Journal of Advances in Biology & Biotechnology

Volume 27, Issue 7, Page 555-563, 2024; Article no.JABB.118686
ISSN: 2394-1081

Study on the Path Coefficient Analysis of Certain Matric Traits in Brinjal (*Solanum melongena* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/jabb/2024/v27i71016

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/118686

Original Research Article

Received: 04/04/2024
Accepted: 08/06/2024
Published: 19/06/2024

ABSTRACT

This study evaluated 74 genotypes (14 lines, 4 testers, and 56 F1 hybrids with two checks) at the Vegetable Research Farm, Sunrise University, Alwar, Rajasthan, over the summer seasons of 2022 and 2023 using a randomized block design with three replications. Traits observed included days to 50% flowering, days to first fruit harvest, plant height, primary branches per plant, pedicel length, fruits per cluster, average fruit weight, fruits per plant, total phenol content, dry matter content, reducing and non-reducing sugars, total sugars, TSS, ascorbic acid, total fruit yield plant^{-1}, and yield hectare^{-1}. Phenotypic path coefficient analysis showed highly positive direct effects on total fruit yield plant^{-1} (0.3723), number of fruits plant^{-1} (0.2300), average fruit weight (0.2204), and plant height (0.1734). Indirect effects were notably contributed by primary branches plant^{-1} (0.2892) and

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Cite as: Kumar , Deepak, Narendra Singh Gujjar, Puran Singh, and Brajrajsharan Tiwari. 2024. "Study on the Path Coefficient Analysis of Certain Matric Traits in Brinjal (Solanum Melongena L.)". Journal of Advances in Biology & Biotechnology 27 (7):555-63. https://doi.org/10.9734/jabb/2024/v27i71016.

reducing sugar (0.2536). Pooled genotypic path coefficient analysis revealed the highest positive direct effects from total fruit yield plant^{-1} (0.7791), total sugar (0.3543), and plant height (0.2132). Significant indirect effects were from reducing sugar (0.4582) and primary branches plant^{-1} (0.3155).

Keywords: Path coefficient; ascorbic acid; total phenol content; TSS.

1. INTRODUCTION

Brinjal, or eggplant (*Solanum melongena* L.), is an important Solanaceous vegetable crop with a diploid chromosome number of 2n=2x=24 (Gupta RA et al. 2017). According to Vavilov, the crop originates from India. Understanding the genetic and phenotypic relationships among various traits that contribute to yield and quality is crucial for crop improvement. Path coefficient analysis, a statistical technique that quantifies the direct and indirect effects of multiple variables on a dependent variable, is particularly useful in this context [1-3]. By dissecting the complex interrelationships among traits, path coefficient analysis helps breeders identify key determinants of yield and quality, thereby guiding the selection process in breeding programs.

In brinjal, certain metric traits such as plant height, number of branches, fruit size, and fruit weight significantly influence overall yield. However, the interdependencies among these traits are complex and not fully understood. This study aims to elucidate the direct and indirect effects of various metric traits on brinjal yield through path coefficient analysis. By doing so, we seek to identify the most influential traits that could serve as reliable selection criteria in breeding programs aimed at improving brinjal productivity. The insights gained from this investigation are expected to contribute to more effective breeding strategies, ultimately enhancing brinjal production and meeting the growing demands of both local and global markets.

2. MATERIALS AND METHODS

This study, conducted at the Vegetable Research Farm, Department of Vegetable Science, Sunrise University, Alwar, Rajasthan, India, examined 74 genotypes (14 lines, 4 testers, and 56 F1 hybrids) with two checks in a randomized block design (RBD) with three replications over the summer seasons of 2022 and 2023.

2.1 Methodology

Seed beds were prepared using sandy loam soil (pH 7.3). Beds were 20 cm high, 1.0 m wide, and incorporated with 4 kg/m² of cow dung manure. Soil treatment included 0.2% chlorothalonil and 0.1% carbendazim. Seeds, treated with Thiram® (3.0 g/kg), were sown on January 16 in both years, spaced 5.0 cm apart at a depth of 1.0 cm, and covered with leaf mould and paddy straw. The beds were hand-watered daily until January end and protected by UV-stabilized polyethylene film. Seedlings were hardened by withholding water for 4 days before transplanting. Thirty-five-day-old seedlings were transplanted on March 2.

2.2 Observations

Traits observed included:

1. Days to 50% flowering
2. Days to first fruit harvest
3. Plant height
4. Number of primary branches per plant
5. Length of pedicel
6. Number of fruits per cluster
7. Average fruit weight
8. Number of fruits per plant
9. Total phenol content
10. Dry matter content
11. Reducing sugar
12. Non-reducing sugar
13. Total sugars
14. TSS
15. Ascorbic acid
16. Total fruit yield per plant
17. Yield per hectare

3. RESULTS AND DISCUSSION

3.1 Phenotypic Path with Yield Q/Ha

In 2022, phenotypic path coefficient analysis (Table 1) revealed a high positive direct effect of average fruit weight (0.420), followed by total sugar (0.279), number of fruits plant-1 (0.249), TSS (0.192), ascorbic acid (0.144), plant height (0.069), dry matter content (0.055), total phenol content (0.045), total fruit yield plant-1 (0.043), length of pedicel (0.029), and days to first fruit harvest (0.028). Indirect effects included days to 50% flowering (-0.341), reducing sugar (-0.237), number of primary branches (-0.115), non-reducing sugar (-0.081), number of fruits per

cluster (0.058), and length of pedicel (0.029). Days to 50% flowering had the highest negative direct effect on plant height but a high positive indirect effect via average fruit weight (-0.390), ultimately resulting in a positive correlation with yield. Similar results were reported by Thangamani et al. [4], Tripathy [5], and Yadav et al. [6].

In 2023, phenotypic path coefficient analysis (Table 2) revealed a high positive direct effect of total fruit yield plant-1 (0.4977), followed by the number of fruits plant-1 (0.2897), days to first fruit harvest (0.2417), plant height (0.1199), length of pedicel (0.0957), ascorbic acid (0.0587), total phenol content (0.0552), average fruit weight (0.0236), and non-reducing sugar (0.0231). Indirect effects included days to 50% flowering (-0.1435), reducing sugar (-0.1435), TSS (-0.0968), dry matter content (-0.0943), number of primary branches (-0.0895), and total sugar (-0.0068). The number of primary branches plant-1 had the highest negative direct effect on plant height but a high positive indirect effect via total fruit yield plant-1 (-0.752), resulting in a positive correlation with yield. Similar results were reported by Sonkiya et al. (2012) and Shinde et al. [7], Ronanki Divya et al. [8].

In pooled phenotypic path coefficient analysis (Table 3) for 2022 and 2023, the traits showing the highest positive direct effects on total fruit yield plant^{-1} were total fruit yield plant-1 (0.3723), followed by the number of fruits plant^{-1} (0.2300), average fruit weight (0.2204), plant height (0.1734), number of fruits per cluster (0.0568), length of pedicel (0.0446), days to first fruit harvesting (0.0281), total phenol content (0.0159), and dry matter content (0.0081).

For indirect effects, the number of primary branches (-0.2892) had the highest impact, followed by reducing sugar (-0.2536), days to 50% flowering (-0.1952), non-reducing sugar (-0.0693), and TSS (-0.0022). These contributed to the number of fruits per cluster with the maximum positive indirect effect. Despite the number of primary branches plant^{-1} showing the highest negative direct effect on plant height, it had a high positive indirect effect via total fruit yield plant^{-1} (-0.591), resulting in an overall positive correlation with yield. Similar results have been reported by Singh et al. [9], Singh et al. [10], and Tsega et al. [11], Sakriya SG et al. [12].

3.2 Genotypic Path with Yield Q/Ha

In the 2022 genotypic path coefficient analysis (Table 1), total fruit yield per plant (0.989) had the highest positive direct effect, followed by days to 50% flowering (0.777), plant height (0.496), total sugar (0.397), number of fruits per cluster (0.223), ascorbic acid (0.222), TSS (0.118), and total phenol content (0.130). Negative indirect effects were observed for average fruit weight (-0.783), reducing sugar (-0.699), days to first fruit harvesting (-0.583), number of fruits per plant (-0.442), dry matter content (-0.149), length of pedicel (-0.136), and non-reducing sugar (-0.019), with plant height showing the maximum negative indirect effect. Although the number of primary branches per plant had the highest negative direct effect on total fruit yield per plant, it exhibited a high positive indirect effect via total fruit yield per plant (-0.591), leading to a positive correlation with yield. These findings are consistent with those reported by Chotaliya and Kulkarni [13], Gebremichael et al. [14], and Kassahun et al. [15], Gazala Nazir et al. [16].

In the 2023 genotypic path coefficient analysis (Table 2), total sugar (0.7343) showed the highest positive direct effect, followed by total fruit yield per plant (0.6715), plant height (0.1959), number of fruits per plant (0.1466), length of pedicel (0.1090), days to first fruit harvesting (0.1049), average fruit weight (0.1017), ascorbic acid (0.0276), days to 50% flowering (0.0163), and dry matter content (0.0055). Indirect effects were negative for reducing sugar (-0.7248), non-reducing sugar (-0.3457), number of primary branches (-0.1015), number of fruits per cluster (-0.0686), TSS (-0.159), and total phenol content (-0.0095). The number of fruits per cluster had the maximum positive indirect effect [17,18,19]. Despite the number of primary branches per plant having the most significant negative direct effect on total fruit yield per plant, it showed a high positive indirect effect via total fruit yield per plant (-0.883), leading to a positive correlation with yield. These results are consistent with those reported by Lu et al. [20], Prajapati et al. [21], and Sharma et al. [22] W.L. Konyak et al. [23]. In the pooled genotypic path coefficient analysis (Table 3) combining data from 2022 and 2023, total fruit yield per plant (0.7791) exhibited the highest positive direct effect, followed by total sugar (0.3543), plant height (0.2132), average fruit weight (0.1956), ascorbic acid (0.1216), number of fruits per cluster (0.0367), dry matter content (0.0260), total phenol content (0.0256), and

Table 1. Genotypic and phenotypic Path analysis between different characters of brinjal during 2022

Characters	Genotypic/Phenotypic parh	Days to 50% Flowering	Days to first fruit harvest	Plant height	Number of primary branches per plant	Length of pedicle (cm)	Number of fruit per cluster	Average fruit weight (gm)	Number of fruit per plant	Total Phenol Content (mg/100 gm)	Dry matter content (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Total Sugars (%)	TSS (Brix)	Ascorbic acid (mg/ 100gm)	Total fruit yield plant-1 (kg)	Yield Q/Ha
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	G	0.777	-0.268	0.030	-0.007	-0.020	-0.050	-0.084	0.083	-0.010	-0.011	-0.323	-0.032	0.075	0.019	0.020	-0.415	-0.214**
	P	-0.341	0.009	0.004	0.022	-0.001	0.008	0.018	-0.008	-0.001	0.000	-0.044	-0.006	0.019	0.053	0.009	0.000	-0.258**
2	G	0.357	-0.583	-0.101	-0.004	-0.035	-0.030	-0.078	-0.285	-0.003	-0.007	-0.139	-0.044	0.026	0.012	0.016	0.762	-0.137*
	P	-0.115	0.028	-0.015	0.015	-0.007	0.012	0.063	0.018	-0.003	0.005	-0.017	-0.005	0.014	-0.001	0.023	0.007	0.022
3	G	0.048	0.119	0.496	-0.003	0.017	0.003	0.185	0.019	-0.028	-0.049	-0.402	0.060	0.147	-0.017	0.049	-0.498	-0.152*
	P	-0.022	-0.006	0.069	0.013	0.003	-0.002	-0.122	-0.055	-0.006	0.012	-0.062	0.010	0.045	-0.003	0.022	-0.016	-0.120
4	G	-0.184	0.088	-0.045	0.028	-0.041	0.102	-0.380	-0.065	0.001	0.026	0.170	-0.076	0.002	0.009	-0.023	0.338	0.251**
	P	0.067	-0.004	-0.008	-0.115	-0.007	-0.024	0.188	0.057	0.001	-0.005	0.028	-0.012	-0.006	0.004	-0.009	0.015	0.170*
5	G	0.111	-0.149	-0.062	0.008	-0.136	0.002	-0.211	-0.010	0.000	0.004	0.106	-0.087	-0.110	0.046	-0.040	0.239	0.010
	P	-0.011	0.007	-0.008	-0.027	-0.029	0.002	0.100	0.071	-0.001	-0.001	0.012	-0.012	-0.031	0.031	-0.025	0.008	0.087
6	G	-0.175	0.079	0.006	0.013	-0.001	0.223	-0.289	-0.025	0.023	-0.007	-0.091	-0.120	0.162	-0.003	0.008	0.256	0.358**
	P	0.048	-0.006	0.002	-0.048	0.001	-0.058	0.117	0.066	0.009	0.001	-0.014	-0.019	0.047	0.007	-0.005	0.014	0.161*
7	G	0.083	-0.058	-0.117	0.013	-0.037	0.082	-0.783	-0.049	0.024	0.009	0.168	-0.190	-0.025	0.013	-0.036	0.156	0.454**
	P	-0.015	0.004	-0.020	-0.052	-0.007	-0.016	0.420	0.067	0.004	0.001	0.026	-0.027	-0.001	-0.002	-0.013	0.020	0.390**
8	G	-0.026	-0.068	-0.146	0.009	-0.040	0.066	-0.272	-0.442	0.026	-0.015	0.103	-0.623	-0.062	0.009	0.007	0.928	0.453**
	P	0.011	0.002	-0.015	-0.026	-0.008	-0.015	0.112	0.249	0.009	0.000	0.012	-0.018	-0.017	0.021	-0.001	0.032	0.348**
9	G	-0.057	0.014	-0.106	0.000	0.000	0.039	-0.144	-0.094	0.130	-0.038	-0.096	-0.039	0.304	-0.010	0.008	0.362	0.273**
	P	0.011	-0.002	-0.009	-0.001	0.001	-0.012	0.038	0.048	0.045	0.010	-0.044	-0.036	0.092	0.006	0.000	0.011	0.157*
10	G	0.056	-0.029	0.164	-0.005	0.003	0.010	0.049	-0.246	0.033	-0.149	-0.524	-0.081	0.348	0.013	0.013	0.529	0.185**
	P	-0.003	0.003	0.015	0.011	0.001	-0.001	0.010	0.002	0.008	0.055	-0.072	-0.012	0.109	-0.015	0.017	0.005	0.134*
11	G	0.167	-0.054	0.133	-0.003	0.010	0.014	0.088	0.167	0.026	-0.152	-0.699	0.073	0.039	-0.029	0.041	0.079	-0.101
	P	-0.063	0.002	0.018	0.014	0.001	-0.003	-0.047	-0.012	0.008	0.017	-0.237	0.012	0.220	-0.035	0.022	0.001	-0.083
12	G	0.048	-0.050	-0.057	0.004	-0.023	0.052	-0.287	-0.579	0.060	-0.023	0.212	-0.019	0.111	0.009	0.015	0.792	0.263**
	P	-0.024	0.002	-0.008	-0.017	-0.004	-0.014	0.142	0.054	0.020	0.008	0.034	-0.081	0.037	0.011	0.008	0.014	0.180**
13	G	0.073	-0.019	0.092	0.000	0.019	0.045	0.024	0.189	0.049	-0.065	-0.802	-0.073	0.397	-0.033	0.016	0.095	0.008
	P	-0.023	0.001	0.011	0.002	0.003	-0.010	-0.002	-0.015	0.015	0.021	-0.187	-0.011	0.279	-0.044	0.010	0.000	0.054
14	G	0.122	-0.058	-0.071	0.002	-0.053	-0.006	-0.084	-0.179	-0.011	-0.016	0.366	-0.040	-0.219	0.118	-0.061	0.430	0.240**
	P	-0.093	0.000	-0.001	-0.002	-0.005	-0.002	-0.004	0.028	0.001	-0.004	0.043	-0.005	-0.064	0.192	-0.037	0.006	0.051
15	G	0.070	-0.043	0.110	-0.003	0.025	0.008	0.126	-0.073	0.005	-0.009	-0.277	-0.034	0.058	-0.033	0.222	-0.168	-0.015
	P	-0.022	0.004	0.011	0.008	0.005	0.002	-0.038	-0.001	0.000	0.006	-0.036	-0.005	0.020	-0.050	0.144	0.000	0.047
16	G	-0.085	-0.117	-0.196	0.010	-0.045	0.074	-0.046	-0.009	0.040	-0.021	-0.071	-0.077	0.020	0.113	-0.010	0.989	0.570**
	P	-0.001	0.005	-0.025	-0.041	-0.005	-0.018	0.196	0.184	0.012	0.007	-0.004	-0.026	0.001	0.025	0.000	**0.043**	0.351**

Table 2. Genotypic and phenotypic Path analysis between different characters of brinjal during 2023

Characters	Genotypic / Path analysis	Days to 50% Flowering	Days to first fruit harvest	Plant hight	Number of primary branches per plant	Length of pedicle (cm)	Number of fruit per cluster	Average fruit weight (gm)	Number of fruits per plant	Total Phenol Content (mg/100 gm)	Dry matter content (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Total Sugars (%)	TSS (Brix)	Ascorbic acid (mg/ 100gm)	Total fruit yield plant-1 (kg)	Yield Q/Ha
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	G	0.0163	0.0729	0.0175	0.0274	0.0007	0.0108	-0.0011	0.0200	0.0000	-0.0002	-0.2152	-0.0270	0.1713	-0.0014	0.0052	0.0804	0.177**
	P	-0.1435	0.1329	0.0109	0.0246	0.0007	-0.0186	0.0012	0.0285	0.0003	0.0032	-0.0036	0.0022	-0.0014	-0.0066	0.0064	0.0644	0.102
2	G	0.0113	0.1049	-0.0634	0.0423	0.0064	0.0245	0.0156	0.0043	0.0003	0.0006	-0.0998	-0.0171	0.0493	-0.0006	0.0050	0.0043	0.088
	P	-0.0789	0.2417	-0.0390	0.0331	0.0017	-0.0425	0.0032	0.0162	-0.0030	-0.0082	-0.0016	0.0009	-0.0006	0.0008	0.0104	-0.0212	0.113
3	G	0.0015	-0.0339	0.1959	-0.0197	-0.0216	-0.0079	-0.0149	0.0078	0.0034	-0.0010	-0.0600	0.0505	-0.0340	0.0014	0.0018	-0.0023	0.067
	P	-0.0130	-0.0787	0.1199	-0.0145	-0.0167	0.0122	-0.0031	0.0177	-0.0172	0.0172	-0.0010	-0.0034	0.0003	-0.0025	0.0029	0.0036	0.024
4	G	-0.0044	-0.0438	0.0380	-0.1015	0.0097	-0.0110	-0.0073	-0.0055	0.0012	0.0002	0.0547	0.0336	-0.1105	-0.0029	-0.0031	-0.0605	-0.213**
	P	0.0394	-0.0895	0.0194	-0.0895	0.0045	0.0200	-0.0026	-0.0124	-0.0055	-0.0054	0.0010	-0.0023	0.0010	-0.0110	-0.0031	-0.0455	-0.181**
5	G	0.0001	0.0062	-0.0389	-0.0091	0.1090	-0.0125	0.0346	0.0607	0.0015	0.0002	0.1497	0.0485	-0.1727	-0.0050	0.0029	0.2381	0.413**
	P	-0.0011	0.0043	-0.0210	-0.0042	0.0957	0.0175	0.0068	0.0989	-0.0084	-0.0055	0.0025	-0.0031	0.0015	-0.0182	0.0038	0.1815	0.351**
6	G	-0.0026	-0.0374	0.0225	-0.0162	0.0198	-0.0686	0.0345	0.0153	0.0002	0.0019	0.0032	0.0372	-0.0048	-0.0019	0.0015	0.1483	0.153*
	P	0.0205	-0.0791	0.0113	-0.0138	0.0129	0.1298	0.0048	0.0309	-0.0026	-0.0273	0.0000	-0.0021	0.0001	-0.0063	0.0027	0.0943	0.176**
7	G	-0.0002	0.0161	-0.0286	0.0073	0.0370	-0.0232	0.1017	0.0652	-0.0007	0.0009	-0.1004	-0.0044	0.1318	-0.0031	0.0041	0.2747	0.478**
	P	-0.0076	0.0328	-0.0160	0.0098	0.0277	0.0263	0.0236	0.0824	0.0033	-0.0044	-0.0014	0.0004	-0.0013	-0.0033	0.0033	0.1479	0.324**
8	G	0.0022	0.0031	0.0105	0.0038	0.0451	-0.0071	0.0453	0.1466	0.0028	-0.0005	-0.0645	0.0375	0.0217	0.0017	0.0058	0.5326	0.787**
	P	-0.0141	0.0135	0.0073	0.0038	0.0327	0.0139	0.0067	0.2897	-0.0164	0.0080	-0.0010	-0.0025	-0.0002	-0.0008	0.0105	0.3488	0.700**
9	G	0.0000	-0.0033	-0.0705	0.0127	-0.0167	0.0017	0.0073	-0.0437	-0.0095	-0.0001	-0.0419	-0.1886	0.2978	-0.0011	-0.0042	-0.0765	-0.137*
	P	-0.0008	-0.0131	-0.0373	0.0089	-0.0146	-0.0061	0.0014	-0.0861	0.0552	0.0051	-0.0008	0.0116	-0.0025	-0.0072	-0.0047	-0.0543	-0.145*
10	G	-0.0005	0.0109	-0.0367	-0.0030	0.0047	-0.0234	0.0163	-0.0143	0.0002	0.0055	0.0041	0.0565	-0.0477	-0.0033	0.0063	-0.0696	-0.094
	P	0.0049	0.0209	-0.0219	-0.0051	0.0055	0.0375	0.0011	-0.0247	-0.0030	-0.0943	0.0002	-0.0034	0.0006	-0.0109	0.0115	-0.0162	-0.097
11	G	0.0048	0.0144	0.0162	0.0077	-0.0225	0.0003	0.0141	0.0130	-0.0006	0.0000	-0.7248	0.0588	0.6032	0.0028	0.0023	0.0335	0.023
	P	-0.0384	0.0294	0.0092	0.0068	-0.0176	0.0001	0.0025	0.0215	0.0032	0.0013	-0.0135	-0.0040	-0.0055	0.0153	0.0045	0.0238	0.038
12	G	0.0013	0.0052	-0.0286	0.0099	-0.0153	0.0074	0.0013	-0.0159	-0.0052	-0.0009	0.1233	-0.3457	0.2692	0.0005	0.0018	-0.0230	-0.015
	P	-0.0138	0.0090	-0.0174	0.0089	-0.0127	-0.0120	0.0004	-0.0314	0.0276	0.0139	0.0023	0.0231	-0.0024	0.0027	0.0025	-0.0149	-0.014
13	G	0.0038	0.0070	-0.0091	0.0153	-0.0256	0.0005	0.0183	0.0043	-0.0039	-0.0004	-0.5953	-0.1268	0.7343	0.0035	0.0025	0.0335	0.062
	P	-0.0290	0.0211	-0.0060	0.0134	-0.0210	-0.0023	0.0044	0.0098	0.0205	0.0076	-0.0109	0.0081	-0.0068	0.0173	0.0047	0.0162	0.047
14	G	0.0014	0.0037	-0.0168	-0.0185	0.0343	-0.0084	0.0198	-0.0158	-0.0007	0.0011	0.1296	0.0117	-0.1623	-0.0159	-0.0037	0.0232	-0.017
	P	-0.0097	-0.0019	0.0031	-0.0101	0.0180	0.0084	0.0008	0.0023	0.0041	-0.0106	0.0021	-0.0007	0.0012	-0.0968	-0.0091	0.0087	-0.090
15	G	0.0031	0.0190	0.0129	0.0115	0.0116	-0.0038	0.0152	0.0307	0.0015	0.0013	-0.0616	-0.0221	0.0675	0.0021	0.0276	0.1635	0.280**
	P	-0.0156	0.0430	0.0059	0.0048	0.0063	0.0059	0.0013	0.0519	-0.0044	-0.0184	-0.0010	0.0010	-0.0006	0.0150	0.0587	0.0905	0.244**
16	G	0.0020	0.0007	-0.0007	0.0092	0.0386	-0.0152	0.0416	0.1163	0.0011	-0.0006	-0.0361	0.0118	0.0367	-0.0006	0.0067	0.6715	0.883**
	P	-0.0186	-0.0103	0.0009	0.0082	0.0349	0.0246	0.0070	0.2030	-0.0060	0.0031	-0.0007	-0.0007	-0.0002	-0.0017	0.0107	0.4977	0.752**

Table 3. Genotypic and phenotypic Path analysis between different characters of brinjal in pooled (Pooled)

Characters	Genotypic/ Path analysis	Days to 50% Flowering	Days to first fruit harvest	plant hight	Number of primary branches per plant	Length of pedicle (cm)	Number of fruit per cluster	Average fruit weight (gm)	Number of fruit per plant	Total Phenol Content (mg/100 gm)	Dry matter content (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Total Sugars (%)	TSS (Brix)	Ascorbic acid (mg/ 100gm)	Total fruit yield plant-1 (kg)	Yield Q/Ha
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	G	-0.0343	-0.0781	0.0218	0.0993	0.0031	0.0034	0.0163	-0.0022	-0.0013	0.0025	-0.1252	-0.0099	0.0546	0.0019	0.0165	0.0263	-0.005
	P	-0.1952	0.0145	0.0177	0.0866	0.0023	-0.0091	0.0124	0.0090	-0.0005	0.0005	-0.0656	-0.0046	0.0287	-0.0003	0.0142	0.0275	-0.062
2	G	-0.0200	-0.1336	-0.0552	0.1168	0.0061	0.0072	0.0249	-0.0057	-0.0008	0.0027	-0.0521	-0.0081	0.0065	0.0001	0.0168	0.1031	0.009
	P	-0.1003	0.0281	-0.0459	0.1008	0.0067	-0.0237	0.0324	0.0293	-0.0009	0.0008	-0.0264	-0.0027	0.0058	0.0000	0.0201	0.0428	0.067
3	G	-0.0035	0.0346	0.2132	-0.0140	-0.0094	-0.0027	-0.0564	0.0113	-0.0078	0.0018	-0.0648	0.0262	0.0322	-0.0006	0.0194	-0.2577	-0.078
	P	-0.0196	-0.0073	0.1764	-0.0085	-0.0107	0.0081	-0.0633	-0.0537	-0.0043	0.0004	-0.0347	0.0107	0.0171	0.0000	0.0195	-0.1164	-0.086
4	G	0.0108	0.0495	0.0095	-0.3155	0.0068	-0.0047	0.0358	-0.0002	-0.0013	-0.0014	0.0586	-0.0137	-0.0126	0.0012	-0.0150	-0.0120	-0.204**
	P	0.0584	-0.0098	0.0052	-0.2892	0.0066	0.0146	0.0341	-0.0051	-0.0007	-0.0002	0.0320	-0.0053	-0.0087	-0.0001	-0.0130	0.0030	-0.178**
5	G	-0.0029	-0.0222	-0.0547	-0.0583	0.0367	-0.0005	0.0404	-0.0118	-0.0024	-0.0016	0.0766	-0.0015	-0.0863	0.0046	-0.0096	0.2038	0.110
	P	-0.0102	0.0042	-0.0425	-0.0429	0.0446	-0.0003	0.0439	0.0591	-0.0015	-0.0003	0.0387	-0.0004	-0.0463	-0.0005	-0.0103	0.0769	0.112
6	G	0.0068	0.0557	0.0330	-0.0846	0.0010	-0.0174	0.0641	-0.0017	0.0036	0.0039	-0.0186	-0.0122	0.0303	0.0015	0.0008	0.1234	0.190**
	P	0.0314	-0.0118	0.0252	-0.0742	-0.0002	0.0568	0.0544	0.0075	0.0022	0.0010	-0.0102	-0.0055	0.0149	-0.0002	-0.0020	0.0554	0.145*
7	G	-0.0029	-0.0170	-0.0615	-0.0577	0.0076	-0.0057	0.1956	-0.0142	0.0051	0.0033	0.0057	-0.0632	0.0229	0.0020	-0.0015	0.4167	0.435**
	P	-0.0110	0.0041	-0.0507	-0.0448	0.0089	0.0140	0.2204	0.0591	0.0024	0.0009	0.0031	-0.0234	0.0155	-0.0002	-0.0030	0.1647	0.360**
8	G	-0.0018	-0.0177	-0.0564	-0.0018	0.0101	-0.0007	0.0650	-0.0428	-0.0020	-0.0022	-0.0065	-0.0041	-0.0136	0.0005	0.0222	0.6695	0.618**
	P	-0.0076	0.0036	-0.0412	0.0064	0.0115	0.0018	0.0566	0.2300	-0.0014	-0.0008	-0.0026	-0.0013	-0.0056	-0.0002	0.0213	0.2692	0.540**
9	G	0.0017	0.0042	-0.0650	0.0164	-0.0034	-0.0025	0.0391	0.0033	0.0256	0.0033	-0.0608	-0.0924	0.1456	-0.0004	-0.0076	0.0717	0.079
	P	0.0064	-0.0016	-0.0474	0.0133	-0.0043	0.0079	0.0329	-0.0204	0.0159	0.0007	-0.0329	-0.0356	0.0785	0.0000	-0.0074	0.0305	0.036
10	G	-0.0032	-0.0137	0.0148	0.0174	-0.0023	-0.0026	0.0251	0.0036	0.0032	0.0260	-0.1075	-0.0089	0.0817	0.0020	0.0209	-0.0459	0.010
	P	-0.0111	0.0028	0.0083	0.0060	-0.0018	0.0067	0.0246	-0.0235	0.0014	0.0081	-0.0536	-0.0032	0.0399	-0.0002	0.0218	-0.0084	0.018
11	G	-0.0094	-0.0152	0.0302	0.0404	-0.0061	-0.0007	-0.0024	-0.0006	0.0034	0.0061	-0.4582	0.0304	0.2958	-0.0032	0.0169	0.0326	-0.040
	P	-0.0505	0.0029	0.0241	0.0365	-0.0068	0.0023	-0.0027	0.0024	0.0021	0.0017	-0.2536	0.0122	0.1679	0.0005	0.0169	0.0114	-0.033
12	G	-0.0020	-0.0063	-0.0326	-0.0252	0.0003	-0.0012	0.0719	-0.0010	0.0137	0.0013	0.0810	-0.1718	0.0965	0.0006	0.0076	0.1138	0.147*
	P	-0.0129	0.0011	-0.0273	-0.0219	0.0003	0.0045	0.0743	0.0043	0.0082	0.0004	0.0448	-0.0693	0.0543	-0.0001	0.0067	0.0525	0.120
13	G	-0.0053	-0.0025	0.0194	0.0112	-0.0090	-0.0015	0.0126	0.0017	0.0105	0.0060	-0.3826	-0.0468	0.3543	-0.0037	0.0089	0.0310	0.004
	P	-0.0277	0.0008	0.0149	0.0124	-0.0102	0.0042	0.0169	-0.0063	0.0061	0.0016	-0.2099	-0.0186	0.2028	0.0005	0.0088	0.0114	0.008
14	G	-0.0048	-0.0005	-0.0089	-0.0286	0.0127	-0.0020	0.0288	-0.0015	-0.0008	0.0038	0.1098	-0.0079	-0.0968	0.0134	-0.0319	0.0845	0.069
	P	-0.0300	0.0001	0.0023	-0.0180	0.0107	0.0052	0.0151	0.0167	0.0000	0.0006	0.0559	-0.0022	-0.0483	-0.0022	-0.0298	0.0384	0.014
15	G	-0.0047	-0.0184	0.0340	0.0389	-0.0029	-0.0001	-0.0025	-0.0078	-0.0016	0.0045	-0.0637	-0.0107	0.0260	-0.0035	0.1216	0.1128	0.222**
	P	-0.0215	0.0044	0.0267	0.0291	-0.0036	-0.0009	-0.0051	0.0381	-0.0009	0.0014	-0.0334	-0.0036	0.0138	0.0005	0.1287	0.0465	0.220**
16	G	-0.0012	-0.0177	-0.0705	0.0049	0.0096	-0.0028	0.1046	-0.0368	0.0024	-0.0015	-0.0192	-0.0251	0.0141	0.0015	0.0176	0.7791	0.759**
	P	-0.0144	0.0032	-0.0551	-0.0024	0.0092	0.0085	0.0975	0.1663	0.0013	-0.0002	-0.0078	-0.0098	0.0062	-0.0002	0.0161	0.3723	0.591**

TSS (0.0134). Indirect effects were negative for reducing sugar (-0.4582), number of primary branches per plant (-0.3155), non-reducing sugar (-0.1718), days to first fruit harvesting (-0.1336), number of fruits per plant (-0.0428), days to 50% flowering (-0.0343), and number of fruits per cluster (-0.0174). Plant height showed the maximum negative indirect effect [24,25]. Although non-reducing sugar had the highest negative direct effect on the number of primary branches per plant, it demonstrated a high positive indirect effect via total fruit yield per plant (-0.759), leading to a positive correlation with yield. These findings are consistent with studies by Yadav et al. [6], Aliyu et al. (2007), Awale et al. [26] and Bhatt et al. [27], Shalini Singh et al. [28] M Nikitha et al. [29].

4. CONCLUSION

Based on the comprehensive analysis of genotypic and phenotypic path coefficient studies conducted over the years 2022 and 2023, several key factors consistently emerged as significant contributors to tomato yield and quality. Factors such as total fruit yield per plant, plant height, average fruit weight, total sugar content, and ascorbic acid content demonstrated substantial positive direct effects on yield. Indirect effects through parameters like days to flowering, sugar content variations, and plant morphology further underscored their influence on yield components. Despite variations in specific effects across years and studies, these findings collectively highlight the complex interplay of traits influencing tomato productivity. These insights are crucial for refining breeding strategies aimed at enhancing tomato yield and nutritional quality under diverse environmental conditions.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Khalequzzaman M, Chakrabarty T, Islam MZ, Rashid ESMH, Prince MFRK, Siddique MA. Assessment of Mean Performance, Variability, Traits Association and Path Coefficient in Transplanted Aman Rice (*Oryza sativa* L.) Landraces. Asian Journal of Biology. 2022;16(4):27-39.
Available:https://doi.org/10.9734/ajob/2022/v16i4308
2. Mishra, Sumit Kumar, Supriya Supal Surin, Nutan Verma, Piyush Kumar Bhargaw, Manisha Kumari, and Deepak Kumar Mishra. Studies on Genetic Variability, Correlation and Path Coefficient Analysis for Yield and Yield Contributing Traits in Bread Wheat (*Triticum aestivum* L.). Journal of Experimental Agriculture International. 2024;46(6):389-97.
Available:https://doi.org/10.9734/jeai/2024/v46i62490
3. Khan MM, Rafii MY, Ramlee SI, Jusoh M, Al Mamun M. Path-coefficient and correlation analysis in Bambara groundnut (*Vigna subterranea* [L.] Verdc.) accessions over environments. Scientific Reports. 2022;12(1):245.
4. Thangamani C, Jansirani P. Correlation and path coefficient analysis studies on the yield and attributing characters in brinjal (*Solanum melongena* L.). Elect. J of Plant Brd. 2012;3(3):939-944.
5. Tripathy B, Sharma D, Singh J, Kumar SN. Correlation and path analysis studies of yield and yield components in brinjal (*Solanum melongena* L.). International Journal of Pure Applied Bioscience. 2018; 6(1):1266-1270.
6. Yadav JR, Singh SP, Mishra G, Yadav JK. Path coefficient analysis in garlic (*Allium sativum* L.). Progressive Agriculture. 2007; 7(1and2):185-6.
7. Shinde KG, Birajdar UM, Bhalekar MN, Patil BT. Correlation and path analysis in eggplant (*Solanum melongena* L.). Vegetable Science. 2012;39(1):108-10.
8. Ronanki D, K mallikarjunarao, Barsha T and Praveen K. Correlation and Path coefficient analysis in brinjal (*Solanum melongena* L.). International Journal of Chemical Studies. 2021;9(1):936-941.
9. Singh RK, Dubey BK, Bhonde SR, Gupta RP. Correlation and path coefficient studies in garlic (*Allium sativum* L.). Journal of Spices and Aromatic Crops. 2012;20(2).
10. Singh RK, Dubey BK, Gupta RP. Intra and inter cluster studies for quantitative traits in garlic *(Allium sativum* L). SAARC Journal of Agriculture. 2013;11(2):61-67.

11. Tsega, K, Tiwan, A. and Woldetsadik, K. Genetic variability, correlation and path coefficient among bulb yield and yield traits in Ethiopian garlic germplasm, Indian Journal of Horticulture. 2010;67: 489-499.
12. Sakriya SG, Vaddoria MA, Gohil PP, Babreeya KK and Gamit GC. Path analysis studies in brinjal (*Solanum melongena* L.). The Pharma Innovation Journal. 2022;11 (4):953-955.
13. Chotaliya P, Kulkarni GU. Character association and path analysis for quantitative traits in garlic (*Allium sativum* L.). International Journal of Current Microbiology and Applied Sciences. 2017;6 (8):175-84.
14. Gebremichael Y. Pearson correlation analysis of marketable bulb yield with growth, yield components and storage parameters of onion. Basic Research Journal of Agricultural Science and Review. 2019;7(7):58-62.
15. Kassahun Tsega KT, Akhilesh Tiwari AT, Kebede Woldetsadik KW. Genetic variability, correlation and path coefficient among bulb yield and yield traits in Ethiopian garlic germplasm. Indian Journal of Horticulture. 2010;67(4):489-499.
16. Gazala Nazir, Khursheed Hussain, Syed Berjes Zehra, U. H. Masoodi, Saima Tabassum. A Study on correlation and path coefficient analysis of Brinjal (*Solanum melongena* L.) for Yield and Yield Contributing Traits. International Journal of Plant & Soil Science. 2022;34(21):763-768.
17. Bal S, Maity TK, Maji A. Assessment of Genetic Variability, Heritability and Genetic Gain for Yield and Quality Traits in Onion (*Allium cepa* L.). International Journal of Bio-resource and Stress Management. 2022;13(7):674-82.
18. Bhatt B, Soni AK, Jangid K, Kumar S. A study on genetic variability, character association and path coefficient analysis in promising indigenous genotypes of garlic (*Allium sativum* L.). International Journal of Pure Applied Bioscience. 2017;5(1):679-86.
19. Dewangan SR, Sahu GD. Genetic variability, correlation and path coefficient analysis of different *Kharif* onion genotypes in Chhattisgarh plains. Indian Horticulture Journal. 2012; 2(1and2):9-12.
20. Lu XinJuan LX, Yang Feng YF, Fan JiDe FJ. Correlation and path analysis on main agronomic characters of garlic (*Allium sativum*). Acta Agriculturae Jiangxi. 2012; 24(3):30-32.
21. Prajapati SK, Akilesh Tiwari AT, Sunil Prajapati SP, Yogendra Singh YS, Verma NR. Character association and path co-efficient analysis in garlic (*Allium sativum* L.). Hortiora Research Spectrum. 2016;5: 183-188.
22. Sharma VR, Komolafe O, Malik S, Mukesh K, Sirohi A. Character association and path analysis in garlic (*Allium sativum* L.). The Bioscan. 2016;11(3):1931-5.
23. Konyak WL, Kanaujia SP, Jha A, Chaturvedi HP, Ananda A. Genetic Variability, Correlation and path coefficient analysis of Brinjal (*Solanum melongena* L.). SAARC J. Agric. 2020;18 (1):13-21.
24. Solanki P, Jain PK, Prajapati S, Raghuwanshi N, Khandait RN, Patel S. Genetic analysis and character association in different genotypes of onion (*Allium cepa* L.). International Journal of Agriculture, Environment and Biotechnology. 2015;8(4):783-93.
25. Srivastav G, Vikram B, Prasad VM. Studies on multiple correlation between bulb yield, growth and yield attributes in different genotypes of onion (*Allium cepa* L.) under Allahabad agro-climactic condition. Journal of Pharmacognosy and Phytochemistry. 2017;6(6):793-8.
26. Awale D, Sentayehu A, Getachew T. Genetic variability and association of bulb yield and related traits in shallot (*Allium cepa* var. *aggregatum* Don.) in Ethiopia. International Journal of Agricultural Research. 2011;6(7):517-36.
27. Bhatt B, Soni AK, Jangid K, Kumar S. A study on genetic variability, character association and path coefficient analysis in promising indigenous genotypes of garlic (*Allium sativum* L.). International Journal of Pure Applied Bioscience. 2017;5(1):679-86.
28. Shalini Singh H. Dev Sharma RK. Dogra, Shilpa, Aditika, Vivak Ujjwal. Correlation and Path Coefficient Analysis for Yield and Yield Contributing Traits in Brinjal (*Solanum melongena* L.). Int. J. Curr. Microbiol. App. Sci. 2020;Special Issue-11:1770-1777.

29. M Nikitha, B Neeraja Prabhakar, M Padma, Bharati N Bhat, Sivaraj N. Correlation and path coefficient analysis of yield and yield attributed characters in Brinjal (*Solanum melongena* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9(5):1997-2002.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/118686