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In vitro degradability and energy value of rapeseed cake produced on farm by cold extraction press

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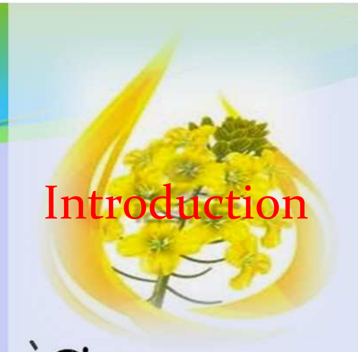
On farm cold extraction process of oil

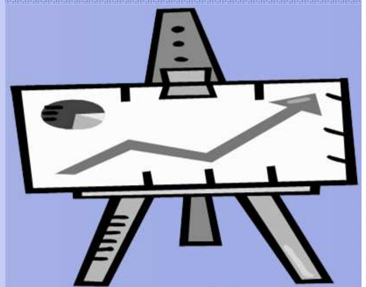


Mechanical extraction at low temperatures

Oil for tractors and farm machines

By-products for animal nutrition rich in residual oil

- economical advantages for the farmer
- positive environmental effects



AIMS

Comparison of three feeds:

- rapeseed cake
- soybean seed
- soybean meal

in terms of:

gas production kinetics using two different *media*:

- Energy deficient and N-rich (Menke & Steingass, 1988)
- N-free (Cone *et al.*, 2009)

energy content using three different equations:

- NRC (2001)
- Menke and Steingass (1988)
- Robinson *et al.* (2004)

Experimental design

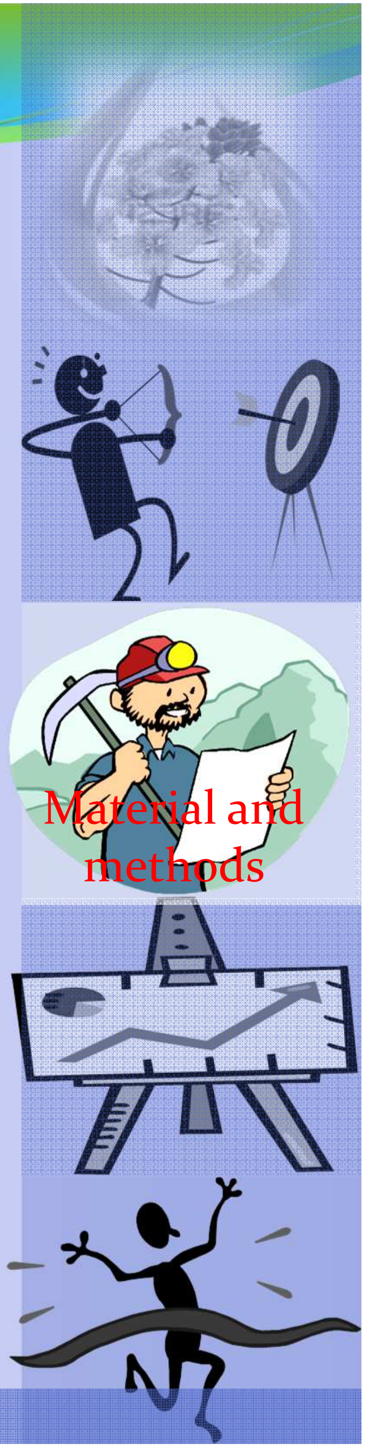
2 different times of incubation

48 h to evaluate NDF and TDM degradabilities (*medium*: Goering and Van Soest, 1970)

3 feeds
8 replications
(plus 8 blanks)

72 h to determine the kinetics of gas production (*media*: Menke and Steingass, 1988; Cone *et al.*, 2009)

2 *media*
3 feeds
4 replications
(plus 8 blanks)



Automatic gas production system

Module for data transmission

Each bottle (310 mL) is equipped with a pressure detector

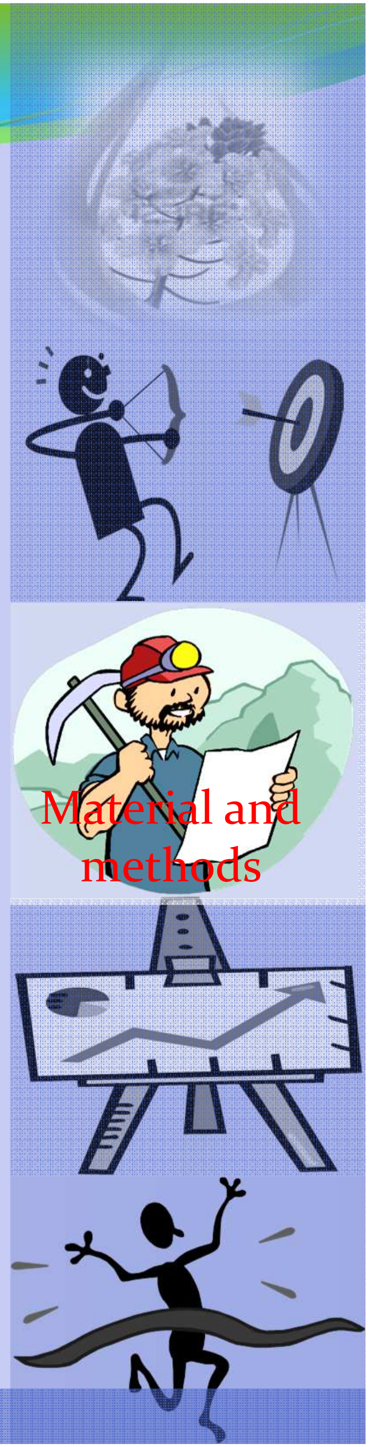
Every bottled was filled with:

- 0.5 g of sample size
- 10 ml of rumen fluid collected by oral probe from dry cows
- 65 ml of buffer

Incubated at 39°C

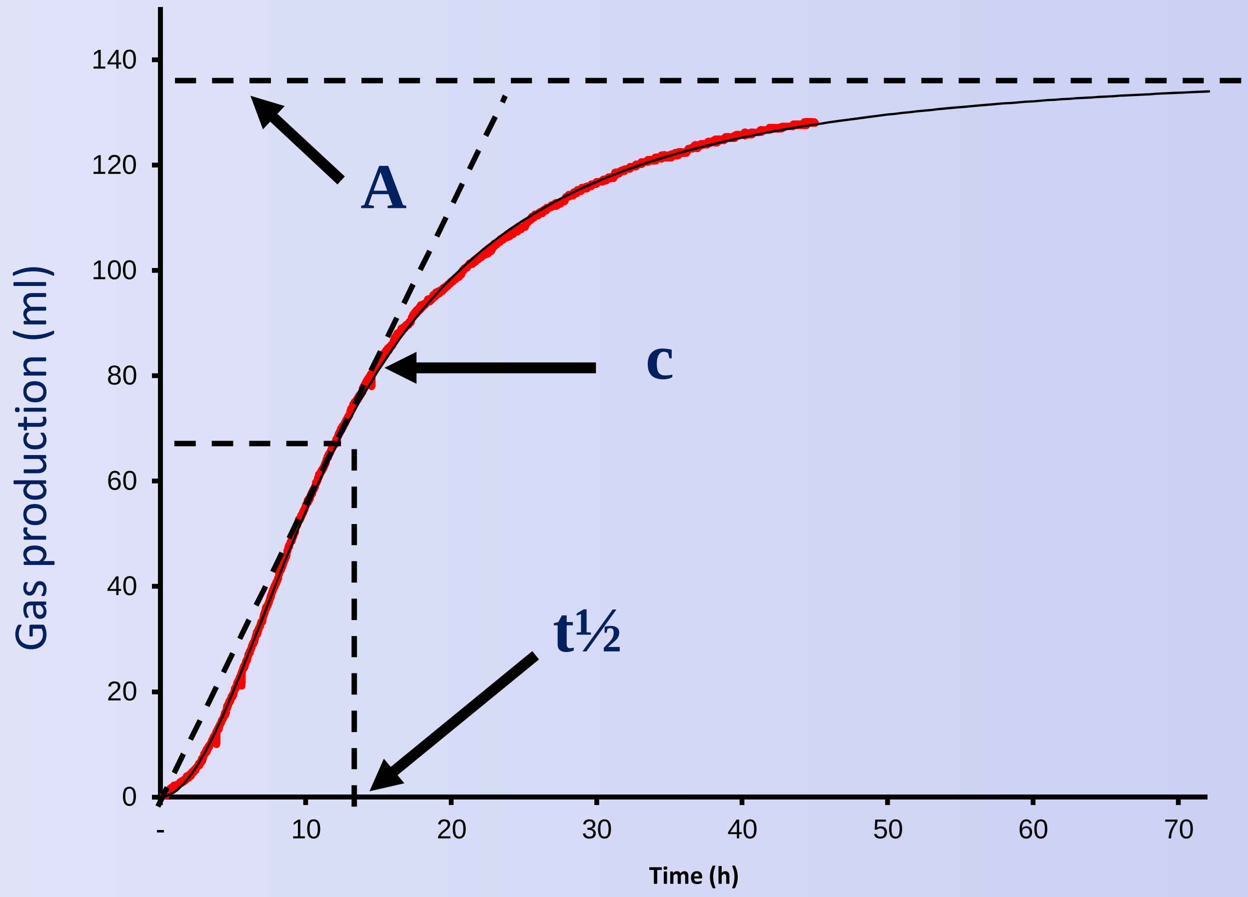
Gas was automatically released when pressure inside the bottles reaches 3.4 kPa

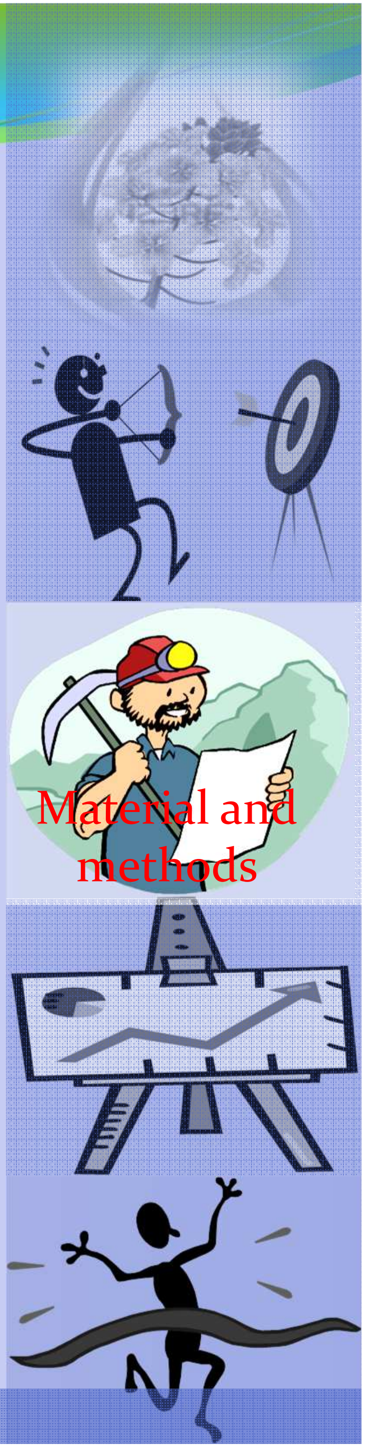
Pressure values were wireless transmitted to a PC



Fitting kinetics of gas production

$GP(t) = A / [1 + (t_{½} / t)^{c}]$ (Groot *et al.*, 1996)





Analyses and computation

Analyses

Crude protein, ash, ether extract (AOAC, 2003)

aNDF (Mertens, 2002)

ADF, ADL (Van Soest, 1991)

NDF degradability (NDFd) after 48 h *in vitro* fermentation

$NDFd\ (\%\ on\ DM) = 100\ [(NDF_{feed} - NDF_{res})/\ NDF_{feed}]$

***In vitro* true DM digestibility (TDMd) after 48 h**

$TDMd\ (\%\ on\ DM) = 100\ [(DM_{feed} - NDF_{res})/\ DM_{feed}]$

Energy value (MJ/kg DM) of feeds :

NRC (2001)

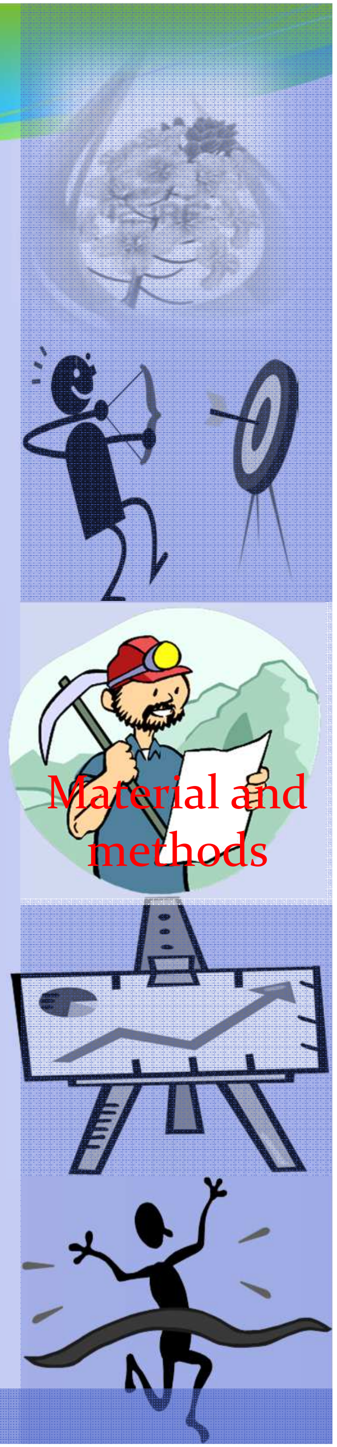
$ME_{NRC} = (-0.45 \times 4.184 + 1.01 \times DE)$ for feed with EE > 3% on DM

Menke and Steingass (1988)

$ME_{Menke} = 1.06 + 0.1570 \times GP24_{200} + 0.0084 \times CP + 0.0220 \times EE - 0.0081 \times ash$

Robinson (2004)

$ME_{UCD} = 1.25 + 0.0292 \times GP24DM + [0.0143 \times (CP - ADICP)] + 0.0246 \times EE$



Statistical analysis

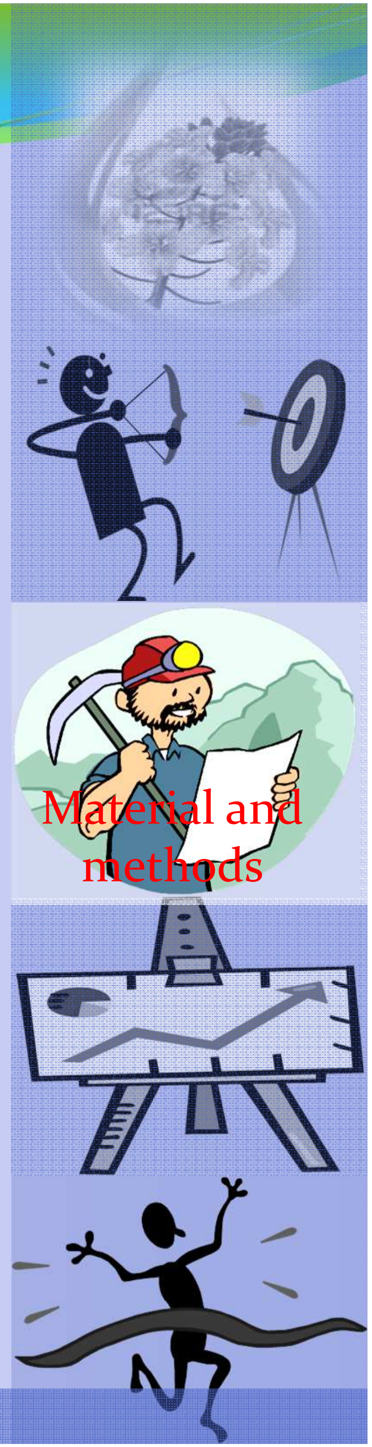
Data analyzed using the general linear models procedure of SAS (2005).

$$y_{ijk} = \mu + F_i + M_j + FM_{ij} + \varepsilon_{ijk}$$

where:

- y_{ijk} = single observation
- μ = overall mean
- F_i = feed effect (i = 1 to 3)
- M_j = medium effect (j = 1 to 2)
- FM_{ij} = first order interaction
- ε_{ijk} = random residual ~ $N(0,\sigma^2_e)$

Significant differences were accepted if $P \leq 0.05$.



RESULTS

Dry matter (DM, g/kg) and chemical composition (g/kg DM) of the feeds

	Soybean meal	Soybean seeds	Rape seed cake
DM	874	888	895
NDF	153	135	291
ADF	74	62	202
Lignin	4	12	75
CP	483	385	287
Lipids	20	202	199
Ash	63	52	66
Starch	38	42	129
NSC[a]	281	226	157

[a]Calculated as NSC = 100 – (CP – Ash – Lipids – NDF)

Degradability and energy values (MJ/kg DM) estimated in according to NRC (2001) (ME_{NRC}), Menke and Steingass (1988) (ME_{Menke}) and Robinson *et al*. (2004) (ME_{UCD}).

	Feeds			
	Soybean meal	Soybean seeds	Rape seed cake	SEM
NDFd[a] (%NDF)	91.0^{A}	91.6^{A}	68.1^{B}	0.95
TDMd[b] (%DM)	98.1^{A}	98.1^{A}	82.9^{B}	0.01
ME_{NRC}[c] (MJ/kg DM)	16.0^{C}	20.2^{A}	18.2^{B}	0.28
ME_{Menke}[d] (MJ/kg DM)	16.6^{B}	18.3^{A}	16.1^{B}	0.33
ME_{UCD}[e] (MJ/kg DM)	19.3^{B}	21.0^{A}	18.2^{B}	0.29

[a]Neutral detergent fiber degradability after 48h of incubation

[b]True dry matter degradability after 48h of incubation

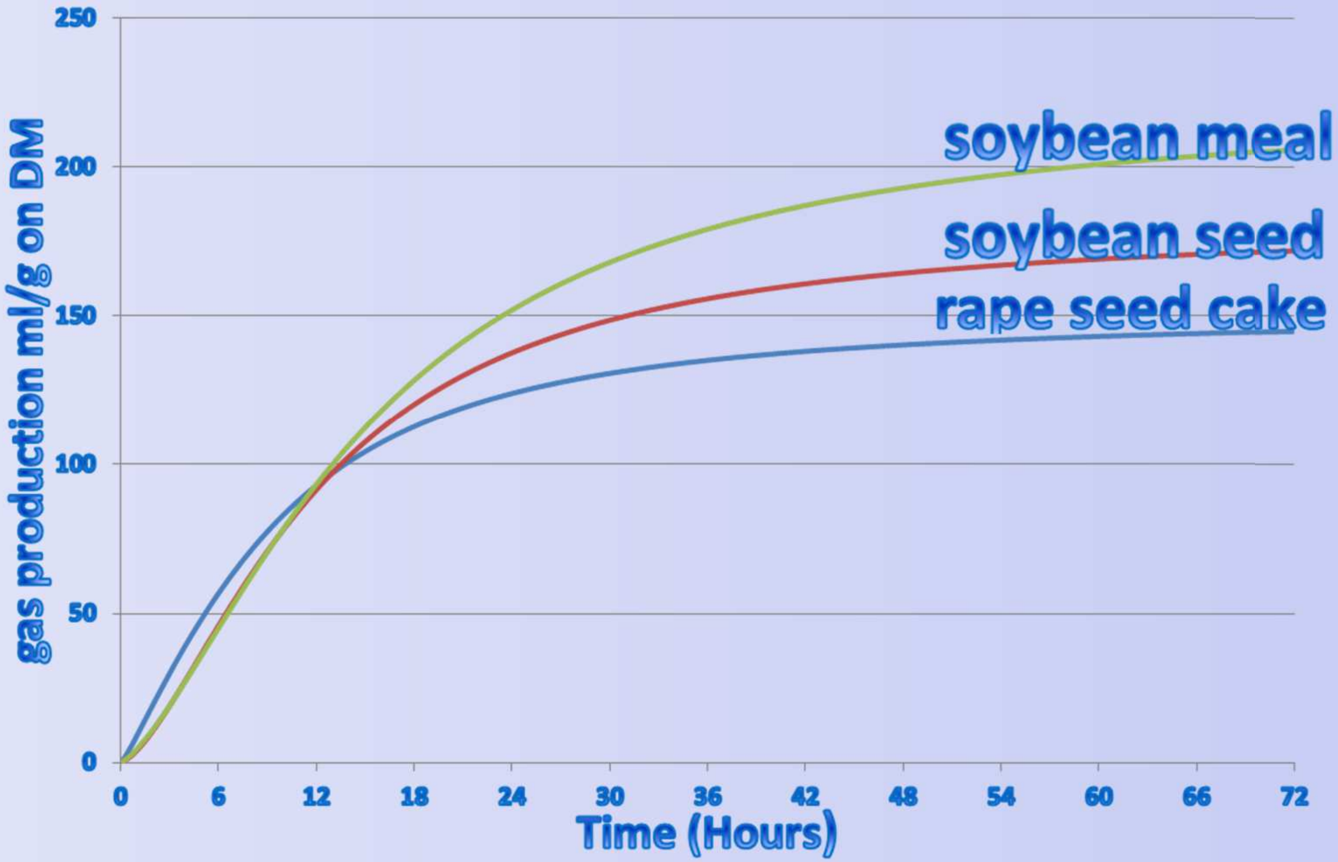
[c] ME contents estimated from the digestible aNDF provided by feeds at 48 h of incubation according to NRC (2001).

[d]ME contents estimated from *in vitro* gas production provided by feeds at 24 h of incubation according to Menke and Steingass (1988).

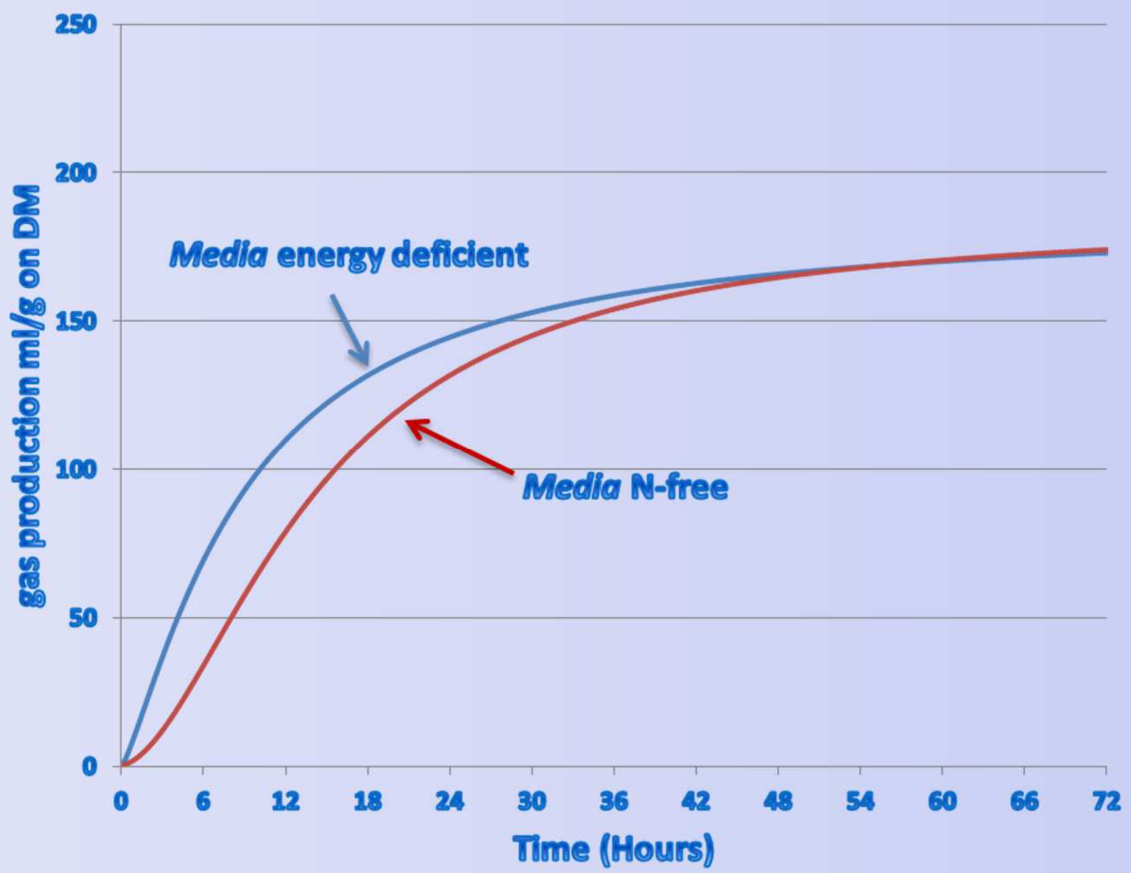
[e]ME contents estimated from *in vitro* gas production provided by feeds at 24 h of incubation according to Robinson et al. (2004).

A,B,C = $P < 0.01$.

Kinetics of gas production of three different feeds with N-free medium (Cone *et al.*, 2009)



Kinetics of gas production of feeds with two different *media*



Media energy deficient (Menke and Steingass, 1988)
Media N-free (Cone *et al*., 2009)

Conclusion

Rapeseed cake can be considered a suitable source of protein in diets for ruminants leading a higher rate of degradation in the first hours of incubation compared to soybean seed.

Rapeseed cake obtained “on farm” could be an alternative to soybean seed in low protein diets, due to higher protein degradation rate.

The small-scale production of oil from rapeseed could be interesting for the positive effects on the environmental impact and feeding costs obtained by the inclusion of rapeseed cake in ruminant diets.

Thanks for

your attention…