

Nutritional value of Lucerne-leaf meal in dairy calf diets

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BACKGROUND OF THE STUDY

- ✘ Forage and ruminants
 - Neonates: rudimentary rumen & NO microbes.
 - fibrous feeds discouraged
- ✘ Rumen development in calves
- ✘ concentrates – **Costly**
- ✘ Alternatives: Proteinaceous forages
 - Lucerne leaf-meal (LLM)
- ✘ Feed value and levels of replacement are not defined



PURPOSE OF THE STUDY

Aim: To assess the nutritive value of LLM relative to calf concentrate feeds

Objectives: Nutrient composition, in vitro degradability & energy supply of LLM & composite diets of LLM with calf concentrate feed

MATERIALS & METHODS

Study site: ARC- API

Lucerne leaf-meal harvesting and processing

- ✦ hand-harvested at pre-bloom stage and air-dried for 4 days.
Stems and petioles removed

Design: CRD

Treatments

1. Concentrate Pellets: 100% (PEL)
2. 65% Concentrate pellets : 35% LLM ($P_{65}L_{35}$)
3. 50% Concentrate pellets: 50% LLM ($P_{50}L_{50}$)

A. Nutrient composition

B. *In vitro* degradation (ANKOM Technology, 2005)

MATERIALS & METHODS

- ✘ Rumen fluid: < 50 days old
- ✘ Incubation periods: 0, 4, 10, 18, 24 and 48 hours
- ✘ DM, NDF & CP degradabilities
- ✘ $PD = a + b(1 - e^{-ct})$ (Ørskov & McDonald, 1979)
- ✘ k_p : 0.05 (LLM diets) & 0.08%/h (PEL)
- ✘ ED_{DM} -calculated

Energy density - diets

- ✘ LRNS (2014) - Level 1
- ✘ Environment : 22 °C, 30% RH and wind-speed =0

STATISTICAL ANALYSIS

- ✘ Data on nutrient analyses, degradation and nutrient fractions (Minitab, 2010).
- ✘ Fishers' (LSD) - at $P < 0.05$.
- ✘ Diet degradation data: ANOVA SAS (2009).

RESULTS

Table 1: Nutrient composition (%DM)

		Treatment		
Variable	LLM	PEL	P ₆₅ L ₃₅	P ₅₀ L ₅₀
Dry matter	95.0	92.3	92.3	92.6
Crude protein	25.0	20.4	22.6	22.8
NDF	22.5	34.1 ^a	30.4 ^b	28.3 ^c
ADF	7.7	11.8	13.8	13.0
NDICP	0.6	3.3 ^a	2.0 ^b	2.2 ^b
ADICP	1.3	0.8	1.0	1.1
Gross energy	16.2	15.8	15.7	15.8
Ether extracts	1.6	4.7 ^a	2.2 ^b	2.0 ^c
Ash	9.5	8.7	8.6	8.7
ADL	0.8	1.8 ^a	0.4 ^b	0.2 ^b
Calcium	1.4	1.0 ^c	1.7 ^a	1.5 ^b
Phosphorus	0.3	0.6 ^a	0.5 ^b	0.4 ^c
Starch	ND	13.4 ^a	10.1 ^b	8.5 ^c

RESULTS CONT".....

Table 2: In vitro degradation

		Treatment			
Variable	Incubation time (h)	LLM	PEL	P ₆₅ L ₃₅	P ₅₀ L ₅₀
DM (%)	24	91.5	84.1 ^b	88.3 ^a	88.9 ^a
	48	97.3	85.4	89.3	92.2
NDF (%)	24	91.5	83.5 ^b	88.3 ^a	88.9 ^a
	48	97.3	83.6	89.8	92.5
CP (%)	24	86.0	71.7	82.9	82.3
	48	91.5	77.0 ^b	88.3 ^a	85.6 ^a
Degradation kinetics of DM					
A+ b(%)			86.3	93.4	94.8
c (h ⁻¹)			0.08	0.06	0.06
ED (%)			84.6 ^b	88.0 ^a	92.0 ^a

RESULTS CONT"

Table 2: In vitro degradation

		Treatment			
Variable	Incubation time (h)	LLM	PEL	P ₆₅ L ₃₅	P ₅₀ L ₅₀
DM (%)	0	55.3	53.6	56.6	55.6
	4	61.1	63.0	62.3	62.1
	10	73.1	69.3	71.6	73.6
	18	79.4	76.3 ^b	77.8 ^a	78.5 ^a
	24	91.5	84.1^b	88.3^a	88.9^a
	48	97.3	85.4	89.3	92.2
NDF (%)	24	91.5	83.5^b	88.3^a	88.9^a
	48	97.3	83.6	89.8	92.5
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RESULTS CONT"

Table 3: Estimated supply of energy fractions of the diets

Variable	Treatment		
	PEL	P ₆₅ L ₃₅	P ₅₀ L ₅₀
Carbohydrates (CHO) (%)	64.7	64.0	63.7
Non-fibre carbohydrates (NFC) (%)	39.7 ^b	40.8 ^a	40.2 ^b
Available fibre (CB ₂) (%)	26.0	23.8	22.9
Starch (CB ₁) (%)	14.5 ^a	10.6 ^b	9.0 ^b
Unavailable fibre (CC) (%)	4.4 ^a	3.5 ^b	3.1 ^b
TDN _{1x} (%)	82.9	81.0	80.1
dTDN (%)	81.0	79.1	78.2
ME (Mcal/kg DM)	2.9	2.9	2.8

DISCUSSIONS

Nutrient composition

- ✘ LLM - > CP & Energy
- ✘ Diets : 22% CP (Hill, 2006) = achieve 0.6kg/day
- Diet P₅₀L₅₀ > Ca: P ratio -3x higher than (NRC, 2001)
- Diet PEL -higher starch

In vitro degradation

- LLM had > CP degradation: < bound protein to the CHO
- LLM substituted diets : >IVDMD

- Diets > 80% : Recommended range by dairy calves (NRC,2001)
- PEL > unavailable fibre: damaged CHO (Millard reactions)
- ME density similar to that reported by Chester-Jones & Broadwater (2009): 2.7 Mcal/kg DM

CONCLUSION

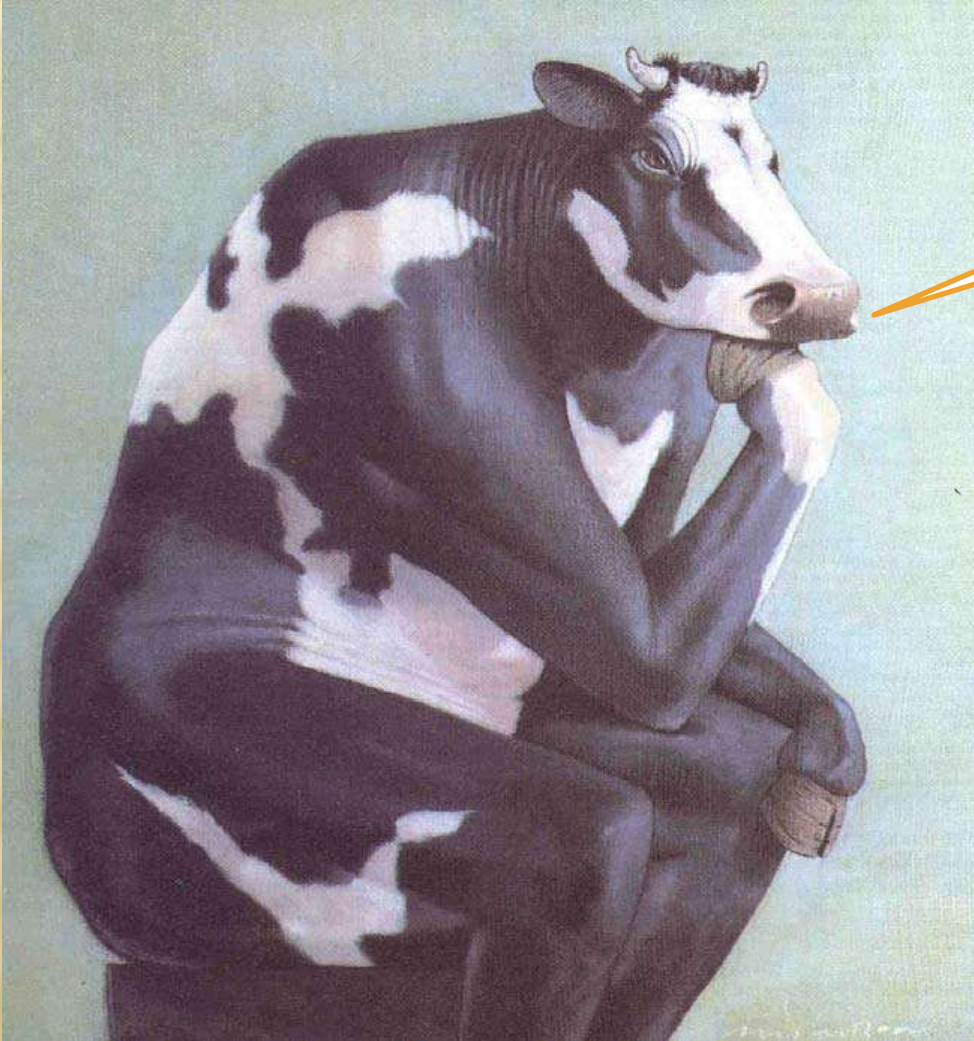
- ✘ LLM > crude protein (25%) & low fibre fractions
- ✘ Diet P₅₀L₅₀ > CP & energy contents, however, had low amounts of starch= Impede rumen papillae development
- ✘ LLM diets were highly degradable= improve intake and nutrient utilization by calves
- ✘ Globally competitive production environment =over 70% of the production costs: manage the use of commercial feeds by widening the feed resource base of neonates.

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ARC • LNR
Excellence in Research and Development

THANK YOU



ANY QUESTIONS?