REGIONAL PASTURE DEVELOPMENT AND ASSOCIATED PROBLEMS III QUEENSLAND

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ABSTRACT

The present state of tropical pasture technology in the high, medium and low rainfall areas of Queensland is summarised. It is concluded that species, establishment fertilizer knowledge and management techniques are adequate for immediate needs in the high rainfall areas. In the medium rainfall areas the largest plantings have been carried out on the fertile brigalow and gidyea soils. Plantings are mainly pure grasses as there is a lack of suitable legumes. This is especially so on the heavy soil areas of central and southern Queensland—the basalt downs areas and the brigalow and gidyea soils. There is also a lack of legumes in the so-called dry tropics where, however, Stylosanthes *spp. are showing considerable promise.*

It is concluded that much greater attention should be given to understanding the native pasture ecosystems, especially in the medium and low rainfall areas.

INTRODUCTION

In a similar paper, Humphreys and Marriott (1963) stated that of 146 m ha of grazing lands in Queensland only 0.75 m ha had been sown to pasture by 1956-57 and 1.052 m ha by 1961-62. This had increased to 1.45 m ha by 1968 (Anon. 1968) whilst the latest available estimate (Lee 1974a) is 3.48 m ha in June 1974. The 1974 figure represents only 8.7% of the potential area of 40 m ha suitable for development to sown pastures (Ebersohn and Lee 1972) and includes approximately 0.5 m ha of Townsville stylo (*Stylosanthes humilis*), much of which is naturalized rather than sown. The acceleration in rate of planting which took place up to 1972 (Figure 1) reflects the increasing confidence of landholders in the usefulness of the current tropical pasture technology. In 1973-74 however, there was a reduction of 50% in

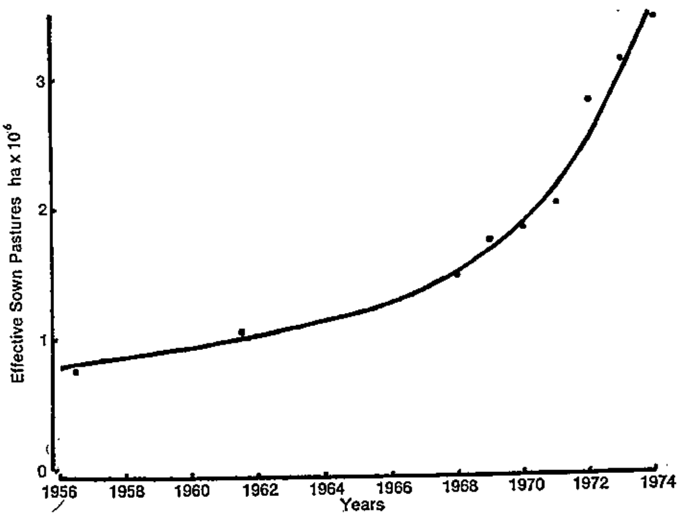

FIGURE 1

The progressive increases in areas of effective sown pastures in Queensland.

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new plantings (144,000 ha) over the previous year (Lee 1974a). This is attributed to both the economic conditions prevailing at the time and an excessively wet season over most of Queensland.

It is proposed to discuss the State's pasture development under three headings (a) high rainfall areas (> 750 mm rainfall in the south rising to > 1,300 mm in the far north) (b) medium rainfall areas and (c) low rainfall areas (< 450 mm in the south rising to < 700 mm in the north-west).

HIGH RAINFALL AREAS

These are the areas that offer the greatest increases in productivity per unit area, although not necessarily per unit cost, when changing from native to sown pastures. Perhaps largely because of this they have received the greatest research input and as a result are the most advanced in pasture technology. However, due to the high cost, the development of pastures in these areas is greatly affected by the economic climate and the availability of adequate capital and incentive.

Species

A wide-ranging suite of legumes and grasses (Hutton 1970) adapted to most sections of the high rainfall area is available. The two major deficiencies of these plants are firstly their restricted cool season growth potential, and secondly the inability of nearly all the perennial legumes to persist under heavy grazing on the wetter low lying situations frequently encountered in the very high rainfall areas. Exceptions are *Desmodium heterophyllum* (Harding 1972), *Lotononis bainesii* (Bryan 1973) and Townsville stylo, all three of which thrive under heavy grazing. Recent releases of cultivars such as Narok setaria (*Setaria anceps*) (Barnard 1972); Makueni guinea (*Panicum maximum*) (Mackay 1974); Belalto centro (*Centrosema pubescens*) (Barnard 1972) and Safari Kenya white clover (*Trifolium semipilosum*) (Mackay 1973) will all have some impact on cool season growth but greater improvement is still required.

Fertilizers

Throughout the high rainfall areas establishment fertilizer requirements are well understood for most situations with phosphorus and molybdenum being almost universally recommended. The other minor elements are of more local use; they are, however, especially necessary within the wallum areas (Bryan 1973). Details of nutrient requirements for other areas have been given by Teitzel and Bruce (1970) for the wet tropical coast and Kerridge, Andrew and Murtha (1972) for the Atherton Tablelands. Far less is known of maintenance fertilizer requirements and especially the role of potassium (Hall 1971). Much more work is needed in this field, particularly in view of recent substantial increases in fertilizer prices. The development of various diagnostic tools (Andrew 1968) for determining nutrient adequacy has not been highly satisfactory as yet.

Management

At present intensities of use, knowledge of grazing management requirements for sown pastures is adequate with continuous grazing being widely practised on beef properties. Rotational grazing is generally used on dairy pastures (Ebersohn 1969) but this appears to be associated with the production responses of dairy cows more than the requirements of the pastures.

Recent work has shown that the major factor affecting production and stability of perennial tropical legume/grass pastures is stocking rate (Bryan and Evans 1973; Jones 1974; Walker pers. comm.). This effect is accentuated under wet conditions on areas of poor drainage. The wet tropical coast, the solodic soils of the Mackay coast and the heath and lower areas of the wallum all have problems in legume persistence under wet conditions and heavy grazing. Under lenient use the problem is minimised but at Mackay once stocking rates exceed 0.6 ha^{-1} beast the standard legume, Siratro (*Macroptilium atropurpureum*) rapidly disappears (Walker pers. comm.). On the wallum, legumes are rarely planted on the lower situations and pangola (*Digitaria decumbens*)—bag nitrogen is the standard pasture although white clover (*Trifolium repens*) can be regularly introduced to improve cool season/ spring production (Wright 1973).

On the wet tropical coast the approach taken to this problem has been to recommend that as much as one quarter of the property be planted to pure grasses fertilized with bag nitrogen (Teitzel, McTaggart and Hibberd 1971). Basilisk signal grass (*Brachiaria decumbens*) and pangola are the standard species used. These pure grass areas are then used to relieve the pressure on the grass/legume pastures in stress periods, which occur in the middle of the wet season when the soil becomes too boggy to carry full stock numbers, and in the cool season when stock requirements exceed pasture growth and excessive grazing of the legumes can occur.

MEDIUM RAINFALL AREAS

These areas include the brigalow and gidyea soils, the heavy and generally self-mulching clays, and the so-called dry tropics north of Mackay whilst the remaining southern areas can be considered as east or west of the Great Dividing Range. The problems differ in some areas and where necessary will be discussed separately. Along the more humid margins much of the technology of the wetter areas will be applicable, especially on the lighter textured and more acid soils.

Brigalow—gidyea—other heavy soil areas

The majority of the pure grass pastures of Rhodes grass (*Chloris gayana*), green panic (*Panicum maximum* var. *trichoglume*) and buffel grasses (*Cenchrus ciliaris*) have been planted on the initially fertile brigalow and gidyea soils although not all of the latter receive greater than 450 mm rainfall. Development of the brigalow areas has received considerable impetus from injection of government finance, but this development, as is that of the gidyea country, is now nearing completion. Residual areas and outliers, however, will continue to be developed privately for some years.

Following initial development these areas give rise to highly productive pastures (Coaldrake and Smith 1967; Coaldrake *et al.* 1969; Round 1966) and once the timber has been removed the only pasture input required is the cost of the seed and its distribution. The initial situation can be regarded as highly satisfactory and, apart from problems of regrowth control, there is little further research requirement for this period of the pasture's life. We do not know, however, what the productive life expectancy will be; nor are the means of restoring fertility to these lands available if and when a decline begins to reduce the levels of production.

Establishment fertilizers are not required and although establishment techniques are generally satisfactory, establishment problems can be encountered on lighter more open scrubs on the arid margins of the brigalow areas, on some heavy flooded clays in the MacKenzie/Isaacs River system (Anderson 1970) and on heavier gidyea soils (Lee 1974b). Maintenance fertilizer requirements are not known but some brigalow soils are initially low in available phosphate (Isbell 1962). The results in this area have been achieved with little in the way of research input due mainly to the high initial fertility of the soils involved and the ready adaptation of the grasses.

There are also areas of heavy textured and generally more alkaline soils in southern and central Queensland outside the brigalow/gidyea areas. These occur within the speargrass areas as well as the extensive areas of the basalt downs soils of the Darling Downs and the Central Highlands. These areas and the brigalow/gidyea have two problems in common. Firstly, considerable difficulties can be experienced in the establishment of small seeded grasses and, secondly, readily adapted long lasting legumes are not available. The establishment problem is essentially one of rainfall reliability (Leslie 1965). In extended wet periods most grasses will establish but in average to drier years establishment is unreliable. Past work (Leslie 1965; Rickert 1973) while substantially increasing establishment percentages has been insufficient, under poor conditions, to make the difference between success and failure.

The main suite of tropical legumes is not adapted to these soils and only lucerne (*Medicago sativa*), leucaena (*Leucaena leucocephala*), and the medics (*Medicago scutellata, M. truncatula* and *M. littoralis*) have shown any promise to date. Lucerne will generally grow well on most of these soils for several years but persistence is lacking, bloat is a problem and some competition with associated grasses for moisture occurs in dry times (Cameron 1973). However it has adequate persistence for use in rotation pastures on cultivation land and will probably always have a role to play on these areas. A more persistent grazing tolerant type such as that offered by the creeping rooted forms (Bray 1970) would vastly increase its value on these soils but bloat will remain a bogey to landholders, especially those with cattle, where single animal losses are more expensive.

The medics are receiving increasing attention (Russell 1969; Jones and Rees 1972) and are being more widely planted in the southern parts of the State, especially south of the Toowoomba-Roma railway line. Sufficient winter rainfall is received to assure good growth at least one year in three with some growth in one other year. This could be sufficient to ensure a nitrogen input which would be adequate to maintain stands of sown grasses. Presently these are showing signs of instability in some areas (Wylie and Bourne 1975). Leucaena has performed well at both Brian Pastures (Cooksley 1974) and Brigalow Research Stations (Wildin pers. comm.), and at least has the ability to provide a valuable protein supplement from pure plantation stands. Some minor problems still exist with its establishment, management and toxicity.

Southern areas (east of Dividing Range)

This section is essentially the southern half of the spear grass zone (Shaw and Bisset 1955; Isbell 1969) and is the section within the medium rainfall areas which has received the greatest input of research effort. A considerable understanding now exists of the characteristics of the native black spear grass (*Heteropogon contortus*) pastures and the scope and role of sown pastures (Addison 1970). Much of the technology from the high rainfall areas is also adapted to this section with Siratro, lotononis and Townsville stylo (Shaw 1961) having all found useful niches. The newer species of *Stylosanthes* also offer prospects of success within the area, although they are as yet relatively untested. The grass species with Rhodes grass, green panic and the buffel grasses, are also adequate, although, as in the high rainfall areas, ability to take advantage of the cool season rainfall would be of value. Sown pastures can give high livestock performance ('t Mannetje 1970) although on many properties for some time to come their role may be to supplement the quality of grazing available from the black spear grass pasture especially in autumn, winter and spring (Scattini 1966).

There are also large areas of old infertile tertiary soils in central Queensland (Gunn *et al* 1967; Story *et al* 1967; Speck *et al* 1968) where presently no pastures are being planted. These, however, offer considerable scope for development and much of the "dry tropics" technology will be of use. It is likely that the newer *Stylosanthes* species in particular will find a role on these soils. Results from the similar solodic soils in south Queensland will also be applicable to some situations. The need for research on these areas is now becoming urgent as the more progressive landholders complete the development of their better class soils and start to consider the poorer areas.

Areas north of Mackay (dry tropics)

North of Mackay the wide range of situations encountered can be collectively discussed under this heading. These are areas of extensive holdings, least development and least sophistication in livestock production. They are collectively characterised by infertile soils, poorer types of native grasses, especially in the far north, and a short, concentrated, but reasonably reliable, rainfall season. It is certain that much simpler and more extensive forms of land use and improvement will prevail in these areas for a long while and much less intensive pastures will be developed. In many ways the problems of the dry tropics are the same whether they occur in northern Western Australia, the Northern Territory, or Queensland, and these problems will be more complex than they are in the more favoured areas because of the higher costs of development and the lower ceilings on anticipated returns.

To date Townsville stylo has been the main legume used in the areas and has probably now been sown or has naturalized on most areas to which it is readily and stably adapted. Verano Caribbean stylo (*S. hamata*) is a recent addition which has yet to make its mark. However, extensive legume introduction testing is under way and the *Stylosanthes* as a group are showing considerable promise. It is considered likely that they will provide plants adapted to many of the situations encountered (Burt *et al* 1974 and Burt *et al* 1970). The grass situation is far less clear. The native perennial species appear unable to form a stable mixture with Townsville stylo in many situations, especially where fertilizer is necessary for its growth and weedy species such as *Sida* and *Hyptis* spp. rapidly invade such stands (Miller pers. comm.). *Urochloa mosambicensis* is one species which may prove a useful companion for the *Stylosanthes* (Gillard 1971). The soils of the area are most infertile and the fertilizer requirements are as yet not completely known although some progress has been made (Crack 1971; Jones and Crack 1970; Jones 1973).

Southern areas (west of Dividing Range)

The medium rainfall areas contain other situations than those already discussed. The solodic soils of southern Queensland (Russell 1967; Leslie, Mackenzie and Glasby 1967), the eastern margins of the mulga lands and the poplar box (*Eucalyptus populnea*) woodlands (Paull 1972) all suffer from the lack of readily adapted and widely planted legumes, although the medics are playing a role on many of these soils (Russell 1969). Most plantings at this stage, however, have been pure grasses with a rapid decline in productivity being noted (Wylie and Bourne 1975). Fertilizers, especially phosphate, are generally required (Paull 1972, Russell 1966) with a minor element requirement also on the solodic soils. As well there are the traprock and granite soil areas of the southern border region. It is on these that temperate species find their greatest use (Clarkson 1970).

LOW RAINFALL AREAS

The boundary of the arid zone in Queensland is the 508 mm isohyet in southern Queensland, 635 mm in central Queensland and 762 mm in north-western Queensland (Perry 1970). In the present discussion, however, slightly lower limits have been used (450 mm rising to 700 mm) to allow all areas where major pasture plantings have taken place to be dealt with within the section on medium rainfalls. This leaves those sections where research is essentially of an ecological nature dealing mainly with development of management strategies to stabilise resources and production. Included here are the mulga (*Acacia aneura*) lands, the Mitchell (*Astrebla* spp.) grasslands and the spinifex (*Triodia* spp.) areas.

The problems remain much as outlined by Humphreys and Marriott (1963), but much more is now known of the basic ecosystem processes especially in the mulga lands where research has concentrated (Burrows 1973; Beale 1973; Silcock 1973). Considerable basic data are now available and Roberts (1973) has summarised the future research needs in the mulga lands. The next stage will be to check the effectiveness of present knowledge in the real property situations. The development of adapted improved species has not progressed far enough for an assessment of their likely potential to be made, although some buffel grass has been planted; but it is suggested that plants capable of establishment in locally favourable sites will eventually colonise larger areas and their identification and development is worth pursuing (O'Donnell, O'Farrell and Hyde 1973).

The current knowledge of the Mitchell grass areas has been reviewed by Orr (1975) who points to the general stability of these areas but to a lack of understanding of the degradation and regeneration processes under varying stocking pressures. Nothing has been attempted as yet within the spinifex areas.

CONCLUSIONS

The overall technology for the high rainfall areas is adequate for immediate needs but there are many aspects which still require refinement to achieve the maximum production potential at least cost (Hutton 1974). There will also continue to be problems of a local nature which require attention. In the main, however, the immediate emphasis for future research should be the medium rainfall areas. Here, despite widespread planting, the stability of the pure grass pastures in the absence of a suitable legume gives grave cause for concern.

Despite the spectacular increases in productivity that can be achieved in the wetter areas by far the most livestock are produced in the medium and low rainfall areas. Many of these come from native pastures. There is a need to know much more about the ecology and stability of these as substantial areas will remain as native grazing for many years. Our research input into native pastures has been badly neglected for a long while and a concerted effort should be made to make up the leeway.

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