Salinity — a holistic approach leads to successful solutions

By Laureta Wallace
Kondinin Group

Farmers need to take a holistic approach to managing salinity and use a range of tools to combat the problem and, in some cases, making saline land more productive.

This is the message coming from FFI CRC saltland pastures specialist Dr Ed Barrett-Lennard (DAFWA). Dr Barrett-Lennard has been the talk-of-the-town recently due to the help he has given to the groundbreaking work on the continual development of a salt-tolerant wheat species.

The so-called 'salt-tolerant wheat' is an amphiploid - a new synthetic plant containing all the genes from two plant species — in this case commercial wheat and sea barley grass — a highly salt- and waterlogging-tolerant weed. The pioneering work to produce the first generation amphiploids was carried out by Dr Tim Colmer (UWA) and Dr Rafiq Islam of the University of Adelaide. The FFI CRC now has 20 of these amphiploids available for further testing.

While his excitement about the potential new species can't be dampened, Dr Barrett-Lennard cautions that the availability of these new plants will not be the sole solution for farmer's salinity woes.

"These plants will definitely have a role but let's not over spruik it," Dr Barrett-Lennard said.

"They will be most beneficial where salinity is lowest."

Instead, he urges farmers to first diagnose the severity of their salt problem and honestly assess its productive capacity.

ABOVE: Irnam Malik (former PhD student in the Colmer group), Dr Tim Colmer (project leader), Michael Lloyd (farmer), Dr Ed Barrett-Lennard and a Japanese farmer delegation inspect the salt-tolerant wheat plot in December 2008. The salt-tolerant wheat amphiploids (left) have remained green, while the barley (middle of) and wheat (right) have died. (Photo: DAFWA)

"Farmers, agronomists and extension officers need to be able to read the landscape and think about the range of opportunities this variation presents for agriculture, and then invest in the parts of the saline landscape where the greatest benefits will be gained," Dr Barrett-Lennard cautioned.

"The optimal management of salinity, for some growers, might mean changing the way they feel about the use of particular parcels of land.

"For others, it might mean considering new technologies, plant species and farming practices.

"The management of salinity will always require a combination of elements. Nobody should be going to farmers and saying 'I can fix this' with one idea.

"And in the case of severely-affected land, we still advise to not use that ground for farming purposes."

key points

- Salt-tolerant wheat is set to arm farmers with a new tool to manage salinity
- Growers need to diagnose the production capacity of their saline land before deciding on a suitable management strategy
- The *Saltland Genie* website, www.saltlandlandgenie.com.au, helps farmers determine the severity of their salinity problem and, based on the result, advises of the best management option.

Salt-tolerant wheat

So what is all the fuss about the salt-tolerant amphiploids and when and how can farmers take advantage of them?

After years spent developing these new cereals, the results from the first year's research have partly vindicated the original promise of the material.

"In the field, the amphiploid demonstrated better tolerance for salinity during germination and establishment than traditional wheat, it also performed better at harvest," Dr Barrett-Lennard said.

He notes the amphiploids are so new, the manufactured cereals do not even have a name yet. Previous amphiploids have been named based on the Latin names of the parent plants. For example, the cereal triticale (also an amphiploid) was named using a combination of its parents; wheat *(Triticum)* and rye *(Secale)*.

Challenges faced

The main challenge faced by Dr Colmer and his team in developing the amphiploids, is the problem of head sterility.

"Obviously we can't commercialise a cereal that only forms seeds in about 20 per cent of its head," Dr Barrett-Lennard said.

He says the sterility problem in amphiploids has been caused by the way in which the researchers have moved the chromosomes.

"The current family of amphiploids were all created by moving the chromosomes from wheat into the sea barley grass," Dr Barrett-Lennard said.

"We believe this is the major cause of the sterility problem."

There is now a major effort in the project to move the chromosomes from sea barley grass into wheat.

"This is a far harder task," Dr Barrett-Lennard warned.

"But success in this area would be a true breakthrough. It would solve our sterility problem and enable the eventual commercialisation of material from the current range of crosses."

This year, Dr Barrett-Lennard and other CRC collaborators will be running more trials at a site near Canberra.

Glasshouse trials have showed the amphiploid demonstrated a better tolerance for waterlogging than traditional cereals.

"Because of this we will be looking for a test site in WA with more waterlogging than our previous sites, so we can test the real potential of the amphiploid," Dr Barrett-Lennard said.

The new variety is likely to be most effective and productive on moderately saline land prone to waterlogging. Dr Barrett-Lennard estimates the amphiploid will be commercially available in about five years.

In the short-term he recommends farmers need to turn their attention to the other tools currently available to tackle salinity.

Tackling salinity — here and now

"The FFI CRC is promoting a whole suite of tools to help farmers develop a salinity-fighting strategy," Dr Barrett-Lennard said.

"Research carried out during the past five years has revealed there were 11 different solutions farmers could adopt to make their salt-affected land productive. Some of these options, such as the growth of saltbush, puccinellia, tall wheatgrass and salt-tolerant trees, will be relatively familiar.

"However, other options have not previously been widely promoted."

A new website *Saltland Genie*, www.saltlandgenie.com.au, brings all these tools together, allowing farmers to make better decisions on how to productively manage their saltland pastures (*Focus on Perennials*, Issue # 6).

An initiative of the Land Water and Wool program and the FFI CRC, with funding from Australian Wool Innovation, the website has been dubbed Australia's leading resource on saltland management, and after just months of being online, has attracted more than 100 hits per week.

"*Saltland Genie* has all the information farmers need to grow saltland pastures on their properties," Dr Barrett-Lennard said.

"The website provides two different kinds of information; generic information about the principles of production from saltland and more specific information for 11 different options available for saltland revegetation."

Dr Barrett-Lennard says before deciding upon a way to tackle salinity, it is important to determine the severity of the problem. To help, *Saltland Genie* hosts a decision-support tool that guides farmers and their advisers in diagnosing the capability of saltland sites and recommends the best site solution based on the information provided.

Saltbush signals a solution

Saltbush continues to be a plant of interest in the management of saltland and is increasingly becoming valued as much for its offerings as a livestock fodder, as it is for its ability to lower water tables.

Saltland Genie details information about the various ways saltbush can be used to contain salinity, including planting it alone as well as using it to allow the establishment of an understorey of more productive and nutritious but less salt-tolerant annual species.

FFI CRC researcher, Dr Hayley Norman (CSIRO Livestock Industries), and a team of researchers, including PhD student Chelsea Fancote (UWA) featured on page 9, are probing the grazing qualities of the native shrub and the benefits the plant's compound such as Vitamin E and Betaine could have on animal health (See page 9 for more information).

"Feeding sheep grain results in a vitamin E deficiency and so by grazing stock on saltbush, which has 10 times more vitamin E than grain, producers can not only manage salinity, but improve their health of their animals," Dr Barrett-Lennard said.

"Of course, saltbush is also drought tolerant and useful in the control of water and wind erosion. It can also be grazed heavily as long as there is sufficient recovery time.

"The profitability of saltbush is usually low — about $5-6 per hectare but there are low maintenance costs after establishment and they can persist indefinitely."

New plant species hold promise

As well as investigating the potential of established varieties, researchers are looking at developing new plants to bolster salinity management. One promising species is *Melitotus siculis* (See page 10 for more information).

"The profitablity of saltbush-based pastures can be increased by to 10-fold if they are underplanted with salt- and waterlogging-tolerant legumes," Dr Barrett-Lennard said.

Melilotus siculis is easily the most salt- and waterlogging-tolerant annual legume we have, and our research team is currently investigating more than 80 rhizobial accessions to ensure this plant can persist during the years after initial establishment."

The future

At the end of the day Dr Barrett-Lennard and other researchers are focused on finding ways farmers can manage salinity and still make a profit.

"Farmers will adopt new technologies that will put money in their pockets," Dr Barrett-Lennard said.

"And with the tools available now this is quite possible."

More information

Dr Ed Barrett-Lennard, DAFWA
T: 0418 133 611
E: egbarrettlennard@agric.wa.gov.au