

How green is our valley?

Australia's much maligned native grasses have come in for a make-over in recent years. And as Graeme O'Neill reports, they needn't weep anymore.

Native grass expert Ian Chivers was harvesting kangaroo grass in a droughted paddock in Craigieburn, in Melbourne's semi-rural north in 1988 - the year of Australia's bicentennial - when a patch of verdant green among nearby rocks caught his eye.

It was high summer, and the intense heat had shrivelled the imported annual ryegrass in the paddock to brown tufts, but this patch of native grass - which he subsequently identified as *Microlaena stipoides* - was green and flourishing.

At the Grain Foods Cooperative Research Centre stand at ABIC 2006, Chivers enticed intrigued delegates to sample Lilliputian but delicious plain and fruit muffins baked from the flour of an Australian native cereal he has dubbed 'Kosciuscko Rice'.

M. stipoides, common names 'weeping grass', 'weeping rice grass' or 'meadow rice grass,' is distantly related to the world's number one human food crop, but yields a flour with much higher protein levels than any of the Big Three cereals.

Chivers, founder and CEO of Native Seeds, a member of the CRC, says its protein content is 22 per cent, compared with only nine per cent for rice, 12 to 14 per cent for the best hard wheats, and up to 18 per cent for the improved, high-protein maize varieties.

He has selected a form for grain production based on seed-head architecture, improved seed retention - an essential characteristic for any harvested grain - and robust, upright stems.

While relatively large for an Australian grass, the grain is much smaller than rice or wheat grains. It resembles a miniature long-grain rice.

As a recent selection from the wild, it has not undergone selection or breeding for larger seed size. "It's not a finished product," Chivers says.

"We've still got a long way to go - it's probably about 60 per cent of the way to domestication. We now need a strong, systematic breeding program."

"We've got it growing at eight locations across the NSW and Victorian cereal belt. We're in the early stages of pushing it out into the market - the ultimate destination is the supermarket.

"Some chefs are very keen to try it out. They've made a native rice pudding, and someone else used it as a flan base."

Weeping grass

In the August/September issue of Australian Life Scientist, we reported on Belgium's new TraitMill high-throughput phenotyping facility near Ghent, which evaluates genetically modified rice and other cereals.

The facility transforms rice with single transgenes that, when over-expressed with various DNA promoter elements, lift yield, increase grain size and influence other traits including shoot and root growth, overall biomass, and seed-head architecture.

Some experimental varieties yield more than twice as much as conventional rice. Across the board, yields in selected transgenic varieties are up by an average of 26 per cent, with a 15 per cent increase in seed weight.

These spectacular results suggest transgenes identified by the project could produce similar gains in other cereals, and potentially, creating entirely new cereal crops from wild grasses like *M. stipoides*.

Weeping grass also shows outstanding potential as a pasture grass. Ian Chivers says the deep-rooted perennial is sweet and highly palatable to livestock.

Its green matter is even higher in protein than the grain: commonly around 25 per cent, but as high as 35 per cent, depending on the season.

It grows in a wide variety of soils, including loam and clay soils, and in acid to mildly alkaline soils (pH 3.8 to 8.0).

The tall, more vigorous Ovens cultivar, a selection from the wheat-sheep country on the Victoria-NSW border, resembles rice in its habit, and makes an ideal fodder grass.

To date, six ecotypes have been selected for commercialisation from tall and leafy varieties for fodder, to stouter hardy varieties for re-vegetation to low, spreading selection for lawns.

"Let's say Joe Bloggs has a 1000ha property at Kilmore, in Victoria," Chivers says. "He puts in 200 hectares of our grass, and lets his beef cattle graze it intermittently for eight months of a year.

"Then he closes the paddock, lets it run to seed, harvests the grain and sells it as a boutique cereal with high-protein flour.

"After harvest, he opens the paddock up for grazing again, so he's getting maximum value. The paddock doesn't need liming to reduce acidity, it doesn't need fertiliser, and because it's deep-rooted, it's not going to die if it's droughted in summer."

A low, spreading selection of weeping grass makes an attractive, shade- and drought-tolerant lawn that can be grown as a single-species sward, or blended with even more drought-tolerant native species like redgrass (*Bothriochloa macra*) and Wallaby grass (*Danthonia*). It stays green through summer and winter, on only half a dozen waterings per year.

It's not invasive like buffalo, couch or kikuyu, and less demanding of fertilisers. Different forms grow in the >450mm rainfall zone from Cape York Peninsula to Tasmania and south-west Western Australia.

Weeping grass thrives in subcoastal and montane environments up to the snowline - hence 'Kosiusko Rice' - and on the inland slopes of the Great Divide, down to the edge of the semi-arid zone.

Redgrass lawns are thriving on the heavy red basaltic soils west of Melbourne, and in inland areas such as Wagga Wagga. Chivers says the very drought-tolerant species could be grown as a low-maintenance, water-frugal lawn almost anywhere across southern Australia.

Native grasses

Ian Chivers has been passionate about Australia's neglected and much maligned native grasses for more than two decades, and almost a lone voice of advocacy in times when most experts viewed native grasses as having few virtues or little value.

"At Melbourne University in the 1970s, my lecturers would thump the desk and say the sooner we got rid of our useless native grasses, and replaced them with useful exotic grasses, the better.

"But like most, they only ever saw native pastures that had been overgrazed, taking out the most palatable native species and leaving the dregs.

"Had they seen ungrazed native pastures, they might have thought differently."

Chivers says few critics had stopped to consider the obvious: that after tens of millions of years of evolution in harsh, seasonably variable environments and infertile soils, our native grasses might actually be much better adapted to Australian environments than imported species.

The preference for imported forage grasses has come at a cost: some imported, perennial species like paspalum, prairie grass and Texas needle grass, have become invasive environmental weeds, along with chance invaders like serrated tussock and feathergrass.

Chivers' company now sells seed for more than 20 species of native grass; they are increasingly popular for stabilising land against erosion, re-vegetating mine tailings dumps, and for landscaping parks, gardens, roadside verges and median strips along city freeways, or as a cover crop to suppress weeds in vineyards and orchards.

Under cultivation, some species are highly productive - even more so than wheat. Channel millet, *Echinochloa turneriana*, grows in the wake of cyclone-spawned floods in the Channel Country of south-west Queensland.

"It has evolved to grow and seed very rapidly, before the country dries out," he says. "It's over my height only six weeks after germinating and produces huge seed heads. "Under cultivation, it yields around 5 to 6 tonnes a hectare."

But Chivers points out that, under irrigation in warmer areas of Australia where cotton is currently grown, its rapid growth cycle could allow two or three crops a year, or more than 20 tonnes per hectare - the record yield for an irrigated wheat crop, grown under a high-nitrogen regime, is just over 16 t/ha, for a crop grown in Canterbury, New Zealand, in 2004.

Channel millet makes a useful fodder crop, but has multi-purpose potential. The seed could be harvested to produce biodiesel, and the cellulose from the leaves and stems could be fermented to make ethanol. Over time, it could also be developed as an edible crop for humans, he believes.

Chivers says that the GrainFoods CRC is collecting and researching native grasses as potential alternative grain crops, or as 'boutique' crops for the food market, which

shows an almost insatiable taste for novelty. With his company as the vehicle for commercialising native grass seeds, it's proving a fruitful collaboration.

Publication from Australian Life Scientist magazine

Graeme O'Neill (Australian Life Scientist) on 15 November 2006

<http://www.lifescientist.com.au>