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RESEARCH ARTICLE

APPLICATION OF FACTOR ANALYSIS IN SORGHUM [*SORGHUM BICOLOR* (L.) MOENCH]

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ABSTRACT

The data of a varietal trial having 40 genotypes evaluated in three replications at Forage Research Project on forage sorghum [*Sorghum bicolor* (L.) Moench] were collected and were subjected to factor analysis using SAS software. The data on Days to flowering(DTF), Plant height(PH), No. of tillers /plant(NTP), Leaf stem ratio(LSR), No. of leaves/ plant(NLP), Leaf length(LL), Leaf width (LW), Stem girth ratio(SG), Green fodder yield(g) /plant (GFYPP), Dry matter content (DMC), and Dry matter yield(g) /plant (DMYPP) were used for the present study. The results revealed that the highest C.V.% (82.8 %) was observed for leaf stem ratio followed by dry matter yield and green fodder yield, number of leaves /plant and stem girth ratio. Almost at par results were observed for range coefficient. The genotypic correlation coefficients between green fodder yield of sorghum with leaf length, leaf width, stem girth and dry matter yield per plant were significant and positive at genetic level. Leaf length is significantly associated with leaf stem ratio, number of leaves per plant leaf width, stem girth and with dry fodder yield. The results of rotated factor analysis score values indicated that the first factor included green and dry fodder yield per plant and stem girth, leaf length and leaf width to be the important factor contributing 31.4 % of common variation in forage sorghum. Besides this the second factor consisted leaf stem ratio, number of leaves and tillers per plant which can contribute about 30.4 % of common variation, while third factor identified days to flowering over and above the two factors having 10.4 % common variation. The total common variation accounted by all three variables was 72.2 % . Green and dry fodder yield and leaf stem ratio exhibited more than 0.8 communality which indicates to have high common variation in sorghum . Thus, overall result suggested that selection of leaf length, leaf width and green and dry fodder yield are more important followed by leaf stem ratio, number of leaves and tillers/plant. Dry matter content and plant height needs to be controlled at the same time as the have negative loadings.

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INTRODUCTION

Factor analysis is a multivariate technique to handle large amount of data. It serves as decision making analysis for extracting subsets of co-varying variables or a means of identifying fundamental and meaningful dimension of a multivariate set of data. The analysis was carried out with the objectives (1) To assess the important biometrical characters as per their factor loadings (2) To estimate common variation explained by different factors and (3) To compare the results obtained by factor analysis with regression analysis in identifying important biometrical characters.

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MATERIALS AND METHODS

There are two main factor analysis methods. One is common factor analysis which extracts factors based on the variance shared by the factors and the other is principal component analysis which extracts factors based on the total variance of factors. Factor loading of 0.5 or higher is required to attribute a specific variable to a factor. An orthogonal rotation assumes no correlation between the factors. The data set with larger number of variables under study was collected from plant breeding programmes. Data was subjected to factor analysis and regression analysis by using SAS (PROC Factor) Software (Version 9.3) available at the department. The data of an varietal trial having 40 genotypes evaluated in three replications at Forage Research Project on forage sorghum [*Sorghum bicolor* (L.) Moench] were collected and were subjected to factor analysis using SAS software.

Table 1. Average values of different characters of forage sorghum

Variable	Mean	Std. Dev.	C.V.%	Min.	Max.	Range Coeff.
Days to flowering(DTF)	61.3	7.2	11.7	48.0	73.0	0.21
Plant height(PH)	220.8	31.5	14.3	116.8	286.5	0.42
No.of tillers /plant(NTP)	2.3	0.6	25.4	1.1	3.6	0.53
Leaf stem ratio(LSR)	0.44	0.36	82.8	0.02	1.3	0.97
No.of leaves/plant(NLP)	12.1	3.8	31.3	6.0	22.9	0.58
Leaf length(LL)	73.1	9.2	12.6	52.0	95.5	0.29
Leaf width (LW)	4.9	1.1	22.7	2.5	8.5	0.55
Stem girth ratio(SG)	0.8	0.2	30.9	0.4	1.9	0.65
Green fodder yield(g)/plant (GFYPP)	125.8	54.1	43.0	39.0	316.0	0.78
Dry matter content(DMC)	28.8	6.8	23.6	17.2	45.8	0.45
Dry matter yield(g)/plant(DMYPP)	36.6	18.9	51.7	9.7	87.5	0.80

Table 2. Genotypic correlation coefficients between different characters in forage sorghum

	DTF	PLH	NTP	LSR	NLP	LL	LW	SG	GFYPP	DMC	DMYPP
DTF	1.00	0.08	-0.14	-0.147	-0.12	0.11	0.19	0.09	0.10	-0.03	-0.02
PLH		1.00	-0.50**	-0.79**	-0.56**	-0.24	0.33*	0.26	0.25	0.72**	0.53**
NTP			1.00	0.43**	0.36 *	0.19	-0.23	-0.31	-0.25	-0.25	-0.23
LSR				1.00	0.85**	0.40*	-0.15	-0.07	-0.07	-0.62**	-0.36*
NLP					1.00	0.40*	-0.08	0.16	0.12	-0.31	-0.08
LL						1.00	0.45**	0.41**	0.61**	-0.17	0.37*
LW							1.00	0.57**	0.75**	0.26	0.75**
SG								1.00	0.86**	0.22	0.71**
GFYPP									1.00	0.18	0.83**
DMC										1.00	0.65*
DMYPP											1.00

* , ** indicates significant at 5 and 1 % level of significance

Table 3. Eigen values of the Correlation Matrix (Total=11, Average=1)

No. of factor	Eigen value	*Difference*	Proportion	Cumulative
1	3.91	1.03	0.36	0.36
2	2.88	1.74	0.26	0.62
3	1.13	0.30	0.10	0.72
4	0.83	0.17	0.08	0.80
5	0.67	0.18	0.06	0.86
6	0.48	0.05	0.04	0.90
7	0.44	0.11	0.04	0.94
8	0.33	0.13	0.03	0.97
9	0.19	0.10	0.02	0.99
10	0.10	0.05	0.01	1.00
11	0.04	-	0.00	1.00

Table 4. First Factor Pattern and final communality of different characters in forage sorghum

Characters	Factor1	Factor2	Factor3	Communality
DMYPP	0.874	0.286	0.253	0.91
PLH	0.727	-0.446	0.082	0.73
GFYPP	0.723	0.601	-0.036	0.88
SG	0.660	0.501	-0.011	0.69
DMC	0.652	-0.341	0.397	0.70
LW	0.627	0.404	-0.145	0.58
NTP	-0.493	0.276	0.306	0.41
LL	0.162	0.787	-0.106	0.6
NLP	-0.379	0.730	0.205	0.72
LSR	-0.635	0.689	0.051	0.88
DTF	0.159	0.000	-0.857	0.76
Variance	3.91	2.88	1.13	--

The data on Days to flowering(DTF), Plant height(PH), No. of tillers /plant(NTP), Leaf stem ratio(LSR), No. of leaves/ plant(NLP), Leaf length(LL), Leaf width (LW), Stem girth ratio(SG), Green fodder yield(g) /plant (GFYPP), Dry matter content (DMC), and Dry matter yield(g)/ plant (DMYPP) were used for the present study.

RESULTS AND DISCUSSION

The highest C.V.% (82.8 %) was observed for leaf stem ratio followed by dry matter yield and green fodder yield ,number of leaves /plant and stem girth ratio. Almost at par results were observed for range coefficient (Table 1).

Table 5. Factor loadings for different characters of forage sorghum

Characters	Factor1	Factor2	Factor3
GFYPP	0.938	-0.036	0.055
DMYPP	0.846	-0.378	-0.227
SG	0.825	-0.068	0.028
LW	0.734	-0.115	0.161
LL	0.645	0.479	0.107
LSR	-0.010	0.935	-0.074
NLP	0.211	0.791	-0.220
NTP	-0.176	0.527	-0.323
DMC	0.264	-0.699	-0.375
PLH	0.243	-0.820	-0.057
DTF	0.102	-0.085	0.861
Variance	3.45	3.34	1.14
%	31.4	30.4	10.4
Cumulative %	31.4	61.8	72.2

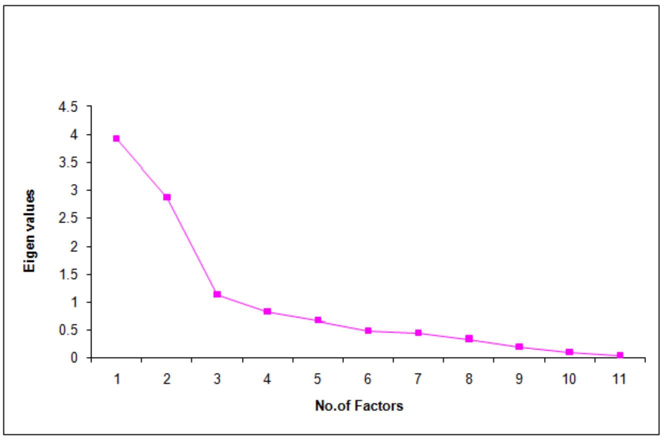

Fig. 1. Scree plot for factor analysis of forage sorghum

The genotypic correlation coefficients between green fodder yield of sorghum with leaf length, leaf width, stem girth and dry matter yield per plant were significant and positive at genetic level. However, positive correlation of stem girth and green fodder yield is not desirable for quality fodder. Leaf length is significantly associated with leaf stem ratio, number of leaves per plant leaf width, stem girth and with dry fodder yield (Table 2). The phenotypic correlations revealed that tillers plant^{-1} and grains spike^{-1} were highly positively associated; hence these yield components can be used as reliable selection criteria to improve grain yield in wheat. Thus estimation of correlation and regression analysis among yield and yield components may provide effective selection criteria to improve wheat grain yield. The results from correlation and regression of plant height indicated significantly positive association with spikelet's spike^{-1}, tillers plant^{-1} and grains spike^{-1} which revealed that increase in plant height will cause corresponding increase in associated traits (Bhutto *et al*., 2016). The results indicated that the first three factor had eigen value more than 1. Thus the three factor will be retained in the further analysis.

The scree plot also supports that there is lower increase in eigen values beyond third factor and thus three factors are sufficient to account major common variation (Fig. 1). The rotated factor analysis score values are given in Table 5. The results indicated that the first factor included green and dry fodder yield per plant and stem girth, leaf length and leaf width to be the important factor contributing 31.4 % of common variation in forage sorghum. Besides this the second factor consisted leaf stem ratio, number of leaves and tillers per plant which can contribute about 30.4 % of common variation, while third factor identified days to flowering over and above the two factors having 10.4 % common variation. The total common variation accounted by all three variables was 72.2 %. Green and dry fodder yield and leaf stem ratio exhibited more than 0.8 communality which indicates to have high common variation in sorghum. Mohamed (1999) found that two factors (grain yield and spike density) accounted for 80.8% of variation among traits in some bread wheat genotypes. Mohsen *et al*. (2014) studied on multivariate statistical analysis of some traits of bread wheat for breeding under rainfed condition. They reported that rotation accentuated the larger loadings in the extracted factors and suppressed the minor loadings thus improving the opportunity of achieving meaningful interpretation of factors. The factor which made the largest contribution accounted for 28% of the total variation and was composed of the some components of grain yield including stem diameter, leaf width, tiller number, spike length, floret number, spikelet number, grain number and grain yield Thus, overall result suggested that selection of leaf length, leaf width and green and dry fodder yield are more important followed by leaf stem ratio, number of leaves and tillers/plant. Dry matter content and plant height needs to be controlled at the same time as the have negative loadings.

REFERENCES

Bhutto, A., Rajpar, A., Kalhoro, S., Ali, A., Kalhoro, F., Ahmed, M., Ahmed, S. and Kalhoro, N. 2016. Correlation and Regression Analysis for Yield Traits in Wheat (*Triticum aestivum* L.) Genotypes. *Natural Science*, 8, 96-104.

Mohamed, N.A. 1999. Some statistical procedures for evaluation of the relative contribution for yield components in wheat. Zagazig. *Journal of Agricultural Research* 26:281-290.

Mohsen, Janmohammadi; Zahra, Movahedi and Sabaghnia, Naser 2014. Multivariate statistical analysis of some traits of bread wheat for breeding under rainfed condition. *Journal of Agricultural Sciences,* 59(1) : 1-14.

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