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VS Pawar

Department of Agricultural
Botany (GPB), Post Graduate
Institute, Mahatma Phule
Krishi Vidyapeeth, Rahuri,
Maharashtra, India

GC Shinde

Department of Agricultural
Botany (GPB), Post Graduate
Institute, Mahatma Phule
Krishi Vidyapeeth, Rahuri,
Maharashtra, India

SD Shinde

Department of Agricultural
Botany (GPB), Post Graduate
Institute, Mahatma Phule
Krishi Vidyapeeth, Rahuri,
Maharashtra, India

Corresponding Author:

VS Pawar

Department of Agricultural
Botany (GPB), Post Graduate
Institute, Mahatma Phule
Krishi Vidyapeeth, Rahuri,
Maharashtra, India

Correlation analysis studies in forage oat (*Avena sativa* L.) genotypes for forage yield and yield contributing characters

VS Pawar, GC Shinde and SD Shinde

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Abstract

A field experiment on forty-four forage oat genotypes was evaluated in Randomized Block Design (RBD) along with three replications at the research farm of MPKV, Rahuri. All the recommended cultural practices were strictly followed during the growing stage of the oat crop. Each and every plot and plant was strictly investigated and on which observations were accurately recorded. The observed characters, i.e. stem girth, plant height, No. of internodes per tiller, No. of leaves per tiller, leaf length and dry matter content, had a positive association with green forage yield. This indicated that indirect selection of this trait has positive implications for the improvement of the oat crop for forage. Among the studied characters, plant height has a highly positive direct association with green forage yield followed by stem girth, leaf length, and No. of internodes per tiller. The study reported that plant height, stem girth, leaf length and number of internodes per tiller are truly important components of green forage yield of oat. Selection of this character is helpful for improving forage yield of oat.

Keywords: Correlation, selection, green forage and forage yield

Introduction

The oat (*Avena sativa* L.) is a hexaploid crop with diploid chromosome number i.e. 42. Oat crop is cultivated worldwide, extensively over a wide area, during the winter season. The oat crop is commonly cultivated for three purposes viz., grain production, pasture and forage as feed for grazing animals. One of the ideal things with oat crop is that it is considered as a dual-purpose crop viz., grain as food for human beings and feed for cattle. According to Ruwali *et al.* (2013) [7], in India the dairy industry is growing day by day very strongly. The oat crop attracted the attention of plant breeders due to the grain crop having higher nutritional value, and it produces quality fodder. In India, the oat crop is predominantly cultivated in the rabi season, primarily in the central and north-western region. However, cultivation was extended to the eastern region of India. Nowadays, more than five lakh hectare area is under oat cultivation in the country. The fodder production and productivity are insufficient for Indian livestock and also have difficulty fulfilling the supply requirement of fodder and feed. Nowadays, India has a net deficit of 63% of green fodder, 24% of dry crop residues and 64% of feeds. Oat fodder is preferred by dairy farmers for their cattle. It can be fed green as fodder and can be converted into hay during limited supply. The oat crop has high grain yielding ability; however, it is limited in green fodder yield viz., 44 to 56 ton / ha. Oat crop has high green fodder yield ability and generation capacity on cutting. Oat improvement requires a multidisciplinary approach and innovative technology. In the present study, germplasm was collected from diverse origins. The magnitude of genetic variability present in the germplasm creates an opportunity for selection. Correlation study of traits and their direct and indirect effects is an important index of selection.

Materials and Methods

The study was conducted at the research farm of Mahatma Phule Krishi Vidyapeeth, Rahuri. For the experiment, forty-four (38 genotypes and 06 checks) genotypes were collected from different AICRP centres of forage crops mentioned in Table No. 1. The experiment was conducted in randomized block design (RBD) with three replications. The experiment plot size was 3.30 × 0.60 cm.

The spacing between two rows was 30 cm, and between two plants was 5 cm. All the recommended cultural practices were followed strictly. Each plot was frequently observed,

and observations were recorded by selecting five plants randomly from each plot.

Table 1: Oat genotypes with their origin

S.N.	Genotype	Origin	S.N.	Genotype	Origin
1	OL-1861-1	Ludhiana	23	HFO-225	Hisar
2	OL-1802	Ludhiana	24	HFO-417	Hisar
3	OL-1842	Ludhiana	25	OL-1866	Ludhiana
4	HFO-619	Hisar	26	UPO-16-4	Pantnagar
5	NDO-1102	Faizabad	27	HFO-514	Hisar
6	OS-377	Hisar	28	OL-1873	Ludhiana
7	JO-10-501	Jabalpur	29	OL-1804-1	Ludhiana
8	OL-1769	Ludhiana	30	SKO-229	Srinagar
9	OL-1876	Ludhiana	31	JO-04-19	Jabalpur
10	JO-05-7	Jabalpur	32	HFO-607	Hisar
11	OL-1869	Ludhiana	33	JO-4-321	Jabalpur
12	OL-1871	Ludhiana	34	OL-1862	Ludhiana
13	OL-1766-1	Ludhiana	35	OL-1769-1	Ludhiana
14	OL-1861-1	Ludhiana	36	OS-424	Hisar
15	HFO-611	Hisar	37	RSO-8	Rahuri
16	JO-05-301	Jabalpur	38	RSO-60	Rahuri
17	HFO-609	Hisar	39	JHO-822 (Ch)	Jhansi
18	SKO-225	Srinagar	40	OS-6(Ch)	Hisar
19	OS-432	Hisar	41	UPO-212 (Ch)	Pantnagar
20	HFO-610	Hisar	42	Kent (Ch)	Hisar
21	UPO-10-3	Pantnagar	43	RO-19 (Ch)	Rahuri
22	PLP-18	Palampur	44	RO-11-1 (Ch)	Rahuri

Table 2: Analysis of variance for different characters of oat genotypes

Sr. No.	Character	Replication	Genotypes	Error
	DF	2	43	86
1	Days to 50% flowering	10.098**	143.511**	1.741
2	Plant height (cm)	23.058**	644.569**	3.149
3	Number of leaves/tiller	1.475**	1.615**	0.184
4	Number of internodes/tillers	5.638**	1.274**	0.195
5	Leaf length (cm)	1.935	85.708**	3.920
6	Leaf width (cm)	0.0396	0.329**	0.020
7	Stem girth (cm)	0.0423	0.614**	0.018
8	Leaf: stem ratio	0.0254*	0.151**	0.007
9	Dry matter content (%)	9.412**	9.486**	1.108
10	Crude protein content (%)	0.066	2.098**	0.091
11	Green forage yield (kg/net plot)	0.144**	0.913**	0.0276

*, ** = significant at 5% and 1% levels, respectively.

Table 3: Genotypic (above diagonal) and phenotype correlation coefficients (below diagonal) of green forage yield and yield contributing characters of oat genotypes.

Character	Days to 50% flowering	Plant height (cm)	No. of leaves / tiller	No. of internodes / tiller	Leaf length (cm)	Leaf width (cm)	Stem girth (cm)	Leaf: stem ratio	Dry matter content (%)	Crude protein content (%)	Green forage yield / (kg / net plot)
Days to 50% flowering	1.000	-0.377**	0.035	0.046	-0.137	0.492**	-0.243**	0.243**	-0.318**	0.148	-0.360**
Plant height (cm)	-0.363**	1.000	0.435**	0.412**	0.124	-0.266**	0.600**	-0.182	0.580**	-0.106	0.876**
No. of leaves/tiller	0.024	0.363**	1.000	0.943**	-0.387**	-0.029	0.291**	-0.255**	0.306**	-0.220*	0.419**
No. of internodes/tiller	0.036	0.328**	0.926**	1.000	-0.230**	0.085	0.319**	-0.232**	0.257**	-0.169	0.427**
Leaf length (cm)	-0.125	0.117	-0.258**	-0.123	1.000	0.213*	0.330**	0.181	0.188*	0.023	0.274**
Leaf width (cm)	0.453**	-0.249**	-0.003	0.083	0.183	1.000	-0.232**	0.350**	-0.279**	0.009	-0.310**
Stem girth (cm)	-0.219*	0.574**	0.251**	0.281**	0.297**	-0.189*	1.000	-0.142	0.428**	-0.114	0.755**
Leaf: stem ratio	0.217*	-0.168	-0.201**	-0.167	0.162	0.312**	-0.127	1.000	-0.082	0.198*	-0.162
Dry matter content (%)	-0.229*	0.514**	0.178*	0.161	0.145	-0.241**	0.360**	-0.066	1.000	-0.293**	0.592**
Crude Protein content (%)	0.130	-0.093	-0.173*	-0.122	0.011	-0.015	-0.093	0.172*	-0.233**	1.000	-0.178*
Green forage yield (kg/net plot)	-0.321**	0.844**	0.337**	0.335**	0.239**	-0.268**	0.714**	-0.151	0.559**	-0.147	1.000

*and ** significant at P= 5 and P = 1 level of significance, respectively

Results and Discussions

- Days to 50% flowering:** recorded significant positive correlation with leaf width (0.492, 0.453), and L:S ratio

(0.243, 0.0217) and negatively correlated with plant height (-0.377, -0.363) and dry matter content (-0.318, -0.229) at phenotypic and genotypic level.

- **Plant height (cm):** It has a positive correlation with No. of leaves / tiller (0.45, 0.363), No. of internodes / tiller (0.413, 0.328), stem girth (0.600, 0.574) and dry matter per cent (0.580, 0.14) at both levels. However, negatively correlated with leaf width (-0.266, -0.249). Selection of plant height was rewarded for character stem girth, no. of leaves and dry matter %.
- **No. of leaves per tiller:** It has positive correlation with number of internodes / tiller (0.943, 0.926), stem girth (0.291, 0.251) and dry matter content (0.306, 0.178). The character was negatively correlated with the character leaf length (-0.387, -0.258), L:S ratio (-0.255, -0.201) and crude protein content (-0.220, -0.173) at genotypic and phenotypic level.
- **No. of internodes /tiller:** It has a significant positive correlation with stem girth (0.319, 0.281) at both levels, dry matter % (0.257) at genotypic level and negatively correlated with leaf length (-0.230) and L:S ratio (-0.232) at genotypic level only.
- **Leaf length (cm):** It has a significant positive correlation with stem girth (0.330, 0.297) at genotypic and phenotypic level. Genotypically, it is positively correlated with leaf width (0.213) and dry matter content (0.188).
- **Leaf width (cm):** It has a significant positive correlation with L:S ratio (0.350, 0.312) and negatively correlated with stem girth (-0.232, -0.189) and dry matter content (-0.279, -0.241) at both levels.
- **Stem girth (cm):** It has a positive correlation with dry matter content (0.428, 0.360) in genotypic and phenotypic levels.
- **Leaf: stem ratio:** It has a positive correlation with crude protein content (0.198, 0.172) in genotypic as well as phenotypic levels, respectively.
- **Dry matter content (%):** It has a negative correlation with crude protein content (-0.293, -0.233) at genotypic and phenotypic levels.

In genotypic and phenotypic levels, characters viz., plant height (0.876, 0.844), stem girth (0.755, 0.714), dry matter content (0.592, 0.559), no. of internodes / tiller (0.427, 0.335) and no. of leaves / tiller (0.419, 0.337) and leaf length (0.274, 0.239) had significant positive correlation with green forage yield. Similar results supported by Bibi *et al.*, (2012)^[1] for flowering, Krishna *et al.*, (2014)^[4] for no. of leaves and stem girth, Dubey *et al.*, (2015)^[3] for no. of leaves and dry matter content, Wagh *et al.*, (2018)^[8] for plant height, stem girth, leaf width, crude protein and no. of leaves, Raj *et al.* (2025)^[6] for no. of tillers per plant and seed yield, and Yaduvanshi *et al.* (2025)^[9] for seed yield / plant, plant height, number of tillers per plant, leaf: stem ratio.

Conclusion

The study reported that among the studied characters, plant height, stem girth, dry matter content, number of internodes per tiller, number of leaves per tiller and leaf length have a significant positive association with forage yield in genotypic and phenotypic levels. The indirect selection of the character is helpful in the improvement of the character for green forage yield. The days to 50% flowering and leaf width are significantly negatively correlated with forage yield. Many characters have genotypic correlation greater

than phenotypic correlation, indicating characters are helpful for yield improvement.

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