High Yielding and Disease Resistant Elephant Grass Suitable for Intensive Smallholder Dairy Farmers in Kenya

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HIGH YIELDING AND DISEASE RESISTANT ELEPHANT GRASS SUITABLE FOR INTENSIVE SMALLHOLDER DAIRY FARMERS IN KENYA

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Abstract

In Kenya, over 80% of milk is produced by the smallholder dairy farmers who mainly practice semi or zero-grazing dairy management system. Scarcity of livestock feed is a great limiting factor in the dairy industry, especially in the small scale farming systems which rely mostly on fodder. Elephantgrass (*Pennisetum purpureum*) is the major livestock feed and its productivity depends mostly on management practices. The current fodder crops grown by farmers have been developed through systematic research of collection/introductions, screening and evaluation of forages for their suitability as livestock feed. These adopted fodder cultivars are undergoing yield reduction due to fungal diseases. This study evaluates new Elephantgrass genetic material with high yielding potential and disease resistance. Results show that accession 16791 (KAKAMEGA 1) is high yielding, highly nutritious and resistant to a fungal disease *Ustilago kamerunensis.*

Keywords: Elephantgrass, high yielding, fungal diseases, zero-grazing

Introduction

The dairy sub-sector is a high priority enterprise in the predominantly agricultural economy of Kenya. Although the country has a potential to produce 4 billion litres of milk annually, the current annual production is only 2.2 billion litres GoK (1997). Over 80% of the milk is produced by smallholder farmers in the high to medium agricultural potential areas. Shortage of improved high quality, high yielding forages is a major production constraint to dairy farming in the smallholder farming systems. Elephantgrass (*Pennisetum purpureum)* is the main fodder crop in Kenya, especially amongst smallholders in densely populated areas, where semi or zero grazing systems are increasingly becoming the only feasible production systems Orodho (1980). Two major diseases of economic importance in East Africa are the White Mould fungus *Beniowskia sphaeroidea* reported by Maher (1936) and described by Nattrass (1941) and the stunting disease reported by Tiley (1969). Elephantgrass varieties most preferred by the farmers are more susceptible to *Ustilago spp.* This study was conducted at a Regional Research Centre in western Kenya located at 0°34' N and 35°00' E and mean altitude of 1500 m asl. The centre receives bimodal rainfall totaling 1962 mm per annum. Relative humidity ranges between 64 and 52%. Soils are largely nitosols, and representative of the soils in the region. The purpose of this study was to introduce and evaluate high yielding Elephantgrass varieties that are resistant/tolerant to fungal diseases.

Material and Methods

Six local Elephantgrass varieties commonly grown by small-scale livestock farmers in Kenya and nine accessions of *Pennisetum* and *Pennisetum* hybrids acquired from ICRISAT through ILRI Forage Network (AFRNET) were grown in a completely randomised block

designed with three replicates. For each treatment 16 splits of uniform sized Elephantgrass planting material were planted in a 6.0 m row. A spacing of 0.4 m and 0.75m were used within and between rows respectively. A border row of one of the local cultivars (Bana) was planted on either side of the block. 40 kg/ha P_20_4 (from DAP) and 40 kg/ha N. (from CAN) were used at planting and as top dressing respectively. Plant heights were measured every two weeks from one month after planting to harvest time in order to determine growth rates. Materials in 2m long sample plots were harvested whenever they attained an average of 1-meter height. The materials were weighed and a random sample of 500 grams dried at 105° C for 24 hours to determine the percentage dry matter. Five representative Elephantgrass plants were picked at random from the sample material and separated into leaves and stems and weighed separately to determine dry matter production and leaf-to-stem ratio. For each plant the width of the third leaf from the bottom of the plant was measured at a $^1/_3$ the leaf length from the leaf sheath using a ruler.

Based on drymatter yield, three best accessions of Elephantgrass introductions and one local variety (Bana) were grown in larger plots of about 0.25 ha. for carrying out feed intake trials. Twenty-four sheep of approximately similar weight and size were randomly allocated to the four promising Elephantgrass treatments. The four groups of sheep were confined in a feed intake zero grazing unit and fed *ad-libitum* on Elephantgrass chopped into pieces of 5 - 10cm long using a chaff-cutter. The time of harvest of the fodder was 6 weeks old during wet season when Elephantgrass was about 1.0 to 1.5 m tall. This was achieved by dividing each of the paddocks of the different Elephantgrass into 42 sub-plots. Each sub-plot was planted on successive days and later harvested daily to feed the sheep in that treatment at the right age of maturity in rotation until the entire plot was harvested. This ensured that harvested fodder was at about the same maturity age. Voluntary intake was assessed over a period of 28 days. The trial was preceded by 14 days preliminary period during which the quantity of Elephantgrass feed was

increased gradually up to treatment proportions. The sheep were individually penned and had constant access to water and mineral block. They were de-wormed prior to the trial and weighed at the start and at the end of the trial for live weight (LW) gain calculation. Samples of feed offered to and refused by sheep were taken daily and bulked over the measurement period. Two samples were taken daily one for dry matter analysis and another was for chemical feed analysis and were dried at 105° C and 65° C respectively.

Twenty local and 10 introduced Elephantgrass varieties/accessions were screened for resistance against the fungal disease (*Ustilago kamerunensis*) at the National Agricultural Laboratory. Inoculation was carried out by dipping 3 node cuttings in a 10^6 spore suspension of *Ustilago kamerunensis* for 3 hours then planted in pots Farrel (1998). The inoculated materials were then observed for susceptibility, tolerance or resistance to the fungal disease.

Results and Discussion

There were significant differences ($P<0.01$) in the rate of establishment, growth rate, dry matter yield, leaf width, and leaf-to-stem ratio among the varieties/accessions studied. Accession 16791 has the greatest promise in the ease of establishment and growth rate. While the local grass (Bana) was significantly superior in dry matter yield, there was no significant differences in the introduced accessions 16798, 16791 and the local French Cameroon variety (Figure 1.). Accessions 16798 and 16791 were among the highest yielding materials. The accessions that had the highest leaf-to-stem ratios (LSR) were 16743 (1.056), 16840 (0.870), and 16838 (0.633). The rest of the varieties/accessions had low LSR ranging from 0.3 - 0.5.

There were no significant differences in the average daily intake among the four Elephantgrass accessions/variety. Similarly no significant differences were found in the average daily gain of sheep fed on the four Elephantgrass accessions. Table 1 gives a three-factor quality

analysis of the tested Elephantgrass varieties. The variety means did not differ (P>0.05) for any of the three factors considered.

Out of the varieties/accessions tested only accession 16791 (KAKAMEGA 1) was resistant/tolerant to Head smut. All the important commonly used local varieties such as Bana, Clone 13, French Cameroon were susceptible to *Ustilago kamerunesis* Farrel (1998). Since incidences of early flowering smut disease on Elephantgrass caused by *Ustilago kamerunensis* was first reported in 1994 in Central Kenya, the effects of the disease has caused alarming losses. The disease has caused serious damage to Elephantgrass in some places, resulting into drastic reduction of biomass or complete loss of yield. Accession 16791 commonly known as KAKAMEGA 1 which was found to be resistant is currently being bulked for use by small-scale farmers.

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Table 1 – Crude protein and ash concentration and drymatter digestibility of four Elephantgrass variety /accessions

	FACTOR		
Variety/Accession	CP (% DM)	Digestibility (%)	Ash (% DM)
16786	13.0	48.8	16.8
16798	13.3	50.6	16.0
16791	13.9	48.3	16.5
Bana	12.2	48.9	16.8
C.V.	23.5	8.7	7.0
LSD	3.0	4.2	1.1

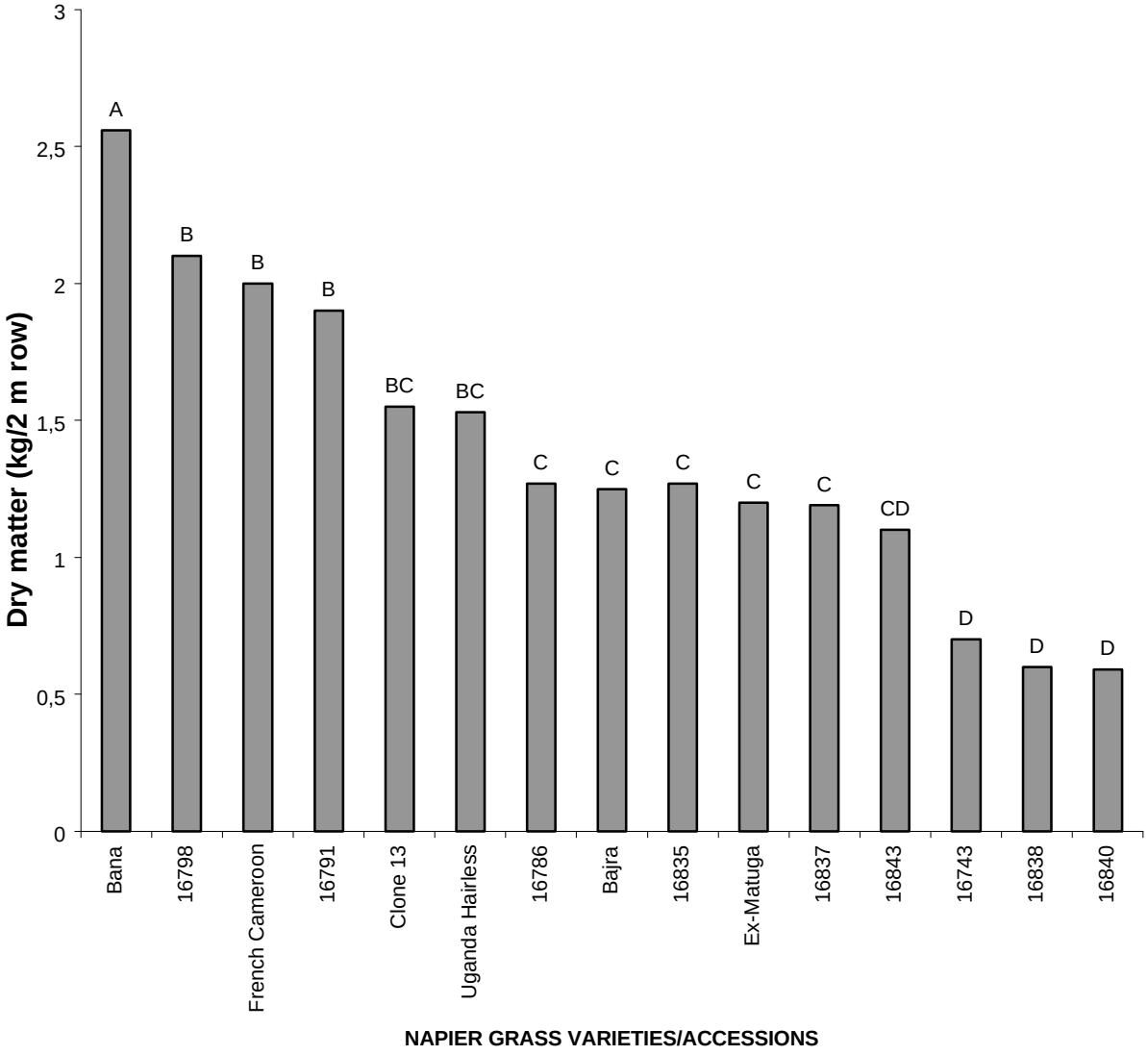

Figure 1 – Dry matter yield of several Elephantgrass varieties/accessions