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Variability and correlation study for forage traits in cowpea (*Vigna unguiculata* (L). Walp)

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Abstract

The present study was conducted with 12 genotypes including two checks at AICRP on Forage Crops Unit, Professor Jayashankar Telangana Agricultural University, Rajendranagar, Hyderabad during *Kharif* 2025. The objective of the study was to determine the extent of variability, correlations and path coefficients among different forage and quality traits. The high value of Phenotypic Coefficient of Variation (PCV) and Genotypic Coefficient of Variation (GCV) was observed for Leaf-stem Ratio followed by Green Fodder Yield. High heritability (> 90%) was estimated for leaf stem ratio and green fodder yield, while more than 70% heritability was observed for most of the characters such as green fodder yield, dry matter yield, crude protein and leaf stem ratio. Higher genetic advance was observed for Leaf-Stem Ratio (79.20%) and green fodder yield. Green fodder yield had significantly positive correlation with green fodder yield per day (0.869), dry matter yield (0.935) and dry matter yield per day (0.777) which indicates that direct selection for these traits will be helpful for the improvement of green fodder yield in Cowpea.

Keywords: Fodder Cowpea, genetic variability, correlations

Introduction

Cowpea (*Vigna unguiculata* (L.) Walp) is one of the members of genus *Vigna* which includes around 80 species throughout the tropics. Africa is the main area of production for cowpea as it is more suitable for low input agriculture. (Dalbir *et al.*, 2017). Cowpea is a quick growing, single cut nutritious legume cultivated in both *Kharif* and summer season in Telangana, cowpea is grown throughout the year. It is gaining importance in the recent years due to its high food value, good fodder and used as an excellent green manure crop. It is quick-growing, tolerates moderate shade and drought by producing higher forage yield often utilized as hay and silage besides fresh feeding. The green vines with pods serve as excellent forage to livestock (Sushma 2020) [20]. Cowpea is grown for various purposes e.g. pulse, vegetable, green pod and as fodder crop.

Cowpea provides excellent quality forage and gives a heavy vegetative growth that covers the ground so well that it checks the soil erosion. (Sahu, 2021 and Devinder *et al.*, 2022) [15]. Among the forage traits, improvement of green fodder yield along with its quality is a major objective for plant breeder, but fodder yield in cowpea is a complex character which depends on the expression of various independent characters, therefore, it is essential to know the association among the various qualitative and quantitative forage traits so as to initiate an effective selection programme aiming at the improvement of forage yield and its quality. For selecting the desired genotypes for future breeding programmes, the assessment of genetic variability for various forage traits is of great importance (Baranda *et al.*, 2018) [4]. Genotypic and Phenotypic coefficients of variability, heritability and genetic advance are considered as very important parameters for the yield improvement (Denton and Nwangburuka, 2011) [8]. Heritability of a character is important for a cowpea breeder because it provides an idea of the genetic control for the expression of a particular character (Chopra, 2000) [6]. Therefore, the present study was carried out to assess the variability with the help of genetic parameters like the coefficient of variability, heritability, genetic advance and association analysis.

Materials and Methods

The present study was conducted during the *Kharif* season of 2025 with 12 genotypes at Forage

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Crops Unit, Agriculture Research Institute, Professor Jayashankar Telangana Agriculture University, Rajendranagar. The material was evaluated in randomized block design in ten rows of three meter with row to row spacing 30 cm and plant to plant spacing of 10 cm along with two checks in three replications. Recommended package of practices was followed to raise a good crop. Observations were recorded on plant height, leaf stem ratio, green fodder yield per hectare per day (kg/ha/day), dry matter yield per hectare per day (kg/ha/day), green fodder yield per hectare and dry matter yield per hectare. The data was analyzed for estimating phenotypic and genotypic coefficient of variation (Burton and De Vane (1953) ^[5], heritability in-broad sense (Hanson *et al.*, 1956) ^[11], genetic advance (Allard, 1960) ^[2], correlation (Johnson *et al.*, 1955) ^[12] and path analysis (Dewey and Lu, 1959) ^[10] were followed in the present study.

Results and discussion

Green fodder yield is a complex trait and it is affected by many characters. Being a quantitative trait, it is affected by the different environments. So, there is a need to deeply understand the interrelationship between green fodder yield and its contributing traits. The estimates of Phenotypic Coefficient of Variation (PCV) was higher than the Genotypic Coefficient of Variation (GCV) for all the traits under study (Table 1), which indicates the influence of environment on the expression of these traits. The highest value of PCV was observed for leaf stem ratio, green fodder yield and dry fodder yield. These results were in the accordance to the results obtained by Vamshi *et al.*, (2022) ^[21], Khan *et al.* (2015) ^[13, 14] and Rohila (2020). Above results suggested that due to higher values of PCV and GCV for Leaf-Stem Ratio, and Dry Matter Yield, so selection for these traits will be effective in future for increasing the green fodder yield.

Heritability and genetic advance

Perusal from the Table 1 indicates that high heritability was present for the characters such as leaf stem ratio (86.3%), green fodder yield per day (75.9%). Similar results were reported by Phogat *et al.* (2017) ^[7, 18] for leaf-stem ratio and green fodder yield per day. The highest genetic advance was observed for leaf-stem ratio (42.41%) and green fodder yield per day (33.03) and green fodder yield (24.29) whereas moderate genetic advance was recorded for dry fodder yield per day (14.74%). The low genetic advance was recorded for plant height (4.84%) and dry fodder

yield (10.14%). Khan *et al.* (2015) ^[13, 14] also reported similar results in their study for heritability and genetic advance. In the present study, high heritability combined with high genetic advance as per cent of mean for leaf-stem ratio and green fodder yield per day. So, more focus should be directed towards the improvement of leaf stem ratio so that green fodder yield can be ultimately increased. From these results, it can be concluded that there is low environmental influence on these traits and genes act additively in the expression of these traits. Moderate or low heritability combined with low genetic advance were recorded for plant height and dry fodder yield which indicates that this trait is governed by non-additive gene action and there is a greater environmental influence on the expression of such traits.

Phenotypic correlation

Green fodder yield is a complex trait affected by the number of other traits which might have positive as well as negative effects on this trait. So, for the improvement of green fodder yield and its components, knowledge of association among different traits, effects and cause of relationship will be helpful for the selection of appropriate breeding method for increasing green fodder yield. Correlation analysis clearly revealed that the magnitude of phenotypic correlation is lower than the genotypic correlation but they showed similar trend in direction. Low phenotypic correlation means that the expression of these traits is influenced by the environment. Correlation coefficient among various traits is presented in the Table 2. Green fodder yield had significantly positive correlation with green fodder yield per day (0.869), dry matter yield (0.935) and dry matter yield per day (0.777) which indicates that direct selection for these traits will be helpful for the improvement of green fodder yield in Cowpea. Similar results were obtained by Khan *et al.* (2015) ^[13, 14], Rohila *et al.* (2019) ^[19] in sorghum, Mushtaq *et al.* (2013) ^[16] in oats and Devinder *et al.* (2022) in cowpea. The positive association between green fodder yield and dry matter yield observed in the present study is also in close agreement with Navaselvakkumaran *et al.* (2019) ^[17], who reported significant positive correlation between green fodder yield and dry matter yield per plant in fodder cowpea, and with Akshitha *et al.* (2024) ^[1], who recorded that green fodder yield was positively and significantly associated with dry fodder yield and dry fodder yield per plant per day in forage sorghum germplasm lines. Green fodder yield per day was positively significant correlation.

Table 1: Genetic parameters of different characters in fodder cowpea

Traits	Var Genotypical (Vg)	Var Phenotypical (Vp)	GCV	PCV	h ² (Broad Sense)	Genetic Advancement 5%	Gen.Adv as % of Mean 5%
Plant height	122.31	879.72	6.30	16.90	0.14	8.50	4.84
Leaf stem ratio	0.01	0.01	22.17	23.86	0.86	0.19	42.41
Green fodder yield per day (Kg/ ha)	0.75	0.99	18.41	21.13	0.76	1.55	33.03
Dry fodd yield per day (Kg/ ha)	17.86	59.94	9.02	16.52	0.30	4.75	10.14
Dry fodd yield (Kg/ ha)	0.01	0.03	11.20	17.52	0.41	0.13	14.74
Green fodder yield (Kg/ ha)	1438.18	2443.34	15.37	20.03	0.59	59.94	24.29

Phenotypic correlation

Table 2: Pearson's correlation coefficients among plant height, leaf–stem ratio, green fodder yield, and dry fodder yield in forage crops

	Plant height	Leaf stem ratio	Green fodder yield (Kg/ha/day)	Dry fodd yield (Kg/ha)	Dry fodd yield (Kg ha/day)	Green fodder yield (Kg/ha)
Plant height	1.000	-0.018	0.240	0.264	0.225	0.301
Leaf stem ratio	-	1.000	0.128	0.045	0.132	0.068
Green fodder yield per day (Kg/ha/day)	-	-	1.000	0.811 ***	0.843 ***	0.869***
Dry fodd yield (Kg/ha)	-	-	-	1.000	0.876 ***	0.935***
Dry fodd yield (Kg ha/day)	-	-	-	-	1.000	0.777***
Green fodder yield (Kg/ha)	-	-	-	-	-	1.000

Conclusion

Selection criteria for dry fodder yield, plant height, leaf stem ratio and green fodder yield per day will be significant for the improvement of green fodder yield in the material under study.

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