Digestible Energy Content of Low Quality Barley Fed to Pigs

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Summary

Current equations may not estimate the digestible energy (DE) content of low quality barley. In this experiment, equations were developed using barley's chemical and physical characteristics to accurately predict the DE content of low quality barley. The best equation explained up to 6% of the variation in barley DE content.

Introduction

The DE content of Western Canadian barley has a large range (637 kcal/kg DM). Being able to predict DE content is essential to accurately formulate diets, reach a predictable swine performance, and minimize feed costs. Current equations that predict barley DE content:

1. do not reflect the DE content of very low quality barley (DE content < 2,984 kcal/kg DM),
2. may not give accurate results to the swine and feed industry, because these were developed using a analytical lab different than the lab used by the swine and feed industry.

Barley from the 2002 Western Canada harvest was used, because much of this harvest was of low quality due to poor weather conditions.

Experimental Procedures

Chemical and physical characteristics of 21 barley samples collected in Saskatchewan were measured in a commercial laboratory (Norwest Labs, Lethbridge, AB). An total tract energy digestibility study was conducted collecting six DE measurements per barley sample, using 63 crossbred barrows (initial weight: 33 kg). Pigs were housed in individual pens for 30 days, starting with a 10-day acclimation to a 96% barley diet followed by two consecutive 10-day periods feeding different experimental diets. Each 10-day period comprised of a 5-day adaptation and a 5-day feces collection. Daily feed allowance was adjusted to three times maintenance.

Table 1. Chemical and physical characteristics of the 21 barley grain samples

	Mean	SD	CV	Lowest	Highest
Physical Characteristics					
Field test weight, kg/hL	55.00	7.20	13.1	31.5	66.1
Clean test weight, kg/hL	56.10	6.60	11.7	35.1	66.8
Dockage, %	1.72	1.12	65.2	0.26	4.10
Moisture, %	13.80	1.60	11.5	10.2	17.9
Chemical characteristics on a DM Basis[a]					
DE, kcal/kg					
Measured	3136	229	7.3	2316	3428
Calculated using Fairbairn et al. (1999)	3153	157	5.0	2674	3330
Reported by Northwest	3721	75	2.0	3500	3840
Crude protein, %	13.70	1.40	10.5	10.0	16.4
Acid detergent fibre, %	6.79	1.52	22.4	4.50	11.4
Neutral detergent fibre, %	26.2	2.90	11.1	21.9	35.1

[a] All chemical analyses were conducted at Norwest Labs, Lethbridge

Results and Discussion

Barley grain chemical and physical characteristics are listed in Table 1. Higher (1 to 2 % units) acid detergent fibre (lignin + cellulose), and lower field test weights (-30%) than previously recorded were measured, and the DE content of 3 samples was lower than previously recorded (< 2,984 kcal/kg DM). The new prediction equations

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Table 2. Barley DE (kcal/kg DM) prediction equations[a]

No.	Equation	R^2
1	DE = 4,054 (± 107) – 135.2 (± 15.3) x ADF	0.80
2	DE = 3,542 (± 206) – 138.8 (± 13.3) x ADF + 39.3 (± 14.1) x CP	0.86
3	DE = 4,796 (± 286) – 63.3 (± 10.8) x NDF	0.64
4	DE = 3,388 (± 560) + 14.2 (± 5.08) x test wt - 39.4 (± 12.6) x NDF	0.75
5	DE = 2,927 (± 516) + 13.7 (± 4.40) x test wt – 43.6 (± 11.0) x NDF + 43.8 (± 16.6) x CP	0.82

[a] Test wt (kg/hL) were measured "as is", all other grain characteristics were measured on a DM basis

explained up to 86% of the data's variability (Table 2), and more accurately predict the DE content of low quality barley than regular laboratory reports (Figure 1), because the DE content reported by the commercial laboratory were higher than our measured DE values. The equation by Fairbairn et al. (1999) estimated the measured DE content based on ADF (R^2 = 0.75), but was not as accurate as the new equations presented here.

Conclusion

New equations to predict barley DE were created, using chemical characteristics measured in a commercial lab, that explain a large proportion of the variability in barley DE content. Such an index of barley DE content will allow barley to be more effectively utilized in swine diets.

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Figure 1. Comparison of DE Values by analysis, ADG equation and actual pig response