CURRENT AND FUTURE DEVELOPMENTS WITH PERENNIAL GRASSES

Kevin Reed
Department of Agriculture and Rural Affairs
Pastoral Research Institute (PRI)
Hamilton, Victoria 3300

The most important component of pasture is the legume and most of our work at PRI relates to that component (Reed and Cocks, 1982).

The relative usage of the four main temperate perennial grasses in Australia can be estimated from Table 1 which summarizes two years of statistics for Australian production, import and export of grass seed.

Perennial ryegrass is the main grass in use. Animal production trials show that it is usually the most productive species but often phalaris pastures are as productive, or in droughts, more productive. Differences in animal production between alternative perennial grasses are rarely more than 10% and the most consistent result is the lower level of production measured from cocksfoot pasture.

TABLE 1: Domestic certified seed production; exports and imports of temperate pasture grass seed into Australia (tonne)

Species	Certified Seed produced		Seed exports		Seed imports	
	1985/86	86/87	1985/86	86/87	1984/85	85/86
Perennial ryegrass	1864	1650	544	1201	1292	1639
Italian ryegrass	34	19	-	-	868	857
Annual ryegrass	-	-	5	15	-	-
Cocksfoot	543	368	308	297	6	3
Tall fescue	569	536	0	513	1	49
Phalaris	320	402	28	22	-	-
Kikuyu	19	12	18	20	-	-
Other temp.grasses	82	66	296	330	430	465

PERENNIAL RYEGRASS

1. Drought tolerance

Summer dormant, winter active strains from Mediterranean countries are well recognized sources of drought tolerant lines. The cultivar Medea was selected from Algerian material by Dr J.H. Silsbury of the Waite Institute and registered in 1967. Since then, selections from Medea have been crossed with cv. Victorian to develop cv. Brumby by Valley Seeds Pty Ltd. Other Mediterranean lines have been used in the breeding of UNE 100 by Professor J. McWilliam and Algerian lines have been selected at dryland sites after two major droughts by the Department of Agriculture and Rural Affairs, Victoria (DARA) (Reed et al. 1987). The latter are now being used in a breeding program, to enhance autumn growth as well as to improve drought tolerance. Late autumn is our period of greatest feed shortage. This species will of course continue to be less drought tolerant than the other, deeper rooted perennial grass species. In the south west Victorian environment, however, grazing management can be used to both reduce plant losses in drought, and to enhance natural regeneration from seed after drought.

2. Disease

Crown rust is the most obvious disease affecting perennial ryegrass and DARA are now developing a resistant cultivar. Cultivar Victorian is quite badly affected compared to the other three cultivars currently recommended in Victoria (Ellett, Nui and Kangaroo Valley). Research at La Trobe University has shown that where crown rust is prevented with fungicide, the yield of Victorian ryegrass is increased considerably (C. Critchet, personal communication). Nutritive value is also reduced by disease. Other diseases for which we are seeking resistance are stem rust, net blotch and blind-seed disease. Barley yellow dwarf virus is a widespread if invisible disease (of perennial ryegrass) on which research is being conducted in Victoria. Some researchers believe this disease may reduce the yield of ryegrass considerably.

3. Winter growth

By European standards, our Australasian ryegrass cultivars mature early. However, Kangaroo Valley is a unique cultivar which heads almost two months earlier than Victorian ryegrass. As David Kemp, New South Wales Department of Agriculture, Orange, has pointed out, this extreme earliness largely explains the exceptional winter production of this old ecotype. Kemp has reported 5-10 fold variation in winter growth rate depending on time of initiation of the reproductive apices.

4. Turf characteristics

A large fraction of Australian produced perennial ryegrass is used in various turf mixtures and there are considerable opportunities to develop specialist cultivars for turf. Currently drought-tolerant prostrate types from the Middle-East are being evaluated for this purpose. In addition selections have been made from cv. Victorian by Ms M.E. Rogers.

5. Nutritive value

New infrared spectroscopy technology is now operational in DARA at the PRI. It is now feasible to screen vast numbers of samples - such as a plant-breeders population - so that selection for enhanced mineral concentrations or low fibre can be made. In favoured districts where long growing seasons are common, it may be possible to prolong lactation curves by utilizing later-maturing cultivars than those currently recommended for general use (Table 2).

TABLE 2: Variation in nutritive value of perennial ryegrass cultivars at Hamilton sampled on 11 December 1987 (Regrowth from 21 October).

Cultivar	Nitrogen (% DM)	In vitro Digestibility(% DM) #	Neutral Detergent Fibre (% DM)
Ellett	2.09	67.1	53.5
Victorian	2.07	62.8	55.6
C1 *	2.21	69.8	52.5
C2a *	2.27	63.6	53.5
C12 *	2.50	67.6	54.5
C13 *	2.62	79.5	48.8
LSD (P = 0.05)	0.305	4.78	3.86

* These are all proprietary cultivars currently under test in Victoria. # Pepsin - cellulase technique.

6. Cultivars recommended

The production of cultivars recommended in Victoria has been measured in up to 19 experiments located in all regions other than the north west during the last four years. The mean cumulative yields from these experiments is shown below for each cultivar - relative to Ellett as 100 (Table 3).

TABLE 3: Relative yield of DARA recommended perennial ryegrass cultivars in Victorian experiments, 1984-85

Cultivar	Experimental Sites	
	Dryland	Irrigation
Ellett	100	100
Nui	97	96
Kangaroo Valley	90	99
Victorian	88	88

Source: Clark and Reed (1988).

The lower yield of Victorian ryegrass is possibly a reflection on its susceptibility to rust (Table 4).

TABLE 4: Rust ratings* made in field trials

Cultivar	Stem rust	Crown rust			
	Hamilton 22.1.87	Hamilton 22.1.87	Hamilton 20.11.87	Kyabram# 5.1.88	Kyabram# 3.3.88
Ellett	2.2	0.8	0.3	1.2	2.2
Nui	1.3	1.0	0.3	1.2	2.3
Kangaroo Valley	1.5	1.1	0	1.7	2.0
Martlet	2.3	2.8	1.8	-	-
Victorian	2.7	3.0	2.3	6.5	9.2

* 0 = no rust, 10 = all plants heavily infected
\# irrigated site

7. Endophyte

A fungus which lives inside the ryegrass plant causes perennial ryegrass staggers. This 'endophyte' only infects plants through the hereditary process. If seed is stored for two years the endophyte in it dies and endophyte-free (and staggers free) pasture can be established.

We have found that it is not advisable to use low endophyte Victorian ryegrass. It is not a vigorous plant and is most susceptible to weed competition. However, low endophyte Ellett seed has made a good pasture at Hamilton.

In New Zealand high endophyte seed is regarded as most desirable as the fungus is most effective at deterring attack by - among other insects - the Argentine stem weevil (ASW). High endophyte plants also survive better in the long term in Victoria, although the ASW has not been found there.

On the other hand, the endophyte reduces pro-lactin in the serum of ewes and considerable increases in lamb mortality have been recorded on high endophyte pasture (44% vs 19% - Foot et al., 1988).

The endophyte is a complication which has only been studied in this decade. It is an important consideration for breeders, agronomists and farmers interested in maximizing the potential of our most important perennial grass.

PHALARIS

The development of Sirosa and Sirolan has proved to be a most valuable advance in terms of seedling vigour and winter growth. Some toxicity problems still occur with these new cultivars but they are quite infrequent.

Productive old stands of Sirosa are common but the new cultivars can have a problem with persistence. This problem has been claimed to be due to (a) poor adaptation to the strongly acid, infertile soils of Northern Victoria and (b) overgrazing. These cultivars are not well suited to sustained heavy grazing. There is circumstantial evidence in South Western Victoria that the production from the old cultivar "Australian" phalaris - a more prostrate and highly tillered cultivar - can be enhanced if grazing management includes spelling.

Persistence problems with Sirosa have also been noted in NSW and Tasmania.

NSW Department of Agriculture research at Scone with Sirolan suggests that because of the synchronous heading characteristic of the newer cultivars they may need to be spelled at some stage in spring to allow reproductive tillers to mature and so maximize the number of dormant crown buds. This is seen as particularly important in dry areas subject to periodic summer rain (M.J. Hill, personal communication).

Pre-ultimate selections of the new cultivars (Sirosa and Sirolan) were tested by DARA at three sites in North East Victoria prior to their release. Over the four years 1969-1974, Mahoney (1974) found that at Strathbogie, the average annual dry matter yields per ha of phalaris was 4.6 t for Sirocco, 5.1 t for Sirosa, 5.9 t for Sirolan and 7.4 t for the hydrid species, Siro 1146. Lower yields but similar rankings were measured over four harvests at Whitfield except that the hybrid was twice as productive as the best Phalaris aquatica cultivar. These experiments were sown in 1968. Recently, Mr J. Shovelton (DARA, Seymour) measured the persistence of the cultivars at the Strathbogie site after 20 years grazing. Cv. Australian was found to have a density half that of the hybrid and twice that of the Sirosa and Sirolan pre-ultimate material. The plots sown to cv. Seedmaster however, were found to contain virtually no phalaris.

Most advisors claim to have seen many paddocks of Sirosa where persistence is satisfactory but there is certainly enough evidence for a plant breeder to consider an improvement program, combining the seedling vigour/winter growth of Sirosa with the greater summer dormancy and dense tillering of Australian. It is alarming that Shovelton's measurements show such poor persistence by the Argentinian selection, Seedmaster. Seedmaster was regarded by CSIRO as virtually indistinguishable from Australian, and because of its greatly improved seed yield Seedmaster has now eclipsed Australian in terms of production of certified seed. Only very limited work has been carried out to test the newer "Australian" type cultivar, Uneta.

There is obviously a need for a formal cultivar evaluation program which has the resources, and is given firm directions sufficient to ensure

adequate testing of long term persistence of perennial pasture species. This is particularly necessary for publicly developed cultivars.

CSIRO are continuing their breeding of hybrid phalaris with the challenging aim of improving palatability. Such a development would be of considerable importance. Siro 1146 has demonstrated excellent persistence coupled with outstanding dry season growth. It has shown its ability to recolonize bare land by vegetative spread at many experimental sites in south-eastern Australia.

CSIRO are also improving the seed yield of Sirosa and are developing a highly winter active cultivar of phalaris (R. Oram, personal communication).

TALL FESCUE

Tall fescue needs to be sown in a mixture free of other grass seeds. High seeding rates (10-20 kg/ha) and moderate grazing in the first 2 years are other factors considered important to convert a good strike into a successful long-term establishment. Seedlings are susceptible to attack by red legged earthmite.

Generally there are few paddocks where this procedure has been followed. It is more common to add 2 kg/ha into a mixture containing one or more other grasses. Consequently the species has not demonstrated its potential.

Deep rooting, adaptation to heavy clay soils, tolerance of severe waterlogging, and good quality feed in summer are the important features of tall fescue. A paddock of tall fescue on late-finishing clay loam flats is possibly the most practical option for Western District graziers wanting a special purpose summer pasture on which to rear spring born lambs.

Demeter and Triumph are the main cultivars in use and Demeter is currently recommended. Triumph has proved to be as productive since trials began in 1985. Triumph has been studied at ten sites and is very similar to Demeter in its growth rhythm. Increased autumn-winter growth can be obtained using North African genotypes such as Melik. Epic is one of these which has given good cool season growth but is not recommended. It has exhibited poor vigour as a seedling. Epic exhibits extreme dormancy in summer.

COCKSFOOT

The lower feeding value of cocksfoot has caused most advisors to promote phalaris in its place but on some light textured soils cocksfoot will persist better.

Very little cultivar evaluation has been attempted in Victoria since Porto was recommended in 1978. Porto has shown some tolerance to extremely wet soil conditions. This is something we do not expect from cocksfoot.

In recent short-term trials with weaner sheep, liveweight gain and wool production from Porto cocksfoot pasture was not significantly different from that obtained from Victorian perennial ryegrass pasture (Kenny and Reed, 1984; 1985). Limited work at Hamilton has shown that the New Zealand cultivars, Wana, and particularly Kara, establish under sub-optimum conditions (late break, wet winter, heavy soil and waterlogged conditions with considerable competition from annual grasses despite use of atrazine). Kara is a D. glomerata x D. lusitanica hybrid. Its feeding value may be different to D. glomerata.

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