Napier Grass (*Pennisetum purpureum*)
Kakamega 1
Seed production manual

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Acknowledgement

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We are also grateful to the contributors of this manual who include KALRO scientists and extension agents.
Preface

Napier grass is a robust perennial grass with vigorous root system and creeping rhizomes. The fodder is the most common with small scale dairy farmers in Kenya. Napier grass variety Kakamega I has been developed and promoted by KALRO. The variety has high yields and tolerant to snow mould, stunting and head smut diseases.

Napier grass Kakamega I is propagated through root splits and/or cane cuttings. Canes of three nodes should be planted in a slanting position to avoid rotting caused by rain water. The estimated selling price is Ksh.3 and 5 for canes and splits respectively.

This manual provides information on how to produce, manage and utilize Napier grass Kakamega I among dairy farmers. It emphasizes the growing of Napier Kakamega I targeting Common Interest Group (CIGs), Vulnerable and Marginalized Groups (VMGs) and Producer Organizations (POs) for seed production as a business.

This work was piloted in KCSAP Counties of Nyeri, Kericho, Bomet and Kakamega.
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1.0 INTRODUCTION

NAPIER GRASS (Pennisetum purpureum)

Napier grass is a robust perennial grass with vigorous root system and creeping rhizomes. The fodder is common with small scale dairy farmers in Kenya. Napier grass forms the basal feed for dairy animals and the yield from an acre is enough to feed 1 Livestock Unit (LU) an equivalent of 1 milking cow, 1 heifer and 1 calf for a year. The average Dry Matter (DM) yield ranges from 12 to 25 tons per hectare per year (4.8 -10 tons per acre). The nutritive value of Napier grass is Crude Protein 7-9%, DM 22% and Crude Fiber 30%. The yield and nutritive value depend on soil fertility, rainfall and management practices.

1.1 Napier grass varieties

Among varieties of Napier grass developed and promoted in Kenya are Kakamega I and II, Bana grass, French Cameroun, Clone 13, Pakistan Hybrid, Uganda hairless, Ouma 1 and 2 and South Africa. These varieties are commonly grown by dairy farmers in the country. Kakamega 1 and 2, Ouma 1 and 2 and South Africa varieties are tolerant to Napier stunting and smut diseases.

1.2 Napier grass Kakamega I

Growing of Napier grass Kakamega I is a low- risk and highly profitable enterprise. The demand for planting material is increasing. There is need to train farmers on how to grow and commercialize Napier production using root splits and cuttings. It’s possible to get 190,000- 200,000 canes per acre/year (475,000 – 500,000 canes per ha.).
This manual provides information on how to produce, manage and utilize Napier grass Kakamega I for seed production as a business.

1.3 General Agro-ecological requirements

- Minimum rainfall: 900 mm
- Altitude: sea level to 2000 m.
- Soil pH: 5 –8, deep, fertile friable loam, well drained soils
- Zones 11, 111 and IV
2.0 FIELD ESTABLISHMENT

2.1 Land preparation

Land/seedbed can be prepared using either conventional or Conservation Agriculture (CA) methods. Conventional methods include hand cultivation, use of an ox or tractor plough and harrowing. Tumbukiza is a CA method of Napier grass establishment.

Plough and harrow the field well before planting. Napier grass planting requires primary ploughing followed by 1st and 2nd harrowing to make a seedbed with a fine tilth.

Primary and secondary land preparation

Picking of trash from the seedbed

2.2 Fertilizer and Manure application

Apply approximately 8 tons farm yard manure and 1 bag (50 kg) of compound (NPK 20:20:0) fertilizer per acre at planting. In case where farm yard manure is unavailable, use 100kgs of NPK (20:20:0) fertilizer per acre. Apply 2 bags of nitrogenous fertilizer (CAN 26%N) per year for top dressing after the second cutting. Where available, apply slurry manure regularly after every subsequent cutting.
2.3 Propagation

Napier grass can be propagated from stem cuttings or root splits only. It is not possible at farm level to harvest and use Napier seeds as planting materials. The quantity of planting material depends on the area to be established.

2.3.1 Inoculation of Napier canes with rooting enhancing hormone (organic fertilizer)

Inoculation is introduction of a bacteria or a hormone meant to accelerate growth and utilization of natural nutrients. The main methods practiced are dipping and sprinkling. When dipping, Napier grass canes/ splits are immersed in a water solution containing inoculants and then transplanted in polythene bags or into a nursery covered with a net to prevent direct sunlight. For sprinkling, a polythene sheet is placed at a soil depth of 30cm to prevent root penetration deep into the soil and conserve moisture. Fill up the gap of 30cm with soil mixed with manure. Establish the cane cuttings or splits in the nursery and sprinkle with the inoculant.

Common inoculants include HB101® or root doctor® among others. The inoculants increase the population of microbes and enhances their activity. This helps in reducing the time taken in rooting of Napier grass and promotes healthy and faster growth. Rooting takes about 3-4 weeks and the rooted canes or splits are ready for sale.
Table 1: Napier grass planting materials

<table>
<thead>
<tr>
<th>Napier grass splits</th>
<th>Napier grass stem cuttings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The use of root splits is the best option to establish Napier grass</td>
<td></td>
</tr>
<tr>
<td>• Root splits can be obtained from mature stand of Napier grass</td>
<td></td>
</tr>
<tr>
<td>• 7,500 splits per acre or 18,750 splits per Ha. is recommended</td>
<td></td>
</tr>
<tr>
<td>• Cane cuttings are obtained from mature stand of Napier grass. When planting using canes, at least 2 nodes should be covered with soil</td>
<td></td>
</tr>
<tr>
<td>• 7,500 cutting per acre or 18,750 cutting per Ha. is recommended.</td>
<td></td>
</tr>
</tbody>
</table>

2.3.2 Spacing and planting

Establish Napier grass by planting one cane cutting or split per hole at a spacing of 60cm within a row x 90cm between rows for medium to high rainfall areas. Plant in holes about 30 cm deep and cover with soil at the onset of rain.

In dry areas the spacing is adjusted to 1x1 m. The canes are suitable for dry planting while, splits can be planted during the rainy season.

An actively growing rooted split with about 2 to 3 tillers is recommended for planting per hole. While one cane cutting of 3 nodes is used per hole, two nodes are covered in the soil.
2.4 Weeding

Napier grass should be weeded at least two times after planting and thereafter every subsequent cutting.
3.0 PESTS AND DISEASES

Main pests affecting Napier grass are Stem borer, Leaf hopper, Mole rats and Fall army worm. The main diseases affecting the fodder are stunting disease, head smut and white snow mould (Table 2 and Table 3).

**Table 2: Pest affecting Napier grass**

<table>
<thead>
<tr>
<th>Pest</th>
<th>Symptoms and control</th>
</tr>
</thead>
</table>
| **Napier stem borer** | • The larvae feed on the funnels before tunneling down to feed on the developing tissues.  
• The young plants are more susceptible to attack by stem borers. Others bore holes into the centre of the stem.  
• This causes stunted growth, the Napier grass stem bends and is twisted making it difficult to harvest. The caterpillars then emerge to pupate.  
• No known control measure                                                                                                                                 |
| **Leaf hopper**       | • Leaf hoppers feed on Napier grass plants and transmit the virus that causes Napier stunting disease. (See Napier stunt disease below)  
• No known control measure                                                                                                                                                                                                 |
| **Mole rat**          | • Mole rats burrow through the soil and feed on the Napier grass stem and roots. They often spoil more roots and stems than they actually eat.  
• Signs of their damage and presence include: small mounds of freshly dug soil, Napier grass leaves being pulled back down into the soil holes.  
• Use mole traps or the recommended pesticide (Fuko Kil®) for control                                                                                      |
Fall army worms

- The caterpillar eats the leaves of the plant. In severe cases the crop is totally defoliated leaving standing stems.
- Control using recommended pesticides

<table>
<thead>
<tr>
<th>Table 3: Main diseases affecting Napier grass</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disease</strong></td>
</tr>
</tbody>
</table>
| Napier grass head smut | - Symptoms of head smut include thinner, shorter stems, fewer leaves and misshapen leaves.  
- Farmers can protect Napier grass crops against head smut by removing infected material and planting resistant varieties such as Kaka-mega 1. |
| Napier stunt disease | - Napier stunt disease is spread by leafhoppers after feeding on an infected plant.  
- Symptoms include stunting and yellowing as the grass re-grows after being cut or grazed. Often the whole stool will die.  
- To control, uproot the affected plant together with soil, bury or burn. |
| Napier white snow mould | - Napier white snow mould is a fungal disease common to all Napier grass varieties except Clone 13. However, this disease is not a threat to herbage production. |

NB. It is not recommended to sell disease or pest infested Napier grass planting materials
4.0 HARVESTING, STORAGE AND GROSS MARGIN ANALYSIS

4.1 Harvesting of planting materials

It takes about 6 -7 months to first cutting of canes depending on weather. Subsequently cut every 5-6 months to get mature canes. The yield is approximately 190,000 - 200,000 canes per acre/year (475,000 - 500,000 canes per ha.).

4.2 Post–Harvest and Storage

After harvesting the stem cuttings or split, they should be kept under shade to protect them from excessive loss of moisture. Alternatively, the materials should be watered using a watering can. The materials should be transported to the planting site within two days.

The mature Napier grass canes are mainly harvested using a panga (Machetes).

4.3 Gross margin analysis

Factors considered in gross margin analysis include the opportunity cost of the land, variable costs such as hired labour, price of fertilizers and inoculants. Gross margin computations indicate that the cost of producing one acre of rooted canes, which is currently being promoted among farmers, indicates a gross profit margin of 70.4% (950,000- 281,200 divided by 950,000). This also translates to a cost per unit of rooted split to KES. 1.48. From the computations below, the cost of production per acre is 281,200 (Table 4).
Table 4: Cost of production and gross margin analysis for 1 acre of napier grass rooted canes

<table>
<thead>
<tr>
<th>NAPIER CANES</th>
<th>Units</th>
<th>No. of units</th>
<th>Cost of units</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Napier grass (1 Acre)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land hire</td>
<td>Acre</td>
<td>1</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Ploughing (tractor hire)</td>
<td>Acre</td>
<td>1</td>
<td>4000</td>
<td>4000</td>
</tr>
<tr>
<td>Heavy harrowing (hire)</td>
<td>Acre</td>
<td>1</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>Light harrowing (hire)</td>
<td>Acre</td>
<td>1</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>Cuttings</td>
<td>pcs</td>
<td>7500</td>
<td>5</td>
<td>37,500</td>
</tr>
<tr>
<td>Planting NPK (20:20:0)</td>
<td>bags</td>
<td>2</td>
<td>6,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Manure</td>
<td>Tons</td>
<td>16</td>
<td>5000</td>
<td>80,000</td>
</tr>
<tr>
<td>Top dressing CAN</td>
<td>bags</td>
<td>4</td>
<td>4000</td>
<td>16,000</td>
</tr>
<tr>
<td>Planting labour</td>
<td>m/days</td>
<td>10</td>
<td>400</td>
<td>4,000</td>
</tr>
<tr>
<td>1st weeding labour</td>
<td>m/days</td>
<td>20</td>
<td>400</td>
<td>8,000</td>
</tr>
<tr>
<td>2nd weeding labour</td>
<td>m/days</td>
<td>20</td>
<td>400</td>
<td>8,000</td>
</tr>
<tr>
<td>Top dressing labour</td>
<td>m/days</td>
<td>10</td>
<td>400</td>
<td>4,000</td>
</tr>
<tr>
<td>Cutting labour</td>
<td>man/days</td>
<td>100</td>
<td>400</td>
<td>40,000</td>
</tr>
<tr>
<td>Rooting labour/bedding labour</td>
<td>man/days</td>
<td>80</td>
<td>400</td>
<td>32,000</td>
</tr>
<tr>
<td>Rooting hormones</td>
<td>pcs</td>
<td>80</td>
<td>100</td>
<td>8,000</td>
</tr>
<tr>
<td>Miscellaneous costs (5%)</td>
<td>Assorted</td>
<td>1</td>
<td>13,200</td>
<td>13,200</td>
</tr>
<tr>
<td><strong>Sub total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>281,200</strong></td>
</tr>
</tbody>
</table>

Gross margin analysis for 1 acre of Napier canes

<table>
<thead>
<tr>
<th></th>
<th>Expected cuttings</th>
<th>cost</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revenue (TR)</td>
<td>190,000</td>
<td>5</td>
<td>950,000</td>
</tr>
<tr>
<td>Cost of production (TC)</td>
<td></td>
<td></td>
<td>281,200</td>
</tr>
<tr>
<td><strong>Gross profit (GP = TR-TC)</strong></td>
<td></td>
<td></td>
<td><strong>668,800</strong></td>
</tr>
<tr>
<td><strong>Gross Profit Margin % (GPM =GP/ TR*100)</strong></td>
<td></td>
<td></td>
<td><strong>70.4%</strong></td>
</tr>
<tr>
<td><strong>Cost of production per split (Kes)</strong></td>
<td></td>
<td></td>
<td><strong>1.48</strong></td>
</tr>
</tbody>
</table>

Assumptions:

- Costs such as salaries, levies, insurance, marketing and promotion are not factored.
- Variable costs may change depending on the region
• Harvesting is done twice in a year and all rooted cane cuttings are sold
• Establishment is done as per the production recommendations
• All other risk factors such as weather uncertainties, theft, crop destruction, pests and diseases are held constant.

4.4 Marketing

For successful marketing of Napier rooted canes, farmers and farmer groups need to focus on some basic marketing principles which include Product, Price, Place and Promotion. These principles help farmers decide on the product and its characteristics, set the price, and decide how to distribute and promote it.

The questions farmers should ask under each include:

**Product**: what to produce? The most preferred planting material is rooted canes.

**Price**: at what price to sell? Kes 5. This is determined mainly by the cost of production and demand.

**Place**: where to sell it? Farmers can sell the rooted splits amongst themselves, other CIGs, VMGs, POs and other institutions.

**Promotion**: how to promote the product? This can be achieved using avenues such as farmer to farmer interactions, churches, schools, shows, milk collection centres and use of printed materials.

4.5 Business model
5.0 FURTHER READING


Smallholder dairy farmer training manual International Livestock Research Institute (ILRI) August 2016

