# DEVELOPED COASTAL FOREST LANDS—WHERE TO FROM HERE? FIELD MEETING, GYMPIE, APRIL 27–28, 1979

A joint field meeting with the Queensland Department of Primary Industries was held on April 27th and 28th near Gympie with the theme "Developed Coastal Forest Lands—Where to from here?" Most of the field sites were owned or managed by Tinana Development Pty Ltd. and their assistance is gratefully acknowledged. Some 80 members and guests attended the first day and 50 on the second day. Three different types of enterprise were examined: renovation of run down pastures, seed production of pasture species, and agroforestry (or pastures under timber). Most attention was given to the possibilities of using cropping as a way of regenerating pastures and a method of diversification of farm enterprises.

## INTRODUCTION TO TINANA DEVELOPMENT

W. DUGGAN

Tinana Developments Pty. Ltd., Gympie

The property, Bungawatta, was established in October 1973 by acquiring several parcels of freehold land totalling 13,500 ha. Of this area approximately 3,500 ha were developed to tropical pastures and together with the native grass country was supporting 3,000 cattle.

Clearing new land started in 1974 and continued until late 1977, at about 1500 ha $year^{-1}$. At this point, 9400 ha have been developed to pastures, of which 1250 ha are planted to kikuyu–clover and the remainder to tropical species. The property has been supporting 10,000 head of cattle for the past 3 years.

### *Development and improvements*

New lands were cleared by chaining and burning after removal of millable timber. Cleared lands were disced and sown to pasture by broadcasting. Subdivision of sown areas was based on a paddock size of 60 ha, capable of carrying 200 to 300 beasts in rotations that coincided with dipping intervals.

### *Livestock management and marketing*

The livestock enterprise encompasses breeding, growing and fattening, with the male portion (approximately 90%) geared to a turnoff at 27 to 30 months at nearly 270 kg carcass weight. Young female stock not suitable for breeding are spayed and marketed at two years. On this coastal belt females are much quicker to fatten than males with surprisingly good slaughter weights. Branding percentage over the past 6 years is 83%, varying from 77% to 88% of calves branded to females exposed.

Selection is based on expression of fertility, suitability to the environment, and growth and conformation. The type of cattle we believe we should and are carrying are those most in harmony with this environment. Essentially, this beast has half or slightly higher Brahman content, possessing a sleek coat and quiet temperament, expressing fertility, fleshy beef qualities and good bone. Such an animal will almost without exception be a good "doer" and of low maintenance cost.

### *Pasture management*

In order to achieve the maximum productive life of a tropical pasture (which in this environment is at best only 7 years) we believe it is essential to fertilize adequately, rotationally graze, and manage the livestock to suit the legume. We believe that research should pay more attention to systems of pasture management on a farm scale. Results from grazing experiments in small areas have little relevance to reality.

The problem with tropical pasture legumes in mixtures with setaria, panicum or Rhodes grass, is the failure of the legume to persist. Even with careful and intelligent management deterioration results in 9 out of 10 cases. Experience on this property suggests that alternative legumes more suited to the low coastal lowlands should have a high priority in research programs.

Kikuyu–white clover pastures establish readily in this area, are adaptable to the environment, and are most acceptable to stock. However, nitrogen at 100 kg $ha^{-1}$ applied to kikuyu alone (in autumn) will carry 2.5 fattening beasts $ha^{-1}$, and coupled with a spring dressing of 100 kg $ha^{-1}$ can satisfactorily grow and fatten 2 beasts $ha^{-1}$.

The economics of applying nitrogen to pastures for beef production is more often questionable than not. The need for a low growing legume such as New Zealand white clover, Haifa white clover or lotononis is imperative. In such a pasture cattle here have fattened to a desired finish at more than 1 beast $ha^{-1}$ with 100 kg N $ha^{-1}$ applied early in autumn. Even without the aid of nitrogen kikuyu–white clover pastures perform well and continue to show their ability to finish stock.

## INTRODUCTION TO THE ENVIRONMENT

B. G. Cook

Department of Primary Industries, Gympie

### *Physiography and soils*

Although similar to the coastal lowlands or "Wallum" country, only a small part of the Bungawatta property lies within the Coondoo landscape of the coastal lowlands. The majority comprises a low hilly terrain partly formed on the old coastal plain and partly on shales and soft sandstones. The altitude is generally about 60 metres above sea level although some sandstone outcrops rise to about 150 metres. Tinana creek and its tributaries drain the property.

Yellow earths and yellow podzolics are the most common soil types on the old coastal plain, and soloths and solodics on the shale and sandstone. Red earths are found in both areas on some of the higher ridges, and gleys on lower slopes and stream valleys.

Natural fertility is low. Available phosphorus levels are of the order of 5 ppm, and exchangeable potassium levels about 0.2 me % (80 ppm). pH values range from 5.5 to 6.0.

### *Climate and vegetation*

The property lies between the 1200 and 1300 mm isohyets. About 75% of the annual total falls between October and March. In a cold year, all the country is subject to frosting.

Prior to development, natural vegetation was a layered sclerophyll forest and woodland on the ridges, with a variety of communities in the lower, more poorly drained situations. Scribbly gum (*Eucalyptus signata*), *Casuarina* spp. and *Banksia* spp. were typical of the old coastal plain areas, while spotted gum (*E. maculata*) and gum topped box (*E. moluccana*) predominated on the sandstone and shale country. Yellow stringybark (*E. acmenoides*) and bloodwood (*E. intermedia*) were fairly evenly distributed on the ridges and even extended on to the flats and more poorly drained country, usually the province of blue gum (*E. tereticornis*), broad-leaved apple (*Angophora subvelutina*) and paper bark tea-tree (*Melaleuca quinquenervia*). These latter species also lined waterways in association with *Eugenia ventenatii* and other fringing forest species.

In its native state, the country carried a kangaroo grass (*Themeda australis*) dominant grassland. Over the last 30 years, the tree stand has intensified and the kangaroo grass given way to blady grass (*Imperata cylindrica*) and other inferior native species.

Before amalgamation the area was used to pasture dry dairy stock from May to September and carried one beast to four hectares. Mineral supplements were necessary and grass was usually burnt in July–August to provide "a green pick". Cattle held after December lost condition.

## DETERIORATION AND RENOVATION OF PASTURES AT "BUNGAWATTA"

R. Hurwood

Tinana Development Pty. Ltd., Gympie

A number of pastures on "Bungawatta" were inspected, including vigorous three year old pastures, run down grass dominated pastures, pastures regenerating under cropping and two year old pastures after a renovation phase. These pastures illustrated the run down and renovation phases described below.

### *Tropical pastures*

#### *Establishment and persistence*

The sowing mixture used early in the pasture development program comprised 2/3 kg Nandi setaria, 1 kg Siratro, 1/2 kg Greenleaf desmodium, 1 kg Cooper glycine, 1 kg Hunter River lucerne and 1/2 kg New Zealand white clover $ha^{-1}$. In recent years the glycine and lucerne have been replaced by Cook stylo and lotononis. The pastures were initially fertilized with 35 kg P (375 kg superphosphate) and 30 kg K (60 kg muriate of potash) $ha^{-1}$. With maintenance fertilizer, soil phosphorus, initially 5 ppm, has built up to about 25 ppm and potassium to 70 ppm K. Wattle regrowth is controlled by a "roller chopper" when two to three metres high, usually in the third year after sowing.

Stocking rates in the year after sowing were usually light, increasing to 1 beast $ha^{-1}$ in years four and five when the pastures were good desmodium–setaria, with Siratro a minor component. After the fifth year however the legume, particularly Greenleaf, declined and the stocking rate had to be lightened to at least 1 beast to 1.5 ha to maintain reasonable performance on the bulky yet nitrogen deficient setaria dominant pasture. This decline had occurred despite lenient rotational grazing and regular topdressing.

#### *Renovation*

Various techniques have been tried to rejuvenate declining pastures. Spelling during the summer growth period has shown some benefit, but only in the short term, and is of little value where legume populations are low. Contour chisel ploughing has not stimulated enough germination of Siratro seed and does not set the grass back enough. Chemical renovation has given only limited success.

The most successful approach has been to get "stuck into the paddock" using disc ploughs to break up the setaria tussocks and turn them into the soil, forming a rough seed bed. This releases a lot of locked up nutrients and the pasture regenerates to a Siratro–setaria sward, Greenleaf then being a minor component. Three modifications of this approach have been used, all with success.

Firstly, the pasture has been allowed to regenerate straight away after ploughing. Two ploughings have been used, one week apart, to minimise the loss of Siratro seed.

Secondly, a grain sorghum crop has been sown and the pasture allowed to regenerate beneath the crop. This has required two ploughings, the first in mid November and the second 4 to 6 weeks later. The sorghum is then sown with a disc drill and the seedbed rolled. Cultivation is again kept to a minimum to avoid losing Siratro seed. Sixty kg N $ha^{-1}$ has been applied at sowing with a further 50 kg at booting. Grain yields in 1977 were 3.0 to 3.5 tonnes $ha^{-1}$, which is roughly a break-even point over all costs. Spraying has been required for *Heliothus* but there has been no major problem with insects or with harvesting despite the coastal conditions. One Siratro–setaria pasture inspected, with a satisfactory legume content, was renovated by this method in 1977. It has carried 1 beast $ha^{-1}$ since renovation.

The third approach has been to sow forage sorghum rather than grain sorghum. This approach is more flexible as time of sowing is less critical than with grain sorghum. Also forage sorghum can be sown on rougher and steeper ground with very little equipment.

All three approaches have given good results but success is apparently dependent on having an adequate reserve of Siratro seed in the soil, so they may not succeed in wetter areas where Siratro persistence has been poor prior to renovation. Setaria always regenerates and because the initial sowings were on virgin land there have been no serious weeds of cultivation. It is likely that renovated pastures may only last three to five years, rather than seven. There is no doubt that it is possible to grow single grain or forage sorghum crops while restoring the legume component of pastures. It may be worthwhile renovating earlier than has been done so far so as to attain better density of Siratro and particularly Greenleaf, as Greenleaf seed does not seem to remain viable in the soil for the same length of time as Siratro. Any new legume species coming on the market could also be introduced during renovation.

### *Kikuyu and white clover based pastures*

Kikuyu–white clover pastures were first planted in 1974 and there are now 1200 ha of these pastures. Establishment has been relatively easy provided the area is ploughed and planted as soon as possible after clearing and before competition starts. The usual planting mixture is 1 kg Whittet kikuyu, 1½ kg Haifa white clover, 1 kg New Zealand white clover and 250 g of lotononis $ha^{-1}$.

In early years 200 to 300 kg N $ha^{-1}$ were applied each year but although steers were fattened the returns were not adequate at the stocking rate of 2 steers $ha^{-1}$. Since then only 100 kg N $ha^{-1}$ has been applied in March to stimulate autumn growth and make the grass more acceptable so that the pasture can be heavily grazed and kept more open to encourage white clover. This, with an autumn potash application, has appreciably improved clover persistence and production.

Many lower areas of failed tropical pastures are being resown in autumn to kikuyu–clover with considerable success. Any weak kikuyu stands in renovated pasture can be improved by an autumn discing and spinning out extra clover. Pastures which are well grazed support adequate clover and kikuyu. Some of these have been maintained for the last two years without application of nitrogen.

# FERTILIZER STRATEGIES FOR PRODUCTIVE GRASS-LEGUME PASTURES

G. E. Rayment
Department of Primary Industries, Indooroopilly

### *Introduction*

Soil fertility is one of several factors that can influence pasture productivity and legume persistence. It is usually possible to maintain or modify soil fertility to suit the nutritional requirements of preferred pasture species. Fertilizer strategies aimed at extending the productive life of pastures should consider nutrient needs of preferred species, current soil fertility, and management flexibility and attitudes.

### *Species*

Nutrient requirements of pasture species vary widely and are accentuated when pasture legumes and grasses are grown in association. For example, it is known that legumes have higher Mo requirements than grasses. Consequently low soil availability of this element would tend to favour the grass. It would also favour those legumes with low Mo needs (lotononis, Townsville stylo) at the expense of legumes which require higher levels of Mo to maintain full productivity (glycine, desmodium, Siratro). Similarly, Siratro is more affected by copper deficiency than is desmodium.

Grass species in a mixed pasture can also influence nutrient supply. For example, where setaria is grown in association with legumes, good levels of P and K must be maintained to counter the vigorous competition from the setaria for these elements.

### *Current fertility*

Soil type and age under pasture influence the nutrient response. Here at Tinana there were major differences between coarse and finer surface textured soils (see Table 1). Generally soil P levels have tended to increase following phosphorus fertilization, whereas K levels have declined.

TABLE 1

*Nutrient responses of Greenleaf desmodium in glasshouse trials using Tinana soils from pastures of various ages*

| Age (years) | Texture of soil surface | |
|---|---|---|
| | Coarse | Fine |
| Virgin | P, S, Mo | P, S, Mo, lime |
| 1 | P, K | P, K, Mo, lime |
| 2 to 3 | P, S, K, (Mo) | P, Mo, lime |
| 7 | P, S, K, Mo, lime | P, S, Mo, lime (K, Cu) |

### *Management*

Mechanical and/or chemical renovation could be undertaken to hasten recycling of nutrients and improve soil physical condition. Fertilizer programs must be adjusted if forage is removed frequently for hay. Manipulation of stocking rates and timing of application of fertilizers can maximize nutrient utilization and minimize losses.

Previous reports on some of these aspects appear in *Tropical Grasslands* Vol. 11, No. 1, pp. 67–78; Vol. 11, No. 2, pp. 216–220; and Vol. 13, No. 1, pp. 53–62. The last of these deals specifically with soils of Tinana Developments Pty. Ltd.

## COASTAL PASTURE SEED PRODUCTION

D. S. Loch

Department of Primary Industries, Gympie

Pasture seed production in coastal southern Queensland can be a practical and profitable form of land use when treated as a crop. Average yields are relatively low, but this is balanced by the fact that pasture seed is generally a high value commodity. Successful seed production depends on both environmental and human factors:

species (or cultivars) chosen must be suited to the environment, and producers must be prepared to treat seed production as a major enterprise rather than as a low-priority sideline.

*Legumes*

*Desmodium intortum* cv. Greenleaf, *D. uncinatum* cv. Silverleaf, and *Macrotyloma axillare* cv. Archer have been grown successfully on a small scale, but restricted markets limit production. *Lotononis bainesii* cv. Miles has been harvested for many years, and there is scope for increase because low yields mean that supplies of seed usually fall short of demand. *Trifolium semipilosum* cv. Safari is a new cultivar which local seed producers have grown successfully and there is also room for additional production. Possible alternative crops include *Aeschynomene falcata* cv. Bargoo and *Stylosanthes guianensis* cv. Oxley.

*Grasses*

Flowering requirements determine where many grass cultivars should be grown. *Cenchrus ciliaris* (buffel), *Chloris gayana* (Rhodes) cv. Pioneer, *Panicum coloratum* (Makarikari), *P. maximum* cv. Gatton, and *P. maximum* var. *trichoglume* cv. Petrie, for example, flower well throughout the growing season and seed crops can make full use of good rainfall received at any time during growth. These species seed freely without any special management. Seed production (as a catch crop) has been most successful in drier regions where advantage can be taken of fertile soils, the cropping tradition, and available machinery. Seed crops of the recently-released *Setaria porphyrantha* cv. Inverell could also be grown in these areas.

Where flowering is stimulated by short daylengths, adequate moisture must be available for crop development during periods of strong head emergence. This can be achieved by irrigation in drier areas or by growing them under natural rainfall in coastal areas where the chances of moisture at the required times are much higher and where there is also less risk of low temperature damage to crops maturing in late autumn. 'Callide' and 'Samford' Rhodes are two late-maturing cultivars of this type and seed crops have done well so far in coastal areas, although previously failing in the drier inland. *Bothriochloa insculpta* cv. Hatch has similar characteristics, with the main autumn crop ripening a little earlier than for 'Callide' and 'Samford' in about mid- to late May. 'Katambora' Rhodes is another coastal crop of this type, but matures earlier in about late April or early May. Regardless of daylength requirements, however, some grasses (e.g., *Paspalum plicatulum*, *Setaria anceps*) are not suited to drier conditions and must be grown in coastal areas.

*"Bread-and-Butter" seed crops*

Every successful seed-growing area needs at least one "bread-and-butter" crop from which large quantities of seed can be readily produced and easily marketed. Until now, no coastal crop met these requirements. 'Narok' setaria and lotononis have found ready markets because demand exceeded supply, but have low yields and limited areas of application. 'Callide' and perhaps 'Samford' Rhodes, with their higher seed yields and large potential market, are likely to fill this role in the future.

*'Callide' Rhodes*

Crop management revolves around the flowering requirements. This limits 'Callide' growers to no more than two carefully timed crops per year, the spring crop ripening in late November or December and the autumn crop ripening in about late May or early June. Even in coastal areas, occasional droughts can result in total or partial crop failures, particularly in spring.

Cleaning cuts for spring crops should be completed in early September because the flowering stimulus weakens quickly if crop development starts later than this. In autumn crops, strong head emergence begins around mid-April provided the cleaning cut is completed by early March; later cleaning cuts can delay crop development and increase the risk of damage from low temperatures and/or frost.

## AGROFORESTRY DEVELOPMENT—NEERDIE

M. ANDERSON, Forester; B. G. COOK, Agrostologist; P. HUTHWAITE, Manager

### *Introduction*

Traditional pasture development in coastal and subcoastal south-east Queensland has entailed removing one vegetation and replacing it with another. This clearing-ploughing-planting approach is expensive and should be limited to areas of limited erosion potential.

The experiment described explores the possibility of introducing a pasture understorey into a thinned eucalypt stand with no land disturbance.

### *Site details*

The experiment was established in the State Forest 904, Parish of Neerdie (26° 0′S and 152° 44′E) at an altitude of 80 to 120 m above sea level. There are two groups of soils at this site; those formed on phyllite and those on sandstone. The phyllite soils are largely hard-setting loams with red clayey subsoils (red podzolics) and the sandstone soils are largely siliceous sands. Both soils have a very low phosphorus status. Potassium levels are good on the phyllite soils and low on the sandstone soils. However, pasture growth on the sands does not indicate potassium deficiency.

The average rainfall at the site over the last eight years is 1460 mm, although long-term data (40 years) average is about 1200 mm. The vegetation divides into two groups; the ridge and the gully group. Spotted gum and broad-leafed red ironbark predominate on the ridges, while grey ironbark, bloodwood and forest red gum or blue gum are more common in the gullies. White mahogany or yellow stringybark are evenly distributed throughout both groups. A variety of small trees, shrubs and grasses (mostly blady grass) forms the understorey.

### *Development*

The whole area was logged and unwanted trees removed by stem injection of "Tordon 105" (5% w/w picloram and 20% w/v 2,4,5-T). The total area of 145 ha averaged a royalty return of $90 per ha and a harvest of 18.5 cu.m. timber $ha^{-1}$. Each merchantable tree cut had a mean volume of 0.99 cu. m with a mean royalty value of $4.83 per tree. This was completed by August, 1974.

The experimental site was divided into two similar areas; one of 68 ha which remained under native pasture, the other of 77 ha which was planted to improved pasture. Table 1 records tree number and basal area at the commencement of the experiment.

TABLE 1

*Tree number and basal area at beginning of experiment*

| | Pasture | | Control | |
|---|---|---|---|---|
| | No. trees $ha^{-1}$ | basal area $ha^{-1}$ ($m^2$) | No. trees $ha^{-1}$ | basal area $ha^{-1}$ ($m^2$) |
| phyllite ridge | 96 (40-150) | 5.2 (1.8-9.8) | 90 (40-140) | 5.7 (2.5-9.4) |
| phyllite gully | 79 (20-130) | 5.3 (1.9-8.9) | 75 (30-120) | 5.2 (1.9-11.1) |
| sandstone ridge | 92 (40-160) | 5.3 (1.9-8.0) | 82 (30-170) | 5.0 (1.4-9.4) |
| sandstone gully | 47 (20-100) | 3.4 (0.8-8.7) | 68 (20-120) | 4.3 (1.0-8.7) |
| Mean | 79 | 4.8 | 78 | 5.0 |

( ) range

The improved pasture block was burnt in December, 1974 and the following seed mixture aerially sown immediately after.

| *Grasses* | | *Legumes* | |
|---|---|---|---|
| Molasses grass | 0.07 kg ha$^{-1}$ | Greenleaf desmodium | 0.85 kg ha$^{-1}$ |
| Green panic | 1.12 ,, ,, | Archer axillaris | 1.12 ,, ,, |
| Katambora Rhodes | 0.28 ,, ,, | Cooper glycine | 1.12 ,, ,, |
| Whittet Kikuyu | 0.21 ,, ,, | Siratro | 0.56 ,, ,, |
| Hamil Grass | 0.37 ,, ,, | Cook Stylo | 0.28 ,, ,, |
| Narok setaria | 0.56 ,, ,, | White clover | 0.56 ,, ,, |
| TOTAL | 2.60 | TOTAL | 4.50 |

Molybdenum trioxide was incorporated into the legume pelleting material at 210 g ha$^{-1}$. The initial application of 500 kg ha$^{-1}$ of superphosphate was aerially applied in March, 1975 and a further 250 kg ha$^{-1}$ of Mo superphosphate was spread in April, 1976.

In this particular development seed and fertilizer were flown on separately. However, this would normally be one operation. Costs of planting in a single operation using current values are:—

| | | |
|---|---|---|
| Seed | \$56.40 ha$^{-1}$ | giving a per hectare planting cost of about \$80.00 |
| Molybdenum trioxide | \$20.90 kg$^{-1}$ | |
| Aerial super | \$96.00 tonne$^{-1}$ | |

*Management*

Both areas are grazed according to the feed needs of the overall property and to restrictions imposed in the interest of legume maintenance. Normally, it is destocked in autumn to permit bulking up for winter feed. However, this year circumstances have prevented destocking, although low stocking rates have allowed some measure of bulking up. Overall stocking rates have been low by local standards; on an annual basis, figures of 1 adult beast to 3.6, 2.6 and 2.3 ha have been calculated.

Future management will probably entail light summer and autumn grazing, heavy winter/early spring grazing, and late spring/early summer destocking.

*Results*

*Pasture*

The most successful legume has been axillaris which has effectively suppressed blady grass and other lower native species, and is still colonising bare areas. Greenleaf desmodium has made a good contribution on the sandy soils and in moist gully situations. Highest grass yields initially came from molasses grass and Narok setaria. This position has not changed although Katambora Rhodes grass and green panic have improved. There has been an increase in grass content of the pasture since the first assessment. Stylosanthes was present throughout with some patches of kikuyu.

*Tree growth*

The table below shows the tree growth in terms of diameter breast height increment from 1976 to 1977 for the two blocks:—

| | *D.B.H. Increment* (cm) 1976–77 Pasture | Control |
|---|---|---|
| Phyllite ridge | 0.91 | 0.91 |
| gully | 0.68 | 0.38 |
| Sandstone ridge | 0.70 | 0.61 |
| gully | 0.64 | 0.39 |
| MEAN | 0.75 | 0.65 |

Improved tree growth in the improved area can only be attributed to the whole system. There is insufficient control to attribute growth differences to differences in phosphate input, nitrogen input, regrowth or fire effects.

*Regrowth*

Significant regrowth suppression (50%) of all woody species has resulted from the pasture system.

*Discussion*

The advantages of this type of development over traditional development are: low cost, reduced frost incidence (due to tree canopy), returns from timber, less erosion, more stable legume component (related to lower, strategically distributed grazing pressure), apparently improved moisture retention in the soil under tree canopy, improved tree growth, and regrowth suppression.

The main disadvantages are: mustering difficulties which can be partly overcome by selecting more suitable stock or by bigger development using trap yards, fence maintenance necessitated by falling trees and branches—but reduced by clearing a track around the perimeter, noxious weed control would be expensive on a regular basis (if aggressive legume not used), and from a forestry viewpoint, regrowth suppression may be too effective for stand replenishment.

*Conclusion*

In a project of this type, the main consideration is legume maintenance. If legume declines, renovation processes such as those used on conventional development are not possible. We have thus erred on the conservative side stocking the pasture. It appears, however, that an aggressive grass such as setaria may also hasten legume decline. In the light of experience, such grasses would be deleted from the seed mix, and more emphasis placed on the less competitive green panic. Molasses grass is a valuable pioneer species. Axillaris, Greenleaf desmodium and Siratro would be retained, and white clover an obvious deletion. Legumes such as white clover, lotononis and Safari clover may have a role after the initial, suppressive phase. Subsequent oversowing with these species may improve their chances of establishment.

## SOME ASPECTS OF CROP CULTURE IN THE COASTAL FOREST LANDS

D. E. Byth

University of Queensland

In considering the future use of coastal forest lands developed for improved pasture, the question of cropping presumably arises for two main reasons. Firstly, extensive pasture degradation has occurred and the existing land use has become less viable. Cropping could be used as a vehicle towards attaining regeneration of those pastures. Secondly, successful cropping exercises would inject useful diversification of land use and income.

The coastal forest lands traditionally have been non-arable. The soils of the area are of poor to medium fertility, low in organic matter, relatively shallow with limited water holding capacity and prone to erosion when cleared and cultivated. They are thus not suitable to present day grain producing technology. However, a ley-farming strategy is relevant, with a short crop phase alternating with a longer pasture phase. A summer crop established in areas of degenerated grass-dominant pastures could act as a vehicle for pasture improvement via natural regeneration or over-sowing with pasture legumes during the crop phase. The cropping phase may provide justification for the fertilizer applications beneficial to the entire system.

Regardless of the strategy developed, the cropping phase should allow regeneration or re-establishment of the legume component of grass/legume pastures, provide sufficient cash flow to at least cover the costs of the exercise and preferably make a profit, create minimum disruption of stock management, and avoid any significant land degradation due to erosion.

The choice of the crop will depend on the market for the product and on the cost of the inputs required. Clearly, a low cost and low input system is desirable.

The root crop cassava or grain sorghum would be suitable but require nitrogen input. Grain legumes such as soybean, mung bean, pigeon pea and adzuki bean do not have this limitation. The use of such crops will depend on markets for the grain and development of agronomic techniques that achieve low cost input, minimal disturbances to prevent soil losses and are successful and economic as means of pasture renovation.

## NEW CROPS AS ALTERNATIVE ENTERPRISES IN A COASTAL ENVIRONMENT

P. Desborough

Agricultural Research Station, Grafton

In recent years there has been a trend to broadacre cropping for increased diversification on coastal beef cattle areas. Commercial experience and research have demonstrated that grain legumes are best adapted to this role. The area sown to dryland soybeans on the North Coast of New South Wales has increased to some 5,000 ha in the 1978/79 season.

Specifically, the research programme based at Grafton aims to provide suitably adapted varieties of soybean, adzuki beans and mung beans, and to investigate various agronomic aspects of the cultivation of these summer grain legume crops under dryland conditions. Additionally, a major effort has been directed towards solving many of the problem areas associated with the introduction of direct drilling (no-tillage) systems as the major method of crop production in the vast areas of erosion-prone land in the region.

### *Soils and crop species*

The soils suited to this cropping expansion are low in phosphorus and nitrogen and moisture stress develops more rapidly on these lighter textured, hill-soils than in the traditionally cropped alluvials. With the addition of adequate amounts of superphosphate, the grain legumes appear best adapted to these conditions. Soybean has been the most successful species (due to high prices, well organised marketing and good average yields). Adzuki beans and black gram have an important, but lesser, role by providing a wider selection of crop types.

### *Cropping systems*

Basically, systems can be thought of in terms of crop/crop or crop/pasture cycles, and everything in between, including forage crops. In the type of enterprise being considered, we need to evolve production systems related to the traditional wheat/sheep concept, i.e. crop/beef. At one end of the scale is the intensive double cropping regime where the most promising system is soybean/winter cereal. This allows maximum utilisation of machinery and land, and increases capital flow, but in the longer term may be over-exploiting the soil resource through creating a higher soil erosion risk. At the other end is the annual soybean crop with opportunity grazing of stubble in winter/spring. In all systems there will no doubt be a need to rotate crops and pastures in the longer term, such that we might have three years of continuous cropping followed by five years of permanent, improved pasture.

*Direct drilling*

Direct drilling of crops appears to be the key-factor to a major increase in crop production on undulating, coastal country. The technique has not been refined sufficiently to be used commercially, but there is light at the end of the tunnel.

In the past three years at Grafton the requirements for a suitable direct drilling implement have been defined through evaluation of a range of coulters and tines. None of the combinations tested to date have embodied all the features necessary to accurately place a large seed and adequate quantities of fertilizer into a suitable prepared slot in chemically treated pasture or crop stubble. A New Zealand machine, which will probably be released next year, offers the greatest hope to date.

*Herbicides*

Glyphosate, MSMA, DSMA, 2,2-DPA and paraquat have been compared for cost-effectiveness in control of carpet grass/paspalum pastures prior to drilling soybeans. Glyphosate has been most effective in both the amount and duration of control but at prohibitive costs ($40 to $50/ha). In the 1978/79 season effectiveness and promptitude were increased at lower rates of herbicide using guar gum additive. This reduced the cost of effective control with glyphosate to about $18/ha.

## KIKUYU AND KIKUYU–WHITE CLOVER PASTURES

R. H. O'Grady

Consolidated Fertilizers, Bundaberg

The problems of poor winter and spring carrying capacities are major concerns in the beef industry. The use of Kikuyu plus Haifa and/or Kenya white clover pasture offers one of the best solutions. Some of the advantages that such pastures offer include: an increased autumn, winter and spring forage quantity and quality, fattening ability, considerable resistance to heavy stocking, regeneration from seed, pasture species suited to areas considered too wet and heavy for Siratro or *Desmodium*, an intensive pasture that can be switched "on" and "off" as required and pasture species capable of reducing "weed" invasion. Kikuyu and Haifa white clover top dressed in February-March with nitrogen provide heavy grazing allowing the spelling and bulk-up of tropical legumes, while at the same time the kikuyu and white clover pasture receives the essential heavy grazing around seedling emergence.

The real role of kikuyu and white clover in coastal conditions is in animal finishing. Application of autumn nitrogen keeps kikuyu palatable and clover growing, but there is a need for more research on use of white clover.

## THE TYPE AND ROLE OF CROPS IN PASTURE RENOVATION

G. D. Elphinstone

Department of Primary Industries, Gympie

Graminaceous and leguminous species for use as potential cash crops in pasture renovation programs for coastal Queensland include oats, sorghum, millet, maize, barley triticale, cowpea, lablab bean, soybean, mung bean, navybean, pigeon pea and lupin. Some of the points that must be considered in determining which of these crops is most suitable (and profitable) include whether it is summer or winter growing, short or long growing season, complexity of seed bed preparation required, whether herbicides will be required and the expertise (experience) required for successful cropping. Farmers will want to consider also whether nitrogen fertilizers will be required, and if the crop will stand high enough to allow harvesting machinery to clear remaining trash (sticks etc.), and whether grain handling equipment is available and if there are markets for the grain produced. Also it is essential that costs of production be such that returns more than justify inputs and that pastures will regenerate.

There are four alternative methods of rejuvenation. These are complete replanting with seedbed preparation, renovation only, with re-introduction of the lost (or new) legume component, fodder cropping and grain cropping. In terms of time, additional costs for renovation, equipment and labour, loss of grazing time and paddock spelling, and success in re-establishment of the pasture, the renovation only alternative rated highest. The best system for any given farm situation will be determined by factors appropriate to that farm.

## CONCLUDING DISCUSSION

G. Cassidy (Moderator)

In response to questions the following points were made in respect of forage species testing and breeding, use and management of pastures in coastal areas.

Levels of potash may need to be monitored closely to guard against significant loss through the B horizon to the creek, particularly in wet-season conditions.

Claims were made that climbing viney legumes were not suited to grazing in this environment and that breeding and/or selection work should aim at palatable and persistent lines.

In response to "how bad is present situation . . . ." various members indicated that this is a real problem with persistence of tropical pastures in the area and not one peculiar to the property visited. Pastures can be expected to produce over a 3 to 5 year period but this is also dependent on intensity of use and location. Near Bundaberg intensive use also caused problems, yet in the Kandanga region the problem was legume dominance rather than loss. Siratro resisted fire but desmodium did not. A period of seven years was considered too short a life for pastures of this kind and further research is required to resolve this problem. It was reported that work with Siratro in this aspect was satisfactory.

Final comments indicated that this type of cropping is technically possible and assisted in pasture rejuvenation. There were some reservations as to suitability to the area and farmer acceptance.