Project 1

EXTRACTION OF PROTEIN IN INNOVATIVE CROPPING SYSTEMS: QUANTITY, QUALITY AND EXTRACTION

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Hypothesis

The high protein content of grasses and legumes pose some intriguing possibilities for their use as a fodder product suitable for weaner calves and pigs if they can be extracted in a biorefinery process.

Aim

The aim of this study is to achieve knowledge on the quantity and quality of protein that can be produced in innovative cropping systems.

Objective

The objective is to investigate the variability of N fractions in a range of crops to indicate their potential as a protein source for animal feed.

Experiments

- ✓ N fractionation in crops from maximum biomass field experiment

Near infrared reflectance spectroscopy (NIR) in compositional analysis of biomass

Amino Acid composition of protein fractions

Methodology

Protein fractionation is performed according to the Cornell Net Carbohydrate and Protein System (CNCPS).

The CNCPS assumes that feedstuffs are composed of protein, carbohydrate, fat, ash, and water.

Protein and carbohydrate DM are subdivided by chemical composition, physical characteristics, ruminal degradation, and postruminal digestibility characteristics.

Methodology

The CNCPS fractionates CP into 5 fractions based on solubility in protein-precipitant agents, buffers and detergent solutions:

A - nonprotein nitrogen (NPN)
B - true protein
- B1 – rapidly degraded
- B2
- B3 – Associated with cell wall

C - Unavailable nitrogen – bound true protein – associated with lignin, tannin-protein complexes and Maillard products

Non-protein nitrogen (NPN), fraction A

This method consists of using a protein precipitant agent, TCA.

NPN = Total nitrogen content - nitrogen content in the residue

Reference

Licitra, G., Hernandez, T. M., & Van Soest, P. J. (1996). Standardization of procedures for nitrogen fractionation of ruminant feeds. Animal Feed Science and Technology, 57(4), 347-358.

Soluble Protein

This method consists of treating sample with Borate–phosphate buffer (pH 6.7-6.8) and sodium azide 10%.

N determined in the residue is an indicator of insoluble protein fraction.

Soluble protein = total crude protein-insoluble protein fraction (IP)

Soluble true protein **(fraction B1)** = soluble protein-NPN

Expression of the result is based on total protein content

Reference

Licitra, G., Hernandez, T. M., & Van Soest, P. J. (1996). Standardization of procedures for nitrogen fractionation of ruminant feeds. Animal Feed Science and Technology, 57(4), 347-358.

ADF and Acid detergent insoluble nitrogen (ADIN), Fraction C

Fibertec digestion aparatus is used.

The method consists of digestion of sample in AD solution for duration of 1 h, filteration and N determination in the residue.

ADF result is on OM basis.

Reference

Licitra, G., Hernandez, T. M., & Van Soest, P. J. (1996). Standardization of procedures for nitrogen fractionation of ruminant feeds. Animal Feed Science and Technology, 57(4), 347-358.

aNDF and neutral detergen insoluble nitrogen (NDIN)

The method consists of digestion of sample in ND solution for duration of 1 h, filteration and N determination in the residue.

aNDF result is on OM basis.

Reference

Licitra, G., Hernandez, T. M., & Van Soest, P. J. (1996). Standardization of procedures for nitrogen fractionation of ruminant feeds. Animal Feed Science and Technology, 57(4), 347-358.

Calculations

Fraction A = NPN
Fraction B1 = True protein (TP) – Insoluble protein (IP)
Fraction B2 = IP - NDIN
Fraction B3 = NDIN – ADIN
Fraction C = ADIN

Thank you