770: Relationship between Beef Heifer Residual Feed Intake and Productivity as Cows

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Abstract

•The relationship between residual feed intake (RFI) in heifers (n=451) and subsequent lifetime productivity as cows was measured over an 8-year period (2005-2013, mating opportunities=1081) at Lacombe, Alberta, Canada. Most probable producing ability for birth weight (MPPAbw) and weaning weight (MPPAww) were calculated to estimate cow productivity. RFI was negatively correlated (P=0.02) to MPPAbw, but was not significant when RFI was adjusted for backfat thickness (P=0.08) or backfat thickness and feeding activity (P=0.10). No significant correlations were found between RFI or adjusted RFI and MPPAww (P=0.64). Lifetime productivity (LTP) was calculated for cows culled from the herd (n=108) over the 8-year period. RFI and LTP were not correlated (P=0.10). Selection for feed efficient, low RFI replacement heifers does not have an impact on their productivity as cows.

Objective

•Determine the relationship between heifer RFI and various measures of cow productivity which include both calf growth traits as well as herd lifetime productivity.

Methods

• Intake was measured in over 450 beef replacement heifers, either British breed cross (Angus and Hereford) or Continental-British cross (Charolais-Maine Anjou x Red Angus),using the GrowSafe™ System from 2006 to 2012.
• Growth, feeding behavior, live animal body composition, fertility and their calf productivity traits were recorded.
• Three measures of residual feed intake (RFI) were determined for each heifer.

•RFI=Standardized DMI-Expected Feed Intake (EFI)

- RFI1: Standardized DMI (SDMI) of each animal within contemporary group was regressed on ADG (kg/d) and metabolic MIDWT ($kg^{0.75}$) to estimate EFI1 using PROC GLM (SAS Institute, Inc. 2009), using the following model:

$$Y_i = b_0 + b_1 ADG_i + b_2 MIDWT^{0.75}_i + e_i,$$

•A second and third model were developed to estimate EFI that adjusted RFI for back fat thickness, BF, measured at the end of the feeding period (RFI2), and back fat thickness and average feeding event frequency during the test, FEF (RFI3) in addition to ADG and metabolic mid-weight.
•Heifers were classified into High [+] and Low [-] RFI groups for some of the analyses.
•Most probable producing ability (MPPA) for birth weight and weaning weight were calculated (Bourdon 2000) to study the relationship between RFI and cow productivity.

$$Y_{ijkl} = \mu + Year_i + b_1 Cowage_{ijkl} + b_2 Cowage^2_{ijkl} + S_j + Cow_k + e_{ijkl}$$

•In addition, a lifetime productivity measure (LTP) was calculated for those cows culled from of the herd.
•Lifetime productivity was calculated as the MPPAww multiplied by number of calves weaned in the lifetime of the cow.

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Table 1. Animal numbers in the herd over 8 years, with trait means for residual feed intake (RFI1) measured on heifers, as well as birth weight (BW) and weaning weight (WW) of calves.

Year	Heifers RFI1 N	Cows Calving N	Calves Weaned N
2005	21	-	-
2006	19	17	14
2007	61	26	26
2008	68	70	67
2009	61	114	104
2010	40	139	119
2011	94	139	132
2012	87	156	153
2013	-	145	144
Trait Summary Across Years			
	Heifer RFI1, kg DM d^{-1}	Calf BW, kg	Calf WW, kg
N	451	806	759
Mean (SD)	0.00 (0.38)	39.9 (4.9)	257.6 (31.9)

Results

- A significant correlation was observed between RFI1 and MPPAbw, but not when RFI was adjusted for backfat thickness and feeding activity (Table 2).
- This correlation suggests that low RFI heifers/cows have slightly heavier calf birth weights.
- Correlations between all RFI measures and MPPAww or LTP were not significant (Table 2).

Table 2. Phenotypic correlations between heifer RFI, MPPA for birth and weaning weights and cow lifetime productivity.

Trait	RFI2	RFI3	MPPAbw	MPPAww	LTP
RFI1	0.98*	0.93*	-0.13*	-0.03	-0.15
N	451	451	299	289	108
RFI2		0.95*	-0.10	-0.04	-0.17
N		451	299	289	108
RFI3			-0.10	-0.02	-0.14
N			299	289	108
MPPAbw				0.24*	0.34*
N				292	108
MPPAww					0.92*
N					108

*P<. 05

Table 3. LSMeans for heifers that were below average [-] and above average [+] in their RFI1, and their MPPA values for birth weight, weaning weight, and lifetime productivity as cows.

Trait	LOW [-]	SE	HIGH [+]	SE	P-Value
N	226		225		
RFI1,kg DM d^{-1}	-0.29	-0.11	0.30	-0.11	<.0001
N	140		159		
MPPAbw, kg	0.11	0.11	-0.11	0.10	0.120
N	137		152		
MPPAww, kg	0.33	0.98	-0.62	0.93	0.485
N	51		57		
LTP, kg	2.93	5.31	-6.12	5.03	0.219

- Least squares means for MPPAbw, MPPAww and lifetime productivity for [-] and [+] RFI heifers were not significantly different (Table 3).

Conclusions

- A significant negative phenotypic correlation was found between RFI and MPPA for birth weight, but this relationship was no longer evident when RFI was adjusted for backfat thickness and feeding activity.
- Animals ranked as high or low RFI have no significant differences in MPPA values for birth weight and weaning.
- **These results suggest that selection for feed efficient, low RFI replacement heifers will have no impact on their productivity as mature cows.**

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