IMPLEMENTATION OF THE CANADIAN FIVE YIELD GRADE RULER

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Introduction: As a means to facilitate North American cross-border beef trade, in January 2019, Canada adapted its grading system from a three-class total lean yield (TLY) to a five-class retail cut yield (RCY). The relationships and implications of this transition provide important historical grading benchmarks.

The aim of this study was to interpret the relationships and implications of the transition from TLY to RCY yield estimations and to adapt the traditional Canadian grading system of three TLY classes to a new system of five RCY classes.

Materials and Methods: A total of 720 animals finished on a common commercial diet were used to establish the relationship between yield percentages, TLY and RCY. All the animals were maintained and cared for according to the guidelines of the Canadian Council on Animal Care (2009). Following splitting of the carcasses, hot carcass side weights (HCW) were recorded. After conventional chilling at 2°C for 72 h, left and right carcass sides were weighed (CCW) to determine cooler shrink loss. After 20 min exposure to atmospheric oxygen, carcasses were assessed by a certified grader from the Canadian Beef Grading Agency (CBGA). Assessment included fat thickness (at the three-quarters position from the spinous process, American system), grade fat (measured at the minimum point of thickness over the rib in the fourth quadrant from the spinous process, Canadian old system, and assigned to fat classes in 2 mm increments, e.g., fat class 1: 2-3 mm, fat class 2: 4-5 mm, etc.), and ribeye area (REA: M. *longissimus thoracis* area in cm^2). Remarkably, this harmonization also entailed the change of the Canadian grade fat measurement at the 12^{th}-13^{th} rib from the minimum point of thickness perpendicular to the outside surface, and within the fourth quarter of the M. *longissimus thoracis*, to the ¾ point from the spinous process. Muscle scores (1-4) were also determined on the basis of M. *longissimus thoracis* length and width, measured at the grade site (Jones et al. 1991). Fat class and muscle score were then used to estimate TLY according to the equation: TLY (%) = 63.5 + 1.05 × (muscle score) – 0.76 × (grade fat) (Jones et al. 1991; CBGA 2020). In turn, the USDA-RCY percentage was calculated using the equation described by Murphey et al. (1960): USDA-RCY (%) = 51.34 – 5.78 × (adjusted fat thickness at the ¾, inches, AFT) – 0.46 × (kidney, pelvic, and heart fat percent, KPH, %) – 0.0093 × (hot carcass weight, HCW, pounds) + 0.74 × (REA, square inches).

Additionally, the RCY matrix was validated with a population of 750 carcasses from three Canadian beef plants with capabilities for Camera Vision Systems RCY evaluations. The predictive ability (R^2, RMSE) was evaluated using SAS 9.4 (2014).

Results and Discussion: The serial slaughter of the cattle from 302.0 to 754.0 kg of live weight, resulted in a range in HCW (192.2 – 536.4 kg), REA (52.0 – 124.0 cm^2), marbling (220 – 710, USDA marbling score units), Canada-TLY (42.5 – 65.6%), and USDA-RCY (45.1 – 55.3%) which were within the actual range of the North American beef carcass market (CanFax, 2020).

The traditional Canadian grade ruler (Figure 1) considered four muscle scores and ten fat classes, ranging from 1 to 9 in 2 mm increments assessed at the minimum point of thickness (mm), perpendicular to the outside surface, and within the fourth quarter of the ribeye. Using muscle score and fat class, estimated TLY class was defined with break points at 59% or more, 58 to 54% and 53% or less for Canada 1, 2 and 3 carcasses, respectively.

Regressing Canada-TLY and USDA-RCY using a linear regression model (Figure 2) resulted in a high regression coefficient (R^2 = 0.80; RMSE = 0.8472; $P < 0.0001$).

By considering both the regression model and the breakpoints for the five classes of the USDA-RCY, a matrix of the estimated RCY percentage was developed and implemented into the Canadian grading ruler, characterized by four muscle scores and fifteen fat classes (Jones et al., 1991). The breakpoints for the five classes of the USDA-RCY were then used to calculate breakpoints for the new Canada-RCY classes, namely, Canada Y1 ≥ 52.3%; Canada Y2 from 52.3 to 50.0%; Canada Y3 from 50.0 to 47.7%; Canada Y4 from 47.7 to 45.4%; and Canada Y5 ≤ 45.4%. The corresponding fat class and muscle score values defining each of the Canada-RCY grades were also included and implemented in the new harmonized Canadian grade ruler (Figure 3). This improvement will provide a common yield grade language to facilitate the trade between Canada and the U.S.

The validation of the adapted Canadian Grade Ruler, including the RCY grade matrix against the Camera Vision Systems RCY estimations showed R^2 values between 0.60 - 0.75, which corresponded with higher accuracy levels than 96.7% for RCY (%) estimation and higher correspondence values than 80.0% for yield grade estimation.

Conclusion: Yield grade evaluations using the Grade Ruler are still required in Canadian beef plants where camera grading has not been implemented, or only partially introduced. Regression analyses of the Canada-TLY and USDA-RCY showed a strong relationship (R^2 = 0.80) in a research population. A successful adaptation of the Canadian grade ruler to a Canada-RCY percentage matrix with five yield class breakpoints (Canada 1 – Canada 5) was carried out. The adapted Canadian grade ruler is an accurate and reliable grading tool and can be implemented to provide harmonization between Canadian and USDA yield estimations, facilitating cross border beef trade.

References

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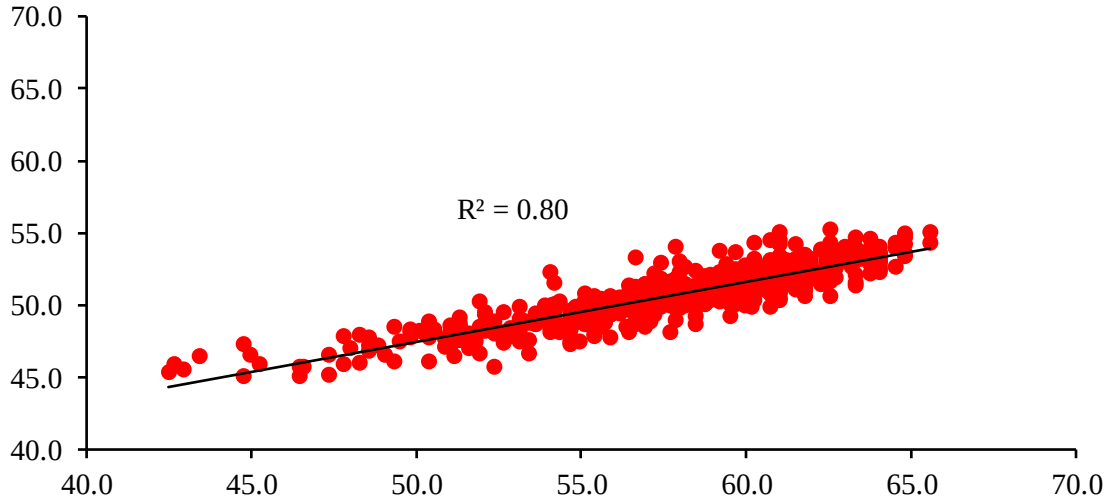
Figure 1. Traditional Canadian grade ruler defined by three total lean yield classes and four muscle scores and ten fat classes.

Figure 2. Relationship (R^2) [a] between the total lean meat yield and retail cut yield.



[a] R^2: coefficient of determination.

Figure 3. Updated Canadian grade ruler defined by five retail cut yield classes and four muscle scores and fifteen fat classes.