EXTENSION

Ranchers Thursday Lunchtime Series

Strategies to "Consider" when Implementing a Heifer Development Program

Dan Stein

Associate Professor

A Heifer's Job is not an Easy One

Strategy: a plan of action intended to achieve an intended set of goals.

Heifer Development

- is one of the most important and costliest components for the cow/calf producer

Primary Objectives

Optimize:

- 1. Reproductive Performance (maintain a 365-d calving interval)
- 2. Economic Efficiency
- 3. Lifetime Productivity

365d – 283d = 82d – 45d PP = 37days (less than 2 estrous cycles)

The Longer her Productive Life…

…the more profitable she is to the enterprise…

→ so she can calve by 24 months of age (unassisted),

→ she is expected to breed at just over a year of age,

→ she is expected to rebreed to maintain a 365d calving interval

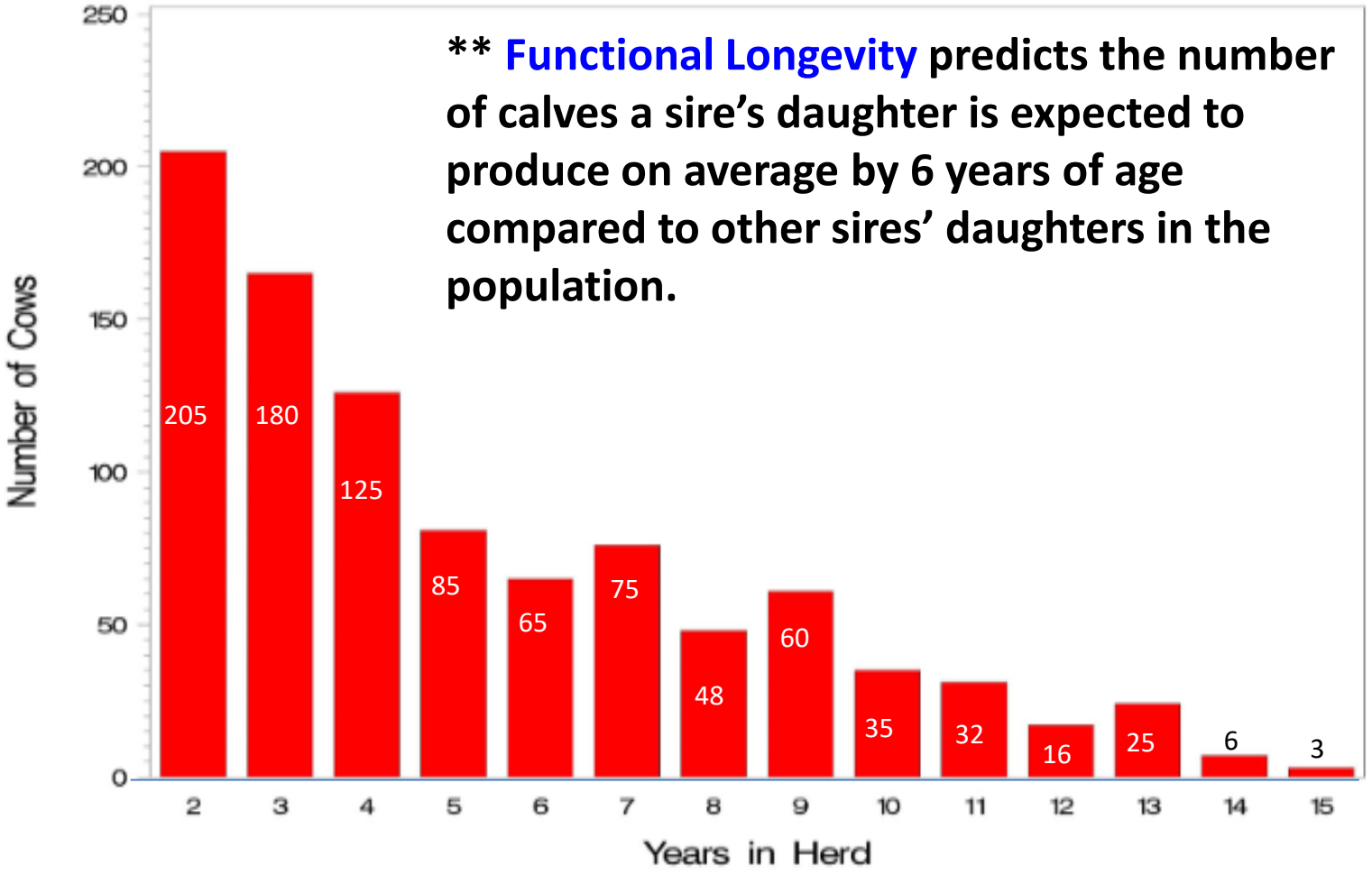
→ wean a healthy calf, genetically capable of performing

Longevity[1] vs. Stayability[2]

[1]the time that producing cows, remain in the herd (length of productive life)

[2] a cow's ability to remain in the herd until a specific point in time (when a replacement heifer recovers her "cost of development")

Distribution of herd longevity for Angus cows that produced a first calf from the East Tennessee Research and Education Center



- The greater the longevity of the cows in the herd, the more selective the producer can be when choosing replacement heifers.
- The **Functional Longevity (FL) ***research*** expected progeny difference (EPD)** was released by the American Angus Association® on October 25.
  - **h^2 estimate is 0.09**

Arnold M. Saxton, Kenneth J. Stalder (Iowa State University) and Robert B. Simpson (East Tennessee Research & Education Center). 2007. Angus Cow Longevity Estimates and Relationship to Production Traits.

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Infertility (and economic losses) of Beef Females can be attributed to three (3) primary groups:

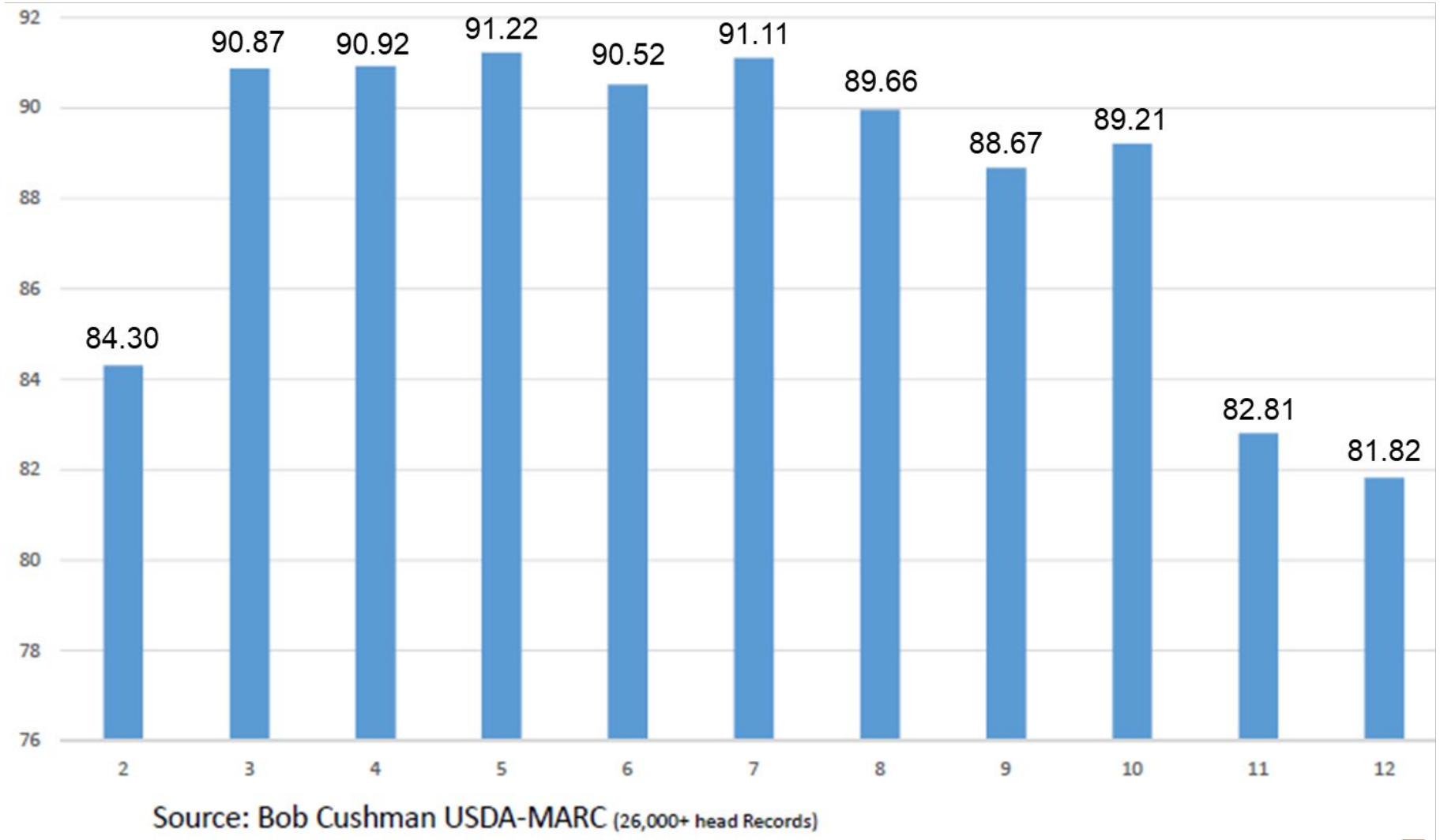
1. Females that fail to become pregnant during the breeding season.

2. Females that become pregnant late in the breeding season.

3. Females that become pregnant but fail to calve.

Lamb, G.C., 2013.

Pregnancy Rate by Cow Age



Courtesy of Brian Freking, OSU Extension

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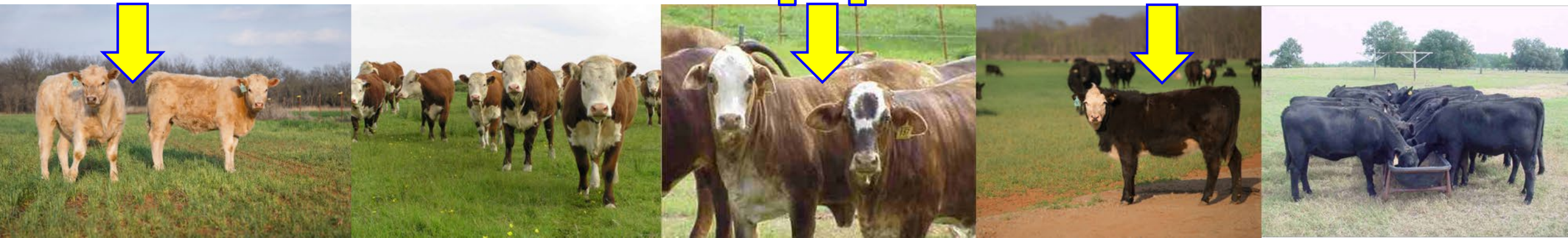
Consideration #1 (actually 3)

- Understand the advantages of **Heterosis (Hybrid Vigor)**(Crossbreeding).
- Understand that there are biological differences between ***Bos taurus*** and ***Bos indicus*** cattle related to reproductive and metabolic functions, as each will respond differently to nutritional and reproductive management strategies. **(Sartori et al., 2016; Cooke et al., 2020).**
- Understand the importance of selecting animals that fits **your environment.**



Heterosis

where crossbred progeny out performs the average of the component purebred parents...

% Heterosis = (Crossbreed avg. - Straightbreed avg.) X 100
Straightbreed avg.

- **Breed A:** Weaning Wt. = **500 lb.**
- **Breed B:** Weaning Wt. = **520 lb.**
- **A x B Crossbred Calf**

→Expected performance: 510 lb.
(average of A and B)

→Actual performance = 540 lb.

→30 lb. (5.8%) = Heterosis

keep this term in mind

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Breed A Breed B

A X B Offspring (F1)

(100 % heterosis)

2-Breed Terminal Cross

Heterosis

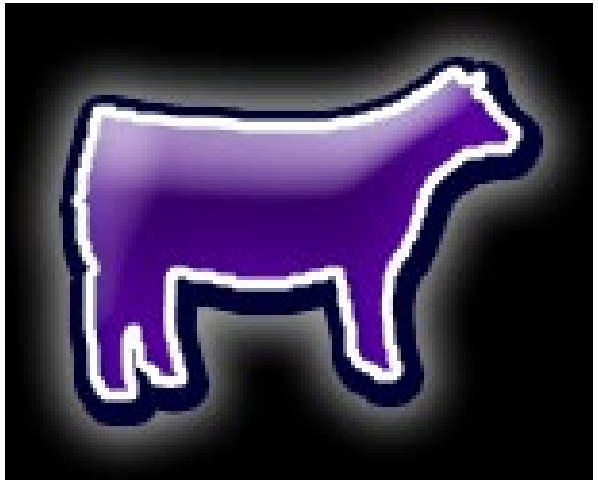
- Cow heterosis = 0%
- Calf heterosis = 100%
- 8.5% ↑ lbs of calf WW

Bos taurus X-breed

Trait	Calf Heterosis: Observed Improvement (units)	Calf Heterosis: Heterosis (%)	Maternal Heterosis (units)	Maternal Heterosis (%)	
calving rate (%)	3.2	**4.4**	3.5	**3.7**	**8.1%**
survival to weaning (%)	1.4	**1.9**	0.8	**1.5**	**3.4%**
birth weight (lb.)	1.7	**2.4**	1.6	**1.8**	**4.2%**
weaning weight (lb.)	16.3	**3.9**	18.0	**3.9**	**7.8%**
yearling weight (lb.)	29.1	**3.8**	*	*	
average daily gain (lb./d.)	0.1	**2.6**	*	*	
longevity (years)	*	*	**1.4**	**16.2**	
Lifetime Productivity					
number of calves			**0.97**	**17.0**	
cumulative weaning weight (lbs.)			**600.0**	**25.3**	

→crossbred cows remain in herd 1.4 yrs longer and average 25% to 30% more calf weight produced over lifetime… Gregory, Cundiff, and Koch, 1999

Phenotype = Genotype + Environment



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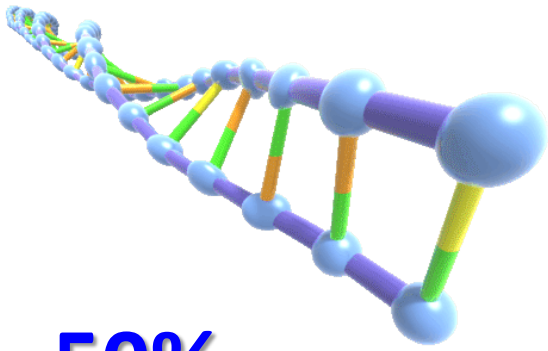

50%

+

50%

Traits	h^2	Heterosis
Reproduction	LOW	HIGH
Growth	Medium	Medium
Carcass	HIGH	LOW

…traits associated with Reproduction have ~5X more $$-value to commercial beef cattle production than those associated with calf growth or milk production…

(Trenkle and Wilham, 1977)

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Consideration #2

What are your Target Production Benchmarks?

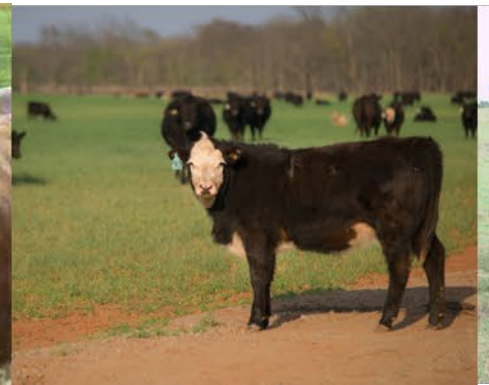
Does it matter when your heifers calve in the calving season?

Heifers calving early in their 1st calving season:

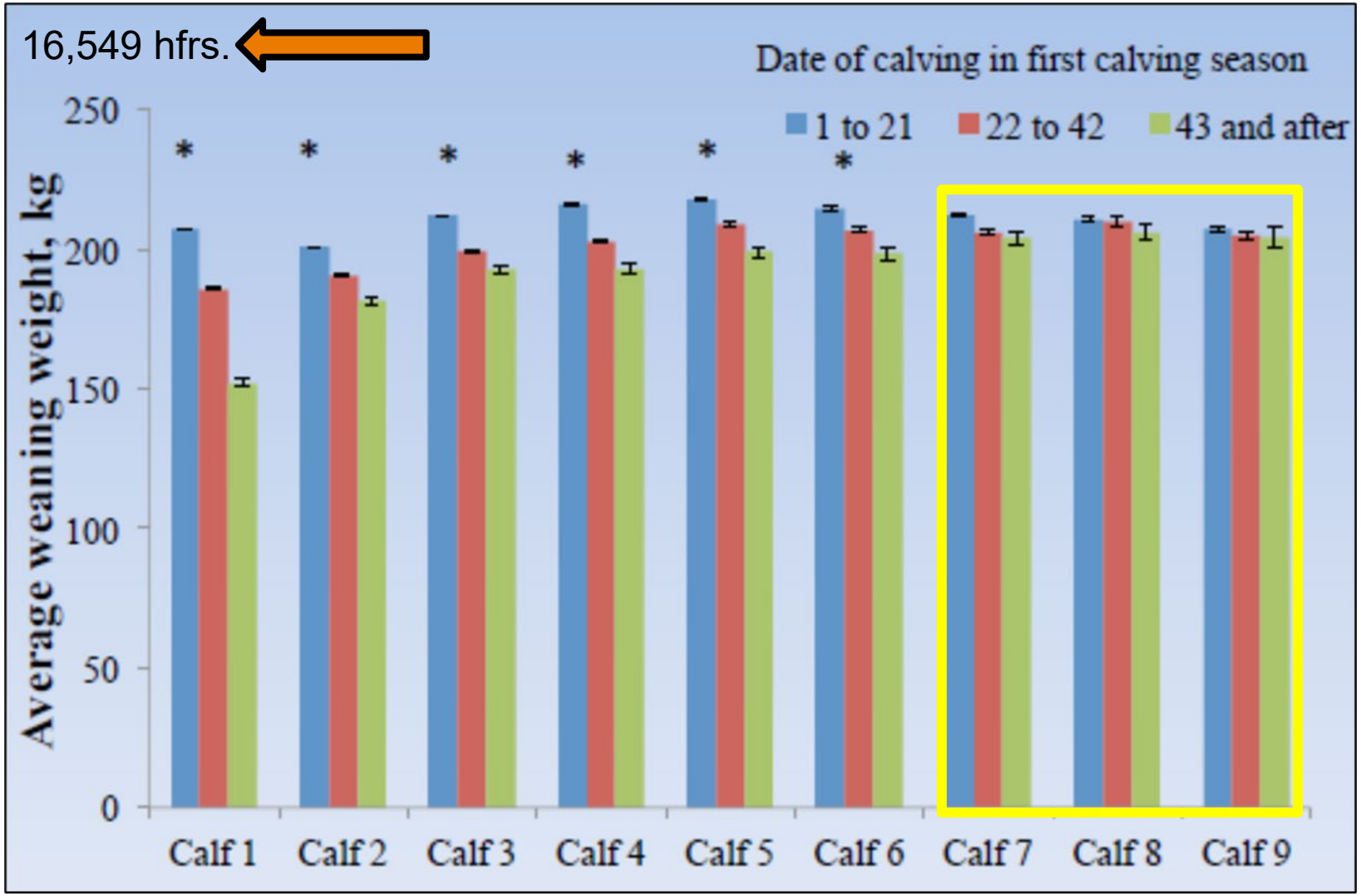
- **have greater lifetime calf production than those calving late**
- **produced more total pounds of weaning weight through six calvings**
- **are more likely to become pregnant at 2 yrs. of age**

Cushman et al., 2013 Lesmeister et al. 1973




Influence of calving date in first calving season on average weaning weight of calves born to USMARC heifers



Cushman, R. A., L. K. Kill,R. N. Funston, E. M. Mousel, and G. A. Perry. 2013. Heifer calving date positively influences calf weaning weights through six parturitions. J. Anim. Sci. 2013.91:4486–4491

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Heifer Purchase Financial Stress Analysis Tool

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Derrel Peel
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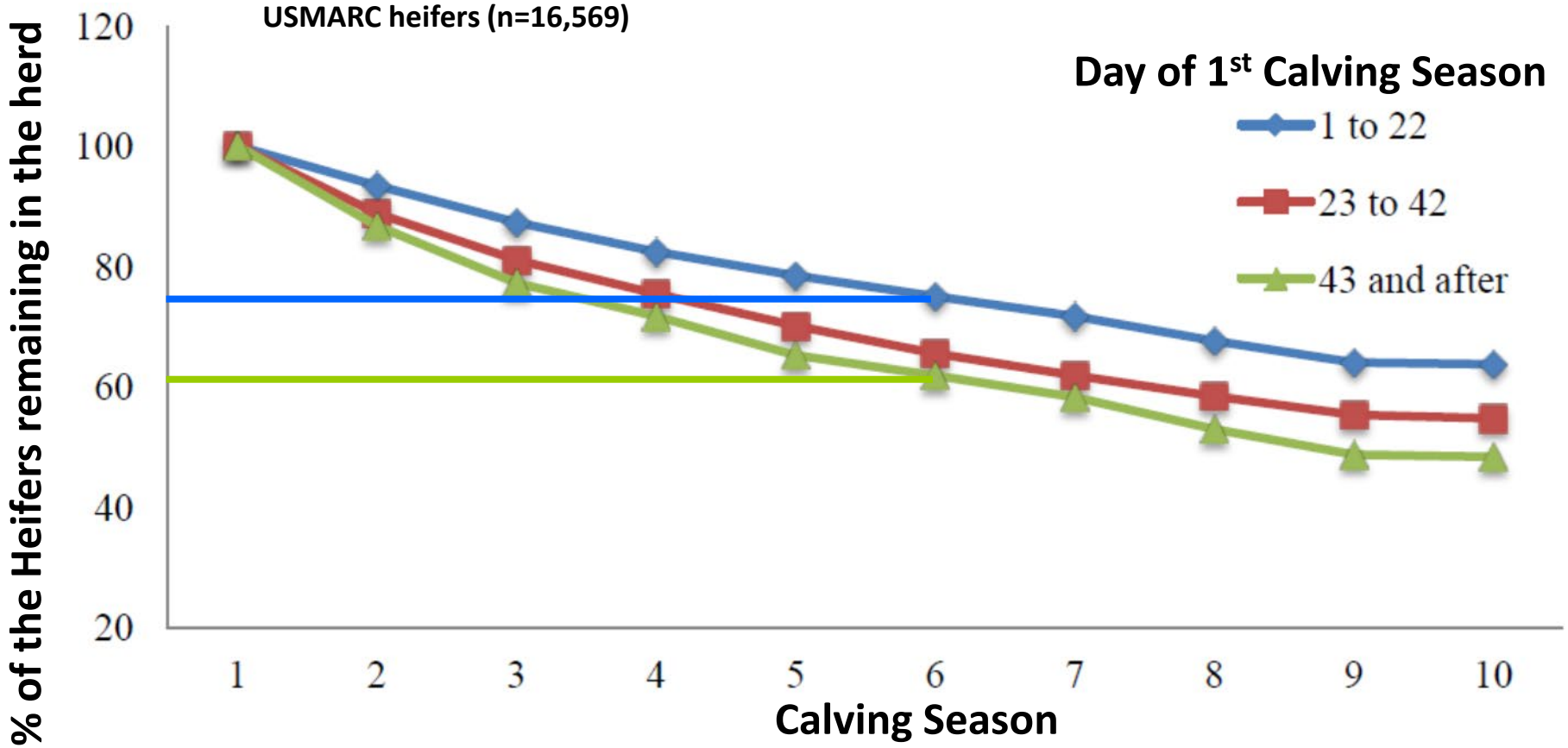
August 2023, Release version 1.0

Head purchased	100	Bred	
Heifer purchase $/head	$ 1,800	Anticipated mature cow weight lbs.	1375
Down payment $/head	$ 400	Heifer retention rate %	50%
Interest rate	9%	Notes: Cells in light green are user entered. Blue, Red, Green and Yellow are calculated.	
Term (years)	5	Enable macros to see calculations.	

Age	Steer weaning weight Bir et al. lbs	Steer weaning weight lbs	Heifer weaning weight Bir et al. lbs	Heifer weaning weight lbs	Annual feed cost $/head*	Annual other costs $/head	Streer sale price $/cwt	Hiefer sale price $/cwt	% Calf crop	% Cull by cow age	Cull cow price $/head	End of Year Head Remaining (Culled)	TOTAL Operating cash flow less down payment	TOTAL Principal and interest	TOTAL Cash surplus or deficit
1	--	--	--	--	$ 600	$ 25	--	--	--	0%	$ 1,400	100 (0)	$0	$ -	$ -
2	449	449	434	434	$ 600	$ 50	$ 250	$ 235	82%	25%	$ 810	75 (25)	$3,088	$ (35,993)	$ (32,905)
3	466	466	451	451	$ 625	$ 50	$ 243	$ 228	86%	10%	$ 1,080	67 (8)	$11,115	$ (35,993)	$ (24,878)
4	480	480	465	465	$ 650	$ 50	$ 238	$ 223	87%	10%	$ 1,125	60 (7)	$9,381	$ (35,993)	$ (26,612)
5	491	491	475	475	$ 675	$ 50	$ 235	$ 220	87%	12%	$ 1,170	53 (7)	$8,442	$ (35,993)	$ (27,551)
6	497	497	482	482	$ 700	$ 50	$ 230	$ 215	87%	20%	$ 1,238	42 (11)	$12,163	$ (35,993)	$ (23,831)
7	499	499	484	484	$ 700	$ 50	$ 225	$ 210	87%	30%	$ 1,238	29 (13)	$14,386	$ -	$ 14,386
8	497	497	482	482	$ 700	$ 50	$ 226	$ 211	87%	40%	$ 1,238	17 (12)	$13,684	$ -	$ 13,684
9	492	492	477	477	$ 725	$ 50	$ 228	$ 213	87%	75%	$ 1,238	4 (13)	$14,965	$ -	$ 14,965
10	483	483	468	468	$ 750	$ 50	$ 236	$ 221	86%	100%	$ 1,238	0 (4)	$4,600	$ -	$ 4,600



Average Longevity (yrs.) for USMARC heifers:

1 - 22 = 8.2 ± 0.3

23 - 42 = 7.6 ± 0.5

> 43 = 7.2 ± 0.1

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2023 Cow Herd Appraisal Performance Software Program (CHAPS) North Dakota Beef Cattle Improvement Association

Heifer Production Benchmarks

What is the **Pregnancy Rate** of my ***first-calf heifers*** for the ***first 60 to 70 days*** of the breeding season?

Mature Cow Production Benchmarks

What is the **Pregnancy Rate** of my ***mature Cows*** for the ***first 60 to 70 days*** of the breeding season?

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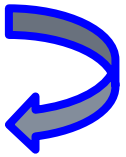
Heifer Production Benchmarks

What is the **Pregnancy Rate** of my ***first-calf heifers*** for the ***first 60 to 70 days*** of the breeding season?

- **~76%** of the calves born by **Day 21**
- **~87%** of the calves born by **Day 42**



11%

- **Remainder** of the calves born by **Day 63**

- if the majority of the **two-year old (first calf) heifers** ***are calving late*** *or* ***in the middle of the calving season***, → the **Heifer Development Program** and/or the **Management** of the first-calf heifers may need to be evaluated

****At weaning, one day age difference can translate into ~1.7 - 2.4 lbs. of WW lost.**

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Mature Cow Production Benchmarks

- What % of my **mature Cows** have calved **by Day 21**, **Day 42**, and **Day 63** of the calving season?
  - **~63%** of the calves born by **Day 21**
  - **~87%** of the calves born by **Day 42**
  - **~96%** of the calves born by **Day 63**

24%

9%

10-year Range: 58% to 64% (Dahlen, NDSU)

- If the percentage of **mature cows calving in the first 21 days is less than 60%** and **mature cows calving in the second 21 days of the calving season is greater than 25%,** a re-evaluation of the herd management is highly recommended.

****At weaning, one day age difference can translate into ~1.7 - 2.4 lbs. of WW lost.**

****If a large majority of the herd fails to calve in the first 21 days of the calving season, those cows fall behind missing the opportunity to re-breed and subsequently, will fail to maintain a 365-day calving interval.**

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What are your Target Production Benchmarks?

- It takes ~5 **(to 6)** calves to recover **developmental and production costs** of each replacement heifer retained. (Mousel et. al., 2012)

- Females that are culled **prior to producing 5 (to 6) calves increase the developmental cost** of other heifers and do not contribute to the profitability and/or sustainability of the operation

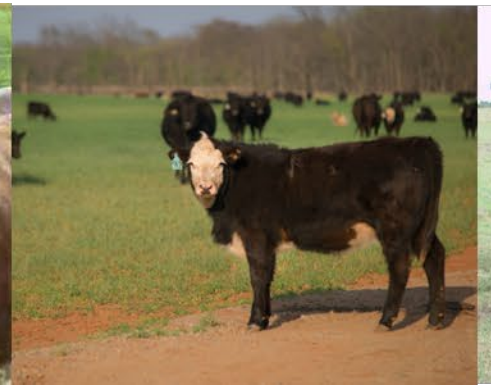
- It takes the profit of **two (2)** *early* calving cows to make up for **one (1)** *late* calving cow. (Funston, 2011)

Consideration #3

What is the Length of your Breeding Season?

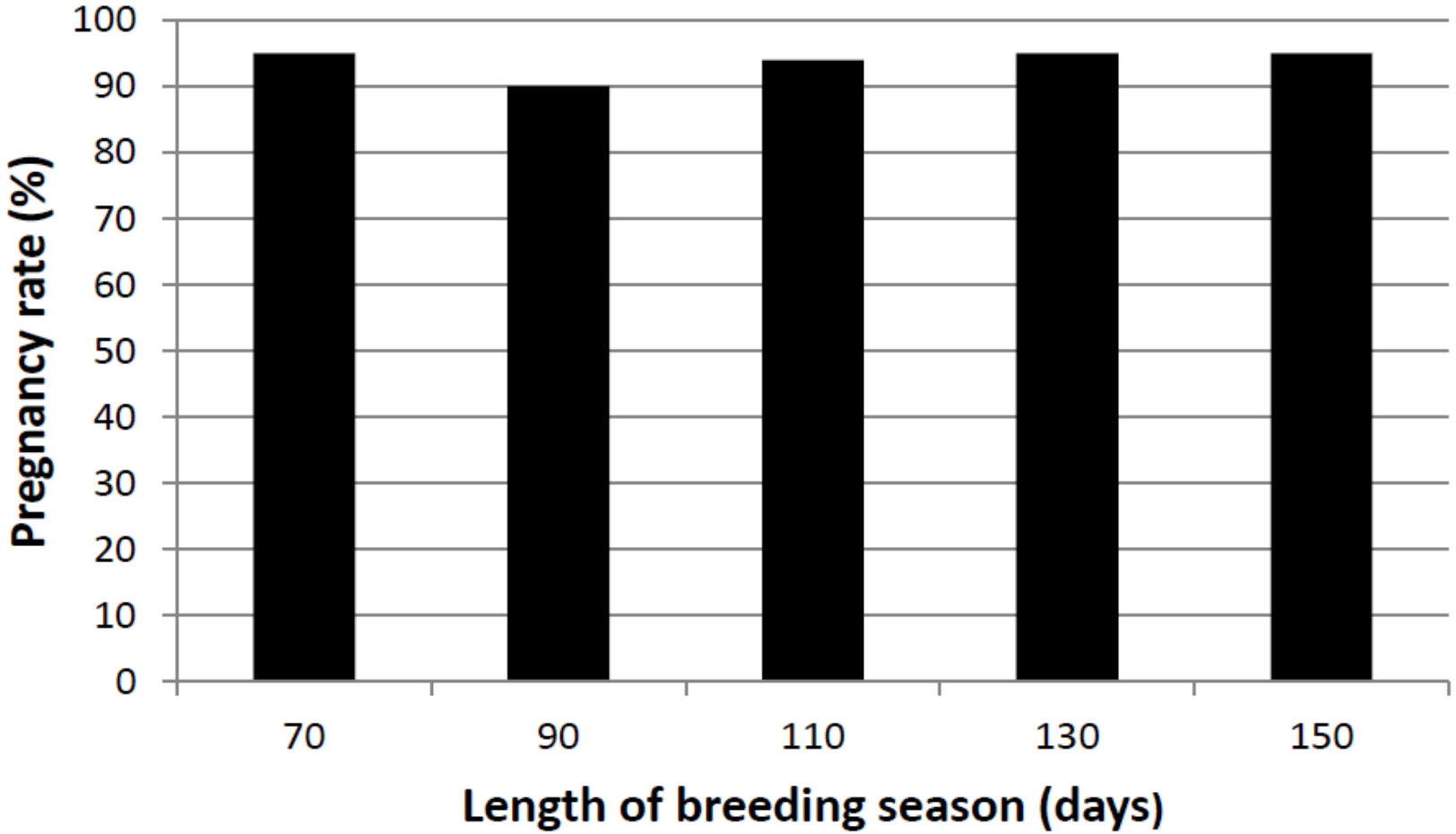
- Extending the length of the breeding season ***IS NOT*** a strategy for increasing **Pregnancy Rate.**




Maintain a Controlled Breeding Season

****extending the breeding season does not increase pregnancy rates**



→230 herds → over 22,000 cows from purebred/commercial herds → various herd sizes

M. Smith and G. Perry. 2015. My Herd is a Reproductive Wreck: What Can I Do?

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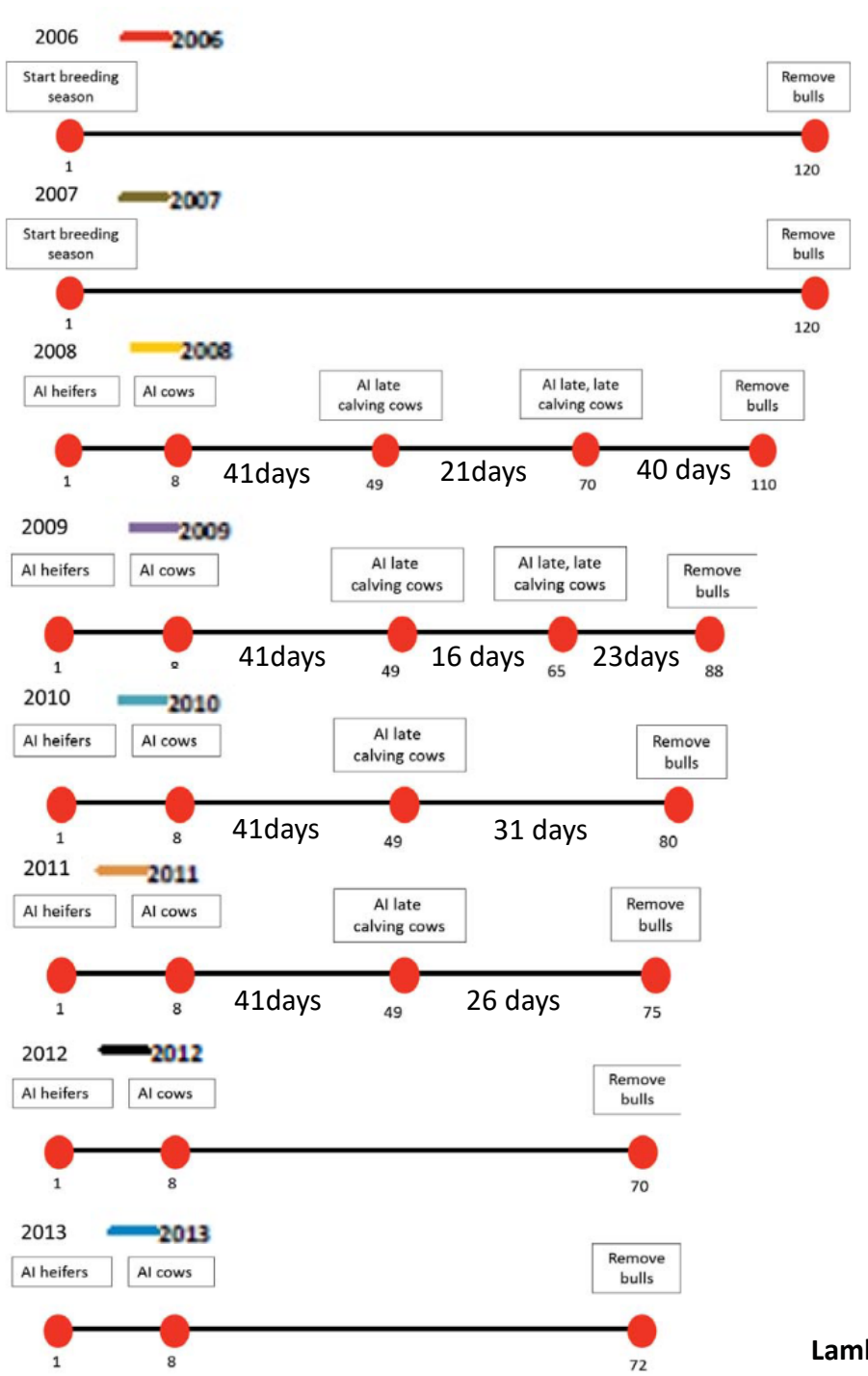
Maintain a Controlled Breeding Season

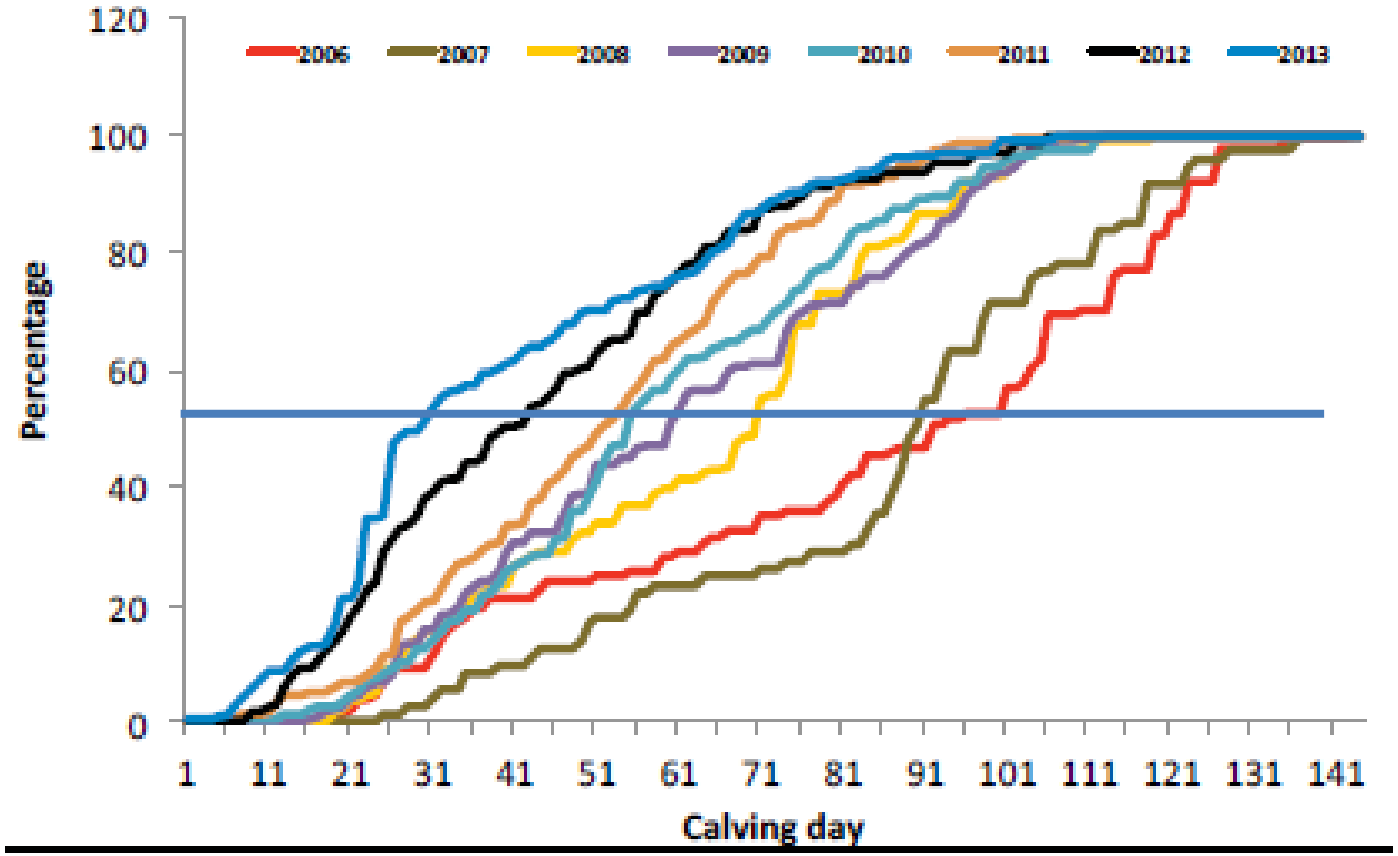
- **Longer Breeding Seasons** result in **Longer Calving Seasons.**
  - those that calve late (usually) don't have time to return to estrus and conceive before the end of the breeding season - further extending the breeding season
- **Decreasing** the length of the breeding season **can increase reproductive performance and weaning weights:**
  - shortening the calving season allows cows more time to return to estrus by the start of the subsequent breeding season
  - can increase weaning weights due to increased calf age at weaning

M. Smith and G. Perry. 2015. My Herd is a Reproductive Wreck: What Can I Do?

Impacts of Estrous Synchronization on Cowherd Performance

Item	Year	2006	2007	2008	2009	2010	2011	2012	2013
Overall PR, %		81	86	84	86	82	94	92	93
Mean calving day[a]		79.2	80.9	59.2	56.2	53.7	47.2	39.5	38.7
Breeding season length, d		120	120	110	88	80	75	70	72





Lamb, 2015; Range Beef Cow Symposium, Loveland, CO

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Mean calving day[a]		79.2	80.9	59.2	56.2	53.7	47.2	39.5	38.7
Breeding season length, d		120	120	110	88	80	75	70	72
Difference from 2006/2007		0	0	21.7	24.7	27.2	33.7	41.4	42.2
Per calf increase in value[b], $		0	0	$87	$99	$109	$135	$166	$169
Per herd increase in value[c], $1,000		0	0	$26	$30	$33	$40	$50	$51

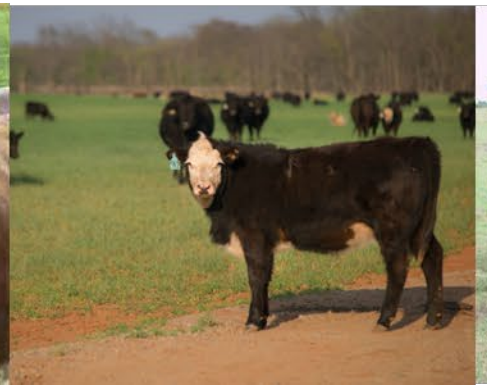
[a] Mean calving day from initiation of the calving season
[b] Increase calf value based on increased weaning weight compared to 2006/2007 mean calving day with 500 lb calf valued at $2.00/lb
[c] Increase calf value based on 300 head cow herd.

Lamb, 2015; Range Beef Cow Symposium, Loveland, CO

Consideration #4

What is the Cost of Missing One+ Estrous Cycle



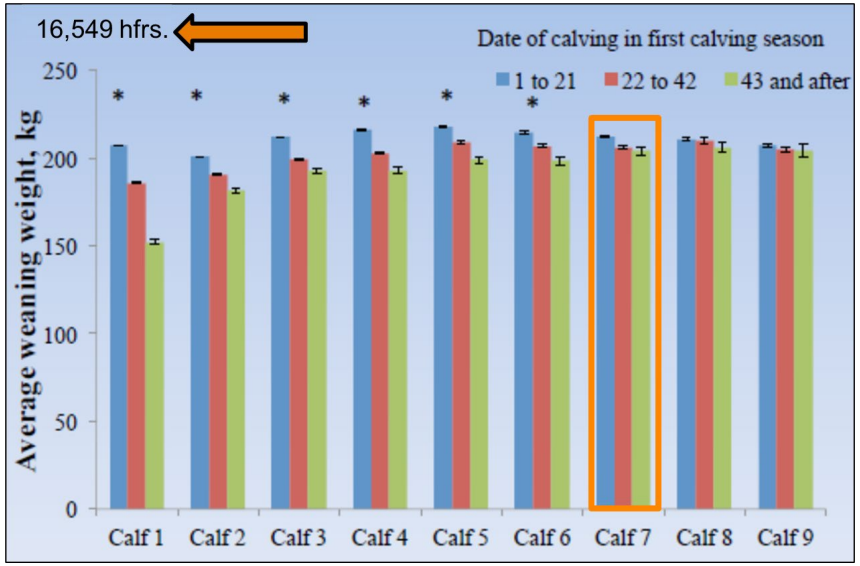




Cost of Missing One+ Estrous Cycles

- Influence of calving date in 1st calving season on average weaning weight of calves born to heifers

Avg. weaning weight for USMARC Heifers (P < 0.01)

- 1 - 21 days = 454 ± 0.66 lbs.
- 22 - 42 days = 428 ± 1.10 lbs.
- > 43 days = 384 ± 2.40 lbs.



Cost of Missing One+ Estrous Cycles

Average Weaning Weight of Calves born to USMARC Heifers

OKC: 12.17.23 **Market Price: (400-436) @ $3.17**

1 - 21 = 454 ± 0.66 lbs.
22 - 42 = 428 ± 1.10 lbs.
} 23 lbs.

26 lbs. X $3.17 = **$82.42**

1 - 21 = 454 ± 0.66 lbs.
> 43 = 384 ± 2.40 lbs.
} 70 lbs.

70 lbs. X $3.17 = **$221.90**

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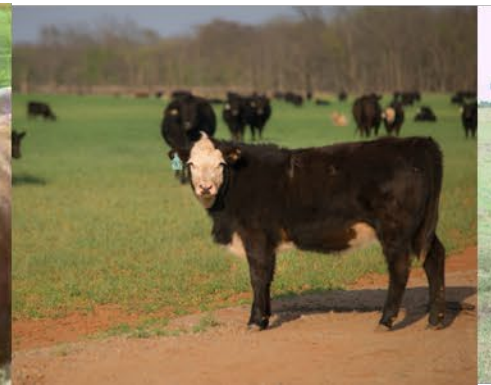
Consideration #5

Nutrition sets the Pattern for Breeding and Calving (Body Condition Score)




Proper Nutrition

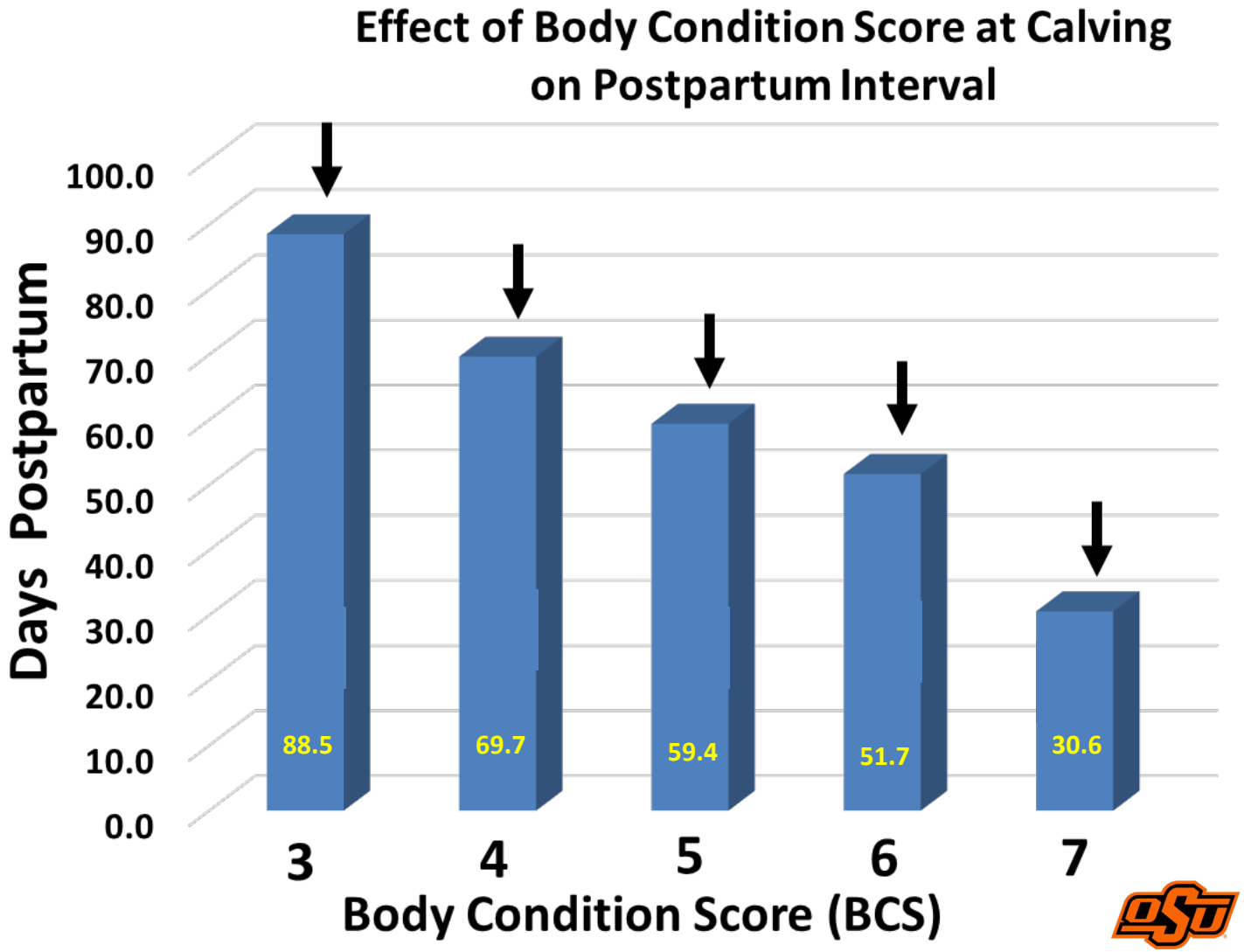
- ***PREPARTUM*** **Nutrition (prior to calving) is more important than** ***POSTPARTUM*** **Nutrition in determining the length of the post-partum interval (PPI).**

Body Energy Reserve at calving is the most important factor that influences the interval from parturition to the first estrus and ovulation in beef cows (Wettemann et al. 2002)

- **Length of Postpartum Interval *increases* as BCS at calving decreases

Suckling has the greatest impact on females:

- in poor body condition
- first calf heifers



adapted from Houghton et al., 1986

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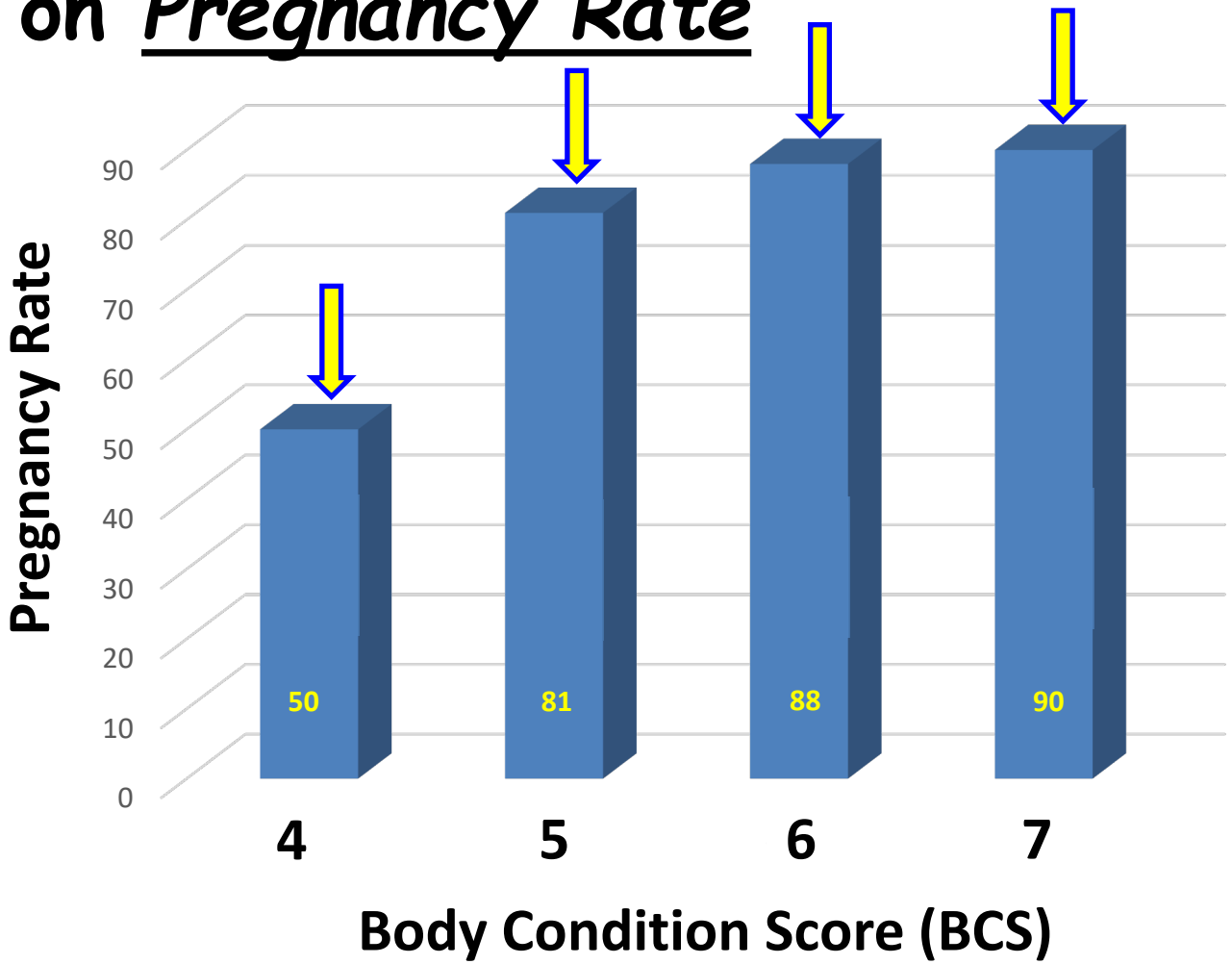
Effect of Body Condition Score *at Calving* on *Pregnancy Rate*

Each unit of change in BCS (range =1 to 9) is associated with: ~75 to 100 lbs. in cow weight



- **Pregnancy Rates at the end of Breeding Season increase as BCS at calving increases** adapted from Selk et al., 1985

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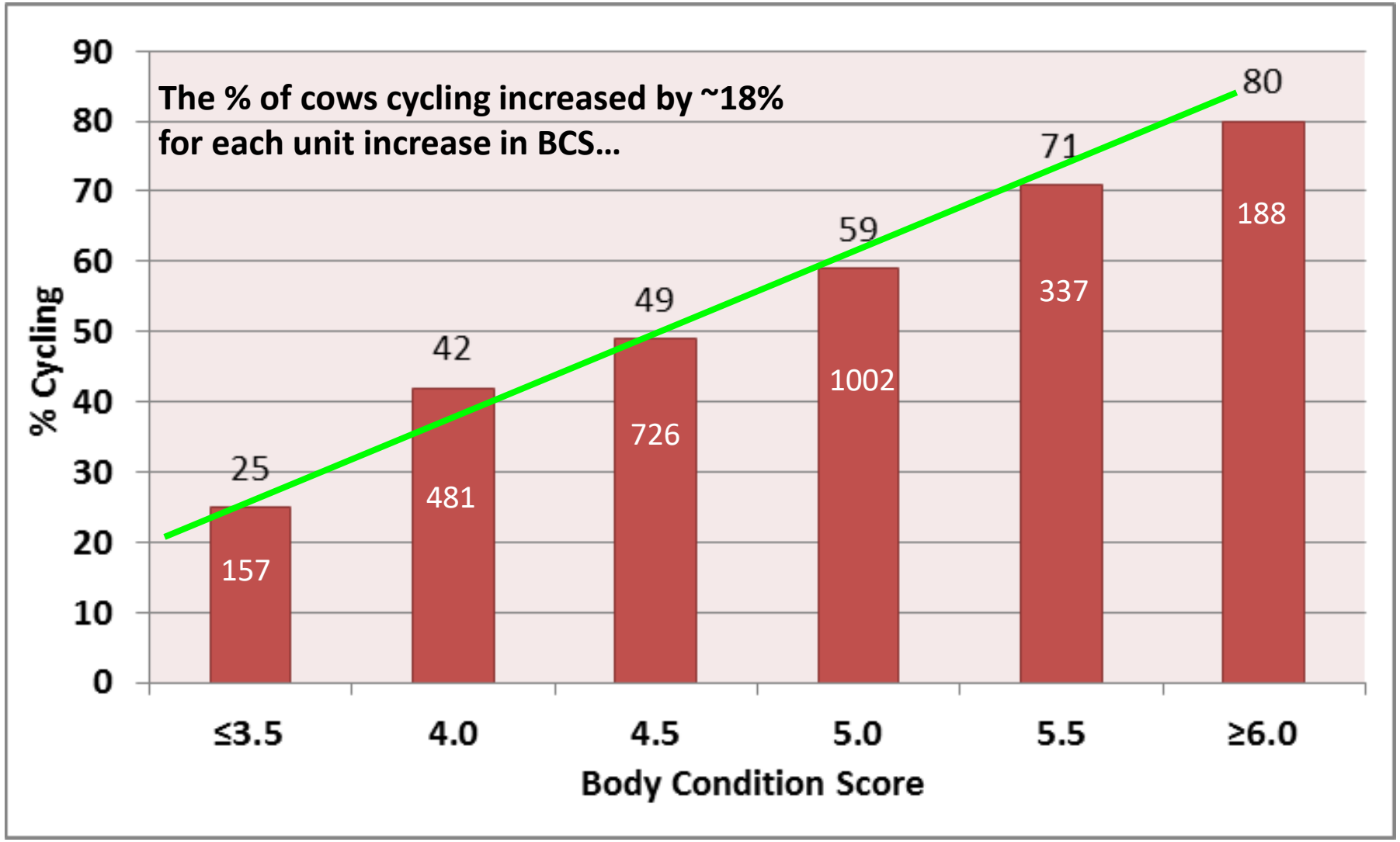
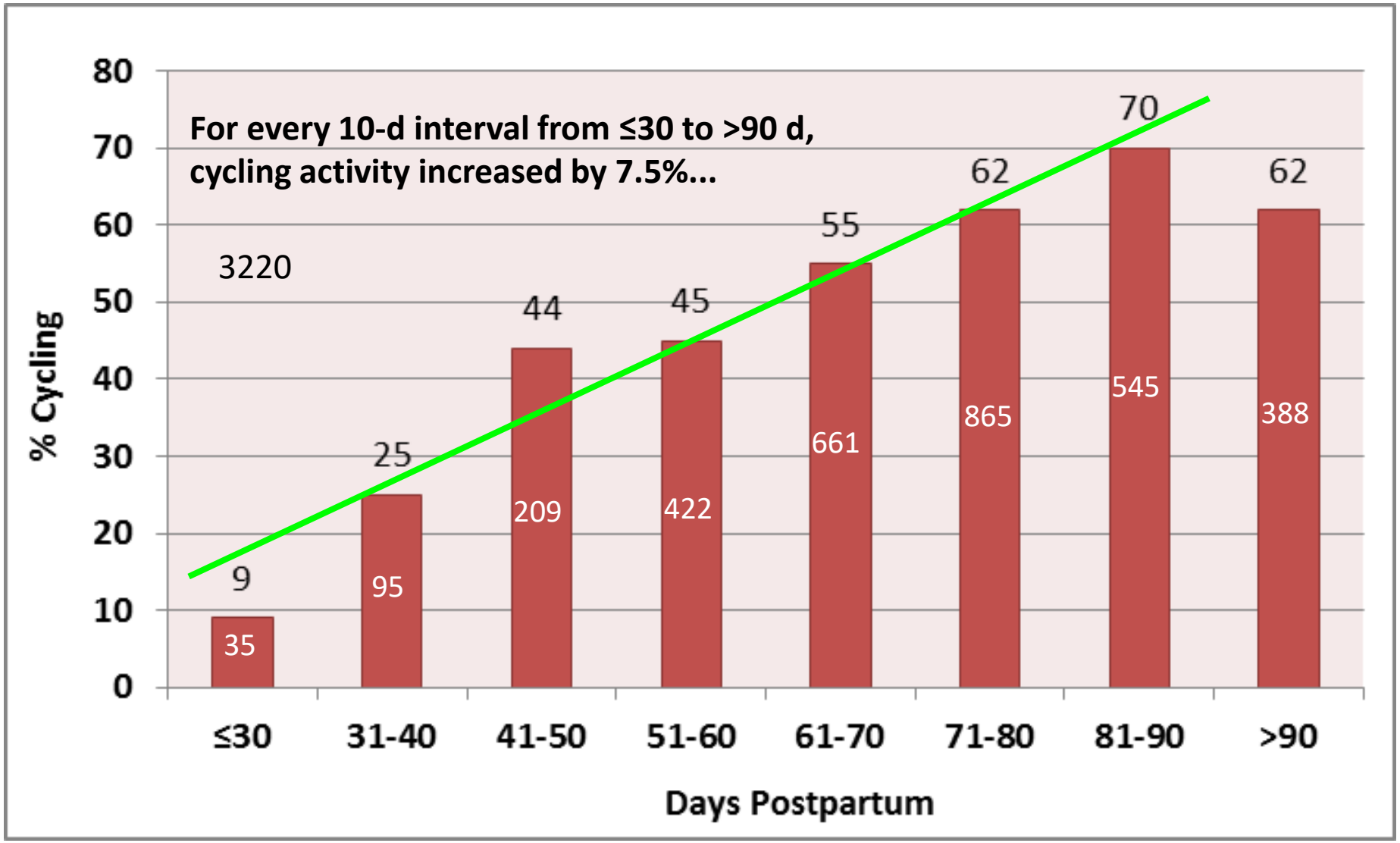
The ability to induce ovulation in anestrous primiparous cows was limited (< 20%) when BCS was less than 5.0



Proportion of suckled cows that were cycling on the first day of the breeding season on the basis of body condition score: values are numbers of cows per category.

Results originated from 3,269 beef cows in seven studies conducted during the spring breeding seasons of 1994 to 2001 in Kansas and Minnesota.

Stevenson et al. (2003)



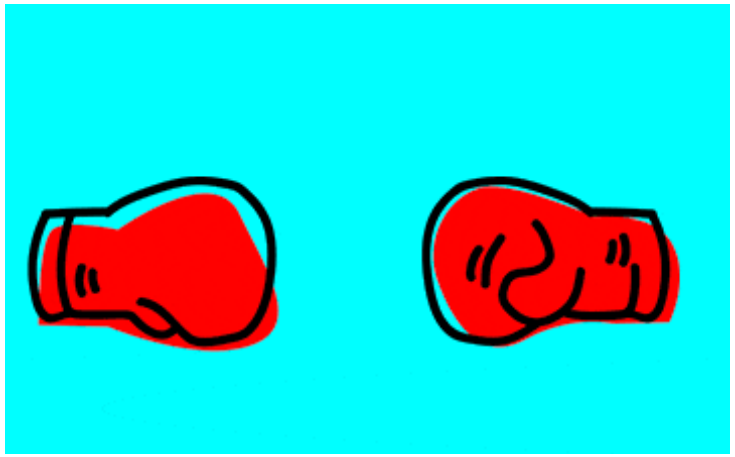
Proportion of suckled cows that were cycling on the first day of the breeding season on the basis of days since calving.

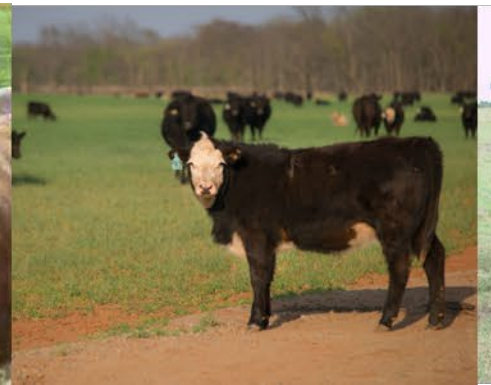
Results originated from 3,269 beef cows in seven studies conducted during the spring breeding seasons of 1994 to 2001 in Kansas and Minnesota…

Stevenson et al. (2003)

Consideration #6

Target Weight: 55% or 65% of mature Body Weight at Breeding?





Age at Puberty

- **Heifers need to calve by 24 mo. of age to achieve maximum lifetime productivity** Patterson et al., 1992

- In order for a heifer to calve at ~24 mo. of age **she must reach Puberty by 12 to 14 mo. of age…**

Main Factors Affecting Puberty

- ✓ ****Age**
- ✓ ****Weight**
- ✓ Breed (genotype)
- ✓ Environment

- Heifers from different breeds reach puberty at different ages, ranging from 10 to 14 months **(with indicus later than taurus)** with **crossbred heifers** usually displaying estrus at an earlier age than **purebreds.**

Hall et.al. 1995; Moorey and Biase. 2020

Growing from Weaning to Breeding

- **The nutritional program is only one facet of proper heifer development the key is to match weight with appropriate frame-size of the heifer**.

  Patsy Houghton, 2009 (former owner of Heartland Cattle Company – Professional Heifer Development)

- **Undernourished heifers** do not attain puberty, as there exists a **"threshold"** weight below which heifers will not cycle. (Kiser et al., 1978; Day et al., 1986)

- To ensure acceptable pregnancy rates and proper size for calving, heifer **must gain weight during the breeding season** and **post-breeding season**.
  - Heifers need to weigh **85% to 90% of mature weight at calving as two-year-olds** to minimize dystocia. Hall et.al., 1995

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Impact Target Weight on Pregnancy Rates In Replacement Beef Heifers

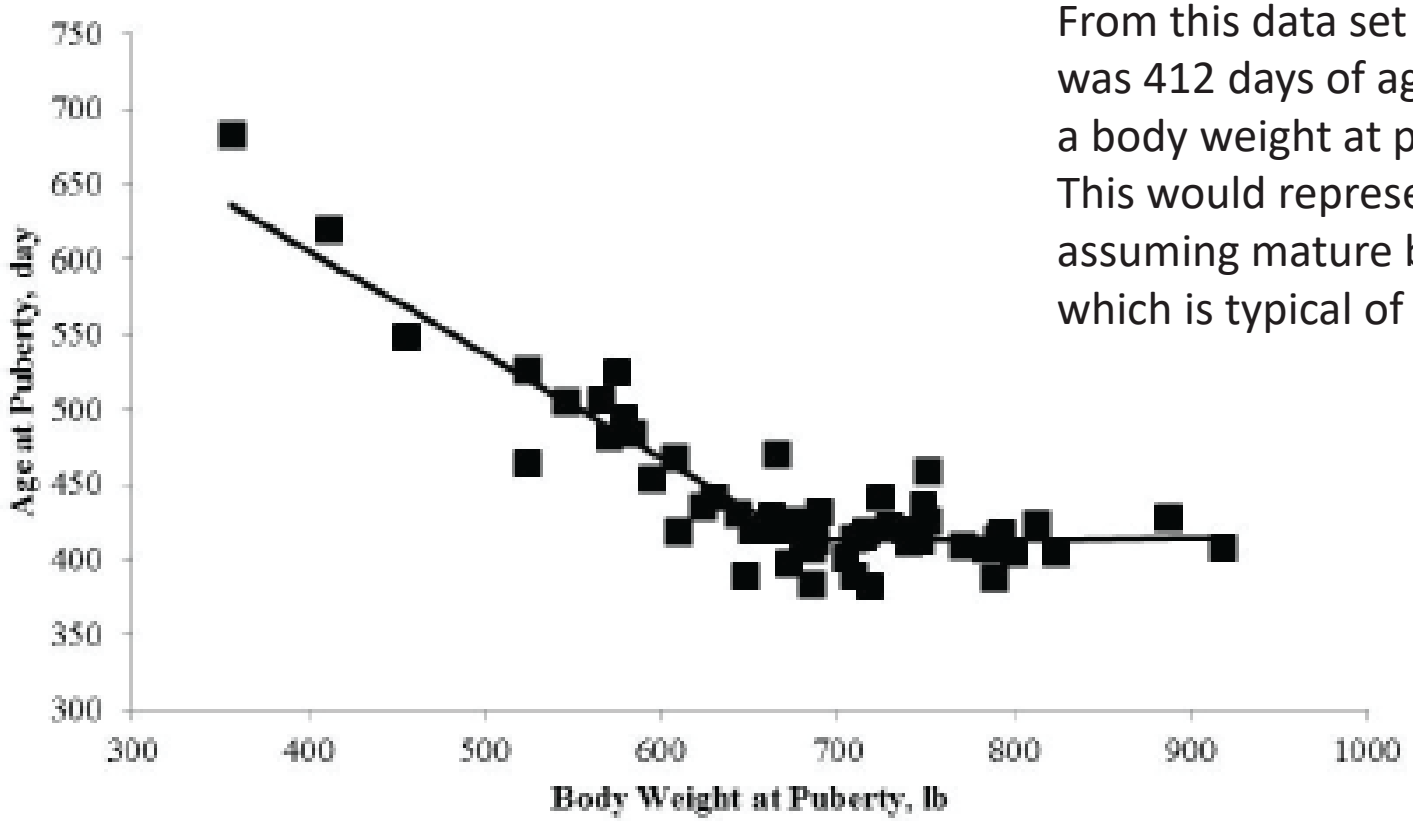
Study	Target Weight* (% of Mature Weight)		
	No. of heifers	55	65
Patterson et al., 1992 (Bos Taurus)	137	84 %	89 %
Funston and Deutscher, 2004	240	92 %	88 %
Martin et al., 2008a	261	87 %	90 %
Roberts et al., 2009	397	87 %	92 %
Eborn et al., 2013	360	77 %	83 %
Mulliniks et al., 2013	191	91 %	84 %
Lardner et al., 2014	176	86 %	88 %
Bailey et al., 2014	203	74 %	77 %

* 65% - Range 58% to 65%; 55% - Range 48% to 56%
[a] In this study 55 = 50% and 65 = 56%

Hall, J.B., N.M. Hall, J.B. Glaze, Jr. 2016. Heifer nutritional development and the target weight Debate. Applied Reproductive Strategies in Beef Cattle, Des Moines, IA. September 7-8.

- When a **rough average** is taken from the results of the above experiments, differences in heifer pregnancy rate at the end of the breeding season were less than 2% (1.63) in favor of the 65% target.
- Six (6) out of eight (8) experiment demonstrated a **numerical advantage** to a 65% target weight, **the differences were not shown to be significant**.
- **A majority of the 55% target weight research has been conducted with **crossbred or composite cattle which, due to heterosis, will reach puberty at a younger age than the purebred or straightbred breeds used to make the crosses.**

- Relationship of age at puberty with body weight at puberty in replacement beef heifers of ***Bos taurus*, *Bos indicus*, and *Bos taurus* × *Bos indicus*** breeding.



From this data set the critical minimum age to achieve puberty was 412 days of age (13.7 months of age), which coincided with a body weight at puberty of 679 lb.
This would represent 56.6% to 61.7% of mature body weight, assuming mature body weight is between 1,100 and 1,200 lb., which is typical of cows found **in Florida**.

(Lancaster et al., 2014, 2017)

Data suggests that heifer development programs should utilize **both a target body weight** and **minimum age.** This would keep from overfeeding heifers to achieve target body weight before they have reached the minimum age that will allow them to attain puberty, which may reduce feed costs of developing replacement heifers.

Growing from Weaning to Breeding

- **In Heifers** - there is up to a **21% increase** in fertility from the **pubertal estrus** to the **third estrus.** Byerley et al. 1987; Perry et al., 1991
- Heifers that have **at least one (1) estrous cycle** prior to the breeding season had higher pregnancy rates, but that multiple estrous cycles prior to breeding **may not** further improve pregnancy significantly. (Vraspir et al. 2014)
- If you are **breeding your heifers ~3 weeks (1-cycle) before the cows** to account for the longer postpartum period in heifers, then…

  …heifers need to reach puberty at least 6 to 10 wks. before you begin breeding cows to increase the proportion of heifers that conceive early in the breeding season. Atkins et al., 2013

Heifers born earlier in the calving season will more than likely reach puberty before the start of the first breeding season

	Birthdate of Heifers relative to Calving Season		
	First 21 days	Second 21 days	Third 21 days
Percent (of each of group) cycling before the start of breeding season	70%[a]	58%[b]	39%[c]
Calve in the first 21 day of calving season	81%[X]	69%[Y]	65%[Y]

(Funston, et al. 2012)

OSU EXTENSION

Consideration #7

Does it matter how the Heifers are fed to reach the desired Target Weight?

- Evaluate heifers at least ***60 days*** prior to the start of the breeding season to ensure enough time to adjust rations to reach target weights.



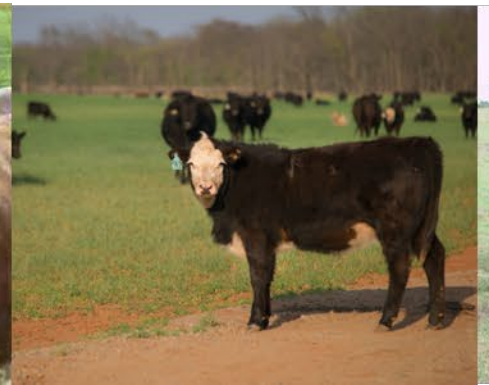
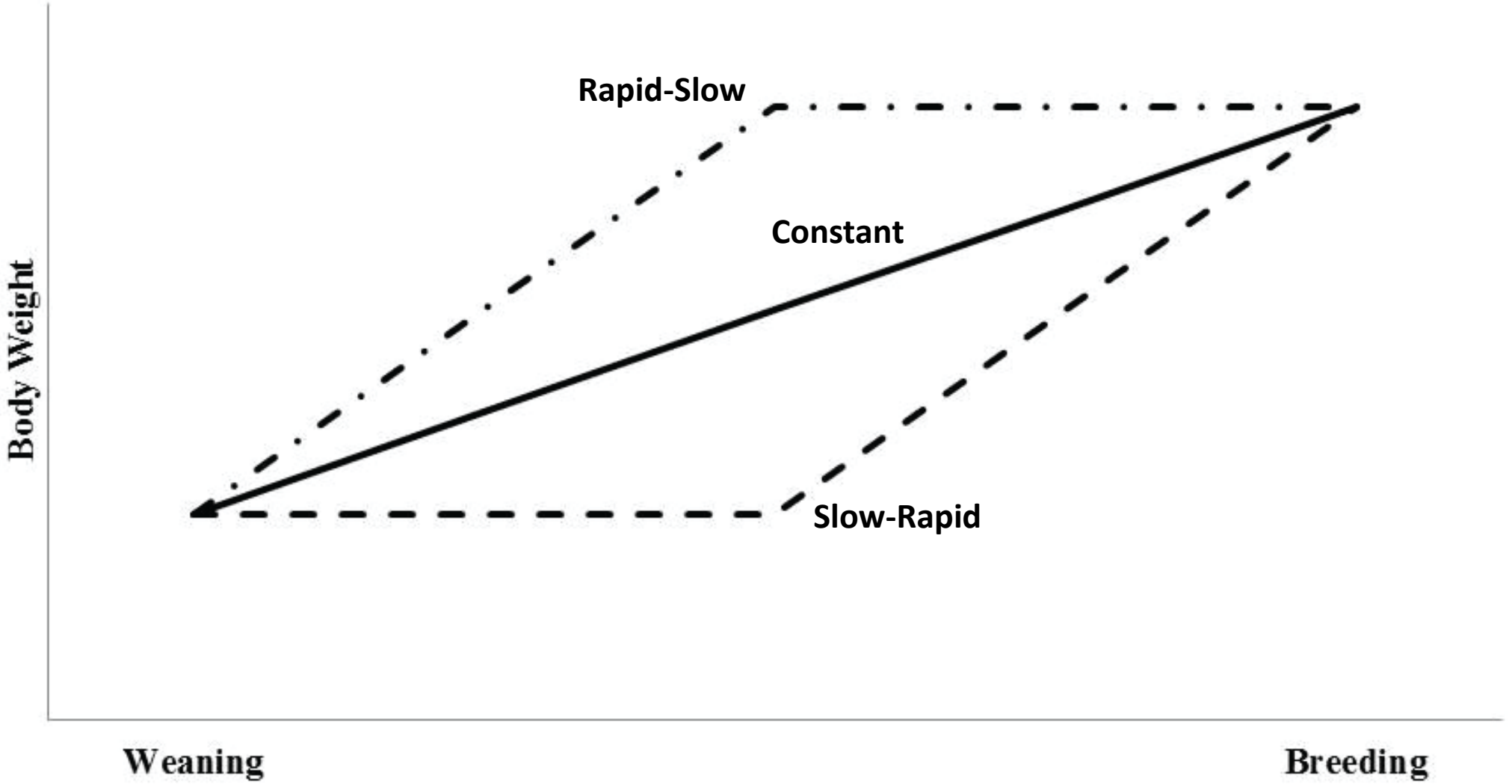
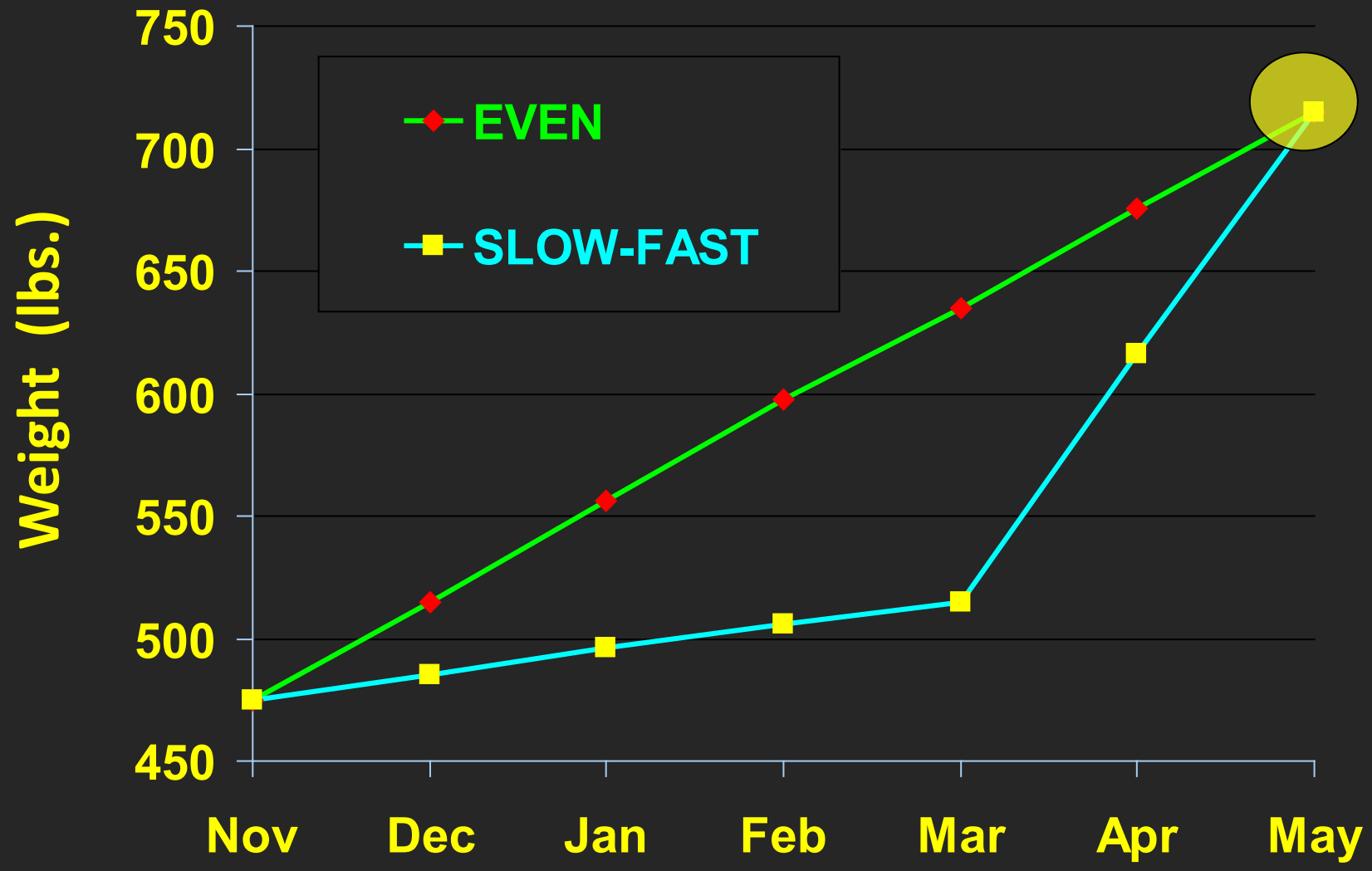




Illustration of different patterns of gain for replacement heifers from weaning to the start of the breeding season



Growing Programs for Heifers

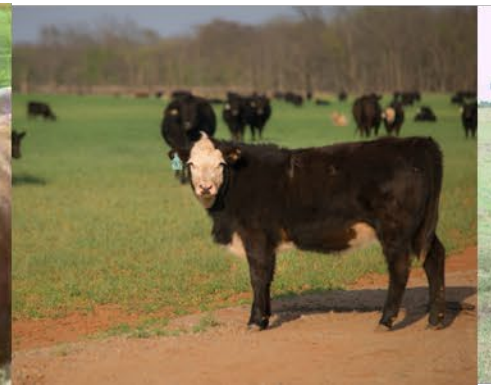


(Lynch, et al., 1997)

Consideration #8

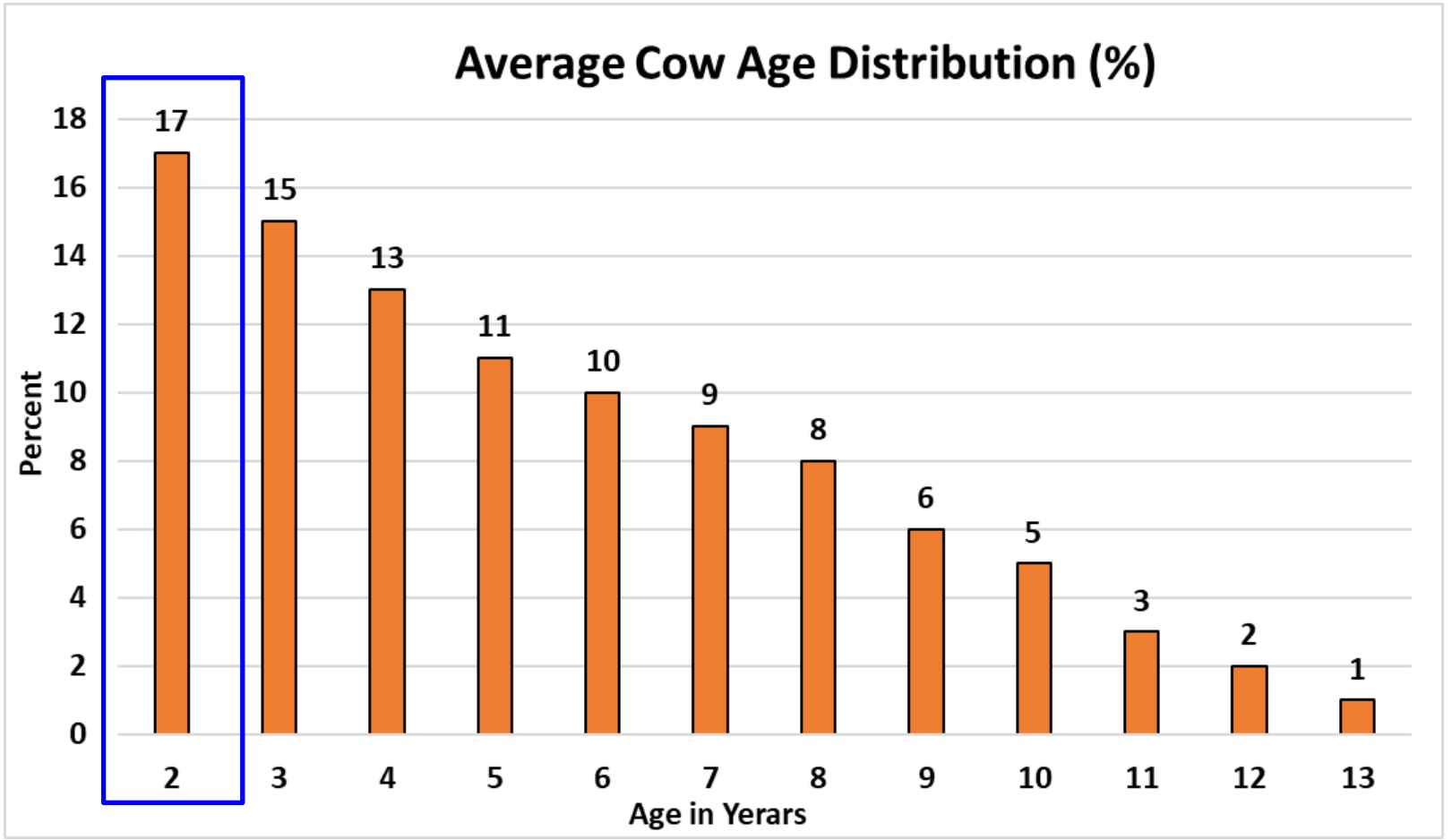
How many replacement Heifers should be held back each year?




Replacement Heifer Numbers

- NDSU research suggests replacement rate for “typical” cow herd is ~17±%
- Breed at least 10% more than needed?

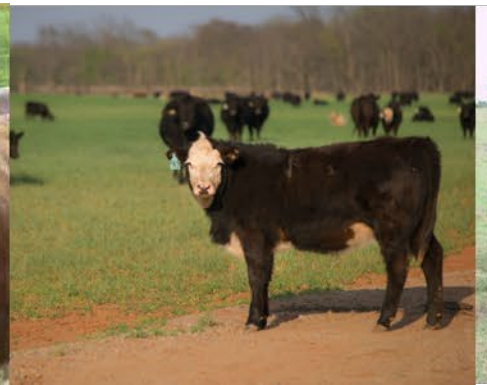


EXTENSION

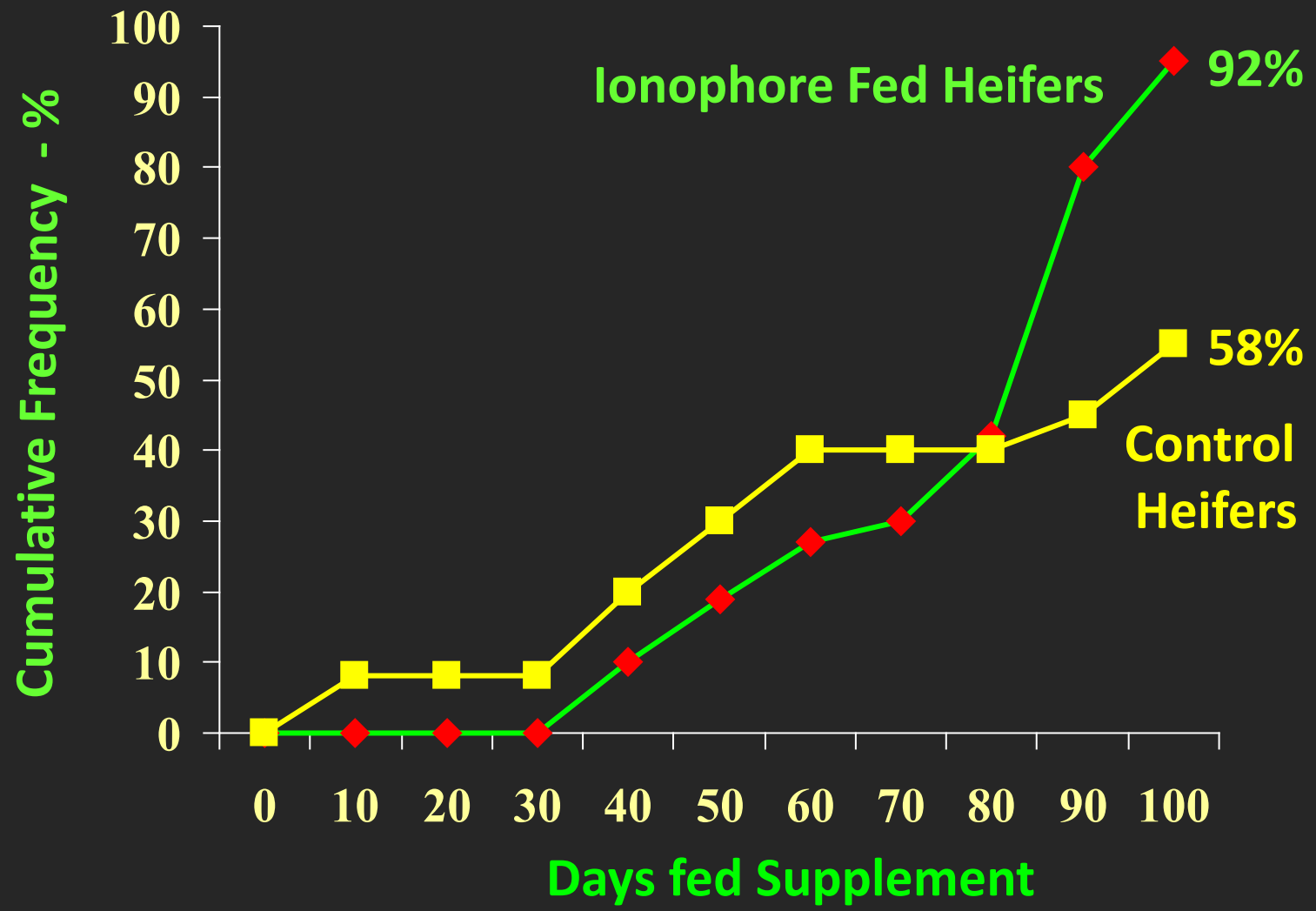
Consideration #9

Use of Ionophores and Growth Implants




- Ionophores (e.g., Bovatec® and Rumensin®) have been shown to reduce age at puberty in replacement heifers ...(Sprott, et al., 1988) (Goehring, et al., 1984) (Moseley et al., 1977)



Use of Ionophores

Age at Puberty

- reduced age at puberty: 8.9 ± 1.48 d. ($P < 0.0001$)

Percent Cycling prior to Breeding Season

- monensin supplementation mean response was 15.9 ± 5.13% more heifers cycling by the beginning of the breeding season ($P = 0.002$)
- percentage of cows exhibiting estrus prior to the breeding season was increased by 19 ± 8% ($P = 0.03$).

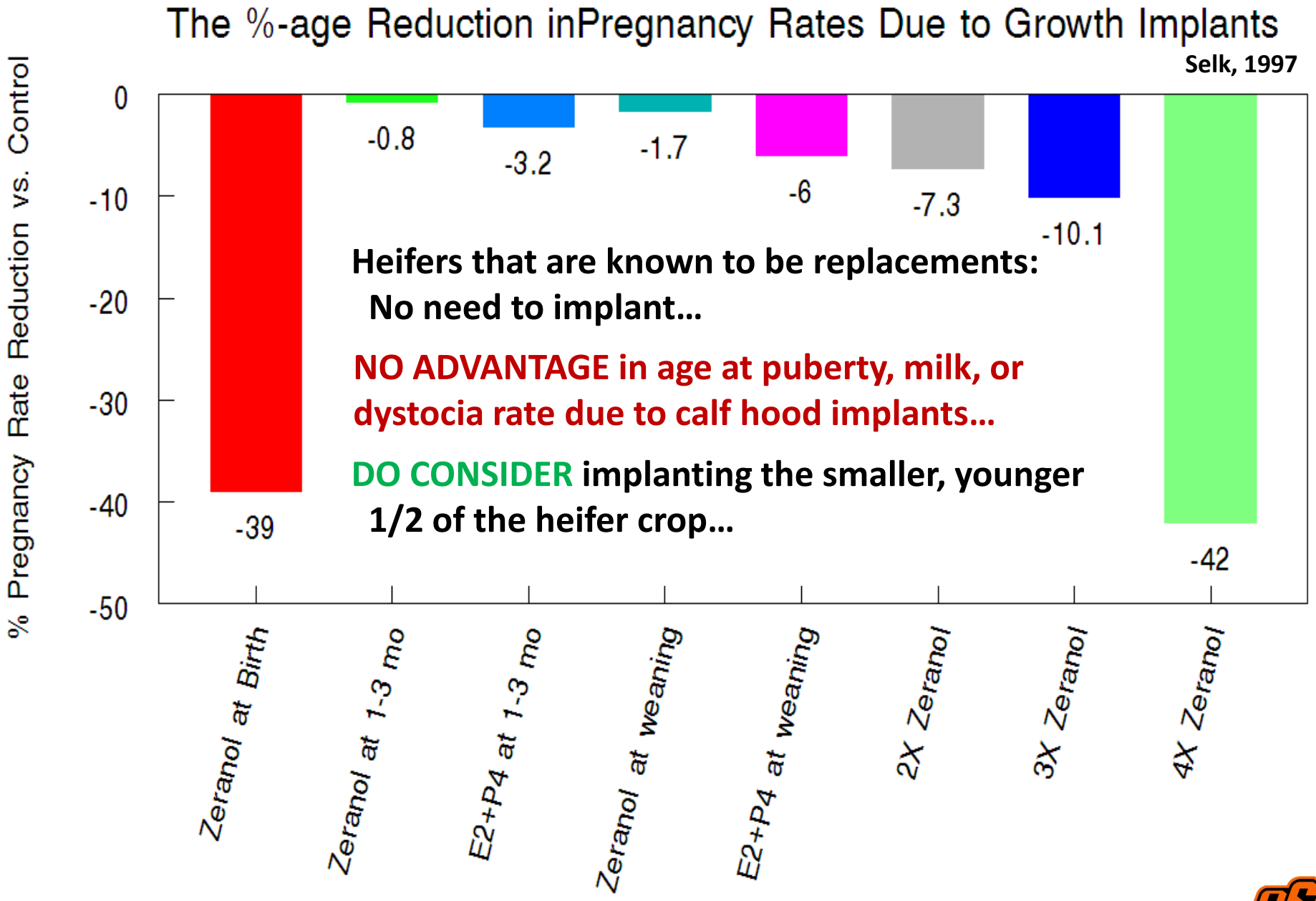
Overall Pregnancy Rate

- There were no differences in artificial insemination pregnancy nor total pregnancy for either the heifer or mature cow data sets.

Reduction in days to First Estrus

- Monensin supplementation resulted in a reduction in days to first estrus by 18 ± 8.2 d ($P= 0.02$)

Gadberry et al., 2022


The %-age Reduction inPregnancy Rates Due to Growth Implants
Selk, 1997
% Pregnancy Rate Reduction vs. Control
0
-10
-20
-30
-40
-50
-39
-0.8
-3.2
-1.7
-6
-7.3
-10.1
-42
Zeranol at Birth
Zeranol at 1-3 mo
E2+P4 at 1-3 mo
Zeranol at weaning
E2+P4 at weaning
2X Zeranol
3X Zeranol
4X Zeranol
Heifers that are known to be replacements:
No need to implant…
NO ADVANTAGE in age at puberty, milk, or dystocia rate due to calf hood implants…
DO CONSIDER implanting the smaller, younger 1/2 of the heifer crop…

**Synovex C: (100-mg progesterone + 10-mg estradiol)

Item	CON[1]	BIMP[2]	WIMP[3]	SEM	*P* value
No. of Heifers	57	61	52		
Body weight, kg					
Weaning weight	223[b]	235[a]	217[b]	4.37	0.01
Yearling weight	218[ab]	228[a]	212[b]	4.22	0.02
Breeding weight	241[ab]	248[a]	235[b]	4.04	0.06
Average daily gain, kg/d					
Weaning to yearling	−0.05	−0.07	−0.05	0.01	0.38
Yearling to breeding	0.28	0.26	0.31	0.02	0.09
Total[4]	0.08[ab]	0.06[a]	0.09[b]	0.008	0.04
Estrus response, %	49	55	72	7.05	0.08
First service conception rate, %	75	65	53	10.56	0.28
Overall pregnancy rate, %	85	81	84	5.86	0.86

[a,b]Means within a row without a common superscript differ.

[1]CON = heifers received no growth-promoting implant.

[2]BIMP = heifers received a single Synovex C implant at 3 mo of age.

[3]WIMP = heifers received a single Synovex C implant at 8 mo of age.

[4]Heifer average daily gain from weaning to the start of the breeding season.

→ Heifers in all treatments had a negative ADG from weaning to yearling, indicating inadequate nutrient availability.

Implant Strategies

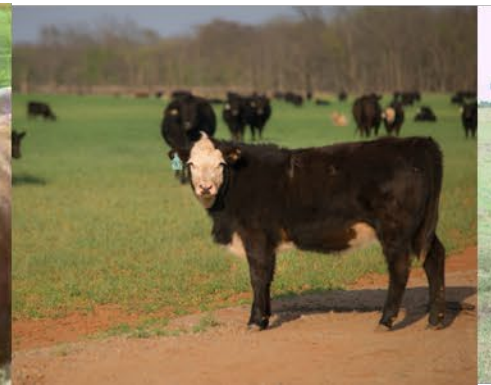
- **If implanting all Heifer calves**
  - ✓retain extra replacement heifers as insurance against potential reduction or delay in pregnancy
- **NOT implanting any Heifer calves known to be replacements**
  - ✓the best option if raising replacements is the priority of the operation
- **Implanting only late-born Heifers**
  - ✓late-born Heifers are usually poor candidates for replacements
    - ✓the improved growth due to the implant will help them catch up in weaning weight
- If purchasing replacement heifers make sure you know the status of the heifers; implanted/not implanted

Consideration #10

How big is she going to be?

Hip Height - Frame Score



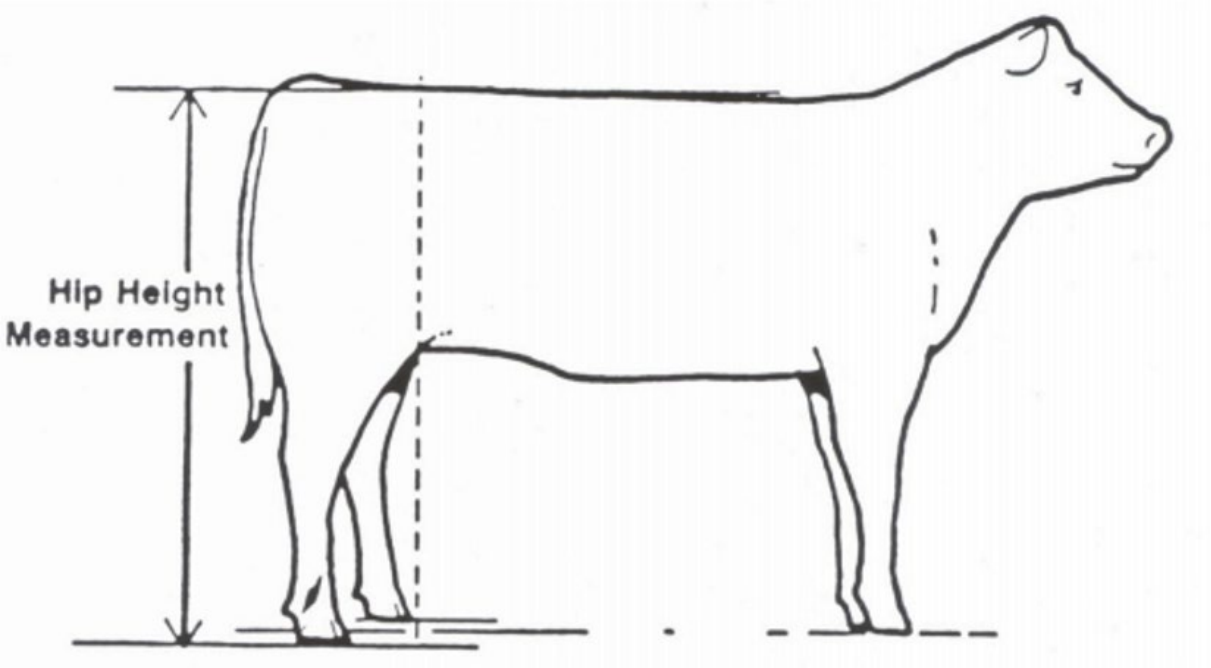



Table 2: Frame score and hip height of female beef cattle at 7-months, 14-months and maturity and body weight of female cattle of different frame scores at maturity and 60 of mature body weight.

Age	Frame Score					
	3	4	5	6	7	8
Hip Height, inches						
7-mo of age	39.2	41.2	43.3	45.3	47.4	49.6
14-mo of age	44.1	46.1	48.0	50.0	52.0	54.0
Maturity	48.2	50.0	52.0	53.9	55.8	57.8
Body Weight, lbs						
Maturity[1]	1000	1100	1200	1300	1400	1500
60% of mature BW	600	660	720	780	840	900

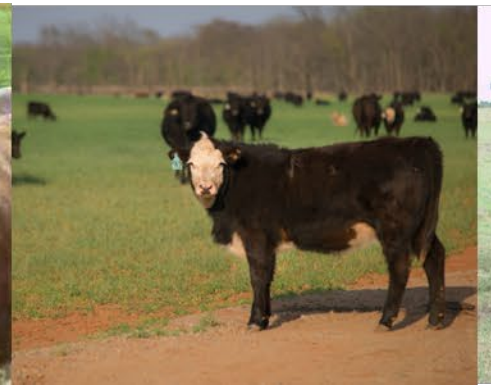
[1] At body condition score 5.

Caution should be taken when using the frame score equations and tables. These calculations were developed from cattle data from the 1970s. Cattle today tend to be heavier, at similar heights, to cattle used to develop the frame score equation.

Consideration #11

Reproductive Tract Score




Reproductive Tract Scoring

- The **Reproductive Tract Score (RTS)** system was developed to assist beef producers with selection of potential replacement heifers before initiation of the breeding season and to estimate pubertal status…
- **RTS** is a subjective **estimate of sexual maturity** (pubertal status) in heifers based on:
  - →**rectal palpation of ovarian activity (structures on ovary)**
  - →**size of the reproductive tract (uterus and uterine horns)**
- **Range: 1 = (immature) through 5 = (cycling)**

Reproductive Tract Scoring

- **Heifers with a RTS of 1, in most cases, should be culled** (Poock and Payne, 2013)

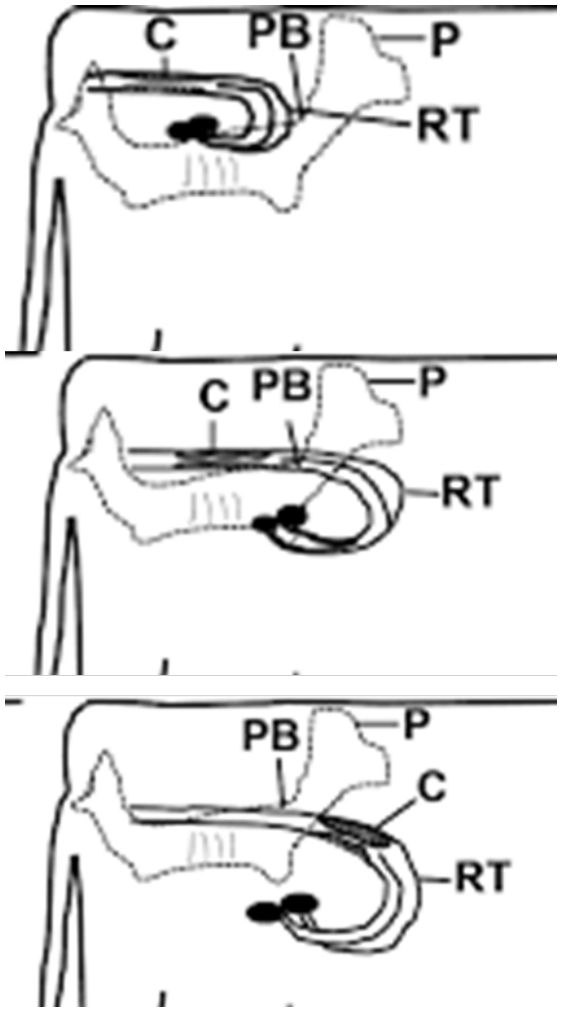
- **If most heifers in a group are assigned a RTS below 4**,
  - it is recommended that the producer evaluate the prepuberal status of the heifers to determine whether there were problems related to the heifer development program

- **An advantage of implementing a progestin-based (i.e. CIDR or MGA) estrus synchronization protocol is that you **will be able to induce estrus and ovulation in the heifers with a RTS of ≥3** (Smith and Perry, 2012) (Gutierrez, 2014)

Description of Reproductive Tract Score

Pea = 6 mm Moth Ball = 12 mm
Penny = 18 mm Ping-Pong Ball = ~30 mm

Reproductive Tract Score	Uterine Horns	Ovaries: Approximate size Length (mm)	Height (mm)	Width (mm)	Ovarian Structure
1	Immature < 20 mm diameter, - no tone	15	10	8	No palpable follicles
2	20 to 25 mm diameter, - no tone	18	12	10	8 mm follicle
3	25 to 30 mm diameter, - slight tone	22	15	10	8-10 mm follicle
4	30 mm diameter - good tone	30	16	12	>10 mm follicle, Corpus Luteum possible
5	> 30 mm diameter, - good tone, erect	>32	20	15	>10 mm follicle, Corpus Luteum present



Reproductive Tract Scoring

Pregnancy Rates resulting form Fixed-Time AI based on Reproductive Tract Score (Fall 2010 – Fall 2016). Missouri Show-Me-Select Replacement Heifer Program™

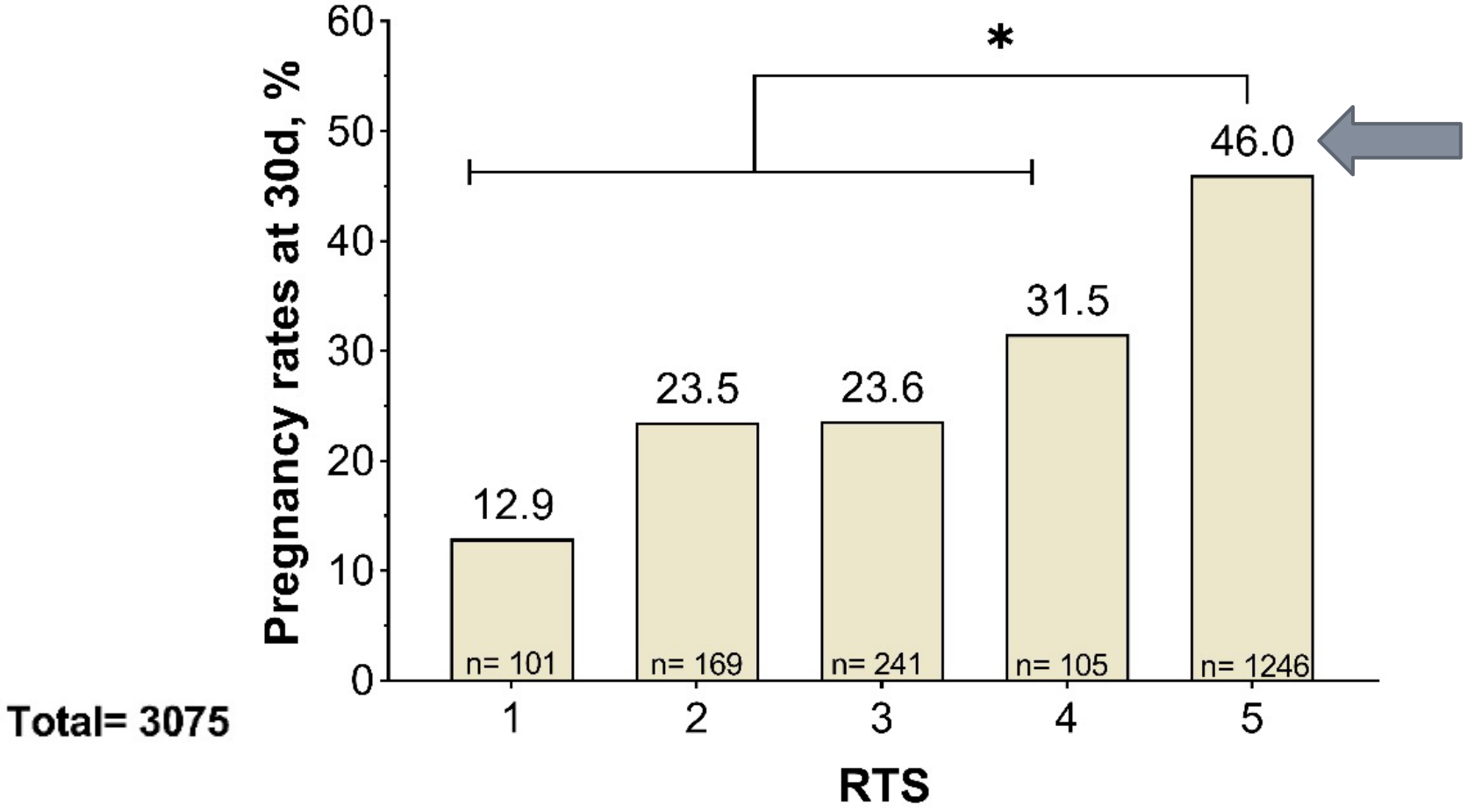
(Locke etal., 2016)

Reproductive Tract Score	1	2	3	4	5	Total
Number of Heifers	163	893	8,422	10,092	9,773	29,343
Number Pregnant	9	255	4,091	5,138	5,088	
FTAI pregnancy rate (%)	6%	29%	48%	51%	52%	

1 = infantile; **2 and 3** = noncycling/prepubertal**; 4 and 5** = cycling/pubertal

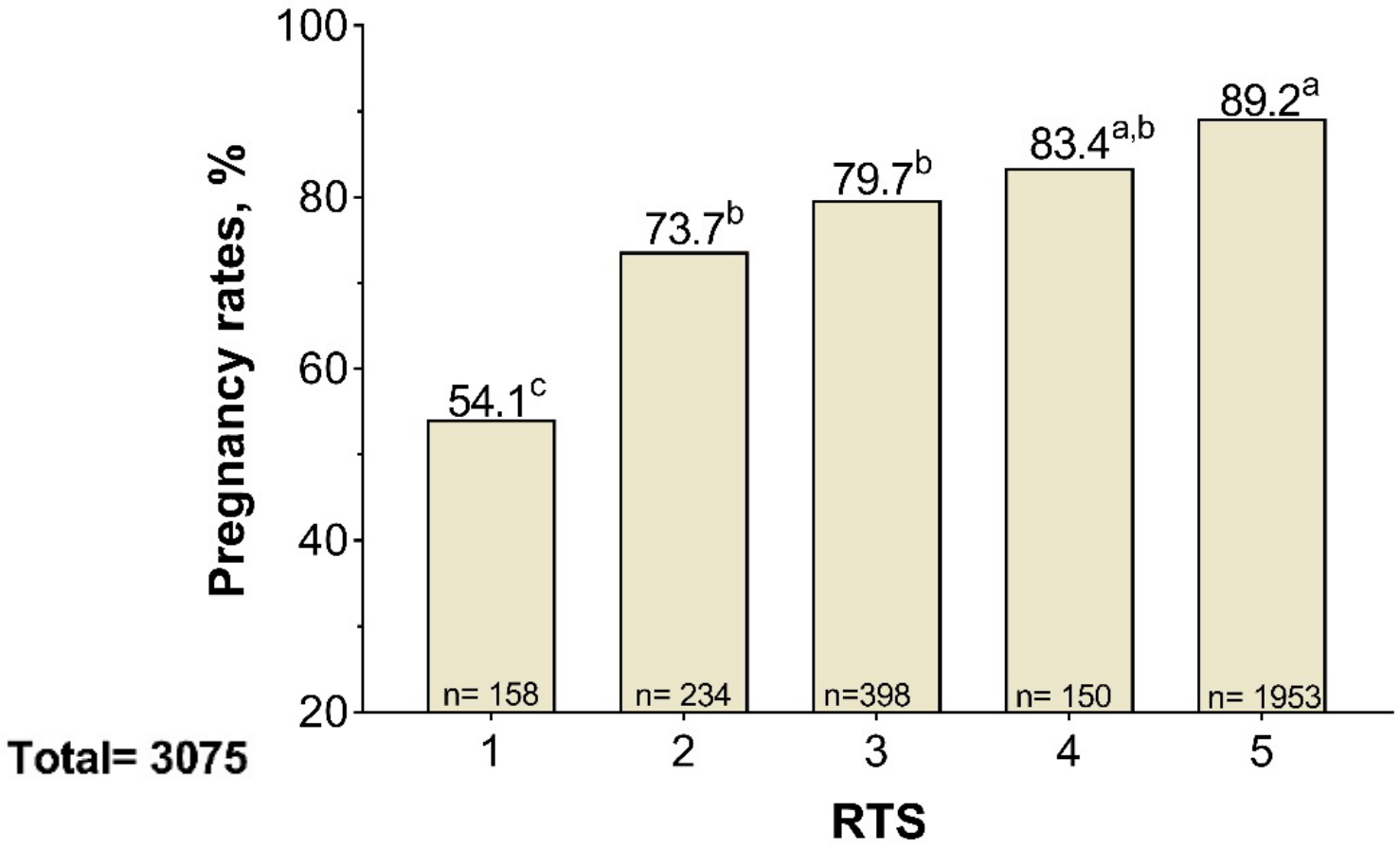
OSU EXTENSION

Pregnancy rates measured 30 days after the beginning of the Breeding Season



Pregnancy rate of RTS5 heifers was greater than every other RTS classes ($P < 0.05$).

Pregnancy rates measured 30 days after the end of the Breeding Season

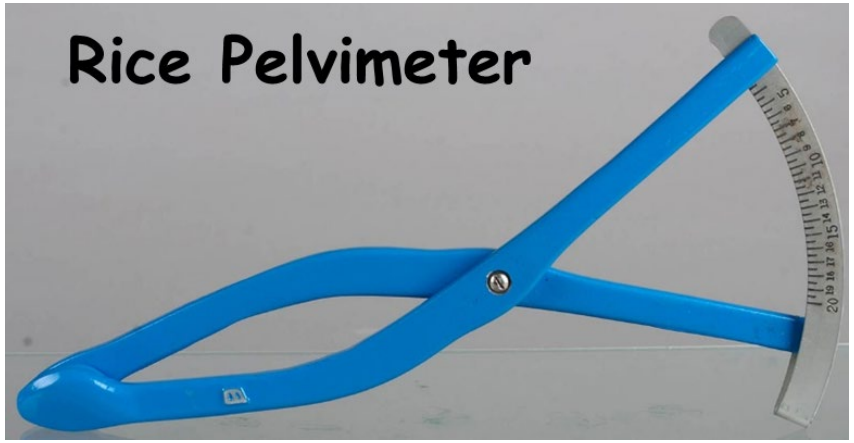


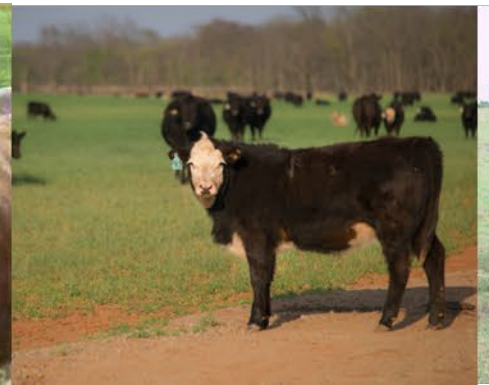
Pregnancy rate of RTS5 heifers was greater than that on RTS classes 1 to 3 ($P < 0.05$), but similar to the RTS4.($P < 0.05$).

Binelli, Mario, 2020-2021,Final Report and Florida Ranking

Consideration #12

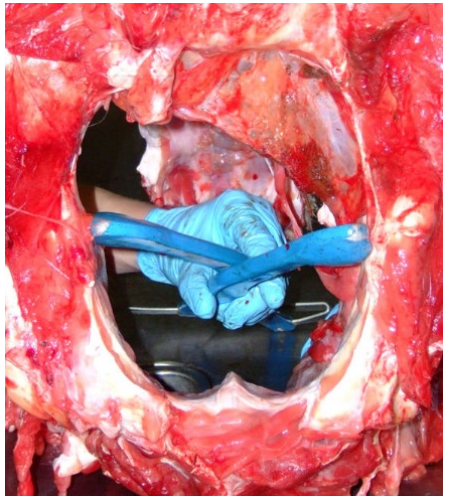
Use of Pelvic Measurement for Culling

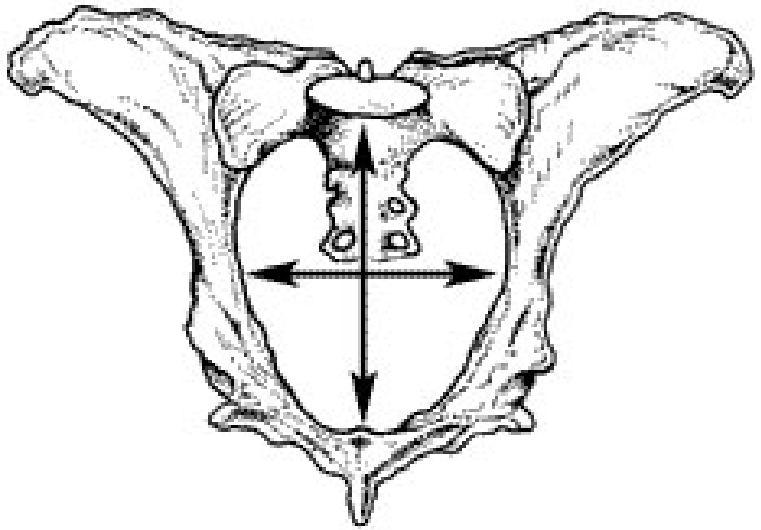


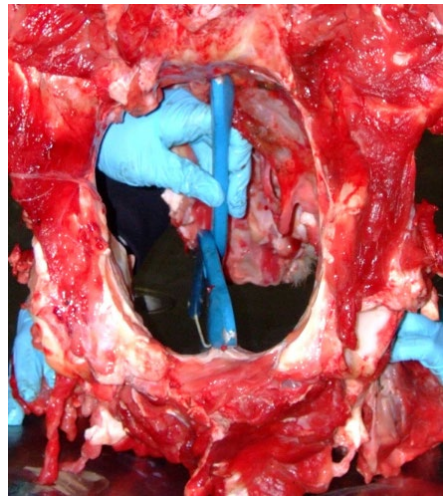


Pelvic Measurement

- **Vertical Measurement:**
  - **is the vertical diameter between the symphysis pubis on the floor of the pelvis and the sacral vertebrae**
- **Horizontal Measurement:**
  - **the widest point between the left and right ileal shafts**







Pelvic Measurement

The single largest peri-natal and post-natal death loss category through the first 96 hours after birth: *Dystocia*

- **Factors affecting Calving Difficulty…**
  - **Birth weight of the calf…**
  - **Pelvic area of the cow…**
  - **Gestation length…**
  - **Sex of calf…**
  - **Inadequacies in Heifer Development…**
  - **Body Condition of the cow at calving…**
  - **Abnormalities in hormone profiles at the time of birth…**
  - **Abnormal presentation of the calf at birth…**

adapted and revised from "Pelvic Measurements for Reducing Calving Difficulty," by Gene H. Deutscher, NebGuide G88-895

Pelvic Measurement

- **The single major cause of Dystocia:**
  - is a disproportion between **size of the calf at birth (birth weight)**

    and
  - the **cow's/heifer's birth canal (pelvic area)**

- **Pelvic Size, independent of cow weight, affects calving difficulty…**
  - **Heifer Weight and Age usually have a positive relationship to pelvic area, but weight is not always a good indicator**

- **Pelvic Measurements can be taken prior to the first breeding season and combined with a Reproductive Tract Score examination**

Pelvic Measurement

- **Be Aware:
  - Selection for pelvic area is likely to result in increased size of the entire skeleton, and thus the size of the animal
  - Increased skeletal size of the dam will be reflected in higher birth weight and dimensions of the calf

- However:
  - Pelvic Measurements can be used to successfully identify an abnormally small or abnormally shaped pelvis

- **Pelvic Measurements should be used in addition to, *not in place of*, selection for Size, Weight, and Fertility…

Pelvic Measurement

- University of Nebraska researchers developed ratios that can be used to estimate deliverable calf size
  - Divide the total pelvic area prior to breeding by a ratio that is based on age and weight to estimate the amount of birth weight a heifer could accommodate as a 2-year-old without substantial difficulty

	Age (months) at Time of Measurement			
Heifer Weight	8 to 9	12 to 13	18 to 19	22 to 23
500 lbs.	1.7	2		
600 lbs.	1.8	2.1		
700 lbs.	1.9	2.2	2.6	
800 lbs.		2.3	2.7	3.1
900 lbs.		2.4	2.8	3.2
1000 lbs.		2.5	2.9	3.3
1100 lbs.				3.4

Questions ?