# Proximate and Fiber Composition of Four Sorghum Cultivars as affected by Age at Harvest

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## ABSTRACT

This study was carried out to evaluate the effect of age at harvest on the proximate and fiber composition of four sorghum cultivars. The experiment was laid out in a 4 × 2 factorial arrangement comprising of four (4) cultivars of sorghum (NGBO1902, NGBO1952, NGBO1591 and NG/SA/07/125) and two (2) age at harvest groups (8 and 12 weeks) in a split plot design replicated three times.

Results show that there was significantly ($p<0.05$) different values on the proximate composition of four sorghum cultivars. The highest value (9.03%) of CP contents was recorded in cultivar NG/SA/07/125 with the lowest value (8.49%) observed in cultivar NGBO1902. There was no significant ($p>0.05$) difference on the proximate composition of four sorghum cultivars as affected by age at harvest except CP and EE contents. The highest value (9.11 and 7.76%) of CP and EE contents was recorded in cultivars harvested at 8 weeks of age. There was significantly ($p<0.05$) difference on the proximate composition of four sorghum as affected by interaction between cultivar and age at harvest. NG/SA/07/125 cultivar harvested at 8weeks recorded the highest (9.30%) CP content with the least value (7.95%) observed in NGBO1902 harvested at 12 weeks.

There was no significant ($p>0.05$) difference on the fiber composition of four sorghum cultivars except NDF and ADF contents. The NDF value ranged from 62.90% in cultivar NGBO1902 to 64.80% in cultivar NG/SA/07/125 and the highest value (36.80%) for ADF content was recorded in cultivar NGBO1591 and NG/SA/07/125. Also, there was no significant ($p>0.05$) difference on the fiber composition of four sorghum cultivar as affected by age at harvest except NDF content. The highest value (64.65%) of NDF content observed in cultivar harvested at 12 weeks of age. In conclusion, there was variation in the qualities of sorghum cultivars at different age at harvest in this present study.

(Keywords: sorghum, cultivars, age at harvest)

## INTRODUCTION

Feeding of green forage to livestock is essential for the maintenance of normal health and reproduction. About 90% of the ruminant's diet consists of low-quality roughage. Moreover, its availability is also far less than that of requirement (Jackson, 1980). As a result, animals can be left under-fed and poorly maintained. This problem is becoming more acute because of steady rise in cattle population and diversion of more areas to grain crops for human consumption. Therefore, cultivation of quick growing good quality perennial forages like Napier, Para, German, Sorghum is urgently needed to mitigate the chronic shortage of fodders for feeding ruminants. Livestock production in Nigeria had been hampered over the years primarily by the non-availability of good quality and quantity of feeds resources.

The shortage of good quality forage needed to sustain livestock growth especially during the dry season has been a perennial problem in Nigeria, when the little available forage is low in quality which result in weight losses, low birth weights, lowered resistance to disease, and critical reduction in animal performance (Onwuka *et al.*, 1989). The rapid increase in human population had also led to an increase in the demand for animal protein by humans. Moreover, the deficit of protein feeds in the

market and high costs are the obstacles facing animal production. Therefore, most researches have focused on improving the status and utilization of different feed resources in order to reduce the high cost of production and maintain optimum performance of animals.

Forage is considered the cheapest major nutritional component in the diets of ruminant animals particularly in rural and sub-urban areas of the tropics (Akinsoyinu and Onwuka, 1988). In the underdeveloped and developing countries of the tropics, ruminant animals depend mostly on forage as concentrate rations are expensive and unaffordable to most stockowners. In most of these countries, the forages that supply the nutrition of animals are provided by the natural vegetation, commonly referred to as natural pastures, which for most of the year do not retain enough nutrients and biomass to satisfy the requirements of the animals (Ademosun, 1973; Mohammed-Saleem, 1994). In order to mitigate the problem of poor nutrition for ruminant animals, the use of sown and purposely managed pastures has been widely suggested (Olanite, 2002; Onifade *et al*., 2005; Dele, 2008).

## MATERIALS AND METHODS

The experiment was carried out at the crop section of Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. Abeokuta lies in the derived savannah zone and has a bimodal rainfall pattern which peaks in June/July for early rain and October for late rain. Four (4) cultivars of sorghum were sourced from The National Centre for Genetic Resources and Biotechnology (NACGRAB), Ibadan. The fertilizer used was Aleshinloye Municipal Waste Fertilizer (AMWF) which was sourced for at Aleshinloye Agro Market store in Ibadan.

The land was cleared, stumped and ploughed and left for two weeks before harrowing. The main plot measuring 75 m × 5 m and sub plots measuring 3 m × 2 m was mapped out. Soil samples were collected randomly from the plots at the depth of 0-15cm using soil auger to collect the topsoil. The experiment was laid out in a 4 × 2 factorial arrangement comprising of four (4) sorghum cultivars (NGBO1902, NGBO1952, NGBO1591, and NG/SA/07/125) and two (2) age at harvest groups (8 and 12 weeks) in a split plot design replicated three times.

Proximate composition (contents of dry matter, crude protein, ether extract and ash) were determined according to A.O.A.C. (1995) while non-fiber carbohydrate was calculated as NFC = 100 - (CP + Ash + EE + NDF). Fiber fraction (Neutral detergent fiber (NDF), Acid detergent fiber (ADF) and Acid detergent lignin (ADL) were determined with the procedure of Van Soest *et al*, (1991). Cellulose content was taken as the difference between ADF and ADL while hemicellulose content was calculated as the difference between NDF and ADF. Data collected were subjected to Two-way analysis of variance and the treatment means were separated using Duncan's Multiple Range Test using SAS (1999) package.

## RESULTS

There was a significant ($p<0.05$) difference on the proximate composition of four sorghum cultivars. The DM value range from 97.21% in NGBO1952 to 98.53% in NG/SA/07/125 cultivar the highest value (9.03%) of CP contents was recorded in cultivar NG/SA/07/125 with the lowest value (8.49%) was observed in cultivar NGBO1902. Meanwhile, the highest value (7.93%) of ether extract (EE) contents was recorded in cultivar NGBO1952 with the lowest value (6.68%) was observed in cultivar NG/SA/07/125 while the lowest value (6.89%) for non-fiber carbohydrate (NFC) was recorded in cultivar NGBO1591. Also, there was no significant ($p>0.05$) difference on the proximate composition of four sorghum cultivars as affected by age at harvest except CP and EE contents. The highest value (9.11 and 7.76%) of CP and EE contents was recorded in cultivars harvested at 8 weeks of age (Table 1).

There was no significant ($p>0.05$) difference on the fiber composition of four sorghum cultivars except NDF and ADF contents. The NDF value ranged from 62.90% in cultivar NGBO1902 to 64.80% in cultivar NG/SA/07/125 and the highest value (36.80%) for ADF content was recorded in cultivar NGBO1591 and NG/SA/07/125. Also, there was no significant ($p>0.05$) difference on the fiber composition of four sorghum cultivar as affected by age at harvest except NDF content.

**Table 1:** Proximate Composition (%) of Four Sorghum Cultivars as affected by Age at Harvest.

| Factors | Dry matter | Crude protein | Ether extract | Ash | NFC |
|---|---|---|---|---|---|
| **Cultivars** | | | | | |
| NGBO1902 | 98.32[a] | 8.49[c] | 7.73[a] | 12.20 | 8.68[a] |
| NGBO1952 | 97.21[b] | 8.53[b] | 7.93[a] | 12.80 | 7.52[ab] |
| NGBO1591 | 97.92[a] | 8.88[b] | 7.53[a] | 12.40 | 6.89[b] |
| NG/SA/07/125 | 98.53[a] | 9.03[a] | 6.68[b] | 12.00 | 7.49[ab] |
| SEM | 0.22 | 0.13 | 0.17 | 0.35 | 0.47 |
| **Age at harvest (weeks)** | | | | | |
| 8 | 97.94 | 9.11[a] | 7.76[a] | 12.65 | 7.52 |
| 12 | 98.05 | 8.35[b] | 7.17[b] | 12.05 | 7.76 |
| SEM | 0.20 | 0.19 | 0.15 | 0.25 | 0.36 |

[a, b] :Means in same column with different superscripts are significantly ($p<0.05$) different.
SEM = Standard Error of Mean
NFC = Non-fiber carbohydrate

**Table 2:** Fiber Composition (%) of Four Sorghum Cultivars as affected by Age at Harvest.

| Factors | NDF | ADF | ADL | Hemicellulose | Cellulose |
|---|---|---|---|---|---|
| **Cultivars** | | | | | |
| NGBO1902 | 62.90[c] | 35.40[ab] | 11.80 | 27.50 | 23.60 |
| NGBO1952 | 63.20[bc] | 35.00[b] | 11.80 | 28.20 | 23.20 |
| NGBO1591 | 64.30[ab] | 36.80[a] | 11.20 | 27.50 | 25.60 |
| NG/SA/07/125 | 64.80[a] | 36.80[a] | 11.80 | 28.00 | 25.00 |
| SEM | 0.54 | 0.57 | 0.72 | 0.76 | 1.02 |
| **Age at harvest (weeks)** | | | | | |
| 8 | 62.95[b] | 38.80 | 12.00 | 27.15 | 23.80 |
| 12 | 64.65[a] | 36.20 | 11.30 | 28.45 | 24.90 |
| SEM | 0.38 | 0.44 | 0.52 | 0.51 | 0.74 |

[a, b, c] :Means in same column with different superscripts are significantly ($p<0.05$) different
SEM = Standard Error of Mean
NDF = Neutral detergent fiber
ADF = Acid detergent fiber
ADL = Acid detergent lignin

The highest value (64.65%) of NDF content observed in cultivar harvested at 12 weeks of age (Table 2).

## DISCUSSION

In the present study, there was a variation in the quality of sorghum cultivar. The crude protein content was higher compare to the value reported by Olanite *et al.,* (2010) for *S. almum*. However, the value for CP is slightly below 105g $kg^{-1}$ and greatly above 42g $kg^{-1}$ reported by Torrecillas *et al.,* (2011) for head and stover, respectively. Therefore, CP content is greatly influenced by grain content of the sorghum. This was similarly observation in CP contents of sorghum as affected age at harvest in which the cultivars harvested at early stage recorded the highest CP content.

Ash is another important criterion in determining the quality of forage (Arshad *et al*., 2010) which represents the mineral level in a feedstuff. Similarly, Rao *et al*. (2007) also reported that decrease in ash content with the plant maturity might be as a result of the dilution effect of higher yields in the presence of a constant amount of available minerals in the soil.

NDF content is important in ration formulation because it reflects the amount of forage that can be consumed by animals (Bingol *et al*., 2007). Therefore, the NDF reported in this study is below the 65% threshold above which dry matter intake is depressed (Meissner *et al*., 1991) and increase in NDF percentage, decreases dry matter intake (Van Soest, 1994).

## CONCLUSION

Forage quality of sorghum may strongly be affected by interactions between the genotype, the maturity stage of the plants at harvest, environmental factors and nutritive value of forage sorghums are significantly influenced by stage of maturity at harvest There was variation in the qualities of sorghum cultivars at different age at harvest in this present study. NG/SA/07/125 cultivar recorded the highest contents of DM, CP, NDF, and ADF contents.

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