

Cause And Effect Relationship For Yield And Shelf Life Attributes In Exotic Lines Of Tomato (*Solanum Lycopersicum* L.)

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Abstract: Cause and effect relationship studies were carried out in 59 tomato genotypes for fourteen yield attributes and four shelf life attributes. Cause and effect relationship analysis for fruit yield per plant revealed that the characters number of primary branches per plant and number of flowers per cluster had high positive direct effect on fruit yield per plant. Cause and effect relationship analysis for shelf-life had revealed that total soluble solids (TSS) had high positive direct effect on shelf-life. Hence, direct selection based on the characters number of primary branches per plant and number of flowers per cluster will be rewarding for improving fruit yield per plant. For improving shelf life in these genotypes direct selection based on high TSS will be rewarding.

Key words: Cause and effect relationship, Genotypes, Yield, Shelf-life, TSS, Direct effect

I. Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most popular and widely grown vegetable crop of commerce in the world ranking second in importance to potato but tops the list of processed vegetables (Chaudhary, 1996). The consumption of tomato products has been associated with a lower risk of developing digestive tract and prostate cancers (Giovanucci, 1999) due to the ability of lycopene and other antioxidant compounds to prevent cell damage. So, it is necessary to evolve varieties with high productivity and processing qualities. Cause and effect relationship analysis facilitates the partitioning of correlation coefficients into direct and indirect effects on yield and other attributes. Hence, an attempt has been made in the present investigation to study the direct and indirect effects of characters based on *per se* performance.

II. Materials And Methods

A net of 59 genotypes comprising of 56 exotic collections of tomato augmented from the National Bureau of Plant Genetic Resources Regional Station, Hyderabad along with three check varieties (Arka Vikas, Marutham and Punjab Chhauhara) were utilized for the present study. The germplasm lines were evaluated in an augmented block design with eight blocks and three checks during *rabi*, 2011-12 at the National Bureau of Plant Genetic Resources, Regional Station, Hyderabad. In each block, seven germplasm lines and three checks were grown. Row-to-row spacing of 60 cm and plant-to-plant spacing of 50 cm was maintained. A plant density of eight plants per row and genotype was maintained. The mean replicated data on various biometric traits were subjected to analysis of variance of augmented block design as per the standard statistical procedure (Federer, 1956). The Cause and effect relationship analysis among yield and quantitative attributes, shelf life and qualitative attributes were calculated using windostat program.

III. Results And Discussion

Path analysis or Cause and effect relationship is a simple standardized partial regression coefficient which splits the correlation coefficient into the measures of direct and indirect effects. In other words, it measures the direct and indirect contribution of various independent characters on a dependent character. As such, it measures the direct influence of one variable on other, such information would be of great value in enabling the breeder to specifically identify the important component traits of yield and utilize the genetic stock for improvement in a planned way.

Cause and effect relationship analysis for fruit yield per plant (Table 1) revealed that the characters number of primary branches per plant and number of flowers per cluster had high positive direct effect on fruit yield per plant. Hence, direct selection based on these traits will be rewarding for crop yield improvement. The characters plant height, number of clusters per plant, days to first fruit set, fruit width and fruit weight had low positive direct effect on fruit yield per plant. Hence, direct selection is not effective. The trait number of fruits per cluster had low negative direct effect on fruit yield per plant indicating the selection of genotype with less number of fruits per cluster for low improvement in fruit yield per plant. These results are in accordance with findings of Asati *et al.* (2008) for plant height, Mohanty (2002) and Mayavel *et al.* (2005) for number of

primary branches per plant per plant, Joshi *et al.* (2004) and Kumar and Thakur (2007) for fruit width, Asati *et al.* (2008) and Indurani *et al.* (2008) for fruit weight.

Moderate positive indirect effects on fruit yield per plant were exhibited by plant height via number of primary branches per plant. Low negative indirect effects on fruit yield per plant were exhibited by number of flowers per cluster via number of primary branches per plant, by days to 50 per cent flowering via days to first fruit set, by days to last fruit harvest via number of primary branches per plant, by number of fruits per cluster via number of flowers per cluster, by fruit length via number of primary branches per plant and fruit width, by fruit width via number of primary branches per plant. This suggested that indirect selection based on these traits will be less effective in yield improvement. Similar results were also reported Singh (2005) and Singh (2009) for these traits. Cause and effect relationship analysis for shelf life (Table 2) revealed that the direct effects of TSS on shelf life are positively high and the correlations are significant, selection based on these trait is effective for shelf life.

IV. Conclusion

The Cause and effect relationship analysis revealed that number of primary branches per plant and number of flowers per cluster were the most important yield contributing traits followed by fruit width and plant height. TSS is the important trait contributing for increasing shelf life. The results were in accordance with Mohanty (2002) and Mayavel *et al.* (2005).

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Table 1: Direct and indirect effects of component characters on fruit yield (kg/plant) in 59 genotypes of tomato

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
I	0.1103	0.0881	0.0138	0.0142	0.0438	0.0082	0.0015	0.0268	0.0099	0.0194	0.0512	0.033	0.0249	0.6507**
II	0.2756	0.3451	0.0251	0.0892	0.129	0.0205	0.0284	0.1176	0.0153	0.0892	0.1784	0.1212	0.069	0.7284**
III	0.0024	0.0014	0.0192	-0.003	0.001	0.0168	0.0085	0.0026	0.0023	0.0025	0.0017	0.0001	0.0009	0.2149
IV	0.0245	0.0492	0.0298	0.1903	0.0503	0.0265	0.0744	0.0894	0.0621	0.0546	0.0124	0.062	0.0371	0.3278
V	0.1191	0.1122	0.0152	0.0793	0.3002	0.0204	0.0219	0.0038	0.1555	0.0586	0.0604	0.0494	-0.135	0.4944*
VI	0.0112	0.0089	0.1308	-0.020	0.0101	0.1494	0.0599	0.0173	0.0145	0.0285	0.0029	-0.008	0.0277	0.1925
VII	0.0009	0.0053	0.0287	0.0253	0.0047	0.0259	0.0646	0.0127	0.0045	0.0026	0.0043	0.0177	0.0071	-0.0008
VIII	0.0105	0.0148	0.0059	0.0204	0.0006	0.005	0.0085	0.0434	0.0014	0.003	0.0044	0.0095	0.0031	0.2996
IX	0.0137	0.0067	0.0184	0.0498	-0.079	0.0148	0.0106	0.005	0.1525	0.0117	0.0068	0.0079	0.0233	0.0486
X	0.004	0.0059	0.003	0.0065	0.0044	0.0043	0.0009	0.0015	0.0017	0.0227	0.0034	0.0042	-0.009	0.2414
XI	0.0238	0.0265	0.0044	0.0033	0.0103	0.001	0.0034	0.0052	0.0023	0.0077	0.0513	0.0388	0.0209	0.5421*
XII	0.0491	0.0577	0.0007	0.0535	0.0271	0.0088	-0.045	0.0361	0.0085	0.0305	0.1244	0.1643	0.0531	0.5143*
XIII	0.0348	0.0308	0.0073	-0.03	0.0069	0.0285	0.0169	0.0112	0.0235	-0.061	0.0628	0.0494	0.154	0.2672

Note: I- Plant height (cm); II-Number of primary branches per plant; III-Days to 50% flowering; IV-Number of clusters per plant; V- Number of flowers per cluster; VI- Days to first fruit set; VII-Days to first fruit harvest; VIII- Days to last fruit harvest; IX- Number of fruits per cluster; X-Number of fruits per plant; XI-Fruit length (cm); XII-Fruit width (cm); XIII-Fruit weight (g).

Table 2: Direct and indirect effects of component characters on shelf life in 59 genotypes of tomato

Character	Ascorbic acid (mg/100 g)	Acidity (%)	TSS (^o Brix)	Correlation values for shelf life (days)
Ascorbic acid (mg/100 g)	-0.2720	-0.0830	0.1310	-0.5950
Acidity (%)	-0.0920	-0.3010	0.0390	-0.4470
TSS (^o Brix)	-0.2320	-0.0630	0.4830*	0.6520*

Residual effect = 0.6236; Underlined diagonal values indicate direct effects
Above and below diagonal are indirect effects

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