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RESEARCH ARTICLE

Genetic variability and diversity for green forage yield in cowpea [*Vigna unguiculata* (L.) Walp.]

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SUMMARY

The present investigation on genetic variability studies in cowpea [*Vigna unguiculata* (L.) Walp.] was conducted by using 44 genotypes of cowpea. High estimates of GCV were observed for green forage yield per plant, dry matter yield per plant, branches per plant in forage cowpea. The magnitude of PCV was more than GCV for all characters. High heritability accompanied with high genetic advance indicated additive gene control in the inheritance for green forage yield per plant, dry matter yield per plant, plant height at 50 per cent flowering, branches per plant.Correlation studies stressed the importance of characters *viz.*, dry matter yield per plant, days to 50 per cent flowering, plant height at 50 per cent flowering, leaf: stem ratio and number of leaves per plant for green forage yield purpose. Path co-efficient analysis indicated that dry matter yield per plant and leaf: stem ratio had high positive direct effect on green forage yield per plant at the same time these traits also had significant and positive correlation with green forage yield per plant.

Key Words : Variability, Heritability, Cowpea, Genotypic and phenotypic correlation, Path analysis

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Cowpea is multipurpose legume grown for seed as a pulse, green pod as a vegetable and whole plant as a fodder in tropics and subtropics. Because of its high protein content (20-25 %) cowpea has been referred as "poor man's meat". India is largest producer (25%), importer (20%) and consumer (20%) of Pulses in the world. In Pulses, cowpea accommodates third position in the world (Anonymous, 2006). In India the area under chickpea is 8.75 million ha., production 8.25 million tons and productivity 943 kg/ha (Anonymous, 2011). The present investigation was, therefore, undertaken to study extent of genetic variability and diversity for green forage yield and its components in cowpea.

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MATERIAL AND METHODS

For the present study forty four genotypes of cowpea were used and grown in Randomized Block Design with two replications. The experiment was conducted at Pulses Improvement Project Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri. Each genotype was sown in single row of 4 meter length. The spacing of 30 cm between the plant and line was maintained. Five competitive plants per genotype were selected at random from each replication for recording observations for eight characters *i.e.* days to 50 per cent flowering (No.), plant height at 50 per cent flowering (cm), number of branches per plant, number of leaves per plant, leaf/stem ratio, green forage yield per plant (g), dry matter yield per plant (g) and crude protein content(%).Mean, range, components of variance, co-efficients of variation and genetic advance were worked out using standard statistical procedures. Path analysis was carried out according to the method suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Variability and genetic parameters:

The analysis of variance (Table 1) revealed significant genotypic differences for all the characters. The magnitude of genotypic variance was maximum for green forage yield per plant (997.37) followed by plant height at 50 % flowering (392.59). The GCV and PCV were highest for green forage yield per plant, followed by dry matter yield per plant, similar results were obtained by Gupta and Lodhi (1979) for plant height, number of leaves per plant, green forage yield per plant and dry matter yield per plant; Sharma *et al.* (1988) for dry matter yield per plant, plant height, green forage yield;

Table 1 : Analysis of variance for eight different characters

Sr. No.	Characters	Mean sum of squares	
		Treatment	Error
1.	Days to 50% flowering	75.64**	4.34
2.	Plant height at 50% flowering(cm)	797.65**	12.46
3.	Braches per plant	4.52**	0.12
4.	No. of leaves per plant	63.96**	13.74
5.	Leaf :stem ratio	0.01**	0.00
6.	Dry matter yield per plant(g)	41.41**	4.60
7.	Green forage yield per plant (g)	2132.07**	137.34
8.	Crude protein content(%)	0.94**	0.08

Table 2 : Estimates of variability parameters for eight different characters of cowpea

Sr. No.	Characters	Range	General mean	σ^2 g	σ^2 p	σ^2 e	G.C.V.	P.C.V	Heritability (b.s.) in per cent	Genetic advance	G.A. (% of mean)
1.	Days to 50% flowering	41.0-69.0	48.86	35.65	37.82	2.17	12.22	12.58	94.30	11.94	24.44
2.	Plant height at 50% flowering (cm)	34.1-122.9	64.82	392.59	398.83	6.23	30.57	30.81	98.40	40.50	62.48
3.	Braches per plant	1.5-7.1	3.97	2.20	2.26	0.06	37.39	37.88	97.40	3.02	76.02
4.	No. of leaves per plant	10.2-35.6	20.35	25.11	31.98	6.87	24.62	27.79	78.50	9.15	44.95
5.	Leaf :stem ratio	0.2-0.5	0.36	0.005	0.005	0.00	19.50	20.19	93.90	0.14	39.04
6.	Dry matter yield per plant (g)	3.3-24.3	11.10	18.41	20.71	2.30	38.65	40.99	88.90	8.34	75.08
7.	Green forage yield per plant (g)	36.7-172.5	75.48	997.37	1066.04	68.67	41.84	43.25	93.60	62.93	83.36
8.	Crude protein content (%)	13.5-16.4	14.96	0.43	0.47	0.04	4.37	4.57	91.40	1.29	8.61

G.C.V.-Genotypic co-efficient of variation σ^2 g -Genotypic variance
P.C.V –Phenotypic co-efficient of variation σ^2 p – Phenotypic variance σ^2 e –environmental variance

Table 3 : Estimation of genotypic and phenotypic correlation coefficients

Sr. No.	Characters	Days to 50% flowering	Plant height at 50% flowering (cm)	Braches per plant	No. of leaves per plant	Leaf :stem ratio	Crude protein content (%)	Dry matter yield per plant(g)	Green forage yield per plant (g)
1.	Days to 50% flowering	1.0000	0.8232**	0.0117	0.6157**	0.7395**	-0.0697	0.8407**	0.8738**
2.	Plant height at 50% flowering (cm)		1.0000	0.0368	0.5238**	0.6988**	0.0053	0.8934**	0.8107**
3.	Braches per plant			1.0000	0.3790**	0.4045**	0.0050	-0.0234	0.0680
4.	No. of leaves per plant				1.0000	0.7131**	-0.1206	0.5090**	0.6545**
5.	Leaf :stem ratio					1.0000	0.0538	0.5964**	0.7508**
6.	Crude protein content (%)						1.0000	-0.0609	-0.0407
7.	Dry matter yield per plant(g)							1.0000	0.9069**
8.	Green forage yield per plant (g)								1.0000

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 4 : Direct and indirect effect for ten characters in cowkpea

Sr. No.	Characters	Days to 50% flowering	Plant height at 50% flowering (cm)	Braches per plant	No. of leaves per plant	Leaf : stem ratio	Crude protein content (%)	Dry matter yield per plant(g)	Correlation with green forage yield per plant (g)
1.	Days to 50% flowering	0.1133	-0.2877	-0.0010	0.0718	0.2625	-0.0011	0.7161	0.8738**
2.	Plant height at 50% flowering (cm)	0.0933	-0.3495	-0.0033	0.0611	0.2481	0.0001	0.7609	0.8107**
3.	Branches per plant	0.0013	-0.0129	-0.0884	0.0442	0.1436	0.000	-0.0199	0.0680
4.	No. of leaves per plant	0.0698	-0.1831	-0.0335	0.1166	0.2531	-0.0020	0.4335	0.6545**
5.	Leaf :stem ratio	0.0838	-0.2442	-0.0358	0.0831	0.3550	0.0090	0.5080	0.7508**
6.	Crude protein content(%)	-0.0079	-0.0019	-0.0040	-0.0141	0.0191	0.0163	-0.0519	-0.0407
7.	Dry matter yield per plant(g)	0.0953	-0.3122	0.0021	0.5930	0.2117	-0.0010	0.8517	0.9069**

Residual (R) = 0.2752 * and ** indicate significance of values at P=0.05 and 0.01, respectively

Bold figures denote direct effect

Anbuselvam *et al.* (2000) for plant height and number of branches per plant; Bharadwaj and Singh (2004) for plant height, green fodder yield and number of branches per plant. The heritability (b.s.) estimates varied from 78.5 per cent (No. of leaves per plant) to 98.4 per cent (Plant height at 50 % flowering) (Table 2). High value of genetic advance as per cent of mean was observed for green forage yield per plant followed by branches per plant, dry matter yield per plant, plant height at 50 % flowering and number of leaves per plant, whereas crude protein content showed the lowest value. In present study high heritability coupled with high genetic advance indicating additive gene action was observed for traits *viz*., plant height at 50% flowering, branches per plant, dry matter yield, green forage yield. Simple selection for such traits should be practiced for improving them. Gupta and Lodhi (1979) reported same results for plant height, dry matter yield per plant and green fodder yield per plant.

Correlation studies:

The green forage yield per plant showed highly significant positive association with almost all characters except branches per plant (0.0680) at genotypic level (Table 3). The character dry matter yield per plant (0.9069) showed highly significant and positive association with green forage yield per plant and it was followed by days to 50 % flowering (0.8738), plant height at 50 % flowering (0.8107), number of leaves per plant (0.6545) at genotypic level. Similar results were obtained by Deshmukh *et al.* (1993) for days to 50 % flowering, number of leaves per plant; Arvindham and Das (1995) for number of branches, dry matter yield, leaf:stem ratio; Borah and Khan (1999) for number of leaves, days to 50 % flowering and dry matter yield.

Path co-efficient analysis:

In the present investigation, it was found that the character dry matter yield per plant recorded magnitudinally the highest direct effect on green forage yield per plant and it was followed by leaf/stem ratio. The character dry matter yield per plant, days to 50 % flowering and number of leaves per plant recorded the maximum and positive magnitude of direct effect on green forage yield per plant and their association with yield was also highly significant and positive (Table 4). Similar results were obtained by Kumar and Mishra (1981) who reported same results for dry matter yield, Deshmukh *et al.* (1993) for days to 50 % flowering, number of leaves per plant and crude protein, Shukla *et al.* (1996) for leaf: stem ratio and dry matter yield per plant, Mittal *et al.* (2006) for dry matter yield per plant. Days to 50 % flowering, plant height at 50 % flowering, number of leaves per plant and L/S ratio had significant positive correlation with green forage yield per plant, which was mainly through their indirect effect via dry matter yield per plant and leaf/stem ratio. Dry matter yield per plant had highly significant positive correlation with green forage yield per plant through its indirect effect via number of leaves per plant.

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