

# TGS news & views

about pasture development in the tropics and subtropics

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## Looking for members

Every year, the Executive worries about declining membership. Institutional researchers and extension people retire and are not replaced. In the current political climate where the urban vote is much stronger than the rural vote and where trees are the current flavour, pastures are considered almost as baddies.

Our President has suggested that we try to boost our numbers and profile in the grazing industry by forming some regional sub-committees—in the north based on Rockhampton, around the Gympie region and around Toowoomba. David Illing's suggestion is for fairly formal sub-committees with a chairperson, a publicity officer, a membership drive person and a 'journalist'. Indeed, there was a regional branch based at Mackay for many years go but declining local staff numbers saw it diminish.

The purpose of local committees would be to build up interest, increase local membership, run field days and feed stories to the newsletter. Beef prices are booming and the interest in pastures, certainly in the south, is high. What better time to spread the gospel and to help producers with their resource.

We would like to do all these things but also realise that the shortage of staff in both DPI and CSIRO with useful pasture experience and knowledge is likely to further diminish. At the same time, everyone seems to be working longer and longer hours with less and less time to think. We need to attract more people within the industry.

### Formal or just friendly?

Maybe we will not be able to form these formal sub-committees but we certainly can improve our networking with informal groups. Pasture people can get together to discuss ways to improve our output and profile — for example by flying our banner and extolling our virtues at field days.

### Use the membership form

Another way we can increase our numbers is to give membership form to potential new members. We have enclosed a form with your newsletter. Give it to someone interested in pastures but not actually a member. You can't get much better for \$25 in the outside world.

### Get them young

Still another suggestion is for us to approach the pasture lecturers at Ag colleges and universities with membership forms and some surplus newsletters. They can encourage their students to join when they enter the industry. We have also contacted Landcare Groups in the south; they often buy our plant identification books for their libraries and members so we have their attention.

### Joining forces

We have allied with a special interest forage group to act as the information carrier for their members through the newsletter. We can welcome over 40 new members from the Leucaena Network this month. Please keep the leucaena stories and pictures coming.

*Welcome to  
the 43 new  
members from the  
Leucaena Network*

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## Society News

Note our  
new Web  
address

Our Internet address

Our old Web address of [www.powerup.com.au/~tgsoaust](http://www.powerup.com.au/~tgsoaust) was difficult to remember so we now have a shorter and friendlier address:

[www.tropicalgrasslands.asn.au](http://www.tropicalgrasslands.asn.au)

See it for membership forms, the book list and pdf newsletter.

Our Society e-mail address: [tgs@tag.csiro.au](mailto:tgs@tag.csiro.au)

Newsletter on line

We have put the newsletter on the Web site as .pdf files in two forms for the last couple of issues. There is a small file without pictures and a larger file with the photographs included.

In the coming year, we aim to make the newsletter available only through a password.

*A membership form is included—please give this to a neighbour or friend who might be interested to join.*

### Date claimer for AGM and field day

The AGM and field day will be held on Thursday 22<sup>nd</sup> of November at the Ebenezer Coal mine just south of Amberley near Ipswich.

They are at the turn-off to Ebenezer.

What will we see? The rehabilitation program—from deep holes in the ground to dense pastures of Rhodes grass and creeping blue grasses.

Where's Ebenezer?

Remember the two Canberra jet bombers displayed on the roadside on the Cunningham Highway south of Ipswich.

Full details of the AGM and field day will be in the September issue of the newsletter.

### Retiring but never shy

A farewell to Errol Weston. Errol is retiring this month after more than 40 years with the DPI in the grassland and pasture field and as a long-standing member of the Society. Errol's career with the DPI started in north Queensland's Mitchell grasslands at Richmond and Julia Creek.

John Harbison, produced the maps of Queensland's native pasture communities that we all still use today.

Errol then switched his attention to agronomy and medics for the restoration of soil fertility in the Downs. He was heavily involved with the Warra trial and more lately with marginal cropping lands at Nindigully.

He was then transferred to Brisbane to produce a resource assessment of the Condamine–Maranoa basin. In the mid-1970s, he started on the Broad Resource Assessment for Queensland and, with

Errol plans to move to wetter pastures in Moreton Bay, living at Redland Bay and catching big fish.

### Nomination of Fellows

Now is the time to nominate some worthy as a Fellow of the Tropical Grassland Society. Fellows include those who have played leading roles in the science

or development of tropical pastures in Australia or overseas.

Please send your nomination and citations in confidence to the Secretary.

### New members

B.B. Chadha                      New Delhi, India  
K.G. Mclaughlin                Yeppoon, Qld  
A.J. Bambling & Co            Gayndah, Qld  
Sergio Burle                      St Lucia, Qld

Research  
Leucaena Network  
Grazier  
Research (Brazil)

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# The Leucaena Network

## Forage of the Future

As you are aware from the Editorial, we are aiming to act as the newsletter for the Leucaena Network. The formation of this Network was officially put to interested people on 30<sup>th</sup> March at a meeting and field day at Peter Larsen's Cedars Park property near Banana.

The morning was devoted to talks under the guidance of Kevin McLaughlin, the Networks energetic publicity man.

Speakers described a variety of benefits and concerns about growing leucaena. They included Col Middleton (DPI Rockhampton), Jim Kernot (DPI Mareeba), Max Shelton and Ben Mullen from the University of Queensland, John Wildin, Greg Brown and Peter Emmerly.

## Plus for the animals

Leucaena is the most productive tropical forage legume in the world—with a quality equivalent to lucerne. It has been used in many parts of the tropics for centuries and has been in Australia for over 100 years.

Leucaena leaf is highly digestible and very palatable—although sometimes stock have to develop the taste first. Crude protein is above 30% which compares dramatically with buffel grass at 12–15% and old speargrass at 3–4%. This protein is protected by tannin so that it passes through the rumen to be digested more efficiently in the intestine.

Steers can put on 270–280 kg a year, at 0.8–1.0 kg a day in summer and 0.5–0.6 kg a day in winter. This allows stock to meet all domestic and export market specifications.

## Plus for the environment

On the environmental side, leucaena can reverse the decline in soil fertility that has occurred since brigalow was cleared. It is deep-rooting (much deeper than the original brigalow) and can lower the water table to prevent surface salinity. And, because of its high feed

quality, rumen function in herbivores is more efficient resulting in lower emission of methane, a greenhouse gas.

Rainfall runoff on leucaena-buffel pasture is similar to that under virgin brigalow and much less than under cropping.

## Minus for the environment?

Is leucaena a potential weed? As we all know, environmental weeds are the current fad of conservationists and, mainly through ignorance, many would like to see leucaena (and buffel) banished.

Max Shelton has surveyed 125 Queensland shires about leucaena as a weed and got a 66% response.

50% of the respondents said they had no problem, 20% said it was minor problem, just under 20% said moderate and 4–5% considered it a major problem.

The total area of weed leucaena thickets in Queensland is less than 10,000 ha; this could be put into context against 20 million hectares of parthenium weed, 7 million hectares of prickly acacia and 30 million of rubbervine.

Leucaena has been around coastal tropical Australia for 100 years without being a major problem, but it could increase. So, we do need to be aware and be careful.

Leucaena seeds can be spread from planted areas by water, wind and by stock. Another survey suggests that there has been no spread from 60 % of blocks, 30% have seen minor spread especially as seedlings between the leucaena rows, but in 10% seedlings have escaped from the planted paddock and in 3%, they have spread off the property. But most of the large commercial leucaena plantings are less than 10 years old. Areas at risk are roadsides, gardens, drainage areas and along riparian woodlands—basically in ungrazed lands.

Grazing is the best control for escaping leucaena.

*Some of the graziers who attended the start-up meeting for the Leucaena Network at Banana*

*We do need  
to be aware  
and to be careful.*

### Wild and improved types

The common or Hawaiian type of leucaena that has been around for a century is different from the newer improved types. The old leucaena is *Leucaena leucocephala* subspecies *leucocephala* whereas the improved types are subspecies *glabrata*. These can be differentiated by DNA fingerprinting, which shows that the old thickets, as at Kabra, are of old Hawaiian naturalised types.

### Preventing unwanted plants

The bruchid beetle can reduce leucaena seed germination to zero by attacking developing seeds in pod.

### Don't lose the potential

Productive leucaena could be planted over some in 10 million hectares in Queensland with enormous benefit to individual incomes, export dollars and the environment. This potential must not be lost through a cavalier attitude that gives credence to the green's objections.

Escaping or unwanted plants should be killed *before* they could become a pest by 'pre-emptive eradication'. The best control of unwanted plants is basal bark or cut stump spraying with the herbicide 'Access' in diesel oil (1:60).

There are 22 species of *Leucaena* with different attributes. The hybrids of some of these are being tested for tolerance of cold conditions, resistance to psyllid attack and maybe to produce sterile seed to reduce weed potential.

John Wildin, the early champion of

commercial leucaena in Queensland, was on hand to describe the early days of development and the need for the Leucaena Network to unite graziers. We must ensure that the plant does not receive unwarranted bad press because of the actions or inactions of a few.

### Greenhouse gas \$\$\$?

Peter Emmery introduced a new topic—leucaena for reducing Greenhouse Gases. Could the Network develop a project to apply for some of the federal funding available? He said leucaena could be regarded as a tree crop that stored an estimated 600–800 kg of carbon per ha per year in stems and roots, that reduced the emission of methane by 60 kg per animal a year through more efficient digestion, and reduced salinity by deep water extraction.

*Mop up those strays  
on the roadside*

## Also at Cedars Park

*Leucaena seed harvester designed for twin row plantings*

*Peter Larsen talks to Sergio Burle from Brazil.*

*Leucaena can be slashed back when it gets too tall for stock and to encourage multiple stems regrowth.*

*Peter Larsen checks the Tritter flail mulcher he has adapted to handle his leucaena.*

*Stems smashed by the Tritter's flails recover well with more bud sites than from stems with a clean cut.*

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# Looking after Lippia

David Illing, David Illing Pastures, Pittsworth

Lippia (*Phyla canescens*) has invaded thousands of hectares of valuable river flats in southern Queensland and northern New South Wales. These fertile clay flats are favoured by stock and so are often grazed heavily.

Lippia may not look unsightly but this low-growing plant with its little white flower has pushed out valuable pasture grasses without offering much in return (except for pollen for bees).

It provides little or no feed although it does provide a short ground cover. Floods scour over the top of Lippia but, unlike tall grasses, it offers no impediment or filter to trap loads of silt. Worse still, it is shallow-rooted and will not bind the soil. During floods, creek banks collapse and erode.

Lippia can be controlled with herbicide but is quite difficult to kill. Ordinary 2, 4-D formulations offer poor long-term control and the recommended herbicide of DP-600 is definitely not cheap for broad-acre spraying.

## Vigorous pastures control weeds

The alternate control uses the ecological approach of competition from a tall and vigorous pasture.

The most suitable grass for these clay flats in Floren bluegrass (*Dichanthium aristatum*). Being a fluffy seeded species, Floren seed is difficult to harvest, clean and sow. Thus seed is expensive and in fairly short supply at present, so I mix it with Bambatsi (*Panicum coloratum*). Bambatsi is cheaper, establishes more

quickly and grows earlier in spring when Floren is slow. But grazed Bambatsi often forms discreet tussocks that allow Lippia to persist in the spaces whereas Floren forms a tighter sward more competitive against the low-growing Lippia.

Establishing and maintaining a solid and vigorous pasture on these heavy clay soils can be difficult—unless you do it properly.

## Do it well or don't do it at all

My crucial operations are:

### Preparation and timing

Mechanical tillage is cheapest, with a cutter-bar doing a good job for the initial break-open

- In cloudy conditions where rain could allow the Lippia to transplant, hit it with 2,4-D before ploughing
- Allow sufficient 'tillage cycles' (rain/germination/recultivate) to get rid of the Lippia seed bank
- Allow 3 months for this tillage/fallow/tillage to allow any allelopathic effect of Lippia to dissipate.
- Level off deep washouts or gutters with a dozer. If you don't, Lippia will remain here and the erosion will continue.

### Planting

Use a high seed rate—about double the normal for the local rainfall. This will give the rapid establishment and strong ground cover to suppress future Lippia and to minimise erosion from floods.

- Sow a pioneer pasture species with fast establishment. Silk sorghum is especially useful on flats prone to regular flooding. Finecut rhodes grass also gives a very fast ground cover in more arid districts.
- Sow species of long-term stability. Floren is the best but I also add Bambatsi.

*Lippia in weak native pasture on the left. Floren bluegrass dominant on the right.*

*The McWilliams of Cropper Creek looking at Jack Gooderham's impressive paddock of Floren in what was once a low mat of Lippia .*

- Even purple pigeon grass can be effective with good management and good fertility.

### Grazing

Allow the sown grasses to establish fully before any grazing.

- Thereafter crash graze and move the animal on quickly.
- Don't graze the pasture below 25–30 cm to keep a full dense ground cover.

Legumes will keep the grass growing vigorously.

- Sow heavy rates of vetch and snail medic once the grasses are established.
- In very wet areas, strawberry clover can be very successful.

### Maintenance

- Always keep on the look out for small infestations of Lippia and hit them with 2,4D or preferably DP-600.
- Don't be afraid to fertilise if the pasture is losing vigour.

### Be totally committed

Commitment is very important. It costs a lot to clean up the land and to plant the pasture and you don't want it to return to Lippia because the pasture cure is not instantaneous.

*Don't be frightened by Lippia.*

*'Once you understand it, Lippia is a most over-rated weed.'*

### Slashing or mulching

Slashing is important for controlling broadleaf weeds that are common in these soils and for knocking back clumps of old established grasses so that the new seedlings can survive. It also provides a mulch to smother Lippia.

# Grazing ley legumes

Maurie Conway, DPI, Emerald

Our farmers' group from the Central Highlands wanted to test animal production from Milgarra butterfly pea (*Clitoria ternatea*) and burgundy bean (*Macroptilium bracteatum*) and to determine the most effective method of grazing these ley pastures.

We planted small paddocks of butterfly pea and of burgundy bean with and without grass and compared results with a buffel grass pasture at Bindaree, just north of Moura.

## Planting the legumes

Scarified and inoculated seed of butterfly pea (10 kg/ha) and burgundy bean (9.1 kg/ha) were planted in January 1999 using a conventional combine planter on 46 cm (18 inch) spacings. Aided by 25 mm rain soon after planting, germination and establishment of both legumes was excellent, but even better in the tractor wheel tracks suggesting presswheels may be beneficial. Spinnaker herbicide (400 mL/ha in March 1999) gave excellent long-term weed control with little weed visible till winter 2000.

Existing buffel grass has been used as the grass component.

## Grazing

The leys could have been grazed in that autumn/winter but we wanted to ensure successful establishment. Instead we harvested 110 kg/ha clean seed from the butterfly pea area.

## The place for burgundy bean

Burgundy bean is a summer-growing short-term perennial legume that will

grow well on black cracking clays and red clay loams. It was selected for the heavier clay cropping soils of southern Queensland and northern New South Wales.

Large (sorghum-sized) seeds ensure rapid establishment. Seedling regeneration is strong for one or two years but as most of the seed is soft, it is unlikely to persist beyond a couple of years or to become a serious weed of subsequent crops. It is very palatable and sought after by cattle so grazing management must allow seed to be set if the crop is to persist. Its high feed quality has produced liveweight gains of up to 1 kg/day—more when there is abundant legume.

## Two burgundy bean varieties

Two cultivars have been registered.

**Cardarga** has an erect form and is consistently high yielding, but can be affected by bean mosaic virus in wet years; **Juanita** is more decumbent, slightly less productive but does not appear to be affected by the mosaic virus.

Butterfly pea is better adapted and more persistent in the hotter areas of northern Australia, especially here in Central Queensland.

## Who's planting peas or beans now?

All farmers within this group have planted butterfly pea. Ross Maclean has planted all of his cultivation – 570 ha (1400 acres) to butterfly pea. Doug Howard had 57 tonnes of butterfly pea seed to plant – enough for 5700 ha at 10 kg/ha.

Average daily gain of steers grazing pastures at Bindaree – 18 Dec 1999 – 22 May 2000

	Dec– Feb 71 days (kg/day)	Feb – March 18 days (kg/day)	March – May 77 days (kg/day)
Butterfly pea	1.02	0.56	0.71
Butterfly pea + grass	0.90	0.54	0.64
Burgundy bean	0.91	1.03	0.80
Burgundy bean + grass	0.88	0.73	0.85
Grass only	0.55	0.52	0.49

Some conclusions from 'Bindaree':

- Butterfly pea's erect growth habit and woody stems help it escape frost better than burgundy bean which is normally frosted to the ground. In spring, surviving bean plants have to grow from the crown whereas the pea can grow from the stem. Butterfly pea may hold its leaves longer into winter and be productive earlier in spring.
- Butterfly pea is more perennial (plants survive longer) than burgundy bean.
- Animal production from butterfly pea and burgundy bean was similar but more leaf remained in the butterfly pea paddock.
- Highest weight gains come from access to most legume.

*Top. Cattle grazing burgundy bean (top) and butterfly pea (left).*

## CQ farmers were looking for ley legumes to restore soil fertility

Comments before the trial

*"Even though production is declining, we still continue to crop. We will be better off in the long-term by planting ley legumes but it does take time".*

*"Problem with rotation is that grass (from the pasture phase) can be a weed in the next crop. Grasses also use nitrogen so, therefore, require a legume in the rotation."*

*"We haven't had a successful short term persistent legume. I have planted lucerne with all pastures but it only lasts for two years. I don't think a ley pasture system will work until we have a persistent legume." "We haven't got a decent legume!"*

*"We have difficulty establishing anything on heavy coolabah soils. We need a pasture with reasonable carrying capacity. Establishing pastures takes time".*

*"You need a legume in a ley pasture, otherwise you don't achieve anything towards sustainability of cultivation. At this stage lucerne is the only legume that is increasing soil fertility."*

*"Zero till is not going to be a quick fix to restore organic matter; not in 2 or 12 years. It may halt depletion but will need ley pasture, (eg, lucerne or something else) to restore organic matter levels quickly".*

*"I think ley legumes have a real place on grey box soils and on our lighter soils, if we could only find the bloody legume. We need to develop a good rotation. I am concerned that grazing animals might cause severe compaction on black soils".*

But remember – legumes will restore soil nitrogen but the fine roots of grasses are needed to restore the soil's organic matter and physical condition.

# Practical Abstracts

from Tropical Grasslands Journal

Volume 35, No. 1 (March 2001)

**Leucaena for weaned cattle in south Florida** — by R.S. Kalmbacher, A.C. Hammond, F.G. Martin, F.M. Pate and M.J. Allison, on pages 1–10.

Weaned cattle in Florida typically go onto pasture in summer when its nutritive value is declining or later when there is also less feed available. Leucaena needed to be evaluated under grazing on Florida's poorly drained soils.

Weaner heifers put on bahia grass with 50% of the area under leucaena in June gained nearly three times the weight of those on grass alone (34 kg/hd v. 12) even though they ate little leucaena for the first 3 months. When the heifers went back into the trial in April the next year, they ate the leucaena leaf out within 2 months and so gained no better than the animals on grass.

In a second trial, weaner steers grazed from July–November in 1996 and 1997. Leucaena leaf declined from an average of 2200 kg/ha to 400 kg/ha by November but the steers gained 53 kg/hd against 8 kg/hd.

Leucaena can help weaners in late summer and autumn but they need to get used to eating it. If they do have the taste before they start grazing, they may overgraze it so heavily that there will be insufficient leaf later in the year.

**Maximising seed yield and seed quality of *Paspalum atratum* through choice of harvest method** — by Chaison Phaikaew, P. Pholsen, S. Tudsri, E. Tsuzuki, H. Numaguchi and Y. Ishii, on pages 11–18.

Pasture grass seed is usually harvested by hand in north-east Thailand. Highest seed yields (1000 kg/ha) and best quality (high germination and purity over 90%) were obtained by intensive methods. In the 'cover' method, seed heads are gathered together and a nylon net bag is placed over the clumped heads; seed is collected every 3 days through an outlet in the bag. In the 'under' method, seed is collected from a nylon net placed along the rows under the seed heads for 3 weeks after 50% seed head emergence.

Yields were lower and seed poorer when harvested by shaking seed heads into a net every 3 days, by cutting seed heads at 15 days after 50% head emergence, by early harvesting at 10 days after emergence or by late harvesting at 20 days after emergence.

**Method and time of establishing *Paspalum atratum* seed crops in Thailand** — by Mike Hare, C. Kaewkunya, P. Tatsapong, K. Wongpichet, K. Thummasaeng and W. Suriyantratonong, on pages 19–25.

Seed crops of atratum cv. Ubon established from seed do not yield in the first year, but those planted from tillers at the beginning of the wet season can yield over 300 kg/ha after 5 months. Late planting severely depressed yields, which may be as low as 25 kg/ha when crops are planted in mid-July. Twenty village farmers in a small project harvested an average of over 600 kg/ha of high-quality seed by hand knocking mature seed into bags everyday.

**Seed yield and its components of *Brachiaria decumbens* cv. Basilisk, *Digitaria milanjiana* cv. Jarra and *Andropogon gayanus* cv. Kent in north-east Thailand under different rates of nitrogen application** — by N.R. Gobius, Chaison Phaikaew, P. Pholsen, O. Rodchompoo and W. Susena, on pages 26–33.

Rapid increases in stock numbers have increased demand for pasture and hence for seed of species tolerant of drought and poor soils.

In this north-east Thailand trial, low yields of Basilisk signal grass were probably due to low plant density rather than moisture stress, but Kent gamba grass produced excellent yields and quality. Yields of Jarra were equivalent to reported values.

Nitrogen increased yield and produced more seed heads but all species lodged with high rates. Gamba grass with its drought resistance, high growth and good seed production under low nitrogen levels is a useful species for the area.

**Competition in pots between two tropical legumes (*Stylosanthes hamata* and *S. scabra*) and two tropical grasses (*Urochloa mosambicensis* and *Bothriochloa pertusa*) at two phosphorus fertiliser levels** — by F.D. Hu and Ray Jones, on pages 34–42.

In the paddock, Bowen pertusa pastures generally have less legume than urochloa pastures despite the apparent lack of allelopathy or endophytes.

In pots, pertusa did not appear more competitive than urochloa against the legumes at either level of phosphorus although Verano was far more competitive than Seca against both grasses.

*continued on next page ...*

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# Grasses and humans

## ***Grasses and humans: the story of human dependence on grasses and the science of grass use.***

Mike Russel has produced this little book bursting with interesting and wide knowledge about grasses. Not just those for grazing but grasses used in a multiplicity of ways—as cereals, sugar, building materials, for lawns and playing fields, for revegetation, as ornamentals, for fibre and paper and so on.

### Grasses use and evolution

The first part looks at the uses of grasses and their history of evolution. This is what differentiates this book from the normal line of pasture publications; it is not so much about the value to livestock as about their use and selection by man over the ages. The term 'kya' for 'thousand years ago' appears frequently.

### Grass science

The second part of the book is about the 'science of grass use' with sections on taxonomy, botany, ecology, interactions with livestock, etc.

So, it's bursting with general overall information but without getting too heavy. It's also bursting at the seams because Mike (and daughters) are the publishers. In self-publishing, costs have to be kept to a minimum so margins are tight and there's not much 'white space' on the pages. There are four pages of colour photographs in the centre, but these seem somewhat arbitrary and maybe Mike could have saved some money by using half-tone pictures within the text. But then grasses are difficult to show in black and white. Again, maybe the cover has trouble encapsulating all the aspects

*Practical Abstracts continued ...*

Despite higher yields with added phosphorus, the grass-legume balance was similar.

*Urochloa* grew better than *pertusa* and grew better with the less competitive *Seca*. *Verano* grew better than *Seca* with both grasses and was more responsive to P.

**Production and nutritive value of grasses cultivated in the coastal area of Benin** — by A. Buldgen, B. Michiels, S. Adjohoun, S. Babatounde and C. Adandedjan, on pages 43–47.

Smallholders on sandy, low fertility soils in coastal Benin need perennial grasses. In the first wet season, guinea grass cv. C1 gave the best production. In an exceptional drought, only guinea grass and gamba grass survived; ruzi grass did not.

of grasses in one painting.

So, for \$25, you can become a more rounded person more able to put grasses into the field of human development—without getting into encyclopaedic detail.

Mike Russel has worked in the Solomon Islands, with CSIRO Division of Tropical Pastures and has lectured in pasture science at Gatton and on mine soil revegetation at the University of Southern Queensland.

Contact Mike if you want to purchase a copy.

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*Ian Partridge*

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**The performance of forage germplasm in a screening trial at Shika, Nigeria** — by A.T. Omokanye, O.S. Onifade, J.T. Amodu and M.S. Kallah, on pages 48–52.

Sixty-one forage species were screened for subhumid Nigeria. The highest yields over 3 years were from a Rhodes grass, a common stylo and from *Sesbania sesban*.

**Forage yield and chemical composition of centro (*Centrosema pubescens*) in the year of establishment at Shika, Nigeria** — by A.T. Omokanye, on pages 53–57.

All forage yields were decreased as planting date was delayed, but were increased with phosphorus application.

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