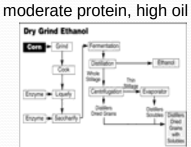
Energy determination of corn co-products fed to finishing pigs and use of *in vitro* OM digestibility to predict *in vivo* ME

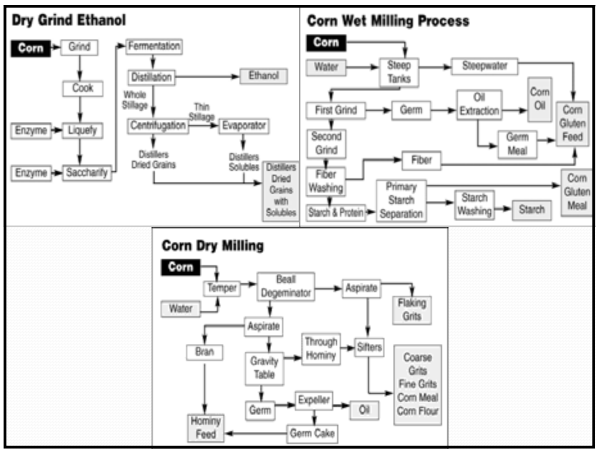
P. V. Anderson*[1], B. J. Kerr[2], G. C. Shurson[3]

Iowa State University, Ames[1], USDA-ARS, Ames, IA[2], University of Minnesota, St. Paul[3]

Introduction

- Energy is the most expensive component of swine diets
- Corn milling technologies are increasing efficiency of starch and oil extraction thereby producing 'new' corn co-products
  - Low oil, moderate fiber, high protein (HP-DDG)
  - Low oil, low protein, high fiber (bran)
  - Moderate fiber, moderate protein, high oil (dehydrated germ meal)



Introduction

- Energy values for "new" corn co-products are needed
- Prediction equations from chemical analysis or *in vitro* assays may be useful
  - Equations are available for complete diets (Noblet et al., 1994) and DDGS (Pedersen et al., 2007)
  - Accuracy of these equations for predicting energy content of these "new" corn co-products is unknown


Objectives

- 1 - Determine the ME content of 20 corn co-products in finishing pigs
- 2 - Develop an equation to predict ME based upon ingredient chemical analysis
- 3 - Evaluate the ability of an *in vitro* OM digestibility assay to predict or improve the prediction of ME for corn co-products in finishing pigs

Materials & Methods

- Co-products were obtained from corn wet-milling and dry-grind plants throughout the United States
  - Dehulled, degermed corn
  - Dried solubles
  - Oil
  - Starch
  - DDGS (7)
  - Gluten meal
  - HP-DDG (3)
  - Bran (2)
  - Germ meal (2)
  - Gluten feed

Nutrient Range (%)
- Ash 0.0 – 14.1
- Starch 0.5 – 100
- CP 10.9 – 66.6
- EE 0.2 – 100
- NDF 2.3 – 61.1

In vivo Method to Measure ME

- Eight groups of 24 finishing gilts were housed individually in metabolism crates
  - (n=192, 112.7 final BW ± 7.9 kg)
- Separate but total collection of feces and urine
- Gilts were randomly assigned to one of five dietary treatments or the basal diet per period
- Each treatment was repeated across two feeding periods resulting in 8 observations per treatment
  - 2 periods with 4 pigs per treatment per period

In vivo Method to Measure ME

- Basal diet contained 97.1% corn
  - Plus limestone, salt, vitamins, and TM (2.9%)
- Treatments were formulated by mixing the basal diet (70%) with the test ingredient (30%)
  - Except for dried solubles (20%) and corn oil (10%)
- Feed was provided at a level equivalent to 3% BW
  - 9 day adaptation period
  - 4 day collection period
- Chemical analysis
  - Feedstuffs were analyzed for moisture, starch, GE, AA, EE, CP, CF, TDF, NDF, ADF, minerals, and ash

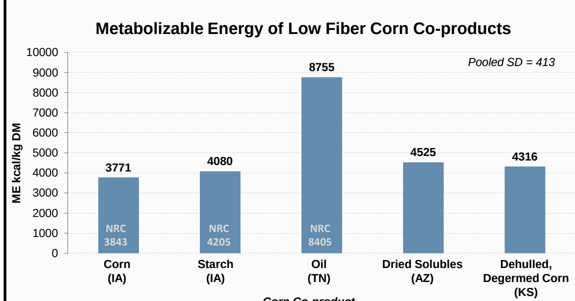
In vitro OM Digestibility

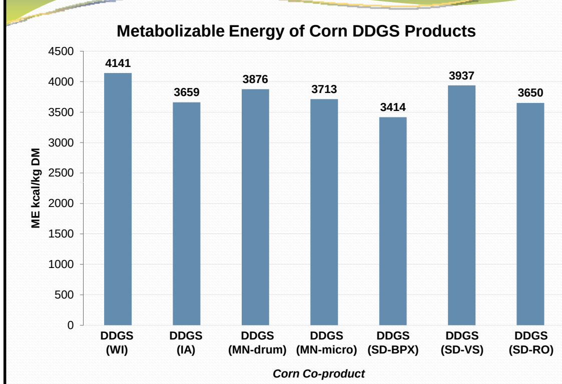
- Used a 3-step enzymatic assay (Boisen and Fernandez, 1997)
  - Enzymes pepsin, pancreatin, and Viscozyme were used and samples were incubated for 24 h
  - Feed samples were ground to 1 mm
  - Samples (0.5 g) were analyzed in triplicate including blanks and controls (corn)
  - After incubation all samples were filtered, dried, and ashed, to determine OM digestibility

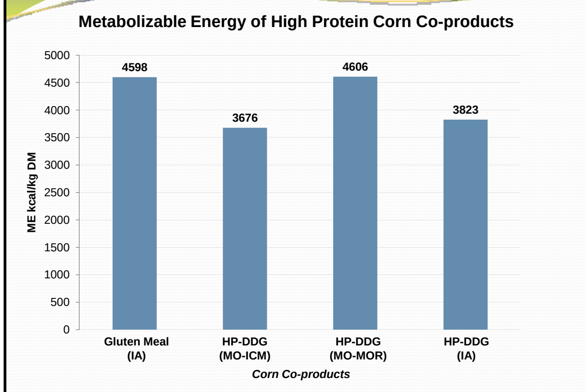
Calculations and Statistics

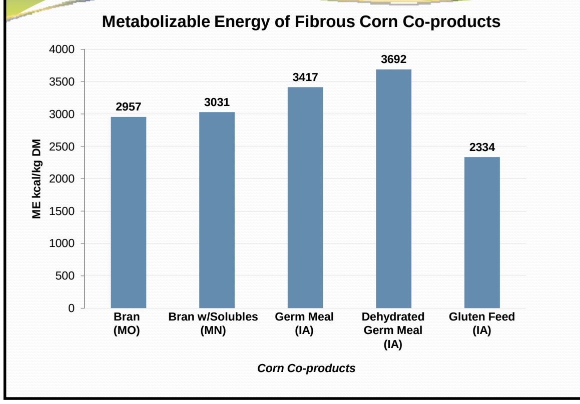
- ME content of the test ingredients was determined by difference from the basal diet (Adeola, 2001)
- Data were analyzed using ANOVA of SAS
  - Individual pig was the experimental unit
- Basal diet ME was used as a covariate
- Stepwise regression was used to determine effects of feedstuff composition on the prediction of ME
  - Variables with $P < 0.15$ remained in the model

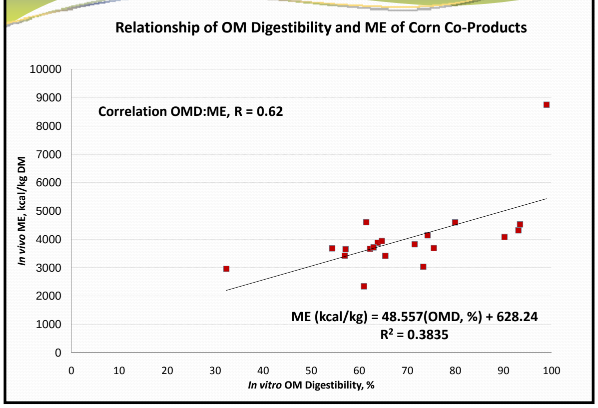
Results and Discussion









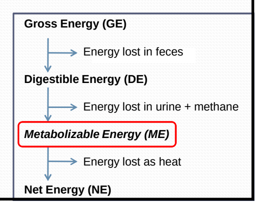


Stepwise Regression Equation

ME kcal/kg DM =

(0.949 × kcal GE/kg DM) – (32.238 × % TDF) – (40.175 × % ash)

$r^2 = 0.95$
SE = 306
$p < 0.01$



Conclusion

- ME and OM digestibility varied substantially among corn co-products
- ME was related to OM digestibility but did not accurately predict ME
- The prediction estimate for ME based on ingredient analysis was not improved by including *in vitro* OM digestibility
- Best predictors of ME in the corn co-products evaluated were GE, TDF, and ash

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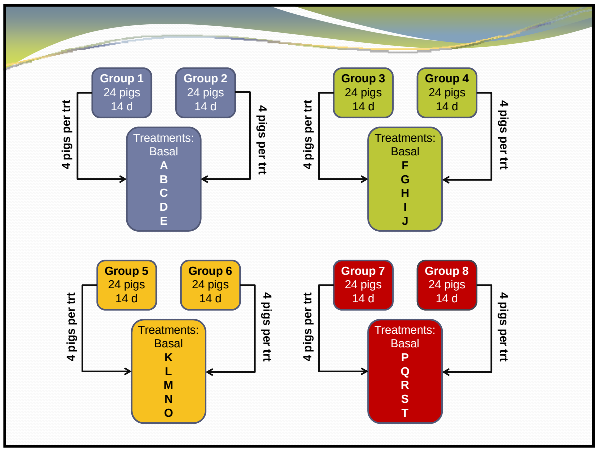
Group 1
24 pigs
14 d
Group 2
24 pigs
14 d
4 pigs per trt
4 pigs per trt
Treatments:
Basal
A
B
C
D
E
Group 3
24 pigs
14 d
Group 4
24 pigs
14 d
4 pigs per trt
4 pigs per trt
Treatments:
Basal
F
G
H
I
J
Group 5
24 pigs
14 d
Group 6
24 pigs
14 d
4 pigs per trt
4 pigs per trt
Treatments:
Basal
K
L
M
N
O
Group 7
24 pigs
14 d
Group 8
24 pigs
14 d
4 pigs per trt
4 pigs per trt
Treatments:
Basal
P
Q
R
S
T