

Managing Reproductive Efficiency: Taking a Systems Approach



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Efficiency in the Cow Herd

- Wide variation in environmental and management conditions in cow-calf production.
- Expected to be metabolically and reproductively efficient in varied and ever-changing environmental conditions.
- Efficiency in one environment ≠ efficiency in a different environment
- Do cows match our production environment?
- What is reproductive efficiency? How can we measure it?

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Reproductive Efficiency

Optimize pregnancy rate early in the breeding season and select/develop replacement heifers that are highly fertile at the lowest cost possible



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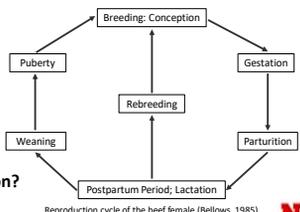
How can we evaluate reproductive efficiency?

- Maintaining records:
 - # females exposed
 - Dates when bulls turned in & removed
 - Pregnancy rates
 - Calving distribution
 - Etc.
- Calculate
 - Pregnancy rate = [(# pregnant/# exposed) x 100]
 - Calving percentage = [(# live calves born/# pregnant females) x 100]
 - Weaning percentage = [(# calves weaned/# pregnant females) x 100]

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Taking a Systems Approach

- Evaluate all factors impacting fertility and reproductive performance
- Identification of leverage points
- Evaluate short- and long-term opportunities and solutions within the system.
 - What are the consequences, both intended and unintended?



Reproduction cycle of the beef female (Bellows, 1985)

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What factors influence reproduction?

- Nutrition
- Health
- Reproductive management
- Stress
- Selection
- Genetics
- Cattle markets
- Feed prices
- Labor cost
- Weather (drought, cold, heat)
- Land availability and value
- Etc.



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Reproductive Efficiency

=

Management

+

Nutrition & Health

+

Selection Pressure

+

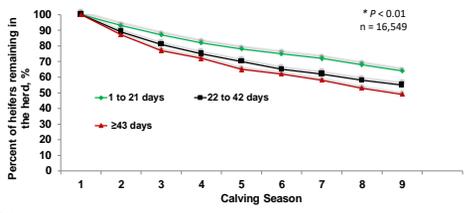
Reproductive Technologies



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Early calving cows are more productive...

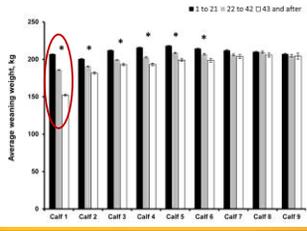


* P < 0.01
n = 16,549

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Early calving cows are more productive...



■ 1 to 21 | 22 to 42 | 43 and after

≈133 lb difference in calf BW for calves in yr 1

(Cushman et al., 2013)

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Selection Pressure

- Select heifers that become pregnant **EARLY** in the breeding season
 - Only retain heifers bred in the first 30 days → market late bred heifers
 - Shorten breeding season length to 30 days → market open heifers as feeders
 - Utilize reproductive technologies → estrus synchronization
- They will wean heavier calves and stay in the herd longer!

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Relationship between Nutrition and Reproduction

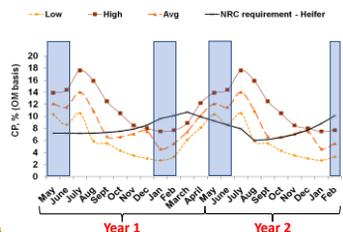
- Nutrition is an important mediator of reproductive events
 - Puberty attainment
 - Anestrus
 - Longevity/retention



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Nutrient availability during critical reproductive periods



— Low — High — Avg — NRC requirement - Heifer

CP % (DOM basis)

Year 1 Year 2

Courtesy of Dr. Eric Schlotterbeck, MSW

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Post-weaning Nutritional Management

- Guidelines for replacement heifers to reach 60-65% of their mature BW by breeding (reviewed by Patterson et al., 1992)
- Lighter target body weight at breeding reduced development costs while not impairing reproductive performance (Funston and Deutscher, 2004; Larson et al., 2011; Mulliniks et al., 2013; Summers et al., 2014).

Can we use post-weaning management to select heifers better adapted to their future production environment?

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Influence of Postweaning Nutrition on Heifer Reproductive Performance

Treatment	Age at puberty*	Heifer pregnancy rate*	Mean Calving date*	Second-year pregnancy rate*	Reference
Even gain vs. Late gain	INCR ^b	NS	—	—	Lynch et al., 1997
Low-High vs. High	—	NS	NS	NS	Freetly et al., 2001
Low gain vs. High gain	DECR ^{c,d}	NS	NS	NS	Funston and Deutscher, 2004
Drylot vs. Extensive	DECR ^{c,d}	NS	NS	NS	Funston and Larson, 2011
Corn Residue vs. Drylot	NS	NS	NS	—	Summers et al., 2014
Low-High vs. CornZart	NS	NS	NS	—	Rozasco et al., 2017

*Effect of treatment on late weaning intake on growth compared with control; INCR = increased compared with control; DECR = decreased compared with control; NS = not significant.
^bAge at puberty (P < 0.05).
^cReported as cycles prior to breeding season.
^dHeifers within study differ (P < 0.05).

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Nutritional Management Impacts Longevity

Breeding Year	50RUP (%)	36RUP (%)	Drylot (%)
1	~95	~85	~80
2	~80	~65	~60
3	~75	~55	~45
4	~70	~45	~40

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BCS at calving vs. Pregnancy Rate, %

	4	5	6
Spitzer et al. (1995)	56 ^a	80 ^b	90 ^b
Lake et al. (2005)	64 ^a	-	89 ^b
Lents et al (2008)	56 ^a	88 ^b	-
Bohnert et al (2013)	79 ^a	92 ^b	-
Average	63.8	86.7	92.5

^aP < 0.05

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What about the adaptability of cows to their production environments?

	Body condition score at calving			SEM	P-value
	4	5	6		
Body Condition Score					
Calving	4.3	5.0	5.8	0.1	<0.01
Branding	3.9	4.3	4.8	0.2	0.05
Weaning	4.6	4.8	5.3	0.1	0.01
Calving date, Julian day	61	61	67	5	0.28
Days to first postpartum ovulation	84	82	80	9	0.93
Pregnancy, %	92	91	90	-	0.68
Calving interval	371	375	371	8	0.85

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Post-AI Nutrition Influences Reproductive Success

Stage	Range (%)	Drylot to Range (%)
Puberty	94	97
AI conception rates	~30	~30

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Health and Vaccination Program

- Herd health program important component of overall management.
 - Biosecurity
 - Parasite control
 - Vaccination
- When should prebreeding vaccines be administered?
 - Heifers and cows should be vaccinated at least 45 days before breeding
 - Naive vs. Previously Vaccinated
 - Animals not previously vaccinated should not receive prebreeding vaccination with a modified live vaccine
 - Establishment of vaccination program in replacement heifers – branding, weaning, pre-breeding, etc.

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Impact of vaccine and timing of vaccination on reproductive success

Vaccine	n =	AI conception (%)	Overall pregnancy rate (%)
Modified live vaccine	775	52 ± 4 ^a	94 ± 1
Chemically altered/inactivated	792	60 ± 4 ^b	92 ± 2
27 to 29 days	217	52 ± 5 ^a	92 ± 2 ^a
30 to 37 days	1053	52 ± 3 ^a	95 ± 2 ^b
46 to 89 days	299	64 ± 4 ^b	91 ± 2 ^{ab}

^{a,b}LSMeans within a column having different superscripts are different (P < 0.05)

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Reproductive Technologies

- Pregnancy Detection
- Estrus Synchronization
- Artificial Insemination
- Others....

Estrus Synchronization with Natural Service

1 Shot PG & NS

• Single injection of Prostaglandin on day 4.5 after bull turnout

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Estrus synchronization can influence the postpartum interval

- 2341 Cows in Missouri
 - 4 Studies
 - Bader et al., 2005
 - Schafer et al., 2007
 - Busch et al., 2008
 - Wilson et al., 2010
 - Cyclic –
 - 1329/2341 = 57%
 - Anestrus –
 - 1012/2341 = 43%

Progesterin and GnRH products reported to “jump start” cyclicity in pre-pubertal heifers and anestrus cows.

Group	Pregnancy rate to FTAL, %
Cyclic	64.8
Anestrus	63.8

Moorey et al. (2022) ARSBC

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Take home message...

- Evaluate all the factors within the system
 - What are the short- and long-term impacts of management decisions?
- Optimizing the number of heifers and cows that conceive early in the breeding season.
- Consider the impact of heifer development on longevity
- Ensure cows and heifers at BCS of 5 at calving.
- Heifers and cows should be vaccinated at least 45 days before breeding.
- Consider vaccination status of cows and heifers
- Can incorporation of reproductive technologies improve efficiency or performance?

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Thank you!!!

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