CORRELATION AND PATH COEFFICIENT ANALYSIS OF GROWTH AND YIELD ATTRIBUTES IN QUALITY PROTEIN MAIZE (*ZEA MAYS* L.)

HASSAN A. H[*], NAMAKKA, A.[1], AND HARUNA, I. M[2].

College of Agriculture and Animal Science, DAC, Ahmadu Bello University, Mando, Kaduna.

[1]Samaru College of Agriculture, DAC, Ahmadu Bello University, Zaria. Nigeria.

[2]Department of Agronomy, Nasarawa State University, Keffi, Nigeria.

***Corresponding author's e-mail: alhassanhamidu@yahoo.com/ namakkasg2000@yahoo.com**

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ABSTRACT

The study of correlation among selected maize traits as well as further partitioning of total correlates into direct and indirect effects on grain of Quality Protein Maize (SAMMAZ 14) was conducted during 2011, 2012 and 2013 dry seasons at Institute for Agricultural Research, Ahmadu Bello University irrigation research station, Kadawa in Kano Nigeria to investigate the degree of associations between growth attributes and yield components as well as the scope of their contributions to yield. The experimental design used for the study was split plot design. Significant positive correlation between plant height, total dry matter, leaf area index, cob length, grain weight and cob diameter was recorded. The highest direct effect and percentage contribution to grain yield was from 100 grain weight followed by cob length, total dry matter, plant height, cob diameter and leaf area index as the least. Therefore selection for 100 grain weight and cob length characters will according to this study will enhance grain yield of quality protein maize var. SAMMAZ 14.

Key words: Quality, Protein, Maize, growth and yield attributes, grain yield, correlation, path coefficient analysis.

INTRODUCTION

Maize (*Zea mays* L.) is important staple food of many countries especially in the tropics and sub-tropics. It is the third most important cereal food crop of the world after rice and wheat (Poehlman, 2006). On global front, maize has gained tremendous importance due to rising demand from diversified sectors like human food, animal feed and ethanol production and as good source of starch, protein, fat, oil and sucrose in addition to some of the important vitamins and minerals (Shukla and Mishra, 2013). Maize displays an orderly sequence of development of yield components namely number of cobs per plant, cob length, cob diameter and kernel weight (Viola *et al*., 2003). Character association reveals the type, nature and magnitude of relationship between growth and yield components with yield and also among themselves. For increase grain yield in maize, study of direct and indirect effects of growth attributes and yield components to grain yield provides basis for its successful breeding programme and hence, the problem of yield increase can be more effectively tackle on the basis of performance of these attributes and selection for characters (Choudhary *et al*., 2002).

Therefore, the object of this study was to investigate the relationships among growth attributes and yield components as well as the direct and indirect effects on grain yield in Quality protein maize.

MATERIALS AND METHODS

A three year study was conducted during 2011, 2012 and 2013 dry seasons at Kadawa irrigation research station of Institute for Agricultural Research, Ahmadu Bello University, Kano, Nigeria (11^{o} 39'N, 08^{o} 2'E and 500 meters above sea level) to investigate the interrelationship of growth and yield components of Quality Protein Maize (SAMMAZ 14) with a view of identifying the trait that contribute most to grain yield. The treatments were laid out in split plot design with a factorial combinations of nitrogen (0, 60, 120 and 180 kgha^{-1}) and irrigation interval (7, 14 and 21 days) as the main plot while sowing date was assigned to sub-plot. The treatments were replicated four times. The gross plot consisted of 6 rows (at the interval of 75 cm between rows) by 5 meters while the net plots consisted of the 2 middle rows. Two seeds were sown per hole at the depth of 3 cm and intra-row spacing of 25 cm. The seedlings were later thinned to one per stand at two weeks after sowing. Fertilizer applications were carried out according to treatments while weeding was done to control weed. The data collected on growth parameters were plant height, total dry matter and leaf area index while cob length, 100 grain weight and cob diameter constituted the yield components. Grain yield was also determined after which they were subjected to analysis of variance by Statistical Analysis System (SAS, 1999). The phenotypic correlation coefficient was worked out according to the method proposed by Singh and Chaudhary (1977). The direct and indirect contributions of individual growth and yield attributes to grain were determined using path coefficient analysis according to Dewey and Lu (1959).

RESULTS AND DISCUSSION

Most of the characters measured correlated with each other, but the extent of the correlation values varies with different character pairs. A positive correlation between desired characters is recommendable for selection while negative correlation hinders the recovery of the recombinants in both characters. The phenotypic correlation coefficient between growth, yield components and yield is shown in Table 1. The results showed highly significant ($P<0.01$) and positive correlation between plant height, leaf area index, cob length,100 grain weight, cob diameter and grain yield. Highly significant ($P<0.01$) and positive correlations among growth and yield attributes were also observed. This finding is in line with that of Shukla and Mishra (2013) who reported significant positive correlation between cob diameter, 100 grain weight, ear length, ear height to the ground, leaf area index and grain yield. Mekonnen *et al*, (2012) also reported significant phenotypic correlation between kernel weight, plant height and grain yield. The direct and indirect effects of the selected growth and yield

attributes to grain yield is presented in Table 2.The highest direct effect to grain yield was observed from 100 grain weight (0.4980) followed by cob length (0.2887), total dry matter (0.2121), plant height (0.2058), cob diameter (0. 1703) while leaf area index (0.0689) made the least contribution to grain yield. The highest indirect effect was through 100 grain weight via cob diameter while the least indirect effect was from plant height via cob length. The high positive direct effects of biological yield per plant and harvest index were reported by Sandeep Kumar *et al*, (2011) while the high positive direct effects of cob length was reported by Bello *et al*, (2010).

Table 1: Correlation coefficient between grain yield, growth and yield attributes

Parameter	Gry	Pl.ht	TDM	LAI	CL	100GW	CD
Gry	1.0000						
Pl.ht	0.4720**	1.0000					
TDM	0.4180**	0.5560**	1.0000				
LAI	0.3260**	0.6650**	0.1740**	1.0000			
CL	0.4650**	0.2410**	0.1780**	0.2190**	1.0000		
100GW	0.1650**	0.0250	0.0420	0.0120	0.2380**	1.0000	
CD	0.3680**	0.1890**	0.1540*	0.1770**	0.3740**	0.1710	1.0000

Gry=Grain yield, Pl.ht=Plant height, TDM=Total dry matter, LAI=Leaf area index, CL=Cob length, 100GW=100 grain weight, CD=Cob diameter.
**=Significant at 1% level of probability. *=Significant at 5% level of probability
r at 1% = 0.2014: r at 5% = 0.2573

Table 2: Direct and indirect contributions of some growth and yield components on grain yield of Quality Protein Maize (SAMMAZ 14)

	Pl.ht	TDM	LAI	CL	100 GW	CD	Collection	
Pl.ht	**0.2058**	0.1181	0.4586	0.0013	0.0322	0.0322	0.4729	
TDM	0.1145	**0.2121**	0.0120	0.0514	0.0021	0.0263	0.4186	
LAI	0.1369	0.0369	**0.0689**	0.0559	0.0027	0.0247	0.3261	
CL	0.0497	0.0378	0.0133	**0.2887**	0.0118	0.0638	0.4552	
100GW	0.0053	0.0091	0.0037	0.0689	**0.4980**	0.9292	0.1660	
CD	0.0389	0.0328	0.0099	0.1082	0.0086	**0.1703**	0.3887	

Bold figures represent direct effects of the characters

Table 3: combined contributions (%) of growth and yield attributes to grain yield and residual effect.

Growth and yield attributes	Percent contribution
Individual contribution (Pi)2	
Plant height	4.23
Total dry matter	4.50
Leaf area index	0.48
Cob length	8.33
100 grain weight	24.8
Cob diameter	2.89
Combine contribution	
Plant height + Leaf area index	1.88
Plant height + Cob length	2.87
Plant height + 100 grain weight	0.05
Plant height + Cob diameter	1.32
TDM + Leaf area index	0.51
TDM + Cob length	2.18
TDM + 100 grain weight	0.09
TDM + Cob diameter	1.12
Leaf area index + Cob length	0.77
Leaf area index + 100 grain weight	0.04
Leaf area index + Cob diameter	0.36
Cob length + 100 grain weight	0.69
100 grain weight + Cob diameter	0.29
Residual	52.6
Total	100

The individual contributions on percent basis is presented in Table 3 as plant height 4.23%, total dry matter 4.5%, leaf area index 0.48%, cob length 8.33%, 100 grain weight 24.8% and cob diameter 2.89%. The combination of 100 grain weight and cob length gave the highest contribution of 12.83% to grain yield while the least combine contribution of 0.04% came from leaf area index and 100 grain weight. The unaccounted variability was 58.58%. The sequence of the total correlation into direct and indirect contributions probably indicated that most of growth and yield attributes made their highest contributions to grain yield through 100 grain weight, cob length, total dry matter, plant height and cob diameter. Mekonnen *et al*, (2012) reported similar findings.

CONCLUSION

In the light of this study, it can be concluded that selection of characters having high yield potential such as 100 grain weight and cob length may be considered. These characters are easily measurable, hence they can be used to enhance grain yield.

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