Association and path coefficient analysis in F_2 population of tomato cross Anagha x IIHR 2896

Comment [NSN1]: Corrected

ABSTRACT

Comment [NSN2]: Corrected

The present experiment was conducted at College of Agriculture, Vellayani to evaluate F_2segregating population of tomato cross involving Anagha x IIHR 2896 for correlation and path analysis. Correlation analysis revealed that plant height, number of primary branches, plant spread, number of days to 50% flowering, number of days to first fruit harvest, number of fruits per plant, fruit weight, fruit volume and number of locules were highly significant and positively correlated with fruit yield per plant. Path analysis revealed that number of fruits per plant, fruit weight and fruit volume had high positive direct effect on fruit yield per plant followed by plant height and plant spread. However, number of primary branches, number of days to 50% flowering, number of days to first fruit harvest and number of locules had negative direct effect on fruit yield per plant. Hence, the characters showing positive correlation and direct effect should be given more emphasis in selection programme for development of superior varieties.

Keywords: Correlation, Path analysis, Anagha, IIHR 2896

1. INTRODUCTION

Comment [NSN3]: Section number added

Vegetables play an important role in nutritional security, and economic viability and fit well into the predominant intensive cropping systems prevailing in different parts of our country. More than 60 kinds of vegetables are grown in India in tropical, subtropical, and temperate agro-climates. Tomato (*Solanum lycopersicum* L. 2n=2x=24) belongs to the large and diverse family Solanaceae, which includes more than 3000 species, occupying a wide variety of habitats (Knapp, 2002). It is a very important vegetable crops grown throughout the world. In fact, it is the fifth most important cultivated crop after rice, wheat, maize, and potato. The fruits are consumed either raw or cooked or processed into various products like juice, ketchup, sauce, paste, puree, etc. The popularity of tomato is on the rise among consumers, not only because of its good taste but also because it contains high levels of vitamin A, vitamin C, potassium, phosphorus, magnesium, and calcium. It also contains lycopene and carotene, which are antioxidants that promote good health. The high demand for tomatoes makes it a high value crop that can generate much income for farmers.

Yield is an important character associated with many other characters with varying degrees of influence. It is crucial to understand how various characteristics contribute to yield

so that superior lines can be selected with higher yield and quality. Analysing correlations and path coefficients can provide insight into genetic variability within populations. Correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for yield improvement. Path analysis splits the correlation coefficients into direct and indirect effects of a set of dependent variables on the independent variable. This aids in the selection of the elite genotypes. In self-pollinated crops such as tomatoes, yield, and quality are typically enhanced through the selection of genotypes with desirable character combinations present in nature or through hybridization process. For any selection program to be effective, it is essential to have information regarding the interrelationships between various characters.Considering the above facts, the present study was conducted to understand the association among the various traits in the F_2 tomato segregating population.

2. MATERIALS AND METHODS

Comment [NSN4]: Section number added

The experiment was conducted at the College of Agriculture, Vellayani, Thiruvananthapuram, Kerala from January 2023 to May 2023. The experimental materials consist of 222 F_2 segregating lines, derived from the cross Anagha x IIHR 2896 along with parents, and F_1were evaluated for yield and its attributing traits. Each plant is labelled for recording ten quantitative characters which includeplant height (cm), number of primary branches, plant spread (cm), number of days to 50% flowering, number of days to first fruit harvest, number of fruits per plant, fruit weight, fruit volume, number of locules and fruit yield per plant.Phenotypic and genotypic correlationcoefficients were assessed as per the proceduresuggested by Singh and Choudhary (1985). Thedirect and indirect effects of the yield contributingfactors were estimated through path analysis(Wright, 1921;Dewey and Lu, 1959).The data were analyzed by using R 4.2.2 Software and GenStat.

3. RESULTS AND DISCUSSIONS

Comment [NSN5]: Section number added

3.1 Correlation Analysis

Comment [NSN6]: Section number added

In this investigation, correlation coefficients were worked out on all possiblecombinations of yield and yield attributing traits in 222 F_2 segregants of cross Anagha × IIHR 2896 and presented in Table 1.Correlation results indicated that fruit yield per plant expressed significantly positive correlation with all the characters under the study*i.e.*,plant height (0.69), number of primary branches (0.40), plant spread (0.75), number of days to 50% flowering (0.34), number of days to first fruit harvest (0.32), number of fruits

per plant (0.21), fruit weight (0.94), fruit volume (0.93) and number of locules (0.16). The results were in accordance with Lekshmi and Celine (2020); Kumar *et al.* (2021)and Nevani *et al.* (2022) for the characters such as plant height, number of primary branches, number of fruits per plant, and fruit weight.However, Rahman *et al.* (2015) reported a negative correlation for fruit weight.

Plant height had positive significant correlation with all the characters except number of fruits per plant (0.022) and number of locules (0.049).Similar results were alsoobtained by Mayavel *et al.* (2005); Akhtar and Najnine(2022). Fruit weight along with fruit volume showed positive significant correlation with plant height (0.67, 0.69), number of primary branches (0.38, 0.39), plant spread 0.70, 0.72), number of days to 50% flowering (0.33, 0.33), number of days to first fruit harvest (0.30, 0.32) and number of locules (0.17, 0.19), respectively. Similar findings were reported by Mayavel (2005), Ravindra *et al*. (2015) andLakshmi *et al.* (2017)for fruit yield per plant and plant height.

Number of primary branches exhibited a positive correlation with all characters. Number of fruits per plant showed a negative correlation with fruit weight (-0.11), fruit volume (-0.0960 and number of locules (-0.018).However, it showed positive association with plant height (0.022), number of primary branches (0.057), plant spread (0.10), number of days to 50% flowering (0.038) and number of days to first fruit harvest (0.04). Number of locules showed a negative correlation with number of days to 50% flowering (-0.04), number of days to first fruit harvest (-0.005) and number of fruits per plant (-0.018), whereas it showed positive correlation with remaining characters i.e., plant height (0.049), number of primary branches (0.12), plant spread (0.14), fruit weight (0.17) and fruit yield (0.19). The above results are in line with the finding of Madhurina and Paul(2012), Maurya et al. (2011), Ara *et al.* (2009), Kumar *et al*. (2014) and Singh (2007).The correlation plot of all the characters is depicted in Fig 1.

Correlation studies indicated that plant height, number of primary branches, plant spread, fruit volume, and fruit weight deserve greater weightage duringselection for fruit yield in tomato. With increasedfruit weight, fruit volume, plant spread, number of branches per plant and plant height, fruit yield per plantincreases because of the presence of a greater number of branches and increase individualfruit mass. Therefore, selection for these traits would be rewarding as it shows a directassociation with fruit yield per plant.

3.2 Path Analysis

Comment [NSN7]: Section number added

The association between yield and its component traits may be positive ornegative; but it is the net result of the direct effect of that particular trait and indirecteffects via other traits. Hence, it is necessary to determine the path coefficients whichpartition the observed correlation into direct and indirect effects and also toreveal thecause and effect relationship between yield and its related traits were computed andthe results are presented in Table 2.

The path analysis results revealed that a high positive direct effect was shown by fruit weight (0.7307), fruit volume (0.2077), and number of fruits per plant (0.3053) followed by plant height (0.0261) and plant spread (0.041) on fruit yield per plant. However, number of primary branches (-0.0114), number of days to 50% flowering (-0.0068), number of days to first fruit harvest (-0.0023), and number of locules (-0.0005) showed a negative direct effect on fruit yield per plant.The high positive indirect effect was shown by fruit weight through plant height (0.4902), number of primary branches (0.2746), plant spread (0.5142), number of days to 50% flowering (0.238), number of days to first fruit harvest (0.2209), fruit volume (0.714) and number of locules (0.1251) on fruit yield per plant. Fruit volume also expresseda positive indirect effect on fruit yield per plantthrough plant height (0.1425), number of primary branches (0.0811), plant spread (0.1499), number of days to 50% flowering (0.069), number of days to first fruit harvest (0.0661), fruit weight (0.203) and number of locules (0.0386).These findings are in accordance with Reddy *et al.* (2013) for plant height and number of fruits per plant, Asati *et al.* (2008) for plant height, number of primary branches, number of days to 50% flowering and fruit weight, Nevani *et al*, (2022) for number of fruits per plant and fruit weight, Joshi *et al.* (2004),Ghosh *et al.*(2010) and Monamodi *et al.*(2013)for fruit weight.The residual effect (0.12)obtained suggests that thecharacters selected are the major contributing characters for the fruityield of tomato; also, small amounts of contribution were from the characters which are not considered in the study.

4. CONCLUSION

Comment [NSN8]: Section number added

The outcome of the results indicated that all the characters studied shows positive correlation with fruit yield per plant. In path analysis high positive direct effect was exhibited by fruit weight, fruit volume and number of fruits per plant. High indirect effect was shown by fruit weight and fruit volume through all other characters except number of fruits per plant. Therefore, improvement in the yield can be brought by selecting the characters such as fruit weight, fruit volume and fruit yield per plant.

COMPETING INTERESTS

Comment [NSN9]: Section added

Authors have declared that no competing interests exist

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Table 1: Phenotypic correlation coefficient for different pairs of characters in F2 population of tomato

	PH	NPB	PS	NDFF	NDFFH	NFPP	FW	FV	NL	FY
PH	1									
NPB	0.52**	1								
PS	0.83**	0.57**	1							
NDFF	0.53**	0.28**	0.42**	1						
NDFFH	0.46**	0.29**	0.39**	0.77**	1					
NFPP	0.022	0.057	0.10	0.038	0.04	1				
FW	0.67**	0.38**	0.70**	0.33**	0.30**	-0.11	1			
FV	0.69**	0.39**	0.72**	0.33**	0.32**	-0.096	0.98**	1		
NL	0.049	0.12	0.14*	-0.04	-0.005	-0.018	0.17*	0.19*	1	
FY	0.69**	0.40**	0.75**	0.34**	0.32**	0.21**	0.94**	0.93**	0.16*	1

*, ** Significant at 5% and 1% levels, respectively

PH – Plant height (cm) NPB- Number of primary branches PS- Plant spread (cm) NDFF- Number of days to 50% flowering NDFFH- Number of days to first fruit harvest NFPP- Number of fruits per plant FW- Fruit weight (g) FV- Fruit Volume (ml) NL – Number of locules FY – Fruit yield per plant

Table 2: Path coefficient for different pairs of characters in F2 population of tomato

	PH	NPB	PS	NDFF	NDFFH	NFPP	FW	FV	NL
PH	**0.0261**	0.0135	0.021	0.0138	0.012	0.0006	0.0175	0.0179	0.0013
NPB	-0.0059	**-0.0114**	-0.0064	-0.0031	-0.0033	-0.0006	-0.0043	-0.0044	-0.0013
PS	0.0340	0.0232	**0.041**	0.0171	0.016	0.0041	0.0288	0.0296	0.0057
NDFF	-0.0036	-0.0019	-0.0028	**-0.0068**	-0.0052	-0.0003	-0.0022	-0.0023	0.0003
NDFFH	-0.0011	-0.0007	-0.0009	-0.0018	**-0.0023**	-0.0001	-0.0007	-0.0007	0.0000
NFPP	0.0068	0.0174	0.0308	0.0117	0.0123	**0.3053**	-0.0329	-0.0292	-0.0054
FW	0.4902	0.2746	0.5142	0.238	0.2209	-0.0788	**0.7307**	0.714	0.1251
FV	0.1425	0.0811	0.1499	0.069	0.0661	-0.0199	0.203	**0.2077**	0.0386
NL	0.0000	-0.0001	-0.0001	0.0000	0.0000	0.0000	-0.0001	-0.0001	**-0.0005**
Phenotypic correlation with fruit yield per plant	0.6891	0.3958	0.7473	0.3378	0.3164	0.2103	0.9398	0.9325	0.1637

Fig 1: Correlation diagram showing the correlation analysis between traits in segregating F2 population of tomato

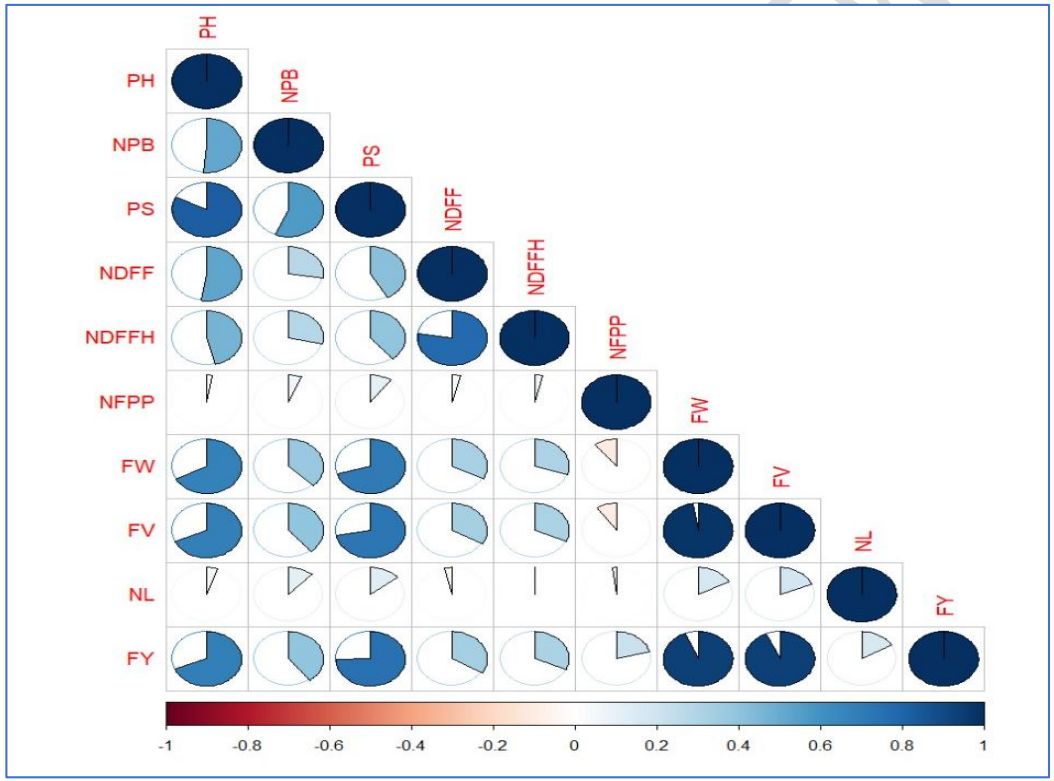

Fig 2: Path diagram showing the direct and indirect effects on fruit yield per plant in segregating F_2 population of tomato