instances have been recorded in which the germination level has increased very largely even after the passage of only one month.

Accelerated aging techniques have been used to predict those samples that have the highest storage potential. To date, these techniques have proved quite promising for evaluating samples with respect to storage potential. This line of work will attract more interest in the future, particularly in view of the poor history of grass seed storage under tropical and sub tropical conditions.

Improved testing conditions

Since seed testing commenced in the temperate regions, the testing conditions required by temperate species have been well documented. This can not be said for tropical species. Research into suitable methods for testing tropical species is well under way but is hampered by the tendency for the optimum conditions to be dictated by the age of the seed. Freshly harvested seed quite often has different temperature requirements than does mature seed. This has meant that such research must be conducted from immediate post-harvest through until the seed becomes "mature". Research at the moment is concentrating on *Brachiaria decumbens* and *Cenchrus ciliaris*. In the past, investigations have been conducted on green panic and *Urochloa mosambicensis*.

Efforts have been made to find efficient methods to reduce the level of hard seed when testing legume seed. Dry heat treatments have received a good deal of attention and it is interesting to note that the temperature of the cooling phase can markedly influence the effectiveness of the dry heat treatment. For example, there are many fewer hard seed in dry heat treated Townsville stylo seed cooled at 0°C than if cooled at 5°C.

FIELD MEETING AT TURKEY STATION, MIRIAM VALE, NOVEMBER 11, 1977

PASTURE IMPROVEMENT IN CENTRAL COASTAL SPEARGRASS COUNTRY

A field day, jointly sponsored by the Tropical Grasslands Society and the Miriam Vale Rural Science Society, was held at Turkey Station near Miriam Vale on November 11, 1977. The field day theme, 'Pasture improvement in central coastal speargrass country', was chosen both to recognise the efforts of local graziers and also as a tribute to Mr N. H. Shaw, C.S.I.R.O., who is retiring in June, 1978, after a long and distinguished career in pasture research, much of it at Rodd's Bay. The field day was opened by Mr D. Murray, Chairman of the Miriam Vale Rural Science Society.

PASTURE RESEARCH AT RODD'S BAY

N. H. SHAW*

The experimental site at Rodd's Bay is on undulating ridgy country which originally carried a mixture of narrow-leaf ironbark, bloodwood and Moreton Bay ash. The soils are derived from granite and are predominantly solodic and lacking in nitrogen, phosphorus, sulphur, molybdenum and potash. The country is generally fairly similar to large areas between Gladstone and Bundaberg. Average annual rainfall is 900 mm but over the period since research started in 1945, the annual total has ranged between 400 and 2100 mm, including three major droughts. Rainfall in

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coastal areas towards Gladstone and Rockhampton is similar to that at Rodd's Bay, whereas rainfall at Miriam Vale and towards Bundaberg is higher, up to 1200 mm annually.

TOWNSVILLE STYLO PASTURES AT RODD'S BAY

Establishment

One advantage of Townsville stylo is that it is easy to establish into native pasture using minimum cultivation techniques. The standard practice at Rodd's Bay has been to broadcast Townsville stylo into roughly cultivated strips covering one-quarter of the paddock area. Aerial sowing has been successful but is less reliable than strip seeding. However, it is acceptable for those areas which cannot be cultivated because of slope, roughness or inaccessibility. Experience has shown that a satisfactory establishment is critical to the subsequent development of good Townsville stylo pastures.

Fertilization and management

An experiment was established in 1966 to study the effect of three superphosphate rates, (0, 125 and 250 kg ha^{-1} yr^{-1}), on native pastures oversown to Townsville stylo and subjected to a range of stocking rates. Adequate molybdenum was applied with the 125 and 250 kg superphosphate treatments. The stocking rates used initially were from 0.41 to 0.82 b ha^{-1} for all three fertilizer levels, but these were increased with time and from 1971 to 1973 were 0.55 to 1.10 b ha^{-1} for unfertilized pastures, 0.67 to 1.37 b ha^{-1} for the lower level of superphosphate and 0.82 to 1.65 b ha^{-1} for the higher level.

The density of Townsville stylo increased with time; initially the increase was greatest at 250 kg superphosphate ha^{-1}, but by 1973 legume density was similar at 250 and 125 kg ha^{-1} whereas it was appreciably lower without fertilizer. Higher stocking rates also increased Townsville stylo density. The native grasses persisted in all treatments, unlike the situation in North Queensland where native perennials are often replaced by annuals after successful oversowing of Townsville stylo and application of superphosphate.

Total pasture yield declined with increasing stocking rate, but the decline was less with 250 kg superphosphate ha^{-1} than with 125 kg ha^{-1}. In the first few years legume yield was greatest at the highest superphosphate level, but the effect of the low rate (125 kg ha^{-1}) gradually increased and from 1972 the two gave equal legume production. With adequate fertilizer, legume yield increased with increasing stocking rate.

Where fertilized Townsville stylo pastures have been adequately grazed, burning is not required even though it would not eliminate the legume. Burning is beneficial where pastures have been undergrazed as it aids re-establishment of Townsville stylo.

Animal performance

A new group of weaner animals was introduced to the experiment each year in October or November. Live weight gain at 125 and 250 kg superphosphate ha^{-1} was always higher than in unfertilized treatments. In some years up to 1973, the 250 kg ha^{-1} superphosphate rate gave better animal production than 125 kg ha^{-1}, but since 1973 animal production has been similar at both rates. Animal production in recent years has been above 200 kg live weight gain ha^{-1} for well grazed and fertilized pastures and approximately 100 kg ha^{-1} for the unfertilized but oversown pasture. This compares with the usual gains from native pasture of about 25 kg ha^{-1}.

Maintenance fertilizer requirements

In 1972/73 the need for maintenance fertilizer was investigated in small plot experiments set up within the grazing experiment. There was no response to additional

superphosphate in pastures previously fertilized with either 125 or 250 kg superphosphate ha^{-1} each year since 1966. This indicated that 125 kg ha^{-1} for six years had built up soil phosphorus to a level sufficient for plant requirements. Maintenance superphosphate application could probably be reduced, but this topic needs further study.

The same fertilizer experiments also showed a big response to potassium with a three fold increase in Townsville stylo yield on pastures previously fertilized with 250 kg superphosphate ha^{-1}. This response is not considered to be due to potassium losses from the improved pastures but to inability of the soil to release sufficient potassium to maintain the higher pasture growth rates. Consequently, the experiment was modified in 1973 to study the effect of an annual application of 60 kg KCl ha^{-1} yr^{-1} on pasture and animal production.

Potassium application has had little effect on total pasture yield but doubled the yield of Townsville stylo and increased live weight gain per head and per hectare by about 20%. This increase is not sufficient to pay for this amount of potassium but it is possible that a lower rate of potash would give the same improvement and therefore be profitable. It is still not completely clear whether Townsville stylo pastures fertilized with superphosphate will stabilize at Rodd's Bay in the absence of potassium fertilizer.

Conclusions

(1) There is a clear benefit from introducing Townsville stylo into native pastures and also from fertilizing with superphosphate.
(2) Superphosphate should be applied to build up the soil P level as quickly as possible, easing off after a total of 600 kg ha^{-1} has been applied.
(3) Stocking rates of at least one beast ha^{-1} are required to properly utilize fertilized Townsville stylo pastures and maintain stylo yields.
(4) Native perennial grasses combine successfully with Townsville stylo in central coastal Queensland.
(5) The maintenance requirements for superphosphate and potash are inadequately understood.

SIRATRO BASED PASTURES

A Siratro-Rhodes grass pasture sown at Rodd's Bay in 1961 is still persistent and productive, although it has received no superphosphate for the past four years. This pasture has been grazed at 1.7 b ha^{-1} except during the 1963-64 drought. This drought eliminated Rhodes grass and set back Siratro, but the Siratro grew well in the following year and Rhodes grass returned after three years. Animal production on a per head basis has been similar to that from fertilized Townsville stylo pastures but has been higher on a per hectare basis as a result of the higher carrying capacity of the Siratro pasture.

LEUCAENA BASED PASTURES

Animal production has been measured on a system of one quarter *Leucaena leucocephala* and three quarters native pasture. It was anticipated that the presence of leucaena would improve winter performance as it carries leaf above frost level and shoots very early in spring. This advantage was realized at Rodd's Bay and leucaena also improved overall carrying capacity, which was 1.6 b ha^{-1} with extra animals in summer to keep the leucaena under control. Although leucaena was successful it can be difficult and costly to establish and requires careful grazing management. Consequently it is not an alternative to pasture improvement with Siratro or Townsville stylo but may be a useful addition in well developed and intensively grazed situations.

ECONOMICS OF PASTURE IMPROVEMENT

L. T. WICKSTEED*

This presentation discussed the economics of pasture improvement, comparing different intensities of pasture improvement and also comparing pasture improvement with other forms of investment. The findings are presented in full in this issue of *Tropical Grasslands* (page 20) so only the main points are outlined here.

Two classes of country were considered, virgin bushland and open grassland which had previously been cleared of timber. Three treatments were compared for bushland; timber treatment by Tordon, Tordon with oversowing of a legume and fertilizer application and Tordon with complete cultivation, sowing and fertilizer. Tordon alone gave a negative return to capital invested whereas Tordon followed by oversowing or complete cultivation gave a 6% return or capital. Two treatments were compared for open grassland: oversowing with fertilization, and complete cultivation, sowing and fertilization. The returns to capital were 12% and 19% respectively. The analysis assumed a ten year life span for pastures and was based on 1975/76 costs and beef prices. These returns on investment should be compared with the 9% interest available from building societies.

These results were encouraging in that even with the present cost/price squeeze pasture improvement was profitable on open grassland. An alternative investment considered was to convert to environmentally adapted cattle by replacing bulls of British breeds by crossbred (Brahman × *Bos taurus*) bulls. This changeover can increase gross income and reduce costs associated with acaricides and labour. The returns from changing breeds appeared higher than those from the most profitable forms of pasture improvement, but possibly with a lower risk factor. This emphasized that pasture improvement programs should be undertaken in conjunction with a breed adaptation program.

During the discussion several speakers suggested that pasture improvement gave even better gains in animal production than was assumed in the analysis, especially for oversown pastures. Evidence also suggested that pastures had an indefinite life compared with the assumed ten year effective life. These comments were encouraging as pasture improvement may be even more profitable than predicted in the economic analysis.

PASTURE IMPROVEMENT ON TURKEY STATION

R. BELL*

Mr Bell discussed the pasture improvement that had been achieved on Turkey Station over the last 15 years. This has been outlined in detail in *Tropical Grasslands* 11, No. 1, p. 93 (1977). Two pastures were inspected, the first being a 'low key' pasture planted four years ago. Tordoned country was cleared, burnt, disced, fertilized with 190 kg superphosphate ha^{-1} and seeded with Siratro at 1.8 kg ha^{-1} with covering harrows following the planter. The pasture still had a good density of Siratro and carried one beast to 0.8-1.2 hectares yearlong. Mr Bell emphasized that superphosphate should still be applied at planting, even with current prices, and stressed the importance of successful establishment. He considered that large scale aerial sowing was unlikely to be successful as it was imperative that oversown Siratro seed make good contact with the soil to enable good germination and establishment.

The second pasture inspected was a 'high key' development where a grass/legume mixture is sown into complete cultivation. The species used were Siratro and

* Department of Primary Industries, Bundaberg.
* Turkey Station, via Bororen.

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.