Feeding the 2009 Crop

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A cold and wet spring which delayed seeding and sprouting has resulted in a late harvest throughout most of the Western Canadian Prairies. The early September Saskatchewan crop report confirmed a harvest that is well behind the 5 year average. Although, a long, dry and sunny fall could significantly improve the outcome, it is reasonable to predict that the 2009 harvest will result in significant amounts of grain that is immature, frozen and or sprouted. Because these grains will be discounted, even relative to feed-grade grains, they represent an opportunity for lowering the overall cost of feed for swine producers.

Barley and Wheat

Grains are primarily incorporated into swine rations to provide energy; protein and amino acids can be supplemented with specific ingredients. The digestible energy (DE) content of a grain is due to the total amount of energy (gross energy, GE) in the kernel (derived from fat, starch and protein) and the digestibility of this energy by the animal. Unfortunately energy digestibility can't be measure directly in an analytical lab. The best we can do is to determine nutrient digestibility experimentally and correlate these measurements to the chemical composition. Prediction equations can then be developed. This has been done in a series of experiments with barley and wheat. An equation developed for barley samples collected in 2002 explained 86 % of the variability in DE. It requires the measurement of acid-detergent fibre (ADF) and crude protein (Clowes et al. 2003) while the best equation for wheat uses neutral detergent fibre (NDF) and crude protein (Zijlstra et al. 2003). The R2 of 0.75 for the wheat equation indicates that 75 % of the variation in DE content can be explained using this equation, or conversely 25 % of the variation in DE content is unexplained (Table 1). This data set is particularly relevant for the current year because 14 of the 16 samples used in this data-set were frost damaged.

Density or bushel weight is commonly used to estimate grain quality. Bushel weight is easy, low-cost and fast, ADF and NDF are none of these. Research over the past 20 years, however, has been unable to demonstrate a good relationship between bushel weight and feeding quality of grains for swine. Frost damaged grains often have a low bushel weight, primarily because of an increased fibre and lower starch content. The degree of damage depends on maturity of the crop and when the frost damage occurred. The following table (adapted from a 1980 Agriculture and Agri-Food publication) and graph (adapted from work conducted at the Prairie Swine Centre in 1993) demonstrate why there is some confusion regarding the use of bushel weight as an indication of grain quality.

It is clear from both of these data sets that a decline in density due to frost –damage correlates with decreased DE content of the grain. However, upon closer examination we can see that this relationship is only valid when comparing extremes, for example when comparing undamaged wheat with a bushel weight of 62 to damaged wheat with a bushel weight of 40 (Table 2) but above a bushel weight of about 40 for wheat or 45 for barley, bushel weight does a poor job of predicting DE.

Additional information on canola, ergot, molds and mycotoxins can be found on the Prairie Swine Centre website at www.prairieswine.ca

Table 2. Relative feed value of damaged cereal grains.

Grain		Density kg/hL	(lbs/bushel)	Composition (%) Protein	Fat	Fibre	Ash	Feed value[2]
Wheat	Not damaged	78	(62)	14.8	1.8	2.6	1.5	105
Wheat	Slightly frozen	70	(56)	14.3	1.9	3.5	1.7	104
Wheat	Frozen or sprouted	63	(50)	14.7	2.1	4.0	1.9	102
Wheat	Frozen or sprouted	50	(40)	14.9	2.6	4.6	2.0	90
Wheat	Burnt (20% charred)	68	(54)	12.1	1.9	4.5	2.1	92
Barley	No damage	63	(50)	11.9	2.1	6.0	2.6	100
Barley	Frozen or sprouted	55	(44)	11.8	2.1	6.6	2.5	94
Barley	Frozen or sprouted	45	(36)	11.8	1.9	7.8	3.0	86
Oats	Frozen or sprouted	40	(32)	13.8	5.1	11.1	2.9	89
Oats	Frozen or sprouted	35	(28)	13.4	4.6	13.9	2.9	85

1. Adapted from "Feeding Frost-Damaged and Sprouted Grain to Livestock" Fact Sheet, Sask. Ministry of Ag. (citing Ag and Agri-Food Canada publ # 1277; 1980)
2. Relative to #1 Feed barley

Figure 1. Correlation of grain density with digestible energy content in 16 wheat samples. Samples indicated by X had optimal growing and harvesting conditions while ◆ samples had some degree of frost damage. Note (To convert kg/hL to lbs per bushel, divide by 1.25 or for example a density of 60 kg/hL is a bushel weight of 48).

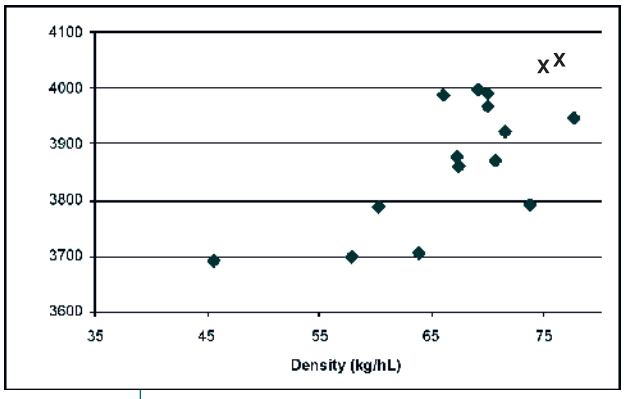

Table 1. Equations to predict DE (Kcal/kg) content of barley and wheat.[1]

		R2
Barley[2] :	DE = 3,542 – 138.8 ¥ ADF + 39.3 ¥ CP	0.86
	DE = 4,054 – 135.2 ¥ ADF	0.80
Wheat[3]	DE = 3,584 + 38.3 ¥ CP – 16.0 ¥ NDF	0.75

1. DE (kcal/kg DM), ADF, ADF and NDF (% DM)
2. Clowes et al. 2003
3. Zijlstra et al. 1999