PRELIMINARY GRAZING TRIALS WITH *STYLOSANTHES GUIANENSIS*-GRASS MIXTURES

By J. L. SCHOFIELD, B.Sc. (Manc.), Agrostologist, Agriculture Branch, Division of Plant Industry.*

SUMMARY.

Grazing trials with Stylosanthes guianensis in admixture with various grasses showed that the legume persisted satisfactorily in association with Para grass and with Kikuyu grass, but was suppressed by various other grasses.

INTRODUCTION.

The initial trials with a number of legumes at the Bureau of Tropical Agriculture in coastal northern Queensland were described in a previous paper (Schofield, 1941). These trials showed that the following tropical exotic perennial legumes were worthy of further study for pasture purposes: *Calopogonium mucunoides* (calopo), *Centrosema pubescens* (centro), *Pueraria phaseoloides* (puero) and *Stylosanthes guianensis* (stylo). Grazing trials with each of these legumes, alone and in combination with one another, were subsequently conducted, and a further grazing trial was carried out with stylo in association with each of eight perennial grasses. The purpose of the last-named experiment was to obtain information on the effect of the grazing animal and of its manurial residues on stylo in combination with a grass. The grasses employed were *Brachiaria decumbens* Stapf, *B. brizantha* Stapf, *B. purpurascens* Raddi (Para grass), *Panicum maximum* var. *typica* (common Guinea grass), *P. maximum* var. *coloratum* C. T. White (purple-topped Guinea grass), *Pennisetum clandestinum* Hochst. (Kikuyu grass), *Melinis minutiflora* Beauv. (molasses grass), and *Paspalum dilatatum* Poir. (paspalum).

A description of the experimental area at the Bureau, including soil and climatic conditions, has appeared in a previous paper (Schofield, 1944).

TECHNIQUE.

Layout.

The layout was an 8 × 2 randomized block, with plots 40 feet by 10 feet. A pathway 6 feet wide separated the two blocks, and adjacent plots were divided by a pathway 4 feet wide.

Soil Preparation.

The experimental area had been under sugar cane for 15 years and when ploughed in October, 1939, a third ratoon crop had just been harvested. Lime was applied in early November to increase the pH of 4·6 (determinations made in June, 1940, gave a mean pH of 6·4), and a basal fertilizer dressing consisting of 1½ cwt. superphosphate, ½ cwt. bonedust, ¼ cwt. blood, ¼ cwt. sulphate of ammonia, and ¼ cwt. potassium sulphate per acre was harrowed in during December.

* Formerly Director, Bureau of Tropical Agriculture.

Seed Scarification.

Prior to planting, the seed of stylo was scarified by grinding with sand. Previous work with this legume had indicated that seed scarification is necessary to ensure uniform early germination. Table 1, which is prepared from the results of germination tests carried out in the Seed Testing Laboratory of the Department of Agriculture and Stock, indicates the improvement in germination effected by scarification of stylo seed.

Table 1.

SHOWING THE EFFECT OF SCARIFICATION ON THE GERMINATION OF SEED OF *Stylosanthes guianensis*.

Treatment.	Germination Temperature deg. C.	Germination Percentage.			Percentage of Hard Seed.
		2 Days.	6 Days.	13 Days.	
Natural	32	Nil	6	13	82
Hull covering removed by hand	32	17	31	33	52
Sandpapered	32	50	82	84	11
Natural	20	Nil	10	13	79
Sandpapered	20	Nil	27	41	40
Natural	20 (night); 32 (day)	4	14	20	68
Sandpapered	20 (night); 32 (day)	32	72	72	20

Planting.

The grasses were planted in mid-January in rows 2 feet apart, with the tillers (or seeds, in the case of molasses grass and paspalum) spaced 2 feet apart. Seed of stylo was sown in the inter-rows midway between the grasses. Satisfactory establishment was obtained in all plots, except that both molasses grass and paspalum had to be reseeded. Inter-row cultivation was carried out until the commencement of the wet season in order to control early weed growth.

Table 2.

SHOWING COMMENCING DATES OF THE 2-4-DAY GRAZING PERIODS AND RAINFALL BETWEEN GRAZINGS

Date.	Rainfall (Inches).
July 4, 1940	99·46
August 9, 1940	1·50
September 29, 1940	2·36
January 6, 1941	10·00
February, 10, 1941	28·83
March 5, 1941	21·01
March 26, 1941	16·08
June 4, 1941	72·12
July 30, 1941	2·38
October 14, 1941	2·64
November 20, 1941	6·19
December 31, 1941	2·79
February 16, 1942	13·61

Grazing.

The plots were first grazed on July 4, 1940, after a period of establishment of 5½ months. Thereafter, the period between grazings was determined by the growth of the herbage. Initially, an electric fence with movable wires was used and each plot was grazed separately. Later, however, the animals were allowed access to all plots: this enabled observations to be made on grazing preferences. Table 2 shows that grazing was carried out on 12 occasions after the initial stocking, the final period being in February, 1942. Notes on the development of each pasture species in the individual plots were made before and after grazing. The plots were heavily stocked, and following each grazing the dung on each plot was spread evenly. From time to time the plots were mowed after grazing to control the ungrazed coarse stemmy material.

Sampling.

Initially, a quadrat 3 feet × 1½ feet was used for sampling herbage and three random cuts were taken per plot. Later, a quadrat 1½ feet × 1½ feet was employed, and two random cuts were made per plot. The cut material was subjected to botanical analysis in the laboratory.

BOTANICAL COMPOSITION.

Botanical analyses of samples taken from six of the eight associations, and comprising five grazing periods, were carried out. The respective percentage contributions to total yield made by stylo are given in Table 3. The results can be considered merely as an indication of the general trend of fluctuation of stylo in each association under grazing, subject to the limitations imposed by restricted sampling from duplicate plots. Nevertheless, the differences between the various treatments became so pronounced during late 1941 and early 1942, and field observations amply confirmed the botanical analyses, that these data provide strong evidence of the ability of stylo to persist in association with two grasses—Para grass and Kikuyu grass; in such associations it is able to withstand heavy grazing and severe plant competition.

Table 3.

SHOWING THE PERCENTAGE CONTRIBUTION TO TOTAL YIELD BY STYLO AT FIVE GRAZING PERIODS.

Period of Growth before Grazing.	*Brachiaria decumbens.*	*Brachiaria brizantha.*	*Brachiaria purpurascens.*	*Panicum maximum* var. *typica.*	*Panicum maximum* var. *coloratum.*	*Pennisetum clandestinum.*
Jan. 20 to July 4, 1940 (Period of establishment)	57	57	42	39	67	24
July 6 to Aug. 9, 1940..	38	48	39	55	50	32
Aug. 2 to Oct. 14, 1941	5	8	43	13	38	50
Nov. 22 to Dec. 31, 1941	3	6	24	9	4	25
Jan. 3 to Feb. 16, 1942	1	6	42	5	11	41

Figures for the molasses grass and paspalum plots are not given because, as already stated, these grasses were late in establishment and no satisfactory comparison could be made on this account. However, the legume developed well, and at the end of the experiment there were numerous seedlings of stylo throughout the plots of these grasses.

The results given in Table 3 are of considerable interest for two reasons: (1) they indicate clearly one of the main limiting factors to the use of stylo in association with certain pasture components, namely the shade factor, and (2) satisfactory self-regeneration of stylo occurs when the associated species allows ample light to reach the legume and when management is such that heavy grazing is avoided during the flowering-seeding period.

FIELD OBSERVATIONS ON GRAZING.

Stylosanthes guianensis (Stylo).

During the early grazing periods of the experiment it was clearly demonstrated that stylo was not grazed by the stock, which had no previous experience with this legume. To accustom the animals to stylo they were placed on a small block of the pure legume for two days. During the first day practically no stylo was eaten but, gradually, the stock commenced to graze, and later took it readily. Once the animals had acquired a taste for stylo, no further serious difficulty was encountered, although there would appear to be a period—when the plant is producing new leaf—during which the foliage is relatively unpalatable. On June 5, 1941, stylo was readily grazed in all pots. During the period July 30-August 1 very little of the legume was taken, but on the two following days it was grazed well in all plots.

In October and November, stylo was not grazed readily and it is of interest to note that this corresponds to a period when new leaf was being developed. During January, 1942, stylo was lightly grazed. In February, it was grazed well in the following plots: Para grass, common Guinea grass, Kikuyu grass and molasses grass. Thus, as the season advanced the relative palatability of stylo would appear to improve progressively.

Stylo-Brachiaria decumbens.

Plate 1 illustrates the associated growth of stylo and *Brachiaria decumbens* prior to the first grazing in July, 1940. By comparison with the other grasses *B. decumbens* was never well grazed. The stock on no occasion grazed the stems but confined themselves to the flag, particularly the deep green flag. The best grazing occurred in February, 1942. The tangled mass of ungrazed stems on these plots necessitated frequent mowing after grazing to prevent the growth becoming too rank.

The dense growth habit of *B. decumbens* effectively cut off light from the associated legume and the stylo population diminished rapidly. The botanical analyses listed in Table 3 show that by February, 1942, only a few stylo plants remained.

Plate 1.

Stylo in association with *Brachiaria decumbens*.

Stylo-Brachiaria brizantha.

The grass was well grazed, occasionally down to as low as 3 inches above ground level. Small amounts of stalky material remained after grazing. This grass by reason of its growth habit inhibited the development of the associated stylo seedlings, but not so severely as *B. decumbens*.

Stylo-Brachiaria purpurascens.

The grass was heavily grazed throughout the period of the experiment. Its open decumbent habit allowed ample light to reach the associated legume. As a result, the stylo plants thrived, flowered and set seed freely, and later self-regeneration was general throughout the plots. The botanical analyses indicate that the legume persisted throughout the two years of the trial.

Stylo-Panicum maximum var. typica.

The grass was heavily grazed throughout, all leaf being taken, leaving stems approximately 1 foot in height. Two factors are responsible for the small number of stylo plants which survived in these plots. One has already been mentioned, namely the shade factor. The second resulted from the stooling habit of Guinea grass, which caused a considerable amount of trampling by grazing stock on the stylo plants situated between the stools.

Stylo-Panicum maximum var. coloratum.

This variety is very palatable and all available leaf was taken readily during every grazing period. Similar factors to those in the common Guinea

grass plots operated against the development of the associated stylo seedlings, except that purple-topped Guinea allowed more light to reach the legume, and as a result the stylo population was somewhat higher than with the previous grass.

Stylo-Pennisetum clandestinum.

Kikuyu grass was lightly grazed during March; heavily grazed in June and August; lightly grazed from October to early January; very well grazed down to 2 inches during February, 1942. The short habit of this grass allowed ample light to reach the associated legume, which developed well, and self-regeneration was general.

Stylo-Melinis minutiflora.

Molasses grass was grazed well throughout. After a period of two years numerous seedlings of stylo were present, particularly at the ends of the plots.

Stylo-Paspalum dilatatum.

Paspalum was grazed lightly. A large number of stylo seedlings was present in these plots at the end of the experiment.

DISCUSSION.

The main object of the trial was to observe the behaviour of stylo under grazing conditions in association with a number of grasses. It appears that the legume shows promise of persisting in association with only two of the grasses under trial, namely Para grass and Kikuyu grass. This observation excludes molasses grass and paspalum, concerning which more evidence is required before any conclusion can be reached.

The trial indicated that stylo can be grazed satisfactorily once stock have acquired a taste for it, and that it will withstand heavy grazing and trampling even after heavy and sustained rainfall. Its palatability appears to vary considerably with the stage of growth. Under grazing, stylo is succulent and grows fairly close to the ground. Refoliation after grazing is good.

Stylo seeds freely for approximately two to three months, and sparingly for a longer period, which varies according to seasonal conditions. Its aggressiveness and self-regenerative powers indicate that it is worthy of consideration for achieving a phase of legume dominance on some of the poorer types of frost-free country in coastal northern Queensland as a first step towards building up soil fertility.

ACKNOWLEDGEMENTS.

Assistance in making the botanical analyses and the field observations was rendered by Messrs. J. Hart and E. J. McDonald.

REFERENCES.

SCHOFIELD, J. L. 1941. Introduced legumes in North Queensland. Qld. Agric. J. LVI. (5): 378-88. Reprinted as Comm. from Bur. Trop. Agric. Grassland Series No. 1.

———. 1944. The effects of season and frequency of cutting on the productivity of various grasses under coastal conditions in northern Queensland. Qld. J. Agric. Sci. 1 (4): 1-58. Reprinted as Comm. from Bur. Trop. Agric. Grassland Series No. 2.