AGRICULTURAL EXTENSION SERVICE • UNIVERSITY OF MINNESOTA

Swine Update

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Feeding Immature, Low Test Weight Corn

Due to a late spring and a rather wet fall season in 1982, many Minnesota swine producers harvested corn with a much lower test weight (42-49 lbs.) per bushel compared to some other years. Therefore, likely questions are, "Can I feed this corn to hogs?" and "What kind of growth performance can be expected?"

Generally, low test weight corn is higher in protein, fiber and mineral content but lower in energy and fat compared to corn with a 56 lb./bu test weight. However, its feeding value is only slightly below that of normal, mature corn when compared on a equal moisture basis and pound for pound. In fact, it has been reported that 42-46 lb. test weight corn has about 95% the feeding value of good corn. Consequently, producers should expect to see only a slight depression in pig growth performance (gain and feed efficiency) when feeding low test weight corn vs. normal corn. Remember, when feeding low test weight corn mix it with the other diet ingredients on a weight basis, not on a volume basis. A bushel volume of lower test weight corn obviously weighs less than a bushel volume of higher test weight corn. Because of its higher fiber content, low test weight corn (42-49 lb.) is generally not recommended for use in pig starter diets up to 40-50 pounds. Instead, it should be used in growing-finishing diets and could be fed to the breeding herd if one is certain that no mold contamination is present.

Producers who are feeding low test weight corn will occasionally report that their hog feeders appear to empty at the same rate as when they fed better quality corn but that their pigs appear to be growing more slowly. Indeed, if feeders are emptying at the same rate, the pigs would be consuming fewer total pounds of feed daily because a diet containing low test weight corn weighs less per unit of space than a diet based on normal corn. If pigs are not eating or growing satisfactorily when low test weight corn is fed, check for signs of heat damage — browning of kernels, toasted odor. It is quite possible that some immature corn was heat damaged during the drying process this past fall. Lower protein quality, namely reduced lysine availability, is often associated with a brown kernel color resulting from heat damage. Usually the darker (more burnt appearing) the kernel color, the greater the heat damage and the greater the

reduction in lysine availability. Feeding this corn of lower protein quality will usually result in poorer growth performance. To achieve better growth performance when feeding heat damaged, low test weight corn, consider the following:

1. Blend it 50-50 with good quality corn, if possible.
2. Formulate your swine diets to provide a higher level of protein (1-2 percentage units higher) than normally fed; or include supplemental lysine (2-3 lbs./ton) in the diet.
3. Add 2-3% (40-60 lb./ton) fat to the diet. This will improve the palatability of the feed as well as increase its energy content. Even in cases where low test weight corn has not been heat damaged, from 2-3% fat could be added to the diet to increase the energy density to a level comparable with diets based on good quality corn.

When the low test weight corn being fed does not appear to be heat damaged and pigs are still not eating well, test the corn for possible mold contamination. If a positive test for molds that cause feed refusal is obtained and the only choice is to feed the corn to hogs, your best bet is to blend the poor quality corn with good corn. You may have to use considerably more good corn than mold contaminated corn in the final mixture to bring feed consumption and growth performance up to satisfactory levels.

Feeding Whole (Full Fat) Soybeans

Lately, because of the low price for soybeans, there has been increased interest in feeding whole (full fat) soybeans to hogs. Before they can be used effectively in swine rations it is necessary to properly heat raw soybeans to reduce the trypsin (digestive enzyme) inhibiting compounds present in them. The proper temperature at which to heat and length of time soybeans are exposed to the heat process are important and will vary depending upon the type of heat treating equipment used.

Whole soybeans contain about 37% protein and 2.4% lysine compared to 44% protein soybean meal which contains 2.85% lysine. Because of this difference, when formulating swine rations it is necessary to add from 20-25% more whole soybeans (ground) than 44% soybean meal to get similar protein levels in the final diet. This assumes there is no difference in protein quality between soybean meal and whole soybeans, although, if whole soybeans are overheated a reduction in lysine availability is likely.

The biggest difference between whole soybeans and soybean meal is fat level. Full fat (whole) soybeans contain about 18% fat versus about 1% fat in soybean meal. Consequently, mixed diets containing full fat soybeans will provide about 3% more fat (and thus more Kcal metabolizable energy) than diets formulated using soybean meal. This energy increase in the diet should enhance growth performance. A review of many research reports reveals that daily gain is either unchanged or improved only slightly and feed efficiency is generally improved by 5-6% when whole (full fat) soybeans are fed to growing-finishing pigs instead of soybean meal. Soybean oil is not used as efficiently by weanling pigs as by growing-finishing pigs. The use of processed whole soybeans may also reduce the amount of feed dust. It is worth noting that more fat rancidity problems are possible with whole soybeans than soybean meal, especially during the warmer months.

Whether to purchase 44% protein soybean meal or use 37% heat processed whole soybeans is essentially a matter of economics. The cost for processing whole soybeans may vary considerably. Also, some processors report approximately 5-8% shrink due to processing. If the charge for processing is $50.00/ton (a reported charge in some areas), the processing cost for the final useable product is about $1.55/bushel. Said another way, if $5.25/bu. soybeans are properly processed, one ton of final product would cost approximately $236. Over the past several weeks, 44% soybean meal has been selling in the area of $175-$185/ton. Unless the processing cost is quite low ($20-$25/ton), more times than not feeding whole (full fat) soybeans will not be cost effective.

Is Supplemental Light Needed During Lactation?

The lactation phase is an important component of sow productivity. Adequate milk yield is necessary for optimal piglet growth and survival. In addition, prompt rebreeding after weaning is a factor influencing reproductive efficiency. Therefore, any potential carry-over effect of lactation environment on interval (days) to rebreeding is important. It has been reported that supplemental light increased milk yield in dairy cows. Likewise, a recent Georgia study showed that sows and their litters exposed to 16 hr. light/day during lactation had heavier litters and increased piglet survival at 4-week weaning compared to those exposed to 8 hr. light/day. No effect on subsequent rebreeding performance was noted. It should be stated that only a total of 26 sows were used in the Georgia study.

In many on-farm confinement farrowing facilities only minimal lighting is provided except during care and feeding of sows and litters. Even though some light may be provided by heat lamps and by natural light through windows or wall fans, it is worthwhile to determine if supplemental light provided during lactation can benefit sow and litter performance. To provide additional information, Kansas researchers conducted a study in a large scale commercial swine operation in Dwight, Kansas. Sows and litters were exposed to either 0 or 16 hours of supplemental light during lactation. The control group (0 hr. supplemental light/day) received light only during daily feedings and when processing new pigs. Sows housed in the treated farrowing rooms received light from 6:00 a.m. to 10:00 p.m. (16 hr. supplemental light/day) each day. The results of this study are shown in the following table.

Influence of Supplemental Light During Lactation on Litter and Sow Performance (adapted from 1982 Kansas Swine Day Report).

Item	Control (0 hr.)	Supplemental (16 hr.)
Litter performance:		
No. litters	164	163
No. pigs nursed	10.2	10.0
No. pigs weaned	9.2	9.1
Survival, %	91	91
Litter wt., lb.	117.7	125.0[a]
Sow performance:		
Days to mating	5.9	5.5
Mated (0-5 days), %	68	83[b]
Total mated, %	95	91

[a] Significantly greater than control ($P < .05$).
[b] Significantly greater than control ($P < .01$).

One could conclude from these data that: 1) supplemental light increased litter weight by about 8 lbs. but had no effect on survival rate; 2) average interval to rebreeding tended to be shorter for treated (5.5 days) than for control (5.9 days) sows; and 3) supplemental light improved the synchrony of the postweaning estrus, as more treated sows (83%) than control sows (68%) cycled and were mated within 5 days after weaning. In short, this study suggests that lights should be on in the farrowing house for approximately 16 hours per day. Is this cost effective? It was in this study, as the electricity costs were estimated to have increased by about $1.00 per day per farrowing room.

Comparison of Gleptosil With Iron Dextran for Anemia Prevention in Young Pigs

The value of supplemental iron for anemia prevention in nursery age pigs has been recognized for a long time. Iron dextran is an injectable iron source that has been used effectively by producers for many years. Recently, a new commercial iron product called Gleptosil has become available for use in the industry. Researchers have shown that a single intramuscular injection providing 200 mg iron from either iron dextran or Gleptosil is necessary to maintain blood hemoglobin levels above 9 grams/100 ml. Iron anemia is generally not a problem in young pigs when the hemoglobin level is 9g/100 ml or above, but could be if the level is lower. It has been postulated that Gleptosil is superior to iron dextran for preventing iron anemia in young pigs.

This past year, researchers at Kansas State compared the effects of Gleptosil (200 mg single injection), iron dextran (200 mg single injection), or no iron injection (control) on anemia prevention in young pigs. Twenty-six litters of pigs were used in the study. Iron injections were given at three days of age, and no creep feed was offered before weaning at 21 days of age. Their data showed that control pigs gained significantly less weight and had lower blood, liver and spleen iron concentrations than those that received iron dextran or Gleptosil. Both iron dextran and Gleptosil were effective for anemia prevention in young pigs. In fact, the results indicate that the iron from either source is utilized for hemoglobin synthesis and iron storage in the suckling pig with similar efficiency. Therefore, the choice of which iron source to use between iron dextran and Gleptosil should be based on the cost per injection of 200 mg iron.

Nipple Waterer Position in Nursery Pens — Up or Down?

Getting pigs off to a good start in the nursery is important. Nursery age pigs need easy access to waterers and an adequate daily intake of fresh water for maximum performance. Nipple waterers are used in many Minnesota pig nurseries, and a practice often followed by producers has been to point nipple waterers upward. Researchers at Nebraska recently studied the position of nipple waterers used in nurseries. Treatments consisted of using nipple waterers equipped with 2 mm or 2.5 mm orifices (water pressure of 45 p.s.i.) with the nipple pointing upward at 45° and the tip 4 inches from the floor, or with the nipple pointing downward at 45° and the tip 12 inches from the floor. Guards to prevent water wastage were installed on all waterers, and meters were used to measure water usage.

Conclusions

Their results showed little difference in daily gain or feed efficiency of pigs between the two nipple positions or orifice sizes. However, there was a large difference in the amount of water used depending upon nipple position. Pointing the nipple waterers downward consistently reduced water usage by as much as 50% without affecting performance. It was noted from day to day observations that the difference in water usage between the two positions was due to pigs playing more with the upward pointing nipple waterer even though "play guards" were used. In addition, lodging of feed particles in the valve (causing the waterer to run continuously) was not a problem when the waterer was placed in a downward position.

It is concluded from this study that, to reduce water usage without affecting performance, nipple waterers should be pointed downward in nursery pens. Also, with water pressure measured at 45 p.s.i., pigs using nipple waterers with a 2 mm orifice should have similar growth performance to and use 30-40% less water than pigs using waterers with a 2.5 mm orifice.

Vitamin C for Nursery Age Pigs

Unlike humans, pigs can synthesize vitamin C (ascorbic acid) in their body tissues. Consequently, it is believed that a dietary source of vitamin C is not essential. There has been some recent evidence that adding vitamin C to the diet may support improved growth performance under certain conditions, like the stress of weaning or crowding. While nursing the sow, young pigs receive a milk diet rich in vitamin C. However, upon weaning they are switched to a cereal grain based diet that does not provide a supplemental source of this vitamin. The possibility exists that the pig may be unable to synthesize vitamin C at sufficient levels, especially when exposed to adverse nursery conditions.

One possible problem with adding vitamin C to swine diets needs to be mentioned — crystalling ascorbic acid, the form of supplemental vitamin C most generally used, is quite unstable in mixed feed. This is particularly true in a warm, humid environment. Some manufacturers do, however, apply a coating to this vitamin to reduce its deterioration. If so, the stability of the vitamin could be considered satisfactory up to about 8 weeks.

The results of several feeding trials have not consistently shown a benefit from adding vitamin C to the diet of nursery age pigs. Scientists at both the University of Minnesota and Ohio State University conducted studies using pigs weaned at 3-4 weeks of age to evaluate the effectiveness of supplementary vitamin C during a 28-day postweaning period. In the Minnesota study, vitamin C levels up to 450 ppm were added to the diet, whereas in the Ohio study levels of 450 to 900 ppm were used. The results from both studies implied a possible benefit of vitamin C supplementation during the first week or two postweaning. However, there was no significant effect on growth performance over the entire 28-day feeding period. It was also reported in the Ohio study that vitamin C had no positive effect on postweaning scours or on the shedding of the enteric rotavirus organism. No difference in response to vitamin C was noted when fed to pigs housed on either elevated, flat-deck, partially slotted floors, or in bedded pens. To date, the evidence in favor of adding vitamin C to the diet for the weanling pig is not strong enough to warrant its recommendation.

Increasing Litter Size in Gilts by Treating With Killed Semen

An increase in litter size is obviously essential to any successful swine operation. This past year some very interesting results from a recent Ohio study suggest that litter size in gilts can be improved as much as one pig per litter by simply using a procedure involving insemination with dead semen approximately three weeks before breeding. Boar semen was collected and freeze-thawed to kill the sperm cells. The scientists then infused from 50-100 cc of the dead semen into the uterus of cycling gilts. On the next heat cycle, gilts were bred by means of A.I. or naturally. Apparently, this treatment allows the gilt to immunologically react to the presence of foreign cells in her uterus and thus becomes better able to react to live sperm upon breeding. Similar results are known to occur in laboratory rodents.

In the Ohio State University work, two experiments were conducted involving a total of 56 gilts. Gilts were assigned to either a control group or a semen treated group. The control gilts were inseminated with a saline solution in both experiments. In experiment 1, treated gilts were inseminated with killed semen three times prior to breeding — at 6 and 3 weeks prior to estrus and again at estrus. From three to five weeks after the third semen treatment, gilts were mated A.I. to the same boars that provided the killed semen. In experiment 2, gilts were treated with killed semen only once followed by mating using natural service 3-4 weeks later. The following table shows the combined results of both experiments.

Comparison of Control and Semen-Sensitized Gilts[a]

	Control	Semen-Sensitized
No. of gilts	31	25
Total pigs born[b]	9.67	10.95
Pigs born alive[b]	9.42	10.48
Live litter wt., lb.[b]	26.09	30.30
Litter size, day 14	8.44	9.10
Litter wt., day 14	67.21	71.00

[a] Adapted from 1982 Ohio Swine Research and Industry Report.
[b] Significant ($P < .05$).

Analysis of these data shows that treating with killed semen prior to mating resulted in a significantly greater number of total and live pigs born and heavier litter weight at birth. However, these are only preliminary results, and more research is needed in this area. Many more practical questions need to be answered — namely, the added time and labor involved and the additional boars needed for such a practice.

The Fuss About Amino Acid Balance — Is It Justified?

Pigs do not require protein. Instead, they require amino acids, the building blocks of protein, which they obtain mainly from consuming proteins. When a corn-soybean meal diet is formulated to meet the need for the most-limiting amino acid (lysine), excesses of others are necessarily fed. In the last few years, many nutritionists have argued that a swine diet that combines high-protein feedstuffs would be more efficient than a diet of grain and soybean meal because the combination would give a more desirable amino acid balance resulting in lesser amounts of excess amino acids in the system. In theory, this argument is valid, since energy is required to remove nitrogen from excess amino acids in the metabolism process. A perfect diet would save energy by supplying each amino acid at exactly 100 percent of the requirement without producing any excesses or deficiencies.

What are the concerns over amino acid excesses in swine diets? The most common observation of an excess of one or more amino acids is a decrease in feed intake (consequently reducing daily gain) but no influence on feed efficiency. This is known as an "amino acid imbalance." There are also known unique relationships between certain amino acids called "antagonisms." For example, an excess of one amino acid may increase the requirement for another amino acid. The way in which amino acids interact (or antagonize) may vary as follows:

1. Amino acids may compete for absorption sites in the intestine.
2. The body produces enzymes that break amino acids into simpler compounds. In some cases, a high blood level of one amino acid will stimulate the activity of an enzyme that breaks down another amino acid.
3. The "food intake center" located in the brain is sensitive to levels of amino acids in the blood, and appetite is depressed by amino acid imbalances.

The most likely amino acid interactions in pig diets are between lysine and arginine and between leucine and isoleucine-valine. As stated earlier, a conventional corn-soybean meal diet is formulated to meet the pig's requirement for the most limiting amino acid — lysine. However, in doing so, arginine is present at about five times its requirement. Therefore, an excess of arginine could cause a deficiency of lysine. Also, leucine is present at about three times its requirement, but isoleucine and valine are present at levels greater than their minimum requirement. It is unlikely, then, that the excess leucine could cause an isoleucine or valine deficiency.

So, is amino acid imbalance a practical problem in swine feed formulation? Extreme examples can be cited where excess amino acids or imbalanced amino acid levels have caused reduction in swine growth performance. In fact, a number of feed companies currently advertize that their feeds are formulated for optimum amino acid balance (minimizing excess amino acids) for improved growth performance over that achieved by pigs fed corn-soybean meal diets. However, corn-soybean meal diets result in only modest amino acid excesses and, despite the suggestions by some that diets with "minimized excess amino acids" will perform better in the feedlot than conventional corn-soybean meal diets, no convincing evidence has been published to support this contention. There are, however, several university studies (Minnesota, Iowa, Illinois, Michigan, Texas A&M, South Dakota) that support the fact that there is no justification to alter the excess amino acid content of a properly balanced corn-soybean meal diet in order to improve performance. While considerably more research is still needed in this area, the reports to date would shed some doubt on some of the marketing information, or implications, being presented to swine producers.

A Note to County Extension Directors

Last month you were sent the first issue of the "Swine Update" newsletter. Presently, there are 9 issues planned for this year, with a specific specialist in charge of each issue. The newsletter will mainly contain information reflecting that specialist's area of expertise. Our proposed schedule for 1983 is as follows:

Specialist in Charge	Month Due
A. D. Leman	Jan., June
J. D. Hawton	Feb., Nov.
C. J. Christians	March, Sept.
L. D. Jacobson	April, Oct.
P. R. Hasbargen	May

(December, July and August issues will not be published.)

We expect each issue to be in your hands no later than the middle of the month due. The newsletter is designed to provide you with updated and timely information. We hope you can use its content in newspaper columns or possibly send out duplicated copies to producers. The last 1/3 of the back page will be left open to allow space for addressing duplicated and folded copies. As always, your comments, suggestions and criticisms are requested.

Prepared by J. D. Hawton, Extension Swine Nutritionist.

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