Journal of Agriculture, Environmental Resource and Management
ISSN2245-1800(paper) ISSN 2245-2943(online)
4(2)359-368; Dec.2019

www.saerem.com

Evaluation of Character Association and Path Analysis on Grain Yield in Maize (*Zea mays* L.) in Uyo, Southeastern Nigeria.

UDO, HANNAH I., NDAEYO, N. U., BASSEY, E. E., Harry. G. I. and Daniel, E. V.

Department of Crop Science, Faculty of Agriculture

University of Uyo, Akwa Ibom State, Nigeria

Corresponding Author: hanyjesu@gmail.com

Abstract

A study was undertaken in early and late cropping seasons of 2017 to evaluate the character association and path analysis in maize in Uyo, Southeastern Nigeria. The experiment was laid out in a randomized complete block design with four replications. Treatments were Oba Super 1, Oba Super 2, Oba Super 48, Oba Super 98, B.White, Uweb and Ukai. Characters studied were maize establishment (%), maize height (cm), number of leaves, leaf area (cm^2), length of cob (cm), circumference of cob (cm), number of rows per cob, number of kernels per row, fresh weight of 100 kernels (cm), dry weight of 100 kernels (cm) and grain yield (tha^{-1}). Results showed that Oba Super 2 had the highest plant establishment (90.03), circumference of cob (12.16), length of cob (17.29) and number of kernels per cob (28.53), B.White was superior for leaf area, fresh weight of 100 kernels and dry weight of 100 kernels, while Oba Super 1 was superior in height, number of leaves and number of kernels per row. Correlation coefficients among agronomic traits indicated that grain yield was positively and significantly associated with number of kernels per row (0.864), length of cob (0.604),number of rows per cob (0.512), fresh weight of 100 kernels (0.710), leaf area (0.732) and dry weight of 100 kernels (0.940). Leaf area (0.2786), plant height (0.1484), number of leaves (0.3412), length of cob (0.1586), number of rows per cob (0.3063), fresh weight of 100 kernels (0.0462) and number of kernels per row(0.3148) had high positive direct effects on grain yield.

Keywords: *Zea mays, morphological characters, grain yield, correlation and path analysis.*

Introduction

Maize (*Zea mays* L.) is one of the overriding grain crops, plays a significant role in human and livestock nutrition globally, thus contributes in alleviating the acute shortage of food. To date, maize is widely cultivated around the world, over a wide range of environmental conditions signifying its global and regional importance to millions of people relying on the crop in the pursuit of food security and livelihoods. Maize crop plays an important role in the world economy and is a valuable ingredient in manufactured

items that affect a large proportion of the world population (Alvi *et a*l., 2016).

The fast-growing maize crop is very promising in Nigeria for its multipurpose uses, with added values. The poultry, dairy, fisheries industries are increasing very rapidly in Nigeria demanding more quality feed, thus, increasing maize production is gaining prime necessity. The production of maize in the country is increasing but not encouraging enough compared to the world perspective, and the demand of the crop in the country is increasing at a higher rate. To meet the ever increasing demand of increasing population of Nigeria, maize breeders need to pay special attention to investigate the genetic diversity of maize that could develop genotypes with higher yield and better quality. The availability of adequate genetic diversity is crucial for gaining significant genetic progress in applied breeding programs. Yield of maize like rest crops is the final product attributed by a complex chain of interrelating effects of different characters (Begum et al., 2016). Therefore, the knowledge of association among characters with yield is precious to plant breeders as it helps in the selection of traits as well as genotypes with better accuracy.

The correlation coefficient indicates the degree of association between characters for the selection of desirable characters in a breeding program. For any crop improvement programs genetic variation and its analysis are important components in planning and executing breeding programs (Alvi *et a*l., 2016). High germplasm diversity for yield and yield attributing characters has an important role in developing prime varieties. As all crop breeding programs aim to amplify yield capacity which is the universal objective, here the concern is to characterize the quality attributes of 7 maize genotypes to assess the genetic diversity among them for isolating potential genotypes that can be utilized for future plant breeding programs as a prerequisite of achieving potential hybrids or improving maize genotypes. Accordingly, the present study was carried out with the objective of generating information on relationship among yield and yield contributing traits to find important traits for selection process.

Materials and Methods

This study was carried out at National Cereals Research Institute Out-Station, Owut Uta in Ibesikpo Asutan Local Government Area of Akwa Ibom State in 2018 early and late cropping seasons. Uyo falls within the tropical rain forest

zone of Nigeria which is located on the latitude $05^{0}03^{l}$N, longitude $07^{0}57^{l}$E and altitude 6m above sea level. The mean humidity is 70.8%, and mean annual temperature is 26.9^{0}C while mean annual rainfall is 2510 mm (NCRI Uyo outstation, 2018).

The experimental materials consisted of Oba Super 1 (OS1), Oba Super 2 (OS2), Oba Super 48 (OS48), Oba Super 98 (OS98), B. White, and two Local cultivars (Uweb (UW) and Ukai (UK)) which wereobtained from the National Seed Service, National Root Crops Research Institute, Umudike, Abia State while two local cultivars (Uweb and Ukai) were obtained from local farmers in Uyo Local Government Area. A land area of 21m x 14.3m was laid out in a randomized complete block design (RCBD) and replicated four times. The entire experimental farm consisted of twenty eight (28) plots, the size of each plot was 5.2m x 1.3m . The land was ploughed and harrowed to obtain good tilth and marked out using measuring tape and rope. Foot paths of 1m apart were created between replicates and plots. Two seeds were planted per hole at a spacing of 75 cm x 25 cm per genotype, 35 plants was planted per plot. Weeding was done two times, at three week intervals by hoeing to prevent competition with crops. Insect pests were controlled by spraying with Ataka supper EC, while NPK 15:15:15 fertilizer was applied at 400kg/ha.

Readings were taken from five randomly selected tagged plants at the centre of each plot and their means recorded for each of the characters studied. The following metric traits were studied: Plant Height (cm), Leaf Area (cm^2), number of Leaves per plant, Length of cob, Circumference of cob, Number of rows per cob, Number of kernels per cob, Fresh weight of 100 kernels, Dry Weight and Grain yield (tha^{-1}) and plant establishment (%). All the data collected were subjected to analysis of variance and significant means separated with Duncan Multiple Range Test at 5% probability level. Correlation and path analysis were also determined.

RESULT AND DISCUSSION

Phenotypic correlation coefficients estimated for all the characters including grain yield are presented in Table (1). Plant height showed positive phynotypic correlation with fresh weight of 100 kernels (0.578), length of cob (0.597), circumference of cob (0.553) and number of kernels per row (0.694). Leaf area was positively correlated with number of rows per cob (0.710), dry

weight of 100 kernels (0.719) and grain yield (tha^{-1}) (0.732) but, negatively correlated with number of leaves (-0.634). Similarly, circumference of cob correlated positively with plant height (0.453), fresh weight of 100 kernels (0.465), length of cob (0.654), number of rows per cob (0.675) and number of kernels per row (0.649), but correlated negatively with grain yield (-0.593). These results is in line with the findings of Ghosh *et al.,* (2014), AL-Ahmad (2014), Katta (2016), Bika and Deepika (2017), Madhav *et al.,* (2019) and. Gurpinder *et al.*, (2017)

Length of cob was positively correlated with plant height (0.597), fresh weight of 100 kernels (0.677), circumference of cob (0.654), grain yield (0.604) and number of kernels per row (0.649). Similarly, number of kernels per row was positively correlated with plant height (0.694), fresh weight of 100 kernels (0.649), number of rows per cob (0.791) and grain yield (0.864). Number of rows per cob showed significant positive correlation with number of kernels per row (0.791), circumference of cob (0.675), leaf area (0.710) and grain yield (0.512). similar results were observed by Ali *et al*., (2017), Jalil (2015) and Dar *et al* 2015). However, negative significant correlation was observed with plant establishment percentage (-0.591). Similarly, fresh weight of 100 kernels showed positive correlation with plant height (0.578), length of cob (0.677), circumference of cobs (0.565) and number of kernels per row (0.694). Dry weight of 100 kernels showed significant positive correlations with leaf area (0.719), circumference of cob (0.612) and grain yield (0.940).

Significant and positive correlation coefficients were also found between grain yield and number of kernel per row (0.864), leaf area (0.732), fresh weight of 100 kernels (0.710), dry weight of 100 kernels (0.940), and length of cob (0.604). Knife *et al.*, (2015) and Alvi *et al.*, (20116). However, negative correlation of grain yield with circumference of cob (-0.593) was observed in early cropping season of 2017. Leaf area (0.732), number of kernels per row (0.864), fresh weight of 100 kernels (0.710) and dry weight of 100 kernels (0.940) were highly correlated with grain yield. Similarly, circumference of cob (-0.593), length of cob (0.604), and number of rows (0.512) correlated significantly with grain yield. These are in harmony with the findings of Jakhar *et al.,* (2017a), Masuma *et al.,* (2017) and Begum *et al.,* (2016).

Phenotypic path-coefficient analysis for yield components of maize genotypes are presented in Table (2). The result revealed that the magnitude of direct effects on grain yield per plant was found to be highest for number of leaves (0.341), followed by number of kernel rows per cob (0.314), number of kernels per row (0.306), leaf area (0.278), length of cob (0.158), plant height (0.148), fresh weight of 100 kernels (0.046) and plant establishment (0.008). the high direct effects of number of leaves, number of kernel rows per cob number of kernels per row and leaf area suggest that these traits are good yielding indices. These results are in harmony with those obtained by Jakhar (2017b), Halidu (2015), Najeeb *et al.,* (2016), Aydin *et al.,* (2017) and AL-Ahmed (2014). However, circumference of cob (-0.117), dry weight of 100 kernels (-0.012) and plant establishment (-0.001) exhibited negative effects on grain yield. This is in line with the report by Bika and Deepika (2017) and Madhav *et al.,* (2019).

Indirect positive effects were found between leaf area and plant establishment (0.241), number of leaves per plant (0.230), plant height (0.020), fresh weight of 100 kernels (0.055), dry weight of 100 kernels (0.009) and circumference of cob (0.020). Similarly, leaf area exhibited indirect negative effects on circumference of cob (-0.024), kernel rows per cob (-0.116) and number of kernels per row (-0.044). These findings were in consonant with reports of Pavant *et al.,* (2011) and Ghost *et al.,* (2014)

Number of leaves exhibited positive indirect effects on leaf area (0.282), plant establishment (0.261), plant height (0.076) and fresh weight of 100 kernels (0.105) but showed negative indirect effects on kernel rows per cob (-0.116) and kernels per row (-0.046). Plant height exhibited indirect positive effect on fresh weight of 100 kernels(0.134), dry weight of 100 kernels (0.083), number of kernels per row (0.068) and circumference of cob (0.098) and indirect negative effect on kernel rows per cob (-0.013). However, no indirect positive effects were found between it and other characters. Kernel rows per cob showed indirect positive effects on circumference of cobs (0.133), dry weight of 100 kernels (0.098) and number of kernels per row (0.078) and also exhibited indirect negative effects on plant establishment (-0.162), leaf area (-0.131), and fresh weight of 100 kernels (-0.094). Same was reported by Knife *et al.,* (2015), Rahman *et al.,* (2016) and Alvi *et al.,* (2016).

Similarly, length of cob exhibited indirect positive effects on plant height (0.105), number of kernels per row (0.125), circumference of cob (0.103) and fresh weight of 100 kernels (0.098) and indirect negative effects on plant establishment (-0.006) and leaf area (-0.013). These observations are in conformity with the findings of Jakhar *et al.,* (2017a), Masuma *et al.,* (2017) and Begum *et al.,* (2016).

Number of kernels per cob produced indirect effects on length of cob (0.242), circumference of cob (0.202), plant height (0.142) and fresh weight of 100 kernels (0.131).There were also indirect negative effects of number of kernels per cob on plant establishment (-0.054), leaf area (-0.049) and number of leaves (-0.041). Fresh weight of 100 kernels showed indirect positive effects on number of leaves (0.014), plant height (0.042), dry weight of 100 kernels (0.022), length of cob (0.028) and negative indirect effect on kernels per row (-0.007). Knife *et al.,* (2015) and Alvi *et al.,* (20116). Dry weight of 100 kernels showed indirect positive effect on plant establishment (0.001) and indirect negative effects on plant height (-0.007), fresh weight of 100 kernels (-0.006), length of cob (-0.076), circumference of cob (-0.077) and number of rows per cob (-0.005).

Table 1: Correlation Analysis of Maize Characters and Grain Yield in Early Cropping Season of 2017

*Correlation is significant at the 0.05 level (2-tailed).** . Correlation is significant at the 0.01 level (2-tailed). PE–Plant Establishment (%), PH-plant height, LA–Leaf Area, NOL-Number of Leaf, COC-Circumference of Cob, LOC-Length of Cob, NRC-Number of Row per Cob, NKR-Number of Kernels per row, FW100K-Fresh weight of 100 kernels,

CHARACTERS	PE	PH	LA	NOR	COC	LOC	NRC	NKR	FW100K	DW100K	GY
PE	1										0.381
PH	0.184	1									0.061
LA	0.111	0.002	1								0.732**
NOL	0.459	0.065	-0.634*	1							0.328
COC	-0.053	0.553*	0.331	-0.289	1						-0.593*
LOC	-0.265	0.597*	-0.282	0.150	0.654*	1					0.604*
NRC	-0.591*	0.391	0.710**	-0.253	0.675*	-0.179	1				0.512*
NKR	0.140	0.694*	0.162	0.059	0.649*	0.186	0.791**	1			0.864**
FW100K	0.514*	0.578*	0.005	0.107	0.565*	0.677*	0.220	0.694*	1		0.710**
DW100K	0.241	0.012	0.719**	0.416	0.612*	-0.384	0.319	-0.135	0.478	1	0.940**

DW100K-Dry Weight of 100 Kernels and GY-Grains Yield (t/ha).

Table 2: Direct and indirect effect (phenotypic) of component characters on grain yield (t/ha^{-1}) in maize in Early Cropping Season of 2017

Maize Characters	Maize Establishment (%)	Plant height (cm)	Leaf Area(cm^2)	Number of Leaves per plant	Circumference of Cob	Length of Cob	Kernels per Row	Number rows per Cob	Fresh Weight of 100 kernels	Dry Weight of 100 kernels
Maize Establishment (%)	**0.0087**	0.0001	0.007	0.0067	0.0001	-0.0003	-0.0045	-0.0015	0.0016	-0.0011
Maize height (cm)	0.0016	**0.1484**	0.0107	0.0332	0.0674	0.0984	-0.0133	0.0689	0.1347	0.0832
Leaf Area (cm^2)	0.2416	0.0201	**0.2786**	0.2303	0.0207	-0.0244	-0.1161	-0.0448	0.0558	0.0094
Number of Leaves	0.2617	0.0763	0.2820	**0.3412**	0.0343	0.0282	-0.1021	-0.0465	0.1050	0.0588
Circumference of cob (cm)	-0.0029	-0.0865	-0.0142	-0.0192	**-0.1905**	-0.1246	-0.0805	-0.1260	-0.0709	-0.1179
Length of cob (cm)	-0.0061	0.1052	-0.0139	0.0131	0.1037	**0.1586**	0.0165	0.1253	0.0981	0.0971
kernels per row	-0.1622	-0.0282	-0.1312	-0.0942	0.1330	0.0327	**0.3148**	0.0784	-0.0502	0.0853
Number of rows per cob	-0.0543	0.1421	-0.0493	-0.0418	0.2026	0.2421	0.0763	**0.3063**	0.1313	0.1326
Fresh 100 kernels weight	0.0086	0.0420	0.0093	0.0142	0.0172	0.0286	-0.0074	0.0198	**0.0462**	0.0229

Dry 100 kernels weight	0.0015	-0.0070	-0.0004	-0.0022	-0.0077	-0.0076	-0.0034	-0.0054	-0.0062	**-0.0125**
Grain yield (t/ha)	0.2982	0.4124	0.3792	0.4814	0.3809	0.4316	0.0803	0.3745	0.4455	0.3578

Conclusion

The purpose of the paper was to identify characters which are positively and significantly correlated with grain yield in maize with high yielding and were recommendation to the farmers. Correlation studies showed that grain yield had significant phenotypic correlation with length of cob, leaf area, number of kernels per row, fresh weight of 100 kernels and dry weight of 100 kernels. Strong association of these traits revealed that selection based on these yield related traits would ultimately improve grain yield. Path coefficient analysis revealed high positive direct effects of some characters with grain yield which was found to be highest for number of leaves, followed by number of kernels per row, number of rows per cob, leaf area, length of cob and plant height.

REFERENCES

AL- Ahmad, A. S. (2014). Genetic Parameters for Yield and its Components in some New Yellow Maize Crosses. *Journal of Applied Science Research*, 2(3): 159-167

Ali, A., Hidayat, R., Sar, S., Kashif, A. S. and Aliji, R. (2017). Genetic variability, character association and path analysis in maize (*Zea mays* L.). *BangladeshJournal of Agricultural Research*. 41(1):173-182.

Alvi, M. B., Rafique, M., Shafique, M., Hussain, A., Mohommad, T., and Sarwar, M. (2016). Characters Associations and Path Analysis of Grain Yield and Yield Components in Maize. *Pakistan Journal of Biological Science*, 6 (2): 136-138.

Aydin, N., Gökmen, S. O., Yildirim, A. A., Figliuolo, G. and Budak, H. E. (2017). Estimating Genetic Variation Among Dent Corn Inbred Lines and Top Crosses using Multivariate Analysis. *Journal of Applied Biological Sciences*, 1(2): 63–70.

Begum, S., Ahmed A., Omy, S. H., Rohman, M. M. and Amiruzzaman, M. (2016). Genetic variability, character association and path analysis in maize (*Zea mays* L.). Bangladesh *Journal of Agricultural Research*. 41(1):173-182.

Bikal, G. and Deepika, T. (2017). Analysis of Yield and Yield Attributing Traits of Maize Genotypes in Chitwan, Nepal. *World Journal of Agricultural Research*, 3(5): 153-162.

Dar, Z. A., Lone, A. A., Alaie, B. A., Ali, G., Gazal, A., Gulzar, S. and Yousuf, N. (2015). Correlation studies in temperate maize (Zea mays L.) Inbred lines. Plant Archives. Journal of agronomy. 15(2): 1191-1194.

Ghosh, A., Subba, V., Roy, A., Ghosh, A. and Kundagrami, S. (2014). Genetic

variability and character association of grain yield components in some inbred lines of maize (*Zea mays* L.). *Journal of Agroecology and Natural Resource Management*, 1(2): 34-39.

Gurpinder, S., Ravindra, K. and Jasmine, N. (2017). Genetic Parameters and Character Association Study for Yield Traits in Maize (*Zea mays* L.), *Journal of Pharmacognosy and Phytochemistry*, 6(5): 808-813

Halidu, J., Abubakar, L., Izge, U. A., Ado, S. G., Yakubu, H. and Marker, S. (2015). Correlation Analysis for Maize Grain Yield, Agronomic Parameters and Striga Affected Traits under Striga Infested/free Environment. *Journal of Plant Breeding and Crop Science*, 7(1): 9-17.

Jalili, B. E. (2015). Genetic Markers and their Utility in plant Breeding. *Journal of Agriculture, Biotechnology and Ecology*, Monograph series 4(1): 5.

Jakhar, D. S., Singh, R., Ojha, V. K. and Kumar, S. (2017a). Correlation studies in maize (Zea mays L.) for yield and other yield attributing International characters. Journal of Advanced Biological Research, 7(2): 246-248.

Jakhar, D. S., Singh, R., and Kumar, A. (2017b.) studies on path coefficient analysis in maize (Zea mays L.) for grain yield and its attributes. International .Journal of Current Microbiology Apply Science, 6(4): 2851.

Katta, Y. S. (2016). A correlation and path coefficient analysis of grain yield of maize (*Zea mays* L.). *Journal of Agricultural Research*, 2(2): 98-114.

Masuma, R., Ahasanul, H. A., Hossain, M. and Abdullah, A. (2017). Variability and Traits Association Analyses in Maize (Zea mays L.) Genotypes. Bangladesh Journal of Agricultural Research. 41(1): 173.

Najeeb, S., Rather, A. G., Parray, G. A., Sheikh, F. A. and Razvi, S. M. (2016). Studies on genetic variability, genotypic correlation and path coefficient analysis in maize under high altitude temperate ecology of Kashmir. Maize Genetics Cooperation News letter, 83:1-8.

Pavan, R., Lohithaswa, W. and Shekara L. (2011). Correlation and Path Coefficient Analysis of Grain Yield and Yield Contributing Traits in Single Cross Hybrids of Maize (*Zea mays* L.). *Electronic Journal of Plant Breeding*, 2:253-257.

Rahman S, Mia, M. M, Quddus, T., Hassan, L. and Haque, M. A. (2015).Assessing Genetic Diversity of Maize (*Zea mays* L.) genotypes for agronomic traits. *Research Agriculture*, 2(1):53-61.