Biomass estimation and some chemical composition of herbage at Dabagi farm grazing land, Usmanu Danfodiyo University, Sokoto- Nigeria

H.B. Birnin-Yauri¹, U.A. Birnin- Yauri², S.A. Maigandi³ and A.A. Mohammed³

¹Department of Agriculture, College of Basic and Advanced Studies, Yelwa-Yauri, Kebbi State- Nigeria
²Department of Chemistry, Usmanu Danfodiyo University, Sokoto-Nigeria
³Department of Animal Science, Usmanu Danfodiyo University, Sokoto- Nigeria

*Corresponding author email: uabyauri@yahoo.com

Accepted 17 August, 2012

Botanical composition, dry matter (DM), crude protein (CP) and crude fibre (CF) contents of herbage at two locations at Dabagi farm grazing land were determined during the rainy season. 20 forage species were identified in both locations. The average DM content from the fallow land was 324.2g/kg and for virgin land was 283.8g/kg and total DM productivity from the two sites were 533.1kg/ha and 499.1kg/ha respectively. The results on chemical analysis showed that herbage on fallow land contained 98.9g/kg CP while that of virgin land was 67g/kg. The CF content of herbage on fallow land was 366.7% and that of virgin land was 433g/kg. It is recommended that estimation of yield and chemical composition should be carried out throughout the year in order to come up with more accurate information on seasonal changes on the productivity of herbage. This will provide the necessary information for determination of the correct number of animals that could be optimally stocked on the farm and other information that may help in determining the suitability of the forages to grazing animals.

Keywords: Herbage, forage, fallow land, virgin land, chemical composition.

INTRODUCTION

Ruminant livestock in most parts of the tropics graze intensively on naturally growing forages which are poor in quality. These tropical forages compared to those in temperate regions usually contain less nitrogen and are less digestible (Minson, 1980). The quantity and quality of these forages become more critical in the dry season imposing more serious constraints to the development and productivity of these animals (Darragi, 1995). Minson, (1982) indicated that low protein levels characteristics of tropical forages during the long dry season are the limiting factors in animal intake and performance. The natural forage resources of the savannah are inadequate to support the production levels desired to satisfy the demand for meat and milk supply resulting in malnutrition (Raay and Deleeuw, 1974). The supply of protein and energy from forages in the savanna regions of Nigeria falls short of meeting the required level needed for maintenance of animals at different physiological stage; consequently there is not only weight loss, lower disease resistance and death but also seasonal anestrous, reduced fertility and slow growth rate (Osori, 1976). Dabagi farm grazing land is not an exception to these problems as such herbage yield and quality has to be evaluated so as to arrive at the correct carrying capacity and stocking rate of the ruminants. This will help in alleviating problems of over stocking. Awad and Elhadi, (2010) reported that the global grazing habit of a large number of domestic ruminants has a detrimental effect on the environment, especially as the stocking density can be very high in marginal lands.

Estimation of yield and chemical composition will also give information to species composition and quality of pasture. Knowledge on quality of pasture is important as it affects the fibrolytic activity of rumen micro organisms which may be restricted when ruminant animals feed on poor quality forage (Fondevila et al., 1995). Palatability of forage may also be determined when the chemical composition is known because factors that relate to plant’s palatability including its chemical composition, particularly the presence of secondary metabolites such
as tannins, volatile oils, alkaloids and glycosides may be known (Malechek and Provenza, 1983; Bryant et al., 1991). Knowledge on the specie composition of the forage/swards will also aid in knowing whether the animals that will graze on the pasture land will have access to a mixed diet as it will provide a more balanced ration and prevents the animal detoxification mechanism from one single toxin if present in any or some of the forage species (Moss, 1991; Bredan and Thomson 1991; Becker and Lohrmann, 1992; Smith, 1992). Greater diversity of forage species within a sward can also improve the supply of the optimum quantities of protein and energy required to obtain the desired level of production from the grazing animals. This may also increase the duration of forage production and buffer variation in production and utilization by animals (Areghoe et al., 2006).

About 75% of Nigerian ruminant animals are concentrated in the northern guinea savannah areas. Pastures in these areas usually fail to yield adequate supplies of protein for livestock production, especially when the forages are mainly grasses (McDowell, 1972). Production of ruminant animals in Nigeria is under the extensive nomadic system; therefore, forage availability and quality become important factors in ruminant livestock production, since the nomads depend almost solely on these forages. These forages represent the major source of feed for the ruminants (Adegbola, 1982). Inadequate protein supplied by tropical pastures is often the first limiting factor to animal production (Mtui et al., 2009) followed by total DM supply and water (Agishi, 1985). Species composition because of their morphological and nutritional diversity greatly influence grazing behavior and diet selection by the animal (Klock et al., 1975). Forage quality and quantity can also be influenced by stage of growth and environmental factors. Younger forage tends to have lower DM, lignin and fiber and higher CP and IVOMD (Invitro Organic Matter Digestibility) than more mature forages. Virgin land tend to have proportions of perennial grasses and some herbaceous species with lower nutritive value compared to fallow land that has a recovery period to establish freshly grown forage of high quality (Crowder and Chheda, 1982). In view of the above mentioned points, this study was designed to compare quantities of DM, CP and CF contents of virgin and fallow lands at Dabagi grazing land farm of Usmanu Danfodiyo University, Sokoto.

MATERIALS AND METHODS

The research was carried out at the Dabagi farm of the Usmanu Danfodiyo University, Sokoto. Sokoto State is located in the sudan savanna zone in the north western part of the country. It falls within longitude 3°6’E and latitude 8°13’N (Mamman et al., 2000). Sokoto State has an annual rainfall ranging from 500 and 1300mm. The annual maximum temperature is 41°C obtained mostly in April and minimum annual temperature of 13°C obtained mostly in January (Mamman et al., 2000). Two experimental sites were selected within the farm, taking 1 hectare each from virgin and fallow lands which were represented as treatments. The data were collected 3 times (serving as replicates) at 11 days interval for each of the lands between the months of July and August. The collection was done by the use of 1.0m² (dimension on quadrant). The quadrant was randomly thrown ten times within each of the hectares for the two sites and 10 samples were collected at a cutting height of 2cm above ground level within each of the hectares for each of the collection intervals in order to have a representative sample of each of the areas. In each point different species were identified, counted and recorded. Collections from the ten points for each site were pooled as a unit and labelled in a polythene bag. The samples were then taken to the laboratory for analysis. The samples were oven dried at 60-70°C. The weight of the dried samples were taken and later ground to powdered form. Representative ground samples were taken for each of the two sites separately. The dry matter yield per hectare was calculated by multiplying the dry matter yield of the ten points sampled for each of the areas and for each of the collection intervals by 10 ln in order to obtain 100m² which is equivalent to a hectare. The samples were analysed for CP and CF as recommended by AOAC, (2003). The data generated was analysed using Student t-test (Steel and Torrie, 1980) with the aid of a statview statistical package (SAS, 2002).

RESULTS AND DISCUSSIONS

The average quantity of dry matter content of herbage from fallow land was 324.2kg while 283.8kg was obtained for the virgin land. These results as shown in table 1 indicate that, the dry matter content of herbage in the fallow land is relatively higher than that of the virgin land. This could be due to its (fallow land) regeneration opportunity when left to grow fallow. This is in line with the observation of Crowder and Chheda, (1982). The result however deviated from the general assumption that there is decrease in moisture content with advancing maturity of herbage (Crowder and Chheda, 1982) because the reverse was obtained in this study. This could be due to the draught experienced during the period of the experiment, which might have led to irregular germination of herbage thus, resulting in the collection of newly germinated herbage along with older ones, which consequently affected the DM content. Aina and Onwukwe, 2002) reported that the chemical composition and nutritive value of the grasses and legume species grown in Nigeria vary greatly depending on the species and season of growth at which the grasses...
Table 1: Herbage Dry Matter Content (g/Kg)

<table>
<thead>
<tr>
<th>Collection Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallow Land</td>
<td>423.7</td>
<td>312.1</td>
<td>236.5</td>
<td>324.2</td>
</tr>
<tr>
<td>Virgin Land</td>
<td>352</td>
<td>251.5</td>
<td>247.8</td>
<td>283.8</td>
</tr>
</tbody>
</table>

Table 2: Herbage Dry matter yield (Kg/ha)

<table>
<thead>
<tr>
<th>Number of Collection</th>
<th>Virgin Land</th>
<th>Fallow Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>444.40</td>
<td>500.90</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>421.80</td>
<td>485.30</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>631.10</td>
<td>631.10</td>
</tr>
<tr>
<td>Average</td>
<td>499.10</td>
<td>533.10</td>
</tr>
</tbody>
</table>

Table 3: Herbage Crude protein and Crude fibre contents (g/Kg)

<table>
<thead>
<tr>
<th>No. of Collection</th>
<th>CP</th>
<th>CF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Virgin Land</td>
<td>Fallow Land</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>47.5</td>
<td>92.5</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>79.1</td>
<td>103.5</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>74.3</td>
<td>100.6</td>
</tr>
<tr>
<td>Average</td>
<td>67.0</td>
<td>98.9</td>
</tr>
</tbody>
</table>

and legumes are cut or grazed.

The Dabagi farm virgin and fallow grazing lands were found to have average DM yield of 499.10 and 533.10 Kg/ha respectively during the early period of herbage growth. Statistical analysis revealed no significant (P >0.05) difference in the DM yield between the two sites. Kowal and Kasal (1978) reported a value of 2324kg/ha for the sudan savannah. This could be due to the fact that in this study, the herbage was cut before attaining its maximum growth. The dry matter yield fell within the range of 500 and 1200Kg/ha reported in the sudan savanna zone of Katsina State-Nigeria (Aduku, 2004). Moreover it is important to note that herbage dry matter yield per hectare varies with rainfall and soil condition (Aduku, 2004). The herbage dry matter yield can be used to estimate the carrying capacity of the grazing land per hectare depending on the period the animals will be allowed to graze a particular area. Table 2.

From table 3 above, it could be seen that the average crude protein content of herbage from fallow land was 98.9g/kg, while that of virgin land was 67g/kg. There were however no significant differences in these results. The crude protein content of herbage from both virgin and fallow lands tended to increase from the first collection period to the second collection period and there after tended to decline. At each interval of collection, herbage from fallow land had higher CP than herbage from virgin land, this might be due to high proportion of grasses compared to legumes observed in the virgin land (which is especially dominated by Andropogon gayanus (Gamba) and Hyperrhenia rupa. The results are in agreement with the observation of McDowell (1972) who reported that pastures, even if established and well managed more often than not fail to yield adequate supplies of protein for livestock production especially when the forage consists mainly of grasses. The average g/Kg CP contents of both the fallow and virgin lands were higher than the values of 5.44±1.89% (54.4±18.9g/Kg) and 2.22±1.75% (22.2±17.5g/Kg) during the early dry season and late dry season respectively for a similar environment of semi arid rangeland of sudan (Awad and El-Hadi,2010). This could possibly be due to the fact that this study was carried out during the rainy season. The CP content of the virgin land was lower than the 8% (80g/kg) CP which is the lower threshold that will warrant giving supplements to livestock (Aduku, 2004). The fallow land was however able to meet the minimum threshold level of CP.

Results on crude fibre content of herbage (table 3) showed that herbage obtained from the virgin land tended to have higher CF content than herbage obtained from fallow land except for the 3<sup>rd</sup> collection. This may be due to grass species domination on the virgin land. The g/Kg CF contents of both the fallow and virgin lands is also comparable to the values of 40.64±3.94% (406.4±39.4g/Kg) and 38.75±4.86% (387.5±48.6g/Kg) obtained during the early and late dry seasons respectively in a semi arid rangeland of Sudan (Awad and El- Hadi, 2010). The g/Kg CF of herbage in both the fallow and virgin lands could also be compared to the report of Mckell (1980) that CF usually ranges between 30 and 40% (300 and 400g/Kg) of the DM in mature plants. The CF contents of both the virgin and fallow lands are in line with the report of Norton, (1982) that tropical legumes and grasses have a CF content of above 28% (280g/Kg). Highly fibrous herbage has been
reported to lower digestibility and livestock production performance (Richard et al., 1994). It is however pertinent to note that with recent advances in analytical techniques and a better understanding of fibre and its application to nutrition, crude fibre values are not necessarily indicative of the quality of a plant (Norton and Poppi 1995). The first issue to evaluate is the analytical technique in identifying fibre fractions.

CONCLUSION AND RECOMMENDATIONS

Results of the study have shown that at the Dabagi farm, virgin and fallow grazing lands have many plant species in common although their composition varies. The common species among the 20 identified species in both sites include; *Pennisetum pedicelatum*, *Borreria radiata*, *Digitaria horizontalis* and *Leptochloa filiformis*. The total DM yield of herbage from the fallow land had relatively higher g/Kg CP and lower g/Kg CF contents compared to that of virgin land. It is recommended that estimation of yield and chemical composition should be carried out at a different time of the year in order to come up with more accurate information on effect of seasonal changes on the productivity of herbage. This will provide information necessary to determine the correct number of animals that could optimally be stocked on the grazing land and other information that may help in determining the suitability of the forages to grazing animals. The grazing land should be intentionally fertilized and not left alone with the accidental fertilization from the manure of farm animals which is not enough. When the pasture is established especially during rainy season, good grazing interval should be given in order to obtain optimum balance between herbage yield and nutritive value.

REFERENCES


