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Tambitkar NB
M. Sc. Scholar,
Department of Agricultural Botany, College of Agriculture, Dapoli, Maharashtra, India

Pethe UB
Assistant Professor,
Department of Agricultural Botany, College of Agriculture, Dapoli, Maharashtra, India

Desai SS
Assistant Professor,
Department of Agricultural Botany, College of Agriculture, Dapoli, Maharashtra, India

Dhopavkar RV
Assistant Professor,
Department of Soil Science and Agril. Chemistry, College of Agriculture, Dapoli, Maharashtra, India

Kadam JJ
Associate Professor,
Department of Plant pathology, College of Agriculture, Dapoli, Maharashtra, India

Corresponding Author:
Tambitkar NB
M. Sc. Scholar,
Department of Agricultural Botany, College of Agriculture, Dapoli, Maharashtra, India

Correlation and path analysis studies in cowpea

Tambitkar NB, Pethe UB, Desai SS, Dhopavkar RV and Kadam JJ

Abstract
An experiment was conducted with forty one genotypes in *rabi* season of 2019-20 at research and education farm, Department of Agriculture Botany, College of Agriculture, Dapoli. Observations were recorded on eleven characters *viz.,* days to initiation of 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.,* dry matter yield per plant and harvest index showed highly significant positive correlation with grain yield per plant at phenotypic and genotypic level. The path coefficient analysis revealed that the characters *viz.,* days to fifty percent flowering, number of pods per plant, number of seeds per pod, plant height at maturity, dry matter yield per plant and harvest index exhibited positive direct effect on seed yield per plant. On the basis of path analysis and correlation study for grain yield, it is concluded that selection on the basis of days to initiation of flowering, number of primary branches per plant, pods per plant and hundred seeds 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) [15] 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 β-carotene (precursor of vitamin A), thiamine, riboflavin, niacin, folic acid and ascorbic acid (Kay, 1979; Tindall, 1983) [7, 13]. 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) [12].

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 2019-20. 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 × 1.5 m area with 5 rows per genotypes. Each row contains 10 plants thus there were 50 plants per population, constitute 100 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 procedure.

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 grain yield per plant and its contributing characters for 41 genotypes at phenotypic and genotypic level are presented in Table 1 and 2 respectively.

Correlation

Seed yield per plant showed positive highly significant correlation with dry matter yield per plant, harvest index. It showed positive correlation with number of primary branches per plant, number of pods per plant, number of seeds per pod, plant height at maturity, hundred seed weight and protein content. Seed yield per plant showed negative non- significant correlation with days to initiation of flowering, days to 50% flowering, days to maturity, pod length and iron content at both genotypic and phenotypic levels. These results were in agreement with Manggoel *et al.* (2012) [8]. Days to 50 % flowering had positive significant with days to maturity and positive correlation with number of seeds per pod, pod length and harvest index both phenotypic and genotypic level. It had negative non-significant correlation with plant height at maturity, hundred seed weight and dry matter yield per plant. Similar results were reported by and Naher *et al.* (2006) [10].

Number of primary branches per plant had highly significant positive correlation with dry matter yield per plant. It had positive correlation with plant height at maturity. It had negative non-significant correlation with number of pods per plant, number of seeds per pod, harvest index both phenotypic and genotypic level. Similar finding were reported by Hugo Leonardo *et al.* (2016) [5] for days to maturity in cowpea.

Path analysis

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

Conclusion

From this study, seed yield had positive and highly significant association with dry matter yield per plant and harvest index. Seed yield had positive correlation with number of primary branches per plant, number of pods per plant, number of seeds per pod, plant height at maturity, hundred seed weight and protein content. Seed yield per plant had negative non-significant correlation with days to initiation of flowering, days to 50% flowering, days to maturity pod length and iron content.

Path co-efficient analysis revealed that days to 50% flowering, number of pods per plant, plant height at maturity, number of seeds per pod, dry matter yield per plant and harvest index had positive direct effect on seed yield. Days to initiation of flowering, days to maturity, number of primary branches per plant, pod length; hundred seed weight had negative direct effect on seed yield per plant.

Table 1: Phenotypic (P) and genotypic (G) correlation coefficients for different characters in 41 genotypes of cowpea

Characters		Days to initiation of flowering	Days to 50 % flowering	Days to maturity	Number of 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 nitiation of flowering	P	1.0000	0.8996**	0.8103**	-0.5053**	0.1471	0.1502	0.2111	-0.0129	-0.1100	-0.1753	0.0234	0.0008	0.1048	0.1693
	G	1.0000	0.9374**	0.8281**	-0.6088**	0.1572	0.1752	0.2596*	-0.0139	-0.1171	-0.1819	0.0243	0.0189	0.1077	-0.1780
Days to 50 % flowering	P		1.0000	0.8396**	-0.4314**	0.1547	0.1217	0.2036	-0.0697	-0.0733	-0.0598	0.0942	0.0181	0.0420	-0.0019
	G		1.0000	0.8711**	-0.4886**	0.2028	0.1384	0.2917*	-0.0759	-0.1193	-0.0623	0.1025	0.0024	0.0433	-0.0067
Days to maturity	P			1.0000	-0.4235**	0.1598	0.0316	0.2215*	-0.0240	-0.0327	-0.0799	0.0829	0.0520	0.0292	-0.0791
	G			1.0000	-0.5184**	0.1834	0.0381	0.2783*	-0.0218	-0.0218	-0.0753	0.1040	0.0719	0.0301	-0.0810
Number of branches per plant	P				1.0000	-0.0426	0.0218	-0.1487	0.0691	0.0092	0.4503**	-0.0875	0.1258	-0.1346	0.0876
	G				1.0000	-0.0864	-0.0114	-0.2019	0.0635	-0.0047	0.5345**	-0.1064	0.2272*	-0.1583	0.1179
Number of pods per plant	P					1.0000	-0.2784*	-0.2112	-0.4424**	0.0466	0.0031	0.0624	-0.2079	0.1697	0.0727
	G					1.0000	-0.3773**	-0.2697*	-0.5254**	0.0079	-0.0108	0.0634	-0.1357	0.1926	0.0478
Pod length (cm	P						1.0000	0.1906	0.0277	-0.0457	-0.0412	0.0693	-0.1154	-0.0800	-0.1770
	G						1.0000	0.2388**	0.0312	-0.1013	-0.0415	0.0821	-0.1170	-0.0960	-0.2367*
Number of seeds per cluster	P							1.0000	0.2775*	0.0467	-0.0687	0.0156	0.0721	0.2227*	0.0019
	G							1.0000	0.3496**	-0.0543	-0.0791	-0.0598	-0.0057	0.2645*	-0.0201
Plant height at maturity (cm)	P								1.0000	0.3481**	0.2459*	-0.1251	-0.0481	-0.0247	0.1473
	G								1.0000	0.3980**	0.2489*	-0.1356	-0.0427	-0.0249	0.1489
Hundred seed weight (g	P									1.0000	0.0938	0.0671	0.0004	0.0709	0.0803
	G									1.0000	0.1235	0.0425	-0.0092	0.0792	0.0556
Dry matter yield per	P										1.0000	-0.2735*	-0.0794	-0.1825	0.4872**
	G										1.0000	-0.3063**	-0.0892	-0.1841	0.4974**

plant (g)															
Harvest index (%)	P											1.0000	0.1916	0.2696*	0.3443*
	G											1.0000	0.2021	0.2900*	0.3631**
Protein content (%)	P												1.0000	-0.2417*	0.0018
	G												1.0000	-0.2708*	0.0023
Iron content (ppm)	P													1.0000	-0.0064
	G													1.0000	-0.0075

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

Characters		Days to initiation of flowering	Days to 50 % flowering	Days to maturity	Number of 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 initiation of flowering	P	-0.3993	-0.3592	-0.3235	0.2018	-0.0587	-0.0600	-0.0843	0.0052	0.0439	0.0700	-0.0093	-0.0003	-0.0419	-0.1693
	G	-1.5543	-1.4570	-1.2872	0.9462	-0.2444	-0.2723	-0.4035	0.0216	0.1819	0.2827	-0.0378	-0.0295	-0.1674	-0.1780
Days to 50 % flowering	P	0.3949	0.4390	0.3686	-0.1894	0.0679	0.0534	0.0894	-0.0306	-0.0322	-0.0263	0.0413	0.0079	0.0184	-0.0019
	G	1.4732	1.5716	1.3690	-0.7679	0.3188	0.2175	0.4585	-0.1193	-0.1875	-0.0979	0.1611	0.0038	0.0681	-0.0067
Days to maturity	P	-0.2125	-0.2202	-0.2622	0.1111	-0.0419	-0.0083	-0.0581	0.0063	0.0086	0.0209	-0.0217	-0.0136	-0.0076	-0.0791
	G	-0.5097	-0.5362	-0.6155	0.3191	-0.1129	-0.0234	-0.1713	0.0134	0.0134	0.0464	-0.0640	-0.0442	-0.0186	-0.0810
Number of branches per plant	P	0.1395	0.1191	0.1169	-0.2761	0.0118	-0.0060	0.0411	-0.0191	-0.0025	-0.1243	0.0242	-0.0347	0.0372	0.0876
	G	0.5271	0.4231	0.4489	-0.8659	0.0748	0.0099	0.1748	-0.0550	0.0040	-0.4629	0.0921	-0.1967	0.1371	0.1179
Number of pods per plant	P	0.0163	0.0171	0.0177	-0.0047	0.1108	-0.0309	-0.0234	-0.0490	0.0052	0.0003	0.0069	-0.0230	0.0188	0.0727
	G	0.0247	0.0319	0.0288	-0.0136	0.1571	-0.0593	-0.0424	-0.0825	0.0012	-0.0017	0.0100	-0.0213	0.0303	0.0478
Pod length (cm	P	-0.0260	-0.0210	-0.0055	-0.0038	0.0482	-0.1730	-0.0330	-0.0048	0.0079	0.0071	-0.0120	0.0200	0.0138	-0.1770
	G	-0.0135	-0.0106	-0.0029	0.0009	0.0290	-0.0769	-0.0184	-0.0024	0.0078	0.0032	-0.0063	0.0090	0.0074	-0.2367
Number of seeds per cluster	P	0.0190	0.0184	0.0200	-0.0134	-0.0190	0.0172	0.0902	0.0250	0.0042	-0.0062	0.0014	0.0065	0.0201	0.0019
	G	-0.0244	-0.0274	-0.0261	0.0190	0.0253	-0.0224	-0.0939	-0.0328	0.0051	0.0074	0.0056	0.0005	-0.0248	-0.0201
Plant height at maturity (cm)	P	-0.0020	-0.0108	-0.0037	0.0107	-0.0684	0.0043	0.0429	0.1546	0.0538	0.0380	-0.0193	-0.0074	-0.0038	0.1473
	G	-0.0051	-0.0280	-0.0080	0.0234	-0.1937	0.0115	0.1289	0.3687	0.1467	0.0917	-0.0500	-0.0158	-0.0092	0.1489
Hundred seed weight (g	P	0.0110	0.0073	0.0033	-0.0009	-0.0046	0.0046	-0.0047	-0.0347	-0.0996	-0.0093	-0.0067	0.0000	-0.0071	0.0803
	G	0.0285	0.0291	0.0053	0.0011	-0.0019	0.0247	0.0132	-0.0970	-0.2438	-0.0301	-0.0104	0.0022	-0.0193	0.0556
Dry matter yield per plant (g)	P	-0.1135	-0.0388	-0.0517	0.2916	0.0020	-0.0267	-0.0445	0.1592	0.0607	0.6477	-0.1772	-0.0514	-0.1182	0.4872
	G	-0.1520	-0.0521	-0.0629	0.4467	-0.0091	-0.0347	-0.0661	0.2080	0.1032	0.8357	-0.2560	-0.0745	-0.1539	0.4974
Harvest index (%)	P	0.0128	0.0515	0.0453	-0.0478	0.0341	0.0379	0.0085	-0.0684	0.0367	-0.1495	0.5466	0.1047	0.1474	0.3443
	G	0.0103	0.0437	0.0443	-0.0453	0.0270	0.0350	-0.0255	-0.0578	0.0181	-0.1305	0.4260	0.0861	0.1235	0.3631
Protein content (%)	P	0.0000	-0.0005	-0.0015	-0.0036	0.0059	0.0033	-0.0021	0.0014	0.0000	0.0023	-0.0055	-0.0286	0.0069	0.0018
	G	0.0059	0.0007	0.0223	0.0706	-0.0421	-0.0364	-0.0018	-0.0133	-0.0029	-0.0277	0.0628	0.3106	-0.0841	0.0023
Iron content (ppm)	P	-0.0095	-0.0038	-0.0026	0.0122	-0.0153	0.0072	-0.0202	0.0022	-0.0064	0.0165	-0.0244	0.0219	-0.0905	-0.0064
	G	0.0111	0.0045	0.0031	-0.0164	0.0199	-0.0099	0.0273	-0.0026	0.0082	-0.0190	0.0300	-0.0280	0.1033	-0.0075

References

1. Anonymous. FAO, FAOSTAT. Food and Agriculture Organization of the United Nations, Rome, Italy 2017.
2. 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.
3. 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.
4. 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.
5. 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.
6. Johanson HW, Robinson HF, Comstock PE. Estimate of genetic and environmental variability in soybeans. Agronomy Journal 1955;47:314-318.
7. Kay DE. Food legumes. London: Tropical Development and Research Institute 1979.
8. 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.
9. Musvosvi C. Morphological characterisation and interrelationships among descriptors in some cowpea genotypes. J Afri. Crop Sci 2009;9:501-507.
10. 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.
11. 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):3897-3904.
12. 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.
13. Tindall HD. Vegetables in the tropics. London: Macmillan Press 1983.
14. 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.
15. Vavilov NI. The origin, variation, immunity and breeding of cultivated plants. Ed. K.S. Tranil, chester, Roland Press Company, New York 1995.