PRELIMINARY WORK ON PASTURE SPECIES AND BEEF PRODUCTION IN SARAWAK, MALAYSIA

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ABSTRACT

In preliminary work on pastures and fodders in Sarawak, Malaysia, Digitaria decumbens *has proved to be the most promising of the introduced species of forage grasses. In a grazing study with cattle, live weight gain was about 0.6 lb/head/day and about 420 lb/ac. Other promising species were* Brachiaria *spp,* Chloris gayana *and* Panicum maximum. Centrosema pubescens *has proved to be a satisfactory forage legume, not attacked by diseases or pests, but a number of other legumes show promise for specific soils.* Pennisitum purpureum *appears the most productive and palatable fodder grass in cutting experiments.*

INTRODUCTION

Sarawak (population 940,000), one of the States of the Federation of Malaysia, covers an area of 48,342 square miles in the north-west of the island of Borneo lying between 0° 50' and 5° north latitude and 109° 30' and 115° 40' longitude. The mean annual rainfall over most of the country is 120-160 inches with no marked dry season.

The 1960 census showed that 78% of the economically active members of the population were engaged in agriculture (Jones, 1962); animal husbandry, however, plays a negligible role in this activity. While pigs and poultry are widely owned in the rural areas they are left largely to fend for themselves and make little contribution either to the diet or the economy of the people (the achievement of self-sufficiency in pork and hen eggs in the last few years has been achieved through a relatively small number of largely semi-urban enterprises). The number of cattle was estimated to be 8,000 in 1968. Apart from a small number of stall-fed milk animals in the urban areas, most of these are found in small herds grazing poor natural pastures either on the marine sands or on the residual hill soils. No castration of scrub bulls is practised and many of the animals are semi-feral and there is a considerable amount of inbreeding. The animals are of indeterminate breed but are probably basically *Bos indicus*, related to the dwarf Zebu Kedah-kelantan with some admixture of *B. taurus*. Some local stock and animals on Departmental stations are predominantly Kedah-kelantan type upgraded by crossing with Sindhi. There are also small numbers of Bali cattle (*B. sundaicus*), which appear to thrive in the hilly areas of the interior.

None of the major epizootics occurs, but protozoal conditions, tick-borne infection and severe worm infestation in cattle (and buffaloes) are common.

The swamp buffalo (*Bubalus bubalis*) has been found in Borneo for centuries, (Cockrill, 1968) but the population is estimated (1968) to be only 5,000. Many are semi-feral but a number are used for timber haulage and for the cultivation of wet rice fields by trampling.

Work over the last few years on pastures and fodders has indicated that cattle could play a much larger role in the agriculture of Sarawak, and this paper describes the work done so far and suggests the lines along which further investigations could be followed.

While fodder grasses for zero grazing have a part to play under the various conditions in Sarawak, the major role in the near-future will be filled by grazed pasture.

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PASTURE SPECIES INVESTIGATIONS

Forage grasses

Pangola grass

Pangola grass (*Digitaria decumbens*) was first introduced into Sarawak in 1960 from Hong Kong and from Queensland. Initial observations were promising and by 1961 a half-acre plot of the Australian material demonstrated that Pangola was probably better than any other species then in use in the State. It was responsive to fertilizer and stood up well to heavy rotational grazing (if continually grazed it was soon colonized by natural grasses). Therefore, in 1963, an area of 13 acres of old secondary dipterocarp jungle was cleared, graded and planted with stem cuttings. Establishment was satisfactory and during 1964 the pasture was lightly grazed. In the first half of 1965 a patchiness appeared in which the plants were stunted, with a tendency to bushiness, short internodes and red colouration of the leaf blades. However, this was without curving or yellowing of the young leaves which was reported as symptomatic of a virus disease from Surinam (Johnston, 1964) and West Malaysia (Mohd, Jamil, 1966) and which had prevented the use of Pangola grass there. Since most Sarawak soils are deficient in phosphorus with a high level of P fixation due to high iron and aluminium levels, the application of rock phosphate relieved this condition.

Grazing experiment

In June, 1965, eight acres of the area was taken for a rotational grazing trial of four paddocks. Each paddock was grazed for 15 days and rested for 45. In the first six months of the trial some poorly drained areas were colonized by *Ischaemum aristatum, Fimbristylis* spp., *Axonopus compressus* and other natural species but they were controlled by spot spraying of paraquat; where areas of several square yards were affected they were replanted with Pangola grass. After grazing, coarse clumps of herbage were slashed, weeds sprayed and the area then fertilized.

Initially the trial was fertilized with 448 lb per acre per year of a mixture of urea, double superphosphate and muriate of potash being 5.8% N : 14.2% P : 3.1% K. In June, 1966, this was altered to 9.9% N : 12.5% P : 3.6% K. There was an immediate response to the additional nitrogen and further increases in growth were achieved when the formulation was again changed in October, 1967, to 20.9% N : 8.0% P : 4.5% K, i.e. 94 lb N/ac/annum. Current work has indicated that applications of up to 200 lb N per acre are beneficial. With the high rainfall and temperatures experienced in Sarawak it is possible that rates of application approaching the 300-500 lb/N/ac reported from Queensland (Henzell, 1968) would result in further increases in yield; however, the economics of such a practice under Sarawak conditions and also the extent to which legumes could be used in pastures need careful assessment.

Since a uniform herd of young bullocks was not available for the trial the area was grazed by a mixed herd with periodic changes of composition. Only an indication of animal production was therefore obtained: for this purpose the term "adult equivalent" (AE) is defined as a body weight of 600 lb: no correction was made for differences in intake due to animal size (Milford and Minson, 1966). At the start of the trial in June, 1965 the stocking rate was 1.25 AE per acre, in October of the same year it was increased to 1.5 AE, in April, 1966 to 1.75 and in June, 1967 to 2.0 AE. Animals were weighed off pasture. From records kept over two periods totalling 153 days in 1966 and six periods totalling 210 days in 1967 it was estimated that liveweight gain in 1966 and 1967 was 0.65 lb/ AE/day; liveweight gain per acre was 415 and 429 lb in 1966 and 1967 respectively.

The health of the animals was excellent except for an attack of ephemeral fever in November and December, 1965.

Of the other introduced pasture grasses considered potentially useful *Brachiaria brizantha* is one of the best. Under conditions of good soil fertility it has vigorous growth which is effective in weed control. It is very acceptable to stock, regenerates well and appears to be capable of good and prolonged production. A large-scale trial on the species is being planted on red-yellow podsolic soils at Semongok. *B. decumbens* has been introduced from Australia and also shows promise. *B. mutica* (Para grass) is commonly found growing in poorly drained areas. It is quick to establish from cuttings but dies out under concentrated grazing. It might be suited to the more poorly drained buffalo grazing areas if carefully stocked. *B. ruziziensis* was introduced from Australia in 1968 and, despite poor germination, has grown well and work on the species will continue.

Chloris gayana (Rhodes grass) was introduced from Australia in 1964. It grows vigorously when sown in a wet month and heavily fertilized: larger-scale trials on it are considered justified.

Panicum maximum (hamil or Guinea grass, including cv. Gatton [Gatton panic]) and the variety *trichoglume* (green panic) have been tested and show considerable promise. Because of its vigour and the ease of propagation by seed further work with hamil grass is justified.

Not yet sufficiently assessed, but considered potentially useful species, are *Paspalum dilatatum, P. notatum* and *Setaria sphacelata.*

Of the species found to be of little potential value, at least on the heavy soils of the Tarat site, are *Melinis minutiflora* (molasses grass) which is very sensitive to grazing, and *Cenchrus ciliaris* (buffel grass), which seems suited only to free draining alluvial or sandy soils.

Naturalized or native grasses are generally slow to recover from grazing and not as responsive to fertilizer. These include *Axonopus compressus* (carpet grass) which was introduced from the Federated Malay States in 1925 (Bean, 1928), and now naturalized in maintained open sites in urban areas. *Paspalum conjugatum,* the most common naturally occurring grass in Sarawak on residual and alluvial soils, is very unpalatable (Ashby, 1941 and Verboom, 1968). *Ischaemum aristatum* and *I. rugosum* are both native but of poor agronomic value. Furthermore, an endemic disease *Sporosporium flagellatum* attacks *I. aristatum* and could well limit the usefulness of this genus in Sarawak.

Forage legumes

No formal trials have been carried out on the use of legumes in pastures in Sarawak but this work is necessary to help overcome the severe nitrogen deficiency of the soils and increase the protein content of the pasture.

The twining or creeping legumes *Centrosema pubescens, Calapogonium mucunoides* and *Pueraria phaseoloides* have been widely used as cover crops in young rubber areas. Established from seed they grow vigorously and are essentially free from pests and diseases. Small-scale observations have indicated that centro combines well with Pangola.

Other twining legumes recently introduced from Australia included *Desmodium intortum, D. uncinatum, Glycine javanica* and *Phaseolus atropurpureus* cv. Siratro. All except *D. uncinatum* proved very susceptible to leaf rot (*Corticium solani*); however this species was severely attacked by chrysomelid beetle (*Phaedonia inclusa*).

Of two native Desmodiums, *D. heterophyllum* (Merrill, 1922) has been used as a cover crop in pepper but its yield is poor, while *D. capitatum* is commonly found in the alluvial clay areas of natural buffalo grazing land. The former species warrants further investigation but the latter is unproductive and unpalatable.

A number of shrub legumes including *Cajanus indicus, Indigofera teysmannii* and *Leucaena leucocephala* grow well and seed freely; however, they are not well suited to the wet tropical climate of Sarawak.

As suggested by its success on the poor sandy soils of West Malaysia, *Stylosanthes guyanensis* (stylo could be a suitable species for the marine sands of Sarawak. However, initial observations on the performance of fine-stem stylo and Schofield stylo have been disappointing while establishment and regeneration of *S. humilis* (Townsville stylo) has been good.

Vigna hosei occurs naturally at Semongok and can be maintained with grass in a pasture. The introduced *V. marina* also appears promising. The annuals *Dolichos lablab* and *Phaseolus lathyroides* also established and grew well but their usefulness was considered limited by their annual habit.

Fodder grasses

The three fodder grasses *Penniselum purpureum* (Napier grass), *Tripsacum laxum* (Guatemala grass) and *Panicum maximum* (Guinea grass) were tested for adaptation and productivity in a factorial experiment involving plant and row spacing, and cutting stage. The area was fertilized quarterly at the rate of 1344 lb mixed fertilizer/acre/annum containing 12.0% N as sulphate of ammonia, 4.6% P as Christmas Island rock phosphate, 7.1% K as muriate of potash. As shown in Table 1 Napier grass gave the highest yield of dry matter and protein per acre; medium and late cutting produced higher yields than early cutting. Row spacing had little effect so the data have been pooled.

TABLE 1

Fodder grass species and spacing experiment. Yields of Dry Matter in lb per acre per year (With percentage nitrogen in parentheses).

Species / Cutting stage	Early	Medium	Late	Mean
Napier	24,065 (1.80)	28,042 (1.49)	26,796 (0.93)	26,301 (1.41)
Guatemala	16,500 (1.54)	19,627 (1.74)	27,679 (1.35)	21,269 (1.54)
Guinea	14,446 (2.60)	16,508 (2.61)	19,404 (2.29)	16,786 (2.50)
Mean	18,337 (1.98)	21,392 (1.95)	24,626 (1.52)	

Napier grass proved to be palatable to stock when chaffed. It is the most promising of the three species and further work has been started on it to ascertain the optimum fertilizer application.

In an observation trial on stall feeding of Guatemala grass it was found that the cattle would consume approximately 70 lb of fresh fodder per AE per day; that the cutting of fodder for a herd of 10 AE took 8 man-hours per day and that under the conditions of the trial an acre of Guatemala grass would supply sufficient fodder for 2.66 AE (an acre of Napier grass would have been sufficient for at least 3 AE). Yields of fodder are affected by rainfall and when estimating acreages of fodder grass required allowance must be made for lower yields in the drier part of the year from May to September.

DISCUSSION

Much more detailed work needs to be done before firm recommendations can be made for economic development of sown pastures and fodders: this includes the further screening of species, the determination of optimum levels of fertilizer application and seasonal variations in the yields of dry matter and protein. Sufficient information is now available to show that further investigation is warranted.

The cost and difficulty of establishment are the major problems in the expansion of pasture work on the red-yellow podsolics (hill soils). With the use of vegetative methods of propagation the cost of planting is likely to remain high, if not prohibitive, if hand planting is to be practised; some satisfactory method of

harrowing or discing in broadcast material must be found. The correct fertilizer application must also be ascertained so that maximum weed control is achieved through the dominance of the improved species with the minimum use of herbicides and hand-weeding.

A few cattle are now to be found grazing the poor natural pastures on the marine sands. In general, these soils are superior to the *bris* soils of West Malaysia; it is therefore reasonable to assume that stylo would do well on them if properly looked after and fertilized. It is suggested that such areas could be best exploited by planting coconuts and grazing stylo or some other species under them.

Fodder grasses could play a useful role. They will be valuable as a supplement on the residual soils and essential for the urban milk producer. They might also be of value on the peat soils where they have done well in West Malaysia. They could then be zero grazed for either cattle or goats and the manure produced used in the improvement of these soils (Coulter, 1957). Evidence points to Napier grass being the highest yielding of the readily available species of fodder grasses. It has been reported (West, 1957) that this species has given a steady yield in excess of 100 tons of fresh material per acre per annum in Singapore. Work on fodder should for the present be concentrated on Napier grass.

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