Genetic Relationship of Growth and Developmental Traits with Seed Yield in Dwarf Field Pea

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Twenty-five genotypes of diverse origin of dwarf pea (*Pisum sativum*, L.) were analysed for their yield and various yield contributing characters. Correlation co-efficient analysis revealed that seed yield was positively associated with days to 50% flowering, first pod bearing node, pods/cluster, pod length, seeds/pod and harvest index. Path co-efficient analysis revealed that harvest index, biological yield, pod number, pods/cluster and pod length seem to be the major yield contributing traits in dwarf field pea.

Key Words: Correlation Co-efficient; Field Pea; Path Analysis

Seed yield is not a unitary character but depends on the development of various plant characters. Contribution of each character towards increase in seed yield varies among the crops. Seed yield primarily depends upon the magnitude and the nature of genetic variability present in the population. The knowledge of association of seed yield with its component traits, helps in achieving success in a breeding programme. Therefore, an experiment was undertaken to determine the direct and indirect association among yield traits through path co-efficient analysis in peas.

Materials and Methods

Twenty-five genotypes of dwarf field pea were grown in Randomized Complete Block Design with three replications during *rabi* 1999-2000, at Indira Gandhi Agricultural University, Raipur. Each genotype was represented by five rows of 4 m, row to row distance was 30 cm and seeds were sown at 10 cm space within each row. Observations on days to 50% flowering and maturity were recorded on plot basis. Plant height, number of branches, number of clusters, first pod bearing node, pod bearing length, % seed setting, pods/cluster, pods/plant, pod length, seeds/pod, 100-seed weight, biological yield, seed yield/plant and harvest index were recorded on five competitive plants in each genotype. Correlation co-efficient among the variables and path co-efficient analysis were computed by using the formulae suggested by Falconer (1964) and Dewey and Lu (1959) respectively.

Results and Discussion

Correlation Co-efficient Analysis

Estimates of genotypic and phenotypic correlation co-efficient showed that genotypic correlation co-efficients in general were higher in magnitude than phenotypic ones for most of the traits (Table 1) indicating, least influence of environmental factors in the expression of these traits.

Genotypic correlations revealed that days to 50% flowering had shown significantly positive correlation with maturity, number of branches, first pod bearing node, pods/cluster and seed yield/plant while it had significantly negative association with clusters/plant. These results are in agreement with Chandirakala and Raveendran (1998). Days to maturity exhibited significant positive association with branches/plant, % seed setting and pods/cluster. These results are in conformity with the result of Pratap *et al.*, (1995). Significant positive association of plant height was recorded with first pod bearing node, seeds/pod and biological yield while it was negative with pods/plant, clusters/plant and harvest index indicating that taller plant adversely affected these traits. Similar findings were also noted by Dev and Rastogi (1999). It is obvious to mention here that branches in field pea had no association with any character and showed independent behaviour.

Clusters/plant had positive and significant association with pod bearing length, pods/plant and harvest index. This clearly indicates that higher number of clusters/plant with longer pod bearing length and higher harvest index will be useful increasing the number of pods and harvest index in dwarf field pea. In contrast first pod bearing node, pod length, seeds/pod and biological yield were negatively associated with clusters/plant. First pod bearing node was positively correlated with pods/cluster, pod length, seeds/pod, biological yield and seed yield/plant. While it had negative association with pod bearing length, % seed setting and pods/plant. The

Table 1. Correlation-coefficient of yield components in dwarf field pea

Characters		Days to 50% flowering	Days to maturity	Plant height	Branches/ plant	Cluster/ plant	First pod bearing node	Pod bearing length	Seed setting per cent	Pods/ cluster	Pods/ plant	Pod length	Seeds/ pod	100-seed wt	Biological yield/ plant	Seed yield/ plant	Harvest index
Days to 50%	G		0.793**	0.213**	0.364**	-0.255*	0.455**	-0.190	-0.031	0.498**	-0.189	0.193	-0.034	-0.129	0.112	0.471**	0.177
Flowering	P		0.795**	0.212	0.163	-0.249*	0.441**	-0.189	-0.027	0.461**	-0.184	0.186	-0.031	-0.121	0.106	0.353**	0.157
Days to	G			0.204	0.503**	-0.015	0.175	-0.043	0.310**	0.278**	-0.019	0.119	-0.165	-0.200	-0.054	0.213	0.165
maturity	P			0.202	0.222	-0.019	0.162	-0.042	0.340**	0.252**	-0.024	0.118	-0.154	-0.187	-0.058	0.152	0.143
Plant height	G				0.093	-0.241*	0.252*	0.273	-0.057	-0.117	-0.308**	0.134	0.242*	-0.066	0.497**	-0.190	-.514**
	P				0.037	0.238*	0.247*	0.266	-0.052	-0.103	-0.297*	0.127	0.228	0.069	0.487**	-0.147	-.466**
Branches/	G					-0.032	0.025	-0.187	-0.097	0.204	0.028	0.219	0.057	-0.141	0.161	0.159	-0.111
plant	P					0.061	0.000	-0.096	-0.099	0.116	0.066	0.104	0.065	-0.036	0.154	0.152	-0.040
Clusters/	G						-0.387**	0.403**	-0.031	-0.153	0.981**	-0.253*	-0.272*	0.033	-0.432**	-0.266*	0.231*
plant	P						-0.370**	0.395**	-0.032	-0.135	0.933**	-0.235**	-0.232**	0.042	-0.410**	-0.201	0.204
First pod	G							-0.312**	-0.261*	0.464**	-0.285*	0.538**	0.561**	-0.173	0.397**	0.734**	0.120
Bearing node	P							-0.310**	-0.251**	0.435**	-0.267*	0.505**	0.523**	-0.171	0.382**	0.562**	0.117
Pod Bearing	G								-0.166	0.036	0.334**	-0.266*	-0.224	-0.277*	-0.136	-0.372**	-0.081
Length	P								-0.164	-0.033	0.314**	-0.249*	-0.208	-0.265*	-0.133	-0.288*	-0.076
% seed setting	G									-0.094	-0.097	0.045	-0.073	-0.124	-0.152	-0.211*	-0.033
	P									-0.089	-0.090	0.046	-0.068	-0.116	-0.155	-0.123	-0.001
Pods/cluster	G										0.050	-0.063	-0.110	-0.518**	0.373**	0.440**	-0.091
	P										0.080	-0.058	-0.096	-0.476**	0.339**	0.347**	-0.054
Pods/plant	G											-0.323**	-0.293*	-0.021	-0.348**	-0.298*	0.166
	P											-0.302**	-0.265*	0.001	-0.315**	-0.140	0.157
Pod length	G												0.694**	0.010	0.098	0.766**	0.398
	P												0.621**	-0.028	0.095	0.525**	0.322
Seeds/pod	G													0.107	0.232*	0.517**	0.117
	P													0.097	0.220	0.376**	0.101
100-seed	G														-0.141	-0.251*	-0.015
weight	P														-0.133	-0.163	0.003
Biological	G															0.058	-.803**
Yield/plant	P															0.051	-.736**
Seed yield/	G																0.528**
plant	P																0.616**

G = Genotypic correlations, P = Phenotypic correlations, * = Significant at 5%, ** = Significant at 1%

observation are in confirmity with the results of Singh and Joshi (1982).

Pod bearing length showed significant positive association with pods/plant but negative with pod length, seed index and seed yield. Similarly, seed setting was negatively correlated with seed yield/ plant. Pods/cluster had significant positive association with biological yield and seed yield/plant However, it was negatively correlated with 100-seed weight. This finding is similar with Sharma *et al.*, (1997). Pods/plant was negative and significantly correlated with pod length, seeds/pod, biological yield and seed yield. Pods/plant is a major yield contributing character its negative correlation with seed yield might be affected by any indirect contributing trait. Pod length and seeds per pod were positively associated themselves and with seed yield/plant. Seeds/pod was also positively associated with biological and grain yield. Similarly, biological yield had negative and significant correlation with harvest index, which are in agreement with earlier findings of Pratap *et al.*, (1995).

It may be concluded from the present findings that seed yields was positively associated with days to 50% flowering, first pod bearing node/cluster, pod length, seeds/pod and harvest index.

Path Co-efficient Analysis

In present investigation path co-efficient analysis was carried out by considering seed yield as dependent and rest of the traits as independent variables. Data are presented in Table 2.

Harvest index had the highest direct affect on grain yield. It also had high positive correlation. Hence, direct selection for higher index in dwarf field pea will lead genetic grain in seed yield. Other important attributes positively contributed towards grain yield were biological yield, pods/plant, pods/cluster and pod length. Cluster/ plant also had high direct effects but in negative direction. Its correlation with grain yield, might be due to negative indirect effect via biological yield. These findings are in agreement with Chandirakala and Raveendra (1998) Pratap *et al.*, (1995).

Table 2. Path coefficient of seed yield contributing characters in dwarf field pea

Characters	Days to 50% flowering	Days to to maturity	Plant height	Branches/ plant	Cluster/ plant	First pod bearing node	Pod bearing length	Seed setting per cent	Pods/ cluster	Pods/ plant	Pods/ length	Seeds/ pod	100-seed wt	Biological yield/ plant	Harvest index	Genetic Correlation with seed yield/plant
Days to 50% flowering	**-0.001**	-0.009	0.010	0.011	0.095	-0.055	0.016	0.001	0.095	-0.058	0.033	-0.033	0.005	0.014	0.227	0.471**
Days to maturity	-0.001	**-0.012**	0.009	0.016	0.006	-0.021	0.004	-0.011	0.053	-0.006	0.020	-0.013	0.008	-0.050	0.211	0.213
Plant height	0.000	-0.002	**0.045**	0.003	0.090	-0.036	-0.024	0.002	-0.022	-0.095	0.023	0.019	0.003	0.460	0.660	-0.190
Branches/plant	0.000	-0.006	0.004	**0.031**	0.012	-0.003	0.016	0.003	0.039	0.009	0.038	0.004	0.005	0.149	-0.142	0.159
Cluster/plant	0.000	0.000	-0.011	-0.001	**-0.372**	0.047	-0.035	0.001	-0.029	0.303	-0.043	-0.021	-0.001	-0.400	0.297	-0.266*
First pod bearing node	-0.001	-0.002	0.011	0.001	0.144	**-0.121**	0.027	0.009	0.089	-0.088	0.092	0.044	0.007	0.368	0.154	0.734**
Pod bearing length	0.000	0.000	0.012	-0.006	-0.150	0.038	**-0.087**	0.006	-0.007	0.103	-0.046	-0.018	0.011	-0.126	-0.104	-0.372*
%Seed setting	0.000	-0.004	-0.003	-0.003	0.011	0.032	0.014	**0.036**	-0.018	-0.030	0.008	-0.006	0.005	-0.141	-0.042	-0.211*
Pods/cluster	-0.001	-0.003	-0.005	0.06	0.057	-0.056	0.003	0.003	**0.191**	0.016	-0.011	-0.009	0.020	0.346	-0.117	0.440**
Pods/plant	0.000	0.000	-0.004	0.001	-0.365	0.034	-0.029	0.004	0.010	**0.309**	-0.055	-0.023	0.001	-0.322	0.213	0.238*
Pod length	0.000	-0.001	0.006	0.007	0.094	-0.065	0.023	-0.002	-0.012	-0.100	**0.171**	0.054	0.000	0.091	0.499	0.766**
Seeds/pod	0.000	0.002	0.011	0.002	0.101	-0.008	0.019	0.003	-0.021	-0.090	0.119	**0.078**	-0.004	0.215	0.151	0.517**
100-seed weight	0.000	0.002	-0.003	-0.004	-0.012	0.021	0.024	0.004	-0.099	-0.006	0.002	0.008	**-0.038**	-0.131	-0.019	-0.251*
Biological yield/plant	0.000	0.001	0.022	0.005	0.161	-0.048	0.012	0.005	0.071	-0.107	0.017	0.018	0.005	**0.927**	-1.031	0.058
Harvest index	0.000	-0.002	-0.023	-0.003	-0.086	-0.014	0.007	0.001	-0.017	0.051	0.067	0.009	0.001	-0.744	**1.238**	0.528**

Residual effect = 0.0.22; The underscored figures denote the direct effects

Some of the attributes indirectly contributed on grain yield like days to 50% flowering and days to maturity also had positive indirect effects on grain yield through harvest index. Plant height and branches/plant had positive indirect effects *via* biological yield. However, these traits had shown negative indirect contribution through harvest index, indicating that further increase in plant height may adversely affect the grain yield in dwarf pea. Clusters/plant had positive indirect contribution through pods/plant and harvest index but negatively contributed through biological yield. Again it is clear that breeder should not try to increase the biomass in dwarf pea. First pod bearing node exhibited high positive indirect contribution through biological yield but also had low two indirect effects via. harvest index and clusters/plant. Pod bearing length exhibited positive indirect contribution through pods/plant while negatively through cluster/plant and harvest index suggesting breeding efforts for closer pod bearing through shorter internodes. Pods/cluster had positive contribution through biological yield and significant positive correlation, indicating that proper attention should be given during selection. Pods/plant had positive contribution through harvest index but negative indirect effects through biological yield and clusters/plant. Whereas, pod length had high positive indirect contribution through harvest index. Biological yield had positive indirect contribution via clusters/plant very high negative indirect effect through harvest index indicating that more emphasis on economic yield is needed.

It is clear from the above findings that harvest index, biological yield, pod number, pods/cluster and pod length seem to be major yield contributing traits in dwarf field pea, hence selection for these traits may lead to improvement in grain yield.

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