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Research Article

Metroglyph analysis of morphological variations in Sorghum germplasm collections

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Abstract
An experiment was conducted during kharif 2008, to assess the pattern of morphological variations through metroglyph technique in local land races of Sorghum collected from different parts of Tamil Nadu. Based on this technique, genetic variability was evaluated for five characters viz., grain yield / plant (g), fodder yield / plant (g), grain size (g), 1000 grain weight and ear head compactness among 63 accessions. The mean values were used for plotting the accessions in a graph. All accessions were grouped into eight distinct groups, which differed amongst themselves. Group II was the largest comprising 25 accessions followed by Group V having 13 accessions with moderate grain yield and fodder yield. Group VI consisted of 3 accessions with high yield and medium fodder yield besides moderate 1000 grain weight and ear head compactness. Group VIII had 3 accessions classified into medium grain yield with high fodder yield consisting of compact ear head and bold grains. Land races are the primitive cultivars which are selected and cultivated by farmers for many generations. Land races have more genetic diversity, wider adaptability and high degree of resistance to biotic and abiotic stresses and even respond to selection for high yield. In the present world of research, great strides in sorghum improvement have been made by transforming the local land races into more productive forms through hybridization to evolve highly adapted hybrids. Since, sorghum is the dual purpose crop, the germplasm lines of Group III, VI, VII and V could be helpful in future breeding programme for achieving higher grain yield, yield components and fodder yield. The study, therefore, indicated the possibility of producing dual purpose sorghum hybrids by combining desirable germplasm accessions.

Key words: Sorghum, Metroglyph, Morphological variability, Germplasm accessions, dual purpose

Introduction

Sorghum is grown in Tamilnadu, predominantly as rainfed due to its inherent adaptation to moisture stress situation. Owing to its drought tolerance capacity, its cultivation in drought prone areas is effectively providing food and fodder on sustainable basis. Number of land races with different plant and grain characteristics are grown traditionally in different parts of the state. Land races are the primitive cultivars which are selected and cultivated by farmers for many generations. Land races have high level of genetic diversity which provides a basic material for launching a crop improvement program. Genetic diversity is the basis for any crop improvement programme. The knowledge of genetic variation existing in the germplasm is an important and essential aspect for initiating any crop breeding programme. Metroglyph analysis and index scoring have been used as useful tool, to assess genetic variability among population (Sabharwal et al., 1995). So, the present study, was conducted to study the variations in 63 local land races of sorghum collected from different parts of Tamilnadu.

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Materials and methods

The material for the study comprised 63 sorghum germplasm accessions. The collection was undertaken in Tamilnadu jointly by the Tamilnadu Agricultural University, Coimbatore and National Research Centre, Hyderabad during 2006 and 2007. These genotypes were raised in a randomized block design with two replications in

the Department of Millets, TNAU, Coimbatore during 2008. Each genotype was raised in two rows of 4m length spaced at 45 cm between rows and 20cm between plants. Five randomly selected plants from each genotype in each replication was taken for recording observations on five characters viz., grain weight (g/plant), fodder weight (g/plant), 1000 grain weight (g), grain size and ear head compactness. The mean for each accession was worked out for each of these characters and range recorded. On a pictorialised scatter diagram the 1st three characters and grain size were categorized as low, medium and bold. Similarly ear head compactness classified as laxy, semicompact, and compact types. The mean values were used to construct the metroglyph analysis as per the model suggested by Anderson (1957). In this, the glyphs were first plotted on the basis of two extremely variable traits namely grain weight (X axis) and fodder weight (Y axis) all the other characters were represented by rays on the glyph (Fig.1)Each ray represents a particular character obtained by dividing the range of variation into three equal classes giving the grades low, medium and high for each characters. The length of ray assigned to the characters depends upon the index scores of accessions for that characters. The glyph positions and rays were used to assess the variability pattern and correlated traits for assessment of their divergent groups. Each germplasm accession has a special number and is represented as a glyph which is the intersection point of mean values of X and Y co-ordinates. The index values and the position of rays and arrows for the different characters are given in Table.

Results and discussion

The 63 glyphs shown in the scatter diagram were divided into three groups for grain weight as low (16 – 22.00 g), medium (22.10g – 28.00 g/plant) and high (28.01 – 34.00 g/plant). Similarly three orbitary categories of fodder yield such as low (125 – 250 g/plant), medium (251 – 375 g/plant) and high (375 – 525 g/plant) were also made, so as to classify all the individuals into nine groups. Variations for other characters were represented by the variations in the lengths of the corresponding rays on all the circles. The length of each ray as a result was either short (low mean value), medium (medium mean value) or long (high mean value). The respective groupings were small, medium and bold for grain size; 16 – 20.5, 20.6 – 25.0, 25.1 – 29.5 for 1000 grain weight; laxy, semi compact and compact for ear head compactness. The group constellations are presented in Table 1.

Landraces of sorghum species fell in different groups are presented in Table 2. The germplasm lines could be categorized into 8 groups which differed amongst themselves. Group I with low seed yield and low fodder yield had 10 genotypes of which two glyphs showed combination of bold grain size, medium 1000 grain weight and compact ear head. Two showed combination of medium grain size and 1000 grain weight and laxy ear head type. Maximum number of genotypes fell under group II. The group comprised 24 lines having medium seed yield, low fodder yield of which four genotypes showed bold grain size and medium 1000 grain weight and compact ear head type. Combinations of medium grain size, medium 1000 grain weight and laxy ear head type were recorded in three glyphs. Three lines had included in Group III with high seed yield and low fodder yield. In this group, only one glyph exhibited bold grain size, compact ear head type and medium 1000 grain weight. Group IV consisted of 7 genotypes with low grain yield and moderate fodder yield. In this group all the genotypes were laxy type of ear head. Only one glyph showed bold grain, medium type 1000 grain weight and laxy ear head type. Mean values for the different characters are presented in Table 3.

Group V consisted of moderate grain weight with moderate fodder yield had 15 genotypes. Medium score for grain size 1000 grain weight and compact ear head was observed in four genotypes. Five genotypes showed low score for grain size, 1000 grain weight and laxy panicles. Only one genotype showed bold size grain, medium for 1000 grain weight and compact ear head. Group VI Consisted of 3 genotypes with high yield and medium fodder yield besides moderate 1000 grain weight and ear head compactness. In Group VII consisted of only one genotype showed low score for all the three characters. In Group VIII three genotypes had observed of these only one glyph combined with bold grain 1000 grain weight and laxy ear head type. One genotype combination with medium grain weight, medium 1000 grain weight and compact ear head was observed.

From these results, it can be easily well known that those genotype fell into different groups can

be crossed to have maximum variability of good combinations of characters. The study therefore indicates the possibility of realizing dual purpose genotypes with high grain yield and fodder yield besides yield contributing characters. Group II had maximum number of genotypes which had favourable combinations of bold grain and compact ear head type for improving specific characters such as grain size and ear head type genotypes may be selected from this group. The grouping can be used in the future hybrid programme for the improvement of sorghum population. Since, grain and fodder are the major economically important product, the germplasm lines of groups VI, III, and VIII could help in future sorghum breeding programme for achieving dual purpose type.

References

Anderson, E.C. 1957. A semi graphical method for the analysis of complex problem.Proc. Nat. Acad. Sci, Washington 43:923-27.

Sabharwal, P.S. Lodhi, G.P., Grewal, P.S., Pahuja, S.K and Nehra, S.S.1995. A study of genetic divergence in forage sorghum crop Res 10:278-84.

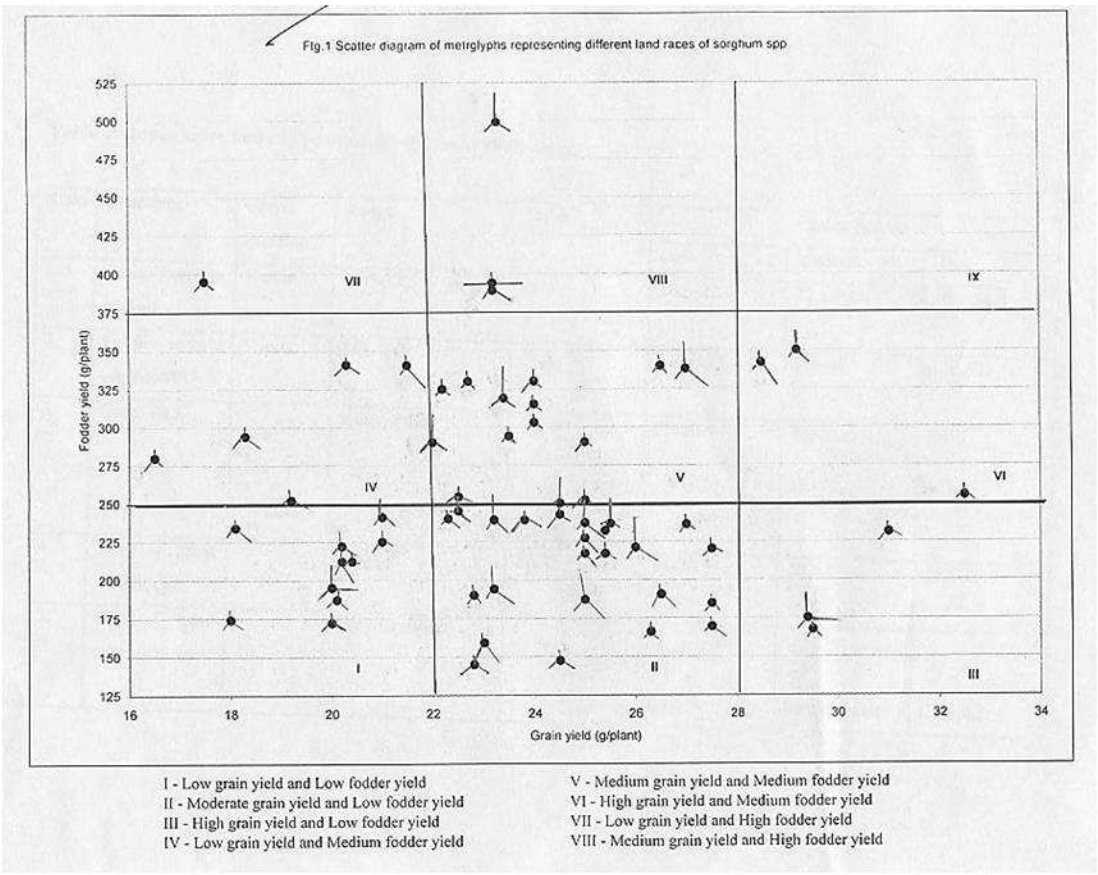

Table 1 - Index score and ray position for different characters.

S.No	Character	Glyph Position	Range	Mean	Index Scores		
					Low	Medium	High
1.	Grainweight g/plant	X axis	16.5-32.5	24.5	16.5-22.0	22.1-28.0	28.1-34.0
2.	Fodderweight g/plant	Y axis	145-499	322	125-250	251-375	376-525
3.	Grain size		Small-Bold	-	Small 	Medium 	Bold 
4.	1000 grain weight (g)		16-29.5	22.75	16-20.5 	20.6-25.0 	25.1-29.5 
5.	Earhead compactness		Laxy-Compact	-	 Laxy	 Semicompact	 Compact

Table 2 - Landraces of sorghum species falling in different groups

Grouping	No of Landraces	Landraces serial numbers a per diagram
I	10	15, 1, 8, 62, 13, 24, 7, 19, 55, 59
II	24	2, 4, 3, 6, 5, 36, 14, 16, 41, 29, 54, 10, 20, 52, 61, 17, 9, 48, 56, 11, 26, 21, 23, 53
III	3	63, 58, 44
IV	5	33, 49, 40, 42, 22
V	14	50, 12, 43, 18, 30, 60, 34, 57, 35, 51, 46, 27, 45, 25
VI	3	32, 39, 28
VII	1	31
VIII	3	38, 47, 37

Table 3 - Mean Values for the different characters in sorghum spp.

S.No	Accession No	Grain weight (g/plant)	Fodder Weight (g/plant)	Grain Size	1000 grain weight (g)	Ear head compactness
1	EG -5	20	172	Medium	22	L
2	EG -6	22.8	145	Medium	23	L
3	EG-8	23	159	Bold	29.5	L
4	EG-10	24.5	147.5	Medium	22	L
5	EG- 11	27.5	169.5	Medium	19	L
6	EG - 12	26.3	166	Small	18	L
7	EG -15	20.2	222	Medium	20	SC
8	EG - 16	20.1	187	Medium	24.2	L
9	EG -17	23.2	239	Medium	20	C
10	EG - 18	26	221	Bold	22	C
11	EG - 19	25	237	Bold	22.2	C
12	EG -20	22	290	Medium	21	C
13	EG - 21	20.2	212	Bold	24	C
14	EG - 22	23.2	194	Bold	22.5	C
15	EG - 23	18	174	Medium	20.4	L
16	EG - 24	25	187	Bold	24.5	C
17	EG - 25	22.3	240	Medium	20	L
18	EG - 27	23.4	319	Medium	22	C
19	EG - 28	18.1	234	Bold	19	L
20	EG - 29	25.4	217	Small	16	L
21	EG - 30	25.5	236.5	Small	16.2	C
22	EG - 31	21.5	340.5	Bold	19	L
23	EG - 32	25.4	232	Small	17.5	L
24	EG - 33	20.4	212	Small	16.5	L
25	EG - 34	27	338	Bold	21	C
26	EG - 35	25	227	Bold	22	L
27	EG -36	24	330	Small	21.3	L
28	EG - 37	32.5	255	Small	17	L
29	EG - 38	27.5	184.5	Small	18	L

Table 3 . Contd..

S.No	Accession No	Grain weight (g/plant)	Fodder Weight (g/plant)	Grain Size	1000 grain weight (g)	Ear head compactness
30	EG - 40	24	315	Small	19	L
31	EG -41	17.5	395	Small	17.5	L
32	EG - 42	28.5	342	Bold	20.5	L
33	EG -43	16.5	280	Small	21	L
34	EG - 44	24	303	Small	17	L
35	EG - 45	25	252	Small	21	L
36	EG - 46	22.8	190	Small	20.4	L
37	EG - 48	23.3	499	Medium	22.2	C
38	EG - 49	23.2	389	Medium	19	C
39	EG - 52	29.2	350	Medium	20.2	SC
40	EG - 53	19.2	252	Medium	20.4	L
41	EG - 54	26.5	190.5	Medium	19.5	L
42	EG -55	20.3	341	Medium	22	L
43	EG - 56	22.2	325	Small	17	L
44	EG - 57	31	231	Medium	22	L
45	EG - 58	26.5	340	Small	18	L
46	EG -59	22.7	330	Small	16.5	L
47	EG - 65	23.2	394	Bold	26.2	L
48	EG - 66	23.8	239	Medium	22	L
49	EG - 67	18.3	294	Medium	21.1	L
50	EG - 68	22.5	254.5	Medium	24.2	L
51	EG - 74	24.5	250	Small	20.4	C
52	EG -76	25	217	Medium	20.2	L
53	EG - 92	27	236	Small	19	L
54	EG - 93	27.5	220	Small	20	L
55	EG - 95	21	225	Small	22.5	L
56	EG - 96	24.5	242.5	Small	21	L
57	EG - 97	25	290	Medium	21.3	C
58	EG - 98	29.4	175	Bold	21.2	C
59	EG - 99	21	241	Medium	17	C
60	EG -100	23.5	294	Small	20.4	L
61	EG - 101	22.5	245	Medium	20.1	C
62	EG - 102	20	195	Bold	23.2	C
63	EG - 103	29.5	167.5	Small	21	L