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A Correlation Study of Maize Yield with its Components

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ABSTRACT

An experiment was conducted on maize for two years at IARI, New Delhi to study the correlation of yield with its associated biometrical characters. The grain yield was found to be highly correlated with stover yield and 1000-grain weight in both the years. The selection indices developed through multiple regression showed that during 1977-78, stover yield, girth of cob and 1000-grain weight covered 98% variation, while during 1978-79, stover yield grain yield per cob and 1000-grain weight covered 95% of the total variation.

Yield is the fore-most consideration in the breeding of any crop. Since the formation of yield depends upon many characters associated with the yield, it is an essential feature of any breeding work to study the contribution of each character in the production of yield.

In the case of maize also, many such attempts were made earlier. Murthy and Roy (1957) obtained a high correlation between yield and length of cob, yield and 100-grain weight, girth of cob and 100-grain weight, but low association between yield and girth of cob, yield and plant height and plant height and 100-grain weight.

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MATERIALS AND METHODS

Field experiments were conducted during 1977-78 and 1978-79 on Ganga hybrid maize at the Indian Agricultural Research Institute, New Delhi to ascertain the responses of graded doses of nitrogen directly applied to maize on the plots of previously sown different leguminous crops, wheat and fallow. The split-plot design was used in which the main plot treatments comprised of lathyrus, gram, lentil, pea, wheat and fallow in which the crops were sown during the previous *rabi* season and 3 doses of nitrogen viz., 0, 60 and 120 kg N/ha applied to *kharif* maize as subplot treatments. There were 3 replications.

Since the objective of this particular study was confined to assess the correlation between the yield and its components alongwith some qualitative characters, only the mean values of each treatments were considered here. The different components that were under study are stover yield (X_1), N-uptake (X_2), P-uptake (X_3), length of cob (X_4), girth of cob (X_5), grain yield per cob (X_6), number of grains

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per cob (X_7), 1000-grain weight (X_8), protein content (X_9), moisture per cent at harvest (X_{10}) and plant height (X_{11}). The correlations worked out and selection indices were prepared through multiple regression equations.

RESULTS AND DISCUSSION

The correlation matrices of yield and the 11 independent characters for the year 1977-78 and 1978-79 are presented in Tables 1 and 2. In both the years, all the characters were found to possess highly significant correlation with the yield. Not only that, all these characters were themselves found to be highly correlated with each other. Even though multicollinearity has been observed, this has not much affected the predictive values of the regression coefficients. However, looking to those characters which are directly concerned with the formation of yield, it is observed that stover yield and 1000-grain weight showed a correlation exceeding 0.9 in both the years. Girth of cob during 1977-78 and grain yield per cob and moisture per cent at harvest during 1978-79 also showed more than 0.9 correlation with yield. The fact that 1000-grain weight possessed maximum amount of correlation with yield (0.98 and 0.96) in both the years and substantially contributed towards yield is supported by Prabhakaran Nair *et al.* (1974) who observed that this character exerted a substantial influence on the grain yield of maize. Shukla and Wassay (1970) found that an increase in the number of cobs, number of grains per cob and weight of grain per cob was reflected in the increased yield of hybrid maize. Mason and Zuber (1976) found that grain weight per ear and number of ears per 100 plants were highly correlated with yield.

When all the characters were regressed with the yield, it was observed that the total variation contributed by these characters (R^2 value) were 99.6% during 1977-78 and 98.8% during 1978-79. The regression coefficients and their standard errors are presented in Table 3.

However, it is obvious that the contribution of all the characters are not of the same magnitude and some of them do substantially contribute than others. In order to examine this aspect, selection indices were prepared through multiple regression equation (Table 4). During 1977-78, out of the 99.6% variation contributed by the 11 characters, three of them, namely, stover yield (X_1), girth of cob (X_5) and 1000-grain weight (X_8) covered 98.2% variation. In the year 1978-79, stover yield, grain yield per cob and 1000-grain weight contributed 94.74% out of a total of 98.8%. With the addition of X_{10}, (moisture per cent at harvest), the coverage had gone upto 96.41 per cent as shown in equation 3. There was a marginal increase of 0.14 per cent when X_7 (No. of grains per cob) was also included as the fifth variable in the equation.

It is therefore obvious that the stover yield and 1000-grain weight are the most important characters in the formation of the yield of maize. Rajput *et al.* (1970) observed that any increase in the 1000-grain weight reflected in the increase in yield of maize.

TABLE 1

Correlation among different characters (1977-78).

		Grain yield	*Stover yield*	*N uptakr*	*P uptake*	*Length of cob*	*Girth of cob*	*Yield per/cob*	*No. of grains per cob*	*1000-grain wt.*	*Protein per cent ic grain*	*Moisn % in groin at harvest*
		Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Stover yield	X_1	0.9752										
N-uptake	X_2	0.9159	0.8682									
P-uptake	X_3	0.7315	0.6260	0.8682								
Length of cob	X_4	0.9424	0.9342	0.9006	0.6650							
Girth of cob	X_5	0.9662	0.9485	0.8908	0.6694	0.9716						
Grain yield per cob	X_6	0.9010	0.8800	0.9584	0.7563	0.9485	0.9221					
No. of grains per cob	X_7	0.8563	0.8258	0.9443	0.7742	0.9299	0.8890	0.9783				
1000-grain wt.	X_8	0.9771	0.9458	0.8816	0.7089	0.9383	0.9487	0.8725	0.8287			
Protein % in grain	X_9	0.7190	0.6574	0.9034	0.8126	0.7000	0.6874	0.8486	0.8258	0.6461		
Moisture % in grain at harvest	X_{10}	0.5042	0.4611	0.7531	0.6914	0.5445	0.5233	0.7469	0.7802	0.4249	0.8735	
Plant ht. at maturity	X_{11}	0.7161	0.6439	0.8849	0.8055	0.6847	0.7115	0.8309	0.8187	0.6200	0.9460	0.8618

TABLE 2

Correlations among different characters (1977-78).

		Grain Yield Y	*Stover yield*	*N uptake*	*P uptake*	*Length of cob*	*Girth of cob*	*Grain yield per cob*	*No. of grains per cob*	*1000-grain wt.*	*Protein per cent in grain*	*Moisture % in grain at harvest*
			1	2	3	4	5	6	7	8	9	10
Stover yield	X_1	0.9367	—									
N-uptake	X_2	0.8763	0.7490	—								
P-uptake	X_3	0.7136	0.6912	0.7904	—							
Length of cob	X_4	0.8908	0.8116	0.7799	0.7342	—						
Girth of cob	X_5	0.8253	0.8040	0.6873	0.6693	0.7755	—					
Grain yield per cob	X_6	0.9245	0.9280	0.7823	0.7190	0.8735	0.8137	—				
No. of grains per cob	X_7	0.8991	0.8030	0.8874	0.6735	0.8737	0.7980	0.8226	—			
1000-grain weight	X_8	0.9631	0.9132	0.9035	0.7676	0.8421	0.8355	0.9270	0.8826	—		
Protein % in grain	X_9	0.8811	0.8152	0.8525	0.8549	0.9088	0.6761	0.8437	0.8029	0.8576	—	
Moisture % in grain at harvest	X_{10}	0.9096	0.8246	0.8469	0.7867	0.8393	0.6852	0.7961	0.8088	0.8702	0.8994	—
Plant ht. at maturity	X_{11}	0.8835	0.8301	0.8812	0.6672	0.7421	0.6519	0.8102	0.8286	0.8386	0.7521	0.831

TABLE 3

Regression coeffects and standard errors.

Characters		*77-78*			*78-79*		
		b	*SE*	*t*	*b*	*SE*	*t*
Stover yield	X_1	0.2761	0.0561	4.93**	0.06696	0.09855	0.68
N-uptake	X_2	0.1255	0.0692	1.81	0.00052	0.07672	0.0067
P-uptake	X_3	0.0531	0.0579	0.92	0.2720	0.1136	2.39
Length of cob	X_4	0.7033	0.7266	0.98	0.5147	0.9859	0.52
Girth of cob	X_5	0.5164	1.5949	0.32	1.0144	0.7997	1.27
Grain yield per cob	X_6	0.1427	0.0885	1.61	0.0303	0.1054	0.29
No. of grains per cob	X_7	0.5848	0.0332	1.76	0.00284	0.0209	0.14
1000-grain wt.	X_8	0.2482	0.0664	3.74**	0.2410	0.2165	1.11
Protein content	X_9	1.7539	1.0733	1.63	1.8574	2.2877	0.81
Moisture % at harvest	X_{10}	0.5051	0.3299	1.53	0.4377	0.3998	1.09
Plant ht. at maturity	X_{11}	0.1025	0.0479	2.14	0.0723	0.08659	0.83

TABLE 4

Selection indices.

	Year	*Multiple regression equation*	*Mult. correln. coefficient*	*Variation explained (%)*
1.	77-78	$-39.6518+0.1867\times1+1.7136\times5+0.1550\times8$	0.9910**	98.2
2.	78-79	$-55.234+0.1330\times1+0.0180\times6+0.3651\times8$	0.9733**	94.74
3.	78-79	$-44.5649+0.1000\times1+0.0515\times6+0.2367\times8+0.6728\times10$	0.9819**	96.41
4.	78-79	$-42.1075+0.0701\times1+0.0707\times6+0.2073\times8+0.6583\times10+0.0115\times7$	0.9826**	96.55

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