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# future farm

PERSONAL STORIES FROM AUSTRALIAN FARMERS

## in this issue



FUTURE FARM INDUSTRIES CRC

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# Mallee industry set for expansion

## Mallee industry gains momentum as biofuel options increase

# Producers demonstrate perennial diversity

It's with great pride that I welcome you to the June 2010 edition of *Future Farm* magazine — an edition that clearly shows a diversity of enterprising thinking and innovation at work among Australian farmers.

Of great excitement to the Future Farm Industries CRC has been the arrival of the mallee harvester prototype invented by Richard Sulman's Biosystems Engineering. Launched on April 12 in Narrogin, Western Australia, the machine has brought hope to farmers who invested in these promising trees decades ago. The invention is tangible evidence the Australian mallee industry means business. In our opening article, farmer Lex Hardie, one of the early champions of the mallee industry through his involvement with the WA Oil Mallee Association reflects on the significance of the mallee harvester prototype as governments search for viable renewable energy options.

Ian Stanley, another instrumental player in the mallee industry and son of Don Stanley, one of the original farmers who formed the Association, is the focus of our first case study. Don goes beyond talking about the natural resource management benefits of mallees and shows how he his turning mallee biomass into biochar and other products to generate electricity or for use in products such as flystrike treatments.

Profit, drought tolerance and efficiency in livestock production are central themes in this edition of *Future Farm*. For years, ABARE has reported how productivity improvement in sheep and beef enterprises has lagged behind cropping. *EverGraze*® can close this gap. Systems based on perennial pasture combinations are being tested on farms in southern Australia, some are featured in this issue.

We hear about how Tasmanian farmer, Humberston McKenzie, is benefiting from a new Spanish cocksfoot variety. Its drought and waterlogging tolerance, resilience to cold weather and ability to respond to summer rain has provided a new and reliable source of feed. Humberston particularly is impressed by the variety's ability to recover from grazing.

Victorian farmer, Judy Griffiths is putting local knowledge about native grasses to work by creating a cost-effective approach to grazing. Her unique approach to rotational grazing has improved native pasture growth on her property resulting in more feed. Still in Victoria, Terry Hubbard talks about the bigger returns he now enjoys on his property after subdividing according to land class and introducing rotational grazing. It's worth noting Terry's attendance at an *EverGraze* Whole Farm Grazing Strategies Course strongly influenced his current management approach.

South Australian farmers, Austin and Joy Johnson, explain how kikuyu provides them with a low maintenance grazing option. Its summer growth pattern complements the other winter-active pasture species making it a great fit on their farm. To finish off, New South Wales farmer, Henry Bridgewater reveals how his perennial pastures keep serrated tussock at bay, reducing soil erosion and providing extra feed for his Merino flock at critical times of the year.

What I particularly like about this issue is that each story has a unique take on how perennials can add value to the farm. I invite you now to read these stories as intently as I have and learn more about the motivations behind the farmers wanting to try something different and the rewards that followed.

**Kevin Goss**

*Future Farm Industries CRC Chief Executive Officer*

*Read about the successes producers across varied landscapes are achieving with perennial pastures and shrubs inside this issue of Future Farm.*

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## our cover

Ian Stanley sees significant potential for mallees — including oil extraction, carbon sequestration, energy and natural resource management.

• See full story page 4.

Photo: Jo Ashworth Photography

# Harvester launch sets industry in motion

The launch of a prototype mallee harvester at Narrogin, Western Australia on April 13, 2010 was a milestone event in the development of a truly regionally-based industry initiative growing, harvesting and processing mallees.

Almost 10 years ago, Colin Barnett as WA Energy Minister, launched the project to build a pilot Integrated Wood Processing plant in Narrogin. At that time, two per cent of generated power had to come from renewable energy. In contrast, the current WA government has set itself a renewable energy target of 20% by 2020. In this context, biomass is in competition with wind and solar as a renewable energy source.

Both wind and sun will always play a part of renewable energy, however their intermittent nature of supply is not ideal. On the other hand biomass creates a continuous supply.

## key points

- As fossil fuels become an unsustainable source of energy, the opportunities for mallees as a potential source of energy becomes more viable
- Australia's farmers have the potential to be net producers of energy through mallees that provide a host of environmental benefits
- The development of a prototype mallee harvester is a significant step towards commercial reality for the mallee industry.

Clearly, the argument for biomass-produced energy is further enhanced by the fact that of all the energy produced, whether it be from fossil fuel or renewable sources, only one has a beneficial impact on the physical environment.

### Role for agriculture

Most Australians, when they think of energy, relate to coal and gas. Many would be surprised to know that farmers are heavily into the energy game — not just as consumers but as net producers.

Historically, agriculture is founded on the production of food to eat and fibre to keep us warm. Future farmers will continue to provide society with those essential ingredients although we are on the cusp of a very exciting and new fibre 'crop' of cellulose — that is biomass.

Capturing the sun's energy through vegetation has been with us since the dawn of ages. Unlike coal and gas, the embedded energy captured in tree crops, such as mallees can be available on a much shorter rotation (three to four years). Nature's design, by way of photosynthesis, has provided remarkable living solar cell technology that presents an opportunity for meeting future energy demands in a clean and sustainable manner.

The birth of a baseload capable bioenergy industry will return many other valued dividends to our community beyond energy. The planting of trees makes environmental sense. Farmers believe in a scientific approach to farming and realise there is much work to be done to restore landscape balance and function. Trees for their part can reduce salinity and wind erosion, shelter fragile soils and stock and increase soil carbon and biodiversity.



Photos: Richard Sulman

*Designed by Richard Sulman, Biosystems Engineering, the prototype mallee harvester is a significant step toward a commercial mallee industry for biofuel production.*

### Mallees provides power

Since the early 1990s, more than 1200 farmers have planted mallees and continue today to seek new land use options to manage the risk of annual returns and climatic influences.

What all the scientific and economic investigators have acknowledged, is that for mallees to be part of the farm enterprise they must pay their way on the land they occupy. Therefore, the drive to build the resource ahead of an efficient and cost-effective harvesting and processing system has been a challenge.

With the release of the prototype, designed by Richard Sulman, Biosystems Engineering, Toowoomba Queensland, funded by Future Farm Industries CRC and the WA Government, the harvesting system takes the next step towards the targeted harvesting capacity and onto commercial production.

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# The changing face of mallees

Carrying on what his late father Don started, today Ian Stanley, has more than 1.3 million mallees growing on his north-eastern wheatbelt property. Ian shared with Laureta Wallace just what he sees as the future for these versatile natives — including oil extraction, carbon sequestration, energy and natural resource management.

## farm info.

**Case study:** Ian and Rob Stanley
**Location:** Kalannie, Western Australia
**Property size:** 25,000 ha
**Mean annual rainfall:** 285 mm
**Soils:** Wodgil soils
**Enterprises:** Grains — wheat, barley, canola; Sheep — Merino wool

"The Western Australian mallee industry has had a dynamic history with varying trains of thought about what path the industry should take," Ian said.

"My family started with the trees during the early 1990s when my father Don, with a group of other farmers, formed the Oil Mallee Association.

In collaboration with the then Department of Conservation and Land Management, the group set out to find what was required to plant trees back into the landscape with the aim of preventing further land degradation, namely that by salinity and wind erosion.

What was needed was a native plant tough enough to survive grazing without being fenced and could in some way contribute as a crop. The mallee ticked all these boxes. Its high oil content made it unpalatable to stock and there was the opportunity to market the oil.

Today, we have about 1.3 million mallees planted in contoured and straight alleys. Our formula on the land we plant to trees is 10 metres of mallees for every 100 m of crop.

Photos: Jo Ashworth, Photography

*Ian Stanley believes an efficient harvesting method will become increasingly important. The harvester pictured above was made in Bulgaria, based on a German design. INSET: Ian Stanley.*

## key points

- The biomass from mallees can be turned into carbon-rich biochar and a combustible gas for bioenergy
- The oil extracted from the leaves can be sold in existing markets — mainly for pharmaceutical and domestic products as well for the treatment of flystrike in sheep
- New industrial products based on mallee products are being developed
- The continual development of robust harvesting techniques will be the key to the long-term sustainability of an Australian mallee industry.

It's difficult to answer whether the trees have improved our land. There is a lot of hydrological work and data collection being carried out on my property but personally I think it's too soon for definite results. However, anecdotal evidence suggests they have been beneficial. The biomass yields at age 15 years on a wodgil soil site have been very impressive at up to 150 dry tonnes per hectare of belt area indicating a very high water extraction capability. As a consequence it appears that land classified as high risk is now coming back into production. The trees alone have not achieved this — they are part of a holistic land management program. We have also found the shelter provided by the mallee belts gives us much more flexibility in cropping wodgil soils.

### From paddock to market

Myself, four other farmers and a nursery expert run a small, local oil mallee processing business — Kalannie Distillers — through which we extract the oil and market it — mostly into the eastern states. The oil is very versatile. It is used in pharmaceutical products and is a fantastic household cleaning agent. Some farmers even use it to treat flystrike. It has an existing market with relatively high prices but if mallee is to become a large volume crop this market would be oversupplied. Hence new product development is important and there is great potential.

Our mallees are harvested using a machine we had made in Bulgaria, based on a German model used to harvest poplars. Before this machine, we used an old forage harvester with a drum and small cutting blades. This was only suitable for small tress and during dry times sand would get into the harvested biomass, which was not suitable for the steaming process to extract the oil.

Having an efficient way to harvest the trees is going to become more important. The older, bigger mallee trees can be problematic if they encroach onto cropping land and dropping branches that need to be picked up before harvest.

This is bound to be a bigger issue with third-party tree planters — for example when the trees leased by sequestration companies start growing across the farmer's cropping country.

## The coming of sequestration

When we started with mallees, the idea of carbon sequestration was way off in the distance but now it is a reality. Mallees are fantastic sequesters — both below and above the ground.

I am involved in research looking at using the carbon sequestered in the mallee biomass as biochar, via a process of called pyrolysis.

A very crude explanation of the process is lighting a log and then covering it with sand. If you let the log smoulder you could then clear the sand off and what's left is a black, burnt-out log — basically charcoal — which consists of the carbon sequestered by the tree. This is opposed to letting the log burn uncovered where ash would be the result with the sequestered carbon largely escaping into the atmosphere.

The charcoal, or biochar, can be returned to the soil. It is not certain just how biochar improves soil fertility and grain yields but my feeling is it is not an immediate outcome. Biochar is more of a soil ameliorate than a fertiliser. The process also generates a combustible gas that can be captured to run gas engines and generate renewable electrical power.

This theory would allow mallees to be harvested, but also be reconsigned for their sequestration ability. The great thing is mallees will coppice (regenerate from the cut stump) for up to 100 years when harvested every three to five years.

People who are not convinced on the value of trees, often ask, if I believe so much in their ability to protect the land why would I cut them down? This is a good question. I believe having trees in the ground for three to five years before they are harvested protects that land for three to five more years than it would have been without the trees. During the trees' growth, the land is given time to rejuvenate and during the one year it takes for the tree to grow back the paddock is in a much better position to withstand degradation from, for example salinity or erosion.

## Harvesting the key to the future

The Future Farm Industries CRC funded prototype harvester is a step in the right direction for the industry. Before its first harvest a mallee typically has one to two trunks. After it coppices it grows more like a bush with 20–30 stems about 8–12 of which grow out to major stems on the plant. A harvester able to handle larger more dense trees is an important breakthrough.

Our family will continue to plant mallees where we think they have a role. Kalannie Distillers is a largely a private venture, with only a small amount of funding for research. My goal is for it to be a small but sustainable interest that will provide a handy income stream for our family."

For more information on the mallee harvester protoype, read *Focus on Perennials* Issue 12, available at www.futurefarmonline.com.au.

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## science behind the story

By John Bartle, Manager, Revegetation Systems Unit

- **Nearly two decades of work has created the foundation for the first profitable, large scale 'woody crop' for the Western Australian wheatbelt — mallee eucalypts grown in belts on cropping land to produce a bulk biomass product for regional processing industries.**

Mallee development has been a partnership between progressive farmers like Ian Stanley taking the initiative in practical areas, and careful scientists grinding away at the technical impediments to progress.

The pioneers of mallees always had big ambitions:

- To create a new woody crop that could be grown in belts without compromising the existing cropping and grazing activities
- For farmers to be able sell biomass at a price that would at least break even with wheat
- The selling price to be attractive to processing industry entrepreneurs
- Pick up the landcare benefits for free.

It's easy to under-estimate how long it takes to develop new industries. Farmers have set the pace with mallees — by the late 1990s enough knowledge on establishment techniques and management had been generated. Enough mallees had been planted for it to be seen by potential buyers and processors as a prospective new resource. But reducing costs; designing better belt layouts; improving yields; developing harvest and delivery systems; and assessing economic viability are challenges that have slowed progress on the supply side. Technical and commercial uncertainty on the processing side has also slowed development leading farmers like Ian to take initiatives in developing processing options.

During the past several years, progress has been made in overcoming supply side hurdles. Strong evidence guides species selection and the breeding program can supply improved seed for all major species. Available water is clearly the main limit on yield. Belts need only have two rows (three metres apart) to use all rainfall, any lateral water flows generate deep and wide zone of depleted water storage. This zone provides a positive sink for efficient capture of lateral flows, but it is also negative in that it imposes competition on adjacent crop or pasture. Regular harvest will help manage the adjacent competition impact of belts. Designing belt layouts to maximise water access improves yield and means the belts will contribute to salinity control. After some seminal work by farmers on developing mallee harvester components (initially under the leadership of Ian's late father Don), harvester development has moved into the engineering workshop and the first commercial prototype was recently launched (see *Focus on Perennials* Issue 12).

Technical knowledge is now sufficient to show mallee belts can be profitable, while supplying biomass to processors at an attractive price for the manufacture of products including bioenergy. Bioenergy markets are potentially large enough to consume all the biomass farmers can grow.

- ***John Bartle leads the Future Farm Industry CRC's* Biomass Supply Assessment *project.***

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# Spanish cocksfoot leads the way

Following three years of drought, which left most existing pastures seriously degraded, Humberston McKenzie, Fingal Tasmania, wanted a pasture species that would be productive, drought and frost tolerant, could stand up to pests, and not be a toxicity risk to his stock.

"I had heard impressive stories about the performance of a new cocksfoot variety recently developed by the Tasmanian Institute of Agricultural Research (TIAR) and decided to dip my toe in the water," Humberston said.

"We first tried a seed trial plot a few years ago, but the grass didn't establish because it was sown too deeply.

We planted about eight hectares of Uplands cocksfoot during April 2009, primarily as a commercial seed crop, but also to provide valuable grazing for the stock during winter. This time the seed placement was more accurate and closer to the soil surface, which I think is important for success — germination was excellent.

The exercise has given me an appreciation of what this new grass is, what it can stand up to, and what it can do.

## Patient persistence

After sowing I made the common observation that the grass was somewhat 'slow out of the blocks' compared with other commercial species we've used in the past. Not discouraged and remembering the words of TIAR researcher Eric Hall, 'be patient with this grass', I watched as the paddock became saturated with the wettest Tasmanian winter-spring rains since World War II.

During the August-September period, we received 246 millimetres of rain and the 'slow starter' was now producing more than 3000 kilograms per hectare of estimated dry matter, standing in water and still growing.

Grazing was the next logical step. During October, we fenced off the block for more than a fortnight to 80 yearling heifers and 400 Merino wethers.

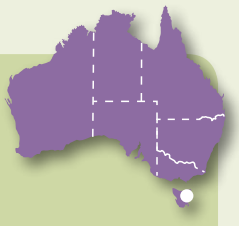
The grass was chewed into the ground and left in what I can only be described as a muddy mess.

My expectation was that I might have overdone it, and the paddock wouldn't recover — however, recover it did, even better than before.

## Follow-up management

I irrigated the paddock during November 2009 and applied nitrogen at a rate of 20 kg/ha.

## farm info.



**Case study:** Humberston and Toni McKenzie

**Location:** Fingal Valley, Tasmania

**Property size:** 2000 ha

**Mean annual rainfall:** 600 mm

**Soils:** Shallow alluvial duplexes (kandosols) with moderate fertility on flats, shallow low fertility calcarols on slopes and bush-runs

**Enterprises:** Mixed farming — wool, first-cross prime lambs (4500 DSE), beef (2000 DSE) grains, poppies and pasture seed

Photo: Catriona Nicholls

*Tasmanian producer Humberston McKenzie (pictured) is an avid convert to the new Spanish cocksfoot Uplands cultivar, which is gathering significant interest not only in Tasmania, but also in the southern mainland states.*

## key points

- A new cocksfoot variety is proving resilient to drought, waterlogging, cold temperatures and grazing, without posing a toxicity risk to livestock
- Re-establishment with persistent perennials after the drought is a priority as they are low-cost stockfeed
- Winter-active grass species such as cocksfoot, respond swiftly to summer rains and a variable climate
- While the variety is slow to establish, patience pays off with bountiful dry matter production when the pasture is well established.

I harvested the paddock for seed at the end of January 2010. February rains after harvest saw this winter-active species continue to grow.

By the first week of March, I estimated there was about 3000-4000 kg/ha of dry matter across the paddock.

The plan was to run the windrow header a second time during early March to maximise seed yield. But such was the bulk of dry matter production during this six-week period, the grass had to be cut under the windrows to run them through the header again.

Looking to the future, I reckon I will sow a lot more of this grass across the farm. TIAR research has shown it to be tough, surviving the driest time people can remember in parts of the State.

It has shown me the grass can take a fair bit of waterlogging too, it doesn't have the associated toxicity issues like some of the other grasses, such as perennial ryegrass and phalaris and appears to be reasonably resilient to grub attack.

Maybe soon we'll see more people dancing to the tango of the Spanish cocksfoots!!!"

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*Two-week growth after harvest shows the substantial feed potential of Spanish cocksfoot. INSET TIAR Research Agronomist Eric Hall (left) and Humberston McKenzie (right), discuss the seed crop of Uplands Spanish Cocksfoot at 'Speyside', Fingal, Tasmania.*

## science behind the story

By Eric Hall, TIAR

- **There are several factors limiting pasture production in the eastern half of Tasmania, including low winter temperatures, pasture grubs and low rainfall. One of the major concerns is the decrease in annual rainfall during the past 20 years.**

Some areas now regularly receive only 70 per cent of their long-term average annual rainfall and drought conditions have become a regular occurrence.

The changing climatic conditions experienced across the region mean perennial ryegrass, the dominant perennial grass species sown, is no longer suitable and producers need to look to better-adapted perennial grass species.

In response to this need, TIAR researchers have bred and commercially released two Spanish cocksfoot cultivars UplandsA and SendaceA.

The new cultivars have much finer leaves than 'traditional' cocksfoot cultivars and are densely tillered. They are highly drought and cold tolerant and endure a high level of pasture grubs. The cultivars can shut down during summer when moisture is lacking, but will respond rapidly when the autumn break arrives, growing actively through to late spring.

This allows them to produce a large bulk of high-protein, high-energy, digestible and nutritious forage.

An *EverGraze*® Supporting Site in Tasmania demonstrates these new cultivars of Spanish cocksfoot. The Site is about two hectares and was established under extremely difficult conditions.

The successful establishment of Spanish cocksfoot here demonstrates the suitability of this grass to establish in a challenging arid environment.

The key messages when sowing these new Spanish cocksfoot cultivars are;

(i) sow shallow, less than 10 mm and

(ii) be patient, the seedlings are slow to get going, but when established they will be there for a long time.

*EverGraze – More livestock from perennials* is a Future Farm Industries CRC, Meat and Livestock Australia and Australian Wool Innovation research and delivery partnership.

- ***Eric Hall is a research agronomist with the Tasmanian Institute of Agricultural Research.***

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**Weed risk note:** CRC weed risk assessment of Cocksfoot, *Dactylis glomeratus*, has indicated it is a high weed risk in parts of WA and a medium risk in parts of SA, Vic and NSW. Care should be taken to minimise the weed risk to the native environment.

# Grazing management makes the difference

A keen interest in managing native perennial grasses as part of a larger perennial-based system has seen Judy Griffiths establish an *EverGraze*® Supporting Site to test the practice behind the theory.

"Over the years, I have become increasingly interested in managing our native grass pastures on our hilly country, but information has been lacking," Judy said.

"We have about 120 hectares of undulating to rising country, which is dominated by native perennial species such as microlaena and wallaby grass.

After years of intensive grazing under sheep in my father's time, followed by the recent drought, the hills have been decimated.

## Perennial beginnings

Our farm has long been a perennial-based system – we have some old phalaris pasture my father planted perhaps 40-50 years ago and the hill country has a native pasture base.

Our country had been fertilised for many years since the 1960s-1980s, and even the hill country, except for some steeper slopes. But in tough years the hill country started to deteriorate under the sheep.

I think the addition of super, on top of constant grazing, takes the tops out of the grasses, with set stocking allowing rubbish such as capeweed to flourish.

At one stage after a run of tough years during the 1970s, the whole hilltops, maybe a sixth of the way down the hillslope, had nothing on it at all.

We backed off the super and the sheep, and started to run cattle in that country a bit more and with the summer rains the natives started to regenerate.

## farm info.

**Case study:** Judy and Chris Griffiths

**Location:** Wangaratta, Victoria

**Property size:** 400 ha

**Mean annual rainfall:** 710 mm

**Soils:** Highly dispersive clay loams on steep hills through to more fertile valley floors

**Enterprises:** Cattle

Photos: DPI Victoria

*Judy Griffiths, pictured second from the right, has found great value in group learning, where producers get the opportunity to share ideas.*

## key points

- Native perennial grasses benefit from deferred grazing after seed set
- Fertiliser can promote competition from weeds to the detriment of native species
- Group learning with on-farm trials allows producers to test theories in a practical environment.

## Seeking information

I took over part of the farm during 2000 and since then we have never had a sheep on the place. I could see the value of the native pastures and wanted to find out more but there was no information about how to recruit and keep them in our system. Information was coming out suggesting microlaena and wallaby grass were of value, but no advice on how to manage them.

Our initial investigations were through our Landcare group and it became evident a low input, low output approach might be a better way to go.

Information from the group brought our learning to the fore – Landcare has been amazing thing for learning and the group situation is great for sharing ideas.

## Putting theory to practice

I've sort of bumbled along trying to find information and trialling several approaches.

During the past few years, we have destocked the native pastures at different times to allow it to set seed.

The most valuable are the summer-active species, as now we are starting to get summer rainfall which benefits their growth.

Microlaena has been the main species we have been chasing as it has some of the best feed quality.

I don't practice the theory to a tee – you learn different things as you go along.

Originally, the theory was to lock the hill country up from spring until the autumn break.

But I've found that if you continue to graze the native species, it's not necessarily a bad thing. During late spring and autumn, if you get summer rain, are good times to let the grasses go to head and seed.

On one of our *EverGraze* Supporting Site paddocks, after being locked up for six months, I only got a fortnight's grazing out of it.

But on the control paddock, I lightly grazed it through spring, summer and autumn.

The other thing I've learned through a test strip approach is not to lime the native pastures – not because they don't do well, but because the weeds do better! Silvergrass on the lime test strip outcompeted the natives completely.

## Rotational approach

This year we started a rotational grazing system and we've been having a reasonable amount of success. I can now start to see the value of doing that.

Both innovation and the control paddocks are 15 ha each and above them are two 30 ha blocks on a 66 per cent slope, and as part of our four-paddock rotational grazing system, they are grazed for a similar time.

So we've got that as our first-block rotation, but we've been held up due to a lack of water over recent dry summers.

But this last year, we have been able to continue and you could see where the cattle had eaten down the hill blocks. The cattle have come away looking healthy.

I have an autumn and spring calving herd. Through spring, I can put my autumn cows and calves and my maiden heifers in a big group and use them through the rotation.

But when you hit spring, to keep the valuable effects of rotation grazing, you need a huge amount of stock, about 2000 dry sheep equivalent (DSE) doing the circuit on these blocks. Come December, I flicked the cows and calves out of that site, took the calves off and put the cows and heifers back. There were less stock and the cows had to calve and come off.

Since then we had 150 mm of rain during February and the phalaris really took off.

I had plenty of feed on the phalaris country to rotate my spring cows and calves and they are just now coming up to weaning and the cows will go up on the hill country.

The autumn cows calve down on the better pastures in the valley floor — the hill country suits the dry stock and the cows and calves do better on the phalaris.

During spring the annual species go mad up amongst the natives and you get stock to eat them so the natives grow out later in the spring rather than the annuals choke them out.

## Paddock approach makes practical sense

The information is just starting to come through on the *EverGraze* site, but we've only had three seasons, which is not near enough.

I think there is really something to have learned, there is no doubt about it. I wanted paddock-scale information and I can't get my mind around small research trials.

I understand the trial sites for research data, but farmers need a paddock-scale site so they can say "so that's what happens in reality".

Producers need to match research information with what fits into a whole-farm system.

We don't get the uptake in the general farming population without them seeing it on farm first. That's what holds back a lot of research adoption; the key is to get people out here looking at it."

*EverGraze — More livestock from perenials* is a Future Farm Industries CRC, Meat and Livestock Australia and Australian Wool Innovation research and delivery partnership.

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## science behind the story

By Jeff Hirth, Agronomist, Springhurst

- **There are two *EverGraze*® paddocks on Judy's property — both contain native pastures and the intention was to rotationally graze them, with one to have a strategic rest when the natives were flowering.**

Judy grew up in this area and her knowledge about how to manage and use native pastures is phenomenal.

The paddocks are on south-east facing mid-slopes of the Murmungee basin, which don't dry out so quickly and favour the persistence of microlaena.

It is reputed glacial activity has left a large semi-circular basin several kilometres across, with steep hills on three sides. Most people farm the valley floor but the steep slopes contain native pastures.

Judy's approach has been to graze the native pastures during winter and spring, and bring stock down to lower country with exotic pastures during summer.

We wanted to investigate year-round rotational grazing of the native pastures in a four-paddock rotation.

But when the project was set up the innovation was to ensure the natives (basically microlaena) thickened up by removing stock at the start of summer, allowing them to set more seed.

We first removed stock at the start of December 2007 to allow the microlaena to flower. Grazing resumed after the autumn break during mid-May 2008.

Rain during December 2007 and again during February 2008 saw the microlaena flower four times during this period.

As such, the livestock production for the control paddock, which was rotationally grazed during the six months the innovation paddock was shut up, benefited greatly from the summer growth of the microlaena.

With the four flushes of new growth during the summer, Judy felt locking it up did not make sense, because the new growth was palatable and nutritious and would be of poor quality when the autumn break arrived. She believed the pasture needed to set seed once and could then be grazed during summer to utilise the quality feed and to open up the sward — she was right.

To increase the density of natives, producers need new seed and space to establish. Grazing shortly after flowering creates such spaces and provides opportunities for germination and seedling establishment, should there be summer and/or early autumn rains.

In a dry season, the seed remains viable and can germinate as late as the following spring.

Grazing native pastures hard during early spring to reduce competition from annuals also has the benefit of opening up the sward for any germinating native seed.

In a sense the innovation didn't work as it focussed only on increasing the native grass seed bank without establishing the complementary conditions that then favour seed germination and establishment.

- ***Jeff Hirth is a private consultant who has more than 30 years experience in pasture agronomy and editorial work.***

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# Paddock subdivision allows more strategic grazing

A desire to better manage his steep hill country has seen Terry Hubbard subdivide larger paddocks according to land class and adopt a more strategic approach to grazing management as he explained to Catriona Nicholls.

"The biggest challenge we have is our terrain, I guess it would be fair to call it undulating to steep," Terry said.

"In addition to this, when we bought the first portion of property back in 1989, and the balance 10 years later, we had a range of paddock sizes from 280 hectares to 120 ha – not a good basis for managing rotational grazing.

As such, we ran a fairly loose grazing regime and this really did nothing for our native perennial pastures.

An approach by the local Department of Primary Industries Branch (DPI Victoria) looking for properties on which to trial controlled grazing on steep hill country to encourage perennials sparked a change.

With support from the Australian Government we divided a 200 ha block into six smaller blocks by land class and experimented with a fixed number of sheep moving through these paddocks.

## Steep decline

"Our hills suffered so badly during the drought they were just bare and when rain did come it was mainly capeweed that dominated – we lost an enormous amount of perennial grasses off the hills.

Our north-facing slopes were most affected as the stock graze them preferentially – the south slope grasses tend to be sour.

## farm info.

**Case study:** Terry Hubbard
**Location:** Three Sisters, Victoria
**Property size:** 840 ha
**Mean annual rainfall:** 600 mm
**Soils:** Friable gravel-based soils
**Enterprises:** Sheep (2000 ewes) and cattle (100 cows)

Photo: Kate Sargeant

*Terry Hubbard's steep hill country is responding to division of northerly and southerly aspects and implementation of strategic grazing to increase native perennial cover.*

## key points

- Subdividing according to landclass allows more strategic grazing management of perennial pasture species
- An *EverGraze*® Whole Farm Grazing Strategies course provides the tools to develop a system of grazing management across the property
- Rotational grazing is the key to promoting productivity and persistence in perennial native grasses and introduced species.

The original funded program locked up the perennials to allow them to set seed.

I'm still doing this to encourage seeding and we are increasing our fencing to better control stock movement.

We've also taken a more whole-farm approach. We lost about 280 ha during the 2007 bushfire and through a generous subsidy we have been able to keep fencing along land class lines and we're about two-thirds of the way through.

We are currently working with a DPI Victoria agronomist, Kate Sargeant and her team, to manage our steep slopes and increase productivity on our more arable areas. We have formed a group of local producers to complete the new *EverGraze*® Whole Farm Grazing Strategies course with Kate and Gary McLarty. This course gave us the tools and skills required to put an ongoing system in place for grazing management of the whole farm.

At this stage, I am anxious to see if we can get some of the microlaena (weeping grass) and danthonia (wallaby grass) to regenerate through grazing management and I am reluctant to interfere by spraying the hills to control the weeds. Although the weeds that emerged after the summer rain were amazing.

During our first two or three fields days, when people first examined our slopes I am sure most thought nothing would grow there.

On more recent visits they were pleasantly surprised the microlaena and wallaby grasses were growing back on the lower slopes.

We are hoping that with prevailing winds and supportive conditions, the grasses will find their way back up the hills.

## Grazing for cover

The decision to move stock through the paddocks is guided by *EverGraze* measurements and through visual evaluation — I can see what it looks like on the other side of the fence where sheep have been excluded.

There is a view that stock will get used to moving through the paddocks, but I have opened up the lower country and am letting lambing ewes graze a few paddocks at once. At the moment, with heavily pregnant ewes, I am reluctant to move them.

Our management perhaps isn't what it could be under rotational grazing. I was disappointed when it came to shearing and we had a break in the wool on the stock running on our Supporting Site. The Grazing Strategies group suggested the break may have been due to inconsistency in the feed availability. That sheep needed to be moved more often, and perhaps through more paddocks to maintain wool quality.

But I was impressed with what happened to the pastures when we moved stock on. We've had a lovely autumn, with good rain at regular intervals and the pastures are responding.

We have a mix of pasture species, a lot of perennial ryegrass and sub-clovers, which have done quite well and are still doing well on the southern faces.

But there were days during the drought where you would see dust blown away. The irony is we would have been totally burnt out if we had the pastures that we have now.

## Mapping the future

Currently, we are working with Kate on mapping the farm electronically as part of the grazing course, which is quite an exciting exercise.

I am trying to plot in all the fences as they are, which will show us the paddocks that have opportunities for more fencing.

In our case, I would like to have a whole-farm plan showing fences, water points and areas of each paddock and land classes.

From there the theory is that we can work out what a particular paddock can carry and for how long stock need to stay on it throughout the year.

Our system is about getting a balance. We have been retired from some time and one of the big things we focus heavily on is revegetating the area of land we have locked up for biodiversity value.

I believe most farmers genuinely believe they would like to leave the farm in a better condition than when they took over."

*EverGraze — More livestock from perenials* is a Future Farm Industries CRC, Meat and Livestock Australia and Australian Wool Innovation research and delivery partnership.

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# science behind the story

By Kate Sargeant, DPI Victoria

- **The Hubbard's Supporting Site is a steep hill country site with a north and south face, divided along the ridge.**

Terry fenced the site to decrease the size of the paddock, which was quite large when the project started.

The initial project was Caring for Our Country and Landcare funded, and while *EverGraze*® has been involved, Landcare was the main driver until this year.

We have now taken on the Site as an official *EverGraze* Supporting Site.

The aim is to increase groundcover on the north-west face while increasing utilisation on the south face. The north-west face is mostly bare during summer, and dominated by capeweed during the growing season. Small tufts of wallaby grass are scattered across the north face. Microlaena patches are evident in wetter areas further down the slope. The strategy for the north slope is to include it in a rotational grazing system with rests of between 30 days during spring and 60 days during autumn and winter to increase the strength of the perennial component.

A heavy graze during early spring controls capeweed before removing stock between November and the autumn break to allow native grasses to seed and germinate. This method should work for wallaby grass, which likes bare ground to germinate, and microlaena on the lower slopes, which likes to germinate with a bit of cover.

No phosphorus fertiliser is being applied to the north face to reduce the competitiveness of the capeweed compared with the native grasses. The aim is to maintain above 70 per cent groundcover throughout the year.

On the southern slopes, groundcover is maintained mostly by perennial ryegrass. The sheep did not utilise this area while the north-west slope was in the same paddock because it is cold and the pasture lost quality as it became rank. By dividing the two aspects, the sheep are forced to graze the southerly slope, hopefully increasing utilisation and feed quality. The group intends to do some feed tests to determine differences in feed quality on the northerly and southerly faces of the hill. This might help to determine why we see preferential grazing and whether productivity is penalised by forcing the sheep to graze there.

The southerly slope can be grazed in the rotation system year-round due to the high groundcover. Using this area during early autumn can help create a feed wedge on areas more suitable for autumn lambing as the weather gets colder. Further increases in feed quality may be achieved if Terry fertilised his southerly slopes to encourage clover. However, the economics of doing this would be worth investigating.

- *Kate Sargeant is a pasture agronomist with the Department of Primary Industries Victoria.*

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# Kikuyu offers low input, low maintenance alternative

Kikuyu pastures are offering Austin and Joy Johnson, South Australia, a low-maintenance option for rearing Friesian X beef heifers. As Austin revealed to Catriona Nicholls recently, this allows them to enjoy a more relaxed pace of life compared with surrounding high-input grazing systems, without compromising on feed quality.

## farm info.

**Case study:** Austin and Joy Johnson

**Location:** Fleurieu Peninsula, South Australia

**Property size:** Two properties 75 ha and 61 ha

**Annual rainfall:** 700 mm

**Soil type:** Derived from glacial sands + alluvial loams

**Enterprises:** Heifer rearing

"We inherited our kikuyu pastures when we bought the properties about 13 years ago," explained Austin.

"Back Valley is a traditional dairying area and kikuyu was first introduced during the 1920s.

Before buying the property we'd had some experience with summer-active perennials coming from a property based on lucerne pastures.

In fact we've only been farming since 1991 after I retired from a career as a civil engineer with the Australian Government.

When we first moved here I did a *PROGRAZE*® course with Tim Prance of Rural Solutions SA and later became part of the Fleurieu Beef Group in order to develop a greater understanding of production in this area — I enjoy it a great deal and refer to it as farming, friendship and fun.

The Group meets on farm each month and provides a source of technical and practical information with guest speakers, farm walks and a great network for sharing experience.

Several group members have had careers in other fields as well as farming.

## key points

- Kikuyu requires little maintenance other than rotational grazing to promote persistence and productivity
- The ability of kikuyu to respond to summer rain ensures green feed during summer
- A high level of crude protein delivers impressive animal production potential from the perennial grass species
- Kikuyu must be effectively managed to minimise the risk of spread into native ecosystems via plant fragments or seed that can be ingested by livestock.

Photo: Brian Tripptree

*Austin Johnson has found that kikuyu is yeilding better weight increases in his heifers than expected.*

Although kikuyu is widespread in our area, popular opinion among many of the local farmers is that it is a weed, which they regularly spray out of their high-input pastures.

However, I was interested in investigating the kikuyu further, because we seemed to be getting good weight increases in our heifers — better than expected.

Before we made a decision to discard it as a pasture species, I wanted to base our decisions on feed results.

Together with local consultant Tim Prance, we ran simple analyses on the feed value of two existing paddocks — I was surprised by the results.

While feed quality varies through the year and at varying growth stages, we have had up to 30 per cent crude protein in our kikuyu pasture, which is pretty impressive.

During good growth stages after summer rain, feed test results have consistently indicated protein levels of above 25% and energy levels in excess of 10 megajoules per kilogram (MJ/kg).

And given it is a hardy species, which can be grazed heavily and provides out-of-season feed, we made the decision to keep it.

### Pasture composition

The kikuyu content of our pastures varies between 40% to 90% with the remainder of species including annual ryegrass, sub-clover — and a range of weeds of course.

I believe animals benefits from a diverse range of species and given kikuyu provides feed only during the warmer months, the winter-active species are an important complement to the perennial grass.

We've done very little in terms of managing the pasture apart from simply rotating our animals through the paddocks as feed on offer demands.

While we had no previous experience with kikuyu, we were well equipped for rotational grazing because of our previous management of lucerne-based pastures.

Unlike many high-input systems, we don't have a strict rotation formula or wagon wheel system where we move our stock every second day.

Our paddocks vary in size and due to the nature of our heifer-raising operation, we run our stock according to their age.

We have turned off up to 100 in-calf heifers in any one year, with up to 300 animals across the two properties at any one time.

However, we are reaching an age where we are contemplating our future and tapering back our pace of life and the kikuyu-based system allows for that nicely.

## Long history — low maintenance

Apart from being easy to manage, kikuyu really looks after itself.

Our kikuyu was probably planted using runners during the 1930s–1950s. It was largely dairy country and I think most dairies would have had kikuyu as an important pasture in the early days.

We are still achieving good results and weight gains from these original stands.

Our cattle are weighed pretty regularly and the gains are extremely good, better than expected, which is one of the reasons we investigated its value initially.

At various growth stages and after grazing, various different circumstances results of up to 30% protein.

But the biggest benefit for us is that we haven't had to do much at all, it looks after itself.

We haven't done a lot of fertilising over the years, it is a summer grower and if you get any sort of rain during summer you get extraordinary growth. You can graze it heavily and it provides high-quality feed.

This growth pattern complements our various winter-active species such as annual ryegrass and clovers.

## The downsides

It is not all goods news, though. Frosts give kikuyu a hard time and severely retard growth.

It is a vigorous grass and I accept that if it were to get into native scrub it would be regarded as a weed. But it is really only the road reserves that have been affected locally from what I can see.

We are small time farmers with a simple rotational grazing system where cattle are sorted by age. We don't have a formal system of rotation, when there's little left in a paddock and lots in the next paddock we move the stock on. Sometimes we move stock on to utilise an excess of feed during periods of rapid growth.

We still carry out supplementary feed during late autumn and winter, but kikuyu is a robust plant that provides a low-maintenance option for a low-input grazing business like ours."

*EverGraze — More livestock from perenials* is a Future Farm Industries CRC, Meat and Livestock Australia and Australian Wool Innovation research and delivery partnership.

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## science behind the story

By Tim Prance, Rural Solutions SA

- **Austin and Joy Johnson's farm has very sandy acid soils derived from glacial material. The soils are extremely infertile with a PBI <10 and available P (Colwell) less than 20 milligrams per kilogram (mg/kg), sulphur less than 5 mg/kg and low available potassium.**

Kikuyu is ideal for these soils, particularly where landowners don't want to pursue a high fertiliser input grazing system. If the kikuyu is grazed down to less than 1000 kg/ha during late autumn, then enough sub-clover and annual weeds can be maintained to provide adequate winter feed for cattle.

Soil fertility is helped by relatively high levels of organic carbon from the kikuyu runners.

Feed tests collected as part of *EverGraze*, show that green actively-growing leafy kikuyu, even when short (300 kg/ha feed on offer) contains high levels of crude protein (CP) (16–30 per cent) regardless of the time of the year.

Metabolisable energy (ME) levels vary according to feed on offer and growth activity. The ME of leafy, active kikuyu regrowth is between 10 and 11 MJ/kg dry matter (DM) with 3000 kg/ha feed on offer. If kikuyu is under severe moisture stress, or if rank and ungrazed with only 20% leaf, ME levels will be 9–9.5 MJ/kg DM with 1000–2500 kg/ha feed on offer.

Crude protein levels of rank kikuyu, or kikuyu under severe moisture stress, can drop to as low as 10%.

Dead, dry kikuyu runners in a hard-grazed stand with no green leaf has low CP (6%) and low ME (7 MJ/kg DM).

Fibre content is high with neutral detergent fibre (NDF) levels of 46–56% even when ME levels are high (>10.5). This will restrict pasture intake of high-performance animals, which explains why local dairy farmers prefer ryegrass and phalaris to kikuyu, particularly with today's highly productive cows compared with those of the 1940s and 1950s. Also, undergrazed rank kikuyu has poor feed value.

However, during summer, this is not an issue with Austin's heifers (nor has it been on kikuyu paddocks grazed with Merino weaners on Kangaroo Island). These animals require protein, and just enough energy for low-to-moderate weight gains. Kikuyu is ideal for this.

Austin's other *EverGraze* paddock contained mostly perennial veldt grass. Perennial veldt grass hasn't been as productive as kikuyu, but green leaf freshens up on light dew during summer and autumn. Leafy veldt with 200 to 1500 kg/ha feed on offer contains 13–25% CP, 9.3–11.3 MJ ME/kg DM with 43–56% NDF.

For 2008 and 2009, the kikuyu paddock has carried 11.2 dry sheep equivalent (DSE)/ha and the perennial veldt paddock has carried 9.2 DSE/ha.

Now that kikuyu seed is available, we are confident new stands can be established from seed especially if the do's and don'ts of kikuyu establishment from Philip Barrett-Lennard EverGreen Farming WA are followed.

Kikuyu has the big advantage of providing groundcover, and animals can be fed in the paddock without risk of soil erosion.

- *Tim Prance is a senior consultant in pastures and grazing with Rural Solutions SA.*

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# Perennials provide productivity and sustainability

For Henry Bridgewater, Monaro Plains New South Wales perennial pastures are the key to both sustainable management and productivity on his alluvial river flats and rocky hill country. Henry explained to Lucy Kealey how a pasture improvement program on the flats and a paddock division project on the hills will get the best out of his country and his sheep.

"Traditionally, the river flats were 100 per cent lucerne production, but lucerne had always been a sideline and our main business of self-replacing Merinos," Henry said.

"We were saving the best feed, making it into hay and selling it! Now we use the best feed for our number one enterprise.

Further, the lucerne system had rising input costs (especially herbicides), high costs of owning hay-making machinery, and it was difficult to find tractor drivers for 2 am in the morning! There had to be a better way.

## A perennial mix

When the lucerne got old, we would crop it for a couple of years with winter wheat, to clean up broadleaf weeds and get some benefit from the stored nitrogen. Then we would go back into lucerne.

Now when lucerne is old and depleted, I still crop it but I resow with a perennial pasture mix called 'Cooma 450' containing lucerne, phalaris, clover and winter-active fescues.

## farm info.

**Case study:** Henry Bridgewater

**Location:** 55 km south of Cooma, New South Wales

**Property size:** 5200 ha total, 700 ha alluvial river flats, 4500 ha non-arable hill country

**Mean annual rainfall:** 500 mm

**Soils:** All basalt derived — friable alluvial soil on the flats; rocky, clay soil on the hills

**Enterprises:** Dual-purpose Merino ewes, self-replacing; poll Herefords, agistment and trades

Photo: Henry Bridgewater

Photo: Michael Noonan

*Henry Bridgewater and his daughter Claudia in a perennial pasture sown during 2004. INSET Henry began replacing his lucerne stands with a perennial pasture mix during 2004, and is renovating one of his river flat paddocks each year. He believes the change has lifted both the productivity and sustainability of his property.*

## key points

- A perennial pasture on river flats provides better weed competition and more groundcover to minimise wind erosion
- The perennial mix meets the feed requirements of Merinos at critical times during the breeding year
- Cell grazing on hill country will enhance the persistence of native perennial species and maintain good groundcover to deter the establishment of serrated tussock.

The first lot of perennial pasture was planted during 2004 and I sow one new paddock every year. The area varies from 20 to 50 hectares.

I have had some great successes and some failures due to lack of seasonal rain but I push on!

Compared with lucerne, the perennial mix provides higher biomass, much better groundcover and with correct grazing management, better weed management.

The perennials require lower inputs and I hope to get 50 years out of a good perennial pasture — a lucerne-only stand might last 10 years and requires annual upkeep.

## More production, more groundcover

We certainly get more grazing out of the perennial mixture. During March this year I put 2200 ewes on 24 ha for nine days (about 140 dry sheep equivalent per hectare). There was still about a third of the pasture left when I took the ewes out.

The perennial pasture has two key uses; a boost for getting ewes into condition for joining and putting weaners onto green grass during summer. It's all about trying to match livestock nutritional needs more closely with grass and not having to provide (or buy) supplementary feed.

My best ever lambing percentage was 135% during 2007 and that's a big production increase I can attribute to the perennial pastures.

If I am selling a mob of five-year-old ewes, for example, and they are not in good enough condition, I will put them onto the flats as well.

The mix of species provides better groundcover than with the lucerne-only stand. There is not much run-off erosion on the flats but there has been some wind erosion — especially during the recent drought years.

Improved groundcover also provides less area for weeds to establish.

## Investing in wire and water

I am also in the process of subdividing big paddocks in the hill country into cells to make better use of native perennial species there. I have done one development so far, and am planning another this winter.

Eventually the hill country will be managed by time-controlled cell grazing so I can rest the country for longer. This will help improve groundcover, making it harder for serrated tussock (our number one weed) to establish.

I have an annual spot-spraying program for serrated tussock but I seem to be going over the same amount of country each year. Now I spend some of that money on wire and water to subdivide big paddocks.

The pasture in the hills is based on native species indigenous to the area — predominantly poa and stipa species but also include kangaroo, red and wallaby grasses.

In the one cell I have set up, quite a few native forbs have reappeared and even some emu's foot. These species definitely need a good rest after grazing to regenerate.

## Business operations simplified

With perennial pasture, I run sheep on the best feed and getting higher production, instead of running them on the worst feed and wondering why they don't do well.

The perennial pasture has reduced input and operation costs, and made the property more productive. I also think the property and business will be more sustainable."

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*A mix of phalaris, lucerne, fescue and sub clover provides excellent feed at key times for the merino flock — leading up to joining and at weaning. The pasture mix is better than lucerne alone to provide groundcover to minimise wind erosion and weed incursions.*

## science behind the story

By Chris Hillman, Landmark

- **The Monaro is a region of diversity. Annual rainfall varies from 450 millimetres on the high basalt plains in the middle of the region to 700 mm on the boundaries.**

The climate is variable — unreliable autumns, cold often very dry winter, and storms through spring and summer providing the most reliable moisture.

Perennial pastures are the mainstay for annual production on the Monaro.

The main benefits of perennial pastures over annual pastures and crops in the region are:

- Better distribution of feed — perennials such as phalaris and lucerne cover most growing periods — having active plants throughout the season
- Better groundcover to compete against serrated tussock and lovegrass invasion
- Better water use efficiency — perennial mixes respond to moisture at any time of the year and a deeper root system allows them to use this more favourably
- Less failures with permanent pasture — once established, good autumn rain is not needed unlike annual crops and annual pastures.

Several important steps guarantee a good establishment of perennial pasture especially from run-down permanent pastures.

Fallow the old pasture during spring, using herbicide, and apply a second spray during early February and then sow a winter cereal. Winter wheat has been popular during recent years.

Start grazing after early tillering has started and the plants cannot be pulled out of the ground easily. However on the Monaro, most graziers want and use the feed late autumn/early winter. Winter wheat is usually grown every second year to eliminate annual grasses and broadleaf weeds before sowing perennial pasture in the following autumn or if the season fails, late August.

The most reliable pasture mix is a combination of phalaris (both winter- and summer-active varieties), sub-clover (an early and late flowering type), a little lucerne, and winter-active fescue. It is commonly called the 'Cooma 450' mix.

Long-term management of perennial pastures relies on several important factors. Firstly, rotational grazing maintains adequate groundcover for weed control and enables the plant to regrow. Secondly, soil fertility has to be kept up. Many graziers are happy to fertilise annual crops and pastures at each sowing but are reluctant to topdress high-performance permanent pastures annually. A minimum of 0.7 kilograms of phosphorus should be applied per DSE carried per year to maintain present soil levels of phosphorus.

- *Chris Hillman is a Landmark agronomist based at the Monaro in New South Wales.*

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**Ian Stanley, farmer Western Australia** *(see story, page 4)*

*"I understand the trial sites for research data, but farmers need a paddock-scale site so they can say so that's what happens in reality."*

**Judy Griffiths, farmer Victoria** *(see story, page 8)*

*My best ever lambing percentage was 135 per cent during 2007 and that's a big production increase I can attribute to the perennial pastures."*

**Henry Bridgewater, farmer New South Wales** *(see story, page 14)*

Future Farm *brings you success stories from people adopting farming systems based on perennial plants that are making their farms, local landscapes and catchments more profitable and sustainable. Dryland salinity, climatic variability and other natural resource constraints threaten the long-term viability of regional areas. However, backed by innovation and good science, farmers are successfully managing these constraints and often turning them to their advantage.*

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