BARLEY IN SWINE DIETS

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Barley grain is a source of dietary energy, so it has been a main constituent of swine feeds in the Prairie provinces of Canada for decades. Old-timer pork producers simply calculated a pork price (100 index) to barley bushel cost to quickly estimate their profitability.

ENERGY

Barley has a lower net energy (NE) value for swine as compared with wheat or corn grain, which is the most important economic attribute for swine. However, once cost per MJ NE delivered on farm is calculated, barley generally prices more readily into swine diets than wheat or corn grain. The French proposed an NE value for barley of 9.7 for sows vs. 9.5 MJ NE/kg for growing pigs. The difference is because sows can derive slightly more dietary energy from the fibre in barley through the production of short-chain fatty acids by bacterial fermentation in the hindgut.

DIGESTIBILITY OF AMINO ACIDS IN SWINE

As the main constituent of swine feeds, cereal grains contribute the bulk of amino acids in the diet. Cereal amino acid composition and digestibility are therefore important. Barley contains more lysine, threonine, methionine and tryptophan than corn with similar standardized ileal digestibility (SID; NRC 2012; Table 13). Therefore, the inclusion of protein meals and crystal amino acids is reduced in feeding barley as compared with corn-based diets.

Table 13. AMINO ACID CONTENT (G/KG) AND STANDARDIZED ILEAL DIGESTIBILITY[1]

	HULLED BARLEY	HULLESS BARLEY	CORN
Lysine	4.00	5.10	2.50
SID	0.75	0.65	0.74
Threonine	3.60	3.70	2.80
SID	0.76	0.70	0.77
Methionine	2.00	2.00	1.80
SID	0.82	0.73	0.83
Tryptophan	1.30	0.13	0.60
SID	0.82	-	0.80

[1]NRC 2012; SID

PHOSPHORUS

Supplemental phosphorus is a costly component of swine feed. Barley grain can also contribute the bulk of dietary phosphorous. However, a large portion of the phosphorus in barley is tied up in a phytate ring and therefore unavailable to pigs (Htoo et al. 2007). It is now common practice to include phytase enzyme to increase phosphorus digestibility in feeds for both swine and poultry. However, barley still contributes more available phosphorus to swine feeds than corn grain (Table 14). Therefore, there is generally no need to supplement phosphorus from inorganic sources to growing-finishing pigs fed barley-based diets even without the use of phytase. This fact has important implications for manure application in some countries where phosphorus directives limit the amount of manure that can be applied on the land. Under these conditions, if phosphorus supplementation is required, the efficiency of utilization must be improved (e.g., feeding phytate enzyme) or the number of swine in the herd reduced in order to comply with regulations.

Table 14. TOTAL AND PHYTATE-BOUND PHOSPHORUS CONTENT (G/KG) AND APPARENT AND STANDARDIZED TOTAL TRACK DIGESTIBILITY

	HULLED BARLEY	HULLESS BARLEY	CORN
Total phosphorus	3.5	3.6	2.6
Phytate phosphorus	2.2	2.6	2.1
ATTD of phosphorus[1]	0.39	0.31	0.26
STTD of phosphorus[2]	0.45	0.36	0.34

[1]*Apparent total tract digestibility*
[2]*Standardized total tract digestibility*

NURSERY PIGS

Newly weaned pigs can be fed hulled barley as the sole cereal grain in the ration. However, due to its relative high dietary fibre content, growth performance may be initially reduced. Feeding hulless barley or a large proportion of wheat initially and progressively replacing it with hulled barley grain may increase growth performance and reduce the cost associated with the need to include fat sources to boost the dietary energy content of the diet (Harrold, 2000). Newly weaned pigs may find it challenging to consume sufficient energy from diets high in barley, but the fibre in barley can also have a prebiotic effect reducing the incidence of diarrhea. Thus, any reduction in growth performance in young pigs may be short-lived. Pigs initially fed diets high in barley may also show compensatory growth during the growing-finishing period, resulting in reduced cost/kg of weight gain to market weight.

GROWING & FINISHING PIGS

Even pigs that have not been fed barley grain during the nursery period can be fed diets based solely or partially on barley grain during the entire growing-finishing period along with supplemental protein sources such as pulses (field pea, lentil, faba bean) or high protein co-products (canola meal, DDGS). This approach can lead to substantial savings in feed cost as compared with corn due to the use of cheaper protein sources at lower levels in the diet, even with consideration that the diets have a lower NE value.

CARCASS & PORK QUALITY

Feeding barley-based diets to finishing pigs reduces dressing percentage (one to two percentage points) compared to wheat. The reduction in dressing is attributed to the relative high fibre content of barley, reducing digesta passage rate and/or increasing gut fill. This reduction in dressing percentage can be compensated for by feeding barley diets slightly longer to increase live market weight by approximately 1.5 to 2.5 kg. This approach can result in a reduced cost of gain as compared with feeding other grains, even with consideration for the slightly longer feeding period.

Feeding high-barley diets to finisher pigs can improve pork quality attributes compared with feeding corn. Barley has a lower fat and linoleic acid content than corn, resulting in firmer pork fat. Feeding barley can also result in whiter pork fat than corn grain, increasing its contrast with myoglobin and thus enhancing the visual appeal of loin marbling (Lampe et al. 2006).

BREEDING GILTS & SOWS

Gestating sows are fed restrictively to prevent excess weight gain and therefore can be fed high-fibre diets that also mitigate the incidence of undesirable chewing behaviours in sows housed in stalls. Gestating gilts and sows can thus be fed barley-based diets with minimal supplemental protein as canola meal, dried distillers grains or soybean meal. Lactating sows can also be fed barley-based diets, but it is usually mixed with wheat grain to further increase the energy content of the diet (Table 15).

PROCESSING FOR FEED

Particle size reduction of barley grain for swine feeding is most commonly achieved by hammer milling. Screen size utilized for barley milling is usually 1/64" to 3/64" smaller than for wheat or corn grain. Barley grain may also be rolled using single- or tandem-pass corrugated rollers that result in more consistent particle size than pulverizing using a hammer mill. Disk-milling barley grain between either a fixed or counter-rotating disk also results in more consistent particle size than hammer milling. Hulls separated during rolling or disk-milling may subsequently be blown off, producing barley with a feed value that is similar to hulless barley and some wheat varieties.

Table 15. PROCESSING METHODS AND MAXIMUM INCLUSION RATES OF BARLEY GRAIN IN SWINE, OTHER LIVESTOCK AND AQUACULTURE DIETS

	PROCESSING METHOD	MAX. INCLUSION RATE (% DM)
Nursery pigs	Hammer mill, dry-rolling, disk-milling	40
Growing and finishing pigs	Hammer mill, dry-rolling, disk-milling	60
Breeding gilts and sows	Hammer mill, dry-rolling, disk-milling	80
Layers and broilers	Whole grain	35
Turkeys	Whole grain	20
Horses	Rolled, extruded, steam-flaked	0.2 (% BW TNC)[1]
Growing rabbits	Whole grain	40 - 45
Breeding rabbits	Whole grain	64
Aquaculture	Extruded pellets	22[2]

[1]*% body weight as total non-structural carbohydrates* [2]*Experimental diets containing barley protein concentrate*