DEVELOPMENTS WITH PERENNIAL LEGUMES

Warren McDonald
Department of Agriculture
Tamworth

There are currently 13 species and 35 listed cultivars of perennial pasture legumes recommended by the Department of Agriculture.

The distribution of these legumes in NSW is largely limited by climatic considerations and the systems of agriculture practised. Perennials tend to predominate in the higher rainfall areas whilst annuals predominate in cropping rotations. However both groups overlap, with lucerne in particular being included in crop rotations and subterranean clover being sown in long-term pastures.

Perennial legumes, because of varying degrees of deep rootedness, dormancy and drought resistance, can increase the grazing period, improve botanical stability and respond to out-of-season rainfall more effectively than annuals. On the other side of the ledger, many perennials are slow to establish, are shy to regenerate or spread from seed.

TABLE 1: Perennial pasture legumes in use in NSW

a) Currently in use

i) Major legumes

Common name	Botanical name
White clover	Trifolium repens
Lucerne	Medicago sativa
Red clover	Trifolium pratense

ii) Minor legumes

Lotus	Lotus pedunculatus
Strawberry clover	Trifolium fragiferum
Kenya white clover	Trifolium semipilosum
Siratro	Macroptilium atropurpureum
Joint vetch	Aeschynomene falcata
Silverleaf desmodium	Desmodium uncinatum
Greenleaf desmodium	Desmodium intortum
Glycine	Neonotonia wightii
Lotononis	Lotononis bainesii
Axillaris	Macrotyloma axillare

b) Potentially useful species

Caucasian clover	Trifolium ambiguum
Sainfoin	Onobrychis vicifolia
Birdsfoot trefoil	Lotus corniculatus
Creeping vigna	Vigna parkeri
Round leaf cassia	Cassia rotundifolia
Pintoi peanut	Arachis pintoi
Oxley fine stemmed stylo	Stylosanthes guianensis

The main perennial legumes contributing to animal production in NSW are white clover, lucerne and red clover. Of secondary importance are species such as lotus, strawberry clover, siratro, Kenya white clover and joint vetch. There are in addition a range of species and cultivars of perennial legumes that have potential for use in NSW, some of which are currently under investigation, others may find a role in the longer term (see Table 1).

The more important developments within these species are outlined below:

WHITE CLOVER

Haifa is the most widely grown cultivar with smaller areas of Grasslands Huia, Irrigation, Tamar, Ladino and Naturalised strains. The recently introduced New Zealand cultivars, Grasslands Tahora, Grasslands Kopu and Grasslands Pitau have yet to show that they have a role. Limited evaluation has indicated that they are inferior in winter yield and persistence. Further testing is needed.

Dissatisfaction with white clover has been increasing on two fronts in NSW. In the main dryland area, the Northern Tablelands, white clover is not persisting as it had in years gone by. In southern irrigation areas, sheep production on irrigated stands of Haifa has become a very popular enterprise but the past two seasons have seen Haifa falling out of favour with a renewed interest in lucerne.

The reasons for the lack of performance and persistence is not clear. On the Northern Tablelands, Sale et al. (1987), list a range of possible causal agents - disease, outcrossing with less productive native clovers causing reduced vigour, reduced fertilizer usage or climatic effects. Critical rainfall for white clover persistence has been less frequent in the 1980's than in the previous three decades when early research on white clover and widespread sowings occurred. Perhaps we are expecting too much of white clover!

In southern irrigation areas, the reasons suggested for the decline of white clover pastures range from viral infection through a combination of mismanagement factors to poor adaptation to the environment. The disappointment with white clover pastures in both high use areas indicates how little is known about white clover in our environment.

Current research into white clover includes variety evaluation trials and research into salt tolerance (in Victoria). In the near future a National White Clover Improvement Programme will be established with initial work on white clover ecology and persistence and the screening of a wide range of material for potential use in Australia.

LUCERNE

Resistance to spotted alfalfa aphid (SAA) in lucerne varieties is now taken for granted. Approximately 90% of seed sown in recent years has been of resistant lucerne cultivars (Pratley and Cregan 1987).

The breeding of cultivars resistant to aphids both here and overseas has stimulated interest in other factors that have reduced persistence and production in the past. Now, after 10 years of breeding and selection as well as imortations, we have a wide range of cultivars across the dormancy spectrum with a useful range of resistance to insect pests and diseases.

The advances made in recent years are evident in Table 2 with the greatest improvements occurring in the resistance levels to root and crown rot.

TABLE 2: A comparison over time of the percentage of commercially available lucerne varieties with at least a moderate resistance rating to pests and diseases.

	Number of cultivars	Spotted alfalfa aphid	Blue green aphid	Phytophthora root rot	Colletotrichum crown rot
1981	35	86	3	57	20
1988	31	90	7	83	44

Satisfactory resistance to blue green aphid (BGA) continues to elude researchers. The recent release of Aurora by the NSW Department of Agriculture is a significant step forward, because Aurora is superior to the moderately resistant cultivar Siriver, which until now has been the best cultivar available. The level of BGA resistance in Aurora is still inferior to what we have come to expect in varieties resistant to SAA. There are still further improvements needed.

The advances in breeding in recent years against losses from root and crown rot are impressive. The number of cultivars with worthwhile resistance to these diseases has increased and the increases have been concentrated in the winter active cultivars giving producers wishing to grow lucerne on heavy soils, or under irrigation (or both), access to more reliable cultivars. Of note is the cultivar Baron which has been grown successfully over large areas on heavy soils under irrigation.

A less important disease, stem nematode, has caused rapid stand decline in the Hunter and Belabula Valleys. The recently released cultivar, Aurora, has shown valuable resistance to this disease in trials in the Hunter Valley over the past two seasons. There is little doubt that the standard cultivars used in infected paddocks, Maxidor II and Pioneer 581, will be rapidly replaced by Aurora.

Currently, 92% of lucerne sown in NSW is in dryland pastures. The suitability of new lucerne cultivars for this purpose has been surprisingly good given that the origin of much of the imported material has been from irrigated hay production areas in the USA.

A recent analysis of dryland trials sown in the State between 1983 and 1987 showed the superiority of the semi-dormant cultivars, under non-rotational grazing systems, over the highly winter active cultivars. Under rotational grazing however, highly winter active cultivars have proved to be persistent. These trials also confirm the superior adaptation of cultivar, Hunter River, to our environment, especially on sites where grazing conditions are harsh. Persistence and production of Hunter River however has been inferior where root diseases or aphids have been a problem (D. Waterhouse, pers. comm.).

The flow of new cultivars onto the market has slowed, but there are likely to be further releases in the medium term. The Departments of Agriculture in South Australia and NSW and the CSIRO in Queensland and Canberra have active research programmes. As well, a seed company is now involved in

breeding work in Australia. Features of current work are:

a) Improving resistance to BGA, Phytophthora root rot, Colletotrichum crown rot;

b) Improving resistance to leaf diseases;

c) Developing and understanding varietal resistance to grazing "mismanagement" and development of cultivars that will persist under "mismanagement";

d) Improving yield potential;

e) Improving the content of sulphur-containing amino acids in lucerne foliage;

f) Development of a bloat free cultivar;

g) Development of cultivars tolerant of waterlogging and salinity;

h) Development of cultivars resistant to a range of lesser pests and diseases such as RLEM, lucerne flea and common crown rot.

Of the 31 cultivars available in NSW, only 18 are fully recommended by the Department. All recommended cultivars have performed satisfactorily when grown in situations that match the characteristics of the cultivar and they are managed appropriately.

Selection of the most suitable cultivar should be based on the insect/disease, and growth pattern, characteristics of the cultivar, the required stand life, and finally seed price.

A recent development to assist in selection of the most suitable cultivar for any particular situation has been a computer software package called LUCVAR. LUCVAR is able to account for all cultivar selection factors, thus enabling the agronomist or producer to decide which is the best cultivar to grow to meet given requirements. Decisions are based on the latest information available. This program is currently under trial with agronomists.

LUCVAR is part of a larger `Expert System' called LATIS (Lucerne Agronomy Technology Information System). This program will ultimately cover a wide range of information on lucerne production, from cultivar selection through to answering questions such as: `Which is the most cost effective chemical mix to control wireweed and thistles and check RLEM at the same time?'

RED CLOVER

Red clover has remained popular as a short term pasture or forage crop in higher rainfall areas and under irrigation. Redquin has slowly been adopted because of low oestrogenic level and slightly better winter growth. Seed price has been a factor in holding back more rapid adoption of Redquin and, as a consequence, Grasslands Hamua and to a lesser extent Grasslands Toroa are popular in some areas. Grasslands Pawera has not been adequately evaluated in NSW.

The major problem encountered with red clover in recent years has been unsatisfactory persistence. The root/crown diseases Rhizoctonia rot (Rhizoctonia spp.) and Colletotrichum crown rot (Colletotrichum trifolii) have been associated with the declining density in many of these stands.

The NSW Department of Agriculture is currently engaged in a selection programme to improve the resistance of Redquin to root and crown rots, with some progress evident. Release of a cultivar however is unlikely in the short term.

MINOR LEGUMES

There are no developments of note in the minor legumes listed in Table 1. The potential of both Kenya white clover and Bargoo joint vetch have not been reached because of a lack of commercial quantities of seed.

LOTUS

Sowings of Maku lotus have increased rapidly in the last 2-3 years despite very high seed prices. Lotus has demonstrated its ability to persist and produce in low-lying, poorly drained situations especially on acid, low fertility soils. It is particularly attractive to producers given that it is a bloat free legume.

Maku is however susceptible to "out of season" frost damage limiting its area of potential use in NSW.

Improvement of lotus has some promise in the longer term. Its potential has stimulated interest in improving its adaptability. CSIRO researchers have expressed interest in breeding a cultivar that is more frost tolerant and that will be more productive during the winter months. The NSW Department of Agriculture has selected two early flowering lines of lotus that may have potential in drier environments. Additional, research is underway in New Zealand to improve Maku lotus especially in relation to improved establishment and better regrowth rates after grazing.

POTENTIALLY USEFUL SPECIES

Although the most likely source of improvement in production and persistence is the major species, there exists an extremely large number of potentially useful species for our environment. Some of the more important species are:

Caucasian clover has shown potential as a very persistent winter growing perennial for use on elevated sections of the tablelands especially where the persistence of white clover is poor because of periodic summer droughts. It is however, unlikely to have a place where white clover is a reliable component of pastures.

The most successful cultivar developed, Monaro, is not available commercially. However it is currently being seed increased in New Zealand. This should allow more widespread evaluation in tableland districts in the near future.

Sainfoin has attracted a great deal of attention in recent years because of its non-bloating characteristic, drought resistance and productivity. Early work on the northern slopes has showed that sainfoin had considerable potential, giving comparable yields to lucerne and establishing well. But further evaluation in recent years in the north of the state has cast doubt on its potential. The main problems are the susceptibility of plants to a range of crown and root rots and inconsistant performance.

The South Australian developed cultivar, Othello, was sown in state-wide lucerne trials during 1987. Preliminary results indicate that

establishment has been inferior to lucerne. Seed of cultivar Othello is being increased with the intention of making it available to producers.

If sown, select well drained soils, preferably alkaline in reaction, and graze as for lucerne.

Birdsfoot trefoil has not been evaluated under our conditions, however its performance in New Zealand indicates that it may have a place as a "poor land" lucerne. Being a lotus species it is bloat free and has the ability to produce well on low to moderate fertility acid soils. Like lucerne it is however sensitive to overgrazing and would most likely be restricted in use to higher rainfall areas in smaller paddocks, so that grazing could be controlled.

Creeping vigna has shown promise as a persistent perennial in moist but not poorly drained soils on the coast north of Raleigh. **Round leaf cassia** has been shown to have some potential on courser textured, even gravelly soils. This species would be worth testing inland as well, although frost would restrict growth.

Pintoi peanut has been developed for use as both a ground cover for use in plantations and as a prostrate perennial pasture legume. **Oxley fine stemmed stylo** has shown promise for use on coarse textured soils in the lower rainfall area of north-east NSW. It has a degree of frost tolerance not commonly found in tropical legumes.

REFERENCES

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