ESTIMATION OF SELECTION CRITERIA WITH CORRELATION AND PATH COEFFICIENT ANALYSIS IN CHICKPEA *(Cicer arietinum* L.) BREEDING

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ABSTRACT

The experiment was conducted at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, to estimate the selection criteria following correlation and path coefficient analysis in 50 genotypes of chickpea (Cicer arietinum L.). seed yield per plant was manifested positive and significant correlation with primary branches per plant, secondary branches per plant, plant height, number of pods per plant, number of seeds per pod, harvest index and 100 seed weight, indicated that these attributes were mainly influencing the seed yield in chickpea. The path analysis revealed that harvest index, secondary branches per plant, plant height, protein content, 100 seed weight and days to maturity affecting directly the seed yield per plant. Therefore, emphasis should be given to the development of chickpea lines with more number of primary and secondary branches per plant, more number of seed per pod, boldness and on high harvest index to improve seed yield per plant. Path analysis showed relatively high values of residual effect (0.721) indicating that there are other traits not recorded in the research, which may significantly be involved.

KEY WORDS: Chickpea, correlation coefficient, path coefficient analysis

INTRODUCTION

Chickpea is traditionally grown in many parts of the world. Like other pulse crops, it has multiple functions in the traditional farming systems in many developing countries. It is also important nourishment for people who do not consume enough animal products in specially developing or under developed countries. Chickpea seeds contain about 16.4-31.2 % crude protein, 38.1-73.3 % carbohydrate, 1.5-6.8 % fat, and 1.6-9.0 % fiber (Sehirali, 1988; Singh *et al.*, 1995). Among a dozen of different grain legumes under cultivation in India, gram is the leading crop and is grown in rabi season. Indian subcontinent accounts for 67 per cent of total production of gram in the world. Chickpea occupies an area of 48.91 and 1.43 lakh hectares in India and Gujarat with an average yield of 720 and 871 kg/ha. It also consumed in the form of processed whole seed (boiled, roasted, parched, fried, steamed, sprouted etc.) or *dal* (decorticated split cotyledons boiled and mashed to make a soup) or as *dal* flour (besan).

The extent of genetic variation is a pre-requisite in any crop improvement and yield is an end product of many field crops (Singh *et al.*, 1995). Some of the characters are highly associated among themselves and with seed

yield. The analysis of the relationships among these characters and their associations with seed yield is essential to establish selection criteria. However, simple correlation coefficients between yield and yield components may not give satisfactory results. Because, the components do not only directly affect the yield, they also affect the yield indirectly by affecting other yield components in negative or positive manner. As a trait has helpful effect on a trait for yield, it can affect some other or all traits negatively (Walton, 1980). Under such situations, the path coefficient analysis helps to determine the direct contribution of these characters and their indirect contributions via other characters (Singh *et al.*, 1990).

MATERIAL AND METHODS

Fifty genotypes of chickpea (*Cicer arietinum* L.) obtained from the germplasm pool maintained at the College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, were evaluated in a randomized block design (RBD) with three replications during *rabi* 2010-11. Genotypes were sown in 2 row plot of 4 meter length with a spacing of 45 x 10 cm. For recording observations, five plants were randomly selected in each plot. The observations were recorded viz., days to 50 per cent flowering, days to maturity, number of primary branches per plant, number of secondary branches per plant, number of pods per plant, plant height (cm.), number of seeds per pods, seed yield per plant (g), 100- seed weight (g), harvest index (%) and protein content (%). Statistical analyses for the above characters were done following Singh and Chaudhary (1995) for correlation coefficient and Dewey and Lu (1959) for path analysis.

RESULT AND DISCUSSION

The correlation co-efficient between grain yield and its components and among the component characters were estimated at phenotypic and genotypic levels for eleven different characters are presented in Table 1. Seed yield per plant was manifested positive and highly significant correlation with primary branches per plant, secondary branches per plant, plant height, number of pods per plant, number of seeds per pod and harvest index and significant positive correlation with 100- seed weight at genotypic level, indicated that these attributes were mainly influencing the seed yield in chickpea. Similar results were also obtained for primary branches per plant, secondary branches per plant, plant height, pods per plant, seeds per pod and harvest index by Ali *et al.* (2011) and Akhtar *et al.* (2011); for pods per plant by Bhavani *et al.* (2008) and Farshadfar and Farshadfar (2008); and for plant height by Meena *et al.* (2006). The seed yield per plant had negative correlation with protein content. Similar result was reported for protein content by Chand and Singh (1997). Days to 50 per cent flowering had highly significant and positive correlation with days to maturity, indicated that flowering time is an important indicator of maturity. This result is in conformity with those of Bhavani *et al.* (2008). Other component traits like number of primary branches per plant, number of secondary branches per plant number of pods per plant, number of seeds per pod, 100 seed weight and harvest index also manifested positive correlation with each other. Therefore, emphasis should be given to the development of chickpea lines with more number of primary and secondary branches per plant, more number of seed per pod, boldness and on high harvest index to improve seed yield per plant.

The direct and indirect effects of seed yield components on seed yield per plant are shown in Table 2 and the direct effects in bold letters. The analysis revealed that highest and positive direct effect on seed yield per plant was recorded by harvest index (0.895) and secondary branches per plant. Ozveren *et al.* (2006) and Ozveren and Anlarsal (2010) also reported similar results for seed yield per plant. Positive but low direct effect was

exhibited by the plant height (0.277), protein content (0.273), 100 seed weight (0.233) and days to maturity (0.098). Similar reports were made by Arora and Kumar (1995) for 100-seed weight and plant height by Farshadfar and Farshadfar (2008). Negative direct effect on seed yield per plant was observed for number primary branches per plant, days to 50 per cent flowering, pods per plant and seeds per pod. Similar results were also reported by Yadav (1990) for pods per plant; Sandhu and Mangat (1995) for days to 50 per cent flowering; Ozdemir (1996) for seeds per pod and Saleem *et al.* (2006) for primary branches per plant. Path analysis showed relatively high values of residual effect (0.721) indicating that there are other traits not recorded in the research, which may significantly be involved.

CONCLUSION

From the overall experimental results, seed yield per plant was manifested positive and significant correlation with primary branches per plant, secondary branches per plant, plant height, number of pods per plant, number of seeds per pod, harvest index and 100 seed weight, indicated that these attributes were mainly influencing the seed yield in chickpea. The path analysis revealed that harvest index, secondary branches per plant, plant height, protein content, 100 seed weight and days to maturity affecting directly the seed yield per plant. Therefore, emphasis should be given to the development of chickpea lines with more number of primary and secondary branches per plant, more number of seed per pod, boldness and on high harvest index to improve seed yield per plant.

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Table 1: Genotypic and phenotypic correlation coefficients of grain yield with other characters in fifty genotypes of chickpea.

Characters		Number of Primary Branches Per Plant	Number of Secondary Branches Per Plant	Days to 50 Per Cent Flowering	Plant Height (cm)	Number of Pods Per Plant	Number of Seeds Per Pod	Days to Maturity	100 Seed Weight (g)	Harvest Index (%)	Protein Content (%)
Seed Yield Per Plant (g)	**G**	0.523**	0.422**	0.194	0.450**	0.423**	0.420**	0.222	0.337*	0.601**	-0.126
	P	0.291*	0.346*	0.138	0.324*	0.336*	0.258	0.075	0.300*	0.479**	-0.117
Number of Primary Branches Per Plant	**G**		1.111**	0.265	0.863**	1.109**	1.122**	0.088	0.446**	0.729**	0.050
	P		0.663**	0.118	0.385**	0.650**	0.319**	0.058	0.271**	0.443**	0.037
Number of Secondary Branches Per Plant	**G**			0.263	0.762**	1.009**	0.687**	0.187	0.997**	0.595**	-0.093
	P			0.136	0.430**	0.815**	0.357**	0.097	0.255**	0.470**	-0.075
Days to 50 Per Cent Flowering	**G**				-0.095	0.184	-0.104	1.321**	0.220	0.015	-0.103
	P				-0.023	0.149	-0.088	0.438**	0.174*	-0.006	-0.087
Plant Height (cm)	**G**					0.751**	0.791**	-0.193	0.252	0.609**	0.017
	P					0.522**	0.350**	-0.020	0.123*	0.415**	0.015
Number of Pods Per Plant	**G**						0.740**	0.096	0.410**	0.586**	-0.063
	P						0.422**	0.106	0.370**	0.523**	-0.059
Number of Seeds Per Pod	**G**							-0.448**	0.573**	0.898**	-0.030
	P							-0.030	0.300**	0.502**	-0.007
Days to Maturity	**G**								0.127	-0.110	-0.119
	P								0.050	-0.046	-0.067
100 Seed Weight (g)	**G**									0.513**	-0.187
	P									0.473**	-0.180*
Harvest Index (%)	**G**										-0.324*
	P										-0.294**

Table 2: Path coefficient analysis showing direct and indirect effects of various characters in chickpea.

Characters	Number of Primary Branches Per Plant	Number of Secondary Branches Per Plant	Days to 50 Per Cent Flowering	Plant Height (cm)	Number of Pods Per Plant	Number of Seeds Per Pod	Days to Maturity	100 Seed Weight (g)	Harvest Index (%)	Protein Content (%)	Correlation Coefficient (rg)
Number of Primary Branches Per Plant	**-0.430**	-0.478	-0.114	-0.371	-0.480	-0.483	-0.038	-0.192	-0.313	-0.021	0.523**
Number of Secondary Branches Per Plant	0.930	**0.840**	0.211	0.640	0.844	0.575	0.157	0.251	0.498	-0.078	0.422**
Days to 50 Per Cent Flowering	-0.005	-0.004	**-0.018**	0.002	-0.003	0.001	-0.023	-0.004	-0.001	0.002	0.194
Plant Height (cm)	0.240	0.211	-0.030	**0.277**	0.210	0.219	-0.054	0.070	0.169	0.005	0.450**
Number of Pods Per Plant	-0.451	-0.410	-0.074	-0.310	**-0.407**	-0.301	-0.039	-0.167	-0.238	0.026	0.423**
Number of Seeds Per Pod	-0.540	-0.330	0.050	-0.379	-0.354	**-0.479**	0.215	-0.274	-0.430	0.013	0.420**
Days to Maturity	0.009	0.020	0.130	-0.019	0.009	-0.044	**0.098**	0.012	-0.010	-0.012	0.222
100 Seed Weight (g)	0.109	0.070	0.051	0.059	0.095	0.133	0.030	**0.233**	0.119	-0.044	0.337*
Harvest Index (%)	0.652	0.532	0.013	0.545	0.524	0.804	-0.090	0.459	**0.895**	-0.290	0.601**
Protein Content (%)	0.013	-0.030	-0.030	0.005	-0.017	-0.007	-0.033	-0.051	-0.088	**0.273**	-0.126

Residual effect = 0.721

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