Factsheet

#21-001 | AGDEX 444/54 | JANUARY 2021

Feeding Small Cereal Grains to Pigs

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INTRODUCTION

In the absence of corn, cereal grains such as wheat and barley can be used very successfully in swine diets. The purpose of this factsheet is to provide guidance on feeding small cereal grains such as wheat, barley, oats, rye and triticale to pigs.

Many countries around the world, as well as other parts of Canada, routinely use wheat and/or barley as the main energy sources for swine rations. Other small grains such as oats, rye and triticale can also be incorporated, although typically at lower inclusion levels.

Just like corn, growing and harvesting conditions can impact the nutritional value of cereal grains. Small grains are similar to corn in terms of their nutritional value; however, there are also some important differences to note. Most importantly, small grains are typically higher in crude protein and lysine compared to corn. This means you may need less soybean meal in your diets to compensate. Small grains also have higher digestible phosphorus (providing economic and environmental benefits) but tend to be lower in energy.

When switching to wheat or barley diets, test ingredients and formulate diets to meet the nutrient demands of your pigs. Table 1 shows the average nutrient content for a variety of small grains. Table 2 shows the recommended maximum inclusion levels of the grains for different stages of pig production. To ensure best animal performance, test your ingredients and work with your nutritionist to come up with properly formulated rations.

Table 1. Reported nutrient values (as-fed basis) for a variety of small grains. Corn is included for comparison.

	Barley	Hulless Barley	Hard Red Wheat	Soft Red Wheat	Rye	Triticale	Oats	Hulless Oats	Corn
Dry matter, %	89.9	89.6	88.7	86.4	89.4	88.5	89.9	91.8	88.3
Digestible energy, kcal/kg	3,150	3,266	3,313	3,450	3,270	3,320	2,627	4,126	3,451
Net energy, kcal/kg	2,327	2,464	2,472	2,595	2,460	2,507	1,893	3,164	2,672
Crude fibre, %	3.90	1.10	2.57	3.00	2.71	2.54	13.50	2.20	1.98
Crude protein, %	11.33	12.77	14.46	10.92	11.66	13.60	11.16	14.70	8.24
Lysine, %	0.40	0.51	0.39	0.35	0.43	0.46	0.49	0.56	0.25
SID[1] lysine, %	75	65	82	82	74	78	76	90	74
Phosphorus, %	0.35	0.36	0.39	0.30	0.30	0.33	0.35	0.38	0.26
STTD[2] of phosphorus, %	45	36	56	56	50	56	39	–	34

[1] SID Lysine = standardized ileal digestible lysine: The % of lysine that is digested by the end of the small intestine.
[2] STTD of phosphorus = standard total tract digestibility of phosphorus: The % of phosphorus digested by the end of the gastrointestinal tract.

Table 2. Recommended maximum inclusion rates of a variety of small grains for different sizes of pigs, and the comparative feeding value relative to corn.

Grain	Starter Pigs	Grow-Finish Pigs	Gestation	Lactation	Comparative Value vs. Corn
Barley	25%	95%	90%	85%	95–100
Wheat	45%	95%	90%	40%	100–110
Rye	10%	35%–50%	20%	10%	100–105
Triticale	25%	95%	25%	40%	95–105
Oats[1]	0%–5%	40%	90%	0%–15%	80–85

[1] The high fibre content of oats means they have lower energy density. Small pigs and lactating sows already struggle to consume enough energy for their needs, so oat inclusion should be limited in these rations. If high test weight oats are used (greater than 36 lb/bu), inclusion rates of 5% for weaner pigs and 15% for lactating sows can be used.

BARLEY

There is a lot of variability in barley varieties that can be used for pig feed. This variability can cause differences in growth rates, feed intake and feed efficiency. For example, hulless barley has higher crude protein and lower crude fibre than hulled varieties. Two-rowed barley is generally better for feed efficiency but has lower grain yields per hectare.

Barley can be used as a complete replacement for corn in grower-finisher and gestation rations but should be combined with a higher energy source grain such as wheat for weaner and lactation rations. Grower-finisher pigs will consume more of a barley-based diet to make up for the lower energy content, whereas weaner pigs are unable to do this. In some regions of the world, barley is considered highly desirable for inclusion into weaner pig rations (at 10%–15%) to help reduce the incidence of diarrhea.

The higher fibre content in barley means that it has a higher heat increment of feeding. In other words, the body generates more heat while digesting this ingredient compared to other feedstuffs like corn or wheat. This may be advantageous in the winter but may lead to reduced feed intake in hot summer months. This is not an issue with hulless varieties, as most of the fibre is in the hulls. Recommended particle size is 700 microns.

WHEAT

Wheat is not always economical to include in swine diets as it is primarily grown for human consumption. However, the benefits to crop rotation may help offset these added costs. Like barley, there can be variations to the nutritional content of wheat. Most variation comes from growing conditions rather than different varieties. Soft wheats typically have lower crude protein than hard wheat varieties, but both are typically higher than the crude protein content of corn. Similar to barley, wheat has higher lysine content than corn, which may help reduce the cost of including wheat in diets due to less need for synthetic lysine. Wheat also has higher available phosphorus than corn, potentially reducing the need for additional P inclusion.

Wheat contains on average 5%–10% less energy than corn, but growth rates of animals are usually unaffected. Grower-finisher pigs will simply increase their intakes to make up for the lower energy content. With weaner pigs and lactating sows (and grower-finisher pigs), a small amount of additional energy can be added to the diet to help increase the overall dietary energy value.

Wheat does not have the same high heat increment of feeding that barley has, so it may be better suited for hot summers. Try to keep the particle size to about 700 microns.

OATS

Hulled oats are an excellent option for gestating sows and can make up 90% of their diet. They are palatable and the high crude fibre content contributes to sows feeling full. The low energy density in oats also helps to maintain reproductive health. However, the high fibre and low energy makes oats a less desirable option for growing pigs or lactating sows and should only be included at low levels. Oats can also be used to prevent constipation in sows, reduce diarrhea in young pigs and prevent ulcers in market hogs and sows. Hulled oats should be finely ground to prevent pigs from sorting out the hulls as they eat.

Hulless oats are a very different feed ingredient than their hulled counterparts as the lack of hull significantly increases their energy content. They also have higher crude protein and lysine content, and the lysine is more digestible.

RYE

Rye is not a common feed ingredient for swine but it can be used if available. There are some issues with the palatability of rye, as well as some potential anti-nutritional factors, so inclusion levels are much lower than wheat or barley. Rye should be kept to a minimum in young pig and lactating sow diets and should not make up more than 50% of a grower-finisher ration. Rye is more susceptible to ergot contamination than other cereal grains, so testing should be done to ensure it is ergot free, especially if you plan to feed it to your breeding herd.

In recent years, new hybrid rye varieties have been developed that have lower anti-nutritional factors and improved ergot resistance. Several feeding trials have been conducted with pigs using some of these hybrid varieties, and animal performance has matched that of corn or wheat-based diets when rations were properly formulated. As development of these hybrid rye varieties continues, they may become a more viable option for swine producers to use as a feed ingredient.

TRITICALE

There is little research on feeding triticale to pigs. Initial studies in North America have shown that growing and finishing pigs fed diets comprised of up to 95% triticale can perform similar to corn or barley fed pigs, as long as diets are balanced nutritionally. Recommended inclusion levels remain low for young pigs and sows due to lack of research data.

POTENTIAL CHALLENGES

Mycotoxins

Similar to corn, small cereal grains are susceptible to fusarium head blight and other diseases that can lead to the development of mycotoxins. Mycotoxins are chemicals produced by moulds or fungi that infect different types of grain. Although there are over 400 known mycotoxins, only a small number of these affect pig performance. The primary mycotoxins of concern in Canada are deoxynivalenol (DON), aflatoxin, zearalenone, ochratoxin A, fumonisins, T-2/HT-2 toxins and ergot alkaloids. Several factors such as temperature, humidity and oxygen availability during growth, harvest, transport or storage periods, as well as insect and/or bird damage can contribute to the production of mycotoxins.

The Canadian Food Inspection Agency (CFIA) has regulatory guidelines for including mycotoxin-contaminated grain in livestock feeds. These guidelines outline the regulated and tolerated levels for certain mycotoxins in livestock feed (across species). Pigs are generally more susceptible to mycotoxins than other species. Hog producers should be extremely careful when feeding contaminated grains.

The most common disease in small cereal grains is fusarium head blight, which can lead to the production of DON. Ergot is another mycotoxin that can be found in all small cereal grains but is more common in rye. In final (mixed) rations for pigs, DON should not be present at levels greater than 1 ppm, and ergot should not be present at levels greater than 4–6 ppm.

For additional reading material on feeding pigs with mycotoxin contaminated grain, please visit the OMAFRA swine website at ontario.ca/livestock.

Nutrient Quality

When small cereal grains have low test weight, they are typically higher in fibre and lower in energy than their high-test-weight counterparts. This must be accounted for when formulating balanced rations for pigs, as feeding low-test-weight grains can lead to lower growth rates and poor feed efficiency. This is no different than the impacts of feeding low-test-weight corn. When feeding oats, it is recommended that low-test-weight batches be fed only to heavy finisher or gestating sows in small quantities.

Inclusion of fibre-degrading enzymes into rations with small cereal grains can significantly improve nutrient availability for the pig and help maximize animal performance. Similar to the practice of including phytase into rations to assist with phosphorus availability, fibre-degrading enzymes

help break apart the bonds that make fibre harder to digest. There are many different products available, so work with your nutritionist to select one that is right for your situation.

The presence of antinutritional factors in some varieties of rye and triticale can be a challenge when feeding these grains to pigs. Enzyme inhibitors that affect the activity of protein digestive enzymes (trypsin and chymotrypsin) reduce the pig's ability to use dietary protein for muscle gain and can impact pig health. However, newer varieties of these grains have often been bred to lower the antinutritional factors and can often be included in rations without issue. It is important to work with your nutritionist to ensure the grains are suitable for swine diets.

IMPACT ON MEAT QUALITY

There are several research papers indicating that replacing corn with wheat or barley has no negative impacts on carcass quality traits in pigs, including dressing percentage, lean yield, loin depth and fat composition when diets are formulated properly. However, there are some consumer markets that prefer pigs raised on wheat-based diets. Japan is an example of a market that prefers pigs raised on wheat-based diets as they want pork that looks and tastes like the pork produced there. Japan is a valuable export market for Canadian pork, and pork selected to enter that market typically comes from wheat or wheat-barley fed pigs.

CONCLUSION

Millions of pigs around the world are fed small cereal grain–based diets. Many finisher pigs in Ontario are being fed rations with wheat and/or barley to help improve carcass traits for the Japanese market. Although it will require some effort and a good relationship with your nutritionist, it is possible to have a successful feeding program with these ingredients. If you have questions or to learn more about feeding cereal grains, visit the OMAFRA website.

RESOURCES

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Published by the Ontario Ministry of Agriculture, Food and Rural Affairs

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ISSN 1198-712X
Également disponible en français (Fiche technique 21-002)

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