Tropical pasture establishment.
11. Producer establishment practices and experiences in north Queensland

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Abstract

Introduced pastures are increasingly sown to improve beef cattle productivity across the north Queensland region. Pasture improvement is heavily concentrated in the south and east of the region in the 750–1000 mm rainfall zone, being related to rainfall reliability, soil suitability and property size and internal subdivision. Sowing techniques range from oversowing small amounts of legume seed into existing vegetation, to forest clearing and complete replacement of the native pasture. Time for the establishing pasture to develop depends on the level of input and the season following sowing; it is usually 3–4 years but can range from 2–8 years. Generally, establishment is not a problem in the north Queensland region and hence is not a constraint to pasture improvement. Some soil disturbance is needed to establish grasses and research has failed to identify legumes suitable for clay soils receiving <1000 mm of rainfall annually.

Introduction

The seasonally dry tropical area discussed in this paper includes the shires of Cook, Aurukun, Burke, Croydon, Carpentaria, Mareeba, Etheridge, Herberton, the northern part of Dalrymple, and Bowen (Figure 1). These shires represent about 80% of the north Queensland region and cover nearly 400 000 km^2. The region has been divided into 4 zones (A-D) to reflect differing rainfall patterns, dominant soil types and soil fertility, and pasture species adaptation. Areas receiving less than 600 mm rainfall suffer a combination of low rainfall and high variability and are considered unsuitable for legume pastures. The wet coastal shires of Hinchinbrook, Cardwell, Johnstone, Mulgrave and Douglas are excluded from this paper since pastures in those shires involve complete replacement of the original vegetation and intensive cultivation and fertiliser inputs. Establishment is assured providing weeds are controlled.

Sown pastures are established on a property to increase both carrying capacity (Graham McDonald, 'Strathmore', Croydon) and per animal productivity (Robert Henry, 'Sugarbag', Mt Garnet), but the relatively small areas sown so far have had little impact on overall productivity in the region. On individual properties improved pastures have resulted in 3-fold increases in stocking rates and in savings through ease of herd management (David Arnold, 'Wrotham Park', Chillagoe). Producer confidence with the available species and in the economic returns means more are developing pasture areas, particularly with legumes.

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Environmental range

Pasture establishment is driven by rainfall. In this region, wet seasons open from north to south but close from west to east. Probable dates of receiving germination rain after 2 sowing dates and then establishment rain in the next 4 weeks are shown for various locations throughout the region (Huda *et al.* 1991) in Table 1. Other climatic data have been derived from McCown (1981; 1982). Pasture species adapted to the

Table 1. Dates of germination rain (at least 35 mm total over 2 consecutive days) and establishment rain (at least 25 mm per week) in the following 4 weeks in north Queensland.

Location	Planting date	Date of germination rain		Weeks with establishment rain	
		50%	70%	50%	70%
Weipa	1 Nov	2 Dec	21 Dec	4	0
	1 Dec	21 Dec	21 Dec	4	3
Laura	1 Nov	12 Dec	23 Dec	1	0
	1 Dec	21 Dec	29 Dec	3	0
Mareeba	1 Nov	11 Dec	26 Dec	1	0
	1 Dec	21 Dec	31 Jan	3	1
Mt Garnet	1 Nov	12 Dec	28 Dec	0	0
	1 Dec	24 Dec	3 Jan	0	0
Georgetown	1 Nov	19 Dec	31 Dec	0	0
	1 Dec	23 Dec	2 Jan	0	0
Charters Towers	1 Nov	26 Dec	17 Jan	0	0
	1 Dec	3 Jan	20 Jan	0	0

Data from Huda *et al.* (1991)

various zones in the north Queensland region are listed in Partridge and Miller (1991).

The 4 zones considered in this paper are shown in Figure 1.

Zone A receives more than 1200 mm of rain annually of which 90% falls between November–April for a median pasture growing season of at least 26 weeks. The probability of receiving any useful rain between May–October is below 10%. Soils are dominated by red earths but extensive areas of mottled yellow earths and grey earths also occur. These are all usually infertile but can carry a dense body of native tall-grass. The soils have been described by Isbell and Smith (1976) and Grundy and Heiner (1991). The vegetation of an area typical of the zone has been described by Neldner and Clarkson (1991).

Zone B receives 1000–1200 mm of rain annually of which >80% falls between November–March; this gives a median growing season of 24 weeks with the expectation of an additional 2 green weeks in the dry season. Soils in the west of the zone are mostly infertile grey earths formed by deposition from watercourses over an almost flat landscape. Frontages along the major rivers are fertile but much of these have been heavily invaded by rubbervine (*Cryptostegia grandiflora*). The major soil in the east of the zone is an extremely infertile red earth on rolling ridges. The land and vegetation in this zone have been described in detail (Anon. 1970).

Zone C receives 750–1000 mm annually of which 80% falls between November–March for a median growing season of at least 22 weeks; a further 4–6 green weeks can be expected in the dry season. Along the summit and to the east of the dividing range the useful effects of dry season rain can be lost through frosts. In the west, the main soils and vegetation are similar to zone B. In the east, there is a mixture of poor to moderately fertile red and yellow earths, fertile volcanics, red texture-contrast soils and granites at an altitude of 600–>900 m. Considerable areas in the south-east have been colonised by Indian couch (*Bothriochloa pertusa*). The land and vegetation in zone C have been described in Perry (1964) and Grundy and Bryde (1989).

Zone D receives 600–750 mm rainfall annually of which 85% falls between December–March; this gives a median growing season of at least 18 weeks although it can be less than 13 weeks in 25% of years. A further 4 green weeks can be expected during the dry season although frost can limit their usefulness in the east. The soils consist of treeless, infertile grey cracking clays west of Normanton, an extremely infertile deep sand around Croydon, and in the east, an association of red and yellow earths, volcanics, texture-contrast soils and granites, all of moderate fertility. There are large areas of naturalised Indian couch. The soils and vegetation of zone D have been described by Perry (1964) and Isbell and Murtha (1972).

Establishment techniques

A range of establishment techniques are used. These are defined according to the level of inputs

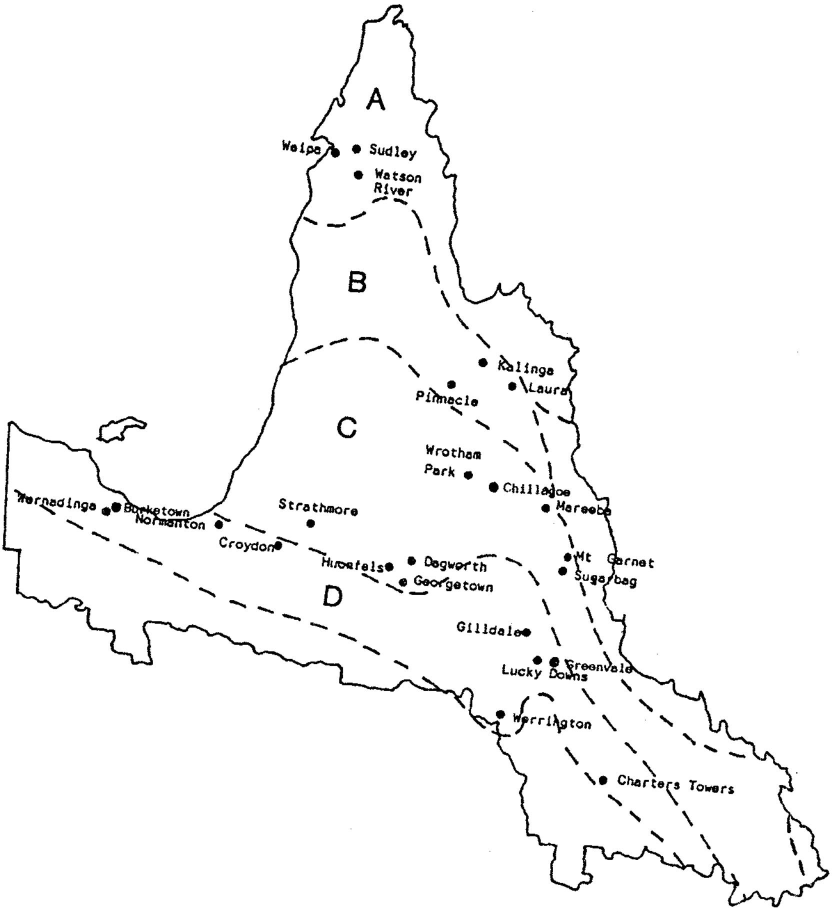

Figure 1. Zones in the north Queensland region based on total and reliability of rainfall, and pasture species adaptation. Properties referred to in the text and some towns are marked.

of seed, fertiliser and land preparation. The length of time before the pasture is fully developed is usually inversely proportional to the level of input.

Low-input systems

Trickle seed from saddlebag or vehicle: Usually small amounts of seed are spread as workers move around the property. Such areas are regarded as a gamble or an experiment to test the plant's adaptation to the local environment. It had been hoped that these localised plantings would spread widely into pastures in the way Townsville stylo (*Stylosanthes humilis*) naturalised across significant areas of the region. This has not happened.

Feed seed in licks: The grazing animal is regarded as the main vehicle of natural spread of stylo seed; more than 40% of stylo seed ingested passes through cattle in a viable condition (Simao Neto *et al.* 1987). Seedpods of Seca and Verano stylo survive well even in licks containing a high percentage of salt (A.E. Holmes and C.P. Miller, personal communication). Using licks as a vehicle for establishing pastures appears to avoid throwing expensive seed into a hostile environment. Although it is a low-cost system there are problems with competition from native grasses and with the inability to manage fires, particularly in higher rainfall areas (zones A and B). C. Paton (personal communication) suggests that the distribution of resulting plants is poor.

Broadcast legume seed in strips from aircraft or tractor: Seed at recommended rates broadcast over uncultivated or cultivated strips will eventually develop into a pasture and contribute to herd productivity. The seeded area may be only 5–25% of a paddock. The time to establish across the whole paddock is dependent on the proportion planted, seasonal factors and grazing management but a period of 10–15 years would be considered reasonable. The land is burnt or heavily grazed to reduce competition and for ease of passage when using tractors. This method has been used most frequently in the eastern part of zones C and D where properties are relatively small and well subdivided. When tractors are used in uncleared woodland, tyre damage can add alarmingly to the cost. Aircraft costs for spreading seed may be as low as $7/ha.

Medium-input systems

Broadcast legume seed from aircraft or tractor with or without fertiliser into natural woodland: This differs from strip sowing only in the percentage of the area covered and with the possibility that fertiliser may be used. In this case 50–100% of a paddock is sown. A developed pasture is expected in 3-4 years in favourable circumstances in zones B and C with recommended sowing rates but it could take up to 8 years in zone D. Seed is broadcast over an area that has been burnt or heavily grazed; the area should not be burned again until seed has been set and natural build up is assured. Seed and aerial sowing costs for 2–3 kg/ha of a mixture of legumes are approximately $25/ha without aircraft ferrying charges; the cost increases to around $45/ha with fertiliser (5 kg/ha P).

High-input systems

Broadcast seed with or without fertiliser on areas pulled, spelled and burned: This method has been used in northern Cape York Peninsula with some success. Trees are pulled as soon as possible after the wet season ends, burned 6 or 18 months later and a mixture of grasses (1 kg/ha) and legumes (3 kg/ha) sown from the air into the ashes with 10 kg/ha P. These pastures cost $110/ha to develop (1988 prices), take 3–4 years to reach stability and will carry a stocking rate of nearly 1 beast/ha (Bob Wincen, formerly 'Sudley', Weipa).

Broadcast or fly on seed and fertiliser with or without a cover crop over cleared and cultivated land: In northern Cape York Peninsula this method offers rapid establishment (2 years), pasture stability at high stocking rates (1 beast/ha), and good regrowth control — but at a high initial cost ($420/ha; 1988 prices). In other zones, intensive pastures have been developed with buffel (*Cenchrus ciliaris*) and urochloa (*Urochloa mosambicensis*) on fertile river frontages or adjacent to airstrips; they are used as weaner paddocks or for making hay.

Perceptions of problems

Establishment problems are not considered an impediment to pasture development in the north Queensland region, except in the low rainfall area of the south-east. There have been few failures and most of these can be attributed to season or legume hardseededness.

Zone A: There are no climatic constraints in the wet season in this environment; indeed the growth of the native pasture competes so intensely with seedlings of oversown species that these have little chance of success (Doreen Quartermaine, 'Watson River', Weipa). Oversown pastures might be successful with high fertiliser rates and control of grazing cattle, but this is difficult to achieve where only part of a large paddock is sown (Bob Wincen, formerly 'Sudley'). Without controlled grazing, new stands are often destroyed by wildfires. Glenn jointvetch (*Aeschynomene americana* cv. Glenn) has been oversown successfully into burnt melonhole country which cattle avoid during the wet season; it may create a feed availability problem because it smothers grasses during the growing season and then dies off in mid year. The limited area of improved pasture in this zone has usually been developed with high-input systems which have consistently produced high quality pastures quickly, regardless of soil type. Timber regrowth, particularly from messmate (*Eucalyptus tetrodonta*) and tea tree (*Melaleuca viridiflora*), has been dense without cultivation. Hot fires have given some control of regrowth without destroying the pasture but it will be an ongoing problem (Bob Paton, 'Sudley').

Zone B: There has been virtually no pasture development in this zone apart from that on or adjacent to airstrips. However, one example of high-input development ($300/ha) on an infertile red earth derived from sandstone is progressing successfully near Laura (Allan Holmes, 'Kalinga'). Other methods seem doomed to failure given the gross infertility of the soil and the fragile nature of the low-yielding native pastures. Oversown pastures with minimal fertiliser inputs could be established on the granite soils but they must be able to tolerate the regular fires needed to control the dense tree seedlings and suckers, particularly of messmate (Bill Raymond, 'Pinnacle', Laura). Seca stylo might not survive this treatment.

Zone C: Most improved pastures in this zone have been oversown into natural woodland. Poor wet seasons cause the only problems with establishment of oversown pastures in this zone (Robert Henry, 'Sugarbag'). Approximately 8000 ha of high-input Townsville, and later Verano stylo pastures were developed on 'Wrotham Park' between 1966–1974; this method has been superceded by oversowing a mixture of Seca and Verano (Gordon Arnold, formerly 'Wrotham Park'). Stocking rates on freshly sown pastures at 'Wrotham Park' were dependent on the wet season but the plan was to stock at 1 breeder/4 ha increasing to 1 breeder/2.5 ha in the second year. With large-scale plantings, seed and fertiliser are broadcast aerially into burnt woodland before the end of October to minimise the risk of rain damage to materials stored in the open (David Arnold, 'Wrotham Park'). Weathering of the legume seed between sowing and the wet season helps to break down hard-seededness.

Zone D: Unreliable wet seasons are the natural order of events in this zone and are the major reason for establishment failure. The chances of success can be improved by sowing later in the year (say December) when germination and follow-up rains are more likely (Henry Daniel, 'Gilldale', The Lynd) but fresh legume seed needs to be treated to reduce the hardseed content. In the high-altitude, southern part of the zone, a combination of poor seasons and low temperatures has resulted in a decade of failed attempts to establish Verano stylo; Verano is now considered unsuitable for this area (Lynley Lethbridge, 'Werrington', The Lynd). The western part of the zone is dominated by heavy clay soils for which there are no suitable legumes. The major gains in productivity in the western parts are to be made by increasing water supplies to better utilise the existing native pasture (Alastair McClymont, 'Wernadinga', Burketown).

Establishment outcomes

In zones A and B, the cost of high-input pasture development to an already depressed industry has meant that, while improved pastures can be readily established, very little development has occurred. Most pasture improvement to date has been concentrated on the more fertile soils in the south and east of zones C and D. In zone C, an oversown pasture is expected to take 3–4 years to develop with average seasons although some good pastures have developed in 2 years (Bill Tincknell, 'Dagworth', Georgetown). In some cases establishment has been slowed markedly by competition from native grass when the site could not be burned or heavily grazed before planting (Henry Daniel, 'Gilldale'). The unreliable nature of wet seasons in zone D has meant that only low-input (low-cost) development is usually attempted because it may take 8 years to reach a stable pasture. On the other hand, oversown improved pastures may have to withstand regular burning if this is needed to control timber density in the native woodlands. Research has failed to identify legumes suitable for clay soils in areas receiving less than 1000 mm rainfall.

In the eastern parts of zones C and D the persistence of perennial native grasses is threatened by heavy stocking following oversowing with legumes (Henry Atkinson, 'Lucky Downs', Greenvale). Many producers are now investigating how to establish stoloniferous grasses into their pastures — often in association with district Land Care groups, but this appears difficult to achieve without severe soil disturbance (John Bethel, 'Huonfels', Georgetown).

The establishment phase is generally not a constraint to sown pasture development in northern dry tropical areas.

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