Silages of Tropical Forages for Feeding Pigs


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1. INTRODUCTION

- Selected tropical forages, in particular legumes, having a high protein content, present an attractive alternative to expensive protein concentrates.
- Year round availability of fresh forages cannot always be ensured.
- Additionally, fiber, bulkiness, high water content, low energy concentration and their content of anti-nutritional components, like tannins and trypsin inhibitors, could reduce their application in pig feeding.
- Thus, the effect of ensiling on forage characteristics was investigated, to include them in pig diets

2. MATERIALS & METHODS

- The legumes *Vigna unguiculata, Stylosanthes guianensis, Centrosema brasilianum Canavalia brasiliensis*, Cratylia argentea, *Flemingia macrophylla*, Desmodium velutinum and *Leucaena diversifolia* and the grass *Brachiaria* hybrid Mulato II were harvested before flowering, chopped and ensiled at a target dry matter of > 30% in small plastic bags on lab scale (Fig. 1).
- Four treatments were applied: control, addition of sucrose (2% of fresh weight), inoculated with a lactic acid bacteria (LAB) strain and LAB+sucrose.
- LAB, whose strain was developed at CIAT, was inoculated with a target 10^5 cfu/g FM.
- Silages were evaluated after 3d for pH and after 90d of ensiling at 25 C° on dry matter (DM) losses, quality and aerobic stability (Fig.2).
- Buffering capacity, which can restrict acidification, and nutritional value of all forages was determined from samples taken before ensiling.


Harvesting


Ensiling


Evacuating air


Silage bags

Fig.1: Harvest and ensiling


Opening silages,


DM and silage bags, scale.


Silage bags, beakers with samples for pH measuring.

Fig.2.: Opening silages for analysis

3. RESULTS & DISCUSSION

- Buffering capacity was highest in *Vigna* and lowest in *Flemingia* (13.6 *Vigna*, 9.3 *Cratylia*, 6.4 *Canavalia*, 6.1 *Leucaena*, 5.5 *Stylosanthes*, 4.8 *Desmodium*, 4.7 *Centrosema*, 3.3 *Flemingia*, 2.2 Mulato).
- Worst silages were produced with *Centrosema* without sugar, having a strong butyric acid smell.
- After 3d of ensiling, the pH, which is a good indicator for the fermentation success, always was lowest in the treatment with LAB+Sucrose and remained like that after 90d (Fig. 3).
- In the grass, as usually compared to legumes, pH after 90d was lowest in the control.
- All treatments were significantly different in final pH (90d) within the same forage species ($P < 0.05$), ranging overall from 3.8-6.2, except for *Canavalia* in the two LAB treatments. The initial advantage of LAB vs. sugar only (Fig.3) diminished after 90d or was even reversed.

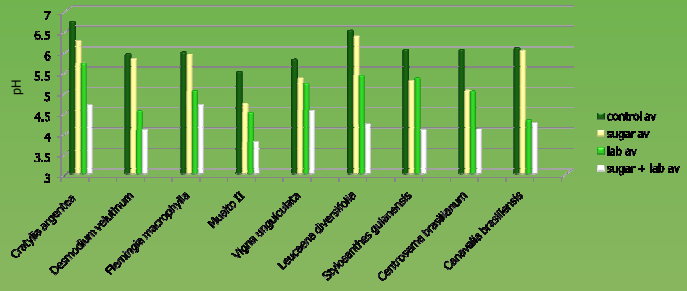

Fig. 3: Average pH after 3d for each treatment

- The German evaluation scheme for silages based on chemical analysis calculates points from <30 (worst) to 100 (best), including butyric and acetic acid content as well as pH (depending on silage DM).
- Table 1 shows preliminary results according to the scheme, as volatile fatty acid analysis is still pending.

Table1: DLG* points for pH depending on silage DM (min. – 5, max. + 10)

	Control	Sugar	LAB	Sugar+LAB	% DM
Cratylia	-5,0^{a}**	-5.0^{a}	-5.0^{a}	3.3^{b}	20.3
Desmodium	0.0^{a}	0.0^{a}	10.0^{b}	10.0^{b}	37.7
Flemingia	0.0^{a}	6.2^{b}	8.6^{c}	10.0^{c}	40.0
Mulato II	-1.5^{a}	4.9^{b}	7.4^{c}	10.0^{d}	27.3
Vigna	-5.0^{a}	-4.5^{a}	-5.0^{ab}	-0.6^{b}	24.2
Leucaena	-5.0^{a}	-3.8^{a}	-5.0^{a}	6.6^{b}	23.9
Stylosanthes	0.0^{a}	10.0^{b}	2.0^{c}	10.0^{b}	30.0
Centrosema	-5.0^{a}	3.3^{b}	-5.0^{a}	7.8^{b}	26.8
Canavalia	0.6^{a}	6.3^{b}	10.0^{b}	10.0^{b}	32.3

Poor quality
Medium quality
High quality

*DLG= Deutsche Landwirtschaftsgesellschaft (German Agricultural Society)
**Different letters within a row indicate significant differences among treatments, p< 0.05.

- Calculating DLG points on behalf of pH and DM, the best fermentation quality of silages was achieved with combined sugar and LAB, contrasting to the control.
- Highest overall losses in DM were found in *Canavalia*, Mulato II, *Cratylia* and *Vigna* silages (37-19%), being followed by *Desmodium* in control treatment with 16%.
- Silages generally remained aerobically stable over 4 days of monitoring.
- First results of *Flemingia* indicate a significant reduction of tannin concentration through ensiling, by up to 45 % of the original content.

4. CONCLUSIONS & OUTLOOK

- **The comparison of additives indicates the relevance of the treatments for the silage quality.**
- **A combination of adding soluble carbohydrates and inoculating effective lactic acid bacteria improves ensiling success.**
- Further analysis comprise:
  - complete fermentation pattern and ammonia-N,
  - the evaluation of differences in the concentration of anti-nutritive factors compared to fresh forage as well as
  - the *in-vitro* digestibility for pigs.
- Those will give a rather complete picture of the potential suitability of distinct silages for pig feeding.

ACKNOWLEDGEMENT

- This study is part of the project "More chicken and pork in the pot and money in pocket" financed by BMZ.