Efficiency of Feed Utilization through Residual Feed Intake (RFI)
1st Industry validation of RFI a success

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Beefbooster seedstock producers, Alberta Agriculture and Rural Development, University of Alberta, Agriculture and Agri-Food Canada-Lacombe, Olds College, GrowSafe Systems, Morison Feedlot and XL Beef-Lakeside Packers collaborated in the first commercial test to quantify the economic benefit to the feedlot of feeder calves produced by low RFI sires. Financial support was received from the Alberta Livestock Industry Development Fund, Alberta Advanced Education and Technology, Beefbooster, Alberta Livestock and Meat Agency and Alberta Agriculture and Rural Development. The preliminary data presented below are from joint projects led by Dr. John Basarab (Application of next generation genomic tools in Beef: Addressing the Phenomic Gap) and Dr. Zhiquan Wang (Development of marker assisted evaluation models for residual feed intake and carcass merit traits for beef cattle genetic evaluation).

The Bottom Line: Preliminary data presented in the following article demonstrate that using offspring from LOW RFI sires saved the feedlot manager $8.50-$17/hd in feed over a 120 day feeding period with no adverse effects on growth or carcass quality. This benefit will increase as more bulls and replacement heifers are selected for LOW RFI and as the industry takes advantage of carbon credits derived from feed efficient cattle due to reduced methane emissions and manure production.

Identification of LOW RFI Sires

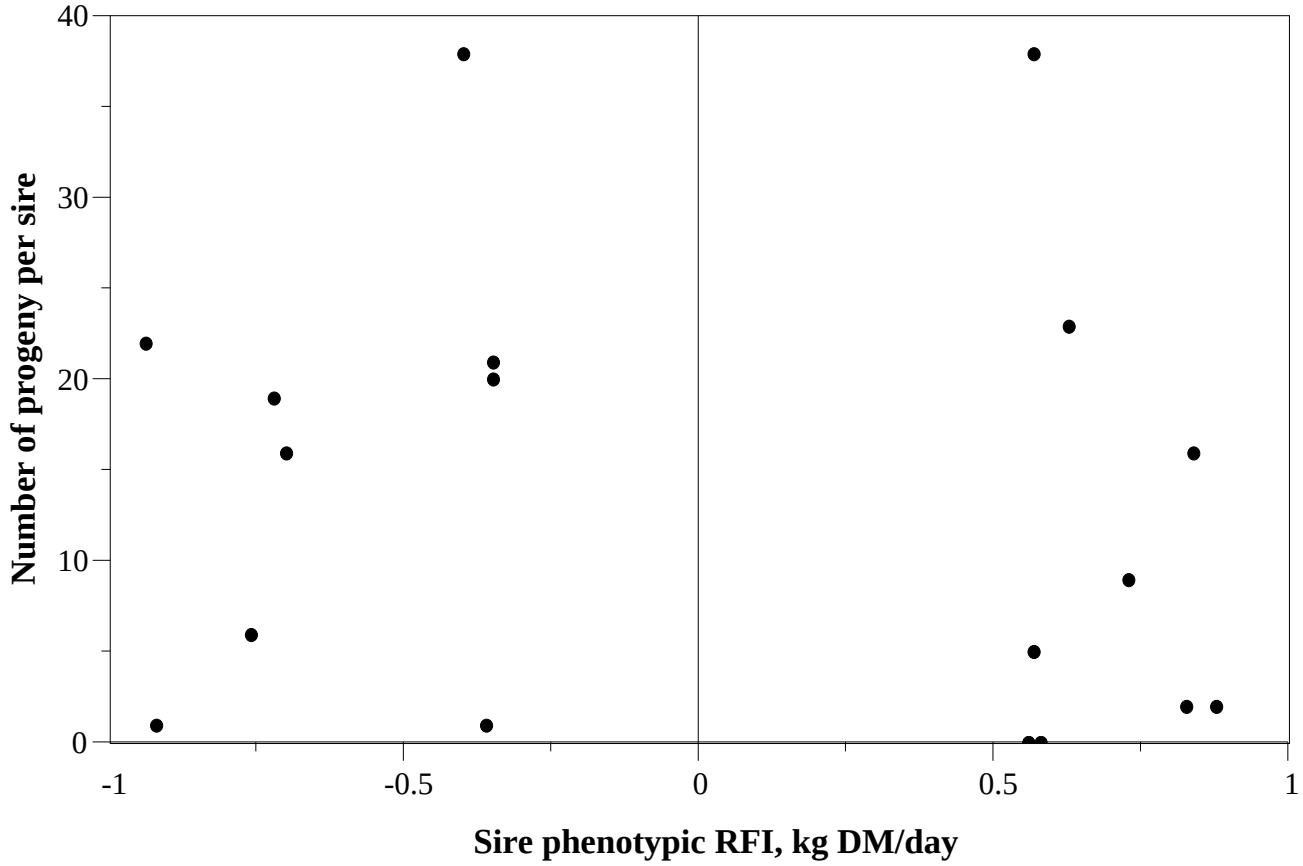
In the winter of 2006/07, 73 yearling TX Beefbooster bulls were blood sampled and tested for individual animal feed intake and growth at the Olds College Bull Test facility using the GrowSafe System. These bulls were given a 28 day period to adjust to test station conditions and diet and then tested for feed intake and growth over an 87 day test period. The test diet consisted of 30.2% barley grain, 52.4% oat grain, 12.3% alfalfa silage and 5.1% 23-20 feedlot supplement on a DM basis (71.1% DM; 11.08 MJ ME/kg DM) and was fed free choice. The test was under the mentorship of Dr. John Basarab, Alberta Agriculture and Rural Development and a member of the Alberta Bovine Genomics Program and followed the guidelines of the Beef Improvement Federation for measuring individual animal feed intake. Upon completion of the test, the RFI of each animal was calculated and the bulls were ranked from most efficient (LOW or - RFI) to least efficient (HIGH or + RFI). All bulls were given a breeding soundness evaluation by a veterinarian upon completion of the test period and nine LOW (mean RFI= -0.64 kg DM/day) and nine HIGH RFI (mean RFI= +0.70 kg DM/day) bulls were selected for subsequent breeding. All bulls used for breeding passed their breeding soundness evaluation test.

Producing LOW and HIGH RFI Progeny

Three Cross Cattle Ltd., Airdrie, Alberta and BeefBooster collaborated to provide facilities and cows for the project. Cows (n=292) were assigned to three breeding groups, such that groups 1, 2 and 3 consisted of 123, 121 and 48 cows, respectively. Three HIGH and three LOW RFI bulls were assigned to breeding groups 1 and 2, and two HIGH and two LOW RFI bulls were assigned to breeding group 3. Two bulls, one HIGH and one LOW RFI, were kept in reserve to replace breeding bulls that became lame or were injured during the breeding season. The breeding season lasted 59 days and was from July 23 to September 20, 2007. Cows calved from the 3rd week of April through June of 2008. Cow-calf pairs then grazed tame pasture from July to the 1st week in November when 244 calves were weaned and placed into

a feedlot and fed a backgrounding or grower ration for 6 months. Feeder calves grew at 0.75 kg/day and were fed a silage based diet. Calves were blood sampled for DNA parentage analysis using a 56 SNP (pronounced 'snip' and means single nucleotide polymorphism) genetic marker panel. The first important result for this trail was that there was no relationship between sire RFI and number of progeny produced per sire (Figure 1). In fact LOW RFI sires produced 60.3% of the progeny.

Figure 1. Relationship between sire phenotypic RFI and number of progeny produced per sire (18 sires)

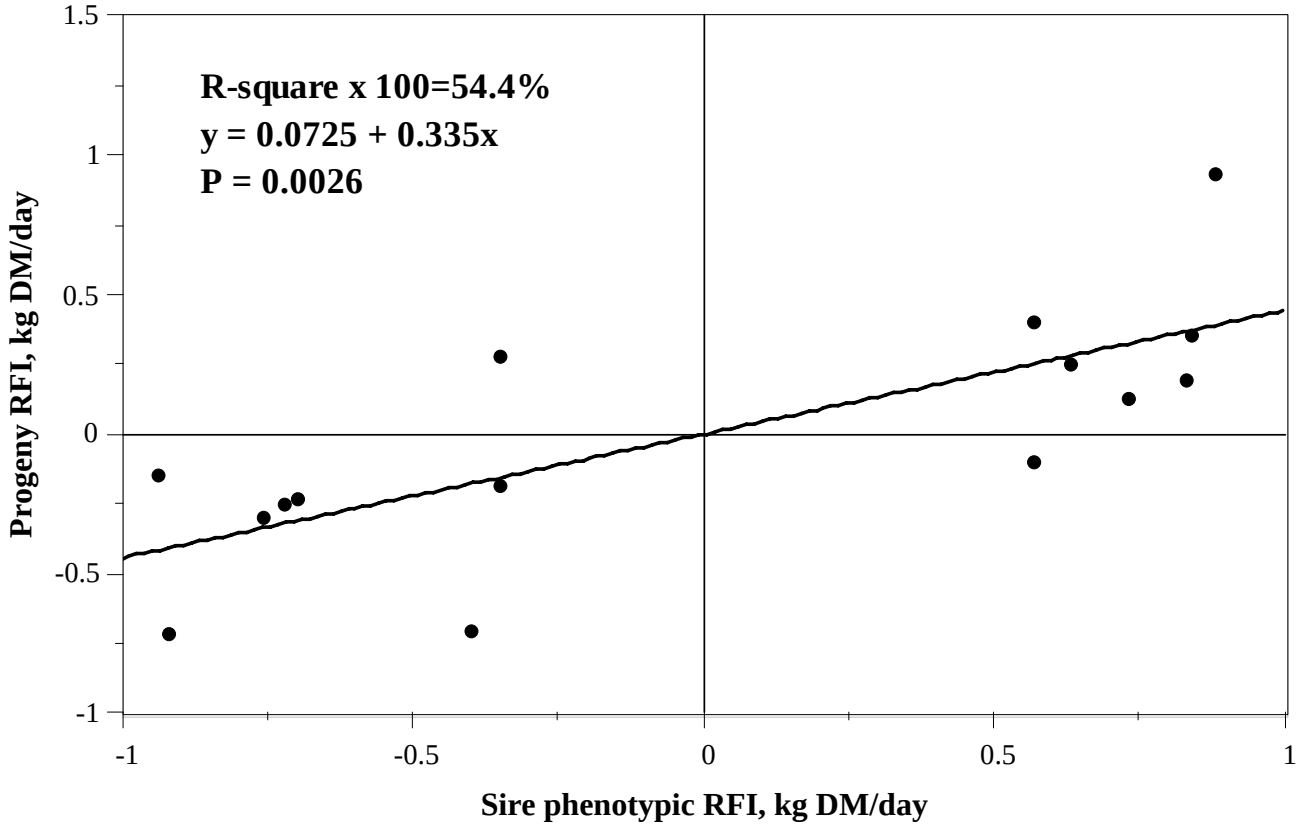


Testing the Progeny for Feed Efficiency

In the 1st week of April 2009, 113 heifers and 138 steers, ranging from 10-12 months of age, were transported to the Morison Feedlot located near Airdrie, Alberta where the feeders were processed and allocated to pens based on gender. Heifers were placed in a pen that contained 14 GrowSafe feeding nodes while steers were placed in an adjacent pen that contained 15 GrowSafe feeding nodes. Over the next 28 days feeders were acclimated to the feedlot and were adjusted to a feedlot finishing ration consisting of 56.6% rolled barley grain, 20% barley silage, 20% brewers mash and 3.4% feedlot supplement (56.93% DM; 10.57 MJ ME/kg DM) on a DM basis and fed free choice. Upon completion of the adjustment or step-up period, steers and heifers underwent an 85 day individual animal feed intake and growth test where feed intake was recorded daily and animal weights were measured on two consecutive days at the

beginning and end of the test period and at 28 day intervals for each animal. Upon completion of the test period the RFI of each feeder animal was calculated. Steers and heifers were fed the same ration within their pens until deemed ready for harvest by the feedlot manager and the owner of the cattle, Three Cross Ranch. Cattle ready for slaughter were trucked to XL Beef-Lakeside Packers, Brooks Alberta in load lots of about 45 head on August 6 (41 steers) , August 10 (46 heifers), August 17 (80 steers and heifers) and September 14 (75 steers and heifers). The cattle were tracked through the plant by a research team that recorded kill sequence, visual tag and carcass tag numbers on slaughter day and detailed carcass data 48-hour later on grading and fabrication day. The striploin from the right carcass side was also recovered from over 88% of the project cattle and transported to the Lacombe Research Centre for detailed work on meat quality and sensory analysis. A subsequent DNA audit will be carried out to confirm whether striploin DNA matches blood sample DNA.

Figure 2. Relationship between sire phenotypic RFI and progeny phenotypic RFI (15 sires with 2 or more progeny)



The second important preliminary result showed that sire RFI is highly related to progeny RFI, meaning that if a LOW RFI sire is selected for use as a breeding bull, it will produce feeder calves that use less feed for the same level of body size and daily gain compared to feeder calves from HIGH RFI sires and from non-selected sires or from the average sire in the beef cattle population. In Figure 2 all but one LOW RFI

sires (7 of 8) produced progeny with LOW (-) finishing RFI whereas 6 of 7 HIGH RFI sires produced HIGH (+) finishing RFI.

Table 1 presents the preliminary finding on the effect of sire RFI on progeny growth rate, feed efficiency as measured by RFI and carcass quality. Feeder cattle from LOW and HIGH RFI sires entered the finishing phase at a similar body weight and grew at the same rate during the 85-day feed intake test. However, feeder animals from LOW RFI sires consumed 0.61 kg less DM per day and had better efficiency of feed utilization by 0.42 kg DM/day compared to their pen mates from HIGH RFI sires. In this trial feed during the finishing phase was priced at $0.232/kg DM or $210.04/ton of DM. Thus feeder animals from LOW RFI sires were $16.98/hd less costly to feed over a 120 day feeding period than their pen mates from HIGH RFI sires or about $8.50/hd less costly than feeder cattle from bulls not selected for LOW RFI. This saving in feeding cost also came with no adverse effects on carcass weight, grade fat, ribeye area, marbling, yield grade or salable meat yield (Table 1).

It is important to note that these are preliminary results and our research team continues to work with industry to expand this study to other herds, and to examine the effects of RFI on meat quality, heifer and bull fertility and cow lifetime productivity. Research teams funded through the Alberta Bovine Genomics program are also working to discover new genetic markers for RFI and other traits of economic importance and to validate commercial genetic marker panel against data sets like the one highlighted in this article. So … stay tuned in the coming months as our research delivers more exciting results on feed efficiency and genetic markers for economically important traits.

Table 1. Effect of sire RFI on progeny growth rate and feed efficiency during the finishing period and on carcass quality.

Progeny or feeder performance during finishing	Sires HIGH RFI	Sires LOW RFI	Significance Level
Number of progeny	95	144	
Progeny initial weight, kg	446.3±8.1	436.4±5.7	0.236
Progeny ADG, kg/day	1.99±0.07	1.94±0.05	0.528
Progeny DMI, kg/day	10.23±0.22	9.62±0.16	0.007
Progeny RFI, kg DM/day	0.30±0.11	-0.12±0.08	<0.001
Progeny end of test ultrasound backfat, mm	8.4±0.4	8.5±0.3	0.871
Progeny carcass weight, kg	365.5±7.3	371.5±5.4	0.432
Progeny carcass grade fat, mm	11.0±0.6	11.3±0.4	0.580
Progeny ribeye area, cm^2	93.5±1.9	93.7±1.3	0.930
Progeny marbling score	4.22±0.09	4.30±0.06	0.365
Progeny yield grade	1.38±0.11	1.45±0.08	0.534
Progeny lean meat yield, %	58.6±0.8	58.4±0.5	0.930