

# 49-DAY FEED EFFICIENCY TRIALS

## SUMMARY

Vytelle currently recommends trials of 70 days in length for accurate calculation of average daily gain (ADG) and residual feed intake (RFI) values when chute weights are used. This duration may be shortened to 49 days using high frequency partial body weights (PBW) collected with In-Pen Weighing Positions. Evidence does not yet support expected progeny difference (EPD) or index calculations for RFI when growth and intake data are collected during different time periods. Variations in animal growth patterns are more pronounced when measured on short timeframes, acting as environmental “noise” which can mask the genetic “signal” of interest.

## RESIDUAL FEED INTAKE CALCULATION

Residual feed intake is a phenotype that quantifies the relative efficiency of animals. To calculate RFI, trends in dry matter intake (DMI) and weight are collected over a defined period of time for a contemporary group of animals. From this input data, animals performing better (negative RFI) or worse (positive RFI) than the group average may be identified. There are two main requirements for accurate calculation of RFI:

1. Accurate mid-weight, ADG and DMI data for individual animals;
2. Appropriate selection of contemporary groups.

## DATA COLLECTION

Animal weight, gain and feed intake patterns vary over time. To obtain values representative of the long-term performance for an individual animal, data must be collected both accurately and over an appropriate timeframe. Studies evaluating the use of Feed Intake Nodes have shown that accurate and representative values for DMI may be obtained in 35 days (Wang et al. 2006, Culbertson et al. 2015, Benfield et al. 2016). This is made possible by the highly accurate and daily feed intake data provided by the equipment, as well as a lower level of variation in individual feed intake trends.

## WEIGHT

Accurate weight measurement, as it applies to RFI, is somewhat more difficult using conventional chute weighing techniques. Animals' weights fluctuate over time due to several factors, including rumen fill, water consumption, feeding patterns, etc. When a chute weight is taken, it is not generally known if an animal is at a heavy or light point in its daily cycle. An analysis of over 40,000 live chute weight measurements found that in many cases consecutive day chute weights can vary by as much as 40 lbs. Table 1 below shows the proportion of consecutive day chute weights with differences greater than the specified amounts. The level of variation in chute weights affects the accuracy of ADG calculations. Such fluctuations in chute weights can be eliminated by collecting multiple body weights each day, using In-Pen Weighing Positions.

**TABLE 1. PROPORTION OF CONSECUTIVE-DAY WEIGHTS WITH DIFFERENCES AT GIVEN THRESHOLD LEVELS**

WEIGHT DIFFERENCE	> 10 lb	> 20 lb	> 30 lb	> 40 lb
PROPORTION OF WEIGHTS	54.0%	25.6%	11.2%	5.0%

## TRIAL DURATION OF 70 VS. 49 DAYS

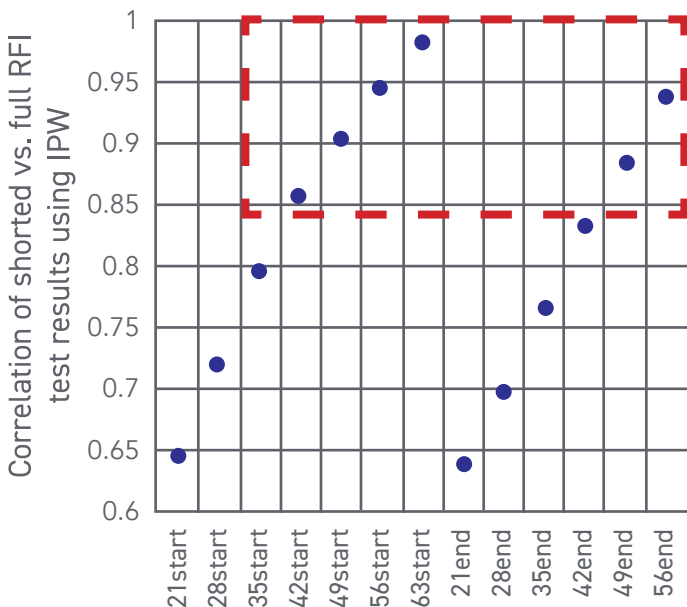
Previous work on efficiency measurement trials using chute weighing have suggested minimum durations for RFI calculation (Wang et al. 2006, Culbertson et al. 2015). The limiting factor to RFI calculation in these cases was measuring consistent ADG values. Including adaptation periods, both published durations for accurate RFI calculation were in excess of 70 days. During trials, adaptation to the Feed Intake Nodes is monitored by Vytelle in parallel with the user of the system. A 70-day trial period with a 10- to 14-day warm up is therefore recommended. Trials may be extended if animals appear to not have adapted to the system during the beginning portion of the trial.

The lower uncertainty of ADG measurements provided by a daily weighing regime (provided by In-Pen Weighing Positions) can reduce the necessary duration of an efficiency measurement trial. An analysis of 27 RFI trials (with 1,874 animals) weighed using In-Pen Weighing Positions determined that a 49-day trial duration (plus approximately 10 days of system adaptation) was adequate to measure RFI and ADG accurately (Benfield, 2016). This study also demonstrated more variability between performance at start and end regions of individual trials, compared to average performance and shortened trial regions, thus demonstrating short-term variability in phenotypes.

Figure 1 below plots the correlations between shortened trial regions, from the start and end of a test period, and a full-length 70-day trial. The figure shows that by only using the first or the last 49 days of weights from the In-Pen Weighing Positions from the full test period, nearly the same results will be achieved. And there is little increase in accuracy with extending the trial period.

## RFI TRIAL PARAMETERS

As RFI is a relative parameter, the composition of the group of animals evaluated affects all RFI values calculated. To isolate differences in efficiency from other effects, a contemporary group should be made up of animals which are similar in terms of sex, breed, age and size. At the start of the trial, animals should be between 8 months (after weaning) and 18 months of age (post weaning to mature weight is highly dependent on the feeding regime), with a maximum range of 90 days between animals, to ensure that composition of gain is consistent and issues due to feeding dominance are minimized. Contemporary groups must have a minimum of four valid animals at the end of trial, in order to calculate RFI. Animals should each be tagged with a new half-duplex (HDX) radio frequency identification (RFID) transponder that is ICAR compliant and be allowed to acclimatize to the functioning data acquisition system for at least 10 days prior to trial data collection. This allows the adaptation period to the system to be monitored.



**Figure 1. Correlations between RFI values calculated for full-length (70-day) and truncated trials. ‘Start’ indicates weights collected from the start date onward and ‘end’ indicates weights collected from the end date back. Example: 21start refers to the first 21 days of the test period while 21end refers to the last 21 days of the test period.**

All animals in a contemporary group should be treated equally and have ad libitum access to feed at all times during the trial. Trial days where animals were unable to access feed at all times should be noted and removed from the calculation. Similarly, any technical issues with feed intake calculation on an individual or pen basis should be grounds for exclusion of data. Animals with other anomalous patterns in intake or gain (due to sickness, poor adaptation or other factors) should

also be excluded from the contemporary group. To accurately identify these patterns in trials using chute weighing, valid feed intake data must be available within five days of the first and last chute weights utilized. Table 2 below gives a summary of recommended parameters for an RFI measurement trial. These are based on a review of the literature as well as in-house analysis, and will continue to be updated based on current research findings.

**TABLE 2: SUMMARY OF CALCULATION PARAMETERS FOR RESIDUAL FEED INTAKE (RFI) TESTING**

	CRITERIA	FEED INTAKE & CHUTE	FEED INTAKE & IPW <sup>1</sup>
Duration	Test Length	≥ 70 Days	≥ 49 Days <sup>2</sup>
	System Adaptation Period <sup>3</sup>	10-14 Days	10-14 Days
	Valid Feed Intake Days <sup>4</sup>	≥ 35 Days	≥ 35 Days
Weight	Range of ADG	0.0-8.8 lb/day (0.0-4.0 kg/d)	0-8.8 lb/day (0.0-4.0 kg/d)
Chute Weights		2 Consecutive Days at Start & End + 1 mid-trial <sup>5</sup>	2 Chute Weights: 1 Chute Weight at Start & End <sup>6,7</sup>
Feed Intake Calculation	Feed Access	Ad Libitum	Ad Libitum
	Missing or Deleted Feed Intakes	Regressed (Linearly)	Regressed (Linearly)
	Average DMI Calculation	Simple Average - Including Regressed Data	Simple Average - Including Regressed Data
	Weigh Day Feed Intakes	Kept <sup>8</sup>	Kept <sup>8</sup>
	Pen Check Failure Intakes	Deleted – Regressed Back In	Deleted – Regressed Back In
	Individual Animal Missed Days <sup>9</sup>	Deleted – Regressed Back In	Deleted – Regressed Back In
	Unaccounted Feed Supply	< 15%	< 15%
	Unaccounted Feed Disappearance	< 10%	< 10%
	Low Intake Threshold	< 25% of Animal Average	< 25% of Animal Average

<sup>1</sup>IPW = In-Pen Weighing Positions; <sup>2</sup>Benfield, D.B. 2015; Benfield, D.B. et al. 2016; <sup>3</sup>Animals should start the trial adapted to the system and to the final diet and must be tagged with new HDX RFID tags that are ICAR compliant; <sup>4</sup>The first 5 consecutive days and the last 5 consecutive days of the trial must each contain less than 5 failed days; <sup>5</sup>Vytelle standards are 2 consecutive Days, but chute weights can also be measured in 14d intervals; the Vytelle Analytics team must be advised on which method is being used; <sup>6</sup>Trials with new breeds or new customers, it is required to have a total of 500 chute weights over 5 separate weighing days; <sup>7</sup>Start Weight: Animals should be in the pen, with an EID tag for approx. 7 days before the start chute weight is taken. End Weight: Animals must go back into the pen for at least 1 day after the final chute weight is taken; <sup>8</sup>Data is always verified whether to be kept, by the Vytelle Analytics team; <sup>9</sup>Individual Animal Missed Days could be for example tag changes, animal escaping pen, and others.

## EXPECTED PROGENY DIFFERENCE CALCULATION

Vytelle has curated records of more than 262,000 animals into multi-breed database to determine EPDs based on RFI (and other) phenotypes. Inputs for this database are measured phenotypes, three generations (or more) of pedigree information on the animals tested and additional information on relevant environmental conditions (location, weather, environment, etc.). Critical to this analysis are four main factors:

1. Consistent data collection and phenotype measurement;
2. Adequate volume of data;
3. Accurate linkage between measured phenotypes and animal pedigree information;
4. Proper contemporary grouping.

Accuracy of EPDs will be compromised if inaccurate EID to registration number references are made. Outputs for this database are efficiency EPDs relevant for making breeding decisions. The RFI EPDs generated are produced using DMI and weight data collected simultaneously. The significance of simultaneous acquisition is that

measured DMI and weight change are coupled together, reducing loss of RFI phenotype accuracy due to short-term variation.

## REFERENCES

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- Culbertson, M.M., Speidel, S.E., Peel, R.K., Cockrum, R.R., Thomas, M.G., and Enns, R.M. (2015), "Optimum measurement period for evaluating feed intake traits in beef cattle", J. Anim. Sci., 93:2482-2487.
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# Vytelle

Vytelle is a precision livestock company reshaping how cattle producers worldwide optimize their herds. Through Vytelle's integrated technology platform, generations of genetic gains can be made in just a few years. This allows producers to sustainably deliver more protein with fewer inputs, helping to ensure meat and milk are viable, competitive food choices for future generations.

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