Forage Res., **44** (3) : pp. 172-175 (2018) **http://forageresearch.in**

ASSESEMENT OF GENETIC VARIABILITY, CORRELATIONS AND PATH COEFFICIENT ANALYSIS IN FORAGE OAT (*AVENA SATIVA* L.)

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(Received : 17 September 2018; Accepted : 15 December 2018)

SUMMARY

The present study was conducted during winter season of 2016-2017 with 27 diverse oat genotypes. The genotypes were analyzed for genetic variability, correlation, path analysis and genetic diversity. High heritability along with high genetic advance was recorded for plant height, number of tillers per meter row length, leaf length, leaf width, leaf/stem ratio, stem thickness and green forage yield. High values of GCV and PCV were observed for leaf/stem ratio and green forage yield whereas low values were observed for dry matter content and number of leaves per tiller. Green forage yield was significantly and positively correlated with number of tillers per meter row length, crude protein content, stem thickness, leaf width, plant height and number of leaves per tiller. Leaf width and crude protein content exhibited highest positive direct effect and significant positive correlation with green forage yield.

Key words : Forage oat, Variability, Correlation, Path analysis

Oat (*Avena sativa* L.) is an important winter cereal in the world. It is mainly cultivated as fodder crop in India. Oat protein has a relatively well balanced amino acid composition. The crop is preferred by the farmers due to its multi-cut nature, high forage yield and good quality nutritious fodder.

The genus *Avena* is large and diverse and contains both wild and cultivated species of polyploidy series. Its stem or culm is composed of a series of nodes and internodes. The nodes are solid, the elongated internodes of the mature stem are hollow in the center but during early vegetative stage of development the internodes are solid or show only a slight indication of the breakdown of pith.

The position of the leaf on the oat plant and the kinds of plant part produced are similar to those in other grasses. The leaves are solitary, alternate, two ranked and sessile. A completely developed oat leaf consists of terminal portion, the blade, a basal portion, the sheath, and a membranous appendage, the ligule. The blade is elongate, flat, narrow and linear. The margin of blade is entire and its tip is acute. The leaf sheath is an open cylinder. In the young plant the sheaths of the older leaves encloses the stem and younger leaves. Each lateral branch terminates in a single apical spiklete. Other spikelet is born on second or third-order of branches. Each panicle may have 20 to 50 spikelets. The flowers are perfect zygomorphic, bracteates and hypogeous (Bhardwaj, 2012). Genotypic correlation coefficients provide a major of degree and directions of genotypic association between characters.

The method of partitioning the correlations into direct and indirect effects by path coefficient analysis suggested by Wright (1921) provides useful information on the relative merit of the traits in the indirect selection criterion for yield. Therefore, the present investigation was conducted with twenty four forage oat genotypes along with three checks (Phule Surabhi, Kent and Phule Harita) to study genetic variability, correlations and path coefficients in forage oat.

MATERIAL AND METHODS

The present investigation entitled, 'Assessment of Genetic variability, correlations and path coefficient analysis in forage oat (*Avena sativa* L.)' was conducted at AICRP on Forage Crops and Utilization, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra during *rabi* 2016-17. The experimental material consisted of 27 diverse

genotypes of oat (*Avena sativa* L.).The genotypes were evaluated in randomized block design (Panse and Sukhatme, 1985) with two replications. Each plot consisted of two rows of 3 m length, spaced 30 cm apart. All the recommended agronomical practices were followed to raise the good crop. Observations were recorded on five randomly selected plants in each replication for all the characters *viz.*, plant height at 50 per cent flowering, number of leaves per tiller, leaf length (cm), leaf width (cm), stem thickness (mm), per cent crude protein content (A.O.A.C., 1990), per cent dry matter except number of tillers per meter row length, leaf stem ratio and green forage yield (Kg/m row length). Standard statistical procedures were followed for estimating genetic parameters such as phenotypic and genotypic coefficients of variation (Burton, 1952), heritability in broad sense (Hanson *et al*., 1956) genetic advance (Allard, 1960), correlation (Johnson *et al* 1955) and path analysis (Dewey and Lu 1959).

RESULTS AND DISCUSSION

Variability

The analysis of variance indicated the existence of significant differences among the genotypes for all the traits except dry matter content revealing presence of sufficient variability among the genotypes studied (Table 1). The estimates of variability parameters for ten characters in twenty seven genotypes of forage oat are presented in Table 2. A wide range of variability was observed for plant height, number of tillers per meter row length, leaf length and stem thickness. High values of GCV and PCV were recorded for the traits namely, leaf/stem ratio (32.20, 33.81) and green forage yield (31.87, 32.70). Low values of GCV and PCV (10%) were observed for two traits *viz.*, dry matter content (1.75, 3.48) and number of leaves per tiller (7.18, 9.96). Seven characters *viz.*, plant height, number of tillers per meter row length, leaf length, leaf width, leaf/stem ratio, stem thickness and green forage yield showed high estimates of heritability accompanied by high genetic advance as percentage of mean indicating these traits were predominantly govern by additive gene action and selection for these characters will be effective.

TABLE 1
Analysis of variance for ten different characters in forage oat

S No.	Character	Mean sum of squares	
		Genotype	Error
1.	Plant height at 50% flowering (cm)	508.5697**	26.7789
2.	Number of tillers per m. row length	513.3732**	32.9458
3.	Number of leaves per tiller	0.6219*	0.1910
4.	Leaf length (cm)	79.0778**	4.0974
5.	Leaf width (cm)	0.3621**	0.0411
6.	Leaf /Stem (L/S) ratio	0.0687**	0.0033
7.	Stem thickness (mm)	73.1571**	7.2922
8.	Green forage yield (kg/m row length)	0.4881**	0.0137
9.	Dry matter content (%)	0.6283	0.3747
10.	Crude protein content (%)	1.4309**	0.3175

*,**Significant at 5% and 1 % levels, respectively.

Shankar *et al.*, (2002) reported high values of GCV and PCV for green fodder yield and leaf/stem ratio; medium values for plant height, leaf length, leaf width and number of tillers per plant and low value was recorded for stem diameter. Singh and Singh (2010) reported high values of GCV and PCV for green fodder yield, plant height and tillers per plant; medium values for leaf/stem ratio and dry matter content. Kapoor *et al.* (2011) reported high values of GCV and PCV for stem girth and number of tillers per plant whereas medium values were observed for number of leaves, leaf width, leaf length and plant height.

Prasad *et al* (2003), Kapoor *et al.* (2011) Bind *et al* (2016) and Jaipal and Shekhavat (2016) reported wide range among the characters studied. High estimates of heritability accompanied by high estimates of genetic advance as percentage of mean for the characters *viz*., plant height, leaf length, number of tillers per plant, leaf/stem ratio, green fodder yield and dry matter yield reported by the Shankar *et al*. (2002).Singh and Singh (2010) reported that characters *viz*., plant height, tillers per plant and dry matter content exhibited high estimates of heritability accompanied by high estimates of genetic advance as percentage of mean. Kapoor *et al*., (2011) observed that leaf width, leaf length and number of tillers per plant showed high estimates of heritability accompanied by high estimates of genetic advance as percentage of mean.

CORRELATION

The genotypic correlation coefficients among ten characters in twenty seven genotypes of forage oat are presented in Table 3. Results indicated that green forage yield was significantly and positively associated with tillers per meter row length (0.7342) followed by crude protein content (0.6507), stem thickness (0.5186), leaf width (0.4717) plant height (0.4282) and number of leaves per tiller (0.3475) and indirect selection based

TABLE 2
Estimates of variability parameters for ten different characters in twenty seven genotypes of forage oat

S. No.	Name of the character	Range	GCV (%)	PCV (%)	ECV (%)	h^2 (b.s.)	G. A. as % of mean
1.	Plant height (cm)	89.50-151.80	13.790	14.537	4.598	90.00	26.950
2.	Number of tillers per meter row length	58.00-113.0	17.428	18.585	6.454	87.90	33.668
3.	Number of leaves per tiller	4.70-7.40	7.177	9.859	6.759	53.00	10.764
4.	Leaf length (cm)	29.00-53.55	13.705	14.434	4.530	90.10	26.805
5.	Leaf width (cm)	1.58-3.13	18.132	20.323	9.180	79.60	33.325
6.	Leaf/Stem ratio (L/S)	0.25-0.88	32.204	33.812	10.303	90.71	63.187
7.	Stem thickness (mm)	14.80-31.90	25.244	27.899	11.879	81.85	47.053
8.	Green forage yield (kg/m. row length)	0.58-2.58	31.878	32.790	7.680	94.56	63.842
9.	Dry matter content (%)	19.48-21.57	1.748	3.477	3.005	52.23	1.810
10.	Crude protein content (%)	5.58-8.36	10.892	13.649	8.225	63.64	17.905

TABLE 3
Genotypic correlation coefficient of green forage yield with yield contributing characters in twenty seven genotypes of forage oat

S. No.	Character	Plant height 50% flowering (cm)	No. of tillers/ meter row length	No. of leaves tiller	Leaf length (cm)	Leaf width (cm)	Leaf/stem ratio (L/S)	Stem thickness (mm)	Dry matter content (%)	Crude protein content (%)	GFY (kg/m row length
1.	Plant height at 50 % flowering (cm)	1.0000	0.1794	0.4849**	0.2125	0.6166**	-0.2285	0.4883**	0.2508	0.4578**	0.4282**
2.	Number of tillers per meter row length		1.0000	-0.1154	0.0024	0.3664**	-0.2704*	0.2935*	-0.0860	0.6593**	0.7342**
3.	Number of leaves per tiller			1.0000	0.0746	0.4594**	-0.0319	0.2133	0.2829*	0.4114**	0.3475*
4.	Leaf length (cm)				1.0000	0.5275**	0.2010	-0.0729	0.0672	0.0089	0.2172
5.	Leaf width(cm)					1.0000	0.1050	0.3633**	-0.1609	0.2910*	0.4717**
6.	Leaf/Stem ratio						1.0000	-0.2078	0.1298	-0.3486**	-0.3210*
7.	Stem thickness (mm)							1.0000	0.2352	0.4373**	0.5186**
8.	Dry matter content (%)								1.0000	0.1242	-0.0979
9.	Crude protein content (%)									1.0000	0.6507**
10.	GFY (Kg/m row length)										1.000

*,**Significant at 5 % and 1 % levels, respectively.

TABLE 4
Genotypic path coefficient of nine independent variables on green forage yield in forage oat

S. No.	Character	Plant height 50% flowering (cm)	No. of tillers/ meter row length	No. of leaves tiller	Leaf length (cm)	Leaf width (cm)	Leaf/stem ratio (L/S)	Stem thickness (mm)	Dry matter content (%)	Crude protein content (%)	Genotypic correlation with GFY
1.	Plant height at 50 % flowering (cm)	-3.4724	-0.9579	-2.3878	-0.6627	5.2087	0.4668	-0.9220	0.8420	2.3135	0.4282**
2.	Number of tillers per meter row length	-0.6229	-5.3403	0.5685	-0.0075	3.0950	0.5523	-0.5542	-0.2886	3.3319	0.7342**
3.	Number of leaves per tiller	-1.6838	0.6165	-4.9242	-0.2327	3.8808	0.0651	-0.4027	0.9497	2.0788	0.3475*
4.	Leaf length (cm)	-0.7378	-0.0128	-0.3673	-3.1188	4.4562	-0.4105	0.1376	0.2257	0.0448	0.2172
5.	Leaf width (cm)	-2.1412	-1.9567	-2.2623	-1.6453	8.4470	-0.2145	-0.6860	-0.5400	1.4707	0.4717**
6.	Leaf/Stem ratio	0.7936	1.4442	0.1569	-0.6268	0.8871	-2.0425	0.3924	0.4357	-1.7617	-0.3210*
7.	Stem thickness (mm)	-1.6956	-1.5674	-1.0501	0.2273	3.0687	0.4245	-1.8882	0.7895	2.2100	0.5186**
8.	Dry matter content (%)	-0.8710	0.4592	-1.3931	-0.2097	-1.3588	-0.2651	-0.4440	3.3570	0.6276	-0.0979
9.	Crude protein content (%)	-1.5897	-3.5210	-2.0256	-0.0277	2.4583	0.7120	-0.8258	0.4169	5.0533	0.6507**

Residual effect=1.4751, Bold figures indicate direct effect.
*, **Significant at 5 % and 1 % levels, respectively.

on these traits will be effective. Chaubey *et al.* (2001), Kumar *et al.* (2004), Mall *et al.* (2005) and Bahadur *et al.* (2008) reported similar results.

Path analysis

Direct effect of any component character

gives an idea about the reliability of indirect selections to be made through those characters to bring about improvement in forage yield. The genotypic correlation coefficients being more important, were only partitioned into direct and indirect effects which are presented in Table 4. Leaf width, crude protein content and dry matter content exhibited high, positive direct effects on green forage yield. Leaf width and crude protein content showed high positive direct effects as well as positive and significant correlation coefficient with green forage yield. Thus, these two components emerged as true components in indirect selection. Chaubey *et al.* (2001) reported the similar results to those obtained in the present investigation.

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