Agri. Res. J. Kerala, 1976, 14 (2) 138—144

PATH COEFFICIENT ANALYSIS OF THE FIRST ORDER AND SECOND ORDER COMPONENT OF FODDER YIELD IN OATS (*Avena sativa L.*) *

P. S. NAIR and Y. K. GUPTA

College of Agriculture, Vellayani, Kerala

Fodder yield, like grain yield is a complex character influenced by various components and is based on the built-in genetic potential of the plant with reference to these components. Not mueh work has been done to isolate the various components of fodder yield in oats *Avena sativa L.*), and to study the relative magnitude of their contributions towards fodder yield. Such information is essential in designing an efficient breeding programme. Hence a study was undertaken to find out the major components of dry matter yield in oat varieties. Path coefficient analysis suggested by Wright (1921), discussed by Li (1955) and used by Durate and Adams (1972) has been found highly useful to analyse the direct and indirect effects of the first and second order components of dry matter yield.

Materials and Methods

Thirty two varieties of oats were grown in a Randomised Block Design with four replications at the farms of Rajasthan College of Agriculture. Each plot consisted of two lines (4.00 m. long and 30 cm. apart) of one variety. Plant to plant distance was 25 cm. in the line. The recommended package of practices were adopted in raising the crop. Fourteen characters, namely days to flag-leaf emergenee, days to maturity (half milk stage), plant height, number of tillers, number of leaves, leaf angle, leaf area, green weight of stem, green weight of leaves, total green yield, stem/leaf ratio, total dry matter yield, per cent crude protein and per cent ash content were recorded from four plants in each of the variety from each replication. Correlations of the different characters studied were computed by the method suggested by Al-Jibouri (1958). The characters, except leaf angle and per cent crude protein, exhibited highly significant correlations and hence further selection was based on heritability, genetic advance, genetic gain and genetic coefficien of variation.

Results and Discussion

All the varieties studied showed highly significant difference in respect of the characters studied. The genotypic and phenotypic correlation coefficients between dry matter yield and the other 13 characters are presented in Table 1,

A part of the M. Sc. thesis submitted by Senior auther to University of Udayapur, Rajastan.

Table 1

Genotypic and phenotypic correlation coefficients between total dry matter yield and all other characters

Sl. No.	Characters	Total dry matteryield Genotypic	Phenotypic
1.	Days to flag leaf emergence	+ 0.283 **	! 0.271 *
2.	Days to maturity:	4 0.307 **	! 0.302 **
3.	Plant height	! 0.598 **	! 0.561 **
4.	Number of tillers	+ 0.795 **	4 0.753 **
5.	Number of leaves	4 0.703 **	0.672 **
6.	Leaf angle	r 0.199 *	4 0.175
7.	Leaf area	! 0.311 **	4 0.307 **
8.	Green weight of stem	0.951 **	: 0.933 **
9.	Green weight of leaves:	0.824 **	0.837 f*
10.	Total green yield	! 0.937 **	0.912 **
11.	Stem/leafratio	— 0.269	— 0.235 **
12.	Per cent crude protein	— 0.101	- 0.064
13.	Per cent ash content	4 0.285 **	0.216 **

Significant at 5 per cent level. ** Significant at 1 per cent level.

The dry matter yield was found to be highly correlated with all characters except leaf angle and per cent crude protein. Dent (1957) also observed the non significant correlation between crude protein content and straw yield in cultivated oats The correlation of dry matter yield with stem/leaf ratio was negative.

Relationship between first order components

Green weight of stem, green weight of leaves, plant height, number of tillers, leaf area and number of leaves were reported to exhibit high heretability, genetic gain, genetic advance and genetic coefficient of variation (Nair, 1976). These were in agreement with the findings of Petr and Frey (1966), Bhagmal, *et* (1970) and Phul *el al* (1972). Correlations between total dry matter yield, green weight of stem and green weight of leaves have been worked out and the results are presented in Table 2.

Table 2

Correlation between first order components

Characters		Green weight of stem	Green weight of leaves
Total dry matter yield	(p)	+0.933	+ 0.837
	(G)	+0.951	+ 0.825
Green weight of stem:	(p)	X	+ 0.905
	(G)	X	+ 0.920

Green weight of stem and green weight of leaves had high positive correlation with dry matter yield as well as between themselves. Therefore these characters were treated as first order components of the dry matter yield. It indicated that improvement, if brought about in these two characters would positively lead to high dry matter yield.

Relationship between second order components

The rest of the characters had highest association with green weight of stem and green weight of leaves and as the characters of the first order components were not independent, being influenced by other morphological characters, the nature of association between them were also worked out. The results are presented in Table 3.

Table 3

Correlation coefficient between second order components

		Green weight of stems	Green weight of leaves	Plant height	No. of tillers	leaf area	No. of leaves
Green weight of stem	(P)	X	+ 0.905	+ 0.499	+ 0.785	+ 0.275	+ 0.759
	(G)	X	f 0.920	0.525	+ 0.835	+ 0.267	+ 0.797
Green weight of leaves	(P)	x	x	+ 0.470	+ 0.648	+ 0.503	+ 0.649
	(G)	x	x	+ 0.515	+ 0.704	+ 0.512	+ 0.666
Plant height	(P)	X	x	x	+ 0.156	+ 0.512	+ 0.103
	(G)	X	x	x	+ 0.175	+ 0.543	+ 0.106
No. of tillers:	(P)	X	x	x	x	– 0.151	+ 0.925
	(G)	X	x	x	x	– 0.160	+ 0.949
Leaf area :	(P)	V	x	x	x	x	– 0.193
	(G)	X	x	x	X	x	- 0.209
No. of leaves	(P)	X	x	x	X	x	x
	(G)	X	x	x	X	x	x

The correlation studies indicated that the number of leaves had less influence on the green weight of leaves than on the green weight of stem. The correlation studies among the characters revealed that plant height and number of tillers were independent. The results indicated that further improvement could be achieved by imposing more emphasis on the above characters.

Path coefficient analysis

(a) First *order components:*

The results of the analysis of first order component are presented in Table 4.

Table 4

Path coefficient analysis of first order components.

Character	Effect via.		Correlation coefficient
	Green weight of stem.	Green weight of leaves	
Green weight of stem	+ 1.256	— 0.305	+ 0.951
Green weight of leaves.	– 0.331	+ 1.156	+ 0.825

Px7 = 0.280

The partitioning of the observed correlation coefficient of the green weight of stem indicated positive and high direct effect (+1.256) of the green weight of stem. On the contrary, the direct relationship of the green weight of leaves was negative (— 0.331) but the indireet effect via green weight of stem was high and positive (+ 1.156). The role of green weight of leaves in increasing dry matter yield was not due to its direct effect but was due to its indirect effect through the green weight of stem. As the photosynthates are translocated from leaves to stem, where it accumilates to increase the dry matter yield, the influence of green weight of leaves as indirect effect is justifiable.

(b) Second order components:

The results based on the partitioning of correlation coefficient in to its direct and indirect effects are presented in Table 5.

It may be observed that number of tillers, leaf area and number of leaves had high direct effect on the green weight of stem as well as on the green weight of leaves. The association of plant height with green weight of stem was due to its direct effect as well as its indirect effect on leaf area. There was little effect of the number of tillers on green weight of stem via plant height

Table 5

Path coefficient analysis of second order components (Green weight of stem and its components)

Characters	Effect via				Correlation coefficient
	Plant height	Number of tillers	Leaf area	Number of leaves	
Plant height:	+ 0.240	+ 0.087	+ 0.159	+ 0.039	+ 0.525
Number of tillers:	+ 0.042	+ 0.498	+ 0.046	0.341	+ O.S35
Leaf area;	+ 0.132	— 0.080	+ 0,290	— 0.075	+ 0.267
umber of leaves :	+ 0.025	+ 0.473	- 0.061	+ 0.359	+ 0.797

P_1x = + 0.307

and via leaf area since positiva and negative values mutually neutralised their effects. When compared to the other components, leaf area had low correlation coefficient with green weight of stem but the analysis showed that its effect was direct than indirect. The number of leaves exhibited direct effect as well as indirect effect via number of tillers in increasing green weight of stem.

The path coefficient analysis on green weight of leaves and its components are prasented in Table 6,

Table 6

Path coefficient analysis of green weight of leaves **and its components**

Characters	Effcet via				Correlation coefficient
	Plant height	Number of tillers	Leaf area	Number of leaves	
Plantheight:	4 0.056	+ 0.081	+ 0.341	+ 0.037	+ 0.515
Number of tillers.	+ 0.010	+ 0.462	— 0.100	+ 0.332	+ 0.704
Leaf area.	+ 0.030	- 0.074	+ 0.628	- 0.073	+ 0.512
Number of leaves.	+ 0.008	+ 0.439	— 0.131	+ 0.350	+ 0.666

x - - 0.302

The results revealed the effect of various characters on green weight of leaves. The simple correlation of plant height was mainly due to its indirect

effect through leaf area than its direct effect on the trait itself. The other direct effects were negligible. The correlation of number of tillers with green weight of leaves comprised largely of the direct effect supplemented with the indirect effect via number of leaves. The direct effect of leaf area was slightly high but it was nullified by the other indirect effects to bring down its simple correlation coefficient to + 0.512. The number of leaves was significantly correlated with green weight of leaves due to its direct effect and its indirect effect through number of tilers.

The residual factor analysis for the unknown causes disclosed comparatively low values to conclude that the impact of external factors were negligible.

The number of tillers, leaf area and number of leaves had to be considered as major components for the increase of green weight of stem and green weight of leaves, which would contribute to the dry matter yield in fodder oats. These characters had i igh heritability, genetic gain, genetic advance and genetic coefficient of variation. Hence due emphasis should be given for the improvement of these three characters which should not only improve the green weight of stem and leaves but ultimately contribute to the dry matter yield.

Summary

Thirty two varieties of oats were analysed for correlation coefficient between 14 characters which enabled the path coefficient analysis of the first order and second order components of dry matter yield in fodder oats (*Avena sativa L*). The analysis revealed that number of tillers, leaf area and number of leaves had major roles in the accumilation of dry matter yield through the first order components, namely, green weight of stem and green weight of leaves. The results indicated that by the improvement of these characters, the dry matter yield also could be increased.

'സിന്റെ ഉണങ്ങിയ കാലിത്തീറ്റ വിളയുടെ പ്രഥമവും ദ്വിതീയവുമായ ഘടക
നത്തിനുപകരിക്കുന്ന പതിന്നാലു് വ്യത്യസ്ത ഘടകങ്ങളും, മുപ്പത്തിരണ്ടു് ഇ ..
അടിസ്ഥാനമാക്കി തിരഞ്ഞെടുത്ത സഹസംബന്ധ ഗുണാംക (Correlation coefficients)
ഈ ഘടകങ്ങളുടെ പഥഗുണാംകം (Path coefficient)

ttfi*Tu-«n"t(8

പ്രധാന

REFERENCES

Al-Jibouri, H. A. Miller, P. A. and Robinson, H. F. 1958 Genotypic and environmental variances and covariances in upland cotton crosses of inter specific origin. *Agron. J* SO, 633 - 637.

Bhagmal Mehra, K. L. and Katiyar, D. S. 1970. Heritable and non-heritable variations in fodder oats. *SABRAO News* 1. 2, 31 - 36.

Deni, J. W. 1957. The chemical composition of straw and grain of some varieties of spring oats in relation to time of harvesting, nitrogen treatment and environment. *Agric, Sci.* 48, 336 - 346.

Durate, R. A. and Adams, M. W. 1972. Path coefficient analysis in some yield component inter relation in field beans, *Crop. Sci.* **12,** 579 - 582

Li, C. C. 1955. Population genetics. The University of Chicago Press, Chicago and London.

Nair P. S. 1976. Genetic variability and path coefficient studies on fodder yield and its components in oats (*AvenaSaliva L.)* (Thesis unpublished)

Pctr, F. C. and Frey, K. J. 1966. Genotypic correlation dominance and heritability of quantitative characters in oats. *Crop. Sci. 6,* 259-262.

Phul, P. S. Arora, N. D. and Mehndiratta, P. D. 1972. Genetic variability correlations and path analysis of fodder yield and its components in sorghum. /. *Res* Ludhiyana 9, 422 - 427.

Wright, S, 1921. Correlation and causation. *J. Agric. Rex.* **20,** 557 * 585.

(M. S. *received: 4-1-1977*)