COMMERCIAL USAGE OF IMPROVED PASTURES IN THE AUSTRALIAN TROPICS

J.H. WILDIN*, A. CAMERON** and D. PRATCHETT+

* Department of Primary Industries, Rockhampton, Queensland. 4700.
** Department of Primary Production, Darwin, Northern Territory. 5790.
+ Department of Agriculture, Kununurra, Western Australia. 6743.

ABSTRACT

Tropical Australia comprises 298 million hectares of which only 29 million hectares (9.6%) are suitable for cultivation or intensive improved pasture development. In 1984 the area with improved pastures was 1.41 million hectares of which Queensland had 1.36 million hectares. The beef herd in tropical Australia in 1984 was 6.4 million head of which 66%, 22% and 12% were in Queensland, the Northern Territory and Western Australia respectively. This reflects in part the distribution of potential cropping lands and the extent of improved pasture development which is constrained by factors of climate, topography, soils and location. The potential for improved pasture, its extent and value, as well as its development in different agro-ecological zones are discussed.

Improved pastures can substantially increase beef production which is presently limited by the low nutritional value of native pastures in the dry season. Reasons for the comparatively small area planted to improved pastures can be quite varied and difficult to assess. Economic and management constraints are likely factors restricting adoption. Future prospects are discussed and some suggestions are offered for future research and extension.

INTRODUCTION

Australia has 298 million hectares of land north of the Tropic of Capricorn. This vast area is characterised by wide variations in climate, topography, soils and vegetation. The pastoral industry, based on native pasture resources, has been viable without government subsidies. Sheep for wool production is important in the drier interior where there is little prospect for sown improved pastures. Beef cattle are concentrated on the coastal and sub-coastal zones where improved pasture is expanding. Dairying is important in favourable locations on the eastern coast where the infrastructure is well developed and native pastures have been replaced with cultivated improved pastures. Cropping has followed pastoral development in central Queensland and is now replacing sown pastures on better arable land.

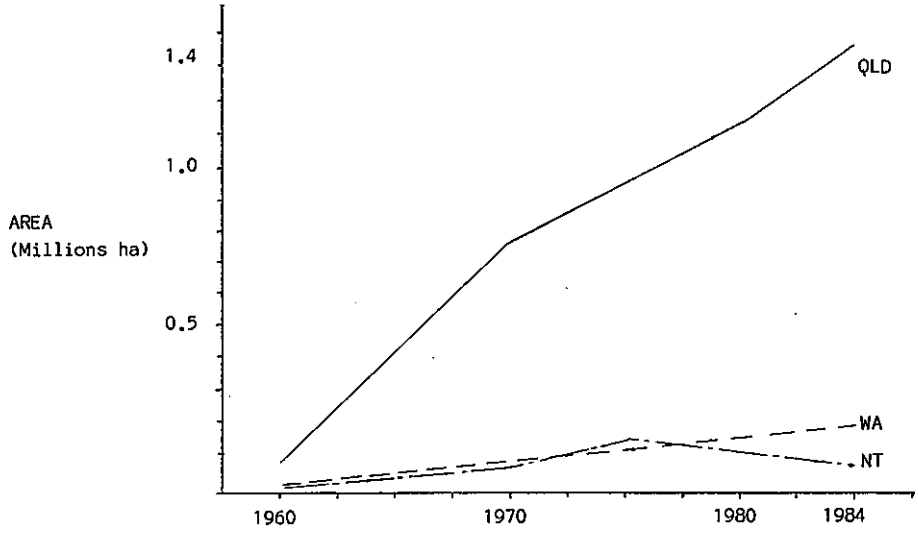
Beef production is the major livestock industry. However, poor nutritional quality of the native pastures in the dry season (Winks 1984) limits the efficiency of beef production in northern Australia. Significant expansion of this industry will rely on better adapted cattle and better nutrition based on adapted improved pastures. Commercial adoption of improved pastures in the Australian tropics was almost non-existent before 1940. Government land development schemes after World War II gave initial impetus to commercial development and expansion was significant from 1960. Since then, the number of

introduced pasture plants, evaluated and released in northern Australia for commercial use in different agro-ecological zones, have increased significantly. The range of new pasture plants available allowed a selection for the development of improved tropical pastures.

This paper examines the potential for improved pastures in the Australian tropics , their extent and value and their commercial usage in the different agro-ecological zones for beef production. The adoption constraints and prospects for the future are also discussed.

POTENTIAL FOR IMPROVED PASTURES

Suitable land for intensive development of improved pasture in the Australian tropics can be defined by climate, topography and soils. With respect to climate, the 500 mm rainfall isohyet is a simple arbitrary inland limit to successful pasture development. If cultivation is a pre-requisite for intensive pasture development, then the potential cropping lands based on climate, topography and soil features would give an estimate of the minimal area suitable for improved pastures. Of the 298 million ha of land north of the Tropic of Capricorn, only 29 million ha (or 9.6%) are suitable for cropping or intensive improved pasture development according to Davidson (1965). This relatively small proportion of suitable land is verified by the estimates of Weston et al. (1984) for cultivated forage sorghum in Queensland where 13 million ha is marginally to well adapted for growing this crop. Of this area only about 7 million ha are north of the tropics. However buffel grass which in not restricted to arable land is adapted to a wide area of tropical Queensland (Weston et al. 1984) indicating that arable land is only a very conservative estimate of the potential area for improved pastures.



Compiled from data supplied by the Australian Bureau of Statistics.

FIGURE 1
The cumulative area of improved pastures in the tropics of Queensland, the Northern Territory and Western Australia from 1960 to 1984

The 29 million ha estimated as suitable for intensive improved pastures in the Australian tropics does not include further areas suitable for improvement by oversowing the native pastures with adapted improved species. Both legumes and grasses could be oversown without a cultivated seedbed. This additional area may account for at least another 12 million ha extending the total area with some improved pasture potential to greater than 40 million ha.

There is competition from other forms of land use for the available arable land. Mining, national parks, state forests and aboriginal reserves take up a portion of this land, but cropping is likely to be the major recurring competitor for intensive improved pasture lands.

EXTENT AND VALUE

The cumulative area sown to improved pastures in the tropics of Queensland, the Northern Territory and Western Australia since 1960 is shown in Figure 1. According to the data of the Australian Bureau of Statistics the total area sown in the Australian tropics up to 1984 was 1.41 million ha. This was only 4.9% of the potential arable area of 29 million ha.

Improved pastures on beef properties can be used to supplement or complement native pastures. Improved pasture will hold its nutritive value longer into the dry season and extend the period of liveweight gains. The value of such pasture is usually expressed in terms of higher stocking rates and higher cattle liveweight gains per year than those of native pastures. It is difficult to estimate the net value of improved pastures in the Australian tropics. However, a conservative estimate of the net value of improved pastures in the year 1984/85 was $54 million (Table 1).

TABLE 1
An estimate of the net value of improved pastures in the Australian tropics in terms of beef value in the year 1984/85

	$ Value of improved pastures in tropical Australia	
	Native Pastures	Improved Pastures
Area (million ha)	1.41	1.41
Carrying capacity (ha/animal)	5	2
Range:	(4-40)	(0.5-3.0)
Number of cattle	281800	704500
Liveweight gain/year (kg)	100	140
Value/kg (c)	80	80
Beef value/year (million $)	24.5	78.9
Net value of improved pastures	$54.4 million	

Benefits of improved pastures are not only confined to higher stocking rates, extension of the period of quality forage on offer in the dry season and increased production per growing animal each year. Higher reproductive rates, earlier turn-off of fattening cattle and

improved efficiency of labour and cattle management are important benefits which are difficult to put into monetary terms. The benefits of pasture improvement in northern Queensland are applicable to the extensive properties in the dry tropics of all of northern Australia.

The experiences at Wrotham Park and Woodhouse with adapted stylos (Edye and Gillard 1985) provide a practical example of the effects of pasture development and improved management on increasing the efficiency of beef cattle production in the normally extensive enterprises of northern Australia. Increased efficiency of production was achieved at Wrotham Park with improved pastures occupying only 1.6% of the total property area. Edye and Gillard (1985) concluded that the expansion of improved pasture development in northern Australia is necessary not only to contain production costs through greater efficiency, but also to obtain a greater concentration of cattle and herd control to meet the requirements of the national scheme to eradicate brucellosis and tuberculosis by 1992.

The extensive pasture improvement programmes as at Wrotham Park involve the augmentation of the native pasture by oversowing with adapted legumes and minimal disturbance of the native vegetation as practised in the dry tropics of northern Australia. Augmentation of native pasture may also involve special improved pastures to supplement and/or complement the native pasture as with ponded para grass or leucaena (Miller et al. 1986). These special pastures completely replace the native vegetation. Examples of each type of pasture improvement are now considered for each agro-ecological zone of the Australian tropics.

COMMERCIAL USAGE OF IMPROVED PASTURES

Clearing trees was an integral part of any beef property development, although most widespread in the south-east tropics. The main objective of tree clearing was to increase native pasture production or to prepare for the establishment of improved pastures. Prior to 1960 tree clearing was mainly carried out by manual means such as clear felling of rain forests or by ring barking. Improved pasture species prior to 1960 were mainly grasses for sowing into cultivated seedbeds or broadcasting into ashbeds. The commercial legumes included the naturalised Townsville stylo (Stylosanthes humilis), Centro (Centrosema pubescens), Schofield stylo (Stylosanthes guianensis) and phasey bean (Macroptilium lathyroides). The area sown to improved pastures in the tropics was minimal up to 1960 but the use of heavy machinery for land clearing since then gave impetus to improved pasture development. The government sponsored Fitzroy Basin (Brigalow) Land Development Scheme initiated large scale improved pasture development in the Australian tropics.

Brigalow Scrub

The brigalow scrubs were developed by pulling a heavy chain between large bulldozers, burning the dry material in the following spring-summer then broadcasting seeds of buffel grass (Cenchrus ciliaris), green panic (Panicum maximum var. trichoglume) and Rhodes grass (Chloris gayana) over the ashbed. The resultant pasture was capable of carrying 1 beast/ha for several years.

Most of the brigalow in the tropics was developed after 1967 as Area III of the Fitzroy Basin (Brigalow) Land Development Scheme. The area of sown improved pasture in the northern brigalow area increased from a negligible area in 1961 to about 0.6 million ha in 1981 and for the same period beef cattle numbers increased from 0.6 million to 1 million (Lloyd 1984). In the virgin state, brigalow has an estimated carrying capacity of one beast to 14 ha but when developed to ash sown improved pasture the stocking rate rises to around 1:2.5 ha and fat cattle are turned off at an earlier age (Lloyd 1984).

Buffel grass is the best adapted species although green panic and Rhodes, while not as drought resistant, are also successful. Silk forage sorghum, Seca stylo (Stylosanthes scabra) and leucaena (Leucaena leucocephala) are now additional species being established on cultivated areas.

Coastal and Sub-coastal Central Queensland

The non-brigalow areas from Rockhampton to Proserpine have been developed to some extent to improved pastures. Again most of these developments have taken place since 1960. On the open downs, cropping is expanding rapidly but improved pastures have been developed using mainly Biloela and Nunbank buffel with limited success. More recently silk sorghum and purple pigeongrass (Setaria incrassata) have been the principal species sown because their relatively large seeds can be drilled into moist soil like a crop to promote establishment.

The heavy clay soils to the north and south of Rockhampton have been planted to buffel, Rhodes grass and green panic with very little success. Most of these areas are growing naturalized Angleton grass (Dichanthium aristatum) capable of withstanding stocking rates of 1:1 ha which is 3-5 times higher than that for speargrass (Heteropogon contortus). Other pasture species becoming popular are Hamil grass (Panicum maximum), Koronivia grass (Brachiaria humidicola) and the legumes Glenn jointvetch (Aschynomone americana) and leucaena.

The coastal woodlands or black speargrass areas were planted to Townsville stylo in the past following clearing and ploughing. On the sandy surfaced duplex soils, Townsville stylo fertilized with superphosphate was very productive until the disease anthracnose (Colletotrichum gloeosporioides) took its toll. Verano (Stylosanthes hamata) and Seca stylo are now being used extensively. Other species which are adapted are Siratro (Macroptilium atropurpureum), Wynn Cassia (Cassia rotundifolia) and leucaena in wide rows and managed as trees (Wildin 1985a). The grasses sown included guinea grasses (Panicum maximum), setaria (Setaria sphacelata), pangola (Digitaria decumbens), signal grass (Brachiaria decumbens) and Koronivia grass. Bothriochloa pertusa has become naturalized in large areas of the grazing lands. In 1984 there was an estimate of 200 000 ha (Anning pers. comm.) of B. pertusa between Bowen, Collinsville and Charters Towers.

The run-on areas, where suitable, have been developed to ponded pastures especially para grass. This species is well adapted to these conditions when banks are constructed on marine plains to hold run-off water. There are 25 000 ha of ponded pastures in Central Queensland

(Wildin 1985b). These pastures have increased beef production by about tenfold from that of its natural state, but more importantly they have provided high quality green pastures in the dry season.

Wet Tropical Coast

The dense rainforest area receiving in excess of 2000 mm of rainfall each year have been developed by tree clearing with heavy machinery, burning the windrows, ploughing, fertilizing to correct deficiencies and seeding with adapted pasture species. These are mainly guinea grass, para grass, signal grass, with centro (Centrosema pubescens), Hetero (Desmodium heterophyllum) and Cook stylo (S. guianensis). The work of Teitzel and Middleton (1983) encouraged rapid development of those areas which were not used to grow sugar cane and bananas. In these high rainfall areas, grass pastures heavily fertilized with nitrogen are very profitable when beef prices are bouyant.

In the Northern Territory, the area around Darwin would grow similar pastures if fertilization was carried out to correct major deficiencies. With little fertilizer the most adapted species are gamba grass (Andropogon gayanus), Calopo (Calopogonium mucunoides), Verano and Seca stylo and the new Centrosema pascuorum cvv. Bundy and Cavalcade.

Semi-arid Tropics

The semi-arid tropics occupy the largest area suited to improved pasture development in Australia, extending across north Queensland and the Northern Territory to the north of Western Australia. The development to improved pastures in this region has been based essentially on the relatively low cost technology of seeding adapted stylos into burnt native pastures and using minimal superphosphate fertilizer. Stocking rate is increased to encourage stylo establishment. The philosophy and technology of Edye and Gillard (1985) on stylo/native grass pasture development and other means of obtaining improved pasture inputs to augment the native pastures (Miller et al. 1986) can be applied across the semi-arid tropics.

The rate of improved pasture expansion in Queensland since 1970 has been around 65 000 ha/year (Fig. 1). Most of this development has been within the semi-arid tropics. In the Northern Territory the area sown to improved pastures (mainly Townsville stylo) reached its peak in 1974 at 138 000 ha and the effective area has been declining since. Only 36 000 ha remained in 1984.

The most successful large scale improved pasture enterprise in the Kimberley is the Ord River Regeneration Area, resumed in the early sixties following severe overgrazing by the lessee, and revegetated by the Western Australian Department of Agriculture. The area was cultivated on the contour and sown to a mixture of birdwood grass (Cenchrus setiger), buffel (C. ciliaris) and Kapok bush (Aerva javanica). The area treated totalled 150 000 hectares, most of which is now being grazed by beef cattle under controlled conditions (Fitzgerald 1968).

Similar work to that carried out on the Ord is being undertaken on the Fitzroy River frontage in the west Kimberley. South of Broome, buffel and birdwood pastures have been established on 5000 ha mainly by aerially broadcasting the seed. Eight stations had 10 000 ha of Townsville stylo by 1973, but little of this has persisted. Some 5000 ha were aerially sown to Verano in 1982 with success. Verano has been observed establishing beneath clumps of spinifex (Trioda spp.) and subsequently replacing it. On the Ord River Station 1000 ha of spinifex country were oversown in the 1984/85 summer to Verano to monitor its effects on spinifex, on a large scale.

Irrigated leucaena pastures

Irrigated leucaena/pangola pastures under experimental conditions at Kununurra in Western Australia have given annual liveweight gains of 200-250 kg/beast at stocking rates of 4-5 beasts/ha. Already 70 ha have been established commercially at Kununurra. A very intensive irrigated system of 40 ha of pure leucaena at Bowen, Queensland, presently used for seed production, aims to utilize this system for fattening cattle inoculated with the DHP detoxifying rumen bacteria. A 50 ha irrigated leucaena pasture is being established on the banks of the McKenzie river in Central Queensland as a trial area for future expansion into intensive beef fattening. Intentions to establish similar schemes have been expressed by beef producers who have suitable irrigation lands along the Fitzroy and Burdekin rivers of Queensland.

CONSTRAINTS TO ADOPTION

The constraints to the adoption of improved pasture development are related to economics or to the grazier's perception of its benefits in relation to other commitments on the property. The incentive to invest capital for improved pasture development will depend on profitable long term returns. This incentive is strongest with freehold land tenure and where infrastructure allows ready cattle marketing throughout the year. Improved pasture sowing is nearly always low on the priority list of works in a property development programme. Essential permanent structures, fencing, water supply, power, herd improvement and woody weed control are usually well ahead of establishing improved pastures.

Adapted pasture species and proven technologies are available for all agro-ecological zones of tropical Australia. However, awareness of this may be relatively low especially in the semi-arid tropics. For ready adoption the "new" technology must be perceived as having substantial benefits, be relatively easy to implement, be compatible with existing management, and be observable on a successful commercial scale. Animal productivity data are essential for the extension effort to highlight benefits. The various state governments and CSIRO have refined technologies and have established successful demonstrations on large scale commercial situations to instill confidence in improved pastures. The extension effort is now more positive and the rate of adoption should rise in the future. However extension research to identify the real constraints to pasture development in the tropics will enhance the success of the extension programme.

FUTURE PROSPECTS AND CONCLUSIONS

Only a very small portion of the potential area for improved pastures has been developed. Prospects for efficient beef property management and increased beef production through improved pastures are very high. While it would not be wise to expand the improved pasture area and the beef cattle population at a rate which adversely affects supply and demand, there is an urgent need to assess the beef production objectives and the attitudes towards improved pastures of individual graziers and those of the beef industry in general. The beef industry should be involved in the assessment of its improved pasture needs, and also assist in extension programmes to promote the development and management of those adapted pastures for the various agro-ecological zones.

Improved pasture development in the Australian tropics has resulted from effective pasture research and extension. More research and extension is needed to achieve a higher adoption rate and a more rapid progress towards the potential beef production of the area. For the cattleman, improved pastures will not only increase the efficiency of production per unit of labour but will also change herd management practices and the herd composition. As well as more and better quality beef from improved pastures, other important benefits include the conservation of the remaining residual native pastures by a reduction in grazing pressure and greater herd control for the eradication of pests and diseases and for breed improvement. Improved pasture therefore warrants a high place on the priority list for property development.

Beef cattle in the Australian tropics is an important industry today. It will be even more important in the northern Australian economy with the expansion of the adapted beef herd through the commercial usage of adapted improved pastures.

REFERENCES

Davidson, B.R. (1965). "The Northern Myth". (Melbourne University Press).

Edye, L.A., and Gillard, P. (1985). In "Ecology and Management of the World's Savannas", editors J.C. Tothill and J.J. Mott., (Australian Academy of Science, Canberra). 303-9.

Fitzgerald, K. (1968). Dept. of Agriculture, W.A. Bulletin No. 3599.

Lloyd, P.L. (1984). In "The Brigalow Belt of Australia", editor A. Bailey, (Qld. Dept. Primary Industries QC84003). 81-96.

Miller, C.P., Wildin, J.H., Cooksley, D.G., Lowe, K.F. (1986). In "Native Pastures in Queensland - The Resources and Their Management", editors W.H. Burrows and J.C. Scanlan, (Qld. Dept. Primary Industries) (in press).

Teitzel, J.K., and Middleton, C.H. (1983). In "The Role of Centrosema, Desmodium and Stylosanthes in Improving Tropical Pastures", editors R.L. Burt, P.P. Rotar, J.L. Walker and M.M. Silvey, (Westview Press, Boulder). 29-42.

Weston, E.J., Harbison, J., Rosenthal, K.M., McCafferty, M.A., and Keleher, V.M. (1984). Qld. Dept. Primary Industries. Bulletin QV84001.

Wildin, J.H. (1985a). Qld. Dept. Primary Industries. Extension Bulletin No. RQR86003.

Wildin, J.H. (1985b). Proceedings of the XV International Grassland Congress, Kyoto, Japan. (in press).
Winks, L.W. (1984). Australian Meat Research Committee Review 45.