PATH COEFFICIENT ANALYSIS ON GROWTH PARAMETERS OF CHEWING SUGARCANE AS AFFECTED BY FERTILITY RATES AND WEED CONTROL TREATMENTS AT BADEGGI, NIGERIA

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Abstract

Field trials were conducted at the upland sugarcane experimental field of National Cereals Research Institute Badeggi, Niger state, Nigeria from 2004–2007 wet and dry seasons to determine the direct, indirect and individual percentage contribution of sugarcane growth parameters to stalk yield (t/ha). The results obtained show the interrelationship between stalk yield with growth parameters in 2004–2005, 2005–2006 and 2006–2007. The growth parameters (stalk length, stalk girth, number of chewable stalks and crop vigour score) had positive and direct contribution to the stalk yield. Through out the study, number of chewable stalks gave the highest of the direct and percentage contribution of 0.5495 and 30.20 to stalk yield in 2004–2005, (0.5510 and 30.36) 2005–2006 and (0.5602 and 31.36) in 2006–2007. This was followed by stalk girth (0.3797 and 14.14) in 2004–2005, (0.3831 and 14.68) in 2005–2006 and (0.3939 and 15.52) in 2006–2007. While the lowest individual percentage contribution was obtained from crop vigour score 0.89 in 2004–2005, 0.91 in 2005–2006 and 0.93 in 2006–2007. The stalk girth and chewable stalks made the highest combined contribution to the stalk yield of 22.17, 22.37 and 22.49 in 2004–2005, 2005–2006 and 2006–2007 respectively.

Key words: sugarcane, growth parameters, contribution, stalk yield

INTRODUCTION

In many crops especially arable ones, yields are mostly dependent on some components or parameters; but direct components of yield vary with crops (Reedy and Ahmed, 1988). Contributions by some parameters towards variations in yields are higher and more important than those of other components most probably because associations between yield and its parameters are more direct in some crops than in others.

For some crops however, there are two aspects of yield, seed and oil are economic important in oil seeds while in sugarcane yield and sugar content are important. In such crops yield parameters will depend on which yield aspect is considered.

Although there is ample evidence in literature of numerous investigators on sugarcane production much attention has been directed to relationship between cane yields and other yield or yield contributory parameters. Path coefficient analysis provides and/or presents a picture of the interrelationship between agronomic (quantitative and qualitative) characters.

This paper therefore, provides information on direct and indirect contributions of sugarcane growth parameters along with their relationships between yield and yield parameters and percentage contribution of various parameters to stalk yield of chewing sugarcane in Southern Guinea Savanna of Nigeria.

MATERIALS AND METHODS

Field trials were conducted on the upland sugarcane experimental field of the National Cereals Research Institute Badeggi (Lat. 9°45′ N, Long.06°07′ E, 70.5 metres above sea level) in the Southern Guinea Savanna ecological zone of Nigeria in 2004–2007 wet and dry seasons. The soil of the experimental site has been classified as ultisol and sandy loam in texture with bulk density per 1.49 m (Ayotade and Fagade, 1993). It has an average annual rainfall of 1 124mm and mean temperature 23–33°C respectively. The treatments tested consist of seven fertility rates and four weed control measures. The treatment therefore include: F0 = control (no cow dung, no inorganic fertilizer), F1 = 120 N – 60 P2O5 – 90 K2O kg/ha alone (NCRI recommended rate for sole sugarcane, F2 = 10 tonnes/ha of air dried cow dung (National Cereals Research Institute Badeggi – NCRI recommended rate), F3 = 10 tonnes/ha of air dried cow dung + 120 N – 60 P2O5 – 90 K2O kg/ha), F4 = 10 tonnes/ha of air dried cow dung + 60 N – 30 P2O5 – 45 K2O kg/ha), F5 = 5 tonnes/ha of air dried cow dung + 120 N – 60 P2O5 – 90 K2O kg/ha and F6 = 5 tonnes/ha of air dried cow dung + 60 N – 30 P2O5 – 45 K2O kg/ha constituted the main plot, while the weed control treatments W0 = Weedy check, W1 = hoe weeding at 1, 2, 3, 4, 5, 6 and 9 MAP, W2 = atrazine 2.0 kg a.i./ha (pre emergence) + dimethametryne 3.0 kg a.i./ha (Post emergence) + Supplementary hoe – weeding at 3, 6 and 9MAP and W3 = Diuron 2.0 kg a.i./ha (P.E) + dimethametryne 3.0 kg a.i./ha (Post emergence)+ supplementary hoe-weeding at 3, 6 and 9 MAP were the sub plot. Each treatment was accommodated in a plot area of 15 m2 (5 × 3 m) and each plot contained 6 rows of chewing sugarcane. Bida Local or Ajax was the chewing sugarcane variety that was used for the

experiment. Air dried cow dung was incorporated into the soil manually using short handle hoe a month before establishing the trial. While the inorganic fertilizer was applied split at planting (½ N – ½ P2O5 – ½ K2O base application) and at 6 MAP during earthing up half ½ N – ½ P2O5 – ½ K2O was applied. Pre-emergence herbicides were applied a day after planting, while the post – emergence was applied at 5 weeks after planting (WAP). Herbicides were applied using knapsack (CP3) sprayer in a spray volume of 250 L/ha. The supplementary hoe – weeding was carried out at 3, 6 and 9 MAP using short handle hoe. Harvesting was done at 10 MAP using cutlass. The sugarcane stalks from the net plot were tied into bundles and weighed on 50 kg scale.

The data collected for the path coefficient analysis included stalk length at 9 months after planting (MAP) using metre rule from the ground level to the last node at the top, stalk girth at 10 MAP using veneer calliper for measuring the sugarcane diameter from the five sugarcane stalks tagged in the net plots, number of chewable stalks per net plot 9 MAP and crop vigour score at 9 MAP using score scale of 0–10, 0 = sick, diseased plants, 10 = healthy, very greenish plant.

The data collected were subjected to statistical analysis of variance as described by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Figures 1–3 and Tables 1–3 shows the interrelationship between stalk yield (t/ha) with growth parameter in 2004–2005, 2005–2006 and 2006–2007. The growth characters (stalk length, stalk girth, number of chewable stalks and crop vigour score) studied had positive and direct contribution to the stalk yield. Throughout the period of experimentation, number of chewable stalks gave the highest direct contribution to the stalk yield (0.5495) in 2004–2005, (0.5510) in 2005–2006 and (0.5602) in 2006–2007. This was followed by stalk girth (0.3797) in 2004–2005, (0.3831) in 2005–2006 and (0.3939) in 2006–2007.

The percentage contribution of growth parameters in 2004–2005, 2005–2006 and 2006–2007 are shown in Table 4. The number of chewable stalks made the highest individual percentage contribution in 2004–2005, 2005–2006 and 2006–2007(30.20), (30.36) and(31.38) respectively. This was followed by stalk girth (14.14, 14.68 and 15.52). While the lowest individual contribution was obtained from the crop vigour score (0.89, 0.91 and 0.93) in 2004–2005, 2005–2006 and 2006–2007.

The stalk girth and chewable stalks made the highest combined contribution to the stalk yield of 22.17, 22.37 and 22.49 in 2004–2005, 2005–2006 and 2006–2007. This was followed by the combined chewable stalks and crop vigour score with 9.43, 9.65 and 9.92 respectively for each of the years.

The path analysis and percentage contribution shows that the growth components made their highest individual contribution to stalk yield through chewable stalks and stalk girth in all the three years study. This observation indicated that these growth parameters are strong contributors to stalk yield. This confirms the earlier report by Milligan et al. (1990), who in his result indicated stalk number and stalk girth as the most important determinant of cane yield. Xie et al. (1991) found stalk number and stalk girth to be the most useful traits when selecting for sugarcane and sugar yields in his path – coefficient analysis studies. Growth and final stalk yield of sugarcane could also be greatly influenced by environmental factors such as sun light duration, temperature and relative humidity (Busari, 2004; Lavabre, 1991).

CONCLUSION

Path coefficient study is very important as it measures the amount of contribution either directly or indirectly and also the percentage contribution of each parameter to the stalk. And therefore, quite useful when selecting for sugarcane and sugar yields. From the results of this study, it can be concluded that number of chewable stalks and stalk girth gave the highest contribution to stalk yield. Therefore, these parameters are very important to be considered when selecting for sugarcane or sugar yields especially in determining possibility of obtaining optimal yield from chewing sugarcane particularly for this ecology.

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Figure 1: A path diagram showing relationship between stalk yield (ton/ha) and some growth parameters in 2004–2005
Key: 1 = Stalk length, 2 = Stalk girth, 3 = Chewable stalks, 4 = Crop vigour score

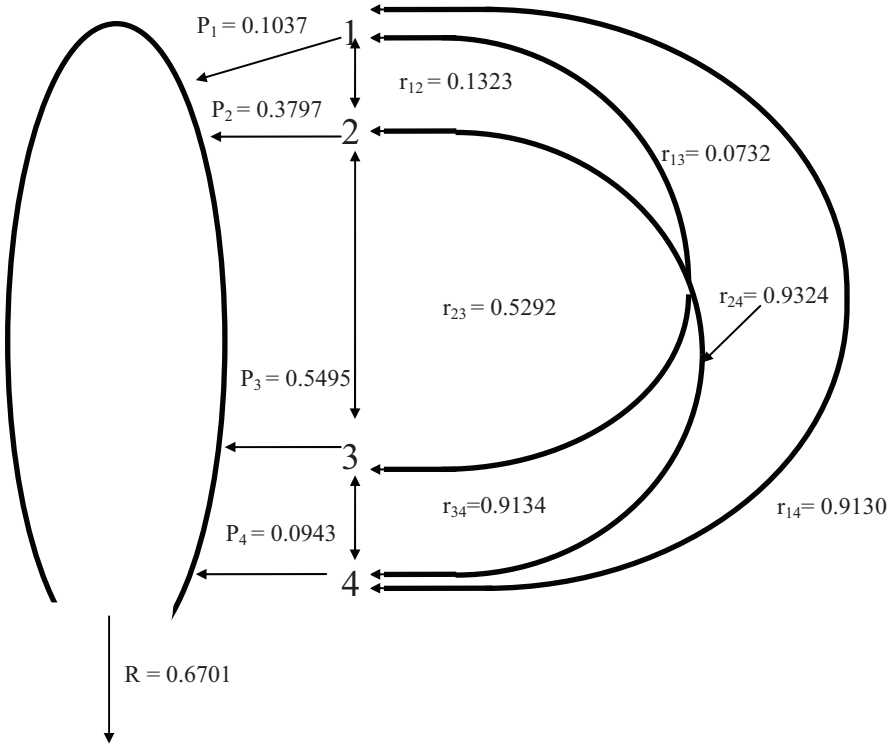


Figure 2: A path diagram showing relationship between stalk yield (ton/ha) and some growth parameters in 2005–2006.
Key: 1 = Stalk length, 2 = Stalk girth, 3 = Chewable stalks, 4 = Crop vigour score

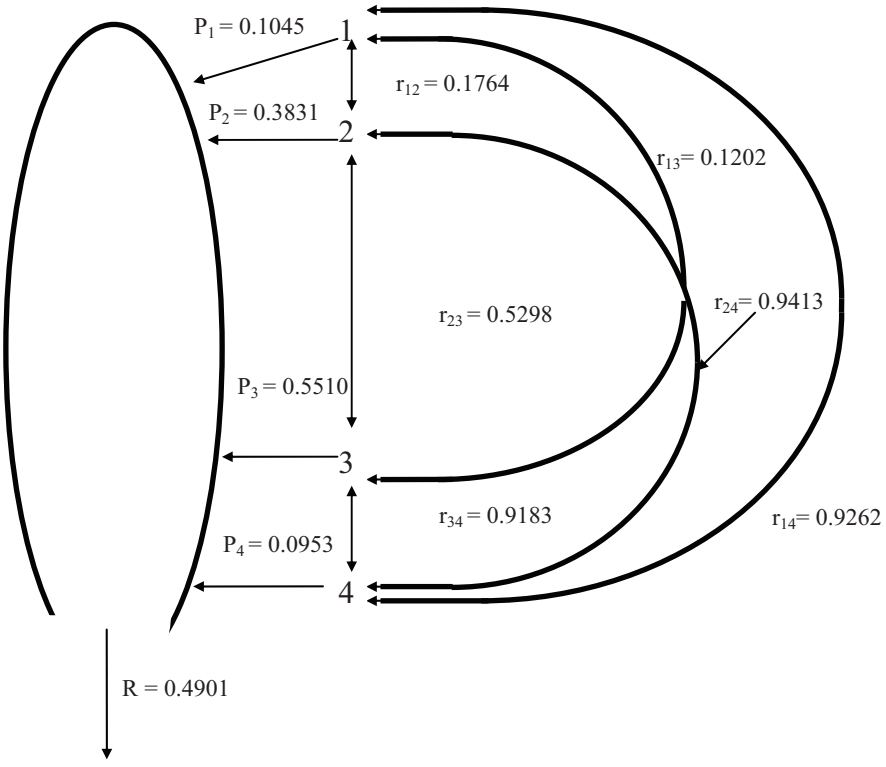
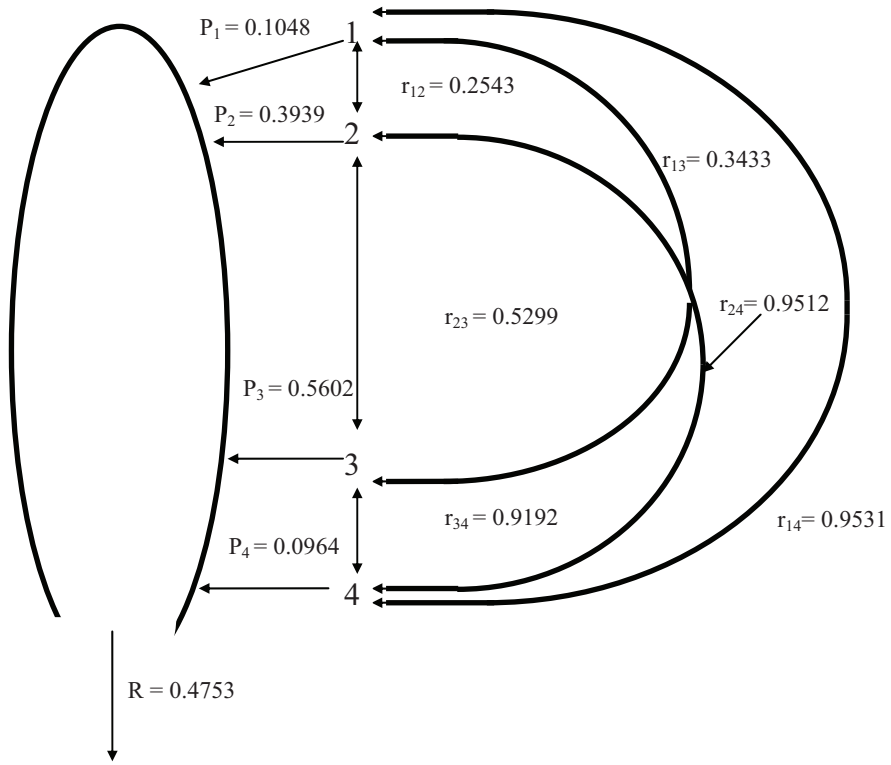


Figure 3: A path diagram showing relationship between stalk yield (ton/ha) and some growth parameters in 2004–2005.
Key: 1 = Stalk length, 2 = Stalk girth, 3 = Chewable stalks, 4 = Crop vigour score



Tab. 1: The direct and indirect contributions of different growth parameters to stalk yield (ton/ha) in 2004–2005

Growth character	Stalk length	Stalk girth	Chewable stalks	Crop vigour score	Total correlation
Stalk length	0.1037	0.0137	0.0211	0.0946	0.1469
Stalk girth	0.0502	0.3797	0.2009	0.3540	0.9648
Chewable stalks	0.0402	0.1307	0.5495	0.2617	0.9921
Crop vigour score	0.0861	0.0879	0.0943	0.0943	0.3626

Direct effect underlined

Tab. 2: The direct and indirect contributions of different growth parameters to stalk yield (ton/ha) in 2005–2006

Growth character	Stalk length	Stalk girth	Chewable stalks	Crop vigour score	Total correlation
Stalk length	0.1045	0.0184	0.0126	0.0967	0.2322
Stalk girth	0.0676	0.3831	0.2030	0.3106	0.9643
Chewable stalks	0.0662	0.0919	0.5510	0.2906	0.9977
Crop vigour score	0.0883	0.0897	0.0875	0.0953	0.3608

Direct effect underlined

Tab. 3: The direct and indirect contributions of different growth parameters to stalk yield (ton/ha) in 2006–2007

Growth character	Stalk length	Stalk girth	Chewable stalks	Crop vigour score	Total correlation
Stalk length	0.1048	0.0267	0.0360	0.0100	0.1775
Stalk girth	0.1002	0.3939	0.2087	0.2747	0.9775
Chewable stalks	0.1923	0.1314	0.5602	0.1149	0.9988
Crop vigour score	0.0919	0.0917	0.0886	0.0964	0.3686

Direct effect underlined

Tab. 4: Percent individual and combined contribution of some growth parameters to stalk yield ton / ha (cane yield)

Parameters	2004–2005	2005–2006	2006–2007	Combined 2004–2007
Individual contribution				
Stalk length	1.08	1.09	1.10	1.09
Stalk girth	14.14	14.68	15.52	14.86
Chewable stalks	30.20	30.36	31.38	30.30
Crop vigour score	0.89	0.91	0.93	0.91
Total	46.31	47.04	48.93	47.16
Combined contribution				
Stalk length and stalk girth	1.04	1.41	1.49	1.51
Stalk length and chewable stalk	0.83	1.32	1.39	1.06
Stalk length and crop vigour score	1.79	1.85	1.9	1.7
Stalk girth and chewable stalks	22.17	22.37	22.47	21.20
Stalk girth and crop vigour score	6.68	6.87	7.22	6.92
Chewable stalk and crop vigour score	9.43	9.65	9.92	9.36
Total	41.94	43.47	44.41	41.75
Residual	11.75	9.49	6.66	11.09
Grand Total	100.00	100.00	100.00	100.00

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