

Unlocking the potential of perennial pastures



By Matt Crosbie

Establishing perennial grasses is one of the key methods of reducing recharge and improving profitability in the low-medium rainfall (400-700 mm) areas – but to do that cultivars need to have some degree of summer activity, be drought tolerant and be able to persist in acid and/or low fertility soils.

And given the recent climatic conditions, that's a big ask.

Across the country in *EverGraze* trials, many cultivars of grasses exhibiting high summer activity have failed to persist during the drought, although summer-active species such as lucerne and chicory have coped relatively well.

But FFI CRC researcher with the NSW Department of Primary Industries at Glen Innes, Carol Harris, believes that tall fescue and cocksfoot may hold the key to developing perennial grass pastures which both provide summer growth and persistence.

"Tall fescue and cocksfoot were identified for improvement as they are both broadly

adapted, have distinctive advantages for particular environments, varying degrees of summer activity and commercial potential," Carol said.

"In fact, studies have suggested the potential area of adaptation in Australia for tall fescue and cocksfoot is 17 and 20 million hectares respectively.

"In Australia, these species have received little attention in recent years from plant breeders concerned with low rainfall environments.

"However, some Mediterranean populations of tall fescue and cocksfoot exhibit incomplete or facultative dormancy. During summer where moisture is limiting these tall fescue and cocksfoot populations display signs of dormancy, but under more favourable moisture conditions these populations remain active. The use of such germplasm could lead to the development of cultivars able to combine summer survival under stress with some ability to respond to summer moisture. This will broaden the area of adaptation of tall fescue and cocksfoot to medium to low rainfall areas."

ABOVE: Tall fescue breeding nursery at Barraba.

ABOVE: Carol Harris inspects promising tall fescue accessions at Barraba North West NSW.

Promising signs

Preliminary results of the grass improvement program supported by Meat & Livestock Australia so far look extremely promising with six tall fescue accessions selected for the development of synthetic varieties.

TABLE 1. Annual average yield, establishment and persistence for tall fescue select accessions at Barraba, NSW.

	Average yield ¹ 2005	Average yield ¹ 2006	Establishment ² 2004	Persistence ³ 2005	Persistence ³ 2006
<i>Demeter</i>	5.0	3.3	91	81	78
<i>Sardinia 1</i>	5.4	5.6	100	100	97
<i>Sardinia 2</i>	4.8	5.1	94	94	91
<i>Sardinia 3</i>	5.4	5.4	100	100	94

¹ Average yield: average of all seasonal yield scores for each year where 1 = poor and 9 = excellent

² Plant establishment: % sown plants alive after eight weeks

³ Persistence: % established plants alive at October 2005 and October 2006

TABLE 2. Mean yield and persistence for cocksfoot select accessions at Bealiba, Victoria

Cultivar/accession	Yield ¹ 2004/05	Yield ¹ 2006	Persistence ² %
<i>Currie</i>	6.8	5.0	94
<i>Mediterranean 1</i>	6.2	7.5	100
<i>Mediterranean 2</i>	5.8	6.9	100
<i>Mediterranean 3</i>	6.4	7.2	100
<i>Mediterranean 4</i>	7.6	6.5	100

¹ Yield score scale: 1 = poor and 9 = excellent

² Persistence: % sown plants surviving at June 2006

key points

- Appropriate varieties of tall fescue and cocksfoot could provide summer pasture options
- Screening of over 200 tall fescue and cocksfoot accessions has identified promising material
- Evaluation of the promising material will start in 2008 at a range of sites.



and some summer activity. The cocksfoot synthetics were based on select plants of accessions from North Africa and included both *D. glomerata* and *D. glomerata* ssp. *glomerata* x spp. *hispanica* hybrids exhibiting persistence, dense tillering and seasonal productivity.

During the trial more than 200 accessions and experimental varieties of tall fescue and cocksfoot sourced from the Mediterranean basin were screened over two years at sites on the north-west slopes of NSW and on the central highlands of Victoria respectively. These were compared with some locally naturalised plants and most of the cultivars available in Australasia as well as cultivars developed for warm temperate and Mediterranean climates in Italy, France, Uruguay and the USA.

Fescue

Approximately 4 Mha with an annual rainfall between 500 and 700 mm and a significant summer component was targeted by the tall fescue part of the program. This includes lower rainfall areas of the tablelands and slopes of NSW (particularly Northern NSW) and lower rainfall areas in Victoria, Tasmania, South Australia and Western Australia that receive some summer rain.

The north-west slopes of NSW are typical of the non-traditional tall fescue locations which fitted the target environments for this project. Sites were selected near Barraba and Inverell, based on soil type and fertility (determined by soil testing), average annual rainfall, altitude and paddock history.

Tall fescue is adapted to a wide range of soil types, including those that are moderately acidic, saline and of medium fertility and is more tolerant of waterlogging than cocksfoot. Traditionally, tall fescue use in Australia was based on spring-summer active cultivars such as Demeter and AU Triumph. The use of winter-active cultivars based on Middle Eastern plants that are associated with low summer activity, such as Melik, Fraydo and Resolute, should extend the range of tall fescue into the summer dry, short growing season areas of Western Australia and Victoria. These cultivars are endophyte free but infection with a select endophyte (AR542 marketed as MaxP) may render them more reliable in lower rainfall areas, by increasing their tolerance of drought and pests such as African Black Beetle (*Heteronychus arator*)

Of the 130 accessions of tall fescue collected from Morocco, Tunisia and Sardinia 36 were evaluated at Hamilton (Victoria) and exhibited broad variation in seasonal growth with some outstanding for summer activity.

Evaluation of 50 well established (viz. >12 years) tall fescue populations from northern NSW (GI accessions) (mainly Demeter; some Kentucky-31) revealed diversity with respect to winter activity, summer activity and persistence at Glen Innes and Armidale (>800 mm) on the northern tablelands of NSW. The persistence and productivity of this material in lower rainfall regions requires evaluation.

Cocksfoot

The target environment for the project's cocksfoot component is approximately 7 Mha within the 400-600 mm rainfall zone including south-west Western Australia, South Australia, northern Victoria and the dry western slopes of the NSW wheatbelt.

The selection of cocksfoot sites was concentrated on the central highlands of Victoria, at Bealiba and Warrak between Ararat and St Arnaud. Sites were selected on the basis of high-exchangeable aluminium, low pH, average annual rainfall and history of poor perennial grass persistence.

Cocksfoot is a productive and versatile grass that has been widely used in southern Australia since the earliest days of pasture improvement. It is hardy, non-toxic, better adapted to low pH and high aluminium soils than most other temperate grasses, and combines well in pasture mixtures with other grasses and legumes. While responsive to added fertiliser, it is considered more able to cope with lower levels of soil fertility than is ryegrass. However, it does not thrive on poorly drained or saline areas where tall fescue or phalaris are preferred and has a slightly lower nutritional value than some other perennial grasses. Present use of cocksfoot in Australia is dominated by two cultivars – Currie and Porto – both of which were derived from Mediterranean accessions.

With the exception of programs in Victoria and Tasmania, only modest work has been undertaken to improve cocksfoot in lower rainfall environments of Australia. Research in central western Victoria has emphasised the value of Mediterranean plants and research in Victoria and Tasmania has characterised and evaluated an extensive collection of approx 150 accessions including 40 from low rainfall locations in the Mediterranean basin. This work has identified some valuable populations and promising genotypes compared to Currie and Porto.

Evaluation of experimental varieties of tall fescue and cocksfoot, resulting from this project, will commence in 2008 at regional sites in the target environments. These varieties will be screened as grazed swards for persistence, nutritive value, seasonal production, drought and disease tolerance. 🌱

More information

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These included three Sardinian accessions that after two years had superior persistence to cv. *Demeter* and recorded the highest yield scores, the mean of which exceeded that of *Demeter* by 64% (see Table 1). A further three selection of North African accessions of tall fescue had similar yield ratings to *Demeter* and that of the best performing winter-active, summer-dormant cultivars.

After two years, four Mediterranean accessions of cocksfoot were selected. These had recorded the highest yield scores, the mean of which was 40% greater than cv. *Currie* (see Table 2), compared to which these accessions were densely tillered and fine-leaved. The four select Mediterranean cocksfoot accessions exhibited 100% persistence, while the persistence of the cultivars ranged from 31-97%.

The best of the best

Select plants of the best performing accessions were subsequently removed from the field sites and transferred to pollen-proof glasshouse chambers for synthesis of experimental varieties. The endophyte-free, tall fescue synthetics were based on Sardinian accessions selected for year round production and persistence or North African accessions that had similar yield to *Demeter* but with improved winter production