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Estimation of Correlation and Path coefficient analysis for yield and its component traits in tomato

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Abstract

An experiment was conducted at agriculture research farm, C.C.R. (PG) College Muzaffarnagar, U.P. to study the path and correlation which are very important association among yield and related component traits. Days to first flowering have significant genotypic and phenotypic correlation with number of primary branch (0.214, 0.189) and plant height (cm) (0.190, 0.150). Similarly, Days to first flowering, number of primary branches and number of fruits/plant show affirmative effect on fruit yield at genotypic and phenotypic levels. Further fruit yield can be improved by making the selection of desirable traits in important progenies of further crop improvement programmes.

Keyword: Tomato, Genotypic Correlation, Phenotypic Correlation and Path Analysis

INTRODUCTION:

Tomato (*Lycopersicon esculantum* Mill.) is a member of the family solanaceae and considered avaluable vegetable crop worldwide (He *et al*., 2003). Vegetables are important part of our diet as provides energy and are also is a rich source of minerals (Iron and phosphorus), vitamins (Vitamin A and C), organic acid, essential amino acids, dietary fibres, etc. Further tomato of fruit provides total sugar (3-4%), total solids (4-7%), ascorbic acid (15-30 mg/100g), Titratable acidity (7.5-10 mg/100ml) and fruit weight of lycopene (20-50mg/100g). Tomato and its products lower risk of developing digestive tract and prostate ford (Giovannucci *et al.,* 2002).

Path analysis and Correlation coefficient are key determinants to objective the association between the yield and related components. For the plant breeders positively correlated with the yield are important for selecting desirable genotype (Feyzian *et al.*2009). All the changes in the components need not, however be expressed by changes in the yield. This may be due to degrees of correlations (positive and negative) among yield and its other components or own among the components themselves. In the present study correlation coefficients and path analysis relevance of direct and indirect association of all characters with the final yield and its components have been studied.

Material and Methods:

The study was conducted during year 2020-21 at Agriculture Research Farm, C.C.R. (PG) College Muzaffarnagar, U.P. The material for the present study comprised of ten parents of tomato, namely EC-620406, EC-163605, EC-165700, EC-631364, EC-164563, EC-521067, EC-528360, EC-145057, Floradade, and Arka Meghali and forty five hybrids were produced through half diallel mating in Randomized Block Design with three replications. All the recommended package of practices was adopted for raising a healthy crop. Five plants were randomly selected from each treatment for observations. Analysis of covariance for all combinations was for to study correlations. Phenotypic/genotypic correlations were calculated by the formulae recommended by Al-Jibouri *et al*. (1958). Path analysis was calculated as per the procedure outlined by Wright (1921), and Dewey and Lu (1959). Phenotypic and genotypic correlations and path coefficient analysis were analyzed using R software (Version 4.1.1). Using Lavaan Package (Rosseel, 2012).

Result and Discussion:

In the present investigation the results revealed Table 1 and 2 that the a significant and positive correlation of days to first flowering at genotypic level was observed with days to 50% flowering (0.951), no. of primary branches/plant (0.215), plant height (0.191) and no. of fruits/cluster (0.178). Days to 50% flowering exhibited significant positive genotypic correlation with no. of primary branches/plant (0.297), number of fruits/cluster (0.267), total yield/plant (0.195), no. of secondary branches/plant (0.174). No of primary branches per plant at genotypic level was observed with no secondary branches (0.533), fruit diameter (0.436), days to 50% flowering (0.297) and days to first flowering (0.215). Plant height at genotypic level was observed with no. of secondary branches per plant, days to first

flowering, days to 50% flowering and pericarp thickness with values of 0.223, o.159, 0.191, and 0.155, respectively. Average fruit weight at genotypic level was observed with total yield per plant (0.574), TSS (0.565), pericarp thickness (0.533), fruit diameter (0.513) and fruit length (0.482). Pericarp thickness at genotypic level was observed with fruit length (0.657), average fruit weight (0.533), TSS (0.451), fruit diameter (0.209), T.A (0.197) and plant height (0.156). Ascorbic acid at genotypic level was observed with days to 50% fruiting (0.293) and no. of fruits per cluster (0.151). Total yield per plant at genotypic level was observed with average fruit weight (0.574), no. of fruits per plants (0.462) TSS (0.413), T.A (0.340) and no. of fruits per cluster (0.259). The results are in line with the previous reports (Singh *et al*. 2018, Mishra *et al*. 2019, Kumar *et al*. 2020, Maurya *et al.* 2020 and Akhter *et al.* 2021).

A significant and positive correlation of days to first flowering at phenotypic level was observed with days to 50% flowering (0.849), number of primary branches/plant (0.190), number of fruits/cluster (0.154) and plant height (0.151). Days to 50% flowering exhibited significant positive phenotypic correlation with no. of primary branches/plant (0.194), no. of fruits/cluster (0.169) and days to first flowering (0.849). No. of primary branches/plant reveled significant positive phenotypic correlation with no. of secondary branches/plant (0.489), fruit diameter (mm) (0.305), days to first flowering (0.190), days to 50% flowering (0.194). Fruit diameter showed significant positive genotypic correlation with average fruit weight (0.418), fruit length (0.290), TSS (0.181), total yield/ plant (0.169), titratable acidity (0.168), pericarp thickness (0.165), number of primary branches/ plant (0.305). Average fruit weight showed significant positive phenotypic correlation with total yield/plant (0.553), pericarp thickness (mm) (0.479), TSS (0.473), titratable acidity (0.214), fruit length (mm) (0.463) and fruit diameter (mm) (0.418). Total yield/plant (g) showed significant positive phenotypic correlation with average fruit weight (g) (0.553), no of fruit/plant (0.452), TSS (0.344), plant height (cm) (0.334), titratable acidity (0.328), number of fruits/cluster (0.193) and fruit diameter (0.169). The results are in line with the previous reports (Mishra *et al.* 2019 and Kumar *et al.* 2020).

The path coefficient is considered an important method for estimating the direct or indirect effect cause of inter/intra association. The similarly genotypic path coefficient analysis was also studied in Table 3 and Figure (1 & 2). The direct effect on total yield recorded to be the highest by average fruit weight (1.120) followed by no. of fruit/plant (1.006), days to first flowering (0.902), plant height (0.195), total yield/plant (0.164), fruit diameter (0.118), T.A. (0.095), pericarp thickness (0.074), ascorbic acid (0.054), no. of primary branches (0.045) and fruit length (0.044). While indirect effect at genotypic level days to first flowering had positive (indirect) effect on total yield via average

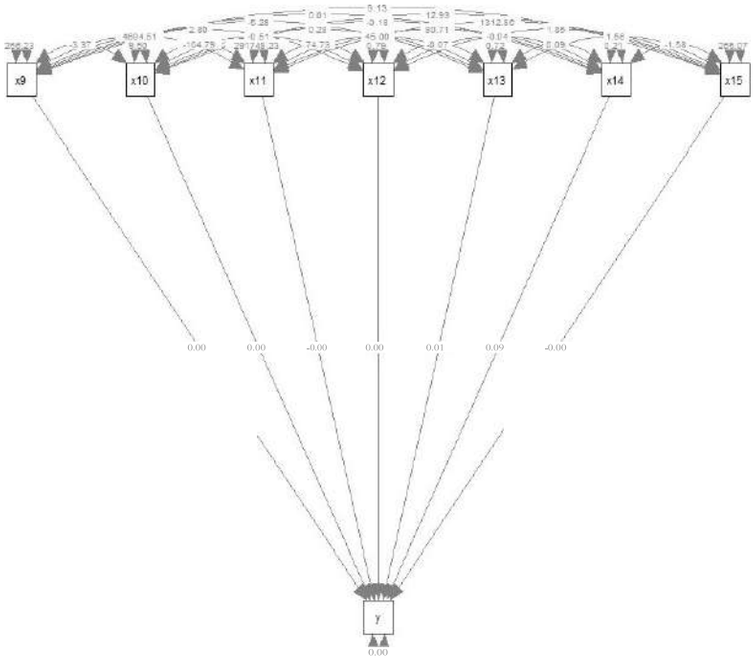
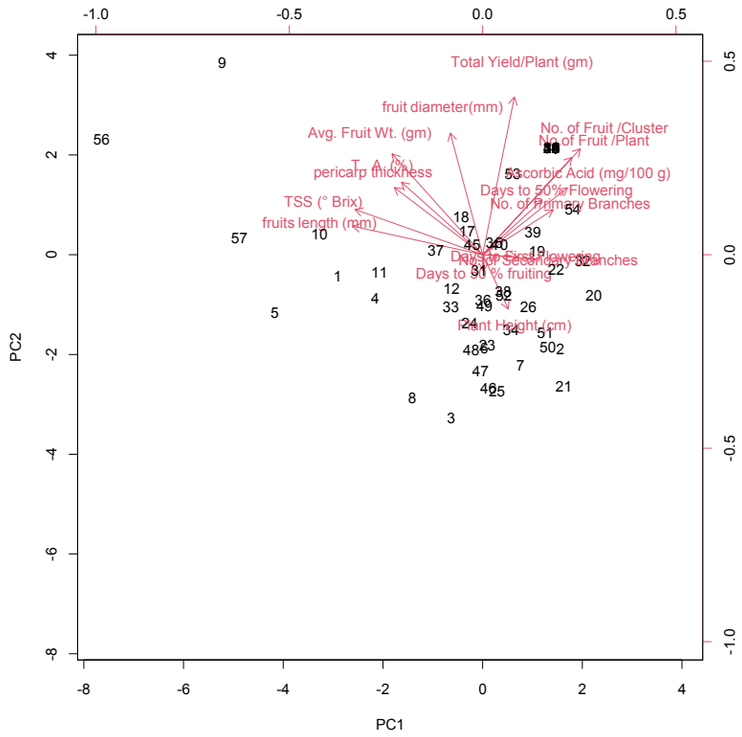


Figure 1. Path coefficient diagram and effect relationships among quantitative traits and total yield.

fruit weight (0.109), no. of fruit/plant (0.090), TSS (0.056), plant height (0.038), days to 50% fruiting(0.017), no. of primary branches (0.010) fruit diameter (0.007). Days to 50% fruiting had positive indirect effect on total yield via days to 50% flowering (0.194), TSS (0.060), plant height (0.023), no. of secondary branches (0.017), ascorbic acid (0.016), pericarp thickness (0.013). No. of secondary branches per plant had indirect effect on total yield via no. of fruit/ plant (0.172), days to first flowering (0.116), days to 50% fruiting (0.058), plant height (0.044), TSS (0.033), no. of primary branches (0.024) and Fruit diameter (0.018). Fruit length had positive indirect effect on fruit yield via average fruit weight (0.539), days to 50% flowering (0.176), pericarp thickness (0.049), fruit diameter (0.041), T.A. (0.032), days to 50% fruiting (0.015), no. of secondary branches (0.009) and fruit/cluster (0.007). Pericarp thickness(mm) had positive (indirect) effect on total yield via average fruit weight (0.597), plant height (0.031), fruit length (0.029), fruit diameter (0.025), T.A. (0.019), no. of primary branches per plant (0.014), ascorbic acid (0.003). Ascorbic acid had positive (indirect) effect on total yield via days to 50% flowering (0.148), TSS (0.132), no. of fruit/plant (0.035), no. of secondary branches per plant (0.006). The finding of these characters is supported by Jogi *et al.* (2018), Namdev and Dongre (2019), Kumar *et al.* (2020) and Singh *et al.* (2021).

Phenotypic path analysis direct and indirect effect on different traits present in table 4. The direct effect on total yield recorded to be highest by average fruit weight (0.800) followed by no. of fruit/plant (0.757), ascorbic acid (0.245), total yield/plant (0.137), TSS (0.085), no. of primary branches (0.054), days to first flowering (0.039), T.A. (0.038), plant height (0.022) and fruit length (0.021).While (indirect) effect at phenotypic level days to first flowering had positive (indirect) effect on total yield via average fruit weight (0.069), number of fruit/plant (0.063) and days to 50% fruiting (0.010). Days to 50% flowering had positive (indirect) effect on total yield via no. of fruit/plant (0.088), average fruit weight (0.073), days to first flowering (0.033), days to 50% fruiting (0.015), no. of primary branches (0.011) and plant height (0.003) show positive (indirect) effect on total yield recorded. Similarly, plant height (cm) also had positive (indirect) effect on total yield via days to first flowering (0.007), no. of fruit/cluster (0.005) and fruit diameter (0.003). Fruit diameter (mm) had positive (indirect) effect on total yield per plant via average fruit weight (0.335), TSS (0.016), no. of primary branches (0.017), days to 50% fruiting (0.009), T.A. (0.007), fruit length (0.006), number of fruit/ cluster (0.003) and first flowering (0.002) show positive (indirect) effect on total yield recorded. Pericarp thickness (mm) show positive (indirect) effect on total yield via average fruit weight

Figure 2: Principal Component Analysis (PCA) Biplot of tomato.



(0.384), TSS (0.028), fruit length (0.013), T.A. (0.010), ascorbic acid (0.008), plant length (0.004) and days to first flowering (0.002) show positive (indirect) effect on total yield recorded. Total Soluble Solid had positive (indirect) effect on total yield recorded by average fruit weight (0.379), titratable acidity (0.024), days to 50% fruiting (0.012), no. of fruits/cluster (0.009), no. of secondary branches (0.005) and days to 50% flowering (0.001) positive (indirect) effect on total yield. Ascorbic acid show positive (indirect) effect on total yield via number of fruit/plant (0.023), no. of secondary branches (0.003), days to 50% flowering (0.002). Titratable acidity show positive (indirect) effect on total yield via no. of fruit/plant (0.173), average fruit weight (0.170), TSS (0.052), days to 50% fruiting (0.009), fruit length (0.007), no. of secondary branches (0.002), no. of fruit/cluster (0.001) and days to 50% flowering (0.001), which fall in line with same previous results (Namdev and Dongre 2019, Kumar *et al.*2020 and Akhter *et al.*2021).

From present investigation it may be concluded that, no. of fruit / cluster, no. of fruits/plant, and fruit diameter and weight were the major yield contributing characters which showed positive and significant association with total yield /plant and also exhibited high direct effect on total yield /plant. Therefore, due there is a need to study characters in for selection which would help in isolating high yielding genotypes from highly segregating population to improve yield potential of tomato.

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