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Research Article

Correlation and Path Analysis in Multicut Fodder Sorghum

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Abstract :
Genotypic correlation coefficient and path coefficient analysis was carried out in 109 genotypes of multicut fodder sorghum between fourteen fodder yields and yield related characters for each cut and subjected to pooled analysis. The result showed that all the characters except hydrocyanic acid, total soluble solids and crude protein had positive significant association with green fodder yield per plant. Among these traits dry fodder yield exhibited high correlation (0.953) coefficient with green fodder yield per plant followed by leaf length, plant height and number of leaves. Plant height exerted the highest direct effect on green fodder yield followed by leaf length and breadth and leaf stem ratio. Hence, selection for any of these traits might result in simultaneous improvement in the yield. The results of correlation and path analysis indicated that due importance should be given for plant height because of its significant correlation and high direct effect, apart from its high indirect effect through dry fodder yield.

Key words:
Correlation, path coefficient, multicut fodder Sorghum

Introduction

Among the cereals, sorghum plays an important role in India, as a major grain cum fodder crop. It is extensively grown as a major source of fodder and it is preferred over maize in kharif because of its high tolerance to various stresses. It is superior to pearl millet in having lower oxalate and fibre content. Quick and profuse tillering, high dry matter content, leafiness, high palatability, hardiness and suitability for silage making makes it an ideal fodder crop. However, significant improvement with reference to high fodder production has not been achieved so far mostly due to inadequacy of information on the genetics of green and dry fodder yields and associated traits. Green fodder yield is a dependent trait, which is influenced by many independent traits. Studies on the correlation of traits and their relative direct and indirect effects on green fodder yield are important, as it is helpful in selection of desirable traits. Hence, an attempt was made to study fourteen quantitative characters, their correlations and effects on genotypes of multicut fodder sorghum.

Materials and methods

One hundred and nine genotypes including four lines and twenty one restorers and eighty four hybrids of multicut fodder sorghum were evaluated with the spacing of 30 cm x 15 cm in a Randomized Black Design. The experiment was laid out with three replications. All the agronomic practices were followed to maintain the crop stand. The biometrical observations on fodder yield and quality components were recorded for each genotypes in all replications at the time of 50 per cent flowering. The replication wise mean values of the genotypes were tabulated. After completion of first cut, the same experimental materials were allowed to grow as a ratoon crop. Similar package of practices was followed as that of first crop and at the time of 50 per cent flowering biometrical observations were taken and tabulated. In the same way third and fourth cuts were allowed to study the ratooning ability habit of the experimental materials. Observations were taken on each cut and were tabulated. The data were subjected to pooled analysis over environment for genotype correlation as per method suggested by Wright (1921) and path analysis as per procedure prescribed by Dewey and Lu (1959).

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Results and discussion

The estimates of correlation co-efficient among the different characters indicate the extent of direct association. The correlation co-efficient provides a reliable measure of association among the characters and helps to differentiate vital associations useful in breeding from those of the non-vital ones (Falconer, 1981). In the present investigation correlation co-efficient were worked out between fourteen characters for each cut (environment) and also for the pooled data. In pooled data over environments, all

the characters except hydrocyanic acid, total soluble solids and crude protein had positive significant association with green fodder yield per plant (Table1). Hence, selection for these characters will help in selecting genotypes with high green fodder yield per plant. A strong correlation with yield indicated that simultaneous improvement of both the characters is possible. Positive association of plant height, number of tillers, number of leaves, leaf area per plant, dry matter yield and crude protein with green fodder yield per plant was noticed by Manickam and Vijendradass (1994). Desai *et al.* (1999) observed that fodder yield was significantly and positively correlated with plant height, number of leaves per plant, leaf length, total leaf area and basal tillering. Total soluble solids recorded a negative significant correlation with green fodder yield. This was in close agreement with Patil *et al*., (1995) while Sun *et al*., (1996) reported that grain yield of the hybrids is negatively correlated with sugar content. Hydrocyanic acid and crude protein recorded non-significant association with green fodder yield per plant. However, the crude protein had significant positive association with green fodder yield in E_1 (first cut).

Regarding inter correlations between different characters, plant height and positive correlation with leaf length, dry fodder yield and number of leaves. Number of tillers had positive association with leaf length and dry fodder yield. Leaf length had highest positive association with dry fodder yield and green fodder yield per plant. Dry fodder yield had positive association with green fodder yield per plot.

Path analysis partitions the total correlation co-efficient into direct and indirect effects and measures the relative importance of the causal factor individually (Dewey and Lu, 1959). In the present study, green fodder yield was considered as dependent character and other characters were taken as independent characters. The component of residual effect of path analysis in the pooled data was 0.228. The lower residual effect indicated that the characters chosen for path analysis were adequate and appropriate. Plant height contributed maximum direct effect to green fodder yield per plant followed by leaf breadth and leaf stem ratio (Table2). Number of tillers and stem thickness also exerted positive direct effect on green fodder yield. The characters leaf length, number of leaves and hydrocyanic acid had a negative influence on green fodder yield. Among these the direction of hydrocyanic acid is a desirable one.

The indirect positive effect of leaf length and dry fodder yield via plant height was maximum followed by number of leaves and number of tillers. The highest negative indirect effect on green fodder yield was recorded by leaf stem ratio via plant height. Hence, selection for either one of the components will have an adverse effect on the other and lead to decrease in yield. Stem thickness had negative indirect effect via number of leaves on green fodder yield, while, it had positive indirect effect through leaf breadth, the direct and indirect effects of number of tillers, plant height and number of leaves were positive. Thus improvement of any of these traits would simultaneously improve green fodder yield per plant because of correlated response of yield by applying strong, selection on these traits.

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Table 1. Correlation coefficients of green fodder yield and yield components

Characters	Plant height	Days to 50 per cent flowering	No. tillers	No. leaves	Leaf stem ratio	Stem thickness	Hydro cyanic acid	Total soluble solids	Crude protein	Dry Fodder yield	Green Fodder yield per plot	Green Fodder yield per plant
Plant height	1.000	0.235*	0.481**	0.580**	-0.766**	-0.053	-0.393**	-0.403**	0.038	0.716**	0.370**	0.594**
Days to 50 per cent flowering		1.000	-0.146	0.512**	0.228*	0.224*	-0.066	-0.672**	-0.236*	0.216*	-0.085	0.321**
No. Tillers			1.000	-0.150	-0.477**	-0.360**	0.128	0.304**	-0.039	0.726**	0.264**	0.541**
No. Leaves				1.000	-0.306**	0.595**	-0.565**	-0.634**	-0.056	0.500**	0.338**	0.593**
Leaf length					-0.469**	0.103	-0.344**	-0.311	0.169	0.737**	0.467**	0.689**
Leaf breadth					-0.206*	1.066**	-0.037	-0.426**	0.159	0.264**	0.052	0.443**
Leaf stem ratio					1.000	-0.074	0.193	0.138	-0.135	-0.624**	-0.312**	0.591**
Stem thickness						1.000	-0.171	-0.595**	0.280**	0.354**	0.007	0.581**
Hydro cyanic acid							1.000	0.139	0.143	-0.119	-0.175	-0.153
Total soluble solids								1.000	-0.111	-0.280**	-0.032	-0.427**
Crude protein									1.000	0.136	0.324**	0.167
Dry fodder yield										1.000	0.379**	0.953**
Green fodder yield per plot											1.000	0.347**

* Significant at 5% level ** Significant at 1% level

Table2 . Path coefficient analysis of different characters with green fodder yield per plant

Characters	Plant height	Days to 50 per cent flowering	No. tillers	No. leaves	Leaf length	Leaf breadth	Leaf stem ratio	Stem thickness	Hydro cyanic acid	Total soluble solids	Crude protein	Dry Fodder yield	Green Fodder yield per plot	Green Fodder yield per plant
Plant height	**3.860**	0.060	0.283	-1.807	-0.919	-0.068	-1.612	-0.430	0.339	-0.015	-0.012	0.229	0.297	0.594**
Days to 50 % flowering	0.907	**0.256**	-0.086	-1.597	-0.425	0.500	0.479	0.180	0.057	-0.025	0.073	0.069	-0.068	0.321**
Number of tillers	1.856	-0.037	**0.589**	0.468	-0.641	-0.756	-1.004	-0.290	-0.111	0.011	0.012	0.232	0.212	0.541**
Number of leaves	2.237	0.131	-0.088	**-3.118**	-0.522	1.205	-0.643	0.479	0.488	-0.024	0.017	0.160	0.271	0.593**
Leaf length	2.789	0.086	0.297	-1.281	**-1.271**	0.129	-0.986	0.083	0.297	-0.012	-0.052	0.236	0.375	0.689**
Leaf breadth	-0.124	0.061	-0.211	-1.783	-0.078	**2.108**	-0.433	0.809	0.032	-0.016	-0.049	0.085	0.042	0.443**
Leaf stem ratio	-2.957	0.058	-0.281	0.953	0.596	-0.433	**2.104**	-0.060	-0.167	0.005	0.042	-0.200	-0.251	0.591**
Stem thickness	-0.204	0.057	-0.212	-1.856	-0.130	2.121	-0.156	**0.804**	0.147	-0.022	-0.086	0.113	0.005	0.581**
Hydrocyanic acid	-1.516	-0.017	0.076	1.759	0.437	-0.079	0.406	-0.137	**-0.864**	0.005	-0.044	-0.038	-0.140	-0.153
Total soluble solids	-1.556	-0.172	0.179	1.976	0.396	-0.897	0.290	-0.48	-0.120	**0.037**	0.034	-0.090	-0.026	-0.427**
Crude protein	0.147	-0.060	-0.023	0.175	-0.215	0.335	-0.284	0.225	-0.124	-0.004	**-0.308**	0.043	0.260	0.167
Dry fodder yield	2.762	0.055	0.427	-1.560	-0.937	0.558	-1.314	0.285	0.103	-0.010	-0.042	**0.320**	0.305	0.953**
Green fodder per plot	1.427	-0.022	0.156	-1.053	-0.593	0.109	-0.657	0.005	0.151	-0.001	-0.100	0.121	**0.803**	0.347**

Residual effects: P = 0.2277 ; *, ** significant at 5 and 1 per cent level respectively Diagonal values (**bold**) are direct effects