The Production and Management of Grass/Legume Mixtures at Agege

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INTRODUCTION

THE management of a good pasture for livestock feed implies the maintenance of a well balanced grass/legume mixture which is high-yielding and palatable. Some tropical pasture grasses are more productive than others, depending upon the frequency of clipping or grazing, height of cutting and the associate legume. Despite the wide use of these grasses, there is very little information on their response to frequency of cutting. The work reported here aims at providing information on how best the various grass/legume mixtures under test can be managed.

The beneficial effects of grass/legume mixtures in terms of animal performance under conditions similar to Nigerian conditions have been reported by many workers. Current work at Serere in Uganda (Horrell, 1965) showed that a mixture of *Chloris gayana* and *Stylosanthes gracilis* gave twice the yield of pure grass. In another experiment by the same author it was shown that stylo tended to delay the decline in yield with age. Rivera-Brenes, Marchan, and Cabrera, (1952) observed that planting a legume in association with grass not only increased both the yield and the protein content of the grass, but also rendered both far more uniform.

The importance of frequency of cutting on the yield of herbage has also received some attention. Burger, Jackobs and Hittle (1962) reported that yields of the various grass/legume mixtures tested, were greater at the hay than at the silage frequencies of cutting. Brougham (1959) has shown that under New Zealand conditions the annual herbage production of a mixture of short rotation rye-grass/white clover was higher under long spelling than under frequent cutting. Oyenuga (1960) reported that green fodder production per day within a year increased directly with the length of cutting intervals from 20 tons per acre when cut at three weekly interval to 28 tons per acre at twelve weekly interval.

MATERIALS AND METHODS

The following eight grass/legume mixtures which had proved, among others, to be highly productive and adapted to soil and climate at Moor Plantation, Ibadan, (Adegbola, 1964) were established at Agege Agronomy Farm in 1962, viz:-

1. *Pennisetum purpureum* (Elephant grass) + *Centrosema pubescens* (Centro)
2. *P. purpureum* + *Pueraria phaseoloides* (Puero or tropical kadzu)
3. *Panicum maximum* (Guinea grass) + *Centrosema pubescens*
4. *P. maximum* + *Stylosanthes gracilis* (Stylo or tropical lucerne)
5. *Andropogon gayanus* (Northern gamba grass) + *Centrosema pubescens*
6. *A. gayanus* + *Stylosanthes gracilis*
7. *Melinis minutiflora* (molasses grass) + *Stylosanthes gracilis*
8. *Cynodon plectostachyum*[1] (giant star grass) + *Centrosema pubescens*

The grasses were established from cuttings planted at 3 feet spacing within and between rows except for *A. gayanus* whose seeds were drilled on 3 feet rows. The seeds of the three legumes were drilled within and between rows of the grasses. The above main treatments were replicated five times. Each main plot of 30' x 20' was split into three sub-plots of 10' x 20' and the cutting intervals of six weeks, eight weeks and twelve weeks respectively were randomised within each main plot. Four weeks after establishment, all plots were mowed down once to permit uniform regrowth. Due to the differences in growth habits of the grass species, cutting heights were as follows:

Mixtures with the bunch type grasses i.e. *P. purpureum*, *P. maximum* and *A. gayanus* were cut at 12 inches, while those with the sod formers i.e. *M. minutiflora* and *C. plectostachyum* were cut at 6 inches.

RESULTS

Herbage yields were generally higher in the first year for most of the mixtures than in the second year of growth. Mixtures with Northern gamba grass gave higher dry matter yields than any other mixtures throughout the experimental period at the three intervals of cutting (Table 1). The superiority of the Northern gamba grass/legume mixtures was more marked in the

1 Preliminary observation on the Cynodon spp. in Nigeria by Dr. B. N. Okigbo, University of Nigeria, Nsukka indicated that this species may be *C. dactylon* (L) Pers (Giant type) and not *C. plectostachyum* (Pilger). (See page 72)

Table 1. Seasonal mean yield of grass/legume mixtures in cwt/acre at different intervals of cutting

Type of mixture	1962 *Season*			1963 *Season*		
Interval of cutting	6 *weeks*	8 *weeks*	12 *weeks*	6 *weeks*	8 *weeks*	12 *weeks*
Elephant grass + centro	50.0	40.3	46.7	30.0	34.9	44.7
Elephant grass + puero	38.6	49.8	54.5	29.9	45.1	67.6
Guinea grass + centro	18.3	12.6	10.8	38.2	48.4	43.3
Guinea grass + stylo	21.5	30.4	21.5	36.5	38.6	37.3
Gamba grass + centro	71.5	102.0	97.4	55.6	69.7	72.4
Gamba grass + stylo	89.0	92.4	102.0	68.2	68.6	77.4
Molasses grass + stylo	42.1	39.5	45.0	26.9	24.5	35.3
Giant star grass + centro	22.5	22.0	19.1	23.5	31.5	20.9

first season of growth. Differences between the mean yields at the different intervals of cutting were erratic in the first growth season. In the second season of growth however, resting the swards for twelve weeks before cutting out-yielded both the six and eight weeks cutting intervals for most mixtures.

At each interval of cutting, mixtures of Northern gamba grass and elephant grass with centro produced higher and highly significant dry matter yields than mixtures of giant star grass and guinea grass with centro for the first two harvests (Figures 1, 2 and 3). Thereafter yields of elephant grass/centro mixture fell to a very low level especially during the dry spell from September 1962 to March 1963. The mixture of Northern gamba grass with centro on the other hand remained

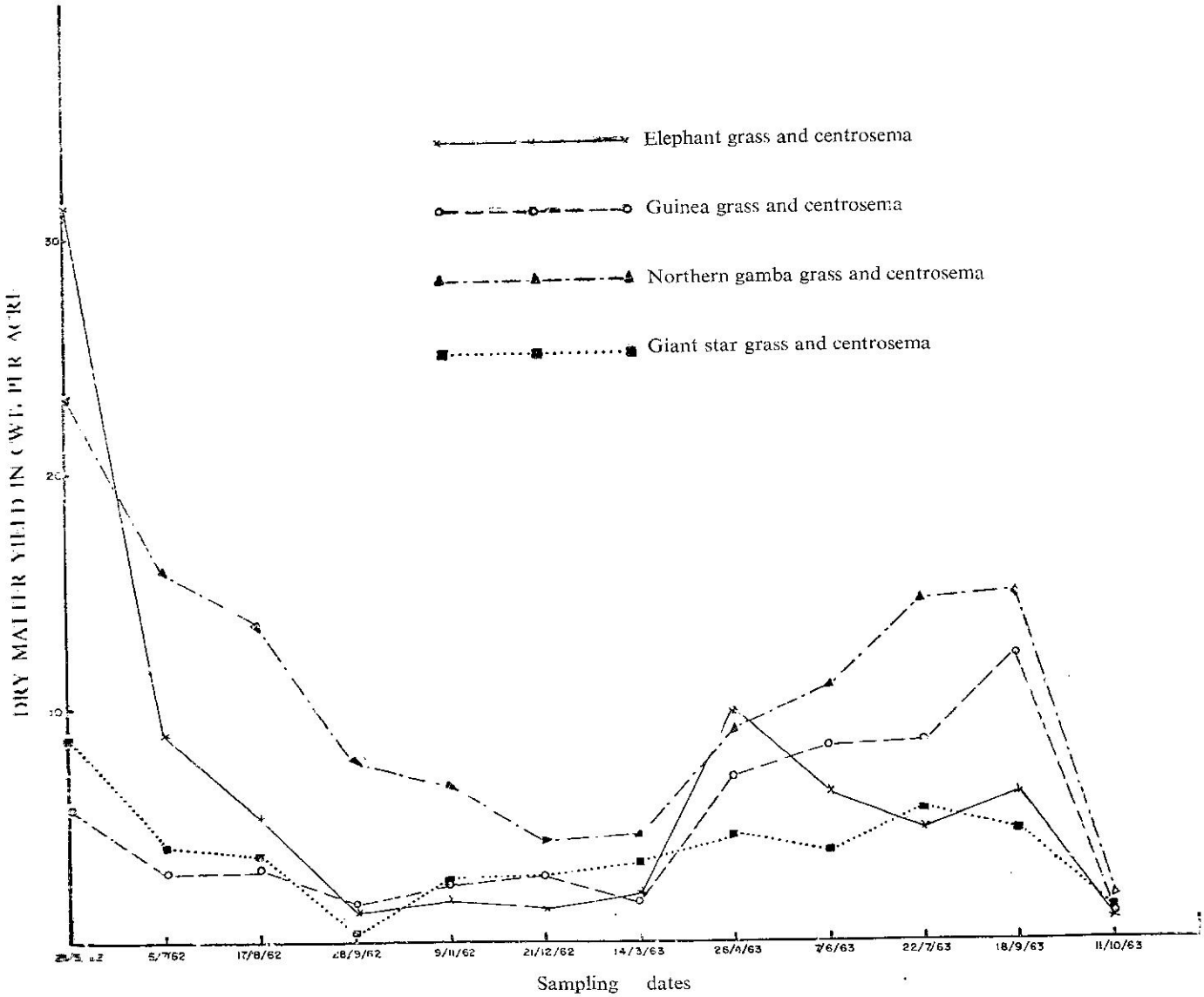

Fig. 1 Seasonal yields of grass/legume mixtures harvested at six weeks intervals at Agege

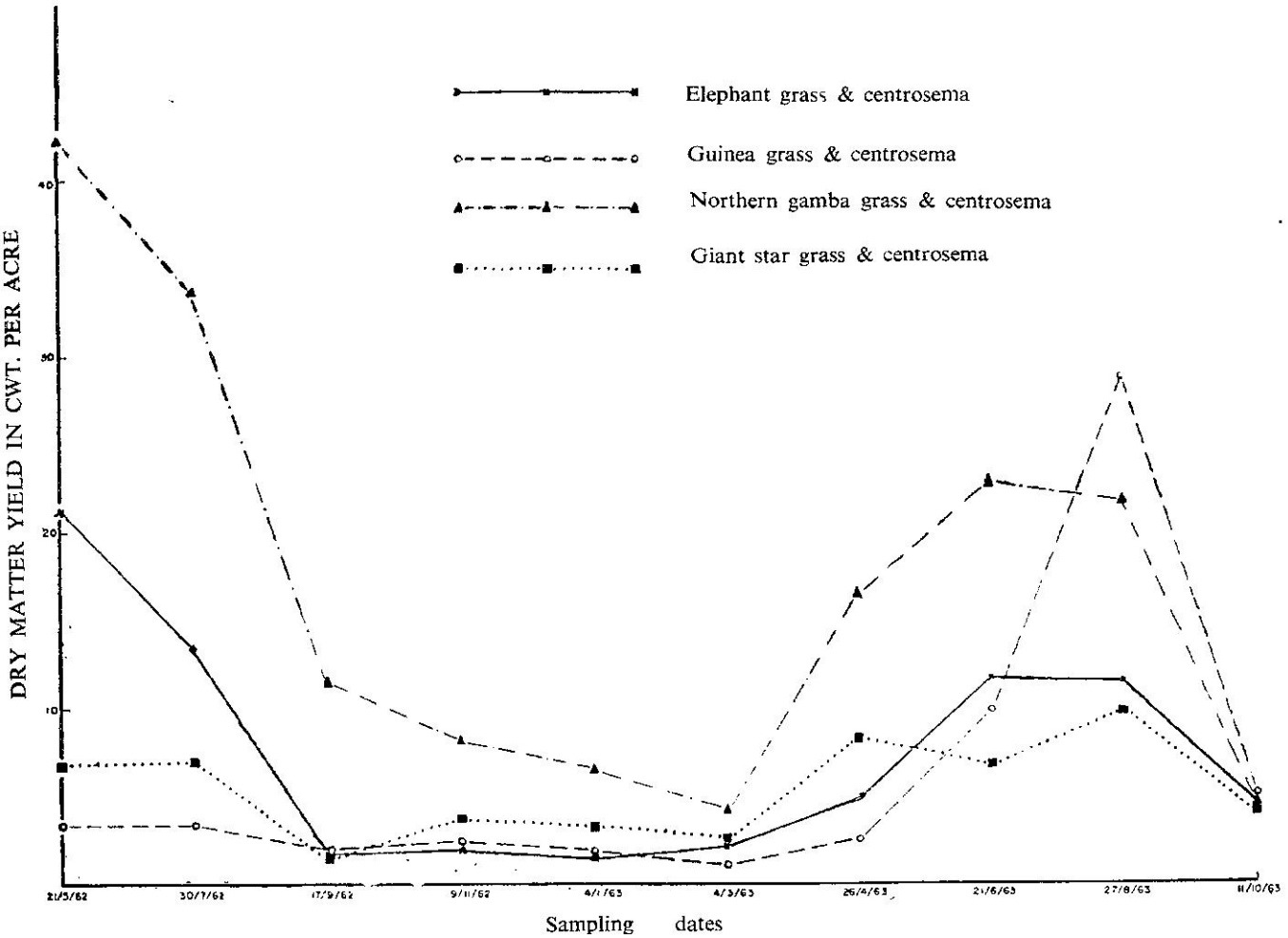

Fig. 2. Seasonal yields of grass/legume mixtures, harvested at eight weeks intervals at Agege

the most productive throughout the rest of the experiment. The swards clipped six weekly produced the lowest dry matter yield on the average, while dry matter production was highest for all mixtures under long spelling of twelve weeks (Figures 4, 5 and 6).

The most marked treatment effect on production was recorded under the twelve weeks cutting regime. Results show that there was a definite relationship between the growth habit of the grass species and the frequency of clippings. Three of the grasses — (gamba, elephant and guinea) characterised by an erect habit of growth were more productive than giant star grass — the only postrate growing species under long spelling during the rains (Figures 2 and 3). On the other hand, frequent clipping seems to favour giant star grass particularly in the dry season (Figure 1). This grass with its companion legume gave steady and higher yields than both elephant and guinea grass/legume mixtures during the dry months from September 1962 to March 1963.

Mixtures of guinea grass with centro whose yields were poorest among the erect species in the first year of growth, became more productive in the second year at all intervals of cutting (Figures 2 and 3). It was observed that yields of the various mixtures under study were more dependent on the grass species than on their companion legumes.

DISCUSSION

The result of this experiment shows that without the application of fertilizers, the yield of Northern gamba grass and centro mixture is superior to that of any of the other mixtures under study. This confirms an earlier finding by Hedrick (1961) that under conditions of low soil fertility, Northern gamba grass outyielded other erect growing grasses. It is probable that under the high rainfall condition of Agege, regrowth is faster in Northern gamba grass after each clipping than in any other grass.

In the first year of growth, herbage yields produced by most of the mixtures were higher than those produced in the second year except for the guinea grass mixtures. This is contrary to the results of a similar experiment on Moor Plantation (Adegbola, 1964). The lower yields

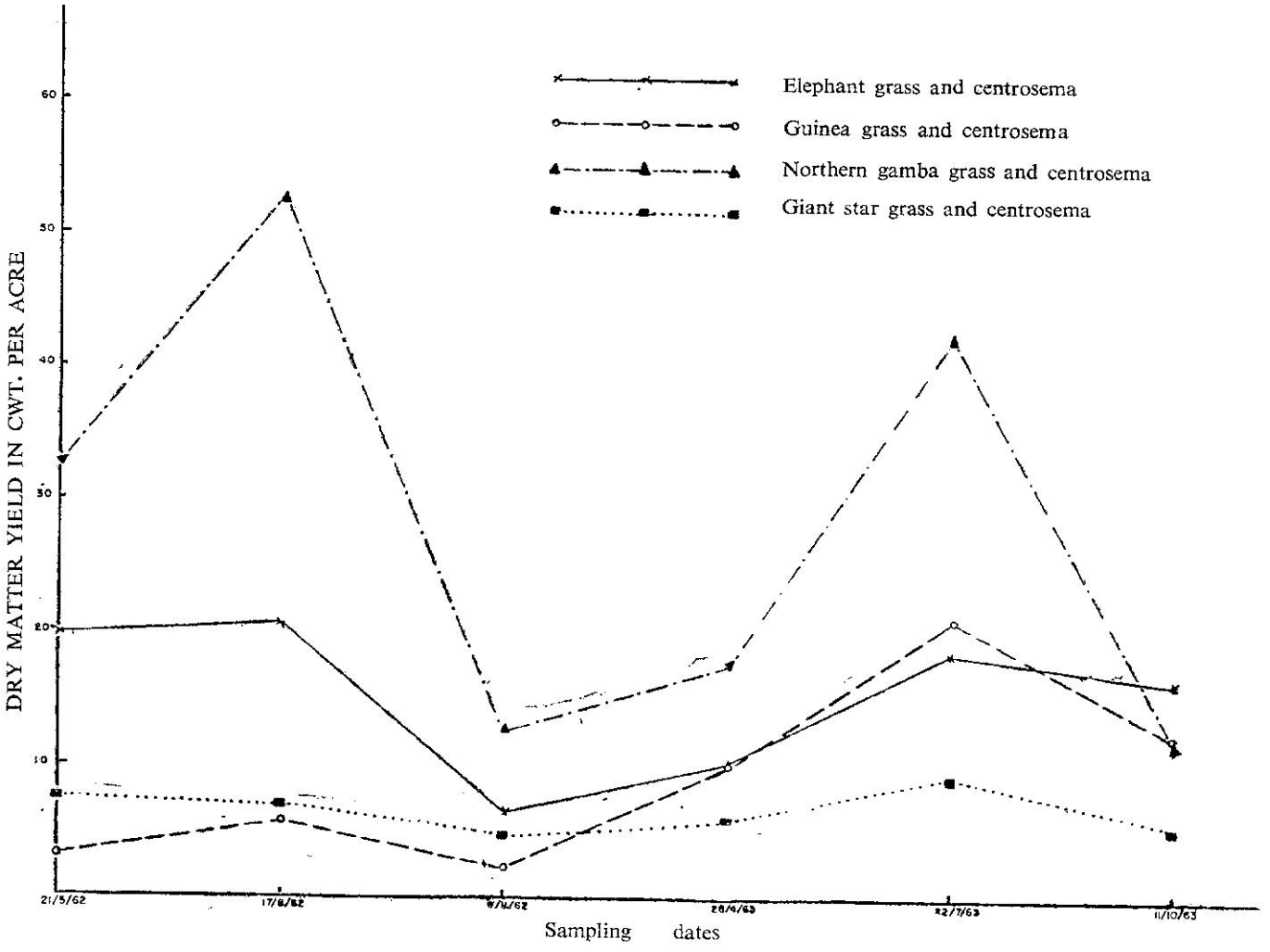

Fig. 3. Seasonal yields of grass/legume mixtures harvested at twelve weeks intervals at Agege

obtained in the second year in this experiment may possibly be due to the fact that the more aggressive grass species suppressed the growth of their companion legume whose beneficial effect was consequently lost to the grass. Hence yield declined with the age of the mixtures. The acid conditions of the soil at Agege may also have prevented effective nodulation in the legumes and resulted in little beneficial effects of legumes to grasses in these mixtures.

Herbage production at all intervals of cutting appears to follow a seasonal trend, depending on rainfall. Dry matter yields for all mixtures were high during the rains but later fell to low values in the dry season. This seems to suggest that lack of water is one of the limiting factors to production in the dry season. Yields of the erect grass species and their companion legumes were lower under frequent clipping particularly in the dry season than under long spelling (Figures 4 and 5). It would seem a better system of management in terms of dry matter yield if swards were rested for a long period during season of low production. A similar point had been made by Vicente-Chandler, Silva and Figarella (1962) in their experiment on the effect of nitrogen fertilizer and frequency of cutting on the yield and composition of three tropical grasses. They showed that variation in forage production could be reduced by either nitrogen application or by longer spelling during seasons of slow growth.

Figures 4, 5 and 6 show that dry matter yields were highest when the pasture was rested for twelve weeks and lowest at the six weeks interval of cutting. Oyenuga (1960) showed that the percentage dry matter of Nigerian fodder grasses is directly related, while that of the crude protein is inversely related to the length of cutting intervals from three to twelve weeks. Similar results have also been obtained by Vicente-Chandler, Silva and Figarella (1962) who showed that yields and lignin content increased while protein and mineral contents

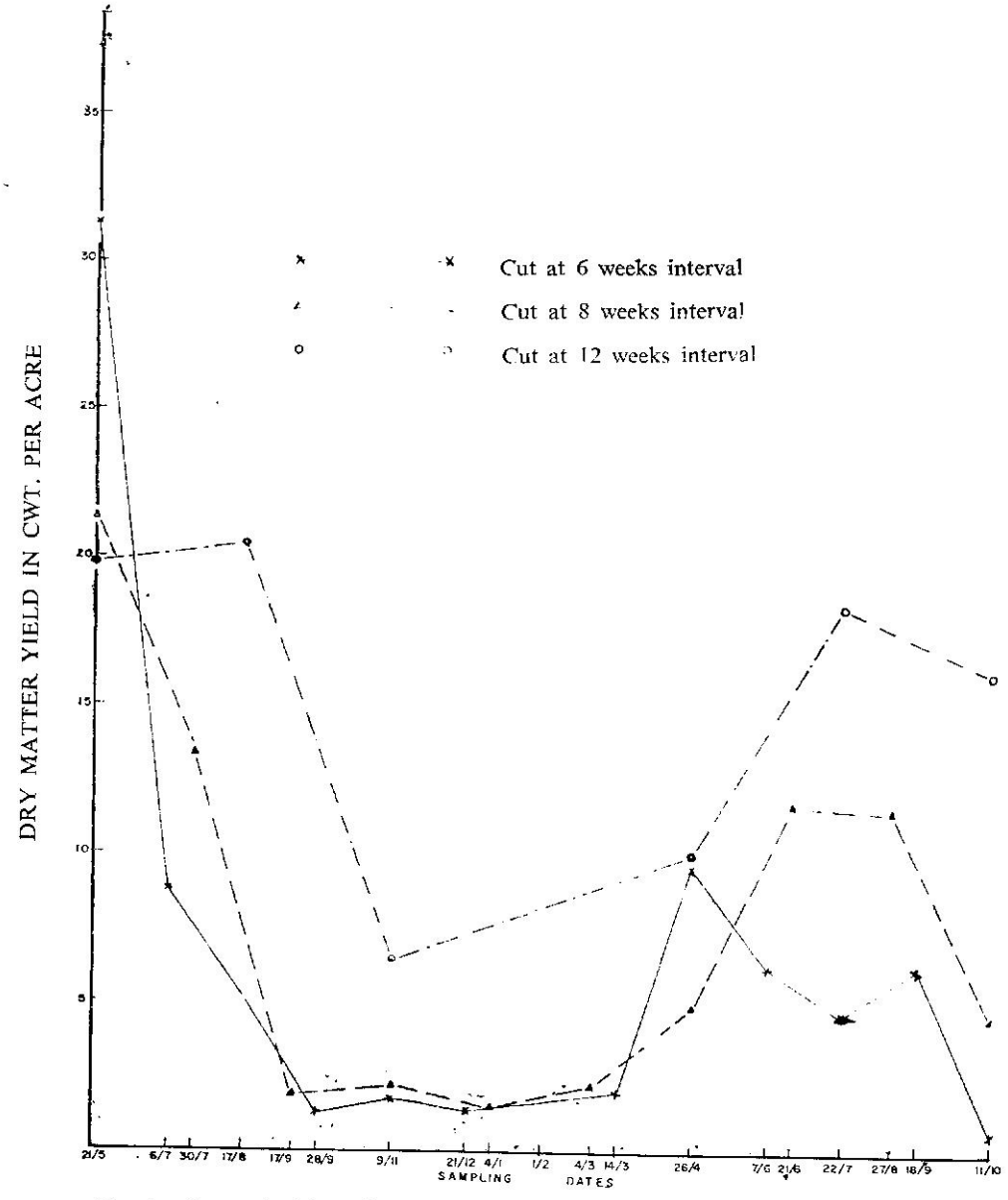

Fig. 4. Seasonal yields of elephant grass/centrosema at different cutting intervals

decreased with length of harvest intervals up to twelve weeks. It is probable that if such analysis were carried out in this experiment results would not have differed from those of the above authors. In which case, the low yield obtained at six weeks cutting intervals would be compensated for by a higher nutritive value to the stock.

Mixtures of Northern gamba grass with centro and stylo should be further investigated as a source of dry matter for livestock feed particularly during the dry season. The high production of this mixture during the rainy season also makes mixtures with Northern gamba grass suitable for all season grazings.

SUMMARY

The production of various tropical grass/legume mixtures under three cutting intervals at Agege was studied during the growing season of 1962 and 1963. The grass/legume mixtures were cut at six, eight and twelve weeks respectively. It was shown that Northern gamba grass/legume mixtures outyielded all other mixtures in each season. The yield differences which exist between the gamba and elephant grass/legume mixture and those of giant star and guinea grass/legume mixtures reached statistical significance at 1 percent level for the first two harvests at each interval. Thereafter, yields of the elephant grass/legume mixture fell to low values. Dry matter yields of all mixtures increased with increasing interval of cutting. Yields of all mixtures tend to follow a seasonal pattern depending on the rainfall. Higher yields were recorded in the rainy season.

Mixtures of Northern gamba and the companion legumes remained the most productive throughout the

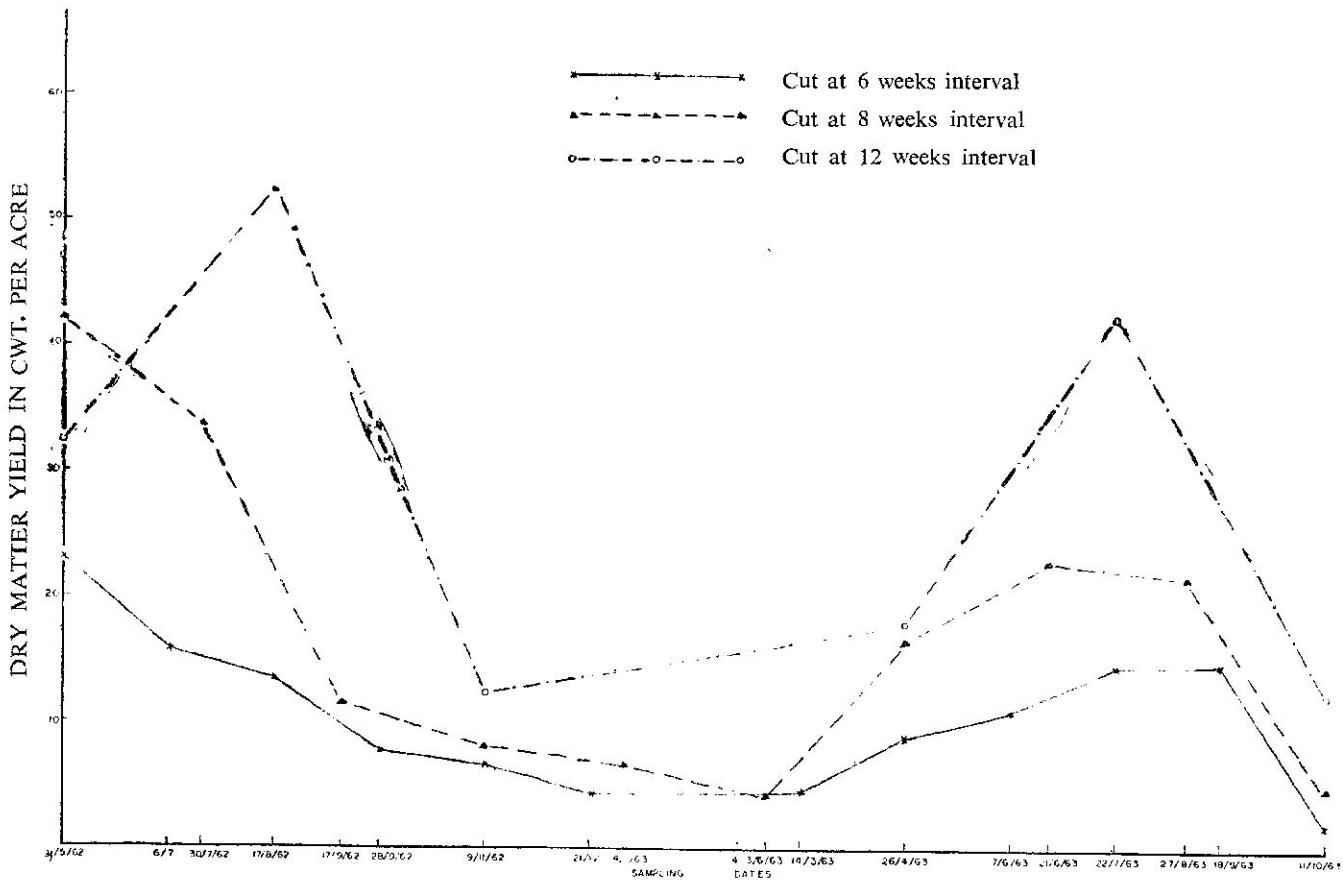

Fig. 5. Seasonal yields of Northern Gamba Grass/Centrosema at different cutting intervals

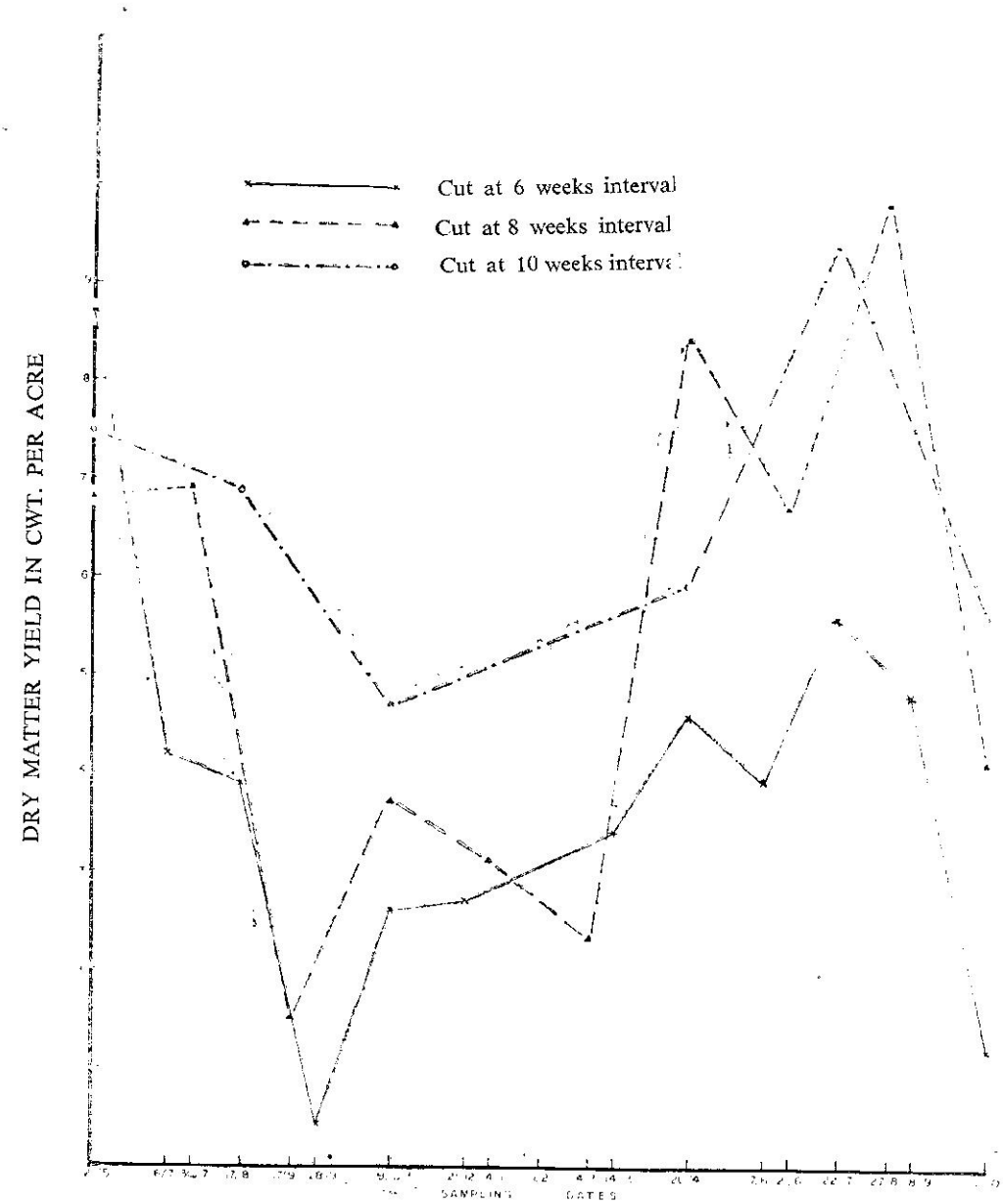

Fig 6 Seasonal yields of giant star grass/centrosema at different cutting intervals

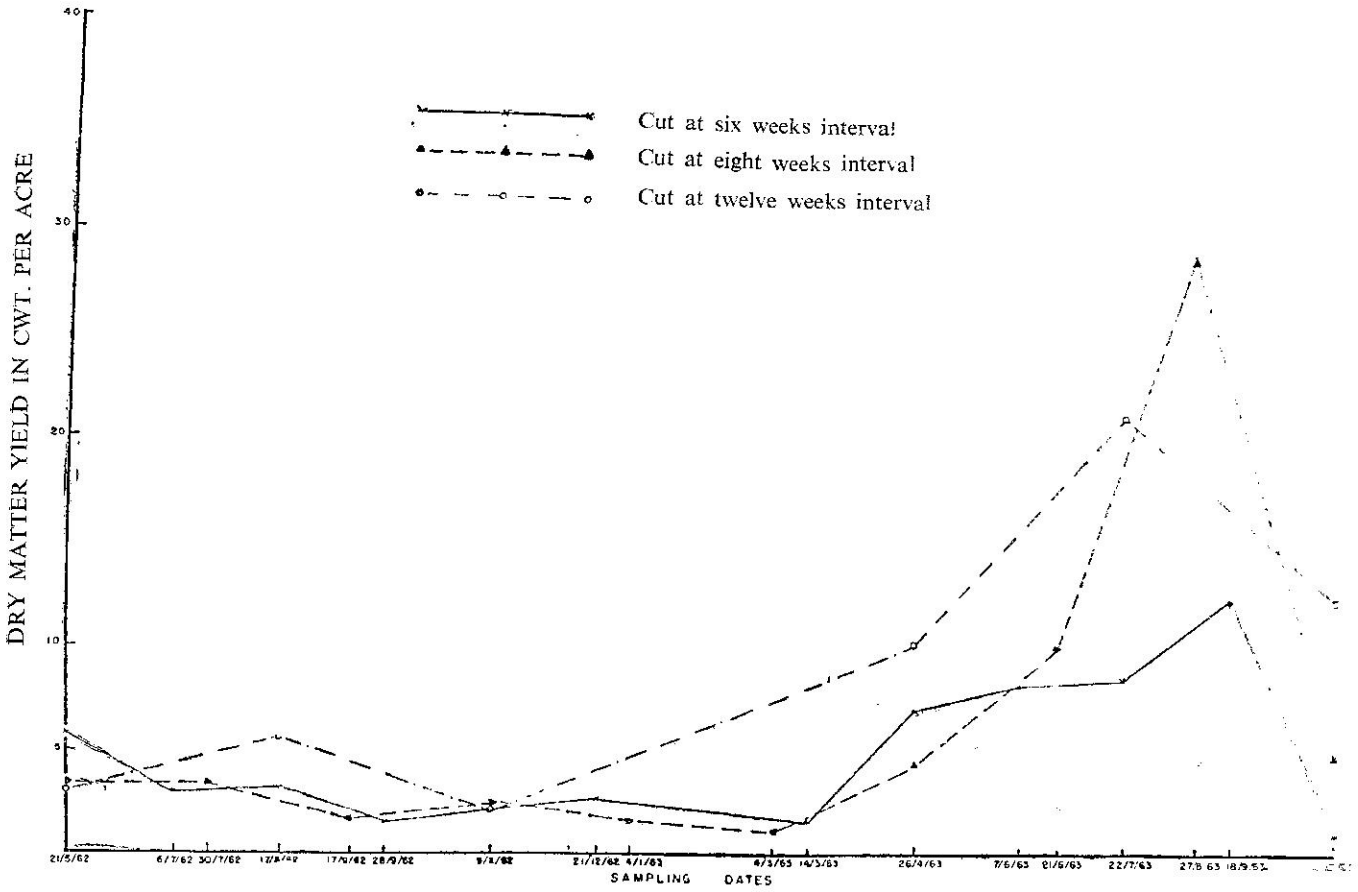

Fig. 7. Seasonal yields of Guinea Grass/Centroma at different cutting intervals

experiment especially under the 12 weeks cutting interval. It is suggested that this mixture be further investigated for use as a source of dry season feed.

ACKNOWLEDGEMENT

The authors are grateful to the Chief Agricultural Research Officer, Ministry of Agriculture and Natural Resources for allowing the publication of this paper. They are also indebted to the staff of the Pasture Agronomy Section without whose assistance the work would not have been carried out.

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