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CARCASS CALCULATOR APP: A QUICK AND EFFECTIVE WAY TO DETERMINE CARCASS CUTABILITY AND QUALITY OF BEEF, LAMB AND PORK CARCASSES

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ABSTRACT

Various complex equations are used to determine carcass merit, such as dressing percentage, yield grade and the cutability of a beef, lamb, or pork carcass. These equations are used by the USDA and throughout the U.S. livestock industry by producers, university faculty, agriculture teachers, carcass graders, buyers, and livestock judges to evaluate carcass merit. Carcass merit and carcass weight are the primary factors used to determine the value of beef cattle, lambs and pigs when marketed on a carcass basis. The WSU Livestock Carcass Grade & Cutability Calculator app was developed to provide evaluators of livestock and carcasses with a quick and easy way to calculate carcass yield grade, dressing percentages, and cutability of beef, pork and lamb carcasses. Individuals can estimate these carcass merit factors from live animal data of beef cattle, lambs and pigs, in addition to calculating actual carcass merit from carcass data.

INTRODUCTION

Various complex equations are used in both live animal and carcass evaluation to estimate or determine the actual carcass merit of beef cattle, lambs and pigs. These equations enable one to determine the expected carcass weight, amount of lean, or expected retail cuts based on a live or carcass basis. These equations are used by the USDA and throughout the U.S. livestock industry by producers, university faculty, agriculture teachers, carcass graders, buyers, judges and others involved in livestock production.

Potential or actual carcass weight and carcass merit are the primary factors used to determine the value of beef cattle, lambs and pigs when marketed as finished animals on a live or carcass basis. However, potential carcass merit is also used to sort and value feeder animals at weaning or sales. Carcass traits are moderately to highly heritable (Utrera and VanVleck, 2004; Mortimer et al., 2014; and Miar et al., 2014). Thus carcass merit in all species can be improved by genetic selection; however nutrition, management and timely marketing of livestock are also important. An understanding of how carcass merit is determined will aid producers, managers and evaluators to make management decisions to improve quality and profitability.

The differences between species and the various factors used within the carcass merit equations cause them to be complex and difficult to recall. Use of a basic calculator can be confusing because algebraic order of operation rules must be followed to ensure accuracy. Most individuals using these equations use a spreadsheet to increase efficiency and accuracy. It is not practical to have a computer available in a barn or carcass cooler to complete calculations. However, according to a survey by *Farm Journal Media*, 87% of all farmers are likely to own a smartphone by 2016 (Potter, 2015). Smartphone and mobile technology allow individuals to have useful decision making aids at their fingertips. To continue providing effective and timely Extension resources for clientele, smartphone apps need to be developed for farming and ranching practices that influence production and profitability (Dvorak et al., 2012).

METHODS

The WSU Livestock Carcass Grade & Cutability Calculator App (Carcass Calculator App) was developed to provide evaluators of livestock and carcasses with a quick and easy way to calculate carcass yield grade, dressing percentages, and cutability of beef, pork and lamb carcasses (Figure 1). Individuals can estimate these carcass merit factors from live animal data of beef cattle, lambs and pigs, in addition to calculating actual carcass merit from carcass data. The Carcass Calculator App not only allows livestock and carcass evaluators to determine important information about animal and carcass merit, but it also allows users to expand their understanding of carcass merit concepts and factors influencing carcass weight and merit.



Figure 1. WSU Carcass Calculator App Platform Advertisement

Carcass Calculator Description

The Carcass Calculator App will calculate dressing percentage, estimated yield grade, actual yield grade, and cutability for the three main graded livestock species; beef cattle, lambs and pigs, from estimated live values or measured carcass data (Busboom et al., 2003 a, b and c; Table 1). The app will report calculated yield grade to the nearest hundredth. The app will also report the yield grade per USDA standards, rounding down the calculated yield grade to the nearest whole number between 1 and 5 (Figure 2). Due to differences in packing plant and harvesting procedures, the Carcass Calculator App will correct chilled carcass weight to a hot carcass basis for all three species and will correct pork carcass merit to a skin-on, head-off basis. For beef cattle, the app also has an information tab about USDA quality grades. Users can review pictures of USDA marbling degrees along with a summary of the degrees of marbling required for "A" maturity beef carcasses to receive various USDA grades (Boggs et al., 2006).

Table 1. Carcass Calculator App Calculations

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
| Beef Cattle/ Beef Carcasses | |
|---|--|
| Estimated Yield Grade ¹ | $2.50 + (2.5 \times \text{estimated backfat thickness}) + (0.20 \times \text{estimated percent kidney, pelvic and heart fat}) + (0.0038 \times (\text{live weight} \times \text{estimated dressing percentage})) - (0.32 \times \text{estimated ribeye area})$ |
| Dressing Percentage ² | $(\text{hot carcass weight} / \text{live weight}) \times 100$ |
| Yield Grade ¹ | $2.50 + (2.5 \times \text{adjusted backfat thickness}) + (0.20 \times \text{percent kidney, pelvic and heart fat}) + (0.0038 \times \text{hot carcass weight}) - (0.32 \times \text{ribeye area})$ |
| Percent Boneless Closely Trimmed Retail Cuts (BCTRC) ² | $51.34 - (5.78 \times \text{adjusted backfat thickness}) - (5.78 \times \text{hot carcass weight}) - (0.462 \times \text{percentage of kidney pelvic and heart fat}) + (0.740 \times \text{ribeye area})$ |
| Lambs/Lamb Carcasses | |
| Estimated Yield Grade ¹ | $(\text{estimated backfat thickness} \times 10) + 0.4$ |
| Dressing Percentage ² | $(\text{hot carcass weight} / \text{live weight}) \times 100$ |
| Yield Grade ¹ | $(\text{adjusted backfat thickness} \times 10) + 0.4$ |
| Percent Boneless Closely Trimmed Retail Cuts (BCTRC) ² | $49.936 - (0.0848 \times \text{hot carcass weight}) - (3.530 \times \text{body wall thickness}) + (2.456 \times \text{ribeye area})$ |
| Pigs/Pork Carcasses | |
| Estimated Percent Muscle | $\{8.588 + [0.465 \times (\text{live weight} \times \text{dressing percentage})] + (3.005 \times \text{estimated loin eye area}) - (21.896 \times \text{estimated } 10^{\text{th}} \text{ rib fat thickness})\} / (\text{live weight} \times \text{dressing percentage}) \times 100$ |
| Dressing Percentage ² | $(\text{hot carcass weight} / \text{live weight}) \times 100$ |
| Percent Muscle (ribbed carcass) ^{2,3} | $\{8.588 + (0.465 \times \text{hot carcass weight}) + (3.005 \times \text{loin eye area}) - (21.896 \times 10^{\text{th}} \text{ rib fat thickness})\} / \text{hot carcass weight} \times 100$ |
| Percent Muscle (unribbed carcass) ^{2,3} | $\{23.568 + (0.503 \times \text{hot carcass weight}) - (21.348 \times 10^{\text{th}} \text{ rib fat thickness})\} / \text{hot carcass weight} \times 100$ |

²Calculated yield grade reported to hundredths. USDA reports official yield grade by rounding down the calculated yield grade to the nearest whole number between 1 and 5. Any calculated yield grades above 6 are rounded to 5 and yield grades below 1 are reported as 1.


²App will correct chilled weight to a hot carcass weight. App will use a 2% correction for typical loss realized during chilling for beef and lamb carcasses and 1.5% for pork carcasses. (Busboom, Unruh, and Lundrigan, 2003; EB1460, EB1461, EB1462)

³App will correct for skin-off and/or head-on for pork carcasses to report pork calculations on a skin-on, head-off basis. App will use 6% correction to carcass weight for skin removal and .1 inch to adjust to a skin-on basis; and will use 6% correction to carcass weight for head remaining on the carcass. (Busboom, Unruh, and Lundrigan, 2003; EB1461)

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Back



Help

Lamb Actual Yield Grade

Adjusted Fat Thickness

Calculate

Calculated Yield Grade = 2.60

USDA Yield Grade = 2

Only back fat is used to calculate official USDA Yield Grade for lamb carcasses. Officially reported USDA Yield Grades are rounded down to nearest whole number between 1 and 5. Calculated Yield Grades less than .99 are

| Yield Grade | % BCTRC |
|-------------|---------|
| 1 | 50.4% |
| 2 | 49.1% |
| 3 | 47.8% |

Figure 2. Calculated Yield Grade and USDA Yield Grade

Within the data entry section for each species and each equation, an expected range is highlighted in gray with the average for that specific carcass measurement identified in parentheses (Figure 3; Boggs et al., 2006). Each species section of the app has a "Help" section with equations and glossary definitions (Figure 4). All measures in the app are reported in U.S. weights and measurements.

Beef Actual Yield Grade

Carcass Weight: 0-9999 pounds

Hot carcass weight?: YES NO

Adjusted Fat Thickness: 0-1.50 in (.45)

Percent Kidney, Pelvic, Heart Fat: 0-5.0% (2.5%)

Rib-Eye Area: 7-20.0 sqin. (...)

Calculate

Calculated Yield Grade = 0

Figure 3. Expected Data Range and Industry Average Identified in Input Cells

Pork Glossary

Live weight - Weight prior to slaughter.

Dressing Percentage - This is the proportion of live weight that is contained in the carcass. (Equation used in app - ((Hot carcass weight / final live weight) x 100). If carcass is not a hot carcass, divide hot carcass weight by 0.985. Most carcasses shrink about 1.5% during the chilling process. Adjust skinned, head-off carcasses to a skin-on basis by dividing warm weight by 0.94 (skin is about 6% of the carcass). Adjust head-on skin-on carcasses to a head-off basis by multiplying warm weight by 0.94 (the head is about 6% of the carcass). Head-on/skin-off and head-off/skin-on carcasses require no weight adjustment.)

Figure 4. Individual Species Glossary Under Species Help Tab

Through the use of the WSU Livestock Carcass Grade & Cutability Calculator app, individuals can expand their understanding of factors that impact carcass merit and how they are calculated. Download of the Carcass Calculator App is available free for both Android and iOS platforms.

Use and Limitations

The Carcass Calculator App was released publicly in the summer of 2015. Use of the app has been promoted through news releases and use at WSU Meat Evaluation and Analysis (MEAT) Team and Extension programs. After approximately 18 months of download availability, the Android platform of the App was downloaded 360 and the iOS platform was downloaded 698 times, for a total 1058 total downloads. However, without direct user contact it is difficult to conduct impact evaluations to determine how users are using the app and if they have made production or management changes as a result of the information they received from using the app.

The accuracy of calculated carcass merit using this app or any computer/calculator is based on the accuracy of measurements entered. To increase accuracy in determining the dressing percentage, yield grade, and cutability, the user needs to have accurate measurements. A basic understanding of carcass evaluation will enhance the user's ability to use the app. This tool is not meant to replace or verify USDA grades determined by USDA graders or grid pricing used to determine value of specific livestock or carcasses.

CONCLUSION

Complex algebraic equations are used to determine carcass merit, which are used in production and marketing of beef cattle, lambs, and pigs. The inaccurate use of carcass equations can negatively impact production by youth and commercial producers from misunderstanding the relationship and impact production decisions have on carcass merit and marketability (Schinckel and Rusk, 2012). The WSU Livestock Carcass Grade & Cutability Calculator app is an easy and portable way for producers, niche marketers, butchers, livestock judges, meat evaluators, and youth to accurately and quickly determine the dressing percentage, yield grade, and cutability of beef, pork or lamb carcasses. As individuals use the app to determine carcass merit, they will learn how specific carcass factors positively or negatively influence the carcass merit, which in turn can be used to impact future decisions about animal selection, production, evaluation, sorting and marketing.

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