POST-AI NUTRITIONAL IMPACT ON REPRODUCTION

Range Beef Cow Symposium
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Outline

- Introduction
- Importance of Reproduction
- Heifer selection/management in U.S.
- Post-Artificial Insemination Management Implications
- Conclusions

Selection

Remember, the only reason to keep a heifer is to improve the quality and profitability of the herd!

$ $

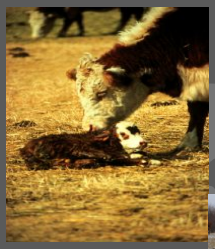
Heifers selection

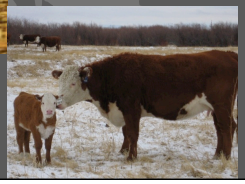
- Select heifers born early in the calving season
  - Indicative of dams fertility
- Retain 10 to 15% more heifers than replacement rate requires
  - ~ 5 to 10% of heifers will fail to conceive
- Do not retain heifers with structural defects

What is important in Heifer selection?

- Maternal traits first and foremost
- Fleshing Ability
- Body Capacity
- Structural integrity
- Feminine look
- Muscle shape

Maternal Traits





Maternal Traits

- Role of the heifer is to become a calf making factory
- Must have maternal instinct
- Good milking ability
  - Coupled with correct udder attachment
- Must be reproductively efficient
  - If she doesn't breed easily the first year, it's probably not going to get any better

Fleshing Ability

Fleshing Ability

- Fleshing ability is crucial in the Western US where forage is limited
- Fleshing ability is directly correlated to BCS
- BCS play an important role in reproductive efficiency and a cows ability to breed annually
- Fleshing ability is also related to mature cow size
  - Your cows should be as big as your environment will allow

Body Capacity

Body Capacity

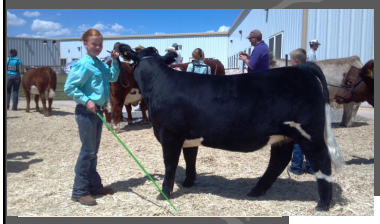
- Remember these heifers are essentially (baby making machines)
- We need rib capacity and depth of body for two major reasons
  - Carry large calves to term
  - Allow maximum room for rumen contents and large amounts of feed to supply nutrients

Structural Integrity

Structural Integrity

- Less than 2% of cows in the US will be culled for structure problems alone.
- However, problems arising from structurally unsound cattle lead to large amount of culls after the first calf is born.
  - Low BCS due to lack of mobility
  - Extreme cases include that of a silent heat due to stress of 'standing heat' during ovulation

Feminine Look



Feminine Look

- It is important for females to look like females and males to look like males.
- Age of sexual maturity in heifers is correlated to scrotal circumference and masculinity of her sire
- Masculinity of bulls is in turn related to the feminine appearance their dam

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
- 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

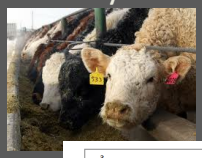
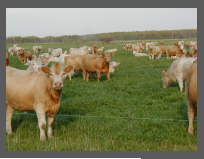
Heifer management strategies

- Most common strategy is feeding heifers to reach a "Target Weight" prior to the breeding season
  - Typical: 65% mature body weight (MBW)
    - 1200 lb cow * 0.65 = 780 lb at breeding
  - To reduce cost of heifer development some suggest using a target weight of 50 to 55% MBW
    - Similar reproductive performance if the breeding season was extended from 45 to 60 days

Heifer Development

- 80% of U.S. herds are Spring calving (USDA, 2010)
- Dry-lot, feed-lot environment
- Targeted growth rates & strategic development programs
- Use of A.I. and estrous synchronization protocols


Things we forget in the beef industry

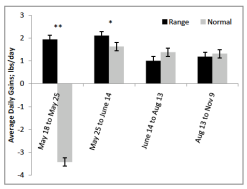
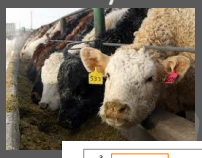
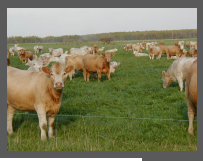
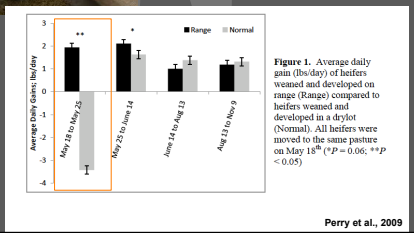


Figure 1. Average daily gain (lbs/day) of heifers weaned and developed on range (Range) compared to heifers weaned and developed in a drylot (Normal). All heifers were moved to the same pasture on May 18th (*$P = 0.06$; **$P < 0.05$)

Perry et al., 2009

Things we forget in the beef industry



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Perry et al., 2009

Post AI Management

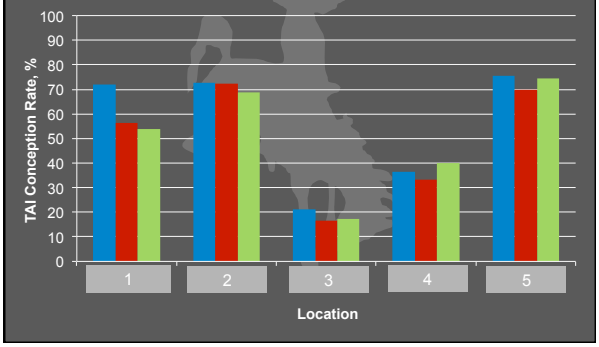
- Low Stress
- Trucking
  - Prior to day 7- or after day 40
- Nutrition
  - Pasture

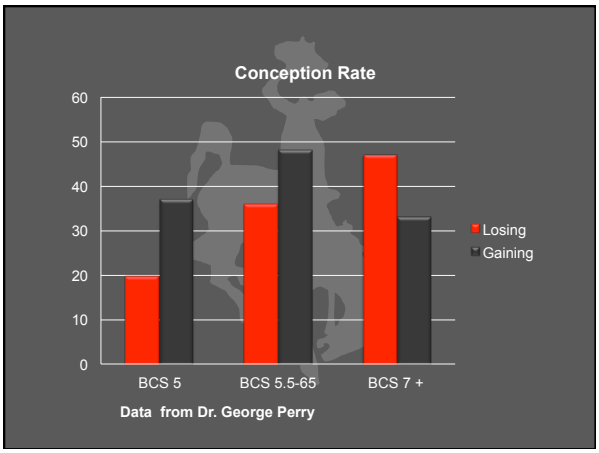
Post AI Management

- Anecdotal evidence
- Heifers fed in feedlots (high energy diet) cycle really well
  - Conception rates vary tremendously
    - (40%-70%)
- Does Post-AI nutritional management play a role?
  - Green grass????

Timed-AI Conception Rate

(Treatment by Location; P > 0.10)





Nutrition and embryo survival

How would a change in nutrition immediately at or following insemination effect embryo survival?

1. Direct impact on conceptus
   - Toxicity
2. Indirect actions to impact conceptus growth
   - A. Alteration in uterine function
     - Uterine secretions required for embryo growth
   - B. Impede other endocrine functions
     - Progesterone production by CL

Impact of Post-AI Diet on AI Pregnancy Rates in Heifers

- Hypothesis:
  - Suppressing nutritional plane of heifers immediately after AI will negatively impact AI pregnancy rates
- Objective:
  - To determine the effect that nutritional plane during the first 21 d post-breeding has on BW, BCS, AI conception rates, and ultimately reproductive efficiency of yearling beef heifers

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Materials and methods

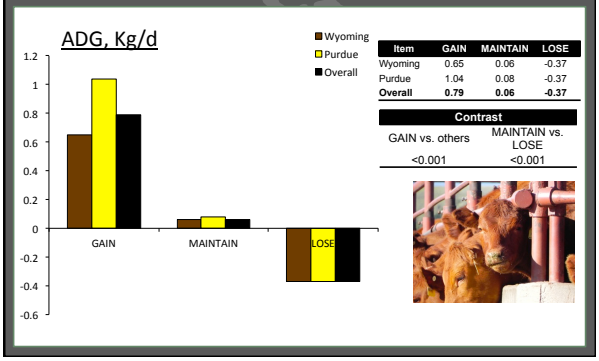
- Dietary treatments:

1. **GAIN:** diet formulated to meet NRC, 2000 requirements for heifers to gain at a rate identical to that prior to initiation of trial
2. **MAINTAIN:** diet formulated to meet NRC, 2000 nutrient requirements for maintenance
3. **LOSE:** 80% of the NRC, 2000 energy requirement for maintenance

Locations

- University of Wyoming, Laramie
  - n = 98 crossbred beef heifers
  - Initial BW = 380 ± 37 kg
  - Initial BCS = 5.2 ± 0.3
  - 7-d CO-Synch + CIDR (timed-AI)
- Purdue University, Lafayette, IN
  - n = 52 crossbreed beef heifers
  - Initial BW = 429 ± 29 kg
  - Initial BCS = 5.2 ± 0.3
  - MGA + PGF (heat detection + AI)

Results

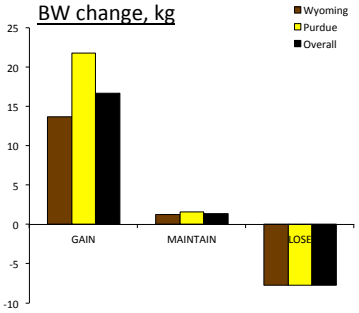


Item	GAIN	MAINTAIN	LOSE
Wyoming	0.65	0.06	-0.37
Purdue	1.04	0.08	-0.37
Overall	**0.79**	**0.06**	**-0.37**

Contrast	
GAIN vs. others	MAINTAIN vs. LOSE
<0.001	<0.001

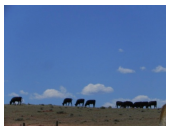
Results

BW change, kg



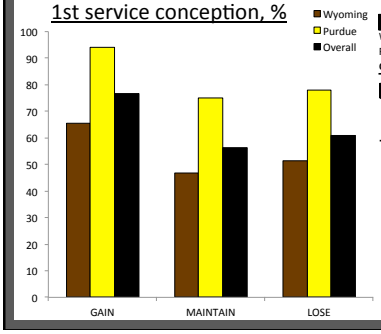
Item	GAIN	MAINTAIN	LOSE
Wyoming	13.72	1.25	-7.75
Purdue	21.78	1.56	-7.72
Overall	**16.67**	**1.36**	**-7.74**

Contrast	
GAIN vs. others	MAINTAIN vs. LOSE
<0.001	<0.001



Results

1st service conception, %

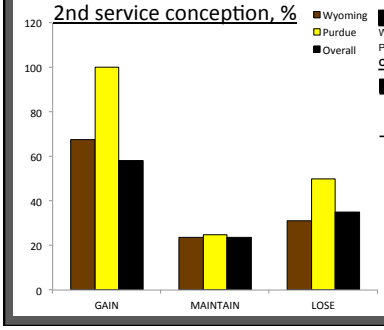


Item	GAIN	MAINTAIN	LOSE
Wyoming	65.6	46.9	51.5
Purdue	94	75	77.8
Overall	**76.5**	**56.2**	**60.8**

Contrast	
GAIN vs. others	MAINTAIN vs. LOSE
0.02	0.68

Results

2nd service conception, %

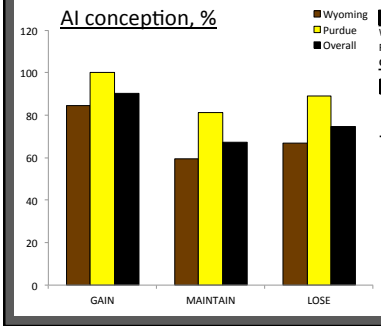


Item	GAIN	MAINTAIN	LOSE
Wyoming	67.6	23.5	31.2
Purdue	100	25	50
Overall	**58.3**	**23.8**	**35**

Contrast	
GAIN vs. others	MAINTAIN vs. LOSE
0.06	0.44

Results

AI conception, %

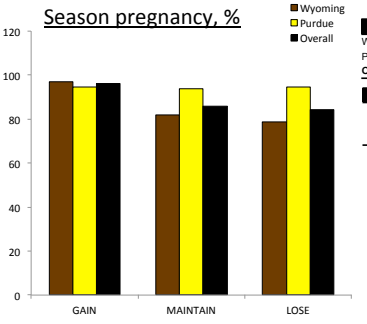


Item	GAIN	MAINTAIN	LOSE
Wyoming	84.4	59.3	66.7
Purdue	100	81.3	88.9
Overall	**90.2**	**67.3**	**74.5**

Contrast	
GAIN vs. others	MAINTAIN vs. LOSE
0.01	0.41

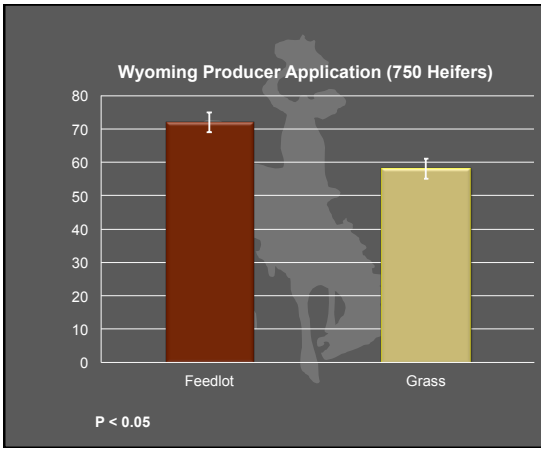
Results

Season pregnancy, %

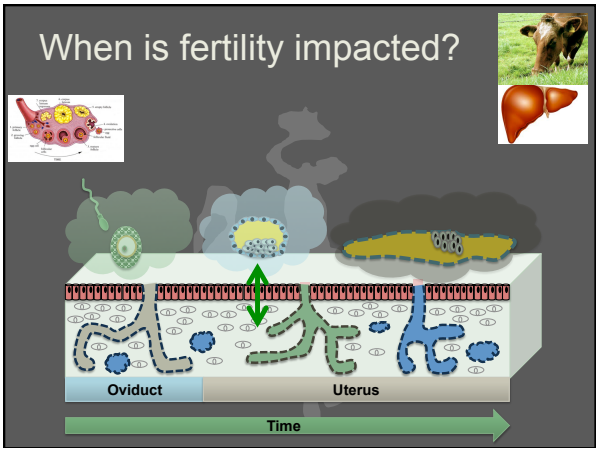


Item	GAIN	MAINTAIN	LOSE
Wyoming	96.9	81.8	78.8
Purdue	94.7	93.8	94.4
Overall	**96.1**	**85.7**	**84.3**

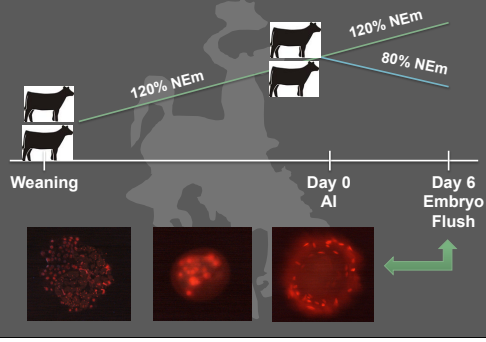
Contrast	
GAIN vs. others	MAINTAIN vs. LOSE
0.06	0.59



When is fertility impacted?



Experimental design



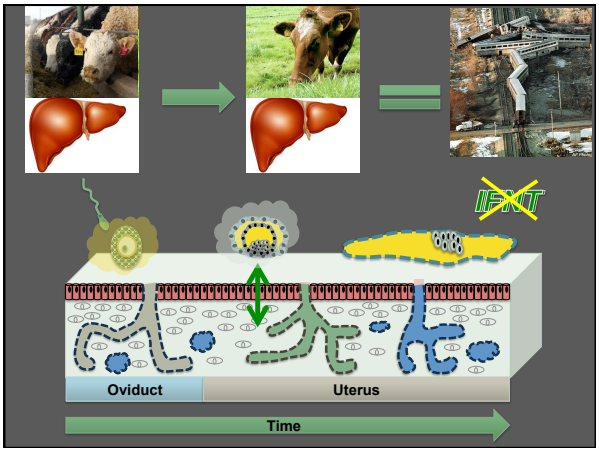
Results

Table 5. Effect of post-AI nutrition on day 6 embryo development

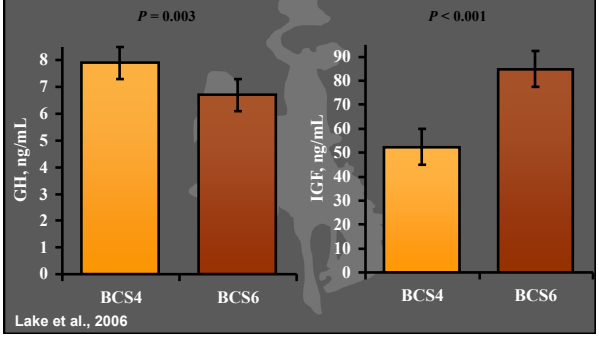
TRT	n[a]	% Embryos Recovered	Embryo Stage[b]	Embryo Quality[c]	Accessory Sperm (n)	Dead Cells (n)	Total Cells (n)	% Live Cells
GAIN	29	70.7 ± 7.2 (29/41)	4.5 ± 0.2	2.0 ± 0.2	20.6 ± 4.6	6.8 ± 1.3	65.1 ± 6.1	82.5 ± 4.6
LOSE	27	65.9 ± 7.2 (27/41)	3.8 ± 0.2	2.9 ± 0.2	14.2 ± 3.2	9.6 ± 1.2	48.3 ± 4.5	70.7 ± 5.2
P-value	.	NS	0.04	0.01	0.56	0.25	0.04	0.10

[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)

Bridges et al., 2012



Effects of Body Condition Score at Parturition on GH and IGF-I



Lake et al., 2006

Conclusions and Summary

- Unquestionably nutrition impacts reproduction
  - Direct and indirect affects
- Both under- and over-nutrition detrimental
- Immediate vs prolonged
  - Oocyte competence
  - Uterine function

Slow down……..

Thank you

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