

THE EFFECT OF CUTTING MANAGEMENT ON THE FODDER YIELDS OF A MIXED CROP OF CALLIANDRA AND NAPIER GRASS

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Abstract

A field experiment was established to study the effect of cutting management on the fodder yields of a mixed crop of calliandra (*Calliandra calothyrsus*) and Napier grass (*Pennisetum purpureum*). Seven treatments were laid out as hedgerows in a randomized complete block design with four replications. Dry matter (DM) yields of calliandra increased significantly ($P \leq 0.05$) with cutting height. Most nutrients were not affected by this management except calcium and magnesium which declined. Dry matter yields of Napier grass declined with increasing cutting height of calliandra in the mixture. No significant differences in nutrient content were observed.

Introduction

The importance of livestock production in many Kenyan highland land-use systems cannot be overemphasised. Depending on different communities and circumstances, various livestock species become important sources of products and services such as food, manure, income, transport and traction. In the highlands of western Kenya, dairy farming is an important traditional form of land use. Because of increased human population densities and diminished acreages of land available to many households, inadequate supplies of quality fodder is an important constraint to sustainable livestock production, improvement of food security and alleviation of rural poverty. As significant deviations from traditional practices of management are now inevitable, many families have reduced their livestock numbers to two or three. These are confined to zero-grazing and semi zero-grazing units. Napier grass (*Pennisetum purpureum*, Schum.) are planted and managed on fodder banks or terrace bunds to supplement the conventional cut-and-carry feeds such as wild grasses and crop residues. Feed shortages, however, are still experienced particularly during dry seasons when herbaceous plants dry up and drop significantly both in quantity and quality.

Commercial concentrates such as bonemeal and meat-and-bone meal are high in protein and available in the market, but are expensive and inaccessible to many resource-poor farmers. Many leguminous trees and shrubs are highly nutritious, can remain green during dry seasons, and can provide cheaper alternatives. Careful introduction and proper management of appropriate woody species in farming systems can greatly mitigate current problems and provide favourable economic opportunities.

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Leucaena, for example, is comparable to the best forage legumes such as alfalfa (NAS, 1977) and some concentrates such as meat meal (Siebert *et al.*, 1976).

Calliandra (*Calliandra calothyrsus*, Meissn.), a native of central America and a member of the legume family and the Acacia Sub-family mimosoideae, has adapted well to the ecological conditions of western Kenya and has responded favourably to cutting management and any cropping (Otieno *et al.*, 1991). It grows fast and coppices well, is high in nutrients and can provide a suitable supplement to existing feed resources. A combination of calliandra and Napier grass on field bunds was mutually beneficial when the shrub was regularly coppiced at 0.5 m above ground (Mengich, 1994). In order to explore other management options and to fill existing information gaps in mixed systems, an experiment in which calliandra was planted in association with Napier grass and managed at various cutting heights, was evaluated as part of ICRAF's Agroforestry Research Network for Africa (AFRENA)'s strategy for technology generation and development for fodder production.

Materials and methods

Location and site description

The study was conducted at the National Agroforestry Research Centre in Maseno, western Kenya. Maseno (34° 35' East and 0° North) is located about 400 km north-west of Nairobi, and 30 km north-west of Kisumu in Nyanza Province. It is at an altitude of 1560 m and has a bimodal distribution of rainfall with a long term annual average of about 1,750 mm.

The experiment was located on a former grazing paddock with a slope of less than 2%. The soils are loam to clay loam and were classified as lixisols (tropical luvisols). The soil has a pH in water of 5.1, 1.5% organic carbon, 0.2% total nitrogen, and 5.6 ppm available phosphorus.

Experimental design and procedures

The field trial was established in April 1990 during the long rains period. It consisted of seven treatments comprising a double row of Napier grass, double rows of calliandra managed at three cutting heights (10, 50 and 130 cm), and napier-calliandra mixtures, with calliandra managed at heights as stated above. Napier was cut at ground level. Calliandra was established using seedlings and Napier was established from cuttings. Napier and calliandra were planted in parallel rows 50 cm apart in an East-West direction in plots 7 m long and 1 m wide. The treatments were replicated four times in a randomized block design. Weeding was done regularly and harvesting of forage was done at intervals of 2.5 months until November 1992. No food crop data were taken although beans were grown as cover crops.

At harvesting, calliandra was separated into leaf (edible fraction including expanded leaves and succulent buds) and wood (stem) fractions. All above-ground biomass of Napier grass was considered as edible material. About 500 g of thoroughly mixed samples of fresh edible material of calliandra and Napier grass were taken and oven-dried at 60°C for 48-72 hours.

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Table 2: The effect of cutting height of calliandra (*Calliandra calothyrsus*) on the DM biomass yields and nutrient concentrations of napier grass (*Pennisetum purpureum*) per metre of row length.

Cutting ht (m)	DM (kg/m)	DM%	CP (kg/m)	CP%	Ca%	Mg%	K%	P%	Adf%	Zn (ppm)	Cu (ppm)
0	0.73 ^a	19.7 ^a	0.05 ^a	7.0 ^a	35.4 ^a	0.22 ^a	0.33 ^a	2.54 ^a	0.18 ^a	24 ^a	9 ^a
0.25	1.30 ^b	20.1 ^a	0.08 ^b	6.5 ^a	36.3 ^a	0.23 ^a	0.37 ^a	2.10 ^a	0.16 ^a	25 ^a	9 ^a
0.5	0.46 ^a	19.5 ^a	0.03 ^c	7.8 ^b	35.8 ^a	0.19 ^a	0.37 ^a	2.39 ^a	0.16 ^a	32 ^b	11 ^a
1.3	0.86 ^a	18.4 ^a	0.07 ^a	8.2 ^a	36.5 ^a	0.21 ^a	0.32 ^a	2.86 ^a	0.16 ^a	27 ^b	11 ^a
Mean	0.84	19.4	0.06	7.4	36.0	0.21	0.35	2.47	0.17	27	10
Sed	0.08	0.56	0.005	0.22	0.44	0.006	0.02	0.17	0.04	0.8	0.3

Conclusions

The results of this study are of great relevance to the resource-poor small scale farmers of western Kenya. Farms in this region are too small to supply sufficient livestock fodder from natural pasture and existing livestock management systems. Napier grass, an indispensable supplement to locally available low-quality wild grasses and crop residues, is high yielding and forms a significant portion of many livestock diets. It is, however, limited in potential because of its low nutrient status and characteristic susceptibility to adverse environmental conditions. High quality commercial feeds are expensive and inaccessible to the majority of households.

Calliandra is one of the many trees and shrubs that are high in nutrients, can withstand adverse environmental conditions and may provide appropriate low-cost alternatives. By virtue of its extensive root system, it is capable of maintaining biomass productivity during dry seasons and for longer periods. The problems associated with the high levels of fibre, which causes reduction in the DM digestibility of this species, should be minimised. With proper management, interactions of calliandra and napier grass in mixed systems and in livestock diets are mutually beneficial.

The DM productivity of calliandra increased with cutting height and showed an inverse relationship with the associated napier grass biomass. This underscores the importance of proper cutting management in mixed systems. Appropriate cutting heights should be adopted to optimize DM and nutrient yields and minimize above- and below-ground competition in any farming, alley cropping and other agroforestry systems.

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