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Association between yield and yield attributes in short duration pigeonpea hybrids

N. PANDEY AND N. B. SINGH
Dept. of Plant Breeding, Rajendra Agrl. University, Pusa, Bihar, Campus- T.C.A.Dholi, Muzaffarpur

Abstract: Significant differences were observed among pigeonpea hybrids for all the traits except number of seeds pod^{-1} in both the years of experiment. Significant genotypic correlations of seed yield plot^{-1} with days to initial flowering and maturity, height of the plant at initial flowering and at maturity, number of primary branches and pods plant^{-1} and seeds pod^{-1}. Phenotypic correlations of seed yield plot^{-1} with days to maturity were found significant in the first year experiment, whereas, in the second year experiment seed yield plot^{-1} showed significant genotypic correlations with days to initial flowering, plant height at maturity, number of primary branches and pods plant^{-1}. However, none of the characters showed significant phenotypic correlations with seed yield plot^{-1}. Harvest index showed significant and negative genotypic correlations with days to initial flowering and maturity, primary branches and pods plant^{-1}, seeds pod^{-1} and 100-seed mass.
(Key words: Association, Yield attributes, Short duration, Pigeonpea hybrids, Kharif).

The relationship between two traits plays an important role in the breeding programme. There are two types of correlations, the genotypic, which is correlation between breeding values and the Johen of joined (Falconer,1960). Genotypic correlations are useful in studying the associated genetic change in two traits under selection pressure, such correlation coefficients provide information by themselves (Miller *et al.* 1958) and would be helpful to the plant breeder since they are based on transmissible genetic variance. Phenotypic correlations may be of genotypic and /or environmental origin and provide information about association observed between two characters. For selection purposes phenotypic correlation is of little practical value unless genotypic and environmental correlation between pairs of traits are in the same direction when estimated separately.

Materials and Methods

Eight short duration pigeonpea [*Cajanus cajan* (L)Millsp.] hybrids *viz.* MSPDT x ICPL 161, MSPNDTx ICPL187, MSPNDT x ICPL 142, MSPNDT x ICPL155, MSPDT x ICPL 291, MSPNDT x ICPL 83008, MST 21 x ICPL 94 and MST 21 x ICPL 155 along with four checks were used in this study. The experiments were conducted at the Research Farm of Tirhut College of Agriculture, Dholi, Muzaffarpur, Bihar, during kharif (July) crop season. The experiments were laid out in Randomized Block Design with three replications. Each plot consisted of four rows of 4m.length. the inter and intra- row spacing was 30 cm and 10 cm respectively. The data for correlation studies were recorded on ten randomly selected plants from each entry and replications. Genotypic and phenotypic correlation coefficients among important economic characters like seed yield plot^{-1}, days to initial flowering and maturity, plant height at initial flowering and at maturity, number of primary branches, pods and seed yield plant^{-1}, number of seeds pod^{-1}, 100-seed mass and harvest index were estimated as per procedure by Searle(1961). The significance of correlation coefficients 'r' values was tested from 'r' table of Fisher and Yates (1938) for (n-2) degree of freedom, where 'n' is the pair of characters.

Results and Discussion

Highly significant and positive genotypic correlations of seed yield plot^{-1} with days to initial flowering and maturity, plant height at flowering and at maturity, primary branches plant^{-1}, pod plant^{-1}, seeds pod^{-1} and 100-seed mass were found for hybrid pigeonpea genotypes. Phenotypic correlation of seed yield plot^{-1} was also found significant with days to initial flowering. Seed yield plot^{-1} showed negative but non-significant correlations with seed yield plant^{-1} at both genotypic and phenotypic levels. Seed yield plant^{-1} exhibited highly positive and significant correlation with number of seeds pod^{-1} on genotypic level and with all the other remaining characters under investigation showed non-significant correlation. Hundred-seed mass showed highly negative and significant correlation with number of seeds pod^{-1} at genotypic level. Harvest index was found to have negatively significant genotypic correlations with number of pods plant^{-1} and seeds pod^{-1} (Table 1).

In the second year experiment, seed yield plot^{-1}showed positively significant genotypic correlation with days to initial flowering, number of primary branches plant^{-1} and number of pods plant^{-1} whereas negatively significant correlation with seed yield plant^{-1} and with remaining all the other characters showed non-significant association. Seed yield plot^{-1} showed non-significant phenotypic correlations with all the characters under investigation (Table 2). Seed

Table 1. Genotypic and phentypic correlation among characters

Branches		Plant height at flowering	Days to maturity	Plant height at maturity	Primary branches plant^{-1}	Pods plant^{-1}	Seeds pod^{-1}	Harvest index	100-seed mass	Seed yield plant^{-1}	Seed yield plot^{-1}
Days to initial flowering	G	0.868**	0.852**	0.749**	0.657*	0.650*	5.314**	-0.473	0.451	0.402	0.980*
	P	0.688*	0.778*	0.577	0.497	0.467	0.255	-0.293	0.269	0.377	0.600*
Plant height at initial flowering	G		0.547	0.980**	0.753**	0.647*	14.015**	-0.510	0.224	0.338	0.793**
	P		0.448	0.970**	0.527	0.592*	0.211	-0.510	-0.209	0.223	0.562
Days to maturity	G			0.358	0.438	0.308	-0.833**	-0.450	0.158	0.233	0.857**
	P			0.278	0.378	0.280	0.001	-0.334	0.099	0.133	0.451
Primary branches plant^{-1}	G				0.671*	0.679*	15.098**	-0.507	0.233	0.267	0.667*
	P				0.472	0.608	0.275	-0.521	0.220	0.155	0.469
Secondary branches plant^{-1}	G					0.450	1.520**	-0.314	0.342	-0.293	0.712**
	P					0.348	-0.049	-0.297	0.165	0.180	0.306
Pods plant^{-1}	G						6.153**	-0.648*	0.378	-0.087	0.658**
	P						0.023	-0.416	0.345	0.046	0.445
Seeds Pod^{-1}	G							-2.679**	-2.791**	7.417**	8.528**
	P							0.036	-0.177	0.288	-0.039
Harvest index	G								-0.237	0.074	0.544
	P								-0.172	0.200	0.353
100-seed mass	G									-0.491	0.655*
	P									-0.245	0.564
Seed yield plant^{-1}	G										-0.203
	P										-0.143

* Significant at P=0.05, ** Significant at P=0.01

Table 2. Genotypic and phentypic correlation among characters

Branches		Plant height at flowering	Days to maturity	Plant height at maturity	Primary branches plant^{-1}	Pods pod^{-1}	Seeds pod^{-1}	Harvest index	100-seed mass	Seed yield plant^{-1}	Seed yield plot^{-1}
Days to initial flowering	G	0.722**	0.937**	0.693*	0.849**	0.926**	1.088**	-0.946**	0.309	0.353	0.596*
	P	0.517	0.905**	0.554	0.749**	0.767**	0.385	-0.488	0.191	0.295	0.362
Plant height at initial floweing	G		0.659*	0.986**	0.458	0.557	0.610*	-0.449	-0.235	0.351	0.182
	P		0.492	0.936**	0.291	0.314	0.213	-0.141	-0.169	0.367	0.136
Days to maturity	G			0.616*	0.679*	0.781*	1.126**	-0.680*	0.131	0.305	0.336
	P			0.506	0.564	0.607*	0.351	-0.328	0.087	0.405	0.541
Primary branches plant^{-1}	G				0.378	0.491	0.694*	-0.468	-0.139	0.483	0.160
	P				0.303	0.358	0.167	-0.233	-0.147	0.398	0.139
Secondary branches plant^{-1}	G					1.066**	0.737**	-0.890**	0.370	0.105	0.629*
	P					0.806**	0.428	-0.598*	0.115	0.080	0.444
Pods plant^{-1}	G						0.790**	-0.998**	0.165	0.225	0.717**
	P						0.321	-0.500	0.171	0.246	0.536
Seeds pod^{-1}	G							-0.681*	0.242	0.686*	0.329
	P							-0.247	0.204	0.002	0.060
Harvest index	G								-0.346	-0.072	0.183
	P								-0.209	-0.098	0.137
100-seed mass	G									-0.805**	0.423
	P									-0.216	0.286
Seed yield plant^{-1}	G										0.690*
	P										0.247

* Significant at P=0.05, ** Significant at P=0.01

yield plant^{-1} showed positive significant correlation with number of seeds pod^{-1} whereas negatively significant correlation with 100-seed mass at genotypic level. Hundred seed mass showed non-significant correlation with all the traits under investigation at both genotypic and phenotypic levels. Harvest index expressed negatively significant associations with days to initial flowering, days to maturity, number of primary branches plant^{-1}, number of pods plant^{-1} and number of seeds pod^{-1} at genotypic level.

The other characters like plant height at initial flowering and days to maturity exhibited highly positive and significant association with days to initial flowering at both genotypic and phenotypic levels. Plant height at maturity with plant height at initial flowering, number of pods plant^{-1} with plant height at initial flowering and plant height at maturity at both genotypic and phenotypic levels showed, positively significant association. Number of primary branches plant^{-1} exhibited significant and positive association at genotypic level with days to initial flowering, plant height at initial flowering and plant height at maturity. In the second year experiments, other characters like days to maturity, number of primary branches plant^{-1} and number of pods plant^{-1} with days to initial flowering; plant height at maturity with plant height at initial flowering; number of pods plant^{-1} with days to maturity and number of primary branches plant^{-1} showed significantly positive association at both genotypic and phenotypic levels. Plant height at initial flowering and at maturity with days to initial flowering and days to maturity; number of primary branches plant^{-1} with days to maturity and number of seeds pod^{-1} with days to initial flowering, plant height at initial flowering, days to maturity, plant height at maturity, number of primary branches plant^{-1} and number of pods plant^{-1} exhibited significantly positive association at genotypic level.

Genotypic correlations were found to be always higher than the phenotypic correlation in the same direction which suggested a fairly strong inherent association between the characters studied. Expression of the phenotypic correlations was reduced most likely under the influence of environments and crop seasons. The above mentioned results indicated that the number of primary branches plant^{-1}, pods plant^{-1} and seeds pod^{-1} were the major yield contributing characters. A suitable combinations of the number of primary branches plant^{-1}, pods plant^{-1} and seeds pod^{-1} should be considered while selecting for high yielding hybrid genotypes. The best index of higher yield of a hybrid genotype among the traits studied was the number of primary branches and pods plant^{-1}. Number of primary branches plant^{-1} is a highly heritable trait (Govina Raju and Sharat Chandra 1972) and has a highly positive correlation with seed yield (Beohar and Nigam 1972). Prakash and Dani (1979) and Awatade *et al.*, (1980) have reported highly significant correlations of seed yield with primary and secondary branches plant^{-1}, pods plant^{-1} and seeds pod^{-1}. Garten (1990) reported that number of branches (primary and secondary), number of pods plant^{-1}, number of seeds pod^{-1} are apparently the main yield contributing characters in pigeonpea.

It may be concluded that the number of primary branches plant^{-1} and pods plant^{-1} are the prime contributing characters to seed yield in short duration pigeonpea hybrids although plant height contributes significantly by increasing all theses traits, which are themselves positively correlated on genotypic basis in this investigation.

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