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# Assessment of the Digestibility of Intercropped Sorghum Stover with (Groundnuts) Legume.

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*Abstract :* This study aimed at looking into ways of improving the nutritive values of sorghum Stover grown under two conditions: one grown sole and another intercropped with groundnuts. As an abundant source of dry season feeds, the study was conducted to determine its nutritional value and digestibility. Nine Yankasa rams weighing 22±2.5 kg, age between 6 and 12 months were used in this experiment. Rams were completely randomized into three treatments with three rams per treatment. Treatment one was sole sorghum, treatment two intercropped sorghum Stover plus 200 grams groundnuts hulms. Treatment three intercropped Stover plus 400 grams of groundnut hulms. Result of the analysis showed that there was an increase in the rate of digestibility in intercropped Stover fed with supplement. This could be due to high nitrogen content available to ruminal bacteria in the intercropped Stover and supplements, which was not in the sole grown Stover. Based on this result, the experiment recommends the intercropping of sorghum with groundnuts to improve law nutrients value and digestibility. At 200 and 400 grams levels of supplementation there was significant increase at ($P<0.05$) digestibility with accompanied increase in body weighed gain. No decrease in weighed gain was observed in treatment one, although 400 grams supplementation showed the highest weight gain of 5.7 kg.

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## I. Introduction

A major problems faced by livestock industry in Nigeria is inadequate supply of feeds toward the end of the dry season. This period coincides with the time when pastures has either being burnt down, overgrazed or have lost their nutritive values, such that they are reduced to high fibre feed with low digestibility. The consequence is the drastic decline in productivity in terms of weight loss, susceptibility to diseases, reduced productivity and general economic losses (Poppi and Maclenon, 1995). Most farmers in the savannah zone engage in sorghum farming which gives raise to large supply of sorghum Stover; which under proper management and storage can serve as feed during such period of scarcity (Tanko, *et al* 1992). Chopping Stover for preservation can increase the intake rate especially by sheep (Osafo *et al.,* 1974). Digestibility of sorghum Stover is low due to high content of lignin, cellulose, hemicelluloses etc. Nitrogen content of sorghum Stover is also low and for it to be degraded adequately for animal utilization, supplementation is necessary. Supplement should be available and cheap. Cowpea, groundnuts haulms as well as lablab haulms are most readily available and have high nitrogen content (Minson and Wilson, 1980).

Conrad and Hibbs (1968) assert in the work that, nitrogen content of lablab, groundnuts haulms or cowpea have adequate nitrogen available for use of ruminant micro biotic fermentation, which aids digestion. Ammonia is also constituents of these legumes residues, which together contribute nitrogen for protein synthesis by the ruminant microorganism to facilitate ruminal fermentation and digestion (Anderson, 1978). Low level nitrogen in sorghum Stover could be due to stage of maturity at harvest or the state of fertility of soil on which they are grown. Agronomic research have shown that, because legume are capable of fixing soil atmospheric nitrogen by symbiotic fixation mechanism, intercropping sorghum with legume may be a possible way of increasing the nitrogen level of sorghum Stover. Another advantage of this (intercropping) is the increase of leaf area ratio, dry matter accumulation and grain yield. Also an added advantage of intercropping is increased organic matter content (Griggs, 1993).

## II. Materials and Methods

*Location of study area*

The study was conducted at the Federal University of Technology Yola Research and Teaching farm. Federal University of Technology is located in Girei local government area of Adamawa state Nigeria, situated at latitude 7° and 11°E and longitude 11°E and 14°E, at 185.5m above sea level. The ambient temperature ranges between 29.2°C and 30°C. Two distinct seasons exist in the study area, each lasting 6 months of the year; with dry season beginning from November to April while raining season lasts from May through October (Adebayo, 1999).

The experiment was carried out under a shade structure constructed out of wooden posts and fed

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separately. They were at last placed into metabolic cages for sample collection.

## III. Experimental Diets

The experimental diets used were sorghum Stover as basal diet produced udder two distinct cropping systems: one grown sole and another grown intercropped with groundnuts: Groundnuts haulms was fed as supplement. The Stover was fed at 600gm twice daily in each case as basal diet. The sole Stover as the control diet was fed to the control animals. On the other hand 600gm 0f sorghum Stover from the intercrop was fed two classes of the experimental animals with graded levels of groundnuts haulms at 200 and 400 gm each; split in each case into two as per daily feeding regime.

## IV. Experimental Animals

Nine Yankasa rams of about 6 months of age weighing between 20-24 kg kept under intensive systems were used, each animal was dewormed with 1 bolus each of albendazole and 2-2.5mls of oxytetracycline 200mg/ml intramuscularly to check secondary bacterial infection, the animals were in good health. They were washed and rinsed with Asuntol (Acaricide) against external parasites.

## V. Experimental Design

The experiment was conducted using Completely Randomized Design (CRD). Animals were allocated treatment numbers which were T1, T2 and T3 as the control. Treatment 2 were animals fed 600gm of sorghum Stover (sorghum Stover grown sole) supplemented with 200 gm of groundnuts haulms split and fed twice, treatment 3 were also fed 600 gm sorghum Stover (intercropped sorghum Stover) with 400 gm groundnuts haulms as supplement, the fed were given twice daily at 6:30 am and 4:30 pm daily, Clean water was given ad-libitum with mineral salt licks.

## VI. Sampling Techniques

The samples of this experiment were feacal and urine samples and the experimental diets. These were analyzed according to AOAC (2000). On assumption of the experiment, this experiment opted for a period of adjustment in which the experimental diets were fed ad-libitum to the animals in preparation for their digestive tract to excrete previous feeds in feaces. These rams were allowed ample time of 3 weeks for adoption physiologically before the experiment commence. At the beginning of the 4th week, measured basal feeds and supplements were fed; 600 gm sorghum Stover only fed to T1 twice; i.e. 300gm in the morning at 6:30am and 300 gm at 4:30 pm. Graded levels of groundnuts haulms and intercropped sorghum Stover was fed to T2 and T3. The Stover was chopped to increase voluntary intake and so residual feed average overall was 150gm. That means about 450 gm of fee control Stover was consumed by T1 and about 750 and 650 respectively for T2 and T3. The data were recorded and noted, consumption to have differed with ambient temperatures. The month of April and late March saw slight decline in intake due to increase in ambient temperatures. The rams were kept outside the metabolic cages until collection period.

Metabolic cages were constructed with care taken to maintain cleanliness and comfort, ensuring that boxes fitted the rams and giving no rooms for turning round in the cages; making sure also that comfort as regards movement, lying down and standing was provided.

To facilitate collection of urine devoid of contamination, a stage of wire mesh through which urine alone can pass was used in constructing the bottom of the cages. The feacal matter was collected in special bags of khaki material fastened by durable shreds which crosses under flank with one on either side over the thurl. They were joined and knotted at the main band that crosses the loin. All feacal matters were collected here and placed into driers to dry at ambient temperature towards oven drying at analysis.

The urine was collected once a day, measured in graduated cylinder and recorded. A sample of each is put into bottles treated with 2% HCL meant to hold the nitrogen content of the urine. Feeding trial and period of adjustment was followed by two weeks of collection period. The collected feaces were labeled according to individual animals; sun dried and stored in labeled polyethene bags. One week collection was done with samples composite separately for separate chemical analysis to be done. This was followed by a straight 14 days collection period. Analysis of this was meant to give comparison for the sake that the first weeks collection would be considered an additional adjustment period. Each 24 hour feacal collection was sundried and weighed; samples were labeled and parceled. The samples were subjected to analysis for crude protein, ether extract, crude fibre, moisture content, ash and minerals, NDF, ADF and NFE.

## VII. Statistical Analysis

Data obtained were analyzed using the analysis of variance of the completely randomized design and least significant difference was used to separate the treatment means.

## VIII. Result and Discussion

Result from Table 1 shows that dry matter and crude protein was significantly higher ($P<0.05$) in intercropped sorghum.

*Table I:* Data for dry matter intake

| Days | T1 | T2 | T3 |
|---|---|---|---|
| 1 | 40 | 44 | 52 |
| 2 | 38 | 43 | 50 |
| 3 | 39 | 45 | 50 |
| 4 | 37 | 46 | 53 |
| 5 | 38 | 45 | 54 |
| 6 | 38 | 43 | 53 |
| Total | 230.0 | 266.0 | 312.0 |
| Mean | 38.3 | 44.3 | 54.0 |

These differences could be due to nitrogen available to the intercropped sorghum, which was not available to the sole cropped sorghum. There was also significantly ($P<0.05$) high neutral detergent fibre and acid detergent fibre in the sole sorghum, ether extract was slightly higher in the intercropped sorghum compared to the sole cropped sorghum, these is in agreement with the findings of Macdonald (2001).

*Table 2:* Data for Daily weight gain in kg.

| Days | T1 | T2 | T3 |
|---|---|---|---|
| 1 | 0.1 | 0.1 | 0.6 |
| 2 | 0.2 | 0.3 | 0.7 |
| 3 | 0.2 | 0.2 | 1.0 |
| 4 | 0.3 | 0.3 | 1.2 |
| 5 | 0.1 | 0.4 | 1.2 |
| 6 | 0.3 | 0.3 | 1.0 |
| Total | 1.20 | 1.60 | 5.70 |
| Mean | 0.20 | 0.33 | 0.95 |

The result of Table 2 shows that there was a significant ($P<0.05$) effect of supplementation on the dry matter intake. The intake increased initially by feeding 600 gm sorghum Stover with 200 gm of groundnuts haulms as supplement by 33 gm.

The intake further increased when the same amount of sorghum Stover was fed with 400 gm of groundnuts haulms supplement, the increase was significant ($P<0.05$), these was accompanied by increase in daily weight gain and agrees with the findings of Hadler and Horst (1991). Digestibility coefficient given as

$$DC = \frac{\text{Grams of feed intake} - \text{Grams in feaces}}{} \times 100$$

Grams of feed intake

The intake increase was indicated when 600 gm was actually eaten and 450 gm was voided; thus

$$D.C = \frac{600 - 450}{600} \times 100 = 25\%$$

The increase reached 45% and 58%; subsequently which was significant ($P<0.05$). The increase in intake continued with an accompanied increase in body weight gain of 1.6 kg when supplemented with 200 gm, which agrees with the report of Humphrey (1985), in his work on nutrients utilization and weight gain in ruminant animals.

Digestibility tables

*Table 3:* (Dry matter)

| Days | T1 | T2 |
|---|---|---|
| 1 | 14.0 | 13.0 |
| 2 | 16.1 | 13.4 |
| 3 | 14.0 | 14.0 |
| 4 | 13.2 | 13.5 |
| 5 | 13.0 | 14.9 |
| 6 | 13.4 | 14.6 |
| Total | 83.7 | 83.40 |
| Mean | 13.95 | 13.90 |

*Table 4:* Neutral Detergent Fibre (NDF)

| Days | T1 | T2 | T3 |
|---|---|---|---|
| 1 | 11.0 | 10.2 | 10.2 |
| 2 | 11.2 | 10.5 | 10.3 |
| 3 | 11.4 | 11.0 | 10.4 |
| 4 | 11.5 | 11.2 | 11.1 |
| 5 | 12.0 | 11.6 | 11.5 |
| 6 | 12.2 | 12.2 | 12.0 |
| **Total** | **69.30** | **66.71** | **65.70** |
| **Mean** | **11.55** | **11.12** | **10.95** |

Further supplementation with 400 gm increased digestibility to 41.66% initially and up to 70.14% at the end of the experiment when 670 gm was eaten and 200 gm of feaces was voided. There was an increase in feed intake.

Given as

$$D.C = \frac{670 - 200}{670} \times 100 = 70.14\%$$

*Table 5:* Digestibility of Acid Detergent Fibre

| Days | T1 | T2 | T3 |
|---|---|---|---|
| 1 | 5.5 | 5.4 | 5.2 |
| 2 | 6.2 | 5.8 | 6.0 |
| 3 | 6.5 | 6.2 | 6.3 |
| 4 | 6.8 | 6.5 | 6.7 |
| 5 | 7.5 | 6.8 | 7.5 |
| 6 | 8.2 | 7.1 | 8.2 |
| **Total** | **40.72** | **37.61** | **39.90** |
| **Mean** | **6.78** | **6.23** | **6.65** |

*Table 6:* Digestibility of Ether Extract

| Days | T1 | T2 | T3 |
|---|---|---|---|
| 1 | 0.20 | 0.13 | 0.13 |
| 2 | 0.10 | 0.15 | 0.14 |
| 3 | 0.10 | 0.16 | 0.15 |
| 4 | 0.20 | 0.18 | 0.16 |
| 5 | 0.30 | 0.19 | 0.17 |
| 6 | 0.30 | 0.21 | 0.20 |
| **Total** | **1.20** | **1.02** | **0.95** |
| **Mean** | **0.20** | **0.17** | **0.16** |

*Table 7:* Digestibility of Total Ash

| Days | T1 | T2 | T3 |
|---|---|---|---|
| 1 | 0.29 | 0.41 | 0.41 |
| 2 | 0.31 | 0.50 | 0.46 |
| 3 | 0.31 | 0.53 | 0.49 |
| 4 | 0.35 | 0.55 | 0.52 |
| 5 | 0.37 | 0.58 | 0.55 |
| 6 | 0.37 | 0.63 | 0.58 |
| **Total** | **2.05** | **3.20** | **3.01** |
| **Mean** | **0.34** | **0.53** | **0.50** |

This increase in digestibility could be due to nitrogen flush available to the microorganisms in the rumen which was not available in the sole Stover diet as earlier reported by Hendrickson *et al* (1981). The crude protein degradation was significant ($P<0.05$) and continued to increase with level of supplementation. Crude protein feaces was least into feed supplemented with 400 gm of groundnuts haulm which is rich in crude protein as reported by Maynard (1975).

There was also significant ($P<0.05$) increase in NDF and ADF digestibility, with the highest in feed supplemented with 400 gm groundnuts haulms. This agrees with Conrad and Hibbs (1968) in their report on effect of legume supplementation on nutrients digestibility. The NDF graded in T2 was about 2.6 higher and about 2.7 in that supplement with 400gm. The ADF graded was also significant ($P<0.05$) at 200 gm supplement reaching about 3.1 in T2 and 1.2 in T3. This as well can be due to the nitrogen content in Stover taken up from the soil Adeniran and Wilson (1978).

## IX. Summary, Conclusion and Recommendation

The result obtained from the analysis of experimental diets, which includes sorghum Stover (sole grown and intercropped), and groundnuts haulms revealed a remarkable variations in nutrients contents. Intercropping groundnuts with sorghum provides nitrogen for uptake by the sorghum which resulted in increased intake and digestibility. Variation in levels of supplementation with groundnuts haulms improved body weighed gain compared to sole fed sorghum Stover. Based on this the use of agronomic practice of intercropping sorghum with legumes could increase productivity and reduce the use of other protein source supplements which are scarce and expensive.

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