



Assessing Corn Energy for Swine and Poultry

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2003 Minnesota Nutrition Conference



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Energy Assessment of Corn Grain. Where are the opportunities?

- Gross Energy
Energy released when sample is burned
- Digestible Energy
GE minus energy in feces
- Metabolizable Energy
DE minus energy in urine
- Net Energy
ME minus heat loss

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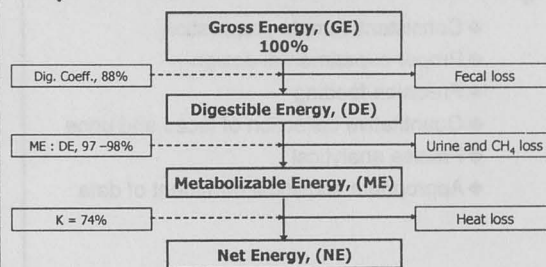
Begin with the End in Mind

- >70% of US corn grain volume is consumed by animal production industries
- Managing available energy concentration (DE, ME, NE) is the most economically important dietary characteristic in feeding animals
- Correctly valuing corn energy concentration is important for the best assessment of competing energy feedstuffs
- Getting the most out of grain reduces waste output

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Current Understanding of Energy Utilization of Corn Grain in Pigs



Noblet, 1995; Ewan, 1989

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Begin with the End in Mind

- Understanding available energy content of corn grain is a priority for Pioneer.
- Pioneer's research efforts are currently yielding valuable information on available energy concentration and the variation that exist in commercial corn grain
- Development of a rapid analysis tool would allow us to sort out differences between hybrid families

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Non-ruminant DE and ME Reference Data Generation

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What do we need to know?

- ◆ Is there variation in grain energy content?
 - Already know about large variation in GE.
 - Does this get multiplied at DE and ME steps?
- ◆ Can a rapid analysis tool be developed for whole grain?
- ◆ Are the differences due to a genetic component?
- ◆ Is there a significant G X E?

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Current Capability

- 36 swine metabolism crates at PLNC
- 12 samples plus 1 check evaluated in three week experiment
 - N=8 for each sample
- Capability of ~200 samples per year
 - Current activity at 120 samples per year

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Methodology Requirements

- ◆ Consistent sample preparation
- ◆ Proper experimental design
- ◆ Precision feeding
- ◆ Quantitative collection of feces and urine
- ◆ Precise analytical
- ◆ Appropriate statistical treatment of data

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Consistent Sample Prep

- Samples are cleaned
- Consistent particle size
 - 450 – 550 microns geometric mean
 - 5 lb pre-grind
 - Pilot scale hammer mill
 - Vibratory feeder for consistent material flow
 - Kice cyclone with air-lock to minimize sample loss
 - 6/64 to 10/64 screen
- Sub-samples for laboratory analysis
 - GE and dry matter
 - Ground through a Knife-Tech prior lab submission

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Facilities

- Pioneer Livestock Nutrition Center (PLNC)
 - 36 swine stainless steel metabolism pens
 - 18 pens in each of two rooms
 - Air temperature maintained 70±5 °F
 - Grinding and mixing equipment
 - Facilities for sample drying and preparation
- Internal labs for bomb calorimeter, dry matter determination
- External labs used for standard proximate analysis

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Experimental Diets

- Test material plus casein, vitamins and minerals
 - 89.5% grain
 - 8.0% casein
 - 2.5% vitamins, minerals, salt, chromium
 - Chromium primarily used to provide consistent feces color, but could be used as an internal marker
- Within sample type, diets offered at a constant GE/unit of metabolic body weight
 - 106 kcal ME/kg BW^{0.75} for maintenance
 - Feed offered at 3X maintenance

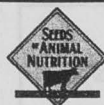
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Experimental Design

- Experiment
 - 12 samples plus 1 check
 - Three 7-day adaptation/collection periods
 - Eight observations/sample; 12 observations/check
- Randomization
 - Pigs randomized to treatment

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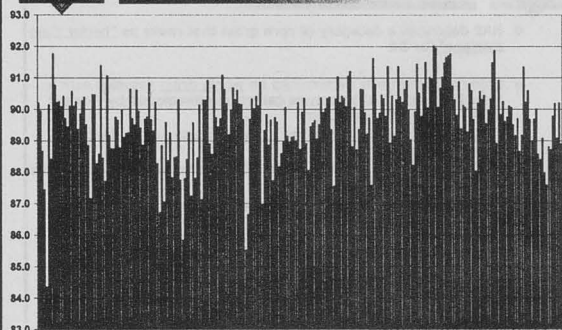
Putting the Data to Work

- ◆ Pioneer has developed a rapid analysis tool predict DE
- ◆ Tool has been used characterize commercial hybrid grain DE
- ◆ Pioneer has established the High Available Energy (HAE) designation.
 - Individual hybrid digestible energy values must be above average to be given the HAE designation.
- ◆ HAE scale is pegged to the NRC, 1998
 - Corn DE = 1800 kcal/lb, 100% dry basis

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Energy Digestibility is Highly Variable for Hybrid Families



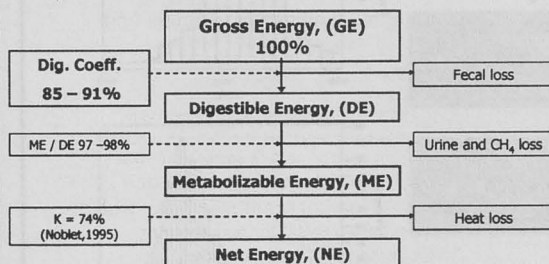
Energy Utilization in Pigs

Gross Energy, (GE)
100%

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Improved Understanding of Energy Utilization of Corn Grain in Pigs

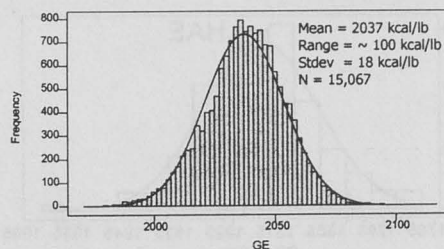


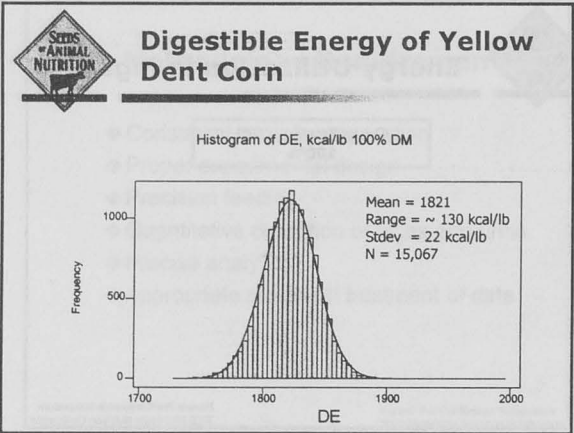
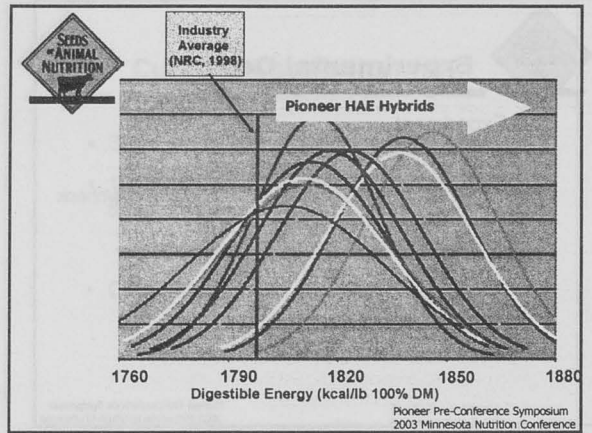
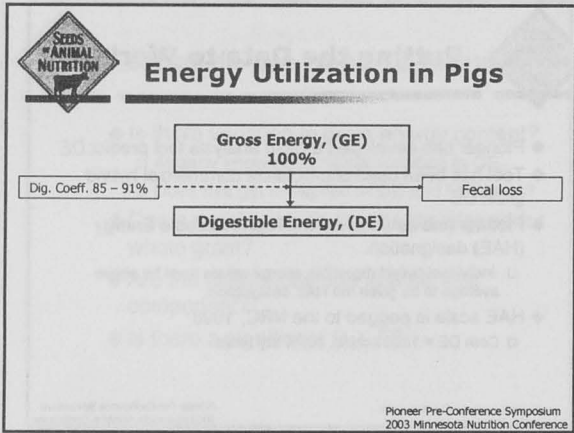
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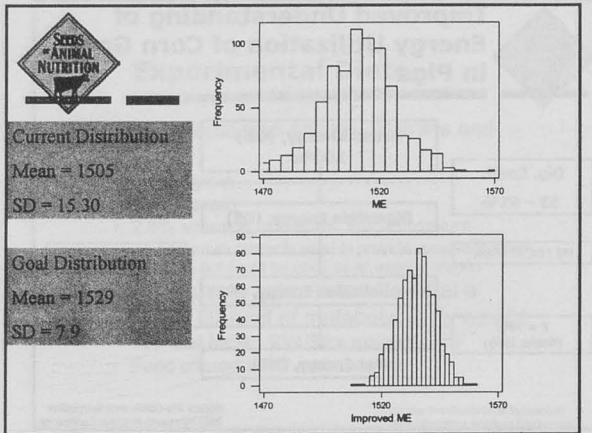
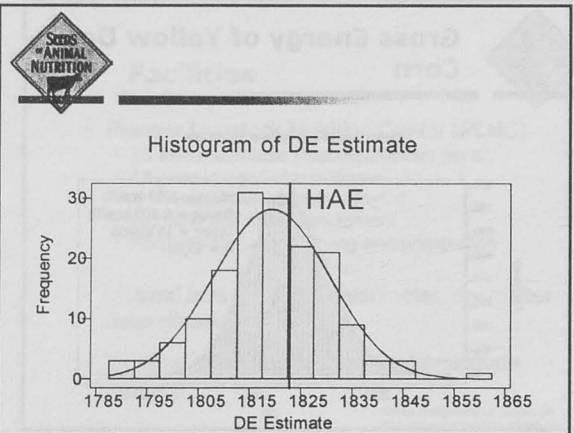
Gross Energy of Yellow Dent Corn

Histogram of GE, kcal/lb 100% DM





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- What is HAE?
How is HAE status determined?**
- ◆ HAE describes a category of corn grain that ranks as "better than average" for DE
 - ◆ Digestible Energy is determined on whole grain samples with a Near Infrared (NIRT) analysis calibration developed by Pioneer scientists over the last 3 yrs
 - NIRT calibration developed using in house animal feeding trial reference data
 - > > 200 unique hybrid grain samples grown in isolated plots and precision fed to pigs
 - Our investment in personnel, and in laboratory and feeding facilities at the **Pioneer Livestock Nutrition Center** has made us world class in energy determination capability
 - First of its kind technology to directly predict DE
 - Proprietary Pioneer technology
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Summary

- Understanding corn energy value is critical to livestock/poultry producers number one goal:
 - Attain the most efficient transformation of grain energy into meat.
- Characterizing commercial corn hybrids for available energy allows producers to:
 - Improve grain consistency and quality
 - Perform more accurate and precise feed formulation
 - Produce less waste output due to increased digestibility
- High Available Energy (HAE) corn hybrids from Pioneer offer pork and poultry producers grain with above average digestible energy and industry leading yield performance.

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