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Improvement in *Sesbania*

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Abstract : Twenty different *Sesbania* collections, 16 collected from different areas ofUttar Pradesh, two from IARI and two from TNAU, Coimbatore were evaluated foreight important characters including growth, yield attributes and duration of maturity.In the experiment carried out from 2000- 2002, considerable variability was observed for most of the traits in both the years. Higher values of genotypic coefficient of variationalong with high heritability for most characters indicated the scope for improvementin *Sesbania* by selection. Further, based on meteroglyph, analysis of six important characteristics in these 20 genotypes was carried out. Based on index scores, it was inferred that genotype 10 was the best on overall basis. Arranging of genotypes into various groupsby meteroglyph would facilitate selection of desirable parents for future hybridizationprogrammes.

Keywords: Genotypic and phenotypic variability, Meteroglyph, Sesbania.

Introduction

Daincha *(Sesbania* species) is a valuable crop of the *zaid* season (March - July) with multivarious uses. It finds use in green manuring, soil reclamation, as an animal feed and in agro-forestry. Some species are even known to control weeds and the seeds of still others have valuable properties for gum production. In this context, improvement in a crop like *Sesbania* has special relevance.Presently it is grown in Bengal, Bihar, Tamil Nadu and Uttar Pradesh but it is high time that the crop be widely adopted to sustainable agriculture.

It is disheartening to note that though this useful crop is grown since long but a review of literature showed no references in the field of cultivar improvement. As successful progress of crop improvement depends on genetic variability present in the population, so a precise knowledge of the same is a pre-requisite for any breeding programme. The present investigation was therefore, carried outwith a view to assess the variability and relative importance of different traits and to arrange the different genotypes on the meteroglyph to depict the morphological divergence between genotypes for important characters ata glance. The need of the hour is to develop short duration varieties giving high biomassyield (within 40 days) and high seed yield (within 120 days) that can comfortably fit in the cropping system between *zaid* and *rabi.*

Materials and Methods

The experiment was carried out in two consecutive years during the summer seasonof 2000 and 2001 at the Department of Botany, Allahabad Agricultural Institute- Deemed University, Allahabad, Uttar Pradesh, using 20 diverse *Sesbania* genotypes (Table

Table 1. List of genotypes included in the study.

Treatments	Species	Status
T_1	*Sesbania aculeata*	Land race
T_2	*Sesbania aculeata*	Land race
T_3	*Sesbania aculeata*	Land race
T_4	*Sesbania aculeata*	Land race
T_5	*Sesbania aculeata*	Land race
T_6	*Sesbania aculeata*	Land race
T_7	*Sesbania aculeata*	Land race
T_8	*Sesbania aculeata*	Land race
T_9	*Sesbania aculeata*	Land race
T_{10}	*Sesbania aculeata*	Land race
T_{11}	*Sesbania aculeata*	Land race
T_{12}	*Sesbania aculeata*	Land race
T_{13}	*Sesbania aculeata*	Land race
T_{14}	*Sesbania aculeata*	Land race
T_{15}	*Sesbania aculeata*	Land race
T_{16}	*Sesbania aculeata*	Land race
T_{17} (EC 178342)	*Sesbania rostrata*	Exotic collection
T_{18} (EC 331970)	*Sesbania rostrata*	Exotic collection
T_{19}	*Sesbania sesban*	Land race
T_{20}	*Sesbania grandiflora*	Land race

1). Sixteen of these were collected from farmers' fields (T1 to T16), two from IARI (T17 and T18) and two from TNAU (T19and T20). These were evaluated in randomized block design with three replications. Recommended doses of fertilizers were applied and cultural practices were adopted. Since the performance of the genotypes in both the years was similar, the data of the second year was used foranalysis. The variances were calculated as per formulae given by Panse and Sukhatme (1967), coefficients of variability as per Burton (1952), broad sense heritability (Lush, 1949) and meteroglyph analysis as developed by Anderson (1957). Six important characters (Table 3) in terms of biomass, seed yield and days to maturity with considerable variability were included for meteroglyph analysis. Seed yield and days to maturity with highest values of genotypic variance (VG) were taken as base characters for plotting graph.

Results and Discussion

A comparative study of the total contribution of the genotypic and environmental components of variation to the phenotype of the plants chosen for the study was made. Prominentcomponents of biomass *viz.*, plant height, number of branches per plant, number of leaves per plant and fresh weight ranged widely which is in accordance with the findings of Yadav*et al.* (2002). For all the characters, the contribution of genotypic component was found to be higher than the environmental

Table 2. Estimates of VG, VE, VP, GCV, ECV, PCV and h^2 (BS) for 20 genotypes of *Sesbania* for different characters

Particulars	VG	VE	VP	GCV (%)	ECV (%)	PCV (%)	h^2 (BS)
Germination percent (6 DAS)	58.42	6.15	64.57	8.89	2.89	9.35	0.905
Plant height (at 50 percent flowering stage)	255.60	1.65	257.30	10.57	0.85	10.61	0.994
Branches / plant (at 50 per cent flowering)	5.99	0.96	6.95	38.06	15.27	4099	0.862
Leaves / plant (at 50 per cent flowering)	300.20	0.603	300.8	63.86	2.86	63.93	0.998
Fresh wt./m^2 (at 50 per cent flowering)	13.01	0.339	13.35	83.30	13.45	84.38	0.975
Seed yield /m^2	4000.01	1105.05	5105.06	11.99	6.30	13.55	0.784
Days to 50 per cent flowreing							
Days to maturity	2545	8.57	2554	32.48	1.88	32.54	0.997

Note :

VG = Genotypic variance
VE = Environmental variance
VP = Phenotypic variance
GCV = Genotypic coefficient of variation
ECV = Environmental coefficient of variation
PCV = Phenotypic coefficient of variation
h^2 (BS) = Heritability in broad sense

component of variation indicating that selection for the improvement of these characters may be fruitful. The same was reported by Kalia*et al.* (2003) in another leguminous crop, faba bean. Genotypic coefficient of variation (GCV) was observed to be the maximum for fresh weight per m^2 followed by days to 50 percent flowering indicating that there is considerable scope for improvement in this germplasm with respect to these characters. Environmental coefficient of variation (ECV) was found to be minimum for plant height followed by days to maturity suggesting that the environment is playing an insignificant role in the expressionof these characters and so selection forimprovement of the characters would be effective.

Heritability estimates in broad sense were quite high for almost all characters ranging from 0.784 to 0.998, which is in accordance with the findings of earlier researchers. Bangar

Table 3. Meteroglyph analysis : Construction of index score.

Treatment	Index Score						
	Plant height (cm)	Fresh weight / m^2 (kg)	Days to 50 percent flowering	Days to maturity	Test weight (g)	Yield/m^2 (g)	Total score
T_1	3(166.00)	2(5.67)	2(42.33)	2(137.67)	2(1.852)	3(660.67)	14
T_2	2 (156.67)	2(3.67)	2(43.67)	2(145.33)	2(1.750)	3(630.33)	13
T_3	3(168.67)	2(3.33)	2(43.00)	2(140.00)	3(1.930)	2(504.33)	14
T_4	2(146.33)	1(2.33)	2(41.00)	2(136.00)	2(1.770)	2(535.33)	11
T_5	2(147.00)	1(2.67)	2(42.67)	2(139.67)	2(1.890)	3(692.33)	12
T_6	2(149.00)	1(2.67)	2(41.33)	2(136.00)	2(1.850)	2(504.67)	11
T_7	2(143.00)	1(2.00)	2(42.33)	2(138.33)	3(2.100)	4(819.33)	13
T_8	1(136.67)	1(2.00)	2(42.33)	2(138.33)	3(2.100)	4(819.33)	13
T_9	3(163.67)	2(5.33)	2(43.67)	2(147.00)	3(1.940)	2(536.33)	14
T_{10}	2(150.00)	2(3.33)	2(41.67)	2(137.67)	3(2.030)	4(851.33)	15
T_{11}	2(155.00)	2(3.33)	2(41.67)	2(137.33)	2(1795)	3(631.00)	13
T_{12}	2(150.67)	2(3.33)	2(43.00)	2(140.67)	2(1790)	3(631.00)	13
T_{13}	2(143.33)	1(2.33)	2(42.33)	2(137.33)	2(1.740)	3(660.67)	12
T_{14}	2(154.67)	2(3.33)	2(42.33)	2(138.33)	2(1.690)	2(536.67)	12
T_{15}	2(149.33)	2(3.33)	2(43.00)	2(143.33)	2(1.910)	3(661.67)	13
T_{16}	2(156.67)	2(5.33)	2(42.33)	2(139.00)	2(1.690)	3(726.33)	13
T_{17}	1(120.00)	1(2.33)	2(40.33)	2(135.33)	1(1.190)	1(157.33)	8
T_{18}	1(114.00)	1(1.67)	2(41.00)	2(135.67)	2(1.810)	1(190.33)	9
T_{19}	3(180.33)	3(15.67)	1(120.00)	1(295.00)	1(1.010)	1(94.67)	10
T_{20}	3(173.67)	3(13.00)	1(215.00)	1(310.00)	4(5.130)	1(-)	13
SEm	0.742	0.336	0.942	1.690	0.004	0.592	--
C.D.	2.129	0.682	2.703	4.849	0.009	1.698	--
F test	S	S	S	S	S	S	--

Table 4. Index scores for meteroglyph analysis

Characters	Range of means	Low index score = 1	Medium =2	High=3	Quite high=4
Plant height (cm)	114.00 to 180.33	Less than 130	130 to 160	More than 160	-
Fresh wt./ m^2(kg)	1.67 to 15.67	Less than 2.75	2.75 to 6.00	More than 6	-
Days to 50 per cent flowering	40.33 to 215.00	More than 50	50 to 40	Less than 40	-
Days to maturity	135.33 to 31.00	More than 150	150 to 135	Less than 135	-
Test weight (g)	1.01 to 5.13	Less than 1.3	1.3 to 1.9	1.9 to 2.5	More than 2.5
Seed yield/m^2(g)	94.67 to 851.33	Less than 260	260 to 600	600 to 800	More than 800

Table 5. Tentative crossing programme.

Characters to be improved	Group combination	Possible crosses
Biomass and earliness	V and VI	T4 x T1
Biomass and seed yield	V and VI	T9 x T1
Biomass and seed yield	VI	T7 x T1
Biomass and seed yield	V and VI	T9 x T10
Seed yield and earliness	V and VI	T4 x T10
Biomass	VI	T7 x T10
Biomass and earliness	IV and VI	T18 x T1
Biomass and earliness	I and IV	T19 x T17
Biomass and earliness	I and VI	T20 x T1
Biomass and earliness	I and VI	T20 x T1
Biomass and seed yield	I and VI	T20 x T10
Seed yield and earliness	IV and VI	T18 x T10
Biomass	I and VI	T19 x T10
Biomass and earliness	I and VI	T19 x T1
Seed yield and earliness	IV	T18 x T17
Seed yield and earliness	V and IV	T4 x T17
Seed yield and earliness	VI and IV	T7 x T17
Biomass and earliness	V and IV	T9 x T17

and Mukhekar (2003) reported a high heritability of 0.978 for days to maturity in their studies on another legume (soybean). High heritability (99.75%) for plant height and (97.03%) forper plant grain yield was reported by Pawar*et al.*, (2002) and (99.60%) and (94.70%) respectively for these characters by Satynarayana *et al.* (2003). Pradhan (2004) in his experiment reported high heritability for germination percentage (82.74%) and yield per m^2 (82.85%). According to Allard (1960) the characters, which have low heritability, are not dependable for selection since their genotypic expressionis super imposed by environmental influence. Panse (1957) based on study suggested that high heritability might be indicating the

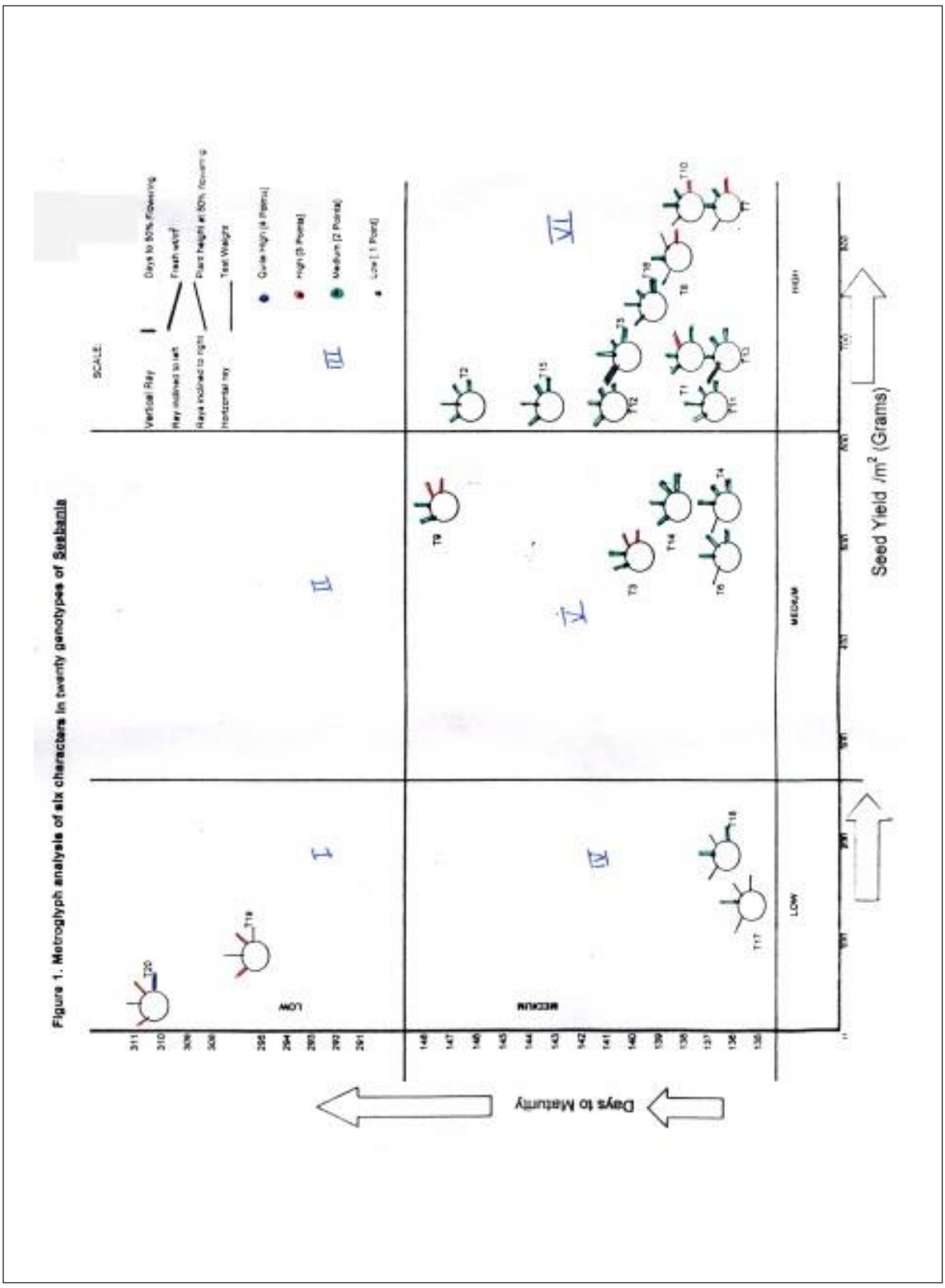

Figure 1. Metroglyph analysis of six characters in twenty genotypes of Sesbania

involvement of additive gene action in the regulation of the concerned characters. In the present study, since the values of heritability along with the values of GCV for the characters plant height, fresh weight, seed yield and duration were appreciably high, it can be inferred that selection may be safely practiced for these characters for developinga desirable genotype.

Meteroglyph analysis (Figure 1) shows the divergence between the 20 genotypes for important characters. The genotypes were divided into six different groups. Group I contained two genotypes *[S. sesban* (T19) and *S. grandifiora* (T20)], group II and III hadno genotypes, group IV had two genotypes (T17 and T18- both *S. rostrata),* group Vhad five genotypes and group VI had eleven genotypes. The last two groups had all *Sesbania aculeata* genotypes. The genotypes from different groups can be used as parents in hybridization (both inter and intra specific) programmes as heterosis can be best exploited by crossing genetically diverse parents. The index scores (Table 3) indicate that T10 *S. aculeata* with the highest index score of fifteen is the overall best. On the basis of morphological divergence and *per se* performance hybridization programme under line x tester mating design is suggested, (Table 5). Since this was a very preliminary trial it gives only a picture of morphological divergence between the genotypes. Further studies on genetic divergence and attempts on hybridization are in progress.

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