optimum dose of 41.5 kg $ZnSO_4$/ha, the maximum yield per unit area, may be adopted to exploit the maximum grain yield from the rice crop.

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CORRELATION AND PATH-COEFFICIENT ANALYSIS IN FORAGE MAIZE (*Zea mays L.*)*

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Correlation coefficients and path coefficient analysis were computed for yield components in parents and hybrids of forage maize. The results revealed that plant height, stem girth, leaf length, leaf breadth and leaf number were highly associated with fodder yield, both in parents and hybrids. Path coefficient analysis indicated differential influence in parents and hybrids. The stem girth followed by Plant height had made direct effect in parents, while leaf breadth followed by stem girth had highest direct effect in hybrids on fodder yield. The results indicated that stem girth and plant height in parents, leaf breadth and stem girth in hybrids should be given importance for breeding for forage production in maize.

There are limited reports on correlation and path analysis of important fodder traits in forage maize and the knowledge of which is so important for initiating any plant improvement programme. The present investigation was, therefore, undertaken to study the extent of association and the magni-

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Consequently a negative correlation results when one of the components is favoured over other in the amount of nutrient received. Perhaps, similar phenomenon might have been operative among leaf and stem development in the present study, causing negative correlation between them. Since both these traits are positively associated with fodder yield there is a need for judicious care in using them as selection index.

Path Analysis

To understand the relative cause and effect due to the seven characters on green fodder yield, path analysis was done separately for parents and hybrids (Table 3 & 4)

In the present study stem girth and leaf breadth had positive direct and indirect effect (one over the other) in both parents and hybrids. Plant height also had influence on yield mostly through stem girth and leaf breadth. The direct and indirect influence of leaf number and leaf length was relatively of low magnitude in parents and neglegible in their hybrid (Table 4). Hence, leaf breadth and stem girth are the important traits to be considered in hybrids. Similar results were also reported by Jhorar and Paroda (1976) in forage sorghum.

The residual effects observed in the path coefficient analysis for the parents and hybrids were found to be high indicating that the traits included in the present study appeared to be inadequate to satisfy their contribution to the yield.

The results so far discussed indicate that the characters namely, plant height stem girth and leaf breadth are important for improving fodder yield. Therefore while selecting the parents for breeding programmes for forage maize, stem girth and leaf breadth may be given relatively more emphasis.

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Table 1 : Correlation coefficients of yield components in forage maize-parents

Characters	Stem girth	Leaf number	Leaf length	Leaf breadth	Leaf/Stem ratio	Days to silking	Fodder yield
Plant height	0.631471**	0.129398	0.768816**	0.674309**	—0.013696	0.315363*	0 748450**
Stem girth		0.100121	0.426694**	0.635080**	0.022737	0.225050	0.712792**
Leaf number			0.030385	0.111290	—0.011228	0.131254	0.345145**
Leaf length				0.493520**	—0.003240	—0.061196	0.578436**
Leaf breadth					0.144920	0.056337	0.675784**
Leaf/stem ratio						0.205330	0.017703
Days to silking							0.248260

*Significant at 5% level **Significant at 1% level.

Table 2. Correlation coefficients of yield components in forage maize-hybrids

Characters	Stem girth	Leaf number	Leaf length	Leaf breadth	Leaf/stem ratio	Days to silking	Fodder yield
Plant height	0 468530**	0.522434**	0.293715**	0.321139**	0.038854	0.467815**	0.468727**
Stem girth		0.473309**	0.050990	0.552098**	0.048393	0.587993**	0.665271**
Leaf number			—0.134736**	0 329212**	—0.022792	0.641557**	0.390392**
Leaf length				0.113188	0.156193	—0.159061	0.149502
Leaf breadth					—0 026043	0.215316*	0.697331**
Leaf/stem ratio						—0.036826	0.097235
Days to silking							0.332552

*Significant at 5% level **Significant at 1% level.

Table 3: Path coefficient analysis showing direct effects and indirect effects of yield components on fodder yield in forage maize — parents.

Characters	Direct effect and indirect effect through							Total Correlation with fodder yield
	Plant height	Stem girth	Leaf number	Leaf length	Leaf breadth	Leaf/stem ratio	Days to silking	
Plant height	*0.256814*	0.211043	0.031852	0.095800	0.134660	0.000302	0.014195	0.748448
Stem girth	0 162170	*0.334209*	0.024645	0.055267	0.126826	—0.000502	0.010129	0.712746
Leaf number	0.033231	0 033461	*0.246160*	0.003935	0.022224	0.005008	0.001148	0.345168
Leaf length	0.197442	0.142604	0.007479	*0.129524*	0.098556	. 0 000071	0.002754	0.578434
Leaf breadth	0.173171	0.212249	0.027395	0.063922	*0.199702*	—0.003202	0.002535	0 675774
Leaf/stem ratio	—0.003617	0.007598	—0.002764	—0.000419	0.028940	*-0.022100*	0.009242	0.016978
Days to silking	0.080989	0.075213	0.032309	0.007926	0.011250	—0.004537	*0.045012*	0.248163

Residual Factor = 0.513756

Table 4. Path coefficient analysis showing direct effects and indirect effects of yield components on fodder yield in forage maize-hybrids.

Characters	Direct and indirect effects through							Total Correlation with fodder yield
	Plant height	Stem girth	Leaf number	Leaf length	Leaf breadth	Leaf/stem ratio	Days to silking	
Plant height	*0.163337*	0.142155	—0.001303	0.012495	0.144817	0.004899	0.002323	0.468727
Stem girth	0.076529	*0.303408*	—0.001460	0.002170	0·248967	0.000486	0.035169	0.665271
Leaf number	0.068999	0.143605	*—0.003085*	—0.005731	0.148457	0.000228	0.038373	0 390392
Leaf length	*0.047975*	0.015474	0 000416	*0.042540*	0.051042	0 001569	—0.009512	0.149502
Leaf breadth	0.052454	0.167511	—0.001015	0.004815	*0.450947*	—0.000261	0.012879	0.687331
Leaf/stem ratio	0.079679	0.014684	0.000070	0.006644	—0.011744	*0.010043*	—0 002142	0.097235
Days to silking	0.006346	0 178401	—0 001979	—0.006766	0 097096	—0.000359	*0.059813*	0.332552

Residual factor = 0.620981

tude of direct and indirect effects of various yield components of green fodder yield.

MATERIALS AND METHODS

The experimental materials for this study consisted of four maize varieties (males), eleven inbred lines (females) and their F_1s. These 44 hybrids were sown along with their parents in January 1979 in a randomized blocks design in three replications. Each parent/hybrid was raised in a single row with a spacing of 50 cm x 20 cm. The observations were recorded on five randomly selected plants at 50 per cent silking. Data were collected on eight attributes namely, Plant height, stem girth, leaf-number, leaf-length, leaf-breadth, leaf/stem ratio, days to silking and fodder yield.

Correlation coefficients (Panse and Sukhatme (1967) and path analysis (Dewey and Lu, 1959) were separately calculated for parents and hybrids for yield with seven other characters.

RESULTS AND DISCUSSION

Association studies :

Simple correlation coefficients were worked out for parents and hybrids separately and presented in Table-1 and 2. In the present investigation in general, all the seven characters showed positive association with fodder yield both in parents and hybrids. Plant height, stem girth, leaf breadth and leaf number showed high association with green fodder yield both in parents and hybrids (Table 1 and 2). Leaf/stem ratio and days to silking showed only low association with fodder yield in those population. The results obtained are in corroboration with the reports made by, Cortez *et al.* (1969) in forage maize, Jhorar and Paroda (1976) in forage sorghum. These traits, namely plant height, stem girth, leaf breadth and leaf length can serve as good selection indices for breeding fodder yield.

Information on the inter-relationship among the yield components was also estimated. These attributes namely plant height, stem girth, leaf length, leaf breadth and days to silking had high positive and significant inter association among themselves in both parents and hybrids. This indicated that possibility of effecting simultaneous improvement in these characters by selection. The reports of Jhorar and Paroda (1976) in forage sorghum agreed with these findings.

The character leaf/stem ratio showed negative association with Plant height, leaf number, leaf length and days to silking in both parents and hybrids. Rana *et al.* (1976) obtained negative and non-significant association of leaf number with leaf length and leaf width in fodder sorghum.

According to Adams (1967) such negative correlations could be expected from developmentally induced relationships between any two developing components which compete for a common nutrient and water supply