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Genetic Analysis of Correlation Coefficient and Path Analysis of Fodder Yield and its Components in Maize (*Zea mays*)

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ABSTRACT

The investigation was carried during *Kharif* season of 2018-19 at the Seed Breeding Farm, Department of Genetics & Plant Breeding and College of Agriculture, JNKVV, Jabalpur (MP), included 31 maize genotypes along with checks (African tall and J-1006) were planted in Randomized Completely Block Design (RCBD) and seventeen observations under study viz., days to 50 per cent tasseling, days to 50 per cent silking, plant height, number of leaves per plant, leaf area, stem girth, inter nodal length, leaf stem ratio, brix's value, crude protein yield per plant , crude protein yield per plant per day, dry matter yield per plant per day, green fodder yield per plant per day, dry matter yield per plant, green fodder yield per plant. Correlation and path coefficient analysis reveal that stem girth, green fodder yield per plant per day, dry matter yield per plant per day and crude protein yield per plant per day has significant correlation and higher direct effect. This indicated that these characters will enhance the effectiveness of selection for higher fodder yield in fodder Maize.

Introduction

Maize (*Zea mays* L.) is one of the most important cereal crops in world agricultural economy for both man and animals. It is an important component of livestock feed, especially in developed nations where 78 per cent of total maize production is used for livestock feed. Growing maize as forage crop is considered as ideal forage because it grows quickly, produces high yields, palatable, rich in nutrients and helps to increase body weight and milk quality in cattle (Sattar *et al.*, 1994). On average, it contains 9-10% CP, 60-64% NDF, 38-41% ADF, 23-25% hemicellulose and 28-30% cellulose on dry matter basis when harvested at milk to early-dough stage. Forage maize can safely be fed at all stages of growth without any danger of oxalic acid, prussic acid as in case of sorghum (Dahmardeh *et al.*, 2009).

Materials and Methods

The investigation was carried during Kharif season of 2018-19 at the Seed Breeding Farm, Department of Genetics & Plant Breeding and College of Agriculture, JNKVV, Jabalpur

(MP), included 31 maize genotypes along with checks (African tall and J-1006) were planted in Randomized Completely Block Design (RCBD) and seventeen observations under study viz., days to 50 per cent tasseling, days to 50 per cent silking, plant height, number of leaves per plant, leaf area, stem girth, inter nodal length, leaf stem ratio, brix's value, crude protein yield per plant, crude protein yield per plant per day, dry matter yield per plant per day, green fodder yield per plant per day, dry matter yield per plant, green fodder yield per plant. Correlation coefficient at phenotypic level was calculated from the variance and covariance according to Johnson *et al.,* (1955). Direct and indirect effect of various contributing traits towards green fodder yield and dry matter yield was calculated using the path coefficients analysis (Dewey and Lu, 1959).

Results and Discussion

Correlation analysis

Correlation studies are of considerable importance in breeding programmes. Galton (1988) was first to suggest the use of correlation index to describe the degree of association between two variables. The degrees of association also affect the effectiveness of selection process. In the present study the correlation has been studied that are presented in (Table 1) Days to 50 per cent tasseling was highly significant and showed positive correlation with days to 50 per cent silking. Plant height observed highly significant and positive correlation with inter nodal length, green fodder yield per plant per day, crude protein yield per plant per day, crude protein yield per plant, dry matter yield per plant and dry matter yield per plant per day. Plant height was highly significant negative correlation with brix's value. Number of leaves per plant had significant and positive correlation with inter nodal length. While, it showed highly significant and negative correlation with dry matter yield per plant followed by significant negative correlation dry matter yield per plant per day, crude protein yield per plant, crude protein yield per plant per day and leaf stem ratio. Leaf area showed positive correlation and significant association with inter nodal length. Inter nodal length showed highly significant and negative correlation with stem girth, significant negative association with brix's value, and significant positive correlation with crude protein yield per plant.

Stem girth observed significant and positive association with green fodder yield per plant. Leaf stem ratio had highly significant and positive correlation with dry matter yield per plant per day followed by significant positive correlation with crude protein yield per plant, green fodder yield per plant per day, crude protein yield per plant per day and dry matter yield per plant.

Green fodder yield per plant per day had highly significant and positive correlation with dry matter yield per plant, green fodder yield per plant, crude protein yield per plant, crude protein yield per plant per day and dry matter yield per plant per day. While, significant and negative association was observed with brix's value.

Dry matter yield per plant exhibited highly significant and positive correlation with crude protein yield per plant per day, crude protein yield per plant, green fodder yield per plant and dry matter yield per plant per day. It was also observed that dry matter yield per plant had significant negative correlation with brix's value. Dry matter yield per plant per day had highly significant and positive correlation with crude protein yield per plant per day, crude protein yield per plant, green fodder yield per plant and highly significant negative association with brix's value.

Table.1 Phenotypic Correlation coefficient analysis in fodder Maize (*Kharif* 2018)

Characters		Days to 50% silking	Plant height (cm)	No. of leaves /plant	Leaf area (cm^2)	Internodal length (cm)	Stem girth (mm)	Leaf stem ratio	GFY/plant /day (g)	DMY/ plant (g)	DMY /plant /day (g)	CPY/ plant (g)	CPY /plant /day (g)	Brix value (%)	GFY / plant (g
Days to 50% tasselling	**P**	**0.674****	**-0.071**	**0.033**	**0.181**	**0.055**	**-0.136**	**0.173**	**0.043**	**-0.047**	**-0.074**	**-0.011**	**-0.004**	**0.153**	**-0.002**
Days to 50% silking	**P**		**-0.046**	**0.065**	**0.125**	**0.07**	**-0.041**	**0.064**	**0.066**	**-0.053**	**-0.054**	**0.004**	**0.007**	**0.078**	**0.007**
Plant height (cm)	**P**			**0.117**	**0.04**	**0.630****	**-0.265***	**0.165**	**0.405****	**0.310****	**0.293****	**0.389****	**0.400****	**-0.458****	**0.086**
No. of leaves/ plant	**P**				**0.048**	**0.238***	**0.037**	**-0.219***	**-0.109**	**-0.276****	**-0.259***	**-0.233***	**-0.222***	**0.066**	**-0.153**
Leaf area (cm^2)	**P**					**0.206***	**-0.187**	**0.18**	**0.032**	**-0.063**	**0.189**	**0.017**	**0.011**	**0.069**	**-0.071**
Internodal length (cm)	**P**						**-0.327****	**0.117**	**0.177**	**-0.022**	**0.058**	**0.205***	**0.177**	**-0.207***	**-0.096**
Stem girth (mm)	**P**							**-0.203**	**-0.067**	**0.104**	**0.122**	**-0.173**	**-0.103**	**-0.006**	**0.254***
Leaf stem ratio	**P**								**0.243***	**0.229***	**0.286****	**0.249***	**0.230***	**-0.079**	**0.064**
Green fodder yield/ plant /day (g)	**P**									**0.672****	**0.371****	**0.578****	**0.566****	**-0.378****	**0.612****
Dry matter yield/plant(g)	**P**										**0.692****	**0.790****	**0.831****	**-0.240***	**0.693****
Dry matter yield/plant /day (g)	**P**											**0.576****	**0.603****	**-0.307****	**0.529****
Crude protein yield/ plant (g)	**P**												**0.939****	**-0.291****	**0.510****
Crude protein yield/ plant /day (g)	**P**													**-0.275****	**0.542****

Table.2 Genotypic path coefficient analysis in fodder Maize (*Kharif* 2018)

Characters	Days to 50% tasseling	Days to 50% silking	Plant height (cm)	No. Of leaves/ plant	Leaf area (cm^2)	Intermodal length (cm)	Stem girth(mm)	Leaf stem ratio	GFY/ plant/ day (g)	DMY/ plant (g)	DMY/ plant/ day (g)	CPY/ plant (g)	CPY/ plant/ day (g)	Brix value (%)	‘’r’’ value GFY/ plant (g)
Days to 50% tasseling	**0.421**	**-0.288**	**0.008**	**-0.005**	**0.039**	**0.000**	**-0.144**	**-0.063**	**-0.013**	**-0.025**	**-0.043**	**0.007**	**-0.020**	**0.001**	**-0.126**
Days to 50% silking	**0.399**	**-0.304**	**-0.001**	**-0.015**	**0.060**	**-0.001**	**-0.060**	**-0.016**	**-0.008**	**-0.025**	**-0.036**	**0.012**	**-0.006**	**0.000**	**-0.010**
Plant height (cm)	**-0.041**	**-0.003**	**-0.079**	**-0.009**	**0.002**	**-0.004**	**-0.104**	**-0.075**	**0.161**	**0.063**	**0.112**	**-0.181**	**0.285**	**-0.003**	**0.124**
No. Of leaves/ plant	**0.032**	**-0.069**	**-0.011**	**-0.065**	**0.019**	**-0.002**	**0.026**	**0.057**	**-0.039**	**-0.066**	**-0.105**	**-0.016**	**-0.182**	**0.001**	**-0.296**
Leaf area (cm^2)	**0.094**	**-0.105**	**-0.001**	**-0.007**	**0.174**	**-0.002**	**-0.149**	**-0.065**	**0.033**	**-0.016**	**0.058**	**-0.016**	**-0.004**	**0.001**	**-0.004**
Internodal length (cm)	**0.008**	**-0.026**	**-0.057**	**-0.018**	**0.047**	**-0.006**	**-0.159**	**-0.041**	**0.048**	**-0.013**	**0.002**	**-0.076**	**0.102**	**-0.002**	**-0.191**
Stem girth (mm)	**-0.147**	**0.051**	**0.020**	**-0.004**	**-0.063**	**0.002**	**0.413**	**0.063**	**-0.012**	**0.035**	**0.044**	**0.065**	**-0.063**	**-0.001**	**0.404**
Leaf stem ratio	**0.102**	**-0.019**	**-0.023**	**0.014**	**0.043**	**-0.001**	**-0.100**	**-0.262**	**0.078**	**0.056**	**0.122**	**-0.117**	**0.179**	**-0.001**	**0.073**
GFY/ plant /day (g)	**-0.018**	**0.008**	**-0.040**	**0.008**	**0.018**	**-0.001**	**-0.016**	**-0.064**	**0.317**	**0.143**	**0.142**	**-0.256**	**0.436**	**-0.003**	**0.674**
DMY/ plant (g)	**-0.061**	**0.044**	**-0.029**	**0.025**	**-0.016**	**0.000**	**0.084**	**-0.085**	**0.264**	**0.172**	**0.228**	**-0.309**	**0.522**	**-0.002**	**0.837**
DMY/ plant /day(g)	**-0.058**	**0.035**	**-0.028**	**0.022**	**0.033**	**0.000**	**0.058**	**-0.102**	**0.145**	**0.126**	**0.312**	**-0.221**	**0.386**	**-0.002**	**0.704**
CPY/ plant (g)	**-0.008**	**0.010**	**-0.039**	**0.019**	**0.007**	**-0.001**	**-0.073**	**-0.083**	**0.220**	**0.144**	**0.186**	**-0.369**	**0.557**	**-0.002**	**0.568**
CPY/plant /day (g)	**-0.015**	**0.003**	**-0.038**	**0.020**	**-0.001**	**-0.001**	**-0.044**	**-0.079**	**0.235**	**0.152**	**0.204**	**-0.349**	**0.589**	**-0.002**	**0.673**
Brix value (%)	**0.091**	**0.011**	**0.042**	**-0.010**	**0.018**	**0.002**	**-0.046**	**0.036**	**-0.156**	**-0.047**	**-0.119**	**0.108**	**-0.197**	**0.006**	**-0.261**
Leaf area (cm^2)	**0.094**	**-0.105**	**-0.001**	**-0.007**	**0.174**	**-0.002**	**-0.149**	**-0.065**	**0.033**	**-0.016**	**0.058**	**-0.016**	**-0.004**	**0.001**	**-0.004**

Highly significant and positive correlation was observed for crude protein yield per plant with crude protein yield per plant per day, green fodder yield per plant and highly significant negative association with brix's value. Crude protein yield per plant per day recorded highly significant and positive correlation with green fodder yield per plant. However, it had highly significant and showed negative correlation with brix's value. Brix's value was significant and showed negative correlation with green fodder yield per plant.

These findings are in agreements with the results of. Borad *et al.,* (2007) for stem girth and crude protein yield with green fodder as well as dry matter yields. Bhoite *et al.,* (2007) for dry matter yield and crude protein yield. Icoz and Kara (2009¬) for green fodder yield and dry matter yield. Prakash *et al.,* (2014) for crude protein yield, plant height, stem girth and number of leaf per plant. Vendruscolo *et al.,* (2016) for dry matter yield per plant and green fodder yield per plant per day.

Path coefficient

Path coefficient analysis allows separation of the direct effect and their indirect effects through other attributes by partitioning the correlation (Wright, 1921). Hence, this important objective was undertaken in the present investigation. Based on the data recorded on the genotype in the present investigation, the phenotypic and genotypic correlation were estimated to determine direct effect and indirect effect of yield and yield contributing characters. path coefficient analysis was carried out using green fodder yield per plant as a dependent variable.

In the present study, path coefficient analysis was carried in (Table 2) out using green fodder yield per plant as a dependent variable. Result revealed that high positive direct effect on green fodder yield per plant was exerted by crude protein yield per plant per day (0.589) followed by days to 50 per cent tasseling (0.421), stem girth (0.413), green fodder yield per plant per day (0.317) and dry matter yield per plant per day (0.312). Low positive direct effect exerted by leaf area (0.174) and dry matter yield per plant (0.172). High negative direct effect exerted by crude protein yield per plant (-0.369), days to 50 per cent silking (-0.304). Moderate negative effect exerted by leaf stem ratio (-0.262). While other traits exerting negligible effect were plant height (-0.079), number of leaves per plant (-0.065), inter nodal length (-0.006).

These findings are in agreements with the results of Kumar and Singh (2004) for days to 50 per cent silking, Bini and Bai (2005) for leaf area index. Shelake *et al.,* (2005) for days to 50 per cent tasseling, Patel *et al.,* (2005) for dry matter yield per plant, Bhoite *et al.,* (2007) for dry matter yield.

Jain and Patel (2012) for leaf area, number of leaves per plant, days to 50 per cent flowering and plant height, Jain and Patel (2013) for green fodder yield per plant and dry matter yield, Singh *et al.,* (2016) for leaf area had direct effect on fodder yield. While, its negative direct effects were observed by Borad *et al.,* (2007) for plant height, inter nodal length and leaf stem ratio. On the basis of correlation and path coefficient analysis it is revealed that stem girth, green fodder yield per plant per day, dry matter yield per plant per day and crude protein yield per plant per day and crude protein yield per plant per day had significant correlation and higher direct effect. This indicated that these characters will enhance the effectiveness of selection for higher fodder yield in Maize.

However, contradictory result was reported by Kumar and Singh (2004) for days to 50 per cent silking, Srivas and Singh (2004) for plant height, leaf area and number of leaves per plant, Borad *et al.,* (2007) for inter nodal length and leaf stem ratio. While, Shelake *et al.,* (2005) observed that crude protein yield had highest negative direct effect.

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