TROPICAL PASTURES IN A CHANGING ENVIRONMENT. DEVELOPMENT OF AN INTERNATIONAL RESEARCH COLLABORATION IN LATIN AMERICA AND THE CARIBBEAN

Forage conservation strategies in the form of silage and hay for critical periods

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Forage conservation strategies in the form of silage and hay for critical periods

- To be consistent with the current realities of livestock, it is necessary to expand these concepts:
- Include protein plants and their conservation in the form of flour.
- Include agro-industrial byproducts and agricultural waste in the concept.
- Validate in this group of foods the technologies developed for forages
- Keep in mind that some of them can also be offered to monogastric species.

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The biggest challenge of tropical livestock is to have enough food all year round.

Advances in technologies aimed at optimizing the use of local resources and animal nutrition do not have reciprocity in the application of results and knowledge transfers.

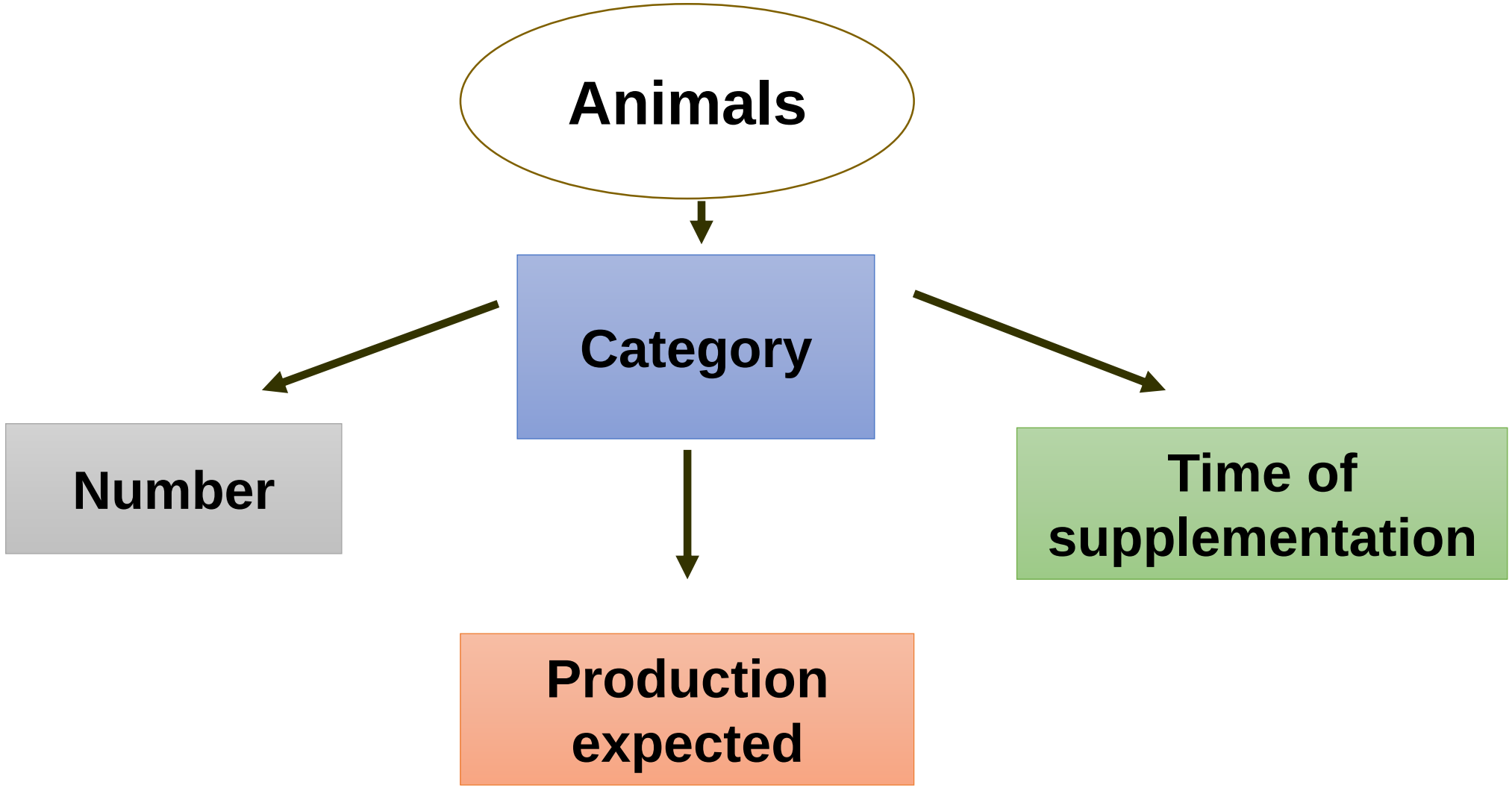
What situations does livestock face?

- Unstable periods of rainfall due to climate change that negatively affect forage availability.
- Diets with nutritional deficit in quantity and quality.
- Does not apply feeding programs that guarantee satisfactory productions.

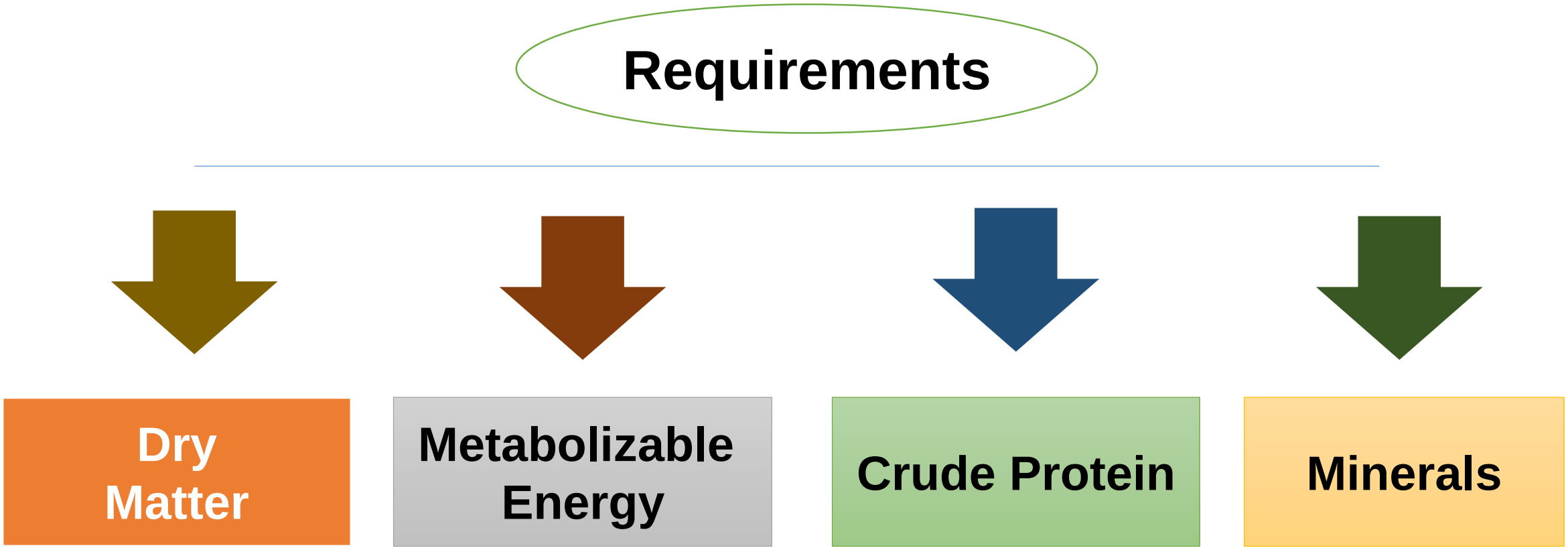
Solutions

- Introduce appropriate feeding systems.
- Use surplus pastures and fodder.
- Incorporate crop residues and agro-industrial by-products as food.
- Apply the knowledge and technologies developed.

What decides the technology to use?



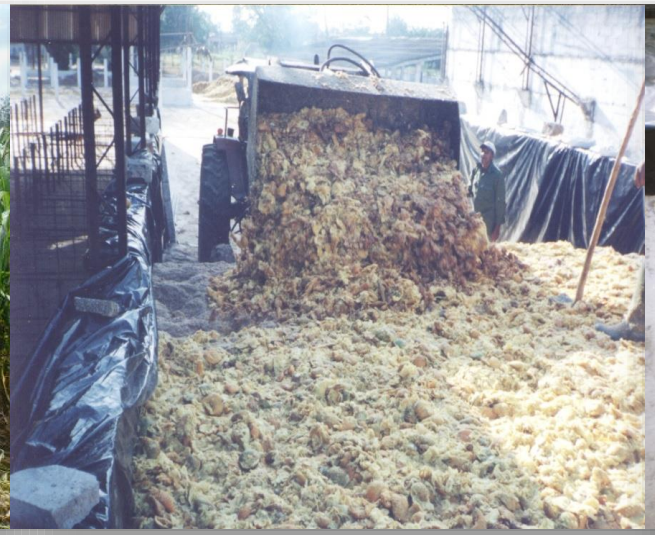
Food Balance

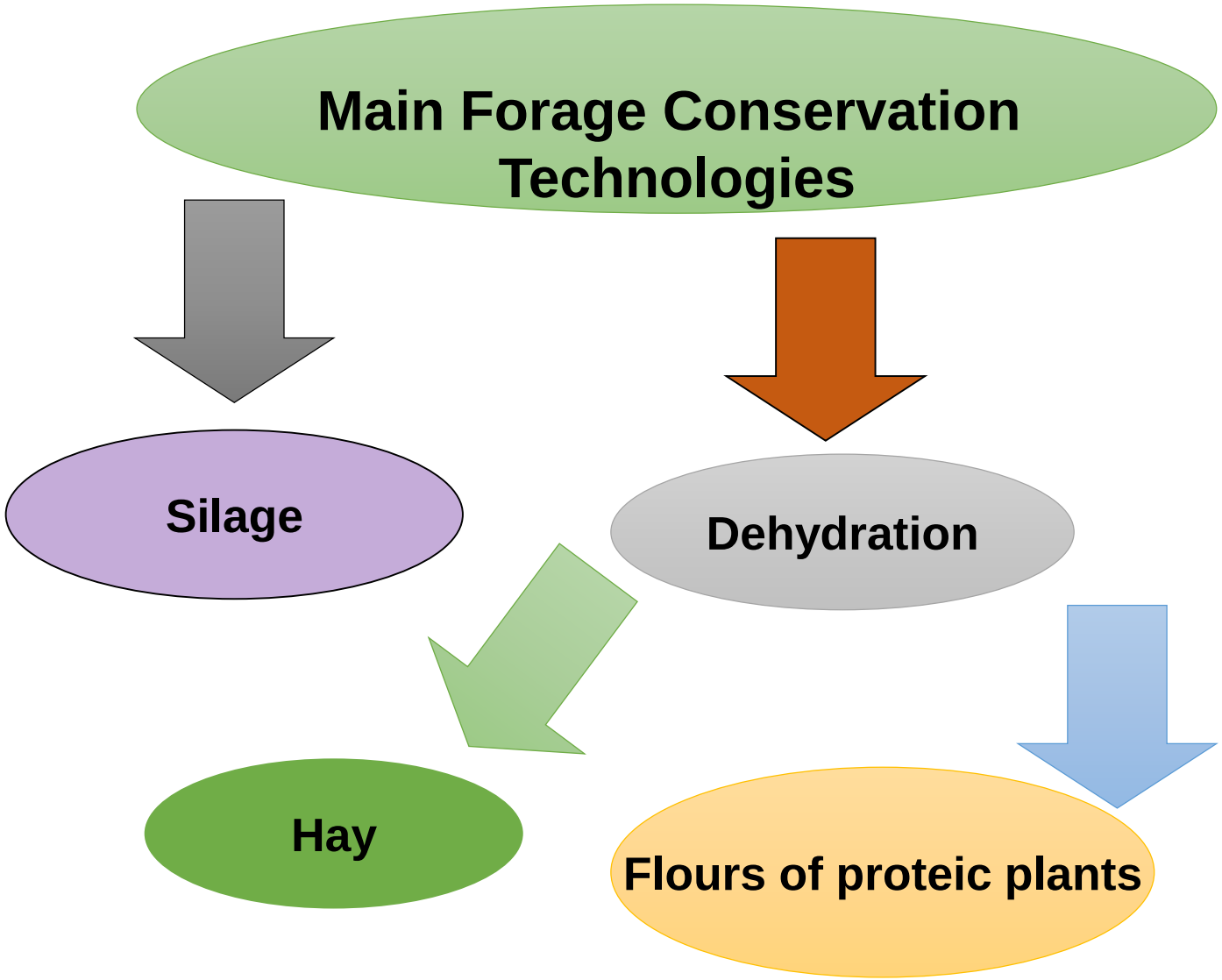


REQUIREMENTS						
Category	Sex	Weight (Kg)	Ingestion capacity (Kg MS)	Weight gain (g/a/d)	CP (g/a/d)	ME (Mcal/a/d)
Fattening	Male	150	4,5	600	492	12,47
Final Fatt.	Male	350	8,6	600	863	17,47
Cows (7L)	Female	400	12,0		1 458	25,80
Ram	Male	30	1,7	100	140	1,82

Needs of food conserved for six months of non-rainy period			
	t/animal		
Category	Silage	Hay	Protein Plants Flour
Fattening	3	0,5	0,45
Adult	5	1,0	0,60
Ram	1	0,2	0,25
Goat	1,5	0,3	0,35

Forage Conservation


Main Forage Conservation Technologies
Silage
Dehydration
Hay
Flours of proteic plants

How to guarantee an adequate quality in the conservation?

Silage

Grass

Grazing: 6-7 weeks

Cut: 9-10 weeks

Dry matter: 30 - 35%

Chopped: 2 - 4 cm

Anaerobicity

Mixed silages

Grasses / Protein plants

(70-60: 30-40)

Corn and sorghum, grains in milky state

Hay

Grazing grasses

- Mow 6-9 weeks
- Vegetative state or beginning to glean
- Manufacture on days with low probability of rain, high temperatures and strong breezes
- Do not expose forages more than 3 days
- Make a turn at 6 hours cut
- Do not use herbaceous or arboreal legumes

Flours of proteic plants

Arboreal and shrubby

Foliage and tender stems

Between 8-10 weeks

Herbaceous legumes

- Beginning of flowering
- Drying in the sun, in the shade in roofed installations or solar dryers
- Blade mill
- Pack in bags that transpire
- Store in fresh and dry places

Technologies for large farms

Silage

Silos≥ 20 t

Silo harvester

With walls

Without walls

Hay

Mowers

Spinning machines

Balers

Storage

Protein plant meal

Solar dryers

Blade mill

Mixer

Pelletizer

Technologies for small farms

Silage

Silos ≤ 5 t
Ring / Bag

Hay

Manual wrapping machines

Protein plant meal

Solar dryers

Blade mill

Mixer

Pelletizer

Cutting machine

Subproducts

Conservation technologies according to their bromatological characteristics

Dry matter: **15-25 %**
Por capas

Fresh sunflower
Orange
Pineapple
Mango
Vegetables
Pseudo banana stem
Similar
83 %

Absorbent material
Hay
Straw bean
Bagasse of cane
Corn whole plant
10 %

Urea
4 %

Lactic Ferments
Whey
3%

Silage

Direct Presecado

Foliage

- **Yucca**
- **Sweet potato**
- **Potato?**
- **Malanga?**

Ground and mixed raw materials

Immature fruits

Bananas
Avocado
Cherimoyas
Papaya
Mango
Similar
70 %

Absorbent material

Wheat bran,
Hay
Straw bean
Bagasse of cane
30 %

Yucca
Sweet potato
Malanga
100 Kg + 200 L water

2 L Natural Yogurt

Subproducts

Conservation technologies according to their bromatological characteristics

Hay

Materials ≥ 80 % DM

Packing after picking the main crop

Large extensions:

Specialized machinery

Small extensions:

Manual o semi-manual

Straws of rice
Straw of beans
Peanut straw
Sesame straw,
Whole silver corn

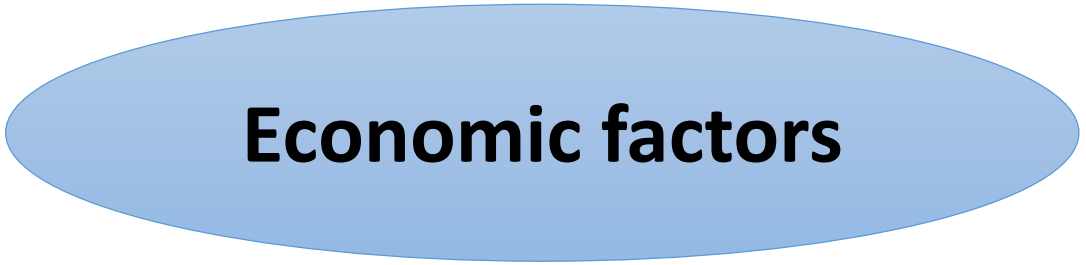
Ammonify?

Flours

Materials ≥ 60 ≤80 DM

Blade mill
Dehydrate
- To the sun
- In the shade in roofed installations
- Solar dryers

Non-commercial waste of:
Yuca, Sweet potato, Malanga, Green banana, Shellfish shells, Fish,
Wastes from the silkworm breeding



Benefits obtained

=

Costs:

Acquisition + Transportation + Treatment + Storage

=

Cost effectiveness

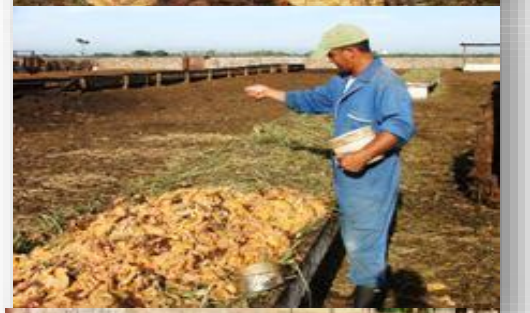
Use of silages

They can not be the only food

They need to be supplemented with energy and protein

To overcome these difficulties:

1. **Carry out restricted pastures (4-6 hours)**
2. **Supplement with hay (10% of total consumption)**
3. **Concentrate (1-2 kg / anima / day)**
4. **Provide fodder (30% of total consumption)**



Supplementation technology according to the pastel procedure

Place a layer of hay equivalent to 0.5 kg / animal in the feeder

Place fresh or silage fruit skins 4 or 5 kg / animal

Sprinkle diluted urea, according to food balance

Incorporate the protein supplement according to the food balance

Add mineral salts, to regulate the speed of consumption

DIET

Restricted grazing
(4-6 horas)

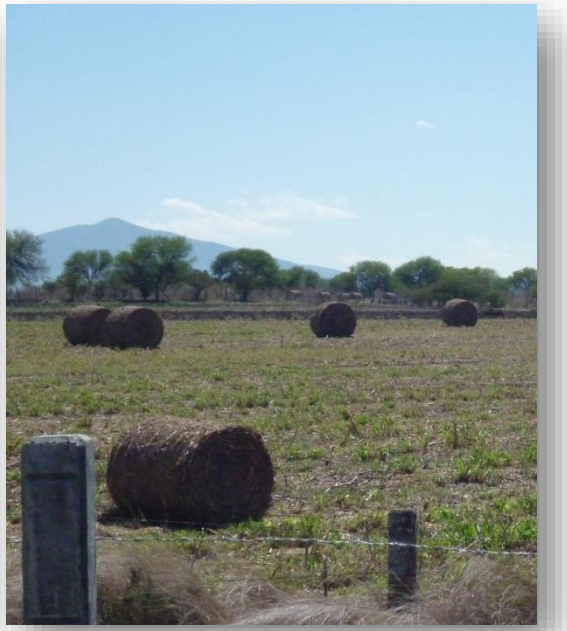
Housing

Supplementation

Silage
+

- Hay
- Forage
- Concentrated
- Byproducts

Hay



Packaging for small producers

Mowing with machetes, scythes or similar.

Preparation of the bales :

- Wooden or plastic box of 100x50x40 cm.
- Place two long strings on the bottom that fall on both sides.
- Deposit a layer of hay and compress with your feet.
- Introduce successive layers until filling the box.
- With the people over to love the bale.

Another procedure :

- Divide a 200 L tank into two halves and join it with sliding hinges.
- Place two strings from the bottom that protrude the edges.
- Introduce successive layers of hay and compact with the feet.
- Fill the tank to the edge and tie the ropes.

Place the bale in a covered, ventilated and dry place.

Avoid storing for more than 6 months.

Protein plant meal

Morus alba

Leucaena leucocephala

Albizia lebbeck

Gliricidia sepium

Protein plant meal

- Perennial plants with high levels of crude protein in their foliage.
- Their nutritional characteristics allow them to be included in unconventional concentrates.



Contribution of nutrients of one ton of flour from tree plants and a cereal concentrate.

Nutrient yield for 1 t of tree meal				
Tree species	**DM (t)**	**CP (t)**	**FB (t)**	**EM (10^3 Mcal)**
Leucaena leucocephala	0,90	0,18	0,17	1,93
Gliricidia sepium	0,98	0,24	0,28	2,17
Albizia lebbeck	0,96	0,23	0,26	2,05
Morus alba	0,97	0,24	0,13	2,36
Concentrado comercial	0,86	0,16	0,05	2,39

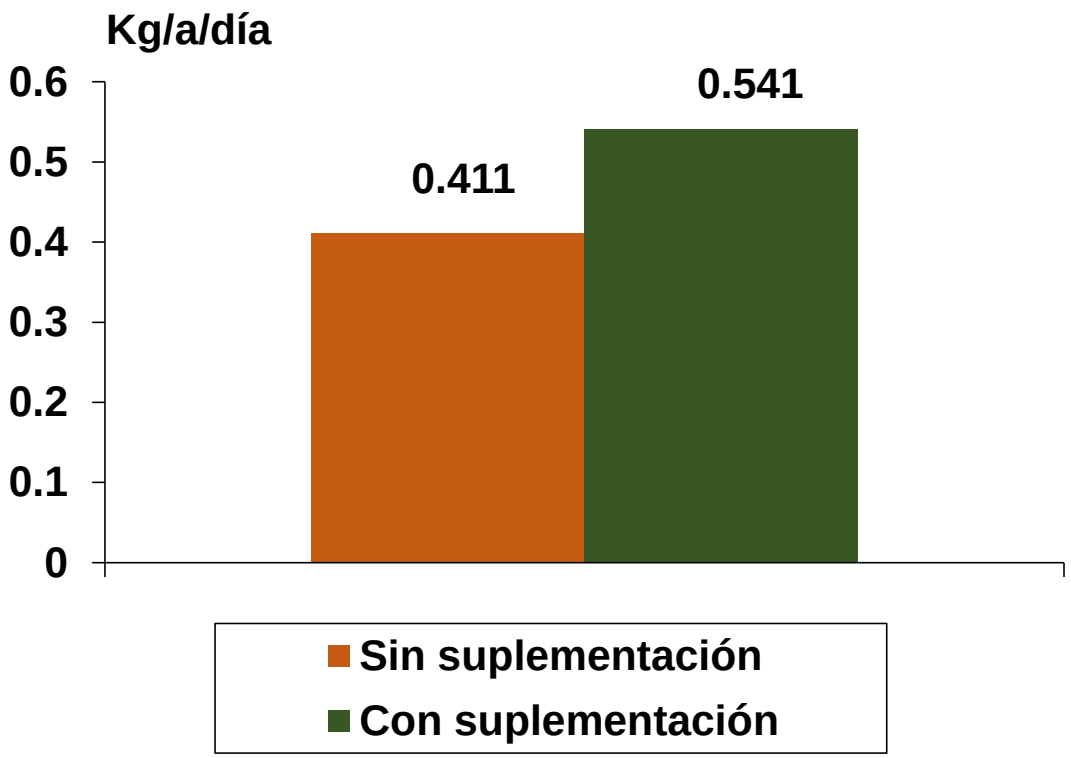
Milk Cows and Bulls Ceba

Raw materials	Non-convencional Concentrate
	Moringa + Morera + Tithonia (%)
Moringa 	37,00
Morera 	25,00
Tithonia 	36,00
Pre-mezcla mineral 	2,00
Bromatological analyzes	
Total protein (%)	23,20
Crude fat (%)	6,19
Metabolizable Energy (Mcal/Kg MS)	3,16
Crude fiber(%)	10,47
Calcium (%)	1,74
Phosphorus (%)	0,44

Example of diets

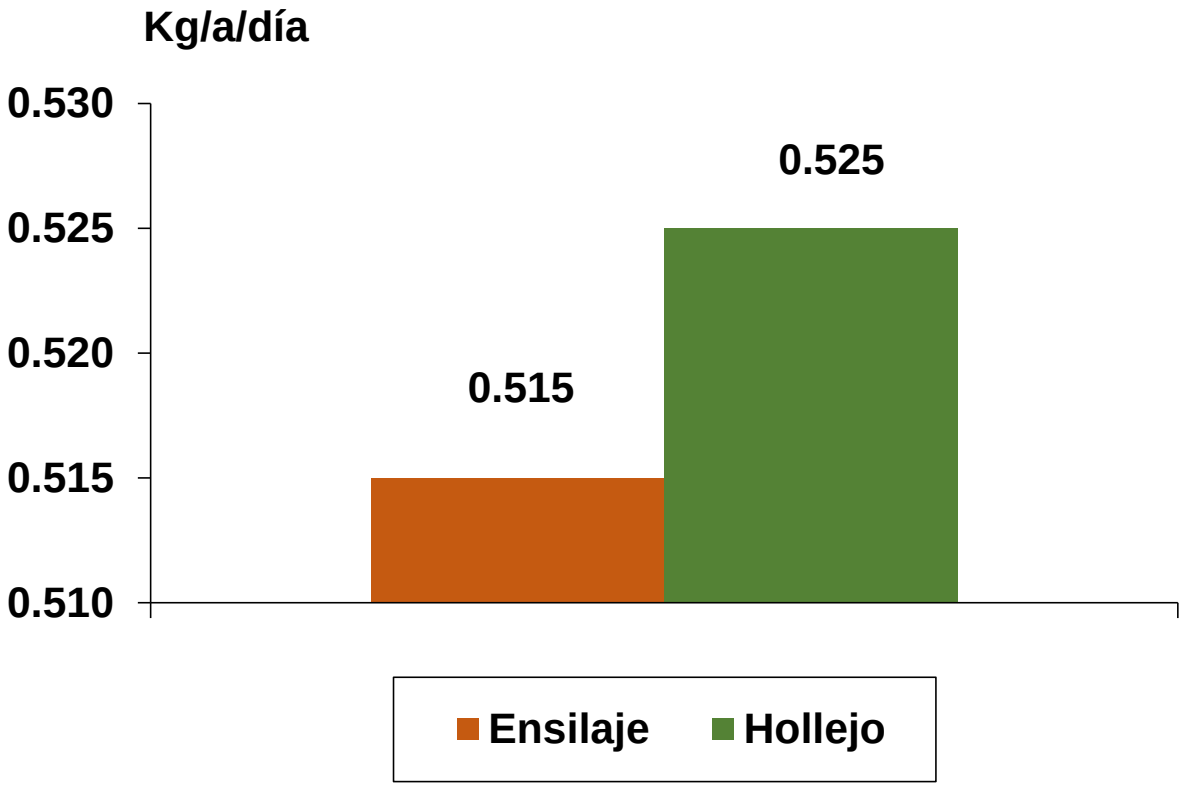



Feeding bulls
Effect of protein supplementation on weight gain in silage diets.



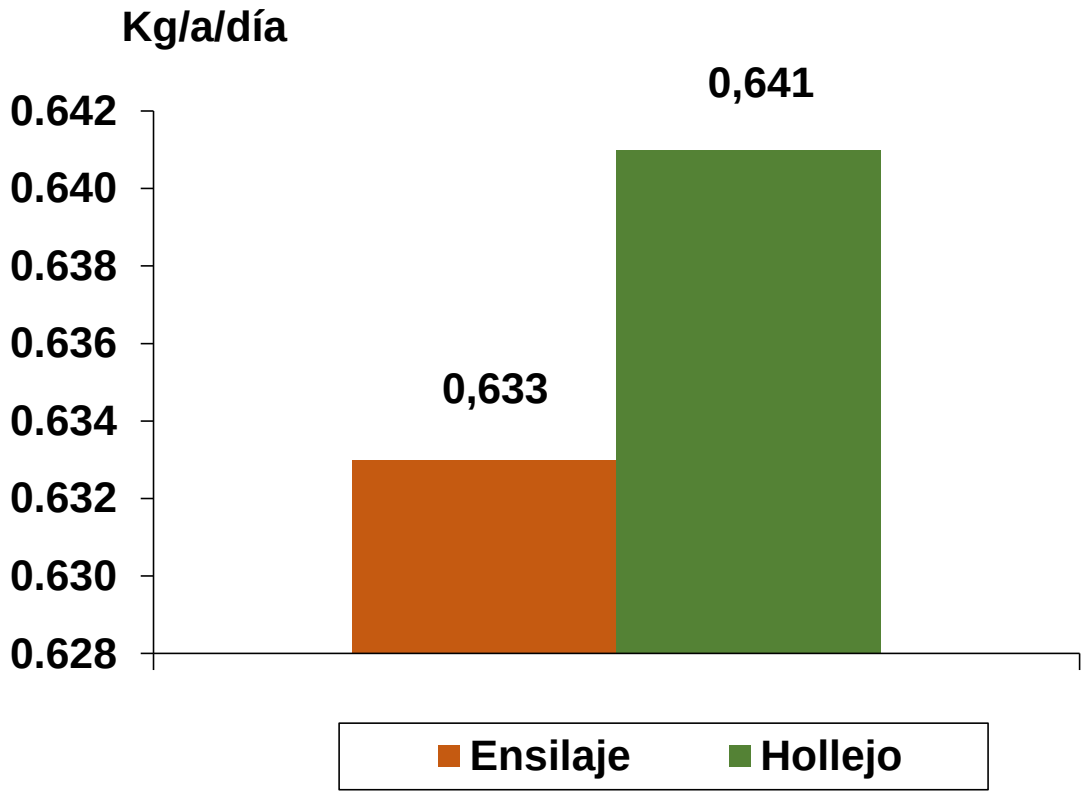
Food (kg/a/día)	Suplementation	
	With	Without
Forage	14,90 ± 0,6	16,00 ± 0,4
Silage	10,20 ± 0,7	12,50 ± 0,2
Salt	0,04	0,04
Hay	1,00 ± 0,1	0,50 ± 0,1
Urea	0,08	0,02
Distillery grains		0,50
Wheat bran		1,00

Feeding bulls
Comparison of weight gains by using fresh citrus skins or silage.



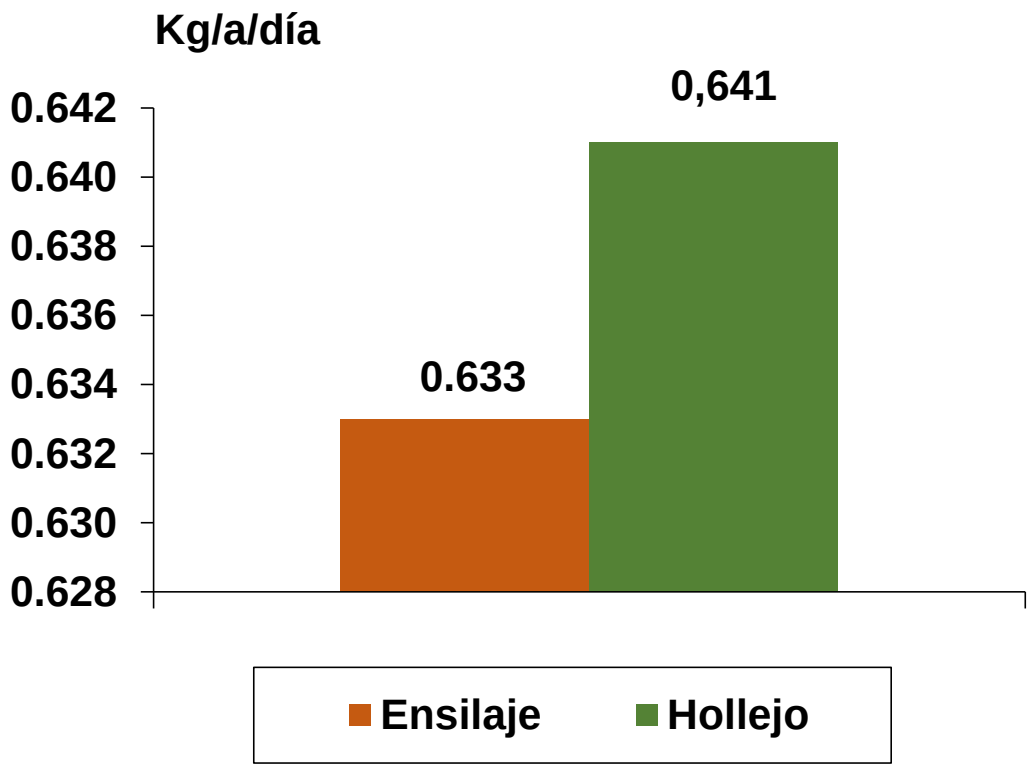
Food (kg/a/día)	Silage	Hollejo
Forage	14,80 ± 0,5	16,20 ± 0,4
Hollejo		20,30 ± 0,5
Silage	9,90 ± 0,4	
Salt	0,05	0,05
Hay	0,50 ± 0,1	0,50 ± 0,1
Urea	0,02	0,05
Distillery grains	1,50	1,50

Feeding bulls
Effect of supplying fresh or ensiled citrus husk by the cake process.



Food (kg/a/día)	Silage	Hollejo
Forage	11,80 ± 0,6	13,90 ± 0,8
Hollejo		16,01 ± 0,4
Silage	10,20 ± 0,5	
Salt	0,05	0,05
Hay	0,50 ± 0,1	0,50 ± 0,1
Urea	0,05	0,07
Norgol	0,80	0,80
Wheat bran	1,10	1,10

Use of fresh or silage citrus skins using the cake for protein supplementation.



Food	Silage	Hollejo
	kg/a/día	
Forage	11,80 ± 0,6	13,90 ± 0,8
Hollejo		16,01 ± 0,4
Silage	10,20 ± 0,5	
Sat	0,05	0,05
Hay	0,50 ± 0,1	0,50 ± 0,1
Urea	0,05	0,07
Grains of distillery	0,80	0,80
Wheat bran	1,10	1,10

What to do?

- Create multisectoral groups able to develop strategies of feeding in the farms.
- Train producers in the preparation of feed and nutritional balances, instant and perspective, by animal category and time of year.
- To determine the needs of forage resources to cover deficits through immediate, medium and long-term solutions.
- Evaluate unconventional food sources in the environment and their utilization potentials.
- Contribute through the incorporation as food of agricultural wastes and by-products, to environmental decontamination.
- Train the producers in the technologies of conservation and use according to their nutritional requirements and economic possibilities.
- Have budgets to implement food and conservation systems.

FINAL CONSIDERATIONS

Using the food resources offered by the tropics and the surrounding livestock areas is a necessity and a challenge. Both actions complement each other and it is up to us to couple them.

MUCHAS GRACIAS

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