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Research Article

Correlation and path analysis studies in red cowpea

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Abstract An experiment was conducted with twenty four genotypes in rabi season of 2020-21 at research and education farm, Department of Agriculture Botany, College of Agriculture, Dapoli. Observations were recorded on fourteen characters viz., days to first flowering, day to 50 per cent flowering, days to maturity, plant height at maturity (cm), number of primary branches per plant, number of pods per plant, number of seeds per pod, 100 seed weight, pod length (cm), dry matter yield per plant, harvest index (%), seed yield per plant, protein content (%) and iron content (ppm). The correlation study revealed that the characters viz., number of pods per plant, number of seeds per pod and harvest index showed highly significant positive correlation with seed yield per plant at both phenotypic and genotypic level. The path coefficient analysis revealed that the characters viz., pod length, plant height at maturity, hundred seed weight, dry matter yield per plant and harvest index exhibited positive direct effect on seed yield per plant at both phenotypic and genotypic level. On the basis of path analysis and correlation study for seed yield, it is concluded that selection on the basis of number of seeds per pod, number of pods per plant, dry matter yield per plant and hundred seed weight could help in genetic improvement of grain yield per plant in cowpea under study.

Keywords : Correlation, path analysis, character association study

Introduction

Pulses are economically cheaper and vital source of protein, vitamins and minerals in Indian diet. Cowpea (*Vigna unguiculata* (L.) Walp) 2n=22 is one of the most widely adapted; drought-tolerant, versatile, and nutritious grain legume crop. Cowpea, a self-pollinating plant species that belongs to the family Fabaceae, is cultivated worldwide (Mahe et al. 1994; Musvosvi, 2009) [9] .It is native to India (Vavilov, 1949) [16] but tropical and central Africa is also considered as secondary centre of origin. Cowpea is an annual herb with strong tap root system and many spreading lateral roots in surface soil. It is used as dry seed or green pod as vegetable or as forage crop. Due to its drought tolerance and ability to grow on poor-quality soils, it is one of the most important food and forage legumes in the semi-arid tropics. It is an important legume crop in eastern, southern, central and western Africa (Emongor, 2007) [3]. It is a highly nutritious legume crop (Kay, 1979) [7]. The seeds contain small amounts of âcarotene (precursor of vitamin A), thiamine, riboflavin, niacin, folic acid and ascorbic acid (Kay, 1979; Tindall, 1983) [7, 14]. It is a major source of inexpensive protein in human diets with grains containing about 23–25% protein (Bressani, 1985; Gupta 1988) [2, 4], 1.8% fat and 60.3% carbohydrates and it is a rich source of calcium and iron (Gupta, 1988) [4]. Cowpea leaves and immature pods are also consumed as a green vegetable (Singh et al. 2002) [13].

Materials and Methods

The present investigation was carried out at Research and Education Farm, College of Agriculture, Dapoli, Dist. Ratnagiri during the period rabi season of 2020-21. The experiment was conducted in RBD with two replications. The seed was dibbled at 30 cm x 20 cm distance. Each plot had 2.0 m × 1.2 m area (excluding the space between each treatment) with 4 rows per genotypes. Each row contains 10 plants thus there were 40 plants per population, constitute 80 plants in two replications. The total fertilizer

dose applied @ 25 Kg N: 50 Kg P_2O_5 per hectare. Out of which half dose of nitrogen in the form of urea was applied at the time of sowing and remaining dose nitrogen was applied one month after sowing. The operation like gap filling was done 10 days after sowing so as to maintain one plant per hill and to maintain the plant population. An recommended package of practices were carried out as and when required so as to maintain good stand of crop as per the standard recommendations.

The simple correlation coefficients and path analysis between yield and yield components were estimated as per the standard procedures.

Correlation coefficients at the genotypic and phenotypic levels with the method given by Johnson et al. (1955) [6]. Path coefficient analysis was carried out using correlation values of yield components on yield as suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

Results and Discussion

The correlation co-efficient and path analysis for seed yield per plant and its contributing characters for 24 genotypes of red cowpea at phenotypic and genotypic level are presented in Table 1 and 2 respectively.

Correlation

Seed yield per plant showed highly positive significant correlation with number of pods per plant, number of seeds per pod and harvest index. It showed positive non-significant correlation with pod length, plant height at maturity, hundred seed weight and protein content. Seed yield per plant showed negative significant correlation with days to first flowering, days to 50% flowering and days to maturity. It showed negative non-significant correlation with number of primary branches per plant and iron content at both genotypic and phenotypic levels. These results were in agreement with Manggoel et al. (2012) [8]. Number of pods per plant had positive significant correlation with dry matter yield per plant and harvest index and positive non-significant correlation with number of seeds per pod at both phenotypic and genotypic level. It had negative significant correlation with hundred seed weight. It showed negative non-significant correlation with protein content, iron content, pod length and plant height at maturity. Similar results were reported by Patel et al. (2016) [11]. Hundred seed weight had highly significant positive correlation with pod length. It had positive non-significant correlation with iron content and dry matter yield per plant. It had negative non-significant correlation with dry matter yield per plant and harvest index at both phenotypic and genotypic level. Similar finding were reported by Sapara and Javia et al. (2014)[12].

Path analysis

Correlation does not provide exact picture of the direct and indirect causes of such association which, can be understand through path analysis. Pod length, number of pods per plant, plant height at maturity, hundred seed weight, dry matter yield per plant and harvest index had positive direct effect on seed yield per plant at both phenotypic and genotypic level. While, number of primary branches per plant and protein content had negative direct effect at both phenotypic and genotypic level. However, it had positive indirect effect through days to first flowering, days to 50 % flowering and days to maturity. It had negative indirect effect through number of seeds per pod. This was in confirmation with reports of Udensi et al. (2012) [14] in cowpea. Pod length had positive direct effect on seed yield per plant at both phenotypic and genotypic levels. It had positive indirect effect through days to first flowering, days to 50% flowering, days to maturity, hundred seed weight, number of seeds per pod, dry mater yield per plant, plant height at maturity, harvest index and iron content. It had negative indirect effect through days number of pods per plant, protein content and iron content. Patel et al. (2016) [11] and Naher et al.(2006) [10] observed similar result in cowpea.

Table 1: Phenotypic (P) and genotypic (G) correlation coefficients for different characters in 24 genotypes of cowpea

Character		Days to first flowering	Days to50%flowering	Days to maturity	Number of primary branches per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Plant height at maturity (cm)	Hundred seed weight (g)	Dry matter yield per plant (g)	Harvest index (%)	Protein content (%)	Iron content (ppm)	Seed yield per plant (g)
Days to first flowering	P	**1.000**	0.9543**	0.8878**	0.2065	-0.6286**	0.4006**	0.1377	0.1326	0.4842**	-0.2561	-0.1688	-0.1773	-0.054	-0.361*
	G	**1.000**	0.996**	0.910**	0.2347	-0.676**	0.524**	0.2127	0.2453	0.714**	-0.2591	-0.1562	-0.1982	-0.0723	-0.396**
Days to 50% flowering	P		**1.000**	0.9113**	0.217	-0.6329**	0.3341 *	0.0652	0.1569	0.4120**	-0.2362	-0.2124	-0.1256	0.0147	-0.394**
	G		**1.000**	0.948**	0.2306	-0.712**	0.469**	0.1784	0.310*	0.727**	-0.229	-0.2046	-0.1406	-0.0001	-0.441**
Days to maturity	P			**1.000**	0.0947	-0.5209**	0.3003 *	0.0429	0.0679	0.3629 *	-0.0317	-0.3409*	-0.1292	-0.0048	-0.328*
	G			**1.000**	0.0864	-0.610**	0.404**	0.1075	0.25	0.750**	0.0163	-0.363*	-0.1494	-0.0365	-0.376**
Number of primary branches/plant	P				**1.000**	-0.198	0.2139	0.1673	0.4584**	0.0262	-0.4390**	0.1719	-0.0855	-0.0727	-0.2113
	G				**1.000**	-0.2171	0.2779	0.2225	0.630**	0.1161	-0.480**	0.2325	-0.1073	-0.0577	-0.2379
Number of pods per plant	P					**1.000**	-0.1679	0.0814	-0.0023	-0.2651	0.4790**	0.2932*	-0.1286	-0.2229	0.778**
	G					**1.000**	-0.1732	0.1144	-0.0765	-0.431**	0.516**	0.327*	-0.121	-0.2245	0.862**
Pod length (cm)	P						**1.000**	0.7924**	0.2494	0.5475**	-0.1484	0.2426	-0.0789	0.1115	0.2439
	G						**1.000**	0.865**	0.1789	0.887**	-0.196	0.2723	-0.0965	0.1256	0.2611
Number of seeds per pod	P							**1.000**	0.2479	0.2286	-0.1402	0.5052**	0.2261	-0.0907	0.456**
	G								**1.000**	0.1761	0.2719	-0.2457	0.599**	0.2531	-0.0865
Plant height at maturity (cm)	P								**1.000**	0.1076	-0.1425	0.2062	-0.1276	-0.1145	0.1115
	G								**1.000**	0.045	-0.2171	0.2358	-0.1529	-0.1178	0.0775
Hundred seed weight (g)	P									**1.000**	0.0661	-0.1119	-0.2414	0.1599	0.0374
	G									**1.000**	-0.0061	-0.2236	-0.305*	0.2615	-0.0138
Dry matter yield per plant (g)	P										**1.000**	-0.4792**	-0.1473	-0.0463	0.411**
	G										**1.000**	-0.553**	-0.1667	-0.0298	0.400**
Harvest index (%)	P											**1.000**	0.2567	-0.0975	0.535**
	G											**1.000**	0.2761	-0.0914	0.531**
Protein content (%)	P												**1.000**	0.1053	0.0117
	G												**1.000**	0.1104	0.0011
Iron content (ppm	P													**1.000**	-0.0711
	G													**1.000**	-0.0515

Table 2: Phenotypic (P) and genotypic (G) path coefficient analysis indicating direct and indirect effects of components characters on seed yield per plant among 24 genotypes of cowpea

Character		Days to first flowering	Days to50%flowering	Days to maturity	Number of primary branches per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Plant height at maturity (cm)	Hundred seed weight (g)	Dry matter yield per plant (g)	Harvest index (%)	Protein content (%)	Iron content (ppm)	Seed yield per plant (g)
Days to first flowering	P	**0.0765**	0.073	0.0679	0.0158	-0.0481	0.0306	0.0105	0.0101	0.037	-0.0196	-0.0129	-0.0136	-0.0041	-0.3613
	G	**-0.283**	-0.281	-0.257	-0.066	0.191	-0.148	-0.060	-0.069	-0.202	0.073	0.044	0.056	0.020	-0.396**
Days to50% flowering	P	-0.0139	**-0.0146**	-0.0133	-0.0032	0.0092	-0.0049	-0.001	-0.0023	-0.006	0.0034	0.0031	0.0018	-0.0002	-0.3944
	G	0.364	**0.366**	0.347	0.084	-0.260	0.172	0.065	0.114	0.266	-0.084	-0.075	-0.051	0.000	-0.441**
Days to maturity	P	0.0139	0.0143	**0.0157**	0.0015	-0.0082	0.0047	0.0007	0.0011	0.0057	-0.0005	-0.0053	-0.002	-0.0001	-0.3279
	G	-0.526	-0.548	**-0.578**	-0.050	0.352	-0.234	-0.062	-0.145	-0.434	-0.009	0.210	0.086	0.021	-0.376**
Number of primary branches /plant	P	-0.0132	-0.0139	-0.0061	**-0.064**	0.0127	-0.0137	-0.0107	-0.0293	-0.0017	0.0281	-0.011	0.0055	0.0047	-0.2113
	G	-0.040	-0.039	-0.015	**-0.170**	0.037	-0.047	-0.038	-0.107	-0.020	0.082	-0.040	0.018	0.010	-0.238
Number of pods per plant	P	-0.2493	-0.251	-0.2066	-0.0785	**0.3966**	-0.0666	0.0323	-0.0009	-0.1051	0.19	0.1163	-0.051	-0.0884	0.7779
	G	0.247	0.260	0.223	0.079	**-0.365**	0.063	-0.042	0.028	0.158	-0.189	-0.119	0.044	0.082	0.862**
Pod length (cm)	P	0.044	0.0367	0.033	0.0235	-0.0185	**0.1099**	0.0871	0.0274	0.0602	-0.0163	0.0267	-0.0087	0.0123	0.2439
	G	0.268	0.240	0.207	0.142	-0.089	**0.512**	0.443	0.092	0.454	-0.100	0.140	-0.050	0.064	0.261
Number of seeds per pod	P	0.011	0.0052	0.0034	0.0133	0.0065	0.0631	**0.0796**	0.0197	0.0182	-0.0112	0.0402	0.018	-0.0072	0.456
	G	-0.091	-0.076	-0.046	-0.095	-0.049	-0.371	**-0.428**	-0.075	-0.117	0.105	-0.257	-0.108	0.037	0.456**
Plant height at maturity (cm)	P	0.0045	0.0053	0.0023	0.0155	-0.0001	0.0084	0.0084	**0.0338**	0.0036	-0.0048	0.007	-0.0043	-0.0039	0.1115
	G	0.042	0.053	0.042	0.107	-0.013	0.030	0.030	**0.169**	0.008	-0.037	0.040	-0.026	-0.020	0.078
Hundred seed weight (g)	P	0.0198	0.0168	0.0148	0.0011	-0.0108	0.0223	0.0093	0.0044	**0.0408**	0.0027	-0.0046	-0.0098	0.0065	0.0374
	G	0.149	0.151	0.156	0.024	-0.090	0.185	0.057	0.009	**0.208**	-0.001	-0.047	-0.064	0.055	-0.014
Dry matter yield per plant (g)	P	-0.1421	-0.1311	-0.0176	-0.2436	0.2658	-0.0823	-0.0778	-0.0791	0.0367	**0.5549**	-0.2659	-0.0817	-0.0257	0.4106
	G	-0.335	-0.296	0.021	-0.620	0.667	-0.253	-0.318	-0.281	-0.008	**1.293**	-0.715	-0.216	-0.039	0.400**
Harvest index (%)	P	-0.1108	-0.1395	-0.2238	0.1129	0.1925	0.1592	0.3317	0.1354	-0.0735	-0.3146	**0.6565**	0.1685	-0.064	0.5346
	G	-0.211	-0.276	-0.489	0.313	0.440	0.367	0.807	0.318	-0.301	-0.745	**1.348**	0.372	-0.123	0.531**

Protein content (%)	P	0.0038	0.0027	0.0028	0.0019	0.0028	0.0017	-0.0049	0.0028	0.0052	0.0032	-0.0056	**-0.0217**	-0.0023	0.0117
	G	0.009	0.006	0.007	0.005	0.005	0.004	-0.011	0.007	0.014	0.008	-0.012	**-0.045**	-0.005	0.001
Iron content (ppm)	P	-0.0055	0.0015	-0.0005	-0.0074	-0.0226	0.0113	-0.0092	-0.0116	0.0162	-0.0047	-0.0099	0.0107	**0.1014**	-0.0711
	G	0.011	0.000	0.006	0.009	0.035	-0.019	0.013	0.018	-0.040	0.005	0.014	-0.017	**-0.154**	-0.052

Conclusion

From this study, seed yield had positive and highly significant association with number of pods per plant, number of seeds per pod and harvest index .Seed yield had positive non-significant correlation with pod length, plant height at maturity, hundred seed weight and protein content. Seed yield per plant showed negative significant correlation with days to first flowering, days to 50% flowering and days to maturity. It had negative non significant correlation with number of primary branches per plant and iron content. Path co-efficient analysis revealed that Pod length, number of pods per plant, plant height at maturity, hundred seed weight, dry matter yield per plant and harvest index had positive direct effect on seed yield per plant. Number of primary branches per plant and protein content had negative direct effect on seed yield per plant at both phenotypic and genotypic level.

References

Anonymous. FAO, FAOSTAT. Food and Agriculture Organization of the United Nations, Rome, Italy 2017.

Bressani R. Nutritive value of cowpea. In: Singh SR, Rachie KO (eds), *Cowpea research, production and utilisation. Chichester:* John Wiley and Sons 1985, 353-359.

Emongor V. Gibberellic acid (GA3) influence on vegetative growth, nodulation and yield of cowpea (*Vigna unguiculata* (L.) Walp.). *Journal of Agronomy* 2007; **6**:509-517.

Gupta YP. Nutritive value of pulses. In: Baldev B, Ramanujam S, Jain HK (eds), Pulse crops. New Delhi: Oxford and IBH Publishing Company 1988, 561-601.

Hugo Leonardo, Coelho Ribeiro, Carlos Antonia Fernandes Santos, Laerte da Silva Diniz. Phenotypic correlations and path analysis for plant architecture traits and grain production in three generations of cowpea. Rev. Ceres, Vicosa 2016; **63**:33-38.

Johanson HW, Robinson HF, Comstock PE. Estimate of genetic and environmental variability in soybeans. *Agronomy Journal* 1955; **47:**314-318.

Kay DE. Food legumes. London: Tropical Development and Research Institute 1979.

Manggoel W, Uguru MI, Ndam ON, Dasbak MA. Genetic variability, correlation and path coefficient analysis of some yield components of ten cowpea [*Vigna unguiculata* (L.) Walp] accessions. *J Pl. Breeding Crop Sci* 2012; **4**(5):80-86.

Musvosvi C. Morphological characterisation and interrelationships among descriptors in some cowpea genotypes. *J Afri. Crop Sci* 2009; **9**:501-507.

Naher Z, Rabbani MG, Rahman MO, Garvey EJ. Variability, correlation and path coefficient analysis of cowpea. *J Bangladesh Agri. Univ* 2006; **4**(1):17-22.

Patel UV, Parmar VK, Patel PB, Malviya AV. Correlation and path analysis study in cowpea (*Vigna unguiculata* (L.) WALP.) *International Journal of Science, Environment and Technology* 2016; **5**(6):38973904.

Sapara, G. K. and R. M. Javia (2014). Correlation and path analysis in vegetable cowpea (*Vigna unguiculata* (L.) Walp.). *International Journal of plant sciences,* **9**(1):134-141.

Singh BB, Ehlers JD, Sharma B, Freire -filho FR. Recent progress in cowpea breeding: In: Fatokun CA, Tarawali SA, Singh BB, Kormawa PM, Tamo M (eds), Challenges and opportunities for enhancing sustainable cowpea production. Ibadan: International Institute of Tropical Agriculture 2002, 22-40.

Tindall HD. Vegetables in the tropics. London: Macmillan Press 1983.

Udensi EV, Ikpeme EA, Edu, Ekpe DE. Relationship studies in cowpea [Vigna unguiculata (L.) Walp.] landraces grown under humid lowlanf condition. *International Journal of Agricultural Research 2012*; **7**:33-45.

Vavilov NI. The origin, variation, immunity and breeding of cultivated plants. Ed. K.S. Tranil, chester, Roland Press Company, New York 1995.