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Quality and seasonal yields of promising forage species in the red soils region of southern China

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Abstract. Following increasing interest in the use of special purpose forages to provide quality feed for small holder beef farmers in the red soil region of inland southern China, 14 of the most promising accessions were evaluated over 2 years to measure their seasonal yield of leaf and stem. Seven grasses (six perennials and one annual) and two non-leguminous broadleaf herbs were fertilised with both 200 and 400 kg of nitrogen (N)/ha.year. Two herbs were fertilised with only 200 kg N/ha and three legumes were fertilised with 60 kg of N/ha. The accessions were evaluated under cutting, as cut-and-carry of improved forages is, and is likely to remain, more widely used than grazing in this region.

The highest yielding accessions were an elephant grass hybrid Guimu-1 [(*Pennisetum purpureum* × *P. americanum*) × *P. purpureum* cv. Mott] closely followed by elephant grass (*P. purpureum*) with total annual yields of 18–24 000 kg/ha in 2002, depending on accession and N rate, and 13–22 000 kg/ha in 2003. Their yields of leaf were 9–17 000 kg/ha in both years. Dwarf elephant grass cv. Mott gave similar yields of leaf but only half the yields of stem. Average leaf yields of the three elephant grass accessions were 24% higher at the higher rate of N in the first year and 40% higher in the second year.

With the exception of the herbs *Cichorium intybus* and *Silphium perfoliatum*, there was negligible growth in the cooler months (November–March) and the periods of peak growth were in July and August. *C. intybus* was the most promising of the legumes and herbs, but is damaged by waterlogging and disease.

Averaging over both years and all harvests, there was very little variation in the protein percentage of the different perennial grasses with levels of 12.4% at 200 kg N/ha and 13.7% at 400 kg N/ha. The corresponding protein percentage of the annual Mexican forage corn was higher (13.5 and 15.0%) but the legumes and herbs had a higher protein percentage (16–23%).

The most promising accession was dwarf elephant grass as it gives a high yield of leaf, but a relatively low percentage of stem. As such, it is well suited to a cut-and-carry system of feeding, especially as the time of cutting is less critical than with other forms of elephant grass, which can rapidly develop a high percentage of stem. However, given good management, higher yields of leaf can be obtained from the elephant grass hybrid.

Introduction

There is an increasing standard of living in China and an increasing demand for beef. Therefore, the Chinese Government is encouraging beef production by smallholder farmers in southern China (Zhang 1991). Although there are some small specialist beef producers, most farmers with beef cattle still rely on rice production as their main enterprise and may have only 1–3 head of cattle (MacLeod *et al*. 2007). Rice straw is the main source of feed during winter and the feed in summer is primarily derived from residues from various crops, such as peanuts, and restricted grazing of low quality native pastures.

In southern China, the 'red soil' region covers some 2.2 million km^2 with a population of ~600 million (Xie *et al.* 1991). Rice production is mainly on the alluvial soils although some rice is grown on the better upland red soil areas. Some of the upland red soils are under native grassland, planted forests or orchards yet some large areas are unused. The quality of the native pasture is low, one of the main species being *Imperata cylindrica.* The area has major climatic contrasts between seasons. Winters are wet and cold, with isolated snowfalls, spring is wet and cool, summer is hot and humid and autumn is warm and dry.

To explore the potential to grow forages on these red soils, three Australian Centre for International Agricultural Research projects (UNE 1993; UNE 1998; CSIRO 2000) evaluated several hundred forage accessions. However, most of these failed. This was largely due to a combination of low soil fertility, low winter temperatures, high temperatures in mid summer and dry periods in autumn. The most promising accessions selected from these projects, together with some others selected from other studies, have been planted more widely as part of a follow-up study on beef production in this area (Wen *et al*. 2000). Although other feed sources, such as ammoniated rice straw, are used in the feed year as a result of these studies, fresh material from summer grown forage is a key component.

However, there was no information on the seasonal distribution of yield of these forages and such information is required to formulate a feed year and to determine the areas of land that are require to provide forage for a known period of

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