Study of correlation and path analysis for green pod yield and its contributing traits in vegetable pea(*Pisum sativum* L.)

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Abstract

Correlation at genotypic and phenotypic levels along with path coefficient analysis were studied for various yield and its component characters in twenty genotypes of pea (*Pisum sativum* L.) during *rabi*, 2009-10. Analysis of variance revealed significant difference for all the characters indicating the presence of good amount of variability in the genotypes studied. Correlation studies revealed that green pod yield per plant was positively and significantly associated with pod length, pod weight and number of grains per pod. Path coefficient analysis revealed that traits like number of pods per plant, pod weight, number of grains per pod, number of pickings and protein content were the important characters for selection of high yielding genotypes as they exerted high positive direct effect as well as positive correlation with green pod yield per plant. The result suggested that these traits could be considered as major yield contributing traits in pea.

Key words: *Pea, correlation, path analysis.*

Introduction

Pea (*Pisum sativum* L.) is an important crop grown throughout the world. In India, it is grown mainly as winter vegetable in the plains of North India and as summer vegetable in the hills. Pea is used as fresh vegetable, canned, processed or dehydrated and seeds are consumed as pulse. Green pods are highly nutritive, containing high percentage of digestible protein (7.2%), carbohydrates (19.8%) and minerals (0.8%) (Aykroyd, 1963). Correlation coefficient is a statistical measure, which is used to find out the degree and direction of relationship between two or more variables. It measures the mutual relationship between various plant characters and determines the component characters on which selection can be exercised for genetic improvement in yield. Path coefficient analysis is an important tool for partitioning the correlation coefficients into direct and indirect effects of independent variables on dependent variable. It has been widely used to identify traits that have significant effect on yield for potential use in selection. Keeping in view the study was conducted to find out correlation at genotypic and phenotypic levels and path coefficient analysis for yield and its contributing traits in pea.

Materials and Methods

The present investigation was carried out at Experimental farm, Department of Horticulture, S.K.N. College of Agriculture, Jobner, Rajasthan during *rabi* 2009–10. The experimental material consisted of twenty diverse pea genotypes namely, AP-1, AP-3, Arkel, VRP-5, VRP-6, VRP-7, VRP-16, VRP-22, VRP-90, VRP-135, VRP-138, VRP-147, VRP-158, VRP-179, VRP-216, VRP-219, VRP-238, VRP-330, VRP-343 and EC-9126. Experiment was laid out in randomized block design with three replications. The seeds were sown at a spacing of 30 cm x 10 cm. Recommended agronomic practices and plant protection measures were followed to maintain optimum plant stand. The observations were recorded on five randomly selected competitive plants from each plot in every replication for the traits *viz.* plant height (cm), days to first flowering, days to 50 % flowering, days to first fruit setting, days to first pod picking, number of pods per plant, pod length (cm), pod weight (g), number of grains per pod, number of pickings, pod yield per plant (g), pod yield per hectare (q), TSS of green seeds (%) and protein content in pods (%). The data were averaged and statistically analyzed for analysis of variance as per the method suggested by Panse and Sukhatme (1995). The genotypic and phenotypic correlation coefficients were calculated from the genotypic and phenotypic covariances and variances as described by Singh and Choudhary (1977) and as per formula given by Johnson *et al.* (1955). The estimates of direct and indirect effect were calculated by the path coefficient analysis as at both phenotypic and genotypic levels.

Result and Discussion

The analysis of variance indicated significant differences among the genotypes for all the observed characters which indicated that high amount of genetic variability was present in the genetic material.

The correlation studies revealed that in general estimates of genotypic correlation coefficients were

higher than the corresponding phenotypic correlation coefficients, which indicated a strong inherent association among different traits under study (Table 2). The lower phenotypic values might be due to environmental interactions. A significant positive correlation of pod yield per plant was observed with pod weight (0.469), pod length (0.395) and number of grains per pod (0.393) at phenotypic level and with number of grains per pod (0.764), pod length (0.664), pod weight (0.542) and number of pickings (0.377) at genotypic level, which, suggested that these characters could be considered as major green pod yield contributing characters in pea. Similar results wer reearlier obtained by Chaudhary and Sharma (2003), Sureja and Sharma (2004), Choudhary *et al.* (2004), Singh and Singh (2005), Nawab *et al.* (2008) and Guleria, Chongtham and Dua (2009).

Pod yield per plant registered significant and negative correlation with days to first flowering (-0.326) and days to first pod picking (-0.369), which, indicated that selection should be practiced for less days to flowering and first fruit setting (earliness). The results were in accordance with the findings of Chaudhary and Sharma (2003), Choudhary *et al.* (2004) and Sureja and Sharma (2004).

Therefore, it can be concluded that, during selection of high yielding genotypes in pea major emphasis should be given on pod weight, pod length, number of grains per pod, days to first fruit setting and days to first flowering as these are significantly associated with pod yield hense, these characters could be considered reliable indices for selection, to enhance the pod yield.

Path coefficient analysis revealed that, days taken to first pod picking exhibited maximum positive direct effect on green pod yield per plant (2.1131) at genotypic level followed by average pod weight (1.5140), number of pods per plant (1.2720), protein content (0.3887), average number of grains per pod (0.1141), days taken to 50 per cent flowering (0.1137) and average number of pickings (0.0905). The highest negative direct effect was exerted by days taken to first flowering, followed by days to first fruit setting, plant height, average pod length and TSS of green seeds. These results were in partial agreement with those of Sureja and Sharma (2004) for appearance of first flower, by Sharma *et al.* (2007) for TSS and by Sardana *et al.* (2007) for plant height.

Days to 50 per cent flowering exhibited maximum positive indirect effect on pod yield per plant via days to first pod picking, number of pods per plant, pod length and protein content at genotypic level. Days to first pod picking had positive indirect effect through number of pods per plant, pod length, days to 50 per cent flowering and protein content. Average number of pods per plant had positive indirect effect on pod yield through days to first pod picking, pod length and days to 50 per cent flowering. Average pod weight exhibited positive indirect effect via days to first flowering, days to first fruit setting, plant height, number of grains per pod, protein content, number of pickings and TSS of green seeds.

Average number of pickings had positive indirect effect on pod yield through days to first flowering, average pod weight, days to first fruit setting, plant height, protein content and number of grains per pod. Whereas, protein content exerted positive indirect effect via day to first pod picking average pod weight, plant height, number of grains per pod, days to 50 per cent flowering, number of pickings and TSS of green seeds.

Keeping in view the estimates of correlation coefficient and direct and indirect contribution of component traits toward pod yield per plant, indirect selection practices on the basis of days taken to first pod picking, average pod weight, number of pods per plant, protein content, number of grains per pod, days to 50 per cent flowering and number of pickings would be rewarding in the genotypes under study enhancing the pod yield per plant as well as per hectare.

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Table 1. Phenotypic correlation coefficients (upper diagonal) and genotypic correlation coefficients (lower diagonal) between different traits in pea

S. No.	Traits	PH	DFF	50% F	DFFS	DFPP	P/P	PL	PW	G/P	Picking	TSS	Protein	Y/P	Y/ha
1	PH	1.000	0.559**	0.657**	0.631**	0.712**	0.739**	0.477**	0.649**	-0.265	-0.602**	0.435**	-0.136	-0.096	-0.039
2	DFF	0.597	1.000	0.933**	0.896**	0.944**	0.274	-0.200	0.483**	-0.0811	-0.699**	0.3613*	0.221	-0.326*	-0.251
3	50% F	0.694	0.935	1.000	0.961**	0.953**	0.437**	-0.299	0.594**	-0.142	-0.614**	0.324*	0.166	-0.318	-0.243
4	DFFS	0.686	0.912	0.977	1.000	0.936**	0.471**	-0.349*	0.649**	-0.220	-0.665**	0.437**	0.136	-0.369*	-0.292
5	DFPP	0.751	0.949	0.955	0.951	1.000	0.459**	-0.304	0.595**	-0.116	-0.759**	0.438**	0.130	-0.271	-0.182
6	P/P	0.933	0.364	0.561	0.573	0.578	1.000	0.517**	0.785**	-0.345*	-0.380*	0.342*	-0.182	0.070	0.106
7	PL	-0.666	-0.293	-0.415	-0.499	-0.421	-0.779	1.000	0.602**	0.664**	0.318	-0.259	0.342*	0.395*	0.366*
8	PW	-0.828	-0.601	-0.739	-0.791	-0.734	-0.835	0.966	1.000	0.488**	0.475**	-0.368*	0.177	0.469**	0.438**
9	G/P	-0.475	-0.140	-0.236	-0.351	-0.195	-0.527	0.815	0.776	1.000	0.225	-0.306	0.182	0.393*	0.400*
10	Picking	-0.664	-0.735	-0.643	-0.693	-0.792	-0.421	0.363	0.587	0.285	1.000	0.632**	0.102	0.246	0.161
11	TSS	0.583	0.454	0.397	0.528	0.543	0.506	-0.325	-0.576	-0.419	0.745	1.000	-0.013	-0.151	-0.100
12	Protein	-0.255	0.308	0.216	0.194	0.172	-0.163	0.517	0.168	0.231	0.092	-0.065	1.000	0.234	0.246
13	Y/P	-0.211	-0.488	-0.440	-0.511	-0.378	-0.017	0.664	0.542	0.764	0.377	-0.271	0.296	1.000	0.986**
14	Y/ha	-0.125	-0.329	-0.331	-0.398	-0.252	0.043	0.599	0.485	0.760	0.257	-0.188	0.310	0.977	1.000

PH = Plant height (cm), DFF = Days taken to first flowering, 50% F = Days to 50% flowering, DFFS = Days to first fruit setting, DFPP = Days to first pod picking, P/P = Number of pods/plant, PL = Pod length (cm), PW = Pod weight (g), G/P = Number of grains/pod, Pickings = Number of pickings, Y/P = Yield/plant (g), Y/ha = Yield/hectare (q), TSS = T.S.S. of green seeds (%), Protein = Protein content in pods (%).

** Significant at $P = 0.01$ level of significance

* Significant at $P = 0.05$ level of significance

Table 2. Direct (diagonal) and indirect effects of different characters on pod yield per plant in pea at genotypic and phenotypic level

Characters		PH	DFF	50% F	I-FS	I-PP	P/P	PL	PW	G/P	Pickings	TSS	Protein	Y/P
PH	P	0.4528	-0.5318	0.0209	-0.1673	0.5764	-0.0355	-0.1261	-0.2356	-0.0149	0.0086	-0.0087	-0.0351	-0.0964
	G	-0.4653	-0.7433	0.0790	-0.5402	1.5880	1.1873	0.1924	-1.2532	-0.0543	-0.0601	-0.0417	-0.0993	-0.2108
DFF	P	0.2535	-0.9500	0.0297	-0.2377	0.7644	-0.0132	-0.0828	-0.1752	-0.0046	0.0099	-0.0073	0.0571	-0.3261*
	G	-0.2779	-1.2447	0.1063	-0.7163	2.0045	0.4630	0.0847	-0.9102	-0.0160	-0.0666	-0.0325	0.1196	-0.4882**
50% F	P	0.2075	-0.8859	0.0318	-0.2548	0.7721	-0.0210	-0.0789	-0.2157	-0.0080	0.0087	-0.0065	0.0429	-0.3179
	G	-0.3232	-1.1636	0.1137	-0.7698	2.0182	0.7137	0.1200	-1.1196	-0.0270	-.058	-0.0284	0.0840	-0.4402**
I-FS	P	0.2857	-0.8513	0.0306	-0.2652	0.7578	-0.0226	-0.0921	-0.2357	-0.0124	0.0095	-0.0088	0.0352	-0.3694*
	G	-0.3192	-1.1353	0.1111	-0.7876	2.0094	0.7285	0.1444	-1.1976	-0.0400	-0.0627	-0.0378	0.0755	-0.5113**
I-PP	P	0.3223	-0.8966	0.0303	-0.2482	0.8099	-0.0221	-0.0802	-0.2161	-0.0065	0.0108	-0.0088	0.0336	-0.2715
	G	-0.3497	-1.1807	0.1086	-0.7489	2.1131	0.7355	0.1218	-1.1119	-0.0222	-0.0717	-0.0389	0.0668	-0.3783*
P/P	P	0.3347	-0.2608	0.0139	-0.1249	0.3721	-0.0481	0.1365	-0.2851	-0.0194	0.0054	-0.0069	-0.0469	0.0705
	G	-0.4343	-0.4531	0.0638	-0.4510	1.2218	1.2720	0.2251	-1.2638	-0.0601	-0.0381	-0.0362	-0.0635	-0.0175
PL	P	-0.2162	0.1900	-0.0095	0.0925	-0.2460	-0.0248	0.2641	0.2187	0.0375	-0.0045	0.0052	0.0884	0.3952*
	G	0.3099	0.3649	-0.0472	0.3936	-0.8907	-0.9910	-0.2889	1.4627	0.0931	0.0329	0.0233	0.2010	0.6636**
PW	P	-0.2039	0.4584	-0.0189	0.1722	-0.4821	0.0577	0.1591	0.3640	0.0275	-0.0068	0.0074	0.0361	0.3699**
	G	0.3852	0.7483	-0.0841	0.6230	-1.5519	-1.0617	-0.2791	1.5140	0.0886	0.0532	0.0412	0.0653	0.5420**
G/P	P	-0.1199	0.0770	-0.0045	0.0584	-0.0939	0.0166	0.1755	0.1772	0.0564	-0.0032	0.0061	0.0469	0.3926*
	G	0.2215	0.1746	-0.0269	0.2764	-0.4112	-0.6699	0.2356	1.1750	0.1141	0.0258	0.0300	0.0899	0.7637**
Pickings	P	-0.2726	0.6643	-0.0195	0.1763	-0.6146	0.0183	0.0839	0.1727	0.0127	-0.0142	0.0127	0.0261	0.2464
	G	0.3091	0.9152	-0.0731	0.5455	-1.6740	-0.5359	-0.1049	0.8895	0.0325	0.0905	-0.0534	0.0358	0.3769*
TSS	P	0.1968	-0.3461	0.0103	-0.1158	0.3544	-0.0106	-0.0685	-0.1338	-0.0172	0.0090	-0.0201	-0.0035	-0.1510
	G	-0.2712	-0.5656	0.0452	-0.4159	1.1476	0.6437	0.0940	-0.8721	-0.0478	0.0675	-0.0716	-0.0254	-0.2715
Protein	P	-0.0615	-0.2100	0.0053	-0.0362	0.1054	0.0087	0.0903	0.0648	0.0102	-0.0015	0.0003	0.2583	0.2342
	G	0.1188	-0.3829	0.0246	-0.1530	0.3630	-0.2077	-0.1494	0.2545	0.0264	0.0083	0.0047	0.1887	0.2961

PH = Average plant height (cm), DFF = Days taken to first flowering, 50% F = Days to 50% flowering, I-FS = Days to first fruit setting, I-PP = Days to first pod picking, P/P = Average number of pods per plant, PL = Average pods length (cm), PW = Average pod weight (g), G/P = Average number of grains per pod, Pickings = Average number of pickings, Y/P = Average yield per plant (g), Y/ha = Average yield per hectare (q), TSS = T.S.S. of green seeds (^{0}B), Protein = Protein content in pods (%)

** significant at P = 0.01 level of significance, * significant at P = 0.05 level of significance, Residual effects : phenotypic = 0.511, genotypic = -0.358. (Note : Diagonal values are direct effect.)