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ASSESSMENT OF CORRELATION COEFFICIENT AND PATH ANALYSIS FOR YIELD AND YIELD-ATTRIBUTING TRAITS IN TOMATO (*SOLANUM LYCOPERSICUM* L.)

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ABSTRACT

This experiment was conducted at the Horticulture Research Farm, Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow (U.P.), during Rabi season 2021-2022. The objectives were to assess the correlation coefficient and the path analysis of yield and yield-attributing traits in tomato (*Solanum lycopersicum* L.). This suggests that the marketable fruit yield per plant, average fruit weight, polar diameter of fruit, equatorial diameter of fruit, and number of primary branches per plant had a highly positive and significant correlation with total fruit yield per plant, indicating that selection for higher yield through these traits would be effective. Path coefficient analysis signifies that the direct selection for marketable fruit yield per plant, polar diameter of fruit, number of primary branches per plant, average fruit weight, number of fruits per plant, and plant height in the desired direction would be very effective for yield improvement. These traits may be given more emphasis for the direct selection of high-yielding tomato genotypes in future breeding programs.
***Keywords* :** Correlation coefficient, path analysis, tomato genotypes, direct selection, high yield.

Introduction

The tomato (*Solanum lycopersicum* L.), having chromosome number 2n=24 and belonging to the family Solanaceae, is one of the most widely consumed vegetables worldwide and a well-studied crop species in terms of genetics, genomics, and breeding (Foolad, 2007). It is native to Peru, Ecuador, and the Bolivia Region of the Andes, South America (Rick, 1969). It is widely utilized in the processing business as well as in fresh marketplaces. Alternative names for it comprise poor man's orange, love apple, and wolf apple. It is universally treated as "protective food" due to its nutritive value (Singh *et al*. 2018). It is essential to human nutrition, is composed of 93.1% water, iron 0.8 mg, calcium 20 mg, phosphorus 36 mg, vitamin A 320 LU, vitamin B 0.07 mg, vitamin B 0.01 mg, vitamin C 31 mg, protein 1.9%, fat 0.3 g, fibre 0.7%, and carbs 3.6%. It contains important vitamins that aid in cholesterol reduction. Tomatoes contain about 20 to 50 mg of lycopene per 100 g of fruit weight (Thamburaj and Singh, 2016). Recent epidemiological studies have shown that consumption of tomato and its products reduces the risk of developing digestive tract and prostate cancers (Khapte and Jansirani, 2014). It is typically a day-neutral plant and a self-pollinated crop, but a certain percentage of cross-pollination also occurs (Sharma *et al*., 2021). China is the world's largest tomato producer, followed by India, Turkey, the United States, Egypt, Italy, Iran, and Spain (Prasanna *et al*., 2023). The global tomato output is 38.82 million metric tonnes. India has a total area of 27.77 million hectares and a total production of 22.28 million tonnes, with a productivity of 25.74 tonnes per hectare, which is much lower than the global average. The major states involved in tomato production in India are Madhya Pradesh, Andhra Pradesh, Karnataka, Odisha, Gujarat, West Bengal, and Tamil Nadu, with 15.91 %, 11.44 %, 10.76 %, 7.87%, 7.06 %, 6.33% and 6.11% respectively (Anonymous 2022-23). Tomato variability is predicted to be considerable, as the fruits vary significantly in shape and size (Bhardwaj and Sharma, 2005). In the present day, the cultivation of tomatoes is the focus of the horticultural industry in the world and takes a distinct place in the realm of vegetable crops.

Fruit yield is a complex character that influences plant growth both directly and indirectly, influenced by many of its contributing characters, which are controlled by polygenes as well as environmental factors (Maurya *et al*., 2020). The study of the correlation between various quantitative characters yields an idea of association that can be used to develop selection strategies for improving yield components. It would be important to assess the relative size of the correlation of various features with yield in any effective selection method, as it provides information on the relationship between different characters. However, the path coefficient analysis provides more insight into the cause of the relationship. It permits the correlation coefficients to be partitioned into direct and indirect impacts of the qualities that contribute to the dependent variable (Nagariya *et al*., 2015). The route coefficient analysis was used to determine the direct and indirect contributions of different features to marketable yield per plant. Wright (1921) established the route coefficient technique, which aids in evaluating the direct and indirect contributions of various components in constructing the total correlation towards yield. Therefore, for a rational approach to the improvement of vegetable yield, it is imperative to have information on the association among different yield components and their relative contribution to the yield and its components (Sharma *et al*., 2021)

Materials and Methods

Experimental Site

This experiment was conducted at the Horticulture Research Farm Number 1, Department of Horticulture of Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, on a well-leveled field with appropriate drainage facilities during the Rabi Season 2021-22. Geographically, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya-Vihar, Rae Bareli Road, Lucknow, is located at 80.52' east longitude; 26.56' north latitude and 111 metres above mean sea level (MSL), lies in the upper Gangetic Alluvial Plain, and it has a humid subtropical climate.

Experimental Details

In this experiment, there are 20 genotypes of tomato, including two checks, which were maintained by ANDUAT, Kumarganj, Ayodhya, and were collected for examination. The list of genotypes used in this experiment is mentioned in Table 1. The experiment used a Randomized Block Design (RBD), with three replications for each treatment. In November 2021, the plants were transplanted to the main experimental field from the nursery. The spacing between rows and between plants was set at 60 cm and 45 cm, respectively. Each plot is 2.00 m × 2.00 m in size and accommodates 16 seedlings. The basic concept of correlation was developed by Galton (1889), which was later elaborated and discussed by Searle (1961). The estimates of direct and indirect effects were calculated by the path coefficient analysis as suggested by Wright (1920) and elaborated by Dewey and Lu (1959).

Table 1: The list of genotypes used in the experiment

S. No.	Name of genotypes	Source of origin
1.	NDT-2	A.N.D.U.A.&T, Ayodhya
2.	NDT-p	A.N.D.U.A.&T, Ayodhya
3.	NDT-5	A.N.D.U.A.&T, Ayodhya
4.	NDT-6	A.N.D.U.A.&T, Ayodhya
5.	NDT-8	A.N.D.U.A.&T, Ayodhya
6.	NDT-5-1-1	A.N.D.U.A.&T, Ayodhya
7.	NDT-67	A.N.D.U.A.&T, Ayodhya
8.	NDT-45	A.N.D.U.A.&T, Ayodhya
9.	NDT-27	A.N.D.U.A.&T, Ayodhya
10	NCT-2	A.N.D.U.A.&T, Ayodhya
11	NCT-1	A.N.D.U.A.&T, Ayodhya
12	NDT-56	A.N.D.U.A.&T, Ayodhya
13	NDT-17	A.N.D.U.A.&T, Ayodhya
14	NDT-15	A.N.D.U.A.&T, Ayodhya
15	NDT-52	A.N.D.U.A.&T, Ayodhya
16	NDT-25	A.N.D.U.A.&T, Ayodhya
17	NDT-47	A.N.D.U.A.&T, Ayodhya
18	NDT-38	A.N.D.U.A.&T, Ayodhya
19	NDT-4 ©	A.N.D.U.A.&T, Ayodhya
20	NDT-7 ©	A.N.D.U.A.&T, Ayodhya

Parameter Recorded

In this study, 12 characters were studied from 16 sample plants in each net plot. The characters taken for experimental analysis during the trial are days to 50% flowering, plant height (cm), number of primary branches per plant, polar diameter of fruit (cm), equatorial diameter of fruit (cm), total soluble solids (ºB), number of fruits per cluster, average fruit weight (g), number of fruits per plant, marketable fruit yield per plant (g), unmarketable fruit yield per plant (g), total fruit yield per plant (g). All the data represent per plant observation except for marketable fruit yield and unmarketable fruit yield, which are computed from net plot observation, and days to flowering and maturity were computed on the basis of harvestable rows in each net plot.

Results and Discussion

Correlation Coefficient

Yield is a complicated quantitative character that is proportional to the number of component characters. From a breeding standpoint, understanding the phenotypic and genotypic correlation of yield with its components and their interrelationship is critical. This is important in establishing a correlated response to selection by simultaneously selecting desirable features. Hence, to estimate the association between the two characters, the correlation coefficient at phenotypic and genotypic levels was worked out in all possible combinations.

Correlation Coefficient Analysis at the Phenotypic Level

At the phenotypic level (Table 2.1), the correlation with yield and yield-attributing characters revealed a highly significant positive correlation with marketable fruit yield per plant (0.846), followed by average fruit weight (0.663), polar diameter of fruit (0.651), and equatorial diameter of fruit (0.365). It has a moderate positive correlation with the number of primary branches per plant (0.279), whereas a positive and non-significant correlation was observed in the number of fruits per plant (0.230) and days to 50% flowering (0.005). Moreover, the highest negative and significant correlation was observed in unmarketable fruit yield per plant (-0.661), followed by total soluble solids (-0.332). The plant height (-0.300) has a moderately significant and negative correlation, whereas the number of fruits per cluster (-0.163) showed the least negative correlation with the total fruit yield per plant.

The polar diameter (0.684) had the greatest beneficial influence on marketable fruit yield per plant, followed by the average fruit weight (0.618), equatorial diameter (0.461), number of fruits per plant (0.411), number of primary branches per plant (0.276), and days to 50% flowering (0.162). The plant height (-0.183), total soluble solids (-0.174), and number of fruits per cluster (-0.153) demonstrated a negative and significant correlation with marketable fruit yield per plant, and showed a negative and non-significant correlation with marketable fruit yield per plant.

Correlation Coefficient Analysis at the Genotypic Level

At the genotypic level (Table 2.2), it was recorded that total fruit yield per plant had a highly positive and significant correlation with marketable fruit yield per plant (0.869) followed by polar diameter of fruit (0.712), average fruit weight (0.670), the equatorial diameter of fruit (0.383) and number of primary branches per plant (0.307). The number of fruits per plant (0.225) and days to 50% flowering (0.033) both demonstrated positive and non-significant correlation, whereas the unmarketable fruit yield per plant (-0.685), total soluble solids (-0.370), and plant height (-0.306) have highly negative and significant correlation with total fruit yield per plant. Moreover, a negative and non-significant correlation was observed in the number of fruits per cluster (-0.160).

The marketable fruit yield per plant resulted in a highly positive and significant correlation with polar diameter of fruit (0.721), average fruit weight (0.629), equatorial diameter of fruit (0.482), number of fruits per plant (0.452), and number of primary branches per plant (0.300). Days to 50% flowering (0.181) has a positive and non-significant correlation with marketable fruit yield per plant, but total soluble solids (-0.204), plant height (-0.186), and number of fruits per cluster (-0.167) demonstrated a negative and non-significant correlation with marketable fruit yield per plant. Similar findings for phenotypic and genotypic correlation were also reported by Mahapatra *et al.* (2013), Kumar (2014), Sudesh and Anita (2016), Khan and Samadia (2018), Meena *et al*. (2018), Sharma *et al*. (2019), Behera *et al*. (2020), Nevani and Sridevi (2022), and Sahoo *et al.* (2022).

Table 2.1: Correlation Coefficient Analysis at the Phenotypic Level

Characters	Days to 50% flowering	Plant height (cm)	No. of primary branches per plant	Polar diameter of fruit (cm)	Equatorial diameter of fruit (cm)	TSS (ºB)	Number of fruits per cluster	Average fruit weight (g)	Number of fruits per plant	Marketable fruit yield per plant (g)	Unmarketable fruit yield per plant (g)	Total fruit yield per plant (g)
Days to 50% flowering	**1.000**	0.115	0.090	-0.102	-0.374**	-0.113	-0.472**	-0.311*	0.487**	0.162	0.059	0.005
Plant height (cm)		**1.000**	0.044	-0.372**	0.035	0.004	-0.164	-0.349**	0.104	-0.183	0.304*	-0.300*

Number of primary branches per plant			**1.000**	-0.047	0.126	-0.201	0.034	0.258*	0.044	0.276*	0.031	0.279*
Polar diameter of fruit (cm)				**1.000**	0.660**	0.032	0.010	0.789**	-0.099	0.684**	-0.508**	0.651**
Equatorial diameter of fruit (cm)					**1.000**	0.168	0.153	0.631**	-0.198	0.461**	-0.359**	0.365**
TSS (ºB)						**1.000**	0.426**	-0.074	-0.144	-0.174	0.252	-0.332**
Number of fruits per cluster							**1.000**	0.051	-0.308*	-0.153	0.011	-0.163
Average fruit weight (g)								**1.000**	-0.360**	0.618**	-0.431**	0.663**
Number of fruits per plant									**1.000**	0.411**	-0.058	0.230
Marketable fruit yield per plant (g)										**1.000**	-0.520**	0.846**
Unmarketable fruit yield per plant (g)											**1.000**	-0.661**
Total fruit yield per plant (g)												**1.000**

*, ** significant at 5% and 1% level, respectively

Table 2.2: Correlation Coefficient Analysis at the Genotypic Level

Characters	**Days to 50% flowering**	**Plant height (cm)**	**No. of primary branches per plant**	**Polar diameter of fruit (cm)**	**Equatorial diameter of fruit (cm)**	**TSS (ºB)**	**Number of fruits per cluster**	**Average fruit weight (g)**	**Number of fruits per plant**	**Marketable fruit yield per plant (g)**	**Unmarketable fruit yield per plant (g)**	**Total fruit yield per plant (g)**
Days to 50% flowering	**1.000**	0.119	0.158	-0.168	-0.450**	-0.153	-0.559**	-0.343**	0.602**	0.181	0.074	0.033
Plant height (cm)		**1.000**	0.055	-0.389**	0.020	0.005	-0.196	-0.357**	0.103	-0.186	0.308*	-0.306*
Number of primary branches per plant			**1.000**	0.004	0.142	-0.238	0.047	0.292*	0.046	0.300*	0.030	0.307*
Polar diameter of fruit (cm)				**1.000**	0.740**	0.085	-0.029	0.843**	-0.086	0.721**	-0.536**	0.712**
Equatorial diameter of fruit (cm)					**1.000**	0.243	0.221	0.674**	-0.234	0.482**	-0.379**	0.383**
TSS (ºB)						**1.000**	0.543**	-0.080	-0.180	-0.204	0.301*	-0.370**
Number of fruits per cluster							**1.000**	0.061	-0.372**	-0.167	0.014	-0.160
Average fruit weight (g)								**1.000**	-0.405**	0.629**	-0.440**	0.670**
Number of fruits per plant									**1.000**	0.452**	-0.054	0.225
Marketable fruit yield per plant (g)										**1.000**	-0.522**	0.869**
Unmarketable fruit yield per plant (g)											**1.000**	-0.685**
Total fruit yield per plant (g)												**1.000**

*, ** significant at 5% and 1% level, respectively.

Path Coefficient Analysis

Path Coefficient Analysis at the Phenotypic Level

At the phenotypic level (Table 3.1), path coefficient analysis was used to assess the direct and indirect effects of different variables on fruit yield per plant. The highest positive direct effect on fruit yield was exerted by marketable fruit yield per plant (0.5224), followed by polar diameter of fruit (0.2045), number of primary branches per plant (0.1549), average fruit weight (0.1479), number of fruits per plant (0.0672), and plant height (0.0148). Substantial negative direct effect on the total yield per plant was shown by unmarketable fruit yield per plant (-0.2959), followed by equatorial diameter of fruit (-0.2660), days to 50% flowering (-0.1962), number of fruits per cluster (0.0990), and total soluble solids (-0.0571). This indicates that direct selection for marketable fruit yield per plant, polar diameter of fruit, number of primary branches per plant, average fruit weight, number of fruits per plant, and plant height in the desired direction would be very effective for yield improvement. Similar findings were reported by Rawat *et al*. (2017), Doddamani *et al*. (2019), Maurya *et al*. (2020), and Himanshu Singh *et al*. (2024).

Substantial positive indirect effect by polar diameter of fruit (0.3571), average fruit weight (0.3229), equatorial diameter of fruit (0.2410), number of fruits per plant (0.2148), number of primary branches per plant (0.1443) and days to 50% flowering (0.0849) on total fruit yield per plant via marketable fruit yield per plant and average fruit weight (0.1614), marketable fruit yield per plant (0.1398), equatorial diameter of fruit (0.1351), total soluble solids (0.0065) and number of fruits per cluster (0.0020) via polar diameter of fruit. Marketable fruit yield per plant (0.0428), average fruit weight (0.0400), equatorial diameter of fruit (0.0195), days to 50% flowering (0.0140), number of fruits per plant (0.0069), plant height (0.0068), number of fruits per cluster (0.0052) and unmarketable fruit yield per plant (0.0047) via number of primary branches per plant on the total fruit yield per plant. While unmarketable fruit yield per plant (-0.2714) via marketable fruit yield per plant, unmarketable fruit yield per plant (-0.1039) via polar diameter of fruit, plant height (-0.0899) and total soluble solids (-0.0744) via unmarketable fruit yield per plant, plant height (-0.0516) and days to 50% flowering (-0.0460) via average fruit weight and TSS (-0.0312) via number of primary branches per plant were found substantial negative indirect effect on total fruit yield per plant. Thus, the polar diameter of fruit, number of primary branches per plant, average fruit weight, number of fruits per plant, and plant height were identified as positive direct contributors for higher fruit yield. Equatorial diameter of fruit, days to 50% flowering, and number of fruits per cluster were found as the main traits that showed a substantial indirect effect on the total fruit yield per plant.

Path Coefficient Analysis at the Genotypic Level

The direct and indirect effects of different traits on the total fruit yield per plant at the genotypic level are represented in Table 3.2. The highest magnitude of positive direct effect on total fruit yield per plant was exerted by average fruit weight (1.3343), number of fruits per plant (1.0523), polar diameter of fruit (0.4356), plant height (0.2871), number of fruits per cluster (0.2407), and number of primary branches per plant (0.1085). While a substantially higher negative direct effect on total fruit yield per plant was exerted by marketable fruit yield per plant (-0.6842), equatorial diameter of fruit (-0.4920), unmarketable fruit yield per plant (-0.4021), total soluble solids (-0.1272), and days to 50% flowering (-0.0750).

The highest positive indirect effect for total fruit yield per plant was exerted by polar diameter (1.1248), equatorial diameter of fruit (0.8988), marketable fruit yield per plant (0.8395), number of fruits per cluster (0.0818), and number of primary branches per plant (0.3899). Whereas, substantial negative indirect effect on total fruit yield per plant was exerted by unmarketable fruit yield per plant (-0.5869), number of fruits per plant (-0.5407), plant height (-0.4761) and days to 50% flowering (-0.4570) via average fruit weight, polar diameter of fruit (-0.4930) and average fruit weight (-0.4305) via marketable fruit yield per plant. Similar results were reported by Tamuly *et al*. (2018), Alam *et al*. (2019), Basfore *et al*. (2020), and Himanshu Singh *et al*. (2024). Thus, the above discussion reveals that the important direct and indirect components exhibited a substantial positive effect via some characters, along with a considerable negative effect via some other traits.

The occurrence of both negative and positive direct and indirect effects of yield components on fruit yield, through various traits, presents a complex scenario where a compromise is needed to achieve a balanced combination of yield components to define the ideal ideotype for high fruit yield in tomatoes. The traits mentioned above are crucial and must be considered when formulating selection strategies aimed at developing high-yielding tomato varieties.

Table 3.1: Path Coefficient Analysis at the Phenotypic Level

Characters	Days to 50% flowering	Plant height (cm)	Number of primary branches per plant	Polar diameter of fruit (cm)	Equatorial diameter of fruit (cm)	TSS (^{0}B)	No. of fruits per cluster	Average fruit weight (g)	No. of fruits per plant	Marketable fruit yield per plant (g)	Unmarketable fruit yield per plant (g)	Total fruit yield per plant (g)
Days to 50% flowering	**-0.1962**	0.0017	0.0140	-0.0208	0.0995	0.0064	0.0468	-0.0460	0.0327	0.0849	-0.0176	0.005
Plant height (cm)	-0.0226	**0.0148**	0.0068	-0.0760	-0.0094	-0.0002	0.0163	-0.0516	0.0070	-0.0956	-0.0899	-0.300*
Number of primary branches / plant	-0.0177	0.0007	**0.1549**	-0.0096	-0.0336	0.0115	-0.0033	0.0382	0.0030	0.1443	-0.0091	0.279*
Polar diameter of fruit (cm)	0.0200	-0.0055	-0.0073	**0.2045**	-0.1757	-0.0018	-0.0010	0.1167	-0.0067	0.3571	0.1503	0.651**
Equatorial diameter of fruit (cm)	0.0734	0.0005	0.0195	0.1351	**-0.2660**	-0.0096	-0.0151	0.0933	-0.0133	0.2410	0.1063	0.365**
TSS (^{0}B)	0.0221	0.0001	-0.0312	0.0065	-0.0446	**-0.0571**	-0.0422	-0.0109	-0.0097	-0.0911	-0.0744	-0.332**
Number of fruits per cluster	0.0927	-0.0024	0.0052	0.0020	-0.0406	-0.0243	**-0.0990**	0.0076	-0.0207	-0.0799	-0.0034	-0.163
Average fruit weight (g)	0.0610	-0.0052	0.0400	0.1614	-0.1678	0.0042	-0.0051	**0.1479**	-0.0242	0.3229	0.1276	0.663**
Number of fruits per plant	-0.0955	0.0015	0.0069	-0.0203	0.0527	0.0082	0.0305	-0.0532	**0.0672**	0.2148	0.0173	0.230
Marketable fruit yield per plant (g)	-0.0319	-0.0027	0.0428	0.1398	-0.1228	0.0100	0.0152	0.0914	0.0276	**0.5224**	0.1538	0.846**
Unmarketable fruit yield per plant(g)	-0.0116	0.0045	0.0047	-0.1039	0.0955	-0.0144	-0.0011	-0.0638	-0.0039	-0.2714	**-0.2959**	-0.661**

Resi = 0.140 ; *, ** significant at 5% and 1% level, respectively

Table 3.2 : Path Coefficient Analysis at the Genotypic Level

Characters	Days to 50% flowering	Plant height (cm)	Number of primary branches per plant	Polar diameter of fruit (cm)	Equatorial diameter of fruit (cm)	TSS (ºB)	No. of fruits per cluster	Average fruit weight (g)	No. of fruits per plant	Marketable fruit yield per plant (g)	Unmarketable fruit yield per plant (g)	Total fruit yield per plant (g)
Days to 50% flowering	**-0.0750**	0.0342	0.0171	-0.0731	0.2216	0.0194	-0.1346	-0.4570	0.6340	-0.1237	-0.0297	0.033
Plant height (cm)	-0.0089	**0.2871**	0.0059	-0.1693	-0.0097	-0.0006	-0.0471	-0.4761	0.1089	0.1276	-0.1237	-0.306*
Number of primary branches / plant	-0.0118	0.0157	**0.1085**	0.0018	-0.0696	0.0303	0.0112	0.3899	0.0487	-0.2053	-0.0121	0.307*
Polar diameter of fruit (cm)	0.0126	-0.1116	0.0005	**0.4356**	-0.3642	-0.0108	-0.0070	1.1248	-0.0907	-0.4930	0.2157	0.712**
Equatorial diameter of fruit (cm)	0.0338	0.0056	0.0154	0.3225	**-0.4920**	-0.0309	0.0532	0.8988	-0.2464	-0.3296	0.1523	0.383**
TSS (^{0}B)	0.0114	0.0013	-0.0258	0.0371	-0.1193	**-0.1272**	0.1308	-0.1073	-0.1898	0.1399	-0.1209	-0.370**
Number of fruits per cluster	0.0419	-0.0561	0.0051	-0.0127	-0.1088	-0.0691	**0.2407**	0.0818	-0.3917	0.1140	-0.0055	-0.160
Average fruit weight (g)	0.0257	-0.1024	0.0317	0.3672	-0.3314	0.0102	0.0147	**1.3343**	-0.4264	-0.4305	0.1769	0.670**
Number of fruits per plant	-0.0452	0.0297	0.0050	-0.0375	0.1152	0.0230	-0.0896	-0.5407	**1.0523**	-0.3091	0.0217	0.225
Marketable fruit yield per plant (g)	-0.0136	-0.0535	0.0326	0.3139	-0.2370	0.0260	-0.0401	0.8395	0.4754	**-0.6842**	0.2101	0.869**
Unmarketable fruit yield per plant(g)	-0.0055	0.0883	0.0033	-0.2337	0.1864	-0.0382	0.0033	-0.5869	-0.0567	0.3574	**-0.4021**	-0.685**

Resi = 0.117; *, ** significant at 5% and 1% level, respectively

Conclusion

Based on the above investigation, it can be concluded that genotypes had wide diversity and variability for most of the traits. The correlation coefficients were higher at the genotypic level than at the phenotypic level, depicting the potential for selection of the genotypes, and particularly useful for breeding. Results also indicated that marketable fruit yield per plant (0.846), followed by average fruit weight (0.663), polar diameter of fruit (0.651), equatorial diameter of fruit (0.365), and number of primary branches per plant (0.279) had highly positive and significant phenotypic correlation with total fruit yield per plant. However, it showed significant positive genotypic correlation with marketable fruit yield per plant (0.869), polar diameter of fruit (0.712), average fruit weight (0.670), the equatorial diameter of fruit (0.383), and number of primary branches per plant (0.307).

The path coefficient analysis at phenotypic level indicated that the marketable fruit yield per plant (0.5224), polar diameter of fruit (0.2045), number of primary branches per plant (0.1549), average fruit weight (0.1479), number of fruits per plant (0.0672), and plant height (0.0148) whereas, at genotypic level of path analysis average fruit weight (1.3343), number of fruits per plant (1.0523), polar diameter of fruit (0.4356), plant height (0.2871), number of fruits per cluster (0.2407), and number of primary branches per plant (0.1085), were identified as positive direct contributors to higher fruit yield. Thus, these traits may be given more emphasis for the direct selection of high-yielding tomato genotypes in future tomato breeding programmes. Hence, there is ample scope for selection for these traits.

Future scope

The current experiment would lay the groundwork for future researchers who are interested in working on the diverse breeding program. Further, it is imperative to emphasize the importance of multidisciplinary approaches that combine traditional breeding with modern biotechnological tools to achieve comprehensive improvement in tomato genotypes accordingly.

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