Strategies for enhancing nutrient availability from roughages and agroindustrial byproducts

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Increasing the efficiency and extent of ruminant production depends on:

- Improving the balance and availability of nutrients from a diet based mainly on agro-industrial byproducts and crop residues

- Improving feeding, breeding and disease control

- Developing animals with genetic capacity to utilize feed efficiently within the environment and management practices

- Developing equitable markets for the products
Rough forages and roughages

Deficient in

N, S and P

High in

Fiber
## Optimum levels in rumen fluid

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Optimum Levels</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ammonia</strong></td>
<td>50 – 80 mg N/liter</td>
<td>Maximize digestibility of fibrous feeds</td>
</tr>
<tr>
<td></td>
<td>150 – 200 mg N/liter</td>
<td>Maximize microbial growth efficiency</td>
</tr>
<tr>
<td><strong>Sulphur</strong></td>
<td>1 – 2 mg S/liter</td>
<td>Maximize digestibility of fibrous feeds</td>
</tr>
<tr>
<td></td>
<td>4 – 10 mg S/liter</td>
<td>Maximize microbial growth efficiency</td>
</tr>
</tbody>
</table>

**Growth of fungi dependent on S availability**

- S

Lower: 5 % digestibility units and 20-40 % intake

**Phosphorus** 75 – 100 mg/liter (Optimum microbial activity)
How to achieve it economically and efficiently?
Urea-Molasses-Multinutrient Blocks (UMMBs)

A Strategic Supplementary Feed

Optimizing utilization of locally available crop residues and agricultural by-products
Some basic components of UMMB

Urea [4 - 10%]
Molasses [0 - 45%]
Bran/roughage source [10 - 30%]
Salt/minerals [0.5 - 30%]
Binder (cement, lime, bentonite etc.) [6 - 15%]
Other ingredients (if necessary) [10 - 20%]
Main justification of UMMB use

Convenience of:

• packing
• storage
• transport
• ease of feeding by farmers
Mixing and transferring ingredients
Transferring mixed ingredients in polyethylene bags
Transferring polyethylene bag containing ingredients in the mould
Compacting the ingredients to make blocks
Opening the mould and removal of the blocks
Urea molasses multinutrient blocks (UMMB)
A shop selling the blocks
Licking of UMMB by animals
Licking of UMMB by animals
Molasses being mixed
Mixing, pressing and removal of the blocks (Indonesia)
UMMB produced by a cooperative in Indonesia
Cassia moschata fruit

Gliricidia sepium
## BLOCKS IN USE IN VENEZUELA

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molasses</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>Urea</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Lime (CaO)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Urea phosphate</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Whole cotton seed</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Phosphate salt</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><em>Gliricidia sepium</em> leaves</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td><em>Cassia moschata</em> fruit</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Commercial mineral mix.</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Chopped hay</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>
Mixing of molasses (Venezuela)
Pressing urea molasses mix in a mould (Venezuela)
Urea Molasses Multinutrient Blocks (Venezuela)
UMMB in Venezuela
Storage of hay for winter in Mongolia
for feeding with UMMB
Effects of UMMB on growth rate

<table>
<thead>
<tr>
<th>Animals</th>
<th>Growth rate (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-UMMB</td>
</tr>
<tr>
<td>FH Steers</td>
<td>210</td>
</tr>
<tr>
<td>Ongole Steers</td>
<td>333</td>
</tr>
<tr>
<td>Sheep (local)</td>
<td>36</td>
</tr>
<tr>
<td>Goats (Does)</td>
<td>40</td>
</tr>
</tbody>
</table>
## Effects of UMMB on milk production of FH

<table>
<thead>
<tr>
<th>Animals</th>
<th>Milk yield in 18 weeks (L)</th>
<th>Milk production of grazing cows (g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-UMMB</td>
<td>+UMMB</td>
</tr>
<tr>
<td>Lembang, West Java</td>
<td>1008</td>
<td>1019</td>
</tr>
<tr>
<td>Garut, West Java</td>
<td>900</td>
<td>1107</td>
</tr>
<tr>
<td>Mageland, Central Java</td>
<td>871</td>
<td>1119</td>
</tr>
<tr>
<td>Cuba</td>
<td>3.1</td>
<td>4.3</td>
</tr>
</tbody>
</table>
Milk yield (liter/cow/month)

- UMMB

+ UMMB

Start of trial

Months (Oct – May)
VENEZUELA

**Urea molasses blocks**

- Pregnancy rate: 40% higher
- Calving interval: 100 days shorter
- Additional 27% new born calves
- Better body condition
UMMB supplementation to cattle

**Improved feed intake**

**Improved efficiency of feed utilization**

**Improved productivity**

- Growth rate of grazing cattle: + 300 g/d
- Body condition: +
- Milk yield: + 1 – 2 liter
- Age at first calving: from 4-5 yrs to 2 yrs
- Calving rate of cattle: from 50 % to 85-95 %
- Birth weight of calves: from 22 to 32 kg
- Survival of young animals: from < 30 % to > 80 %
- Intercalving interval of cattle: from 2 yrs to 12-15 months
USE OF POULTRY MANURE & MOLASSES MIX
(Sudan)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Farmers</td>
<td>75</td>
</tr>
<tr>
<td>Number of Cattle</td>
<td>400</td>
</tr>
<tr>
<td>Increase in milk</td>
<td>1 liter</td>
</tr>
<tr>
<td></td>
<td>(20 % increase in milk fat)</td>
</tr>
<tr>
<td>Cost of supplement</td>
<td>0.02 US$</td>
</tr>
<tr>
<td>Selling price of one litter of milk</td>
<td>0.43 US$</td>
</tr>
<tr>
<td>Profit/cow/d</td>
<td>0.43 US$</td>
</tr>
<tr>
<td></td>
<td>(10 % increase in income)</td>
</tr>
</tbody>
</table>
Fish Silage Blocks

60 % fish waste + 40 % molasses
Stirred daily for two weeks
pH dropped from 5.8 to 4.5; no fish odour
Silage hardened by adding 10 % Wheat bran

Press and sun dry to form 2 – 5 kg Silage Blocks

27 % CP
7.5 % Fat
30 % Sol. sugar
1.2 % Ca, 1 % P
Other options for enhancing nutrient availability from crop residues

1. **Harvesting and storage**

- Rapid removal of stover *reduces* Leaf loss
- Storage under cover, movement of air *completion* Drying process
- Transport long distance *from stems* Stems *(in situ use)*
- Leaves compact to bale
- Reduced transport cost
- Reduced storage space
Other options for enhancing nutrient availability from crop residues

2. Physical treatment

- Reduction in particle size **enhances** Microbial attack, rate of digestion, intake
  - Ensiling

  For sheep, more beneficial than cattle (lower retention time)

  **Caution**

  Fine grinding

  Expensive Reduce intake due to dustiness
Other options for enhancing nutrient availability from crop residues

3. **Amount of roughage offered and chemical treatment**
   - Excess straw feeding
     - straw: leaf, sheaf, stem
     - **opportunity for selection**
       - Selective feeders; Sheep, goats
       - Rejected material
       - Non-selectors; cattle
   - Ensilaged

4. **Partial supplementation of ensiled roughage**
   - 20 – 25% of total straw intake through urea ammoniated straw
     - Increase total straw intake
Some options for enhancing nutrient availability from crop residues

• Urea-molasses multinutrient blocks
• Poultry litter-molasses multinutrient blocks
• Fish waste-molasses silage, and its blocks using bran
• Harvesting and storage
• Physical treatment
• Excess offering of crop residues
• Supply of some green forage or tree leaves