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Use of cactus (*Opuntia ficus-indica*) rejects silage in sheep feeding: nutritive value and carcass parameters

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Introduction

Arid and semi arid areas in Morocco are characterized by:

Constraints

- feed unavailability and low quality feed during dry season.
- High cost of feed supplement.
- Low ruminant production performances
- Need for development of valorization processes.

Potentialities

- Large cactus areas and cactus by products
- Availability of agricultural & agro-industrial by products
- Good integration between animal and crop production systems
- livestock husbandry well anchored in the local farming systems

Introduction (1)

Potentialities of cactus pear and Argan by product

Cactus pear

- Large national production of cactus pears
- Rejected pears: from 30 to 50 % (wasted, not used by none human or animals)
- Rejects are rich in fermentable sugars (12 to 16% FM)
- Possibility to integrate cactus pear in different feed formulations

Argan by product

- Argan pulp (mesocarpe): source of carbohydrate: 0,9 UF/kg DM
- Argan cake : excellent source of protein (CP: 41– 48 %)
- Argan cake: excellent source of crude fat (CF: 20-28 %)
- Available at affordable price (compared to others protein sources)

Objectives

1. Valorization of cactus pear reject and Argan by product trough silage making
2. Evaluation of animal (sheep) performances based on this silage formulation
3. Economical evaluation based on on-farm trials
4. Scaling up process of silage making

Steps of research work

History of silage cactus works for animal feeding (INRA,2008-2010)

1. Laboratory silage optimization

- **Nature, type and level of dry matrix** ***(hays, by product)***
- **Behavior kinetic of cactus pear in silage** ***(pH, residual sugar, N-NH_3)***

2. *In vivo* digestibility trials

- **Nutritive value and nutrient utilization (DMD, CPD, N balance, OMD,...)**

3. Feeding trials

- **Effects of feeding cactus silage on fattening parameters (WG, fat, etc.)**
- **Economical aspects (cost of meet production)**

4. Scaling up process of cactus/Argan silage

- **New manufacture (machinery design,...)**
- **Optimization of manufacturing process**
- **Logistics & economical aspects**

MATERIALS & METHODS

Materials & methods

Table 1: Study parameters of the cactus silage pear by adding 4 by product

n	Basic ingredient
33 silo	Alfalfa hay
33 silo	Sunflower Cake
33 silo	Soja Cake
33 silo	Argan Cake

+

Ingredient	%
Cactus pear	53
Barley straw	3
Urea	2
CMV	2

Parameters studied:

- pH kinetic at 0,2, 4, 8, 12, 16, 20, 24, 28, 32 and 36 days of fermentation
- Residual sugar
- N-NH_3

Materials & methods

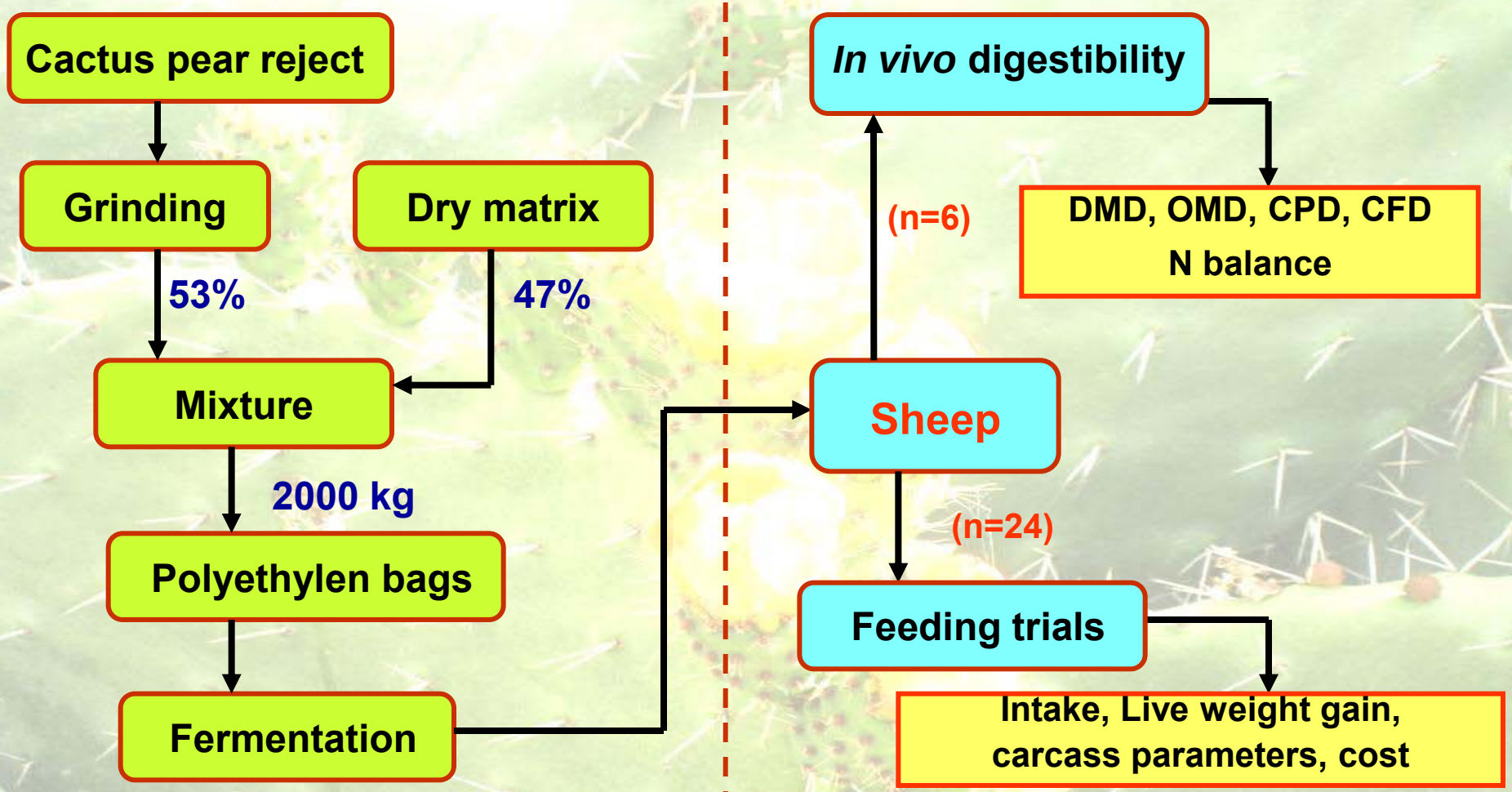


Figure 1: Cactus pear silage preparation and animal use

Step 1: Ingredient weighting

Step 2: Argan cake and chopped straw

Step 3: Adding Argan pulp

Step 4: Adding minerals & vitamins

Step 5: Adding wheat bran

Step 6: Material for grinding and mixing

Step 7: Grinding cactus pears

Step 8: Cactus pears juice

Step 9: Adding cactus pears juice

Step 10: Mixing all the ingredients

Step 11: Final product ready for fermentation

Step 12: Plastic bags filling for final fermentation

Step 13: Sealing bags

Step 14: Spine removal steps (painful)

RESULTS

Composition of dry Matrix used for cactus reject silage

Ingredient / parameter	CP (g/kg)	%
Cactus reject	40	53
Argan cake	410	26
Argan pulp	80	8
Wheat bran	180	6
Barley straw	30	3
Urea	46	2
Mineral & vitamin	0	2
	Total	100

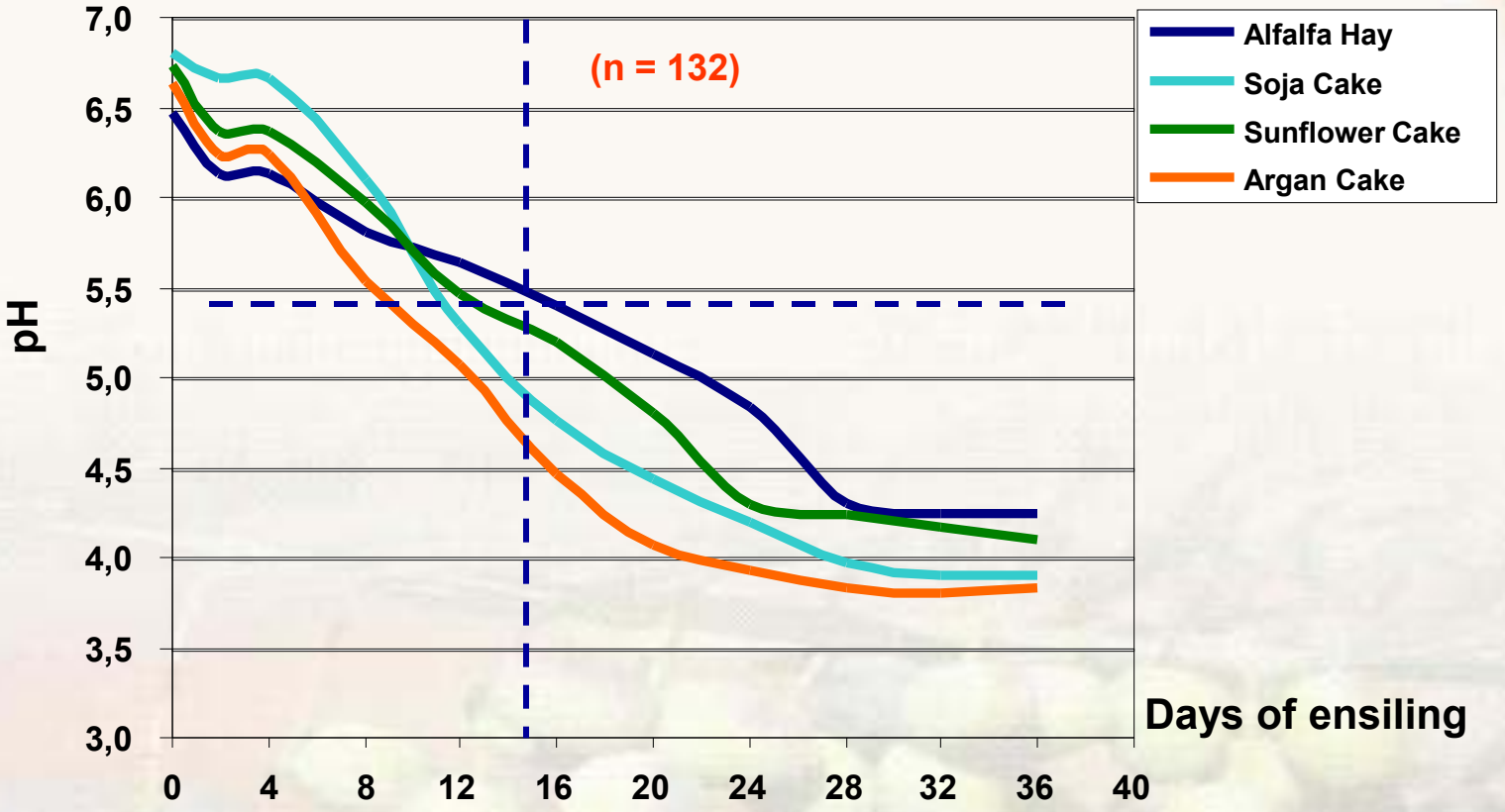
RESULTS

Chemical composition and cost of cactus reject silage

Nutrients	Content (g/Kg DM)
Dry Matter	445
Organic Matter	945
Crude Protein	161
Crude Fiber	153
Crude Fat	132

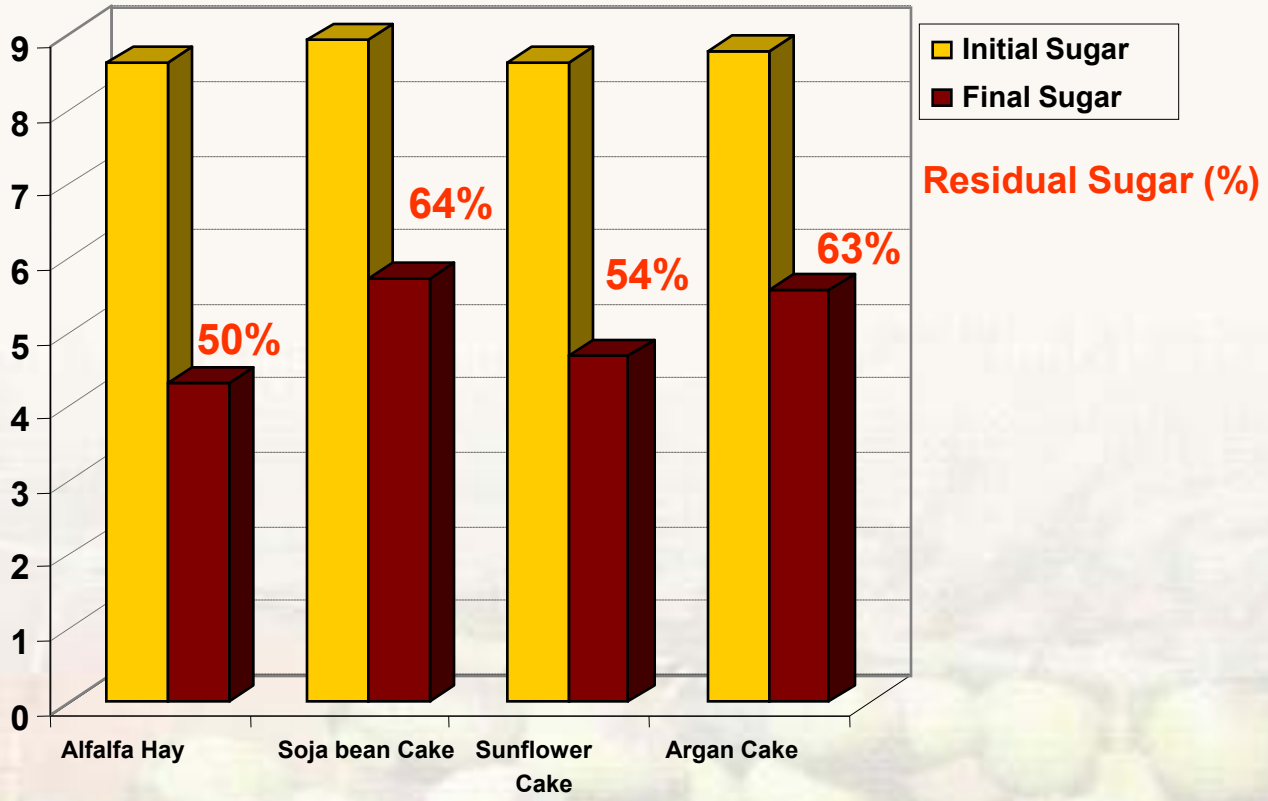
cost of cactus reject silage	
Cost (Dh/kg FM)	1,32

RESULTS



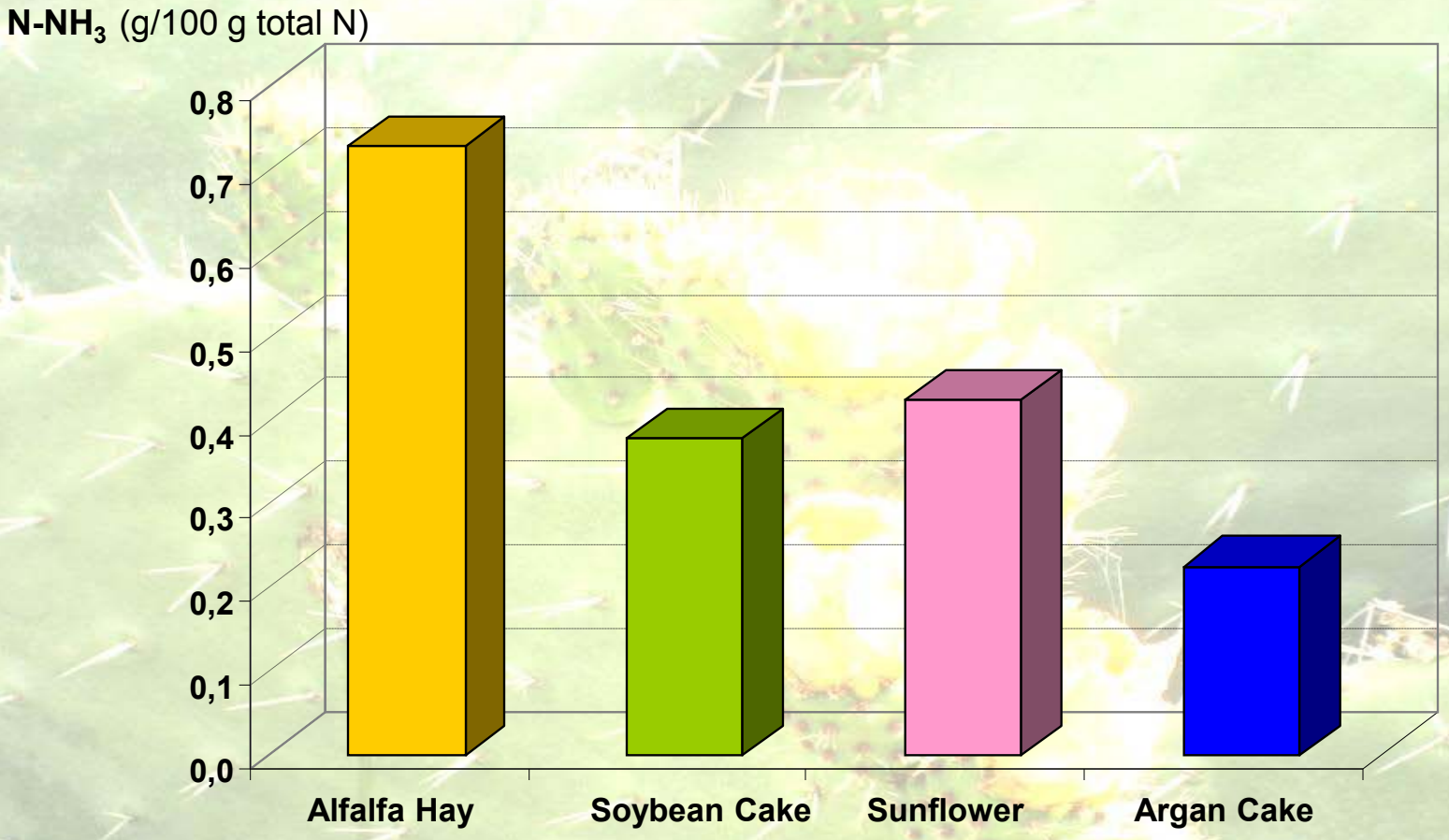
pH evolution in cactus pear silage supplemented with 4 by product

RESULTS



Sugar values of cactus silage according to the addition of by product

RESULTS



Ammoniacal nitrogen ($N\text{-}NH_3$) in cactus silage according to the addition of by product after 36 days of fermentation

RESULTS

Apparent nutrient digestibility of cactus reject silage (CRS) and commercial feed concentrate (CFC) diets

Parameter / Diet	CFC	CRS	SL
Dry Matter	0,82	0,61	* * *
Organic Matter	0,82	0,66	* * *
Crude Fiber	0,75	0,71	ns
Crude Proteins	0,84	0,77	* *
Crude Fat	0,88	0,90	*
Nitrogen balance	0,83	0,71	* *

* P<0,05; * * P<0,01; * * * P<0,001

Results

Effect of the cactus reject silage (CRS) and commercial feed concentrate (CFC) on the lamb performances and cost during 80 days of fattening

Parameter / Diet	CRS	CFC	LS
Voluntary intake (g/h/d)	2750	1320	* * *
DM diet (%)	45	91	* * *
DM intake (g/$LW^{0,75}$)	72	60	* *
Daily Gain weight (g)	195	255	* * *
Feed Cost (Dh/kg)	1,38	3,25	* * *
Cost of live weight gain (Dh/kg)	15,87	25,51	* * *

* P<0,05; * * P<0,01; * * * P<0,001

Difference

9,6 Dh/kg LW Gain


Slaughtered sheep shows good visual quality carcasses

RESULTS

Effect of the cactus reject silage (CRS) and comercial feed concentrate (CFC) on the carcass parameters of lambs during 80 days of fattening

Parameter / Diet	CRS	CFC	LS
Weight before slaughter (kg)	38,63	45,07	ns
Carcass weight (kg)	19,13	24,55	* *
Carcass yield (%)	49,29	54,24	* * *
Carcass lenght (cm)	66,14	68,64	ns
Chest width (cm)	20,87	22,51	ns
Leg length (cm)	33,95	33,36	ns
Mesenteric fat weight (g)	732	1382	* * *

* P<0,05; * * P<0,01; * * * P<0,001

CONCLUSIONS

1. **Cactus pear reject and Argan by product trough could be valorized through silage making:**
   a. **Dry matter addition in cactus silage is less than 50%.**
   b. **Cactus pear juice preserved without energy consumption.**
   c. **A high proportion of fermentable sugar (64%) are preserved from microbial degradation in bags.**
2. **Evaluation of animal (sheep) performances based on this silage formulation**
   a. **Daily weight gain: 195 g** (vs 255 g)**, mesenteric fat: 732g** (vs 1380 g)
   b. **Competitive cost of cactus silage improve the income of meat production**
   c. **To avoid initial weight losses problems Silage, pH should be corrected before feeding.**

CONCLUSIONS

3. Economical evaluation based on on-farm trials

a. **Cost of feed: 1,38 Dh/kg** (*vs* 3,25)

b. **Economical gain: 9,6 Dh/kg LW Gain** (*vs* CFC)

4. Scaling up process of silage making

a. **New manufacture (machinery design,...)**

b. **Optimization of manufacturing process**

c. **Transfer research results to farmers**


THANK YOU