



CORRELATION AND PATH ANALYSIS STUDIES IN F₂ GENERATION OF INTERSPECIFIC HYBRIDS IN COWPEA (*VIGNA UNGUICULATA* SSP. *UNGUICULATA* AND *VIGNA UNGUICULATA* SSP. *SESQUIPEDALIS*)

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ABSTRACT

Studies on correlation between yield and yield components in 25 F₂ populations of inter subspecies crosses of cowpea and their 14 parents revealed that dry yield per plant, harvest index, number of pods per plant and number of pods per cluster would be more appropriate than other characters. The selection criteria based on number of clusters per plant, pod length and green pod yield for vegetable purpose and number of clusters per plant, pod length, seeds per pod and hundred seed weight for seed yield will give fruitful results for yield improvement in cowpea.

KEYWORDS: cowpea, interspecific hybrids, correlation, path analysis.

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) 2n=22 is one of the most widely adapted; drought-tolerant, versatile, and nutritious grain legumes or pulse crop. It is used as dry seed or green pod as vegetable or as forage crop. It is originated and domesticated in southern Africa and was later moved to East-West Africa and Asia. Cowpea belongs to family Leguminaceae, sub family Fabaceae, a genus having 170 species. In cowpea, four sub species have been identified as *Unguiculata*, *biflora*, *textilis* and *sesquipedalis*. Out of these subspecies two mostly cultivated in India are *unguiculata* var. *sinensis* is the grain type cowpea, with medium length, pendent pods, medium sized, kidney shaped or roundish seeds, while var. *sesquipedalis* (vegetable type) is known as yard long or asparagus bean which has long pendent pods which are inflated when green and shrivel when ripe, with elongate, kidney shaped seeds. Yield is a complex character influenced by various components towards yield. Correlation and path coefficient analysis are the important biometrical techniques to determine the yield components. The characters that are positively correlated with yield are of considerably important to plant breeder for selection purpose. Although the correlation coefficient indicates the nature of association among the different traits, path analysis splits the correlation coefficients into measure of direct and indirect effects, thus provides understanding of the direct and indirect contribution of each characters towards yield. With this view, a study was made to understand the nature of correlations among yield and yield components in 25 F₂ populations of inter sub species crosses of cowpea namely *Vigna unguiculata* ssp. *unguiculata* and *Vigna unguiculata* ssp. *sesquipedalis* and 14 parents to understand the possibility of utilisation of these two subspecies in the improvement of vegetable cowpea.

MATERIALS & METHODS

Materials selected for the study consisted F₂ populations of 25 crosses and 14 genotypes namely, Konkan safed, Konkan sadabahar, Pusa dophasali, Pusa phalguni, PCP-9723, ACP-109, PCP-97102, V-585, ACP-1264, PCP-97100 as female parents from *Vigna unguiculata* ssp. *unguiculata* and Konkan wali, Arka garima, UBA-1 and DPL-YB-5 as male parents from *Vigna unguiculata* ssp. *sesquipedalis*. Study was carried out at Education and Research farm, Department of Agricultural Botany, College of Agriculture, DBSKKV, Dapoli during Rabi 2016-2017. The mean data of F₂ population for each cross was used for analysis. The F₂s along with their parents were sown at a spacing of 45 x 30 cm. In F₂ a total of 30 plants were grown in each cross in three replication and observations were recorded on five randomly selected plants on fourteen quantitative characters namely, plant height, number of primary branches per plant, days to first flowering, days to maturity, number of clusters per plant, number of pods per plant, number of pods per cluster, pod length, number of seeds per pod, green pod yield per plant, dry pod yield per plant, hundred seed weight, harvest index and seed yield per plant. All the recommended cultural practices were followed. The simple correlation coefficients and path analysis between yield and yield components were estimated as per the standard procedure.

RESULTS & DISCUSSION

The correlation co-efficient and path analysis for seed yield per plant and its contributing characters for F₂ and base population at phenotypic and genotypic level are presented in Table 1, 2, 3 and 4 respectively. The seed yield per plant expressed a positive significant correlation with number of pods per cluster, number of pods per plant and dry pod yield per plant.

Interspecific hybrids in cowpea

TABLE 1. Estimates of phenotypic correlation coefficient for fourteen quantitative characters

Character	Plant height	Number of primary branches/ plant	Days to first flowering	Days to maturity	Pod length	Number of seed/pod	Number of pod/cluster	Number of clusters/ plant	Number of pods/ plant	Green pod yield/ plant	Dry pod yield/ plant	Hundred seed weight	Harvest index	Seed yield/plant
Plant height	1.000	0.1744	0.2464**	0.2860**	0.6750**	0.2434**	-0.1181**	0.0553	-0.0413	0.4936**	-0.1066	0.2233*	-0.3050*	-0.4362**
No. of primary branches/ plant		1.000	0.1111	0.2466**	0.0513	-0.0614	-0.0825	-0.1230	-0.0947	0.1125	0.2899**	0.2057*	-0.0894	0.0479
Days to first flowering			1.0000	0.3343**	0.1137	0.2411**	-0.1924*	-0.1288	-0.1973*	0.1975*	0.0712	-0.0395	0.1467	0.1209
Days to maturity				1.0000	0.3268**	0.3451**	0.1614	-0.0165	0.1142	0.3429**	0.2862**	0.1404	-0.2044*	0.0897
Pod length					1.0000	0.4567**	-0.0395	0.1437	0.0790	0.5328**	0.1021	0.2552**	-0.3921**	-0.2758**
Number of seeds/pod						1.0000	-0.1839*	0.0015	-0.1083	0.3514**	-0.0509	0.0679	-0.1826*	-0.2161*
Number of pods/ cluster							1.0000	0.0858	0.6370**	-0.0643	0.2040*	-0.0430	0.2213*	0.3004**
Number of clusters/ plant								1.0000	0.7995**	0.3681**	0.1874*	0.0571	0.2835**	0.1754
Number of pods/ plant									1.0000	0.2527**	0.2930**	0.0027	0.3417**	0.3327**
Green pod yield/ plant										1.0000	0.2855**	0.2659**	-0.1640	-0.0325
Dry pod yield/ plant											1.0000	0.0202	0.0202	0.5276**
Hundred seed weight												1.0000	-0.1141	0.1261
Harvest index													1.0000	0.4997**

*Significant at 5 per cent

**Significant at 1 per cent

TABLE 2. Estimates of genotypic correlation coefficient for fourteen quantitative characters

Character	Plant height	Number of primary branches/ plant	Days to first flowering	Days to maturity	Pod length	Number of seeds/pod	Number of pod/ cluster	Number of clusters/ plant	Number of pods/ plant	Green pod yield/ plant	Dry pod yield/ plant	Hundred seed weight	Harvest index	Seed yield/ plant
Plant height	1.0000	0.1954*	0.2724**	0.3213**	0.7039**	0.2996**	-0.1252	0.0543	-0.0425	0.5124**	-0.1062	0.2407**	-0.3186**	-0.4503**
No. of primary branches/ plant	1.0000	1.0000	0.1309	0.2527**	0.0650	-0.0827	-0.0756	-0.1374	-0.1031	0.1214	0.3263**	0.2412**	-0.1148	0.0474
Days to first flowering	1.0000	0.3939**	1.0000	0.3939**	0.1150	0.3469**	-0.2462**	-0.1271	-0.2216*	0.2212*	0.0933	-0.0558	0.1754	0.1368
Days to maturity	1.0000	0.3524**	1.0000	1.0000	0.3524**	0.4161**	0.1942*	-0.0277	0.1215	0.3671**	0.3087**	0.1794	-0.2337*	0.0968
Pod length	1.0000	0.5463**	1.0000	0.5463**	1.0000	0.5463**	-0.0425	0.1545	0.0832	0.5415**	0.1057	0.2640**	-0.4066**	-0.2851**
Number of seeds/pod	1.0000	0.1962*	1.0000	0.1962*	1.0000	1.0000	-0.1962*	0.0029	-0.1014	0.4158**	-0.0574	0.1063	-0.2226*	-0.2686**
Number of pods/ cluster	1.0000	0.1282	1.0000	0.1282	1.0000	0.6367**	1.0000	0.1282	0.6367**	-0.0581	0.2147*	-0.0185	0.2311*	0.3308**
Number of clusters/ plant	1.0000	0.8378**	1.0000	0.8378**	1.0000	0.8378**	1.0000	0.8378**	0.8378**	0.3778**	0.1979*	0.0667	0.3002**	0.1819*
Number of pods/ plant	1.0000	0.2623**	1.0000	0.2623**	1.0000	0.2623**	1.0000	0.2623**	1.0000	0.2623**	0.2969**	0.0199	0.3482**	0.3327**
Green pod yield/ plant	1.0000	0.2918**	1.0000	0.2918**	1.0000	0.2918**	1.0000	0.2918**	1.0000	1.0000	0.2918**	0.2762**	-0.1635	-0.0346
Dry pod yield/ plant	1.0000	0.0235	1.0000	0.0235	1.0000	0.0235	1.0000	0.0235	1.0000	1.0000	1.0000	0.0235	0.0160	0.5378**
Hundred seed weight	1.0000	0.1225	1.0000	0.1225	1.0000	0.1225	1.0000	0.1225	1.0000	0.1225	0.1225	1.0000	-0.1225	0.1520
Harvest index	1.0000	0.5175**	1.0000	0.5175**	1.0000	0.5175**	1.0000	0.5175**	1.0000	0.5175**	0.5175**	1.0000	0.5175**	0.5175**

*Significant at 5 per cent

**Significant at 1 per cent

TABLE 3. Path analysis at phenotypic level for fourteen quantitative characters

Character	Plant height	Number of primary branches/ plant	Days to first flowering	Days to maturity	Pod length	Number of seeds/pod	Number of pod/ cluster	Number of clusters/ plant	Number of pods/ plant	Green pod yield/ plant	Dry pod yield/ plant	Hundred seed weight	Harvest index	Seed yield /plant
Plant height	-0.3550	-0.0619	-0.0875	-0.1015	-0.2396	-0.0864	0.0419	-0.0196	0.0147	-0.1752	0.0378	-0.0793	0.1083	-0.4362
No. of primary branches/ plant	-0.0138	-0.0792	-0.0088	-0.0195	-0.0041	0.0049	0.0065	0.0097	0.0075	-0.0089	-0.0229	-0.0163	0.0071	0.0479
Days to first flowering	0.0380	0.0172	0.1544	0.0516	0.0176	0.0372	-0.0297	-0.0199	-0.0305	0.0305	0.0110	-0.0061	0.0226	0.1209
Days to maturity	0.0284	0.0245	0.0332	0.0993	0.0325	0.0343	0.0160	-0.0016	0.0113	0.0340	0.0284	0.0139	-0.0203	0.0897
Pod length	0.0088	0.0007	0.0015	0.0043	0.0131	0.0060	-0.0005	0.0019	0.0010	0.0070	0.0013	0.0033	-0.0051	-0.2758
Number of seeds/pod	-0.0301	0.0076	-0.0298	-0.0427	-0.0565	-0.1237	0.0228	-0.0002	0.0134	-0.0435	0.0063	-0.0084	0.0226	-0.2161
Number of pods/ cluster	-0.0109	-0.0076	-0.0177	0.0148	-0.0036	-0.0169	0.0920	0.0079	0.0586	-0.0059	0.0188	-0.0040	0.0204	0.3004
Number of clusters/ plant	0.0005	-0.0011	-0.0012	-0.0002	0.0013	0.0000	0.0008	0.0092	0.0074	0.0034	0.0017	0.0005	0.0026	0.1754
Number of pods/plant	0.0006	0.0013	0.0028	-0.0016	-0.0011	0.0015	-0.0089	-0.0112	-0.0140	-0.0035	-0.0041	0.0000	-0.0048	0.3227
Green pod yield/ plant	-0.0016	-0.0004	-0.0007	-0.0011	-0.0018	-0.0012	0.0002	-0.0012	-0.0008	-0.0033	-0.0009	-0.0009	0.0005	-0.0325
Dry pod yield/ plant	-0.0466	0.1269	0.0311	0.1252	0.0447	-0.0223	0.0893	0.0820	0.1282	0.1249	0.4377	0.0088	0.0088	0.5276
Hundred seed weight	0.0572	0.0527	-0.0101	0.0360	0.0654	0.0174	-0.0110	0.0146	0.0007	0.0681	0.0052	0.2562	-0.0292	0.1261
Harvest index	-0.1117	-0.0328	0.0537	-0.0749	-0.1436	-0.0669	0.0811	0.1038	0.1252	-0.0600	0.0074	-0.0418	0.3662	0.4997

Note: Bold figures indicate direct effects

Residual effect= 0.5720

TABLE 4. Path analysis at genotypic level for fourteen quantitative characters

Character	Plant height	Number of primary branches/plant	Days to first flowering	Days to maturity	Pod length	Number of seeds/pod	Number of pods/cluster	Number of clusters/plant	Number of pods/plant	Green pod yield/plant	Dry pod yield/plant	Hundred seed weight	Harvest index	Seed yield /plant
Plant height	-0.4591	-0.0897	-0.1251	-0.1475	-0.3232	-0.1376	0.0575	-0.0249	0.0195	-0.2353	0.0488	-0.1105	0.1463	-0.4503
No. of primary branches/ plant	-0.0288	-0.1472	-0.0193	-0.0372	-0.0096	0.0122	0.0111	0.0202	0.0152	-0.0179	-0.0480	-0.0355	0.0169	0.0474
Days to first flowering	0.0673	0.0323	0.2470	0.0973	0.0284	0.0857	-0.0608	-0.0314	-0.0547	0.0546	0.0231	-0.0138	0.0433	0.1368
Days to maturity	0.0299	0.0235	0.0367	0.0932	0.0328	0.0388	0.0181	-0.0026	0.0113	0.0342	0.0288	0.0167	-0.0218	0.0968
Pod length	0.1146	0.0106	0.0187	0.0573	0.1627	0.0889	-0.0069	0.0251	0.0135	0.0881	0.0172	0.0430	-0.0662	-0.2851
Number of seeds/pod	-0.0842	0.0232	-0.0975	-0.1169	-0.1535	-0.2810	0.0551	-0.0008	0.0285	-0.1168	0.0161	-0.0299	0.0626	-0.2686
Number of pods/ cluster	0.0291	0.0176	0.0573	-0.0452	0.0099	0.0457	-0.2329	-0.0299	-0.1483	0.0135	-0.0500	0.0043	-0.0538	0.3308
Number of clusters/ plant	-0.0279	0.0705	0.0652	0.0142	-0.0793	-0.0015	-0.0658	-0.5134	-0.4301	-0.1939	-0.1016	-0.0343	-0.1541	0.1819
Number of pods/plant	-0.0262	-0.0636	-0.1367	0.0749	0.0513	-0.0625	0.3927	0.5166	0.6167	0.1618	0.1831	0.0123	0.2147	0.3327
Green pod yield/ plant	0.0158	0.0038	0.0068	0.0113	0.0167	0.0128	-0.0018	0.0117	0.0081	0.0309	0.0090	0.0085	-0.0051	-0.0346
Dry pod yield/ plant	-0.0423	0.1299	0.0371	0.1228	0.0420	-0.0228	0.0854	0.0788	0.1181	0.1161	0.3979	0.0094	0.0064	0.5378
Hundred seed weight	0.0787	0.0788	-0.0183	0.0586	0.0863	0.0347	-0.0060	0.0218	0.0065	0.0903	0.0077	0.3269	-0.0401	0.1520
Harvest index	-0.1173	-0.0423	0.0646	-0.0861	-0.1497	-0.0820	0.0851	0.1106	0.1282	-0.0602	0.0059	-0.0451	0.3683	0.5175

Note: Bold figures indicate direct effects

Residual effect= 0.4903

These results were in agreement with Malarvizhi *et al.* (2002) and Oseni *et al.* (1992) in case of pods per plant. Number of pods per cluster showed positive significant correlation with seed yield per plant, number of pods per plant and dry pod yield per plant. As the number of pods in a cluster increases, automatically number of pods in a plant increases thus yield also. The same observations were recorded by Manggeol *et al.* (2012) and Sharma *et al.* (2015). Green pod yield per plant showed positive correlation with dry pod yield per plant, pod length and hundred seed weight. The above findings are in agreement with Vidya and Oommen (2002) and Sapara and Javia (2014). Surprisingly, Plant height, pod length and number of seeds per pod had significant negative correlation with seed yield per plant. The seed yield is complex character and each character had its own effect for establishing correlation with yield. The path coefficient analysis revealed that the characters number of pods per cluster, pods per plant, dry pod yield per plant and harvest index exhibited high positive direct effect on seed yield per plant. Among the character dry pod yield per plant exhibited highest positive direct effect on seed yield per plant at both phenotypic and genotypic level. Green pod yield per plant had negative direct effect on seed yield per plant at genotypic and phenotypic level. Sapara and Javia (2014) and patel *et al.* (2016) observed similar result at genotypic level.

CONCLUSION & RECOMMENDATION

It is to be stated that, on the basis of correlation and path analysis studied, seed yield per plant could be improved through simultaneous selection of number of pods per cluster, number of pods per plant, dry pod yield per plant and harvest index. It is desirable to give more weightage to

these characters in selection programme for both seed yield and green pod yield per plant.

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