Towards a tropical grass package for northern New South Wales

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Abstract. *Tropical grasses are suited to large areas of northern New South Wales and are increasing in usage due to their adaptability, persistence, ability to respond to summer rainfall, and capability of producing large quantities of forage. Despite growing awareness of these advantages, there has been reluctance for more widespread adoption of tropical pastures in north-west New South Wales for a number of reasons, most of which can be overcome by development of an 'agronomic package'. This paper describes the components of a package drawing on known information and recent research; knowledge gaps requiring further attention are highlighted.*

Introduction

Large areas of the North-West Slopes of New South Wales (NSW) have a history of cultivation and many of the lighter soil types have become unproductive because of low fertility, poor soil organic matter and deteriorating soil structure. Permanent pastures are an effective means of ameliorating these soils and restoring productivity (Whitbread *et al.* 1996).

The North-West Slopes of NSW offers a unique and challenging environment for perennial pastures. It is unique in that the region has a summer dominant rainfall distribution, but effective winter rainfall, making it potentially suitable for both summer and winter growing species. The challenge is for species to persist, therefore, temperate grass species need to be summer-dormant (S.P. Boschma *et al.*, unpublished data) while tropical species need to be frost-tolerant (McCormick *et al.* 1998). Traditionally, temperate grasses have been recommended for this region, however, producers report that temperate pastures do not persist (Reeve *et al.* 2000). Recent research confirms the poor persistence of current varieties (S.P. Boschma *et al.*, unpublished data) making them uneconomical (Scott *et al.* 2000). By contrast, there are tropical grass pastures in the region which are over 35 years old and still persisting.

Tropical grasses were first evaluated in northern NSW in the 1950s (Johnson 1952; Buckley 1959). The potential for tropical grasses was recognised and their use recommended in pasture mixtures, but poor seed availability and pursuit of grain farming meant that adoption was low. On the North-West Plains, species evaluation was conducted in the 1970s (Watt 1976) and establishment methods investigated in the 1980s and 1990s (Bowman 1990; Campbell *et al.* 1993). In the 1990s, a range of grass species and cultivars were evaluated in NSW at over 20 sites from Forbes in central NSW to the Queensland border and west from the Great Dividing Range to Walgett (McCormick *et al.* 1998). More recently, studies conducted near Manilla on the North-West Slopes highlighted the superior persistence and production potential of tropical grasses compared to the temperate grasses (S.P. Boschma *et al.*, unpublished data).

Some producers have been successfully using tropical grasses in their systems for many years (viz. Murray 2004), but it is only in the last five or so years with dry conditions and stop-start seasons that tropical grasses have shown their advantage as a responsive and persistent option. While many producers have shown an interest in tropical grasses, there has been a reluctance to sow them, thereby curtailing widespread adoption. A series of workshops to investigate producer perceptions of tropical grasses identified quite a number of barriers (L.H. McCormick, unpublished data) with the common concerns including difficulty to establish, poor forage quality, previous bad experiences and a general lack of information. While there were suitable grasses ready for adoption, there was no 'agronomic package' to assist producers.

A comprehensive package needs to cover five areas: species options, establishment, maximising herbage production, grazing management and impacts on animal production. To date, only some of the components of the package for tropical grasses have been developed. The aim of this paper is to report details of components of the tropical grass package which have been developed, discuss components currently under development and identify gaps in knowledge requiring further work.

The 'right species'

Through the 1990s, an evaluation of tropical grasses was undertaken across northern NSW at sites representing a range of soil types, rainfall and altitude (McCormick *et al.* 1998). These experiments consisted of 34 entries representing nine species; viz. Rhodes grass (*Chloris* *gayana*), panics (*Panicum* spp.), creeping bluegrass (*Bothriochloa insculpta*), bahia grass (*Paspalum notatum*), forest bluegrass (*Bothriochloa bladii* ssp. *glabra*), digit grass (*Digitaria eriantha* ssp. *eriantha*), purple pigeon grass (*Setaria incrassata*), buffel grass (*Cenchrus ciliaris*) and birdwood grass (*Cenchrus setiger*).

Results from this study showed the adaptability of tropical grasses in our environment, and that cultivar performance was more closely related to soil type and pH and less to rainfall and latitude. However, rainfall was obviously an important factor, especially for the 300 mm rainfall zone where buffel grasses were the best adapted (McCormick *et al.* 1998). A summary of the adaptation of grass species to soil type is shown in Table 1.

Gatton panic (*Panicum maximum*) and Petrie green panic (*P. maximum* var. *trichoglume*) did not perform well in this evaluation, however, recent research in northern NSW has identified a number of lines with superior persistence and herbage production compared with the current cultivars (Harris 2008). A number of *P. coloratum* types have also shown promise (Harris 2008). The promising lines of *P. maximum* and *P. coloratum* will be evaluated under grazing with the best performing lines being developed for commercial release from 2011.

Commercial practice shows that tropical pastures are commonly sown as a mixture of grass species and cultivars across a range of soil types. Mixtures have the advantage of different species finding their own niche within the variation that exists in a paddock. For example, Premier digit grass on medium soils, Bambatsi panic (*P. coloratum* var. *makarikariense*) on heavier water-logged prone soils, and Katambora Rhodes grass to fill the gaps between plants. However, the disadvantage of mixtures is that competition can occur between species, sometimes to the detriment of one or more in the mix.

Work at Tamworth found Katambora Rhodes grass was highly competitive in an establishing pasture, with the ability to out-compete both Premier digit grass and Bambatsi panic even at a low plant proportion of 25% (G.M. Lodge and S.P. Boschma, unpublished data). The seedling vigour and spreading habit of Katambora Rhodes grass allowed establishing plants to spread quickly, potentially swamping other seedlings in an establishing pasture. Katambora Rhodes grass seedlings are so competitive that in a study assessing the ability of individual cultivars to compete with common grass weeds, Katambora Rhodes grass was equally competitive as liverseed grass (*Urochloa panicoides*) and more competitive than awnless barnyard grass (*Echinochloa crus-galli*) (G.M. Lodge and S.P. Boschma, unpublished data). While Rhodes grass has a role in mixtures, viable seed numbers should not exceed 20 per cent of the total, otherwise it will out-compete the other sown species.

Planning and preparation before sowing

Pasture establishment is a 'numbers-game' dependent on germination of the seed, emergence of the seedling and its survival as a juvenile plant. The aim when establishing a tropical grass pasture is to achieve a plant population of about 10 plants/m^2 (W.J. Scattini, personal communication). Key elements of planning and preparation for sowing centre around weed control and sourcing high quality grass seed.

Table1. Tropical grass species and cultivars suitable for light, medium and heavy soils in northern NSW (McGufficke and McCormick 2008)

Light soils	Medium soils	Heavy soils
	Soil groups and pH range	
Sands, sandy loams; pH <5.0–7.0 ($CaCl_2$)	Clay loams, silty clay loams; pH 5.0–7.0 ($CaCl_2$)	Red/grey clays, black earths; pH 6.0–8.0 ($CaCl_2$)
	Species and cultivar	
Lovegrass (*Eragrostis curvula* type conferta) cv. Consol Digit grass (*Digitaria eriantha* ssp. *eriantha*) cv. Premier Rhodes grass (*Chloris gayana*) cv. Pioneer and Katambora Forest bluegrass (*Bothriochloa bladii* ssp. *glabra*) cv. Swann Buffel grass (*Cenchrus ciliaris*) cv. America and Gayndah	Digit grass cv. Premier Forest bluegrass cv. Swann Creeping bluegrass (*Bothriochloa insculpta*) cv. Bisset Rhodes grass cv. Katambora Purple pigeon grass (*Setaria incrassata*) cv. Inverell[A] Panic (*Panicum coloratum* var. *makarikariense*) cv. Bambatsi[A]	Purple pigeon grass cv. Inverell Panic cv. Bambatsi Bluegrass (*Dicanthium aristatum*) cv. Floren Buffel grass cv. Biloela[B]

[A]Performs with higher nutrition
[B]Flood free areas

Weed control

Weeds typically have vigorous seedlings, short life cycles and the ability to set large quantities of seed which can survive in the soil for years. Sown perennial species, by comparison, tend to be less vigorous and are sown at low rates compared to the seed-bank of weeds likely to be present. Control of the main annual summer-grass weeds, liverseed grass, awnless barnyard grass and stink grass (*Eragrostis cilianensis*) is essential, requiring control for two years prior to sowing to reduce the seed-bank to minimal levels. In an experiment conducted near Manilla, two years of annual grass weed control were necessary to reduce the grass weed seed-bank to low levels (15 seeds/m^2). By comparison, controlling weeds for only one summer, or the spring prior to sowing, resulted in 1,650 and 5,500 seeds/m^2 in the seed-bank, respectively (G.M. Lodge, unpublished data). Bambatsi panic sown at 4 kg/ha (bare seed, adjusted for germination) is equivalent to sowing about 400 germinable seeds/m^2. At this sowing rate, Bambatsi panic seed numbers are in the minority unless there has been two years of weed control.

Seed quality

Poor establishment is often blamed on insufficient rainfall or sowing too deep, however, seed quality can be variable and the possible cause of poor establishment in many cases. Knowing the purity and germination percentage of the seed purchased is important. A bag of seed can include weeds, inert material such as trash, empty florets, and dead and viable seed. A seed purity and germination test from a National Association of Testing Authorities (NATA) accredited laboratory will identify the species (desirable and weeds) present in the seed sample tested, their proportions, the proportion of inert material and germination rate of each of the desirable species. With seed costs ranging from $18–40/kg it is important to 'get what you pay for'.

Low germination percentage means that sowing rates need to be increased to ensure a high number of viable seeds, while weed contamination could be introducing weeds that might negatively impact on farm productivity and animal health. Seed-coating is common in tropical grasses, but sowing rates do need to be increased for the additional weight of the coating which can be as high as 80 per cent. There are no published data from field studies to indicate that seed-coating assists emergence or establishment. However, seed-coating has the advantage of assisting seed-flow through a planter and therefore more accurate seed placement is possible.

Some species have seed dormancy mechanisms meaning that they need to be stored for a period of time or treated before they will germinate. These dormancy mechanisms are either based within the embryo or in the structures covering the embryo (Adkins *et al.* 2002). Dormancy involving chemical inhibitors in the seed embryo is strongest in freshly harvested seed, decreasing with age (Harty *et al.* 1983). Species vary in dormancy (Table 2) and establishment can be affected if dormant seed is sown. Storing seed for 12 months overrides the dormancy mechanism in most grasses. Work at Tamworth has shown that Katambora Rhodes, Premier digit grass, Swann forest bluegrass (*Bothriochloa bladii* ssp. *glabra*) and Bambatsi panic do not have any post-harvest dormancy either as bare seed or in the floret (G.M Lodge, unpublished data).

Factors to consider at sowing

Sowing time and depth

A suitable sowing time for successful establishment is dictated by considerations of soil temperature and the

Table 2. Dormancy of tropical grass species available in NSW (Sources: Anon 2007; G.M. Lodge, unpublished data)

Species with known post-harvest dormancy	Species which do not have post-harvest dormancy
Mitchell grass (*Astrebla lappacea*)	Rhodes grass[A] (*Chloris gayana*) diploids eg. cv. Katambora
Creeping bluegrass (*Bothriochloa insculpta*)	Digit grass (*Digitaria eriantha* ssp. *eriantha*)
Buffel grass (*Cenchrus ciliaris*)	Bambatsi panic (*Panicum coloratum* var. *makarikariense*)
Rhodes grass[A] (*Chloris gayana*) tetraploids eg. cv. Callide	Forest bluegrass (*Bothriochloa bladii* ssp. *glabra*)
Bluegrass (*Dicanthium aristatum*)	
Lovegrass (*Eragrostis curvula* type conferta)	
Panic (*Panicum maximum*)	
Green panic (*Panicum maximum* var. *trichoglume*)	
Paspalum (*Paspalum dilatatum*)	
Bahia grass (*Paspalum notatum*)	
Kikuyu (*Pennisetum clandestinum*)	
Setaria (*Setaria sphacelata* var. *sericea*)	
Purple pigeon (*Setaria incressata*)	

[A]Rhodes grass can be either diploid of tetraploid. Seed of the diploids has little or no post-harvest dormancy while seed of the tetraploids may not reach maximum germination for 3–6 months, and sometimes up to 18 months post-harvest (Cook *et al.* 2005).

time of year when the likelihood is highest of receiving at least 50 mm of rain over 2–3 days. Optimum emergence is dependent on correct sowing time and sowing depth. Tropical grasses have different soil temperature requirements for germination and emergence. For example, the minimum soil temperature (at 9 am) at the optimum sowing depth for buffel grass is 13°C, Rhodes grass 14°C, Bambatsi panic and bluegrass 17°C and purple pigeon grass 25°C (McCormick 2004).

A study at Tamworth showed that emergence of tropical grasses was high from December through to March (G.M. Lodge, unpublished data), however, sowing late in summer can affect the ability of establishing plants to survive winter. In a separate study conducted near Tamworth (M.A. Brennan *et al.*, unpublished data), five species were sown in November, January and March. Plant frequency was measured after sowing in May (prior to the first frost) and in September (when growth recommenced). There was little change in plant frequency for the November and January sowing, indicating excellent winter survival. However, plant frequency fell by up to 70 per cent for the March sowing. Spring herbage production of the grasses sown in March was also reduced by 50–99 per cent the year after establishment (M.A. Brennan *et al.*, unpublished data). Studies conducted near Walgett also found significant plant losses during winter (Bowman 1990).

Summer rainfall on the North-West Slopes and Plains typically falls in high intensity storms preceded and followed by high temperatures. This results in the soil surface wetting and drying quickly, often within 24 hours on lighter soils, which is inadequate for germination. Tropical grass seeds have the ability to imbibe water then dry again without loss of germinability provided the radical has not emerged. This is termed hydropedesis (Watt 1978). The advantage of hydropedesis is that the seed has been 'primed' and will germinate sooner than if it has not been wetted previously. While tropical grasses have this ability, the use of ground-covers (such as cereal crops) and practices which help retain surface soil moisture (such as minimum-till) assist establishment especially during years with marginal conditions for pasture establishment.

Tropical grass seed size is variable but generally small, therefore, sowing depth is crucial with the optimum depth varying with species and soil type. In a study conducted at Tamworth (G.M. Lodge, unpublished data), seedling emergence was highest for the smaller seeded cultivars such as Premier digit grass, Katambora Rhodes grass and Floren bluegrass (*Dicanthium aristatum*) at 10 mm sowing depth, while Bambatsi panic (with a larger seed) was able to emerge from up to 50 mm depth. Seedling emergence from seed placed on the soil surface was poor except during spring when day-time temperatures were lower. From December, evaporation rate is high so it is difficult to keep the soil surface wet for a sufficient period to allow germination.

Tropical grasses are commonly sown with conventional cultivation practices into a fine seed-bed. Direct-drilling is also affective if there is good seed-soil contact and the seed is placed at the optimum depth. Direct-drilling into a cereal stubble can be effective, however, drilling into areas which have not had any preparation (eg. a degraded pasture) can be high risk, and not recommended for a number of reasons, including competition from weeds and the existing pasture, poor stored soil-moisture and poor seed-bed produced by the drill. Where depth is difficult to control, sowing the seed on the surface and incorporating with a small chain and press-wheel can provide soil-cover and contact for the seed. Establishment from aerial seeding into stubble before or after harvest has proven unreliable (Campbell *et al.* 1995).

Factors to consider post-emergence

Post-emergent herbicide options

Controlling grass weeds in an establishing grass pasture is not possible, reinforcing the need to control grass-weeds prior to sowing. However, broadleaf weeds can be controlled post-emergent, once the pasture has developed secondary roots (about 4–6 leaf stage). Unfortunately, there are no chemicals currently registered in NSW to control broadleaf weeds in tropical grass pastures. In January 2008, a range of herbicide options for control of broadleaf weeds in establishing tropical grasses was assessed. This study evaluated 20 herbicide treatments and identified 11 which gave effective broadleaf weed control, with little damage (<20% reduction in herbage production) to the establishing pasture. A permit is currently being sought for those chemicals which showed the most potential.

Management during the first year

Guidelines for the grazing management of tropical grasses in the establishment year are largely drawn from knowledge of temperate pastures and farmer experience. The limits for grazing in the first year have not been studied in NSW, however, this will be an area for future research.

Since tropical grasses grow at a much faster rate, it is contended that there is more flexibility with the management of tropical grass pastures in the establishment year. In favourable years, light grazing can encourage tillering and greater seed production in an establishing pasture. However, letting grasses flower before the first frost to allow regenerative buds to form at the base of the tillers is recommended. If temperate legumes are to be over-sown in the autumn following grass establishment, the bulk of grass material needs to be removed by grazing to open the sward for legumes to germinate.

Beyond the first year

Two of the greatest attributes of tropical grasses is their ability to persist once established and their ability to produce large quantities of herbage following rainfall. Studies conducted in the Tamworth area over the last three years have been monitoring the effects of nitrogen (N) fertiliser and defoliation intensity on herbage production and forage quality (S.P. Boschma, unpublished data), and the soil water use of tropical grasses. The following information is based on results from this study.

Herbage growth and forage quality

Tropical grasses begin active growth in September–October as day temperature starts to rise. Growth rate continues to increase, peaking during summer before declining over autumn and ceasing when frosts commence.

During the summer, growth of tropical grasses is commonly restricted by a lack of N, rainfall and/or sub-soil moisture. In the Tamworth area, Premier digit grass and Katambora Rhodes grass have had growth rate recorded as high as 160 and 175 kg DM/ha/day, respectively, when N was applied, while growth rate without N was 45 and 20 kg DM/ha/day, respectively (S.P. Boschma, unpublished data).

Addition of N increases herbage production, even during periods of below average rainfall. In the 2006–07 growing season, rainfall for the period October–April was 150 mm below the long term average (340 mm), yet the addition of 100 kg N/ha increased herbage production by 23 per cent and 56 per cent for Premier digit grass and Katambora Rhodes grass, respectively. In comparison, during the peak growth period when above average rainfall was received (December 2007–February 2008), the application of 100 kg N/ha resulted in 14,500 and 8,300 kg DM/ha for Premier digit grass and Katambora Rhodes grass, respectively; compared to 4,700 and 2,000 kg DM/ha where nil N was applied.

There was a herbage production response to the addition of most rates of N, however, the greatest increase per unit of N applied was with 50 kg N/ha (additional 6,000 kg DM/ha compared to nil N) for Premier digit grass with production plateauing at about 250 kg N/ha. In contrast, Katambora Rhodes grass continued to increase to the highest rate of N applied (300 kg N/ha). Herbage production was higher when the tropical grasses were cut every 6 weeks compared to every 2 weeks, however, the percentage of stem and dead material was higher and forage quality lower.

Tropical grasses have lower forage quality than temperate grasses at the same growth stage, however, it is important to appreciate that their growth patterns are contrasting, and comparisons of quality need to account for these contrasting growth patterns. For example, during summer, when tropical grasses are actively growing, temperate species are relatively dormant with little or no green leaf and therefore their quality can be lower. Likewise, during cool season months, while temperates are actively growing and vigorously producing high quality green leaf, tropicals are generally dormant, presenting low quality senesced leaf for grazing.

It is important when comparing tropical grasses with alternative forages [eg. sorghum (Sorghum bicolour x *S. sudanense*) and lucerne (*Medicago sativa*)], to do so at the same time of year. The Tamworth study recorded green Premier digit grass leaf (two weeks regrowth) with a crude protein (CP) level of 18.5% and metabolisable energy (ME) of 9.6 MJ/kg DM (Table 3). The quality of Katambora Rhodes grass was lower with 16.5% CP and 9.1 MJ/kg DM ME. These values rank tropical grasses lower than lucerne but higher than sorghum.

To maximise animal production, the pasture needs to be managed to maintain a high proportion of green leaf as it has the highest quality of all plant fractions. The addition of N increases forage quality because it promotes 'leafiness'; similarly, regular defoliation increases forage quality because it promotes growth of

Table 3. Forage quality of Premier digit grass and Katambora Rhodes grass cut every 2 and 6 weeks with either 0 or 100 kg/ha N applied (S.P. Boschma, unpublished data)

	Premier digit		Katambora Rhodes	
	0 kg N/ha	100 kg N/ha	0 kg N/ha	100 kg N/ha
	Crude protein (%)			
2 weeks	15.3	18.5	12.7	16.5
6 weeks	13.6	15.5	13.4	15.2
	Metabolisable energy (MJ/kg DM)			
2 weeks	9.3	9.6	8.6	9.1
6 weeks	9.1	9.1	8.9	8.6

new green leaf. Management practices that maximise green leaf production and minimise stem and dead material, improve forage quality and therefore increase grazing value and animal production.

The upright growth habit of tropical grasses and high levels of CP (where N is applied) allow grazing animals to increase their intake compensating for lower ME levels. Cattle growth rate of 0.7–0.9 kg/head/day is generally achieved and growth rate of 1 kg/head/day has been recorded (McCormick 2004).

After the establishment year, the pasture can be grazed once growth recommences and herbage mass reaches 1,500–2,500 kg DM/ha depending on livestock enterprise. During periods of good rainfall and nutrition, high pasture growth rate can result in herbage production surpassing animal intake (unless stock numbers are increased). During such times, rotationally grazing a smaller area and maintaining the herbage mass between 1,500–3,000 kg DM/ha (McCormick 2004) with a shorter grazing interval will help maintain a higher proportion of green leaf and maximise animal production.

Legume compatibility

For transitional temperate/tropical environments as occurs in north-west NSW, temperate legumes are a cost-effective means of supplying N for the long term productivity of a tropical grass pasture. Subterranean clover (*Trifolium subterraneum*) is commonly used, broadcast during autumn after the pasture has established. Biserulla (*Biserulla pelecinus*) and serradella (*Ornithopus* spp.) have been used successfully on lighter sandy more acid soils, while lucerne has been used in higher rainfall areas. Careful management is essential to minimise selective grazing of the legume and to ensure regeneration of the annual legume. Also, to ensure maximum regeneration of a winter annual legume, tropical grass pastures need to be grazed so that the sward is opened to allow annual legumes to germinate. Further research is required to identify legumes (tropical and temperate) adapted to northern NSW which would be persistent and productive in tropical grass pastures.

The amount of N fixed by legumes in a pasture is related to the quantity of herbage produced by the legume. As a guide, subterranean clover in a grazed pasture may produce around 2,000 kg DM/ha of herbage. Assuming legumes fix 20–25 kg shoot N/1,000 kg DM produced (Peoples and Baldock 2001), this is equivalent to 40–50 kg N/ha fixed by the legume.

Water-use and species selection

Tropical grass species have varying plant root depth and efficiency by which they convert water into forage. A study near Tamworth monitored Premier digit grass, Katambora Rhodes grass and Swann forest bluegrass with a number of other treatments including lucerne, forage oats (*Avena sativa*), forage sorghum and a native pasture (predominantly redgrass (*Bothriochloa macra*), bluegrass (*Dichanthium sericeum*) and wallaby grass (*Austrodanthonia bipartita*) cv. Bunderra). Of the sown perennial grasses, Premier digit grass had the highest herbage production and water use efficiency (16.1 t DM/ha and 32.4 kg DM/ha/mm, Murphy *et al.* 2008a), but Katambora Rhodes grass had a greater rooting depth (1.6 m vs. 1.2 m, Murphy *et al.* 2008b).

Lucerne is well known for producing a lot of herbage under moist soil conditions, but with a dry profile growth stops until further rainfall is received. Katambora Rhodes grass acts similarly, however, it is unable to respond quickly once rainfall is received because during extended dry periods the runners die back to the crown. In comparison, Premier digit grass is able to respond quickly and with great efficiency once rainfall recurs.

This has implications for the persistence of these species in a mixture and also for preferred location in the landscape. In areas where maximum soil drying is required (but not waterlogged areas), Katambora Rhodes grass is effective. However, for maximum herbage production, better response following rainfall and therefore better continuity of feed, Premier digit grass is a better option. Katambora Rhodes grass is commonly considered to be less drought-tolerant. This could partly be due to its slow recovery after a dry period, allowing other species to respond to rainfall, and potentially shading-out the slower growing Katambora Rhodes grass plants. It is noteworthy from the Tamworth study that N application resulted in Katambora Rhodes grass plants using the stored soil water quicker, and being drought affected quicker than plants which had less N. Premier digit was not affected like this.

More work to be done

The agronomic package for tropical grasses is not complete. More work needs to be done on grass/legume compatibility, grazing management for persistence, strategies to use the huge quantities of feed produced and applications in grazing systems. Some of these will be addressed in research planned to commence in 2009.

Conclusions

There is potential in northern NSW to increase grazing performance and at the same time to restore degraded land with tropical pastures. Encroaching climate change and the need to accumulate more carbon will make the use of tropical grasses attractive. However, for widespread adoption of tropical grasses in northern

NSW, an 'agronomic package' is required detailing species options, guidelines for pasture establishment, maximising herbage production, optimal grazing management for persistence and sustainable animal production. Development of this package has commenced and the completed components are summarised in this paper. The ongoing development of additional components of the package are planned to commence in 2009.

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