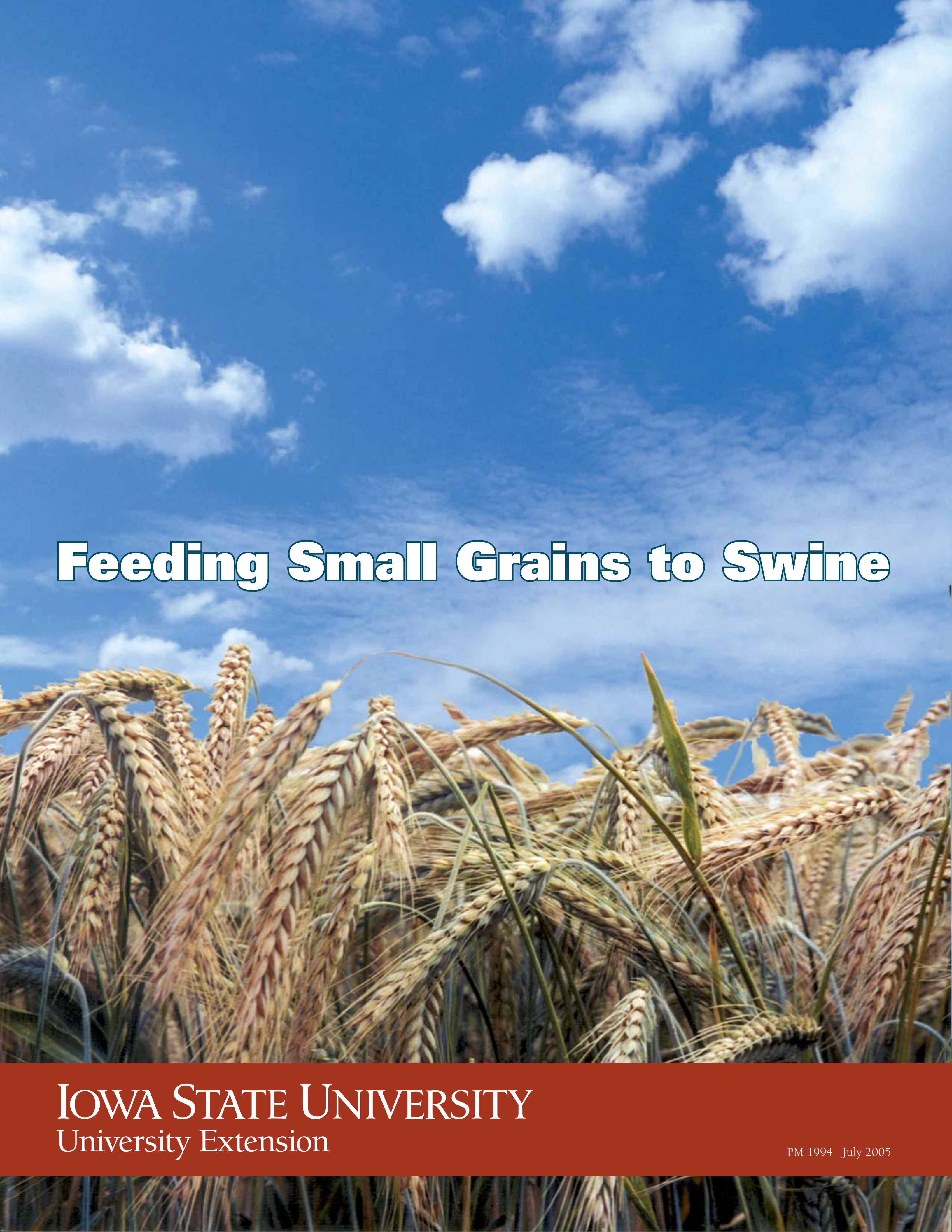
Feeding Small Grains to Swine



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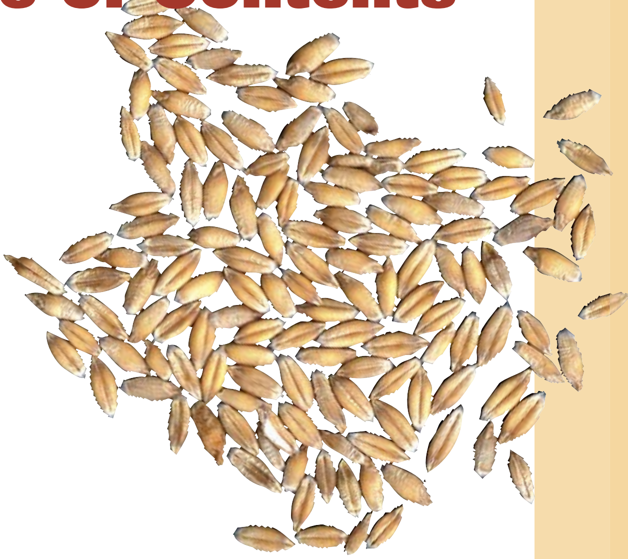



Introduction

Small grains, such as barley, oats, rye, triticale, and wheat can be useful feedstuffs in swine feeding programs. In many instances, pigs fed well-balanced small grain-based diets can perform as well as those fed corn-based diets. Nutritionally, small grains are similar to corn in some aspects, but there are differences depending on the grain. Small grains are higher in crude protein than corn and, more importantly, they are higher in lysine, the first limiting amino acid in cereal grain-based swine diets. Small grains are also higher in digestible phosphorus than corn, but tend to be lower in energy content.

When viewed in the context of an integrated crop and livestock system, several additional attributes also make small grains attractive. Addition of an extra crop to the corn-soybean rotation typical of the U.S. Corn Belt can reduce costs, improve distribution of labor and equipment, improve yields of corn and soybeans, provide better cash flow, and reduce weather risks. Lengthening the time between crops on the same ground can decrease the prevalence of some pests, most notably soybean cyst nematode and corn rootworm. Straw from small grains is an excellent source of bedding that becomes available in the late summer when corn stalks stored since the previous fall may be in poor condition. Small grains also provide environmental benefits, such as erosion control and improved nutrient recycling.

Proper grain testing and diet formulation are important aspects of maximizing the performance of small grains as swine feed. Growing and harvesting conditions can greatly influence the nutritional composition of small grains even within the same variety. Testing for lysine concentration is especially important because improper protein supplementation is a major cause of problems when feeding small grains.

The first section of this publication provides information and guidelines common to inclusion of barley, oats, rye, triticale, and wheat in swine diets. The middle section contains information specific to the feeding of each small grain species to the various classes of swine. The last section contains summarized guidelines for including small grains in swine diets. The information should be consulted carefully as some small grains should only be fed in limited amounts in certain situations. University swine extension specialists and company-based or independent swine nutritionists can be contacted for more information on feeding small grains to swine.

Nutrient Composition of Small Grains

Small grains contain more crude protein than corn and greater levels of several essential amino acids, including lysine, threonine, and tryptophan (Table 1). The higher lysine concentration in small grains is especially important. Lysine is the first limiting amino acid in many swine diets, so balancing the diet on the basis of lysine content usually provides adequate levels of the other essential amino acids. Compared to corn, small grains contain 30 to 50% more lysine, which reduces the need for soybean meal in small grain-based finishing diets by about 100 lb/ton. This increases the feed value of small grains relative to corn by 5 to 7%. Lysine concentration is the most important consideration when balancing small grain-based swine diets with protein or amino acid supplements. Balancing on crude protein alone is often ineffective because the amount of lysine relative to protein varies among small grains and corn. If lysine concentration is unknown, substituting small grains for corn on an equal weight basis would be a conservative approach for constituting swine diets.

The phosphorus (P) in small grains is more available to swine than that in corn, which provides both economic and environmental benefits. Even though cereal grains contain significant amounts of P, much of it is chemically bound within phytate. Since pigs lack the enzymes needed to remove P from phytate, inorganic P must be added to the diet to meet the pig's requirement for this mineral. Dicalcium phosphate, the most common P source, is an expensive ingredient. Feeding grains with more available P reduces the amount of inorganic P supplementation in the diet, which minimizes negative environmental impacts connected with excessive P in swine manure. Most of the phosphorus locked in phytate is excreted in the manure and makes its way into streams and lakes if it is spread on erodible farmland already high in soil P. Since the P in small grains is more available than that in corn, there may be up to 30% less P secreted by animals fed small grains. Phosphorus availability is 10 to 15% in corn, 20 to 30% in barley and oats and 45 to 50% in triticale and wheat.

Small grains are lower in fat, higher in fiber, and typically contain less metabolizable energy than corn (Table 1). Rye, triticale, and wheat contain 5 to 10% less energy than corn, but these differences do not appear to have negative effects on average daily gains when fed in finishing diets. In many studies, these grains have successfully replaced 100% of the corn used in control diets. The lower energy has affected feed efficiency in some instances because pigs on small grain diets ate more than pigs on corn-based diets. When palatable, pigs generally consume higher amounts of small grains to meet their energy requirements. Barley and oats have

Table 1. Average analysis of cereal grains as swine feed (data on as-fed basis)*. Source: NRC Nutrient Requirements of Swine, 1998

	Barley, six row	Corn	Oats	Rye	Triticale	Hard red spring wheat	Hard red winter wheat	Soft red winter wheat
Dry matter (%)	89.0	89.0	89.0	88.0	90.0	88.0	88.0	88.0
Crude protein (%)	10.5	8.3	11.5	11.8	12.5	14.1	13.5	11.5
Lysine (%)	0.36	0.26	0.40	0.38	0.39	0.38	0.34	0.38
Methionine (%)	0.17	0.17	0.22	0.17	0.20	0.23	0.20	0.22
Threonine (%)	0.34	0.29	0.40	0.32	0.36	0.41	0.37	0.39
Tryptophan (%)	0.13	0.06	0.16	0.12	0.14	0.16	0.15	0.26
ME (kcal/kg)	2,910	3,420	2,710	3,060	3,180	3,250	3,210	3,305
NDF (%)	18.6	9.6	27.0	12.3	12.7	–	13.5	–
ADF (%)	7.0	2.8	13.5	4.6	3.8	–	4.0	0.04
Calcium (%)	0.06	0.03	0.07	0.06	0.05	0.05	0.06	0.39
Phosphorus (%)	0.36	0.28	0.31	0.33	0.33	0.36	0.37	0.39
Bioavailability (%) of Phosphorus	30.0	14.0	22.0	–	46.0	–	50.0	50.0

*a dash indicates that data are not available higher fiber content than other small grains because the kernels are encased in a hull. The higher fiber content of barley does not appear to negatively affect gains in growing-finishing swine if plump, high-test weight grain is fed. However, high fiber content lowers oats' feed value to about 80% of that of corn. Lower energy limits the use of oats to only a portion of swine diets, but the high fiber can be useful for adding bulk to the diets of gestating sows.

Barley and oats also have relatively high heat increment content. Heat increment is the increase in heat production from digestion of feed. High heat increment of a feedstuff can help keep an animal warm in cold environments, hence feeding oats and barley during the winter may be advantageous. However, in hot conditions, feeding oats and barley may decrease feed intake, because the additional heat generated by the fibrous feeds is not needed by the animal.

Bedding

Straw from small grain makes excellent bedding for pigs. Oat straw is one of the most absorbent bedding types commonly available. Oat straw is about 10% more absorbent than pine saw dust or shredded corn stalks. Wheat and triticale straw are about 25% less absorbent than oat straw. Barley straw is about 33% less absorbent than oat straw. Good straw should be clean, bright, and free of mold or dust. Shredded barley straw is preferred for floating biocover for manure storage structures. Because straw is an important economic component of a small grain crop, it should be harvested in a timely manner.

Possible Challenges of Feeding Small Grains to Swine

Ergot. Ergot is most common in rye, and is only occasionally found in barley, oats, and wheat. This does not mean it cannot be a problem in these grains under certain conditions. A serious ergot infestation of barley occurred in northeast Iowa in 1996. Rye is particularly susceptible to ergot infestation and should be fed with extreme caution. Ergot is caused by a fungus that regularly infests wild and cultivated grasses in Iowa and other humid areas. Ergot produces dark purple to black sclerotia (bodies) that replace the grain in the heads and contaminate the harvested grain. Grain with more than 0.1% ergot sclerotia (about 1 body in 1000 kernels) should not be fed to growing-finishing swine unless it is diluted to lower levels with ergot-free grain. Ergot concentrations above this level can reduce feed intake, slow growth, and reduce feed conversion. If fed at levels that are too high, ergot can even cause death. Grain containing any ergot should not be fed to breeding stock.

Ergot sclerotia (2x)

Ergot sclerotia contain alkaloids, which stimulate contraction of small blood vessels. Early symptoms of ergot poisoning include animal lameness, usually in the hind limbs, appearing a few weeks after first ingesting ergot. Continued ergot consumption results in gangrene and sloughing of tissue extremities such as the nose, ears, tail, and limbs. Ingestion of very low levels of ergot by lactating animals markedly reduces, and may stop, milk production. Occasionally ergot alkaloids affect the animal's nervous system causing convulsions and staggering.

Symptoms vary with ergot alkaloid content, amount ingested, frequency of consumption, and the climatic conditions during sclerotia growth. Some ergot sclerotia are similar to the grain kernels in size, while others are larger. A large size difference between the sclerotia and the grains allows for removal of the ergot bodies with grain cleaning equipment.

In triticale research at Iowa State University, ergot levels varied greatly with variety and growth environment. In most cases, ergot levels were not problematic in winter triticales. However, most spring varieties had ergot levels near or greater than 0.1%. AC William was the only spring triticale variety with ergot levels as low as wheat. Ergot is most prevalent in areas and seasons with wet soil surface conditions during spring and early summer combined with rainy weather during flowering.

To minimize ergot infestation, select low ergot varieties and avoid planting small grains in fields that contained pasture or forage grasses the previous growing season.

Scab. All small grains can be infected with the fungus *Fusarium graminearum* resulting in what is commonly called scab. With severe *Fusarium* infection, the grain becomes shriveled and takes on a chalky white or pink appearance. Scab is most likely to occur under cool, wet weather during early summer. Scabby grain can contain unacceptable levels of deoxynovalenol (DON) or vomitoxin, a mycotoxin associated with feed refusal in swine. Pigs fed diets having harmful DON levels will gain slowly and have poor feed efficiency. Contaminated grain should not be fed to gestating or lactating sows or pigs weighing less than 50 lb. For growing-finishing swine, contaminated grain may be blended with non-contaminated grain to reduce the DON concentration below 1 ppm, usually a no effect level. Cattle and other ruminants may be better alternatives for feeding scab infested small grains because they are less sensitive to DON than swine.

Fusarium graminearium (scab) infection causes small grain kernels to shrivel and take on a chalky white or pink appearance. The kernels in the row at the top of the picture are infested with scab. The bottom row contains normal kernels.

Enzyme inhibitors. Some varieties of rye and triticale contain excessive levels of antinutritional compounds that interfere with the activity of trypsin and chymotrypsin, enzymes that assist the digestion of proteins. Inhibition of these enzymes reduces gain, diminishes muscle growth, and negatively affects pancreatic health. Trypsin inhibitor levels vary widely among rye and triticale genetic lines. Newer triticale varieties have acceptable trypsin inhibitor levels, thus their use in swine diets should not be limited by these factors.

Low-test weight. Less than ideal growing and harvesting conditions can lower small grain test weight. Low-test weight grain has higher fiber content and lower energy density than high test weight grain. Pigs fed low-test weight grain may gain poorly or have poorer feed efficiency versus those fed high test weight grain. Test weight differences may account for the variability in pig performance found among oat feeding trials. It has been commonly accepted that oats should not constitute more than 20% of a growing-finishing pig diet. However, research with high-test weight oats (at least 36 pounds per bushel) at Iowa State University found that oats could make up 40% of the diet without affecting pig performance. Low-test weight oats are best used as a feedstuff in gestating sow diets or as a small percentage of finishing diets where feed intake usually is not the limiting factor.

Barley

Most Corn Belt swine producers have limited experience with barley and are unaware of its wide use in other parts of the U.S. and the world. While millions of pigs are fed annually on barley-based diets, there is great variability in the types of barley used for swine feeding programs. Barley can be two-rowed or six-rowed and hulled or hulless. These differences between barley types can equate to notable differences in growth rates, feed intake, and feed efficiency. Two-rowed barley produces fewer, but larger kernels per plant than six-rowed barley, so it generally has better feed efficiency, but lower grain yields per acre. Hulless barley has higher crude protein and lower crude fiber than hulled barley, as the hull contains a large portion of the crude fiber.

Barley is particularly well suited in growing-finishing diets since feed intake is usually not a limiting factor and pigs are able to perform as well as on corn-based diets. An Iowa State University study found pigs fed barley-based diets tended to have a higher quality fat (more firm and less susceptible to rancidity and off flavors) than those fed corn-based diets. The pigs' performance was statistically identical for corn-based and barley-based diets. Even though the barley-based diets were lower in energy than corn-based diets, pigs were able to compensate by eating more. They will simply eat enough to meet their energy requirements. Even so, producers may find it advantageous to use barley in combination with higher energy grains, such as corn or wheat. Barley can also be used as the sole cereal grain in sow diets during gestation. However, low energy density suggests limiting the use of barley to 85% of the cereal grain in lactating sow and 25% in weanling pig diets unless it is pelleted.

Oats

Oats can be an effective addition to swine diets, but there are limits on the amount that can be fed. Although oats are very palatable, they have more fiber content and lower energy density relative to corn and other small grains. The high crude fiber content makes oats desirable for gestating sow diets where limiting energy intake is beneficial for maintaining reproductive health. Oats may compose up to 90% of the diet in this situation. Small pigs and lactating sows have difficulty consuming enough feed to meet their energy requirements when oats are more than 5% of the diet. However, high-test weight oats (greater than 36 lb/bu) can be used for up to 5% of the diet for weanling pigs and 15% for lactating sows.

Oats can compose up to 20 to 40% of the diet of growing-finishing swine. A study in deep-bedded hoop barns at Iowa State University found no differences in animal performance or carcass measurements when oats replaced 20 and 40% of the corn in a swine finishing diet.

Oats are often added to swine diets for reasons other than energy. At 5 to 15% of the diet, oats can help minimize diarrhea problems common in recently weaned and small feeder pigs. Oats can also protect against constipation in sows and ulcers in growing pigs. Oats should be finely ground to prevent the pigs from separating out the hulls.

Rye

Rye acreage harvested for grain production in North America is fairly small relative to barley, oats, and wheat. Rye is most commonly grown for bread and whiskey production with a small amount fed to livestock. Rye's market potential is limited by the perception that it contains toxic factors that reduce its nutritive value. While some reasons for this discrimination are valid, many are unfounded. Rye is particularly susceptible to ergot infection, which is a major concern with frequent rainfall during spring and early summer. Since these conditions are prevalent in most corn growing regions, extreme caution should be used when feeding rye produced in these areas.

It is recommended that ergot-free rye be substituted for no more than 50% of the corn in a growing-finishing diet. Dustiness may be a problem with rye. A coarsely ground meal or the addition of fat or vegetable oil will reduce the problem. Rye is not recommended as a feedstuff for weanling pigs as it may be of lower palatability. Because maximum feed intake is critical for nursing sows, rye should not be fed to lactating sows either. Very little rye feeding research has been conducted with breeding stock. If rye is to be included in the diet of sows it must be ergot-free.

Triticale

Triticale (trit-ah-kay-lee) is a synthetic small grain produced by crossing durum wheat with rye. Triticale varieties typically contain the combination of the high crude protein and digestible energy of wheat and the hardiness, disease resistance and protein quality of rye. In most production environments, triticale yields are superior to both wheat and rye making it a practical and economical feedstuff.

The first triticale varieties, released in the late 1960s and early 1970s, had multiple traits that made them poorly suited for grain production, including poor standability, shriveled grain, and ergot susceptibility. However, the vigorous growth and high biomass production of triticale has led to its adoption as a forage crop that now occupies as many as one million acres in the U.S. Several breeding programs have continued developing grain-type triticales and great progress has been made toward eliminating problematic traits. Improvements have been significant enough that triticale varieties now occupy a sizeable production area in Australia and northern Europe, where the grain is used for livestock feed. Triticale has not been widely grown or fed to livestock in North America, but evidence suggests that it has potential. In studies from Florida, Georgia, North Carolina, and Canada, growing and finishing pigs fed triticale performed similarly to pigs fed corn-based and barley-based diets when they were balanced for lysine concentration with soybean meal or synthetic lysine.

The apparent high feed value and high yields of triticale recently led a group of researchers at Iowa State University to begin exploring the possibilities of including triticale into Corn Belt crop and swine feeding systems. This research includes testing of winter and spring triticale varieties; expanded three and four crop rotations with corn, soybean, triticale, and forage legumes; triticale planting management; soil quality analysis; and swine feeding trials. At least one spring triticale variety has been identified with grain yields near 100 bu/acre and several winter triticale varieties with yield potentials above 100 bu/acre. The economics of producing spring triticale compared well with oats and the economics of winter triticale compared favorably with corn and soybean production.

Testing has shown considerable variation among triticale varieties in agronomic traits, ergot susceptibility and nutrient composition. Therefore, it is critical to know the variety and its traits when growing triticale and using it in swine diets. Like rye, some triticales are susceptible to ergot. Ergot-infested triticale should not be fed to the breeding herd and triticale with ergot above 0.1% should not be fed to growing-finishing swine without diluting it with other grains. Since wheat is quite tolerant to ergot fungus, screening during the plant breeding process has allowed for the selection and development of triticale varieties with low ergot susceptibility.

Table 2.
Triticale varieties with low ergot levels and good agronomic characteristics for grain production in Iowa tritical performance tests.

Winter varieties	Spring varieties
Alzo	AC William
Décor	
Kitaro	
Lamberto	
NE426GT	
Presto	
Roughrider	
Trimark™ Brand 336	
Trical® Brand 815	
Sorento	
Vero	

The triticale varieties in Table 2 have been identified as having low ergot levels, high yields, and good agronomic characteristics when grown in Iowa. Several of these varieties should be available within Iowa and surrounding states. Although widely available, forage triticale varieties generally make poor choices for grain production because they are later-maturing, have lower yields, and are more susceptible to ergot than grain varieties. Older varieties may contain levels of trypsin and chymotrypsin inhibitors inherited from its rye parent. Most recently developed varieties have acceptable levels of these antinutritional factors. Feed refusal has been observed in a few swine feeding trials with triticale. Crop producers are advised to get variety information on agronomic characteristics, ergot tolerance, and feed performance before planting triticale. Swine producers are advised to try triticale diets with small groups of pigs before committing to unknown sources or varieties.

Limited triticale feeding research has been done on starter diets. One study found that triticale could replace all of the corn and about 10% of the soybean meal in starter pig diets balanced for lysine without influencing daily gain or feed intake. However, another study showed lowered feed intake and palatability problems with triticale. Currently, Iowa State University recommends including triticale at a maximum of 25% of starter pig diets until more research is conducted on varieties with agronomic potential in our region.

As mentioned earlier, several studies have found that growing-finishing pigs receiving a triticale-based diet, balanced for lysine, did not differ in daily gain versus pigs receiving corn-based diets. Triticale feeding research is currently being conducted at Iowa State University on varieties suitable for grain production in Iowa. Triticale grain is being fed at 0, 40, and 80% of the total diet weight to growing-finishing pigs housed in deep-bedded hoop barns. Pigs fed a diet of Trical® 815, a winter triticale, and soybean meal had daily gains and meat quality similar to pigs fed a corn/soybean diet. However, pigs fed triticale ate more feed resulting in slightly poorer feed efficiency than those fed a corn-based diet.

Research with triticale in breeding herd diets has not been reported. Until more research is conducted to determine the nutritive value of triticale for breeding stock, a limit of 25% of the total diet is suggested.

Wheat

Wheat is grown primarily for human food and used in livestock diets only when it is economical. When viewed in the context of cash grain markets, wheat appears to be an expensive feed grain in the Corn Belt. It often brings a substantially higher price per bushel than corn and most wheat is produced outside the region, which makes transportation costs a deterrent to its use. However, wheat

can have a positive role in integrated crop-livestock system when it is fed on or near the farm where it is produced. When viewed within this perspective, wheat becomes a much more desirable option in the Corn Belt. Wheat can be used as the sole cereal grain in growing and finishing swine diets. It is recommended that wheat occupy no more than 85 to 90% of the diet for the breeding herd and 45% of small pig diets.

Wheat classes produced in the U.S. include hard red winter, hard red spring, soft red winter, hard white, soft white, and durum. From both grain production and animal feed perspectives, hard red winter and soft red winter are best suited for the Corn Belt. Hard red spring may be more desirable than the winter wheats for some areas of the northern Corn Belt where winter injury to the crop may be of concern. From an animal feed perspective, there are few differences between red or white wheats. However, the relatively high rainfall conditions of the Corn Belt can cause preharvest sprouting in white and durum wheats. There are slight differences between hard and soft wheats. Hard wheat tends to have more protein, a higher content of essential amino acids (though a slightly less desirable profile), and less energy than soft wheat. However, feeding trials of soft and hard wheat have generally found equal performance in growing-finishing pig diets. Differences in feeding values for wheat are more attributed to variation in growing or harvesting conditions than differences among classes or varieties. Therefore, for wheat as well as all small grains, the grain should be sampled and analyzed by proximate analysis for moisture, crude fat, crude protein, and crude fiber. It is also recommended to analyze a sample for available lysine and phosphorus.

Guidelines Summary

Small grains, such as barley, oats, rye, triticale, and wheat can be useful feedstuffs in swine feeding programs. In many instances, pigs fed well-balanced small grain-based diets can perform as well as those fed corn-based diets. Most small grains can be fed to all types of swine – sows, piglets, and finishing pigs. Table 3 shows recommended inclusion rates of small grains for various swine phases (gestating sows, starter pigs, and growing-finishing pigs). The relative value of each small

Table 3. Recommended inclusion rates of small grains in various swine diets and their relative value compared to corn.

Feedstuff	Gestation	Starter	Grow-Finish	Relative Value vs Corn
Triticale	0-90	0-25	0-95	90-105
Barley	0-90	0-25	0-95	100-105
Oats	0-90	0	0-40	80- 85
Wheat, hard	0-90	0-45	0-95	110-115

Barley, oats, and wheat relative values from Life Cycle Swine Nutrtion PM-489, ISU Extension
Relative value vs. corn-based on energy content, lysine %, and available phosphorus.
Triticale rates for gestating sows based on barley, oats, and wheat recommendation.

Table 4. Sample diets for finishing pigs (150-250 lbs.) with a high level or low level of small grain inclusion.

Feedstuff	high	low	high	low	high	low
Triticale or wheat	1769.00	500.00				
Barley			1786.00	500.00		
Oats[a]					800.00	200.00
Corn			1215.00	1223.00	934.0	1508.00
Soybean meal[b]	195.00	244.00	175.00	235.00	225.00	250.00
Dicalcium phosphate		8.90	6.20	10.70	10.00	12.00
Limestone	23.95	20.05	20.75	19.25	18.95	17.95
Salt	6.80	6.80	6.80	6.80	6.80	6.80
Mineral premix	2.00	2.00	2.00	2.00	2.00	2.00
Fat soluble vitamin premix	3.00	3.00	3.00	3.00	3.00	3.00
B-vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25
Total, lb.	**2000.00**	**2000.00**	**2000.00**	**2000.00**	**2000.00**	**2000.00**

[a] Assumes feeding heavy oats (>36 lb/bu).
[b] Assumes 47.5% crude protein.

grain compared with corn is shown in Table 3 based on the energy, lysine, and available phosphorus content of each grain. The relative value is useful in pricing small grains compared with the corn market.

The compositions of sample diets for finishing pigs (150 lb) are shown in Table 4. For each small grain, a high inclusion and low inclusion diet is shown. Each diet has been formulated to meet the nutritional needs of a 150 lb pig. Each diet with small grain has reduced amounts of corn, soybean meal, and inorganic phosphorus source (dicalcium phosphate) compared with a conventional corn-soybean meal diet. Using typical ad libitum (free-choice) finishing diets with high small grain inclusion rates, the reduction of soybean meal and dicalcium phosphate is significant. Table 5 shows the amount of soybean meal and dicalcium phosphate that can be removed from a corn-soybean meal diet when small grains are added. Gestating sows are capable of using a wide range of feedstuffs and are well suited for small grain use. Table 6 shows sample diets with small grains that will meet the sows' nutritional requirements. The two triticale diets are based on 1) a conservative approach using 25% triticale and 2) a 90% triticale diet based on barley, wheat, and oats inclusion recommendations. These sow diets are based on feeding under standard production conditions starting at a base rate of 4 lb/head/day with adjustments for parity, genetics, thermal environment, sow condition, and sow weight loss during the previous lactation. For further information see ISU Life Cycle Swine Nutrition, PM-489.

Table 5. Change in pounds of soybean meal and dicalcium phosphate added in one ton of feed for finishing pigs (150-250 lbs.), compared to a corn-soybean meal diet.

Feedstuff	Inclusion rate, %	Soybean meal	Dicalcium phosphate
Triticale or wheat	88.5	-70.00	-12.30
Barley	89.3	-90.00	-4.90
Oats	40.0	-40.00	-2.30

Example, including triticale in the diet at 88.5% will decrease the amount of soybean meal needed in one ton by 70.0 lb and the amount of dicalcium phosphate needed by 12.3 lb when compared with a corn and soybean meal-based diet.

Table 6. Sample diets for gestating sows with maximal small grain inclusion.

Feedstuff						
Triticale	500.00[a]	1800.00[b]				
Wheat			1800.00			
Barley				1800.00		
Oats					1800.00	
Corn	1430.00	149.00	148.00	146.00	147.00	1909.00
Soybean meal	14.00	—	—	—	—	33.00
Dicalcium phosphate	31.00	21.50	21.75	28.00	29.00	34.50
Limestone	16.50	21.00	21.75	17.50	15.50	15.00
Salt	5.00	5.00	5.00	5.00	5.00	5.00
Sow trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00
Sow fat soluble vitamin remix	0.35	0.35	0.35	0.35	0.35	0.35
Sow B-vitamin premix	0.40	0.40	0.40	0.40	0.40	0.40
Sow folic acid premix	0.25	0.25	0.25	0.25	0.25	0.25
Choline premix	1.50	1.50	1.50	1.50	1.50	1.50
Total. lb.	**2000.00**	**2000.00**	**2000.00**	**2000.00**	**2000.00**	**2000.00**

[a]Triticale diet based on conservative recommendation (25%), see text.
[b]Triticale diet based on barley, wheat, and oats recommendation and probable sow performance.

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Additional Resources

AED 41 Hoop Barns for Grow-Finish Swine

AED 44 Hoop Barns for Gestating Swine

PIH 138 Managing Market Pigs in Hoop Structures

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