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CORRELATION AND PATH COEFFICIENT STUDIES IN INDUCED MUTANTS OF CHICKPEA (*CICER ARIETINUM* L.)

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Abstract

Correlation and path coefficient analysis study was accomplished on 21 diverse true breeding mutant lines of chickpea (*Cicer arietinum* L.). Phenotypic and genotypic correlations were found between yield and yield components. Path coefficient analysis showed maximum direct and positive influence of number of grains per plant on yield per plant (1.0365) followed by 100-grain weight (0.7859). Both the traits may be good selection criteria for yield. The indirect influence of other yield components is also presented.

Introduction

Grain yield is a complex trait and highly influenced by many genetic factors and environmental fluctuations. In a plant breeding program direct selection for yield as such can be misleading. A successful selection depends upon the information on the genetic variability and association of morpho-agronomic traits with grain yield. Correlation studies along with path analysis provide a better understanding of the association of different characters with grain yield. Lot of information regarding association among yield and yield components has already been reported in chickpea by various workers (Arshad *et al*., 2003, Arshad *et al*., 2002, Guler *et al*., 2001, Rao & Kumar, 2000, Yadav *et al*., 1999; Khan & Sharma, 1999), but little information is available in case of induced mutants of chickpea. The aim of the present study was to generate information on character association, direct and indirect influence of characters on grain yield in the induced mutants of chickpea.

Materials and Methods

The experimental material for the present studies comprised of 21 diverse true breeding mutant lines resulting from 10 and 15 kR of gamma irradiation of variety C727. The experiment was conducted in a randomized block design with three replications at NIAB, Faisalabad during rabi 2001-02. Each plot consisted of four rows of 1.0 m long, with a row spacing of 30 cm. Plant to plant distance was kept at 15 cm. At maturity five guarded plants from central two rows were taken from each plot in each replication for recording data on plant height, number of branches per plant, number of pods per plant, number of grain per pod, 100 grain weight, number of grains per plant and grain yield per plant. Phenotypic and genotypic correlations were obtained by the use of formulae given by Miller *et al*., (1958). Path coefficient analysis was done according to Dewey & Lu (1959).

Results and Discussion

Coefficients of correlation: Grain yield per plant had the highest positive and significant correlation with number of pods per plant (0.6763) followed by number of grain per plant (0.6490) and 100 grain weight (0.4778) (Table 1). Other characters viz. plant height and number of branches per plant showed no correlation with yield per plant, while number of grain per pod showed a negative correlation with grain yield. Similar type of work has been reported by Arshad *et al*., (2003), Bakhsh *et al*., (1999), Vivek *et al*., (1999) and Dwivedi & Pandey (1983).

Number of grains per plant had the highest significant positive correlation with the number of pods per plant (0.9585) followed by number of branches per plant (0.4473). This trait had negative correlation with number of grain per pod and 100 grain weight. Plant height had a very meager correlation with this trait. Number of grains per plant and 100 grain weight both had positive significant association with grain yield per plant. It may be concluded that increase in number of grains per plant through increasing number of pods per plant without loosing its 100 grain weight would be a worthwhile selection criteria.

The 100 grain weight had negative to significant negative correlation with the number of pods and number of branches per plant. Negative correlations have also been reported by Bakhsh *et al*., (1999), Chand & Singh (1997) and Singh *et al*., (1978).

Number of grain per pod had significant positive correlation with plant height. The trait also showed highly significant negative correlation with number of branches and number of pods per plant. Similar negative correlations were reported by Bhambota *et al*., (1994) and Eser *et al*., (1991).

Number of pods per plant had negative correlation with plant height, possibly because excessive vegetative growth may adversely effect the reproductive phase, thereby limiting pod formation. The number of branches had highly significant positive correlation with this trait. Similar work was reported by Bhambota *et al*., (1994), Waldia (1981) and Singh *et al*., (1978).

Path coefficient analysis: Path diagram showing cause and effect relationships of grain yield and its components is presented in Fig. 1. The estimates of the direct, indirect and total effects of yield components on grain yield is presented in Table 2. The number of grains per plant had the largest direct effect on grain yield (1.0369) followed by 100 grain weight (0.7859). Plant height showed negligible positive direct effect on yield per plant (0.0114). This trait had maximum positive and indirect effect (0.1393) through 100 grain weight.

Number of branches also showed very meager positive direct effect on yield (0.0163) and substantial indirect negative effect via 100 grain weight (-0.3894) and number of pods per plant (-0.1107). The number of pods per plant had positive correlation with grain yield, but path analysis showed that its direct effect was negative. The positive correlation was because of its positive indirect effects through number of grains per plant. Number of grain per pod showed a substantial negative direct effect on yield (-.1268) but the trait showed an equal magnitude of positive and indirect effect (0.1269) through number of pods per plant.

Table 1. Phenotypic (P) and genotypic (G) correlation coefficients among single plant yield and its components.

S. No.	Character		No. of branches/ plant	No. of pods/plant	No. of grains/pod	100 grain weight	No. of grains/plant	Grain yield/plant
1.	Height	P	-0.693**	-0.0763	0.5118*	0.1761	0.0959	0.1883
		G	-0.696**	-0.0769	0.5159*	0.1772	0.964	0.1887
2.	No. of branches/plant	P		0.5701**	-0.6601**	-0.4934*	0.446*	0.0585
		G		0.5716**	-0.6663**	-0.4955*	0.4473*	0.0564
3.	No. of pods/plant	P			-0.6503**	-0.273	0.9582**	0.6773**
		G			-0.6556**	-0.2737	0.9585**	0.6763**
4.	No. of grains/pod	P				0.0531	-0.418	-0.3952
		G				0.0538	-0.4246*	-0.4026
5.	100 grain weight	P					-0.3348	0.472*
		G					-0.336	0.4778*
6.	No. of grains/plant	P						0.6513**
		G						0.6490**

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

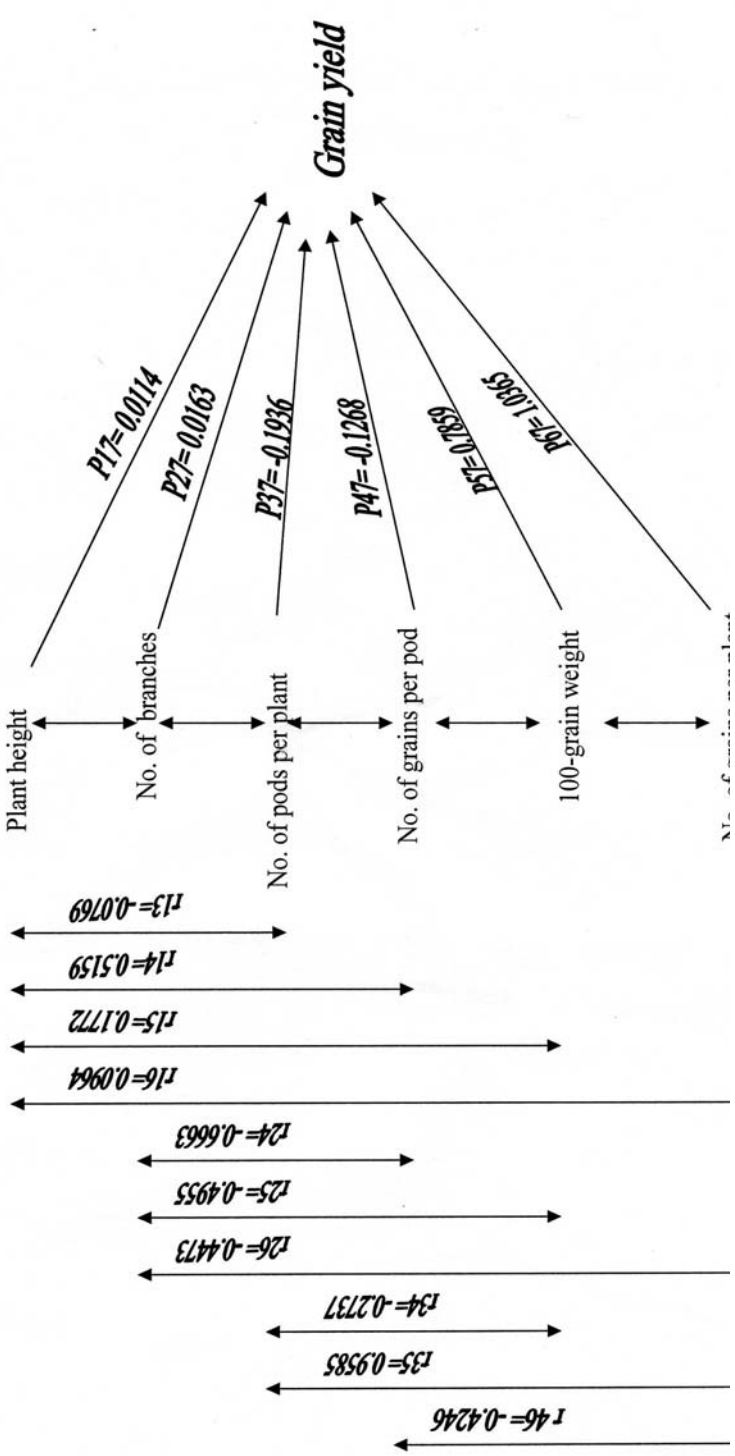

Fig. 1. Path diagram representing cause and effect relationships among yield components and grain yield.

Table 2. Estimation of direct, indirect and total effect of yield components on grain yield.

Cause and effect relationship components Grain yield and components	Effect		
	Direct	**Indirect**	**Total**
Plant height (1) and yield	0.0114	Via2 = -0.0114 Via3 = 0.0149 Via4 = -0.0654 Via5 = 0.1393 Via6 = 0.0999	0.1887
Branches per plant (2) and yield	0.0163	Via1 = -0.0079 Via3 = -0.1107 Via4 = 0.0845 Via5 = -0.3894 Via6 = 0.4636	0.0564
Pods per plant (3) and yield	-0.1936	Via1 = -0.0009 Via2 = 0.0093 Via4 = 0.0831 Via5 = -0.2151 Via6 = 0.9935	0.6763
Seeds per pod (4) and yield	-0.1268	Via1 = 0.0059 Via2 = -0.0109 Via3 = 0.1269 Via5 = 0.0423 Via6 = -0.4401	-0.4026
100 seed weight (5) and yield	0.7859	Via1 = 0.002 Via2 = -0.0081 Via3 = 0.053 Via4 = -0.0068 Via6 = -0.3482	0.4778
Grains per plant (6) and yield	1.0365	Via1 = 0.0011 Via2 = 0.0073 Via3 = -0.1856 Via4 = 0.0538 Via5 = -0.2641	0.649

Conclusion

From the results of present studies, it may be concluded that number of pods, number of grains per plant and 100 grain weight are the major yield contributing traits. Number of pods had highest positive correlation with number of grains per plant and plant yield. The positive effect on yield was indirectly through number of grains per plant. Number of grains per plant and 100 grain weight had the highest direct effect (1.0368 and 0.7859) on plant yield. Since the two major contributing traits viz., number of grains per plant and 100 grain weight influence plant yield negatively via each other, therefore increase in grains per plant through increase in number of pods per plant without effecting 100 grain weight may be used as a reliable selection criteria.

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