli, Varieties, Planting dates, Palam Vichitra, Growth parameters, Quality parameters.

Introduction

Broccoli (*Brassica oleracea* var. *italica* L.), commonly referred to as green sprouting or Italian broccoli, is an important cool-season vegetable belonging to the family Brassicaceae. It is believed to have originated from wild forms of *Brassica oleracea* and was cultivated historically in the Mediterranean region, particularly in and around Italy. Subsequently, its cultivation spread to other parts of Europe and North America. In India, broccoli cultivation is concentrated mainly in temperate and subtropical regions, including Himachal Pradesh, Uttarakhand, Uttar Pradesh, Jammu and Kashmir, the Nilgiri Hills of Tamil Nadu and the

northern plains (Syed *et al.*, 2023).

Broccoli is a cool-season crop whose growth, head initiation and head quality are strongly influenced by temperature. Exposure to unsuitable temperature conditions can adversely affect head development, compactness and market quality. In northern India, broccoli is generally sown during September–October and harvested from November to early February, depending on the cultivar. Optimum curd quality has been reported under favourable temperature conditions, with daytime temperatures around 25–26°C and nighttime temperatures of 15–16°C, within an overall favourable range of 18–26°C. Adequate soil fertility and moisture

management are also important for proper head development and prevention of physiological disorders such as stalk hollowness. Broccoli performs well in well-drained sandy loam soils with a pH of 5.5–6.8 (Kohil *et al.*, 2006).

Planting date is an important agronomic factor influencing crop establishment, vegetative growth, head development and yield. Variation in planting time exposes the crop to different temperature regimes during critical growth stages, thereby affecting productivity and head quality. Earlier planting has been reported to provide a longer growth period and favourable conditions for vegetative development, whereas delayed planting may reduce yield (Bianco *et al.*, 1996). Gautam *et al.* (1998) reported that earlier-planted crops produced taller plants, more leaves, greater plant spread and larger leaf area, with fewer abnormal curds, resulting in improved curd yield.

Under Telangana conditions, information on suitable broccoli varieties and optimum transplanting time is comparatively limited. Therefore, the present investigation was undertaken to evaluate the growth and yield response of different broccoli varieties to different planting dates under the Central Telangana agro-climatic conditions.

Materials and Methods

A field experiment was conducted during the *Rabi* season of 2025–2026 at the University Farm, PGIHS, SKLTGHU, Mulugu, Siddipet district, Telangana, India. The experimental site was situated at an altitude of 451 m above mean sea level, at 17°43' 16" N latitude and 78°37' 30" E longitude, and falls under the Central Telangana Agro-climatic Zone.

The experiment was laid out in a Factorial Randomized Block Design (FRBD) involving two factors and three replications. Factor I comprised four broccoli varieties: Palam Samridhi (CSKHPKV, Palampur), Palam Vichitra (CSKHPKV, Palampur), Pusa Purple Broccoli-1 (IARI, New Delhi) and Saki (Sakata Seed Corporation). Factor II consisted of four planting dates, *viz.*, 15 September, 30 September, 15 October and 30 October 2025. Thus, the experiment consisted of sixteen treatment combinations (V_1D_1 to V_4D_4), each replicated three times.

Seedlings were raised in pro-trays using cocopeat and compost and were hardened for 28 days before transplanting. Transplanting was carried out at a spacing of 60 × 45 cm. Farmyard manure was incorporated at 20 t ha⁻¹ before planting. Fertilizers were applied at 80:100:100 kg N₂O₅₂ O ha⁻¹, with half of the nitrogen applied as top dressing at 30 days after transplanting.

Irrigation was provided through drip irrigation, supplemented with mulching. Intercultural operations included weeding and earthing up at 25 days after transplanting. Pest and disease management was carried out using imidacloprid, emamectin benzoate, copper oxychloride and mancozeb.

Observations were recorded for growth and yield-related parameters, including plant height, average weight of lateral head, harvest index, total head yield per plot and total dry matter Content.

Statistical analysis

The data were statistically evaluated using the Analysis of Variance (ANOVA) method as outlined by Panse and Sukhatme (1985). The standard error of the mean (SE, m) and critical difference (C.D.) were computed at a 5% significance level. The findings were illustrated through appropriate graphs, figures and tables.

Results and Discussion

Plant height

The statistical analysis revealed that the interaction between broccoli varieties and planting dates for plant height was non significant, indicating that the varietal response remained consistent across different sowing times. This suggests that the genetic potential governing plant height in each variety operated independently of the environmental variations associated with planting dates. Although, minor numerical differences were observed among treatments, these variations were insufficient to establish a combined influence of genotype and planting time on vegetative growth. The absence of a significant interaction implies that the ranking order of varieties in terms of plant height did not change with different planting dates, confirming that the effect of genotype and environment acted additively rather than synergistically. Such independence between genetic and temporal factors highlights the stability of varietal performance under varying sowing conditions.

Average weight of lateral head

The differences among varieties, planting dates and their interaction for average weight of lateral head were statistically non significant. This indicates that the variation observed in lateral head weight was not significantly influenced by either genotype, planting date or their interaction under the conditions of the present investigation. Although, certain numerical differences were recorded across treatments, these variations lacked statistical validation and therefore cannot be attributed to treatment effects. The absence of significance suggests that the genetic potential of the varieties and the

environmental influence of different planting dates acted independently, without producing a combined effect on lateral head development. This outcome highlights that lateral head weight is largely governed by inherent physiological processes and prevailing environmental conditions rather than by specific genotype $\times$ environment interactions. Consequently, the observed numerical differences should be interpreted with caution, as they represent natural variability rather than true treatment induced responses.

Harvest index (%)

Harvest index differed significantly among varieties, planting dates and their interaction. Among the varieties, Palam Vichitra (V_2) recorded the highest harvest index of 19.8%, whereas Pusa Purple Broccoli-1 (V_3) recorded the lowest value of 9.1%. Among planting dates, transplanting on 30 September (D_2) recorded the highest mean harvest index of 16.3%, while transplanting on 15 September (D_1) recorded the lowest value of 11.2%.

The interaction between variety and planting date was also significant. Palam Vichitra transplanted on 30 September (V_2D_2) recorded the highest harvest index of 26.2%. The lowest value was recorded by V_3D_1 , with a harvest index of 7.9%. The higher harvest index recorded by V_2D_2 indicates comparatively greater allocation of plant biomass towards the harvested heads under this treatment combination. Similar variation in the response of broccoli to transplanting time and genotype has been reported by Thirupal *et al.* (2014) and Pandey *et al.* (2021).

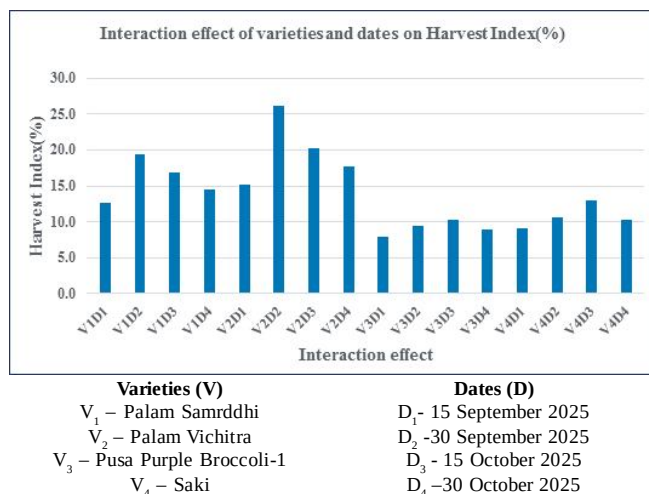


Fig. 1 : Effect of varieties, planting dates and their interaction on Harvest Index (%).

Total head yield per plot (kg)

Total head yield per plot differed significantly among varieties, planting dates and their interaction. Among the

Table 1 : Effect of varieties, planting dates and their interaction on harvest index (%) of sprouting broccoli.

Varieties	Dates				
	D ₁	D ₂	D ₃	D ₄	Mean(V)
V ₁	12.6	19.3	16.8	14.4	15.8
V ₂	15.2	26.2	20.2	17.7	19.8
V ₃	7.9	9.4	10.2	8.8	9.1
V ₄	9.1	10.5	12.8	10.2	10.7
Mean (D)	11.2	16.3	15.0	12.8	
Factors	SE(m) ±		CD@5%		CV %
Factor (V)	0.698		2.027		17.4
Factor (D)	0.698		2.027		
Factor (V X D)	1.397		4.053		

varieties, Palam Vichitra (V_2) recorded the highest mean total head yield of 10.7 kg per plot, followed by Palam Samridhi (V_1), which was statistically at par with Saki (V_4). Pusa Purple Broccoli-1 (V_3) recorded the lowest mean yield of 5.7 kg per plot.

Among the planting dates, transplanting on 30 September (D_2) recorded the highest mean total head yield of 9.9 kg per plot and was statistically comparable with transplanting on 15 October (D_3), which recorded 9.3 kg per plot. The lowest mean yield of 6.4 kg per plot was recorded with transplanting on 15 September (D_1).

The interaction between variety and planting date was significant. Palam Vichitra transplanted on 30 September (V_2D_2) recorded the highest total head yield of 13.4 kg per plot, followed by Palam Samridhi transplanted on 30 September (V_1D_2), which recorded 12.2 kg per plot. The lowest yield was recorded by Pusa Purple Broccoli-1 transplanted on 15 September (V_3D_1), with 4.4 kg per plot.

The superior yield performance of Palam Vichitra under the 30 September planting date may be associated with better adaptation of the genotype to the prevailing environmental conditions during the crop growth period. However, physiological mechanisms such as greater photosynthetic efficiency, assimilate translocation or dry matter accumulation should be interpreted as possible explanations unless supported by corresponding physiological observations. Similar varietal and planting-date effects on broccoli productivity have been reported by Hossain *et al.* (2011), Abou El Magd (2013), Thirupal *et al.* (2014), Gawariya *et al.* (2015) and Tejaswini *et al.* (2018).

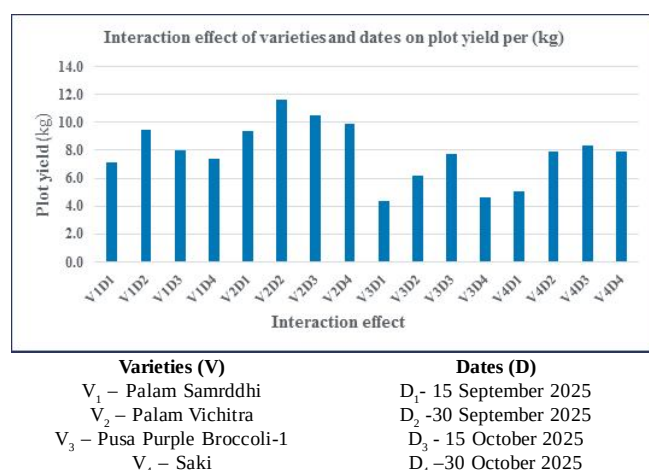


Fig. 2 : Effect of varieties, planting dates and their interaction on Total head yield per plot(kg).

Table 2 : Effect of varieties, planting dates and their interaction on total head yield per plot (kg).

Varieties	Dates				Mean(V)
	D ₁	D ₂	D ₃	D ₄	
V1	7.1	12.2	8.0	7.4	8.6
V2	9.4	13.4	10.4	9.8	10.7
V3	4.4	6.2	7.7	4.6	5.7
V4	5.0	7.9	8.3	7.8	8.0
Mean(D)	6.4	9.9	9.3	7.4	
Factors	SE(m) ±	CD@5%	CV %		
Factor (V)	0.503	1.460	20.9		
Factor (D)	0.503	1.460			
Factor (V X D)	1.006	2.921			



a) Palam samridi



b) Palam vichitra



c) Pusa purple broccoli-1



d) Saki

Total dry matter content (%)

The differences among varieties, planting dates and their interaction for total dry matter content were statistically non significant. This indicates that the treatments did not produce statistically significant

differences in total dry matter accumulation under the conditions of the present investigation. Although numerical variation was observed among the treatments, such differences lacked statistical validation and therefore cannot be attributed to varietal or environmental effects. The absence of significance suggests that the genetic potential for dry matter accumulation remained stable across planting dates, and that the influence of genotype and environment acted independently rather than synergistically. This outcome highlights that dry matter content is largely governed by inherent physiological processes and prevailing environmental conditions, with no combined effect of genotype × planting date interaction. Consequently, the observed numerical differences should be interpreted cautiously, as they represent natural variability rather than true treatment induced responses.

Conclusion

The present investigation demonstrated that broccoli performance under Central Telangana conditions was influenced by genotype and transplanting date, particularly for harvest index and total head yield per plot. Among the varieties evaluated, Palam Vichitra recorded the highest mean harvest index (19.8%) and total head yield per plot (10.7 kg). Among the planting dates, 30 September recorded the highest mean harvest index (16.3%) and total head yield per plot (9.9 kg).

The interaction between variety and planting date was significant, and Palam Vichitra transplanted on 30 September (V₂D₂) recorded the highest harvest index (26.2%) and total head yield per plot (13.4 kg). In contrast, plant height, average lateral head weight and total dry matter content did not show statistically significant treatment effects in the present experiment.

Thus, Palam Vichitra transplanted on 30 September showed the most favourable performance for yield-related parameters under the experimental conditions of Central Telangana. Further evaluation across seasons and locations would strengthen the basis for recommending this variety–planting-date combination for wider commercial cultivation.

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