Replacement Female Strategies

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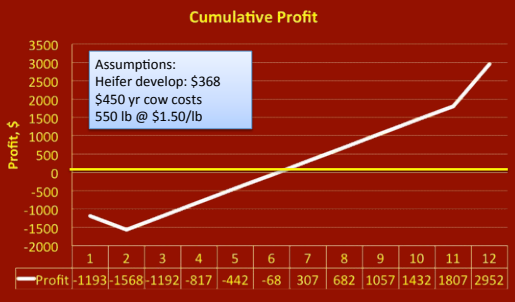
What is the right "equation" for creating the ideal replacement heifer?

$[(S_{election})^3 \times (N_{utrition})^2 \times H_{ealth}]^{Management} =$

Return on Investment



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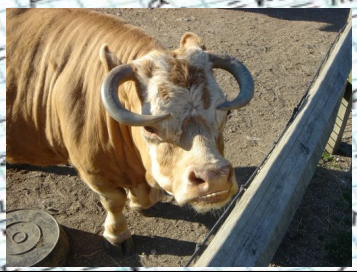


Retain heifer or purchase replacement??

Develop or purchase?

- Complex decision, driven by multiple factors
- Should be evaluated yearly
  - Market fluctuations, feed supply, business model, etc.
- Specific for <u>your</u> operation

Develop or purchase?

- "Heifer Conundrum"
- Don't let 10% of herd dictate the decisions made for the other 90%
- Purchased replacement female does not have to be a heifer
  - Purchased cows = less calving issues, greater probability of breeding back
  - Calving this year or next?
  - Longevity in herd

Drivers of choice

<u>Financial</u>

Dollars and cents

<u>Convenience</u>

Management and fence

Financial evaluation tool

Comparing Purchasing vs Raising Beef Replacement Females

Created by Dr. Jack Whittier and Kevin Miller; Colorado State University

http://www.ansci.colostate.edu/beef/pdf_files/Buy-or-Raise-2011-Replacement-Decision-Aid.xls

Current analysis

Summary for the Retain vs Buy

Breakeven for the Raised Heifer calf — $ 0.84 /lb

Interpretation: Based upon the example computations outlined above:
the sale price of the raised heifer calf could change from $ 1.50 to $ 0.84
before it would cost less to raise replacements from within the herd than purchasing them at $ 1,750.00

Breakeven for the Purchased Bred Heifer — $ 1,839.38 /hd

Interpretation: Based upon the example computations outlined above:
a producer could pay up to: $ 1,839.38
before it would be more costly to purchase than raise a replacement

Breakeven annual additional weight change for Raised vs. Purchased — 6 lbs.

Interpretation: Based upon the example computations outlined above:
raised heifers would need to produce an extra 6 lbs
of calf **per year in prodcution** to make an equal contribution to ranch net income.

When does selecting the replacement heifer begin?

- Replacement heifer selection begins at sire selection
  - 85% of genetic make-up of cow herd is contributed by sire selection
- Dam selection is also critical but often less managed on most farms
- What comprises phenotypic selection?

Phenotype = Genetics + Environment

"The look"
Weaning Wt
Milk production
1st service preg rate

Phenotype = Genetics + Environment

EPDs

- Expected Progeny Differences (EPDs)
  - EPD accuracies are as important as the EPD
  - Genomic selection and Molecular EPDs

Trait	CED	BW	WW	YW	SC	CEM	Milk
EPD	-1	5.7	68	118	.5	9	10
Acc	.86	.97	.96	.95	.95	.88	.93

Recommendations when using EPDs

1. Prioritize traits of economic importance
   - Heifer vs. Steer
   - BW, CEd, CEm, WW, YW, MA, SC, STAY, DOC, What is important to your herd, not your neighbors
2. Match select traits with environment
   - Don't select high milk if don't have enough feed
3. "Optimize" rather than "Maximize"
   - Don't single trait select!
   - Well-rounded with multiple traits above average

Cal…kt?

Reproductive goals for heifers

- Reach puberty by 12 to 13 months of age
  - Age at puberty influenced by genotype, nutrition, and environment
  - Conception rate after 3rd estrus is ~20% greater compared to conception rate at 1st estrus
- Conceive by 15 months of age
- Calve by 2 years of age
  - Most profitable

Reproductive goals for heifers

- Need minimal assistance calving
  - Selection for growth, BW, and pelvic area
- Rebreed as a 2-yr old cow
  - Difficult as cow must partition nutrients into lactation, growth, and reproduction
  - Breed heifers 2-3 weeks before mature cows to "buy insurance"

Heifers selection

- Select heifers born in the first half of the calving season
  - Easier to reach target weights at breeding
  - Indicative of dams fertility
- Retain heifers with heavy **actual** weaning weights
  - Cheapest to feed to target weight
  - You can't adjust for day of age at breeding
- Retain 10 to 15% more heifers than replacement rate requires
  - ~ 5 to 10% of heifers will fail to conceive
  - ~30% of heifers born
- Do not retain heifers with structural defects
- Avoid freemartins
  - Female twin with a bull twin
  - Infertile

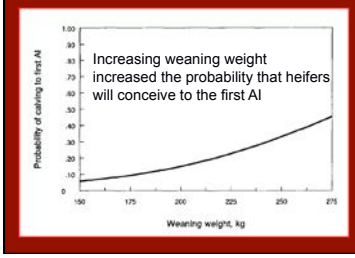
Antral follicle count – Future selection criteria?

- Antral follicle count is the assessment of the number of follicle visible on the ovary

- Greater numbers of antral follicles has been associated with greater fertility (Ireland et al., 2008; Cushman et al., 2012)
- Selection of heifers at early age with greater antral follicle count may yield benefits – research ongoing

Pre-weaning growth and puberty

- Many studies have demonstrated that pre-weaning growth rate has a greater impact on age at puberty than post-weaning growth rate



Ways to Increase WW:
1) Implant – Bad idea
2) Mother Milk Production
3) Creep Feeding
4) Early Weaning

Post-weaning nutrition

- Most common strategy is feeding heifers to reach a "Target Weight" prior to the breeding season
  - Typical: 65% mature body weight (MBW)
    - 1300 lb cow * 0.65 = 845 lb at breeding
    - This is not an average wt of the herd, but rather all heifers should meet or exceed this weight
    - Must know mature body wt of cow herd
  - If I know the WW and 65% MBW target, how do I calculate how much I need to feed?

How much do I feed??

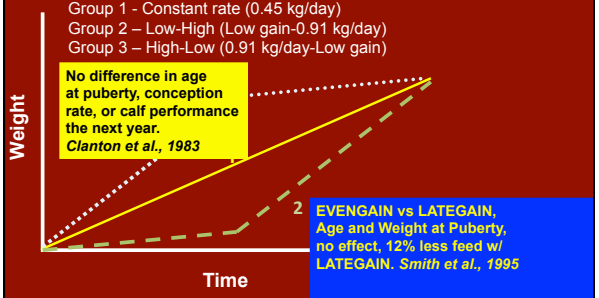
- Example:
  WW = 550 lb
  Target Wt = 845 lb
  Age at weaning = 220
  Age at breeding = 450

$$\frac{(845-550)}{(450-220)} = 1.28 \text{ lb/day}$$

Wiltbank et al., 1985	Desired weight at start of breeding season (target wt)		
	600 lb (~55% MBW)	700 lb (~65% MBW)	Difference
# of heifers	110	111	
Corn fed (lb)	748	1232	484
Cost ($, $0.11/lb corn)	82	136	
Wt at breeding (lb)	617	714	97
Showing heat at:			
20 d	33	63	30
40 d	56	80	24
60 d	71	92	21
Preg. after breeding			
20 d	9	39	30
40 d	27	57	30
60 d	47	74	27
Calving %	63	80	17
Lb of calves weaned	23140	32810	9760
Lbs/heifer exposed	210	296	86
$/heifer exposed ($1.10/lb)	231	326	95
$ return above feed	149	190	41
Preg. next year	68	85	17

Growth rate and puberty attainment

Group 1 - Constant rate (0.45 kg/day)
Group 2 – Low-High (Low gain-0.91 kg/day)
Group 3 – High-Low (0.91 kg/day-Low gain)



No difference in age at puberty, conception rate, or calf performance the next year. ***Clanton et al., 1983***

EVENGAIN vs LATEGAIN, Age and Weight at Puberty, no effect, 12% less feed w/ LATEGAIN. ***Smith et al., 1995***

- Clanton et al., 1983 (An x He - 185 kg)
- Changed nutrition midpoint (176 d)

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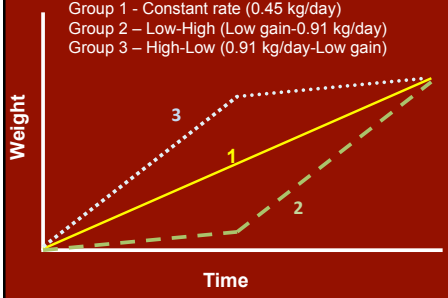


Feeding strategies

- If there is a wide variation in WW between heifers, it may be beneficial to split the group
  - Prevent larger heifers from gaining to much weight
  - Reduce cost of developing larger heifers
  - Ensure smaller heifers achieve target weight
- Avoid getting heifers to fat
  - Impairs mammary development and reduces milk production
  - Calving difficulty
  - Reduced conception rates

Weight changes and feed cost for light and heavy heifers when fed separately or as a group (Varner et al., 1977)

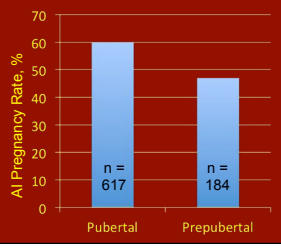
	Fed together		Fed Separately	
Variable	Light	Heavy	Light	Heavy
Number of heifers	10	10	19	20
Weaning wt (lbs)	376	475	374	464
Daily gains (lbs)				
Projected	1.5	1.4	1.7	1.2
Actual	1.3	1.5	1.8	1.2
Breeding wt (lbs)				
Projected	715	715	715	715
Actual	620	719	669	722
Winter feed cost/head/day	$0.75	$0.75	$0.89	$0.67
	Combined $0.75		Combined $0.78	

Reproductive performance for light and heavy heifers when fed separately or as a group (Varner et al., 1977)

	Fed together		Fed Separately	
Variable	Light	Heavy	Light	Heavy
Number of heifers	10	10	19	20
Age at puberty (days)	423	404	405	389
Cycling at start of breeding (%)	60	90	79	90
Pregnant in 45-day breeding season (%)	60	80	79	90
	Combined 70%		Combined 85%	

Why is achieving puberty prior to breeding so critical?

- Regardless of estrous synchronization and AI or natural service, pubertal heifers conceive earlier in breeding season!



Time of 1st calving and retention in herd

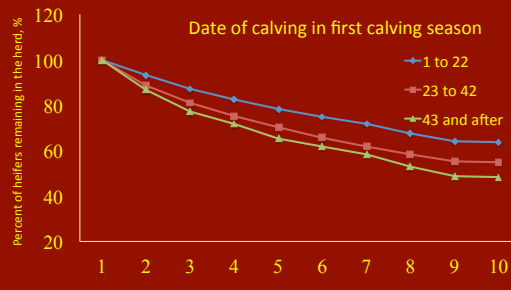


Figure 1. Influence of calving date in first calving season on longevity within the USMARC heifers (P<0.01; n = 16,469).

E. Mousel, SDSU

Time of 1st calving and retention in herd

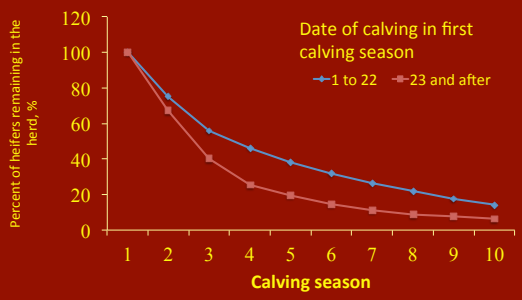


Figure 2. Influence of first calving date in first calving season on longevity within the South Dakota heifers (P<0.01; n = 2,195).

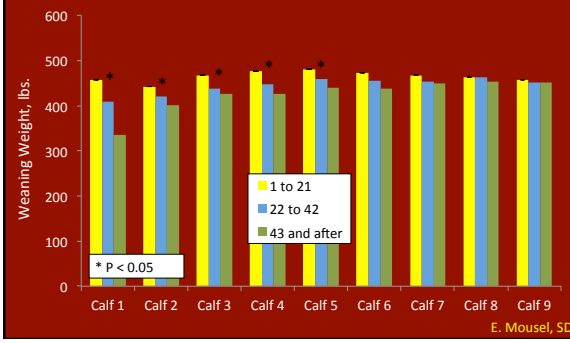
E. Mousel, SDSU

Longevity in the Herd

- Of the heifers that calved with their first calf in the first 21 d period of the calving season at the USMARC:
  - 63.7% of them were still in the herd after 10 calving seasons
    - 54.7% of heifers in 2nd 21 d
  - 14.3% of South Dakota heifers remained after 10 calving seasons
    - 6.4% of heifers in 2nd 21 d
- Positive relationship between early calving heifers and longevity in the herd.

E. Mousel, SDSU

Time of 1st calving and calf weights



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Profitability of SD Herds

- Mean return per female:
  - 1st 21 d period $1,055.69
- Mean return per female:
  - 2nd 21 d period and after $705.45
- Mean return per female:
  - Whole herd $908.19

Heifers that calve in the 1st 21 d represent as much as 75% of future income

E. Mousel, SDSU

Growth rate and puberty attainment

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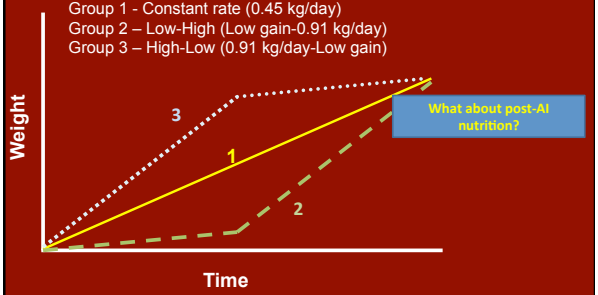

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Things we forget in the beef industry

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Growth rate and puberty attainment

Weight

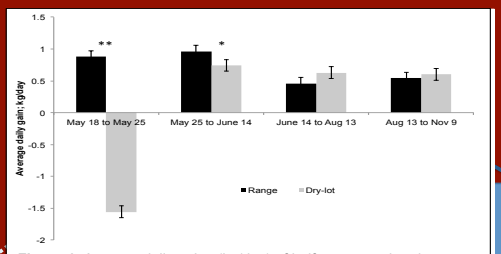


Figure 1. Average daily gains (kg/day) of heifers weaned and developed on range (Range) compared to heifers weaned and developed in a dry-lot (Dry-lot). All heifers were moved to a common pasture on May 18th. *P = 0.06, **P < 0.05

Perry et al., 2009

Post-AI nutrition and AI pregnancy rate

Table 1. AI and breeding season pregnancy rates in beef heifers fed to 120% (Gain), 100% (Maintain), and 80% (Lose) NEm following insemination.

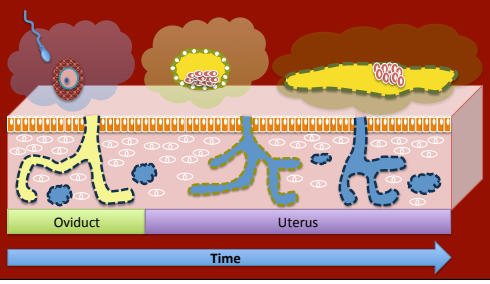
	Treatment (Trt)				*P*-value	
	Gain 120% NEm	Maintain 100% NEm	Lose 80% NEm	Trt	Contrast: Gain vs Maintain + Lose	Contrast: Maintain vs Lose
AI pregnancy rates[1], % (n)	72.9% (86/118)	62.3% (71/114)	64.7% (75/116)	0.13	0.05	0.73
Breeding season pregnancy rates[2], % (n)	94.1% (111/118)	87.7 (100/114)	88.8 (103/116)	0.24	0.106	0.69

[1] Treatment x Replication, P = 0.39, thus replications combined for analyses.
[2] Treatment x Replication, P = 0.65, thus replications combined for analyses.

P. Gunn, R. Lemenager, R. Arias, S. Lake

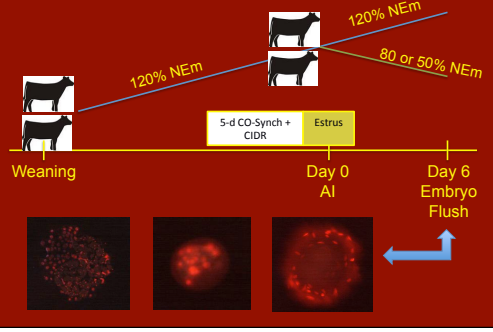
Similar results have been demonstrated in the laboratory of G. Perry (SDSU)

Post-AI nutrition and embryo development



Experimental design - UMN

- Virgin heifers
- UMN; n = 41 (2 reps)
- SDSU; n = 41 (1 rep)



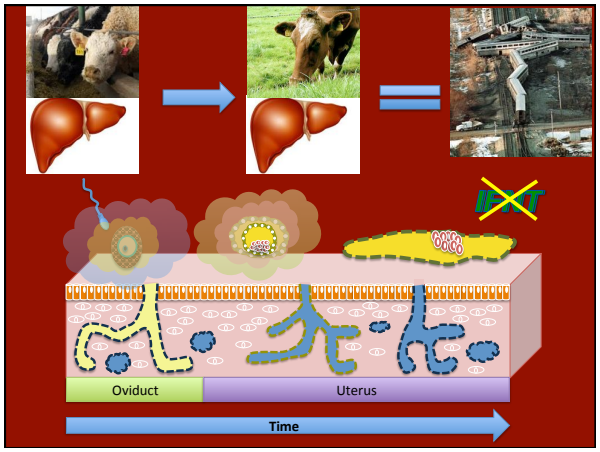
Effect on day 6 embryo quality

Effect of post-AI nutrition on day 6 embryo characteristics: Combined

TRT	n[a]	Embryo Recovery (%)	Embryo Stage (n[b])	Embryo Quality (n[c])	Access. Sperm (n)	Dead Cells (n)	Total Cells (n)	Percent Live Cells (%)
GAIN	46	70.8 (46/65)	4.6 ± 0.1	2.0 ± 0.2	22.7 ± 3.8	7.8 ± 0.9	70.6 ± 5.6	83.3 ± 3.0
LOSE	42	62.1 (42/66)	3.8 ± 0.2	2.8 ± 0.2	16.7 ± 3.8	9.7 ± 1.0	48.9 ± 3.9	71.1 ± 4.1
P-value	.	NS	< 0.01	0.02	0.64	0.42	0.03	0.01

[a] Defined as embryo number; not heifer with the exception of recovery rate
[b] Stage of development (1-9;1 = UFO; 9 = expanded hatched blastocyst; per IETS Standards)
[c] Quality of embryo (1-5;1 = excellent; 5 = degenerate; per IETS Standards)

*No Treatment x Replication Interaction for any variable analyzed so data pooled.



Summary

- Proper heifer selection is critical
- Improper development can result reduced longevity and performance
- Nutrition pre- and post-breeding critical

Thank you

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