



TECHNICAL REPORT

by **Groupe Cérès and Nutrition Athéna**



CORN WEIGHT AND NUTRITIONAL VALUE

Dan Bussi eres, B.Sc., agr., Jean-Philippe Martineau, M.Sc., agr. & Martine Pelletier-Grenier, B.Sc., agr.
Swine nutrition specialists for Nutrition Athena inc. and Shakespeare Mills inc.

LACK OF MATURITY AT HARVEST

This fall, corn crops will have lower maturity at harvest time in many Canadian areas. Besides the probability of a lower than usual test weight (lb/bushel or kg/hectoliter), there are other consequences impacting the corn quality that must be considered.

A HIGHER HUMIDITY LEVEL AT HARVEST AND SOMETIMES, EVEN AT THE RECEPTION AFTER THE DRYING PERIOD

A lack of maturity at harvest can often lead to a higher humidity level. On a 100% dry basis, there is no impact on the corn nutritional value, but on a as fed basis, a higher than normal humidity level will have an impact on the corn nutritional value. The humidity percentage of dry corn from the 2018 harvest was between 13 and 14% on average. A maximum level of 15% is usually approved as a quality criteria when receiving corn. An increase in humidity of 1% will lead to a decrease in energy value of 1.2% in corn which is approximately 30 kcal/kg EN.

RISKS OF OVERHEATING DURING DRYING PERIOD WITH RISKS OF BURNING THE SEEDS OR BREAKING THEM

As hard as it can be to clearly point out the consequences of overheating corn during the drying process, studies have shown some negative impacts on animal performances. Maillard's reaction, which can happen when reaching too high of a temperature for too long of a period, will affect some nutrients' digestibility, mainly amino acids. Visual approbation and the detection of burnt seeds must be reported and considered at the reception of corn. For corn of grade 3 or more, the maximum standard is 0.5% of burnt seeds.

Broken seeds' rate can also increase during the drying period with a higher humidity level. Broken seeds will let more humidity come out of the grain kernel which could lead to a higher risk for the development of molds and mycotoxins. For corn of grade 3 or more, the maximum percentage of broken seeds and other foreign material is 5%.

See next page

November 2019



CORN SPECIFIC WEIGHT, NOT AS IMPORTANT AS WE MAY THINK

The bushel weight is a good indicator of the energy value for barley and oats, as it is highly correlated with the proportion of hulls, which determines fiber content. As for wheat, the relationship between energy level and its specific weight is less correlated. For corn, weight and energy seem to have a poor correlation for values between 62 and 68 kg/hl (50 to 54.5 lb/bushel). Studies' data shows that only the lowest specific weight will decrease corn's nutritional value for pigs.

In study done in the 1990's with Ontario corn samples weighing 49 lb/bushel (61 kg/hl), energy level was

determined to be 5% below previous year with good corn bushel weight. Nevertheless, it was specified in the study that the lower weight had a minimal impact on energy level. Other factors had larger impact on the corn energy value, such as variety, maturity level during intense frost, humidity during harvest, drying temperature and kernel damages.

Experiments on growing pigs with the same corn from the same harvest year with lower bushel weights have not shown any difference regarding their performance.

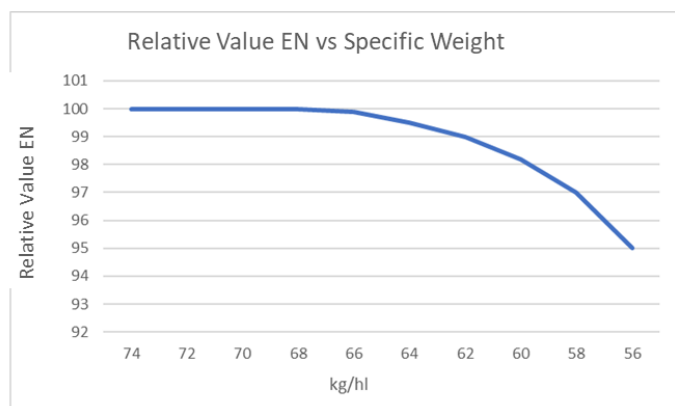
Therefore, only the lower specific weights (<56-58 kg/hl or <46 lb/bushel) seem to affect the animal's performance significantly. The relationship between energy value and specific weight is not as linear as we thought.

THE TRIAL DONE IN QUEBEC CONFIRMS OLDER DATA

In a trial done in 2005 at the CRSAD in Deschambault, QC, three types of corn with the same growing maturity were cultivated on the same site. No major differences of composition or energy value were observed between the three specific weight categories, which were classified as high, medium and low (73.9, 66.6 and 62.1 kg/hl). Energy digestibility was lowered with the decrease in weight, with a more significant decrease of 2% with the lighter seed.

If we adjust the energy value of the corn and by formulating for isocaloric diets, we can obtain.

Graph 1. Relative Value in EN pig vs Corn Specific Weight



IN PRACTICE, WHAT SHOULD WE DO?

Taking into consideration all the past results and observations on pigs, there is no real need to adjust the energy value of lightweight corn up until its specific weight reach 62 kg/hl or less and assuming that moisture level, broken, and split seeds are in normal range.

On the other hand, with an inadequate maturity and the higher risk of broken and heated seeds this will add to the potential impact of dealing with lower energy value with the lighter corn. We estimate that when we reach a weight level below 62 kg/hl or 50 lbs/bu, we would have a reduction in net energy between 0.5 and 1.5% (table 1).

Table 1: Corn Level vs Specific Weight and Predicted Energy Level

Grade	Lb/bushel	kg/hl	Relative EN
# 1	54.4	68	100
# 2	52.8	66	99.9
# 3	51.2	64	99.5
# 4	49.6	62	99
# 5	46.4	58	97

See next page

DO WE NEED TO CHANGE THE FEED FORMULAS FOR AN INFERIOR LEVEL OF CORN?

It is important to know, not only the grade category, but also the specific weight of corn. Corn can be downgraded because of too many broken/split seeds, but it could still have the proper bushel weight. Going from a 68 kg/hl corn to a 66 kg/hl, there is no need to change the formula.

With corn at 64 kg/hl (grade 4), we can assume it would have about 0.5 to 1% less energy if broken seeds are <5%. There is still not really a need to change the formulas.

If broken seeds levels are more than 5-7%, the energy level is probably lower by 1 to 1.5%. It would then be advised to adjust the formula considering that the corn used would have a lower net energy.

For an on farm diet, if we do not have access to an energy source to make up for the lowest energy value of corn, we can anticipate a small deterioration in feed efficiency. As for the impact on average daily gain, it is harder to predict because pigs can adjust their feed intake in order to maintain their daily consumption of energy.

BE VIGILANT WHEN BUYING CORN

The humidity level has an impact on the energy content, the economic value of corn, and therefore, its price value. It is possible that new crop corn will come from areas where the crop matured later on, and will have higher moisture level if not dried properly.

The number of broken or damaged kernels will be another factor to keep an eye on. The toxin levels must also be watched for, especially when corn is higher in moisture than usual and with a higher percentage of broken seeds.

Example of discount value for different corn grade

Level # 1	Level # 2	Level # 3	Level # 4	Level # 5
Same value	Same value	\$2 /t off	\$7 /t off	\$20 /t off or rejected

Considering that #3 corn (64 kg/hl) is almost equivalent to #1 and #2 corn regarding nutritional value, there is no problem buying this type of corn to feed your pigs. It is not recommended to pay a premium price for #1 and #2 corn, if the price to pay is higher than price for # 3 corn.

For # 4 corn, there is, on average, a decrease of 1% in net energy value with a lower price of \$7/t than level #1 and #2 corn. By decreasing the energy value of 1% and by adjusting the corn price by \$7/t, we can formulate an isocaloric diet and save \$2.50 to \$3.00/t of feed.

For level # 5 corn, if the broken seeds' percentage and the humidity level is acceptable, we can think about using this type of corn with a discount of \$20/ton. By decreasing the energy value by 3% and by adjusting the price by \$20/t, we can formulate an isocaloric diet and save \$6.50 to \$7.00/t of feed.

OTHER REFLECTIONS

Lighter corn can be harder to grind, therefore it can slow down your grinding efficacy.

CONCLUSION

Nutrient value and the price to pay for corn will depend on many different factors. Among them, humidity level is the main one followed by broken or damaged seeds.

A lower bushel weight doesn't automatically mean that corn nutrient value is much lower and that feed formulation need to be adjusted. The different grade of corn and price should be compared using their relative energy value as shown in this document. Decisions must be made by taking into account the price of corn and its impact on feed cost while knowing and controlling all the other quality criteria.

To know more and discuss further about this subject, don't hesitate to contact our nutrition specialist.