EFFECT OF FERTILIZERS ON THE FODDER YIELD AND NUTRITIVE VALUE OF MAIZE

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ABSTRACT
This study evaluated the effect of fertilizers on the fodder yield and nutritive value of maize. Urea (T2), Nat-soil (T3) and Wonder (T4) fertilizers were applied with No fertilizer (T1 – control) laid out in a completely randomized design experiment. The agronomic parameters estimated include number of leaves, plant height, plant width, leaf length, leaf width, number of cob, and cob weight. The result of this experiment indicated that T4 was significantly higher ($p<0.05$) in plant height, plant width, leaf number, leaf length, leaf width, stem girt and yield parameters compared to other fertilizer treatments. However, the agronomic and yield parameters of all the fertilizer treatments were significantly better ($p<0.05$) than the control treatment. The chemical analysis of maize hay, T1 had the highest DM value (29.95%) while T4 had the least DM value (27.50%). T4 had the highest CP value (12.19%) while T2 and T3 had relatively the same CP value (10.6% and 10.64% respectively) as the least CP value was recorded in T1. The CF value was higher in T1 and T4 (32.32% and 32.40% respectively) as the least CF value (30.34%) was recorded in T3. T2 had the highest ADF value (43.21%) while T4 had the least ADF value (35.85%). T3 had the highest NDF value while T1 had the least value. It could be concluded that maize treated with fertilizers had better growth, yield as well as nutritive value. However, maize treated with wonder fertilizer showed outstanding response.
Keywords: Effect, fertilizer, fodder, yield, nutritive, maize.

INTRODUCTION
The quality of fodder determines to a large extent the productivity of ruminant animals. The non-availability of high yielding quality fodder round the year aggravates the problem of sustainable animal farming (Naik *et al.,* 2013). In Nigeria, fodder scarcity is considered a major limiting factor to the livestock industry. This has made imperative efforts to increase production of fodder through application of fertilizers. Nitrogen is an essential element for fodder production (Nwamo *et al*., 2017). Maize as green forage, particularly when it contains the leaves and ears, stalks, it is an energy-rich source of feed for ruminant livestock, while maize forage is usually ensiled in cooler regions, year round maize production in the tropics may allow the continuous harvesting of green forage, making ensiling unnecessary (Brewbaker, 2003). Maize is a short duration fodder with potential for high yields on small plots; however its productivity is limited by the low nitrogen content of African soils (Naik *et al.,* 2012). This can be corrected through application of nitrogen fertilizer which most frequently is the soil nutrient that determines yield of fodder maize. The soil nutrient not only affects the forage production, but also improves the quality of forage from the view point of its protein content (Ayub *et al.,* 2002). Maize fodder is a valuable feed for ruminants in terms of yield and nutritive value and its use for animal feeding is becoming very important on small scale mixed farms in the tropics (Methu, 2006), which has been achieved with the use of nitrogen fertilizer to improve plant yield. Therefore this study was thus aimed at assessing the fodder yield and nutritive value of maize cultivated with different fertilizer treatments.

MATERIALS AND METHODS
Experimental Site:
The experiment was carried out at the veterinary research farm at The Oke-Ogun Polytechnic Saki located at the longitude 8.6275ºN and latitude 3.4058ºE.

Experimental Design

The experiment was laid out in a completely randomized design with four replicate plots per treatment. The fertilizer treatments include T1 (Control), T2 (Urea fertilizer), T3 (Nat soil fertilizer), T4 (Wonder fertilizer) which were purchased from commercial stores.

Cultural practices

The experimental field was cleared, ploughed twice and harrowed and then laid out according to the experimental design. Maize was planted at the rate of 2 seeds per hole with 3cm depth at the spacing of 25cm by 75cm. Re-supplying was also done five days after planting. Thinning and weeding was also carried out four weeks after planting. Fertilizers were applied; Control (No fertilizer), Urea fertilizer (7.22g per stand), Nat-soil fertilizer (3.8g per stand) and Wonder fertilizer (1.9g per stand). The fertilizer rates applied were calculated based on the nitrogen contents of each fertilizer

Hay making

Maize plants were harvested at bloom stage (tasseling stage) at 6 weeks, allowed to wilt on the field for about 2 hours, the plants were chopped into 4cm bits, spread and air-dried on a concrete floor under a shed for a period of 4- 6 weeks until desirable moisture content was achieved, sub-samples weighing 100g were taken from the hay produced oven dried and kept for analysis.

Chemical analysis

Samples of hay from all treatments were taken to the laboratory for proximate and fibre analysis according to the procedure of AOAC (2000).

Data collection and analysis

Data collected include plant height, plant width, leaf number, leaf length, leaf width, stem girth, number of cobs and weight of cobs. The data collected were subjected to one way analysis of variance procedure of the general linear model (SAS 2008). The means were separated using the Duncan's Multiple Range Test.

RESULTS

There were significant differences ($p<0.05$) in the means of all the agronomic parameters of forage maize (Table 1). The result of this experiment indicated that T4 was significantly higher ($p<0.05$) in plant height, plant width, leave number, leaf length, leaf width, stem girt and yield parameters compared to other fertilizer treatments. However, the agronomic and yield parameters of all the fertilizer treatments were far better than the control treatment. The chemical analysis of maize hay T1 had the highest DM value (29.95%) while T4 had the least DM value (27.50%). T4 had the highest CP value (12.19%) while T2 and T3 were had relatively the same CP value (10.6% and 10.64% respectively) as the least CP value was recorded in T1. T1 was had the least EE value (0.28%) as the highest EE value (0.96%) was recorded in T3. The CF value was higher in T1 and T4 (32.32% and 32.40% respectively) as the least CF value (30.34%) was recorded in T3. It was also observed that T1 and T3 had higher ash content value (11.00% and 11.62% respectively) compared to T2 and T4 ash content value (10.40% and 10.21%). T1 had the highest CHO value (37.10%) while the least CHO value (34.63%) was recorded in T4. T2 had the highest ADF value (43.21%) while T4 had the least ADF value (35.85%). T3 had the highest NDF value (81.86%) while T1 had the least NDF value (72.62%).

Table 1: Agronomic and yield parameters of forage maize

Parameters	T1	T2	T3	T4	SEM	Pvalue
Plant height	66.43^{c}	71.90^{cb}	75.13^{b}	94.80^{a}	1.31	<0.0001
Plant width	50.75^{cb}	55.40^{b}	46.83^{c}	71.48^{a}	1.13	<0.0001
Leave number	7.98^{c}	8.98^{b}	9.98^{a}	10.38^{a}	0.12	<0.0001
Leaf length	54.63^{b}	52.65^{b}	65.15^{a}	68.25^{a}	1.03	<0.0001
Leaf width	5.67^{c}	6.99^{b}	7.17^{b}	8.10^{a}	0.11	<0.0001
Stem girth	3.21^{c}	3.46^{b}	3.69^{b}	5.45^{a}	0.08	<0.0001
Number of cobs	761.00^{c}	833.00^{b}	868.00^{b}	914.00^{a}	50.91	<0.0001
Weight of cobs	74.00^{c}	80.00^{b}	85.00^{b}	90.00^{a}	1.23	<0.0001

^{abc} Means with different superscripts are significantly different ($p<0.05$)

Table 2: Chemical analysis of maize hay

Parameters	T1	T2	T3	T4
DM	29.95	28.60	27.80	27.50
CP	9.65	10.67	10.64	12.19
EE	0.28	0.31	0.96	0.57
CF	32.32	31.95	30.34	32.40
ASH	11.00	10.40	11.62	10.21
CHO	37.10	36.12	35.94	34.63
ADF	37.91	43.21	39.29	35.85
NDF	72.62	76.92	81.86	79.03

Keys: DM: dry matter, CP: crude protein, EE: ether extract, CF: crude fibre, ASH: ash, CHO: carbohydrate, ADF: acid detergent fibre, NDF: neutral detergent fibre.

DISCUSSION

An optimum plant height is claimed to be positively correlated with productivity of plant (Saeed *et. al.,* 2001). T4 was recorded with the highest plant height value indicating that the plant height was influenced by the fertilizer giving it optimum chance of growth. The number of leaves per plant was dependent on fertilizer used this study was in line with the view of Stefano *et al*., (2004) who reported that fertilizer application resulted in luxuriant growth with excessive leaves. Higher stem girth value recorded in T4 also indicated that there proper retention of appropriate amount of assimilate in the stem for leaf production thereby indicating the proper supply uptake and utilization of applied fertilizer. Photosynthesis is the most important source of weight for grain yield during the grain filling period (Gardner *et al., 1985*) as this study indicates that the highest weight of cob and number of cob was recorded in T4 and this shows that there is proper supply and utilization of nutrient by the plant through photosynthesis. Gardner *et al.,* (1985) added that nitrogen is needed by plants during their vegetative growth period, such as the effect on the formation of wider and longer leaves. As it was observed in this study that T4 has the highest plant width, leaf length and leaf width value indicated optimum nitrogen was supplied by the fertilizer. The dry matter (DM) content was within the range for maize fodder cited by Heuze and Tran (2016) as 12.6% – 47.6%. The crude protein content in this study was lower than 17.51 – 25.52 (Nwamo *et al*., 2017). However, increased nitrogen fertilization in this study was in accordance with the finding of Mahmud (2003) that the increase in protein contents with increasing fertilizer levels may be as a result of enhancement in amino acid formation due to fertilization. Ullah (2015) also reported that the increasing nitrogen dose indicated better nitrogen up take by the fodder maize plants, signifying the escalating trend of chlorophyll content resulting to more greenish leaves which was also observed among the treatment groups with T4 having more greener leaves than other treatments. Acid Detergent Fibre was slightly higher than 32.20 - 35.70% reported by Nwamo *et al*. (2017) and according to Kellems and Church (2001) forages with less than 40% ADF was categorized as high quality forages while those greater than 40% was categorized as poor quality forage. Therefore, based on this assertion, maize fodder fertilizer by T4, T3 and T1 could be classified as high quality forage.

CONCLUSION

It could be concluded that maize treated with fertilizers had superior growth, yield as well as nutritive value. However, maize treated with wonder fertilizer gave outstanding responses.

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