



# Native legumes yield wide-range benefits

By Megan Ryan

**N**ative legume species have broad appeal for use in innovative perennial farming systems and for the past five years, CRC Salinity researchers with the *Using native perennial species in agriculture* project have been exploring the possibilities.

Native legumes are well adapted to many of the harsh environmental conditions that currently limit the growth of exotic perennial legumes such as lucerne. In particular they can cope with low and irregular rainfall and as such, are likely to have deep roots and the ability to use water both from deep in

the soil profile all year-round. Depending on their natural environment they also could be adapted to highly acid or saline soils and low soil fertility.

Domesticating native species can provide other benefits such as avoidance of the quarantine restrictions associated with importing exotics while providing biodiversity benefits. Rapid gains may be possible with natives as the broad distributions of many species across several states and large rainfall gradients means a significant amount of genetic variation is likely to be present for exploitation in a breeding program.

## Focus on features

The search was on for native perennial legume species whose natural distribution suggested they would grow well in the low to medium rainfall zones of the Australian wheatbelt. Based on existing information, a number of

TABLE 1. Collections of promising native perennial legume species

Genus	Numer of species	Number of collections (accessions)
<i>Cullen</i>	7	54
<i>Glycine</i>	5	26
<i>Kennedia</i>	3	17
<i>Lotus</i>	2	41
<i>Swainsona</i>	28	89

genera looked promising, including *Lotus*, *Cullen*, *Swainsona*, *Glycine* and *Kennedia*.

Based on herbarium records, collection trips were then made in Western Australia, South Australia, Victoria and New South Wales. Seeds and soil (from which to isolate root nodule bacteria) were collected. Plants were grown out and seed bulked up in the glasshouse or small field plots. Root nodule bacteria were isolated and bulked up at the Department of Primary Industries, Rutherglen, Victoria.

From the 45 species collected (see Table 1) four or five merited further development. A number of key characteristics were examined, including seed production (such as whether seeds were retained or shed), growth form and productivity. In addition, potential challenges such as complicated seed dormancy mechanisms, poor tolerance and response to fertilisers, poor response to grazing and poor feed quality and/or presence of toxic compounds were monitored.



ABOVE: Richard Bennett, Dion Nicol and Lori Kroiss (PhD students) after a hard days sampling in the WA wheatbelt

LEFT: Megan Ryan, Jiayin Pang, Tammy Edmonds-Tibbett and Richard Bennett checking out a glasshouse experiment looking at species of *Kennedia* (Photo: S Bennett)



BELOW: Jiayin Pang – UWA postdoctoral fellow looking at aspects of P nutrition in perennial legumes (Photo: R Bennett)



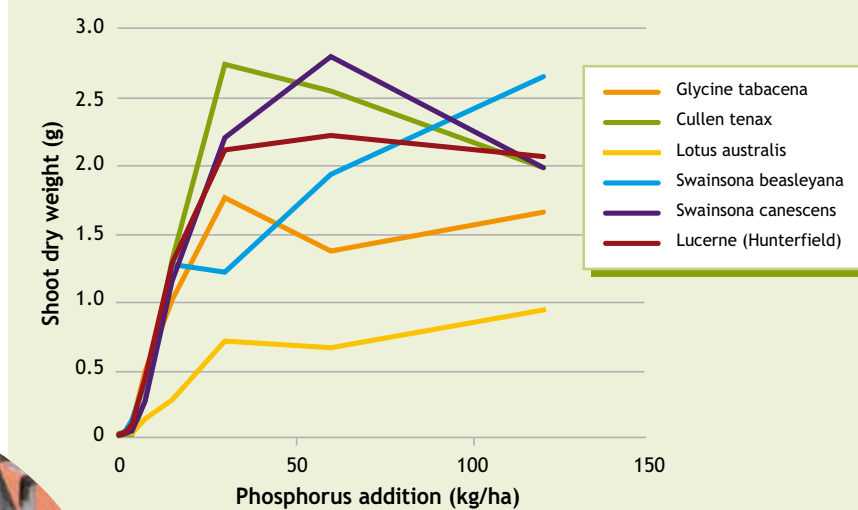
Initial expectations were not particularly high - after all - if these species were so promising why had they been overlooked before? Some surprising results have occurred.

### Fertiliser response

While natives are expected to grow well at low levels of soil fertility – as exist in their native environment – they were not expected to respond well to addition of fertiliser – as has been shown for native plants including some *Banksia* species.

However, while the response of the natives to phosphorus (P) was varied it was not significantly different to that of lucerne (see Figure 1). The natives grew well at all P levels and even out-grew the lucerne in

FIGURE 1. Response to added phosphorus of selected perennial legumes (shoot dry weight) in a glasshouse experiment.



some instances. Postdoctoral fellow at the University of Western Australia (UWA), Jiayin Pang, is examining further the mechanisms that affect responses to P by native legumes.

### Feed and grazing quality

Feed quality and response to cutting (simulated grazing) were examined in a glasshouse experiment for several natives and the two exotics lucerne and *Lotus corniculatus*. Most natives did not survive the frequently cut treatment. However, a few performed well in terms of biomass accumulation when cut every six or 12 weeks; many comparable to *Lotus corniculatus*. In particular, *Cullen tenax* looks promising as it produced well under frequent and infrequent cutting; regrowing from a crown.

Under field conditions at Medina, WA, four-week old regrowth of five native species showed promising feed quality (see Table 2).

### Best bets

Early on in the project species in the genus *Cullen* were identified as showing particular promise. SARDI researchers have undertaken a number of trials with *Cullen*

*australasicum*. In WA, a number of *Cullen* species are being examined in more detail in PhD projects (see page 4). Dion Nicol is examining the potential for *Cullen cinereum* and *Cullen graveolens* on alkaline heavy clays at Muckinbudin. Lori Kroiss is examining the breeding systems of *Cullen* and their potential to become weeds.

### Fitting the systems

It is unlikely a native cultivar will be developed that will compete with lucerne in existing pasture systems. Natives will best fit into pasture systems where lucerne is not suited, but where they can still provide on-farm benefits. Such niches could include acid soils in low (<350 mm) rainfall areas where natives could be used to provide extended green feed into summer and during the summer-autumn feed gap. Natives could prove useful in low-input, low-intensity situations where soil fertility is low.

Salt-tolerant natives have also been identified and natives with feed properties such as beneficial levels of tannins are being examined.

### Future opportunities

Several species of *Cullen* are currently being considered for further development in a GRDC-funded FFI CRC breeding project, subject to final funding approval. It is anticipated that investigations of the physiology, agronomy and ecology of *Cullen* will continue and species from the other genera will be looked at more closely. In particular, we know little about species of *Swainsona*. Whilst there may be problems with toxins in this genus their productivity appears promising. 🌱

### More information

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TABLE 2. *In vitro* Dry Matter Digestibility (DMD) and Crude Protein (CP) concentrations in leaves and stems of native perennial legumes grown in the field, four weeks after cutting

Species	Dry Matter Digestibility (DMD)		Crude Protein (CP)	
	Leaf	Stem	Leaf	Stem
<i>Swainsona colutooides</i>	83	70	29	14
<i>Swainsona swainsonioides</i>	86	78	30	22
<i>Cullen tenax</i>	81	71	28	18
<i>Glycine tabacina</i>	76	52	29	14
<i>Kennedia prorepens</i>	68	57	20	12