CORRELATION AND PATH COEFFICIENT STUDIES IN MAIZE

BY

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ABSTRACT

Two diallel sets (15 and 45 F_1 hybrids) were used in this work during two two successive seasons 1985 and 1986 to estimate the correlation coefficients as well as path coefficient analysis to determine the direct and indirect effects of some charecters contributing to the yield of maize.

Results indicated positive and significant correlations between grain yield per plant and each of number of kernels per row, number of rows per ear and 100-kernel weight, in the first set. Whereas, positive and highly significant correlations were obtained between grain yield per plant and each of number of kernels per row and number of rows per ear in the second set.

Weight of 100 kernels appeared to have the highest direct effect on grain yield in the first set, whereas, both number of kernels per row and number of rows per ear had the highest and positive direct effect on yield in the second set.

Also, results showed that the most important sources of variation for plant yield (71.63%) in the first set were: direct effect of 100-kernel weight, direct effect of number of rows per ear, and indirect effect of number of kernels per row through 100-kernel weight. In the second set of study, the main sources of variation (61.88%) were: Direct effect of number of rows per ear, direct effect of number of kernels per row, and the indirect effect of number of rows per ear via number of kernels per row.

INTRODUCTION

Grain yield, an extremely complex charecter, is the result of many growth functions of the plant. It is an example of integration in which the components of yield are partially interdepended in their development.

In corn (Zea mays, L.) breending, considerable emphasis currently is being placed upon the development of high-yielding cultivars. The main four components of grain/plant are number of ears/plant, number of row/ear, number of kernels/row and 100-kernel weight. Knowledge of the inter-relationships among these components is therefore important.

Significant positive correlation was recorded between 100-kernel weight and each of, number of kernels/row (Mahgoub, 1979) and number of rows/ear (Johnson, 1973; Ibrahim, 1977 and Mahgoub, 1979).

Grain yield per plant was significantly and positively correlated with each of number of rows/ear (Omer et al., 1970 and Katta, 1976), number of kernels/row (El-Marakby, 1964; Omer, et al., 1970; Nigem, 1976 and Ibrahim, 1977) and 100-kernel weight (Nigem, 1976 and Ibrahim, 1977).

The present work was undertaken to estimate the relative contribution of causal factors to corn yield using two sets of F_1 hybrids.

MATERIALS AND METHODS

Six inbred lines, namely; G. 102, G. 307 A, Moshtohor-15, 16, 17 and 26 were used as a first diallel set. Ten inbred lines, namely: G. 504 A, G. 507 A, G. 241 A, G. 303 A, G. 307 A, K 6, Rg II, Moshtohor 22, 25 and 26 were involved in the second diallel set. All possible combinations, without reciprocals were made in 1984 season. The 15 hybrids of the first diallel set, were grown during 1985 and 1986 seasons. For the 2nd diallel. Two experiments involved the 45 hybrids were planted in June 4th and July 3rd in 1985 season. A randomized complete block design with three replications was used at the Agricultural Research and Experimental Station of the Faculty of Agriculture, Moshtohor.

Each plot in the four experiments, consisted of two ridges of six cm. long and 70 cm. in width. Hills were spaced at 30 cm. with three kernels per hill on one side of the ridge. The seedlings were thinned one plant per hill. A random sample of 20 guarded plants in each plot was taken to evaluate, number of rows/ear, number of kernels/row, 100-kernel weight (g) and grain yield/plant (g). The combined data of yield and some of its components were subjected to simple correlation calculated according to Snedecor and Cochran (1957), as follow:

$$r_{ph} = M_{12} \Big/ \sqrt{(M_1)\ (M_2)}$$

where: M_{12} is the phenotypic covariance between pairs of two traits, and M_1 and M_2 are the phenotypic mean of squares of the two traits.

Path coefficient analysis was done between grain yield and its components, i.e., number of kernels per row, number of rows per ear and 100-kernel weight. Means of 15 and 45 hybrids in the 1st and 2nd diallel sets, respectively were used in this respect. This analysis was made according to the method outlined by Wright (1921, 1923 and 1934).

RESULTS AND DISCUSSION

Simple phenotypic correlation:

Table (1) shows that values of simple correlation coefficient between grain yield/plant and each of its components. In the first set, significant positive phenotypic correlation values were found between grain yield/plant and each of its components. This result indicates that selection for one or more of these components would be accompanied by high grain yield/plant. In the second set, significant positive phenotypic correlation between grain yield/plant and each of number of kernels/row and number of rows/ear was studied. Therfore, selection for high number of kernels/row and/or rows/ear are more effective criteria for the breeder to obtain higher yielding genotypes. Positive and significant correlation was previously found between grain yield and each of number of kernels/row, (El-Marakby, 1964; Johnson, 1973; Maghgoub, 1979; Mohamed, 1984 and Abd El-Sattar, 1986), number of rows/ear (Nawar *et al.*, 1984 and Abd El-Sattar, 1986) and 100-kernel weight (El-Marakby, 1964; Pande *et al.*, 1971; Ibrahim *et al.*, 1976 and Abd El-Sattar, 1986).

Positive and significant correlation coefficient was found between number of kernels per row and each of number of rows per ear and 100-kernel wight in the first set of crosses, however such association did not detected in the second set.

Table (I): Simple correlation coefficients between grain yield per plant and yield components in the two diallel sets.

	Character	No. of kernels/ row	No. of rows/ ear	I00-kernel weight
I st set	- Grain yield/ plant	0.557*	0.637*	0.782**
	- No. Of kernels/ row		0.653**	0.52I*
	- No. of rows ear	----	---	0.448
2 nd set	- Grain yield/ plant	0.633**	0.599**	0.292
	- No. of kernels row		0.I58	0.I99
	- No. of rows/ ear	- -	--	-0.034

* and ** Significant at 0.05 and 0.0I levels of probability, respectively.

Path analysis:

Partitioning of simple correlation coefficient between grain yield per plant and some other yield components in the two sets are presented in table (2). Weight of 100-kernels proved to have a high direct effect on grain yield compared with number of rows per ear. Whereas, number of kernels/row had no effect on grain yield per plant.

In the second set, both number of kernels/row and number of rows/ear had a large and positive direct effect on yield compared with 100-kernel weight. As mentioned before (Table 1) correlation coefficient values were significant and positive for both components, however, insignificant value for 100-kernel weight was detected.

The coefficients of determination were calculated for the direct and indirect effects of the three yield factors studied, transformed into percentages in order to evaluate these factors according to their importance as sources of variation in plant yield are presented in table (3). The results revealed that the most important sources of variation for plant yield at 1st set in descending order were: 1) the direct effect of 100-kernel weight, 3) the firect effect of number of rows/ear and 2) the indirect effect of number of kernels/row through 100-kernel weight. These three sources alone account for approximatly 71.63%.

In the second set, the main sources of variation for palnt yield in descending order were: 1) the direct effect of number of rows/ear, 2) the firect effect of number of kernels/row, and 3) the indirect effect of number of rows/ear through number of kernels/row. These three sources account for approximately 61.88% of grain yield per plant variation. Such apparent contradiction in results could be attributed to different genotypes and environmental effects in both diallel sets.

In this connection, Abd El-Sattar (1986), found that the most important sources of variation in plant yield was the direct effect of number of kernels/row and its indirect effect through number of row/ear and through 100-kernel weight. These three sources alone account for approximately 82.18% and 63.03% at the early and late planting dates, respectively.

Table (2): Partitioning of simple correlation coefficients between grain yield per plant and its components in the two diallel sets.

Source	Values I st set	Values 2 nd set
1- Grain yield vs No. of kernels row		
Direct effect (Py_1)	-0.002	0.508
Indirect via No. of rows, ear	0.235	0.083
Indirect via 100-kernel weight	0.324	0.041
Total correlation (ry_1)	0.557	0.633
2- Grain yield vs No of rows/ear		
Direct effect (Py_2)	0.360	0.525
Indirect via No. of kernels/row	-0.001	0.080
Indirect via 100 kernel weight	0.279	-0.007
Total correlation (ry_2)	0.637	0.599
3- Grain yield vs 100-kernel weight		
Direct effect (Py_3)	0.622	0.208
Indirect via No. of kernels row	-0.001	0.101
Indirect via No. of rows/ear	0.161	-0.018
Total correlation (ry_3)	0.782	0.292

Table (3): Components (direct and joint effects) in percentage of grain yield variation in the two diallel sets.

Sources of variation	1 st set C.D*	1 st set %**	2 nd set C.D.	2 nd set %
1- No.of rows ear	0.1293	12.93	0.2760	27.60
2- No.of kernels row	0.0000	00.00	0.2582	25.82
3- 100-kernel weight	0.3866	38.66	0.0434	4.34
4- No.of kernels row x No.of rows/ear.	-0.0009	- 0.09	0.0846	8.46
5- No.of kernels row x 100 kernel weight	0.2004	20.04	0.0422	4.22
6- No.of rows ear x 100-kernel weight	-0.0012	- 0.12	-0.0075	- 0.75
7- Residual Factors	0.2858	28.58	0.3032	30.32

* C.D. Coefficient of determination

** % Percentage contributed.

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دراسات عن الارتباط ومعامل المرور فى الذرة الشامية

على عبد المقصود الحصرى سيدهم أسعد سيدهم سعد عباس محمد

استخدم فى هذا البحث مجموعتين من الهجن التبادلية اشتملت المجموعة الأولى على ١٥ هجين فردى والمجموعة الثانية على ٤٥ هجين فردى ، وذلك لدراسة الارتباط بين محصول الذرة الشامية ومكوناته الأساسية وهى عدد الصفوف فى الكوز ، وعدد حبوب الصف ، ووزن المائة حبة ، بالاضافة الى تقدير التأثير المباشر والغير لهذه المكونات على المحصول من خلال تحليل معامل المرور • ولقد استخدمت هاتين المجموعتين من الهجن الفردية فى الدراسة خلال موسمى الزراعة ١٩٨٥ ، ١٩٨٦ بمحطة البحوث والتجارب الزراعية بكلية الزراعة بمشتهر •

ويمكن تلخيص أهم النتائج فيما يلى :—

* كان هناك ارتباط معنوى وموجب بين محصول النبات من الحبوب وكلا من عدد حبوب الصف بالكوز ، وعدد صفوف الكوز ، ووزن المائة حبة وذلك فى مجموعة الهجن الأولى • ولكن الارتباط كان موجبا وعالى المعنوية بين محصول النبات من الحبوب وكلا من عدد حبوب الصف ، وعدد صفوف الكوز فقط فى مجموعة الهجن الثانية•
* كان لوزن المائة حبة أعلى تأثير مباشر على محصول الحبوب فى مجموعة الهجن الأولى، بينما كان لكل من عدد حبوب الصف ، وعدد صفوف الكوز أعلى تأثير مباشر على محصول الحبوب فى مجموعة الهجن الثانية •
* كذلك أظهرت النتائج أن أكثر مصادر التباين لصفة محصول النبات والتى بلغت ٧١ر٦٣٪ فى مجموعة الهجن الأولى كانت : التأثير المباشر لوزن المائة حبة ثم التأثير المباشر لعدد صفوف الكوز ثم التأثير الغير مباشر لعدد حبوب الصف من خلال وزن المائة حبة • وفى مجموعة الهجن الثانية،كانت المصادر الأساسية للتباين لصفة محصول النبات والتى بلغت ٦١ر٨٨٪ هى :التأثير المباشر لعدد صفوف الكوز ، ثم التأثير المباشر لعدد حبوب الصف ثم التأثير الغير مباشر لعدد صفوف الكوز من خلال عدد حبوب الصف •