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Stability Analysis For Yield And Yield Contributing Characters Of Tomato Under High Temperature Conditions

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Abstract

The current study was aimed at evaluating the stability of tomato yield and yield-contributing characteristics during three sowing intervals (February, March, and April) under high-temperature regimes, Pooled analysis of variance was performed on twenty-five genotypes, including eight parents, fifteen hybrids, and two checks, for seventeen agronomic traits. Except for plant height, ANOVA findings have revealed substantial differences among tomato genotypes, with environmental conditions playing a major role on genotype performance. The genotypes differed significantly in terms of days to 50% flowering, number of flowers per cluster, and fruit length, indicating significant variability among growing seasons. Furthermore, root length showed significant genotype x environment interactions, whereas the remaining variables are found non-significant. Among the three sowing intervals, February sowing (1st interval) was found to be the most beneficial environment for tomato growth, yield, and quality features, with the highest positive environmental indices for the majority of growth, yield, and quality contributing traits. In contrast, the April sowing period (3rd interval) was found to be most unfavorable, with the highest negative environmental indices for the traits studied. This study underlined the significant influence of environmental factors on the performance of tomato genotypes, in terms of multiple yield and yield-contributing attributes. The findings emphasize the importance of choosing the optimum sowing interval, with February as the most favorable season for cultivating tomatoes in the present study location under high-temperature conditions. These findings would help to guide the decision-making process in similar agro-climatic regions to improve the tomato output and quality.

Keywords: Tomato, Phenotypic Stability, Yield and Yield Contributing Characters, Environment

Introduction

Tomato (Solanum lycopersicum L.) is a significantly cultivated vegetable crop globally, after potato and sweet potato. However, it takes the top position in canned vegetables and is the second most important vegetable crop grown in India, following potato. The popularity of tomato stems from various factors, including its short life cycle, adaptability to various regions, high yield potential, acceptable flavor, nutritional value, and versatility in culinary and processing industries.Tomato cultivation covers an area of approximately 0.865 million hectares, with a production of around 21.056 million metric tons and a productivity of 24.35 metric tons per hectare, according to the III Adv. Estimates of Horticulture crops, Department of Agriculture and Farmers Welfare for the year 2020-21.

The optimum temperature range for tomato growth and development is 20–24°C. However, as per projections of the Intergovernmental Panel on Climatic Change (IPCC) in 2001, the global average temperature is expected to increase by around 1˚C and 3˚C higher than the current temperature by the years 2025 and 2100, respectively. This temperature raise may have adverse effects on tomato growth and yield due to its sensitivity to high temperatures. Day temperatures above 34°C are considered super-optimal thermal stress, and night temperatures above 18°C are likely to inhibit pollen production and fruit set in tomato plants. High day and night temperatures can lead to irregular flower development, reduced pollen production, pollen viability, fruit drop, and ovule abortion, all of which can ultimately result in decreased yield. Flowering and fruit set stages are particularly sensitive to heat stress.

The potential negative impact of rising temperatures on tomato cultivation, make it imperative to develop or identify tomato varieties that are resistant to high-temperature stress. Such heat-resistant varieties would help enhance tomato production in warm summer regions.For the successful commercialization of new tomato hybrids, stable genotypes are essential. However, genotype x environment interactions can interfere with the evaluation of genotypes and hinder the progress of selection in a plant breeding program. Therefore, it is necessary to estimate the nature and magnitude of genotype x environment interactions for yield and yield components to identify stable genotypes that perform consistently well across different environments. Many stability models have been developed to measure genetic differences for adaptability, and among them, the Eberhart and Russel (1966) model has been widely used in this context. This model helps in identifying genotypes that exhibit stable performance across various environmental conditions, thus aiding in the selection of suitable tomato varieties for commercial cultivation.

Materials and Methods

In this study, twenty-five genotypes were evaluated, which included 8 parents, 15 hybrids, and 2 checks. The experiment was conducted in a randomized block design with three replications over three dates of sowing at monthly intervals, i.e., February, March, and April sowings in the year 2015. The study was undertaken at the Vegetable Research Station, Rajendranagar, Hyderabad, Telangana state.

Seventeen yield and yield-contributing characters were recorded for each genotype viz., Plant height (cm), Root length (cm), Root to shoot ratio, Number of primary branches per plant, Days to fifty percent flowering, Number of flowers per cluster, Number of clusters per plant, Stigma exertion (%), Fruit set (%), Days to the first fruit harvest, Days to the last fruit harvest, Number of fruits per cluster, Number of fruits per plant, Fruit length (cm), Fruit width (cm), Average fruit weight (g), and Fruit yield per plant (kg).

The stability of the genotypes was evaluated by using the Eberhart and Russell (1966) model. According to this model, a stable genotype exhibits three characteristics, viz., 1. High mean yield: i.e, high average yield across different environments. 2. Regression coefficient (bi) equal to unity, this represents the scope of the genotypes performance in different environments. A value of bi=1 indicates a stable performance. 3. Mean square deviation from the regression line (S2di) nearer to zero: This parameter measures the deviation of a genotype's performance from its regression line. A smaller value of S2di indicates more stable performance.

These stability parameters (mean, regression coefficient, and mean square deviation from regression) were estimated for all seventeen traits to identify stable genotypes with consistent performance across various sowing dates and environments. The results would help in selecting superior tomato varieties suitable for commercial cultivation that thrive well in different environments.

Results and Discussion

The analysis of variance (ANOVA) results for the tomato genotypes showed significant differences among them for all traits, except plant height. It indicates that the genetic variations among the tomato genotypes had a significant impact on most of the studied traits.The mean sum of squares due to environments was significant for all traits, except plant height. This significant influence of the environment on the genotypes suggests that environmental factors played a crucial role in shaping the performance of the tomato genotypes for most of the traits studied. It implies that different environmental conditions, such as different sowing dates (February, March, and April) during summer, had a noticeable effect on the expression of the traits in the tomato genotypes.

The genotypes showed significant differences for days to fifty per cent flowering, the number of flowers per cluster, and fruit length. This significant variation among the genotypes indicates that there was considerable variability in the performance of the tomato genotypes across different sowing dates and environments. It suggests that some genotypes flowered earlier, had more flowers per cluster, and produced larger fruits compared to others, indicating their suitability for specific environmental conditions or market preferences.Significant mean sum of squares due to genotype x environment interactions were observed for root length, but they remained non-significant for the rest of the traits. This indicates that the genetic performance of root length in the tomato genotypes was influenced by the specific combination of genotype and environment. In contrast, for other traits, the genotypes performed consistently across different sowing dates and environments, showing less sensitivity to varying environmental conditions.

Overall, these findings highlight the importance of genetic variability and genotype x environment interactions in determining the performance of tomato genotypes for different traits. Identifying stable genotypes that perform consistently well across various environments becomes crucial in plant breeding programs to develop tomato varieties that can thrive under diverse climatic conditions and meet market demands.

The results of partitioning the mean squares due to environments and genotype x environment interactions (G x E) were significant for all the studied traits, indicating the existence of G x E interactions for all the traits. This means that the performance of the tomato genotypes was influenced by the specific combination of genotype and environment, and the genotypes responded differently across different environmental conditions.The sum of squares due to environments and genotype x environment interactions was further partitioned into linear effects of environment, genotype x environment interactions, and pooled deviation. Significant variation due to the linear effects of environment and genotype x environment interactions was observed for all traits except plant height, root to shoot ratio, number of flowers per cluster, number of clusters per plant, number of fruits per cluster, number of fruits per plant, and fruit yield per plant. This indicates that the environmental effects and additive environmental variance played a significant role in shaping the performance of these traits. Additionally, the genotypes significantly differed in their linear response to environmental changes for these traits. For the traits where linear effects of environment and genotype x environment interactions were not significant, the mean sum of squares for pooled deviation was significant. These traits include root length and stigma exertion percentage. The significant pooled deviation suggests non-linear responses and unpredictable behavior of the genotypes, indicating that they significantly differed in terms of stability.

Paroda and Hayes (1971) proposed that the regression coefficient could be used as a measure of a variety's response to environmental fluctuations, while the deviation around the regression line could be a suitable measure of its stability. According to this approach, genotypes with non-significant deviation from the regression line were considered stable, while those with significant deviation were considered unstable. Therefore, the mean performance, along with the regression coefficient and deviation from linearity, of each genotype indicated its adaptability to varied environments.

Thus, the study identified the existence of genotype x environment interactions among all the traits evaluated, highlighting the importance of environmental conditions in evaluating tomato genotypes. Some traits showed significant linear responses to environmental changes and genotype x environment interactions, while others exhibited non-linear and unpredictable behavior, indicating the need to identify stable genotypes for successful commercialization and cultivation across diverse environments.

Plant height (cm)

Based on the regression coefficient values (bi) obtained from the analysis, certain genotypes were classified as having below-average stability being adoptable to favorable environments and while others were considered to possess above-average stability specifically adaptable to unfavorable environments. Genotypes with regression coefficient values greater than unity (bi>1) identified as having below-average stability and adaptability to favorable environments include Arka Alok, PKM-1 x AVTO-1002, Arka Vikas x AVTO-9001, and Arka Vikas x AVTO-1002. These genotypes showed a linear response to environmental changes with a regression coefficient greater than 1, indicating that their performance varied significantly in response to favorable environmental conditions and they may perform well and yield better in favorable growing conditions.

The genotypes Arka Alok x AVTO-0101, PKM-1 x AVTO-9001 PKM-1 x AVTO-0101, and Arka Vikas x AVTO-9803 with regression coefficient values less than unity (bi<1) were considered to possess above-average stability and specific adaptability to unfavorable environments indicating that their performance was relatively consistent across different unfavorable environmental conditions. This suggests that they may be more suitable and stable in varied growing environments.

Root length (cm)

Based on the regression coefficient values (bi) for root length (cm), certain genotypes were classified as having below-average stability and adaptability to favorable environments, while others were considered to possess above-average stability and were specifically adaptable to unfavorable environments. Genotypes with regression coefficient values greater than unity (bi>1) showing below-average stability and adaptability to favorable environments include AVTO-1007, AVTO-9803, AVTO-9001, Arka Alok x AVTO-9803, Arka Alok x AVTO-0101, PKM-1 x AVTO-1007, PKM-1 x AVTO-9001, PKM-1 x AVTO-0101, Arka Vikas x AVTO-1007, Arka Vikas x AVTO-9007, Arka Vikas x AVTO-1002. These genotypes with regression coefficient greater than 1, perform significantly well in response to favorable environmental conditions with longer root lengths.

The genotypes with regression coefficient values less than unity (bi<1) were considered to possess above-average stability and specific adaptability to unfavorable environments include PKM-1, Arka Alok x AVTO-1007, Arka Alok x AVTO-9001, Arka Alok x AVTO-1002, PKM-1 x AVTO-1002, Arka Vikas x AVTO-0101. These genotypes with regression coefficient less than 1, indicated that their performance was relatively consistent across different unfavorable environmental conditions and may have shorter root lengths but stable performance in challenging growing environments.

Root to shoot ratio

Genotypes with regression coefficient values greater than unity (bi>1) considered to possess below-average stability and specifically adoptable to favorable environments include: Arka Alok, PKM-1, AVTO-1007, AVTO-9803, AVTO-9001, Arka Alok x AVTO-0101, PKM-1 x AVTO-9001, PKM-1 x AVTO-0101, Arka Vikas x AVTO-9001, Arka Vikas x AVTO-9002. These genotypes exhibited a linear response to environmental changes with a regression coefficient greater than 1, indicated that their root to shoot ratio varied significantly in response to favorable environmental conditions and may have a higher root to shoot ratio in favorable growing conditions.

Genotypes with regression coefficient values less than unity (bi<1) considered to possess above-average stability and specifically adoptable to unfavorable environments include Arka Alok x AVTO-1002 and Arka Vikas x AVTO-1007. These genotypes exhibited a linear response to environmental changes with a regression coefficient less than 1, indicating that their root to shoot ratio was relatively consistent across different unfavorable environmental conditions and may have lower root to shoot ratio with stable performance in varied growing environments.

Number of primary branches per plant

Stable genotypes with regression coefficients (bi) greater than unity (bi>1), suitable for favorable environments are Arka Alok, Arka Vikas, AVTO-9803, AVTO-9001, Arka Alok x AVTO-1007, Arka Alok x AVTO-9803, PKM-1 x AVTO-1007, Arka Vikas x AVTO-1007, Arka Vikas x AVTO-9803,Arka Vikas x AVTO-1002. Genotypes with regression coefficients less than unity (bi<1), showing above-average stability and adaptable to unfavorable environments are AVTO-1002, Arka Alok x AVTO-9001, Arka Alok x AVTO-0101, Arka Alok x AVTO-1002, PKM-1 x AVTO-9001, Arka Vikas x AVTO-9001. These genotypes' performance in terms of primary branches per plant suggests their suitability for specific environments. The ones with higher regression coefficients are more favorable for environments with better conditions, while the ones with lower coefficients show better adaptability to unfavorable conditions.

Days to 50% flowering

The stable genotypes for days to 50% flowering with regression coefficients greater than unity (bi>1) are Arka Alok, PKM-1, AVTO-9803, AVTO-9001, AVTO-0101, and Arka Vikas x AVTO-9001 indicate their below-average stability, and suitability for favorable environments. Conversely, the genotypes AVTO-1007, AVTO-1002, and Arka Vikas x AVTO-9803 with regression coefficients less than unity (bi<1), indicated their above-average stability and are recommended for unfavorable environments, as they adapt better to varied growing conditions.

Number of flowers per cluster

The genotypes with regression coefficients greater than unity (bi>1) for number of flowers per cluster were identified as Arka Vikas, AVTO-9001, AVTO-1002, Arka Alok x AVTO-9001, Arka Alok x AVTO-0101, Arka Alok x AVTO-1002, PKM-1 x AVTO-0101, and PKM-1 x AVTO-1002. This indicates their below-average stability, and suitability for favorable environments. Contrastingly, the genotypes Arka Alok, PKM-1, AVTO-1007, AVTO-9803, Arka Alok x AVTO-1007, PKM-1 x AVTO-1007, Arka Vikas x AVTO-1007, and Arka Vikas x AVTO-9001 showed regression coefficients less than unity (bi<1), indicating above-average stability and recommended for unfavorable environments, as they adapt better to challenging environmental conditions for the traits concerned.

Number of clusters per plant

The trait number of clusters per plant showed distinct response in different genotypes. Genotype AVTO-9803 exhibited regression coefficient greater than unity (bi>1), indicating its below-average stability and more suitability for favorable environments. while, the genotypes AVTO-1007 and Arka Alok x AVTO-1007 with regression coefficients less than unity (bi<1), revealed their above-average stability and better suitability for unfavorable environments.

Stigma exertion (%)

Stigma exertion (%) displayed different patterns among the stable genotypes. Genotypes Arka Alok, Arka Vikas, AVTO-9803, AVTO-0101, Arka Alok x AVTO-1007, Arka Alok x AVTO-9803, Arka Alok x AVTO-0101, PKM-1 x AVTO-1007, PKM-1 x AVTO-9803, PKM-1 x AVTO-0101, and PKM-1 x AVTO-1002 exhibited regression coefficients greater than unity (bi>1), indicating their below-average stability and well-suitability for favorable environments.

Conversely, genotypes PKM-1, AVTO-1007, AVTO-9001, AVTO-1002, Arka Alok x AVTO-9001, PKM-1 x AVTO-9001, Arka Vikas x AVTO-9803, Arka Vikas x AVTO-9001, Arka Vikas x AVTO-0101, and Arka Vikas x AVTO-1002 showed regression coefficients less than unity (bi<1), revealing their above-average stability and are recommended for unfavorable environments, as they exhibit better adaptability.

Fruit set (%)

The genotype AVTO-9803 displayed a regression coefficient greater than unity (bi>1) for the trait fruit set (%) indicating its below-average stability and recommended for favorable environments. In contrast, the genotypes AVTO-0101, Arka Alok x AVTO-9803, PKM-1 x AVTO-9803, Arka Vikas x AVTO-9803, and Arka Vikas x AVTO-9001 showed regression coefficients less than unity (bi<1), revealing their above-average stability and are recommended for unfavorable environments, as they exhibit better adaptability for the trait under consideration.

Days to first fruit harvest

Genotypes AVTO-9001, AVTO-0101, Arka Alok x AVTO-9803, and Arka Vikas x AVTO-1007 exhibited greater unity (bi>1) for the days to first fruit harvest, indicating their below-average stability and suitability for favorable environments. The genotypes Arka Alok, PKM-1, Arka Vikas, AVTO-1007, and PKM-1 x AVTO-9803 revealing above-average stability with regression coefficients less than unity (bi<1) and are recommended for unfavorable environments, as they exhibit better adaptability for the trait under consideration, and may perform well in varied growing environments with respect to the time taken to produce the first fruit.

Days to last fruit harvest

The genotypes exhibited a range from 113 days (AVTO-9803) to 143 days (Arka Vikas x AVTO-1002), with an overall average of 134 days for the trait, days to last fruit harvest. Among the genotypes, significant and least deviation from the regression line (S2di) was observed in Arka Alok x AVTO-1007, Arka Alok x AVTO-1002, PKM-1 x AVTO-9803, PKM-1 x AVTO-0101, PKM-1 x AVTO-1002, Arka Vikas x AVTO-1007, Arka Vikas x AVTO-9001, and Arka Vikas x AVTO-0101 genotypes indicating the preponderance of an unpredictable component of genotype by environment (G x E) interaction.

None of the genotype was found to be statistically superior to the best check, Lakshmi, which had a harvest time of 149.10 days. This information provides insights into the variation in the days to last fruit harvest among different genotypes studied and the unpredictable nature of the G x E interaction in this trait.

Number of fruits per cluster

Based on the results for stability of the number of fruits per plant, the genotypes AVTO-9803 and PKM-1 x AVTO-9803 exhibited below-average stability with regression coefficients greater than unity (bi>1) indicating that they can be recommended for cultivation in favorable environments. Conversely, the genotypes Arka Alok x AVTO-9803 and Arka Vikas x AVTO-9001 which displayed above-average stability with regression coefficients less than unity (bi<1) are the one is recommended for cultivation in unfavorable environments.

Number of fruits per plant

Stability analysis for the number of fruits per plant revealed the genotypes Arka Alok x AVTO-9803, PKM-1 x AVTO-9803, and Arka Vikas x AVTO-9803 with regression coefficients greater than unity (bi>1), indicating their below-average stability and are recommended for cultivation in favorable environments. None of the genotypes in the study registered a regression coefficient less than unity (bi<1), suggesting that no genotype exhibited above-average stability performance in unfavorable environments.

Average fruit weight (g)

The study of fruit yield per plant (kg), a comparison of different genotypes was made to assess their performance under varying environmental conditions. The highest fruit yield per plant (3.72 kg) was observed in the cross Arka Vikas x AVTO-9803, while the lowest yield (1.18 kg) was recorded in Arka Alok.The overall mean yield across all genotypes was calculated to be 2.07 kg. Among the twenty-three genotypes evaluated, three crosses, namely PKM-1 x AVTO-9001, PKM-1 x AVTO-1002, and Arka Vikas x AVTO-1007, displayed significant and minimal deviation from the regression line (S2di). This finding indicates the presence of unpredictable components in the genotype with environment interaction, implying that external factors may influence fruit yield considerably.

Certain genotypes were identified as stable performers, specifically Arka Alok x AVTO-1007, PKM-1 x AVTO-9803, Arka Vikas x AVTO-9803, and Arka Vikas x AVTO-9001. These genotypes demonstrated statistically significant fruit yield per plant compared to the superior check US-618 (1.97 kg). Interestingly, these stable genotypes also exhibited regression coefficients (bi) greater than unity (bi > 1), suggesting that they performed below average in terms of stability and adaptability to favorable environments.

Contrastingly, the genotypes AVTO-9803, Arka Alok x AVTO-9803, and Arka Vikas x AVTO-1007 displayed regression coefficients less than unity (bi < 1), indicating above-average stability performance. As a result, these genotypes are recommended for cultivation in unfavorable environments where they have shown better adaptability.

Fruit yield per plant (kg)

Stability analysis on fruit yield per plant (kg) revealed that the highest fruit yield per plant (3.72 kg) was observed in the cross Arka Vikas x AVTO-9803, while the lowest yield (1.18 kg) was recorded in Arka Alok. The overall mean yield across all genotypes was found to be 2.07 kg/plant. Among the twenty-three genotypes evaluated, three crosses, namely PKM-1 x AVTO-9001, PKM-1 x AVTO-1002, and Arka Vikas x AVTO-1007, displayed significant and minimal deviation from the regression line (S2di) indicating the presence of unpredictable components in the genotype environment interaction, implying that external factors may influence fruit yield outcomes.

Some genotypes viz., Arka Alok x AVTO-1007, PKM-1 x AVTO-9803, Arka Vikas x AVTO-9803, and Arka Vikas x AVTO-9001 were identifies as stable performers. They demonstrated statistically significant fruit yield per plant compared to the superior check genotype US-618 (1.97 kg). Interestingly, these stable genotypes also exhibited regression coefficients (bi) greater than unity (bi > 1), suggesting that they performed below average in terms of stability and adaptability to favorable environments.

Conversely, the genotypes AVTO-9803, Arka Alok x AVTO-9803, and Arka Vikas x AVTO-1007 displayed regression coefficients less than unity (bi < 1), indicated above-average stability performance. As a result, these genotypes are recommended for cultivation in unfavorable environments, where they have shown better adaptability.

Environmental indices

The study presented mean values and environmental indices for seventeen characters under investigation in each of the three environments (1st, 2nd, and 3rd intervals), namely February, March, and April sowings, in Table 10. February sowing exhibited the most favorable environment for enhancing plant height, root length, root to shoot ratio, number of primary branches per plant, number of flowers per cluster, number of clusters per plant, fruit set percentage, days to last fruit harvest, number of fruits per cluster, number of fruits per plant, fruit length, fruit width, and fruit yield per plant. March sowing was found to be a favorable environment for average fruit weight and the number of seeds per fruit. April sowing proved to be the preferred environment for days to fifty percent flowering, indicating earliness of the genotypes.

The mean performance of tomato genotypes across the three different sowings (February, March, and April) in Table 11 revealed that as summer advanced, the growth and yield-contributing characters decreased. However, superior cross combinations continued to exhibit significant performance compared to the check. The estimates of environmental index in the Table 10 could help to identify the most favorable environment for expressing the maximum potential of the genotype. Among the different intervals of sowing, the 1st interval (February sowing) emerged as the best environment for tomato cultivation, as evidenced by the highest positive environmental indices for most growth, yield, and quality attributing characters. Conversely, the 3rd interval (April sowing) was found to be unfavorable, as indicated by the highest negative environmental index.

The increasing temperatures associated with climate change have a detrimental effect on tomato cultivation, specifically impacting fruit setting and flowering. Enhanced temperatures, along with humidity, rainfall, and light intensity outside the optimal range during the growing season, lead to reduced tomato yield (Abdulla and Verkerk, 1968). Higher temperatures likely to have increased the floral abscission following anthesis. Day temperatures exceeding 32°C and nighttime temperatures above 21°C are reported limiting factors for fruit set due to disruptions in pistil physiological processes, resulting in floral or fruit abscission (Picken, 1984). High temperatures, particularly at night, during the summer season adversely affect fruit set in tomatoes. Consequently, the changing climate and the shift towards higher average temperatures have made successful tomato cultivation challenging during the summer months. Similar studies conducted by Alam et al. (2010) indicated that fruit setting in tomatoes was interrupted at temperatures above 26/20°C (day/night), and it is often completely arrested above 38/27°C (day/night) as established by the studies of Steven and Rudich, 1978, El Ahmadi and Stevens, 1979, Kuo et al., 1979.

The stability analysis results demonstrated that the crosses, that exhibit higher mean values with regression coefficients around unity, resulted in greater production and stability for fruit yield. The stability of genotypes for fruit yield was reported to be consistent for their component traits by Grafius, 1956. Results of the environmental index in Table 10 for various traits under different environments revealed variable responses. February sowing is found to be the most favorable for fruit yield and yield-contributing components, while the other two sowing periods are not conducive to fruit yield per plant due to poor flowering and fruit setting under high temperatures, whether increasing or fluctuating. These findings align with the studies conducted by Ummyiah et al. (2015), Arun et al. (2016), and Shankar et al. (2016).

Conclusion

In conlusion, the cultivation of tomatoes is significantly hindered by high temperatures, especially in the summer. Nonetheless, certain tomato varieties that display resilience to heat stress have shown promising performance under such challenging circumstances. The evaluation of stability in this investigation has indicated that sowing in February offers advantageous conditions for successful tomato cultivation. Moreover, specific hybrid varieties have exhibited stability across various traits, highlighting their potential for practical application. Given that this study is confined to a single location, namely Hyderabad, it is imperative to conduct multi-location experiments spanning several years in order to validate these findings for commercial cultivation.

Table: 01 Stability parameters for plant height and root length in tomato

Genotype/cross	Plant height (cm)			Root length (cm)		
	bi	µ	S²di	bi	µ	S²di
Arka Alok	1.87	71.93	34.87	2.27*	30	-2.37
PKM 1	-0.33	71.32	174.38**	-0.3	32.56	-1.96
Arka Vikas	2.59	61.59	64.52*	-0.29*	30.91	-2.46
AVTO 1007	1.23	90.73	233.83**	1.06	35.57	-2.34
AVTO 9803	-1.5	75.38	223.91**	1	33.25	-2.5
AVTO 9001	4.14	79.29	102.25*	2.98	28.27	-1.8
AVTO 0101	0.38	76.54	554.42**	2.30**	28.04	-2.5
AVTO 1002	4.19	74.19	184.39**	-0.07**	26.47	-2.5
A. Alok X AVTO 1007	4.63	97.49	825.21**	0.59	34.55	1.37
A. Alok X AVTO 9803	3.28	92.32	748.31**	1.54	38.13	-1.51
A. Alok X AVTO 9001	0.18	102.02	270.41**	0.82	37.53	-0.66
A. Alok X AVTO 0101	0.53	89.46	-2.41	1.38	32.15	7.21
A. Alok X AVTO 1002	-0.49	101.38	90.97*	0.2	31.25	2.06
PKM-1 X AVTO 1007	1.62	92.1	114.84**	1.28	35.89	7.05
PKM-1 X AVTO 9803	-2.58*	84.12	-17.69	0.75	35.9	13.04*
PKM-1 X AVTO 9001	-1.4	94.97	-13.18	1.37	35.91	6.74
PKM-1 X AVTO 0101	-1.63	91.62	42.21	1.62	35.14	-1.44
PKM-1 X AVTO 1002	2.41	94.22	20.78	0.16	33.14	3.17
A. Vikas X AVTO 1007	-0.51	108.65	55.02*	1.36	38.13	-0.52
A. Vikas X AVTO 9803	0.62	76.91	-15.21	0.88	34.61	16.12**
A. Vikas X AVTO 9001	2.77	99.97	27.43	1.56	30.32	-1.64
A.Vikas X AVTO 0101	1.69	96.49	214.17**	0.61	34.21	-1.34
A. Vikas X AVTO 1002	1.19	92.01	-12.03	1.87*	30.36	-2.5
Lakshmi	-0.05	67.76	21.88	-0.18**	26.57	-2.5
US 618	0.18	103.03	133.55**	0.27*	30.1	-2.49
Mean		87.42			32.76	
SE of bi	2.49	9.53		0.39	1.31	
CD (5%)		7.85			1.08	

Table: 02 Stability parameters for root to shoot ratio and number of primary branches per plant in tomato

Genotype/cross	Root to shoot ratio			No. of primary branches plant		
	bi	µ	S²di	bi	µ	S²di
Arka Alok	3.73	0.42	0	1.1	7.51	-0.05
PKM 1	1.66	0.46	0	1.02	7.57	-0.09
Arka Vikas	-3.21	0.52	0.01**	1.12	8.42	-0.1
AVTO 1007	2.45	0.4	0	1.05**	6.93	-0.1
AVTO 9803	4.42	0.46	0	1.21	8.67	-0.09
AVTO 9001	1.92	0.35	0	1.14	7.67	-0.1
AVTO 0101	0.27	0.37	0.01**	1.22*	9	-0.1
AVTO 1002	-0.09	0.38	0.02**	0.93	7.29	-0.1
A.Alok X AVTO 1007	-2.26	0.37	0	1.15	9.07	-0.09
A.Alok X AVTO 9803	3.49	0.43	0.01**	1.1	9.16	-0.09
A.Alok X AVTO 9001	-0.75	0.37	0.00*	0.91	9	-0.02
A. Alok X AVTO 0101	2.21	0.37	0	0.91	9	-0.02
A.Alok X AVTO 1002	0.94	0.31	0	0.43	8.78	0
PKM-1 X AVTO 1007	-0.49	0.39	0	1.4	8.96	0.25
PKM-1 X AVTO 9803	2.32	0.43	0	1.29	8.87	0.31 *
PKM-1 X AVTO 9001	2.07	0.38	0	0.66	8.93	0.09
PKM-1 X AVTO 0101	1.62	0.39	0.00*	0.38*	8.58	-0.1
PKM-1 X AVTO 1002	-0.07	0.36	0	1.79	9.18	0.85 **
A.Vikas X AVTO 1007	0.95	0.35	0	1.09	8.8	0.08
A.Vikas X AVTO 9803	0.12	0.45	0.00*	1.13	9.2	-0.1
A.Vikas X AVTO 9001	1.47	0.31	0	0.49	8.82	-0.1
A.Vikas X AVTO 0101	-1.07	0.36	0	1.62	9.16	0.80**
A.Vikas X AVTO 1002	1.76	0.33	0	1.48	9	0.56 *
Lakshmi	0.57	0.4	0	-0.18	7.31	1.37**
US 618	0.99	0.3	0	0.56	7.62	0.33*
Mean		0.39			8.5	
SE of bi	1.38	0.04		0.52	0.35	
CD (5%)		0.03			0.29	

Table : 03 Stability parameters for days to 50% flowering and number of flowers per cluster in tomato

Genotype/cross	Days of 50% flowering			No. of flowers per cluster		
	bi	μ	S²di	bi	μ	S²di
Arka Alok	1.68	38.89	0.05	0.87	4.26	-0.01
PKM 1	1.16	39.33	-0.54	0.98	4.78	-0.03
Arka Vikas	1	38.33	-0.64	1.11	5.11	-0.02
AVTO 1007	0.78	36.56	-0.41	0.93	5.49	0.02
AVTO 9803	3.20*	33.22	-0.64	0.16	6.12	0.02
AVTO 9001	1.93	38.67	-0.57	1.3	5.29	-0.02
AVTO 0101	2.19	42.33	-0.58	1	5.56	-0.02
AVTO 1002	0.65	48.33	-0.52	1.15	5.64	-0.02
A. Alok X AVTO 1007	-1.57	37.67	57.89**	0.54	5.47	0
A. Alok X AVTO 9803	-2.03	37.67	0.27	1.02	5.58	0.31**
A.Alok X AVTO 9001	-0.93	40.78	18.92**	1.08*	5.07	-0.03
A.Alok X AVTO 0101	0.93	46.89	18.92**	1.38	5.16	0.03
A.Alok X AVTO 1002	3.58	43.56	43.63**	1.43	5.02	0
PKM-1 X AVTO 1007	0.94	44.44	4.41**	0.76	5.02	-0.02
PKM-1 X AVTO 9803	-0.98	34.89	4.41**	1.79	5.53	0.26**
PKM-1 X AVTO 9001	0.6	41.11	2.64 *	1.9	5.24	0.08*
PKM-1 X AVTO 0101	1.05	40.78	50.38**	1.07	5.11	0.01
PKM-1 X AVTO 1002	5.6	43.44	2.44*	2.15	5.24	0.01
A.Vikas X AVTO 1007	1.63	38.89	1.95*	0.87	5.07	-0.01
A.Vikas X AVTO 9803	-0.11	34.78	-0.17	0.72**	5.76	-0.03
A.Vikas X AVTO 9001	1.93	37.44	-0.35	0.52	5.24	0.07
A.Vikas X AVTO 0101	-1.55	44	46.07**	0.26	5.22	0.42**
A.Vikas X AVTO 1002	0.96	46.33	7.15**	0.83	5.38	0.42**
Lakshmi	1.75	35.22	16.14**	0.45	5.38	0.01
US 618	0.58	34.67	9.77**	0.72**	5.29	-0.03
Mean		39.93			5.28	
SE of bi	1.87	2.44		0.53	0.2	
CD (5%)		2.01			0.17	

Table: 04 Stability parameters for number of cluster per plant and stigma exertion in tomato

Genotype/cross	No. of clusters per plant			Stigma exertion (%)		
	bi	μ	S²di	bi	μ	S²di
Arka Alok	0.71	18.98	-1.59	1.11	15.61	-2.01
PKM 1	0.71	20.2	-1.68	0.99	17.49	-2.42
Arka Vikas	0.9	25.78	-1.68	1.03	16.42	-2.37
AVTO 1007	0.62	33	-1.66	0.96	17.89	-2.25
AVTO 9803	1.44	39.02	-1.19	1.2	13.97	-1.96
AVTO 9001	0.96	24.29	-1.69	0.9	19.33	-2.27
AVTO 0101	0.73	19.58	-1.63	1.21	18.77	5.54
AVTO 1002	0.77	22.33	-1.67	0.76	16.25	6.76
A.Alok X AVTO 1007	0.3	30.91	0.671	1.16	18.48	6.01
A.Alok X AVTO 9803	1.33	32.31	20.43**	1.26	18.66	2.06
A.Alok X AVTO 9001	1.01	22.44	2.97	0.93	19.07	-2.14
A.Alok X AVTO 0101	0.87	19.4	0.55	1.01	15.7	-0.21
A.Alok X AVTO 1002	1.3	20.18	-0.86	1.11*	16.3	-2.45
PKM-1 X AVTO 1007	0.09	19.82	-0.79	1.41	16.54	-2.4
PKM-1 X AVTO 9803	1.68	40.8	6.88*	1.07	20.11	-1.18
PKM-1 X AVTO 9001	2.83	29.98	39.57**	0.63	20.28	-1.11
PKM-1 X AVTO 0101	2.09	22.27	0.83	1.06	15.76	2.37
PKM-1 X AVTO 1002	0.73	24.16	3.26	1.09	16.71	2.83
A.Vikas X AVTO 1007	-1.7	29.07	67.80**	1.2	18.9	15.77**
A.Vikas X AVTO 9803	1.73	42.22	6.97*	0.87	19.37	0.01
A.Vikas X AVTO 9001	3.34	32.22	69.64**	0.5	18.94	-1.84
A.Vikas X AVTO 0101	0.33	24.02	0.61	0.75	16.83	-1.18
A.Vikas X AVTO 1002	0.41	21.62	1.55	0.77	16.81	5.94
Lakshmi	0.73	24.34	-1.27	0.94	16.51	3.72
US 618	1.1	24.36	-0.92	1.09	17.35	4.91
Mean		26.53			17.52	
SE of bi	0.89	2.22		0.28	1.35	
CD (5%)		1.83			1.11	

Table: 05 Stability parameters for fruit set and day to first fruit harvest in tomato

Genotypes/crosses	Fruit set (%)			Days to first fruit harvest		
	bi	µ	S^2di	bi	µ	S^2di
Arka Alok	0.97	29.41	-8.16	0.76	64.56	-1.71
PKM 1	1.22	25.81	-8.58	0.87	71.89	-1.77
Arka Vikas	1.13	29.5	-8.63	0.78	63.22	-2.01
AVTO 1007	1.03	28.32	-8.7	1.06**	66.22	-2.03
AVTO 9803	1.46	53.41	-4.05	0.9	59.11	16.60**
AVTO 9001	1.06	23.46	0.01	1.2	62.67	-1.99
AVTO 0101	0.95	21.03	3.09	1.29	66.56	-1.53
AVTO 1002	1.01	24.16	-8.71	1.03	81.89	-1.88
A.Alok X AVTO 1007	0.74	44.04	129.37**	0.65	70.22	16.52**
A.Alok X AVTO 9803	0.07	64.94	-8.81	1.3	69.89	3.44
A.Alok X AVTO 9001	0.97	39.67	-9	1.19	75	1.31
A.Alok X AVTO 0101	0.91	31.96	-6.99	0.57	76	2.64
A.Alok X AVTO 1002	0.98	34.52	-1.1	-0.18	74.22	1.27
PKM-1 X AVTO 1007	1.07	31.35	12.47	1.94	78.56	2.27
PKM-1 X AVTO 9803	0.73	66.52	-8.81	0.41	69.89	1.87
PKM-1 X AVTO 9001	1.39	45.86	211.52**	1.11	74.78	-0.81
PKM-1 X AVTO 0101	1.31	33.64	-2.34	1.51	72.89	55.46**
PKM-1 X AVTO 1002	0.6	32.59	6.28	0.55	74	1.62
A.Vikas X AVTO 1007	0.55	33.64	156.15**	1.26	69.33	-1.69
A.Vikas X AVTO 9803	0.78	69.79	-8.98	1.37	68.11	11.61
A.Vikas X AVTO 9001	0.7	58.57	-5.68	1.16	70.22	26.71**
A.Vikas X AVTO 0101	1.07	32.21	-8.28	0.89	74.22	12.20**
A.Vikas X AVTO 1002	1.44	33.84	-9.61	1.32	80.44	18.33**
Lakshmi	1.16	23.92	-9.18	0.73	73.11	-1.52
US 618	1.72	30.27	138.26**	1.34	73.67	-1.58
Mean		37.7			71.23	
SE of bi	0.7	3.94			2.02	
CD (5%)		3.25			1.66	

Table: 06 Stability parameters for days to last fruit harvest and number of fruits per cluster in tomato

Genotype/cross	Days to last fruit harvest			No. of fruits per cluster		
	bi	µ	S^2di	bi	µ	S^2di
Arka Alok	0.61	114.6	-16.47	0.78	1.27	-0.03
PKM 1	0.71	122.4	-17.64	0.96	1.24	-0.02
Arka Vikas	0.97	138.3	-18.36	1.04	1.53	-0.03
AVTO 1007	1.05	118.8	-17.53	1	1.56	-0.03
AVTO 9803	0.83	112.8	-14.4	1.16	3.27	0
AVTO 9001	1.11	135.3	-15.63	1.04	1.27	-0.01
AVTO 0101	0.97	124.7	-18.31	0.84	1.18	0.02
AVTO 1002	1.02	142.1	-18.32	0.96	1.38	-0.02
A.Alok X AVTO 1007	2.69	134.3	246.95**	0.56	2.4	0.28**
A.Alok X AVTO 9803	-1.38*	130.1	-17.29	0.76	3.62	0.07

A.Alok X AVTO 9001	1.16	134.3	-18.2	1	2.02	-0.03
A.Alok X AVTO 0101	1.43	133.3	-18.25	1.04	1.67	-0.03
A.Alok X AVTO 1002	1.02	133.4	110.45**	1.12	1.76	-0.01
PKM-1 X AVTO 1007	0.28	133.2	-8.22	0.84	1.58	0.02
PKM-1 X AVTO 9803	0.58	134.8	144.30**	1.37	3.69	0.14
PKM-1 X AVTO 9001	1.4	135.7	44.33	1.77	2.47	0.77**
PKM-1 X AVTO 0101	0.66	131.3	76.11*	1.16	1.73	0
PKM-1 X AVTO 1002	1.02	140.6	668.88**	0.96	1.71	-0.02
A.Vikas X AVTO 1007	1.37	142.6	123.64**	0.48	1.71	0.40**
A.Vikas X AVTO 9803	1.87*	133.8	-18.26	1	4.02	-0.03
A.Vikas X AVTO 9001	0.44	130.9	255.81**	0.8	3.07	0.04
A.Vikas X AVTO 0101	2.94	142.2	212.48**	0.88	1.69	0
A.Vikas X AVTO 1002	-0.19	143	44.65	1.12	1.82	-0.01
Lakshmi	1.40*	149.1	-18.39	0.87	1.29	-0.03
US 618	1.04	148.1	-7.61	1.49	1.62	0.28**
Mean		133.6			2.02	
SE of bi	0.9	6.5		0.5	0.22	
CD (5%)		5.4			0.18	

Table : 07 Stability parameters for number of fruits per plant and fruit length in tomato

Genotype/cross	**No. of fruits per plant**			**Fruit length (cm)**		
	bi	µ	S^2di	bi	µ	S^2di
Arka Alok	0.73	27.33	-1.12	0.48**	3.86	-0.03
PKM 1	0.76	29.51	0.03	0.47*	3.91	-0.03
Arka Vikas	0.8	32.04	6.41	0.65*	4.13	-0.03
AVTO 1007	0.74	32.04	5.25	0.58	5.72	-0.03
AVTO 9803	1.55	51.18	42.16**	0.94	3.64	-0.03
AVTO 9001	0.83	28.07	4.81	1.12	5.12	-0.03
AVTO 0101	0.76	26.02	4.39	1.05	4.59	-0.03
AVTO 1002	0.66	31.33	1.75	0.52**	4.41	-0.03
A.Alok X AVTO 1007	-0.53	40.84	28.40*	1.22	4.75	0.78**
A.Alok X AVTO 9803	1.65	48.8	5.79	-0.96	4.42	0.49**
A.Alok X AVTO 9001	0.86	30.27	-4.93	1.52	4.86	-0.02
A.Alok X AVTO 0101	0.83	22.44	3.95	0.95	4.56	-0.03
A.Alok X AVTO 1002	1.37	23.91	6.47	0.21	4.69	0.02
PKM-1 X AVTO 1007	0.4	26.11	-5.63	1.65	4.67	0
PKM-1 X AVTO 9803	1.7	60.41	6.63	-1.78	4.56	0.47**
PKM-1 X AVTO 9001	1.65	34.43	135.26**	2.54	5.19	0.12*
PKM-1 X AVTO 0101	1.05	24.44	-4.49	3.33	4.92	0.07
PKM-1 X AVTO 1002	0.92	25.76	5.68	-0.18	4.94	0.08
A. Vikas X AVTO 1007	-2.54	36.29	27.42*	0.33	5.15	-0.01
A.Vikas X AVTO 9803	1.41	64.27	-5.56	1.03	4.2	-0.02
A.Vikas X AVTO 9001	3.56	43.02	41.72**	4.93	4.82	0.25**
A.Vikas X AVTO 0101	1.09	25.69	-1.39	0.55	4.96	0.12*

A.Vikas X AVTO 1002	1.33	26.8	9.69	1.51	4.65	-0.01
Lakshmi	1.14	27.91	4.75	1.76	4.05	0.01
US 618	2.28	31.8	25.70*	0.58	3.94	0.01
Mean		34.03			4.59	
SE of bi	1.15	4.3		1.61	0.24	
CD (5%)		3.54			0.2	

Table : 08 Stability parameters for fruit width and average fruit weight in tomato

Genotypes/crosses	**Fruit width (cm)**			**Avg. fruit weight (g)**		
	bi	µ	S^2di	bi	µ	S^2di
Arka Alok	0.77	4.58	0.01	0.51	43.36	-6.54
PKM 1	0.79	4.87	0.01	0.57	48.66	-6.56
Arka Vikas	0.81	5.07	-0.01	0.74	56.33	-6.58
AVTO 1007	0.95	4.75	-0.02	0.6	57.3	-6.42
AVTO 9803	0.54*	3.35	-0.02	0.79	42.59	-6.65
AVTO 9001	0.98	5.34	-0.01	1.20*	73.23	-6.66
AVTO 0101	0.87	5.14	-0.02	1.20**	70.13	-6.66
AVTO 1002	0.73	4.89	-0.02	0.7	64.48	-6.41
A.Alok X AVTO 1007	1.41	5.21	1.02**	0.25	62.61	298.34**
A.Alok X AVTO 9803	0.26	4.96	1.06**	2.85	60.84	192.91**
A. Alok X AVTO 9001	1.11	5.69	-0.02	1.17	70.03	-6.64
A.Alok X AVTO 0101	1.08	5.38	-0.02	1.51	62.96	1.37
A.Alok X AVTO 1002	1.04	5.51	-0.02	1.5	64.7	0.16
PKM-1 X AVTO 1007	0.81	5.49	0.02	0.32	66.31	-4.82
PKM-1 X AVTO 9803	-0.01	4.82	0.04	0.49	58.23	18.17
PKM-1 X AVTO 9001	0.97	5.53	0.01	-0.02	64.99	2.31
PKM-1 X AVTO 0101	0.46	5.38	0.03	0.49	61.93	7.36
PKM-1 X AVTO 1002	1.92	5.58	0.01	2.53	67.87	-5.72
A.Vikas X AVTO 1007	1.55	5.54	0.01	0.02	68.86	-5.66
A.Vikas X AVTO 9803	0.88	4.59	-0.02	0.35	57.82	1.05
A.Vikas X AVTO 9001	2.38	5.2	0.39**	2.75*	62.34	-6.48
A.Vikas X AVTO 0101	1.05	5.53	0.15**	0.07	67	70.83**
A.Vikas X AVTO 1002	1.65	5.57	-0.02	1.81	67.84	1.69
Lakshmi	1.01	4.66	0.05	0.7	65.13	7.81
US 618	1.01	4.5	0.01	1.9	63.39	12.41
Mean		5.08			61.96	
SE of bi	0.78	0.25		0.72	3.74	
CD (5%)		0.21			3.08	

Table : 09 Stability parameters for fruit yield per plant in tomato

Genotype/cross	**Fruit yield per plant (kg)**		
	bi	µ	S^2di
Arka Alok	0.34	1.18	-0.02
PKM 1	0.41	1.43	-0.01
Arka Vikas	0.45	1.79	0
AVTO 1007	0.42	1.84	0.01

AVTO 9803	0.69	2.16	0.02
AVTO 9001	0.61	2.04	0.01
AVTO 0101	0.55	1.81	0.01
AVTO 1002	0.44	1.99	0.01
A. Alok X AVTO 1007	1.74	2.55	-0.02
A. Alok X AVTO 9803	0.42	2.81	-0.01
A. Alok X AVTO 9001	1.11	2.12	-0.02
A. Alok X AVTO 0101	1.01	1.42	0.02
A. Alok X AVTO 1002	1.47	1.56	-0.01
PKM-1 X AVTO 1007	0.23	1.73	-0.02
PKM-1 X AVTO 9803	1.76	3.51	0.04
PKM-1 X AVTO 9001	2.1	2.23	0.09
PKM-1 X AVTO 0101	0.69	1.5	-0.02
PKM-1 X AVTO 1002	1.68	1.77	0.10*
A.Vikas X AVTO 1007	-1.27	2.5	0.80**
A.Vikas X AVTO 9803	1.56	3.72	0.01
A.Vikas X AVTO 9001	2.98	2.63	0.19
A.Vikas X AVTO 0101	1.55	1.75	0.03
A.Vikas X AVTO 1002	2	1.84	0
Lakshmi	1.57	1.83	-0.02
US 618	1.34	1.97	0.11
Mean		2.07	
SE of bi	0.76	0.21	
CD (5%)		0.17	

Table: 10 Environmental indices for each environment for yield and yield contributing characters in tomato

Sl. No.	**Character**	**Environmental indices**		
		April	**March**	**February**
1	Plant height (cm)	-4.285	1.184	3.101
2	Root length (cm)	-2.214	-1.639	3.853
3	Root to shoot ratio	-0.006	-0.024	0.03
4	No. of primary branches	-0.444	-0.318	0.762
5	Days to 50% flowering	-1.329	0.058	1.271
6	No. of flowers per cluster	-0.31	-0.121	0.431
7	No. of clusters per plant	-1.847	-0.98	2.827
8	Stigma exertion (%)	5.303	-1.445	-3.858
9	Fruit set (%)	-2.235	-4.148	6.383
10	Days to first fruit harvest	5.76	0.413	-6.173
11	Days to last fruit harvest	-8.631	4.009	4.622
12	No. of fruits per cluster	-0.238	-0.273	0.511
13	No. of fruits per plant	-1.175	-2.994	4.17
14	Fruit length (cm)	-0.095	-0.078	0.173
15	Fruit width (cm)	-0.285	-0.059	0.345
16	Average fruit weight (g)	-5.616	4.703	0.913
17	Fruit yield per plant (kg)	-0.254	-0.038	0.292

Table: 11 Average performances of genotypes in each environment and in pooled analysis for yield and yield contributing characters in tomato

Sl. No.	**Character**	**Environment**			
		April	**March**	**February**	**Pooled**
1	Plant height (cm)	83.14	88.6	90.52	87.42
2	Root length (cm)	30.54	31.12	36.61	32.76
3	Root to shoot ratio	0.38	0.36	0.42	0.39
4	No. of primary branches	8.06	8.18	9.26	8.50
5	Days to 50% flowering	38.6	39.99	41.2	39.93
6	No. of flowers per cluster	4.97	5.16	5.71	5.28
7	No. of clusters per plant	24.69	25.55	29.36	26.53

8	Stigma exertion (%)	22.83	16.08	13.66	17.52
9	Fruit set (%)	35.46	33.55	44.08	37.70
10	Days to first fruit harvest	76.99	71.64	65.05	71.23
11	Days to last fruit harvest	125	137.6	138.21	133.59
12	No. of fruits per cluster	1.78	1.75	2.53	2.02
13	No. of fruits per plant	32.85	31.04	38.2	34.03
14	Fruit length (cm)	4.49	4.51	4.76	4.59
15	Fruit width (cm)	4.8	5.03	5.43	5.08
16	Average fruit weight (g)	56.34	66.66	62.87	61.96
17	Fruit yield per plant (kg)	1.81	2.03	2.358	2.07

Table: 12 Summary of stability parameters for different environments in tomato genotypes

Sl. no.	Character	Poor or rainfed environment (bi<1)	Rich or irrigated environment (bi>1)	Stable (bi=1)
1	Plant height	Arka Alok x AVTO-0101,	Arka Alok, PKM-1 x AVTO-1002	
2	Root length	PKM-1 x AVTO-9001,	Arka Vikas x AVTO-9001	
3	Root to shoot ratio	PKM-1 x AVTO-0101 and	Arka Vikas x AVTO-1002	
4	Number of primary branches per plant	Arka Vikas x AVTO-9803		
5	Days to 50% flowering	PKM-1, Arka Alok x AVTO-1007 ,	AVTO-1007, AVTO-9803,AVTO-9001,	AVTO-9803
6	Number of flowers per cluster	Arka Alok x AVTO-9001,	Arka Alok x AVTO-9803,	
7	Number of clusters per plant	Arka Alok x AVTO-1002,	Arka Alok x AVTO-0101,	
8	Stigma exertion (%)	PKM-1 x AVTO-1002 and	PKM-1 x AVTO-1007, PKM-1 x AVTO-9001,	
9	Fruit set (%)	Arka Vikas x AVTO-0101	PKM-1 x AVTO-0101,	
10	Days to first fruit harvest		Arka Vikas x AVTO-1007,	
11	Days to last fruit harvest		Arka Vikas x AVTO-9007 and	
12	Number of fruits per cluster		Arka Vikas x AVTO-1002	
13	Number of fruits per plant	Arka Alok x AVTO-1002 and	Arka Alok, PKM-1, AVTO-1007,AVTO-9803, AVTO-9001, Arka Alok x AVTO-0101,	
14	Fruit length	Arka Vikas x AVTO-1007	PKM-1 x AVTO-9001, PKM-1 x AVTO-0101,	
15	Fruit width		Arka Vikas x AVTO-9001 and	
16	Average fruit weight		Arka Vikas x AVTO-9002	
17	Fruit yield per plant	AVTO-1002,	Arka Alok, Arka Vikas, AVTO-9803,	PKM-1

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