PLANT INTRODUCTION AND RESEEDING IN THE MULGA ZONE

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ABSTRACT

The values of exotic and indigenous pasture species are assessed for long term grazing use in semi-arid to arid areas of the mulga zone.

Progress of plant introduction and reseeding research is outlined for three regions. In the Northern Territory and Queensland the priority is to find an easily established, bulky, persistent, perennial grass. The major requirement in Western Australia is to determine if reseeding with palatable indigenous species will be more successful than natural revegetation following exclosure of stock.

INTRODUCTION

The more highly regarded mulga grasses, such as *Danthonia bipartita*[a], *Neurachne mitchelliana*[b] and *Digitaria* spp. do not produce much dry matter and tend to decline under grazing; their place then may be taken by less desirable grasses, such as *Aristida* spp. and shrubs, such as *Eremophila gilesii* and *Cassia artemisioides*. When mulga is present, stock generally are able to ingest sufficient protein so the main priority is to increase the supply of persistent energy-rich grasses (Ebersohn, 1969).

Hartley (1960) claimed that indigenous species were well adapted to their environment, therefore chances for introducing perennial grasses into the Australian arid zone were low, unless competition from the indigenous species was reduced or eliminated. If exotic species had a greater capacity to absorb nutrients from the soil, then long term decline in soil fertility was also possible (Marriott, 1955). In view of the fact that plant introduction in arid and semi-arid New South Wales over the last 50 years has been unsuccessful, a greater amount of research with the indigenous species was advocated (Whalley, 1970).

Economic aspects were considered to be unfavourable (Millington and Winkworth, 1970) for broadscale sowing of pastures in central Australia, although species were required for degraded areas and favoured sites. Christie (1970) concluded that planting of buffel grass was advisable only on sites where soil moisture or nutrient status was more favourable.

The higher productivity of introduced pastures on mulga soil has been reported (Wilson, 1964, Ebersohn, 1970). Successful plant introduction and pasture development on other soils of semi-arid Queensland (Marriott, 1955; Purcell, 1964, 1965; Humphreys, 1967; Bishop, 1969) demonstrate that openings exist in different habitats. Plant introduction aimed at these "open" habitats could be highly rewarding.

A reconnaissance survey in South America and Africa was undertaken in 1966 (Ebersohn 1969) specifically to provide material from similar homoclimates to initiate a comprehensive plant introduction programme for semi-arid north-eastern Australia (especially the mulga zone of south west Queensland.)

RECENT RESEARCH

Plant introduction work has not been organised on a national basis. This paper presents recent research in three regions.

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[a] Blake (1972a) considers this species should be named *Monachather paradoxa*.

[b] Blake (1972b) considers this species should be named *Thyridolepis mitchelliana*.

Western Australia

Two reseeding exclosures were set up near Gascoyne Junction (long. 115.5°E, lat. 25°S. mean annual rainfal 200 mm) as no appreciable regeneration of indigenous species had occurred even after 5 years exclusion of grazing animals. Although within the mulga zone, neither site contains mulga trees; other *Acacia* spp are present at low densities, e.g. *A. victoriae* and *A. eremeae*. A shrub layer mainly of *Kochia* spp was present before these lands became degraded. Perennial grasses such as *Danthonia bipartita, Eragrostis setifolia* and *Eriachne helmsii* were once present, and have been replaced by less desirable species such as *Eriachne aristidea* and the annual *Aristida contorta*.

A mouldboard plough was used for seed bed preparation, and a slow release fertiliser was applied to the furrows. Indigenous and exotic grasses and shrubs were sown in the rows.

Preliminary results rank the best species as Molopo buffel (introduced group) and *Kochia polypterygia* (indigenous group). Biloela, Gayndah, Nunbank and West Australian buffels, and *Cenchrus setigerus* germinated satisfactorily. Of the indigenous species planted *Enchylaena* sp., *Kochia georgei, K. aphylla* and *Rhagodia gaudichaudiana* gave good germination.

Northern Territory

Research on different aspects of plant introduction has been in progress for a number of years. A summary of this work is outlined.

Since 1956 seed of 285 perennial grasses, browse shrubs and trees has been introduced for initial screening and seed increase at Alice Springs. Selected plants were then assessed for yield and in persistence trials using irrigation for establishment. Four strains of *Cenchrus ciliaris* and one of *Panicum antidotale* have been outstanding and gave higher yields than the naturalised *C. ciliaris* growing in the Alice Springs area. Ease of establishment and ability to spread from the original rows need study (Millington and Winkworth 1970).

Germination and establishment of exotic perennial grasses in soils of low fertility in an arid climate were investigated (Winkworth, 1964, 1971). Pot trials showed that establishment would be severely hampered without the addition of phosphate. A field trial showed that dormant seed of *C. ciliaris* retained some viability even after 4 years burial.

Range introduction of selected plants over several years throughout the Alice Springs and Barkly Tablelands districts was reported by Albrecht (1970). Preparation of a seedbed and improving rainfall infiltration by contour furrowing and pitting were found to be most important for establishment. Pasture establishment occurred in years of above average rainfall, and sown areas had yields several times greater than the surrounding untreated areas in drier years.

Queensland

During 1967, a nursery was established at the Charleville Pastoral Laboratory for preliminary screening and seed increase of introductions. Most of the accessions were collected in 1966 (Ebersohn, 1969). A site for small sward evaluation of introductions was established in 1969. The soil, a non-eroded red earth (Gn 2.11) is typical of much of the mulga forest country east of the Warrego River (Isbell et al, 1967).

Introductions, mostly as seed, each in 42 m^2 plots (5 × 10 yds) were planted in 1969, and qualitative observations have been made on a total of 43 lines over the last 2½ years. Those considered to have some potential in the zone are listed in Table 1.

TABLE 1
Preliminary evaluation of introduced plants on a mulga habitat with a red earth soil at Charleville

		High potential in this environment	
		Annual	Perennial
Grasses:	*Anthephora pubescens*	—	CPI 43713/4
	Cenchrus ciliaris	—	Q 10077
	Cactyloctenium giganteum	Q 10091	—
	Eragrostis curvula	—	CPI 30379 CPI 30380 CPI 33944
	Schmidtia bulbosa	—	CPI 43715/6
	Moderate potential in this environment		
		Annual	Perennial
Grasses:	*Anthephora hermaprodita*	Q 9138 Q 9838	
	Cenchrus ciliaris	—	Q 10087
	Cenchrus pilosus	Q 9142	
	Chloris gayana	—	Q 10060
	Dactyloctenium sp.	—	Q 10878
Legumes:	*Stylosanthes mucronata*	—	CPI 40615
	Stylosanthes viscosa	—	Q 10042

The perennial species with high potential, shown in Table 1, have wide scale application as pasture species. *Anthephora pubescens* and *Cenchrus ciliaris* have relatively high palatability, *Schmidtia bulbosa* and *Eragrostis curvula* have low palatability. *A. pubescens* and the *E. curvula* lines are more frost tolerant. *E. curvula* seedlings seem to be the most hardy; and mature plants the most free seeding, but older plants of C.P.I. 30379 seem to lack vigour. *S. bulbosa* is the most common 'weed' around the site. Seven species of moderate potential, shown in Table 1, have made reasonable growth,but have weaknesses, e.g. poor frost tolerance, or are of low priority, e.g. legumes.

Exotic annual grass species may be useful for initiating secondary succession by colonising bare or scalded areas of soil (Ebersohn, 1969). Annual grasses can establish on less rainfall and can produce more dry matter than perennial grasses over a season. Meeuwig (1970) showed that plant and litter cover significantly increased the infiltration of rainwater into soil. Plant litter also traps and holds seeds, and small amounts of windblown soil. As a result of these factors the microenvironment is enhanced by the litter and becomes more suitable for germination and establishment of slower growing perennial species. Giant button grass (*Dactyloctenium giganteum* Q 10091) showed most promise of the annual grasses tested.

During autumn 1971, a plot of *Neurachne mitchelliana* was established; and during late winter 1971 several introduced and indigenous species, including *Danthonia bipartita, Eragrostis eriopoda, Aristida armata* and *Eragrostis curvula* C.P.I. 30380 were planted either as seed or transplants. All perennial grasses that had produced a significant amount of dry matter were harvested in June 1972. Herbage was weighed fresh and samples were taken for moisture content determination.

Table 2 shows the superior yield from introduced species for both age groups of plants. Further evaluation, including grazing trials, will be necessary to determine the most suitable species or species mixture.

DISCUSSION

Evidence presented shows that both exotic and indigenous species can contribute to herbage productivity in the various mulga environments. Only in the Northern Territory has research in this field been in progress long enough for practical recommendations to be made. Pastures which could be established, with the aid of seed bed

TABLE 2

Presentation yield of introduced and indigenous perennial grasses grown under natural conditions on a mulga habitat with a red earth soil

Species	Introduction Number	Yield (kg D.M./ha)
(a) Established 12 months		
Schmidtia bulbosa	CPI43715	5,450 (105)*
Anthephora pubescens	CPI43713	3,840 (95)
Cenchrus ciliaris	Q 10077	3,040 (39)
Eragrostis curvula	CPI30379	1,440 (21)
Neurachne mitchelliana	**	530 (101)
(b) Established 11 months		
Eragrostis curvula	CPI30380	2,740 (51)
Eragrostis curvula	CPI33944	1,240 (33)
Aristida armata	**	1,180 (44)
Danthonia bipartita	**	400 (16)
Cymbopogon obtectus	**	180 (30)

* Number of plants contributing to yield.
** Indigenous species used as standards.

preparation and water harvesting showed the greatest advantage over untreated native pastures during dry years, when they would be of most use (Albrecht, 1970). Initially the establishment of productive perennial grasses will enable properties to become less vulnerable to seasonal drought rather than to increase the number of stock. At certain times of stress, small areas of high quality forage would be of considerable benefit (Williams, 1961). On a long-term basis a small area would also provide cheap seed for further sowing.

The Western Australian work, concerned mainly with the revegetation of over grazed and somewhat eroded sites has been in progress for only a short time, so its wide or even small scale feasibility is not yet known.

In Queensland, one annual exotic grass (for initiating secondary succession), and several perennial grasses show considerable promise. Preliminary evaluation suggests that, if these perennial species established on sites with better soil moisture or fertility, then natural spread would eventually occur on other areas.

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