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Full Length Research Paper

Performance of *Andropogon gayanus (*KUNTH) at Different Stages of Growth in Gangam Rangeland, Sudan Savanna Ecological Zone of Sokoto, Nigeria

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ABSTRACT: The research was carried out of Janzomo farm, Shagari LGA, Sokoto State. The study showed that there were variations in growth parameters, tiller production, dry matter production and moisture content at different stages of growth. The result revealed that the grass species attained the stem height, leaf number, leaf length and width of 73.2cm, 13, 46.8cm and 1.8cm respectively during 6th to 10th week growth period. These rose to 170 cm, 42, 63.4cm and 2.4cm respectively at the 12^{th} to 16^{th} week growth period. This indicated high vegetative growth occurred at the latter stage possibly due to its perennial nature. The grass species also produced 11 tillers during 6^{th} to 10^{th} week while 22 were produced during the latter stage of growth (12^{th} to 16^{th} week). The result further showed the dry matter production was 326.4g/m^2 at the 6^{th} to 10th week and increased to 1225.4 g/m^2 during the 12th to 16th growth period. The high dry matter production at the latter stage was due to maturation of tissues and complete vegetative growth. The plant should be harvested and or fed to the animals at this stage for its high dry matter content. In terms of moisture content, it was 63.8% at the 6^{th} to 10^{th} weeks and declined to 42.7% at 12^{th} to 16^{th} week growth period. The decline was attributed to high evapo-transpiration rate and depletion of soil moisture content at latter stage of growth.

Keywords: Performance; Andropogon gayanus; Sudan savanna; Gangam; Rangeland

INTRODUCTION

Animals feed on forages and convert them into protein for human consumption. The forages are either grazed by animals in situ, cut and carted away and fed to these animals where they are penned in a form of conserved hay / silage, or in a form of standing hay. The importance of any forage crop/grass lies in its nutritive value and palatability (McDonald et al., 1998). Hence, animals fed with high quality forages would comparatively be more plants productive in terms of human food than those animals that are not cared for.

Fodder plants grown on the rangelands and grazing reserves provide over one-half of the feed supply in many countries and up to 85 -95% in others. Other attributes of grazing reserves/rangeland may also be of importance in addition to providing food for livestock. For instance, grasses and legumes provide soil cover and thus retard run-off, therefore increasing the rate of water infiltration into the soil and reduce or prevent soil erosion caused by wind or water. In 2005, the population of goats, sheep and cattle was put at 28 million, 23 million and 15.2 million respectively (FAO, 2006).This is in addition to other livestock in the country. Government in the past had made attempts to improve on their production. The establishment of grazing reserves/rangelands is one of such efforts (Maigandi *et al.,* 1994; Shiawoya and Adeyemi, 2003).

The problem of inadequate feed availability for the ruminants (and other livestock) is more severe in the semi-arid environment where the animals are able to make appreciable weight gains during the short wet season only. There is usually the abundance of good quality pasture in the grazing reserves/rangelands during this period which provides adequate nutrition. On the other hand, in the long dry season the pasture becomes reduced both in quantity and quality and the animals are unable to meet their nutritional requirements for maintenance which lead to serious weight loss. Thus, the animals' overall annual productivity is low (Maigandi and Owanikin, 2002). Therefore, forage production is vital for actualising sustainable livestock production, particularly in Sokoto, a semi-arid zone of Nigeria. Hence, the urgent need to increase the feed availability (in terms of quality and quantity) in order to improve the productivity of livestock production in the state which vast land for forage production (Pagot, 1993).

Grasses usually occur in a mixture with other herbs, shrubs and trees. They cover more than half of the land surface in the tropics and sub tropics. Grasses are monocotyledons belonging to the Poaceae family. Grasses may be annual or perennial. Almost all grass plants are herbaceous and are widely divergent in size, shape and habit of growth. *Andropogon gayanus* Kunth belongs to the family *Poaceae* and *tribe Andropogoneae*. It is indigenous and widely distributed throughout the Savanna areas of Nigeria and the rest of tropical Africa. It is commonly known as Gamba grass or bluestem and locally called Gamba in Hausa and Gombol in Fulfude. It is a tall, pererennial grass, erect, tufted/tussock with stems 2– 4 metres high. It has various tillers and abundant foliage especially during the rainy seasons (Akobundu, 1987; Pagot, 1993). It is propagated by needs which are broadcasted or drilled in rows and vegetative by splitting the tufts. The field emergence of seeds usually occurs 2 – 10 days of sowing. It is relatively free of major pests and diseases and is resistant to grazing and burning. These make it a useful grass for supporting large number of ruminant animals in Northern Nigeria. It is also one of the high yielding grasses in West Africa (Pagot, 1993).

MATERIALS AND METHODS

The study was conducted at Janzomo Farm, Shagari LGA, Sokoto State. Sokoto is located on latitude $12:00^0$ and 13.60^0N and longitude 4.08^0 and 6.50^0 E. It lies at an altitude of 350m above sea level (Kowal and Knabe, 2002). The study involved $100m^2$ of the farm demarcated using 100m measuring tape and ranging poles for the measurement. The study plot was divided into 5 sub-plots of $10m^2$. In each sub-plot, 5 quadrats of $1m^2$ each were demarcated with one of them centrally placed and the remaining ones placed around it in the four directions of East, West, North and South. Sample of individuals plants were identified for the measurement of shoot height, leaf number, length, diameter and tillers using a 100cm ruler. The measurement started after 6 weeks of emergence. This was repeated at 2 weeks interval and continued up to the end of the growing period. Three quadrats of M^2 each were randomly selected and harvested at 5cm above ground level using knife and secateurs, after 6 weeks of emergence. The samples were brought to the laboratory for the determination of dry matter and moisture content. The mean weight of fresh samples were determined and noted, using Metler pm 16-k balance. The dry matter and moisture content were determined by drying the fresh samples in Plus II Gallen Kamp oven to a constant weight (using the above named balance) at 60^0C as outlined by Krishna and Ranjhan (1980) and Payne (1994). This procedure continued at 2 weeks interval up to the end of the growing period. The results obtained were pooled together and grouped into 6^{th} – 10^{th} and 12^{th} – 16^{th} weeks. The results obtained were subjected to analysis of variance (ANOVA), using statistical analysis system (SAS, 2003). The results obtained from 6^{th} – 10^{th} weeks were compared with those of 12^{th} – 16^{th} weeks as presented in **(**Tables 1and 2**)**.

RESULTS AND DISCUSSION

The Result presented in Table 1 indicated that at 6^{th} to 10^{th} week the mean stem height was 73.2 cm but rose to 170 cm at the 12^{th} to 16^{th} week. This indicated that more vegetative growth occurred at the latter stage of growth. Similarly, the mean number of leaves stood at 13 at the 6^{th} to 10^{th} week and increased to 42 during the 12^{th} to 16^{th} week growth period. This also indicated that more leaves were produced at the latter stage of growth. In terms of leaf length, the mean was 46.8 cm and 63.4 cm at the 6^{th} to10^{th} and 12 to16^{th} weeks respectively. The leaf width reached 1.8 cm at the first growth phase (6^{th} to 10^{th} weeks) and increased to 2.4cm at the 12^{th} – 16^{th} week growth period when the study was terminated. The mean tiller production per plant was 11 at the 6^{th} – 10^{th} week and jumped to 22 during the 12^{th} to 16^{th} week growth phase. The result showed that significant differences (p≤) existed in terms of stem height, leaf number, length, width and tillers in which the latter stage of growth (12^{th} to 16^{th} week) had more. The accelerated vegetative growth during this period was attributed to the availability of soil moisture due to adequate rainfall and nutrients. These may have increased the absorption level of the grass species which in-turn enhanced the photosynthetic activities and subsequent vegetative growth during that period. The slow growth during the first phase was possibly as a result of inadequate rainfall and soil

Table 1: Growth rates of *Andropogon gayanus* Kunth at different stages.

Time (weeks)	Stem height (cm)	Leaf number	Leaf length (cm)	Leaf width (cm)	Tillers (m^2)
6 – 10	73.2[b]	13[b]	46.8[b]	1.8[b]	11[b]
12 – 16	170[a]	42[a]	63.4[a]	2.4[a]	22[a]
S.E±	9.6	2	2.5	0.7	2
Significance	S	s	s	S	s

Note: Within a column, means followed by similar letters are not significantly different at 5% level using LSD.
S = Significant; S.E. = Standard error

Table 2: Dry matter and moisture content of *Andropogon gayanus* Kunth at different stages of growth.

Time (weeks)	Dry matter (g/m^2)	Moisture content (%)	Dry matter production (%)
6 – 10	326.4[b]	63.8[a]	36.2[b]
12 – 16	1225.4[a]	42.7[b]	57.3[a]
S.E±	10.73	3.69	3.62
Significance	S	s	S

Note: Within a column, means followed by similar letters are not significantly different at 5% level using LSD.
S = Significant; S.E. = Standard error

moisture. Thus, the grass species was unable to absorb same from the soil at that time of establishment. Similar observations were made by AFRIS (1980) and Payne (1994), who reported that adequate soil moisture and nutrients accelerated the growth of plant species.

On the other hand, the result contained in (Table 2) indicated that the dry matter production was 326.4g/m^2, which is equivalent to 3.260.4kg/ha at the 6th to 10th week. Furthermore, during the latter phase of growth period (12th to 16th week), the dry matter jumped to 1225.4g/m^2 that was converted to 12,254kg/ha. This revealed that dry matter accumulation by the grass species was significantly higher during the latter stage of growth (12th to 16th week). The complete vegetative growth, consolidation and maturation of tissues at this period may have influenced high dry matter accumulation at this period. Umunna and Orji (1993) also stated that grasses attained optimum dry matter content when the minimum precipitation requirement is met. The dry matter of 12,254kg/ha recorded at the latter stage was more than 8,570 kg/ha reported by Haggar (1971) at Samaru, Zaria, and Northern Nigeria. It was however, within the range of 9,000 to 25,000kg/ha. The difference in weather conditions, edaphic factors, length of time and management practices might have been responsible for the variation. It is vital therefore to feed ruminant animals in particular and other livestock at the latter stage when the dry matter was high. It should also be noted that the roughage substances such as cellulose, hemi cellulose and lignin in the dry matter are very useful to livestock. This is because they reduce the incidence of colon cancer, hold water, soften stool and ensure proper working of the digestive system. The roughage, however, may bind mineral elements and increases heat output of animals as reported by Payne (1994) and Hotchkiss and Potter (1996).

Furthermore, the moisture content at the 6th – 10th week was 63.8%, but declined to 42.7% during the 12th – 16th weeks period. The high moisture content during first phase was attributed to availability of soil moisture and succulent nature of the young plants. The moisture content of plants varies with stage of growth where young and succulent plants in their early stage of growth have usually high moisture content of 70% or more. It then declined to less than 50% in their late stage of growth as stated by McDonald *et al* (1998). The findings of this research were therefore closer and in agreement with the above findings. The fodder moisture content assists in digestion and transportation of digested food in the animals' body (Hotchkiss and Potter**,** 1996; Shiawoya and Adeyemi 2003). The depletion of soil moisture content and high rate of evapo-transpiration might have been responsible for the low moisture content at the latter stage. Payne (1994) also reported that grasses have low moisture content at an advanced stage of growth. The dry matter production during the first phase of growth (6th – 10th weeks) stood at 36.2% and increased to 57.3% during the 12th – 16th week growth period. *Andropogon gayanus*.html (2004) reported 59.4% dry matter of the grass at an advanced stage and 30.9% young grass. These observations were within the range of this research findings.

In conclusion, it could be seen that this grass species exhibited high vegetative growth at the advanced stage.

The dry matter accumulation was also higher during the latter stage of growth. However, the moisture content was higher at the early stage of growth. The dry matter and moisture play a significant role in the normal growth development of ruminants in particular and other livestock that feed on this grass species. More so, as dry matter and moisture in the feed meet the nutritional and water requirements of animals respectively.

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