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Tropical perennial grasses – the role of fertilisers and nitrogen

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Nitrogen, phosphorous and sulfur applied to an establishing tropical perennial grass pasture can enhance vigour and production. In an established pasture, nitrogen, phosphorus and sulfur should be applied annually to account for nutrients lost through product removal and ensure the pasture remains vigorous, producing high quality forage.

When there are no legumes in the pasture application of nitrogen is essential to achieve maximum growth rates, forage production and quality. Growth rates up to 160 kg of dry matter per hectare per day can be achieved with the application of nitrogen. As a rule-of-thumb, an additional 100 kg of herbage is produced in the growing season per kg of nitrogen applied. Nitrogen applied at rates of 50–100 kg per hectare will give good responses and higher quality in tropical grass pastures.

Plant nutrition is important during establishment of new pastures and for the ongoing production of established pastures. A fertilised pasture is more persistent, responds quickly to rainfall, and has higher growth rates producing more herbage of higher quality – all important contributors to animal production.

Fertiliser application in the establishment year

Tropical grasses have low seedling vigour. This vigour can be enhanced with the application of nitrogen, phosphorus and sulfur at sowing or after the pasture has emerged. A soil test conducted prior to sowing will highlight soil nutrient deficiencies. An application of 10–15 kg/ha of nitrogen as part of a compound fertiliser will greatly enhance establishment in low to moderate fertility soils. Fertiliser will improve the vigour of a pasture and also the vigour of any weeds that are present. Up to two years of weed control prior to sowing the pasture and selection of high quality weed-free seed will ensure the fertiliser is used by the pasture and not by the weeds.

Fertiliser application on established pastures

Nitrogen, phosphorus and/or sulfur may need to be applied annually to maximise herbage quality and production from a tropical grass pasture. Soil testing will identify deficiencies in macro and micro nutrients. Fertiliser, in particular nitrogen, increases pasture growth rates, annual production and forage quality. Pastures use the applied fertilisers most effectively when the nutrients are in correct proportion to one another. For example, as a general rule if 50 kg/ha of nitrogen is applied, phosphorus and sulfur may need to be applied at ~15 kg/ha; but if nitrogen is applied at 100 kg/ha the equivalent phosphorus and sulphur would increase to ~25 kg/ha. While the addition of a legume to a perennial tropical grass pasture can provide nitrogen, the application of phosphorus and sulphur will improve legume and overall pasture performance.

In inland NSW, tropical grass pastures grow during the warmest months of the year. Growth commences in spring, as day temperatures rise and slows in late summer-autumn, as overnight temperatures fall. Growth ceases when frosts commence, with little to nil growth during winter. Therefore tropical perennial grasses can be productive for ~9 months of the year on the North and Central-West Plains, 7–8 months on the North-West Slopes and 5–6 months on the Northern Tablelands.

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Within these periods growth rates may vary with grass species. Research has shown that growth rates of Premier digit grass and Katambora Rhodes grass fertilised with 100 kg/ha of nitrogen peaked in early summer; Premier digit at 160 kg of dry matter (DM) per hectare per day (kg DM/ha/day) and Katambora Rhodes grass at about 105 kg DM/ha/day.

In addition to variation in growth rates between species, there is also variation with stored soil moisture and fertility status. For example, when soil water is adequate unfertilised tropical grass pastures produce about 34 kg DM/ha/day in December (Table 1). With the addition of 100 kg/ha of nitrogen growth rates average about 83 kg DM/ha/day, but can be as high as 160 kg DM/ha/day (Figure 1). However, once the pasture has used the stored soil water, growth will decline to less than 10 kg DM/ha/day.

Table 1. Average growth rates (kg DM/ha/day) of unfertilised and fertilised perennial tropical grasses measured at four times in a growing season. A fertilised pasture consistently has higher growth rates than one that is unfertilised.

Season	Unfertilised pasture	Fertilised pasture
Spring	15	29
End-spring	56	72
Summer	34	83
Autumn	25	38

Figure 1. Premier digit grass fertilised with 100 kg/ha of nitrogen (top) and unfertilised (bottom) with 8 days regrowth in March. The fertilised grass has higher growth rates and quality and therefore higher animal production potential than the unfertilised tropical grass.

A fertilised tropical pasture is more responsive to rainfall and with higher growth rates its total production will also be higher. The question is how much nitrogen needs to be applied? Research at Tamworth in northern NSW has found that the response of tropical grasses to increasing nitrogen fertility was variable. Premier digit grass responded to rates up to 250 kg/ha of nitrogen, whilst forage sorghum peaked at 200 kg/ha of nitrogen. Katambora Rhodes grass production continued to increase even when 300 kg/ha nitrogen was applied (Figure 2). While nitrogen levels as high as these are not recommended because they are unlikely to be economical and may have potential environmental consequences, they do show the relative responsiveness of different tropical grasses. This study showed that as a rule-of-thumb, for each kilogram of nitrogen applied an additional 100 kg of herbage was produced in the growing season. Over an average growing season, the application of 50 kg/ha of nitrogen to Premier digit grass could increase herbage production from 5 to 10 t DM/ha, while the addition of 100 kg/ha nitrogen could increase production by 10 t DM/ha. Therefore an annual application of 50–100 kg/ha of nitrogen is recommended as it provides a high response for moderate nitrogen input.

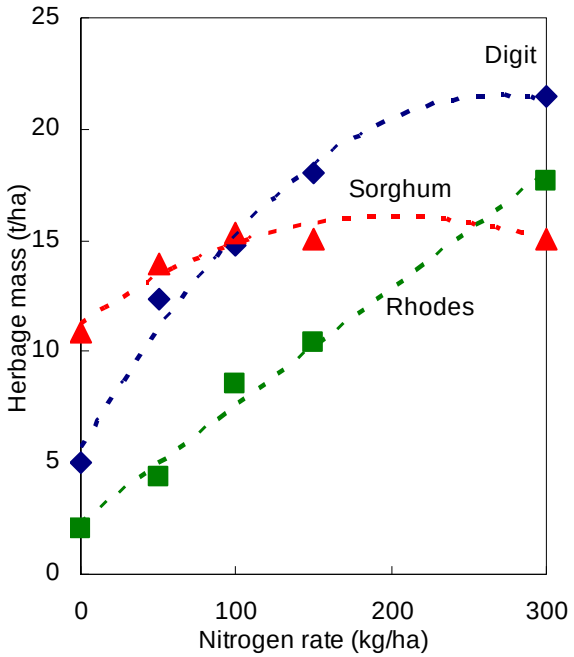

Figure 2. Application of nitrogen increases annual production, but the quantity varies with species. Production of Premier digit grass (♦) peaked at 250 kg/ha of nitrogen, while Sweet Jumbo forage sorghum (▲) peaked at 200 kg/ha of nitrogen. Katambora Rhodes grass (■) production continued

to increase even when 300 kg/ha of nitrogen was applied.

Nitrogen can be made available to a tropical grass pasture either as fertiliser or by incorporating a legume into the pasture. Legumes are considered the most economical source of nitrogen and have the advantage of potentially increasing the period that forage is available to livestock and providing a 'buffer' to a farm and enterprises, particularly if the climate is highly variable.

On average, temperate legumes fix about 35 kg of nitrogen per tonne of herbage produced (taking into account nitrogen produced in the shoot and roots)[1], however this value varies widely with legume species, existing soil nitrate levels and pasture vigour. Competition between the grass and the legume in a mixture for nitrogen can also affect the rate of nitrogen fixation. Of this 35 kg, about 13 kg/ha is available to plants in a perennial pasture[2]. Therefore, in a tropical grass pasture an annual legume that produces about 3 t DM/ha of herbage per year would provide about 40 kg/ha nitrogen per year. A perennial such as lucerne that produces 8 t DM/ha of herbage annually may provide about 105 kg/ha of nitrogen for the tropical grass pasture. These nitrogen levels (40–105 kg/ha) are within the range required to achieve high quality pasture production and therefore good animal production.

References

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Further reading

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