XVIII INTERNATIONAL SILAGE CONFERENCE
Offered paper
Silage Feeding and Utilization II

Evaluation of stylosanthes silage with concentrate levels in diets for beef cattle: intake and digestibility

T.C. da Silva[1], O.G. Pereira[2], D.R. da Costa[2], R.M. Martins[2], S.C. Valadares Filho[2], K.G. Ribeiro[2]

[1] Federal Rural University of Amazon, Belem, Brazil
[2] Federal University of Vicosa, Vicosa, Brazil

July, 2018
Bonn, Germany

Questions to answer

- Why ensiling tropical legumes?
- Is that possible?
- What species are used?
- How is the fermentation pattern?
- What are the effects on ruminants?

Legume silages - in general

Usually “poorly fermented silages”

- buffering capacity: high
- water soluble carbohydrates: low
- dry matter content at ensiling: low

What can we do?

- wilting, additives, mix with other crops, nothing

Legume silages – world context

J. Dairy Sci. 86:2598–2611

Comparison of Grass and Legume Silages for Milk Production. 1. Production Responses with Different Levels of Concentrate

R. J. Dewhurst,* W. J. Fisher,† J. K. S. Tweed,* and R. J. Wilkins‡
Institute of Grassland and Environmental Research
*Plas Gogerddan, Aberystwyth SY23 3EB, U.K.

Proceedings of the New Zealand Grassland Association 60: 105–109 (1998) 105

The potential benefits of ensiling the forage legume sulla compared with pasture

J.H. NIEZEN, G.C. WAGHORN, T.B. LYONS, and D.C. CORSON
AgResearch, Grasslands Research Centre, Private Bag 11008, Palmerston North

Potential food production from forage legume-based-systems in Europe: an overview

J.L. Peyraud[1,2,3]†, A. Le Gall[3,4] and A. Lüscher[5]
[1]*INRA, UMR 1080, Production du Lait, F-35590 Saint Gilles, France*
[2]*Agrocampus Ouest, UMR 1080, Production du Lait, F-35590 Saint Gilles, France*
[3]*Institut de l'Elevage, Site de Rennes, F-35652 Le Rheu Cedex, France*
[4]*UMT Recherche et Ingénierie en Elevage Laitier, F-35590 St Gilles, France*
[5]*Agroscope Reckenholz-Tanikon Research Station ART, Reckenholzstrasse 191, CH-8046 Zurich, Switzerland*

Legume silages – environmental context

- Why do use legume silage?
  - Biological nitrogen fixation (high CP content)
  - Decrease N fertilization
  - Decrease nutrient losses (N)
  - <u>GHG emissions*</u>

Abberton (2010), FAO (2007), Luscher et al. (2014), Wood and Cowie (2004)

Source:thecattlesite

Legume silages – environmental context

The use of non-conventional and adapted crops would impact positively in the sustainable intensification of livestock systems by reducing feed cost, decreasing competition for food with humans, contributing to decrease nutrient input from non-local sources and to the feed supply (Negesse et al., 2009).

Tropical legume forages, either herbaceous or shrubs, are a rich source of crude protein and minerals for animal production, in addition to their contribution to a sustainable agroecosystem (Albrecht and Beauchemin, 2003; Peters et al., 2001; Schultze-Kraft and Peters, 1997).



Tropical Legume silages

- Species
  - Forage peanut (*Arachis pintoi*)
  - Pigeon pea (*Cajanus cajan*)
  - Lab-lab (*Lablab purpureus*)
  - Soybean (*Glycine max*)
  - *Stylo (Stylosanthes* spp.)
  - Cowpea (*Vigna unguiculata*)
  - *Cratylia argentea*
  - *Desmodium* spp.

Abberton (2010), Heinritz et al. (2012)

Stylo silage studies

Animal Science Journal
Animal Science Journal (2011) **82,** 549–553 doi: 10.1111/j.1740-0929.2011.00873.x

ORIGINAL ARTICLE

The effects of wilting and storage temperatures on the fermentation quality and aerobic stability of stylo silage

Qinghua LIU,[1] Jianguo ZHANG,[1] Shangli SHI[2] and Qizhong SUN[3]

[1]*Department of Grassland Science, South China Agricultural University, Guangzhou,* [2]*Pratacultural College, Gansu Agricultural University, Lanzhou, and* [3]*Grassland Research Institute, CAAS, Huhhot, China*

Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Short communication

Stylosanthes cv. Campo Grande silage with or without concentrate in sheep diets: Nutritional value and ruminal fermentation

T.C. da Silva, O.G. Pereira*, M.C.N. Agarussi, V.P. da Silva, L.D. da Silva, L.L. Cardoso, K.G. Ribeiro, S.C. Valadares Filho

Animal Science Department, Federal University of Vicosa, Vicosa, 36570-000 MG, Brazil

JOURNAL OF ANIMAL SCIENCE
The Premier Journal and Leading Source of New Knowledge and Perspective in Animal Science

Intake, digestibility, nitrogen efficiency, and animal performance of growing and finishing beef cattle fed warm-season legume (*Stylosanthes capitata* plus *Stylosanthes macrocephala*) silage replacing corn silage

W. F. Souza, O. G. Pereira, K. G. Ribeiro, S. A. Santos and S. C. Valadares Filho

Animal Science Journal
Animal Science Journal (2012) **83,** 128–135 doi: 10.1111/j.1740-0929.2011.00937.x

ORIGINAL ARTICLE

Characteristics of isolated lactic acid bacteria and their effectiveness to improve stylo (*Stylosanthes guianensis* Sw.) silage quality at various temperatures

Qinhua LIU,[1] Mingxia CHEN,[1] Jianguo ZHANG,[1] Shangli SHI[2] and Yimin CAI[3]

[1]*Department of Grassland Science, South China Agricultural University, Guangzhou,* [2]*Pratacultural College, Gansu Agricultural University, Lanzhou, China and* [3]*National Institute of Livestock and Grassland Science, Nasushiobara, Tochigi, Japan*

Contents lists available at ScienceDirect

Animal Feed Science and Technology

journal homepage: www.elsevier.com/locate/anifeedsci

Effects of silage crop and dietary crude protein levels on digestibility, ruminal fermentation, nitrogen use efficiency, and performance of finishing beef cattle

L.D. da Silva, O.G. Pereira*, T.C. da Silva, S.C. Valadares Filho, K.G. Ribeiro

CSIRO PUBLISHING
Animal Production Science
http://dx.doi.org/10.1071/AN15781

Stylosanthes cv. Campo Grande silage and concentrate levels in diets for beef cattle

T. C. da Silva[A], *O. G. Pereira*[A,B], *R. M. Martins*[A], *M. C. N. Agarussi*[A], *L. D. da Silva*[A], *L. D. A. Rufino*[A], *S. C. Valadares Filho*[A] *and K. G. Ribeiro*[A]

[A]Universidade Federal de Viçosa, Av. P.H. Rolfs, sn, Centro, Viçosa – Minas Gerais, 36570-000, Brazil.
[B]Corresponding author. Email: odilon@ufv.br

Stylo silage - trials

Table 1- Chemical composition (g/kg DM, otherwise stated) of Stylosanthes Campo Grande (StS) and corn silages (CS)

Chemical composition	StS	CS
DM (g/kg FM)	300	359
CP	112	69.2
NDF	664	523
Lignin	123	40.2
pH	4.27	3.74
NH_3-N (g/kg TN)	67.4	42.6
Lactic Acid	54.8	50.4
Acetic acid	25.4	36.3
Propionic acid	14.3	18.5
Butyric acid	1.50	1.80

Souza et al. (2014)

Souza et al. (2014)
Similar ADG to corn silage (beef cattle)

Da Silva et al. (2015)
Similar DMI to corn silage (sheep)

Objective

To evaluate the nutrient intake, apparent nutrient digestibility in beef cattle fed diets containing Stylosanthes cv. Campo grande silage (StS) with concentrate levels.

Materials and Methods

Treatments

- StS with different concentrate levels (C), (DM basis, g/kg):
  - 200 (StS-200),
  - 400 (StS-400),
  - 600 (StS-600),
  - control treatment with 600 g/kg CS and 400 g/kg concentrate (CS-400)

- Experimental design: 4×4 Latin square

Materials and Methods

- Experimental period: 16 days, with 10 days of adaptation to the diets and 4 days for collecting samples and data.
- Four Holstein×Zebu bulls with ruminal and abomasal cannulas, and with an average initial body weight (BW) of 429 ± 15 kg, were used.

Materials and Methods

- Ensiling process of Stylo and corn

Corn: dough stage (120 days after sowing)

Stylo: pre-flowering stage (150 days after sowing)

Materials and Methods

- Ensiling process of Stylo and corn

Both Stylo and corn were chopped into ~2cm particles and stored in drive over piles for 3 months

Materials and Methods

Table 2. Chemical composition of the ingredients in the experimental diets

	CS	StS	Concentrate
Dry matter g/kg NM	345	292	864
	Chemical composition, g/kg DM		
Organic matter	968	929	952
Crude protein	61.7	116	128
Ether extract	24.3	13.9	42.2
NDF	501	598	119
NFC	382	201	664
Cellulose	256	367.7	29.0
Hemicellulose	218	129.4	77.5
Lignin	26.4	101.1	12.1
iNDF	148	348	14.8
pH	3.76	4.81	-

CS= corn silage, StS= *Stylosanthes* cv. Campo Grande (*Stylosanthes capitata* and *Stylosanthes macrocephala)*;
NM= natural matter, NDF= neutral detergente fiber, NFC= non-fiber carbohydrates, iNDF= indigestible NDF

Table 3. Proportion of ingredients and chemical composition of experimental diets.

	Corn silage	Stylosanthes silage[1]		
Concentrate, g/kg DM	400	200	400	600
	Proportion of ingredients, g/kg DM			
Stylosanthes silage	-	800.0	600.0	400.0
Corn silage	589.2	-	-	-
Urea / AS[1]	10.8	-	-	-
Corn grain	358.0	179.0	358.0	537.0
Soybean meal	32.0	16.0	32.0	48.1
Mineral mixture[2]	10.0	5.0	10.0	14.9
	Chemical composition, g/kg DM			
Dry matter, g/kg FM	548.9	406.5	520.9	635.3
Organic matter	928.0	933.3	938.1	942.8
Crude protein	118.5	118.2	120.6	123.0
NDF	31.2	19.5	25.2	30.9
NFC	453.8	293.4	386.0	478.6
iNDF	93.1	281.3	214.6	148.0

[1]Urea and ammonium sulfate (9:1); [2]Limestone = 14.79%, dicalcium phosphate = 56.58%, common salt = 25.19%, copper sulfate = 0.77%, zinc sulfate = 2.59%, potassium iodate = 0.02%, cobalt sulfate = 0.06%, and sodium selenite = 0.01%;

Materials and Methods

- Data were submitted to ANOVA and the means were compared by contrasts (α=0.05).

(1) StS-200 versus CS-400;

(2) StS-400 versus CS-400;

(3) StS-60 versus CS-400.

- The statistical model considered the fixed effect of treatment, the reandom effects of animal and experimental period, and the random error.

Results and discussion

Table 4. Nutrient intake and apparent digestibility in bulls fed diets containing *Stylosanthes* cv. Campo Grande silage (StS) or corn silage (CS) with different concentrate levels (g/kg DM).

	CS	StS			SEM[1]	Contrasts[2]		
Concentrate, g/kg DM	400	200	400	600		1	2	3
	Nutrient intake (kg/day)							
Dry matter	7.55	6.23	7.80	8.72	0.32	0.08	0.70	0.11
Organic matter	7.21	5.89	7.41	8.34	0.31	0.07	0.75	0.11
Crude protein	0.90	0.73	0.91	1.03	0.04	0.05	0.86	0.11
NDF[3]	2.31	2.79	2.75	2.31	0.12	0.14	0.16	1.00
NFC[4]	**4.03**	**2.15**	**3.48**	**4.71**	**0.26**	**<0.01**	**0.04**	**0.03**
TDN[5]	**5.52**	**3.66**	**4.76**	**5.91**	**0.26**	**<0.01**	**<0.01**	**0.24**
	Apparent digestibility (g/kg)							
Dry matter	**676**	**574**	**590**	**655**	**15.4**	**0.01**	**0.03**	**0.54**
Organic matter	**690**	**603**	**616**	**678**	**14.3**	**0.02**	**0.04**	**0.70**
Crude protein	627	506	455	555	21.5	0.02	<0.01	0.13
NDF	568	474	514	513	17.3	0.04	0.20	0.19
NFC	791	776	725	780	13.1	0.67	0.07	0.75

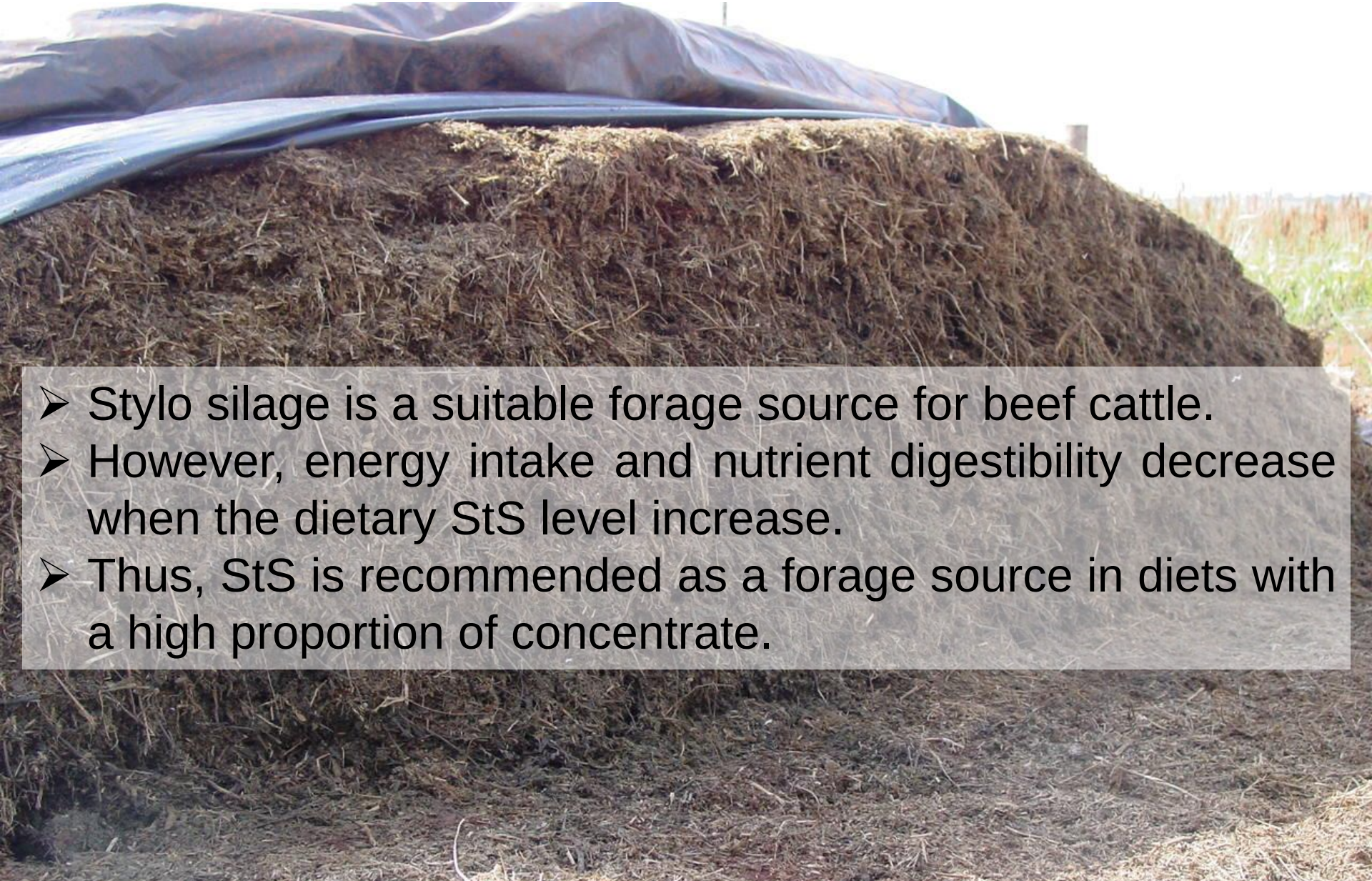
[1]Standard error of mean; [2]1- StS-200 vs. CS-400; 2- StS-400 vs. CS-400; 3- StS-600 vs. CS-400; [3]Neutral detergent fiber; [4]Non-fiber carbohydrates. [5]Total digestible nutrients.

Results and discussion

Table 3. Proportion of ingredients and chemical composition of experimental diets.

	Corn silage	Stylosanthes silage[1]		
Concentrate, g/kg DM	400	200	400	600
	Chemical composition, g/kg DM			
Dry matter, g/kg FM	548.9	406.5	520.9	635.3
Organic matter	928.0	933.3	938.1	942.8
Crude protein	118.5	118.2	120.6	123.0
NDF	31.2	19.5	25.2	30.9
NFC	453.8	293.4	386.0	478.6
Lignin	20.4	83.3	65.5	47.7
iNDF	93.1	281.3	214.6	148.0

Conclusions



- Stylo silage is a suitable forage source for beef cattle.
- However, energy intake and nutrient digestibility decrease when the dietary StS level increase.
- Thus, StS is recommended as a forage source in diets with a high proportion of concentrate.

Obrigado *Thank you* *Danke* 谢谢

Federal Rural University of Amazon, Belém, Pará, Brazil

Thiago Carvalho da Silva
E-mail: timao22@hotmail.com
www.gerfam.com.br