

CORRELATION AND PATH COEFFICIENT FOR YIELD COMPONENTS AND QUALITY TRAITS IN TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)

C. Indu Rani, I. Muthuvel, and D. Veeraragavathatham.

Horticultural College and Research Institute,
Tamil Nadu Agricultural University, Coimbatore - 641 003, India

ABSTRACT

Correlation studies conducted in 23 hybrids of tomato (*Lycopersicon esculentum* Mill.) revealed that fruit weight, pericarp thickness, acidity, ascorbic acid and lycopene were positively and significantly associated with yield per plant, while number of fruits per plant was associated negatively. On the other hand, path analysis studies exhibited that fruit weight had the highest positive direct effect on yield per plant, while, fruit weight was also having high positive indirect effect on yield per plant. Therefore, these characters could be reliably looked for, while selecting a high yielding genotype.

Key words: Correlation coefficients, Direct and indirect effects, Path analysis.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the most economically important vegetables in Asia. It tops the list of industrial crops because of its outstanding processing qualities. Tomatoes are mainly used as a food ingredient. The fruits are consumed raw, cooked or processed as juice, ketchup, sauce, paste, puree etc. It is a good source of Vitamin C, Vitamin A and Vitamin B. The consumption of tomato products has been associated with a lower risk of developing digestive tract and prostate cancers (Giovannucci *et al.*, 2002) due to the ability of lycopene and other antioxidant components to prevent cell damage. The future of processing tomato in India is bright due to the rapidly increasing domestic consumption and export potential. This has made it necessary to evolve varieties with high productivity and processing qualities.

Association of characters would help in minimizing the pressure of time on breeders, by providing correct information on the characters, which have to be considered for formulating a selection index. Path coefficient analysis provides an effective means of partitioning direct or indirect causes of association. Correlation measures only the mutual association between two variables, whereas

path coefficient analysis specifically measures the relative importance of different yield components.

In any crop improvement programme, knowledge on the association of characters is of significant importance since it contributes indirectly to the success of selection. Yield is a complex entity associated with number of component characters. It is the prime concern of the plant breeder and final factor on which selection programmes are to be envisaged. According to Graffius (1964) all changes in yield must be accompanied by changes in one or more characters. All changes in the components need not, however, be expressed by changes in yield. This is due to varying degrees of positive and negative correlations between yield and its components and among components themselves. A study of association of these characters helps in selection of genotypes and also suggests the advantage of a selection scheme for more than one character at a time, which could be explained that improvement of one character results in the simultaneous improvement of all positively related characters (Kalloo, 1988).

The aim of the present study was to find out the association of characters between yield components and quality traits and path coefficient

* **Corresponding Author:** Dept. of Food and Agrl. Process Engineering, AEC & RI, TNAU, Coimbatore 641 003, India. Email: indunathan@gmail.com

analysis of yield attributes on yield in resistant F₁ tomato hybrids.

MATERIAL AND METHODS

The present study was carried out at the College Orchard, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. Twenty three (23) hybrids along with 11 parents were raised in the field in a completely randomized design with two replications during the year 2001. A total number of 20 plants in each cross and parents were maintained in each replication. Observations were recorded on plants in each genotype/line and in each replication for plant height, number of fruits/plant, fruit weight, pericarp thickness, TSS, acidity, ascorbic acid, lycopene and yield per plant.

The correlations of coefficients among yield and quality attributes were calculated as suggested by Panse and Sukhatme (1957). Path coefficient analysis was carried out according to Dewey and Lu (1959) by partitioning the genotypic correlation coefficients into direct and indirect effects.

RESULTS AND DISCUSSION

The correlation co-efficient between yield and yield components were shown in Table 1.

Correlation coefficients between yield components and quality traits :

Plant height showed significant positive association with number of fruits per plant (0.518) and TSS (0.475). Similar results were also reported by Aruna, (1992) and Premalakshmi, (2001) The number of fruits per plant was negatively and significantly correlated with fruit weight (-0.677) and acidity (-0.423) and yield per plant (-0.289), while it was positively and significantly associated with TSS (0.352). This was in accordance with the findings of Jawaharlal (1994) and Premalakshmi (2001).

Positive and significant association of fruit weight with yield per plant (0.835) was observed among the genotypes studied. The significant reduction in number of fruits and better leaf area would have resulted in the better sink by the individual fruit for the photo assimilates which would increase the fruit weight resulting in increased yield. Fruit weight also showed positive and significant association with pericarp thickness (0.399), acidity

(0.646), ascorbic acid (0.455) and lycopene content (0.378).

Pericarp thickness showed significant and positive association with yield (0.446). The same was reported by Jawaharlal (1994). This trait also showed positive and significant association with TSS (0.351), acidity (0.401), ascorbic acid (0.341) and lycopene content (0.364).

The TSS did not have a significant association with yield as well as fruit weight. Sankari (2000) also reported a non-significant association of TSS with yield and fruit weight. This would help the breeder to evolve good F₁ hybrids with better yield as well as TSS. The TSS had strong positive and significant inter-association with ascorbic acid (0.342) and lycopene (0.224) which was also reported by Aruna (1992), Jawaharlal (1994) and Indu Nair (1995).

Acidity was positively and highly significantly associated with ascorbic acid (0.492), lycopene (0.393) and yield per plant (0.612).

Ascorbic acid and lycopene showed positive and significant association with yield per plant (0.501 and 0.524 respectively). This has been earlier reported by Jawaharlal (1994) and Indu Nair (1995). Besides favourable association of characters with yield, an inter relation of characters would simplify selection schemes. Doku (1970) suggested that intercorrelations among the yield components should be estimated because the rate of improvement of one component does not hinder the improvement of other components.

Therefore, the present study suggests that fruit weight, pericarp thickness, acidity, ascorbic acid and lycopene content should be considered together as primary yield determining traits in tomato.

Path coefficients of component traits on yield

Among the traits subjected to path analysis, fruit weight exerted very high direct effect upon yield per plant (Table 2). The direct effect of number of fruits per plant was also appreciably high (1.198) towards yield per plant and it was followed by number of fruits per plant (0.682). The results were similar to that of Hazarika and Das (1998) and Sankari (2000).

The direct effects of number of fruits per plant (0.682) and acidity (0.113) were also positive upon

Table 1: Genotypic (G) and phenotypic (P) correlation between yield and yield components

Character	Plant height	Fruits/plant	Fruit weight	Pericarp thickness	TSS	Acidity	Ascorbic acid	Lycopene	Yield / plant
Plant height	G	1.000	0.518**	0.077	0.475**	-0.041	0.103	0.171	0.026
	P	1.000	0.517**	0.076	0.456**	-0.039	0.092	0.170	0.025
Fruits/plant	G	1.000	-0.677**	-0.089	0.352**	-0.423**	-0.061	0.003	-0.289**
	P	1.000	-0.666**	-0.088	0.336**	-0.418**	-0.052	0.003	-0.281**
Fruit weight	G	1.000	1.000	0.399**	0.090	0.646**	0.455**	0.378**	0.835**
	P	1.000	1.000	0.385**	0.083	0.630**	0.385**	0.370**	0.838**
Pericarp thickness	G	1.000	1.000	1.000	0.351**	0.401**	0.341**	0.364**	0.446**
	P	1.000	1.000	1.000	0.329**	0.391**	0.286**	0.360**	0.430**
TSS	G	1.000	1.000	1.000	1.000	0.105	0.342**	0.224*	0.176
	P	1.000	1.000	1.000	1.000	0.095	0.296**	0.216*	0.163
Acidity	G	1.000	1.000	1.000	1.000	1.000	0.492**	0.393**	0.612**
	P	1.000	1.000	1.000	1.000	1.000	0.434**	0.389**	0.597**
Ascorbic acid	G	1.000	1.000	1.000	1.000	1.000	1.000	0.373**	0.501**
	P	1.000	1.000	1.000	1.000	1.000	1.000	0.331**	0.426**
Lycopene	G	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.524**
	P	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.512**
Yield / plant	G	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	P	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

* Significant at 5 per cent level

** Significant at 1 per cent level

Table 2: Direct and indirect effects of different traits on yield per plant

Character	Plant height	Fruits/plant	Fruit weight	Pericarp thickness	TSS	Acidity	Ascorbic acid	Lycopene	Genotypic Correlation Coefficient with yield/plant
Plant height	-0.126	0.354	-0.144	0.002	-0.065	-0.005	-0.003	0.014	0.026
Number of fruits/plant	-0.065	0.682	-0.811	-0.002	-0.049	-0.048	0.002	0.001	-0.289**
Fruit weight	0.015	-0.463	1.198	0.009	-0.012	0.072	-0.016	0.031	0.835**
Pericarp thickness	-0.009	-0.061	0.478	0.024	-0.048	0.045	-0.013	0.030	0.446**
TSS	-0.060	0.241	0.107	0.009	-0.137	0.011	-0.012	0.019	0.176
Acidity	0.005	-0.288	0.773	0.010	-0.014	0.113	-0.018	0.033	0.612**
Ascorbic acid	-0.012	-0.041	0.545	0.008	-0.047	0.056	-0.037	0.030	0.501**
Lycopene	-0.021	0.002	0.452	0.009	-0.030	0.044	-0.014	0.082	0.524**

* Significant at 5 per cent level

** Significant at 1 per cent level

Residual effect = 0.346

yield per plant which was also reported by Premalakshmi (2001). These characters could be reliably looked for, while selecting a high yielding genotype. Acidity showed positive and significant association with ascorbic acid and lycopene. Supporting evidence could be obtained from the results of Jawaharlal (1994) and Indu Nair (1995).

Acidity exerted low positive direct effect (0.113) on yield. TSS and plant height exerted very high and negative direct effects on yield per plant. It influenced the yield indirectly and positive through

fruit weight, acidity and lycopene content. The residual effect was 0.346 in the present path analysis suggesting that the number of characters considered for path analysis were appropriate and still a number of characters have not been considered in the present study. This finding strongly confirms the reliability of the characters viz., fruit weight and number of fruits per plant directly and indirectly via pericarp thickness, acidity, ascorbic acid and lycopene content in selecting a superior type for yield per plant.

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