PLANT BREEDERS ASSOCIATION OF NIGERIA
HYBRID ANNUAL CONFERENCE, MAKURDI 2023
(ISSN: 3027-088X)

EVALUATION OF GRAIN YIELD AND YIELD RELATED ATTRIBUTES OF SELECTED MAIZE (*Zea mays*) GENOTYPES

Lawal, I.T. and **Ajiwe, S. T**
Department of Crop and Animal Science, Faculty of Agriculture,
Ajayi Crowther University, Oyo, Oyo State, Nigeria.

Olasunkanmi, T. C.
National Agricultural Seeds Council, Lokoja – Abuja Road, Sheda, Abuja, FCT.

Sobowale, O. O. and **Oladokun, E. O.**
Department of Plant Breeding and Seed Technology,
Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

***Correspondence**:* it.lawal@acu.edu.ng

Abstract
Six maize (Zea mays) genotypes were planted at the Teaching and Research Farm, Federal University of Agriculture, Abeokuta in 2018 to determine their grain yield performance and yield related traits. The field experiment was laid out in randomized complete block design with three replications. Data collected on ear height, leaf length, leaf width, leaf area, days to anthesis, days to 50% tasseling, days to 50% silking, plant height at flowering, cob weight, weight of 100 kernel and grain yield were subjected to Analysis of variance; heritability (broad sense); correlation and path coefficient analyses. The result revealed that the six maize genotypes differed significantly with respect to all characters tested. The small difference between the phenotypic coefficient of variation and genotypic coefficient of variation observed for most characters indicated that the variability was primarily due to genetic differences. Meanwhile, heritability was highest for plant height at flowering (H_B = 96.66%) and was lowest for leaf width (H_B = 66.24%). Grain yield had positive and significant correlation with plant height at flowering (r=0.55), leaf area (r=0.64), cob weight (r=1.02) and 100 kernel weight (r=0.72), while the highest direct effect was observed for leaf area (15.41). Thiz study therefore concluded that variability exist among the six maize genotypes used and leaf area with positive and direct effect on yield could be used as a criterion for selection in future maize breeding programme.

Introduction
Maize (*Zea mays* L.) belongs to the family Graminaceae (IITA, 2009). It is one of the most important cereal grains grown worldwide in a wider range of environments because of its greater adaptability. Maize is the third most important food crop in the world surpassed only by two other grains, wheat and rice (Oladokun *et al.,* 2018). Maize is majorly grown for food, forage and processed industrial products. More so, it has now become the most important raw material for animal feed. Maize crop started as a subsistence crop in Nigeria and has gradually risen to a commercial crop on which many agro-based industries depend on as raw materials (Iken, and Amusa, 2014). Maize is referred to as corn which literarily means “that which sustains life”.

Genetic variability in maize genotypes plays a vital role in grain yield variation (Tahir *et al.,* 2008). Significant variation found in the germplasm of maize for ear height, ear length, plant height, 100-grain weight and ear girth (Hussain *et al.,* 2005). Maize production could be increase through development of improved genotypes capable of producing enhanced yield under different agro climatic conditions.

Maize contributes 2.2% to the value added in agriculture and 0.5% to gross domestic production. It also accounts for more than 40 % of total staple food caloric intake (Muhunyu, 2009). Despite this importance and the efforts farmers invest in production, there is still a considerable gap between the yield potential of the improved varieties and national average yield. Development of high yielding varieties is the most fundamental goal of any maize breeder to increase yield. This study therefore focuses on exploring diversity in maize germplasm to provide information suitable for maize improvement programme.

Materials and methods

Seeds of six (6) maize genotypes used for this study were sourced from International Institute of Tropical Agriculture (IITA), Ibadan, Oyo State. These include; W10xD W1xA W1xC W2xC W7xA and W9xD. The experiment was carried out during the raining season of 2018 at the teaching and research farm of the Federal University of Agriculture, Abeokuta (Lat. 7°15′N and Long. 3°25′E) altitude 144m above sea level in Ogun State. The field was laid out in a randomized complete block design (RCBD) with 3 replications. Planting was done at the rate of 2 seeds per hole with spacing of 75cm x25cm and weeding was done manually as at when necessary. Maize were harvested at physiological maturity and data were collected on: ear height, leaf length, leaf width, leaf area, days to anthesis, days to 50% tasseling, days to 50% silking, plant height at flowering, cob weight, weight of 100 kernel and grain yield. The data collected were subjected to analysis of variance (ANOVA) to test for significance among the genotypes. Genotypic coefficient of variability (GCV), phenotypic coefficient of variability (PCV) and heritability (broad sense) were calculated. Correlation and path coefficient analyses were also carried out.

Results and discussion

Information on genetic diversity and relationships in crop plants are important for efficient selection of parental lines for new crosses and preservation of germplasm by plant breeders (Ojo, 2000). The six maize genotypes evaluated were significantly different ($P<0.01$) for all grain yield parameters examined (Table 1). This suggests that there is sufficient variation in the materials studied.

Phenotypic and genotypic variances, phenotypic and genotypic coefficients of variability, broad sense heritability estimate and genetic advance for the characters evaluated in six maize genotypes are presented in Table 2. The result revealed that distinct variation was observed between phenotypic variance and genotypic variance for ear height (20.51), leaf length (11.14), leaf area (2832.35), plant height at flowering (58.62), cob weight (434.91) and grain yield (782.74). Also, a phenotypic coefficient of variance is higher than genotypic coefficients of variance for all characters evaluated. Broad sense heritability was higher for all yield characters evaluated, with values ranging from 81.98% (for days to 50% silking) to 96.66 % (for plant height at flowering). Also, the genetic advance had its highest value plant height at flowering (62.97), followed by grain yield (53.43), while the lowest genetic advance was observed in days to anthesis (6.68). Generally, higher heritability estimate in the range of 81% to 97%. Characters with higher heritability value should be considered when selecting for improvement programme. Combination of high broad sense heritability and genetic advance are important indicators of predominant role of additive gene effect in traits (Manju and Sreelathakumary, 2002).

Table 3 presents the correlation coefficient of twelve grain yield characters evaluated in six maize genotypes. The result shows that ear height had positive and highly significant correlation with leaf length ($r=0.61$), leaf width ($r=0.73$), leaf area ($r=0.71$), plant height at flowering ($r=0.89$) and 100 kernel weight ($r=0.63$) but negatively correlated with days to anthesis (r=-0.76) and days to 50% tasseling (r=-0.61). Also, leaf length had positive and highly significant correlation with leaf width (r=0.86), leaf area (r=0.96), plant height at flowering (r=0.76), (cob weight (r=0.68), 100 kernel weight (r=1.00) but negatively correlated with days to anthesis (r=-0.65) and days to 50% tasseling (r=-0.76). Grain yield had positive and significant correlation with plant height at flowering (r=0.55), leaf area (r=0.64), cob weight (r=1.02) and 100 kernel weight (r=0.72). Characters with positive and significant relationship means that increase in one will lead to increase in the other and vice versa. Positive and significant association has been reported among maize grain yield characters (Oladokun et al, 2018).

In breeding programs, yield improvement is desired but cannot be singly altered. Inter-character association helps to determine the direction of improvement of yield components that will ultimately improve yield. Table 4 shows the direct and indirect effect of eleven grain yield characters on grain yield in maize. Ear height, days to 50% tasseling and days to 50% silking showed negative direct effect on grain yield. The highest direct effect was observed for leaf area (15.41). Substantial indirect effect on grain yield per plant was obtained for leaf width through leaf area (15.05).

Conclusion

The current study has shown that variability exists among the maize genotypes. High genotypic coefficient of variation and high heritability is helpful in making selection of superior genotypes. Characters with highest broad-sense heritability estimate can be used as selection criterion for maize improvement programme. Path coefficient analysis revealed leaf area with highest direct effect on grain yield.

Table 1 present the mean square value of six maize genotypes evaluated grain yield parameters

Characters	Replicate	Genotypes	Error
Ear height	67.03	352.72**	61.52
Leaf lenght	0.70	383.39**	33.43
Leaf width	0.52	2.09**	0.70
Leaf area	1779.48	60200.05**	8497.04
Days to anthesis	0.75	11.79**	2.03
Daysto50%tas	3.05	22.19**	3.69
Daysto50%sk	4.91	21.67**	3.91
Ptheightflow	14.22	5259.27**	175.85
Cob weight	1929.09	9521.00**	1304.74
Weight 100ker	10.72	55.61**	7.03
Grain yield	1868.12	14934.98**	2348.21
DF	**2**	**5**	**12**

*,** significant at 5 and 1% probability level, respectively.
DF= degree of freedom

Table 2: Phenotypic and genotypic coefficient of variability, broad sense heritability and genetic advance for 6 maize genotypes.

Character	Mean	PV	GV	EV	PCV	GCV	H^2	GA
Ear height	52.70	117.57	97.07	20.51	0.21	0.19	82.56	34.99
Leaf lenght	73.32	127.80	116.65	11.14	0.15	0.15	91.28	28.99
Leaf width	7.53	0.70	0.46	0.23	0.11	0.09	66.24	15.11
Leaf area	560.63	20066.68	17234.34	2832.35	0.25	0.23	85.89	44.70
Days to anth	50.64	3.93	3.25	0.68	0.04	0.04	82.80	6.68
Days to 50%tas	48.05	7.40	6.17	1.23	0.06	0.05	83.38	9.72
Days to 50% sk	55.67	7.22	5.92	1.30	0.05	0.04	81.98	8.15
PH @ flower	132.40	1753.09	1694.48	58.62	0.32	0.31	96.66	62.97
Cob weight	245.74	3173.67	2738.75	434.91	0.23	0.21	86.30	40.75
Weight100ker	30.64	18.54	16.19	2.34	0.14	0.13	87.36	25.29
Grain yield	229.26	4978.33	4195.59	782.74	0.31	0.28	84.28	53.43

Table 3: Correlation coefficient of grain yield characters evaluated in maize genotypes

Character	Leaf length	Leaf width	Leaf area	Days to anth	Days to 50% tas	Days to 50% sk	PH @FL	Cob weight	Weight 100 ker	Grain yield
Ear height	0.61**	0.73**	0.71**	-0.76**	-0.61**	-0.34	0.89**	0.17	0.63**	-0.03
Leaf lenght		0.86**	0.96**	-0.65**	-0.76**	-0.90**	0.76**	0.68**	1.00**	0.39
Leafwidth			0.98**	-0.64**	-0.42	-0.56*	0.92**	0.78**	1.22**	0.50
Leafarea				-0.67**	-0.62**	-0.75**	0.86**	0.72**	1.09**	0.64**
Daystoanth					1.04**	0.86**	-0.90**	-0.33	-0.61**	-0.25
Daysto50%tas						0.87**	-0.68**	-0.32	-0.52	-0.17
Daysto50%sk							-0.59**	-0.73**	-0.80**	-0.55*
Ptheightflow								0.63**	0.79**	0.55*
Cobweight									0.91**	1.02**
Weight100ker										0.72**

*,** significant at 5 and 1% probability level, respectively.

Table 4: Direct and indirect effect of eleven grain yield characters on grain yield in maize.

		Indirect effect										
	Direct effect	Ear height	Leaf length	Leaf width	Leaf area	Days to anth	Days to 50% tas	Days to 50% sk	PH @FL	Cob weight	Weight 100 ker	**Grain yield**
Ear height	**-1.23**		-4.90	-3.64	10.99	-0.03	-1.10	0.49	0.06	-0.05	-0.39	-0.03
Leaf length	**-7.98**	-0.76		-4.29	14.79	-0.03	-1.37	1.29	0.05	-0.20	-0.62	0.39
Leaf width	**-4.98**	-0.90	-6.87		15.05	-0.03	-0.75	0.80	0.06	-0.23	-0.75	0.50
Leaf area	**15.41**	-0.88	-7.66	-4.86		-0.03	-1.12	1.08	0.06	-0.22	-0.68	0.44
Daystoanth	**0.04**	0.94	5.22	3.19	-10.30		1.88	-1.23	-0.06	0.10	0.38	-0.25
Daysto50%tas	**1.81**	0.75	6.05	2.08	-9.54	0.04		-1.25	-0.05	0.10	0.32	-0.17
Daysto50%sk	**-1.44**	0.42	7.16	2.77	-11.58	0.04	1.57		-0.04	0.22	0.50	-0.55
PH@flower	**0.07**	-1.09	-6.10	-4.59	13.19	-0.04	-1.22	0.85		-0.19	-0.49	0.55
Cob weight	**-0.30**	-0.20	-5.43	-3.90	11.15	-0.01	-0.57	1.04	0.04		-0.56	1.02
Weight100ker	**-0.62**	-0.77	-8.00	-6.07	16.86	-0.02	-0.95	1.15	0.05	-0.27		0.72
Residual effect	**0.01**											

References

Hussain N, Hayat K, Zubair M, Aziz A, Zaman Q. 2005. Adoptability of maize varieties to D.I. Khan ecology. Indus J. Plant Sci., 4(2): 191-195.

Iken, J.E. and Amusa, N.A. (2004). Maize Research and Production in Nigeria. *Afr. J. Biotechnol., 3*(6): 302–307

International Institute of Tropical Agriculture (2009). Annual Report on Maize Production. *IITA Ibadan, Oyo State*, Nigeria.

Manju, R.R. and Sreelathakumary, I. (2002). Genetic variability, heritability and genetic advances in hot chili (*Capsicum chinensis* JACQ.). *Journal of Tropical Agriculture,* 40: 40-46.

Muhunyu, J.G., 2009. Structural analysis of small-scale maize production in the Nakuru District: challenges faced in achieving stable and high maize productivity in Kenya. Journal Developments in Sustainable Agriculture 3, 74–91.

Ojo, D.K. 2000. Genotype X environment analysis and selection for yield stability and adaptability in tropical soybean genotypes. *Nigeria Journal of Ecology2:49-55*

Oladokun, E.O., Ojo, D.K., Amira, O.J., Lawal, I.T., Akanbi, O.T. and Sobowale, O.O. (2018). Genetic Variability, Correlation and Heritability of Seed Yield and Yield related traits in selected Maize (Zea mays L.) genotypes. *Proceeding of Association of Seed Scientists of Nigeria* (ASSN). 4: 100-106.

Tahir M, Tanveer A, Ali A, Abbas M, Wasaya A. 2008. Comparative yield performance of different maize (*Zea mays* L.) hybrids under local conditions of Faisalabad-Pakistan. Pak. J. Life Soc. Sci., 6(2), 118-120.