USE OF IN-PEN PARTIAL BODY WEIGHTS IN BEEF CATTLE

Dr. Michael MacNeil
Delta G
Miles City, MT

Acknowledgements

Reference: MacNeil, M. D., D. P. Berry, S. A. Clark, J. J. Crowley & M. M. Scholtz. 2021. Evaluation of partial body weight for predicting body weight and average daily gain in growing beef cattle. Translational Animal Science 5:1-12. https://doi.org/10.1093/tas/txab126

This work was in part funded by Vytelle LLC. Vytelle were allowed to review a draft of the article prior to submission in order to avoid the unintended disclosure of their proprietary intellectual property

Technology

Scale conjoined with a watering device or feed trough

Passive capture of body weight or partial body weight

Currently, several companies market such products

Protocols need to be evaluated

Frequent weight recording

- May increase accuracy of weight records and ADG
- May shorten test periods
- Management uses
- Less stress on animals
- Less labor and need for human-animal interaction
- Experimental applications in studying effects on patterns of growth

Objectives

Determine the utility of partial body weights in predicting both full body weight and ADG

Determine length of test required to accurately measure ADG when using partial body weights

The data

- Partial body weights, predicted full body weights and recorded body weights

- 8,972 growing cattle evaluated over a 63^{+}day period
- 35 contemporary groups
- different breed types - *Bos indicus*, *Bos taurus africans*, *Bos taurus*, crosses and composite bulls and heifers

- Focused on the beginning and end of a performance test, and on ADG over the performance test period

Results – Beginning of test

- Partial body weights
  - the interaction of the contemporary group with the regression of recorded body weight on partial body weight was highly significant ($P < 0.01$)
  - $b = 1.82 \pm 0.15$ (range 1.86 ± 0.19 to 0.85 ± 0.04)
  - $r = 0.95$ (range 0.99 to 0.73)
  - For eight contemporary groups, the intercept of the regression of recorded body weight on partial body weight was positive ($P < 0.05$). This indicates that a multiplicative adjustment to predict recorded body weight from partial body weight would produce a biased estimate of recorded body weight

Results – Beginning of test

- Predicted body weights
  - The interaction of the contemporary group with the regression on predicted body weight was highly significant ($P < 0.01$)
  - $b = 1.02 \pm 0.05$ (range 1.11 ± 0.13 to 0.84 ± 0.02)
  - $r = 0.97$ (range 0.99 to 0.87)
  - Deviations of predicted body weight from measured on-test body weight were significant for about half of the contemporary groups and ranged from 29.61 ± 0.96 kg to -9.91 ± 1.48 kg

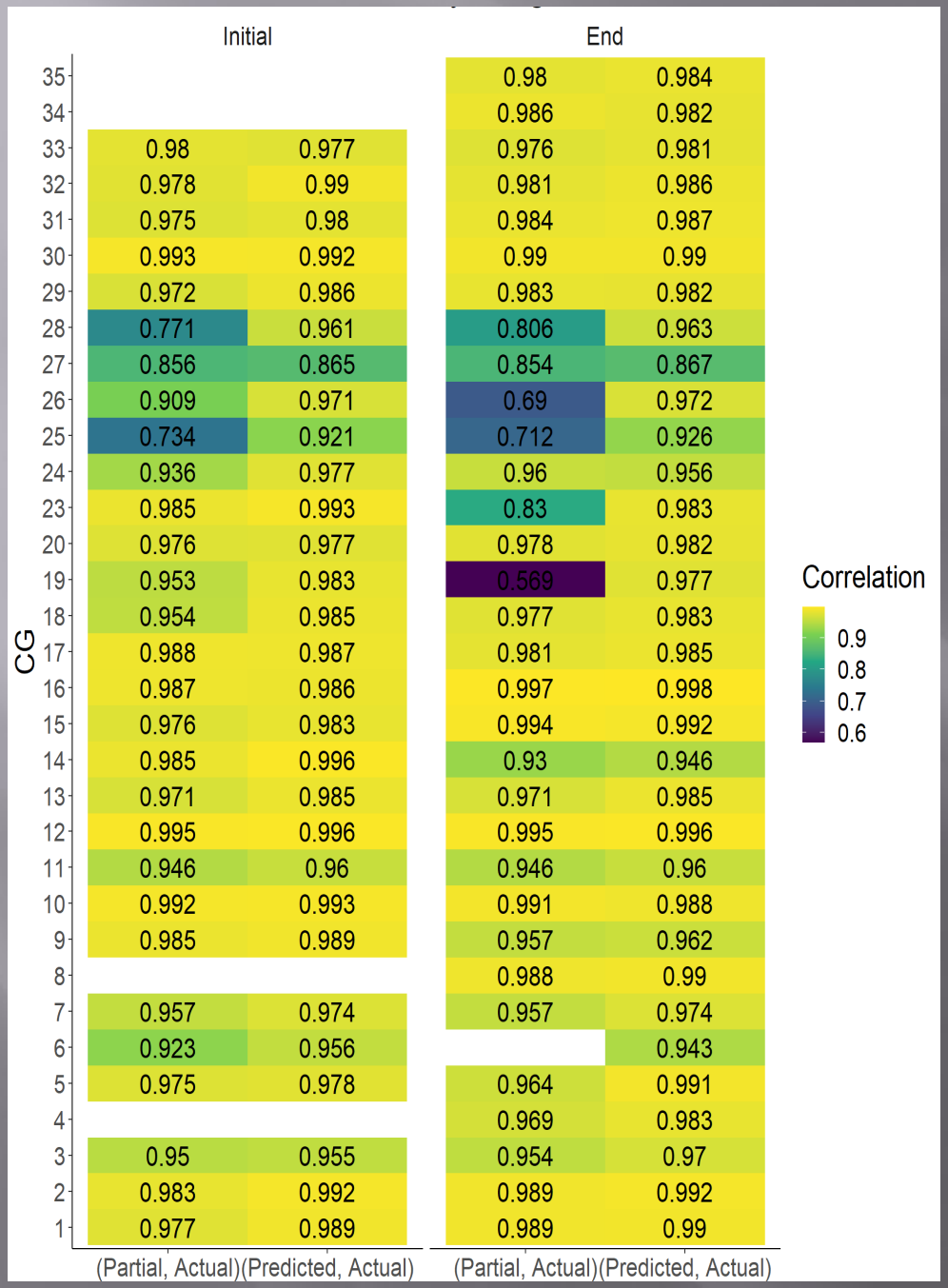
Results – End of test

- Partial body weights
  - b = 1.73 ± 0.09. (range 1.90 ± 0.15 to 0.78 ± 0.07)
  - r = 0.95 (range 0.99 to 0.71)

  - Use of a multiplicative adjustment to predict recorded body weight from partial body weight would produce a biased estimate of recorded body weight for eight contemporary groups.

Results – End of test

- Predicted body weights
  - The interaction of the contemporary group with the regression on predicted body weight was highly significant ($P < 0.01$)
  - $b = 1.02 \pm 0.05$ (range 1.12 ± 0.04 to 0.78 ± 0.05)
  - $r = 0.97$ (range 0.99 to 0.87)
  - Deviations of predicted body weight from measured on-test body weight were significant for about half of the contemporary groups and ranged from 28.75 ± 1.47 kg to -9.63 ± 2.37 kg

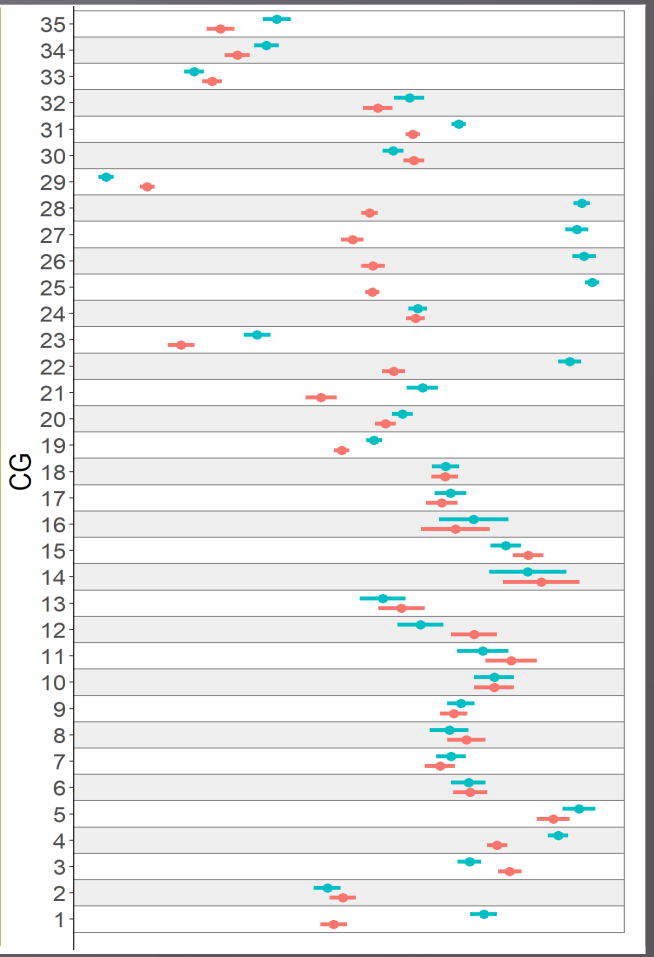


- Correlation of partial body weight with predicted body weight was very high (0.96)
- Tendency for regression of recorded body weight on partial body weight to increase over the test period, suggesting that a constant adjustment for a contemporary group may not be sufficient

Results – Average Daily Gain

Correlations of ADG from recorded body weight with ADG from partial body weight and predicted body weight averaged 0.81 ± 0.03 and 0.78 ± 0.04, respectively

ADG derived from predicted body weight was generally greater than ADG from recorded body weight

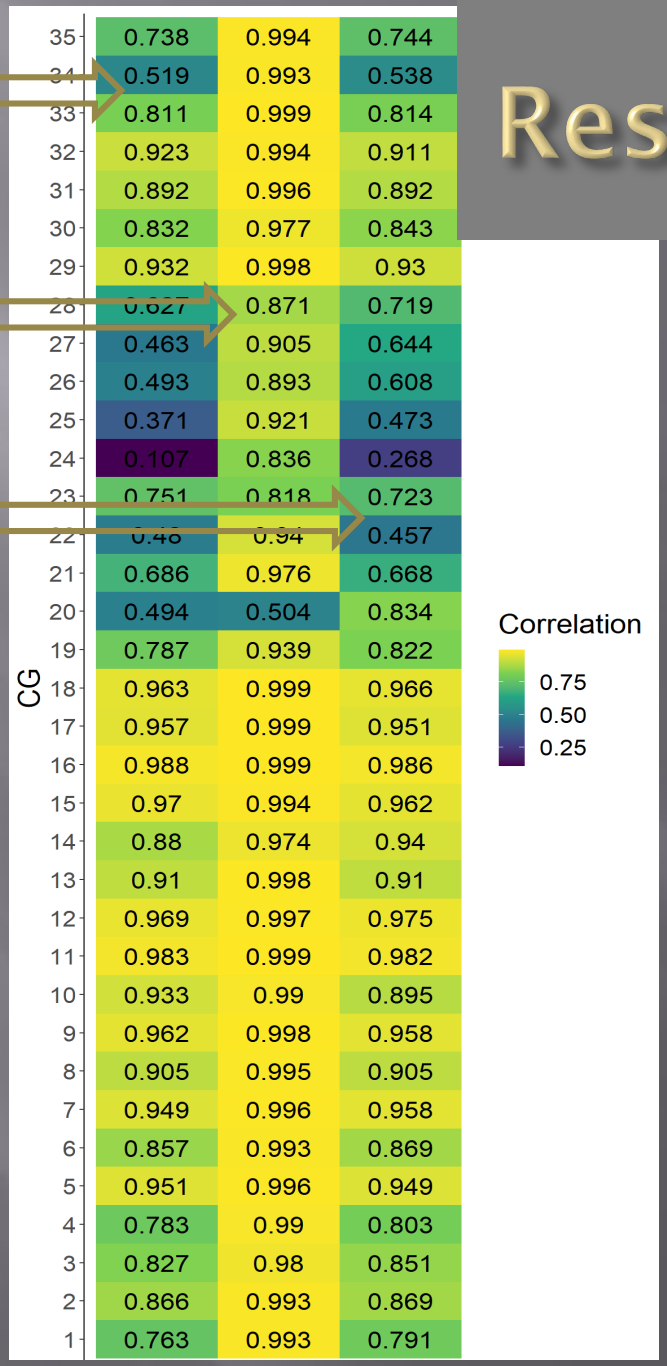


Results – ADG

Predicted weight, Recorded weight

Predicted weight, Partial weight

Recorded weight, Partial weight



Length of test

- Made use of predicted body weight
- Previous studies which attempted to determine the required minimum length of the test period for determining ADG made use of the part-whole correlation that has an asymptotic value of 1.0
- The suggested approach is based on model-order dependent regression with the first part of the test not being adjusted for the latter part of the test, but the sum of squares due to regression for the latter part of the test being adjusted for the portion of the test that preceded it

Results – Length of test

- 35- and 43-day tests were found inadequate for measuring ADG
- ADG in the first 50 days of the test period explained 80.0% of the within contemporary group variance with the latter part of the test explaining only 2.0% more
- Non-statistical factors affect the decision regarding length of the test period

Conclusions

- When the capacity of the facilities limits the number of animals that can be tested, a 50-day test and testing more animals will likely result in greater power of the test for the hypothesis of interest
- If the number of animals that are available to test is the limiting factor, then a longer test is probably preferable
- Adjustment from partial body weight to body weight likely changes over the test period
- Predicting full body weight from partial body weight is likely to have acceptable accuracy in many applications

Personal Opinions

- In a research context, researchers need to control the data; to me, black boxes that edit data and predict values are not desirable
- Opportunities are lost when the hundreds of partial body weights captured for each animal on a day are summarized into daily values
- It seems there is little problem using partial body weights to predict a residual intake and gain phenotype
- Using records generated from partial body weight observations in the context of genetic evaluation needs further research
- Curious if partial body weights could be efficacious in monitoring for onset of bovine congestive heart failure

Questions