Kazungula setaria. These pastures have persisted well with little or no weed ingress and have carried one beast per hectare yearlong. However, no high key pastures have been sown in the last four years and the pasture improvement program has concentrated on sowing Siratro into native grassland.

FIELD MEETING AT TEDLANDS, MACKAY DISTRICT, NOVEMBER, 25, 1977

DEVELOPMENT AND MANAGEMENT OF IMPROVED PASTURES ON COASTAL DUPLEX SOLODIC SOILS

A field day organized by the Central Queensland Branch of the Tropical Grasslands Society was held on November 25, 1977 at "Tedlands", a property 65 km south of Mackay with an annual rainfall of 1500 mm. The theme of the field day was "Development and management of improved pastures on coastal duplex solodic soils". The first presentation outlined the pasture development that had taken place on "Tedlands" and following this the results of a grazing experiment carried out on the property were described. Different approaches to renovation of run-down Siratro pastures were then considered.

LAND DEVELOPMENT AND PASTURE IMPROVEMENT AT TEDLANDS, KOUMALA

P. C. DAVIDSON

Australian Agricultural Consulting and Management Company Pty. Ltd., Tamworth, New South Wales.

History

"Tedlands" was purchased by the present owners in 1968 and at that time the total area was about 5,700 ha.

Land development commenced in August, 1968 and by the end of that year, 600 ha had been cleared, cultivated and sown down to perennial grass-legume pasture. Currently the areas of improved pastures on "Tedlands" are:

1 900 ha—perennial grass-legume
100 ha—perennial grass
1 200 ha—annual Townsville stylo.

The cattle enterprise incorporates both breeding and fattening and is based on a Brahman infused herd with on average of more than 50% *Bos indicus* blood.

Land development

Perennial grass—legume pasture

Land clearing took place as soon as possible after the end of the wet season. This was followed by the first cultivation with a disc plough, the aim being to complete this initial working while soil moisture was sufficient to allow a cultivation depth of 12 to 15 cm.

A second ploughing was commenced after the onset of storm rains, preferably during late October early November. Seeding followed immediately after this second ploughing and both operations were carried out simultaneously so that the seeding of any one area was never more than four days after the final ploughing. Culti-packer rollers were used to consolidate the seed-bed immediately after planting.

Points worthy of note are as follows:

(a) Two cultivations with a disc plough eliminated all timber regrowth problems
(b) The second ploughing produced a satisfactory seed bed provided sowing took place immediately after cultivation. Where large areas were being developed, three operations, namely ploughing, sowing and rolling had to be carried on simultaneously. Alternatively, with limited equipment, the three operations would have to be completed on relatively small areas before commencing the cultivation of the next area.
(c) Fertilizer was placed under the ground, but seed was placed directly on the soil surface and covered by light harrows.
(d) It was considered essential to complete clearing, cultivation and sowing in the same year to avoid the problem of weed invasion on disturbed soil.

Perennial grass pasture

Exactly the same clearing, cultivation and seeding techniques applicable to grass-legume pasture establishment, was used for *Brachiaria decumbens*. In the case of pangola, grass establishment, clearing and cultivation were the same, but instead of applying seed, runners were disced into moist soil.

Townsville stylo pasture

Tordon was used to kill timber on most of the area established. Dense patches of wattle saplings were cleared and raked but there was no seed bed preparation. The seed-superphosphate mixture was applied from the air.

Fertilizer

Fertilizer was applied at the following rates:

	Superphosphate (kg ha^{-1})				
Year	1	2	3	4	5
Grass-legume	500	250	250	250	125
Townsville stylo	250	—	125	—	125

Mo superphosphate was used every fourth year and pangola and *Brachiaria* pastures received the equivalent of 250 kg superphosphate and 375 kg urea ha^{-1} each year.

Pasture species

Various combinations of Kazungula setaria, *Paspalum plicatulum*, Guinea grass, *Brachiaria decumbens*, Schofield stylo, Siratro and Tinaroo glycine were used in pasture mixtures. In addition, pangola and *Brachiaria decumbens* were used on their own as all-grass pastures. Townsville stylo was oversown into native grass pasture.

Based on an assessment of compatability, palatability, persistence and grazing animal performance, Guinea grass, *Brachiaria decumbens* and pangola grass proved to be the best grasses and Siratro and Townsville stylo have been the best legumes.

In perennial grass-legume mixtures, grass dominance had become a serious problem by the third year. In an endeavour to maintain legume dominance for as long as possible, grass seed application rates were decreased and legume seed rates increased. For example, the seeding rate for a Guinea grass and Siratro mixture was 0.7 and 4 kg ha^{-1} respectively. Where Townsville stylo was oversown into native pasture, the seeding rate was 6.7 kg ha^{-1}.

Productivity

While individual animal performance was similar for the various pasture types, there was a substantial difference in carrying capacity and therefore, beef produced per unit area.

Cattle growth rates achieved from improved pastures are set out below:

	kg day^{-1}	L.W. at slaughter	Age at slaughter
Maximum	0.57	550 kg	2.5 years
Average	0.39	528 kg	3.5 years

Average beef production per unit area of pasture can be calculated by applying average carrying capacity figures as follows:

Pasture type	ha head^{-1}	L.W. gain maximum	(kg ha^{-1} yr^{-1}) average
Perennial grass-legume	0.8	260	178
Perennial grass + N	0.4	520	356
Townsville stylo	1.2	173	118

Cost comparisons

During the period 1969 to 1972 development and establishment costs were as follows:

Development type	Cost ha^{-1} ($)	ha head^{-1}	Cost per beast area ($)
Full clearing and cultivation			
Perennial grass-legume pasture	136	.8	110
Perennial grass + Nitrogen	160	.4	64
Full clearing—No cultivation			
Townsville stylo pastures	99	1.2	119
Tordon timber treatment			
Townsville stylo pasture—aerial seeded	32	1.2	38

The cost ha^{-1} figure quoted here covers the cost of seed and fertilizer, and of clearing and cultivation where appropriate, but does not include costs of fixed improvements such as watering points or yards. Also there are costs associated with slashing uncultivated but fully cleared areas to control timber regrowth or with re-treatment of wattle and ti-tree regrowth on areas treated with Tordon.

While land development and pasture establishment costs have increased substantially since 1972, the cost comparison for each type of development is still largely the same as the above. For instance, Tordon treatment of timber followed by aerial seeding with Townsville or Verano stylo still offers by far the cheapest approach to pasture improvement on a cost per beast area basis.

Conclusions

In view of the present depressed state of the Queensland beef industry the development of land for pasture improvement is uneconomic. Even if the value of land was discounted completely, a land development program could not be justified on economic grounds.

There are two situations where land development may be considered feasible, namely:

(a) Where a property owner has another income earning enterprise, e.g. sugar production, and also has surplus time and equipment available. He may consider that the pasture improvement of otherwise unproductive land is warranted because his only direct costs would be the price of seed, fertilizers and fuel.

(b) Other property owners may decide to improve unproductive land in anticipation of a dramatic rise in cattle values.

A sufficient improvement in cattle prices to justify land development appears unlikely at the moment. Moreover, few specialist beef producers would have the necessary financial resources to embark on a pasture improvement program of any

magnitude. Therefore, in the immediate future at least, any increase in the area of improved pasture on the Mackay coast is likely to be restricted to properties with a surplus of resources and another source of income besides beef.

Recommendations

Assuming that the cost of pasture improvement can be justified for reasons already outlined, the following approach offers best value for money spent.

1. On the poorer country treat timber with Tordon and aerial seed with Townsville or Verano stylo. Provided soils are of a sandy loam texture and the land is not swampy, low natural fertility will not adversely affect establishment so long as superphosphate is applied with the seed.
2. With areas of arable land, pangola grass grown on its own with strategic nitrogen applications or a mixture of *Brachiaria decumbens* and Siratro is preferred.
3. On undulating country with good soils that are unsuitable for cultivation, Guinea grass or *Brachiaria decumbens* and Siratro mixtures offer the best alternative.

There is no real difference in animal performance from the various improved pasture mixtures, but there is a substantial difference in carrying capacity. Moreover, pangola grass and Townsville or Verano stylo pastures are capable of withstanding sustained, heavy grazing for considerable periods. Periods of anticipated feed shortages can be partially offset by increasing the application rate of nitrogenous fertilizer on pangola or *Brachiaria decumbens* pastures.

Available evidence suggests that there is no advantage in rotational grazing of pastures. In fact, spelling of pastures during the growing season can lead to the production of rank growth that is difficult to control. Rather than rotational grazing of pastures, stocking rates should be varied according to the conditions of pastures.

A balanced approach to pasture development on individual properties is most important. Besides selecting species best suited to the various land and soil types, it is essential that a suitable balance be achieved so that at least 40% of the total area improved is capable of withstanding heavy stocking pressures during extended dry season periods.

TEDLANDS GRAZING EXPERIMENT

B. WALKER

Queensland Department of Primary Industries, Rockhampton, Queensland.

Introduction

In 1970 in the Mackay area there were many useful pasture species available. We knew how to grow these species and where they were best suited. They needed fertilizer, mainly phosphorus, molybdenum, sulphur, and we knew how much was needed for successful establishment.

However, little was known about grazing management for beef production or about pasture stability. An experiment was therefore planned to study the effect of stocking rate on pastures of *Macroptilium atropurpureum* cv. Siratro, *Stylosanthes guianensis* cv. Schofield and *Setaria anceps* cv. Kazungula, the most widely planted pasture species in the Mackay area, and suitable for much of coastal Queensland. Siratro in particular is a widely adapted legume and information on grazing management of Siratro-based pastures was urgently needed.

Treatments

There are six stocking rates (5.0, 3.3, 2.5, 2.0, 1.7 and 1.2 steers ha^{-1}) and three pastures, high legume/low grass, low legume/high grass and grass + 300 kg N

ha^{-1} $year^{-1}$. The grass + N treatment is only at the heaviest two stocking rates. The different legume/grass proportions were achieved by adjusting the seeding rates of setaria, Siratro and Schofield stylo. There are two replicates with three Brahman crossbred steers $plot^{-1}$.

Fertilizer applications were 800 kg ha^{-1} of Mo superphosphate and 100 kg ha^{-1} of muriate of potash at establishment and yearly maintenance dressings of 200 kg ha^{-1} superphosphate and 50 kg ha^{-1} of muriate of potash. We used high fertilizer rates to remove the limiting effects of deficiencies of these nutrients on plant growth. On the grass only treatment nitrogen was applied in five applications each of 60 kg N ha^{-1}, ten weeks apart.

Site

The site selected at Tedlands was covered mainly with ti-tree (*Melaleuca* spp.). The soil was an infertile duplex (Dy 3.42) with a sandy loam "A" horizon of 40 cm overlying a yellow clay. The area was gently sloping and subject to local waterlogging from January to March during heavy rains.

Establishment and management

The area was cleared in August 1970, ploughed twice and disc harrowed before planting in December 1970. The experimental area was grazed evenly until July 1971 and the pastures were then spelled until November 1971, when the experiment proper commenced. Fresh steers with mean live weight around 200 kg were then introduced every November. All pastures were continuously grazed. On the legume grass treatments, the heaviest stocking rate of 5 steers ha^{-1} had to be discontinued after 6 months due to overgrazing.

Results

After five years the two legume/grass pastures were similar for animal production and botanical composition whereas the effects of stocking rate on pasture yield, composition and animal performance were considerable. Only the low legume pasture is considered here, since this closely represents pastures in the area.

Legume populations

After four years of grazing, Schofield stylo had virtually disappeared from all treatments except in pastures grazed at 1.7 steer ha^{-1}, where there were about 2 plants m^{-2}. There were fewer than 2 Siratro plants m^{-2} in plots grazed at 3.3 steers ha^{-1} whereas at the lighter stocking rates there were 5-7 mature plants m^{-2}. More than half of the plants on the 1.2 and 1.7 steer ha^{-1} plots were derived from stolons, compared to none on the heavily grazed treatments. There were more seedlings on the heavily grazed plots than there were on the lightly grazed treatments. Siratro seed reserves in the soil ranged from 200 to 500 m^{-2}, the lower amounts were on the heavily grazed plots where seed reserves had accumulated in the establishment year, the only time when Siratro flowered in this treatment.

The population data can help us to work out guidelines for maintaining Siratro in pastures. Stocking at no higher than 1.7 steers ha^{-1} ensured that adequate populations (5 to 7 plants m^{-2}) were maintained. At higher stocking rates, provided there are adequate seed reserves in the soil, there are always enough seedlings to ensure good populations.

Pasture yields

Legume yields of over 1 200 kg ha^{-1} are maintained only at stocking rates below 1.7 steers ha^{-1}. At heavier stocking rates legume yields are negligible. Total herbage yields on offer, which by 1976 ranged from 300 to 13 000 kg ha^{-1}, reflect the low legume yields. Weed yields (mainly sedges) vary with stocking rate. There are practically no weeds with light stocking but the amount increases appreciably with heavy stocking rates.

Diet selection

The dietary pattern of steers on the 1.7 steer ha^{-1} treatment was determined with oesophageal fistulated steers. Whereas in December cattle selected about the same amount of legume (4%) as that on offer, in June they selected 38% legume from only 7% on offer. Grass leaf was preferred to grass stem at both times—the proportion selected by steers was more than three times the proportion of leaf on offer.

Cattle performance

Over the period of the experiment the cattle on the 1.7 and 1.2 steer ha^{-1} treatments maintained a level of live weight gain of 160 to 180 kg steer^{-1} year^{-1}. On the heavier stocking rates the rate of weight gain progressively declined each year. These differences were also reflected in the condition of the cattle. The steers on the lighter stocking rates were in "forward store" condition when taken off the trial compared to the poor condition of steers from the other treatments.

Conclusions

Stocking pressure has a major influence on production and stability of Siratro based tropical pasture. The "optimum" stocking rate will vary with site, rainfall and fertilizer input. It is important to determine locally what the stocking rate should be, for the consequences of overgrazing can be deceptive and the effects are long lasting.

RENOVATION OF SIRATRO PASTURES

H. G. BISHOP

Queensland Department of Primary Industries, Mackay, Queensland.

In the Mackay area persistence of Siratro is not a problem on the better drained brown earth soils, provided the pastures are not continually overgrazed and are adequately fertilized. However, on the duplex soils stocking rate is more important, for Siratro yields can decline and populations may almost completely disappear from well fertilized pastures. This Siratro decline is associated with either overgrazing or excessive grass competition and is also probably connected with these soils being waterlogged for a few weeks to several months during the wet season. In these pastures Siratro soil seed reserves are usually in excess of 50 kg ha^{-1} and are adequate for pasture regeneration.

On badly overgrazed pastures our experience is that resting is necessary for one and preferably two growing seasons before a substantial yield (1 000-1 500 kg ha^{-1}) of legume can be obtained.

On pastures not badly overgrazed, but where Siratro has nevertheless declined, reducing grazing pressure does improve legume yield but not very quickly.

With Kazungula setaria there can be excessive grass competition/dominance at light stocking rates and burning off the pasture after the first showers in November/December does allow a large number of Siratro seeds to germinate and develop into vigorous seedlings. Provided pastures are not then overgrazed Siratro yields can be improved.

However, these methods produce only a gradual improvement in legume yields. In preliminary trials more rapid improvements have been achieved by ripping the top 10 cm with a tined cultivator at the start of the wet season. Siratro yields in excess of 1 000 kg ha^{-1} have been obtained in three months by this method compared to less than 200 kg ha^{-1} by resting only. Further trials using these methods are planned for the 1978 season.