ANNUAL LEGUMES : THE PERSISTENCE AND PRODUCTIVITY OF SUBTERRANEAN CLOVER AND MEDICS

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Annual pasture legumes constitute an essential component of both cropping - pasture ley and pure grazing enterprises. They are the dominant source of nitrogen in areas receiving as little as 300 mm annual rainfall to areas receiving as much as 900 mm and they contribute significantly to the quality of available herbage.

In most cases the maximum benefit from annual legumes is only achieved if they persist in pastures for a number of years, coping with wide variations in both management and seasonal conditions.

Climate alone can impose considerable stress with large variations in the total amount of rainfall, the time the season starts and finishes and the distribution of rainfall through the year. Annuals are particularly sensitive to these variations at critical stages such as seedling establishment, flowering and seed set.

To obtain persistent cultivars it is important to select a cultivar which flowers and sets seed before significant moisture stress occurs. This can be a difficult choice considering spring rainfall can be highly erratic. If a very early flowering cultivar is chosen, high seed yields are more likely but a significant penalty is paid in terms of herbage production due to early maturity. Conversely, if a later flowering cultivar is sown, short term productivity may be greater but persistence may be sacrificed due to unreliable seed set. The challenge therefore is to strike a balance between seed set and herbage productivity. The large range of legume cultivars available, differing greatly in maturity, assists this balance being achieved.

As persistence is the key to long term productivity, the thrust of agronomists, particularly breeders of annual legumes, has been to improve those characteristics which convey improved persistence. A high priority has been to increase the level of hardseed and disease resistance in subclover and aphid resistance in the annual medics. Advances have been dramatic with significant improvements in some characteristics such as tolerance to root rots, leaf diseases and blue green aphids.

To demonstrate the improvements made over the past few years it is worth comparing the performance of the old and new cultivars in on-farm field trials.

RECENT IMPROVEMENTS IN ANNUAL LEGUMES

1. Subterranean clover

(i) Cultivar Junee

Junee was released as a more hardseeded, slightly earlier maturing cultivar, adapted to situations where Woogenellup performance was poor due to fluctuating seasonal conditions or root rot or false breaks depleting seed reserves; i.e., suitable for more marginal Woogenellup areas. The

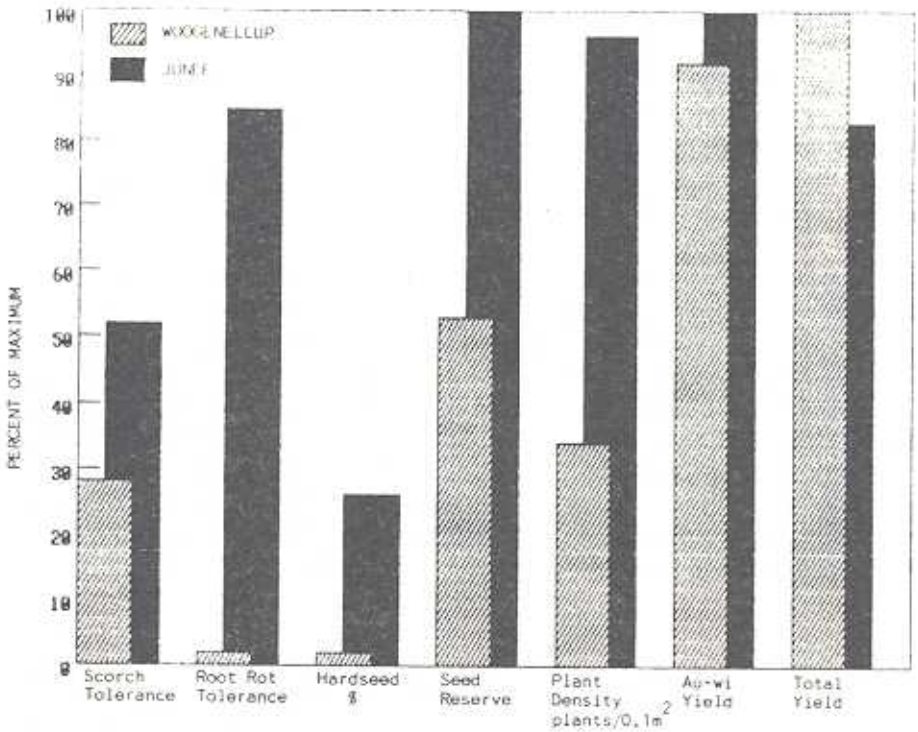
object was to improve seed reserves which would have the effect of improving its density and persistence and long term productivity.

After 4 years, the core trials in more marginal Woogenellup areas have shown dramatic increases in seed reserves of Junee swards (averaging 126% improvement) compared to Woogenellup.

The improved seed reserves are a by-product of increased hardseed levels, earlier maturity and improved disease resistance.

These higher seed reserves have in turn led to greatly improved clover density. Long term results show that Junee swards have between 26 and 700% more plants than Woogenellup swards with an average improvement of 225% when measured in Temora, Wagga and Wellington trials in 1986 and 1987.

Figure 1: A comparison of important features of the cultivars Junee and Woogenellup



Herbage production of Junee in winter-early spring has been shown to be at least equal to Woogenellup but often superior, although the more prostrate growth habit of Junee has tended to make it appear otherwise. Increases in autumn-winter production of between 7 to 8% have been recorded as a result of sowing Junee instead of Woogenellup. Total herbage production of Junee, which includes late spring growth, is less than that of Woogenellup due to the earlier maturity of Junee. Total production by Junee however is superior where either disease or seasonal conditions have affected the persistence of Woogenellup.

Junee has several other important improvements. It has greatly increased tolerance to the serious root rot Phytophthora clandestina, and the leaf disease, clover scorch.

These long term findings suggest that in marginal Woogenellup areas, the widespread use of Junee should significantly improve the persistence and productivity of subclover.

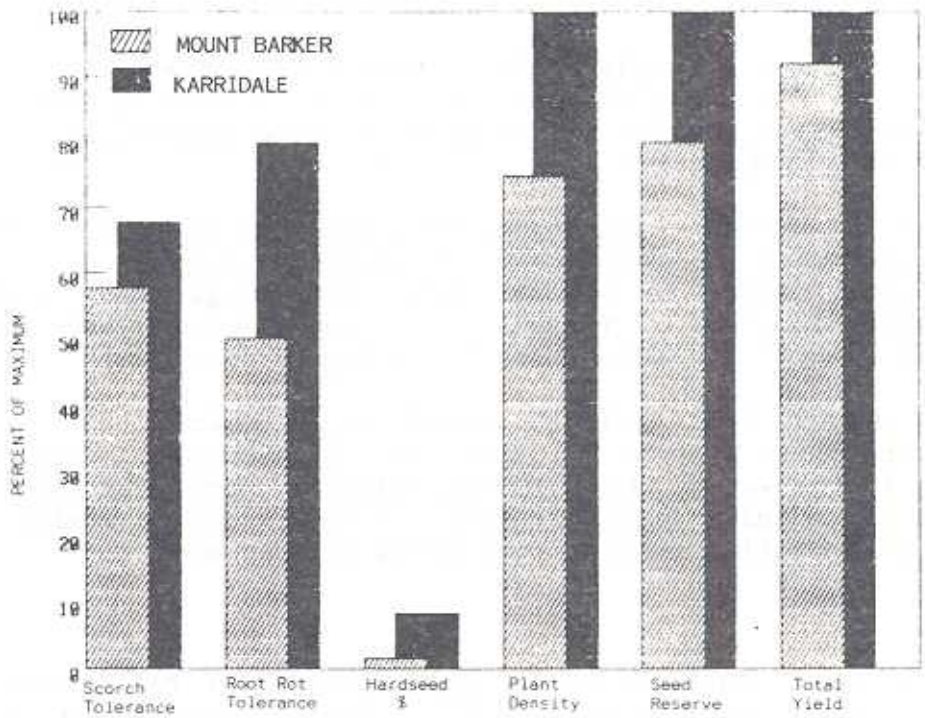
(ii) Cultivar Karridale

Karridale was released as a replacement for Mount Barker although Mount Barker has not yet been removed from the recommended list. Subsequent experience from the core trials has shown that Karridale is a marked improvement over Mount Barker. Data from Wagga and Temora and from the trials of Peter Simpson, John Dymock and Harry Kemp at Goulburn, Crookwell and Bega show that once established, plant density of Karridale is between 7 to 100% better. Plant vigour scores show a slight improvement at Goulburn and considerable improvement at Crookwell.

Seed reserves are consistently better while the hard seed level is increased from 1.5% for Mount Barker to about 8.3% for Karridale.

Herbage production has also increased at most sampling times, commonly by around 20% which is considerable. Root rot tolerance of Karridale is 29% better than that of Mount Barker and clover scorch tolerance is 32% better.

Figure 2: A comparison of the older cultivar Mount Barker with the new cultivar Karridale.



Results from other states also confirm the superiority of Karridale over Mount Barker. For example, at five sites in Tasmania, with annual rainfall ranging from 550 to 750 mm, Karridale has produced higher seed yields, thicker clover stands and more herbage than Mount Barker (see Table 1).

Further studies in Victoria (Hotton and Curnow, 1987) have shown that when Karridale was sown into an old Mount Barker pasture it was able to prevent the Mount Barker from dominating (less than 3%) while most other new cultivars succumbed to competition from Mount Barker. This shows that Karridale can be successfully introduced into run down Mount Barker pastures and replace the older variety.

Table 1: A comparison of Mount Barker and Karridale over two years at five sites in Tasmania (1986-1987)

Character	Cultivar Mount Barker	Karridale	% Improvement
Seed yield (seeds/m^2)	1000	1470	47%
Regeneration (Seedlings/m^2)	23.8	29.0	22%
Herbage Production (kg/ha)	735	1136	55%

(unpublished data courtesy Mr P Evans)

The field trials are therefore showing Karridale to be markedly superior to Mount Barker and suggest a switch from Mount Barker to Karridale would boost persistence and productivity of subclover in higher rainfall areas.

(iii) Cultivar Dalkeith

Dalkeith was released to replace the oestrogenic cultivar, Dwalganup, but has proved to be so hardy that it is being grown further west in drier areas than originally intended. It is therefore more appropriate to compare its performance with Nungarin.

Trial results at Ardlethan and Temora show Dalkeith is able to equal the seed yield and plant density scores of Nungarin despite the fact that Dalkeith flowers some 7 to 10 days later than Nungarin. Therefore by growing Dalkeith in place of Nungarin it is possible to extend the period of green feed by up to 2 weeks and still have a good seed set.

The results suggest that Dalkeith should be recommended not only as a Dwalganup replacement but also for use in mixtures with Nungarin particularly in the wetter fringe of the Nungarin zone. The more upright growth habit of Dalkeith is also a plus for this cultivar making it more attractive for hay making and more competitive against weeds.

2. Medics

The quality of medic pastures in the western districts has generally been declining in recent years (Cregan 1985). An increase in the amount of cereal cropping combined with attacks by three insect pests, the blue green aphid (BGA), the spotted alphalfa aphid (SAA) and the pea aphid (PA) are largely thought to be contributing to this decline or lack of persistence. To improve the persistence of annual medics, several new cultivars have been introduced which improve the insect resistance of the more important medic species.

(i) Cultivar Sephi (Barrel medic; Medicago truncatula)

Sephi became commercially available in 1985. Like Paraggio this cultivar was released as an aphid tolerant replacement for the cultivar Jemalong.

Sephi has slightly longer spines on the seed pods than Jemalong but they should not increase the degree of wool fault. In the northern districts of the state, Sephi has outyielded the older cultivar Jemalong.

Sephi has good tolerance to BGA and superior tolerance to SAA compared to Paraggio. It also has a more vigorous seedling than Jemalong or Paraggio and, with superior seed production, Sephi should thus be more persistent.

(ii) Cultivar Paraggio (Barrel medic; Medicago truncatula)

Paraggio was released in 1982 for the central and southern areas of New South Wales. It became commercially available in 1984. Growth of Paraggio is superior to Sephi in the southern areas of the state although Paraggio seedlings do appear to be sensitive to frost. Paraggio has about 70% hardseed which is relatively low for a medic and this is considered an advantage as it encourages good regeneration in the second year.

Limited observations suggest Paraggio may not grow as well in poorly drained situations and may be more prone to crown and root rot diseases than Sephi.

The maturity of Paraggio is similar to Jemalong and is recommended for areas receiving annual rainfall down to 500 mm in the north of the state and 400 mm in the Riverina.

Compared to the older variety, Jemalong, Paraggio has better second year germination, better seedling vigour and worthwhile tolerance to BGA and SAA.

(iii) Cultivar Zodiac (**Medicago murex**)

A new medic variety called Zodiac will become commercially available in 1989 (Gillespie 1988). This medic differs from other medics in that it is adapted to growing on more acid soils (pH $CaCl_2$ 4.5 - 6.0). Research results over the last 4 years at Temora have shown that this medic will grow well in areas normally suited to Seaton Park, Junee and Woogenellup subclover. Its major advantage over subclover is a much higher level of hardseed which will assist long term persistence by resisting false germinations due to summer or early autumn rainfall. When grown alone its production is equal to that of subclover but when grown in a mixture with subclover, the latter tends to dominate. Other advantages include better drought tolerance in spring which delays senescence and therefore maintains the quality of the feed for longer. This characteristic is often referred to as the "kick-on" factor. Western Australian experiments have resulted in improved liveweight gains by stock in late spring and early summer. Zodiac is susceptible to SAA but has some tolerance to BGA, PA and red legged earth mite (RLEM). Coumestrol levels in Zodiac are very low and no effect on ewe fertility is likely. This cultivar will be provisionally recommended in NSW in 1989 although more long term experience will be required before its full potential is known.

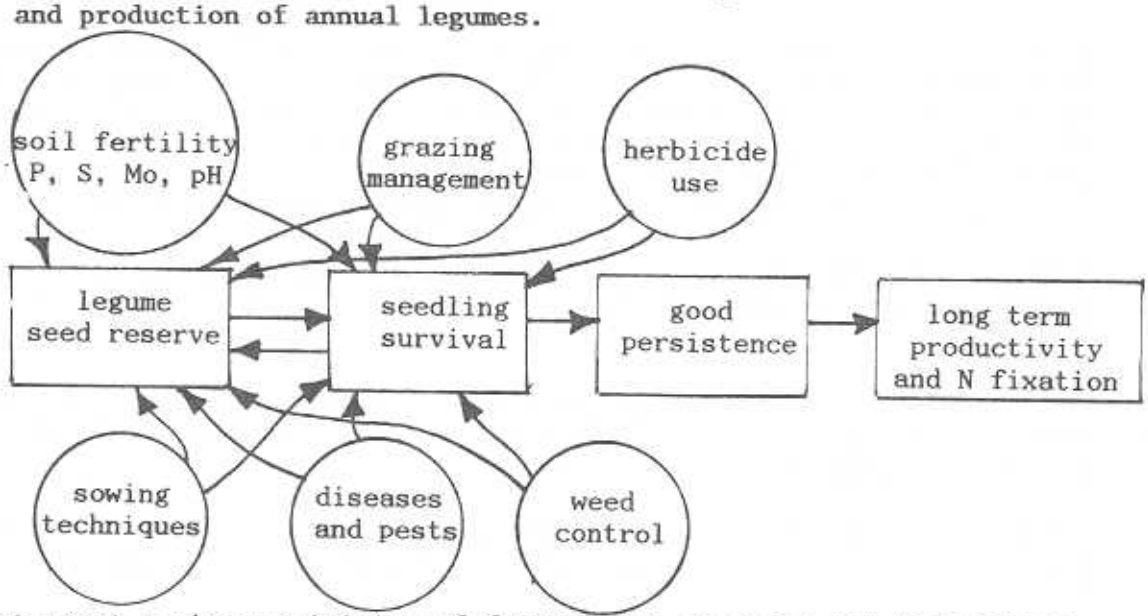
ANNUAL LEGUME PASTURE MANAGEMENT IN THE 1990'S

Many agronomists and farmers are relying on the advances incorporated within new cultivars to solve the problem of persistence while ignoring management factors which are now assuming greater importance in affecting persistence. Some of the more important management factors are highlighted in Figure 3.

Although cultivars are better adapted agronomically, insufficient attention is paid to soil fertility (phosphorus, sulphur, Mo and pH), weed control, sowing techniques and herbicide use in both the cropping and pasture phases. These are all factors within the farmers' control. These

management factors are more likely to be the cause of poor pasture productivity and legume decline in both the medic and subclover zones than deficiencies in the recommended legume variety.

Figure 3: Some farmer controlled factors which affect persistence and production of annual legumes.



This is not meant to be a criticism of farmers but to point out that future productivity of pastures and hence profitability will rely on a new integrated, multifactor pasture management approach.

No longer should tbe district agronomist be asked "What is the best variety to sow on my place?" and leave it at that, but rather "What is the best variety to sow and the series of management practices needed to be followed to ensure it persists and is productive?" The answer should cover proper establishment techniques, early weed control strategies, grazing management to encourage good seed set, a long term fertilizer strategy, insect and pests likely to be a problem and appropriate control strategies. The answer should also highlight critical stages at which checks are made, and critical insect numbers, weed densities, etc. which will indicate certain responses are required.

DEVELOPING PASTURE MANAGEMENT SYSTEMS

The responsibility for instigating an integrated pasture management approach lies with both farmers and agronomists.

Because of the number of areas to be considered and acted upon, it is important to use a system such as the check list being used by Geoff Pitson at Cootamundra. Such a check list could include the following items:

Prior to sowing check

A. Which cultivar or cultivar mixture is best suited to the paddock?
B. Has the soil pH changed over the last few years and is lime required?
C. Does the soil pH suggest inoculation is required?
D. Has molybdenum been applied in the last 4 years?
E. Will the seeder sow the pasture at the optimum depth?
F. If covercropping, which is the best covercrop to use and at what sowing rate?

After sowing check

A. What herbicides will be needed and when should weed seedlings be checked?
B. Will spray-grazing, winter-cleaning or spray-topping be the most appropriate strategy?
C. When should the pasture be inspected for insect damage (RLEM, BGA)?
D. What is the best grazing management in the first year to maximise establishment and seed set?

Monitoring Pasture Performance

A. Is the pasture achieving its production potential (DSE/ha)?
B. Is the legume content adequate?
C. Are grasses becoming dominant, and if so what should be done about it?
D. Is grazing management optimising legume content?
E. Are soil P levels adequate for growth and seed set?

While many farmers already consider these factors it is easy for the pressure of other important operations such as stock or crop work to distract the farm managers attention at crucial times, so that critical times for spraying pests or weeds are missed. The result is that more costly herbicides may be needed or control may be less effective.

The above check list may seem too involved but similar management systems are already being used with great success by some farmers, particularly for cotton, rice and high yielding wheat crops.

The conclusion is that the introduction of insect resistant medic cultivars and improved subclover cultivars will result in improved persistence and pasture productivity only if a complete management package is followed. The challenge for the 1990's will be to develop pasture management systems which ensure that technology is applied to its best effect.

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