SWINE UPDATE

Kansas State University Agricultural Experiment Station
and Cooperative Extension Service

Animal Sciences & Industry

August 1999 Vol. 21, No. 3

Feeding Wheat to Swine

With this year's wheat harvest recently completed, many swine producers are considering the potential use of wheat in swine diets. Fortunately, initial concerns regarding quality problems with this year's crop did not materialize as test weights and yields appear to be very good. Wheat can be an excellent replacement for a portion or all of the milo or corn in most swine diets. However, like most ingredients, there are advantages and disadvantages of feeding wheat to swine. The following addresses some of the more frequently asked questions about the use of wheat in swine diets.

What is the Relative Feeding Value of Wheat Compared With Other Grains?

Wheat contains approximately 30% more lysine and over 3 times the amount of available phosphorus than either corn or milo (Table 1). Therefore, when adding wheat in place of either of these two cereal grains, the amount of supplemental soybean meal and inorganic phosphorus can be reduced. For example, a wheat-based finishing diet will require approximately 100 lb/ton less soybean meal and only one-third the amount of dicalcium, or monocalcium phosphate, than a corn- or milo-based diet. Because of the greater lysine and available phosphorus concentration, we can generally afford to pay a little more for wheat than either corn or milo on a hundred weight (cwt.) basis and still lower diet costs. As a rule of thumb, as long as wheat is no more than approximately $.30/cwt. more than either corn or milo, wheat will be an economical alternative.

Table 1. Nutrient Composition of Corn, Milo, and Wheat[a]

Item	Corn	Milo	Wheat
Crude protein, %	9.2	8.5	13.5
Lysine, %	.26	.22	.34
Threonine, %	.29	.31	.37
Tryptophan, %	.06	.10	.15
Ca, %	.03	.03	.06
P, %	.28	.29	.37
Available P, %	.04	.06	.19
ME, Kcal/lb	1,550	1,515	1,456

[a]NRC, 1998

How Much Wheat Can I Add to My Diets?

Wheat can be either a partial or complete replacement for the corn or milo in most swine diets. The keys to successfully feeding wheat to swine are in diet formulation and feed processing. As mentioned earlier, properly adjusting diet formulations to take into account wheat's higher lysine and available phosphorus concentrations is essential to maximize the economic benefit of feeding wheat and decreasing nitrogen and phosphorus excretion into the environment. Secondly, proper feed processing is necessary so that the wheat will not turn into flour and reduce feed intake. Whereas in almost all swine diets we recommend producers grind to a particle size of approximately 700 microns, wheat-based diets should be slightly coarser (700 to 900 microns) to reduce the risk of it becoming flour. As a rule of thumb, it is recommended that a wheat kernel be broken into 4 to 5 pieces as a compromise between optimum consumption, feed efficiency, and diet flowability. Depending on your feed processing equipment, this might involve increasing the screen size of a hammer mill from the ⅛ inch screen typically used for milo and replacing it with a 3⁄16 inch screen to process wheat. Because of their shape and uniform distribution of particle size, roller mills are excellent for grinding wheat.

Wheat contains slightly less energy than either corn or milo; however, based on a review of several studies using wheat in finishing and starter diets (Tables 2 and 3), the differences in energy content do not appear to have a negative affect on feed efficiency. In these studies, wheat successfully replaced 100% of the grain used in the

control diets; however, a more conservative approach when using wheat is to replace only 25 to 50% of the corn or milo. The lower substitution rates may be advisable when wheat quality or proper processing may be a problem.

Table 2. Comparison of Corn and Wheat as Energy Sources for Finishing Swine[a]

Item	Corn	Wheat
ADG, lb	1.67	1.68
ADFI, lb	5.33	5.33
F/G	3.19	3.17

[a] Summary of 15 experiments with 984 pigs from 47 to 215 lb (Kansas, Kentucky, and Texas Tech). Cromwell et al. 1985.

Table 3. Comparison of Corn and Wheat as Energy Sources for Starter Pigs (16 to 52 lb)

Item	Corn	Wheat
ADG	.98	.95
ADFI	1.93	1.83
Feed/gain	1.95	1.91

Adapted from Allee, 1985. Based on 4 experiments with 238 pigs.

Do I Need Soybean Meal in Wheat-based Diets?

Because of its higher lysine concentration, when adding wheat to swine diets the amount of soybean meal can be reduced. However, this does not mean it can be eliminated. Data from the University of Kentucky shows that the amino acid threonine, is second limiting in wheat-based diets after lysine. Results show that pigs fed an all wheat diet (no soybean meal) had the poorest growth performance of all experimental treatments. Adding only L-lysine HCl (6.0 lb/ton) improved daily gain and feed efficiency somewhat, but the best growth performance was observed in pigs fed diets with added L-lysine HCl and synthetic threonine, or the same amounts of these amino acids provided by soybean meal. The take home message is that unless you have economic access to synthetic threonine, wheat-based diets will still need to have some soybean meal added to ensure proper amounts of the other essential amino acids.

Can I Feed Soft Wheat to My Pigs?

While traditionally most of the wheat production in Kansas has been in hard red varieties, soft wheat also makes an excellent feed ingredient in swine diets. Studies comparing soft red wheat to hard red winter wheat in finishing pigs diets reveal virtually no differences in pig performance (Table 4). Therefore, soft wheat can be as effectively utilized in swine diets as hard red wheat.

What Effect Does Wheat Test Weight Have on Pig Performance?

Test weight is an important quality indicator for establishing the relative economic value of wheat. Studies show that when test weight decreases, pigs need to eat more feed to meet their energy requirements. This does not affect average daily gain; however, feed efficiency becomes poorer. Studies evaluating pigs fed wheat show 6.5 and 8.0% poorer feed efficiency as test weight decreased to 51 and 45 lb, respectively (Table 5). Therefore, when purchasing wheat with test weights below 60 lb, some discount should be anticipated to offset the expected decreases in feed efficiency. If test weight is below normal, another option might be to use the wheat as only a partial substitution for corn or milo.

Do I Need to Add Enzymes to Wheat-based Diets?

Wheat contains the anti-nutritional factor, pentosans, a non-starch polysaccharide. Pentosans increase the viscosity of the digesta resulting in decreased nutrient digestibility. Studies have shown that poultry fed wheat-based diets supplemented with pentosanases (enzymes designed to breakdown pentosans), had improved growth performance. Recent evaluation of the addition of pento-

Table 4. Soft Versus Hard Wheat For Finishing Pigs

			Wheat Type			
			Hard		Soft	
Trial	No. pigs	Initial–Final wt, lbs	ADG, lb	F/G	ADG, lb	F/G
1	54	135–266	1.79	3.67	1.86	3.69
2	144	148–229	1.66	3.92	1.66	3.94
3	60	146–215	1.88	3.29	1.79	3.46

Hines, 1982.

Table 5. Effect of Test Weight of Hard Red Winter Wheat on Performance of Finishing Pigs[a]

	Bushel wt, lbs			Milo +
Item	59	51	45	45 lb wheat
Avg. daily gain, lbs	1.78	1.79	1.81	1.76
Avg. daily feed intake, lbs[b]	6.53	6.98	7.16	6.87
Feed/gain[b]	3.67	3.91	3.97	3.89

Hines, 1982.

sanases to swine diets failed to show any improvement in growth performance in wheat-based diets (Table 6).

Table 6. Effect of Enzyme Supplementation of Wheat-based Diets on Finishing Pig Performance[a]

Item	No Enzyme	Added Enzyme
ADG, lb	1.97	1.98
ADFI, lb	6.57	6.47
F/G	3.33	3.27

[a] Adapted from Mavromichalis (M.S. Thesis), 1997. A total of 320 pigs (two experiments), 143 to 250 lb, means represent 16 observations/treatment.

Can I Feed Scabby Wheat to Pigs?

Cool wet weather conditions during early summer can provide ideal conditions for the development of wheat scab or head blight disease. This disease is caused by the fungus, *Fusarium graminearum*, which can produce vomitoxin. Vomitoxin is a mycotoxin known for dramatically reducing intake of contaminated feeds. Infected grains are generally shrunken or shriveled and have a high percentage of pink kernels. Studies show that feeding grain contaminated with .75 ppm vomitoxin resulted in decreased feed intake (Table 7). Contaminated wheat should not be fed to weaning pigs up to 50 lb or gestating or lactating sows. Blending contaminated wheat with other non-contaminated grains to reduce the vomitoxin concentration below 1 ppm may be an option in growing–finishing diets.

Table 7. Effects of Vomitoxin Contaminated (Scabby) Wheat

	Vomitoxin, ppm		
Item	0	.75	2.07
ADG, lb	1.91	1.71	1.56
ADFI, lb	6.57	5.62	4.66
F/G	3.44	3.29	2.99

Koch and Pollmann, 1982

Can I Feed Sprout Damaged Wheat to Pigs?

With the heavy rains immediately before harvest, many were concerned about the potential for sprout damage in this year's wheat crop. Fortunately, occurrences of severe sprout damage were isolated and do not appear to be a major problem with the 1999 wheat crop. For producers who may have a late harvested field of wheat that does contain some sprout damage, the limited research available indicates that wheat with up to 15% sprout damage will not negatively affect growth performance of finishing pigs compared to those fed a normal wheat-based diet (Table. 8).

Table 8. Effects of Sprout-damaged Wheat on Growth Performance[a]

	Soft Wheat Control damage	Soft Wheat 15% sprout damage	Hard Wheat 20% sprout
ADG, lb	.99[a]	1.10[b]	1.12[b]
ADFI, lb	1.92	1.99	1.91
F/G	1.94[a]	1.81[b]	1.71[c]

[a] Gatel and Bourdon, 1989. Values represent means of 168 pigs initially 19 lb and over a 34 day test period.

However, as with any weather-damaged crop, care should be taken to ensure that sprout damage or low test weights are not in conjunction with mycotoxin contamination.

Where Can I Find Some Representative Wheat-based Diets?

Listed in Table 9 are some examples of wheat-based diets substituted for 50% and 100% of the milo.

Table 9. Examples Growing–Finishing Diets Substituting Wheat for 50 and 100% of the Milo.

	Dietary Lysine, %									
Ingredient	1.00	1.00	.90	.90	.80	.80	.70	.70	.60	.60
Milo	751.3	0.0	787.6	0.0	829.6	0.0	865.7	0.0	903.9	0.0
Soybean meal, 46.5%	444.9	410.8	371.9	336.3	297.9	260.4	225.0	185.8	151.7	110.8
Hard Red Winter Wheat	751.3	1539.7	787.5	1613.2	829.6	1699.6	865.8	1773.7	903.9	1852.3
Monocalcium Phosphate, 21% P	16	11	16	11	8	3	8	3	6	0
Limestone	20.5	22.5	21	23.5	20.5	22.5	21	23	20	22.5
Salt	7	7	7	7	7	7	7	7	7	7
Vitamin premix	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5
Trace mineral premix	3	3	3	3	2	2	2	2	2	2
Lysine HCl	3	3	3	3	3	3	3	3	3	3
TOTAL	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0
Calcium, %	0.65	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.50	0.50
Phosphorus, %	0.57	0.54	0.56	0.53	0.46	0.44	0.45	0.42	0.41	0.38
Available phosphorus, %	0.29	0.29	0.29	0.29	0.21	0.21	0.21	0.21	0.18	0.18

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SWINE UPDATE

KSU Swine Day

Thursday, November 18, 1999

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