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Full Length Research Paper

Sambisa Game Reserve, Borno State, Nigeria: Stylosanthes guianensis germination, dry matter production and nutritional value

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The study is on the introduction of perennial pasture crop *Stylosanthes guianensis* (Stylo) into the Sambisa Game Reserve in Borno State, Nigeria. Stylo is a tropical herbaceous legume primarily used as a pasture crop for humid tropical regions. The objectives were to observe the growth and establishment of stylo in the game reserve of Sudan Savanna ecological zone of Nigeria; examining the emergence rates using some pre germination treatments, determine the yield and the nutritive value of herbage. Viability of 65% was obtained although the emergence was highest when sulphuric acid was used as pre germination treatment. There was no significant difference between the treatments (P > 0.05). A yield of 308 kg DM/ha was obtained. The sample herbage for determination of yield and chemical composition were determined to be 93.0% DM; 5.95% CP; 3.0% EE; 38.0% CF and 5.0% ash. The cultivation of stylo is therefore, recommended in game reserves for increased forage quality and quantity to herbivorous game animals as a conservation strategy.

Key words: Sudan savanna, stylo, germination, dry matter yield and nutritive value.

INRODUCTION

The inadequate quantity and poor quality of forage can be a significant factor limiting the number of wildlife species in a habitat. Estimates of approximate eleven million hectares of tropical forest are cleared annually, which is a major threat to wild games losing their food and shelter (World Resources Institute, 1990).

A significant effort towards reversing the trend of losing wild game is the adoption of range management techniques in game reserves by introducing such forage species within a reserve for animals to graze as pasture. Introduction of pasture species into Nigeria began in the 1950s. Agashi (1979) gave a list of species found to be adapted and recommended some for production in large scale in the Nigerian savanna zones including *Stylosanthes* species. The criteria adopted for the evaluation of this species were based on ease of establishment, high dry matter yield, nutritive value, persistence, suitability and good seed yield (Foster and Mundy, 1961; Miller et al., 1964; Hagger et al., 1971; de Leeuw, 1974).

*Stylosanthes guianensis (*stylo*)* is a tropical herbaceous perennial legume, primarily used for pasture in humid tropical regions, which improves the quality of tropical rangeland and can also be used as a cover crop, green manure crop and as fallow crop (Bogdan, 1977; t' Mannetje, 1992). Most legume forages are rich in many essential nutrients such as protein and minerals. Stylo has assumed a very important position as a pasture legume for grassland but also for degraded forest area and waste lands in recent years (Hazra, 1997). Stylo has been found promising and combines both disease resistances with other favorable agro- forestry characteristics. Bogdan (1977) however, said that stylo is a prolific seed producer but over 70% of the seeds can be hard seeded and seed may be viable up to three years in the soil. Bogdan (1977) and t'Mannetje (1992) pointed out that seed of stylo is hard and must be scarified before planting to permit faster and uniform germination. They also suggested scarification procedures such as treating with boiling water or sulfuric acid as well as mechanical scarification or freezing.

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The objective of this study was to examine the germination rate of stylo using different pre-germination treatment methods in comparism to a control and to determine the herbage yield and nutritive value with a view of introducing the specie as a pasture crop in game reserves in the savanna ecological zone of Nigeria. This is because most of the native forages are annuals; hence, introducing stylo will maximize as well as pro -long the green growth and nutritive value of available forage plants for game.

The result of the study would serve as a basis for the improving rangeland resources especially forage to maximize and conserve wildlife resources in the game reserves and the savanna ecological zone in particular which is endowed with diverse wildlife resources.

MATERIALS AND METHODS

Study area

Sambisa Game Reserve is located between longitude 13°30' and 14°00' East and Latitude 11°00' and 11°30' North. It is about 70 km south of Maiduguri in Borno state, 40 km off Kawuri along the Maiduguri – Bama road. The reserve covers an area of about 518 km^2. The major occupation of the people in the area includes: farming, livestock rearing and hunting.

Sambisa Game Reserve is on a fairly flat land, drained by three main seasonal flowing streams (Kwada, Sambisa and Yuwe) which are tributaries of River Yedzeram. The drainage is poor and the soil is liable to flooding.

Parent materials are classified as recent and older alluvia. Bordering the rivers, the soils are of a leached holomorphic type, sandy loam to clay with a strongly structural "B" horizon (MNR, 1978).

The climate of the area is characteristic of Sudan savanna, marked by hot, dry and wet periods with mean annual temperature range of between 28 - 29°C and maximum temperature of 48°C at the onset of the rains. The minimum temperature of 21.5°C is recorded between December and February during the Harmattan period. The rains commence in May and ends in September with annual rainfall of about 700 mm. (BOSG, 2008).

The vegetation of the Game Reserve is broadly that of the Sudan savanna with open Woodlands and patches of gallery forest. The combined long time effect of grazing and felling of trees have significantly altered much of the natural vegetation of the Game Reserve. Prominent of the large tree species are *Tamarindus indica, Diospyros mespilliformis, Balanites aegyptiaca*, *Combretum* sp*, Zizipus* sp*, Acacia* sp*, Adansonia digitata,* among others.Typical *g*rasses include *Andropogan gayanus, Cenchrus biflorus*, *Schoenefeldia* sp *and Aristida* sp*.* The Reserve has relatively abundant fauna resources. Commonly sited mammal species includes the primates, gazelles, antelope, quicker, hare and squirrel while prominent Birds include guinea fowls, ostrich, francolin, weavers etc.

Land preparation

One hectare of land was cleared, ploughed and equally divided into 4 plots. The 4 plots were sub-divided each into 4 giving a total of 16 sub-plots, that is, 4 × 4 experimental design (Akindele, 2004).

Pre-treatment of seed before sowing

The seed was obtained from the National Animal Production Research Institute (Zaria), Nigeria.

For the cold water treatment

The seed was put in a cloth and soaked in cold water for 12 h. It was then dried in the sun for 2 h before sowing (Emery, 1987).

For the hot water treatment

Seed was put in a cloth and immersed in hot water at 37.8°C for 2 min. Subsequently, it was dried in the sun for about 2 h before sowing, (Emery, 1987).

For sulfuric acid treatment

97% H_2S0_4 was poured onto the seed in an earthenware container for 2 s after which it was removed and washed. Sowing took place immediately afterwards, (Emery, 1987). According to FAO (1974), a solution of sodium bicarbonate was kept readily available as an antidote to accidental skin contact with the acid as it is caustic and dangerous.

Trial management

The seed was sown by broadcasting at the rate of $5g/m^2$ when the rains became steady on the 1^{st} of July, 2008. The seeds were completely covered with soil at a depth of 1cm to prevent seed being carried away by ants.

Control of broad-leaf weeds was done by selective roughing (pulling out) of brush and other herbs. The area was fenced to prevent animal encroachment.

Data collection

Germination of the seeds was monitored for 14 days after sowing. Seeds were counted in the morning hours in $1m^2$ quadrant.

Dry matter (DM) yield was determined following the method of Stoddard et al. (1975) and Akosim et al. (2004). It consists of clipping to ground level the pre-determined forage plants within randomly selected 5 sub-plots of 0.5 × 0.5 meter square. The fresh weight of the clipped herbage for each sub plot was recorded by using electrical balance scale of 145 g to the nearest 0.01 g. Individual samples were sun dried to a constant weight to determine the dry matter yield. Plots were harvested at an age of e16 w eks.

The nutritive value was assessed by performing chemical analysis to determine the crude protein (CP), crude fibre and ash using the AOAC (2002) methods.

Data analyses

The data collected were processed into a suitable format for various analyses. Descriptive statistics and analysis of variance (ANOVA) were applied by using SPSS 14.0 program.

RESULTS AND DISCUSSION

Seed emergence

The number of seed germination per- day is shown Table1. Emergence was first noticed on the fourth day after planting. It increased steadily until the eighth day when it raised to its peak for every treatment (Figure 1). Of

Table 1. Daily emergence of *S. guianensis* seedlings at Sambisa Game Reserve, Nigeria during 14 days after sowing.

Days after sowing	Control	Cold water	Hot water	Acid scarification
4	6	8	7	11
5	10	11	15	25
6	25	16	23	30
7	51	35	55	53
8	85	70	90	131
9	49	32	43	60
10	22	28	37	39
11	18	19	31	27
12	12	16	27	21
13	9	15	21	13
14	8	15	21	7
15	8	10	19	7
16	2	5	3	0

Seed source; National Animal Production and Research Institute, Zaria, Nigeria.

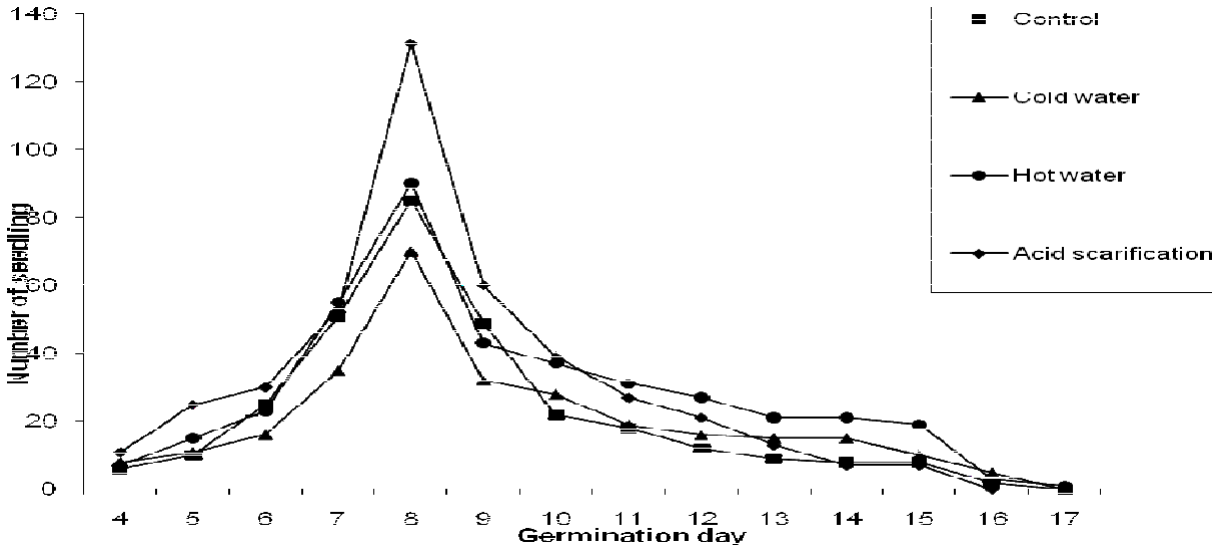

Figure 1. Mean seedling emergence per day of Stylo for cold water, hot water and acid scarification.

raised to its peak for every treatment (Figure 1). Of all treatments acid scarification had the highest emergence although no significant differences were found (Figure 1).

Emergence of seedlings from the hot water treatment continued increase still after the 10th day of sowing (Figure 1) while it ceased in the control on the 16th day and the remaining treatments thereafter.

Dry matter yield

The dry-mater yield obtained was 308kgDM/ha (Table 2). The species is found to adapt well to this ecological zone with high herbage production. The species was evaluated and recommended based on ease of establishment, high dry matter yield, nutritive value, persistence, good seed yield and their suitability for consumption as silage or hay (Agishi, 1979). It is a good supplement where the native forage species are mainly annual grasses such as those in Sambisa Game Reserve.

The dry-matter yield of (308 kg/ha) is low because no fertilizer was applied and growth is based on natural conditions. Cameron (1987) attained a yield of 950 kg/ha when fertilized with super phosphate in Queens land, Australia, Agishi (1971) stated that a yield of 5 - 7 tons/ha of stylo can be attained in the Northern Guinea Savannah

Table 2. Sample fresh and dry weight (gm/0.25 m^2) of herbage yield.

Quadrat number	Fresh weight (g)	Dry weight (g)
1	25	15
2	36	15
3	45	19
4	39	15
5	39	15
Sub-total	182	77
Mean	36.4	15.4

Over all mean = 15.4gm/0.25m^2. Yield (kg DM/ha) = 308.

Table 3. Chemical composition in percentage.

Dry matter	Moisture content	Crude protein	EE or Fat	Crude fibre	Ash
93.0	7.0	5.95	3.0	38.0	5.0

of Nigeria.

Chemical composition

The chemical composition of stylo was 93% dry-matter (DM); crude protein (CP), 5.95%, ether extract or fat (EE), 3.0%; crude fiber (CF), 38.0% and ash 5.0% (Table 3.)

The herbage was clipped at maximum growth stage i.e. at flowering. The dry matter of 93.0% showed that the forage was of high bulk and protein content (5.95%). This forage pasture plant as analyzed in Congo contains 18.1% crude protein, fat or ether extract of 2.1% compared to 3.0% obtained at this ecological zone (Jingura et al .,2001).

Percentage ash of 5.0% as compared to 8.3% obtained in Congo is appreciable (Jingura et al., 2001).

CONCLUSION AND RECOMMENDATIONS

This study provides a base-line of introducing a perennial pasture (stylo) of high nutritive value, yield and uniform germination when subjected to certain pre germination treatments in the savanna ecological zone. The viability of the seeds was confirmed to be between 65.70% which was obtained on germination on the field. Though the rainfall was erratic the mean germination using the various pre-germination treatments was high. The success of wildlife conservation is ensuring quality and quantity forage to the game and which stylo is a good source of perennial herbage which can be of good supplement as the dominant forage in the reserve are annual grasses. With dry matter yield of 308 kg/ha compared to 637 DM kg/ha on equally unfertilized natural pasture in Queensland, (Cameron, 1987); tendencies of improved yield can be obtained especially when phosphate fertilizer is applied.

Vigilance by protection staff in the reserve should be intensified as the small game herbivores always visit the site while grazing, thus, they will serve as prey to poachers. Un-prescribed burning should also be avoided as the seeds produced could be disseminated across the reserve.

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