

SWINE NEWS

August, 2001 • Volume 24, Number 7

IS FIBER GOOD FOR THE PIG?

Hardly a day goes by that we are not bombarded with information about how we should eat. More vegetables, fruits, iso-flavones, beta-carotenes, and fiber are all the buzz. Among these, fiber seems especially emphasized, as it supposedly reduces cholesterol and coronary heart disease, decreases appetite, improves intestinal health, etc.

While it may be a good idea to add fiber to a human's diet, what about adding it to pig diets, especially in light of recent environmental concerns over disposal of hog waste?

Fiber gives plants their strength. It forms the walls around the cells, protecting what is inside. Fiber consists of a diverse group of compounds, most of them carbohydrates (sugars). These sugars are linked together to form long chains responsible for the strength of the fibers. Many of the bonds in these sugars, though, can not be broken down by human or animal enzymes, and nutritionally fiber does not yield much energy (which suggests it is a good food for dieters).

Although it may be a good idea to add fiber to a human's diet, what about pig diets, especially in light of recent environmental concerns? First of all, fiber adds bulk to a diet. Most of the energy contained in the fiber is not released in the small intestines due to the lack of enzymes to break down the fiber. This means that the animal is transporting bulk through its small intestines into which other nutrients get trapped and thus get flushed into the large intestines. As a result, fiber decreases the digestibility of energy but also protein, vitamins, and minerals in a typical diet.

In the large intestine, large amounts of bacteria are present that will break down the fiber, as well as any available nutrients. This fiber fermentation leads to the production of volatile fatty acids, such as acetic acid (vinegar), propionic acid, and butyric acid, and to production of methane. The volatile fatty acids can be absorbed by the animal and serve as an energy substrate, enabling an estimated 50 percent of the energy contained in fiber to be used by the pig. However, when excreted in the feces, these compounds can contribute to unpleasant odors; butyric acid especially is very odorous (rumen fluid smells strongly like butyric acid). The methane is expelled as a gas, and pigs on high-fiber diets can produce large quantities of this gas.

One other major category of nutrient, protein, also may be dragged undigested into the large intestine with fiber. Some of these proteins are unabsorbed feed protein, and

some are from secretions by the animal into the intestines that are not re-absorbed. Bacteria can break down these proteins, but the resulting amino acids are not used by the animal. Instead, they are used by the bacteria for growth or they are broken down for energy. Depending on the type of bacteria, the products of this degradation can range from water, carbon dioxide, and ammonia to extremely malodorous compounds, such as indole and skatole. Protein degradation by bacteria is likely the major culprit in the unpleasant odors emanating from swine farms.

To recap, we know that fiber is poorly utilized in the small intestine; yet it can be partially broken down in the large intestine to yield energy—a plus. The minuses are that it reduces the digestibility of other nutrients, and it also may contribute to odor and methane emissions.

So, should we add fiber to pig diets?

Practically speaking, high-fiber feed ingredients, such as soy hulls and wheat midds, are cheap, and because they increase gut-fill, they reduce activity and possibly stress in gestating pigs that are limit-fed. However, fresh pig feces consist of approximately 40 percent fibrous particles left over after the digestion of the corn and soy. If this fraction could be eliminated, waste potentially could be reduced substantially.

Swine diets range in fiber from 0 percent neutral detergent fiber (NDF) for the milk the piglet consumes, through 5 to 10 percent NDF for nursery diets and 10 to 15 percent NDF for grower diets, to 20 to 30 percent for a high-fiber gestation ration. Fiber typically is increased as the animal ages because aging is associated with an increase in bacterial activity in the large (and possibly small) intestine, thus allowing the animal to better utilize high-fiber diets.

Typical corn-soybean meal diets used in grow-finish contain around 10 percent NDF. Inclusion of barley (18% NDF), canola meal (21% NDF), Bermuda grass (71% NDF), or industrial byproducts such as distillers grain (40% NDF) and wheat midds (36% NDF), can substantially increase the fiber content of the feed. Lower fiber ingredients are less common: bakery byproducts (2% NDF), potato protein concentrate (2% NDF), and degermed, dehulled corn (3% NDF).

Studies have shown that for every 1 percent of extra fiber that is added to the diet, the digestibility of protein,

energy, and dry matter decreases by at least 1 percent. A recent study at North Carolina State University has shown that by formulating pig feed so that it is low in fiber (5.5% NDF), waste production can be reduced by 35 percent compared to a regular corn-soybean meal diet (10% NDF) and by 58 percent compared to a diet supplemented with 20 percent soybean hulls (18% NDF). All these diets were formulated on a least-cost basis, and although the low-fiber diet was 3 percent more expensive than the corn-soybean meal diet, the differences were small, especially since the low-fiber diet was more digestible (92% vs. 88%).

Data on the impact of fiber on odor are not readily available, and information in the studies that are available is contradictory, probably because researchers looked at different responses to fiber. Results from NC State University show that manure from low-fiber diets was perceived as the least odorous. However, manure from pigs fed a poorly fermentable high-fiber diet also was not very odorous. Still, farm data from Denmark suggest that high-fiber diets will increase odor emission.

Dutch researchers have been touting high-fiber diets as a means of reducing ammonia emission, and their data (based on lab experiments) show reductions in ammonia emission when fiber is increased. The mechanism behind this is that when fiber is increased, bacterial activity in the large intestine increases, and these bacteria will accrete protein in a stable form rather than allowing it to be excreted in the form of unstable urea. Findings from our laboratory confirm that adding fiber results in a shift in nitrogen excretion from urine to feces, and theoretically, this should result in a reduction in ammonia emission.

Danish research carried out under field conditions also confirms this shift in nitrogen excretion. But as feces containing fiber are more “sticky,” the researchers observed that pen

fouling was more of a problem. Further, because pen fouling increases ammonia emission, no net reduction in ammonia emission was observed. Indeed, feces from the trial with three different levels of fiber contained 30 percent dry matter for pigs on the high-fiber diets, with these feces having a sticky, clay-like consistency, while feces from pigs on the low-fiber diet had 40 percent dry matter and a crumbly consistency.

High-fiber ingredients are sometimes hard to avoid, especially since they are cheap. Enzyme companies, however, are working to develop supplements that can break down fibers in the small intestine of the pig, thus preventing some of the negative effects of fiber. Work with Xylanase in our lab has shown an improvement of approximately 2 percent in energy, dry matter, and protein digestibility in a variety of high-fiber diets, at which level of improvement enzymes are economical to add to swine diets. Although a 2 percent increase in digestibility sounds minor from an environmental standpoint, looking at the effect on the indigestible fraction shows that it can have some nice benefits. For example, a typical corn-soybean meal diet has a digestibility of 88 percent. Improving this to 90 percent would reduce waste from 12 percent of feed intake to 10 percent, which is an absolute reduction of 17 percent.

As in humans, fiber can have several positive effects on animals—less constipation, possibly fewer ulcers, and possibly fewer intestinal health problems. In addition, it is a cheap feed ingredient. On the negative side, fiber will increase fecal volume, increase methane emissions, and likely increase unpleasant odor emissions. Thus, farmers need to assess whether adding high-fiber feed ingredients to their swine diets is justifiable in light of environmental concerns and our better understanding that fiber can block the pig’s ability to use other feed ingredients completely.

Theo van Kempen

CALENDAR OF EVENTS

August

20-22 PORK 101
Michigan State University
East Lansing, MI

September

10-12 PORK 101
Oklahoma State University, Stillwater, OK

15-18 Allen D. Leman Swine Conference
Minneapolis, MN

17 Permeable Lagoon Cover Project
1 credit hour as course number AB06130006
Contact Diane Rashash, 910-455-5873

17-19 PORK 101
Penn State University, University Park, PA

19 2001 Option 2—Land Application Training and Demonstration Center
6.0 credit hours as course number AB01300102
Contact Karl Shaffer, 919-515-7538

19-21 2001 Swine Educators Conference
Des Moines, IA

26 2001 Option 1—Land Application Training and Demonstration Center

6.0 credit hours as course number AB01300101
Contact Karl Shaffer, 919-515-7538

27 2001 Option 3—Land Application Training and Demonstration Center

6.0 credit hours as course number AB01300103
Contact Karl Shaffer, 919-515-7538

October

3-5 International Symposium: Addressing Animal Production and Environmental Issues
Sheraton Imperial, Research Triangle Park, NC

12-21 North Carolina State Fair
North Carolina State Fairgrounds, Raleigh, NC

31 Healthy Hog Seminar
Pitt County Agricultural Center
Greenville, NC

November

2 Healthy Hog Seminar
Sampson Agri-Exposition Center, Clinton, NC

HEALTHY HOG SEMINAR

Wednesday, October 31, 2001 • Greenville, Pitt County Agricultural Center

and

Friday, November 2, 2001 • Clinton, Sampson Agri-Exposition Center

General Morning Session: Morgan Morrow, Chair

- 9:00 a.m. **Introduction** • Morgan Morrow
Welcome and Introduction of Carlos Pijoan, Hans Altheusen speaker. • Jim Floyd
- 9:20 a.m. **Opportunities to Eradicate Diseases.** • Carlos Pijoan
- 10:00 a.m. **What will happen in N.C. if a Foreign Animal Disease (FAD) is found.** • Jim Kittrell
- 10:20 a.m. **My experience with Foot and Mouth Disease (FMD).** • Harry Snelson
- 10:40-11:00 a.m. **Break**
- 11:00 a.m. **Recognizing Signs of FADs, including FMD.** • Jim Kittrell

11:20 a.m. **How to prevent FADs, including FMD, on your farm.** • Mary Battrell

11:45 a.m. **Q&A session with all morning speakers.**

Noon-1:15 p.m. **Lunch**

Concurrent Afternoon Sessions: 1:15-3:30 p.m.

- 1. PRRS: Monte McCaw, Chair,**
 - A. Why PRRS diagnostics and vaccines fail.** • Monte McCaw
 - B. PRRS eradication.** • Carlos Pijoan
- 2. Ventilation Workshop: John Roberts, Chair**
 - A. Principles of ventilation.** • Steve Matthis
 - B. Charts and hands-on measurement.** • John Roberts
- 3. Current Issues in Farm Management: Joel Flores, Chair** (Clinton site only: For Spanish speakers.)

The program will conclude at 3:30 p.m.

WHAT IS PORK 101?

“Pork 101” is a three-day, hands-on educational opportunity for interested participants to learn about quality and consistency in the pork industry. It includes information on value differences in swine, pork carcasses, pork primals, and processed pork products due to quality variation.

Through “Pork 101,” participants will have the chance to evaluate eight live hogs. The animals will be processed during the class, and participants will learn about grading, food safety, and product processing.

Finally, the class will make and sample processed products from the hogs, including pumped loins, bacon, hams, and sausage.

Anyone involved in the production, processing, and marketing of pork will benefit from this course, including pork producers, veterinarians, researchers, educators, pork packers, meat processors, retail merchandisers, food service, exporters, allied industry, media, pharmaceutical companies, breeding companies, and investors.

For more information about “Pork 101,” call Dr. David Meisinger, assistant vice president of pork quality, National Pork Producers Council, at 515-223-2767, or Dr. Thomas Powell, executive director, American Meat Science Association, at 217-356-3182, or on the Web at <http://www.meatscience.org>.

INTERNATIONAL SYMPOSIUM SLATED

The link between the production of food animals and the environment continues to be a major concern across the nation and around the world. An autumn symposium, “Addressing Animal Production and Environmental Issues,” is designed to provide an update on the efforts of the research community to address those concerns during the past few years.

The event, scheduled for October 3-5 in the Research Triangle Park, is sponsored by the Multi-State Consortium for Animal Waste Management, the National Center for Manure and Animal Waste Management, the North Carolina State University Animal and Poultry Waste Management Center, the North Carolina Water Resources Research Institute, the Southeastern United States Water Resources Research Institutes, Waste Management Programs of the North Carolina State University College of Agriculture and Life Sciences, the North Carolina Cooperative Extension Service, and the North Carolina Agricultural Research Service.

A number of promising technologies that are being developed in the United States to reduce the environmental risk from animal byproducts will be discussed. Speakers from several state and federal agencies and from the Federation of Animal Science Societies will be featured during the General Session.

White Papers on specific environmental issues will be presented by members of the National Center for Manure and

Animal Waste Management. Research projects being conducted at land-grant and other universities around the world, as well as by industry, will be highlighted in break-out or poster sessions.

A special feature of the symposium, “virtual” tours of a number of industry-scale tests of new technologies, will be

presented via videotape by principal investigators and their team members Friday morning.

For further information about the symposium, contact Gerald Havenstein, symposium chair, NCSU Department of Poultry Science, Box 7608, Raleigh, NC 27695-7608; phone 919-515-5555; fax 919-515-2625; email gerald_havenstein@ncsu.edu.

ON-FARMPERFORMANCE TESTING: The following breeders with validated herds have tested animals in the past 30 days.

<i>Breeder</i>	<i>Address</i>	<i>Breed</i>
Bob Ivey*	314 N.C. 111 S, Goldsboro 27530	L,D,H,Y,CW,X
Wesley Looper*	4695 Petra Mill Road, Granite Falls 28630	Y,L,H,D,X
Thad Sharp, Jr., & Sons	5171 N.C. 581 Hwy., Sims 27880	Y,D,X
Tommy Spruill	Rt. 1, Box 149, Columbia 27925	L,X
Thomas Farms	8251 Oxford Road, Timberlake 27583	X
UCPRS (<i>Swine Development Center</i>)	Rt. 2, Box 400, Rocky Mount 27801	X

*Realtime Ultrasound

—Frank Hollowell, David Lee