Strategic Development Directions for East Africa’s Forage Sub-Sector

Nairobi, 13 July 2019

- **Introduction**
- **Common regional constraints**
- **Specific country constraints:**
  - Kenya
  - Ethiopia
  - Uganda
- **Recommendations**
- **Discussion**
Introduction

Authors:

Jos Creemers, SNV Kenya-KMDP/ProDairy EA Ltd

Adolfo Alvarez Aranguiz, Wageningen UR-Livestock Research
Introduction of the Forage scan

Objectives:

• Describes the current situation of the forage sub-sector in Kenya, Uganda and Ethiopia

• Gives recommendations to enhance availability of quality forages

Methodology:

• Desk study, questionnaires, interviews and field visits
3 Countries in East Africa

Uganda

Kenya

Ethiopia
Main Topics Considered in the study for Future Forage development

1. General constraints
2. Forage species and research
3. Forage quality
4. Seasonality
5. Preservation of forage crops
6. Seeds, planting material and fertilizer use
7. Mechanisation
8. Inputs and services
9. Forage market
10. Education and training
11. Intensified Sustainable forage production
12. Innovations
13. Policy framework
# East Africa Dairy sector

<table>
<thead>
<tr>
<th>Country</th>
<th>Milking Cows (x1000)</th>
<th>Consumption L/Capita/Yr.</th>
<th>Production Growth Rate (%)</th>
<th>Milk Production L/cow/day</th>
<th>National Population 2019 (x 1000)</th>
<th>Deficit/Gap (tonsx1000) /Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ethiopia</strong></td>
<td>11,400</td>
<td>40</td>
<td>2.5</td>
<td>2</td>
<td>112,080</td>
<td>19,371,023</td>
</tr>
<tr>
<td><strong>Kenya</strong></td>
<td>4,300</td>
<td>110</td>
<td>5.3</td>
<td>8</td>
<td>52,305</td>
<td>6,361,090</td>
</tr>
<tr>
<td><strong>Uganda</strong></td>
<td>3,749</td>
<td>70</td>
<td>6</td>
<td>4</td>
<td>45,809</td>
<td>6,661,888</td>
</tr>
</tbody>
</table>
Farming Systems in Ethiopia, Kenya and Uganda

1. **Intensive** (zero grazing, cut and carry system, Urban and peri-urban)
2. **Semi Intensive** (pasture grazing, supplementation)
3. **Extensive** (commercial ranching, agro-pastoralism, pastoralism, communal grazing)
Common constraints faced by the forage sub-sector in EA

- **Forage Quality and Quantity:**
  - Low digestible forage (high NDF%)
  - Low Feed Efficiency
  - High feeding cost
  - Unbalance rations
  - Forage Analysis

- **Seed/plant material**

- **Seasonality** (highly rain dependent):
  - Forage preservation
  - Climate change

- **Education and training:**
  - Agronomy : Animal Nutrition
  - From seed to milk
Common constraints faced by the forage sub-sector in EA

- Forage Quality and Quantity:
  - Low digestible forage (high NDF%)
  - Low protein content forage
  - Low Feed Efficiency (Intake)
  - Breed : Feed mismatch
  - Forage analysis
  - Unbalanced rations
  - High feeding costs
Recommendations

Forage Quality and Quantity

We Don’t need to Reinvent the Wheel
Recommendations
Forage Quality and Quantity
Common constraints faced by the forage sub-sector in EA

Seed/plant material

- Availability
- Accessibility
- Affordability
- Awareness

Forage crop entries in the national variety list since 1955 (Kenya)

<table>
<thead>
<tr>
<th>Legume / Pasture grass</th>
<th>Oldest entry on the variety list</th>
<th>Latest addition to the variety list</th>
<th>Number of varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhodes</td>
<td>1960</td>
<td>1976</td>
<td>3</td>
</tr>
<tr>
<td>Seteria</td>
<td>1956</td>
<td>1956</td>
<td>2</td>
</tr>
<tr>
<td>Panicum</td>
<td>1955</td>
<td>1955</td>
<td>1</td>
</tr>
<tr>
<td>Lucerne</td>
<td>2015</td>
<td>2015</td>
<td>5</td>
</tr>
<tr>
<td>Brachiaria</td>
<td>2016</td>
<td>2016</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Advantage Seeds 2018

Seed distribution by ILRI-Ethiopia 1990-2010

- Number of seed samples

Source: Advantage Seeds 2018
Recommendations
Availability & Accessibility
Improved Seed/plant material

Certification process
Importation of new varieties
New species introduction

Faster
Less complicated
Less costly

Increase demand -> demonstration plots
More repetitive buying
Involvement of private sector
Utilize strong distribution network

Enable private stakeholder to test & register proven certified seed
Increased demand

Awareness
Common constraints faced by the forage sub-sector in EA

Seasonality

- Seasonality (highly rain dependent):
  - Forage preservation
  - Rainwater harvesting
  - Climate change

- Highlands: Bimodal rain pattern
  - High potential
  - **Land:** Food crop : Forage : Urbanization

- Lowlands: <900 mm/year
  - Land available for forage
  - Irrigation potential
Recommendations

Intensify sustainable forage production

- Species/varieties selection
- Forage preservation
- Rainwater harvesting (irrigation)
- Climate change
Solutions to counter **seasonal shortages**

**Forage preservation technology**

**Preservation:**

- Utilize excess biomass during rains
- Stage of harvesting
- Minimize losses

* Harvesting
* Ensiling
* Feed out
Solutions to counter seasonal shortages
Forage preservation technology

- Innovations
  - Knowledge & skills
  - To scaled machinery
  - Contracting services
  - Scaling
  - Smart logistics
  - Financing

- Kenya: Hay, silage, haylage
- Ethiopia: Hay
- Uganda: Hay, silage
Common constraints faced by the forage sub-sector in EA

- Education, training, skills:
  - Agronomy : Animal Nutrition
  - From seed to feed to milk
  - Dissemination, implementation, adaptation
Education and skills training in all ‘links’ of the chain
Quality feed starts with quality seed

FODDER CHAIN - FROM SEED TO FEED

Crop Production
- Soil management
- Land preparation
- Quality seed
- Fertilization
- Planting
- Crop management

Fodder preservation
- Harvesting (timing)
- Hay/pellets
- Silage bunker design
- Compaction
- Covering

INPUT SUPPLIERS
- Soil testing
- Farm mechanisation
- Fertilizers
- Seed suppliers
- Agrochemicals
- Crop testing

AGRICULTURAL CONTRACTORS
- Farm Mechanization
- Agrochemicals
- Polythene sheets
- Feed testing

Milk
Ration formulation
Main problems faced by the forage sub-sector in Kenya

**Forage Market:** High demand for forage. No quality control or certification, price is not related with quality, unformal

**Economic analysis:** Feed budgeting, Nutrients value, feed cost analysis

**Forage production and preservation skills:** Farmers, contractors

**Machinery:** Old, lack of replacement parts and mechanical support

**Forage crop options:** Limited

**Land:** Urbanisation expansion

**Health = Food safety = Feed safety**
Feed Pricing by Nutrient Unit

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>Price Kg (Fresh) Ebr</th>
<th>DM content %</th>
<th>Price Kg (DM) EBr</th>
<th>Protein Content %</th>
<th>Price Protein Unit EBr</th>
<th>Energy Content MjME</th>
<th>Price Mj ME EBr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spent Brewery</td>
<td>1.5</td>
<td>25</td>
<td>6</td>
<td>25</td>
<td>0.24</td>
<td>10</td>
<td>0.6</td>
</tr>
<tr>
<td>Groundnut cake</td>
<td>9</td>
<td>90</td>
<td>10</td>
<td>32</td>
<td>0.31</td>
<td>10.5</td>
<td>0.95</td>
</tr>
<tr>
<td>Wheat Bran</td>
<td>7</td>
<td>90</td>
<td>7.7</td>
<td>16</td>
<td>0.48</td>
<td>10</td>
<td>0.77</td>
</tr>
<tr>
<td>Hay</td>
<td>4</td>
<td>90</td>
<td>4.5</td>
<td>7</td>
<td>0.63</td>
<td>7</td>
<td>0.64</td>
</tr>
<tr>
<td>Straw</td>
<td>3</td>
<td>90</td>
<td>3.3</td>
<td>4</td>
<td>0.82</td>
<td>6</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Cow Breed = Forage Quality

Introduction of improved forage
Main problems faced by the forage/fodder sector in Ethiopia

### Milk Market: Weak and inconsistent

### Land (Government Property): Competition Food: Urbanisation: Forage

<table>
<thead>
<tr>
<th></th>
<th>Natural Grass</th>
<th>Crop Residues</th>
<th>Improved Forage</th>
<th>Hay</th>
<th>By Products</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main livestock feed (%)</td>
<td>59.53</td>
<td>28.27</td>
<td>0.20</td>
<td>7.36</td>
<td>0.79</td>
<td>3.86</td>
<td>100</td>
</tr>
</tbody>
</table>

(Source: Ylima et al., 2011)

### Forage Preservation: Hay

### Feed Cost: Very high, poor quality, informal

### Water Use: Inefficient from plant and animal point of view
Milk Market

Farm Confidence in Dairy Farming

More land allocated for forage

Forage Quality

Better Profit

Lower Feed Cost

Government

Private Sector

Milk Demand

Farmer

Government

Awareness
Knowledge
Machinery
Inputs
Services

Education
Improved Forage
Extension support

New Preservation Methods

LAND

GHG

https://we.tl/t-knYtIfLImG
Main problems faced by the forage sub-sector in Uganda

**Water availability:** rainwater harvesting, storage, efficient use

**Farmers knowledge & skills:** uptake, implementation, adaptation incl. preservation technology

**Mechanisation:** available, to scale, affordable

**Financing:** small margins → discourage investments

**Investments in forage seed:** resulted in limited improvements

**Land:** Land competition, subdivision and urbanization

**Quality Inputs:** available, affordable
Enable participation of youth & women

Water harvesting & management

Scaled machinery, maintenance and repair, replacements parts

Dissemination of knowledge & transfer skills
Recommendations

FULL PACKAGE CONCEPT FOR THE FARMER
Recommendations

• Develop, strengthen and/or expand an internal and external quality based and safe milk market as a driver of quality forage production

• Develop modular curriculum emphasizing climate smart forage production from “Seed to Feed to Milk”; disseminate to the farmer a full package of requisite practical knowledge and skills

• Intensify forage production (productivity and quality) as the main driver to improve profitability of dairy farms in a sustainable way

• Optimize milk production through use of quality forages in balanced rations

• Encourage & enable Private Sector involvement to create a vibrant and competitive forage sub-sector
Intensification

More production per cow = More Milk

FOOD SECURITY
NOW

Sustainable

Less Cows
More production per cow
Quality forage based
Climate smart practices

RESOURCES SECURITY
FUTURE GENERATIONS
Identify best options for dissemination of improved forage technology

Education and training: dissemination, implementation, adaptation, adoption

Tv
Radio
Mobile apps
Software
News paper, magazine, leaflet
Books
Curriculum
Demo plots
Practical dairy training farms
Private consultants
Public extension service

More milk
Better practices

One Voice
Knowledgeable
One message
Realistic
Farmer → Implements → Adapts & Adopts
Future forage sub-sector

a) Reforms allowed young, entrepreneurial dairy farmers to grow their farms
b) Young entrepreneurs had access to finance
c) Education: skills training and academic curriculum are combined
d) Research: Links plant science (agronomy) and animal science (ruminant nutrition)
e) Farmers have abundant choice and suitable forage crops are available for every feeding system
f) At farm level quality forages are the basis of well-balanced rations.
g) Forage production has intensified and is environmentally sustainable
h) Active and voluminous feed and forage market based on price / quality (DM, ME, CP)
i) The forage seed sector is vibrant with abundant choice and variety
j) Farm coaching and advisors are qualified and competent
k) Machinery at scale which performs technically to the expected and required standard
Thank You Very Much For Your Attention
## Forage Quality and Quantity

### Low digestible forage (high NDF%)

<table>
<thead>
<tr>
<th>Dry matter</th>
<th>Crude protein</th>
<th>ME ruminants</th>
<th>NDF</th>
</tr>
</thead>
<tbody>
<tr>
<td>% as fed</td>
<td>% DM</td>
<td>MJ/kg DM</td>
<td>% DM</td>
</tr>
</tbody>
</table>

### Milking Cow

<table>
<thead>
<tr>
<th>Species/variety</th>
<th>Dry matter</th>
<th>Crude protein</th>
<th>ME ruminants</th>
<th>NDF</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pennisetum pedicellatum</em></td>
<td>15-19</td>
<td>10-12</td>
<td>35-45</td>
<td>26.3</td>
</tr>
<tr>
<td><em>Panicum ssp</em></td>
<td>30.3</td>
<td>7.2</td>
<td>8.4</td>
<td>75.5</td>
</tr>
<tr>
<td><em>Pennisetum purpureum</em></td>
<td>17.9</td>
<td>9.7</td>
<td>8.2</td>
<td>71.5</td>
</tr>
<tr>
<td><em>Chloris guyana</em></td>
<td>27</td>
<td>9.5</td>
<td>8.4</td>
<td>71.4</td>
</tr>
<tr>
<td><em>Brachiaria brizantha</em></td>
<td>29.6</td>
<td>10.4</td>
<td>8.1</td>
<td>66.8</td>
</tr>
<tr>
<td><em>Desmanthus virgatus</em></td>
<td>35</td>
<td>15.8</td>
<td>9</td>
<td>46.7</td>
</tr>
<tr>
<td><em>Lablab purpureus</em></td>
<td>22.1</td>
<td>18.4</td>
<td>9.2</td>
<td>44.6</td>
</tr>
<tr>
<td><em>Maize silage</em></td>
<td>33.5</td>
<td>6.8</td>
<td>10.7</td>
<td>44.3</td>
</tr>
<tr>
<td><em>Leucaena spp</em></td>
<td>29.9</td>
<td>23.3</td>
<td>11</td>
<td>40.9</td>
</tr>
<tr>
<td><em>Sesbania sesban</em></td>
<td>17.3</td>
<td>25.5</td>
<td>11.5</td>
<td>25.5</td>
</tr>
</tbody>
</table>

- Species/variety
- Soil management
- Fertilization
- Cutting stage
- Skills / training
Dilemma faced by the forage sub-sector in EA

Low digestible forage (high NDF%)

Digestibility : Intake : Production

<table>
<thead>
<tr>
<th>NDF g/kg DM</th>
<th>DMI kg/d</th>
<th>Predicted milk L/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>18.7</td>
<td>24</td>
</tr>
<tr>
<td>400</td>
<td>16.0</td>
<td>18</td>
</tr>
<tr>
<td>450</td>
<td>14.2</td>
<td>14</td>
</tr>
<tr>
<td>500</td>
<td>12.9</td>
<td>10</td>
</tr>
<tr>
<td>550</td>
<td>11.8</td>
<td>7</td>
</tr>
<tr>
<td>600</td>
<td>10.8</td>
<td>4</td>
</tr>
<tr>
<td>650</td>
<td>9.9</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Dr. Martin Staines, Rumen8, Nairobi 2019
Recommendation
Highly digestible forage
forage analysis → balanced ration → higher margin
Effect of better-quality forage and balanced ration on MY
<table>
<thead>
<tr>
<th>Forage crop &amp; cutting stage</th>
<th>NDF g/kg DM</th>
<th>CP g/kg DM</th>
<th>DMI kg/day</th>
<th>Milk l/day</th>
<th>MAFC KES/c/day</th>
<th>Feed % Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Napier &gt; 120 cm</td>
<td>681</td>
<td>4.2</td>
<td>10.5</td>
<td>1.3</td>
<td>0</td>
<td>99%</td>
</tr>
<tr>
<td>Napier = 120 cm</td>
<td>695</td>
<td>8.8</td>
<td>10.3</td>
<td>2.7</td>
<td>5</td>
<td>94%</td>
</tr>
<tr>
<td>Napier &lt; 60 cm low CP</td>
<td>630</td>
<td>12.5</td>
<td>11.3</td>
<td>6.4</td>
<td>115</td>
<td>49%</td>
</tr>
<tr>
<td>Napier &amp; Maize bran</td>
<td>553</td>
<td>13.5</td>
<td>13.0</td>
<td>12.1</td>
<td>241</td>
<td>43%</td>
</tr>
</tbody>
</table>

Better quality forage better for farmer, cow and environment

Higher Feed Efficiency, higher margin
Better quality forage better for farmer, cow and environment

**reduced methane intensity**

<table>
<thead>
<tr>
<th>Forage crop &amp; cutting stage</th>
<th>NDF g/kg DM</th>
<th>CP g/kg DM</th>
<th>DMI kg/day</th>
<th>Milk l/day</th>
<th>CH4 g/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Napier &gt; 120 cm</td>
<td>681</td>
<td>4.2</td>
<td>10.5</td>
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<td>12.5</td>
<td>11.3</td>
<td>6.4</td>
<td>51.4</td>
</tr>
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<td>13.5</td>
<td>13.0</td>
<td>12.1</td>
<td>26.7</td>
</tr>
</tbody>
</table>
Improve forage production practices

Education and training:  - Agronomy  ↔  Animal Nutrition

Minimum tillage and soil disturbance
Crop rotation and intercropping
Stage of harvesting - cutting interval
Maintain soil fertility