Swine Nutrition

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Q. Omnivore, Carnivore, or Herbivore?

- Pigs are omnivorous!
- Very much like humans!
- Feral pigs eat: eggs, bird chicks, reptiles, frogs, earthworms and other invertebrates, fruit, seeds, roots, tubers, bulbs, and plant foliage
- Feral pigs prey on newborn lambs and reduce yields of cereal grain, sugarcane, fruit, and vegetable crops.
Guidelines for fattening hogs:
- Corn, barley, and oats
- Corn meal was superior to whole corn
- Middling, potatoes, and beets were good options
- Wet feed (soaking or cooking of grains) was good
- Skim milk, meat scraps, and pasture was important for good performance
- Maintained in sunshine, away from pens, and kept on natural earth, allowed to roam on pasture
- Feed to 300 lbs. by 1 year of age
- Customers wanted lean pork, so allow for exercise
“The Hog Book”

By H. C. Dawson, 1911

• Based on his 50 years of practical experience of handling swine in the “American Corn Belt”

• Results of a survey he did for the “best and most economical rations for raising hogs.”
  – Good legume pasture (alfalfa, standing soy, clover) was #1
  – Corn, barley, or ground soy
  – Skim milk for slop feeding
  – Wood ashes, charcoal, and salt
  – Water
Production Characteristics
- Live-weight feed efficiency of 2.4 (2.4)
- Fat-free lean gain efficiency of 5.9 (5.8)
- Fat-free lean gain of 0.95 lbs. per day
- Marketed at 156 (164) days of age
- Weighing 270 pounds
- All achieved on a corn-soy equivalent diet from 60 pounds
- Free of all internal and external parasites
- From a high-health production system
- Immune to or free of all economically important swine diseases
- Produced with Environmental Assurance
- Produced under Pork Quality Assurance® Plu® and Transport Quality Assurance™ guidelines
- Free of the Stress Gene (Halothane 1843 mutation) and all other genetic mutations that have a detrimental effect on pork quality.
- Result of a systematic cross-breeding system, emphasizing a maternal dam line and a terminal sire selected for growth, efficiency and superior muscle quality
- From a maternal line weaning >25 pigs/year after multiple parities

Carcass Characteristics
- Hot carcass weight of 205 lbs.
- LMA of 6.5 (7.1)
- 10th rib backfat of 0.7 (0.6) inch
- Fat-Free Lean Index of 53.0 (54.7)

Quality Characteristics
- Muscle color score of 4.0
- 24-hour pH of 5.9
- Maximum drip loss of 2.5 percent
- Intramuscular fat level of 3.0 percent
- Free of within-muscle color variation and coarse muscle texture
- Free of ecchymosis (blood splash)
- Provides an optimum balance of nutrients important for human nutrition and health
- Provides a safe, wholesome product free of all violative residues and produced and processed in a system that ensures elimination of all foodborne pathogens
Colorado Agriculture Rank Among States (as of 2012):
- Number 15 in all hogs and pigs.
- Number 15 in market hogs and pigs.
- Number 13 in breeding hogs and pigs
- Number 12 in pig crop

Farms
- Number of farms: 36,700
- Land in farms (in acres): 31,300,000
- Average farm size (in acres): 853

Livestock Hogs and Pigs Inventory By Class (as of December 1st, 2012)
- Hogs and Pigs total inventory: 720,000
- Breeding: 145,000
- Sows farrowed annually: 275,000
- Pig Crop Annually: 2,708,000
Protein Metabolism is Rocket Science

- NRC Recommendations
  - Does not make a total diet CP recommendation anymore
  - Focuses only on amino acid profile and bioavailability at the small intestine for each feed ingredient
- Mammalian protein sources (especially milk and blood) have much higher concentration and availability of AA than plant sources
- Reduce the use of unavailable sources of protein that are not absorbed by the terminal ileum
- Optimize the protein quality of the diet, making it more “purified,” so that pigs are more efficient
- Reduces nitrogen excretion into the environment
- New Terms:
  - “Standardized Ileal Digestibility (SID) amino acid content” = makes a correction for MCP and endogenous AA turnover and losses, digestible portion
  - “Crystalline” amino acids = the pure form (i.e. 98.5% L-Lysine)
• IF YOU THINK YOU UNDERSTAND PROTEIN DIGESTION, ABSORPTION, AND METABOLISM, IT HAS NOT BEEN PROPERLY EXPLAINED TO YOU!
Where is the ileum?
- Duodenum
- Jejunum
- Ileum
Why do pigs have a high iron requirement?
Iron

• Iron is needed for hemoglobin (Hb) in RBC, myoglobin, muscle, transferrin in serum, uterofermin in placenta, lactoferrin in milk, and function of certain enzymes

• Sows milk is deficient in Fe, and increasing it in the sow’s diet does not improve the transfer of it in milk

• Neonates become anemic

• IM injection of 100-200 mg Fe (iron dextran shots) in first 3 days of life is most effective

• Acute Fe toxicity can occur, so don’t over-do the shots or provide in addition to high Fe concentrations in the feed!!
Why elevate Cu and Zn in the diet of young pigs?
Cu and Zn Supplementation

• Bacteria, yeasts, and viruses are rapidly killed on metallic copper surfaces “on contact,” known since ancient times, Cu is considered the oldest recognized “antimicrobial”
  – Causes apoptosis and cell death on contact!
• Weaning causes small-intestinal atrophy and dysfunction, which causes diarrhea and reduces nutrient absorption of weaned pigs. High levels of Zn is beneficial for maintaining the normal morphology of the GI tracts in weaned pigs.
• Feeding high Cu and Zn together does not have additive benefits, but is additive when an antibiotic is offered!
• In Starter Diets:
  – Feeding 3,000 ppm Zn for (as ZnO) for 1-1.5 weeks, then 2,000 ppm for following 2-2.5 weeks- improves growth performance and reduces scours in weanling pigs
  – Prolonged feeding (>28 days) causes decreased growth
• In Grower Diets:
  – Feeding 75-150 ppm Cu (as CuSO₄) stimulates growth in pigs and has antimicrobial affects
Mash vs. Pellets?
Pros & Cons?
What makes organic feeds different?

• Certain customers demand Organic, the USDA certifies it to be:
  – Only organic herbicide, pesticide, and fertilizers can be used
  – No GMO’s (which is hard to prove)
  – No bacterial sterilization using irradiation
• No difference in formulation = no nutritional difference
• In some cases, the nutritional soundness is compromised because they won’t allow us to use:
  – Lysine (and limitations on other amino acids)
  – B-Vitamins
  – Mycotoxin binders
  – Flavor enhancers
  – Animal Proteins (including fish meal)
• Harder to grow, harder to find ingredients = more expensive
• Ingredients are sourced further away = more freight
• More bugs and weeds because affective herbicides and pesticides can’t be used
• Shorter shelf life (because of above)
Tips for each phase of production
Rule of Thumb on DMI

- Sows in Gestation = ~1.5% of BW
- Sows in Lactation = ~3.0-4.0% of BW
- Nursery Pigs = 4.5-5.0% of BW
- Grow Phase = 3.0-5.0% of BW
- Finish Phase = 3.0-2.0 of BW
  - Tapers off as they get bigger!
How much does a sow weigh?
Depends on Number of Parities!

- 1\textsuperscript{st} Parity Gilts = 300 lbs.
- 2\textsuperscript{nd} Parity = 360 lbs.
- 3\textsuperscript{rd} Parity = 400 lbs.
- 4+ Parities = 450-500 lbs.
Feeding Practices

- **Gestating Sows**
  - Limit-Fed (restricted diet) to ~1.5% of BW
  - 12-16% CP
  - 0.6% Lysine (SID)
  - 3% Fat
  - 1500 kcal of ME/lb.
  - Early Gestation = 3-5 lbs. of feed to meet average energy requirement
  - End of Gestation = 5-6 lbs. to support fetal growth
  - First Parity Gilts = Provide an extra 10-15% of DMI

- **Boars**
  - Limit-fed (restricted diet)
  - Keep them lean!
  - Typically feed like sows in early gestation:
    - 4-6 lbs. of feed, adjust to maintain appropriate body weight
Farrowing

• Lactating Sows
  – Typically come off feed during periparturient period
  – Constipation = feed bulky laxative like bran or pumpkin, 5-7 days before farrowing
  – Feed 4-6 lbs. + 1 extra lb./day for each pig in the litter
  – Free-feed full amount of feed day of farrowing
  – Charting and watching feeders for crumbs
  – Feed free-choice through weaning to gain back body condition for re-breeding and to support lactation

• Lactating Sows
  – 16-18% CP
  – 1.05% Lysine
  – 5% Fat
  – 1500 kcal of ME/lb.
Neonates (Pre-Weaning)

- Fostering
- Milk replacers
- Most expensive to feed ($/ton) due to dried milk products, protein, and fat levels
- Very palatable, high-protein, high-fat, milk-based mini pellets
- Begin mat or creep feeding at 3-5 days prior to weaning
  - Same result as starting feed at 3-5 days, huge cost savings!!
- The sooner they go to dry food, the better!
- 20-24% CP
- 1.5% Lysine (SID)
- 7-10% Fat
- 1550 kcal/lb. of ME
Starter-Nursery (15-30 lbs.)

- 2nd most expensive to feed ($/ton)
- Introduce to self feeders
  - 2-4% of pigs won’t go to feeder in first 36-48 hours
  - Teaching pre-weaning feeding behavior is important!
- Growing pigs will eat 1-8 meals/day
- Will consume 4.5-5% of BW (DMI)
- 18-20% CP
- 1.35% Lysine (SID)
- 5-6% Fat
- 1550 Mcal/lb. of ME
  - Denagard @ 35g/ton
  - Chloretetracycline @ 400 g/ton
20% PIG START-UP DEN/CTC

MEDICATED
For Pigs Weighing 15-30 Pounds

S2412BM

ACTIVE DRUG INGREDIENTS

Chlortetracycline..............................................................................................................400 g/ton
For the treatment of bacterial enteritis caused by Escherichia coli and Salmonella cholearaesuis
and bacterial pneumonia caused by Pasteurella multocida susceptible to Chlortetracycline.
Tiamulin Hydrogen Fumarate.............................................................................................35 g/ton
For the control of swine dysentery associated with Brachyspira (formerly Serpulina or
Treponema) hydysenteriae susceptible to Tiamulin

GUARANTEED ANALYSIS

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<th>(Min)</th>
<th>%</th>
<th>(Min)</th>
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INGREDIENTS

Ground Corn, Soybean Meal, Dried Whey, Egg Products, Fish Meal, Monocalcium Phosphate, Dicalcium Phosphate,
Calcium Carbonate, Animal Fat (preserved with BHA), Dextrose, Blood Meal, Salt, Animal Plasma, Animal Serum,
Serum Globulin, Lactose, L-Lysine, Sodium Propionate (A Preservative), L-Tryptophan, DL-Methionine, Natural and
Artificial Flavors, Extracted Citric Acid Prescaker, Wheat Dextrin, Zinc Oxide, Ferrous Sulfate, Soy Lecithin,
Defluorinated Phosphate, Mineral Oil, Nicin Supplement, Manganese Sulfate, Zinc Sulfate, Vitamin E Supplement,
Copper Sulfate, Calcium Pantothenate, Magnesium Oxide, Biotin, Menadione Dimethylpyrimidinol Blauflute, Vitamin A
Supplement, Riboflavin Supplement, Pyridoxine Hydrochloride, Vitamin B12 Supplement, Folic Acid, Calcium Iodate,
Vitamin D3 Supplement, Sodium Selenite, Wheat Middls, Oste, Barley, Ethoxyquin, Sodium Bentonite, Brewer’s Dried
Yeast, Dried Saccharomyces cerevisiae Fermentation Solubles, Hydrated Sodium Calcium Aluminosilicate, Silicon
Dioxide, Hydrated Calcium Aluminosilicate, Hydrated Sodium Aluminosilicate, Yucca Schidigera Plant Extract, Dried
Lactobacillus acidophilus Fermentation Product, Dried Bacillus subtilis Fermentation Extract, Silicon Dioxide, Dried
Aspergillus niger Fermentation Product, Chromium Propionate, Propionic Acid, Propylene Glycol.

FEEDING DIRECTIONS

Feed as the sole ration to swine weighing 15-30 lbs. Target intake should be 0.5 - 1.5 lb/head/day (or 4-5% of
bodyweight.)

WARNING: WITHDRAW 2 DAYS PRIOR TO SLAUGHTER
Grow (30-150 lbs.)
Finish (150-270 lbs.)

- Split Sex
  - Gilts will eat less than barrows
- Phase feeding (step-up)
- Constantly sort and feed by weight (dominance and fights)
- Feed free-choice in most commercial settings
- Show Pigs: hand-feed the last 100 lbs. (or last 60 days)
- As they get older, they will eat fewer, but larger meals
- Intake will be ~3-4% of their body weight
- 16-20% CP
- 0.60-0.90% Lysine (SID)
- 3-5% Fat
- 1500 Mcal/lb. of DE
  - Denagard @ 35 g/ton during Grow (2 day withdrawal)
  - Tylan @ 100 g/ton during Finish
  - Ractopamine @ 4.5 g/ton for last 45-90 lbs. of gain
15% COMMERCIAL PIG FINISH-UP

FOR PIGS WEIGHING 150 LBS to MARKET

GUARANTEED ANALYSIS

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<th>Ingredient</th>
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<th>Max</th>
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<td>Crude Fat</td>
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<td>Phosphorus</td>
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<tr>
<td>Zinc</td>
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INGREDIENTS

Ground Yellow Corn, Wheat Midds, Millet, Barley, Corn Distillers Dried Grains, Sunflower Hulls, Soybean Meal, Calcium Carbonate, L-Lysine, Salt, Vitamin B12 Supplement, Riboflavin Supplement, D-Calcium Pantothenate, Niacin, Menadione Sodium Bisulfite Complex (source of Vitamin K), Pyridoxine Hydrochloride, Thiamine Mononitrate, Folic Acid, Biotin, Processed Grain By-Products, Roughtage Products, Mixed Tocopherols (preservative), Citric Acid, Rosemary Extract, Natural & Artificial Flavoring, Dried Aspergillus niger Fermentation Product, Sodium Selenite, Vitamin E Supplement, Choline Chloride, Vitamin A Supplement, Zinc Sulfate, Vitamin D Supplement, Ethylenediamine Dihydriodide.

FEEDING DIRECTIONS

Feed free-choice as the sole ration to swine weighing 150 lbs to market weight (pigs on this weight rate will usually consume 2.5-3% of their BW daily).

Store feed in a clean environment free of moisture, rodents, insects, and other pests. Do not feed moldy or repugnant feed. This product has been formulated specifically for swine and is not intended for other species.

DO NOT FEED TO SHEEP DUE TO HIGH COPPER

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Ingredient Choices

- Plant Protein Sources
  - Soybean Meal is King
  - DDGS
  - Brew Grains
  - Canola
  - Sunflower Meal
  - Corn Gluten Meal
  - Peanuts
  - Peas

- Animal Protein Sources
  - Meat & Bone Meal
  - Poultry Meal
  - Fish Meal
  - Blood Meal
  - Feather Meal
  - Yeast/Brew Yeast
  - Little Pigs:
    - Whey/Milk Protein/Casein
    - Plasma
    - Eggs
Ingredient Choices

• Source of Calories (Carbs)
  – Corn is King
  – Wheat
  – Wheat Midds
  – Millet
  – Barley
  – Oats
  – Rice
  – Sorghum/Milo
  – Molasses

• Source of Calories (Fat)
  – Vegetable Oil
  – Full Fat Soybeans
  – Animal Fat
  – Sunflowers
  – DDGS
  – Flax
Ingredient Choices

• Sources of Fiber
  – Alfalfa
  – Wheat Midds
  – Soy Hulls
  – Oats/Oat Groats
  – Beet Pulp
  – Pumpkin

• Nutraceuticals
  – VTM
  – Crystalline Amino Acids
  – Probiotics (DFM)
    • Fungal
    • Bacterial
    • MOS
  – Enzymes
  – Organic/Chelated TMs
  – Flavorings
  – Omega-3
  – Mycotoxin Binders
  – Chromium
Deworming

• At Weaning
  – Banmith (pyrantel tartrate)
    • In feed for 3 days
    • Wait till one week post-weaning
  – Ivermectin IM shot
    • 1cc/100 lbs. BW

• Grow-Finish
  – Atguard (DCV)
    • Granular single dose packet
  – Safeguard (FBZ)
    • In Feed for 3-12 days
  – Safeguard (FBZ)
    • Granular top-dress for 3 days
Medications

- Denagard (tilmicosin) & CTC (chlortetracycline)
  - Broad-spectrum antibiotics
  - Improves weight gain
  - Prevents dysentary (acute ileitis) & pneumonia
  - 7 day withdrawal

- Tylan (tylosin or sulfamethazine)
  - Prevents bacterial infections, atrophic rhinitis, dysentery (acute ileitis) & pneumonia
  - Improve feed efficiency
  - Withdrawal depends on dose

- Terramycin (oxytetracycline)
  - Prevent pneumonia
  - Prevent abortions due to leptospirosis
  - 5 day withdrawal

- Paylean (ractopamine)
  - β agonist
  - Increase lean muscle gain
  - Finisher for last ~21 days
  - No withdrawal
Dealing with a Feed Company

- Do they formulate using science and NRC requirements?
- You should be able to ask AA content, Energy content, etc.
- You should be able to ask what ingredients they use
- If claiming “Organic,” have them prove with USDA Organic Certificate, otherwise you’re buying blue sky
- Ask for price/ton and minimum order requirement
- Include delivery costs (figure ~$4.00 per loaded mile)
- Bulk (will need a bulk bin and auger system)
- Bagged or in totes (will need warehouse space)
- Custom- know what you want customized
- Formulated commercial feeds vs “Grind and Mix”
- Supplements
Questions?