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FUTURE FARM INDUSTRIES CRC

Oil mallee harvest set to reap rewards

New harvest technology investment could give the industry the vital boost it needs



Oil mallee industry prepares to reap rewards

By Laureta Wallace
Kondinin Group

ABOVE: Suitable harvesting technology could see the oil mallee industry surge into full-scale production.

The Future Farm Industries Cooperative Research Centre (FFI CRC) is firing up the nation's oil mallee industry – driving the development of the specialised technology needed to harvest the oddly-shaped trees.

Australia oil mallee industry is ready to take off and capitalise on new market opportunities once the necessary technology is engineered.

The FFI CRC has embarked on a project to put together the technology needed to cost-effectively harvest Australia's growing number of oil mallees. The completion of the project will see a new industry open up for Australian farmers, many who are struggling with decreased rainfall and the resulting reduced production in traditional rural commodities such as grain and livestock.

FFI CRC Commercial Director, Mark Stickells, said the ability to economically harvest oil mallees would provide farmers with a new set of options.

key points

- New and developing markets for oil mallee oil and biomass include renewable energy, oil feedstock and fibreboard
- An efficient and economic harvesting system is key to the success of the alternate crop and the FFI CRC is coordinating the engineering of an oil mallee harvester
- The project has recently received a commitment of \$1.5 million of funding from the WA Government dependent on additional public and private sector funding.

"The oil mallee was first planted for environmental purposes – to manage water and combat salinity in the Western Australian wheatbelt," Mark said.

"However, the oil mallee is proving to be a versatile plant with a number of promising market options such as activated carbon, oil feedstock and as a component in Medium Density Fibreboard (MDF).

"There also has been research into using oil mallees as a renewable energy source – many people think of renewable energy as sun, wind and water but oil mallees present a very practical source of energy."

Supporting change

Mark said essentially the FFI CRC is preparing farmers for the uncertainties of climate change and the impact that would have on their businesses.

"Oil mallees are well placed to provide farmers, particularly those in marginal areas, with another weapon in their armoury," Mark said.

"It is not too far-fetched to expect that oil mallees could soon become an important part of farm business in the not too distant future.

"They could also play a role in a carbon trading scheme."

Mark said there also needs to be significantly more oil mallees planted, and on a larger scale, to ensure the viability of an Australian oil mallee industry.

The harvest challenge

There are about 12,000 hectares of oil mallees in WA's wheatbelt. Crops of the native tree are also becoming increasingly popular in central New South Wales, Victoria and South Australia.

The form and size of the oil mallee requires a unique harvester design – one that is more robust than existing forage harvesters, but also lighter and more efficient than conventional forestry equipment when applied to small trees.

During the late 1990s, WA Department of Environment Conservation (DEC) engineers tackled the problem drawing on the sugarcane harvester for inspiration. The sugarcane harvester was modified to travel continually while harvesting and having the ability to convert whole trees directly into bulk whole-tree biomass in a single operation.

Along with DEC, the Oil Mallee Association and WA's Verve Energy invested in the initial engineering process. During 2005 Verve Energy proved that mallee biomass could commercially generate electricity while producing carbon and eucalyptus oil. The company remains committed to investing in a commercial-scale oil mallee processing plant.

The harvesting system was, in theory, correct, but the modified machine needed significant engineering to make the process commercially viable. It was determined that a machine needed to be capable of harvesting at least 20 tonnes of oil mallee biomass per hour to be cost-effective. It was estimated the project would cost about \$5 million.

FFI CRC involvement

As part of its initial project commitments, the FFI CRC had a first-year target to finalise a commercial business plan for the engineering of a viable oil mallee harvester – based on the principles developed using the modified sugar cane machinery.

The CRC realised the potential for oil mallees to provide farmers with another stream of income while delivering land sustainability benefits. The CRC was interested in oil

mallee research from the point of view of genetic development, biomass production and the development of possible end markets. But the State's cultivated mallee population was growing and the FFI CRC realised the urgent need to find a way to economically harvest the native trees.

"In a sense we want to reward the farmers, who have invested in oil mallees for their environmental commitment, with additional options for economic returns," Mark said.

"The benefit of a body like the CRC driving this project is that we can work with the Commonwealth and State Governments, as well as industry partners to solve the oil mallee harvesting challenge.

"It's about industry, government, scientists and engineers working together."

Team effort pays off

As a result of industry and government collaboration the WA State Government recently put \$1.5 million towards the oil mallee harvester project. The funding is through the Government's Low Emission Energy Development (LEED) initiative and is dependent on the CRC attracting private sector funding.

"The money will be used for the design, fabrication, commissioning and field testing of a new prototype harvester," Mark said.

"The necessary private sector funds could come from people looking to invest in an exciting new industry, as well as those with a vested interest such as potential processors, end users and even farmers."

A phase one (P1) prototype of the harvester is planned to be ready for a field trial in Narrogin during December 2009. By December 2010, designs and specifications for the final harvester, P2, are expected to be ready for commercialisation.

"By the end of the project, the FFI CRC aims to have an operational harvester capable of reliably harvesting mallee trees at a high rate," Mark said.

"The most efficient rate of production is anticipated to exceed 50t per hour. However, the rate will be determined after further systems analysis has been carried out including an analysis of the nature of the chipped biomass.

"The final outcome will be a machine that can be commercially viable for a harvest contractor – perhaps an operator already engaged in the harvesting of similar crops." ↴

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ABOVE: A visiting delegation at Verve Energy's Narrogin Integrated Wood Processing Plant during 2005 to see the trial processing of harvested oil mallees.

WA moves forward with industry development plan

Another positive sign the oil mallee industry development is maturing was the announcement by the Western Australian Government of the Oil Mallee Industry Plan in November.

Announced by the new WA Forestry Minister, Terry Redman, the Industry Development Plan (IDP) provides an outline of WA Government's favoured strategy to launch the industry's expansion into the State's emerging carbon and renewable energy markets.

In the plan, FFI CRC is acknowledged as a leading stakeholder and makes specific reference to the CRC's responsibility in overseeing the design and commercialisation of an oil mallee harvester – viewed as a critical milestone.

Central to the IDP is the identification of the roles the WA Forestry Commission, other government agencies, the private sector, research institutions, natural resource management groups, industry bodies, landholders and rural communities will play

in the development of the industry. The importance of the need to develop and locate specific industries best suited to regional biophysical characteristics and available infrastructure is also emphasised.

It is anticipated the WA Oil Mallee Industry will continue to gain momentum through the current interest shown by resource and energy-intensive industries in planting tree crops to offset carbon emissions.

The IDP is a joint project between the WA Forest Commission and the Oil Mallee Industry of WA with funding from the National Action Plan for Salinity and Water Quality. The 106-page strategy can be downloaded from the WA Forestry Products Commission website: www.fpc.wa.gov.au ↴

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Genie provides online salinity solutions



ABOVE: The Saltland Genie website provides farmers with the tools and knowledge needed to turn their salt-affected land into profit.

By Laureta Wallace
Kondinin Group

Finding the right solutions for tackling your salinity problem can now be found on one easy-to-use website – the *Saltland Genie*.

The website is the result of almost seven years of research into sustainable farming on salt-affected land and has been brought to life by the FFI CRC.

The new *Saltland Genie* website, www.saltlandgenie.org.au is the one-stop shop for farmers, agronomists and others tackling salinity.

key points

- The new *Saltland Genie* website will provide farmers, agronomists and other land managers with the information they need to manage salinity
- By answering a few simple questions farmers and extension officers can determine the best management strategy for their salt-affected paddocks
- The website includes research papers, case studies, videos and farmer stories as well as an interactive forum.

The interactive, easy-to-navigate, site provides customised, on-farm recommendations on how to make more money from salt-affected land.

FFI CRC researcher Dr Nick Edwards, South Australian Research and Development Institute (SARDI) says *Saltland Genie* is the first of a new generation of land management websites that allows users to quickly bypass irrelevant information and get the answers and information they want.

"The site has a fresh and modern design, but more importantly it is well laid-out with farmers able to quickly find the information they are looking for," Dr Edwards said.

"Visitors to the website can go straight to the 'Your Saltland: Genie's Advice' section and by answering four simple questions about their property can find out which of a possible 11 solutions is suited to their situation."

The questions relate to region, rainfall, the severity of the salinity and waterlogging, and the motivation for seeking a remedy – productivity and/or profit. The proposed solutions are diverse ranging from excluding grazing through to establishing saltbush, salt-tolerant grasses and legumes.

As well as providing advice on the most suitable pasture options and how to best manage salt-affected land, *Saltland Genie* contains one of the largest information collections about Australian dryland salinity, in the website's 'Genie's Library' section.

Collaboration proves fruitful

Saltland Genie, and the 11 saltland solutions are the result of a huge body of research and development carried out by the successful national *Sustainable Grazing on Saline Lands* (SGSL) initiative between 2001-07.

Dr Edwards currently leads FFI CRC's *Saltland Knowledge Exchange* project and was previously the national coordinator of the SGSL research sites.

"A lot of really useful and practical information on managing saltland came out of the SGSL initiative and we want to make sure people who need this information can get hold of it easily and use it by having a single, credible source of information," Dr Edwards said.

Information at your fingertips

Saltland Genie users can view research papers, case studies, videos and stories from farmers that provide scientific and personal insights into how salinity can be managed to boost productivity and improve the environment.

"The website is even able to provide farmers with knowledge of what work is being done on salinity in their area by accessing the 'What's Happening Where' section," Dr Edwards said.

"You click onto whichever State you are in and a map will come up outlining all the research, farmer trials and case studies



The 'Advice' section guides farmers as to which, out of 11 possible solutions, is the best way to tackle salinity on their property.

relevant to your district – and this will be added to as work continues.”

The resources section of the website includes other information applicable to the whole of Australia along with other material such as an electronic version of the *SALTdeck* plant species identification cards produced by SGSL. The 50 individual cards cover common grasses, legumes, herbs, shrubs, rushes and trees associated with saltland or used in saltland rehabilitation.

Each card has pictures of the plant to help identification, along with a description, information on its value, growing conditions and salt tolerance.

Interact and stay informed

The interactive features of *Saltland Genie* complement the wealth of digital



The 'Explorer' section provides farmers with a range of resources on salinity including research papers, case studies, photographs, videos and farmer stories.

information on the site. For those farmers who have a unique problem or would just rather talk directly to an expert they can. By clicking on the 'Interactive' tab and then 'Forum', farmers can post a question so that one of the *Saltland Genie* team can promptly reply.

The forum also allows farmers to interact with each other – share their stories, experiences and solutions.

Getting back to basics

For those land managers who are new to tackling salinity, the 'Saltland Uni' section covers seven units outlining the basics of salinity, its history in Australia, its effect on livestock and the environment, the economics of rehabilitating saltland and a glossary.

A dynamic resource

The *Saltland Genie* website is regularly updated with the latest results from the ongoing saltland research and development by the FFI CRC and its partners.

Saltland Genie is an initiative of the Land, Water and Wool program and the FFI CRC, both of which receive funding from Australian Wool Innovation (AWI).

For more information visit: www.saltlandgenie.org.au

More information

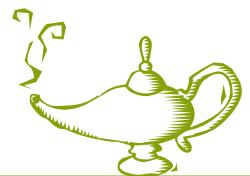
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For those new to salinity problems the 'Saltland Uni' provides a masterclass in the basics of salinity including its history in Australia and the current status of the problem.



Saltland Genie: out of the bottle

User-friendly, thorough and very impressive' were the words Dan Ferguson of the Avon Catchment Council (ACC) used to describe the *Saltland Genie* website.

Employed as the ACC's Sustainable Agriculture Program Manager, Dan recently attended a *Saltland Genie* workshop and was suitably impressed with the innovative resource.

"I think the level of information available was excellent – there really is just about all you need to know about salinity on the site."

"I particularly like the land capabilities assessment, whereby answering a few simple questions, people can find out the best options for dealing with their salt problem.

"I foresee *Saltland Genie* as being a really useful resource for people at the coal face

of salinity – extension officers who are giving information direct to farmers," Dan said.

"Before they go out to the paddock, or after they come back, they can use the website to find the best and necessary management actions for their client."

As a part of the workshop, the group travelled to some salt-affected paddocks south of Doodlakine, to test the website's accuracy. After assessing the paddocks, Dan entered the information into the website.

"It returned the recommendations I thought it would," Dan said.

"Because the website is continually being updated it will be a great site for people like myself, to jump onto and check out the latest developments when it comes to salinity in Australia." ↴



Island safari finds tough perennials with local possibilities

By Laureta Wallace
Kondinin Group

ABOVE: *Tedera's ability to survive the hostile environment of the Canary Islands could see it adapt easily to Western Australia's wheatbelt.*

Department of Agriculture and Food Western Australia's (DAFWA) senior plant breeder Dr Daniel Real is, along with his Spanish collaborators, are developing a perennial plant that has been left alone for thousands of years.

Bituminaria bituminosa var albomarginata, or Tedera, as it is more commonly known by Canary Island farmers, has the potential to offer a solution to lucerne's shortcomings in Australian farming systems. Dr Real is determined to develop the perennial to its full potential even if it means battling the unforgiving land of the Canary Islands.

Most people visit Spain's Canary Islands with a holiday in mind, but not Dr Real. Rest and relaxation were not on the agenda when he set out in search of the rare legume. The trip, which was funded by the Australian Academy of Science, was Dr Real's second Canary Island expedition. This time he combined plant collecting with a chance to

chat with Spanish farmers and spend time studying Spanish breeding plots.

The Canary Islands are the only place in the world where the plant in its many varieties, albeit in small quantities, is found. During his trip, he spoke with Spanish researchers who have been working with the plant for the past 15 years. Daniel was excited to learn that the legume had withstood 2000 years of goat grazing and more than 500 years subject to rabbits, all while battling the arid climate of the Canary Islands.

As a result, a fruitful collaborative project began between Spain's Murcian Institute of Agriculture (IMIDA) and Australia's FFI CRC and DAFWA. The project has seen Dr Real work closely with IMIDA plant breeder Enrique Correál and Pilar Mendez and Arnaldo Santos from Canarian Institute of Agricultural Research (ICIA).

"It has so far been a very successful partnership with Spain providing us with the germplasm and the previous breeding and agronomy experience to develop a joint breeding program," Dr Real said.

Dr Real has had exciting test results in Australia with two Tedera varieties, *albomarginata* and *crassiuscula*. The results have seen Tedera become a star student in the FFI CRC's plant breeding program.

"The thing about these plants is their remarkable ability to maintain green foliage throughout a tough summer and withstand heavy grazing," Dr Real said.

Trial plots in south-west WA have demonstrated Tedera's willingness to survive in areas that had, during the past two seasons, an annual rainfall of 200 mm.

"The plants are both drought tolerant and productive," Dr Real said.

Tough going

It is no surprise Tedera has excelled in WA's wheatbelt – it's homeland is a much more hostile environment.

The Canary Islands cluster is made up of seven islands each with their own distinct climate. The islands are characterised by volcanic activity, rocky, poor-quality soils, low rainfall and extreme temperatures – both hot and cold.

Islands, Lanzarote and Fuerteventura, are the closest to Africa and the warmest of the islands. It is on these islands that *albomarginata* or Albo Tedera is found.

Lanzarote, is of volcanic origin, and is characterised by a surface smothered with volcanic rock. It was on inspection of the island, with his Spanish counterparts, that Dr Real began his hunt for the promising perennial.

"I was joined by the Canary Islands main botanist, Arnaldo Santos, and forage researcher from ICIA, Pilar Mendez," Dr Real said.

"Without these two colleagues I could not have found what I was looking for."

The trio's plant collecting endeavours were carried out at the end of June this year – in the middle of Spain's summer and when the landscape was at its most barren. After some careful searching Albo Tedera was located – looking green and healthy despite the toughest of conditions.

At home in the desert

Next stop was the island of Fuerteventura. The island is relatively flat, by Spanish standards, and the countryside resembles the Sahara desert with an annual rainfall of just 150-200 mm. Goat farming, for cheese production is the main rural industry and



key points

- A collaborative plant breeding project between Australia and Spain saw breeder, Daniel Real travel to the Canary Islands to investigate *Bituminaria bituminosa var. albomarginata*, or Tedera as it is better known
- The plant has impressed with its drought tolerance and hardiness against grazing, particularly when pitted against lucerne
- Farmers in the Canary Islands are endeavouring to graze their goats more heavily on Tedera as they highly rate its nutritional value.

while the goats require supplementary feed they spend much of their day grazing native forage – mainly Tedera.

“We walked four hours over very difficult-to-negotiate rocks into to a group of cacti, where the plant was growing, protected from goats by the cacti,” Dr Real said.

“Every plant outside the cacti had long ago been eaten but the protected ones were thriving, even flowering, during the middle of summer.”

High on the mount

The island of Tenerife is home to Spain’s highest peak, Teide Mountain. The mountain is home to the variety *crassiuscula* or Teide Tedera.

“Here this variety of Tedera spends six months under snow, which demonstrates it is very cold tolerant and would be most suited to our colder climate farming areas,” Dr Real said.

Fact finding from farmers

Canary Island farmers are struggling with input costs, mainly that of corn and grain needed to feed their goats.

On the small island of La Palma, farmers are returning to what they believe is their best source of native forage, Tedera. Dr Real spoke with farmers who reported about the excellent nutritional value of Tedera and

how they believed their goats did better, and were healthier, when grazed on the native forage alone. But with an increasing number of goats, there is not enough Tedera to sustain the whole flock.

“One innovative young farmer has collected seeds and is attempting to replant Tedera in a more coordinated manner to allow him to obtain a sustainable mix of native forage and supplementary feed for his flock,” Dr Real said.

“The farmers were able to afford corn and grain when they became part of European Union, but lately subsidies have been going down and the price of grain, especially, has been going up.”

Trial plot investigation

Returning to Murcia and Alicante in the extremely dry south-east corner of Spain, Daniel caught up with his Spanish research partners to check out their latest Tedera breeding plots. Where Tedera was compared with lucerne, the results were startling. Lucerne, a deep-rooted perennial, had completely dropped its leaves as a survival mechanism while the Tedera was still covered in green foliage. After he had selected the promising Tedera varieties, Dr Real made sure they passed Biosecurity Australia’s vigorous Weed Risk Assessment before bringing them into Australia.

Dr Real says he continues to be impressed by Tedera hardiness, ability to withstand drought and palatability and is excited about the role it could play in Australian farming in the future. 🌱

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BELOW: Tedera has the ability to flourish under conditions that would find lucerne struggling. (Photo: Dr Real)



Turning on to Tedera’s hardiness

The challenge ahead is to find why Tedera, a shallow-rooted, perennial is more drought tolerant than lucerne.

PhD student Kevin Foster (UWA) has made it his mission to get to the bottom of Tedera’s hardiness, determined to leave no stone unturned in his investigations.

“We know how lucerne survives drought and summer, its deep roots simply access another water supply and it decreases evaporation by shedding its leaves,” Kevin said.

“But Tedera is shallow-rooted and it does not drop its leaves.

“I’m taking an extremely lateral approach and not closing my mind to any possibility.”

Kevin is progressing with his three-year study under the supervision of one of Australia’s leading plant biologists, Hans Lambers of the University of Western Australia (UWA). Prof Lambers is accompanied in supervision by plant breeder Dr Megan Ryan, also of UWA, and Dr Real.

“Hans has provided me with some invaluable physiological input on measurement,” Kevin said.

“Other students have also been fantastic in their encouragement and said from their experience they had found unexpected results.”

With two field trials of Tedera in low- and medium-rainfall areas of WA’s wheatbelt, Kevin will spend two years examining the plants across a range of parameters.

“I will be looking at a many different issues including stigmata control, leaf folding, light-avoiding mechanisms, water usage and leaf water content,” Kevin said.

An integral part of the study will involve comparing the Tedera with lucerne in both irrigated and non-irrigated environments.

“Research into understanding how plants use water has become popular recently with the increased focus on climate change,” Kevin said.

“And while it is early days yet, Tedera has performed so well it could just be what Australian farmers are looking for.”

Kevin said Tedera seedlings in a trial plot at Lake Grace, WA had performed better during the past summer than mature lucerne plants in the same trial.



ABOVE: Rain out shelter containing drought-tolerant perennial legumes as part of Kevin Foster’s research. (Photo: D Real)

“The seedlings were amazing, growing even in the hot of summer, while the large lucerne plants with canopies did not perform well,” Kevin said.

“I will be also looking at the plants levels of drought tolerance at varying times during its lifecycle.”

Preliminary results of Kevin’s research are expected to be available during April/May 2009. 🌱

More information

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Did we forget to mention...

During the past 12 months the FFI CRC has achieved some significant outcomes across its program portfolio. Many of these have been featured in the past five editions of *Focus on Perennials* – but by no means have they all received the limelight they deserve.

Following are just a few of the wallflowers from the past year that deserve a special mention as the year draws to a close. Some of the following projects have received coverage in *Focus on Perennials* and *Future Farm*, many have not. It just goes to show how much is going on behind the scenes with FFI CRC researchers and our collaborators across the country.

Even more new *Lotus* varieties hit the hot spot

The development of new perennial pasture varieties is a key focus for many CRC's researchers. Their quest is to breed or find new and better-adapted variety options for southern Australia to improve producers' ability to adapt to a rapidly changing climate in a sustainable way.

While John Ayres' work on the development and commercialisation of two new Birdsfoot trefoil (*Lotus corniculatus*) varieties has featured twice in *Focus on Perennials* recently (see Issue 2 and Issue 5) there have been some other quiet achievers waiting in the wings.

FFI CRC Researcher Dr Graeme Sandral, NSW Department of Primary Industries (NSW DPI) said his work with Dr Daniel Real, Department of Agriculture and Food WA (DAFWA) had led to new Birdsfoot trefoil cultivars, which have extended the species' range well beyond the boundaries set by current varieties.

"These new varieties come with the expectation of being highly productive and hardy when grown in acidic and low-fertility soils in areas receiving an annual average

rainfall of 500-1000 mm, particularly where winter waterlogging is an issue," Dr Sandral said.

"Sale of these cultivars to farmers could transform areas of land previously thought as being too difficult for a productive perennials legume."

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Woody perennials establish their way

The benefits of woody perennials such as saltbush are well known. During the past year researchers in the *Future Livestock Production* Program have made inroads into successful establishment techniques and technology to facilitate their use.

"New technology for the establishment of specific woody perennials has been developed to increase efficiency and lower costs," project leader Dr Phil Nichols said.

"These technical advances make it likely that Oldman saltbush will be reliably established from seed with conventional agricultural equipment using a combination of seed harvest, physical and chemical treatments."

Specific treatments have been identified to enhance establishment of a number of recalcitrant species.

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New species: new opportunities

FFI CRC researchers look not only at adapting existing species, but identifying new and novel species that could prove useful.

An example is the *Understorey* project, a new salt- and waterlogging-tolerant pasture legume (*Melilotus siculus*) has been identified as having substantial stress tolerance advantages over current commercial options.

Understorey is now developing a new salt-tolerant *Melilotus siculus* cultivar as part of the CRC's *PastureSearch* initiative. The challenge is now to find better performing root bacteria suited to saline environments.

Project leader Andrew Craig, South Australia Research and Development Institute (SARDI) said nodulation failure has occurred repeatedly in regenerating plots across

several trial sites and seasons in South Australia and Western Australia.

"Recent measurements have shown about 70 per cent of plants are failing to nodulate in the year after establishment," Andrew said.

Eliminating or significantly reducing nodulation failure is the first research priority for this project.

"Considerable effort is being directed towards identifying a rhizobial inoculant that will persist in highly saline pastures," Andrew said.

In addition, studies of various agronomic practices that may increase rhizobial survival and reduce the impact of salt are being assessed. After these constraints are

overcome, research from this project will result in the release of a new salt-tolerant pasture legume cultivar and an accompanying salt-tolerant rhizobial inoculant. This will represent a significant advancement for Australian agriculture which will allow greater utilisation of this marginal land.

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Research expands pasture species' range

It's not all about new varieties and species though – researchers in the *Future Livestock Production* program have been investigating the options with existing varieties.

"Our team has discovered the unrealised potential of sub-tropical perennial grasses in northern New South Wales. Grasses that can greatly extend the perenniality of pastures in regions receiving a high proportion of summer rain," program leader Dr Joe Jacobs said.

The research optimised the agronomy of pasture establishment in the region and produced benchmark performance standards for production, quality, water use and water-use efficiency. All the information was combined to demonstrate the economic implications of the new techniques.

The potential of chicory as a short-term, high-quality forage break crop in the cereal belt and medium-rainfall permanent pasture zone of southern Australia has been further explored, extending its use well beyond its traditional use in the high-rainfall zone.

"We have investigated the role of winter-active Mediterranean ecotypes of cocksfoots, fescues and phalaris in the medium-rainfall wheatbelt and the need to select for increased levels of summer dormancy," Dr Jacobs said.

Researchers have also been busy identifying the value of *Lotononis bainesii* as the perennial subtropical legume most capable

of persisting in medium- to low-rainfall cool temperate/mediterranean regions that receive some summer rainfall.

Lucerne remains a key focus for researchers in the livestock production team and the hardy perennial continues to prove its superior drought tolerance and persistence across a diversity of sites, justifying further efforts to extend the limits of adaptation of this valuable species with a focus on increasing tolerance to grazing, waterlogging and acid soils.

"We also have recognised the excellent persistence of the Australian native grass *Austrodanthonia caespitosa*, which is enabling the subsequent development and release of the first cultivar of this species," Dr Jacobs said. "*Austrodanthonia caespitosa* also has a low-to-negligible environmental weed risk, compared to cocksfoot and phalaris."

For low-rainfall areas legume germplasm has been consolidated with Lancelot trefoil (*Bituminaria bituminosa* var. *albomarginata*) showing the greatest potential.

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Wireless sensing still on the radar

Developmental research continues to develop wireless sensing technologies for vegetation studies.

This offers benefits of improved experimental design via flexible equipment deployment, improved monitoring access in logistically challenging environments (such as tall tree canopies) and increased density of observations for better validation of models and hypotheses. ↘

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Postgraduate training

FFI CRC has seen the successful recruitment of 18 new postgraduate students for this first year of the CRC.

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Perennials make a bold statement

After more than seven years of research and almost one year in preparation the FFI CRC's *Prospects for profitable perennials in mixed farming systems* publication will soon be distributed to farmers, extension officers and other industry stakeholders.

Put together by UWA researcher Dr Sarita Bennett, the publication comes as changing conditions threaten the sustainability of farming operations across southern Australia.

"An increasingly variable climate and recent drought years have led to the realisation that current farming practices in the low- to medium-rainfall farming areas of Australia need to be altered in order for farmers to remain viable," Dr Bennett said.

"Perennial plants with deep roots can access water in the soil profile, and as a result provide out-of-season feed, are regarded as

one way mixed farmers can maintain their profitability."

The *Prospects for profitable perennials in mixed farming systems* publication is based on six years of research by the former CRC for Plant-based Management of Dryland Salinity and provides perennial plant options for farming regions across southern Australia.

"It takes a region-by-region approach based on temperature, rainfall and soil type," Dr Bennett said.

"During the past lucerne has been the most popular perennial but I have also looked at other perennial legumes, grasses and herbs such as chicory."

Dr Bennett said the publication was a handy reference to perennial plants for both farmers and extension officers.

"They can look at the information that is relevant to their area, decide what perennial

plants are most suitable for their needs and also find out more about different farming systems which include perennial plants."

Farmer case studies support the scientific data and demonstrate, in a practical way, how perennial plants are being successfully and profitably incorporated into Australian mixed farming operations.

The publication also includes a cost-benefit analysis comparing perennial plants with annual forage and out-of-season feed and a weed risk analysis.

The *Prospects for profitable perennials in mixed farming systems* publication is set to be released early during 2009. ↘

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Risk protocol proves its worth with researchers

By Jill Griffiths
Kondinin Group

ABOVE: Researchers have used the protocol to assess the potential weed risk of Enrich species such as *Rhagodia preissii*. (Photo: J Emms)

The Weed Risk Protocol, developed under the FFI CRC Biodiversity Program, has been published on the CRC’s website and in the *Journal of Experimental Agriculture*. But what does it mean for researchers and landholders?

Dr Lynley Stone, Department of Environment and Conservation, WA (DEC) worked with researchers in the FFI CRC and CRC for Australian Weed Management to develop a Weed Risk Assessment Protocol. The Protocol uses a series of questions about a plant’s biology and ecology to assess its potential to become an environmental weed.

The CRC recognises it has a responsibility to minimise the chance of new perennials causing harm and to foster a risk-management culture within the organisation.

Dr Stone said that researchers already had well-developed measures for assessing aspects such as a plant’s toxicity, and meat and wool taint potential, but methods for evaluating environmental weediness are still evolving.

Dr Stone explained that the Protocol was developed for southern Australia and as such was quite general in the level of information it could provide. She sees the Protocol as a dynamic document, which will be refined over time and could be adapted for specific areas.

“Natural Resource Management groups may want to develop specific weed risk protocols for their catchments, using the Protocol as a starting point, with information on local conditions and priorities incorporated,” Dr Stone said.

FFI CRC researchers have been assessed using the Protocol (see Table 2). Each plant was assessed separately for Western Australia, South Australia, Victoria and New South Wales, as a plant’s potential as an environmental weed depends upon where it is grown.

“When species are found to have a low or negligible environmental weed potential, that signals the end of our involvement,” Dr Stone said.

Take these for example

For example, birdsfoot trefoil (*Lotus corniculatus*) (see *Focus on Perennials* Issue 2) has a low environmental risk so researchers can promote it knowing that it is unlikely to cause problems in the environment.

Similarly, *Melilotus siculus* was found to have negligible environmental weed potential. *Melilotus siculus* is an annual legume that is highly tolerant to salinity and waterlogging. Although the plant is naturalised in Australia, it is new to Australian agriculture and not

key points

- The Weed Risk Protocol uses a questionnaire to assess its potential environmental weed risk
- NRM groups can use the Protocol as a starting point for developing their own risk assessment protocol
- Questions are divided into sections relating to invasiveness, impacts and potential distribution
- Researchers are embracing the Protocol in their investigations of potential plant species.

Invasiveness, impacts and distribution

Questions on the Protocol are divided into sections relating to invasiveness, impacts and potential distribution. Plants are scored depending on the answers. Scores for each section are multiplied together to acknowledge the interactions between the criteria and to give a broad spread of scores (i.e. invasiveness x impacts x potential distribution). Plants are then assigned a score and one of five weed risk categories (see Table 1).

Dr Stone said that it is a lengthy process to assess a plant and, to date, 15 plants of interest to

Table 1. Weed Risk Protocol categories

Frequency band	Weed risk score	Weed risk
80 – 100% (top 20% of possible scores)	Greater than or equal to 236	Very high
60 – 80%	<236	High
40 – 60%	<111	Medium
20 – 40%	<49	Low
0 – 20%	<18	Negligible

Table 2. Completed weed risk assessments of species in the FFI CRC

Species	WA	SA	Vic	NSW
Orange wattle (<i>Acacia saligna</i>)	Medium	High	High	High
Old man saltbush (<i>Atriplex nummularia</i>)	Low	Low	Negligible	Low
Wallaby grass (<i>Austrodanthonia caespitosa</i>)	Low	Low	Negligible	Low
Chicory (<i>Cichorium intybus</i>)	Negligible	Negligible	Negligible	Negligible
Cullen (<i>Cullen australasicum</i>)	Low	Low	Negligible	Low
Cocksfoot (<i>Dactylis glomerata</i>)	High	Medium	Medium	Medium
Perennial veldt grass (<i>Ehrharta calycina</i>)	Very high	Very high	Medium	Medium
Flat-topped yate (<i>Eucalyptus occidentalis</i>)	Negligible	Negligible	Negligible	Negligible
Flooded gum (<i>Eucalyptus rudis</i>)	Low	Low	Negligible	Negligible
Birdsfoot trefoil (<i>Lotus corniculatus</i>)	Negligible	Negligible	Low	Low
Panic grass (<i>Megathyrsus maximus</i>)	Medium	Low	Low	Medium
Melilotus (<i>Melilotus siculus</i>)	Negligible	Negligible	Negligible	Negligible
Kikuyu (<i>Pennisetum clandestinum</i>)	High	High	Medium	High
Rhagodia (<i>Rhagodia preissii</i>)	Medium	Low	Low	Low
Mountain rye (<i>Secale strictum</i>)	Negligible	Negligible	Negligible	Negligible

available commercially. SARDI researcher Andrew Craig is assessing its worthiness for commercialisation and its potential value to agriculture.

“We can go through a process to make sure the plant is worthwhile agronomically but we also need to know it has low risk. We have a duty of care to make sure there are no insidious side effects, including its chances of becoming a weed,” Andrew said.

Andrew, who was also involved in the early stages of developing the Protocol, likened it to insurance. He said it draws upon a different skill set to those that plant breeders and agronomists traditionally have.

“Plant breeders and agronomists are not necessarily asking those questions that the Protocol asks. You need to ask the right questions to get the right answers,” he said.

“With *Melilotus*, we don’t really know how it will perform. The weed risk assessment shows its potential as a weed is quite low – it does not appear to pose a significant threat. We have the reassurance that we have a necessary check and balance that we didn’t have before.”

Enriching experience

Dr Jason Emms, a SARDI researcher with the *Enrich* project, said that one of the *Enrich* species, *Rhagodia preissii*, has been thoroughly assessed under the Protocol. It was found to have low weed risk in SA, NSW and Victoria and medium risk in WA.

Dr Emms said that *Rhagodia preissii* was not well researched previously and there were scarce published data. As such, the *Enrich* research was vital to completing the Protocol.

“Data collection has been increased to gather information for the weed Protocol,” Dr Emms said.

Some of the same biological traits important for agricultural potential were also important for weed potential. Others were measured primarily due to their effect on weed potential. For example, seedling recruitment is not generally considered when assessing perennial shrubs’ agricultural potential, as they are planted out at optimal density when a stand is established so recruitment is not a necessary attribute. However, seedling recruitment is a contributing factor to a plant’s weed potential so was measured on species of interest to *Enrich* researchers.

Dr Emms said that the Protocol provided a necessary safe-guard for researchers but it was important not to consider it to be a licence to proceed without caution.

“We don’t really know a lot about *Rhagodia*. As our knowledge grows, our assessment may change. It may be prudent for us to come back to the Protocol and reassess it later,” Dr Emms said.

Management guidelines

When a plant is found to have a medium to high risk, management guidelines are developed to minimise its environmental impact.

“For example kikuyu (*Pennisetum clandestinum*) is widely promoted, but has a high to medium weed risk, especially in riparian environments,” Dr Stone said.

Dr Stone is currently working on guidelines for kikuyu. The kikuyu guidelines will be the first developed under the revised Protocol and will provide the prototype for developing future guidelines. They are expected to be completed by mid-2009.

“The guidelines will be for land managers,” Dr Stone said. “The Protocol is for plant researchers but the management guidelines will give land managers information so they can make informed decisions about how they use a species, or if they use it at all.”

Guidelines may cover management aspects such as preventing seed set or recommending that a plant is not grown in particular areas, such as near watercourses. Such recommendations would depend upon an understanding of the plant’s biology.

Dr Stone said for many plants, management for profitability would also lead to appropriate management for environmental weed risk. For example, the best pasture production of perennial grasses is generally when plants are kept in an active growing phase, rather than a reproductive one. In their reproductive phase, grasses tend to grow rank and unpalatable and are less nutritious. And it is in this phase that they set seed and disperse propagules, which causes them to spread beyond pasture areas.

For species that are found to have a very high risk, the CRC policy is to not recommend their use and to remove them from trial sites. Veldt grass (*Ehrharta calycina*) scores a very high risk for WA and SA so would not be recommended in those states. In Victoria and NSW it scores a medium risk, so would be subject to management guidelines.

The FFI CRC Weed Risk Protocol can be downloaded from: www.futurefarmcrc.com.au/publications.html

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BELOW: Dr Lynley Stone sees the Protocol as a dynamic document that can be adapted for specific areas over time. (Photo: J Emms)





Workshopping the business of farming

Playing farmer for a day can have great benefits for anyone associated with the agricultural industry, according to researcher Dr Amir Abadi.

Dr Abadi, a business analyst with the Department of Environment and Conservation (WA) and the FFI CRC, facilitates workshops where participants experience the sorts of challenges farmers face on a regular basis. Participants use a computer model to make planning, managerial and financial decisions for a hypothetical dryland broadacre farm. They are confronted with opportunities, risks and uncertainties posed by climate,

By Jill Griffiths
Kondinin Group

environment and markets, all of which interplay in a real-world scenario.

Dr Abadi said that a wide range of people have participated in the workshops and all can benefit in doing so. Participants have included scientists, students, researchers, bankers, natural resource management officers and farmers.

Growers who participate benefit from seeing how innovations such as perennial pastures, trees or drains fit into their business from a whole-of-farm perspective. It helps participants see the cash flow, profitability and hydrological consequences of past decisions and their implications for the future. The CRC also benefits because Dr Abadi brings the perspectives of the participants back to the centre to help inform future research directions.

"Farming is complex," Dr Abadi said. "It incorporates many things – biology, hydrology, finance."

Facilitating a greater understanding

Dr Abadi said it is useful for researchers and bankers to see the many different aspects that farmers need to contend with in making their decisions. And for farmers, it is good for them to see how their decisions in managing

ABOVE: Workshop participants work in pairs to experience the vagaries of farming during a one-day workshop featuring a complex computer simulation. (Photo: A Abadi)

one area of the farm can affect other areas of their business.

"It's not a lecture, seminar or symposium," Dr Abadi said. "It is a group of participants working with a facilitator to go through a set of circumstances. The software keeps us on track and ensures that agronomic and financial requirements are met."

The software at the heart of the workshops was developed by Dr Abadi and colleagues at the FFI CRC. It places participants as the managers of a hypothetical broadacre dryland farm.

Credit, topographical and hydrological information is provided for the farm's nine paddocks. Year-to-date and forecast rainfall, market information, and commodity prices are also provided, but in a limited way – participants receive the information as 'news', piece by piece. They must make their decisions on the information available, then wait to see what happens in a way that mimics real-life, where farmers must make decisions on the basis of available information but with much uncertainty.

Group interaction

The workshop is run over one day, during which up to 30 participants work in pairs

i key points

- A computer model has been developed to help simulate a hypothetical dryland broadacre farm
- Workshop participants are confronted with realistic challenges and opportunities which replicate real-life, on-farm experiences
- The workshops simulate up to 25 years of farm management experiences in a single day.

to manage their 'farm' for up to 25 years, dealing with the cumulative impacts of their decisions and seasonal fluctuations. Everything is explained to participants – they are not expected to have expertise or extensive background knowledge on the subjects discussed.

Real-life dynamics

Participants are challenged to make commercially viable choices. For example, the program will not allow participants to revegetate the entire farm at once. The program will not provide 'finance' for such a project; the software tracks the equity of the business from year to year and it will only permit commercially viable options.

Similarly, decisions must be agronomically sound. Participants will see their profits continue to decline, and their need for inputs continue to rise, if they try to crop wheat across the entire farm year after year. However, if they sow lupins for a year or lucerne for a few years, then they will see an increased return on the wheat they sow the following year, reflecting the real-life benefit of crop rotation.

The parameters of the game are set, but the results are contingent on the decisions made by participants. During the course some participants find that their earlier management decisions impede their ability to implement desired farm plans. Depending on how they manage their 'farm', participants may have insufficient funds and equity to cover the costs of their proposed farm plan. Understanding this dynamic aspect of running a business is a real eye opener for many participants.

Capacity building

Dr Abadi considers this workshop to be a training opportunity that is ideal as a capacity-building exercise. It enables mutually beneficial consultation between CRC researchers, growers and agribusiness specialists.

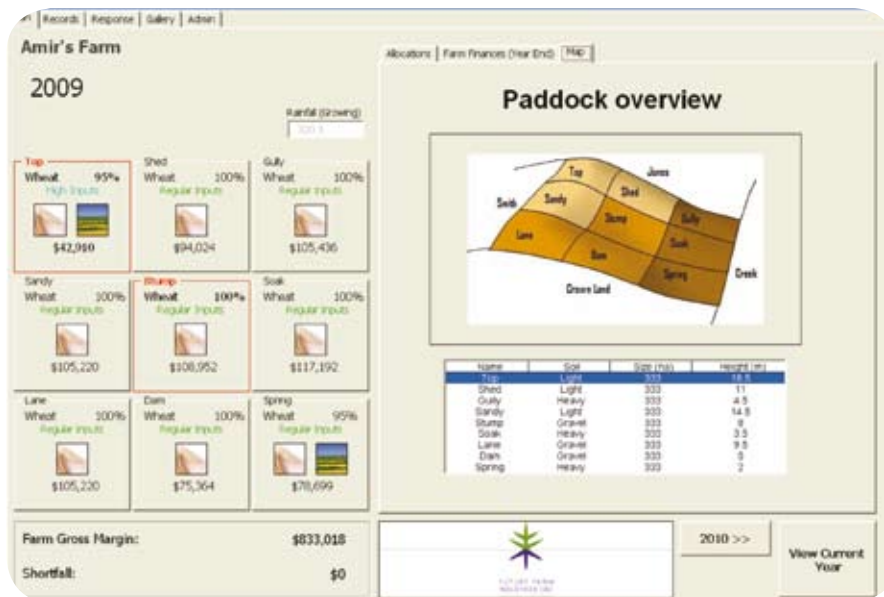
A farmer who attended a precursor to the current workshops said that he enjoyed the workshop and believed it was "a great tool to learn more about risk".

A commodity marketing advisor who attended that same workshop said: "No other workshop so clearly illustrates the real profitability drivers of farm businesses. A good feature is that the program encourages participants to get a feel for risk/reward ratios, or how to handle farm business risk according to their own needs and preferences".

Expert facilitation required

Dr Abadi said that for the workshop to be effective, a skilled facilitator is required.

"It can't go on the internet or be an off-the-shelf product," he said. "Participants benefit from having a facilitator help diagnose the issues, integrate the ideas and question



unrealistic assumptions or perceptions. The facilitator needs to have knowledge of farm management, finance, risk, adult learning, agronomy, livestock and hydrology. This helps the facilitator bring out the teachable moments for the cohort of participants, who come from different walks of life," Dr Abadi said.

Monica Durcan from Avongro and Michael Stace from Rabobank participated in a trial version of the Farm Business Workshop during August this year.

Monica, who is in the business of promoting tree crops on broadacre farmland, said the workshop was a "very good" exercise.

"It's good for people like me who promote tree crops but don't really know about other farm business considerations and it's good for farmers who know all about cropping and planning but don't necessarily know about tree crops," Monica said.

Michael said the workshop was thought provoking and a worthwhile exercise, but felt that it was too biased towards putting trees on farms. He added that he thought the program had been fine-tuned since the workshop he did.

Dr Abadi said the program is updated using information from completed workshops so that errors and biases are removed and the program continually improves.

"The most important thing is that the training workshop has evolved as business, policy and scientific needs have evolved since 1995 (when he first started working on it)," Dr Abadi said. "The workshops are continuing to evolve to address the business and environmental needs of the community."

Dr Abadi said that although the software package was designed to mimic reality, it is not reality; it is a game, and there are no right or wrong answers.

"It's about a narrative that we tell that engenders debate and discussion in the room. It's an awareness-raising exercise," Dr Abadi said.

ABOVE: Each tile (at left of screen) gives a summary of how a paddock is being managed in any given year. It also shows the returns from the field in that year. Participants learn about the farm and its features including the nine paddocks (fields).

"It's real enough to perturb people but it's not so real as to bog people down. It's about having fun and learning something as well.

"The game is a scenario. Where else are you going to be able to see how your decisions will play out 25 years on?"

"You can go to various specialists to find out about different things, but who tells the big picture of how it all fits together? No-one sits down and talks about how all these new things fit together. The game lets people see the 'whole-of-the-farm' concept. It helps people manage risk in the short and long term."

Dr Abadi said that participants work together to bring a new dynamic to the situation. The facilitator's role is to push participants to make new distinctions, to work together to question each others' paradigms and complement each others' work.

The workshops are sponsored by the FFI CRC and attendance is free. 🌱

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Perennial crop systems – future of food

LEFT: The development of perennial crop varieties, such as perennial wheat, could be the solution to the age-old challenge of ecologically-sound food supply. (Photo: C Nicholls)

grain production – the ultimate goal is to grow perennial grains in cropping systems that contain more than one species.

“The simplest system would include a perennial cereal and a legume that grows only vegetatively, for nitrogen fixation,” Dr Cox explained.

“But eventually, two or more species both grown for seed harvests in as-yet undetermined sowing arrangements could provide more resilience, closer to the highly diverse perennial systems that covered what are now agricultural lands.”

In Western Australia, alternating strips of trees and perennial wheat could serve to obtain successful production while preventing the rise in water tables that causes increasing salinity problems.

Local developments

Research into suitable perennial wheat options for Australian conditions continues to progress (see *Focus on Perennials* Issue 3).

CSIRO researcher Dr Phil Larkin is leading the team of Australian researchers investigating the suitability of perennial wheat germplasm imported from the US for Australian conditions.

The perennial wheat team recently met at the New South Wales DPI Cowra research station in to consider how to best manage the trial site to achieve favourable conditions that best express the variety’s capacity for perenniality and summer dormancy. How to maximise seed increase for more extensive assessment of the most promising accessions was also discussed.

The team also made new plans regarding future experimentation to assess extent of the root systems, disease resistance and genomic composition for the different kinds of perennial wheat being trialled.

“The accessions we have growing are diverse and interesting. Some are much like wheat in morphology and seed size, while others more like the *Agropyron* grass parent,” Dr Larkin said.

“As well as the prospects of contributing a perennial habit, we suspected that the *Agropyron* parent would donate new resistances to significant diseases. Preliminary experiments are encouraging of this expectation.” 🌱

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Perennial grains combined with established and novel sustainable-agriculture practices could help end the conflict between food production and ecological health according to Dr Stan Cox, senior scientist at the Land Institute, United States.

Visiting Australia to speak at the recent Australian Society of Agronomy Conference, Dr Cox shared his views on the role researchers and agronomists are playing in broadening future food supplies through the development of perennial crop varieties.

“Agriculture’s impact on the Earth has been amplified by industrial farming, but the fundamental problem has its origins 10,000 years ago, in the domestication of annual crops that are still the staples of the global food supply,” Dr Cox said.

Annual crops with ephemeral, often low-density, root systems have a lower capacity than perennials to foster microbial ecosystems in the soil or micro-manage nutrients and water. And the means modern agriculture currently relies on to overcome weaknesses of annual crops cannot simultaneously resolve the key problems.

For example, no-till methods curtail erosion in the top layer of soil but, done consistently on a large scale, require heavier use of chemical inputs and leave the lower soil profile unimproved. Conversely, organic methods eliminate toxic pesticides but not the soil erosion and water deterioration that occur as consequences of tillage.

“We’re consequently trying to develop perennial grain crops to replace annual crops agronomists work with today,” Dr Cox said.

There are currently no perennial crops in production.

“Unfortunately our ancestors made an honest mistake 5000 to 10,000 years ago,” he said.

“They ended up domesticating exclusively annual crops such as wheat and maize, even though they were gathering seed from perennial plants at the time, they did not domesticate those.

“That led to a host of problems over the centuries. More civilisations have fallen to the plough than to soil erosion.”

Legacy of the annual crop

Dr Cox explains that before the dawn of agriculture more than 95 per cent of the planet’s surface was inhabited by a mixture of perennial crops.

“Agriculture has undone all of that and the lower layers of the soil suffered because of it,” he said.

One of the most striking results of annual cropping has been the emergence of soil salinisation in parts of Australia.

In an effort to resolve a range of modern agricultural dilemmas, such as salinity, plant breeders in the US, Australia and other countries are now breeding perennial counterparts of annual grain and legume crops, including wheat, wheatgrasses, sorghum, sunflower and others. With longer growing seasons and a greater opportunity for carbon fixation, these diverse systems aim for both grazing and grain production.

“The germplasm and strategies are in place to develop perennial cereals, oilseeds, and grain legumes,” Dr Cox said.

“The time scale needed to bring such crops to the farm varies across species.”

Although some perennial grain species could be available many years before others, and some could have dual uses – for grazing and

Bring on the revolution and the tree crops

Agricultural change occurs incrementally, but every so often it takes a leap forward in what we might describe as a revolution.

The benchmark is probably the agrarian revolution of 18th century Europe; most recently we think of the Green Revolution following World War II with agricultural chemicals and improved crops.

In a keynote address to the VegFutures Conference in Toowoomba, WA farmer and board member of the Rural Industries Research and Development Corporation (RIRDC), Alex Campbell, predicted that “the next revolution of the 21st century will be toward ‘tree crops’, or the domestication and commercialisation of a host of perennial woody plants for a multitude of end uses.”

Alex homed in on four simultaneous triggers for this revolution, at least in southern Australia:

- The rapid decline of native forests, or at least access to them
- Rising global population and living standards
- Global warming and the need for carbon sequestration
- Post ‘peak oil’ production and its implication for the price of fuel and oil-based products.

“More than a decade ago the Joint Venture Agroforestry Program (JVAP)¹ reported that market potential for environmental services provided by farm forestry were at best minimal and generally non-existent,” Alex commented.

“That report added that land use policies at the time sanctioned or at least tolerated many land use activities with high negative externalities. There was little policy incentive for activities which generate positive externalities, for example improving catchment health, mitigating salinity, or absorbing CO₂.

“Of course times have changed and markets and government policies now appear to be catching up with environmental realities. We now have a government in Australia that is committed to recognition of climate

By **Bruce Munday**
JVAP

change, emissions trading, alternative energy sources, and a move from drought assistance toward drought preparedness or resilience.

“To my mind this opens the door to a woody revolution based on ‘tree cropping’.

“I use the term ‘tree crops’ rather than agroforestry, for several reasons:

- Scale will only be achieved if the enterprise is profitable to the farmer
- Future woody crops in lower rainfall areas are likely to be short rotation and more closely resemble an annual cropping system than long rotation plantation activity
- Mechanisation of short rotation woody crops could well use, at least in part, existing farm machinery and handling and storage infrastructure
- A ‘crop’ that is resistant to drought, flood, fire and frost and can be harvested throughout the year offers enormous economic diversification, social and environmental benefits.

“Historically the mainstream RDCs have shown little interest in farm forestry, but FFI CRC’s *Enrich* project, evaluating native woody shrub species for use as forage in integrated grazing systems, has attracted

LEFT: Enrich aims to develop profitable and sustainable integrated farming systems. (Photo: D Revell)

great interest and funding support from JVAP along with Meat & Livestock Australia and Australian Wool Innovation.”

For Alex, *Enrich* is the icon of the woody revolution in southern Australia, presenting a broad range of activities aimed at developing profitable and sustainable integrated farming systems in the livestock-cropping zones.

“One of these activities involves modelling new farming systems that incorporate shrubs in different areas of the cropping-livestock zone, exploring scenarios based on biological, economic and environmental issues likely to affect the whole-farm profitability of shrubs.

“The MIDAS model has been used to optimise profitability against familiar factors such as plant density, biomass, nutritive value, establishment cost, and commodity prices. What is quite exciting is the modelling for CO₂ sequestration.

“If agriculture is included in a carbon trading scheme, shrubs could potentially increase farm profit by attracting payments for long-term carbon sequestration,” Alex said. “Preliminary modelling indicates the profit maximising area of shrubs on some farms increases markedly as the price of carbon increases. If it reaches \$50 per tonne of CO₂ equivalent, the optimal shrub area may be four-fold higher than without a carbon price.

“Even without a price on carbon, incorporating perennial shrubs into mixed farming enterprises boosts profit. This means that producers can confidently start plantings now and be ahead, regardless of carbon pricing.

“Given the economic and environmental conditions farmers are operating in, it is no surprise that many are taking a very active interest in the *Enrich* project as the standard bearer of the next agricultural revolution.”

¹JVAP – a partnership of RIRDC, Land & Water Australia, and Forest & Wood Products Australia.

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Enrich update

The latest addition to the *Enrich* stable is a native forage shrub evaluation trial consisting of 50 species and 4700 plants at the Condobolin New South Wales DPI Agricultural Research and Advisory Station.


The trial is exploring the potential use of native Australian shrubs for low rainfall (300-600 mm) farming systems. Condobolin was selected for the focus of the main NSW evaluation as it represents a large area of the NSW low rainfall mixed farming zone.

The trial shrubs have been selected from an intensive screening of more than 60 species for biomass production, nutritive value for livestock, and bioactive effects on rumen micro organisms and gastrointestinal parasites. They were selected from two project planting sites in South Australia and Western Australia during the past three years.

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About Focus on Perennials

 **Focus on Perennials** is a quarterly research-in-progress newsletter published by the Future Farm Industries CRC Ltd (FFI CRC) ACN 125 594 765.

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Focus on Perennials draws on the work of both CRCs, to describe the potential application of Profitable Perennials™ to innovative farming systems and new regional industries better adapted to southern Australian dryland-farming conditions.

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