Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP3: 45-48

Sanjay Kumar Sanadya
Assistant Professor, Department of Agriculture, Mandsaur University, Mandsaur, Madhya Pradesh, India.

Smrutishree Sahoo
Ph.D Scholar, GBPUAT, Pantnagar, Uttarakhand, India

Bhagwati Baranda
Ph.D Scholar, SKRAU, Bikaner, Rajasthan, India

RA Sharma
Director, Department of Agriculture, Mandsaur University, Mandsaur, Madhya Pradesh, India

Correspondence
Sanjay Kumar Sanadya
Assistant Professor, Department of Agriculture, Mandsaur University, Mandsaur, Madhya Pradesh, India.

(Special Issue- 3)
National Conference
"Sustainable Agriculture and Recent Trends in Science & Technology"
(February 22nd & 23rd, 2019)

Study on correlation coefficient and path coefficient analysis in the accessions of Sewan grass (*Lasiurus sindicus* Henr.) for green fodder yield and related traits

Sanjay Kumar Sanadya, Smrutishree Sahoo, Bhagwati Baranda and RA Sharma

Abstract
Indigenous sewan grass is popularly known as the "king of desert grasses". The present study was conducted to determine the variability (through PCV only), correlation and path coefficients among eleven green fodder yield and related characters in 30 accessions of sewan grass. Number of tillers per plant and dry matter yield per plant showed high PCV whereas it was moderate for leaf length, green fodder yield per plant, dry matter yield per plant, and leaf: stem ratio. Number of tillers per plant, spike length and dry matter yield per plant had significant positive correlation with green fodder yield per plant. The path coefficient analysis at phenotypic level revealed that green fodder yield per plant had exhibited largest direct effect on dry matter yield per plant followed by days to complete seed maturity, plant height and number of tillers per plant. Selection based on these traits would ultimately improve the yield.

Keywords: PCV, path analysis, Sewan grass, correlation coefficients and green fodder yield.

Introduction
Dichanthium-Cenchrus-Lasiurus type grasslands are associated with sub-tropical arid and semi-arid regions a coverage of more than 436,000 km^2 between 23^o and 32^o N and 68^o and 80^{o}E. The principal perennial grass species of such grasslands are *Cenchrus ciliaris*, *Cenchrus setigerus*, *Dichanthium annulatum*, *Cymbopogon jawarancusa*, *Cynodon dactylon*, *Eleusine compressa*, *Lasiurus sindicus*, *Sporobolus marginatus*, *Dactyloctenium sindicum*, *Desmostachya bipinnata* etc. (Bhagmal, *et al.*, 2011) [2]. In deteriorated rangelands of Saudi Arabia, sewan grass helps to control the low value invasive species *Rhazya stricta* by smothering its seedlings (Assaeed and Al-Doss, 2001) [1]. Sewan grass is mainly grazed by ruminants, generally in association with *Cenchrus ciliaris* and *Cenchrus setigerus*, which occupy the same agro-ecological niche, especially in Rajasthan and Pakistan (Khan *et al*., 1999) [7]. The dominant perennial grass i.e. indigenous sewan grass is popularly known as the "king of desert grasses". Sewan grass (*Lasiurus sindicus* Henr.) belongs to family *Poaceae* is native to dry areas of North Africa, Sudanese and Sahelian regions, East Africa, and Asia.
Sewan grass is a diploid species with somatic chromosome number (2n) 20. Propagation is done either by sowing or root slips. It is a bushy, multi-branched desert grass with ascending to erect wiry and glaucous stems, up to a height of 1-1.6 m, and a stout woody rhizome (FAO, 2010) [5]. The inflorescence is a silky, about 10 cm long raceme bearing hairy spikelets. spikelets often three at each node, two sessile and one pedicelled; sessile spikelets 6-9 mm long, the lower glume flat, hirsute. The fruit is a caryopsis (eFloras, 2010) [4]. Sewan grass forms bushy thickets in sandy deserts where it is used for pasture, hay and fodder for livestock. It is found in dry open plains, rocky ground and gravelly soils (Quattrocchi, 2006) [9]. It grows best on alluvial soils or light brown sandy soils with a pH of 8.5. In India, sewan grass covers 0.1 million hectares of area (Bhagmal, *et al.*, 2011) [2]. This grazing pasture is of utmost importance in areas where annual rainfall is below 250 mm (Ecocrop, 2010) [3]. 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 up to 3.4 tonnes DM/ha in well-established swards (FAO, 2010) [5].

The variability in plant population is the first requirement for improvement in any crop. Correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for genetic improvement in yield. Path analysis simply splits the correlation coefficient into the measures of direct and indirect effect of a set of independent variables on the dependent variables. The present study was undertaken to derive information on correlations among green fodder yield and yield component traits and to estimate the direct and indirect effects of yield component traits on green fodder yield. This helps in selection of superior accessions in sewan grass.

Material and Methods

The present investigation was carried out during *kharif*-2017 at Research Farm, Agricultural Research Station, Swami Keshwanand Rajasthan Agricultural University, Bikaner (Rajasthan). The present experimental material comprised of 273 accessions of sewan grass. Character association and direct/indirect effects were analyzed for 30 best accessions out of 273 accessions based on higher green fodder yield per plant. The mean performances of 30 best accessions with respect to different morphological characters are presented in Table 2.

Source: All the germplasm accessions are established in germplasm block of AICRP on Forage Crops and Utilization, Agricultural Research Station, SKRAU, Bikaner.

Table 1: List of 30 best accessions of sewan grass used for present investigation

S. No.	Accessions	S. No.	Accessions
1.	RLSB 1-9	16.	RLSB 4-41
2.	RLSB 1-19	17.	RLSB 4-43
3.	RLSB 1-22	18.	RLSB 7-25
4.	RLSB 1-27	19.	RLSB 7-41
5.	RLSB 1-31	20.	RLSB 8-4
6.	RLSB 1-38	21.	RLSB 8-6
7.	RLSB 1-41	22.	RLSB 8-20
8.	RLSB 2-34	23.	RLSB 9-44
9.	RLSB 2-45	24.	RLSB 10-1
10.	RLSB 2-46	25.	RLSB 10-17
11.	RLSB 3-26	26.	RLSB 10-23
12.	RLSB 3-28	27.	RLSB 11-7
13.	RLSB 4-21	28.	RLSB 11-26
14.	RLSB 4-31	29.	RLSB 11-47
15.	RLSB 4-41	30.	RLSB 11-50

Observations recorded

Due to perennial nature of sewan grass, observations were taken from 1st June 2017 to 10th September 2017. The observations were recorded for eleven characters viz., days to 50% flowering, days to complete seed maturity, plant height, numbers of tillers per plant, leaf length, leaf width, spike length, green fodder yield per plant, leaf: stem ratio, dry matter percentage and dry matter yield per plant. For the present investigation, following statistical analyses were done in 30 accessions of sewan grass:-

$$\text{Phenotypic Variance} = \frac{(P_1 - \bar{P}) + (P_2 - \bar{P}) + \ldots (P_n - \bar{P})}{n}$$

$$\text{Phenotypic coefficient of variation (\%)} = \frac{\sqrt{\sigma^2_p}}{\bar{P}} \times 100$$

$$\text{Phenotypic correlation coefficien t} = \frac{\text{Cov.xy(p)}}{\sqrt{\text{Vx(p).Vy(p)}}}$$

The significance of correlation coefficient was be tested at 5% and 1% level of significance against the expected value from Fisher "t" table at (n-2) degree of freedom using the following formula.

$$t = \frac{r}{\sqrt{(1 - r^2)}} \times \sqrt{(n - 2)}$$

The direct and indirect effects were estimated through path coefficient analysis as suggested by Wright (1921) and elaborated by Dewey and Lu (1959). The statistical analysis for correlation and path coefficient using statistical software OPSTAT of HAU, Hisar was online available.

Result and discussion

The accession RLSB 1-41 recorded high *per se* performance for green fodder yield per plant followed by RLSB 10-1, RLSB 1-27, RLSB 11-50 and RLSB 1-38. Therefore, these accessions can be utilized in further breeding programme for developing superior varieties for green fodder yield or any related character. 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. The accessions RLSB 1-19 (66 days) and RLSB 11-50 (66 days) recorded early maturity. Similar observations were taken by Shekhawat *et al.* (2003) [11] and Sanadya *et al.* (2018) [10] in this grass for some characters. The estimates of range, mean, phenotypic variances and PCV for 11 characters have been given in Table 3.

The estimates of phenotypic coefficient of variation (PCV) observed high (>46%) for number of tillers per plant, whereas it was moderate (23-46%) leaf length, green fodder yield per plant, dry matter yield per plant, and leaf: stem ratio and it was low (<23%) plant height, leaf width, dry matter percentage, spike length, days to 50% flowering, days to complete seed maturity.

Character association was computed for different pairs of morphological attributes including green fodder yield per plant and at phenotypic levels due to the non replicated design using for present investigation. At phenotypic level, green fodder yield per plant had significant and positive correlation with number of tillers per plant. Similar results were reported by Yadav and Krishna (1986) [12] in sewan grass and Gore *et al.* (2016) [6] in marvel grass. At phenotypic level, green fodder yield per plant had significant and positive correlation with spike length. Similar result was reported by Yadav *et al.* (1974) [13] in *Cenchrus ciliaris*. Green fodder yield per plant showed no significant and positive association with plant height. Similar result was reported by Zhang *et al.* (2009) [14] in *Pennisetum purpureum*. Green fodder yield per plant showed no significant and positive correlation with leaf: stem ratio and dry matter percentage. Similar result was reported

by Gore *et al.* (2016) [6] in marvel grass. The estimates of path coefficient analysis in sewan grass have been given in Table 4. The path coefficient analysis at phenotypic level revealed that green fodder yield per plant show direct effect with dry matter yield per plant followed by days to complete seed maturity, plant height and numbers of tillers per plant. Similar result was reported by Ramakrishanan *et al.* (2013) in guinea grass.

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

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

Table 3: Estimates of range, mean, phenotypic variance and PCV among characters in sewan grass

Variables	DOF	DcM	PH	NOT	LL	LW	SL	DM%	DMY	LSR	GFY
Range	36-48	66-81	55.3-110.3	7-140	15.10-39.52	0.32-0.68	7.08-11.04	27.49-62.19	0.260-0.825	0.50-1.48	0.873-1.971
Mean	39	71	87.82	53.27	26.47	0.49	8.16	40.62	0.467	0.92	1.145
Phynotypic variance	8.12	7.22	154.27	1436.25	4677	0.01	1.08	42.99	0.02	0.06	0.08
PCV	7.33	3.81	14.14	67.68	25.84	20.61	12.75	16.14	29.84	27.23	24.12

Table 4: Phenotypic path coefficient analysis among characters on green fodder yield per plant

Variables	DOF	DcM	PH	NOT	LL	LW	SL	DM%	DMY	LSR	GFY
DOF	**-0.067**	0.034	-0.012	-0.001	-0.002	0.000	0.000	0.254	-0.348	-0.005	-0.147
DcM	-0.027	**0.084**	-0.008	0.000	0.002	0.004	-0.002	-0.044	-0.017	-0.005	-0.012
PH	0.020	-0.018	**0.040**	0.000	0.000	-0.004	-0.001	-0.184	0.389	0.005	0.248
NOT	0.041	-0.017	0.008	**0.001**	0.001	0.005	-0.001	-0.137	0.463	0.002	**0.368***
LL	-0.016	-0.018	-0.002	0.000	**-0.007**	-0.010	0.001	0.227	-0.576	-0.003	**-0.405***
LW	-0.001	-0.016	0.008	0.000	-0.003	**-0.022**	0.000	0.016	-0.068	0.001	-0.056
SL	-0.005	0.033	0.013	0.000	0.002	0.000	**-0.004**	-0.044	0.410	-0.001	**0.398***
DM%	0.023	0.005	0.010	0.000	0.002	0.000	0.000	**-0.734**	0.779	0.006	0.093
DMY	0.019	-0.001	0.012	0.000	0.003	0.001	-0.001	-0.457	**1.251**	0.003	**0.830****
LSR	-0.025	0.027	-0.014	0.000	-0.001	0.002	0.000	0.314	-0.259	**-0.014**	0.030

Residual effect= 0.008 *, ** Significant at 5 and 1 percent level respectively Diagonal values (bold) are direct effects

DOF= Days to 50% flowering; DcM= Days to complete seed maturity; PH= Plant height (cm); NOT= Number of tillers per plant; LL= Leaf length (cm); LW= Leaf width (cm); SL= Spike length (cm); LSR= Leaf: Stem ratio; DM%= Dry matter percentage (%); GFY= Green fodder yield per plant (kg); DMY= Dry matter yield per plant (kg)

Conclusion

The selection for high to moderate variable characters will be effective for overall improvement of green fodder yield and its related characters. The conclusion that can be drawn from studies on correlation is that three agronomic traits viz., number of tillers per plant, spike length and dry matter yield per plant had significant and positive correlation with green fodder yield per plant and number of tillers per plant. The

path coefficient analysis at phenotypic level revealed that the characters viz., dry matter yield per plant had exhibited largest direct effect on green fodder yield per plant followed by days to complete seed maturity, plant height and numbers of tillers per plant. Selection for these characters will be effective for improvement of green fodder yield per plant and dry matter yield per plant.

References

1. Assaeed AM, Al-Doss AA. Seedling competition of *Lasiurus* sindicus and *Rhazya stricta* in response to water stress. Journal of Arid Environments 2001; 49:315-320.
2. Bhagmal, Singh KA, Roy AK, Ahmed S, Malviya DR. Forage crops and grasses. In: Handbook of Agriculture. ICAR (6th revised edition), New Delhi, 2011, 1353-1417.
3. Ecocrop. Ecocrop database. FAO, Rome, Italy, 2010.
4. eFloras: A collection of online floras from around the world. Harvard University. Herbaria, Cambridge, MA, 2010.
5. FAO. Grassland Index. A searchable catalogue of grass and forage legumes. Rome, Italy, 2010.
6. Gore VR, Surana PP, Shinde GC. Genetic variability studies for forage yield and associated traits in marvel grass (*Dichanthium spp*.). Forage Research 2016; 42(3):172-175.
7. Khan MF, Anderson DM, Nutkani MI, Butt NM. Preliminary results from reseeding degraded Dera Ghazi Khan rangeland to improve small ruminant production in Pakistan. Small Ruminant Research. 1999; 32:43-49.
8. Ramakrishnan P, Babu C, Iyanar K. Genetic variability, character association and path analysis studies in guinea grass (*Panicum maximum* Jacq.). Electronic Journal of Plant Breeding. 2013; 4(3):1265-1270.
9. Quattrocchi U. CRC World dictionary of grasses: Common Names, Scientific Names, Eponyms, Synonyms and Etymology. CRC Press, Boca Raton, USA, 2006, 2408.
10. Sanadya SK, Shekhawat SS, Sahoo S, Kumar A. Variability and inter-relationships of quantitative traits in sewan grass (*Lasiurus sindicus* Henr.) accessions. International Journal of Chemical Studies. 2018; 6(6):1843-1846.
11. Shekhawat SS, Garg DK, Pundhir P, Joshi P, Yadav NS, Chhipa R. Evaluation of *Lasiurus sindicus* Henr. Collection for their performance in zone IC of Rajasthan. Forage research. 2003; 29(2):76-78.
12. Yadav MS, Krishna GVSR. Studies on variability, correlations and path analysis in desert pasture grass *Lasiurus sindicus* Henr. Annals of Arid Zone 1986; 25(2):157-163.
13. Yadav MS, Mehra KL, Magoon ML. Genetic variability and correlation of a few quantitative characters in the pasture grass, *Cenchrus ciliaris*. Indian Forester 1974; 100:512-517.
14. Zhang X, Hong-ru Gu, Cheng-long D, Neng-xiang, Jing-song R. Relation analysis between yield and morphological traits in *Pennisetum purpureum* Schum. Acta Agrestia Sinica. 2009; 05:20-27.