ISSN Print: 2394-7500
ISSN Online: 2394-5869
IJAR 2015; 1(5): 298-300
www.allresearchjournal.com
Received: 07-02-2015
Accepted: 13-03-2015

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Correlation and path coefficient analysis of fodder yeild traits in Oat (*Avena sativa* L.)

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Abstract
An experiment was conducted to study the correlation and path coefficient analysis of fodder yield traits in oat. In general genotypic correlation coefficients were higher than their corresponding phenotypic correlation coefficients. Green and dry fodder yields were positive and significantly correlated with plant height, stem diameter, number of leaves/plant, leaf length, leaf breadth and dry fodder yield. Path coefficient analysis showed that plant height, stem diameter, number of tillers/plant, number of leaves/plant, leaf breadth and length were the principal components of green as well as dry fodder yield. It is advocated that selection should be based on these characters for accelerating genetic improvement of fodder yield in oat.

Keywords: Correlation coefficient, path analysis, fodder yield

Introduction
Oat is most important fodder crop grown during *rabi* season. Its fodder is highly nutritious. For faster improvement of any crop through selection, the knowledge of the association of yield and other traits is a basic need. Further, the information on the direct and indirect influences of these traits helps in making selection more effective. Therefore, the present study was undertaken to investigate the extent and nature of association between the fodder yield and other morphological characters and to determine the yield components in oat crop through path coefficients analysis.

Materials and Methods
The experimental material comprising 45 genotypes of forage oat were laid out during *rabi* 2009-10 (26.11.1999) ate the experimental farm of the Department of Genetics & plant breeding, Brahmanand Mahavidyalaya, Rath - 210 431 (Hamirpur) U.P. India. Two row plots of 4 m length for each genotype were gornw using randomized block design following recommended package of practices during crop season. The observations on five randomly selected plants form each genotype in e ach replication were recorded on 10 metric *viz*., days to 50% flowering, plant height (cm,), number of tillers/plant, stem diameter (mm), number of leaves/plant leaf length (cm), leaf breadth (cm), leaf-stem ratio, green fodder yield/plant (g) and dry fodder yield/plant (g). The genotypic and phenotypic correlation coefficient were calculated following the formulae as suggested by Robinson *et al*. (1951) [3]. Path coefficient analysis were worked out using genotypic correlation as per Dewey and Lu (1959) [2].

Results and Discussion
High significant genotypic difference was observed for all the characters under study. In general the genotypic correlation coefficients were higher than their corresponding phenotypic correlation coefficients for various characters in both the environments (table -1). This reflected the strong inherent association between various traits and therefore, phenotypic selection will be quite effective. However, in most cases, correlation coefficient were more pronounced under late sown than under normal sown conditions. Green and dry fodder yields/plant were found to be positive and significantly correlated with plant height,

stem diameter, number of leaves/plant, leaf length and leaf breadth under both the conditions and with *in vitro* dry matter digestibility. However, leaf length was positive and significnatly associated with leaf breadth and dry fodder yield/plant under both the environments. Leaf breadth showed positive and significant association with dry fodder yield/plant in both the conditions, and with *in vitro* dry matter digestibility under late sown condition. Leaf-stem ratio had positive and significant association with crude protein content under late sown condition. Crude protein content was positive and significant correlated with *in vitro* dry matter digestibility under both the conditions. The above results indicate that the plant height, stem diameter and leaf traits should be given due importance in selection for higher yield.

Path coefficient analysis (Table 2 and 3) showed that stem diameter exhibited considerable direct effect on green fodder yield/plant under normal sown condition, while plant height and leaf breadth had highest direct effect under late sown condition. Number of tillers/plant also had high positive direct effect on green fodder yield and indirect effect via number of leaves/plant in both the environments. These results are in close agreements with the findings of Choubey and Gupta (1986) [1], Roy *et al*. (2006) [5] and Rajbahadur *et al*. (2008) [6]. Stem diameter and number of tillers/plant had substantial of indirect contribution on dry fodder yield/plant under normal sown condition, whereas, plant height and stem diameter had highest direct effect under late sown condition. Indirect effect of stem diameter, leaf length and leaf breadth on both green and dry fodder yield was high and positive via plant height in both the environments and these traits were highly associated with green and dry fodder yield/plant.

It is obvious from the path-coefficient analysis that plant height, stem diameter, number of tillers/plant, number of leaves/plant, leaf breadth and leaf length were the component traits of green and dry fodder yield/plant as these had high values of direct effects. Most of these characters also had high positive indirect effects on green and dry fodder yield through each other. Hence, the selection should be based only on plant height, number of tillers/plant, stem diameter, number of leaves/plant, leaf length and leaf breadth for accelerating genetic improvement of fodder yield and quality in oat.

Table 1: Genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficient among green and dry fodder yield in forage oat.

Characters	Env.	Days to 50% flowering	Plant height (cm)	No. of tillers/ plant	Stem diameter (mm)	No. of leaves/ plant	Leaf length (cm)	Leaf breadth (cm)	Leaf: stem ratio	Dry fodder yield/plant (g)	Green fodder yield/plan (g)
Days to 50% flowering	E_1 E_2	-	0.0185 0.2145	0.0444 -0.1952	0.1346 0.2346	0.3481 -0.547	-0.0261 0.1949	0.2023 0.2050	0.1889 0.0591	-0.0021 0.1024	0.1234 0.1089
Plant height (cm)	E_1 E_2	0.0175 0.2113	- -	-0.4293 -0.3652	0.6175 0.5076	-0.1063 -0.0202	0.5158 0.4597	0.6838 0.3947	- 0.2812 - 0.2727	0.5544 0.7119	0.4816** 0.6879**
No. of tillers/plant	E_1 E_2	0.0355 -0.1888	- 0.4149** -0.3408*	- -	-0.2744 -0.2240	0.7703 0.8160	-0.0247 -0.2857	-0.4928 -0.3071	0.2116 0.1504	0.0807 0.1427	0.1648 0.1842
Stem diameter (mm)	E_1 E_2	0.1224 0.2229	0.5680** 0.4705**	-0.2430 -0.2078	- -	0.1318 0.1092	0.5576 0.2249	0.7998 0.8277	0.1362 0.0400	0.6004 0.5928	0.6165** 0.5886**
No. of leaves/plant	E_1 E_2	0.3302* -0.0553	-0.1180 -0.0303	0.7699** 0.7935**	0.1064 0.0987	- -	0.1033 -0.1541	-0.0761 0.0107	0.4024 0.3925	0.2826 0.2930	0.4066** 0.3669**
Leaf length (cm)	E_1 E_2	-0.0270 0.1883	0.4982** 0.4504**	-0.0176 -0.2788*	0.5196** 0.2072	-0.1009 -0.1516	- -	0.3921 0.3034	0.3226 - 0.0812	0.4754 0.3023	0.4882** 0.2970*
Leaf breadth (cm)	E_1 E_2	0.1926 0.1865	0.6452** 0.3718**	- 0.4334** -0.2723*	0.7273** 0.7186**	-0.0716 0.0051	0.3714** 0.2858*	- -	0.1073 0.0604	0.4287 0.4790	0.4545** 0.5078**
Leaf: stem ratio	E_1 E_2	0.1607 0.0612	-0.2690 -0.2510	0.2197 0.1306	0.1059 0.0037	0.3870** 0.3506*	0.2912* -0.0688	0.0987 0.0533	- -	0.0052 -0.1947	0.1088 -0.1241
Dry fodder yield/plant (g)	E_1 E_2	-0.0051 0.0955	0.5306** 0.6851**	0.1271 0.1650	0.5442** 0.5340**	0.2853* 0.3112*	0.4566** 0.2947	0.3988** 0.4531**	0.0262 - 0.1722	- -	0.9234** 0.9588**
Green fodder yield/plant (g)	E_1 E_2	0.1155 0.1023	0.4568** 0.6650	0.2085 0.2000	0.5556** 0.5358**	0.4250** 0.3811**	0.4671** 0.2840*	0.4219** 0.4820**	0.1214 - 0.1086	0.9254** 0.9583**	- -

*, ** Significant at P, 0.05 **, Significant at P, 0.01; E_1, Normal sown condition; E_2, Late sown condition.

Table 2: Path coefficient analysis of green fodder yield versus other traits in forage oat.

Characters	Env.	Days to 50% flowering	Plant height (cm)	No. of tillers/ plant	Stem diameter (mm)	No. of leaves/ plant	Leaf length (cm)	Leaf breadth (cm)	Leaf: stem ratio	'r' with FGY
Days to 50% flowering	E_1 E_2	-0.0066 -0.0270	0.0046 0.1184	0.0151 -0.012	0.0529 0.0262	0.0526 -0.0149	-0.0030 -0.0113	0.0229 -0.0149	-0.0150 -0.0076	0.1234 0.1089
Plant height (cm)	E_1 E_2	-0.0001 -0.0057	0.2504 0.5521	-0.1457 -0.0264	0.2426 0.0566	-0.0161 -0.0055	0.0588 -0.0270	0.0773 0.1084	0.0144 0.0351	0.4816** 0.6879**

No. of tillers/plant	E_1	-0.0003	-0.1075	0.33940	-0.1078	0.1165	-0.0028	-0.0557	-0.0169	0.1648
	E_2	0.0053	-0.0911	0.1597	-0.0249	0.2226	0.0166	-0.0843	-0.0194	0.1842
Stem diameter (mm)	E_1	-0.0009	0.1546	-0.0931	0.3928	0.0199	0.0635	0.0904	-0.0108	0.6165**
	E_2	-0.0063	0.2803	-0.0357	0.1116	0.0298	-0.0131	0.2273	-0.0051	0.5886**
No. of leaves/plant	E_1	0.0023	-0.0266	0.2614	0.0518	0.1512	0.0118	-0.0086	-0.0321	0.4066**
	E_2	0.0015	-0.0112	0.1303	0.0122	0.2728	0.0089	0.0029	-0.0505	0.3669**
Leaf length (cm)	E_1	0.0002	0.1292	-0.0084	0.2191	0.0156	0.1139	0.0443	-0.0257	0.4882**
	E_2	-0.0053	0.3120	-0.0454	0.0251	-0.0420	-0.0412	0.0833	0.0105	0.2970*
Leaf breadth (cm)	E_1	-0.0013	0.2179	-0.1672	0.3142	-0.0115	0.0447	0.1131	-0.0085	0.4545**
	E_2	-0.0055		-0.0490	0.0923	0.0029	-0.0176	0.2746	-0.0078	0.5078**
Leaf: stem ratio	E_1	-0.0013	-0.0453	0.0718	0.0535	0.0608	0.0367	0.0121	-0.0796	0.1088
	E_2	-0.0016	-0.1506	0.0240	0.0045	0.1071	0.0047	0.0166	-0.1287	-0.1241

Table 3: Path coefficient analysis of dry fodder yield versus other traits in forage oats

Characters	Env.	Days to 50% flowering	Plant height (cm)	No. of tillers/ plant	Stem diameter (mm)	No. of leaves/ plant	Leaf length (cm)	Leaf breadth (cm)	Leaf: stem ratio	'r' with DFY
Days to 50% flowering	E_1	-0.0472	0.0089	0.0214	0.0701	-0.0370	0.0001	-0.0142	-0.0039	-0.0021
	E_2	-0.0333	0.1230	-0.0390	0.0511	-0.0088	-0.0170	0.0359	-0.0092	0.1024
Plant height (cm)	E_1	-0.0008	0.4760	-0.2067	0.3215	0.0113	-0.0023	-0.0481	0.0037	0.5544**
	E_2	-0.0071	0.5733	-0.0330	0.1105	-0.0032	-0.0402	0.0691	0.0426	0.7119**
No. of tillers/plant	E_1	-0.0021	-0.2043	0.4816	-0.1428	-0.0820	0.0001	0.0347	-0.0043	10.0807
	E_2	0.0065	-0.0947	0.1998	-0.0487	0.1322	0.250	-0.0537	-0.0235	0.1427
Stem diameter (mm)	E_1	-0.0063	0.2939	-0.1321	0.5206	-0.0140	-0.0025	-0.0563	-0.008	0.6004**
	E_2	-0.0078	0.2911	-0.0447	0.2177	0.0177	-0.0197	0.1448	-0.0062	0.5928**
No. of leaves/plant	E_1	0.0164	-0.05069	0.3709	0.0686	-0.1065	-0.0005	0.0054	-0.0082	0.2826*
	E_2	0.0018	-0.0115	0.1630	0.0238	0.1620	0.0135	0.0019	-0.0613	0.2930*
Leaf length (cm)	E_1	0.0012	0.2455	-0.0119	0.2903	-0.0110	-0.0045	-0.0276	-0.0066	0.4754**
	E_2	-0.0065	0.3635	-0.0570	0.0490	-0.0250	-0.0875	0.0531	0.0127	0.3023*
Leaf breadth (cm)	E_1	-0.0095	0.3254	-0.2373	0.4165	0.0081	-0.0018	-0.0705	-0.0022	0.4287**
	E_2	-0.0068	0.2263	-+0.0614	0.1802	0.0017	-0.0265	0.1750	-0.0094	0.4790**
Leaf: stem ratio	E_1	-0.0089	-0.0862	0.10419	0.0709	-0.0428	-0.0014	-0.0076	-0.0206	0.0052
	E_2	-0.0020	-0.1564	0.0300	0.0087	0.0636	0.0071	0.0106	-0.1564	-0.1947

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