INCORPORATING NEW VARIETIES -

THEIR CONTRIBUTION TO SUSTAINED PROFITABILITY

Warren McDonald
Special Agronomist (Pastures)
Department of Agriculture, Tamworth. NSW

New species and varieties can contribute significantly to sustained profitability by increasing the reliability of production, by increasing seasonal or overall production, by reducing the cost of production or by providing more flexibility to the grazing system.

There is a constant stream of new varieties, many developed locally, others imported. What contribution do they make? Is it worth paying the often high seed prices asked?

Local research and commercial use take time to sort out the place of new varieties in our farming systems. Many varieties fall by the wayside. For example over the past 15 years, there have been 89 pasture varieties registered in Australia. Of these, approximately 72 varieties would have to be seen to be potentially useful for NSW at the time of registration.

Of these 72 varieties, 35 have been subsequently recognised by the Department of Agriculture as being of 'value' to the industry by classifying them as "recommended" or "provisionally recommended".

These newer varieties represent about one-third of varieties currently recommended in NSW. They have consequently found a niche where they can contribute to agricultural production.

Australian breeders have made significant inroads into the marketplace. For example of the 28 lucerne varieties currently available, 9 have been produced in Australia and of these, 6 have had good market penetration despite intense commercial competition.

The benefits

The benefits from new varieties have been many and varied. Table 1 lists important releases made in recent years.

These benefits include increases in the quantity of feed produced, improved seasonal distribution of feed, insect and disease resistance, persistence, seedling vigour, reduction of animal health problems and specific genetic improvements to aid management. Examples of contributions by selected varieties are outlined below.

Table 1 Major Variety Releases 1971-1986

Variety	Year Regn.	Main Benefits
Haifa white clover	1971	Production & persistence
Northam sub. clover	1972	Extend area of use & persistence.
Porto cocksfoot	1972	Production & seedling vigour
Tetraploid ryegrasses	1972-	High production as forage crop.
Safari Kenya white cl.	1973	Persistence.
Sirosa phalaris	1974	Seedling vigour, winter growth.
Trikkala sub. clover	1975	Root rot resistance
Nungarin sub. clover	1976	Persistence, extend area of use
Falkiner lucerne	1976	Root rot resistance-persistence.
Inverell purple pigeon grass	1977	Vigorous perennial for northern inland.
Sirolan phalaris	1978	Seedling vigour - drier areas
Redquin red clover	1979	Low oestrogen, better autumn winter growth.
Aphid resis. lucernes	1979-	Production & persistence
Sava snail medic	1980	Production, persistence & regeneration.
Consol love grass	1982	Persistent perennial-semi-arid areas.
Paraggio barrel medic	1982	Aphid resistance replacement
Uneta phalaris	1982	Increased seed retention
Dalkeith sub. clover	1983	Persistence
Midmar ryegrass	1983	Production, disease resistance.
Selphi barrel medic	1984	Production & persistence
Junee sub. clover	1985	Persistence,disease resistance
Karridale sub. clover	1985	Persistence,disease resistance

(Barnard 1972; Mackay 1982)

For these benefits to be realised as profits at the farm gate, the improvements shown in research and early testing have to be expressed on the farm as animal production or in the case of fodder as increased returns from the improved production or quality. Often the extent of profit derived will be closely related to the efficiency of utilization of feed. There is little point in paying extra for a new variety, with a 10% increased production if management is not ajusted to utilize it. Improvements in persistence tend to contribute more to profitability than production increases.

In the area of production increases, there are many examples of potentially valuable productivity increases. Haifa white clover has been one of the most noteable releases.
Table 2 indicates the potential yield increases of Haifa white

clover on the North Coast. A subsequent grazing trial failed to show any animal production advantage of Haifa white clover over naturalised white clover (O'Brien, 1978). Despite these results, commercial stocking rates have been observed to double from 1 breeding cow to 2.5 ha to 1 breeding cow to 1.25 ha where Haifa white clover is present on fertilized country as opposed to unfertilized native pasture . Additionally, increased animal growth rates, and higher calving percentages have been observed (Betts - pers. comm.)

On current gross margin analysis this increase in stocking rate alone represents an increase from $85/ha to $170/ha (Bryant, Patrick, 1986).

This overall increase in production is considered to be related to the increased persistence of Haifa white clover over naturalised strains, as well as increased dry matter production.

Table 2

White clover variety trials-DM yield of white clover (kg/ha)

Site	Podzolic sandstone soil			Podzolic shale soil		
Variety	1965*	1966	1967	1966*	1967	1968
Haifa	720	340	1,940	9,320	3,320	1,140
Naturalized	390	70	920	6,560	3,730	570
G'lands Huia	370	30	130	6,740	2,640	120
Ladino	630	90	110	10,410	3,380	100

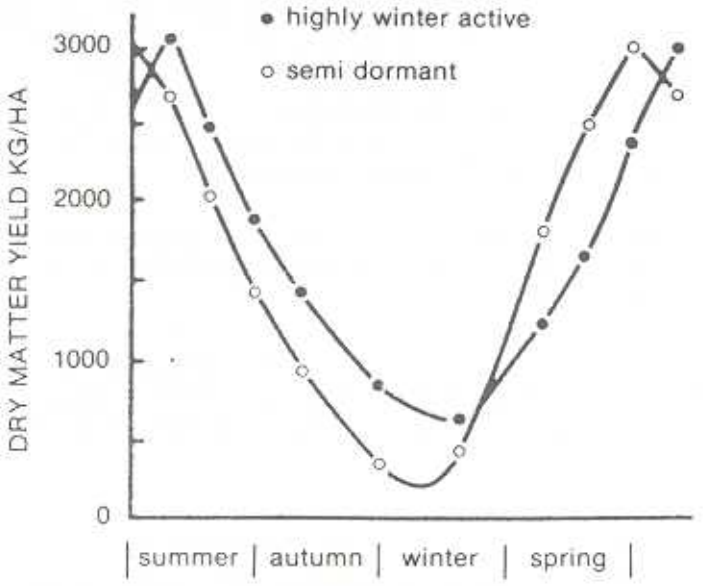
(Yield increased by effect of cultivation on first year stands).

(O'Brien, 1970)

Many recent introductions have contributed by their differences in seasonal growth usually by contributing to the winter feed supply. Noteworthy here is the extra autumn winter production of Redquin red clover, the tetraploid ryegrasses, Sirosa phalaris, Sephi barrel medic and lucerne.

Many farmers claim that the winter contribution of highly winter active lucerne varieties (Fig. 1) has reduced the cost of winter forage crop production for dairyman and taken the pressure off early growth of winter pastures in the more extensive grazing industries.

Figure 1 A comparison between a highly winter active and a semi-dormant variety for their seasonal yield characteristics.



(McDonald, Waterhouse, Cregan, Nichols, 1986)

The arrival of the spotted alfalfa aphid was estimated to cost NSW $9.7 million (Mohr. 1978) in direct loss of production. Today, 9 years later, varieties with adequate aphid resistance have been bred and can be purchased for as low as 10 cents/kg more than the susceptible Hunter River variety.

The breeding of the winter active lucerne cultivar Aurora by the Department of Agriculture illustrates the advances that have been made in insect resistance. This variety a high level of resistance to the main lucerne aphids than any variety available to Australian farmers.

Table 3 Aphid resistance of selected lucerne varieties
% Seedling Survivors

Variety	Spotted Alfalfa Aphid	Blue green Aphid
Aurora	96.1 a	80.0 a
Nova	87.7 b	- -
CUF101	58.1 c	50.0 d
Falkiner	43.3 d	- -
Hunter River	0.7 e	14.8 g
Siriver	- -	63.2 c

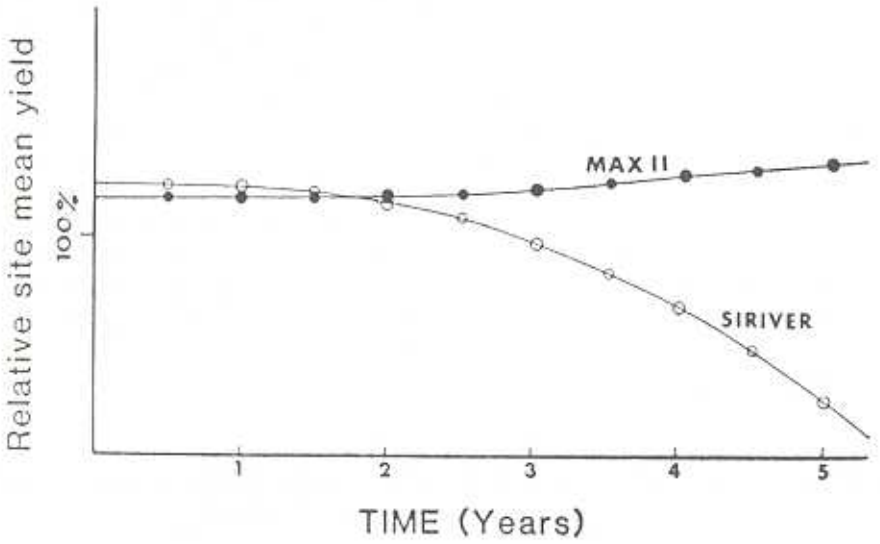
(Varieties with the same letter in a column are not significantly different to each other).

(Nichols, Waterhouse, 1985)

Turning to disease resistance, substantial increases have been made in the root and crown rot resistance of lucerne varieties. This has had a pronounced effect on the survival and production of lucerne in poorly drained situations. (Fig. 2).

The effect of profitability is marked in this instance. The improved variety lasted two seasons longer producing approximately 12 tonnes of hay per hectare adding $1110/ha to income after costs. In addition, the establishment costs are spread over 5 years instead of 3 years and the grower has more flexibility and carries less risk with a more persistent variety.

Figure 2 The relative performance of two lucerne varieties under irrigation at Tamworth.



(Waterhouse, 1986.)

Persistence of sub. clover has been improved by increasing the percentage and number of hard seeds set, so that soil seed reserves can buildup. This is illustrated in the success of Dalkeith, a new variety of Daliak maturity that has the persistence of much earlier maturing varieties (Table 4) because of the ability to set large quantities of hard seed.

Table 4
Performance of sub. clover varieties at Dunnedoo NSW

Variety	Seed Yield (kg/ha)					Forage yield*	
	Dec 1979	July 1980	Dec 1980	July 1981	Dec 1981	Aug 1980	Aug 1981
Nungarin	1760	1020	930	540	1000	5	6
Dalkeith	760	980	770	220	680	5	8
Seaton Park	890	260	220	30	170	4	4
Woogenellup	900	20	10	0	20	2	1

The results show that the traditional varieties Seaton Park and Woogenellup fail to maintain adequate soil seed reserves (200kg/ha). The carrying capacity of country at Dunnedoo in which sub. clover has failed to persist has been estimated to be in the range 1.8 - 2.5 dse/ha while country with effective sub. clover pastures carry between 5.0 and 6.2 dse's/ha. (Hennessy, pers. comm.). Again using gross margin analysis as an indicator of the change in profitability, the gross margin for Merino wool production would increase on average from $33.78/ha to $47.55/ha. (Muir, 1986)

The most notable example of the reduction of animal health problems by breeding and selection has been the reduction in oestrogenic activity in sub. clover varieties, potentially reducing infertility in sheep. The losses attributed to oestrogenic affects in sub. clover in Australia have been estimated at $10m per annum. (Culvenor, 1986). The varieties with high oestrogenic activity were Dwalganup, Yarloop, Dinninup, Geraldton, Howard and Tallarook. These varieties have been replaced and now thirteen varieties are recommended in NSW, all unlikely to cause infertility.

Pasture establishment is perhaps the area where breeders can make a dramatic impact on profitability. The introduction of Sirosa phalaris with improved seedling vigour has meant that many farmers can now establish a successful phalaris pasture, with increases in establishement similar to those evident in Table 5 because of increased seedling vigour.

Table 5
Establishment of grasses surface sown into herbicide treated native pasture at Canberra

Species	Establishment (% of viable seed sown)
Australian phalaris	7.9
Sirosa phalaris	19.9
Victorian ryegrass	18.7

(Dowling et al, 1971)

Profits have been enhanced by the reduced risk of establishment failure, the increased production in some situations and the advantages of botancial stability and drought resistance.

In the area of increasing profitability by reducing management problems, a recent highlight has been the breeding of improved seed retention into Australian phalaris with the release of Uneta. Additional seed harvested from Uneta has been recorded as high as 88% over Australian phalaris. This will be of great assistance to seed growers and farmers alike who will

benefit from less expensive seed.

The future

Legumes

Australian plant breeders see scope for releasing a wide range of material that can contribute to sustained profitability.

The Department of Agriculture has a winter-active variety of lucerne ready for release that has the highest level of resistance of blue-green aphid attack of any variety as well has having high levels of resistance to root and crown rots. Other winter active lines with increased leaf disease resistance are currently in field trials that may reduce the losses incurred in more humid environments and under irrigation.

Researchers working with sub. clover foresee replacements for Mt Barker and Woogenellup becoming available in three years or so which will be more resistant to scorch and root rot diseases as well as being more persistent.

Similarly, replacements are being sought for Seaton Park and Trikkala sub. clovers. Seaton park lacks resistance to root rot and both varieties lack adequate resistance to scorch and they would be more adaptable if the level of hard seed was increased further. More persistant and productive alternatives for Clare sub. clover are being sought for use on neutral to alkaline soils.

Farmers using medics have benefited recently by the introduction of aphid resistant replacements for Jemalong barrel medic in the form of Paraggio, Sephi and Parabinga barrel medics.

We still do not have a suitable replacement for Cyprus or Harbinger barrel medics for use in western areas. Promising replacement material has been identified, but is at least three years away from release.

The development of murex medic in Western Australia is an exciting development as it could provide a medic for use in acidic soils that could add to increased persistence and total production.

Additionally, breeders see potential in a wide range of medics that could be of benefit to NSW including *M. polymorpha* (burr medic) and *M. aculeata* a potentially adaptable aphid resistance medic.

Researchers in Western Australia will shortly release a serradella that has shown wide adaption throughout Australia on deep light textured soils.

Two further lines of serradella that have shown promise in NSW are currently being considered for release. One is an early flowering line with good winter production and the other of Pitman maturity, which is particularly well adapted to acid soils with high levels of exchangeable aluminium.

For wetter areas on the tablelands and coast there are two varieties of lotus that have shown promise to compliment the Grasslands Maku lotus variety. Both varieties offer high quality feed late in the summer in wet situations.

Other recently available legumes with potential for use particularly in our southern areas include balansa clover (*T. balansa*) a self regenerating annual and potential replacement for Trikkala sub. clover for poorly drained conditions and Tamar white clover (*T. repens*) which is showing promise relative to Haifa white clover in southern irrigation areas.

Victorian researchers are hopeful that Persian clover (*T. resupinatum*) can be improved by selecting lines that are more persistent than Maral.

Grasses

One of the main activities in temperate grass development is the drive for more persistence in perennial ryegrass. One promising line has been developed in NSW while the Victorian Department of Agriculture is evaluating lines of Victorian ryegrass and overseas introductions for drought resistance.

With phalaris, the recent breakthrough with the release of Uneta, a variety with particularly good seed retention characteristics has lead the way to the possible breeding of Sirosa, Sirolan and Sirocco types with greatly increased seed retention. Such varieties would lead to reduced seed costs and increased sowings. CSIRO, is currently working on reducing the phalaris poisoning problem and developing varieties suited to acid soils.

The potential for domestication of native grasses has been raised earlier in this conference and adds a new dimension to the pasture scene.

Added to these developments and possibilities is the activity likely to occur should Plant Variety Rights (PVR) be introduced and the possibilities in the longer term of technology such as genetic engineering being used. Already CSIRO is working with lucerne and sub. clover in this regard.

The path from breeder to commercial use of new varieties is often not smooth and the valuable contribution that new varieties can make may not be realised for many years. It must be evaluated in appropriate areas under grazing and put into commercial use as soon as possible.

This is often a long drawn out process, but one that innovative farmers can help immensely by co-operating with agronomists in sowing trials or demonstration areas. This process needs speeding up if we are to capitalise on the efforts of breeders.

It is also essential that new varieties have reasonable seed yields and have a good market demand, to interest seed growers as they may have to put considerable effort into establishing techniques to grow the new variety efficiently and market seed. For example the potential of Kenya white clover and Bargoo joint vetch for use on the North Coast has been long realised, however adoption has not occurred because of inadequate seed supplies. Other potentially useful species that have not reached commerce because of inadequate seed supplies include Noonan kikuyu, a variety tolerant to kikuyu yellows and Orthello sainfoin, a summer non-bloating perennial legume.

There is then scope for further improvement by breeders, agronomists, graziers and seed producers to work toward the release and rapid adoption of new varieties to improve, the profitability of production through our pastures.

References

Barnard, C. (1972) Register of Australian Herbage Plant Cultivars, CSIRO.

Betts, J. Pers. comm. Agric. Research & Advisory Centre, Grafton NSW.

Bryant, M.J., Patrick, I.W. (1986) New England Budget Handbook - Livestock & Winter Cereals NSW Dept. of Agric. pp 37.

Culvenor, C.C.J. (1986) Review-Detremental Factors in Pastures & Forage. In, "Temperate Pastures: Their Production Use and Management" Eds J.L. Wheeler, C.J. Pearson &G.E. Robards (Pub. by Aust. Wool Corp.-CSIRO Melb., In Press).

Dowling, P.M., Clements, R.J., McWilliam, J.R., (1971) Establishment and survival of pastures species from seeds sown on the soil surface.
Australian Journal of Agricultural Research 22: 61-74.

Hennessy, G. Pers. comm. NSW Dept. of Agric., Mudgee.

Mackay, J.H.E (1982) Register of Australian Herbage Plant Cultivars (Supplement to 1972 Edition) CSIRO.

McDonald, W.J., Waterhouse D.W., Cregan P.D., Nichols P.G.H., (1986) Lucerne varieties: 1986 NSW Dept. of Agric. Agfact P2.5.13.

Mohr, G. (1978) On estimating the losses to agricultrue from exotic lucerne aphid infestions in New South Wales. Proc. Lucerne Aphid Workshop, Tamworth NSW pp 175-177.

Muir, A.M. (1985) Livestock & pasture budgets for Central Western NSW. NSW Department of Agric., Orange NSW pp 9.

Nichols, P., Waterhouse, D. (1985) Submission for registration of Fpx9/83 to NSW Herbage Plant Liaison Committee.

O'Brien, A.D. (1970) White Clover (*Trifolium repens L*) in a sub. tropical environment on the East Coast of Australia. Proceedings 11th International Grassland Congress. Surfer's Paradise pp 165-8.

O'Brien, A.D (1978) Report to Australian Meat Research Committee on Project DAN 1 (unpub.).

Waterhouse, D.W. (1986) Lucerne variety performance. Proceedings of lucerne workshop, Yanco 1986 (in print) NSW Dept of Agriculture.

Wolfe, E.C. Pers. comm. Agric. Research Centre, Tamworth NSW.