Feeding Wheat to Hogs

William G. Luce
Extension Swine Specialist

Wheat has been fed to hogs in varying amounts for many years. Interest in wheat as a swine feed depends largely on the price relationship between wheat and other cereal grains. There have been periods in recent years when wheat has been competitively priced with other cereal grains, justifying its use in swine diets. When wheat is competitively priced with other cereal grains, it becomes especially attractive to Oklahoma pork producers since Oklahoma is a major wheat producing state. Wheat production in the state ranges from 100 to 200 million bushels annually. Often the state's wheat harvest is five times as great as the combined production of sorghum grain, barley, corn and oats. Feeding wheat to hogs is viewed as a grain marketing alternative by some wheat producers who also raise hogs.

Wheat as a Major Swine Diet Ingredient

When wheat replaces another cereal grain such as corn or sorghum grain for swine, consideration must be given to nutrient content of wheat as compared to the other grains. Table 1 presents typical nutrient contents for hard red winter wheat, sorghum grain, and corn.

Wheat is equal in energy to sorghum grain but slightly lower than corn. Wheat is also normally higher in crude protein and essential amino acids than corn or sorghum grain. Calcium and phosphorus content of wheat is also higher than usually found in corn or sorghum grain and recent data suggests that phosphorus availability in wheat is slightly higher. The higher lysine and phosphorus level in wheat makes it necessary to feed a supplement that is especially designed for feeding with wheat if producers wish to take advantage of the higher lysine and phosphorus in wheat.

Several feeding trials have been conducted in the past comparing wheat with sorghum grain or corn at the Oklahoma Agriculture Experiment Station and other state experiment stations. A summary of this research shows that wheat has 97 and 99 percent the values of corn and sorghum grain respectively as measured by average daily gain in growing-finishing swine. Wheat had 99 and 101 percent the value of corn and sorghum grain respectively as measured by feed efficiency. However, a more recent trial demonstrated KARL variety hard red winter wheat to be 100 and 105 percent the value of yellow corn based on average daily gain and feed efficiency for nursery age pigs respectively. When considering the savings of feeding less supplemental protein and phosphorus the feeding value of wheat is increased even more.

Suggested diets using wheat or a mixture of wheat and corn or sorghum grain are shown in Tables 2 and 3. Table 2 is for growing and finishing hogs and Table 3 is for sows.

Oklahoma Cooperative Extension Fact Sheets are also available on our website at:
http://osufacts.okstate.edu

Diets were calculated to contain adequate lysine for the growing, finishing and sow diets respectively. Protein content of these diets vary and are generally higher for wheat than corn or sorghum grain based diets since wheat contains more crude protein that sorghum grain or corn. Even so, a certain amount of soybean meal, other high quality protein supplement or synthetic lysine is still necessary to bring the lysine content of wheat diets up to the recommended level. Failure to provide sufficient lysine will result in reduced performance.

The bred sow diets in Table 3 are formulated to be fed at a level of 4 to 5 pounds per head daily during gestation. The exact level of feed during gestation should be adjusted based on weight, age, and condition of the animal and climatic conditions or environmental temperature.

The lactating sow diets in Table 3 are for high producing sows weaning an average of 9 or more pigs per litter. These recommended diets assume that lactating sows are full fed

Table 1. Typical nutritive values for wheat, corn, and sorghum grain.[1]

	Wheat[2]	*Sorghum grain*	*Corn*
Crude fiber, %	2.6	2.2	2.5
Metabolizable energy (kcal/lb)	1475	1475	1550
Calcium, %	.05	.02	.02
Phosphorus, %	.30	.27	.25
Crude protein, %	12.20	8.90	8.50
Lysine, %	.38	.22	.24
Trytophan, %	.17	.09	.09
Threonine, %	.37	.27	.32
Methionine + Cystine, %	.50	.29	.40

[1] Dry matter was assumed to be that normally found in air dry feeds.
[2] Hard red winter wheat.

Table 2. Suggested growing and finishing diets using wheat.

	40 to 75 lb			*75 to 140 lb*			*140 lb to market*		
Ingredients	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*
Wheat, hard red winter	1567	760	758	1611	783	780	1734	842	840
Corn	-	760	-	-	782	-	-	843	-
Sorghum grain	-	-	758	-	-	780	-	-	839
Soybean meal, 44%	380	425	430	340	385	390	220	268	275
Calcium carbonate	16	16	16	17	16	17	17	17	17
Dicalcium phosphate	27	29	28	22	24	23	19	20	19
Salt	7	7	7	7	7	7	7	7	7
Vitamin-trace mineral mix[a]	3	3	3	3	3	3	3	3	3
Total lb.	2000	2000	2000	2000	2000	2000	2000	2000	2000
Protein, %	17.92	17.33	17.46	17.31	16.69	16.81	15.42	14.74	14.91
Lysine, %	.85	.85	.85	.80	.80	.80	.65	.65	.65
Trytophan, %	.25	.23	.23	.24	.22	.22	.22	.19	.20
Threonine, %	.61	.62	.61	.59	.60	.58	.51	.52	.50
Methionine + Cystine, %	.62	.59	.55	.60	.58	.54	.56	.54	.49
Calcium, %	.70	.71	.70	.66	.65	.66	.61	.61	.60
Phosphorus, %	.60	.60	.60	.55	.55	.55	.50	.50	.50
Metabolizable energy, kcal/lb.	1433	1459	1433	1436	1464	1437	1439	1469	1441

[a] See Table 4.

and that they consume at least 12 pounds of feed per day. The lysine level in the diets could be reduced to .75% for average sows weaning 8 pigs or less per litter.

Constipation may be a problem around farrowing time. If constipation is a problem, substitute 20 percent wheat bran or 10 percent dehydrated alfalfa meal or beet pulp for grain in the diet starting 3 to 4 days before farrowing and continuing up to 1 week following farrowing. Some producers may want to treat this problem by adding 20 pounds of magnesium sulfate, (Epsom salts) or 15 pounds of potassium chloride per ton of feed.

Antibiotics and Other Feed Additives

Specific recommendations and other feed additives have not been included in the diet formulations since the choice of additives varies among farms. The greatest benefits from antibiotics or other feed additives are achieved when added to the diet of weanling and growing pigs. The advantages are less for finishing pigs. Antibiotics often are included in sow diets especially at breeding time and just before and after farrowing. When using feed additives be sure to follow label guidelines for the specific levels to feed, and adhere to the withdrawal times on the label. For a more complete discussion on feed additives see PIH-31, "Feed Additives for Swine" in the Pork Industry Handbook.

Determining Relative Values of Wheat

The overall value of grain has to include the relative value of each grain on the basis of both energy content and protein and amino acid content. Since wheat is normally higher in crude protein and amino acid content than corn or sorghum grain, the relative value of wheat depends to some extent on the price of soybean meal or another protein supplement. Fact Sheet 3503, "Relative Value of Grains for Market Hogs," contains a nomograph for determining the relative value of wheat compared to corn or sorghum grain with varying prices of soybean meal. As the price of soybean meal increases, the relative value of wheat as compared to corn or sorghum grain is enhanced. Computer programs to formulate least cost diets can also be used to determine which grain is the best buy.

Processing of Wheat

Research has recently been concluded at Oklahoma State University on particle size of grind of wheat for growing-finishing swine. Average daily gain and feed efficiency was improved when a fine grind wheat (average particle size of 665 microns) or a close dry roll was fed as compared to feeding a medium grind (average particle size of 936 microns).

Research at the Oklahoma State University and other state experiment stations has shown pelleting to be an effective method to improve feed efficiency and daily gains for growing-finishing swine. Pelleting of wheat diets resulted in a 3.8 percent improvement in daily gains and an 8.0 percent improvement in feed efficiency. This response is similar to what would be expected from pelleting corn or sorghum grain diets but less than barley diets. The cost of pelleting will determine if it is feasible.

Table 3. Suggested sow diets using wheat.

	Bred sows						*Lactating sows*			
Ingredients	*1*	*2*	*3*	*4*	*5*	*6*	*1*	*2*	*3*	*4*
Wheat, hard red winter	1699	826	824	1618	788	785	1541	750	748	1493
Corn	-	825	-	-	788	-	-	750	-	-
Sorghum grain	-	-	823	-	-	785	-	-	748	-
Soybean meal, 44%	225	272	277	210	250	257	385	425	430	375
Alfalfa meal, dehy, 17%	-	-	-	100	100	100	-	-	-	60
Calcium carbonate	20	20	20	16	16	16	21	20	20	18
Dicalcium phosphate	41	42	41	41	43	42	38	40	39	39
Salt	10	10	10	10	10	10	10	10	10	10
Vitamin-trace mineral mix[a]	5	5	5	5	5	5	5	5	5	5
Total lb.	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Protein, %	15.31	14.65	14.78	15.34	14.62	14.79	17.87	17.23	17.35	17.87
Lysine, %	.65	.65	.65	.65	.65	.65	.85	.85	.85	.85
Trytophan, %	.22	.19	.19	.22	.20	.20	.25	.23	.23	.26
Threonine, %	.51	.52	.50	.51	.52	.50	.61	.62	.60	.62
Methionine + Cystine, %	.56	.53	.49	.56	.53	.49	.61	.59	.55	.61
Calcium, %	.91	.91	.90	.90	.91	.90	.91	.91	.90	.91
Phosphorus, %	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70
Metabolizable energy, kcal/lb.	1417	1447	1418	1385	1413	1386	1417	1444	1419	1398

[a] See Table 4.

Table 4. Suggested vitamin-trace mineral mix.[1]

Nutrient	*Amount per[2] pound of premix*		*Suggested source*
Vitamin A	2,000,000	IU	Vitamin A palmitate-gelatin coated
Vitamin D	200,000	IU	Vitamin D3-stabilized
Vitamin E	10,000	IU	dl-tocopheryl acetate
Vitamin K (Menadione equivalent)	800	IU	Menadione sodium bisulfate
Riboflavin	1,200	mg	Riboflavin
Pantothenic acid	4,500	mg	Calcium pantothenate
Niacin	9,000	mg	Nicotinamide
Choline chloride	20,000	mg	Choline chloride (60%)
Vitamin B12	5	mg	Vitamin B12 in mannitol, (.1%)
Folic acid	300	mg	Folic acid
Biotin	40	mg	D-Biotin
Copper	.4	%	$CuSO_4$:$5H_20$
Iodine	.008	%	KIO_4
Iron	4.0	%	$FeSO_4$. $2H_20$
Manganese	.8	%	$MnSO_4$.H_20
Zinc	4.0	%	ZnO(80%Zn)
Selenium	.012	%	$NaSeO_3$ or $NaSeO_4$.

[1] Vitamin and trace mineral mixes may be purchased separately. This is advisable if a combination vitamin-trace mineral premix is to be stored longer than 30 days. Vitamins may lose their potency in the presence of trace minerals.

[2] Premix is designed to be used at a rate of 5 pounds per ton of complete feed for sow and baby pigs and 3 pounds per ton of complete feed for growing finishing swine.

Effect of Rapid Cereal Grain Change

One of the concerns of some pork producers in switching from one grain to another on the basis of economics is the effect of abrupt changes in feed ingredients on the performance of swine. Research at Oklahoma State University indicates that a weekly rotation of corn, sorghum grain and wheat diets for growing-finishing swine had little effect on performance. Daily gain and feed efficiency were nearly identical for pigs fed a constant standard sorghum grain diet as compared to those fed a diet in which the cereal grain (corn, wheat or sorghum grain) was rotated every seven days.

Problems Resulting from Feeding Wheat

Occasionally reports are received that the performance of pigs fed wheat is less than expected. Problems resulting from feeding wheat can often be explained by failure to provide sufficient protein supplement to meet the requirement for lysine and other essential amino acids. The nutrient composition, especially amino acid content, must be taken into consideration when formulating optimum wheat diets for swine.

Pork producers who purchase complete commercial protein supplements to mix at home with grain often try to use less of the supplement when feeding wheat since wheat is higher in crude protein than corn or sorghum grain. This is usually unsatisfactory, since the amount of complete supplement in the ration is decreased, mineral and vitamin content of the diet as well as protein content is reduced. Inadequate levels of minerals and/or vitamins can be very detrimental to pig performance. When using a complete protein supplement, it is usually necessary to substitute wheat for corn or sorghum grain on a pound for pound basis or purchase a supplement specifically designed to be fed with wheat.

To efficiently utilize the higher crude protein and amino acid content of wheat, it may be necessary to formulate a diet using different ingredients such as soybean meal, dicalcium phosphate, calcium carbonate, salt, and vitamin-trace mineral premix as done in Tables 2 and 3.

Reduced feed intake is another problem occasionally reported when fed wheat diets. This is sometimes thought to be the result of feeding poor quality wheat with a high percentage of foreign material or heat damaged wheat. Moldy wheat can cause a drastic decrease in feed intake and possibly abortions in bred sows. It is also occasionally reported that extremely fine grind wheat doesn't flow well in self feeders.

Summary

Wheat can be used successfully in swine diets. It is equal in energy to sorghum grain but slightly lower than corn. It is normally higher in crude protein and essential amino acids than corn or sorghum grain.

The actual value of the higher protein and amino acid level of wheat is dependent on the cost of soybean meal or other protein sources. When soybean meal or other protein sources are relatively high compared to the price of cereal grains, the value of wheat to other cereal grains is enhanced. However, to effectively utilize the high crude protein and amino acid content of wheat, it is usually necessary to formulate special diets using different ingredients such as soybean meal, dicalcium phosphate, etc. as was done in Tables 2 and 4. Purchased complete supplements are usually designed to be fed with only corn or sorghum grain.

Problems resulting from feeding wheat can often be explained by improper supplementation with a protein source to balance the diet for lysine and other essential amino acids. The nutrient composition, especially amino acid content, must be taken into consideration when formulating optimum wheat diets.

Reduced feed intake is another problem occasionally reported when feeding wheat diets. This may be the result of feeding poor quality wheat that is heat damaged, moldy or has a high percentage of foreign material.

The decision to feed wheat should be based largely on economics. Pork producers should not hesitate to feed wheat when it appears economically feasible.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Robert E. Whitson, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 20 cents per copy. 0607