

# Silage quality of whole and crushed *Vigna unguiculata* beans inoculated with lactic acid bacteria strains from sow milk



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## 1. Introduction

Weaning piglets often suffer from diarrhea and weight loss caused by the abrupt change from milk to solid feed. Early weaning (d 21-35) is nowadays also practiced in Colombia. Lactic acid bacteria (LAB) from sow milk to ensile *Vigna unguiculata* (cowpea) grains (Fig. 2) should be identified in order

- to profit from the beneficial effects of organic acids and probiotics on the intestinal tract by ensiled weaner diet in combination with cowpea grain as local high-quality feed resource,
- to increase feed acceptance of silage by supplying sows during lactation with fermented cowpeas.

For the ease of handling, whole grains were tested for their ensilability compared to crushed beans.



Fig. 1: Piglets in Colombia



Fig. 2: *Vigna unguiculata*, ripening pods

## 2. Materials & Methods

- *V. unguiculata* whole grains were soaked overnight in tap water.
- In a second trial, dry *Vigna* grains were crushed in a forage chopper before soaking for 17 h in 486 ml water/kg grain.
- The material was ensiled for 30 d at ~27 °C in vacuum sealer bags (Fig. 4).
- Three treatments were applied: Control, LAB 605 and LAB 628, inoculated at  $10^6$  cfu/g fresh matter (Fig. 3).
- Strains had been isolated from two different sows and pre-selected in an *in-vitro* test with minced *Vigna* grains (Rostock Fermentation Test).
- Dry matter (DM) content before ensiling was 400 g/kg for the soaked whole beans and about 600 g/kg for the ground material.
- When opened, silages (Fig. 5) were evaluated for their fermentation quality (ammonia, organic acids, DM losses, pH).
- The number of epiphytic LAB before ensiling was  $3.5 \cdot 10^3$  cfu/g fresh matter (FM) in the soaked whole and  $2.0 \cdot 10^5$  cfu/g FM in the ground material.



Fig. 3: LAB in MRS broth

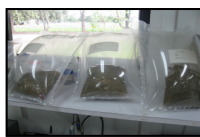


Fig. 4: Bloating silage bags with whole cowpea grains



Fig. 5: Whole cowpea grains after ensiling

## 3. Results & Discussion

- In the whole beans, lactic acid was remarkably lower than butyric acid content (Fig.6).
  - whole, intact beans, probably reduced nutrient availability for the lactic acid bacteria.

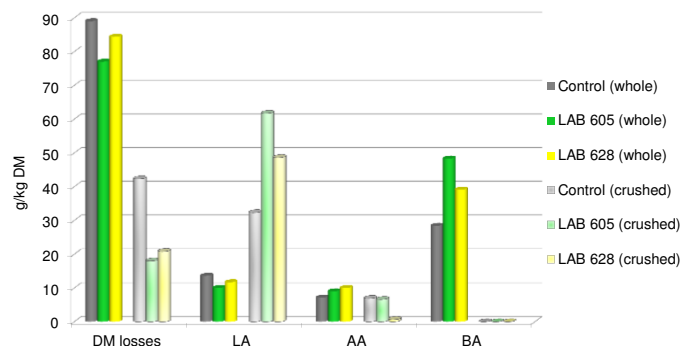


Fig. 6: DM losses and organic acids of whole and crushed *Vigna* beans  
DM= dry matter, LA= lactic acid, AA= acetic acid, BA= butyric acid

- In crushed beans, fermentation quality was clearly improved: lactic acid was significantly higher, while DM losses, pH, butyric acid and ammonia-N were lower than in the whole beans (Fig.6, Table 1).
- The use of inoculants affected all parameters except for butyric acid.
- No butyric acid in crushed beans, where higher osmotic pressure may have favoured LAB (Fig. 6).
- No statistical difference in fermentation products among the whole bean LAB treatments.
- In crushed beans, LAB 605 showed a significantly higher lactic acid production and lower ammonia-N than LAB 628 (Fig. 6, Table 1).
- The interaction between inoculants and grain treatment (significant for lactic acid,  $\text{NH}_3\text{-N}$  of N total and the pH) indicate that the effect of inoculants depends on the texture and condition of the plant material.

Table 1: Analysis of  $\text{NH}_3\text{-N}$  of total N and pH in whole and crushed cowpea beans

	Whole beans			Crushed beans		
	Control	LAB 605	LAB 628	Control	LAB 605	LAB 628
$\text{NH}_3\text{-N}$ (g/kg N)	52.8	55.0	57.9	23.7	12.5	29.0
pH	6.2	5.9	6.1	5.0	4.3	4.6

## 4. Conclusions & Outlook

- It is recommended to crush dry cowpeas prior to soaking in a defined volume of water, what contributes to better fermentation characteristics, probably together with the higher DM content.
- LAB 605 and 628 are both suitable to promote fermentation, with slightly better attributes achieved by LAB 605.
- In further steps, the bacteria will be evaluated for their probiotic characteristics together with other strains, and their phylogenetic relations.

## Acknowledgement

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