

**Pastures for production and  
protection:  
Poster abstracts**

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## Developing agroforestry systems for river frontage country in central Queensland

H.G. BISHOP<sup>1</sup>, R. ALLEN<sup>1</sup>, T.B. HILDER<sup>1</sup> AND C.M. BARRETT<sup>2</sup>

<sup>1</sup> *Department of Primary Industries, Mackay*

<sup>2</sup> *Secretary, Nebo Broadsound Landcare Group, Mackay, Queensland, Australia*

Many of our Queensland grazing systems and enterprises are actually natural agroforestry systems, drawing income from both cattle and timber sales. Most on-property timber sales from native forests growing on river/creek frontages are for construction timber, sleepers, or fence posts and rails. A wide range of timber is also used on-property for constructing sheds and yards and some property owners mill their own timber for house construction. Property owners sometimes lose sight of the potential monetary value of standing timber by focusing solely on maximising the growth of grass, cash crops and cattle. Over the past decade, the economic and environmental value of native forest and plantation timbers, and their role in sustainable agriculture, are increasingly being recognised.

A new partnership project between DPI, landholders and Landcare aims to: increase the economic and environmental value from existing native forests on river frontages; evaluate plantation timber hardwoods for frontage country already cleared; and improve catchment biodiversity (more grass and tree cover) and health (fewer weeds and less soil erosion).

Five hectares of native timber growing on frontage country has been selected on each of 5 properties in the Isaac-Connors catchment in the Nebo and Broadsound Shires to develop and demonstrate silvicultural practices that will increase the value of the timber resource. Five trial sites of 1–2 ha, on each of 5 properties, have been selected for planting rootstocks of 20 hardwood species/providences/hybrids to determine adaptation, growth rate, tree form, timber quality and market opportunities. The response from graziers and landholders to meet these objectives is very encouraging as judged by their interest and participation. The first plantings will take place during April–May 2000. Funding support from the Commonwealth Natural Heritage Trust is thankfully acknowledged.

## Recovery of Queensland bluegrass pastures in Nebo and Broadsound Shires

T.B. HILDER, H.G. BISHOP, G.A. LAMBERT, R.M. DODT AND C.M. BARRETT

*Department of Primary Industries, Mackay, Queensland, Australia*

During the 1990s, Queensland bluegrass pastures within the Nebo and Broadsound Shires deteriorated from an undefinable, but acceptable to the local community, standard to severely degraded and unacceptable. With favourable rainfall after 1998, most of these pastures returned to acceptable standards but, in some cases, the proportion of desirable plant species ('3P' species—Perennial, Palatable, Productive) remained low. While there may be varying quantities of total pasture mass, this alone is a poor indication of pasture health and quality.

During the mid-1990s, degradation, due to the stocking pressure during drought being abetted by nitrogen and energy supplementation, was sometimes so severe that it seemed that these pastures could not recover.

Pasture renovation activities during the period 1996–1999 showed that degraded pastures could regenerate, and this was monitored over 12 GRASS CHECK sites on 6 properties since 1996. Depending on the initial degree of degradation, the speed of recovery varied according to stocking rate, rainfall events, spelling and the introduction of native or introduced seed. Recovery was hastened on a severely degraded site by reseeding with improved pasture; this also resulted in weight gain in cattle during a 'protein drought' in 1999, while cattle on native pasture lost liveweight.

Local communities expect that degraded bluegrass pastures will recover, but monitoring suggests that, where renovation has not been undertaken, pasture condition is not as healthy as perceived.

Continued monitoring is recommended to show trends in pasture condition, and to allow the application of appropriate pasture management strategies.

## The effect of timber treatment on native pasture nutrition in the Alice River tableland. Are pastures running down?

P.R. SPIES<sup>1</sup>, G.F. BOURNE<sup>2</sup> AND R.J. MAYER<sup>3</sup>

<sup>1</sup> Department of Natural Resources, Clermont, and

<sup>2</sup> Emerald

<sup>3</sup> Department of Primary Industries, Townsville, Queensland, Australia

Concern has been expressed that clearing timber on lower fertility soils may result in rundown of nutritive value of desirable perennial grasses and, with time, lower quality grasses may prevail. The intent of this project is to see if various timber treatments such as pulling, blade ploughing, discing and seeding have instigated any pasture rundown. The soil types of the Alice River tableland are predominantly red and yellow earths with some deep A horizon duplexes. Soils are of low fertility with P lower than 4 ppm. The pasture community is predominantly soft spinifex with areas of *Aristida-Bothriochloa* with an overstorey of silver-leafed ironbark, with areas of poplar box and yellowjack.

Sampling has been carried out across 23 sites in the study area since April 1996, of which 15 are cleared and 8 sites are virgin timber. Fourteen of these sites were paired on soil type and vegetation. Sampling is carried out 3 times a year—end of the wet season, mid-dry season and start of wet season. Green leaf of desirable perennial grasses is sampled, dried and analysed for Total N and P using Kjeldahl digestion followed by colorimetric analysis.

Results indicate no significant difference in plant nutritive value (either percent N or P) between cleared and virgin sites to date, nor any pasture decline or rundown. The Rosedale airstrip site was cleared in the early 1960s yet grass samples revealed no difference in grass nutritive value from those at comparable virgin sites. However, there have been peaks and depressions in nutritive value with seasonal conditions. Sampling after rainfall events results in higher plant P and N due to mobilisation of nutrients within the soil. *Cenchrus ciliaris* responds better to rainfall, with higher nutritive value compared with the native species sampled. However, *Bothriochloa ewartiana* retains its nutritive value better into the dry season.

## Monitoring land trend and condition in the Jericho Shire

P.R. SPIES<sup>1</sup>, P.A. JONES<sup>2</sup> AND N.O. CLIFFE<sup>3</sup>

<sup>1</sup> Department of Natural Resources, Clermont

<sup>2</sup> Department of Primary Industries, Emerald, and

<sup>3</sup> Mackay, Queensland, Australia

The QGRAZE project was developed to monitor rangeland condition and trend by recording changes in vegetation and soil surface condition on fixed sites over time. The pasture community of Jericho Shire is predominantly soft spinifex with areas of *Aristida-Bothriochloa*. There are concerns, within the shire, about declining land condition through overgrazing—exacerbated by climate variability. The objective of this study is to provide, through collected QGRAZE data, information about longer-term rangeland trend and condition within the shire for a regional enterprise reconstruction scheme in the Desert Uplands area of central Queensland.

Twenty-one QGRAZE sites were monitored in 1996, 1997 and 1999. A DOS-based computer program and manual were used to collect data. Analysis was based on frequency of decreaser and increaser grasses, and changes in ground cover. Decreaser grasses include *Triodia* spp., *Bothriochloa ewartiana*, *Chrysopogon fallax*, *Panicum* spp., *Themeda triandra*, *Digitaria* spp. and *Heteropogon contortus*. Wire-grasses (*Aristida* spp.) were treated as increaser species.

Our information suggests that land condition has been maintained from 1996 to 1999, most likely due to good wet seasons in 1997–98 and 1998–99 and a lack of fire. Frequency of decreaser grasses has been maintained or has improved, while the frequency of increaser species has also increased; total ground cover has improved.

## The native grasslands of the Central Highlands region

MELINDA FLETCHER

*Queensland Parks and Wildlife Service, Emerald, Queensland*

The 'downs' grasslands of the Central Highlands region stretch in a band from Kilcummin (north of Clermont) to Rolleston, but with isolated patches elsewhere; they occur on heavy black soils on basalt and on fine-grained sedimentary rocks.

The downs are essentially treeless plains, but often carry scattered mountain coolibah, red bloodwood, brigalow and black teatree. These native grasslands are dominated by bluegrass (*Dichanthium sericeum*), white speargrass (*Aristida leptopoda*), native millet (*Panicum decompositum*), Yabila grass (*Panicum queenslandicum*) and shot grass (*Paspalidium globoides*). Forbs such as bell vine, rhynchosia, phyllanthus, corchorus and sida are also common.

In 1997, it was estimated that only 51% of the original area of native grasslands was left in the Central Highlands region—mostly on private land where it is subject to various grazing and rotational cropping regimes. Invasion by parthenium weed and a reduction in the cover of perennial grasses are major

concerns for the long-term viability of the remaining native grasslands. Although 2 national parks have been declared to conserve and protect native grasslands, they represent only 1.4% of the remaining area of native grassland in this region.

Conservation values of native grasslands are extremely high. It was only recently that a presumed extinct daisy (*Trioncinia retroflexa*) was rediscovered in roadside grassland 60 years after it was last recorded. The vulnerable king bluegrass (*Dichanthium queenslandicum*) has suffered serious decline in the Darling Downs area, and now survives in the Central Highlands region only in the most conservatively grazed paddocks. *Cyperus clarus* is pending an endangered status and *Verbena macrostachya* is a herb endemic to the grasslands of the Central Highlands (Fensham 1999). Native grasslands provide habitat for many small mammals such as dunnarts and planigales, birds, reptiles and larger mammals such as kangaroos. Three highly endangered reptiles (*Lerista allanae*, *Tympanocryptis lineatus* and *T. pinguicollis*) are known to occur in the region but have not been recorded since the 1960s. The first of these species is known only from the native grasslands of the region.

## Restoring production from black speargrass pastures: practices and profitability

T.W.G. GRAHAM<sup>1</sup>, N.V. MILLS<sup>2</sup> AND P.F. EMMERY<sup>3</sup>

<sup>1</sup> *Tropical Beef Centre, Rockhampton Queensland*

<sup>2</sup> *'Melrose', Morinish*

<sup>3</sup> *'Muldoon', Marlborough, Queensland, Australia*

Options for improving the production and stability of droughted and overgrazed native pastures were evaluated by the Morinish Landcare group in central Queensland. Main suggestions were: roughen the soil surface for better rainfall infiltration; reduce runoff by rapidly improving ground cover through reseeding; and spell and burn pastures to control less desirable wiregrasses.

A 140 ha paddock of native pasture, mainly black speargrass (*Heteropogon contortus*) and forest bluegrass (*Bothriochloa* spp.) growing on undulating iron-bark-bloodwood country was fenced into 5 paddocks allowing 3 levels of cultivation (deep-rip, chisel plough, pitting-crocodile planter) with reseeding, one spell-burn and one control treatment. Cultivation paddocks were oversown with Bisset creeping bluegrass, Premier digit grass and stylo legumes in January 1996. In each of 3 years, crossbred weaners were allocated to paddocks according to feed supply estimates and weighed regularly.

The benefits of renovation were still evident after 3 years. Chisel ploughing and reseeding appeared to be the most cost-effective renovation option (\$98/ha) producing an extra 63 kg LW/ha by the second year. An economic evaluation based on the difference in livestock production (valued at \$1.20/kg) between the control and the pasture renovations showed that the net economic benefits from the 3 cultivation-renovations were satisfactory but similar. Chisel ploughing gave the highest internal rate of return (IRR) of 24% over 6 years. The choice of renovation options depends on the amount of capital available and the area (ha) to be treated. Greater benefits were achieved from the deep-ripping option but at a higher cost (\$393/ha). The crocodile planter was less successful. Burning pasture in spring for 2 successive years effectively increased the frequency of black speargrass and reduced, by 50 per cent, the frequency of the undesirable wiregrass (*Aristida* spp.).

The re-emergence of a pasture degradation problem can be avoided by adjusting stock numbers to feed supply. Under this management, pasture condition improved over time resulting in liveweight gains of 180–200 kg/hd/yr from black speargrass pasture.

## Regeneration of drought-affected pastures

G.A. LAMBERT, H. BISHOP, T. HILDER AND R. DODT

*Department of Primary Industries, Mackay, Queensland, Australia*

This demonstration aimed to introduce grasses and legumes into severely degraded, black soil, 'bluegrass downs' country in central Queensland. Both native and exotic species were introduced, first in small plots and then in extended commercial (100ha) sites. Six large sites were planted in the shires of Nebo, Broad-sound and Peak Downs.

This land type is fragile, the soils being highly erosive. The 'desired' native bluegrass pasture species (e.g. Queensland bluegrass) are selectively grazed and readily succumb to heavy grazing.

Selections from the small plots were planted into heavy cracking, black clay soil paddocks in 1996. The prolonged dry weather and continued grazing during the drought, left "downs" country bare enabling it to be sown without land preparation. Planting was done with either a roller-drum grass seed planter with covering harrows, or a 'Crocodile' planter. These large areas were fenced to control stock.

The planted grass mixture was purple pigeon, Floren bluegrass, Bambatsi panic, a mixture of mitchell grasses and Qld bluegrass. Milgara butterfly

pea and desmanthus were the legumes used. This mixture was planted at 2.5 kg/ha.

Of the 6 sites planted, 4 became excellent stands. Only one failed outright. Here, Bowen Indian blue couch was the dominant grass and it swamped the introduced species after rain. Another site received no rain for 3 months after planting and only low levels of introduced species are present today. As always, rainfall after planting is the main determinant for successful pasture establishment.

Purple pigeon grass is the most vigorous and easiest to establish. Floren bluegrass is ideal for heavy soils and is readily grazed. Bambatsi is slow to establish and is overtaken by the other grasses because of this. Queensland bluegrass is the most successful of the planted native grasses, but makes up only a small proportion of the pasture stand after 3 years.

Of the legumes used, Milgara is selectively grazed and stocking pressures need to be managed carefully. Desmanthus needs to be spelled during the summer to allow it to bulk up.

Cattle performance is now being measured on 3 of the 100ha sites. To date, cattle are gaining at about the same rate as they are on native pastures on the same soils in the area (0.55 kg/d in the growing season and just holding their own in the dry season), but at twice the grazing rate. Note that this is about the same rate as achieved from buffel grass during this same period.

## Dual purpose trees in tropical pastures — more on the true albizias

BRIAN LOWRY

*CSIRO Tropical Agriculture, Indooroopilly, Queensland, Australia*

Some large, free-standing tree species may enhance pasture production or quality below the canopy; other species can provide feed by the dry season fall of leaves, flowers or pods while some, if pruned to give a clean stem to 3–4 m, could also provide cabinet timber.

Establishing trees for both timber and forage offers a distinctive agro-forestry system for the wet-dry tropics.

Among the most promising of these 'dual purpose' trees are 3 closely related native species in the genus *Albizia*. The following characteristics illustrate their promise.

The siris tree — *Albizia lebbek*

- Genuinely native in northern Australia — but also widely introduced.
- Wood has value — sold in Hawaii at the same price as Australian red cedar.
- Fallen leaf can be utilised as feed and to promote digestion of dry season grass.

- Capacity for volunteer establishment where not wanted may obscure its value in the pastoral system.

Belmont siris — *Albizia canescens*

- Found only in northern Australia; occurs widely in inland country, but usually not common.
- Regarded as a Queensland cabinet timber last century; must have been much more abundant.
- Leaves are highly palatable, and isolated trees show strong grass enhancement.
- A potentially valuable tree that must be becoming rarer, is perhaps endangered, and should be recognised and encouraged.

Forest siris — *Albizia procera*

- Grows vigorously and spontaneously in regenerating rainforest in northern coastal areas.
- Already recognised as a Queensland 'rainforest' timber; isolated trees grow naturally in good log form.
- Good fodder tree and promotes sub-canopy green panic.
- Volunteer growth in coastal areas may obscure its ability to grow, if planted, in drier inland areas.

## Burning a stylo-dominant pasture

DERYK COOKSLEY

DPI, Queensland Beef Industry Institute,  
Mareeba, Queensland, Australia

Native pasture oversown with stylo can become legume-dominant under grazing; some of the older pastures are over 90% stylo. These pastures may be unsustainable, especially if an unpalatable weed establishes in the nitrogen-enriched soil.

In a grazing trial to address stylo dominance, treatments assessed spelling from grazing, annual burning, and sowing introduced grasses. Paddocks were grazed at a beast/3.5 ha. Spelled paddocks were rested from the start of the wet season until the black speargrass flowered (10–11 weeks). However, a wild fire completely burnt all treatments in spring 1999.

The effects of one wild fire after 6 years of no burning against 6 years of annual burning are compared on the basis of presentation yields of stylo, native grass and introduced grass at the end of the pasture spelling period.

### Native pasture oversown with stylo

- A single burn reduced stylo yield advantage from a factor of 6 to that of the annually burnt pasture.
- Native grass yield was similar and unchanged in the 2 burning regimes.
- Grass yield in spelled pasture was double that of the continuously grazed pasture under both burning regimes.

### Native pasture oversown with stylo then sown to introduced grass

- A single burn reduced stylo yield advantage from a factor of 2 to half that of annually burnt pasture.
- A single burn reduced total grass yield to below that of the annually burnt pasture.
- Sabi grass and native grasses responded well to the single burn.
- Indian couch and buffel grass were suppressed by the single burn.
- Grass yield (predominantly introduced grass) in spelled pasture was double that of the continuously grazed pasture under both burning regimes.

## Estimating edible dry matter yield of temperate and tropical pastures using a sward stick

S.C. WHITE, T.J. LESTER AND J.J. MOORE

The University of Queensland, Gatton,  
Queensland, Australia

Measurements using a sward stick were related to edible yield characteristics of Gatton panic (*Panicum maximum*) and lucerne (*Medicago sativa*) through regression.

Sample quadrats of plants at varying morphological stages were destructively harvested and their biomass recorded. Edible yield was calculated as total

plant biomass less plant biomass below the grazing horizon.

In lucerne, total height was a good explanatory variable of edible yield; in Gatton panic, ligule height gave the best estimate of edible yield.

As an introductory assessment, *in situ* measurements can be highly correlated with edible yields in temperate and tropical pasture species, saving time and effort in destructive sampling. Our inadequate sampling range and frequency may warrant further research, when the evaluation of basal diameter and stem density with height should be considered.

## Summer legumes increase cattle production in the Maranoa

T.J. HALL AND J.R. DOUGLAS  
*Department of Primary Industries, Roma,  
 Queensland, Australia*

Primar and Unica are 2 new cultivars of the summer pasture legume, Caatinga stylo (*Stylosanthes seabrana*). They have recently been released for use on the clay soils in the tropics and subtropics. Caatinga stylo grows well on the heavy cracking clay soils supporting brigalow communities in the Maranoa.

The growth rate of weaner steers on a sown pasture was compared with that on native grass pasture. The sown pastures were established in recently cleared and cultivated brigalow-belah-wilga country on a gilgaied, heavy cracking clay soil in the Surat district. The 11 ha legume pasture had 4 ha each of Primar and Unica Caatinga stylo oversown with Bambatsi panic (*Panicum coloratum*), and 2.8 ha of Jaribu desmanthus (*Desmanthus virgatus*) and 0.2 ha of Milgarra butterfly pea (*Clitoria ternatea*) with self-sown Queensland bluegrass (*Dichanthium sericeum*). The

native pasture was dominated by Queensland bluegrass; both paddocks were grazed continuously by cattle from sowing on February 10, 1997.

Steer liveweight gain on the mixed legume-Bambatsi pasture was 85% higher (0.57 kg/d) than on the native grasses (0.31 kg/d) when stocked at the same stocking rate (1.95 ha/hd) from August 1998 and June 1999. Average starting liveweight was 278 kg. The legume pasture produced gains of 0.66 kg/d in spring and summer and 0.48 kg/d from late summer to winter. Primar (22 plants/m<sup>2</sup> at 75 % frequency) and Unica (20 plants/m<sup>2</sup> at 78 % frequency) stylo plant populations have increased, while desmanthus (1.2 plants/m<sup>2</sup> at 28 % frequency) and butterfly pea populations (1.5 plants/m<sup>2</sup> at 26 % frequency) have declined over 3 years of continuous grazing. The Caatinga stylos, Primar and Unica, with Bambatsi have persisted for 3 years and have produced high annual steer growth rates on brigalow clay soils under continuous grazing in the Maranoa.

## Water-use efficiency of perennial summer grasses

N. RETHMAN, DIANA MARAIS AND  
 J. ANNANDALE  
*University of Pretoria, Gauteng, South Africa*

The inclusion of perennial pasture species in livestock production systems in South Africa often depends on their ability to survive and produce quality forage under moisture stress. Since irrigation water is limited, choice of crop and irrigation scheduling should ensure maximum water-use efficiency. The responses of Bermuda, buffel, finger, guinea and kikuyu grasses to different levels of moisture stress were studied. While the control had no stress, being brought to field capacity each week, the other treatments received 75%, 50% and 25% of the water supplied to the control. Together with water used from the soil profile, the average water use for these 4 levels over the summer growing season was 1023, 805, 641 and 436 mm, respectively.

In terms of total forage produced, the average water-use efficiencies (kg/ha/mm) of buffel, Bermuda, finger, guinea and kikuyu were 20, 17, 15, 11 and 10, respectively. With limited moisture, buffel headed the list followed by Bermuda and finger grasses; both guinea and kikuyu were very disappointing. With no moisture stress, both buffel and Bermuda did well followed by finger, guinea and kikuyu in that order.

The most notable finding was the remarkable increase in WUE with increasing stress, indicating that deficit-irrigation strategies should be strongly considered where irrigation water supply is limited.

Forage responses were also interpreted in terms of quality. While digestibility and crude protein data indicated that guinea, kikuyu and finger were superior to Bermuda and buffel in the first season, this trend was reversed in the second season. Similarly, trends of quality parameters associated with the degree of moisture stress were inconsistent.

## Practical indicators of pasture production and sustainability — a field guide for graziers

L.H. McCORMICK<sup>1</sup> AND G.M. LODGE<sup>2</sup>

<sup>1</sup> *NSW Agriculture, Manilla, and*

<sup>2</sup> *Centre for Crop Improvement, Tamworth, New South Wales, Australia*

Producers are becoming increasingly aware of pasture production and sustainability issues as a result of the Sustainable Grazing Systems Key Program and initiatives undertaken by NSW Agriculture. Until now there has been no simple, easy-to-use guide that graziers could use to quickly assess the health of their pasture systems on a paddock basis. Without such a guide, it is often difficult to know at what level a pasture is performing, if the current management is okay, or what parts of pasture management need to be improved.

A field guide has been developed, initially for pastures on the north-west slopes of NSW, but the concept can readily be adapted to other areas. The simple guide requires little training or equipment, and so can be used in the paddock on a day-to-day basis. It consists of a seven-point checklist to assess pasture production and sustainability. It is based on indicators that a grazier can see and subjectively measure. These

include: ground cover, litter, soil surface condition, proportion of productive pasture species, proportion of green-to-dead leaf, percent legume and animal production.

While animal production is important, it is deliberately placed last on the list. Most producers have good skills at assessing animal condition, but are less likely to monitor pastures and soils.

When using the guide, graziers assess the 7 indicators as having either a low, medium or high score. Acceptable levels of these different categories are included in the guide. Indicators with low values immediately highlight those areas that are in most need of management to improve them. If all areas are given a high score, the pastures are probably on-track and in good shape, but should be monitored regularly.

The field guide has proved popular with producers. They have found it to be particularly useful in breaking down the pasture system into simple, easy-to-follow parts that can be readily seen and assessed. The field guide has been incorporated into a pasture health kit produced by the Sustainable Grazing Systems, North-west Slopes Producer Committee.

## New buffel grass cultivars from South Africa

N. RETHMAN AND W. BOSHOFF

*University of Pretoria, Gauteng, South Africa*

Two new buffel grass cultivars — Mopane and Kalahari — were registered by the University of Pretoria in 1999, and will be marketed by Panter Seed<sup>1</sup>. These cultivars were identified in screening trials conducted over a 10-year period in southern African countries. In the initial phase, 30 accessions from Africa, America, Asia and Australia, were compared with Molopo from South Africa, and T-4464 from USA. Intensive studies on productivity and quality conducted in Pretoria, supported by multi-site ecological adaptation evaluations, facilitated the selection of 10 ecotypes for further screening.

In terms of ecological adaptation, soil texture played a determinate role in successful establishment and productivity—with sandy soils giving the best results. Summer temperatures, ranging from 29–33°C mean maximum in the warmest month, were close to ideal for this species. In contrast, mean minimum temperatures in the coldest month (–3–3°C) could have been a limitation; this was particularly true when tufts were defoliated at the onset of winter. Rainfall (349–700 mm between sites and seasons) influenced

success of establishment and productivity, but was not extreme enough to influence survival of established plants.

Although seed production varied from season to season, both Mopane and Kalahari were consistently amongst the best seed producers. Most importantly, these cultivars were not as subject to seed dormancy as either Molopo or T-4464. However, seed dormancy problems might be overcome with the refinement of seed-cleaning technology. In terms of productivity, and especially leaf production, measured over 3 growing periods, Mopane and Kalahari were the top performers, and these cultivars also had more extended growing seasons than other selections and cultivars. However, there was a tendency for these more vigorous cultivars to have inferior nutritive value and palatability, indicating the importance of utilising them at a young stage of growth.

<sup>1</sup> Panter (Pty) Ltd., PO Box 19, Greytown 3250, South Africa: Tel-27-33-4131131; Fax-27-33-4171208.



## Establishment of Pinto peanut direct-drilled into a tropical grass pasture

M.H. LAVERS<sup>1</sup> AND B.A. SILVER<sup>2</sup>

<sup>1</sup> Southedge Seeds Pty Ltd, Mareeba

<sup>2</sup> DPI, Kairi Research Station, Kairi, Queensland, Australia

Pinto peanut (*Arachis pintoi* cv. Amarillo) is a suitable legume for heavily stocked dairy and beef pastures on the Atherton Tableland in far north Queensland. Many of these pastures are on steep land subject to erosion if fully cultivated.

Tropical grass pastures are often of poor quality due to the lack of a persistent tropical legume and the resultant low soil nitrogen status. Many of the early legume introductions, for example, Greenleaf desmodium (*Desmodium intortum*), Silverleaf desmodium (*Desmodium uncinatum*), Tinaroo and Malawi glycine (*Neonotonia wightii*), have failed to persist under higher stocking rates.

In January 1997, Amarillo pinto peanut was direct-drilled into an established pasture of signal grass

(*Brachiaria decumbens*) at Butcher's Creek on the Atherton Tableland using a Mason Deere zero-till planter. The peanut was planted at 6 and 10 kg/ha in 75 cm rows. Roundup®, (a.i. glyphosate) was applied at planting at 0, 1.5 and 3 L/ha to suppress grass growth in the low planting rate plot.

After 3 years of grazing (March 2000), each plot was visually appraised to determine the legume cover using a 20 × 20 cm quadrat. At a high stocking rate (higher than the district average of 1.6 Adult Equivalents/ha), the percent coverage of the peanut was 51, 66 and 55% for the zero, low and high rates of herbicide. The high planting rate plot (also with no herbicide) had a similar legume cover to the low planting rate, zero herbicide plot (52 vs 51%).

We conclude that successful long-term establishment of pinto peanut can be achieved by direct-drilling the seed into signal grass pastures using a seeding rate of 6 kg/ha without needing a grass-suppressing herbicide.

## The effect of temperature and water potential on seedling growth and shoot:root ratio in *Arachis pintoi*

AMANDA CLEARY AND MAX HESLEHURST

University of Queensland, Gatton Campus, Queensland, Australia

*Arachis pintoi* is a tropical forage legume suitable for ground cover in orchards, and for grazing for both milk and meat production in the tropics and subtropics. The characteristics that make the legume successful include its ability to withstand intensive grazing pressure and its adaptation to a variety of conditions including environmental stress once established.

However, establishment from seed in the field has been a problem with many growers failing to achieve

optimum seedling establishment due to environmental conditions. By determining the optimum temperature range for seedling establishment and the degree to which it can tolerate water stress, we can establish a more accurate planting window that takes these factors into consideration. Higher germination rates will result in increased dry matter production.

Seedling growth of *A. pintoi* species is particularly sensitive to high temperatures and water stress. Both parameters affect root and shoot length, thereby influencing seedling establishment. When the temperature during germination is sub-optimal and water stress exists, the rate of establishment will be limited by the sensitivity of the species.

## Managing seed set of Wynn cassia in grazed cassia-grass pastures

C.K. McDONALD AND R.M. JONES  
CSIRO Tropical Agriculture, Brisbane,  
Queensland, Australia

Wynn cassia (*Chamaecrista rotundifolia* cv. Wynn), a tropical legume adapted to the lighter sandy soils in the 600–1000 mm rainfall region, is sown widely in Queensland. Its low acceptability to animals creates concerns of cassia dominance in some pastures.

Cassia plants generally live for only 1–2 years, occasionally 3, but can set large amounts of seed. This enables cassia to recruit quickly from seed after periods of plant death. Reducing seed set could help reduce cassia dominance.

Seed set of cassia in grazed pastures is poorly related to its herbage yield; age and size of individual cassia plants and the variation in the yield of the companion grass have a greater impact. Cassia sets seed in summer and autumn but plants less than 1-year-old and small plants with stems less than 200 mm long set very little seed. Similarly, seed set is substantially

reduced when grass yield exceeds about 3000 kg/ha, irrespective of the age or size of the cassia plant.

It is difficult to control the seed set in summer as cassia is not readily eaten at this time. Managers could stock heavily so that both cassia and the grass are eaten, but as animals preferentially graze grass at this time, this would affect the grass more than the legume and would also depress animal production. An alternative may be to destock or very lightly graze to allow the grass to grow and seed. This would enhance grass vigour while suppressing cassia seed set—but only if grass yields are likely to exceed 3000 kg/ha.

Heavy grazing in autumn, when the grasses have usually matured and seeded and when cassia is readily eaten, will reduce seed set provided it is undertaken before pods mature and either dehisce or pass through animals.

These difficulties in controlling cassia balance suggest careful consideration before sowing cassia into a soil and rainfall environment where cassia is well adapted but where soil fertility, and hence potential grass growth, are very low.

## Leucaena KX2: propagation aspects

CHRIS GARDINER<sup>1</sup> AND RAYMOND JONES<sup>2</sup>

<sup>1</sup> James Cook University, Townsville

<sup>2</sup> CSIRO, Townsville, Queensland, Australia

Many livestock producers in parts of tropical Queensland and in developing countries regard leucaena (*Leucaena leucocephala*) as *the* premium forage shrub. It possesses many of the attributes sought in a shrub forage plant; however, to other members of the community, some of these attributes, particularly its high seed production and capacity to spread into non-target areas, make it an environmental weed.

The hybrid leucaena, known as **KX2** (*Leucaena leucocephala* × *L. pallida*) is psyllid-resistant and more productive in terms of total biomass than *L. leucocephala* but does not produce abundant seed. Although it is most unlikely to present a weed risk, it is difficult to establish for livestock production or as a multipurpose shrub legume. Simple vegetative propagation methods need to be developed.

### Cuttings and grafting

Mature KX2 shrubs were slashed in June and cuttings (av. 6 mm diameter and 2 nodes in length) were taken 6 weeks later from the vigorous regrowth. These were dipped in "Rootex-P" cutting hormone, planted into 9 cm diameter pots containing a 50:50 mixture of sand and peat, and placed under 70% shade at ambient temperature with water for one hour daily from overhead micro-sprinklers.

Cuttings were also grafted using approach or wedge techniques on to either 1-year-old *Leucaena* cv. Tarramba plants in pots or on to mature *L. leucocephala* in the field. All pots received monthly foliar applications of a complete fertiliser.

### Results

47% of the cuttings rooted successfully; successful cuttings had a mean stem diameter of 8mm. 29% of the approach and 14% of the wedge grafting techniques struck.

## Performance of Jarra and Strickland grasses under grazing on well and poorly drained soils

H.G. BISHOP, T.B. HILDER AND

C.M. BARRETT

*Department of Primary Industries, Mackay, Queensland, Australia*

Jarra and Strickland finger grasses (*Digitaria milan-jiana*) were released in 1991 and 1995, respectively, and are being sown widely in northern Australia as alternatives to pangola grass (*D. eriantha* ssp. *pentzii*). These new cultivars can be established by sowing seed whereas pangola has to be established vegetatively from runners. Pangola grass is widely sown and valued in northern Australia as a forage for grazing and haymaking and also has an important role in land management, stabilising waterways and erosion-prone areas and suppressing weeds. Koronivia grass (*Brachiaria humidicola* cv. Tully) is also widely used in northern Australia, and has a stoloniferous growth habit similar to pangola. It can be sown by seed or runners, but is slow to establish from seed.

Two producer demonstration sites have been established in the Proserpine district to compare dry matter growth, climatic/soil adaptation and steer liveweight

gain for these 4 grasses. Three 5 ha paddocks on 2 properties were sown to pangola from runners, Tully from runners and seed, and Jarra/Strickland (separately, half and half) from seed.

Site 1 is a well-drained sandy loam soil (12 ppm bicarb P; 900 mm AAR) while Site 2 is a poorly drained duplex (4 ppm bicarb P; 1500 mm AAR). DAP was applied at 100 kg/ha to Site 2 in Years 1 and 2. Steers were weighed on to Site 1 in May 1999; Site 2 is not yet stocked.

Preliminary performance information indicates:

- Jarra and Strickland are both sensitive to water-logging, with Jarra more sensitive.
- On well-drained fertile soils, both establish more quickly than pangola or Tully.
- Jarra and Strickland are very palatable (Strickland most palatable) and are grazed in preference to pangola grass which is grazed in preference to Tully.
- Early liveweight gain results suggest Jarra/Strickland > pangola > Tully while the opposite order is indicated for standing dry matter.

## Impact of Pangola Stunt Virus on grazing and hay enterprises in northern Australia

H.G. BISHOP

*Department of Primary Industries, Mackay, Queensland, Australia*

Pangola Stunt Virus (PSV) was identified on pangola grass (*Digitaria eriantha* ssp. *pentzii*) and naturalised summer grass (*Digitaria ciliaris*) in south-east Queensland in the early 1980s (Teakle *et al.* 1988, *Aust. J. Agric. Res.*, **39**, 1075-1083). With no quick and easy ID test available, documentation of PSV occurrence has not proceeded. PSV has been identified on pangola from Mackay (2 properties in 1995; 2 in 1999) by symptomatology based on plant disease symptoms: stunted and multiple tillering; discolouration of leaf; susceptibility to rust; crinkled racemes on seed head; degenerating root system; and lack of growth even under ideal conditions. Both (1999) properties said their pangola stopped growing despite luxury levels of NPK fertilisers and plenty of water. One 20 ha hay paddock was not cut for 18 months and then ploughed out.

An estimated 20 000 ha of pangola, with annual gross value exceeding \$8M, is grown on the Mackay wet coast in central Queensland. There are approximately 10 specialist growers of pangola hay in Mackay and a large percentage of coastal properties bale their own pangola hay for weaning. Most commonly these weaners are then grazed on pangola pastures. Pangola is also grown in north and south-east Queensland, the NT, WA and northern NSW. The question also arises: 'Could PSV impact on new *Digitaria* cultivars Jarra, Strickland, Premier, Arnhem and the *Digitaria* turf grasses'?

A current survey of landholders will help determine the importance and \$ value of pangola to the grazing and hay industries in northern Australia. This information will support funding applications to research PSV (field ID test, means and rate of spread, potential production decline, susceptibility of seeding types, control and management practices). All RD&E workers are invited to help determine the potential impact of PSV on the grazing and hay industries of northern Australia.

## NIRS predicts seasonal changes in diet quality of cattle

TAOUFIK KSIKSI<sup>1</sup>, ANDREW ASH<sup>2</sup>,  
PETER FRY<sup>1</sup> AND PETER ALLEN<sup>2</sup>

<sup>1</sup> Queensland Department of Primary Industries,  
Charters Towers

<sup>2</sup> CSIRO Tropical Agriculture, Townsville,  
Queensland, Australia

We studied how diet quality and composition (C3:C4 species) changes in response to land condition, utilisation rate and season, using Near Infrared Reflectance Spectroscopy. The study sites in the Dalrymple shire represented 3 major soil types of the seasonally dry tropics of northern Queensland. Faecal samples were collected every 4–5 weeks for light, moderate and high pasture utilisation rates and 2 pasture condition states (good condition, State 1; degraded condition,

State 2) within each soil type. We estimated *In Vitro* Dry Matter Disappearance (IVDMD), faecal nitrogen and the proportion of grass in the diet.

Faecal N and IVDMD declined significantly as the season progressed for the 3 soil types. On the more fertile soils, the proportion of grass in the diet was lower as utilisation increased while cattle grazing State 1 paddocks had higher average grass proportions in their diets than did those in State 2 paddocks. We did not find enough evidence, for all 3 soil types, that cattle shifted to higher quality C3 plants as grass availability declined. Despite the lack of evidence to assess the extent of buffering effects of cattle, the results showed that NIRS can be a good tool to predict seasonal changes in diet quality of cattle grazing on northern Queensland rangelands.

## Adaptive management: attainable rubber vine management

J. MCKENZIE, R. LOWE AND S. TURNER  
Tropical Weeds Research Centre, Department of  
Natural Resources, Charters Towers,  
Queensland, Australia

Several methods to control rubber vine are currently available, but have not been adopted by many land managers for a variety of reasons. Our 'adaptive management' project aims to provide a process to increase the knowledge about rubber vine, and hence increase the level of control activities within the National Containment line.

Adaptive management draws on the collective knowledge of both landholders and scientists to develop management plans for rubber vine control specific to an area.

The steps involved in the process are: assessing the problem; identifying key gaps in knowledge; developing and implementing a management plan; monitoring for outcomes; reviewing the outcomes; and adjusting the plan, if necessary. It allows land managers to proceed responsibly in the face of uncertainty by breaking problems down to a step-by-

step process. Participants can also gain an insight into the interaction these developing plans have on the whole ecosystem and, in turn, how these influence rubber vine control.

This project started in September 1998. There are now 3 adaptive management working groups based at Charters Towers, Georgetown and Home Hill, representing diverse areas of rubber vine in north Queensland. Groups consist of, on average, 8 properties with both local and state government agencies represented.

Due to the nature of the infestations, primary treatments predominantly incorporate timing of either mechanical methods or fire with some pasture reseeding. Each group has implemented all primary control treatments, with the Georgetown group initiating the secondary treatments. Assessment of all sites will be done when pasture biomass has reached a maximum (Apr–May) and before the wet season (Oct–Sep). Group participants are being evaluated to gauge the impact adaptive management is having on adoption levels. In the first year of operating, there has been a remarkable increase in control work conducted on group participants' properties.

## Cut-stump treatment of woody weed regrowth using a brushcutter

P.V. BACK

*Department of Primary Industries, Tropical Beef Centre, Rockhampton, Queensland, Australia*

Heavy-duty brushcutters fitted with some type of spray reservoir, pump and nozzle are being used for the cut-stump treatment of woody weeds. When used correctly, this is a very useful technique for treating larger (up to 75 mm basal diameter) woody weeds and woody regrowth. This poster explains the correct use of these machines and the equipment needed to ensure safe operation.

The minimum appropriate personal safety equipment needed when operating a heavy-duty brushcutter is: head-, ear- and eye-protection along with overalls, or long sleeve shirt and trousers, and heavy-duty steel-capped work boots. The operator needs to be in good physical condition and take regular rest breaks as this work is heavy and strenuous. The machine must be kept in good running order with a sharp blade and

blade guard in place. Only cutter blades approved for this purpose are used, and the operator must ensure there are no other people in the work area.

The plant to be treated is cut off as close to the ground as is practical (50-100 mm) using a horizontal cut and the cut surface sprayed immediately and thoroughly with the appropriate herbicide mix. For this reason, only one plant is cut off at any one time. Care must be taken to avoid having cut off plants falling on smaller plants and concealing them. Stems up to 150 mm diameter can be treated with a brushcutter, but it is usually more economical to stem-inject plants greater than 75 mm basal diameter.

Only herbicides registered for cut-stump treatment are used, and these are mixed according to the herbicide label directions. Soft, clean water and an added wetting agent are used when mixing water-based spray mixes. Clean with detergent and thoroughly flush the herbicide applicator after use and store it and any batteries (after recharging) in a dry place.

## Attributes of sown pastures to control giant rat's tail grass

STEVEN BRAY, COL PATON AND BILL SCHULKE

*QBII, Department of Primary Industries, Queensland, Australia*

Well managed native and sown pastures have few weed problems. Drought and overgrazing weaken pastures, lower their competitiveness and create gaps allowing weed seeds to germinate and establish.

Once a weed has established in a pasture, it can be difficult to control, particularly if it is a robust, unpalatable, perennial grass like giant rat's tail grass GRT (*Sporobolus pyramidalis*).

One GRT control strategy in arable and semi-arable country consists of:

- removing the pasture that has been invaded by GRT;
- reducing or controlling the large soil seedbank; and
- replanting with a competitive, sown pasture.

The fodder pre-crop and pasture replanting option described in the 'Giant rat's tail grass — best practice manual' is an example. Selecting the best pasture

species for replanting is an important part of this strategy.

Fourteen sown pasture species were evaluated at 4 sites in S.E. Queensland for competitiveness and potential use in a GRT control program.

These species were chosen on the following attributes:

- stoloniferous or rhizomatous growth habit;
- resistant to over-grazing;
- fast establishing;
- provide competition year round (does not open up in late winter/spring);
- maintain competitiveness as soil fertility declines;
- palatable and productive;
- cheap seed (economical to sow at high rates);
- compatible with pre-emergent and post-emergent herbicides effective against GRT;
- little seed production once established (low weed risk); and
- well adapted to the environmental conditions and soil type.

Experience gained in the evaluation has expanded the list and highlighted the importance of some of the attributes. Planting combinations of species with complementary attributes may be successful.

## Native plant seedbank for central Queensland

N. ASHWATH, S. FESUK AND B. HEARD  
*Central Queensland University, Rockhampton,  
 Australia*

The Native Plant Seedbank project was commenced in 1998, with funding support from the NHT's Bushcare program. The aim of the project is to understand seed-germination and seed-storage properties of a wide range of plants (forbs, grasses, vines, shrubs and trees), and to make this information readily available to native plant growers. A network of seed collectors has been established, and seeds of over 750 accessions (representing *c.* 500 species) have been collected from a number of plant communities. The seeds of over 580 accessions were germinated soon after collection in a controlled environment using sand as the germinating medium. The overall germination percentage was 32%

with nearly quarter of the tested species failing to germinate immediately after collection. More than half of the tested species had less than 20% germination, indicating the need to develop appropriate procedures to break seed dormancy. An Access database has been developed to collate research data and to disseminate these to users via a Website. Seed of more than 165 accessions (representing 42 families and 72 genera) has been stored under 4 contrasting conditions to determine optimum storage conditions. The project is continuing and the planned studies include: tests to determine suitable treatments to break seed dormancy; collation of information on native plants; training selected Landcare groups in native plant seed technology; and establishment and maintenance of a Website for dissemination of information to native plant enthusiasts.

## Lablab is a viable option for cropping rotations in central Queensland

K. McCOSKER<sup>1</sup>, P. DURKIN<sup>2</sup>, A. SCHWARZ<sup>3</sup>  
 AND R. KELLY<sup>1</sup>

<sup>1</sup> *Department of Primary Industries, Emerald*

<sup>2</sup> *'Silverton', Theodore*

<sup>3</sup> *'Juanita', Fernlees, Queensland, Australia*

In central Queensland, continuous grain cropping over 20–40 years has led to significant decline in soil fertility so that many areas of cultivation are now considered marginal for farming. Nitrogen is widely applied at a high cost, but the erratic rainfall means that economic responses are not always achieved. This has led farmers on depleted soils to examine the feasibility of short-term forage legume rotations, and to query whether the nitrogen benefits and grazing returns from a legume rotation can offset the opportunity costs of not growing a grain crop. Two on-farm rotation trials were established to test whether the benefits from lablab to the subsequent sorghum crop make the legume a viable option when compared with a continuous cereal rotation.

Both trials compared a continuous cereal rotation plus budgeted nitrogen fertiliser with a legume rotation from 1997–1999. At Fernlees, a wheat/sorghum

rotation was compared with a lablab/sorghum rotation on an 80 cm low-fertility open downs soil. At Theodore, a sorghum/sorghum rotation was compared with a lablab/sorghum rotation on a 120 cm medium-fertility brigalow soil.

At Fernlees, sorghum grown after lablab produced almost 20% more yield than when grown after wheat; protein increased from 8% to 9%. The gross margin from the fertilised cereal rotation totalled \$262/ha for the 2 seasons, while that from the lablab rotation totalled \$309/ha. At Theodore, sorghum grown after lablab produced less yield than after sorghum, but the protein content increased from 9% to 10%. The gross margin from the lablab rotation totalled \$396/ha for the 2 seasons, while the fertilised cereal rotation totalled \$390/ha.

The results indicate lablab can supply the nitrogen requirements of a following cereal crop, and that the rotation is a viable option particularly when grazing animals increase in value as well as size. Any nitrogen gained may come at little or no cost to the grower, reducing the exposure to risks due to seasonal variability.

## Seed production of new ley legumes

J.M. HOPKINSON, K.G. COX, R.W. WALKER  
AND B.H. ENGLISH

*DPI, QBII, Walkamin Research Station,  
Walkamin, Queensland, Australia*

Experience of seed multiplication of prospective ley legumes at Walkamin provides preliminary information on the prospects for commercial seed production.

Of the new annual forage legumes, lablabs are the most prominent, and new types differ from old only in detail. Seed will probably continue to be produced mainly in northern low frost-risk areas.

Of the longer-lived ley species under test, *Macroptilium bracteatum* and *Vigna oblongifolia* accessions can mostly be induced to produce seed abundantly, but

will need to be suction-harvested to realise heavy (1000 kg/ha) yields. This will probably limit seed production to soils without strong surface crumb structure and districts where relevant machinery is already available.

*M. erythroloma* and *V. lasiocarpa* tend to be more amenable to efficient recovery by direct heading, and accessions of the former ripen early enough to escape frost. Such properties generally widen the geographical scope for feasible seed production.

Other potential ley legumes of less immediate interest but of which seed has recently been multiplied include accessions of other species of *Macroptilium* and of the genera *Alysicarpus*, *Desmanthus* and *Macrotyloma*.

## Assessing land for irrigated pasture within the Emerald district, Queensland

SCOTT IRVINE

*Department of Natural Resources, Emerald,  
Queensland, Australia*

Any new water allocation or transfer in Queensland must be accompanied by an approved land and water management plan (LWMP). To assess these plans requires an understanding of soil properties that may limit or restrict production of irrigated pasture. This has led to the development of criteria to assess the sustainability of irrigated pastures on land resources. The assessment takes into account a number of physical limitations of soils that may hinder production and management of particular pastures. The limitations are based on the 1990 Land Resources Branch guidelines for land evaluation:

- I. Flooding (*frequency of flooding*)
- II. Frost (*frequency of frosts*)
- III. Furrow infiltration (*infiltration of water for flood or furrow irrigation*)
- IV. Intake potential (*potential for intake areas to transport salt in the landscape*)
- V. Micro-relief (*amount and size of gilgai*)
- VI. Nutrient loss (*potential for nutrient leaching*)
- VII. Outflow potential (*potential for discharge areas to develop*)
- VIII. Rockiness (*amount and size of rocks*)

- IX. Salinity (*amount of soil salinity within the root zone of the plant*)
- X. Slope (*percentage slope*)
- XI. Soil complexity (*uniformity of soil types within an area*)
- XII. Soil depth (*physical depth of a soil*)
- XIII. Surface condition (*physical surface features of a soil*)
- XIV. Water availability (*amount of water that a soil can hold*)
- XV. Water erosion hazard (*potential for erosion*)
- XVI. Wetness (*soil's ability to transmit and drain water*).

Every soil type within the Emerald District that is associated with new water allocation or transfer has been assessed on these limitations. The suitability for a particular irrigated pasture is determined by rating limitations with increasing severity on a scale of 1 to 5. The limitation rating is known as a subclass and the level of the most severe limitation subclass indicates the final land suitability class for a particular pasture on the individual soil type.

The use of this assessment has allowed individuals to plan ahead for their respective irrigation development and to provide government with an adequate scheme to assess land for its sustainable use for irrigated pasture.

## Native species for specialist mine-site rehabilitation roles

RICHARD G. SILCOCK AND JODIE A. TRACE  
*QBII, Department of Primary Industries,  
Toowoomba, Queensland, Australia*

Native species adapted to growing on skeletal soils may have a role for rehabilitation of old mine sites where available topsoil is minimal. A review in 1990 by Silcock suggested some options, based purely on local observations, which the Queensland mining industry might wish to investigate. Studies would eventually have to show that extremes of acidity, alkalinity or salinity could be tolerated by such plants once they germinated. Informal discussions 5 years later showed that little had been done to follow up on the species mentioned although a great deal had been done on smoke-induced germination of species such as *Triodia* (the desert spinifexes). We therefore undertook some studies to see if it was feasible to go the first few steps towards proving whether these plants were potentially useful.

We attempted to collect viable seeds, to germinate those seeds and then to grow the seedlings readily

towards sexual maturity. With herbaceous plants that could be an understorey for trees, some success was achieved with tableland couch (*Calyptochloa gracilima*), poverty grass (*Eremochloa bimaculata*) and blue trumpet (*Brunoniella australis*) and its relatives in the family Acanthaceae, but not with one-seed grass (*Cleistochloa subjuncea*) or sawsedge (*Gahnia aspera*). Eucalypts such as gum-topped bloodwood (*Corymbia erythrophloia*) and rusty gum (*Angophora costata*) germinated readily as fresh seed and grew well in confined pots, thus conforming to the general story published about this group in other texts.

Shrubby species suitable for a mixed understorey were not easy to germinate in some cases, e.g. dog's balls (*Grewia latifolia*) and quinine bush (*Petalostigma pubescens*) but fairly straight-forward in others, e.g. yellow-berry plant (*Maytenus cunninghamii*) and nipan (*Capparis lasiantha*). The overall conclusion is that nothing can be assumed about the ease with which particular plants set viable seed nor that such seed can be germinated and grown under nursery conditions.

## A grass for top yields and reclamation

PIETER A. PIETERSE  
*Department of Plant Production and Soil  
Science, University of Pretoria, Republic of  
South Africa*

Although perennials must form the main basis of revegetation programs, at least one species should be fast-growing and capable of providing a good ground cover soon after seeding. Species should also provide forage of reasonable quality and be acceptable to animals.

Different species and ecotypes of *Urochloa* were collected in the northern provinces of South Africa in March 1995. Small plot trials were established on a soil with a clay content of  $\approx 38\%$  and P and K concentrations of 28 and 120 mg/kg, respectively. N, in the form of limestone ammonium nitrate LAN (28%), was applied at 120 kg N/ha. The first harvest was taken when the first species reached the flowering stage.

The development of seedlings of *U. brachyura*, ecotype UP1 and No. 2 far exceeded the others. Despite the creeping habit of these 2 ecotypes, the

yield of erect leaves and stems was significantly higher than from any of the other species and ecotypes included in the trial.

The most promising annuals (*U. brachyura* types) were compared with *U. mosambicensis* cv. Nixon in a grazing trial. All plots received 385 kg/ha of LAN. Sheep were introduced at the flowering stage, when the grass was  $\approx 1$  m high. The quantity and quality of intake were determined at different stages of defoliation. Sheep exhibited no preference for any ecotype. The crude protein and IVDOM content of the diet selected varied from 17.7% and 80%, respectively, at the start to 15.7% and 75% at the end of the grazing period. The average dry matter intake was 2.8% of body mass and the average DM yield on UP1 was estimated at  $\pm 17$  t/ha.

*Urochloa brachyura* shows good promise for use in reclamation and animal production systems. However, more research on its adaptability to different climates and soils, its regrowth potential after defoliation and its reaction to different levels of fertilisation needs to be done.