Trop. J. Anim. Sci. 4 (2): 39 - 45 (2001)
ISSN: 1119 - 4308

# EFFECT OF GRAZING AND BUSH BURNING ON THE ESTABLISHMENT OF FIVE PASTURE SPECIES IN HUMID TROPICAL ENVIRONMENT

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Target Audience: Ruminant nutritionist, animal scientist, pastoralist, and agronomist.

## ABSTRACT

**Five pasture species, *Andropogon gayanus* (Gamba grass), *Panicum maximum* (Guinea grass), *Pennisetum purpureum* (Elephant grass), *Calopogonium mucunoides* (Centro), *Centrosema pubescens* (Calopo) were used to determine the effect of grazing and bush burning on their establishment. The forage dry matter yield was monitored for two years. The results showed that there were significant differences among the pastures species on the forage yields at various treatments ($P<0.05$). *Pennisetum purpureum* recorded the highest forage yield particularly on the ungrazed burnt treatments. The grazed treatments in all the five pasture species had lower significant dry matter forage yield than the ungrazed treatments ($P<0.05$). Bush burning significantly affected *C. mucunoides*, *C. pubescens*, *A. gayanus* and *P. maximum* under grazing condition but had no effect on the ungrazed three grass species. Methods of land preparation such as burning and clearing affected the level of crude protein, Calcium, and Phosphorus in the five pasture species.**

Keywords: Grazing, bush burning, and pasture species.

## DESCRIPTION OF PROBLEMS

Bush burning is a common phenomenon, which occur in tropical savanna and sub-savanna regions particularly during the dry season. It is often seen on rangeland in many ecological zones especially during harmattan seasons and the fire set by farmers or hunters to achieve some purpose such as clearing or hunting probably initiates it. The problems associated with bush burning include destruction of lives and properties, exposure of land to erosion and leaching, reduction of soil organic matter, living organisms and soil nutrients among others (1).

However, bush burning has played a prominent role in pasture production and management (2,3). Burning of matured dried fibrous vegetation of some grass species encouraged increased tillering and faster regrowth of these species (3). Also increased germination of some legume and grass species have been associated with the burning of seeds from these plants species (4). Some scholars have argued that bush burning could serve as natural way of checking over-population of many plant species on rangeland

thereby reducing competition among them. The point here is that plant species resistance to bush burning, can persist more on rangeland. Such plant species are useful pasture materials and identifying them is vital in pasture production. The objective of this study is therefore to evaluate the effect of grazing and burning on the establishment of five forage species.

## MATERIALS AND METHODS

Five pasture species, *Andropogon gayanus* (Gamba grass), *Panicum maximum* (Guinea grass), *Pennisteum purpureum* (Elephant grass), *Calopogonium mucunoides* (Calopo) and *Centrosema pubescens* (Centro) which were established on Paddock Development Unit of Animal Science and Fisheries, Ebonyi State University in 1997, were used for this study (5,6). The forage species that were randomly assigned to 120 (5m x 5m) plots were divided into two equal parts using 2 x 4 x 5 factorial design. Sixty plots were put on grazing condition while the other sixty were left not grazed before the experiment commenced. The treatment includes, clearing of the dried old vegetation and removing them from the plots, clearing and leaving the vegetation on the plots, setting fire on the dried vegetation, and leaving some plots not cleared and without burning until there were regrowth of the pasture. The pasture was harvested after eight weeks of regrowth for the 1st cutting, while 2nd, 3rd and 4th cuttings occurred at two weeks interval. The samples were dried, weighed and the dry matter yield was determined in Tonnes per hectare. The proximate nutrient compositions of the samples were conducted according to the method of Association of Official Analytical Chemist (7). The data obtained were subjected to analysis of variance and treatment mean compared (9).

## RESULTS AND DISCUSSION

Table 1 represents the mean dry matter forage yield in tonnes/Hectare. The results show that there was significant difference among the five pasture species on their forage yield at various treatments ($P<0.05$). There were high forage yields from *Pennisetum purpureum* suggesting that the grass specie was the most tolerant pasture specie among other four forage species. Also there were high values among the ungrazed burnt treatment revealing that burning increased tillering ability as well as vegetative growth of the grass specie. This has supported the earlier report of Humphrey (3). *A. gayanus* and *P. maximum* had similar trend on the ungrazed treatment. The two grass species had lower forage yield than *P. purpureum* in all the grazed treatment. This could be due to the fact that the ruminant prefers the two grass species to *P. purpureum* and so they fed more on them. This affected the performance of the two pasture species along the treatment. The two legumes, *C. mucunoides* and *C. Pubescens* recorded very low yield on all the

Table 1. The mean dry matter yield (Tonnes/Ha) of the five pasture species

| PASTURE SPECIES | UNCLEARED | | BURNT | | CLEARED REMOVED | | CLEARED ONLY | |
|---|---|---|---|---|---|---|---|---|
| | ungrazed | grazed | ungrazed | grazed | ungrazed | grazed | ungrazed | grazed |
| *A.gayanus* | 3.25$^{b}$ | 1.94$^{d}$ | 3.60$^{b}$ | 0.59$^{f}$ | 3.10$^{b}$ | 0.74$^{f}$ | 3.33$^{b}$ | 1.48$^{e}$ |
| *P.maximum* | 3.27$^{b}$ | 1.74$^{d}$ | 3.60$^{b}$ | 1.78$^{d}$ | 2.94$^{c}$ | 1.73$^{d}$ | 3.30$^{b}$ | 2.48$^{cd}$ |
| *P.purpureum* | 3.35$^{b}$ | 2.95$^{c}$ | 5.00$^{a}$ | 3.06$^{bc}$ | 3.06$^{bc}$ | 2.30$^{cd}$ | 3.43$^{b}$ | 2.68$^{c}$ |
| *C.pubescens* | 2.40$^{cd}$ | 2.08$^{d}$ | 1.99$^{d}$ | 0.60$^{f}$ | 2.36$^{cd}$ | 1.17$^{e}$ | 3.09$^{bc}$ | 1.98$^{d}$ |
| *C.mucunoides* | 2.27$^{cd}$ | 1.93$^{d}$ | 1.72$^{e}$ | 0.59$^{f}$ | 2.25$^{cd}$ | 1.65$^{d}$ | 2.80$^{c}$ | 1.88$^{d}$ |

* Mean for 120 replicates

* a, b, c, d, e, f, mean on the same row or the same column with different superscripts are significantly different from each other ($P<0.05$).

grazed treatment. Also burning affected them more than the grass species. This could be as a result of the morphological difference, which make legume less adaptive to burning.

*Nutrient Composition:*

Table 2, shows the proximate nutrient composition of the five pasture species.

The results show that there was significant difference in the present crude protein of the five pasture species under various treatments ($P<0.05$). There was general high percentage of crude protein in C. Pubescens and C. mucunoides than the three grass species in all the treatments; which is in agreement with McDonald (9). Grazing significantly reduced the crude protein percent in all the five pasture species in accordance with earlier report (3). The method of land preparation such as clearing and burning during the pasture establishment had no significant role in the crude protein level among the five pasture species.

The neutral detergent fibre was generally higher in the areas grazed than areas ungrazed while the acid detergent fibre (ADF) was higher in the ungrazed areas than the grazed areas although there was no significant difference in all the treatments. The reason could be due to lignifications of plants that might have taken place among the forage species in the ungrazed areas.

Like the NDF and ADF, there was no significant difference in the either extract among the five forage species under various treatments. However, the ungrazed uncleared areas had marginal better percentage ether extract in all the five pasture species then all other treatments. The reason may be due to stability in the soil condition (10).

There was significant difference ($P<0.05$) in the calcium and phosphorous level in all the five pastures under various treatments. While burning significantly affected the level of calcium and phosphorus ($P<0.05$), clearing and removal reduces the level of the two elements remarkably. The reason for this could be due to the level of the elements in the soil, which affected the uptake by the pasture species for tissue formation. This is because; calcium and phosphorus among other elements could be added into the soil during bush burning (9). On the other hand, cropping removes the mineral from the soil, which were hitherto cleared and removed and thus caused reduction in the soil nutrient (11).

## CONCLUSION

The work has shown that grazing affected early establishment of the five pasture species and the interaction of grazing and clearing or burning lowers

Table 2: Proximate Nutrient Composition of the five Pasture Species

CRUDE PROTEIN (%)

| SPECIES | UNCLEARED | | BURNT | | UNCLEARED & REMOVED | | CLEARED ONLY | |
|---|---|---|---|---|---|---|---|---|
| | Ungrazed | grazed | Ungrazed | grazed | Ungrazed | grazed | Ungrazed | grazed |
| *A.gayanus* | 10.85$^{d}$ | 8.23$^{c}$ | 8.32$^{c}$ | 4.15$^{a}$ | 9.15$^{c}$ | 4.35$^{a}$ | 10.43$^{d}$ | 5.50$^{ab}$ |
| *P.maximum* | 11.05$^{d}$ | 7.60$^{b}$ | 8.72$^{bc}$ | 4.26$^{a}$ | 8.20$^{bc}$ | 5.10$^{ab}$ | 10.82$^{a}$ | 5.30$^{ab}$ |
| *P.purpureum* | 11.00$^{d}$ | 7.30$^{b}$ | 7.33$^{b}$ | 5.32$^{ab}$ | 8.72$^{c}$ | 5.32$^{ab}$ | 11.30$^{c}$ | 5.35$^{ab}$ |
| *C.pubescen* | 20.12$^{ef}$ | 9.30$^{f}$ | 20.30$^{g}$ | 18.32$^{ef}$ | 21.03$^{g}$ | 19.32$^{f}$ | 21.32$^{g}$ | 18.25$^{ef}$ |
| *C.mucunoides* | 17.20 | 15.83$^{e}$ | 16.10$^{e}$ | 14.16$^{de}$ | 16.80$^{e}$ | 16.80$^{e}$ | 16.83$^{e}$ | 14.75$^{de}$ |
| NEUTRAL DETERGENT FIBRE (NDF) % | | | | | | | | |
| *A.gayanus* | 20..3 | 21.65 | 23.10 | 23.38 | 22.32 | 23.33 | 23.63 | 22.83 |
| *P.maximum* | 18.97 | 19.90 | 20.30 | 21.11 | 20.10 | 21.10 | 20.43 | 20.65 |
| *P.purpureum* | 18.80 | 20.32 | 23.10 | 24.20 | 23.10 | 23.30 | 22.00 | 20.15 |
| *C.pubescen* | 25.10 | 28.28 | 28.78 | 29.10 | 29.35 | 28.35 | 28.75 | 20.30 |
| *C.mucunoides* | 31.10 | 34.20 | 33.20 | 33.50 | 33.60 | 33.35 | 32.32 | 33.10 |
| ACID DETERGENT FIBRE (ADF) % | | | | | | | | |
| *A.gayanus* | 28.11 | 18.72 | 27.32 | 25.10 | 27.44 | 24.95 | 27.30 | 22.45 |
| *P.maximum* | 29.32 | 20.33 | 27.00 | 20.77 | 28.97 | 21.78 | 28.75 | 20.30 |
| *P.purpureum* | 30.11 | 27.35 | 29.01 | 27.33 | 29.11 | 25.40 | 29.83 | 27.35 |
| *C.pubescen* | 26.31 | 25.62 | 28.31 | 25.12 | 28.33 | 25.10 | 27.00 | 28.32 |
| *C.mucunoides* | 28.97 | 24.52 | 29.88 | 27.23 | 29.35 | 26.66 | 28.55 | 25.11 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **ETHER EXTRACT (%)** | | | | | | | | |
| *A.gayanus* | 1.20 | 1.11 | 1.10 | 1.00 | 1.11 | 1.00 | 1.20 | 1.11 |
| *P.maximum* | 1.70 | 1.51 | 1.47 | 1.32 | 1.47 | 1.30 | 1.80 | 1.48 |
| *P.purpureum* | 1.50 | 1.50 | 1.40 | 1.22 | 1.50 | 1.38 | 1.50 | 1.45 |
| *C.pubescen* | 3.70 | 2.32 | 2.30 | 2.20 | 2.30 | 3.10 | 3.71 | 2.45 |
| *C.mucunoides* | 4.20 | 3.71 | 3.10 | 2.80 | 3.68 | 3.20 | 4.51 | 3.90 |
| **CALCIUM (%)** | | | | | | | | |
| *A.gayanus* | $0.30^{b}$ | $0.13^{a}$ | $0.45^{b}$ | $0.32^{b}$ | $0.27^{ab}$ | $0.10^{a}$ | $0.30^{b}$ | $0.28^{b}$ |
| *P.maximum* | $0.32^{b}$ | $0.20^{ab}$ | $0.50^{c}$ | $0.35^{b}$ | $0.25^{ab}$ | $0.25^{ab}$ | $0.33^{b}$ | $0.30^{b}$ |
| *P.purpureum* | $0.29^{b}$ | $0.25^{ab}$ | $0.34^{bc}$ | $0.31^{b}$ | $0.27^{ab}$ | $0.26^{ab}$ | $0.31^{b}$ | $0.29^{b}$ |
| *C.pubescen* | $0.80^{d}$ | $0.60^{d}$ | $0.98^{e}$ | $0.87^{de}$ | $0.68^{cd}$ | $0.65^{cd}$ | $0.80^{de}$ | $0.75^{d}$ |
| *C.mucunoides* | $0.75^{d}$ | $0.50^{c}$ | $1.10^{f}$ | $0.80^{de}$ | $0.70^{d}$ | $0.60^{cd}$ | $0.70^{d}$ | $0.70^{d}$ |
| **PHOSPHOROUS (%)** | | | | | | | | |
| *A.gayanus* | $0.11^{a}$ | $0.08^{a}$ | $0.23^{bc}$ | $0.20^{b}$ | $0.10^{a}$ | $0.05^{a}$ | $0.11^{a}$ | $0.10^{a}$ |
| *P.maximum* | $0.20^{b}$ | $0.15^{b}$ | $0.25^{c}$ | $0.21^{b}$ | $0.20^{b}$ | $0.17^{b}$ | $0.22^{bc}$ | $0.16^{ab}$ |
| *P.purpureum* | $0.32^{d}$ | $0.27^{cd}$ | $0.37^{e}$ | $0.29^{d}$ | $0.30^{d}$ | $0.24^{bc}$ | $0.34^{e}$ | $0.29^{d}$ |
| *C.pubescen* | $0.25^{c}$ | $0.18^{b}$ | $0.30^{d}$ | $0.25^{c}$ | $0.21^{bc}$ | $0.17^{b}$ | $0.27^{cd}$ | $0.27^{cd}$ |
| *C.mucunoides* | $0.20^{b}$ | $0.18^{b}$ | $0.30^{d}$ | $0.23^{bc}$ | $0.22^{bc}$ | $0.20^{b}$ | $0.21^{bc}$ | $0.18^{b}$ |

* Mean for 120 replicates

* a, b, c, d, e, f, mean on the same row or the same column with different supersripts are significantly different from each other ($P<0.05$).

the rate of establishment of the pasture species. Burning affected the legumes more than the grass species and should be avoided if legumes species are involved in the establishment. However, burning increases the calcium and phosphorus level but reduces the crude protein level of the forage species.

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