Tropical grasses – do they have a role in both recharge and discharge environments in northern New South Wales?

S. P. Boschma, G. M. Lodge and M. A. Brennan

NSW Department of Primary Industries, Tamworth Agricultural Institute,
4 Marsden Park Rd, Calala NSW 2340

Traditionally livestock production systems on the North-West Slopes of NSW have relied on temperate pastures and annual crops such as oats to breed and fatten stock. However northern NSW has a summer-dominant rainfall distribution (60% of rain falling from November to March; Clewett *et al.* 2003), favouring summer-based livestock production systems (McDonald 1996).

Tropical grasses have been evaluated in northern NSW for over a decade (McCormick *et al.* 1998). This work led by Lester McCormick and Bob McGufficke, NSW Department of Primary Industries (DPI) District Agronomists for Manilla and Inverell respectively, has shown that there are a range of tropical grasses which are high producing and have the potential to provide green feed during summer and carryover dry feed during winter. However, these studies have largely focussed on recharge environments. Little work has been conducted in saline discharge environments in northern NSW, but as more salt-affected areas begin to appear there is an increasing need to assess the suitability of different pasture species.

In summer 2003-04 a series of experiments containing perennial tropical grasses were sown in experiments in a recharge and saline discharge area. This paper reports winter and summer production of a range of perennial tropical grasses sown in recharge and discharge sites on the North-West Slopes of NSW. This work was undertaken as part of a national field evaluation program within the Cooperative Research Centre for Plant-based Management of Dryland Salinity (CRC PMDS).

Materials and methods

Recharge sites

Two recharge sites were located about 12 km west of Manilla, NSW (30.74°S 150.61°E, elevation 400 m, 650 mm AAR) in the Namoi catchment, on the North-West Slopes of NSW on a Brown Vertosol soil. The experimental area consisted of a paired comparison of a permanent native pasture (*Austrostipa aristiglumis* dominant) and a previously cropped area (history of summer and winter grain and forage crops), typical of the district. In December 2003, 4 perennial tropical grasses (Table 1) were shallow sown in 4 replicates using a 6-row cone seeder (20 cm between rows) in plots 1.3 by 6 m.

Plant numbers were recorded 6-8 weeks after establishment (60 by 15 cm quadrats). Herbage mass (as a calibrated visual assessment) was recorded at the end of every season from June 2004 in each subplot strata.

Discharge sites

Discharge sites were located about 7 km south-east of Tamworth, NSW (31.18°S 150.98°E, elevation

435 m, 674 mm AAR) in the upper reaches of Calala Creek in the Namoi Catchment, on the North-West Slopes of NSW on a Red Chromosol soil. The experimental area consisted of a paired comparison of a naturalised pasture (dominated by *Cynodon dactylon*) and a previously cropped area (history of summer and winter grain and forage crops). Soil salinity (EC_e) in the surface (0-10 cm) ranged from 0.6-7.1 dS/m within the cropped area and 1.4-4.7 dS/m within the naturalised area in October 2003. Salinity levels tend to increase with depth to maximum at 70-100 cm (average 10.9 dS/m) in the cropping area and 40-70 cm (6.6 dS/m) in the naturalised area, before again declining.

In December 2003, furrows (about 5 cm deep and 20 cm apart) were made across the slope and 6 tropical grass species (Table 2) were hand-sown in plots 1 by 2 m at 10 kg/ha in 5 replicates. Plant numbers were recorded 6-8 weeks after establishment (40 by 10 cm quadrats). Herbage mass was recorded using the method described above.

Results

Recharge sites

Although sown in December 2003, both experiments did not germinate until end of January 2004 following 155 mm rainfall (Fig 1*a*). All species established on the previously cropped site, with *B. bladhii* having the least number of plants. On the native pasture site, only *C. gayana* and *D. eriantha* established (data not presented).

At the end of winter, after 3 months of regrowth, herbage mass was greater on the cropped area (mean of 870 kg DM/ha) than the native pasture area (mean 170 kg DM/ha). On both sites, *C. gayana* had the highest production (1340 kg DM/ha), although it was not significantly different to *D. eriantha* and *D. aristatum* on the cropped site ($P<0.01$)

After 3 months summer growth, *C. gayana* had the highest herbage mass at both sites, followed by *D. eriantha*. On the cropping site (Table 1*a*) the production of these 2 species was not significantly different (mean 7000 kg DM/ha), but both were

Figure 1. Monthly rainfall (mm) and long term average (LTA) from January 2003-February 2005 at (*a*) the recharge sites at Manilla, and (*b*) discharge sites at Tamworth

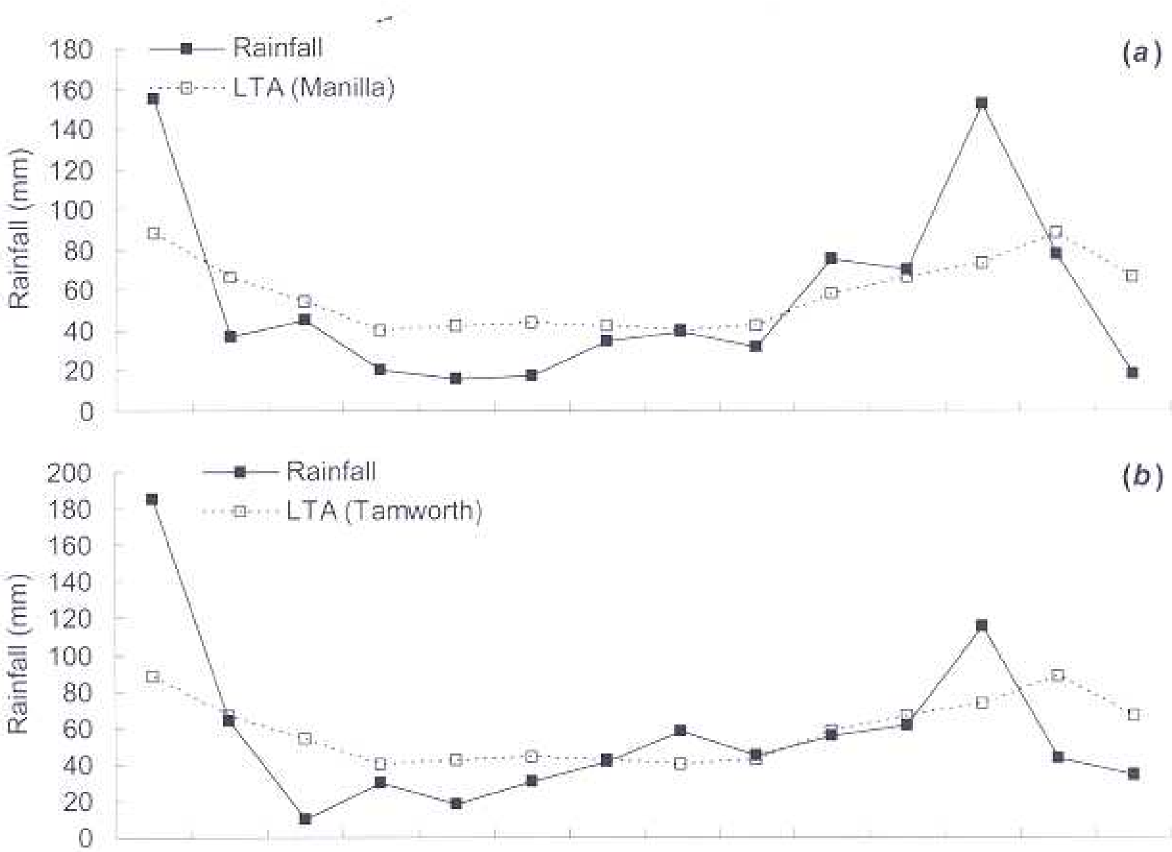

Table 1. Herbage mass (kg DM/ha) at the end of winter 2004 and end of summer 2005 on the (a) previously cropped, and (b) native pasture recharge sites. Values followed by the same letter within a site and assessment are not significantly different (P<0.01)

Species	Winter 2004	Summer 2005
(*a*) Cropped site		
Chloris gayana cv. Katambora	1339a	7144a
Digitaria eriantha cv. Premier	919a	6812a
Dichanthium aristatum cv. Floren	889a	4154b
Bothriochloa bladhii ssp. *glabra* cv. Swann	328b	4455b
(*b*) Native pasture site		
C. gayana cv. Katambora	625a	12708a
D. eriantha cv. Premier	53b	5397b
D. aristatum cv. Floren	0b	0c
B. bladhii ssp. *glabra* Swann	0b	0c

Table 2. Herbage mass (kg DM/ha) at the end of winter 2004 and end of summer 2005 on the (a) cropped, and, (b) naturalised discharge sites. Values followed by the same letter within a site and assessment are not significantly different (P<0.01)

Species	Winter 2004	Summer 2005
(*a*) Cropped site		
Chloris gayana cv. Katambora	666a	3248a
Setaria incrassata cv. Inverell	410bc	2823ab
Panicum coloratum cv. Bambatsi	164d	1590bc
Digitaria eriantha cv. Premier	461ab	1935abc
Dichanthium aristatum cv. Floren	171cd	1169c
Bothriochloa bladhii ssp. *glabra* cv. Swann	100d	1026c
(*b*) Naturalised site		
C. gayana cv. Katambora	515a	3526a
S. incrassata cv. Inverell	444a	3069ab
P. coloratum cv. Bambatsi	222a	2129b
D. eriantha cv. Premier	244a	1829bc
D. aristatum cv. Floren	105a	882bc
B. bladii ssp. *glabra* cv. Swann	3b	644c

higher (P<0.01) than *D. aristatum* and *B. bladhii* (mean 4300 kg DM/ha). On the native site *C. gayana* produced 12700 kg DM/ha while *D. eriantha* produced 5400 kg DM/ha (Table 1*b*).

Discharge sites

Similar to the recharge sites, these experiments did not germinate until January following 185 mm rainfall. *B. bladhii* had the lowest plant numbers of the 6 species. Fewer plants established on the naturalised area (138 plants/m^2) compared with the cropped area (169 plants/m^2).

For the winter 2004 herbage mass assessment, all species had similar production on both areas. On the cropped site (Table 2*a*) *C. gayana* had higher herbage mass than all species except *D. eriantha* (P<0.01), while on the naturalised site all species had similar herbage mass except *B. bladhii* which was lower (P<0.01, Table 2*b*).

At the end of summer 2005, *C. gayana* had the highest herbage mass of the 6 species at both sites, with production being slightly higher for the naturalised site. The lowest yielding species were *B. bladhii*, *D. aristatum* and *D. eriantha* at both sites, and *P. coloratum* on the cropped site (Table 2).

Discussion

These preliminary data support earlier studies indicating that tropical grasses are widely adapted (McCormick *et al.* 1998), with the ability to grow and produce in both recharge and discharge environments. Studies in Queensland have also found *C. gayana* and *P. coloratum* to be salt tolerant (Russell 1976). Other saline areas along the Calala Creek, previously covered with salt scalds and low producing species such as *C. dactylon*, have been successfully revegetated as part of Landcare Programs, with cv. Bambatsi having good establishment and persistence (I. Mead, pers. comm).

The higher herbage mass production of *C. gayana*, *D. eriantha*, *S. incrassata* and *P. coloratum* was partly related to their upright growth habit. In contrast, *D. aristaum* and *B. bladhii* have a leafier habit and stems that are not as tall and coarse. The seed quality of *B. bladhii* was also poor accounting for its low establishment in these experiments, however, 12 months after establishment plants thickened and production was higher.

One of the interesting features of tropical grasses is their ability to rapidly respond to rainfall, producing large quantities of feed. At the recharge cropping site, tropical grasses in summer produced an average 11.0 kg DM/mm rainfall. In comparison, temperate grass species sown in an adjacent area produced 3.7 kg DM/mm rainfall. During winter months tropical and temperate grasses produced 3.1 and 6.5 kg DM/mm rainfall, respectively. Although fattening livestock production systems in the region are more commonly based on temperate species, the performance of tropical grasses indicated that production systems based on sown summer-growing species may have merit.

Producer attendance at the 2004 Grassland Society of NSW Conference and 2 follow-up field days has demonstrated the increasing popularity of tropical grasses in northern NSW, however, little is known of their fertiliser and grazing requirements to maximise forage quality and persistence and their legume compatibility. Understanding the basic agronomy of these grasses is essential for widespread adoption by producers.

The ability of tropical grasses to respond to summer rainfall, in both recharge and discharge saline environments shows their adaptability and potential in northern NSW and these studies will continue until 2006.

Acknowledgments

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