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Mean performance for quantitative traits in germplasm of tomato (*Solanum lycopersicum* L.)

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Abstract
The present study was conducted at the College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya. The experiment was conducted in Randomized Block Design with three replications during autumn- winter season in 2022-23 to assess the performance of 41 genotypes. Each treatment consisted of twelve plants in two rows, having spacing of 60 x 50 cm with net plot size of 3.0 × 3.0 m^2. The seed were shown in nursery bed on 04-10-2022 and transplanted on 03-11-2022. Among the test entries, range for total fruit yield per plant (g) varied from 1211.93 to 4697.59 and it was highest in NDT 2022-11 followed by NDT 2022-24, NDT 2022-23, NDT 2022-12 were found significant against total fruit yield per plant of the check Narendra Tomato-4.

Keywords: Tomato, *Solanum lycopersicum*, high yield, earliness, superior performance

Introduction
Tomato (*Solanum lycopersicum* L., 2n=2X=24) belongs to the Solanaceae family within Solanum genus. Muller (1940) [4] divided the genus into two subgenera: Eriopersicon and Eulycopersicon. Eriopersicon has green fruit, whereas Eulycopersicon has red fruit. Tomato is commonly known as 'Protective Food' due to strong epidemiological evidence that they reduce the risk of some cancers (Nguyen and Schwartz, 1998) [5].

Global production of grown tomatoes is expected to be 186.82 million tons. China, India, Turkey, the United States, Egypt, and Italy are the world's major tomato producers. India comes second in terms of both area and production, after China. Tomato cultivation covers 8.48 lakh hectares of total grown vegetables, with a yield of 20.42 million tonnes (Anonyms, 2022-23) [1].

Tomato have therapeutic value, pulp and juice are digestible, promoting gastric output and purifying the blood. It is beneficial for treating mouth cancer and sour mouth. Lycopene, a primary carotenoid found in tomato, is responsible for its nutraceutical properties due to its strong natural antioxidant effects. It scavenges free radicals that destroy healthy cells and have been linked to degenerative diseases such as cancer, arthritis, and heart disease. It provides significant financial benefits to small and marginal farmers when it cultivated in greenhouse during the off-season.

Tomato production is highly influenced by environmental elements such as temperature, light, relative humidity and carbon dioxide levels in the atmosphere. The optimal temperature range for maximum production is 20-24 ℃. Lycopene, which is responsible for the red hue, is generated at temperatures ranging from 20 to 24 ℃.

Tomato fruit colour is commercially important. Commercialization of tomato varieties with diverse colours, or the use of these genotypes in breeding efforts to improve antioxidant levels among existing cultivars, can significantly contribute to enhancing the food value of the tomato crop. The basic tool for advancing genetic development in tomato is harnessing genetic variability. When the variation within a population primarily stems from genetic factors rather than environmental influences, there is a greater chance of identifying superior genotypes. In tomato, enhancing yield involves understanding its polygenic nature, which is influenced by agronomic, morphological, and physiological traits. Direct selection based on these traits can often be misleading. Breeding progress in such populations depends largely

on the magnitude and nature of genotype-environment interactions. It is genotypic and phenotypic coefficients of variation help assess the extent of variability in genotypes, while heritability and genetic advance shed light on how much influence the environment has on trait expression and the potential for improvement through selection (Patel *et al*., 2013) [6]. Yield is a complex character with multiple contributing individuals and their interactions. It is essential for any crop improvement program to closely examine the relationship between yield and the factors which affect it. Studies such as correlation and path analysis can help us understand the relationship between different variables and yield.

Materials and Methods

The experiment was conducted in Randomized Block Design with three replications during autumn- winter season in 2022-23 to assess the performance of 41 genotypes. Each treatment consisted of twelve plants in two rows, having spacing of 60 x 50 cm with net plot size of 3.0 × 3.0 m^2. The crop will be raised using recommended Package of Practices of Vegetables by Department of vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya.

The data were collected on days to 50% flowering, days to first fruit harvest, plant height (cm), number of primary branches per plant, polar diameter of fruit (cm), equatorial diameter of fruit (cm), pericarp thickness (mm), locules per fruit, average fruit weight (g), number of fruits per plant, total fruit yield per plant (g) (Table 1).

Results and Discussion

Days to 50% flowering ranged from ranged from 29.33 days (NDT 2022-41) to 39.67 days (NDT 2022-12 and NDT 2022-14). Days to 50% flowering were minimum in the genotype NDT 2022-41 (29.33) followed by NDT 2022-31 (32.33) and NDT 2022-35 (32.67) and highest in the genotype NDT 2022-12 and NDT 2022-14 (39.67) with grand mean 35.62 days. Similar result was found in Eppakayala *et al.,* (2021a) [3] for days to 50 % flowering, they observed maximum days to 50 % flowering (49.30) was recorded in and lowest (29.20).

Days to first harvest ranged from 77.33 (NDT 2022-37) to 92.67 (NDT 2022-9). The grand mean for this character is 83.84. Out of 41 genotypes only seven *viz*.**,** NDT 2022-37 (77.33) followed by NDT 2022-31 (77.67), NDT 2022-35 (78.00), NDT 2022-41(78.00), NDT 2022-23 (78.33), NDT 2022-39 (78.33) and NDT 2022-32 (79.00) were found significant than best check Narendra Tomato- 4 (81.33). Similar result was found in Eppakayala *et al.,* (2021b) [3] for days to first fruit harvest which range from (61.43 to 79.17) days.

The plant height (cm) at the time of final harvest varied from 66.33 (NDT 2022-36) to 161.33 (NDT 2022-11) with grand mean 115.36 cm. fourteen genotype *viz*., NDT 2022-11 (161.33), NDT 2022-31 and NDT 2022-25 (156.33), NDT 2022-21 (156.00), NDT 2022-22 (152.67), NDT 2022-13 (152.67), NDT 2022-12 (151.33), NDT 2022-9 (151.00), NDT 2022-16 (149.33), NDT 2022-29 (148.00), NDT 2022-34 (147.67), NDT 2022-26 (146.33), NDT 2022-10 (145.67) and NDT 2022-32 (143.33) were found significant than check Narendra Tomato- 4 (142.67). A similar result was found by Yadhuraj *et al.,* (2023a) [13] for plant height, which ranged from (86 to 156 cm).

Number of primary branches per plant at the time of final harvest ranged from 3.00 (NDT 2022-7) to 6.80 (NDT 2022-27) with grand mean 4.31. Highest no of primary branch was observed in NDT 2022-27(6.80) followed by, NDT 2022-32 (6.60), NDT 2022-10 (6.40), NDT 2022-27 (6.27), NDT 2022-21(5.80) and NDT 2022 -38 (5.50). A Similar result was found by Singh *et al.,* (2015) [10] for number of primary branches per plant, which varied from (2.25 to 6.7).

Significant variations were recorded for Polar diameter of fruit ranged from 3.20 (NDT 2022-7) to 8.03 (NDT 2022-24). Significantly highest Polar diameter of fruit was observed in the genotype NDT 2022- 24 (8.03) which is statistically at par with NDT 2022- 11 (7.80), NDT 2022- 40 (6.93), NDT 2022- 6 (6.63), NDT 2022- 8 (6.27) and the grand mean is 4.99. A Similar result was found by Singh *et al.,* (2018a) [9] for polar diameter of fruit, which ranged from (3.50 to 6.23 cm).

Significant variations were recorded for Equatorial diameter of fruit ranged from 3.37 (NDT 2022- 26) to 6.87 (NDT 2022- 40). Significantly highest Equatorial diameter of fruit was observed in the genotype NDT 2022- 40 (6.87) followed by NDT 2022-39 (6.00), NDT 2022-8 (5.97), NDT 2022-30 (5.77) and the grand mean 4.74. A Similar result was found by Regassa *et al.,* (2012) [7] for equatorial diameter of fruit, which ranged from (4.80 to 6.95 cm).

The number of locules per fruit ranged from 2.40 (NDT 2022-5) to 6.13 (NDT 2022-40) with grand mean for this character 4.36. Out of 41 genotypes thirty-three genotypes *viz*., NDT 2022-40 (6.13) followed by NDT 2022-26 (6.07), NDT 2022-33 (5.73), NDT 2022-13 (5.67), NDT 2022-21 (5.53) were found significant against number of locules per fruit the check Narendra Tomato- 4 (3.40). A similar result was found by Singh *et al.,* (2006) [11] for the number of locules per plant, which ranged from (2.00 to 6.00).

The pericarp thickness ranged from 2.77 (NDT 2022-35) to 5.17 (NDT 2022-18) with grand mean for this character 4.05. Out of 41 genotype nineteen genotype *viz*., NDT 2022-18 (5.17) followed by NDT 2022-37 (5.13), NDT 2022-11 (5.10), NDT 2022-12 (5.07) and NDT 2022-30 (4.93) were found significant against number of locules per fruit the check Narendra Tomato- 4 (4.13). A similar result was found by Shanker *et al.,* (2013) [8] for pericarp thickness, which varied from (3.83 to 6.70).

The Average fruit weight ranged from 35.47 (NDT 2022-7) to 91.97 (NDT 2022-40) with grand mean for this character is 60.73. Out of 41 genotypes only twenty-one genotypes *viz*., NDT 2022-40 (91.97) followed by NDT 2022-11 (89.90), NDT 2022-24 (78.33), NDT 2022-8 (77.17) and NDT 2022-23 (75.40) were found significant against average fruit weight the check Narendra Tomato- 4 (60.23). A similar result was found by Yadhuraj *et al.,* (2023b) [13] for average fruit weight, which varied from (19.20 to 84.20 g).

Table 1: Mean performance of 41 genotypes for twelve characters in tomato

Genotypes	Days to 50% flowering	Days to first fruit harvest	Plant height (cm)	Number of primary branches per Plant	Polar diameter of fruit (cm)	Equatorial diameter of fruit (cm)	Locules per fruit	Pericarp thickness (mm)	Average fruit weight (g)	Number of fruits per plant	Total fruit yield per plant (g)
NDT-2022-1	36.33	89.33	88.33	3.13	5.23	5.60	3.00	3.37	67.80	46.13	3095.00
NDT-2022-2	34.67	86.33	86.67	3.87	5.40	4.97	2.93	4.30	60.20	36.67	2204.67
NDT-2022-3	35.00	86.67	83.33	3.73	4.57	4.00	2.60	3.43	49.67	35.20	1749.49
NDT-2022-5	34.67	80.00	83.67	3.13	4.23	4.47	2.40	4.27	52.70	36.53	1915.20
NDT-2022-6	35.33	86.67	83.00	3.53	6.63	4.33	3.53	3.27	71.30	37.53	2661.99
NDT-2022-7	38.00	84.33	80.00	3.00	3.20	3.47	2.60	4.33	35.47	34.00	1211.93
NDT-2022-8	37.00	86.67	84.00	4.27	6.27	5.97	3.60	4.53	77.17	40.40	2565.59
NDT-2022-9	39.33	92.67	151.00	3.60	4.57	4.87	4.67	3.80	60.90	54.60	3328.71
NDT-2022-10	39.00	90.00	145.67	6.47	5.47	5.00	3.00	4.47	68.33	54.47	3704.10
NDT-2022-11	38.00	86.67	161.33	4.80	7.80	5.33	3.87	5.10	89.90	49.60	4697.59
NDT-2022-12	39.67	90.00	151.33	3.53	5.60	4.57	5.47	5.07	64.93	60.93	3949.21
NDT-2022-13	36.33	82.67	152.67	3.37	5.47	4.83	5.67	4.73	64.80	55.33	3589.15
NDT-2022-14	39.67	87.00	83.33	5.13	4.37	4.17	5.47	4.10	59.20	48.47	2870.47
NDT-2022-15	37.33	85.33	140.33	3.47	5.77	5.73	4.47	2.87	72.43	36.40	2640.49
NDT-2022-16	38.67	86.00	149.33	4.87	3.97	3.73	6.13	3.87	49.43	30.47	1507.97
NDT-2022-17	36.33	85.00	85.67	3.60	3.53	3.63	3.73	4.07	41.07	36.07	1480.75
NDT-2022-18	35.33	82.67	82.33	4.37	4.33	4.33	3.53	5.17	55.77	37.67	2094.43
NDT-2022-19	34.67	80.00	83.00	4.47	5.57	5.60	4.47	3.43	67.83	35.07	2382.48
NDT-2022-20	36.67	85.00	140.00	4.27	4.43	4.43	4.40	3.57	57.53	55.47	3196.67
NDT-2022-21	34.67	84.67	156.00	5.80	4.33	4.33	5.53	3.63	56.03	54.87	3089.62
NDT-2022-22	35.00	81.00	152.67	6.27	5.40	5.73	5.07	4.27	71.17	53.33	3791.91
NDT-2022-23	34.33	78.33	89.67	5.27	5.57	5.70	3.20	4.50	75.40	56.93	4288.39
NDT-2022-24	35.33	84.67	85.00	3.40	8.03	5.60	3.80	4.07	78.33	56.93	4462.12
NDT-2022-25	34.67	85.67	156.33	3.80	3.57	3.50	5.47	4.83	45.10	55.13	2489.87
NDT-2022-26	35.00	81.67	146.33	4.17	3.50	3.37	6.07	2.93	40.70	48.47	1978.19
NDT-2022-27	35.67	87.33	81.67	6.80	4.43	4.27	3.53	3.20	56.57	53.93	3048.77
NDT-2022-28	37.33	86.67	80.33	4.47	4.93	4.93	4.47	4.33	62.40	36.47	2281.95
NDT-2022-29	36.00	84.67	148.00	5.80	4.50	4.30	4.93	3.80	56.33	50.07	2825.72
NDT-2022-30	35.67	83.33	98.00	4.67	5.93	5.77	4.73	4.93	61.17	53.60	3281.75
NDT-2022-31	32.33	77.67	156.33	3.60	3.67	3.60	4.13	3.87	39.20	47.87	1867.27
NDT-2022-32	34.33	79.00	143.33	6.60	3.90	4.13	3.80	3.13	47.13	59.60	2807.79
NDT-2022-33	32.67	82.67	136.33	3.60	4.90	4.87	5.73	4.77	62.57	54.47	3403.10
NDT-2022-34	35.67	82.67	147.67	3.47	4.33	4.47	5.33	3.83	58.37	36.87	2148.63
NDT-2022-35	32.67	78.00	82.67	3.27	5.53	5.07	4.73	2.77	71.17	46.33	3294.61
NDT-2022-36	35.00	81.00	66.33	5.13	4.50	4.50	3.60	4.50	58.10	50.60	2938.94
NDT-2022-37	33.00	77.33	130.67	4.40	4.27	4.40	4.87	5.13	57.07	57.27	3273.59
NDT-2022-38	38.67	85.67	133.67	5.50	5.57	5.57	3.47	3.47	61.57	34.27	2097.21
NDT-2022-39	34.00	78.33	129.33	3.87	5.43	6.00	5.53	4.53	72.00	54.47	3926.24
NDT-2022-40	35.67	84.67	78.00	3.17	6.93	6.87	6.13	3.40	91.97	35.20	3233.07
NDT-2022-41	29.33	78.00	73.67	3.60	3.53	3.60	5.53	4.27	40.73	35.07	1425.47
Narendra Tomato- 4 (C)	31.33	81.33	142.67	3.47	5.37	4.87	3.40	4.13	60.23	55.77	3376.99
Mean	35.62	83.84	115.36	4.31	4.99	4.74	4.36	4.05	60.73	46.55	2833.59
C.V.	5.88	5.56	7.23	9.92	6.51	5.69	9.51	10.80	7.10	6.67	10.45
S.E.	1.21	2.69	4.82	0.25	0.19	0.16	0.24	0.25	2.49	1.79	170.98
C.D. 5%	3.40	7.57	13.55	0.69	0.53	0.44	0.67	0.71	7.00	5.04	481.19
C.D. 1%	4.51	10.04	17.97	0.92	0.70	0.58	0.89	0.94	9.29	6.69	638.03
Range Lowest	29.33	77.33	66.33	3.00	3.20	3.37	2.40	2.77	35.47	30.47	1211.93
Range Highest	39.67	92.67	161.33	6.80	8.03	6.87	6.13	5.17	91.97	60.93	4697.59

Number of fruits per plants the genotypes varied from 30.47 (NDT 2022-16) to 60.93 (NDT 2022-12) with grand mean for this character is 46.55. Out of 41 genotypes only five genotypes *viz*., NDT 2022-12 (60.93) followed by NDT 2022-32 (59.60), NDT 2022-37 (97.27), NDT 2022-24 (56.93) and NDT 2022-23 (56.93) were observed significant against number of fruits per plant of the check Narendra Tomato- 4 (55.77). A similar result was found by Cholin *et al.*, (2021a) [2] for number of fruits per plant, which ranged from (18.25 to 89.75).

Total fruit yield per plant (kg) varied from 1211.93 (NDT 2022-7) to 4697.59 (NDT 2022-11) with grand mean for this character is 2833.59. Out of 41 genotypes only eight genotypes *viz*., NDT 2022-11 (4697.59) followed by NDT 2022-24 (4462.12), NDT 2022-23 (4288.39), NDT 2022-12 (3949.21), NDT 2022-39 (3926.24) and NDT 2022-22 (3591.91) were found significant against total fruit yield per plant of the check Narendra Tomato- 4 (3376.99). A similar result was found by Ullah *et al.*, (2015) [12] for total fruit yield per plant, which varied from (1000 to 5800).

Conclusion

Tomato *(Solanum lycopersicum* L., 2n=2X=24) is one of the important vegetable crops of Solanaceae family. The present investigation was undertaken to evaluate 41genotypes of tomato for horticultural traits. The genotypes *viz* NDT 2022-

11 followed by NDT 2022-24, NDT 2022-23, NDT 2022-12 and other 8 more performed better over the check (Narendra Tomato- 4) in terms of total fruit yield per plant (g). It can be concluded that, as a wide range of variation for almost all the economically important traits was present in this crop, so there is a vast scope for improvement through different breeding procedure.

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References

1. Anonymous. Indian Horticulture Database, Ministry of Agri., Gov. of India, Gurgaon, Haryana; c2022-23.
2. Cholin S, Raghavendra S. Assessment of genetic variability in tomato (*Solanum lycopersicum* L.) for yield and yield attributing traits. Pharm Innov J. 2021;10(1):399-403.
3. Eppakayala K, Pidigam S, Natarajan S, Amarapalli G, Komatireddy RR. Study of genetic variability, heritability and genetic advance for yield and yield parameters in tomato (*Solanum lycopersicum* L.) germplasm. J Pharmacogn Phytochem. 2021;10(1):768-771.
4. Muller CH. A revision of the genus Lycopersicon (No. 382). US Department of Agriculture; c1940.
5. Nguyen ML, Schwartz SJ. Lycopene stability during food processing. Proc Soc Exp Biol Med. 1998;218(2):101-105.
6. Patel SA, Kshirsagar DB, Attar AV, Bhalekar MN. Study on genetic variability, heritability and genetic advance in tomato. Int J Plant Sci. 2013;8(1):45-47.
7. Regassa MD, Mohammed A, Bantte K. Evaluation of tomato (*Lycopersicon esculentum* Mill.) genotypes for yield and yield components. Afr J Plant Sci Biotechnol. 2012;6(1):45-49.
8. Shankar A, Reddy RVSK, Sujatha M, Pratap M. Genetic variability studies in F1 generation of tomato (*Solanum lycopersicon* L.). IOSR J Agric Vet Sci. 2013;4(5):31-34.
9. Singh AK, Solankey SS, Akhtar S, Kumari P, Chaurasiya J. Correlation and path coefficient analysis in tomato (*Solanum lycopersicum* L.). Int J Curr Microbiol Appl Sci. 2018;7(1):4278-4285.
10. Singh N, Ram CN, Deo C, Yadav GC, Singh DP. Genetic variability, heritability and genetic advance in tomato (*Solanum lycopersicum* L.). Plant Arch. 2015;15(2):705-709.
11. Singh PK, Singh B, Pandey S. Genetic variability and character association analysis in tomato. Indian J Plant Genet Resour. 2006;19(2):196-199.
12. Ullah MZ. Genetic divergence in tomato lines (*Solanum lycopersicum* L.). J Bangladesh Agril Univ. 2015;13(1):61-64.
13. Yadhuraj VK, Wilson D, Chimmalagi U, Kumar PD, Binolin G, Sathiyavarsha K, et al. Genetic variability studies for yield and quality trait in tomato (*Solanum lycopersicum* L.). Pharma Innov J. 2023;12(6):2312-2316.