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Correlation and Path Coefficient Analysis Studies in OAT (AVENA SATIVA L.)

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Abstract

Fifty genotypes of oat were evaluated to study the character association and path coefficient during rabi 2014-15. The correlation studies revealed positive and significant correlations of seed yield/plant with 100-seed weight, number of spikelets/panicle and number of tillers/plant. Strong association of these traits revealed that the selection based on these traits would ultimately improve seed yield and it is also suggested that hybridization of genotypes possessing combination of above characters is most useful for obtaining desirable high yielding genotypes. Path coefficient analysis revealed that 100 seed weight, number of spikelets/panicle, number of tillers/plant, plant height, flag leaf length, internode length, axis length and days to maturity had positive and direct effects on seed yield/plant, while the characters viz., days to 50% flowering and peduncle length showed direct negative effects. The results revealed that the traits like, 100-seed weight, number of spikelets/panicle and number of tillers/plant should be given due consideration while performing selection for seed yield in segregating generations of OAT.

Keywords: Correlation, Avena sativa, path analysis, seed yield.

1. Introduction

OAT (*Avena sativa* L.) is widely cultivated for use as food, feed and fodder. The crop has been adopted well by the farmers because of its multicut nature and high yield of nutritious and palatable fodder. Among fodder crops grown in *rabi*, oat possesses relatively more dry matter content, 7 to 10% protein, resistance to diseases and is specially suited for silage. It also gives highest green fodder yield per unit area per unit time with minimum irrigation. Seed yield is a complex trait and is influenced by several component characters. It is also very difficult to improve yield by directly selecting for seed yield/plant. Therefore, it was felt that it would be of great help in selecting the desirable genotypes for yield if there is certain association of seed yield with certain easily measurable plant characters. Correlation between different characters could arise due to linkage or pleiotropy. Correlation due to linkage can be manipulated or changed through recombination but it would be impossible to overcome the correlation due to pleiotropy. In the later case, genetic improvement in one trait is not eventually possible without bringing a change in the associated component characters. Path coefficient analysis provides more realistic picture of the relationship among the characters. The path coefficient analysis reveals whether the association of each individual character with yield is due to its direct effect on yield or is a consequence of indirect effects *via* other component characters. Thus, path coefficient is essential to know the effectiveness of selection for simultaneous improvement in these characters. Looking into all these aspects an attempt was made to study the correlation and path coefficient analysis in 50 genotypes of OATs.

2. Material And Methods

The field experiment was conducted on 50 genotypes of Oat at Forage Research Area and Seed Science & Technology Section laboratory of the Department of Genetics & Plant Breeding, CCS, Haryana Agricultural University, Hisar during *Rabi*-2014-15. All the genotypes were grown in Randomized Block Design (RBD) with three replications each genotype having single row of three metre length with 15 cm plant to plant distance and 45 cm row to row spacing. All the recommended package of practices were adopted to raise a good crop. Observations were recorded on five randomly selected plants from each entry on Plant height at maturity (cm), Peduncle length (cm), Stem internode length (cm), Axis length (cm), Flag leaf length (cm), Tillers per plant (number), Spikelets (number), Seed yield/plant (g), 100 seed weight (g), Days to 50% flowering and Days to maturity. Seed quality parameters viz., Standard germination test (%), Shoot length (cm), Root length (cm) , Seedling length (cm) and Seedling dry weight (g) were estimated as per ISTA, 2004 while Seed Vigour indices were calculated according to the method suggested by Baki and Anderson (1970). The correlation coefficient at phenotypic and genotypic level was calculated from the variance and covariance according to Johnson et al. (1955). Direct and indirect effect of various contributing traits towards green fodder yield and dry matter yield was calculated using the path coefficients analysis (Dewey and Lu, 1959).

3. Results And Discussion

Correlation coefficient

The correlation coefficients at genotypic level have shown higher magnitude than their corresponding correlation coefficients at phenotypic level thereby, revealing a good amount of strong inherent association between different attributes (Table 1). Seed yield/plant exhibited positive correlation with number of tillers/plant (0.374), number of spikelets/panicle (0.58) and 100 seed weight (0.183) and negative correlation with days to 50% flowering (-0.247) and days to maturity (-0.046) . Similar results for one or more characters were reported by many researchers, Krishna Pal et al. (1992), Babber et al. (1998), Ahmed et al. (2013), Vaisi et al. (2013) and Krishna et al. (2014). These results indicated that number of spikelets/panicle, number of tillers/plant and 100 seed weight are the major yield contributing traits to be given more selection pressure for improving yield.

Path coefficient analysis for direct and indirect effects on seed yield/ plant

Path coefficient analysis was done on the basis of genotypic correlation coefficients in which diagonal values are direct effects and off-diagonal values are indirect effects (Table-2), indicates that spiklets/panicle had the highest direct and positive effect (0.69411) on seed yield/plant, followed by germination (0.28919), flag leaf length (0.25469), days to maturity (0.24843), number of tillers/plant (0.22395), internode length (0.18216), axis length (0.1573), seed vigour index I (0.12658), seedling length (0.04085), 100 seed weight (0.0346) and plant height (0.00071). The direct negative effects were observed for days to 50% flowering (-0.35258), seedling dry weight (-0.21881), peduncle length (-0.20521) and seed vigour index II (-0.19452). Similar results for one or more characters were reported by Solanki et al. (1973), Murtza et al. (1979), Acar-z et al. (1994), Choubey et al. (2001), Vaisi et al. (2013) and Krishna et al. (2014).The residual effect (0.2707) indicated that the component characters under study were responsible for about 73% of variability in seed yield/plant. Partitioning of genotypic correlation between seed yield per plant and its component characters revealed that the direct effects were, in general, of higher magnitude than that of their indirect effects for all the characters.

Selection for higher number of spiklets/panicle, germination, flag leaf length, days to maturity, number of tillers/plant, internode length, axis length, seed vigour index I, seedling length, 100 seed weight and plant height will be significant for the improvement of seed yield while progess in breeding for enhanced seed yield may adversely be affected by selection for traits like days to 50% flowering, seedling dry weight, peduncle length and seed vigour index II due to negative association of these traits with seed yield. The results, thus, observed in the present study would provide some guidelines in the selection of parents and in the prediction of possible merits for genetic recombination and would also be of value in formulating model plant type for selection in segregating generations.

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Table 1: Phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients among sixteen characters in OAT.

	PH (cm)	FLL (cm)	PL (cm)	IL (cm)	AL (cm)	SL/P	T/P	DF (days)	DM (days)	SI (g)	G (%)	SL (cm)	SDW (g)	SVI I	SVI II	SY (g)
PH (cm)		0.078	-0.182*	-0.001	0.14	0.054	0.134	0.146	0.133	-0.11	0.048	0	0.14	0.074	0.032	0.072
FLL (cm)	0.167		0.03	0.003	0.014	-0.061	-0.012	0.094	0.033	0.138	-0.07	0.017	0.079	0.104	0.091	0.082
PL (cm)	-0.175	0.045		0.173*	0.251**	0.126	-0.068	-0.161*	-0.138	0.305**	-0.012	0.101	0.162*	-0.054	0.135	-0.037
IL (cm)	-0.03	0.013	0.336		0.176*	0.082	0.206*	-0.133	-0.073	0.153	0.107	0.248**	0.314**	0.134	0.308**	0.094
AL (cm)	0.167	-0.018	0.313	0.204		-0.037	0.077	-0.036	-0.02	0.097	0.410**	0.167*	0.233**	0.216**	0.274**	0.113
SL/P	0.078	-0.007	0.174	0.033	-0.087		0.262**	-0.059	-0.066	0.220**	-0.026	-0.029	0.175*	0.299**	0.103	0.518**
T/P	0.173	0.072	-0.077	0.246	0.114	0.137		-0.078	-0.04	0.011	0.142	0.08	0.237**	0.250**	0.258**	0.363**
DF (days)	0.242	0.186	-0.278	-0.167	-0.022	-0.04	-0.124		0.558**	0.026	-0.116	0.026	-0.028	-0.117	0.063	-0.174*
DM (days)	0.242	0.124	-0.138	-0.118	-0.019	-0.117	-0.061	0.661		0.133	-0.01	0.001	-0.013	-0.02	-0.038	-0.022
SI (g)	-0.204	0.183	0.42	0.2	0.126	0.348	0.035	0.002	0.138		0.057	0.117	0.311	0.095	0.158	0.136

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G (%)	-0.029	-0.112	0.052	0.105	0.504	-0.127	0.076	-0.145	-0.005	0.1		0.204*	0.345**	0.497**	0.350**	0.269**
SL (cm)	-0.04	0.119	0.145	0.363	0.207	-0.007	0.06	0.06	-0.016	0.13	0.212		0.459**	0.209*	0.172*	0.046
SDW (g)	0.241	0.121	0.221	0.415	0.259	0.22	0.263	-0.007	-0.001	0.346	0.376	0.538		0.233**	0.339**	0.167*
SVI I	0.09	0.149	0.008	0.227	0.26	0.289	0.169	-0.153	-0.01	0.13	0.504	0.309	0.256		0.319**	0.515**
SVI II	0.045	0.112	0.171	0.429	0.32	0.094	0.292	0.085	-0.045	0.213	0.385	0.155	0.379	0.397		0.087
SY (g)	0.059	0.155	0.003	0.146	0.156	0.58	0.374	-0.247	-0.046	0.183	0.237	0.07	0.169	0.553	0.092	

*Significant at 5 percent

** Significant at 1 percent PH= Plant height (cm) , FLL= Flag leaf length (cm), PL= Peduncle length (cm), IL=Internode length (cm), AL= Axis length (cm), S/P=Spikelets/panicle, T/p=Tillers/plant, DF= Days to 50% flowering, DM= Days to maturity, SI= 100 seed weight (g), G%= Germination% , SL= Seedling length (cm), SDW= Seedling dry weight (g), SVI I = seed vigour index I, SVI II = seed vigour index II, SY = Seed yield/plant(g).

Table 2: Path coefficient analysis of seed yield /plant with its component characters in OAT.

	PH (cm)	**FLL (cm)**	**PL (cm)**	**IL (cm)**	**AL (cm)**	**SL/P**	**T/P**	**DF (days)**	**DM (days)**	**SI (g)**	**G (%)**	**SL (cm)**	**SDW (g)**	**SVI I**	**SVI II**	**Genotypic correlation with seed yield /plant**
PH (cm)	**0.00071**	-0.01582	0.03591	-0.00548	0.02624	0.05430	0.03875	-0.08539	0.06000	0.01023	-0.00849	-0.00161	-0.05271	0.01134	-0.00882	**0.05916**
FLL (cm)	-0.00004	**0.25469**	-0.00917	0.00241	-0.00288	-0.00477	0.01603	-0.06553	0.03076	-0.00918	-0.03244	0.00486	-0.02658	0.01886	-0.02180	**0.15522**
PL (cm)	-0.00012	0.01138	**-0.20521**	0.06121	0.04930	0.12087	-0.01715	0.09818	-0.03434	-0.02108	0.01515	0.00592	-0.04846	0.00106	-0.03322	**0.00349**
IL (cm)	-0.00002	0.00336	-0.06896	**0.18216**	0.03214	0.02266	0.05499	0.05897	-0.02929	-0.01004	0.03037	0.01483	-0.09080	0.02871	-0.08337	**0.14571**
AL (cm)	0.00012	-0.00466	-0.06431	0.03722	**0.15730**	-0.06066	0.02557	0.00770	-0.00465	-0.00630	0.14583	0.00847	-0.05658	0.03292	-0.06232	**0.15565**
SL/P	0.00006	-0.00175	-0.03574	0.00595	-0.01375	**0.69411**	0.03073	0.01419	-0.02915	-0.01746	-0.03684	-0.00028	-0.04817	0.03661	-0.01835	**0.58016**
T/P	0.00012	0.01823	0.01572	0.04473	0.01796	0.09525	**0.22395**	0.04356	-0.01527	-0.00178	0.02200	0.00247	-0.05764	0.02138	-0.05686	**0.37382**
DF (days)	0.00017	0.04734	0.05714	-0.03047	-0.00344	-0.02793	-0.02767	**-0.35258**	0.16433	-0.00011	-0.04179	0.00244	0.00160	-0.01932	-0.01646	**-0.24675**
DM (days)	0.00017	0.03153	0.02837	-0.02147	-0.00295	-0.08144	-0.01377	-0.23322	**0.24843**	-0.00692	-0.00157	-0.00065	0.00013	-0.00131	0.00872	**-0.04595**
SI (g)	-0.00014	0.04659	-0.08620	0.03644	0.01976	0.24145	0.00795	-0.00079	-0.05018	**0.0346**	0.02878	0.00533	-0.07575	0.01650	-0.04146	**0.18254**

G (%)	-0.00002	-0.02857	-0.01075	0.01913	0.07933	-0.08843	0.01704	0.05096	-0.00135	-0.00499	**0.28919**	0.00866	-0.08226	0.06373	-0.07483	**0.23684**
SL (cm)	-0.00003	0.03031	-0.02976	0.06612	0.03262	-0.00470	0.01352	-0.02104	-0.00398	-0.00655	0.06131	**0.04085**	-0.11782	0.03908	-0.03018	**0.06975**
SDW (g)	0.00017	0.03094	-0.04545	0.07559	0.04067	0.15281	0.05899	0.00258	-0.00014	-0.01737	0.10872	0.02199	-**0.21881**	0.03238	-0.07381	**0.16926**
SVI I	0.00006	0.03796	-0.00171	0.04132	0.04091	0.20075	0.03783	0.05382	-0.00258	-0.00654	0.14561	0.01261	-0.05598	**0.12658**	-0.07726	**0.55338**
SVI II	0.00003	0.02854	-0.03504	0.07807	0.05040	0.06548	0.06546	-0.02983	-0.01114	-0.01070	0.11125	0.00634	-0.08303	0.05027	**-0.19452**	**0.09158**

Residual effect = 0.2707 PH= Plant height (cm) , FLL= Flag leaf length (cm), PL= Peduncle length (cm), IL= Internode length (cm), AL= Axis length (cm), S/P= Spikelets/panicle, T/p=Tillers/plant, DF= Days to 50% flowering, DM= Days to maturity, SI= 100 seed weight (g), G%= Germination% , SL= Seedling length (cm), SDW= Seedling dry weight (g), SVI I = seed vigour index I, SVI II = seed vigour index II, SY = Seed yield/plant (g)