

The nutritional value of condensed distillers solubles for cattle

De Boever J.L., Millet S., Blok M.C.,
Fiems L.O. & De Campeneere S.

64th EAAP Nantes (26-30th 2013)
Session 5b

Institute for Agricultural and Fisheries Research

Animal Sciences Unit

www.ilvo.vlaanderen.be

Agriculture and Fisheries Policy Area

Introduction

- CDS is a byproduct of bio-ethanol production based on grains/grain starch
- Pasty feed with a high crude protein and fat content



Nutritive value for cattle?

Difficulties:

- How measure digestibility of feed with little physical structure?
- How determine the protein value as nylon bag technique is not applicable?

Material

5 types of CDS:

- Protiwanze (wheat starch + sugars, Belgium, 250.000 ton/y),
- Tarweferm (wheat starch, Belgium, 30.000 ton/y)
- Protisyr (mainly wheat grain, Belgium)
- Verbio (wheat grain, Germany),
- Sastapro (wheat starch, The Netherlands)

Methods

- Chemical composition
- Amino acids
- Minerals and trace elements
- Digestibility sheep \Rightarrow net energy lactation
- In vitro degradability with enzymes \Rightarrow protein value (DVE, OEB)

Methods: digestibility and energy value

- CDS mixed with maize silage (MS) in a ratio of 40/60 on DM-basis
- 6 trials (5 CDS & MS) with 6 mature sheep (Texel) per trial in LS-design
- Feed amount: 1 kg DM-equivalent per day in 2 meals
- Adaptation period: min. 10 days
- Experimental period: 10 days → total feces collection
- Digestion coefficients of OM, CP, CF, Cfat, OC, NDF derived by difference

⇒ Net energy lactation: **NEI** (Van Es, 1978)

with GE = gross energy by bomb calorimetry
ME calculated from digestible nutrients



Methods: protein degradability

- **Rumen fluid** not suitable as inoculum because not only protein degradation, but also formation of microbial protein

- Use of enzymes \Rightarrow ***Streptomyces griseus***

(Cone et al., 1994)

○ Freeze dried samples ground through 1 mm

○ Incubate 200 mg CP-eq. with 50 ml protease in borate-phosphate buffer at pH 6.7 and 40°C during 0 (=1 h buffer alone), 1, 6 and 24 hours

○ Centrifuge tubes and analyse N in supernatant

\Rightarrow Protein degradability: SG0, SG1, SG6, SG24

\Rightarrow potential predictor of in situ protein values using a dataset of 28 protein-rich feeds



Methods: estimation of protein value

28 protein feeds: untreated/treated (heat, formaldehyde), incl. 14 DDGS

Protein value according to Dutch system (Tamminga et al., 1994; 2007)

⇒ **Digestible CP in intestines: DVE**

⇒ **Degraded protein balance: OEB**

- Rumen bypass protein (RBP): 3 lactating cows

- Intestinal digest. RBP (IDRBP): mobile bag technique



	Mean ± SD	Multiple parameters	R ²	RSD
RBP, %	58.9 ± 12.3	SG6, CP	69	6.8
IDRBP, %	91.0 ± 6.2	SG6, CP, NDF, ash	64	3.8

Results: chemical composition (g/kg DM)

	Mean \pm SD	Range	CDS/wheat*
Dry matter, g/kg	278 \pm 34	248 – 325	-
Crude protein	325 \pm 99	238 – 495	2.5
Crude fat	71 \pm 14	61 – 95	3.1
Crude ash	78 \pm 26	41 – 108	4.6
NDF	96 \pm 44	43 – 154	0.67
Starch	19 \pm 7	11 – 30	0.03
Sugars	123 \pm 24	97 – 154	4.6
Glycerol	95 \pm 52	36 – 168	-
Lactic acid	33 \pm 19	18 – 65	-
VFA + alcohols	14 \pm 16	5 – 43	-
pH	4.0 \pm 0.5	3.5 – 4.7	-

* Dutch Feed Tables (CVB, 2011)

Results: minerals (g/kg DM) & trace elements (mg/kg DM)

	Mean ± SD	Range	CDS/wheat	Dairy cow req.*
Calcium	1.7 ± 0.5	0.9 – 2.2	3.7	3.2 – 4.2
Phosphorus	11.6 ± 5.2	5.8 – 19.1	3.4	2.5 – 3.3
Magnesium	3.2 ± 1.6	1.6 – 5.1	3.1	2.1 – 2.4
Potassium	13.2 ± 6.6	2.1 – 19.3	3.1	7.2 – 8.1
Sodium	9.7 ± 9.6	0.8 – 20.9	84	1.1 – 1.4
Sulphur	10.2 ± 7.0	2.5 – 16.9	89	2.0
Iron	129 ± 63	73 – 237	2.0	8.1 – 12.8
Manganese	69 ± 25	43 - 111	2.1	40
Zinc	70 ± 27	52 – 116	2.3	26 - 33
Copper	8.5 ± 2.1	6.4 – 11.9	1.8	11 – 13

* Tables Book Livestock Feed (CVB, 2010)

Results: amino acids (g/16 g N)

	Mean \pm SD	Range	Wheat*	SBM*
Lysine	3.0 \pm 0.5	2.2 – 3.6	2.8	6.2
Methionine	1.3 \pm 0.1	1.2 – 1.4	1.6	1.4
Tot. Ess. AAs	31.9 \pm 1.1	30.9 – 33.3	34.3	45.3
Glutamine	21.8 \pm 4.6	15.7 – 28.1	28.3	17.8
Total AAs	80.9 \pm 5.1	73.5 – 87.6	92.1	95.1

* Dutch Feed Tables (CVB, 2011)

Results: digestibility (%) & energy value

	Mean \pm SD	Range	Wheat*
DC-Crude protein	78.9 \pm 3.8	73.3 – 83.5	74
DC-Crude fat	86.0 \pm 2.6	82.4 – 88.5	68
DC-NDF	77.6 \pm 17.9	52.5 – 100.0	-
DC-Other carbohydrates	96.3 \pm 5.9	91.2 – 106.1	93
DC-Organic matter	88.6 \pm 3.0	85.0 – 92.7	89
NElactation (MJ/kg DM)	8.31 \pm 0.38	7.75 – 8.83	7.09

* Dutch Feed Tables (CVB, 2011)

Results: protein value

	Mean \pm SD	Range	Wheat*	SBM*
RBP, %	31.1 \pm 5.3	22.2 – 35.3	23	41
IDRBP, %	86.6 \pm 9.3	76.6 – 96.6	91	98
DVE, g/kg DM	143 \pm 47	104 - 220	98	275
OEB, g/kg DM	126 \pm 63	67 - 228	-26	164

* Dutch Feed Tables (CVB, 2011)

Conclusions

- Compared to wheat, CDS has a higher crude fat content and a similar digestibility resulting in a higher net energy value
- CDS has a high CP-content, a moderate RBP and IDRBP, resulting in a good DVE-content and a positive OEB-content
- The amino acid content in total CP is reduced
- CDS is a good source of most minerals
- **The nutritional value can vary considerably among production processes, which necessitates plant-specific values**