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Importance of Yield Contributing Characters for Improved Yield Potential in Chilli

G. Kranthi Rekha[1*], C. Venkata Ramana[2], L. Naram Naidu[2], K. Umajyothi[3], M. Paratpararao[4] and K. Sasikala[5]

[1]Department of Vegetable Science, COH, Dr. Y.S.R. Horticultural University, V.R.Gudem-534101, India.
[2]HRS, Lam Farm, Guntur-522034, Dr. Y.S.R. Horticultural University, India.
[3]Department of Vegetable Science, COH, Dr. Y.S.R. Horticultural University, V.R.Gudem-534101, India.
[4]Department of Genetics and Plant Breeding, COH, Dr. Y.S.R. Horticultural University, V.R.Gudem-534101, India.
[5]Department of Agronomy, COH, Dr. Y.S.R. Horticultural University, V.R.Gudem-534101, India.

Authors' contributions

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

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ABSTRACT

Chilli is one of the most important commercial crops in India. It is grown almost throughout the country. Chilli yield is a complex quantitative character controlled by several genes, and its improvement depends on the functioning and interaction of several components that vary for different genotypes. A study was conducted to investigate associations among traits and their direct and indirect influences on yield using path analysis and correlation procedures in Chilli genotypes to understand how inter-character relationships influence fruit yield. Correlation and path coefficient analyses were carried out for characters of yield and its components. Differences were observed among genotypes. The characters like plant spread, a number of fruits per plant, average dry fruit weight, fruit length and a number of seeds per fruit showed positive and significant correlation with dry fruit yield per plant. The results of path analysis revealed a fairly high positive direct effect of a number of fruits per plant on dry fruit yield per plant followed by plant spread, fruit length and dry fruit weight as major yield components which could be considered indices for improvement. Thus in the present study correlation and path analysis collectively revealed the importance of average dry fruit weight, number of fruits per plant, plant spread, number of seeds per fruit and fruit length in determining selection criteria for improvement of dry fruit yield per plant.

**Corresponding author: E-mail: kranthi.mscoleri@gmail.com;*
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Keywords: Chilli; yield potential; correlation and path analysis.

1. INTRODUCTION

Chilli is an important spice cum vegetable crop grown in almost all parts of the world. Even though India ranks first in area and production of chilli its productivity is low as compared to other countries. Since yield is a complex trait governed by a large number of component traits it is imperative to know the interrelationship between yield and it's component traits to arrive at an optimal selection index for improvement of yield. Wright [1] was first to propose the correlation and path analysis to organise the relationship between the predictor and response variables. Correlation measures the association between yield and other traits whereas path coefficient analysis permits the separation of correlation into direct effects (path coefficient) and indirect effects (effects exerted through other variables). Therefore field investigation was carried out intending to study the character association and direct and indirect effect of independent characters on dependent chilli yield by assessing the chilli genotypes at HRS, Lam, Guntur (Andhra Pradesh).

2. MATERIALS AND METHODS

The experiment was carried out at Horticultural Research Station, Lam during 2013-2014 with 43 chilli genotypes. The trial was laid out in a randomised block design with three replications. Seedlings were transplanted at a spacing of 75 x 30 cm. The crop received timely management practices as per recommended package of practices. Ten randomly selected plants in each experimental plot were used for recording observations on plant height (cm), plant spread (cm), Days to 50% flowering, Number of fruits per plant, fruit diameter(g), fruit length(g), dry fruit weight (g), number of seeds per fruit, 1000 seed weight (g), dry fruit recovery (%) and dry fruit yield per plant (g). The crop was maintained properly till last harvest and observations on growth, yield, as well as yield contributing characters, were noted on five randomly selected plants in each plot at different stages of the crop. The phenotypic correlation coefficient and genotypic correlation coefficient and direct and indirect effects were computed by using procedure given by Dewey and Lu [2].

3. RESULTS AND DISCUSSION

A complex association exists among different plant characters and character themselves do not exist in isolation. These characters are often correlated with each other either due to pleiotropy is due to genetic linkage [3]. For rational approach towards the improvement of yield, selection will be more rewarding when it is based on the components of yield. The study of correlations among different characters revealed that in general, the genotypic correlation coefficients were higher than phenotypic correlation coefficient (Table 1). Similar observations made by Shumbulo et al. [4]. This indicates a strong inherent association among various characters. The genotypic correlation of fruit yield per plant was significant and desirable correlations with all other traits except primary branches and fruit diameter. Hence, yield per plant can be improved by selecting the lines with more number of fruits per plant, fruit length, fruit weight, plant spread and dry fruit recovery.

Days to 50% flowering showed a negative correlation with dry fruit yield per plant. So, minimum days to 50 per cent flowering could also be used as one of the criteria while selecting for yield. Pradeep et al. has reported the high correlation between fruit yield per plant and other component characters et al. 2014, Priyanka and Mishra [5] and Shumbulo et al. [4].

Plant spread was a significant positive correlation with plant height, primary branches per plant, number of fruits per plant and fruit yield but significant negative correlation with fruit length, fruit diameter, dry fruit weight and number of seeds per fruit. Average dry fruit weight showed a positive correlation with fruit length, fruit diameter, number of seeds per fruit, 1000 seed weight, dry fruit recovery and fruit yield. The trait was negatively correlated with plant height, plant spread and a number of primary branches. These results are in conformity with Pradeep et al. [6] and Priyanka and Mishra [5].

Dry fruit recovery showed a positive correlation with a number of fruits per plant, fruit length, dry fruit weight and a number of seeds per fruit but it was negatively correlated with the number of primary branches per plant. So the selection of plants with more number of fruits, a number of seeds per fruit and higher dry fruit weight will get the more dry fruit recovery and higher fruit yield.

The genotypic correlation sometimes is misleading because the correlation between the two characters is not a simple relationship but is rather the product of the interaction of the direct

Table 1. Genotypic and phenotypic correlation coefficients for eleven quantitative traits in Chilli (*Capsicum annuum* L.)

Character		Primary branches per plant	Plant spread cm²	Days to 50% flowering	Fruits/ plant	Fruit diameter	Fruit length	Dry fruit weight (g)	Seeds/ fruit	1000 Seed weight (g)	Dry fruit recovery (%)	Dry fruit yield/ plant (g)
Plant Height cm	G	0.3060	0.4920	-0.2537	0.2591	-0.2611	-0.4038	-0.3992	-0.2465	-0.2195	0.2529	**-0.0474**
	P	0.0912	0.3195	-0.1691	0.2115	-0.1338	-0.3646	-0.2799	-0.1562	-0.1954	0.1364	**-0.0135**
Primary Branches/ Plant	G		0.4873	-0.0200	0.1969	-0.3098	-0.4161	-0.3427	-0.3255	-0.1751	-0.3307	**0.0293**
	P		0.4138	-0.0485	0.0762	-0.1573	-0.1207	-0.1958	-0.2084	-0.1707	-0.1087	**-0.0350**
Plant Spread (cm²)	G			-0.1034	0.5029	-0.3005	-0.6641	-0.4154	-0.2305	-0.0267	0.1364	**0.3343**
	P			-0.1229	0.3295	-0.1708	-0.3789	-0.2688	-0.1794	-0.0228	0.1550	**0.2201**
Days to 50% Flowering	G				-0.0819	0.0424	0.1209	0.0722	0.0749	0.1100	0.0173	**-0.0013**
	P				-0.0983	0.0272	0.0701	0.0870	0.0575	0.1196	-0.0195	**-0.0115**
Fruits/ Plant	G					-0.0928	-0.1091	-0.1323	-0.0057	0.3002	0.6147	**0.7697**
	P					-0.0941	-0.0446	-0.1078	0.0075	0.1727	0.3511	**0.6430**
Fruit Diameter	G						0.5062	0.8900	0.6959	0.5768	0.1375	**0.2742**
	P						0.3851	0.5581	0.3719	0.2809	0.1479	**0.1153**
Fruit Length	G							0.6869	0.3086	0.2808	0.2017	**0.2521**
	P							0.5503	0.2328	0.1577	0.2081	**0.2087**
Dry Fruit Weight (g)	G								0.6693	0.5433	0.3541	**0.3264**
	P								0.5278	0.4221	0.2129	**0.2474**
Seeds/ Fruit	G									0.4778	0.3720	**0.3520**
	P									0.3177	0.2034	**0.2924**
1000 Seed Weight (g)	G										0.0071	**0.5256**
	P										0.0313	**0.3494**
Dry Fruit Recovery (%)	G											**0.6430**
	P											**0.4368**

Table 2. Genotypic path coefficient analysis for dry fruit yield in Chilli

Character	Plant height cm	Primary branches/ plant	Plant spread cm²	Days to 50% flowering	Fruits/ plant	Fruit diameter	Fruit length	Dry fruit weight (g)	Seeds/ fruit	1000 seed weight (g)	Dry fruit recovery (%)
Plant Height cm	**-0.1289**	-0.0394	-0.0634	0.0327	-0.0334	0.0337	0.0520	0.0515	0.0318	0.0283	-0.0326
Primary Branches/ Plant	-0.0068	**-0.0221**	-0.0108	0.0004	-0.0043	0.0068	0.0092	0.0076	0.0072	0.0039	0.0073
Plant Spread cm²	0.2321	0.2299	**0.4718**	-0.0488	0.2372	-0.1418	-0.3133	-0.1960	-0.1087	-0.0126	0.0643
Days to 50% Flowering	0.0039	0.0003	0.0016	**-0.0153**	0.0013	-0.0006	-0.0019	-0.0011	-0.0011	-0.0017	-0.0003
Fruits/ Plant	0.1735	0.1318	0.3368	-0.0549	**0.6698**	-0.0621	-0.0731	-0.0886	-0.0038	0.2011	0.4117
Fruit Diameter	0.0692	0.0821	0.0797	-0.0112	0.0246	**-0.2651**	-0.1342	-0.2359	-0.1845	-0.1529	-0.0364
Fruit Length	-0.1624	-0.1673	-0.2671	0.0486	-0.0439	0.2036	**0.4022**	0.2762	0.1241	0.1129	0.0811
Dry Fruit Weight (g)	-0.1353	-0.1161	-0.1408	0.0245	-0.0448	0.3017	0.2328	**0.3389**	0.2269	0.1841	0.1200
Seeds/ Fruit	-0.0670	-0.0884	-0.0626	0.0203	-0.0015	0.1890	0.0838	0.1818	**0.2717**	0.1298	0.1011
1000 Seed Weight (g)	-0.0073	-0.0058	-0.0009	0.0037	0.0100	0.0192	0.0093	0.0181	0.0159	**0.0333**	0.0002
Dry Fruit Recovery (%)	-0.0186	0.0243	-0.0100	-0.0013	-0.0452	-0.0101	-0.0148	-0.0260	-0.0273	-0.0005	**-0.0735**
Dry Fruit Yield/ Plant (g)	**-0.0474**	**0.0293**	**0.3343**	**-0.0013**	**0.7697**	**0.2742**	**0.2521**	**0.3264**	**0.3520**	**0.5256**	**0.6430**
Partial R²	0.0061	-0.0006	0.1577	0.0000	0.5155	-0.0727	0.1014	0.1106	0.0956	0.0175	-0.0473

and indirect cause. Path coefficient analysis partition, the direct and indirect effects via other variables and measures the relative importance of causal factors. The genotypic correlations were partitioned into direct and indirect effects to know the relative importance of the component traits (Table 2). The results of path analysis revealed a fairly high positive direct effect of the number of fruits per plant on dry fruit yield per plant followed by plant spread, fruit length, dry fruit weight, number of seeds per fruit and 1000 seed weight. Earlier findings of Pradeep et al. support these results [6], Shumbulo et al. [4] and Srividya et al. [7].

Average dry fruit weight also showed high positive indirect effect via fruit length, fruit diameter, number of seeds per fruit on dry fruit yield per plant. This indicating that the direct selection for average dry fruit weight and indirect selection for fruit length and fruit diameter and number of seeds per fruit has increased yield, Similar findings were reported by Pradeep et al. [6] and Shumbulo et al. [4].

Days to 50 per cent flowering showed a negative direct effect on yield though in correlation with yield was much smaller and negative. This led to the conclusion that early flowering varieties produced higher yields. Similar results were obtained by Ajjapplavara et al. [8] and Pradeep et al. [4].

The characters like plant spread, a number of fruits per plant, average dry fruit weight, fruit length and a number of seeds per fruit showed positive and significant correlation with dry fruit yield per plant. These characters exhibited positive direct effects on dry yield per plant. Thus in the present study correlation and path analysis collectively revealed the importance of average dry fruit weight, number of fruits per plant, plant spreads, number of seeds per fruit and fruit length in determining selection criteria for improvement of dry fruit yield per plant.

4. CONCLUSION

In the present study correlation and path analysis collectively revealed the importance of average dry fruit weight, number of fruits per plant, plant spread, number of seeds per fruit and fruit length in determining selection criteria for improvement of dry fruit yield per plant.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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