Performance of tropical forages (Mulato II and Forage Sorghum) for silage conservation in the Caribbean

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INTRODUCTION
Agricultural Diversification: *Small Ruminants*

- Food / fibre/ income
- Wide variety of herbage, landscapes
- Lower investment costs than cattle
- High quality protein source

In recognition of its importance to rural development and poverty alleviation, agricultural diversification and regional food security, CARICOM governments designated the small ruminant industry as a priority area for development.
CONSTR AN TS

Policy
Absence of clear-cut policy on small ruminants/ or no implementation if they exist
Problems in land tenure (unsuitable or high cost)
Inadequate measures in place to deal with praedial larceny

Production
Natural disasters
Unavailable quality breeding stock or inadequate numbers
FEED. High cost of concentrates, limited supply of agro / industrial by-products.
Deficiencies in the management practices (i.e. pre weaning mortality)

Support systems (credit/ technical or extension) inadequate

Marketing
Small ruminant marketing is currently mainly ad hoc
Unbridled importation of cheap and poor quality old meat
Poor support infrastructures for slaughtering and meat processing to meet intl standards
No established meat quality standards

Agricultural Extension and Economics Dept. UWI (2006)
Agricultural Diversification: Small Ruminants

FRAMEWORK – St. Kitts and Nevis

• Closure of sugar industry
• Available land, need for employment
• Agricultural Development Strategy MoAMR

• CARICOM net importer
• Consumer demands
Agricultural Diversification: Small Ruminants

FRAMEWORK – St. Kitts and Nevis - Survey results of CARDI study (2008) show:

- Almost 100% of SR farmers graze their animals
- More than 72% (goat) and 79% (sheep) rely only natural pastures
- Pastures mainly local, scrub vegetation of low quality.
- Little or no pasture management is practised

Intensive: 31%

Extensive: 61%

Semi-Intensive: 8%

Own pastures: 29%

Free roam and communal areas: 43%

Leased and rented pastures: 28%
Research Problem and Objectives
GAPS and OPPORTUNITIES in SR Production

• On going breeding units and Veterinary SS Projects SK

• High costs of grain (worldwide food crisis)

• Available land (SK)

Forage based production systems
Research problem

• Low quantity and quality of forages

• Seasonal availability

• Poor nutrition
INTERVENTIONS

1) Establishment of forage crops
2) Management of forages
3) Harvesting and ensiling technique
3) Animal performance studies
Specific objectives:

a) to incorporate mulato grass and forage sorghum into feeding systems as alternative species to increase forage production and quality;

b) to introduce forage conservation techniques to balance the periods of forage scarcity with the conserved forage from periods of overproduction;
ESTABLISHMENT OF FORAGES,
MANAGEMENT, SILAGE PREPARATION
Small Ruminants: Establishment of forages: January to June 2012

- Management / Agronomic Practices for Successful Establishment
- Data collection, observations and sampling

Seeding/ re-seeding

Weed control/Fertilization

Measurements: ruler and quadrat

Sampling: quadrat

Weekly field observation
## FORAGE CROPS MANAGEMENT

<table>
<thead>
<tr>
<th>Crop management</th>
<th>Forage Sorghum</th>
<th>Mulato grass</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variety</strong></td>
<td>BMR hybrid, Great Scott TX</td>
<td>Mulato II, Tropical Seeds FL</td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td>5 acres</td>
<td>5 acres</td>
</tr>
<tr>
<td><strong>Planting date and density</strong></td>
<td>March 2&lt;sup&gt;nd&lt;/sup&gt; 2012</td>
<td>November 2&lt;sup&gt;nd&lt;/sup&gt; 2012</td>
</tr>
<tr>
<td></td>
<td>22 lb seed / acre</td>
<td>12 lb seed / acre</td>
</tr>
</tbody>
</table>
| **Fertilization** | No pre-plant fertilization ; 100lbs/acre at 7 wks NPK (20:10:10) | Pre-plant fertilization with 100lb urea/acre; | a. No pre-plant fertilization or during growth until April 2012  
                        b. 200lbs/acre NPK (20:10:10) and 250lb urea/acre after harvest or brush cut |
| **Harvest**     | May 24, 2012   | January 25, 2013 | 1<sup>st</sup> harvest: July 27, 2012  
                        2<sup>nd</sup> harvest: November 15, 2012  
                        Brush cut every 6 wk |
| **Weed control** | No pre-plant or growth stage weed control | pre-emergent herbicide and post emergent broad leaf control | No pre-plant or growth stage weed control, until April 2012; Post emergent broad leaf control |

*First planting was washed away by torrential rains (Dec 2011); replanted are in April because of high weed infestation*
“Zoning” of Forage crops at Belle Vue

Section E’
Section B’
Forage sorghum: 5 acres

Section D’

Section A’
Mulato grass: 5 acres

Section C’
Section B’
ESTABLISHMENT: MULATO GRASS

Seeded Mulato grass area at Belle Vue

Emerging Mulato grass at Belle Vue
**CARDI’s Strategic Plan for re-establishment of Mulato**

<table>
<thead>
<tr>
<th>Crop Management</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land preparation</td>
<td>Ploughed, harrowed, rotorvated to a fine tilth</td>
</tr>
<tr>
<td>Planting date</td>
<td>April 20, 2012</td>
</tr>
<tr>
<td>Planting density</td>
<td>- Density: 16 lb seeds / acre; to account for low germination rate;</td>
</tr>
<tr>
<td></td>
<td>- 2 ft between rows; 1 – 1.5” depth, with carrot seed plate</td>
</tr>
<tr>
<td>Fertilization</td>
<td>- NPK (20:10:10) rotorvated into soil at rate of 100 lbs / acre;</td>
</tr>
<tr>
<td></td>
<td>- Strategic re-fertilization with N fertiliser in the rainy season</td>
</tr>
<tr>
<td>Weed control</td>
<td>- Pre-emergent herbicide pendimethalin (Prowl) applied 2 wk before planting; 2,4 D applied for broad leaves (July 5, 2012)</td>
</tr>
<tr>
<td>Harvest</td>
<td>Every 6 – 7 weeks (harvest or brush cut)</td>
</tr>
</tbody>
</table>
# Agricultural Diversification: Small Ruminants

## Measurements and sampling summary

<table>
<thead>
<tr>
<th>FORAGE (mulato and forage sorghum)</th>
<th>Silage (mulato and forage sorghum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage establishment - (quadrat method) (height, soil coverage, # tillers, weeds)</td>
<td>Kg forage ensiled</td>
</tr>
<tr>
<td>Plant maturity: physiological state</td>
<td>Kg silage yield</td>
</tr>
<tr>
<td>Weed development (area covered, type)</td>
<td>Successful storage, post harvest losses (Kg spoiled forage)</td>
</tr>
<tr>
<td>Kg of biomass produced (quadrat method)</td>
<td>Monthly pH</td>
</tr>
<tr>
<td>Final yield in kg</td>
<td></td>
</tr>
</tbody>
</table>

**Environmental:**
- weed development, f. sorghum invasiveness, covered soil erosion in forage crop lands,
- composition and proportion of natural forage spp
Results

Establishment parameters measurements

- Soil cover (%)
- Plant height
- Biomass yield
- Physiological state
RESULTS

Mulato grass establishment

Area covered %

- mulato grass
- dry material and weeds
- bare soil
RESULTS

ESTABLISHMENT OF Mulato grass

% of area covered by mulato grass along the year

GENERAL MANAGEMENT: Seeding in February 3rd; Strategic Plan re-seeding in April 20; brush cut and harvest July 26; brush cut September 05. Strategic fertilizations with rain.
RESULTS BIOMASS production of Mulato Grass

- seeded in the dry season with great weed infest.; re-seeded areas
- 7-16 lb/acre; 35% germination rate
- 12 wk growth in dry season; patched re-seeded areas
- fertilized 100 lb/acre NPK[20:10:10]
- herbicide: late control in seeded, pre-emergent in new areas

CARICOM P. July 10, 2012
Belle Vue - St. Kitts

10,184 kg/ha

CARICOM P. August 22, 2012
Belle Vue - St. Kitts

13,354 kg/ha

Research plots (2007-08) ^
CARDI Trinidad/ SFC Research Station

• seeded: no info
• 7 lb/acre; min 60% germ. rate
• 6 wk growth
• fertilized 178 lb/acre/year
• herbicide: pre-emergent and contact herbicides

RESULTS  BIOMASS production Mulato Grass

Dry season

April 20

Strategic plan for establishment CARDI (seeding zone A & B)

Jul-10

Zones A+B+C

4,783 kg DM/ha

Aug-22

10,184 kg DM/ha

3.5 wk growth Zones B+C July 10 to Aug 22

Sep-05

12,771 kg DM/ha

6 wk growth Zone A July 26 to Sept 05

Improve management & rainy season effect

Zone A harvested for silage July 26

Zone B and C are brushcutted
RESULTS

BIOMASS production - Forage sorghum

• Seeded in the dry season, non-irrigated
  • 145,000 seed/acre
  • non pre-plant fertilization
  • 81 d growth; 3 ft height

• Seeded in the rainy season, non-irrigated
  • 145,000 seed/acre
  • pre-plant fertilization with 100 lb/acre urea
  • 46 d growth; 3 ft height

Field condition:
Dept. Agriculture,
Belle Vue - St. Kitts

- Irrigated: 12 inches applied during growing
- 100,000 seed/acre
- fertilized with 212 lb/acre N and 80 lb/acre P₂O₅
- 115 d growth
- 6.5 ft height

Research plots;
Scott Seed Co.
Research Station, TX

26,697 kg/ha

1,874 kg/ha DM
2,820 kg/ha DM
RESULTS  Dry and rainy season
BIOMASS production - Forage sorghum

CYCLE 1 dry season
1,874 kg/ha DM
81 d harvest
50 d re-growth

CYCLE 2 rainy season
3,429 kg/ha DM
60 d harvest

Dry and rainy season
RESULTS  Silage Production Forage Sorghum

Methodology: harvest, filling, compaction and storage

4.21 (6 weeks)
RESULTS  Silage Production Mulato grass

<table>
<thead>
<tr>
<th>Month packaged</th>
<th>Month of reading</th>
<th>pH Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 2012</td>
<td>October 2012 (4 weeks)</td>
<td>5.64</td>
</tr>
<tr>
<td>Oct/Nov 2012</td>
<td>January 2013</td>
<td>4.7</td>
</tr>
<tr>
<td>July 2012</td>
<td>January 2013</td>
<td>4.47</td>
</tr>
</tbody>
</table>

Very good  Good
# RESULTS

Forage harvested and stored

<table>
<thead>
<tr>
<th>FORAGES</th>
<th>Total established</th>
<th>Ensiled forage Total fresh kg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forage sorghum Cycle One</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Season</td>
<td>2.0 has (5 acres)</td>
<td>23,595 kg</td>
</tr>
<tr>
<td>Rainy Season</td>
<td>2.0 has (5 acres)</td>
<td>3,243 kg</td>
</tr>
<tr>
<td><strong>Mulato grass</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Season</td>
<td>2.0 has (5 acres)</td>
<td>3,060 kg</td>
</tr>
<tr>
<td>Rainy Season</td>
<td>2.0 has (5 acres)</td>
<td>6,050 kg</td>
</tr>
</tbody>
</table>
ANIMAL PERFORMANCE
## Methodology:

### Sites: Bourkes & Belle Vue

<table>
<thead>
<tr>
<th>5 farms</th>
<th>5 animals</th>
<th>Control</th>
<th>Natural pasture (day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 animals</td>
<td>Treatment</td>
<td>Natural pasture (day) + Mulato Silage (night: 5pm to 8am)</td>
<td></td>
</tr>
</tbody>
</table>

- **CIFSRF - IDRC - CIDA CARICOM Food Security Project**
Agricultural Diversification: Small Ruminants

Measurements summary:

- Live body weight, change
- Consumption (offer - refused)
- Average daily gain
- Fecal egg count
Preliminary RESULTS Animal Performance Studies

On farm animal trials – first 2 months

Average daily gain (g/d) ADG

- Control: Natural pasture
- Natural pasture + Mulato silage

Days after weaning:
- Day 0-50 (adaptation)
- Day 51-68
- Day 69-89
- Day 90-96

Average daily gain (g/d)
CONCLUSIONS

• Mulato II and Forage Sorghum can be grown and ensiled successfully in SK which increased year round availability of forages

• Reduced dependence on grains and poor quality forages will increase productivity

• Technology transfer through training and demonstration
“Impact of interventions in food security in the region”
Possible impacts

• Increase in quality and quantity of forages

• Reduced seasonal shortages through the introduction of a forage conservation technique

• Increased farmers income through lower cost of production and increased productivity

• Increased supply of animal protein in the market place, reduce imports

• Creation of downstream activities like commercial forage conservation/sales

• Appropriate farm model for the region

• Alternate use for underutilized land in SK: sustainable agriculture

• Mechanized service to attract women interest in small ruminants production (reduce effects of heavy duties of cut & carry)
Thank you,

SMALL RUMINANTS TEAM
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A. Hosein and N. Gibson, CARDI
S. Borucki and L. Phillip, McGill University

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