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Variability and characters inter-relationships in accessions of sewan grass

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Abstract
The present investigation was conducted to estimate morphological variation for green fodder yield and related traits in sewan grass accessions. The observations were recorded for eleven characters during *Kharif* 2017 at ARS, SKRAU, Bikaner. Among 273 accessions, variability and character association were analyzed for 30 best accessions based on green fodder yield. Phenotypic coefficient of variation was observed high for the number of tillers per plant (67.68%) followed by dry matter yield per plant (29.84%), leaf: stem ratio (27.23%) and green fodder yield per plant (24.12%) that indicated relative magnitudes of the variation are existing among the accessions. Green fodder yield per plant showed positive and significant correlation with spike length, number of tillers per plant and dry matter yield per plant. Dry matter yield per plant also showed positive and significant correlation with the number of tillers per plant, green fodder yield per plant and dry matter percentage at phenotypic level, revealing possibility of simultaneous improvement of these characters along with green fodder yield per plant and dry matter yield per plant. Superior accessions for green fodder yield per plant and dry matter yield per plant were RLSB 1-41, RLSB 1-27, RLSB 4-37, RLSB 10-1 and RLSB 11-50 on the basis of their mean values for the identified characters.

Keywords: Accessions, Character association, *Lasiurus*, Phenotypic variation

Rangeland ecosystems play a major role to enhance the livestock productivity, livelihood and rural economics in India. Presently these grasslands are under heavy grazing pressures, and have been deteriorated largely and need rejuvenation for sustainable production (Roy *et al.,* 2019). *Dichanthium-Cenchrus-Lasiurus* type grasslands are associated with sub-tropical arid and semi-arid regions comprising the northern portion of Gujarat, the whole of Rajasthan, excluding the Aravalli ranges in the South, western Uttar Pradesh, Punjab, Haryana and Delhi State with a coverage of more than 436,000 km^2 between 23^o and 32^o N latitudes and 68^o and 80^o E longitudes. The dominant perennial grass of this grassland is the indigenous sewan grass popularly known as the 'king of desert grasses'. Sewan grass (*Lasiurus sindicus* Henr.) belongs to *Poaceae* and is native to dry areas of North Africa, Sudanese and Sahelian regions, East Africa, and Asia. Sewan grass is diploid in nature carrying 20 chromosomes in somatic cell. Sewan grass is a perennial grass that can live up to 20 years and is propagated by both seeds as well as rooted slips.

It grows best on alluvial soils or light brown sandy soils with a pH of 8.5. This grazing pasture is of utmost importance in areas where annual rainfall is below 250 mm. The crude protein in sewan herbage is high (8.14%) in the early vegetative stage of growth. A 30-day cutting interval at a height of 15 cm gives the best dry matter yields. Sewan grass yields 2.7 to 10.5 tonnes fresh forage/ha/year and upto 3.4 tonnes DM/ha/year in well-established swards. Species like sewan grass are very important in arid environments because they provide forage for both wild mammals and livestock, acts as soil cover and stabilizes the sand dunes and hummocks (Ecocrop, 2010; FAO, 2010). In deteriorated rangelands of Saudi Arabia, sewan grass helps to control the low value invasive species *Rhazya stricta* by smothering its seedlings and helps in rangeland management (Assaeed and Al-Doss, 2001). In India, sewan grass covers around 0.1 million hectares of area (Bhagmal *et al.,* 2011).

The variability in plant population is the first requirement for improvement in any crop. The amount of variability in the accessions of any crops sets the limit for progress that can be achieved through selection. Inter-relationship measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for genetic improvement in yield. Therefore, the present investigation was conducted to study the phenotypic variation and inter-

relationship in 30 best accessions out of 273 accessions of sewan grass based on mean values of green fodder yield per plant.

All the germplasm accessions were established in germplasm block of AICRP on Forage Crops and Utilization, Agricultural Research Station, SKRAU, Bikaner. Each accession was established in unreplicated design with 1m x 1m spacing. Plot size was 273 m^2 in which each accession was represented as one plot and observations were recorded based on single plant. Due to the perennial nature of sewan grass, observations were taken between first cutting on 1st June 2017 and second cutting which was on 10th September 2017. The observations were recorded for eleven characters *viz*., days to 50% flowering (DOF), days to complete seed maturity (DOM), plant height (PH), numbers of tillers per plant (NOT), leaf length (LL), leaf width (LW), spike length (SL), green fodder yield per plant (GFY), leaf: stem ratio (LSR), dry matter percentage (DM%) and dry matter yield per plant (DMY). For leaf length, leaf width and spike length five observations were recorded for each plant and averaged to obtain mean and for remaining characters single observation were recorded. Due to unreplicated design some genetic parameters *i.e.* GV, GCV, heritability and genetic advance could not be determined. However, data were statistically analyzed for variability (Burton, 1952) and correlation (Johnson *et al.,* 1955). The correlation coefficient was tested at 5% and 1% level of significance against the expected value from Fisher 't' table at n-2 degree of freedom.

The estimates of genetic parameters *i.e.* range, mean, phenotypic variances, PCV and SEm for 11 characters were recorded (Table 1). In the present investigation, wide ranges of differences for PCV were observed which varied from the lowest 3.81% for days to complete seed maturity to the highest 67.68% for the number of tillers per plant. The estimate of the phenotypic coefficient of variation (PCV) observed was high for number of tillers per plant (67.68%). Such result was also reported earlier by Yadav (1974) in the pasture grass, *Pennisetum pedicellatum*. Moderate variability was observed for leaf length, leaf: stem ratio, green fodder yield per plant and dry matter yield per plant, whereas low variability was observed for plant height, leaf width, dry matter percentage, spike length, days to 50% flowering and days to complete seed maturity.

Mean values for the different characters are recorded (Table 2). The accession RLSB 1-41 (1.971 kg) had high *per se* performance for green fodder yield per plant followed by RLSB 10-1 (1.806 kg), RLSB 1-27 (1.753 kg), RLSB 11-50 (1.347 kg) and RLSB 1-38 (1.340 kg). The increased green fodder yield per plant in accession RLSB 1-41 was due to higher mean values of plant height and number of tillers per plant. Similar observations were reported earlier by Shekhawat *et al.* (2003) in sewan grass for some growth characters.

Indeed, accessions were divided into three classes having low, medium and high mean performance for specific characters. Accession RLSB 1-41 had high mean value for green fodder yield per plant, dry mater yield per plant, spike length, number of tillers per plant and dry matter yield per plant with low mean value for days to 50% flowering and days to complete seed maturity. Accession RLSB 4-37 had the highest mean value for dry matter percentage and dry matter yield per plant. Therefore, the above accessions can be used in the future breeding programme as these are having a high level of performance in the desired direction for component characters which are directly related to the yield.

Character association of green fodder yield per plant and dry matter yield per plant with different characters was recorded (Table 3). At phenotypic level, green fodder yield per plant had significant and positive correlation with number of tillers per plant. Similar results were reported earlier by Yadav and Krishna (1986) in sewan grass, Rajora (1998) in buffel grass, Thakral and Jatasra (1994) in *Cenchrus setigerus*, Patel *et al*. (2007) in anjan grass (*Cenchrus ciliaris*) and Gore *et al*. (2016) in marvel grass. At phenotypic level, green fodder yield per plant had significant and positive correlation with spike length. Similar result was observed by Yadav *et al*. (1974) in *Cenchrus ciliaris*. At phenotypic level, dry matter yield per plant showed significant and positive phenotypic association with number of tillers per plant and green fodder yield per plant. Similar results were reported by Yadav and Krishna (1986) in sewan grass, Rajora (1998) in buffel grass and Babu and Bai (2000) in guinea grass. Dry matter yield per plant showed significant and positive phenotypic association with green fodder yield per plant. Ray and Harms (1994) reported similar results in wheatgrass. Days to 50% flowering had significant and positive inter-relationship with days to complete seed maturity. This result was in accordance with Kumari *et al*. (2013) in pearl millet.

Table 1. Estimates of range, mean, PV, PCV and SEm for 30 best accessions of sewan grass

Particulars	Range	Mean	PV	PCV	SEm
DOF	36-48	39.00	8.12	7.33	0.52
DOM	66-81	71.00	7.22	3.81	0.49
PH	55.3-110.3	87.8	154.27	14.14	2.27
NOT	7-140	53.27	1436.55	67.68	6.92
LL	15.10-39.52	26.47	46.77	25.84	1.25
LW	0.32-0.68	0.49	0.01	20.61	0.02
SL	7.08-11.04	8.16	1.08	12.75	0.19
GFY	0.873-1.971	1.145	0.08	24.12	0.05
DM%	27.49-62.19	40.62	42.99	16.14	1.2
DMY	0.260-0.825	0.467	0.02	29.84	0.02
LSR	0.50-1.48	0.92	0.06	27.23	0.05

PV: Phenotypic variation; PCV: Phenotypic coefficient of variation; SEm: Standard error of mean

Table 2. Mean performances of 30 best accessions of sewan grass for eleven characters

Accession no.	DOF	DOM	PH	NOT	LL	LW	SL	GFY	DM %	DMY	LSR
RLSB 1-9	42	71	84.3	20	38.30	0.60	7.18	1.015	34.21	0.347	1.04
RLSB 1-19	36	66	110.3	116	36.18	0.48	8.72	1.031	40.15	0.414	0.59
RLSB 1-22	38	69	80.2	40	33.36	0.50	7.82	0.900	39.66	0.357	1.30
RLSB 1-27	36	69	98.4	49	20.98	0.56	7.08	1.753	40.66	0.713	0.82
RLSB 1-31	38	71	89.1	75	24.60	0.40	7.58	0.902	40.02	0.361	0.94
RLSB 1-38	37	71	74.3	69	23.26	0.38	7.64	1.340	43.75	0.586	0.85
RLSB 1-41	36	68	91.1	125	17.32	0.48	9.60	1.971	40.89	0.806	1.24
RLSB 2-34	37	72	93.4	32	27.64	0.40	8.14	0.873	42.58	0.372	1.09
RLSB 2-45	37	68	83.4	140	22.72	0.42	7.42	1.310	40.99	0.537	0.99
RLSB 2-46	38	70	73.2	42	23.32	0.40	7.16	0.970	41.82	0.406	0.79
RLSB 3-26	38	68	96.4	24	39.52	0.54	7.46	1.065	39.62	0.422	1.21
RLSB 3-28	38	70	97.4	65	26.90	0.56	8.08	0.924	40.74	0.376	0.78
RLSB 4-21	37	71	79.3	48	17.36	0.46	7.18	1.020	37.28	0.380	1.16
RLSB 4-31	37	72	90.1	79	32.72	0.50	7.50	0.965	45.62	0.440	0.89
RLSB 4-37	37	70	90.1	75	26.56	0.60	9.16	1.327	62.19	0.825	0.50
RLSB 4-41	48	81	76.2	11	22.48	0.32	9.76	1.187	43.79	0.520	1.48
RLSB 4-43	37	71	84.3	125	19.32	0.32	8.14	1.154	39.41	0.455	0.89
RLSB 7-25	39	70	80.6	87	27.04	0.40	7.58	0.963	39.43	0.380	0.57
RLSB 7-41	43	70	83.4	70	36.40	0.68	7.16	0.908	28.79	0.261	1.07
RLSB 8-4	39	71	103.4	43	30.36	0.60	7.80	1.163	47.53	0.553	0.56
RLSB 8-6	37	72	80.6	50	19.26	0.66	7.64	0.967	51.79	0.501	0.64
RLSB 8-20	39	70	83.3	12	24.96	0.50	10.06	1.060	33.42	0.354	0.70
RLSB 9-44	45	69	71.3	19	37.40	0.66	7.80	0.945	27.49	0.260	1.18
RLSB 10-1	39	75	107.3	95	22.52	0.48	11.04	1.806	33.10	0.598	0.88
RLSB 10-17	39	72	93.8	34	24.46	0.58	10.06	1.067	41.99	0.448	1.09
RLSB 10-23	38	71	78.3	89	35.34	0.56	8.52	1.167	37.42	0.437	1.29
RLSB 11-7	37	70	94.3	57	21.12	0.42	7.82	0.927	40.93	0.379	0.69
RLSB 11-26	39	71	102.1	20	15.10	0.50	8.76	1.128	43.05	0.486	0.77
RLSB 11-47	42	70	55.3	12	25.16	0.34	7.14	1.203	34.54	0.416	0.96
RLSB 11-50	43	66	109.3	20	22.42	0.42	7.78	1.347	45.70	0.616	0.74

Table 3. Phenotypic correlation coefficient among characters in sewan grass

Characters	DOM	PH	NOT	LL	LW	SL	GFY	DM%	DMY	LSR
DOF	0.405*	-0.291	-0.611**	0.233	0.022	0.069	-0.147	-0.346	-0.278	0.367*
DOM	1	-0.208	-0.201	-0.208	-0.195	0.394*	-0.012	0.059	-0.013	0.317
PH		1	0.195	-0.04	0.189	0.318	0.248	0.25	0.311	-0.362*
NOT			1	-0.194	-0.24	0.143	0.368*	0.187	0.371*	-0.17
LL				1	0.447*	-0.225	-0.403*	-0.31	-0.461**	0.2
LW					1	-0.02	-0.086	-0.022	-0.054	-0.072
SL						1	0.404*	0.06	0.328	0.063
GFY							1	0.093	0.830**	0.03
DM%								1	0.623**	-0.427*
DMY									1	-0.205

*(P< 0.05); **(P<0.01)

Three agronomic traits *viz*., number of tillers per plant, spike length and dry matter yield per plant had a significant and positive correlation with green fodder yield per plant and number of tillers per plant. Green fodder yield per plant and dry matter percentage had a positive and significant correlation with dry matter yield per plant. Selection for these characters will be effective for improvement of green fodder yield per plant and dry matter yield per plant. Days to 50% flowering had significant and positive inter-relationship with days to complete seed maturity which revealed that early flowering showed early maturity.

The present investigation revealed that the highest mean performance for the characters were observed in RLSB 1-41 (1.971 kg) for green fodder yield per plant and RLSB 4-37 (0.825 kg) for dry matter yield per plant. These accessions are worthy of utilization in future breeding programme of sewan grass.

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