Evergreen FARMING

incorporating Western Australian Lucerne Growers

Newsletter of Evergreen Farming Issue 32 June 2010

Look, Listen, Learn

Field Days provide a great opportunity to learn. At a recent Field Day at Bob and Anne Wilson's farm at Lancelin, attendees not only got to look at over 1200 hectares of well managed tagasaste and subtropical perennial grass pastures, they were able to listen to Bob explain what he's done, and what he's learnt about perennials over the last 25 years. Invaluable! But the learning opportunities didn't end there, with a diverse and interesting group of guest speakers, discussing topics ranging from soil carbon to perennial establishment to animal management and even the slightly esoteric life cycle analysis. The photo shows attendees inspecting a trial paddock sown to both Tagasaste and Perennial Grasses in 2009. Photo 13 Apr 10.

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feeding whole lupins to cattle to finish for slaughter. Contrary to to some misinformation at the time, of tainted meat and dark cutting, these were beautiful carcases, so much so that the buyer, Mal Norton (Western Meat Packers) wanted to know how quickly I could do another draft. And this happened to be at a time that it was difficult to get a booking to kill. The tag became an important part of our farm program.

The water I didn't really see as a problem because it was good quality, I believed it could be an asset if the right pastures were grown. Initially I sowed a mix of strawberry and balansa clovers along with Roberta ryegrass which I had seen growing in southern NSW. This mix grew prolifically where there was a high perched water table but dropped off markedly once the water table was lowered. I tried some pioneer rhodes grass but because I undersowed it with oats, it wasn't successful. This was my first lesson that perennials don't like competition on establishment. I had seen a lot of other perennial plants doing very well in areas around Rockhampton in Qld where it wasn't much hotter but a lot colder than Cataby so I reckoned they were worth a try. The first lot we sowed just west of the Brand Hwy in an area that was inundated each year. A formal trial plot was set up by the Moora Ag Dept and Tim and his kids and I spread the rest of the area by hand (about 1.5 ha) and rolled it in with a Steiger. There were several different varieties and they all germinated to varying degrees. The fantastic growth that occurred I think gave a lot of people the confidence to "look outside the square" and try these subtropicals. I also tried very hard to grow lucerne at "Joanna" but we couldn't get it to nodulate. However several years later whilst managing "Yathroo" we were able to grow substantial areas of very productive lucerne some of which persisted for 5 years, then grew very good wheat crops.

I believe we are at the cutting edge of a very exciting program with Pasture Cropping. The benefits in being able to leave some cover and root structure in the more fragile soils are immense. Also the cover keeps the soil cooler and creates a better environment for microbes and other useful bugs.

I am now involved with a property at Regans Ford where we have perennials sown in 2009 and will be oversown with oats and serradella this year principally as a fodder crop but may be harvested depending how the season goes.

Committee Column

Erin Gorter (President), Kojonup

It's that time of year again when we bring you the Pastures for Profit series. We endeavour to make sure we have something for everyone in the way of ideas and inspiration to take home at the end of the day. This year the days will be held in Mt Barker and Dandaragan, so I hope you can get there. Don't forget to bring a friend or car pool with another member – it always makes the trip even more valuable sharing ideas on the drive to and from home! Lamb will be the 'flavour' of topics for the day, but remember that whatever animals you are using to graze your pastures, many of the principles are the same and can be shared across enterprises. I have often been quoted as saying I can learn as much about lamb production from cattle farmers as I can from sheep farmers!

The Perennial Pasture Companions project (through Caring for our Country) is coming to a close this year after a successful 2 years. This project has seen Evergreen work closely with WA Lucerne Growers, who are now merged with Evergreen, and Saltland Pastures Association (SPA). The challenge for your committee has been to gain further funding from this point forward, which we are still pursuing. With the winding down of the Saltland Pastures Association this year we need to ensure the finger is not taken off the salinity pulse, as saline land is certainly still a major issue for many in this state. SPA and affiliates are to be congratulated for the huge amount of work they have done in bringing salinity issues to the forefront of agriculture.

At our latest committee meeting it was decided that a study tour to the Eastern States would be organized for March 2011 for any interested members. This would be a fantastic opportunity to view what is being done in the east and what we have been hearing about for a number of years. The Grower Group Alliance are supportive of grower groups instigating study tours to further their knowledge so we will be working with them to make this happen for Evergreen members. Watch this space if this sounds like something you might like to add to your 2011 calendar.

This bloke below needs no introduction to most of you – he has devoted years to making perennials work and thrive in this state and brings a wealth of knowledge and experience to the committee.

Committee Exposé

Bob Leeson, Lancelin

As a foundation member of Evergreen Farming I have seen a lot of change in our organisation. We started from a loose knit group of producers in the Midwest of WA with similar thoughts and ideas on perennial pastures drawn together by Tim Wiley in the early '90s. To get from there to where we are today as a professional organisation is a massive jump in less than 20 years. The two biggest factors in our success have been that: i) we are farmer driven and ii) bringing John Duff (agVivo Pty Ltd) in to formalise our operation. John's ability to source funding and collate information was invaluable. We farmers knew what had to be done but didn't have the time to put into it. We were too busy trying to grow something sustainable.

I took over the management of Joanna Plains in 1988 and was confronted with two environmental problems, wind erosion and a rising water table.The windblown areas were sown to Tagasaste and strategic tree planting was undertaken immediately. The areas sown to Tag later became some of the most productive land. We were able to use it as the fibre component while

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The Coming Famine

Julian Cribb, Julian Cribb & Associates, ACT, julian.cribb@work.netspeed.com.au

Most of us have by now heard the forecast there will be 9.2 billion people in the world of 2050. But current projections suggest human numbers will not stop there – but will keep on climbing, to at least 11.4 billion, by the mid 2060s.

Equally, the world economy will continue to grow – and China, India and other advancing economies will require more protein food.

Thus, global demand for food will more than double over the coming half-century and we will then eat around 600 quadrillion calories a day.

The central issue in the human destiny in the coming half century is not climate change or the global financial crisis.

It is whether humanity can achieve and sustain such an enormous harvest.

The world food production system today faces critical constraints. Not just one or two, but a whole constellation of them, playing into one another – and serious ones.

This is the great difference from the global food scarcity of the 1960s. Then the constraints were around skills and technology – and the generous sharing of knowledge and technology in the Green Revolution was able to overcome them.

Today the world faces looming scarcities of just about everything necessary to produce high yields of food – water, land, nutrients, oil, technology, skills, fish and stable climates, each one playing into and compounding the others.

So this isn't a simple problem, susceptible to technofixes or national policy changes.

It is a wicked problem.

The first of these issues is the looming scarcity of fresh water.

By 2050, 7-8 billion people will inhabit the world's cities. They will use about 2,800 cubic kilometres of fresh water – more than the whole of irrigation agriculture uses worldwide today. Desalination may supply some but for most cities, it will be cheaper and simpler to grab the farmer's water. This is already happening, around the world.

Then there is the slice of farm water that climate change is already stealing, whether it is rainfall over the great grainbowls, evaporation from storages, shrinking rivers and groundwater or the loss of meltwater from mountain regions. The Himalayan glaciers are disappearing and the North China Plain is running out of water. These two regions feed 1.7 billion people now and must feed twice that many in the future. If they fail, the consequences will affect everyone.

Worldwide, groundwater levels and rivers are dropping as they are pumped dry. Immense waterbodies like Lake Chad are simply vanishing. Australia has emptied its vast Murray-Darling basin.

IWMI director general Colin Chartres says "Current estimates indicate that we will not have enough water to feed ourselves in 25 years time, by when the current food crisis may turn into a perpetual crisis."

Today almost a quarter of the world's farm land is affected by serious degradation, up from 15% two decades ago.

Though no-one has done an accurate assessment, it appears the world may be losing one per cent (50,000 km^2) of its farmland annually – due to a combination of degradation, urban sprawl, mining, recreation, toxic pollution and rising sea levels.

If we've already lost 24% and we lose around 1% a year from here on in, you can figure out for yourself how much land our grandchildren will have left to double their food supply. The world may be close to 'peak land'.

In 1900 every human had 8 hectares of land to sustain them – today the number is 1.63 and falling. Put another way, between 1990 and 2005, world demand for food grew 15 times faster than the area of land being farmed.

By 2050 the total area of farm land buried under cities may exceed the total landmass of China, and the total area of land diverted to recreation and other non-food activities may rival that of the United States. This is nearly all prime farm land in river valleys and on coastal plains.

Many of these cities will have 20$^+$ million inhabitants – yet little or no internal food production capacity. They will be in huge jeopardy from any disruption to food supplies.

The world is haemorrhaging nutrients at every link in the chain between farm and fork. On farm it appears anything up to half of applied nutrients can be lost into soil, water and the environment.

Our resources of mineral nutrients are starting to fail. When Canadian Patrick Dery applied Hubbert's peak theorem to phosphorus he found, to his dismay, we had passed it in 1989. According to the International Energy Agency peak oil and gas are due in the coming decade. These spell scarcity and soaring prices in the primary nutrients – N, P and K – that sustain all advanced farming systems worldwide.

At the other end of this equation we are ruining our rivers, lakes, seas and oceans in ways that prevent our getting more food from them. Each year we pump around 150 million tonnes

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more nitrogen and 9 million tonnes more phosphorus into the biosphere than the earth's natural systems did before humans appeared: we have utterly modified the planet's nutrient cycle, more radically even than the atmosphere or fresh water cycle. That we may double our release of nutrients to the environment as we seek to redouble food output is alarming. According to Nature this is one of the safe planetary boundaries the human race has already crossed.

Then there's waste. In developed countries we throw away from a third to half of all food produced, in developing countries we lose similar amounts post-harvest. All told, the Stockholm Institute calculates we waste 2600 out of every 4600 kilocalories of food harvested.

Put another way, half the achievements of world agricultural scientists and farmers of the past 50 years are going to landfill.

While a billion starve, we waste food enough to feed 3 billion.

Peak oil has already happened in the United States, in Australia, Britain and in 49 out of 65 of the world's oil producing regions. Yet 51 million new cars continue to hit the world's roads every year.

By 2040 dwindling reserves of fossil oil may well be reserved for the military and everyone else will have to get by as they can, including food producers.

The average citizen of a developed country today consumes the diesel distillate from 66 barrels of oil a year, such is the dependency of our modern food systems on fossil fuels. The high-yielding crops we pin our hopes on will be of little use if there is not enough fuel to sow, harvest or transport them.

One of the most pressing questions is where the energy to power the world's tractors, trucks, trains and ships that move the food will come from in future. It cannot come from the farm: to do that would reduce world food output by 10 - 30 per cent, at the same time as we need to double it.

Optimistically, we may have until 2030 to solve this problem and convert the whole of the world's advanced farming systems to another energy source, algal biodiesel maybe. Or hydrogen. Or solar-electrics. But there seems little sense of urgency about this issue from governments.

Natural gas will also peak shortly and since it helps make 97 per cent of the world's nitrogenous fertilizer, an N scarcity is also on the cards.

By the 2040s it is unlikely we will be using fossil fuels in agriculture. There needs to be a crash global research effort to head off a farm energy crisis.

The risk of soaring global food prices in the event of a world energy shortage is real.

Lying in wait for us is a marine timebomb. 29 per cent of world fisheries are in a state of collapse according to Canadian scientist Boris Worm and colleagues. The majority could be gone by the 2040s they warn. Plagues of jellyfish in the world's oceans signal the impact of overfishing and nutrient pollution, while carbon emissions are turning them acidic, imperilling the entire marine food chain.

The FAO says "the maximum wild capture fishery potential from the world's oceans has probably been reached" and the same applies to freshwater.

If we cannot double fish production as food demand doubles, then we will have to get the additional 100 million tonnes of meat from land animals. This will require a billion tonnes more grain and 1000 cubic kms of extra fresh water.

FAO's projected increase in world meat demand by 2050 is 185 million tonnes. Add this to the fish deficit and we would need to discover three more North Americas to grow sufficient grain to feed all these animals. This gives some impression of the scale of the challenge to meet global protein demand by 2050.

The UK's Hadley Centre projects that drought could regularly affect 40 per cent of the planet's land area by the end of this century. Their soil moisture projection suggests that regions once thought to have big farming potential, like Brazil, southern Africa and the Indian grain bowl, may prove unreliable.

The International Food Policy Research Institute has warned of a potential 30% drop in irrigated wheat production in Asia and 15% in rice, due to climate factors. The World Bank fears African productivity could halve and India's drop by as much as 30 per cent, unless urgent steps are taken.

The Global Footprint Network (GFN) estimates we consume the total productivity of 1.3 Earths in food, water, energy and other resources. If the trend continues, they say, we will be using 2 planets' worth of production by 2050.

If the GFN is even partly correct, then today's diet and agricultural systems are not sustainable in the longer term.

We must reinvent them.

The challenge facing the coming generation of farmers is to double the global food supply:

- using half the water
- on far less land and with increasingly depleted soils,
- without fossil fuels,

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- with increasingly scarce and costly fertiliser and chemicals
- under the hammer of climate change.

Furthermore, farmers are going to have to accomplish this miracle using less science and technology.

On top of the scarcities of land, water, energy and nutrients the world's farmers are driving into a huge technology pothole.

This is the result of decisions by national and regional governments worldwide, by aid donors and academic institutions, to slash resources for agricultural research and extension over four decades.

In the year 2000 the rich countries spent just 1.8 cents in every research dollar on agricultural research, so unimportant has the issue of sustaining food production become to them.

Between 1980 and 2006 the proportion of the world's aid budget devoted to raising food output fell from 17 to just 3%.

The cost is high. In local research stations, in national agriculture departments, in universities, colleges, research agencies and in the international agricultural research enterprise, support has been cut or allowed to erode, hundreds of labs and field stations have been shut, and thousands of vital research programs terminated.

Of the scientists who fed the world in the past 40 years most have quit, been fired, or have retired.

The dilapidation in the enterprise that feeds the Earth has disheartened a generation of young would-be agricultural scientists, especially in developed countries where many universities and colleges of agriculture cannot find enough students to fill the places they offer. Disciplines vital to reinventing agriculture, like soil science, are languishing.

Global funding for agricultural research, public and private, is estimated to total around $40 billion.

There is a stark contrast with the $1500 billion the world now spends on weapons.

There has been almost no real increase in funding of the international ag science effort since the 1970s – although the human population has doubled.

The effects of all this are evident in the declining growth in world crop yields. The gains are now below 1 per cent a year - less than half what is needed to keep us fed.

Generally speaking, it takes around 20 years for a piece of research to be completed, turned into technology or advice, commercialised and adopted by farmers. Often far longer.

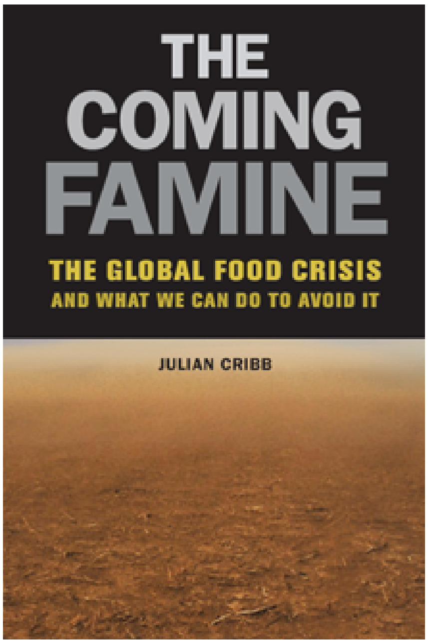
The global decline in agricultural R&D in the past four decades means less new technology will be available to farmers between now and 2030 than in the past. Also, much of the existing new technology will not help to raise global food output because it is geared more to the needs of agribusiness corporations than it is to the needs of farmers or consumers.

Much of this technology is quite unsuitable for use in the developing world, and will do nothing to overcome hunger and unsustainability as it is highly dependent on costly and increasingly scarce inputs. So the rate of technology diffusion from the developed to the developing world is also going to fall.

There is an urgent need, not only to redouble the agricultural research effort worldwide but to develop a new 'eco-agriculture' that is sustainable and less dependent on heavy use of energy, water, nutrients and other increasingly scarce industrial inputs.

Creating it is humanity's most pressing scientific challenge.

This new food producing system has to be science-based. It has to be low input. It has to replenish, not destroy. And it has to work for farmers large and small, everywhere.



"The Coming Famine" will be published by the University of California Press and CSIRO Publishing in August 2010.

It was supported by the Crawford Fund and Land & Water Australia.

Kikuyu for summer feed and wind erosion control

Ronald Master, DAFWA, Albany, Ph: (08) 9892 8521.

Background

Erica Ayers and Phil Cleghorn farm a property 25-30 km north east of Esperance on typical sand plain soils. They have a variety of annual pastures and crops on the property and have a mix of sheep and cattle.

They have both had an interest in perennials and in 2003 decided to take the plunge with 38 ha of kikuyu pasture. This was driven by a number of factors. Firstly they were keen to use some of the summer rainfall they had been receiving and perennials seemed to be a good way to do this. Secondly they were keen to get more out of season feed. This would hopefully help to reduce their hand feeding as well as allowing them to turn animals off quicker. And thirdly they were keen to reduce the wind erosion risk on some of their lighter paddocks.

Establishment

The paddock was sprayed with a double knock using initially 1.5 L/ha of Roundup in preparation for a September plant. This was then followed up one month later by 1 L/ha of Spray. Seed. The paddock was then planted with 1 kg/ha of kikuyu (Whittet). Alpha-cypermethrin was used post establishment for wingless grasshopper control.

The paddock was fertilised with super potash 3:1 at 125 kg/ha at planting. This was followed up the next year with 100 kg/ha of super phosphate and 60 kg/ha of sulphate of ammonia.

Benefits to animals

The key aims for establishing the kikuyu was to provide more out of season feed and stabilise the paddock. The kikuyu provided both of these however the story was not that simple.

As can be seen (Table 1) the kikuyu was providing a significantly higher DSE throughout both 2008 and 2009. In particular in the summer/autumn period of 2008 the kikuyu had 17 DSE on it while the annuals only had 4 DSE with an average DSE across the entire period of 12 for the kikuyu and 9 for annuals.

The supplementary feeding data for the two paddocks however tells a different story. The kikuyu used far more lupins, barley and hay then the annuals; interestingly however this all occurred in 2008 with no supplementary feeding on kikuyu in 2009.

Table 2. Supplementary feeding for kikuyu and annual paddock Dec 07 - Dec 09

Pasture Type	Barley (kg)	Lupins (kg)	Hay Rolls (500 kg rolls)
Kikuyu	6900	7700	39
Annuals	5500	960	25

As it turned out, 2008 was a particularly difficult year with a late break and little feed early. The annual paddocks were starting to bare off and become susceptible to erosion so the kikuyu was essentially used as a feedlot. It was stocked for nearly two and half months with almost all of the feed going on to the kikuyu during this extended period of grazing.

Feeding the grain out on the kikuyu was more effective as it was easier for the animals to pickup then on bare sandy paddocks. It also allowed the grazing pressure on the annual paddocks to be reduced which helped to limit the wind erosion in a difficult year and allowed the annuals time to recover. It also helped to knock the kikuyu back for the break of season, giving the annuals more time to come through.

Amazingly, despite the heavy stocking rates of between 21 and 37 DSE/ha for the 2.5 month period the kikuyu did not blow and remained stable. The stand was not damaged and in 2009 carried more stock then the annuals with no supplementary feeding (table 1).

2008 really reinforces the value of the kikuyu to Phil and Erica. It helps to provide the out of season feed they were after and stabilises the paddock. It also plays a critical role in reducing the impact of adverse seasons on the soil by allowing them to use the paddock as a feedlot without the risk of it blowing therefore reducing pressure on surrounding paddocks.

The paddock was divided into three sub paddocks in 2009 using 3 electric hot wires which have allowed them to better utilise the feed. They have established another paddock of kikuyu and intend to establish more in the coming years. Additionally they are aiming to start fertiliser trials with the aim of better tailoring fertilisers to the kikuyu.

Table 1. Average DSE and grazing days

	Grazing 2008				Grazing 2009			
	Summer / Autumn		Winter / Spring		Summer / Autumn		Winter / Spring	
	DSE	Grazing Days	DSE	Grazing Days	DSE	Grazing Days	DSE	Grazing Days
Kikuyu	17	3113	9	1630	9.5	1732	10	1775
Annuals	4	678	16	2991	7	1333	7	1339

Companion annual legumes for perennial grasses

Brad Nutt & Geoff Moore, DAFWA Pasture Science, FFI CRC, South Perth, Ph: (08) 9368 3870.

The use of sub-tropical perennial grasses in the NAR continues to increase on sandy soils which are marginal or unsuitable for cropping. However, many of these perennial grass paddocks have low or no annual legume content which limits productivity.

The exception is blue lupins which are well adapted to pale deep sands in coastal areas, have large seedlings with a strong taproot which can survive false breaks and provide nitrogen for the grasses. However there are issues with blue lupins in terms of seed availability (pods shatter when mature), lupinosis, alkaloid poisoning and they are susceptible to lupin anthracnose disease.

A producer summed up the strong interest in alternatives; "It would be good to have a legume the stock can eat!"

The addition of a high quality annual legume component would increase feed quality during the growing season and provide the nitrogen input to drive the productivity of the grasses.

There are a number of potential ways of introducing annual legumes into established perennial grasses, while maintaining these legumes in the system is not necessarily straightforward. To look into these issues and have input into the research and development undertaken by DAFWA and the Future Farm Industries CRC, a Producer Focus group was recently formed in the West Midlands.

(a) Understanding serradella

On the well drained, sandy soils where the perennial grasses are mainly grown serradella is the best annual legume alternative to blue lupins. Dr Brad Nutt who developed many of the serradella varieties made some salient observations at the recent Focus group meeting.

A key to successfully growing serradella is to understand the strengths and weaknesses of the plants and the seed bank dynamics.

The strengths of serradella include: adaptation to deep, infertile sandy soils; acid soils tolerance (pH_{Ca} >4.0); deep root system; palatable to stock with high nutritive value and the ability to harvest seed on-farm; while a weakness is the susceptibility to native budworm during seed production.

In relation to seed bank dynamics it is useful to understand hard-seed breakdown and the subsequent germination patterns. Yellow serradella and hard-seeded French serradella behave quite differently, while 'Cadiz' French serradella is 100% soft-seeded.

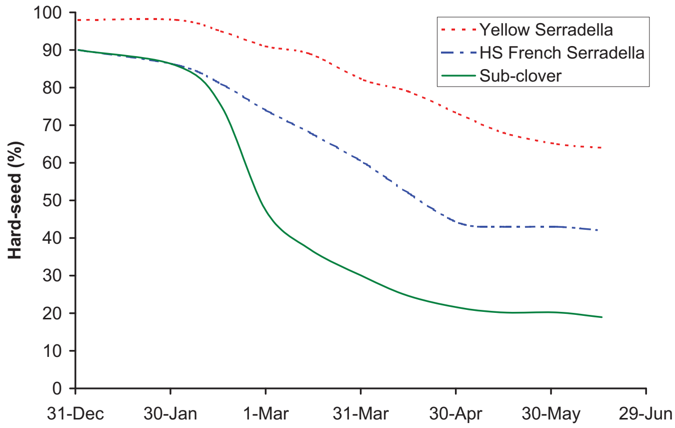


Figure 1. Typical hard-seed breakdown patterns.

'Margurita' and 'Erica' are hard-seeded French serradella varieties, however they have a different proportion of hard-seed and a different seed softening pattern to the commercial yellow serradella varieties. Commercial varieties of yellow serradella have a high proportion of hard seed which will persist for many years in the soil (~70%), with only about 30% of the seed softening in any one year, while with hard-seeded French serradella about 50-60% of the seed softens each year.

Hard-seed breakdown occurs in response to large diurnal changes in soil temperature over the summer – early autumn period. However, there are not only differences in the proportion of seed softening between species but also in the hard-seed breakdown pattern (Figure 1). For example, in subterranean clover almost all the hard-seed breakdown for that year has occurred by mid-March and the seed is then ready to germinate.

There are also differences between varieties as to when the 'softened' seed will germinate (Figure 2). The commercial varieties of yellow serradella have a delayed germination after the onset of moist soil conditions, while the hard-seeded French serradella germinates within the first 10 days providing the soil moisture is adequate (e.g. seed not sitting in a pocket of non-wetting sand).

For example, last year at Badgingarra when there was a clear break to the growing season on May 21-22 with good soil moisture the French serradella germinated within a week, while in comparison the Santorini yellow serradella seedlings continued to germinate until early July.

As mentioned, budworm is an issue for seed production in serradella and it is essential that they are controlled in a 'seed

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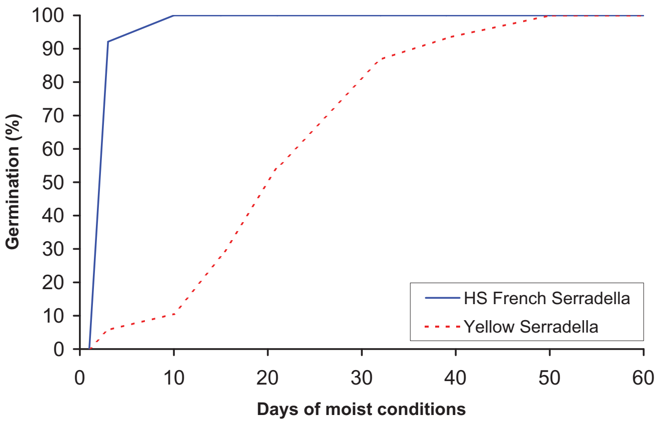

Figure 2. Germination patterns for 'softened' seed of yellow serradella and hard-seeded French serradella.

crop'. The damage from budworm appears as holes eaten through the sides of the pod. Budworm attack green pods, however they will not eat pods once they begin to harden up.

The main period for budworm attack is from mid September to late October and their effect can be avoided by growing early flowering serradella varieties that develop ripe pods before the budworm numbers build-up.

(b) Preliminary results – Companion annual legumes

In 2009 we undertook some preliminary trials to investigate the following questions in relation to companion annual legumes:

- Which species/varieties will reliably self-regenerate in competition with the perennial grasses after a once only introduction?
- Can soft-seed annual legumes be broadcast before the break of the season with frequent re-introduction?
- What is the most appropriate low cost, reliable method(s) of introducing annual legumes into an established perennial grass-based pasture?

(i) Simulated annual legume seed bank

The aim was to evaluate how annual legumes with different hard-seed breakdown patterns regenerate under an established perennial pasture (panic grass, Rhodes grass).

A replicated small plot (10 m x 10 m) trial was set up at Badgingarra Research Station with 4 replicates and 6 annual legume treatments (i.e. Margurita French serradella, Cadiz French serradella, Santorini yellow serradella, Hard-seeded French serradella 3.1, Yellow serradella 72.1A, Blue lupins -naturalised). Pod was broadcast in March 2009 @ 100 kg/ha of pod except for blue lupins (25 kg/ha seed) to simulate a seed bank and then lightly covered with soil.

RESULTS: There was excellent regeneration of all serradella treatments with seedling densities >200 plants/m^2, except for Santorini yellow serradella. The blue lupins had an average of 7 plants/m^2, which is an adequate density (Table 1).

The biomass and composition was measured prior to the first grazing in early September and all treatments had produced between 4.0 to 4.8 t DM/ha with a high annual legume content, except for Santorini yellow serradella (total biomass 3.75 t DM/ha), but only 730 kg/ha of 'sown' annual legume (Table 1).

The legumes plots were all well grazed by the sheep, but the blue lupins were preferentially grazed down to the main stems and there was subsequently poor recovery post-grazing.

OBSERVATIONS: With a hot, dry summer followed by a well defined break to the annual growing season in late May the conditions were favourable for hard-seeded annual legumes and this was reflected in the trial results for 2009, except for the poor regeneration of Santorini yellow serradella. This highlights, that in the case of the very hard seeded Santorini Yellow serradella, a large seed bank is required to achieve a high plant density and subsequently high biomass production.

Table 1. Seedling counts and biomass (8 Sept 09) in the simulated seed bank trial at Badgingarra Research Station.

Annual legume (cultivar/accession)	**Average seedling counts (plants/m2) - 23 Jun 09**		**Average biomass (kg DM/ha) - 8 Sept 09**		
	'Sown' annual legume	'Other' annual legume	Total	'Sown' annual legume	'Other' annual legume
Marguita French serradella	299	11	4616	2509	478
Cadiz French serradella	266	10	4803	2651	373
Santorini yellow serradella	38	9	3754	735	486
Hard-seeded French serradella 3.1	229	11	4709	2841	330
Yellow serradella 72.1A	206	13	4054	1947	598
Blue lupins (naturalised)	7	49	4691	1522	544

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(ii) Proof-of-concept - broadcasting soft-seeded annual legumes

The aim was to evaluate whether the broadcasting of soft-seeded annual legumes either each year or every couple of years is a viable alternative to relying on the regeneration of hard-seeded annual legumes.

A replicated small plot (10 m x 10 m) trial was set up at Badgingarra Research Station with 4 replicates and 8 treatments: i.e. Mandolup narrow-leaf lupins (@ 20, 30 kg/ha), Teo yellow lupins (@ 20, 30 kg/ha), Cadiz soft-seeded French serradella (@ 10, 20 kg/ha), early French serradella (experimental line @ 10 kg/ha). The 'Teo' yellow lupins have moderate alkaloid content (0.1%) which may reduce grazing during the growing season.

The seed was broadcast on May 18 2009 prior to the break of the growing season (May 21-22).

RESULTS: All of the annual legume treatments established well, with average seedling densities of 15-30 and 83 to 135 plants/m^2 for lupins and the French serradella respectively (Table 2). By early spring there was good to excellent biomass in all the treatments with the serradella having an average total biomass of 3.8 to 4.4 t DM/ha, while the lupins had an average total biomass of 5.8 to 7.3 t DM/ha (Table 2).

During the first grazing in early September both the narrow-leaf lupins and yellow lupins were preferentially grazed and within ~4 days had been grazed down to the main stems. Many plants did not recover and died, while the remainder had a weak recovery after grazing with poor growth. As a result there was little or no seed set from the lupin plots.

OBSERVATIONS: Broadcasting soft seed annual legumes was successful, but the trial needs to be repeated over a few years with different rainfall patterns in late autumn-early winter.

Margurita French serradella in a perennial grass-based pasture

There was no affect of the moderate alkaloid levels in Teo yellow lupins in reducing grazing pressure. All of the lupin plots were heavily grazed and their subsequent recovery was poor. It needs to be noted that as the trial only represented a small part of the overall paddock the stock may have preferentially grazed the lupin plots for added variety in their diet.

(iii) Low cost methods of establishing annual legumes

In 2009/10 we are also investigating different methods of introducing annual legumes:

- Twin sowing – which refers to broadcasting pod of hard-seeded serradella when sowing the perennial grasses in spring. Ideally there is minimal germination in spring with the majority of the legume to germinate the following autumn.
- Summer sowing – which refers to broadcasting or drilling of hard-seeded French serradella into established perennial grass pastures in February – March and relying on hard-seed breakdown to soften seed by the start of the annual growing season.

Table 2. Seedling counts and biomass (8 Sept 09) in the soft-seed concept trial at Badgingarra Research Station.

Annual legume/cultivar	Average seedling No. (plants/m2) - 23 Jun 09		Average biomass (kg DM/ha)		
	Sown annual legume	Other annual legume	Total	Sown annual legume	Other annual legume
Cadiz French serradella (@ 10 kg/ha)	106	20.5	4017	1386	1292
Cadiz French serradella (@ 20 kg/ha)	135	30	4380	2071	868
Early French serradella (@ 10 kg/ha)	83	26	3799	1002	1202
Mandolup narrow-leaf lupins (@ 30 kg/ha)	31	78	6885	3481	777
TEO Yellow lupins (@ 30 kg/ha)	23	85	7284	3768	595

Perennials use more soil water than annual pastures

Greg O'Reilly, Department of Water, Manjimup, Ph: (08) 9771 1878.

There is some evidence that perennial pastures can help to reduce the amount of water moving below the root zone and eventually into the ground water table; the primary cause of dryland and river salinity in WA. However there is much more that can be learnt about how this actually works, and new technologies designed for the vineyard are being applied to the paddock to find out more.

Funded by the South West Catchments Council and the Department of Water, an innovative study in the Warren River catchment is using a method called frequency domain reflectometry (FDR) to estimate moisture in soil profiles under various perennial and annual pastures. Sensors installed at 10 cm depth intervals in a sealed PVC tube down to 1.6 m record soil moisture automatically every 15 minutes.

The soil moisture probes have been installed for one full year now and reveal patterns in water use at various depths. Figure 1 shows a kikuyu pasture established in 2007. This site has become significantly drier and more productive under kikuyu and the soil moisture results help to explain why. Water is being used all year round in the perennial-based pasture whereas water use becomes significant in the annual pasture only during the spring growth flush (mid-September to early December in 2009). Just one or two very wet winter days can fully recharge the perennial soil profile just as it does to the soil under annuals, but instead of staying waterlogged, the perennials continue to use water, including from deeper in the profile, creating a dry buffer zone before the next winter rains.

Perennials keep their cool on hot days

The soil moisture probes also record temperature just below the soil surface and this data has revealed some interesting trends also. The hotter the day, the bigger difference there is in temperature. On a day during summer when it reached 40°C in Manjimup, the thick cover of kikuyu at the Dorrell Farms site kept the soil a whopping 6°C cooler than the adjacent annual paddock (Figure 2). While this cooling effect appears consistent for kikuyu and chicory (up to 3°C cooler), it is less pronounced for tall fescue.

The Warren River catchment produces in excess of 250 gigalitres of water per annum, and with an average salinity levelling off at around 700-800 mg/L, there is potential to recover an important water resource in the future. While the large tracts of native and plantation forest play an important role in keeping salinity in check, perennial pastures have significant potential to value-add to other catchment protection works while maintaining sustainable and profitable farming.

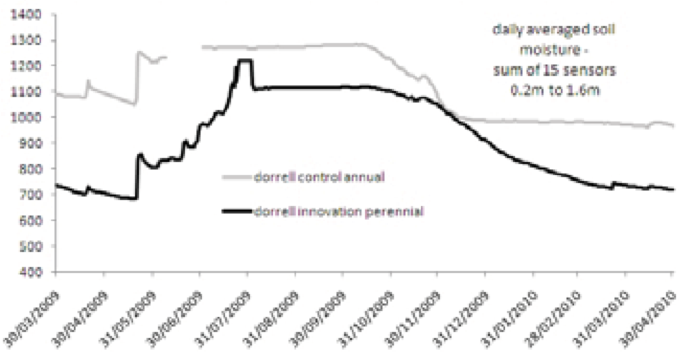

Figure 1. Time-trace of soil moisture over one full year (all sensors combined to 1.6m depth). Dorrell farms kikuyu sown 2007 versus adjacent annual pasture paddock

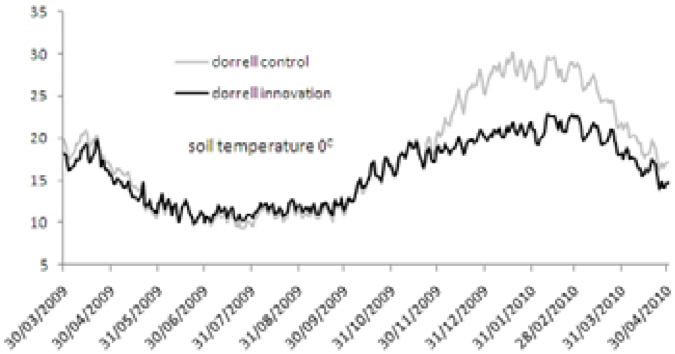

Figure 2. Soil temperature (°C) under kikuyu (innovation) and adjacent annual (control) pastures over one full year. Dorrell Farms, Manjimup.

Installing a soil moisture probe using a slurry mix to ensure good soil contact. Summer-active tall fescue on loamy soil near Manjimup April 2009

Downloading data from logger adjacent to summer-active tall fescue. November 2009. CD Mottram and Son.

Soil carbon build-up under kikuyu pastures

Dr. Jonathan Sanderman, CSIRO Land and Water, South Australia, Ph: (08) 8273 8135.

Over the past year, it has been hard to pick up a newspaper without a headline referring to soil carbon as our climate saviour - the proverbial win-win situation. Within the agricultural community, the potential to get paid for doing something that can also help increase productivity, profitability and sustainability has obviously stirred a lot of interest. Despite all the headlines, hype and anecdotal accounts, there is a surprising lack of scientific research into soil carbon sequestration particularly in pastoral systems. Recently CSIRO, with funding from the Department of Agriculture, Fisheries and Forestry (DAFF), and the Grains Research and Development Corporation (GRDC) has begun a systematic study of soil organic carbon (SOC) change under perennial pastures (see Evergreen Newsletter June 2009).

Why might we expect carbon levels to increase under perennial pastures?

Perennial grasses, compared to annuals, generally allocate a greater fraction of productivity to the maintenance of a deeper and more extensive root system and associated mycorrhizal fungi. Increasing belowground carbon allocation coupled with an increase in duration of carbon inputs and decreased surface erosion should lead to an increase in the amount of carbon present in soil when compared to annual pastures. Additionally, decomposition of SOC may be reduced under perennial grasses because summer rains are effectively and rapidly utilized by perennial grasses thereby reducing the water available to microorganisms that decompose SOC.

Measuring and tracking changes in the amount of organic carbon stored in soils is difficult due to both large variations across even small distances and slow changes through time. Fence-line comparisons are particularly troublesome because there is no way of knowing if soil carbon levels were exactly the same back in the year that the perennial grasses were sown. Fortunately, subtropical perennial grasses produce organic carbon with an isotopic composition that is distinct from most temperate grasses. This difference allows us to track the amount of carbon entering the soil from these perennial grasses and measure the proportion of SOC that originated from the perennial grasses.

Initial findings.

In July 2009, we collected soil samples to a depth of 30 cm from a pasture dominated by Kikuyu (initially sown with a mixture of Kikuyu and Rhodes grass in 1999) and a neighbouring paddock composed of a typical mixture of winter-active annual grasses in Wellstead, WA. Soils in these pastures are typical of this region with a sandy surface horizon over laterite with variable gravel content below 20 cm. Nearly 240 soil samples were collected, and then processed for organic carbon, nitrogen and isotope analyses at CSIRO's laboratory in Adelaide.

Soil organic carbon content was found to be 22% higher in the perennial pasture than in the annual pasture with the majority of the difference occurring in the upper 10 cm (Table

Table 1. Soil organic matter[a] (mean ± standard deviation) change after 10 years of kikuyu.

Depth (cm)	Carbon (t C ha^{-1})		Nitrogen (t N ha^{-1})		Perennial C (% of total)[b]
	Annual	Perennial	Annual	Perennial	
0 - 10	24.5 ± 5.3	32.1 ± 7.8	1.82 ± 0.42	2.43 ± 0.75	21.2 ± 2.0
10 - 20	7.1 ± 2.1	8.4 ± 4.9	0.43 ± 0.14	0.42 ± 0.24	7.3 ± 2.3
20 - 30	4.5 ± 1.9	3.5 ± 2.9	0.27 ± 0.12	0.20 ± 0.16	0.9 ± 2.3
Total (0 - 30)	36.1 ± 6.0	44.0 ± 9.7	2.52 ± 0.45	3.05 ± 0.80	16.8 ± 3.3
Rate of change	**0.8 ± 0.2 t C ha^{-1} yr^{-1}**		**52 ± 16 kg N ha^{-1} yr^{-1}**		**0.7 ± 0.2 t C ha^{-1} yr^{-1}**

[a] Measured on the < 2 mm soil fraction

[b] Percent of carbon in the perennial pasture that can be attributed to the new perennial grasses based on the carbon isotope results

Continued

1). Differences in SOC content across the two management systems were not significant for the 10-20 and 20-30 cm depths. Trends in total soil nitrogen, which is dominated by organic N, were very similar to the trends in SOC. With the perennial grasses being sown 10 years ago, these differences translate to an average SOC sequestration rate of 0.8 tonnes of C per hectare per year. At the same time, soil N has been accumulating at a rate of 52 kg N ha^{-1} yr^{-1}.

The carbon isotope results corroborate the bulk SOC results. For the total 30 cm depth, about 17% of the SOC present in the perennial pasture is now attributable to the perennial grasses in only 10 years. This value translates to a sequestration rate of 0.7 t C ha^{-1} yr^{-1}. Not only do the isotope results agree with the bulk measurements, but the differences are much clearer due to lower variability between samples.

Discussion.

From a carbon trading standpoint, these initial findings are very encouraging with sequestration rates of 2.9 ± 0.7 tonnes CO_{2-e} ha^{-1} yr^{-1}. However, we must caution that these results are only from a single 33 ha paddock, and it is unlikely that this rate of increase in SOC would continue indefinitely. SOC stocks typically reach a new equilibrium in response to management changes within 10-30 years. As this project moves forward in 2010, we will be sampling several dozen perennial pastures of varying ages across multiple regions of WA, thereby enabling a much more robust estimate of carbon sequestration rates associated with a shift from annual to perennial grasses.

From a pasture productivity standpoint, these large carbon gains appear to be a mixed blessing. For the first 5 years after conversion, productivity gains translated to increases in stocking rate from 7.5 DSE to 10-12 DSE. After 5 years of high productivity and likely much of the soil carbon gain, grass production began to decrease along with soil moisture and available soil nitrogen. Without external N inputs, it appears that much of the formerly available nitrogen has been incorporated into soil organic matter.

We are looking forward to sampling many of your pastures over the next several months. By this time next year, we will have a clearer picture of soil carbon change under perennial pastures.

Gibberillic Acid for Pastures

Sam Taylor, agVivo, Dardanup, Ph: 0429 332 593.

The late break for many producers this year will see stored fodder reserves near exhaustion in coming weeks. Colder weather conditions associated with a late break will also lead to slow pasture growth rates, meaning an extended period of supplementary feeding will be required before pastures kick in. An application of Gibberillic Acid to pastures with a high grass content will increase the amount of Dry Matter on offer, reducing the requirement for supplementary feeding.

What is Gibberillic Acid?

Gibberillic Acid is a plant growth regulator that is used to increase the availability of pasture feed in colder growing conditions. Gibberillic Acid, a naturally occurring plant hormone, that stimulates the plant through cell expansion. This results in elongation of the stem and leaf material and therefore an increase in plant biomass. Gibberillic Acid has been used in horticulture for many years and is registered for use in organic and biological farming systems, indicating its safety on plant and animals.

Where to use it?

The best results from using Gibberillic Acid will be obtained where the pasture consists of a high density of desirable pasture species such as ryegrass. In general, paddocks that are self regenerating will have a higher density than those sown in the current season. Apply only to paddocks that have good nutrient and moisture availability.

How to apply it?

Gibberillic Acid is applied via boomspray. Perennial pasture species such as Phalaris and Kikuyu are more responsive to Gibberillic Acid and lower rates can be used. Application rates vary depending on the formulation, however 20 gm/ha of ProGibb or 80 mL/ha of Gala is recommended. Once applied, pastures may appear lighter in colour as the accelerated growth dilutes nutrient concentration in the plant momentarily. Gibberillic Acid is compatible with common insecticides for Red Legged Earthmite and Lucerne Flea control and liquid fertilisers such as Spurt N or Flexi N.

Untreated (left) vs treated with ProGibb + 25N (right)

Grazing Management

Responses from applications of Gibberillic Acid are often seen within 7 days of application, and last for up to 4 weeks. Multiple applications of Gibberillic Acid can be used in conjunction with a rotational grazing program, although applications later in the season when average temperature increases will result in lower responses.

Local Trials

Trials of Gibberillic Acid in 2007 resulted in some significant dry matter yield responses. In one paddock at Dardanup, a stand alone application of 20 gm/ha of ProGibb produced an extra 200 kg/ha of Dry Matter in 20 days. When combined with Nitrogen fertiliser (55 kg/ha Urea), an extra 500 kg/ha of DM was produced. Similar results were achieved at Capel in 2006. Grower experience in recent seasons has seen similar results and the use of Gibberillic Acid has resulted in growers managing their winter feed supply with increased confidence and less reliance on supplementary feeding.

Cost of Dry Matter

The extra growth from Gibberillic Acid is a cheap source of supplementary feed, without having to feed out hay or grain. Responses of 200 kg/ha (the low end of the expected response range) result in dry matter costing approx 10c/kg, while the higher responses achieved with Nitrogen applications see this dry matter costing approx 12c/kg. Where hay costs are approaching $150/T as fed dry matter costs ~16c/kg. The DM produced using Gibberillic Acid is higher in energy making it a much more suitable feed source for young growing stock, ewes approaching lambing or cows in peak lactation where high quality feed is required.

Should we be sowing digit grass?

Geoff Moore, DAFWA Pasture Science, FFI CRC, South Perth, Ph: (08) 9368 3293.

The current commercial mixes for the Northern Agricultural Region (NAR) consist of Gatton panic, Rhodes grass and signal grass. In paddocks with a mix of perennial grass species, stock will often preferentially graze the panic and signal grass, especially if the Rhodes grass growth is mature.

There have been a small number of cases of secondary photosensitisation in stock grazing perennial-grass based pastures caused by saponins, which can be present in both signal grass and panic grass – refer to *'Saponins in grasses – what is happening?'* (Evergreen Newsletter December 2009).

Rhodes grass does not contain saponins, but it would be useful to have another species in the mix which is highly palatable and does not contain saponins.

The most likely option appears to be **digit grass** (*Digitaria eriantha*) which is a palatable bunch grass with no reported livestock disorders.

Digit grass is:

- persistent and drought-tolerant
- adapted to a wide range of soils
- a palatable grass which tolerates heavy grazing once established
- less productive than panic grass
- not tolerant of waterlogging

Digit grass has had limited commercial testing in WA, although it has been evaluated in replicated plot and row trials since 2005. It has not been as productive as the panic grasses on poor sands in WA, however it does grow strongly in response to summer rainfall.

In northern NSW digit grass has persisted and performed well on a wide range of soils and environments. It has survived severe droughts and persisted in the long-term under commercial grazing and as a result is their most widely sown summer-active perennial grass.

Five year old Premier digit grass at Badgingarra – Photo taken on March 31st 2010 following rain 9 days earlier

Digit grass is a palatable bunch grass which could be a useful addition to the perennial grass mix in the NAR

The only commercial variety is 'Premier' (public variety). Digit grass has a small, slightly hairy seed which will require a carrier to improve flow and ensure even distribution when seeding, if not using coated seed (the suggested sowing rate is 1-2 kg/ha @ 40% germination when sown alone). It does not have post-harvest seed dormancy.

The potential of digit grass would be worth testing (e.g. test strips or include in mix over small area) if establishing perennial grasses on well drained medium-textured soils or sandy soils, apart from deep pale sands.

Should signal grass be retained in the mix?

Signal grass comes from 'tropical' environments and is only marginally adapted to the NAR. It is sensitive to cool conditions and is the first perennial grass to shut down in autumn and the last to re-grow in spring, while both persistence and productivity are lower than Panic and Rhodes. In addition, there are numerous reports in the literature connecting signal grass with saponin-induced photosensitisation. The main reason for including Signal grass in the 'mix' is because it will emerge from depth (e.g. 40-50 mm) if wind erosion following seeding causes sand in-fill to bury the seed at depth.

Pasture Cropping: A Powerful Mix

Sarah Knight, Mingenew-Irwin Group, Mingenew, Ph: (08) 9928 1646.

Pasture cropping is something that is fairly new in the Northern Agricultural Region (NAR) with farmers only in the early stages of trials; however eastern states farmers have been experimenting for quite some time. Pasture cropping is the sowing of crop into an established pasture. In the NAR it is the sowing of an annual crop into a perennial pasture whether that be sub tropical perennial grasses, bluebush or native grass.

Outcomes

Pasture cropping has a number of outcomes including increased fodder over a wider season. Having crop stubble and perennial grasses coexisting in the one paddock allows livestock to feed on a mixed diet. If used as a standing fodder crop it is great for finishing off livestock.

Pasture cropping also generates further income through grain production from previously grazing-only country. For those livestock orientated farmers, this provides an option to diversify business and reduce risk.

Is pasture cropping for me?

Do you live on sand plain and have an interest in sub tropical perennial grasses, or do you live on heavier country and have naturally occurring bluebush paddocks? Are you interested in cropping? Do you have livestock? Does your farm suffer from wind erosion? Are you concerned about sustainability? Would you like to offset your carbon emissions and sequest more than you emit? Would you like to bring paddocks back into productive cropping that have not been cropped for years?

If you answer yes to any of these, then pasture copping is potentially an option for you.

Where to start

If you already have a subtropical perennial grass paddock you can experiment here, using discs or tynes. A disc seeder will cause minimal soil disturbance and possess little risk to established perennial grasses. A typical tyne seeder will rip perennial grasses from the ground. The amount ripped from the ground will depend on the seeding depth, how you initially seeded the perennial pasture or if you are wet or dry sowing. Be aware that there is potential for damage with this seeding technique, however, there is also the potential to freshen up and spread the perennials.

A bluebush paddock can be seeded with either technology. If using knife points, then you may have to detangle the occasional bluebush plant from your points as they can be ripped from the ground.

Wheat being grown over subtropical grasses by Craig Forsyth at Donagara.

If you don't have a perennial pasture then you can start from scratch. If your perennials are planted at row spacings that are the same as your normal seeding machinery then it will make pasture cropping much easier, however this is not a requirement.

Sow your perennial grasses in late August when the soil temperature is rising. Species selection is dependent on what you would like from your perennials plus your aim for pasture cropping.

Once your perennials have established (6-9 months after sowing) you should be ready for pasture cropping. If in doubt about your establishment then wait another year to ensure their roots are well secured.

What species should I use?

There are a number of different options to choose when deciding which sub tropical perennial grass species will best suit your soils and pasture cropping aims.

1) Gatton Panic is a good option as it is a bunch grass and therefore easier to crop through.
2) If predominantly crop orientated, then premier digit grass is useful in the NAR for those seeking a grass with lower biomass and is drought tolerant. This option is better if you do not have many livestock.
3) A mixture of species can give you the most robust system for grazing, providing feed quality, drought tolerance and biomass. The three most common grasses to the NAR are Rhodes grass, Gatton panic and Signal grass and the three provide a good grazing platform.

Continued

Placement of crop

Most people are under the impression that the best place for the annual crop to be seeded is between the perennial rows, however observations tell us that this is not the case. We have seen on a number of occasions that the best place for the annual seed to be sown is 5 to 10cm from the crown of the perennial plant. Crop which is nearer the perennial grass is visually taller and more vibrant then those further away from a plant.

The relationship between a perennial plant and crop is not entirely understood. The theory is that as the perennial grass is deep-rooted, they are able to bring up nutrients that are not accessible by annual crops. As the perennials bring nutrients up the annual crops are then able to make use of them. There is also believed to be a symbiotic microbial relationship as well.

If you have an existing perennial paddock there is less chance you will be able to accurately place the crop. Don't stress, you will still get a crop yield and benefit from both the perennial and annual crop.

Benefits to consider

There are many benefits from pasture cropping. Because of the year round ground cover, there is little risk of wind erosion. This is particularly important with unseasonal weather patterns and in particular, summer storms. By having year round cover, the soil health is also greatly improved. The once exposed soil is not baked over summer, instead the perennials keep the soil temperature down and shaded. This in turn helps the survival of soil microbes and the overall soil ecology.

Pasture cropping means there can be green feed all year round; this can result in a number of things. One, the livestock have a reduced chance of being vitamin E deficient. Two, livestock are able to gain weight over summer, rather than just hold their condition on stubble and dry annuals; and three, a green paddock is a visually stimulating environment and can do wonders for the psyche.

For those farmers who have livestock, the perennial pastures are able to make use of out of season rainfall. While summer rain will generally damage dry annual pastures, it will rejuvenate the perennial pastures.

The potential to sequest more carbon than you emit is another benefit for pasture cropping. Preliminary studies in the NAR have shown that perennial grasses can sequest a significant amount of carbon. If farmers have to be accountable for the carbon they emit, pasture cropping can play a major role in ensuring their carbon balance remains positive.

One of the last benefits which also needs more researching, is some trials have shown crop yields higher in perennial grass paddocks than in their traditional cropping paddocks. The relationship seems to show the perennial grass benefits the crop rather than taking away from the yield.

The flip side

A major disadvantage is the potential for grain contamination. This is particularly evident for bluebush pasture cropping, where twigs can cause many problems with your sample at CBH. Grading the grain will most likely be a necessity.

Another logistics problem can occur when the paddock is taken out of the grazing rotation during the crop growing period. This can be a problem for farmers who are predominantly crop orientated yet still run livestock. Often these paddocks are relied on to host their stock during this time. This can put increased pressure on other pasture paddocks.

For those farmers with a predominant livestock business, the cost of sowing and harvesting crop can be a significant issue, particularly if they don't have available equipment.

Management

Having stock is preferable, though not essential to adequately mange your pasture crop. If you do have livestock then it is best to graze your perennial before sowing the crop. This takes away some of the bulk to make seeding easier. A knockdown is necessary to suppress the perennials prior to sowing but also as weed control.

At present famers have been using either Spray.Seed or Roundup as a knockdown. Rates depend on the season and the condition of your perennial grasses. The aim is only to suppress, not to kill them. Spray.Seed between 500 ml to 1 L/ha seems an effective rate. It suppresses the perennials and gives a reasonable weed kill. Roundup is probably not one of the safest chemicals to use if your perennial stand includes Rhodes grass. When the perennials are growing actively, Roundup will have the greatest impact on the perennials, so be aware of this.

Weed control is essential. It is best to start controlling weeds in the paddock the year prior to seeding. The one essential thing to remember is to treat your paddock as a cropping paddock and treat your crop as a harvestable produce, otherwise this can undo pasture cropping very quickly.

This information has been provided by Mingenew-Irwin Group as part of the "Perennial Pasture Companions" project funded by Caring For Our Country.

Rotational Grazing at Woodanilling

Perry Dolling, DAFWA, Katanning, Ph: (08) 9821 3261.

About 30 people turned out on the 20th April to hear Woodanilling farmers Mike and Sonya Harcourt-Smith discuss planned grazing systems, annual and perennial pastures, grazing with rest periods, economical infrastructure (fencing and water) and animal and soil health with lower input costs. Mike told the audience that they farm over 2000 ha with 300 ha of crop this year and 1200 ha of pasture. The crop area is down from 700 ha and they would like to reduce the area cropped even further as it is of less interest compared to running cattle. The crop area remains in their system to generate cash flow. Their cattle enterprise revolves around trading with cattle bought in January to May around 250 kg live weight and then sold in December to February. The cattle are grazed intensively in small paddocks for a short time and then moved to another small paddock.

The perennial grass paddocks locked up to provide late Autumn grazing.

The seeds of change were sown in 2005 when the Harcourt-Smith's went on a "Grazing for Profit" course run by RCS. Reasons for attending this course was that they were concerned about the increasing quantity and cost of inputs, the detrimental impact of chemicals and fertilisers on soil health, and they wanted a more resilient farming system. Subsequent to this course they attended another RCS course specialising in rotational (planned) grazing near Ballarat in Victoria. Both courses brought about many changes to their farming system including the introduction of rotational grazing of their livestock, a focus on soil health and establishing perennials. Previous to this course they were "rotational set stocking" on annual pastures which involved set stocking for a long period and then moving the livestock to another paddock. The move to a cattle enterprise occurred last year with the selling of the sheep flock. The reasons for this are that the cattle are easier to mange and they have less impact on the pasture especially perennial pastures. The new farming system has increased Mike's passion for farming.

The Harcourt-Smith's strive to obtain 100% ground cover 100% of the time. As they have learnt about their new farming system they have increased the amount of residue left after grazing. They appear to be getting a better response in pasture growth by leaving a thatch of material which creates a layer of mulch. When there are early rains like this year the thatch is important to keep green grass growing withstanding lengthy dry periods. The first site that Mike showed the group was young cattle grazing an annual pasture which had about 5-6 t/ha of dry residue with a small amount of green grass as a consequence of March rains.

They have not applied fertiliser on pasture for three years but they still put fertiliser on their crop. They realise that you can not just take away something without replacing it or it would be detrimental to productivity. Therefore they are using animals grazed intensively to replace nutrients, so rather than nutrients from the pasture going into stock camps they are returned more evenly using rotational grazing. Their main aim is to grow grass and animals are just a tool to grow more grass. By reducing the amount of inputs, the risk associated with farming has also reduced. With the cost of fertiliser Mike thinks that they could decrease the stocking rate by 2-3 DSE/ha to break even but they have not seen any decrease. They have also not had to drench their livestock for six years except the young sheep. Mike believes the long rest period each paddock has helps reduce the worm numbers.

The biggest challenge in changing their farming system was to convert theory into practice. Mike said that it has been very difficult. They are using a planned grazing goal and everything they do is about achieving this goal. They want a healthy system with high rainfall infiltration rates. One of the issues has been water distribution to each of the 4-10 ha paddocks. Water is critical as the cattle can go into a panic mode if the supply is too slow. They pump water from dams to tanks on hills and use gravity to provide water to portable troughs. It takes Mike 40 minutes to move the trough, cattle and electric fence to another paddock. They have been rotationally grazing for 6 years and it is not until recently they have improved their water distribution at a cost of \$60-70/ha. They have established 40 water points using 2 inch pipe with risers at each watering point to which they can attach the portable trough. Another issue has been that if the cattle are left in the paddock too long they can get bored and they can go through the electric fence.

The first lot of fencing to set up the small paddocks consisted

Continued

of permanent electric fence with 3 live wires. It was established in a wagon wheel arrangement with a central permanent watering point. They have since bought a temporary electric fence system with tread posts and two live poly wires. This is set up and removed using a motor bike. For this system to work well it requires a high voltage and this is supplied by a portable solar powered energiser.

At the start of summer (the non-growing season) Mike goes around to each paddock and estimates the number of grazing days available. This allows him to plan his grazing for the next 6 months. Estimating the number of grazing days takes a bit of experience and Mike is still learning with the number of grazing days being underestimated this year. The cattle spend 1-2 days in each paddock before being moved. During the non-growing season each paddock is grazed once and during the growing season twice. The difference compared to conventional grazing is that the stocking rates are extremely high for a short time which is equivalent to a lower stocking rate over the whole year. The time the animals spend in the paddock is dependent on how much rest the pasture requires before grazing again. Mike is aiming for 80-90 days rest during the growing season. The pasture can become very rank. However, this is partly eaten during the summer and some dry residue is carried forward to the following growing season. Winter pastures tend to be high in protein but low in fibre. Therefore the dry residue provides the fibre for a more balanced diet. No supplements are given other than a small amount of minerals. During winter the growth rate of the cattle is 1 kg/day and in summer it is 0.25 kg/day.

With this system of grazing Mike has found that annual ryegrass is increasing and he is encouraged because it is a good source of feed. In comparison the proportion of barley grass and spear grass has decreased over time. Mike finds that the animals graze the plants they want to. These plants that are grazed tiller more and become more robust. The plants they do not graze go into the reproductive stage earlier and they do not produce as much seed as the grazed plants. Over about two years the proportion of more desirable plant species has increased relative to the less desirable species. Mike has found that the diversity of plant species has also increased. Mike has changed his view on what is a good pasture and now anything that is green is valuable. Animals require a variety of species and so does the land.

The second site that Mike showed the group was an area of perennials. A total of 100 ha were sown in 2005. The perennials consisted of Tall Wheat Grass, Phalaris and Tall Fescue. This

Cattle behind one temporary hot wire on tread-in posts.

was their first paddock of perennials and they chose neither their best nor their worst paddock to trial the system. The last grazing the perennials get occurs late in the growing season (October-November) and then saved for the livestock in late autumn, even if they are not green. The grazing days are no greater than the annuals but they provide feed at critical times (eg. late Autumn). Also the perennials recycle nutrients. Mike has found that there is more grass in the perennial pastures compared to annual pastures especially ryegrass and less broad-leaf. Mike explained that when grazing perennials the focus is on what plant species you want to keep. For example, if you want to keep the phalaris then once it is grazed it is time to move the stock on rather than leaving them on at the risk of overgrazing. Since 2006 the Harcourt-Smith's have concentrated on investing extra "water and wire" rather than more perennials as they believe the return on investment is greater. In future years, once the fencing and water infrastructure is in place, investment may swing back to more perennials.

The cattle numbers have been 1200 over the growing season and 300 over summer. However, they are re-thinking this strategy. One idea is to have a lower number (perhaps 900) over the whole year. They would then sell and buy cattle in the same market replacing the cattle they have sold. This reduces the risk of buying stock at one time of the year and selling at another time at a lower price. They are however, not sure what the total number should be. Mike and Sonya are continuing to improve and learn about their new system of farming. Their advice for farmers who want to have a go is to start by boxing up mobs and use your existing paddocks to get the required animal impact (high stocking rates for a short time).

"Show us your grass"

Overgrazed Panic

This shows what can happen when you set stock your perennials. This mature Gatton Panic plant has been grazed so hard for so long that the entire centre of the plant crown has been destroyed, leaving only a few tillers on the edge of the crown alive. Another year of hard grazing and this plant could be dead. This is why rotational grazing with adequate rest is so important. Photo 29 Apr 10 courtesy Sarah Knight.

Novel points

When Nic de Vries of Greenough converted his combine to furrow sow perennial grasses, he created these homemade points out of an old scrap traffic light pole. By cutting a section of the thick walled pipe on the diagonal and then welding two pieces together he created a point that creates an excellent furrow. As the saying goes, one man's trash is another man's treasure...!

Not fancy but effective

Lindsay Williams from Northampton converted this rusty old Inter 511 Culti-trash combine for furrow sowing perennials. The machine is not the prettiest, but the results he achieved last year were outstanding. The key features are the 21" row spacing, the conveyor belting to eliminate soil throw, the seed tubes are pulled back and drop right in to the furrow, and the press wheels. Simple!

Dung beetles

Most farmers are keen to build soil biology, but remember not all the critters are microscopic. Dung beetles are an important part of soil biota and do an amazing job of burying dung, aerating soil, lifting soil fertility, reducing worm burdens, and building soil carbon - just to name a few benefits. This dung pad at Gingin was completely buried by a population of Bronze dung beetles (Onitis alexis). Photo 1 May 10.