Increasing Production Efficiency

Rick Funston
Reproductive Physiologist


Reproduction is the single most important factor for profitable beef production.

Improving Efficiency

- [Dam Weight*Lean Value of Dam + No. Progeny*Progeny Weight*Lean Value of Progeny] - [Dam Feed*Value of Feed for Dam + No. Progeny*Progeny Feed*Value of Feed for Progeny].

- By simply increasing number of progeny per dam through either selection, heterosis from crossing, or better management, we will increase efficiency of production.

Time of Calving Affects Feedlot Performance

Steer calves (n = 661)	Period of calving, 21 day periods		
	1st	2nd	3rd
Weaning weight, lb	515	483	435
Feedlot ADG, lb/day	3.61	3.62	3.63
Carcass weight, lb	816	800	771
Marbling score	574	554	527
Yield grade	3.0	2.8	2.6
Choice, %	84	83	73
≥ Average choice, %	30	17	12
Carcass value	$1632	$1600	$1542

Time of Calving Affects Heifer Progeny

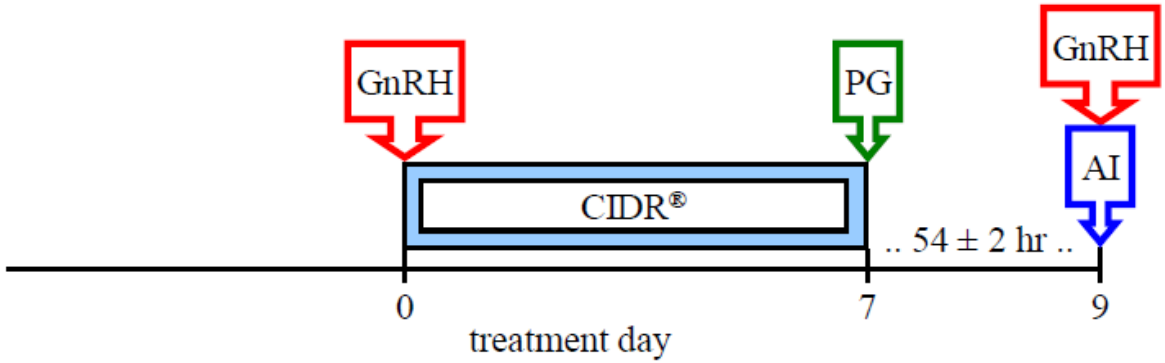
Heifer calves (n = 1019)	Period of calving, 21 day periods		
	1st	2nd	3rd
Preweaning ADG, lb	1.83	1.83	1.90
Weaning weight, lb	483	470	434
Prebreeding ADG, lb	.86	.90	.90
Prebreeding weight, lb	653	644	609
Cycling, %	70	58	39
Breeding ADG, lb	1.59	1.63	1.70
Pregnancy rate, %	90	86	78
Calved in 1st 21 d	81	69	65

2024 Heifer Protocols-Fixed Time AI (TAI)

beefrepro.org

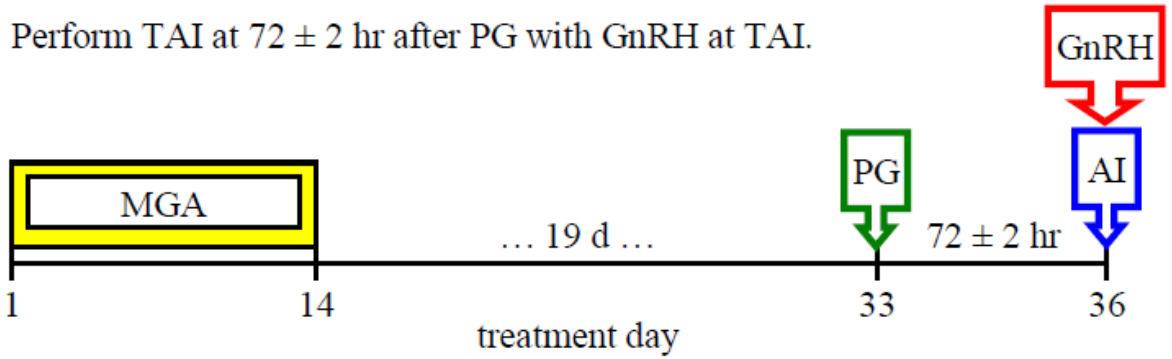
7-day CO-Synch + CIDR®

Perform TAI at 54 ± 2 hr after PG with GnRH at TAI.



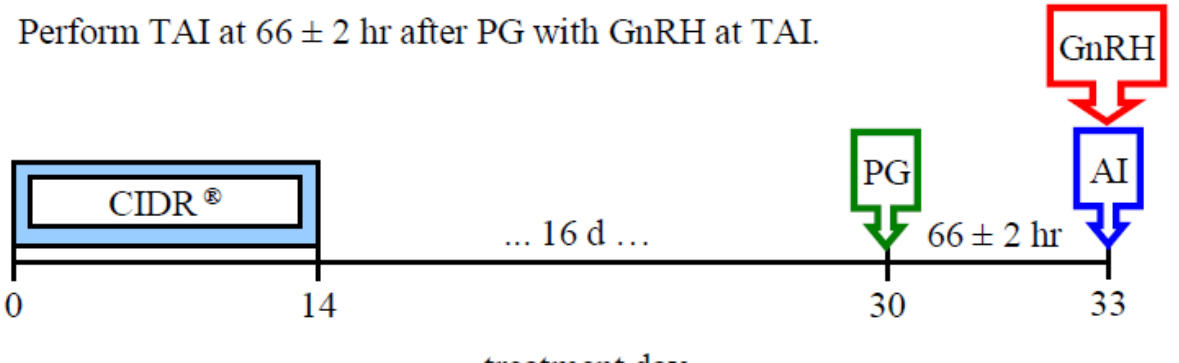
MGA®-PG

Perform TAI at 72 ± 2 hr after PG with GnRH at TAI.



14-day CIDR®-PG

Perform TAI at 66 ± 2 hr after PG with GnRH at TAI.

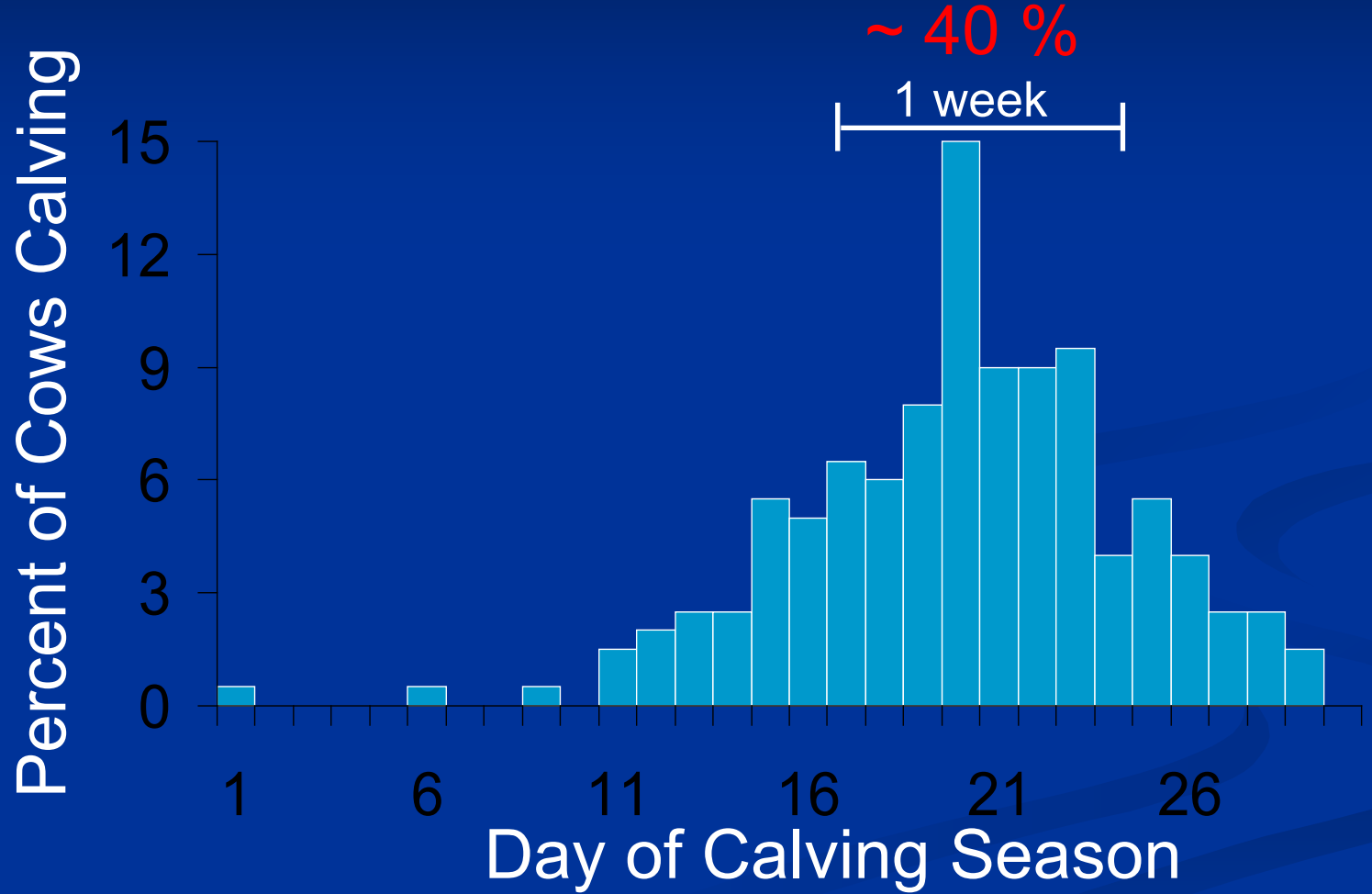


Summary of AI and final pregnancy rates of varying bull to female ratios obtained in cited studies.

Synchronization Protocol	AI Method	Female age	Number of females	Breeding season length	AI Preg Rate, %	Final Preg rate
Normal bull to Female ratio was 1:20 to 30 in natural service setting						
1 shot PG, CIDR for 7 d, Rest none	NS	All cows but 1 group	3,982	Range from 64-120	NA	87.8% Ave
Normal Bull to cow ratio was 1:20 to 30 following estrus synchronization and AI						
Various synchronization methods	Both TAI & HD	Both heifers & cows	2,806	30 to 90 days	56.1%	87.8%
Intermediate bull to cow ratio 1:31 to 49 following estrus synchronization and AI						
Various synchronization methods	Both TAI & HD	Both heifers & cows	1,092	30 to 60 days	46.5%	82.6%
Half bull to cow ratio 1:50 to 60 bull to female ratio following estrus synchronization and AI						
Various synchronization methods	Both TAI & HD	Both heifers & Cows	5,057	29 to 85 days	55.6%	89.2%

da Silva et al, 2016

Calving Distribution of Beef Cows that Conceived on a Single Day



What are the primary problems?

- Cattle are not good candidates for an estrus synch/AI program
- Protocol compliance
- Sire selection
- Semen handling
- Facilities
- Shipping (trucking) stress
- Cattle lose weight during the breeding season
- Unlikely that the biological activity of the ES products is compromised

Stress and AI?

♀ + Bucket Load of Estrogen + Off Feed 24 Hours +

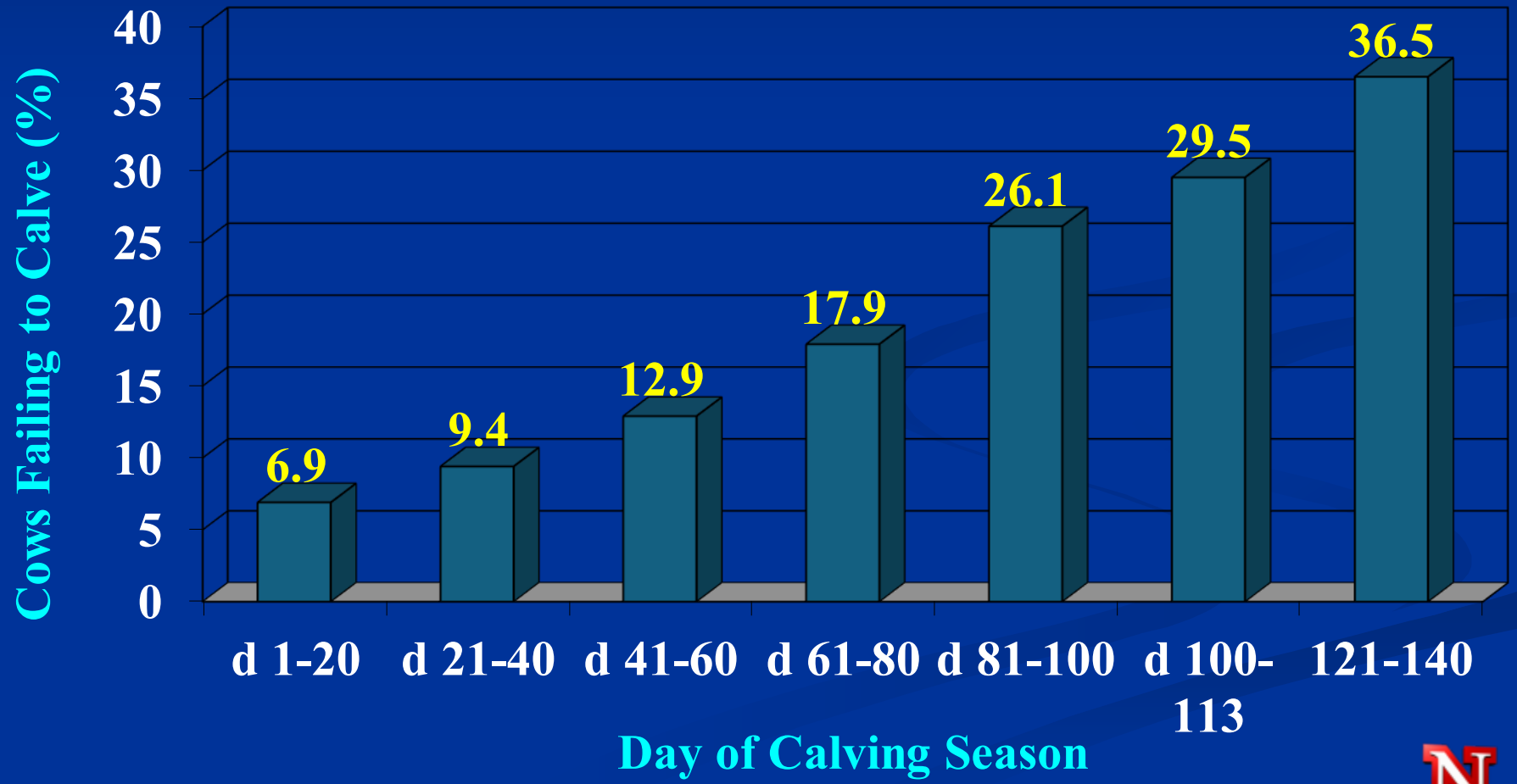
Pushed Around by Friends for 12 Hours + Pack Her Own Weight 30 Times in 12 Hours +

Cowboy's Arm in Rectum + .5 cm Rod in Vagina/Cervix = Stress is Maximized

Handling Cattle after AI

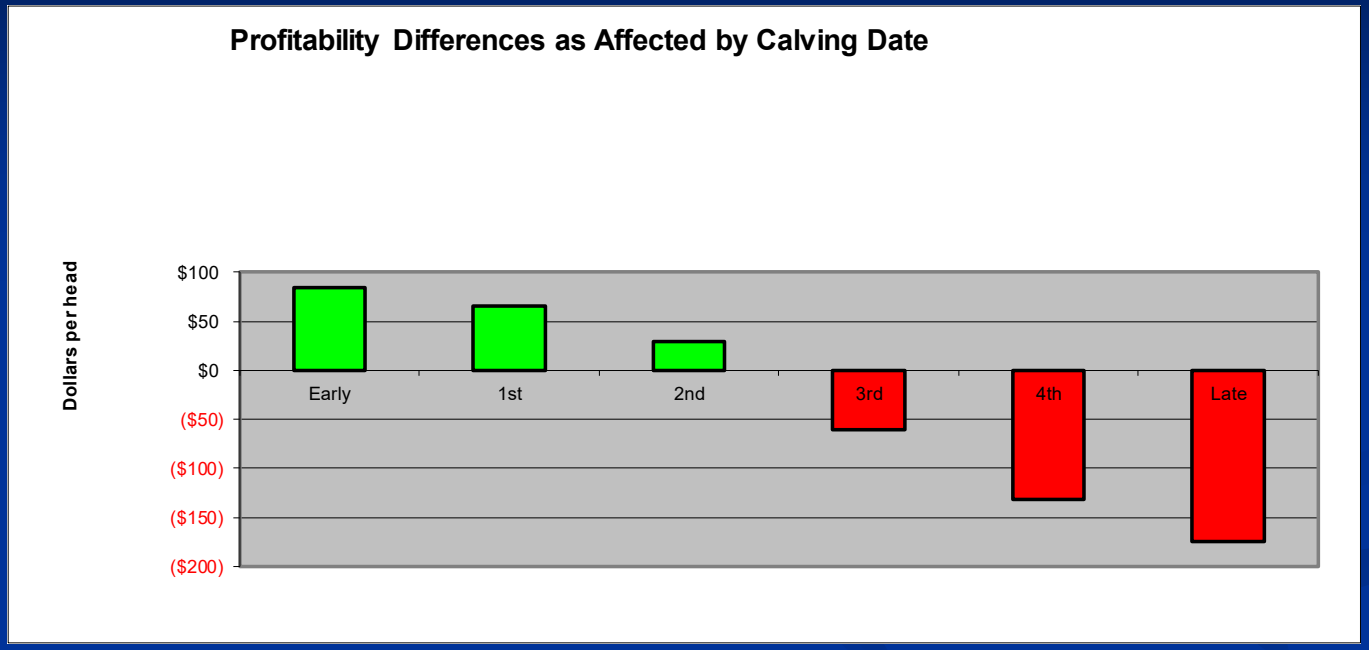
	Day Transported after AI		
	1 - 4	8 - 12	29 - 33
Synchronized Pregnancy Rate	74%	62%	65%
Breeding Season Pregnancy Rate	95%	94%	94%
Mean Day of Conception	9.6	13.4	13.6

Effect of Calving Date on the Number of Cows Calving the Following Year



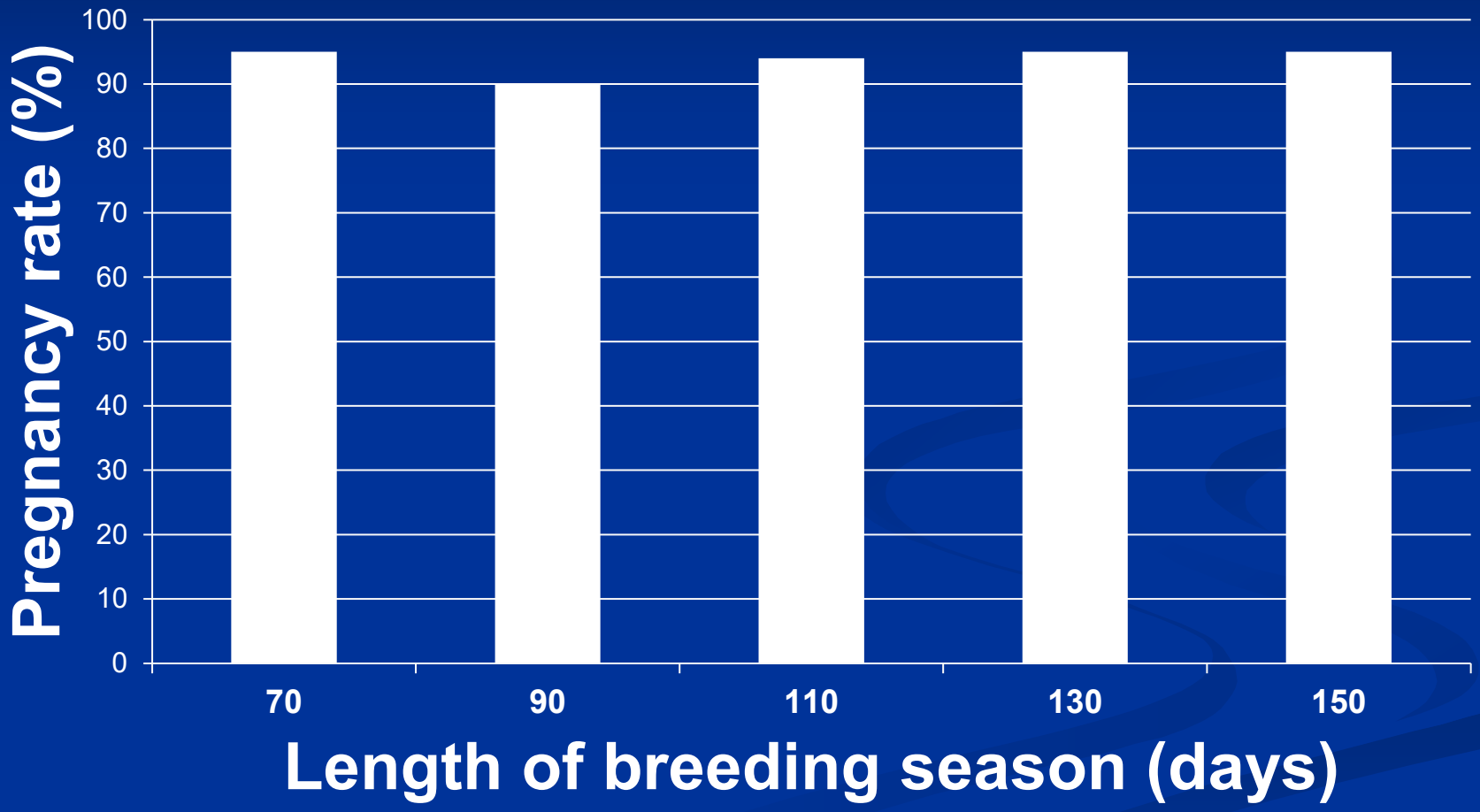
(Patterson et al., 1992)

Actual Profit Differences are Large



- It takes the profit from two early-calving cows to cover the loss from one late-calver.
- A cow that calves in the first 21-day calving interval her entire 8 or 9-year life, will produce the weaning weight equivalent of 1 ½ to 2 ADDITIONAL calves in her lifetime compared to one that starts late and stays late.

Length of Breeding Season and Pregnancy Rate



Heifer Selection and Development

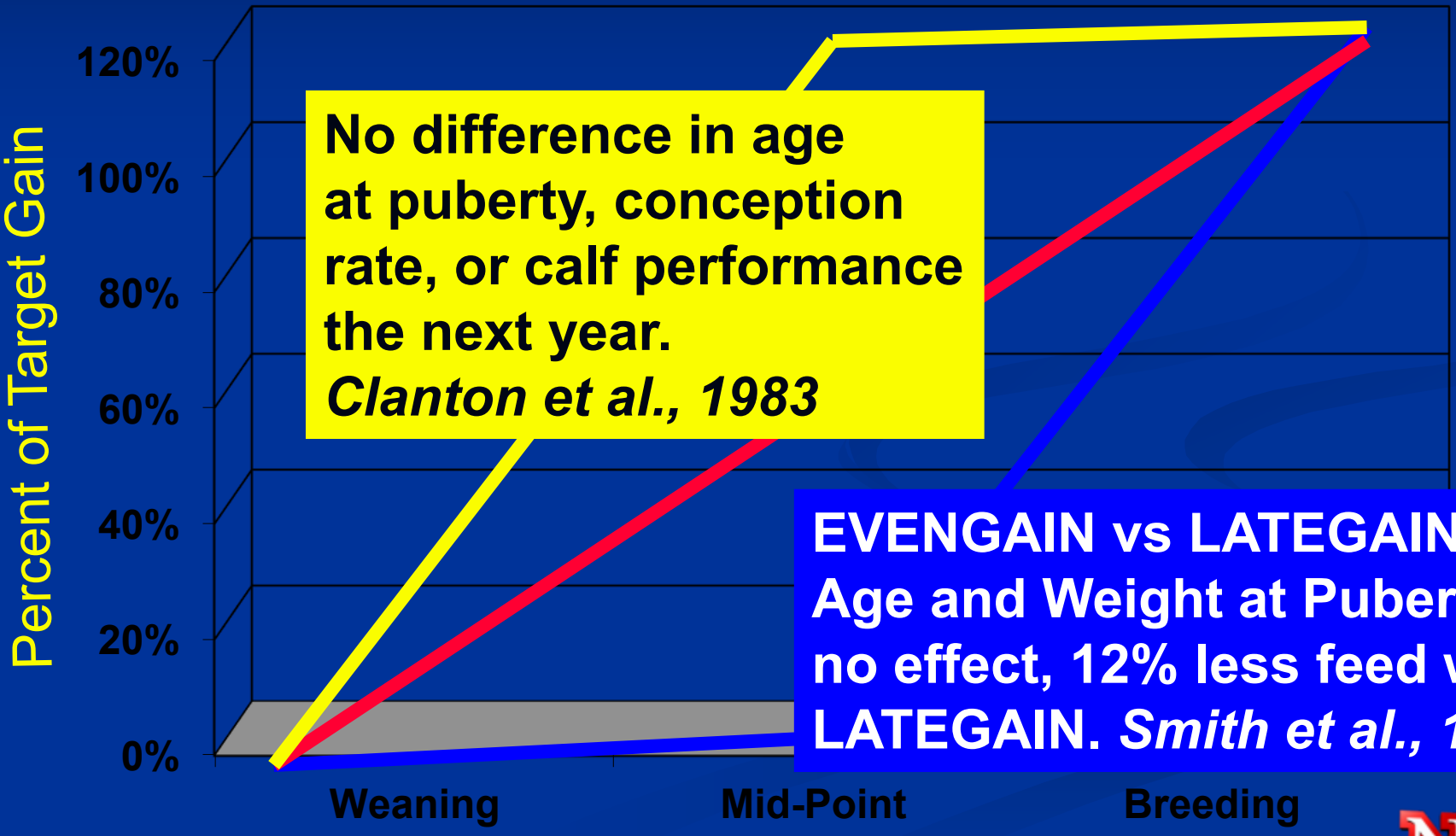
Extensive heifer development systems

- Lower Development Costs $100 +
- Selling open heifers was profitable
- Determine adaptability early?
  - Short breeding season
  - Lighter breeding weights
  - Lighter mature weights?
- Must continue to grow through calving

Target Weight Method

Heifer WW	Days/wt gain	Target BW
Nov. 1	180 d	May 1
500 lb	250 lb	750 lb
Gain needed	1.40 lb	

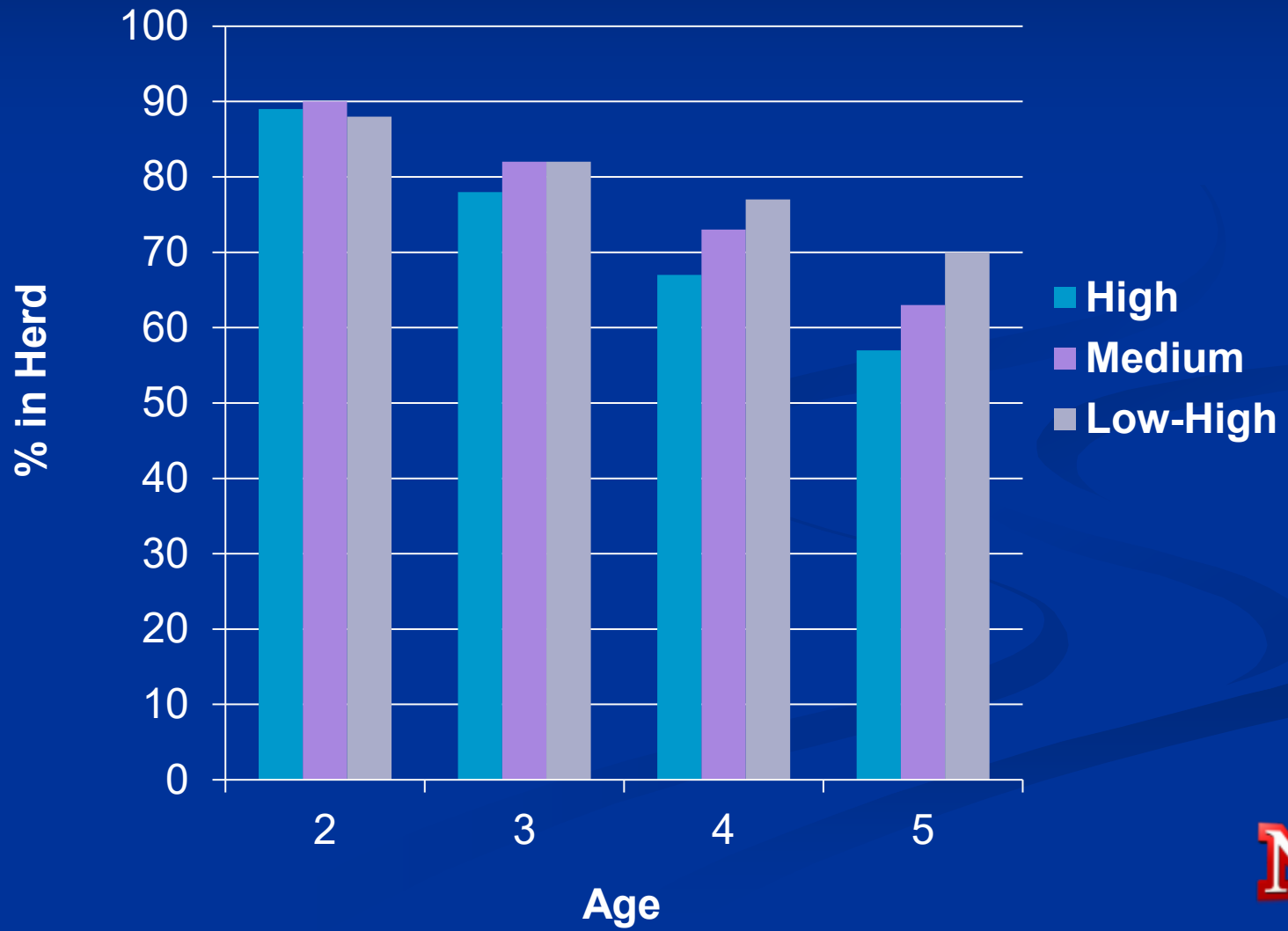
Effect of Time of Gain From Weaning to Breeding on Heifer Performance



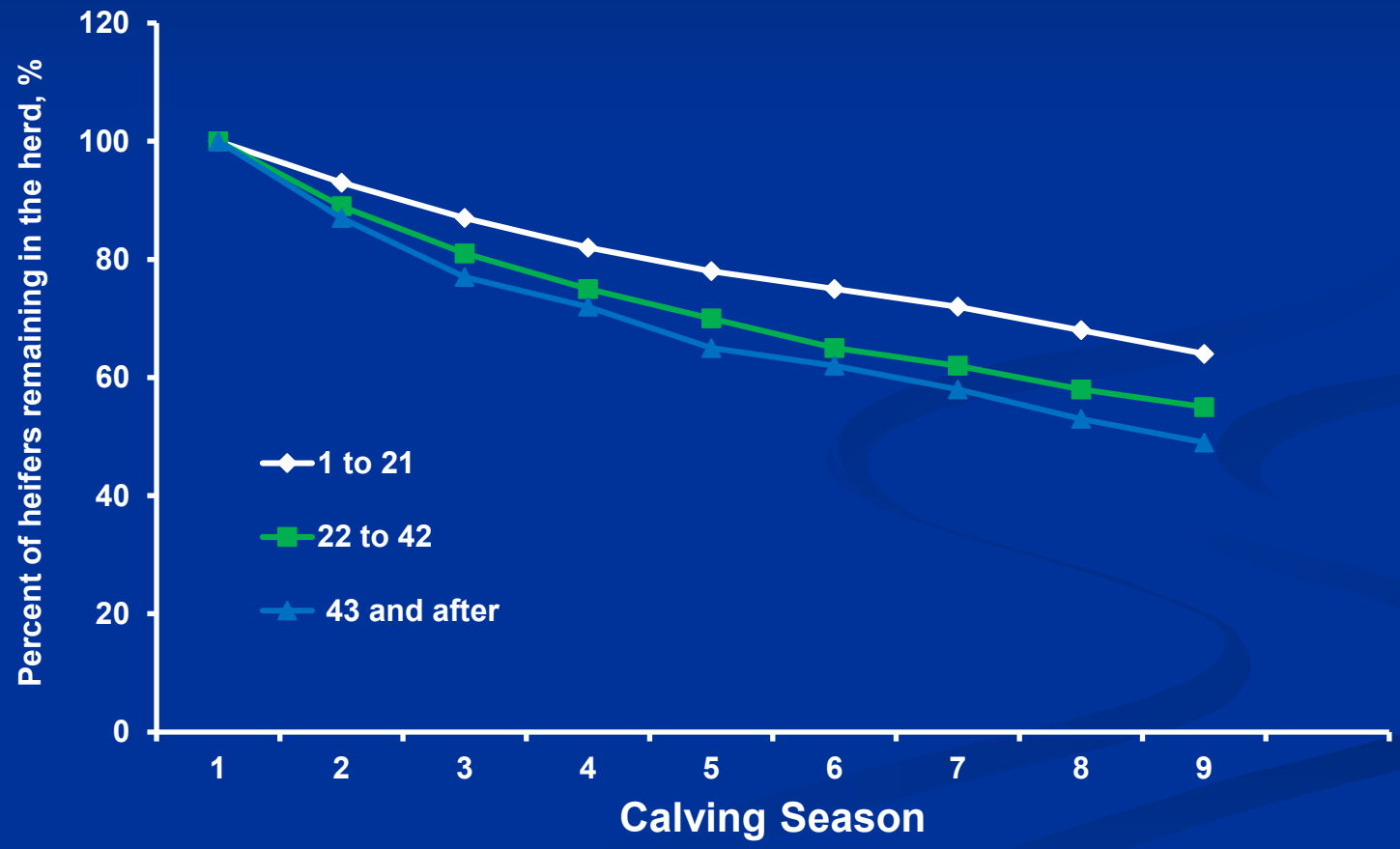
Timing of Gain and Reproductive Performance

Item	Even Gain	Late Gain
FSCR	56.4	71.1
Overall	87.5	87.5

Longevity and Heifer Development System



Advantages of calving early as a heifer



Cushman et al., 2013. JAS 91:4486

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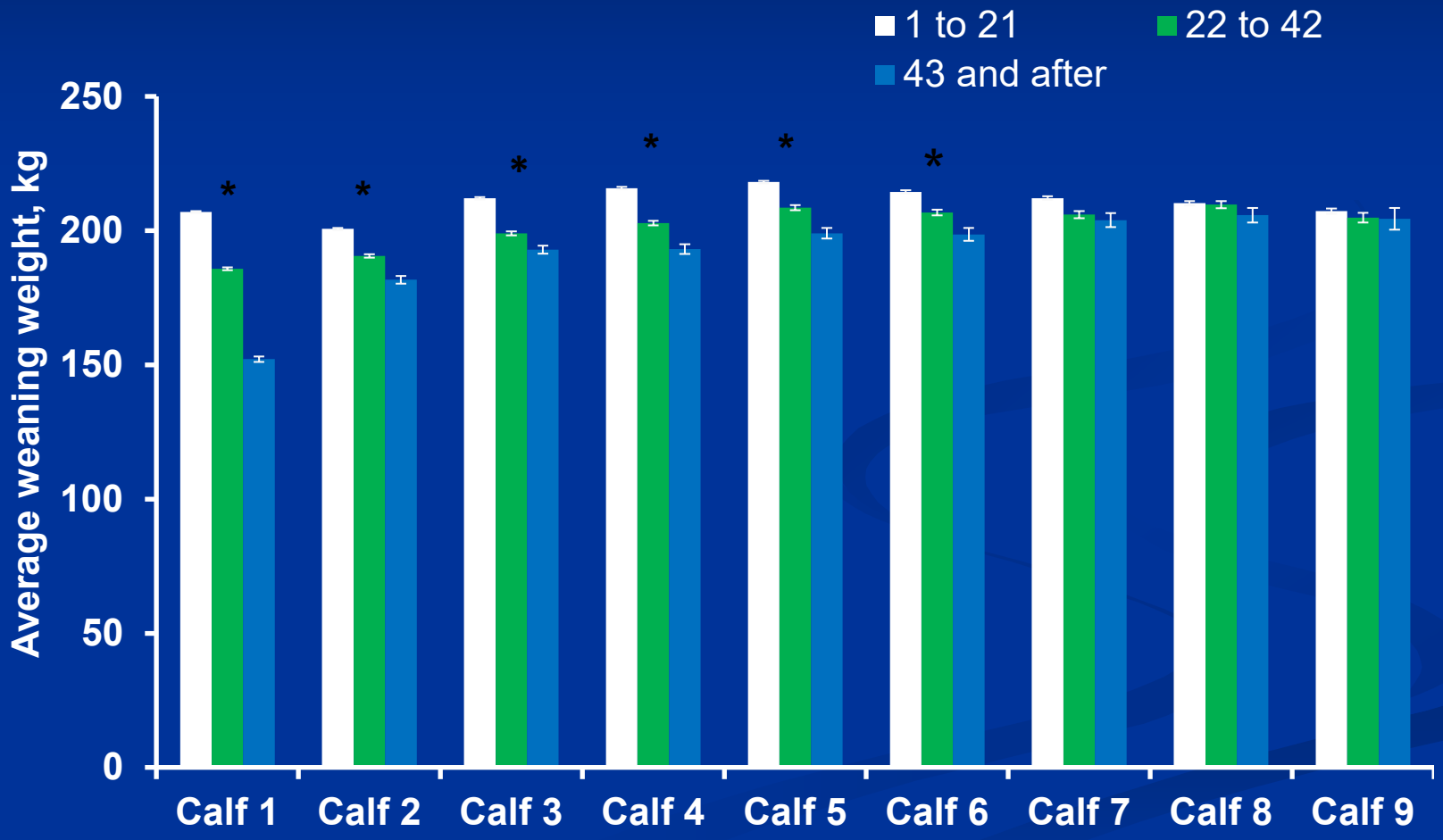

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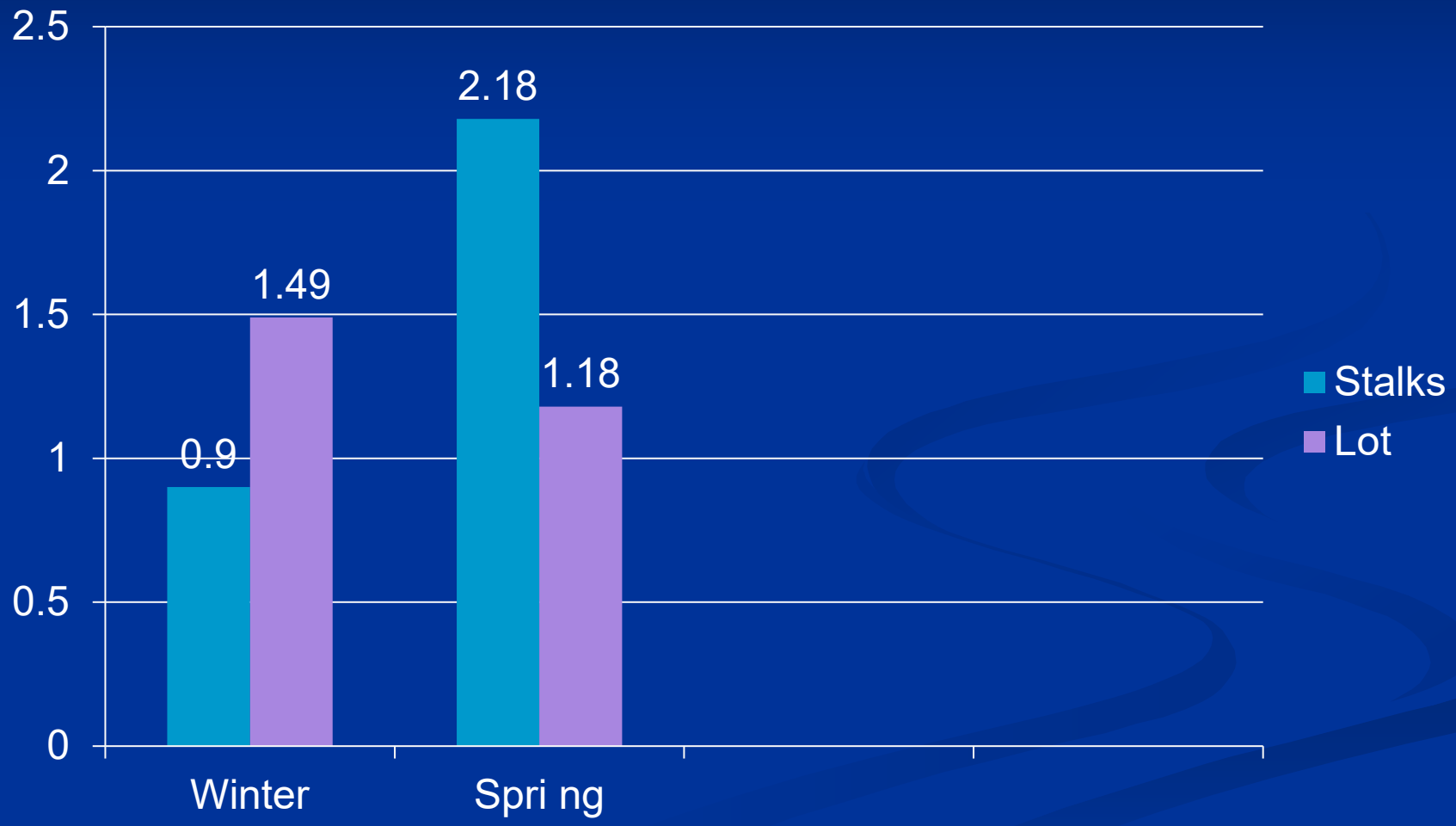
Heifer Development

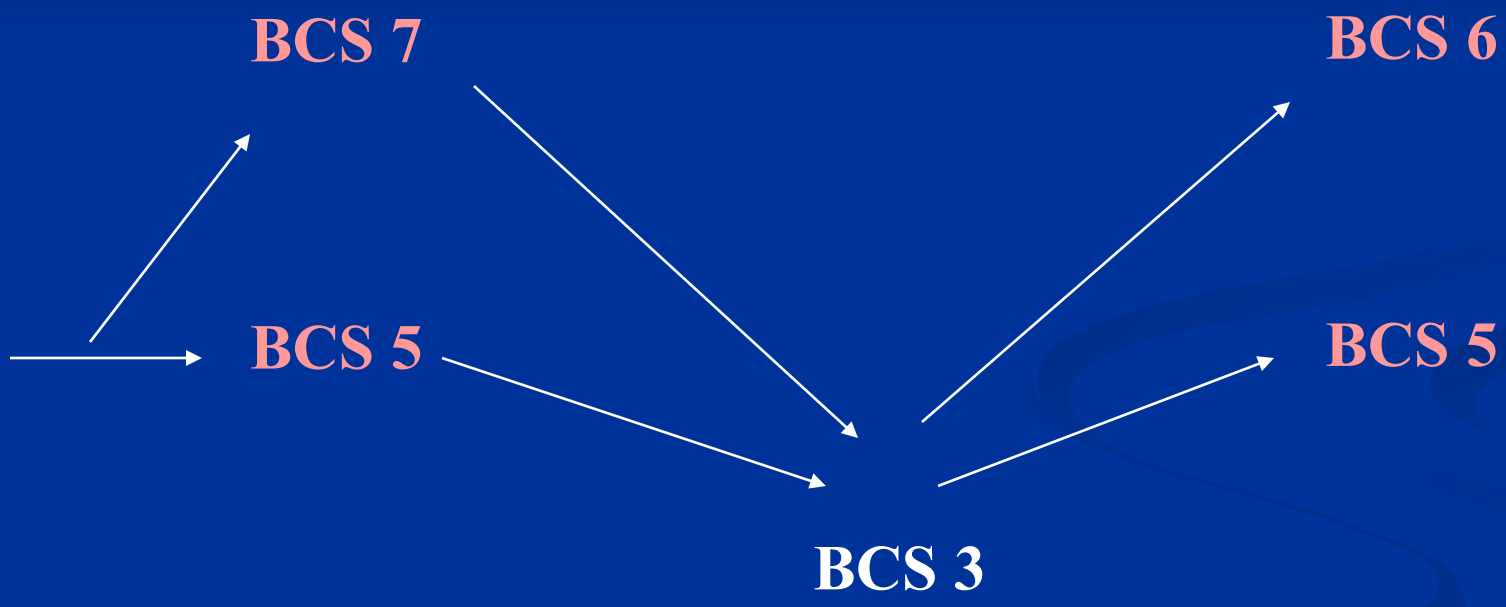
Weight, lb	665	727
ADG Wean -> Pre	.84	1.23
AI Pregnancy rate, %	86	58
WHY ?		
ADG Pre	1.4	2.14
ADG Post	1.27	.81

Development Stalks vs Dry Lot

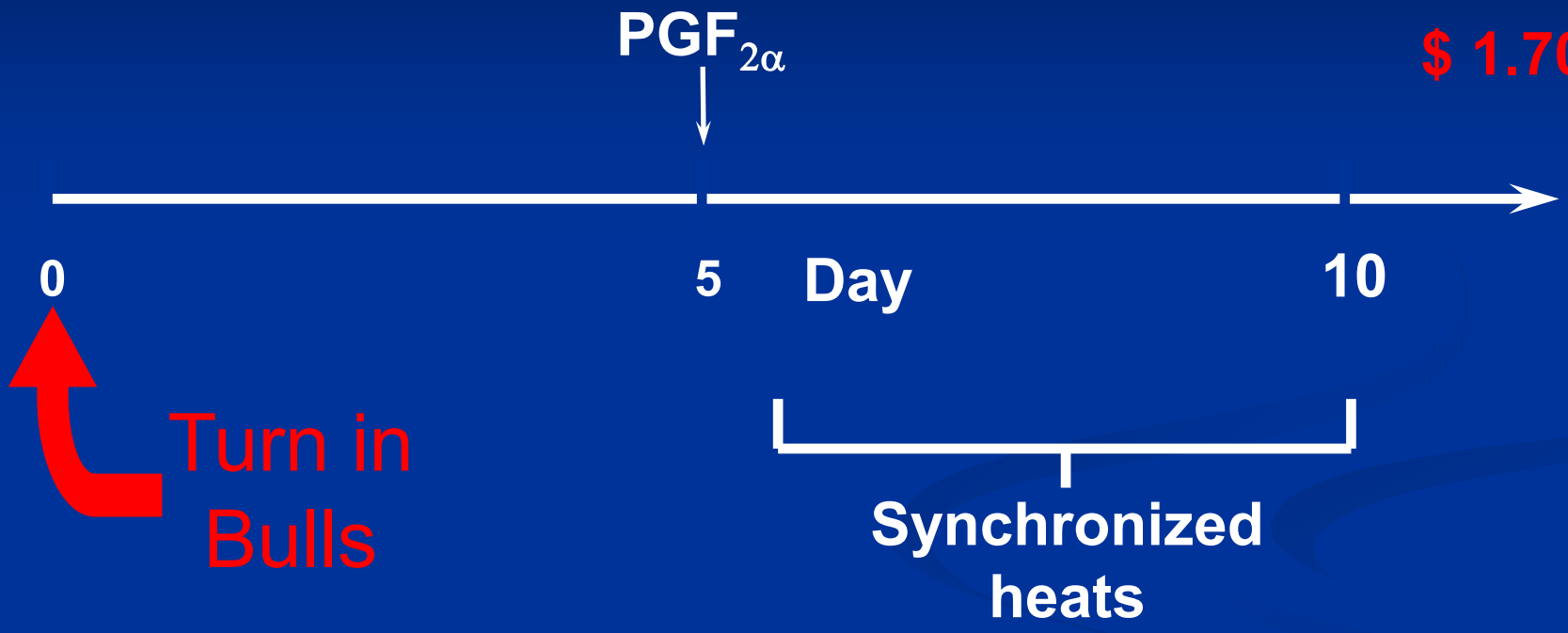


Restriction

Re-feeding

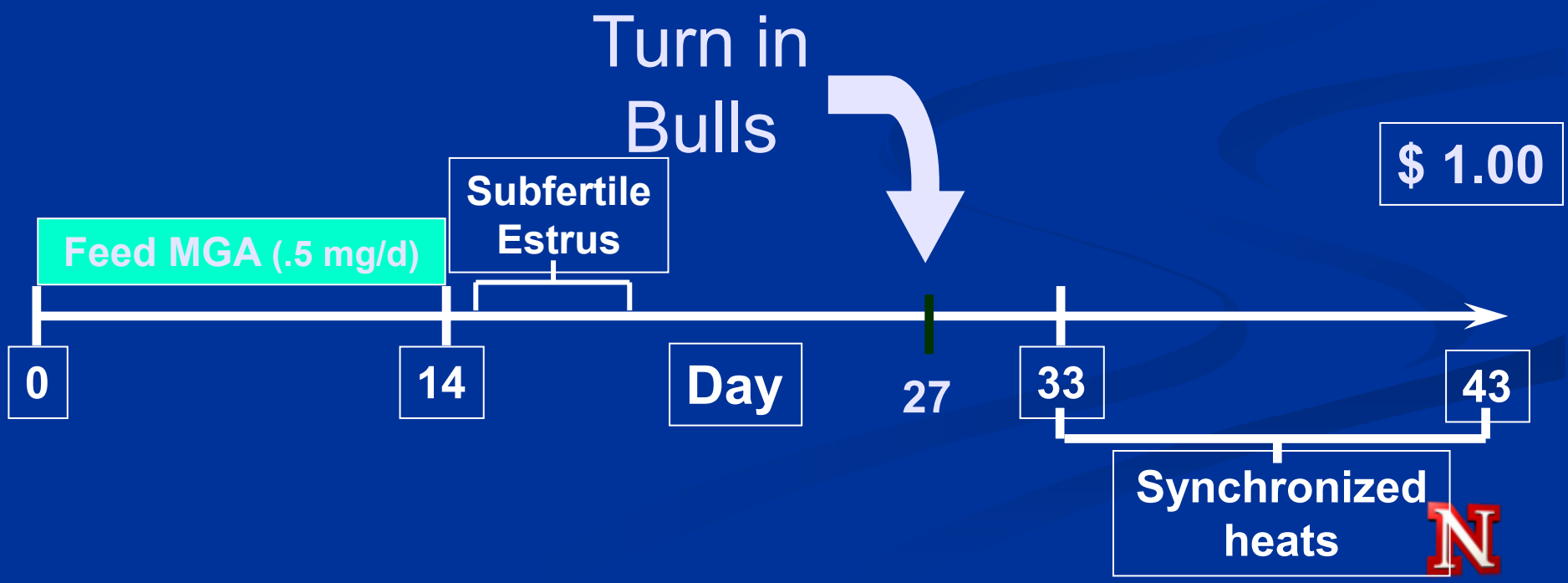


Synchronization of Estrus in Cyclic Cows/heifers

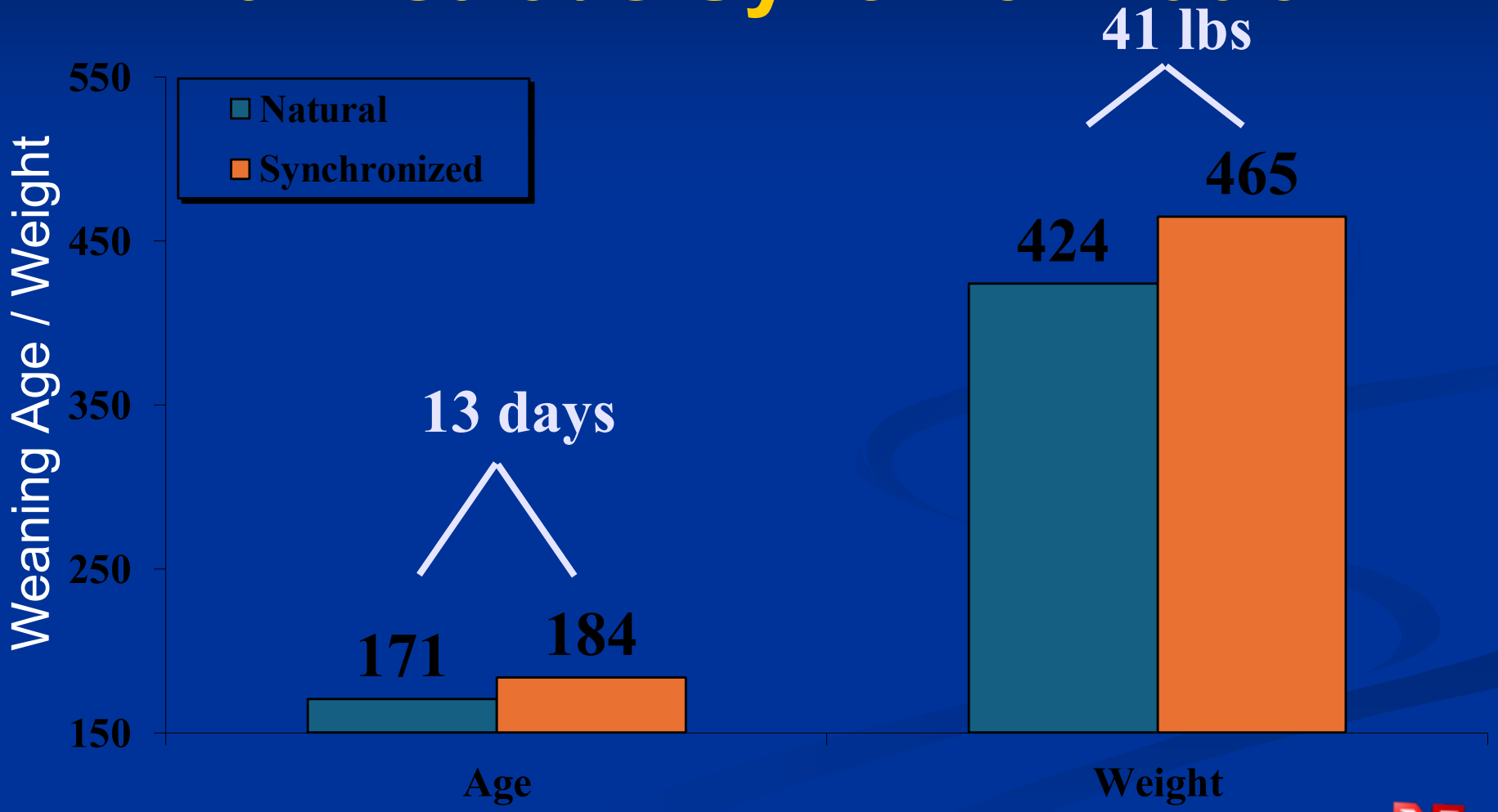


- ✓ Used with 32-day breeding season at Fort Keogh with the Season of Calving herds over the past 3 years and has consistently yielded pregnancy rates > 85%.

Estrous Synchronization with Natural Service for Heifers

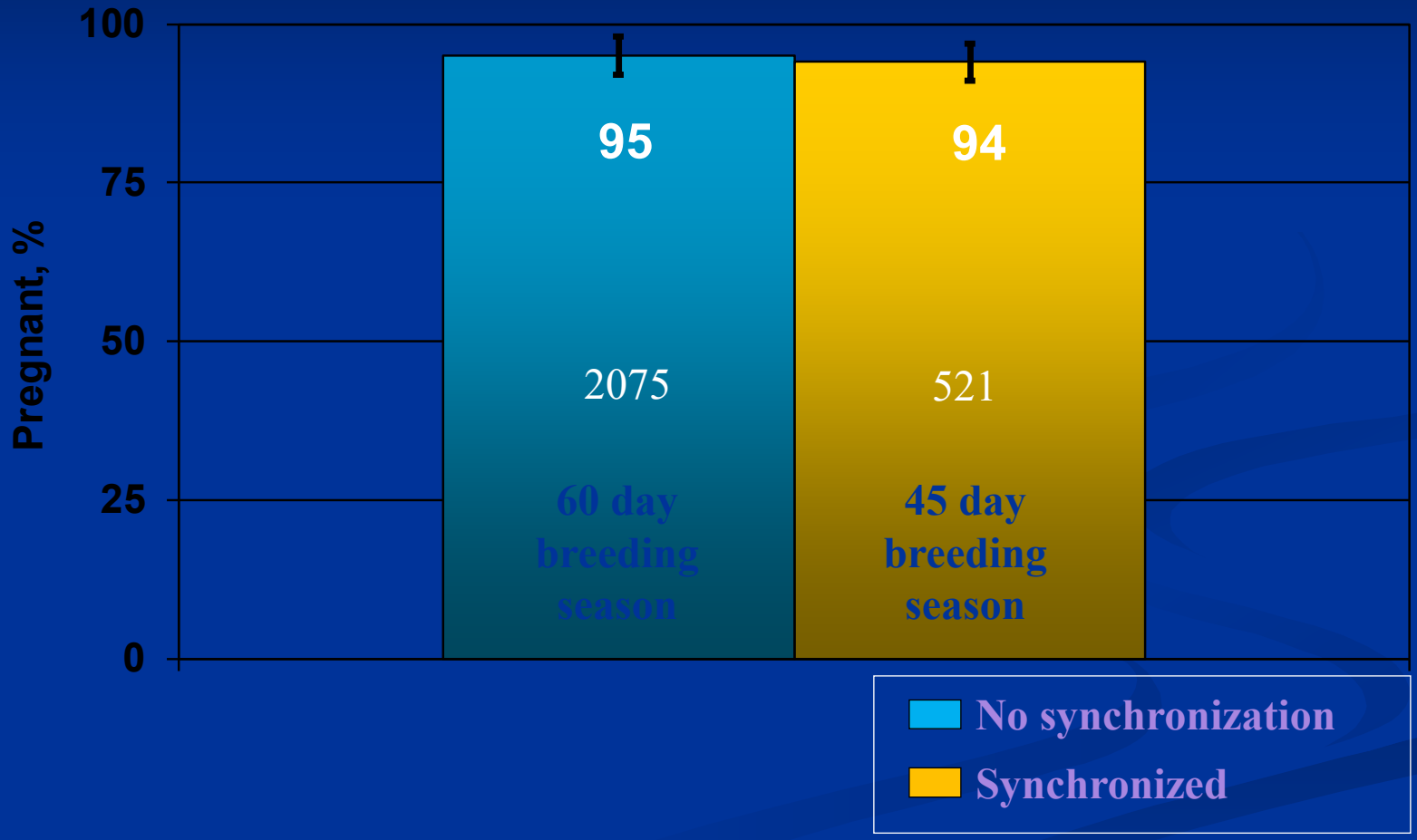


Increased Calf Weaning Age and Weight with Estrous Synchronization



Schafer et al., 1990 CSU Beef Report. p. 115

Pregnancy Rate



Calf Production

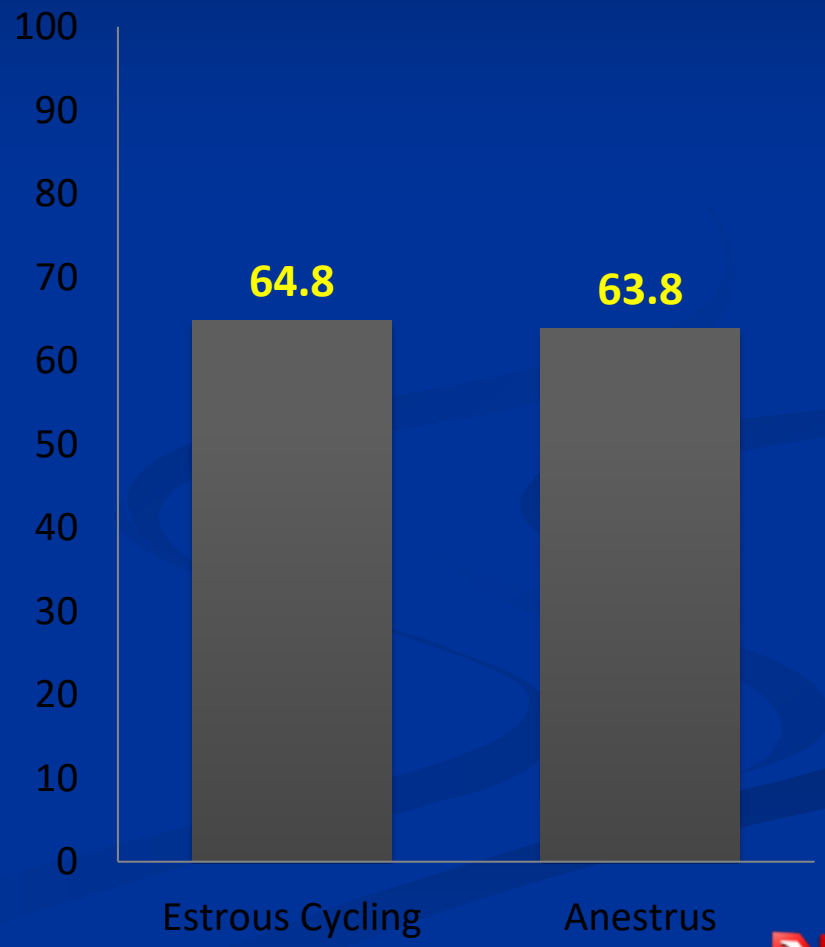
	Length of breeding season	
	60 days	45 days
	No Synch	Synch
Calved in 1st 21 d, %	61	73
Calf birth date, Julian day	86	85
Calf birth BW, lb	84	81
Calf weaning BW, lb	483	503
Calf value, $/calf	870	905

Hughes, 2005

- Opportunities for increasing profits lie in moving females from the later calving periods forward toward the first and second calving periods.
- High production herds see 61% of the calves born by day 21, 85% by day 42 and 94% by day 63.

FTAI Pregnancy rate in Anestrous Cows

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



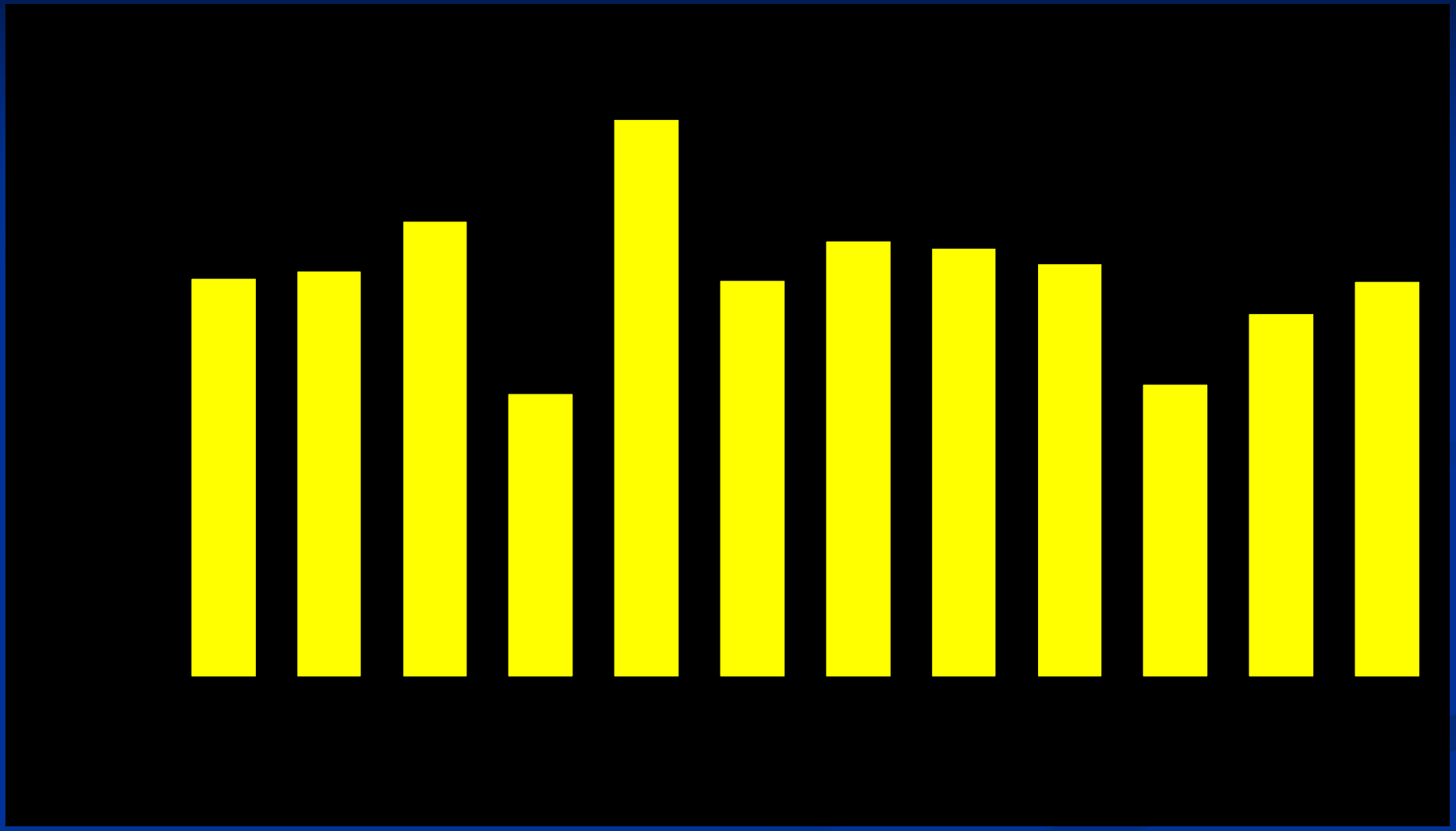
Cattle Insert

Breed More Cows in Less Time


EAZI-BREED
CIDR

CUE-MATE

Effect of Location on Pregnancy Rates



Embryonic Mortality

- Fertilization rate in beef cattle has been estimated to be between 90-100%.
  - (Sreenan and Diskin, 1983)
- Embryo death accounts for more than 30% of overall reproductive failure.
  - Diskin and Sreenan (1980)
- Embryonic loss occurs throughout pregnancy in cattle, but mainly in the first 40 d after breeding.
  - Goeseels (2000)

Can you cull a cow based on one year's progeny carcass data when you don't know who the sire is?

Sire Selection

- Determines more than 85% of the total improvement made in a herd

Reproductive Traits

1. Puberty/ Resume cycling
2. Fertile ovulation
3. Conception (Cow and Bull)
4. Maintenance of Pregnancy
5. Give birth to live calf

These interdependent traits culminate in a qualitative response, measured 1 time every year.

Calving Ease

- 16 % advantage in conception rate to cows not having dystocia (2000 head; Laster 1973)
- Short duration of labor; 10% more in estrus at beginning of breeding season; 14% higher fall pregnancy % (Doornbos 1984)

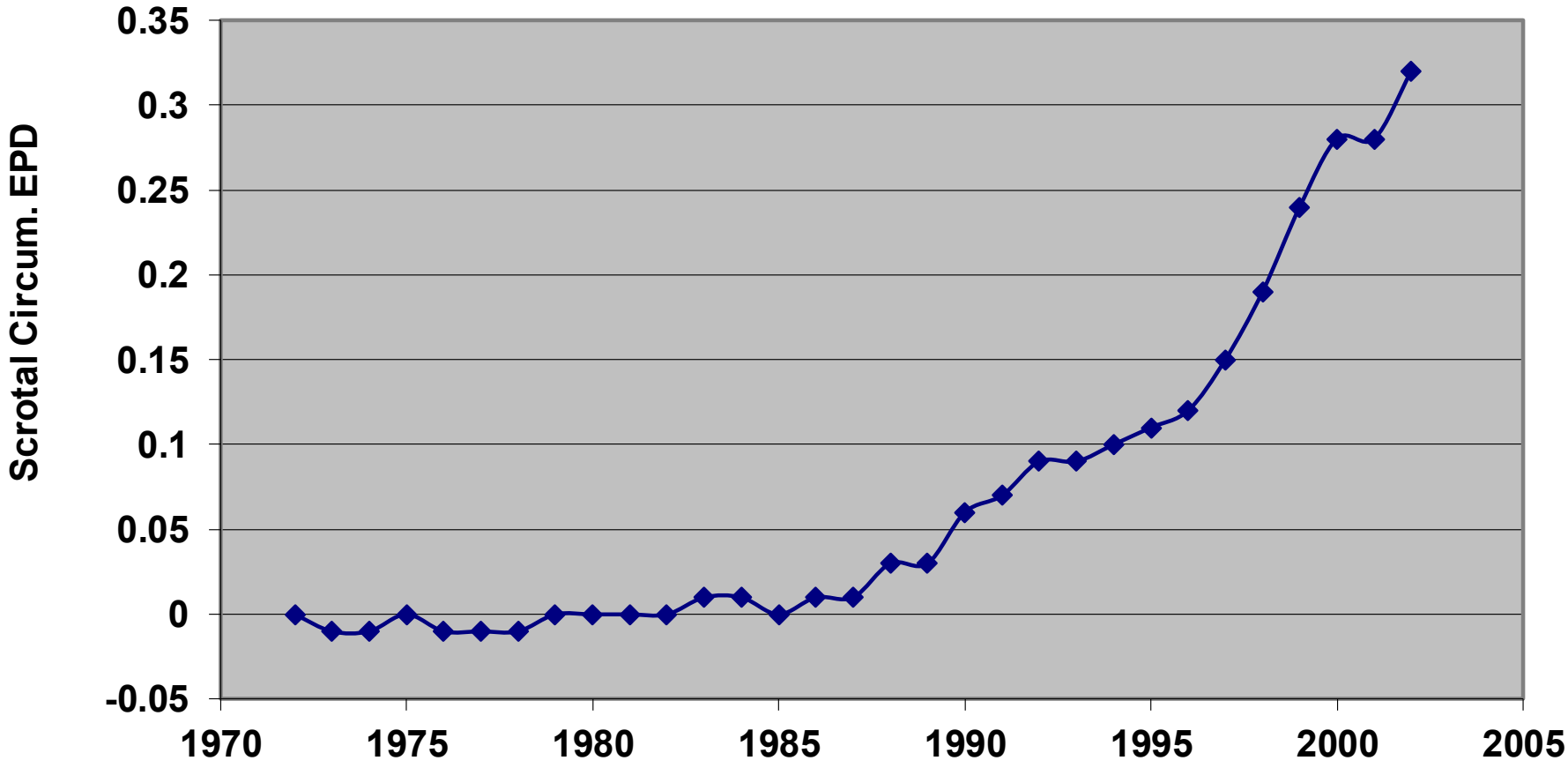
Calving Assistance

Item	Late	Stage II Early
Calf Vigor	1.1	1.2
PPI	51	49
% in heat	82	91*
Services/conception	1.24	1.15
Fall Pregnancy	78	92*
Calf ADG	1.63	1.74*
Calf WW	387	422*

Scrotal Circumference

- 21 day reduced age at first estrus; 1.6cm increase in scrotal circumference in progeny from 141 sires selected for scrotal circumference (Morris, 1993)
- Daughters of bulls with a high SC EPD reached puberty 62 days earlier than a low SC EPD line (Hough, 1991)

Has Age of Puberty Changed?



Milk Production

- Balance between productivity and resource availability and cost

- Selection for increased milk will not be profitable in all systems

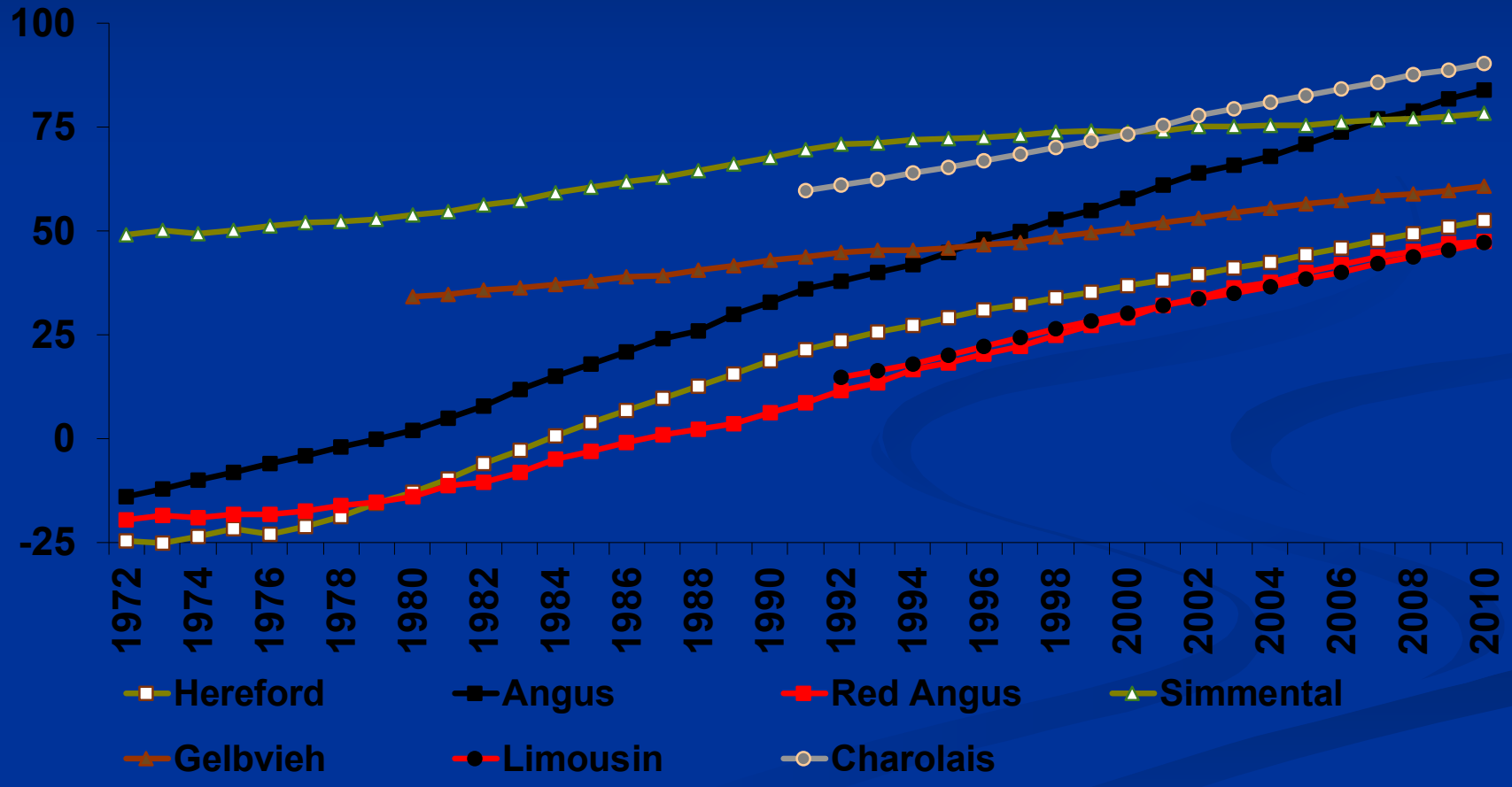
Mature Size

- Increased feed requirements per cow.
- Related positively to other growth traits.

- Most desirable = cows that excel in early growth, but mature at moderate weight.

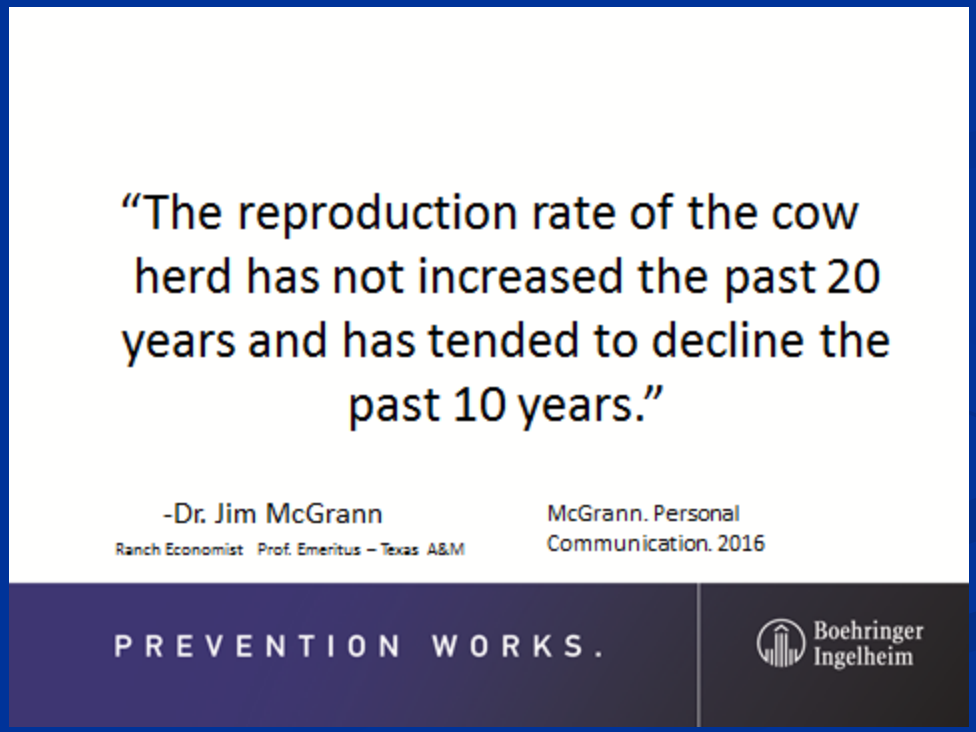
Kolstad, 1993; MacNeil et al., 1994; Koots and Gibson, 1998

Genetic Trends for Yearling Weight, lb



Adapted from Spring 2012 Genetic Trends from Breed Associations and 2012 AB-EPD factors (Keuhn et al., 2012)

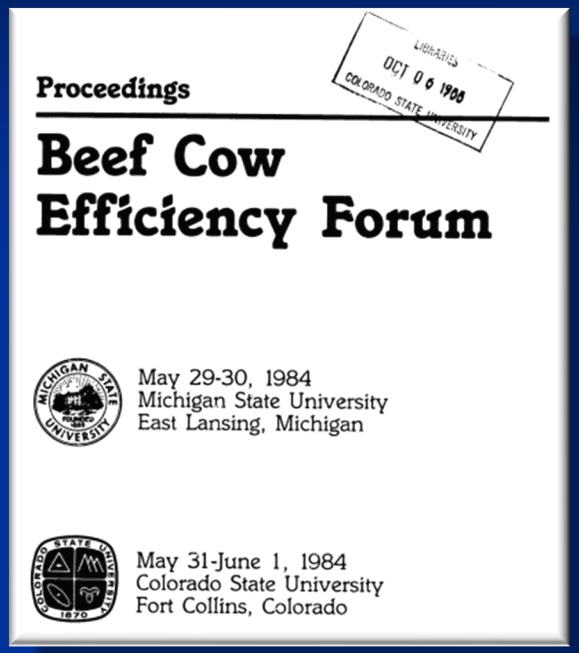
If a producer was using angus bulls with average EPD for milk, WW and YW in 1998-2000, the same bulls would be ranked in the bottom 5 % for these traits today



FEED EFFICIENCY
≠
PRODUCTION EFFICIENCY

It's more than a matter of perspective…

- Efficiency of growing animals (Individual)
  - Dilution of maintenance
  - Increased ADG
  - Lean vs. Fat accretion
- Cow Efficiency (Herd)
  - Driven by reproductive rate
  - Interaction of nutrient demand (given genetic potential for mature weight and milk) and nutrient supply
  - Metrics: lb of calf weaned/cow exposed; value of calves / $100 input cost



"Thus, as we strive to improve growth rate in the cattle industry and to make the commercial cow more efficient from the standpoint of utilizing nutrients, we must insure that we do not deviate from the goal of maintaining an optimum level of reproductive efficiency."

--Dr. Larry R. Corah, K-State

Time of Calving

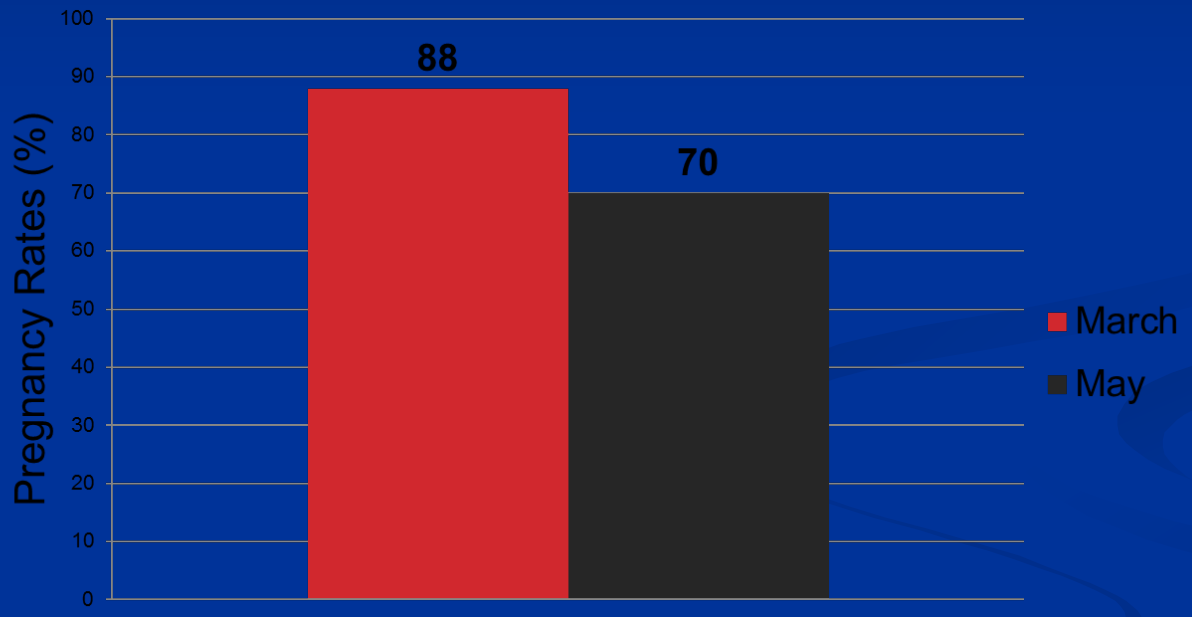
TOC Pregnancy Rate

Trait	March	June	August
% Pregnant	93.5	93.0	90.3
	May		
2010 3s	65		
Older	93		
2011 3s	75		
Older	93		
Heifers		High 64	Low 52

May-Born Heifer Performance

March vs. May Pregnancy Rate

March vs. May Pregnancy Rates



Two-Year-Olds

Year	May Wean Date	May Preg Rate	March Wean Date	March Preg Rate
2019	10/16	57% Mdw 79% Range 35%	10/2	93%
2018	10/17	64% Mdw 75% Range 52%	10/3	93%

2018 Cows

	Cow Wt	BCS	Calf Wt	%Preg
March	1016	4.6	477	90.8
May	1059	4.9	436	92.0

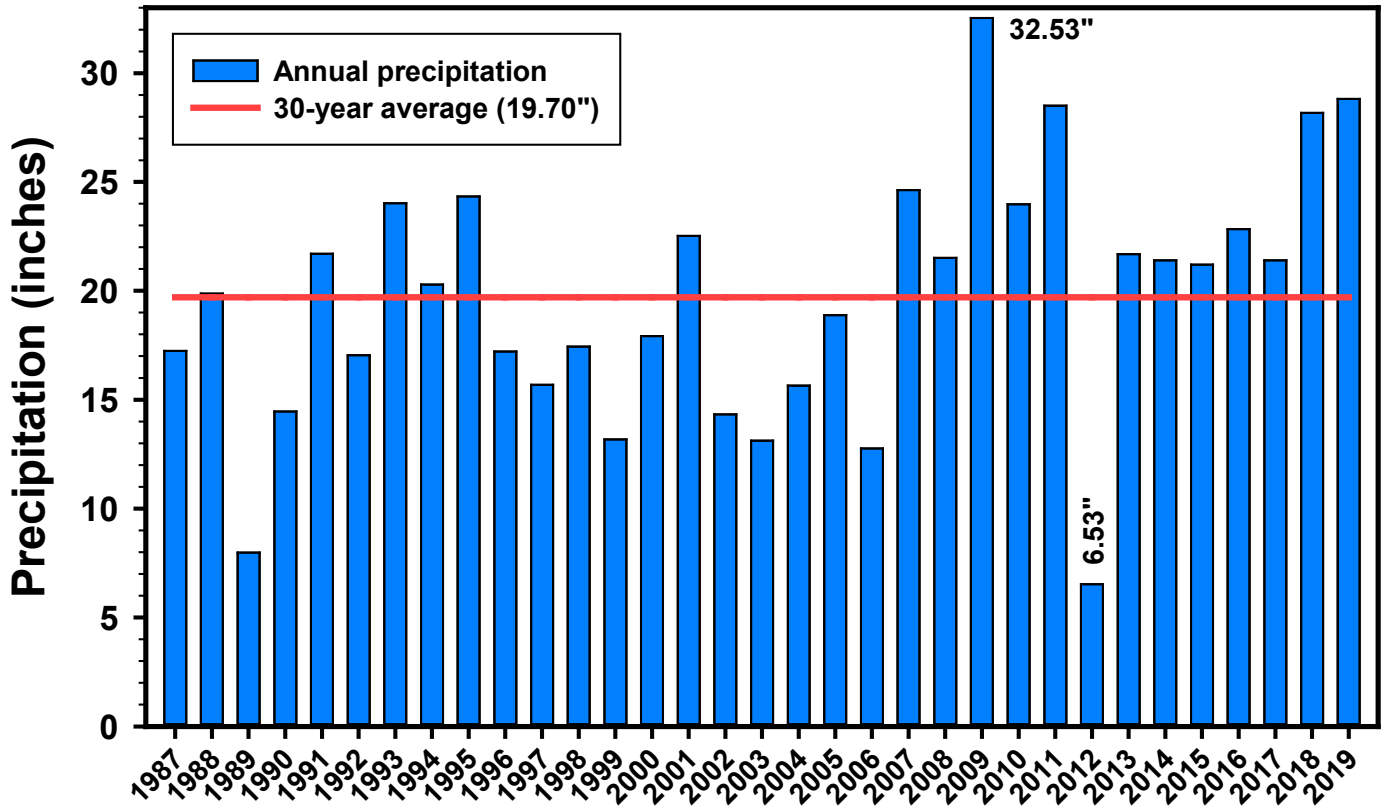
2019 Cows

	Cow Wt	BCS	Calf Wt	% Preg
March	1060	5.33	494	85.4
May	1158	5.25	491	95.6

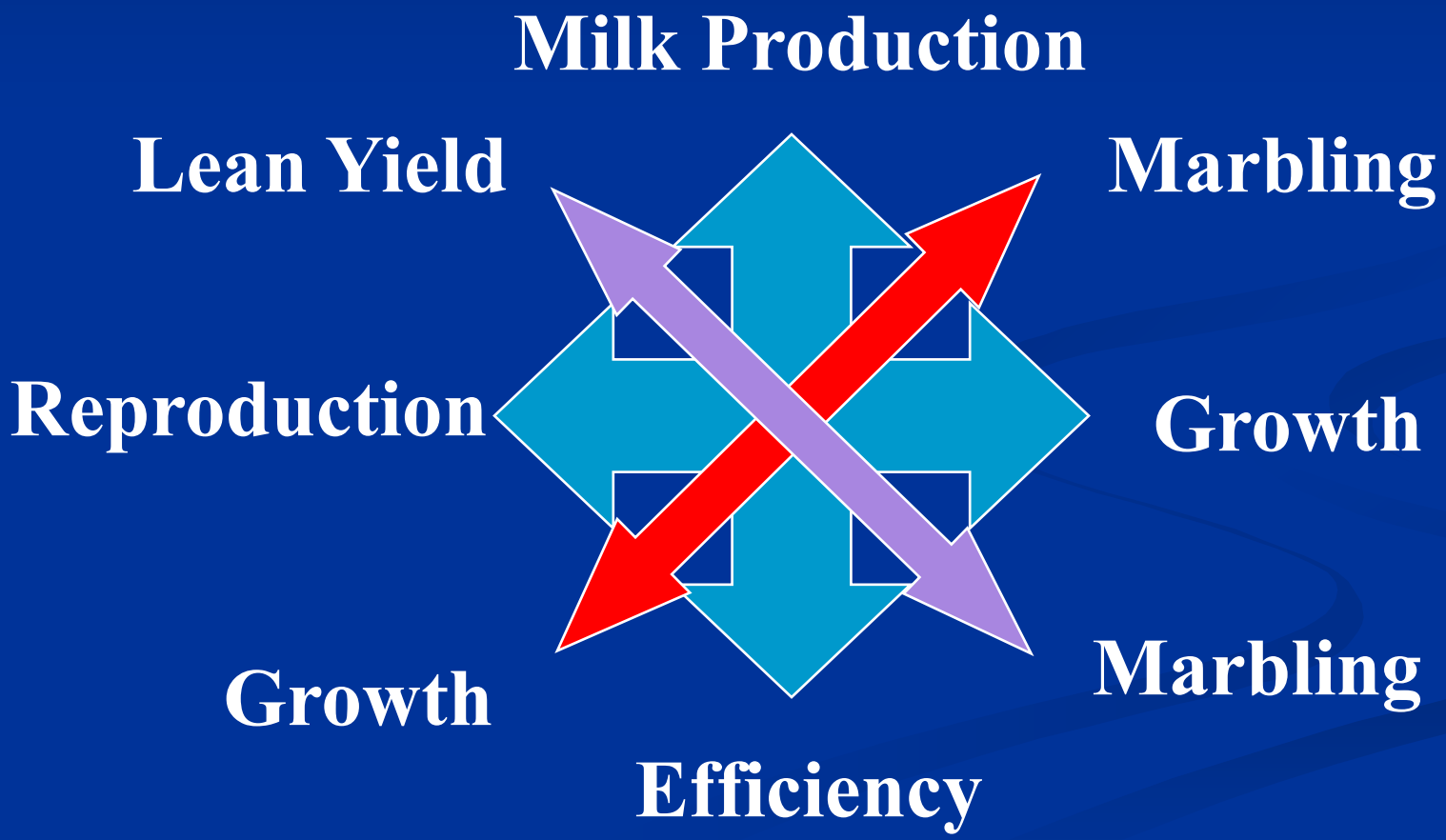
2018 March heifers	71.9%	6.0	797
2018 May heifers	82.4%	5.8	822

2019 March heifers	72.9%	6.0	809
2019 May heifers	80.4%	5.7	807

Annual and 30-year averge annual precipitation at the Gudmundsen Sandhills Lab., Whitman, NE (1987-2019)

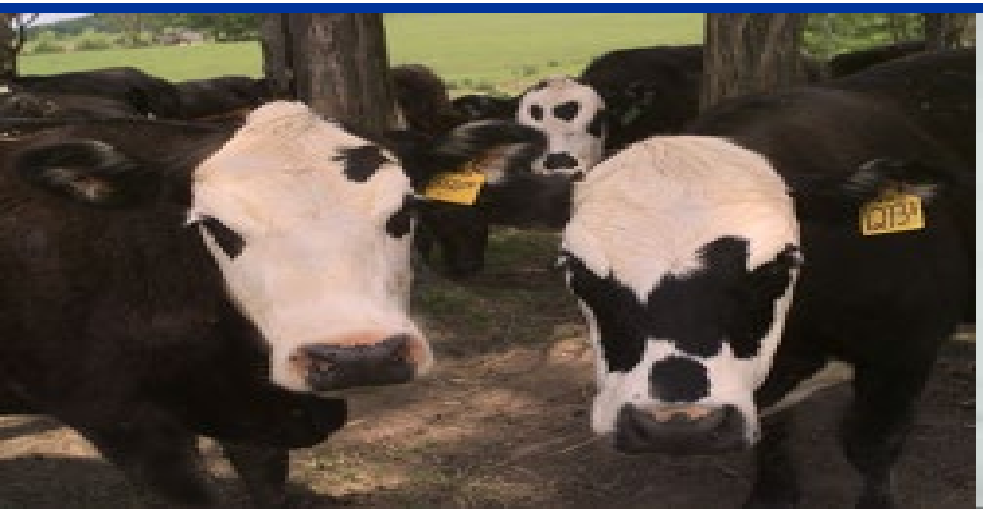


Which Direction to Go?



Advantage of Crossbred Cows

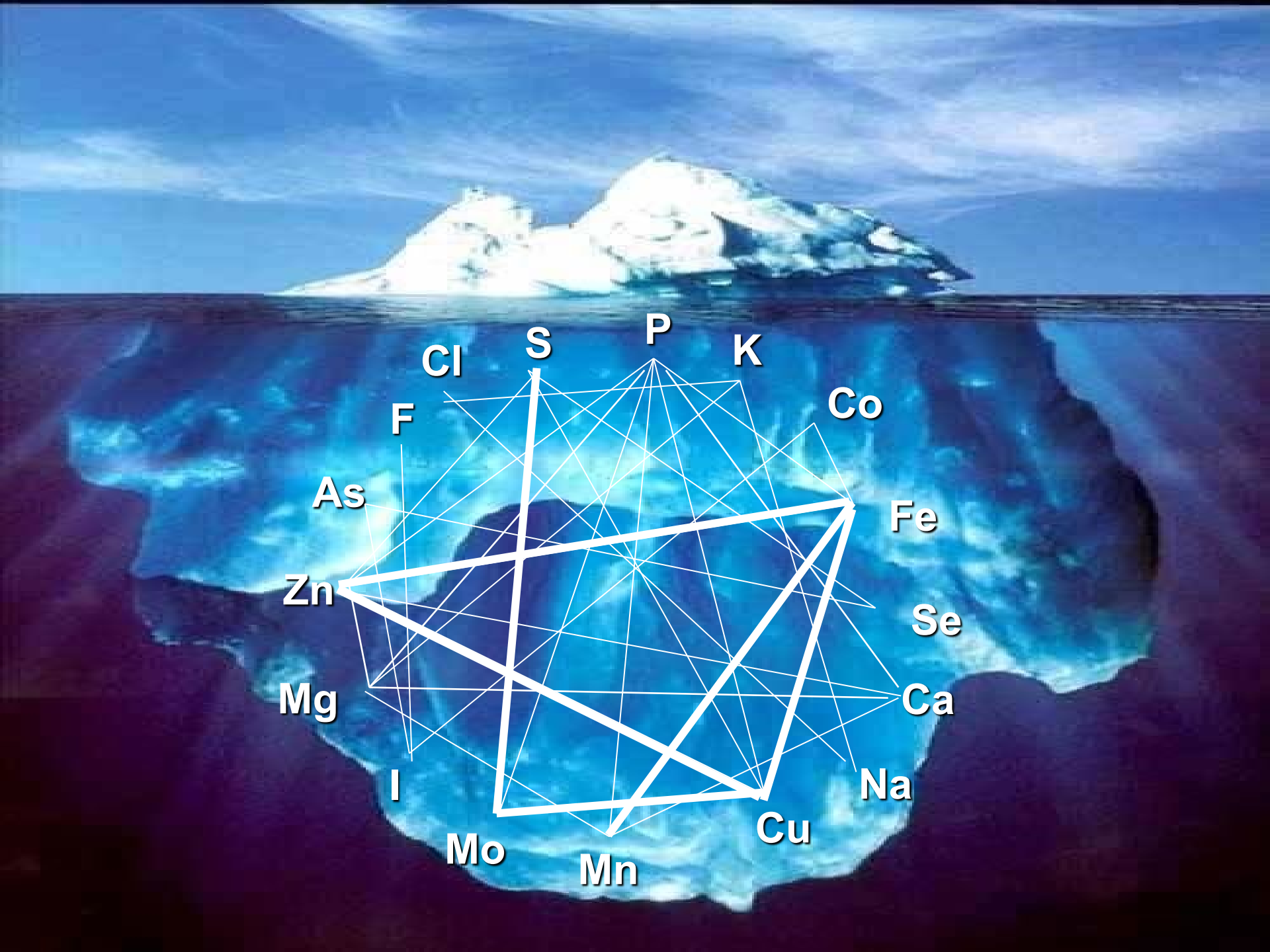
Trait	Maternal Heterosis
Longevity	1.2 yrs (44%)
Calf Weight/Cow Exposed	74 lb (25%)
Net Profit/Cow Exposed	$100



Fat Supplementation

- Safflower
- Sunflower
- Cottonseed
- Rice Hulls
- Soybeans
- Canola
- Flax
- Fish Meal
- Ca Salts of FA
- Tallow, Yellow Grease

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Effect of Rumensin on Puberty and Conception Rates

Group	No. heifers	% Cycling	% Bred
Rumensin	24	92	55
Control	26	58	47

Treatment	Age @ Puberty	% Pregnant
High Roughage	383	83
Rumensin +90% HR	369	96
Rumensin +100% HR	369	96

BALANCED NUTRITION: KEY TO OPTIMIZING PRODUCTION

- ✓ Protein
- ✓ Energy
- ✓ Minerals
- ✓ Vitamins
- ✓ Water

Factors Affecting Embryonic Loss

GENETIC

- Expression of lethal genes
- Abnormal chromosomal numbers
- Inbreeding

ENVIRONMENT

- Heat stress
- Transport
- Handling/chute work

NUTRITION

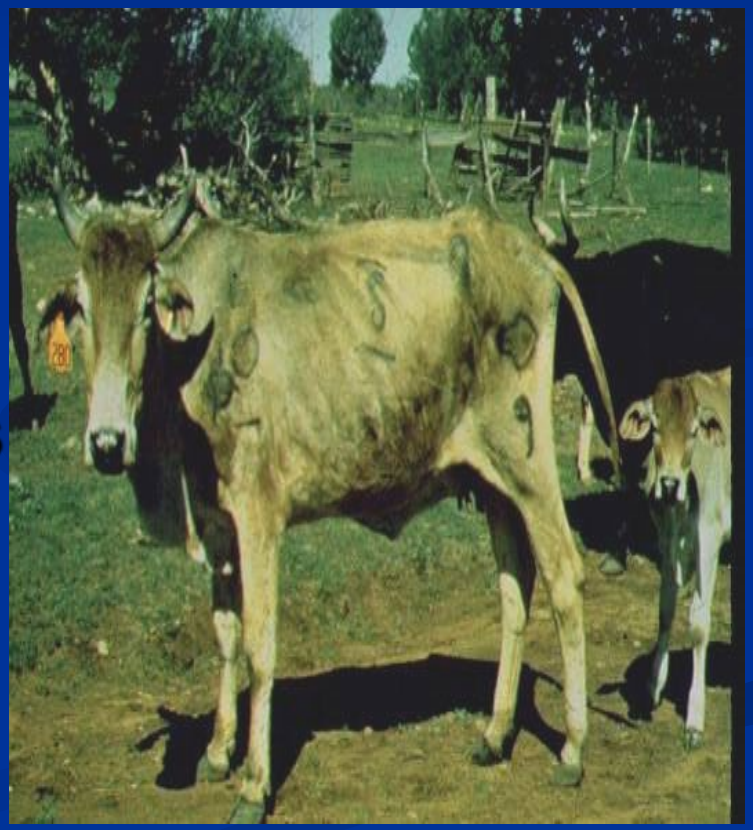
- BW&BCS at breeding
- Excess protein
- Toxins

MISCELLANEOUS

- Low progesterone production
- Age of dam
- Semen quality
- Infectious agents

Body condition at calving and prepartum nutrition

- Prepartum nutrition more important than postpartum nutrition in determining length of postpartum anestrus
- Inadequate dietary energy during late pregnancy lowers reproduction even when energy is sufficient postpartum
- Animals should be BCS 5-6 at calving



Effect of BCS at Calving on PPI

BCS	Postpartum Interval	Pregnancy % (90d)
3	88.5	
4	69.7	50
5	59.4	81
6	51.7	88
7	30.6	90

Effect of Age and Time on Return to Estrus

Age of Cow	Days after calving						
	40	50	60	70	80	90	100
	% Cycling						
5 or older	55	70	80	90	90	95	100
2-3 years	15	30	40	65	80	80	90

Requirements for Protein and TDN

Animal	Protein	TDN	TDN:CP Ratio
800 lb heifer, not pregnant	7	54	7.7
Pregnant heifer, 1.25 lb/d gain	8	55	6.9
Lactating cow, 15 lb milk/d	11	62	5.6

Moore and Kunkle, 2000

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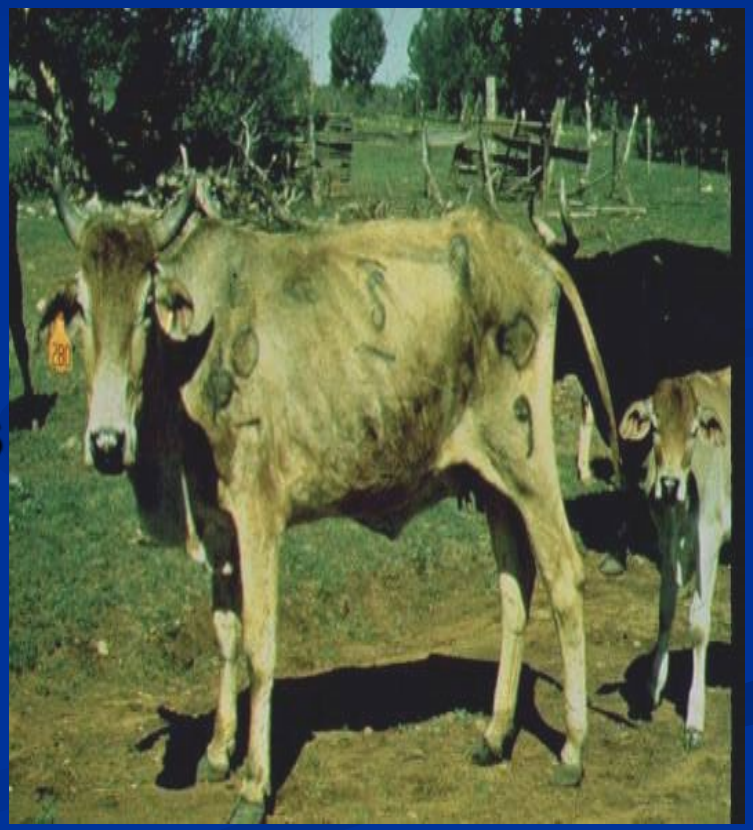
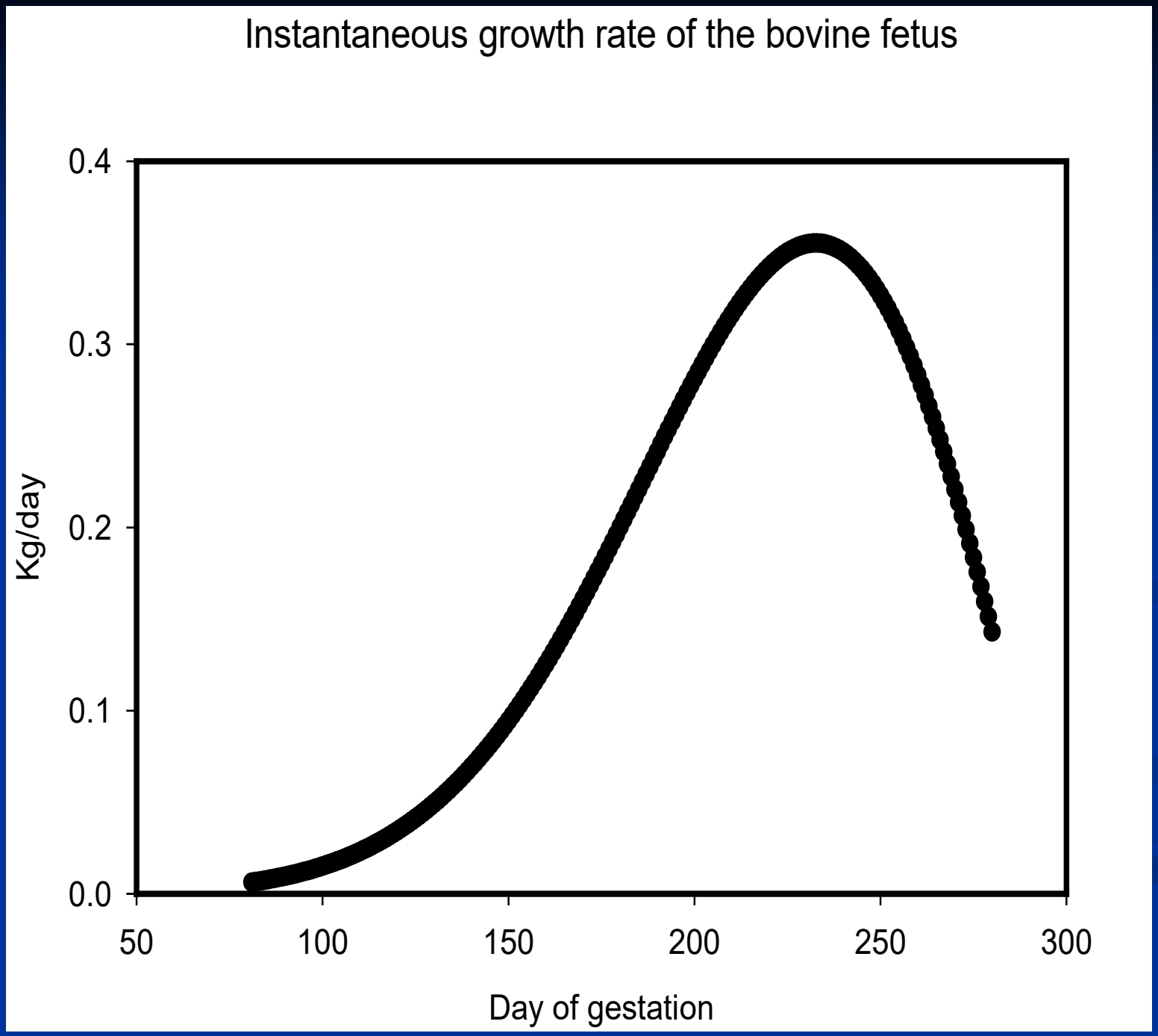
- Inadequate dietary energy during late pregnancy lowers reproduction even when energy is sufficient postpartum
- Animals should be BCS 5-6 at calving



Feed is the single greatest variable cost in beef production

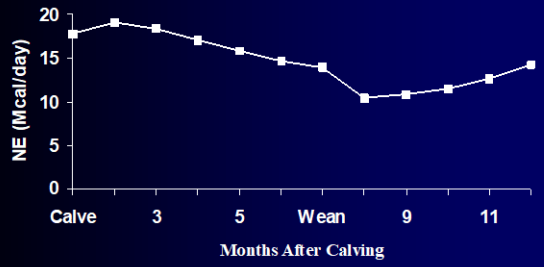
Decreasing harvested forage needs may decrease production costs

Crude protein in cattle diets on Sandhills range


Instantaneous growth rate of the bovine fetus
0.4
0.3
0.2
0.1
0.0
Kg/day
50
100
150
200
250
300
Day of gestation

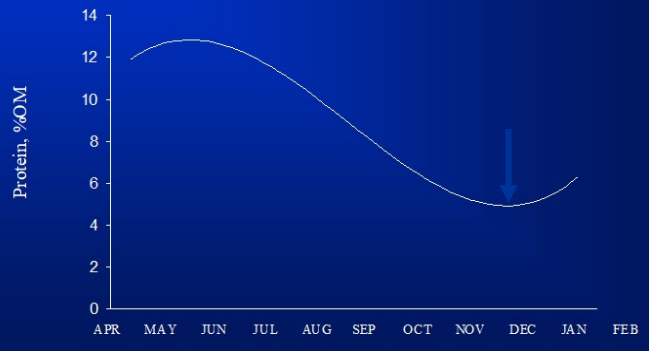
Winter Supplementation

Net Energy (NE) Requirement for a 1200 Lb March Calving Cow With 23 Lbs/day Peak Milk Production

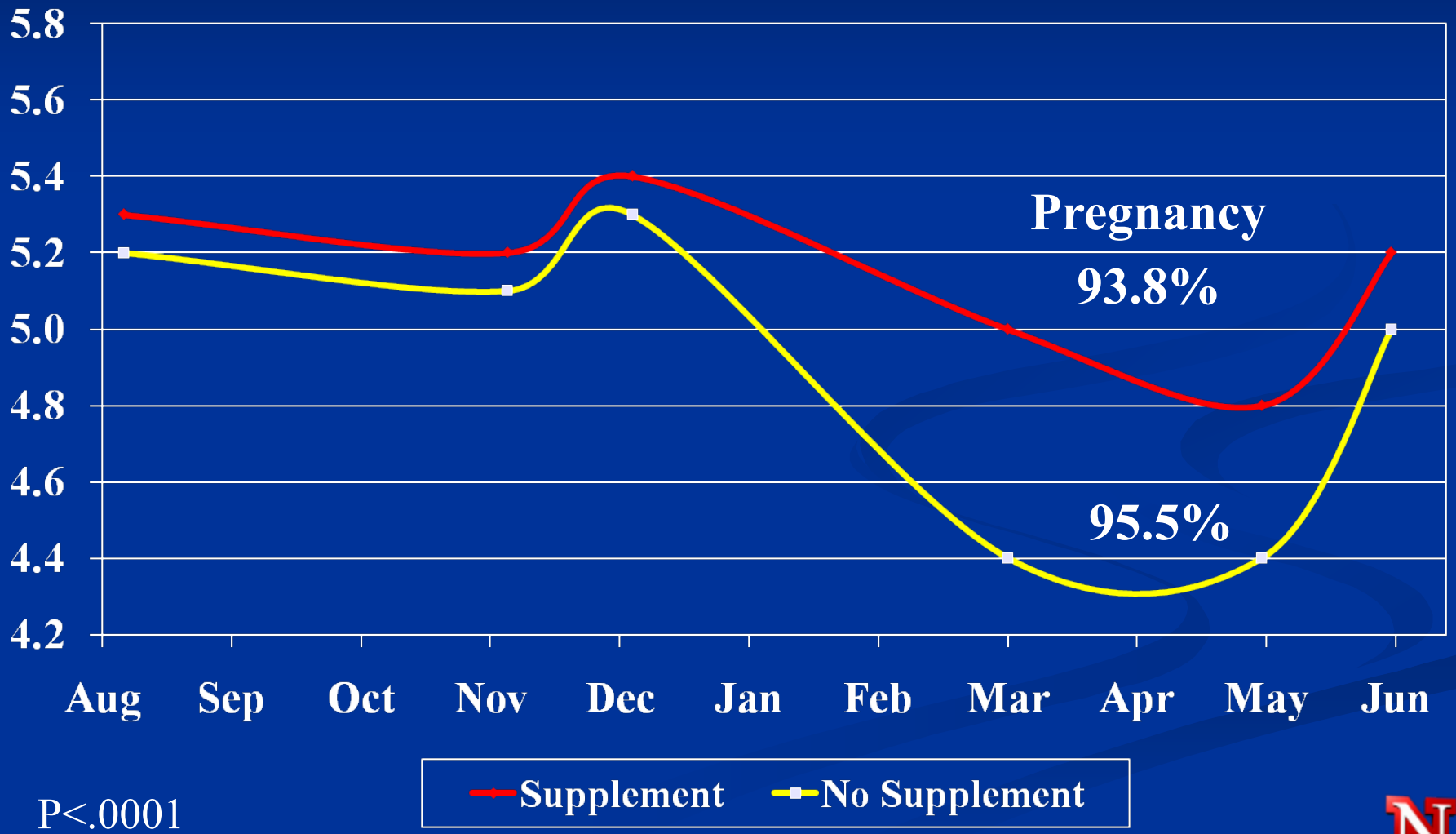


NRC (1996)

Crude protein in cattle diets on Sandhills range



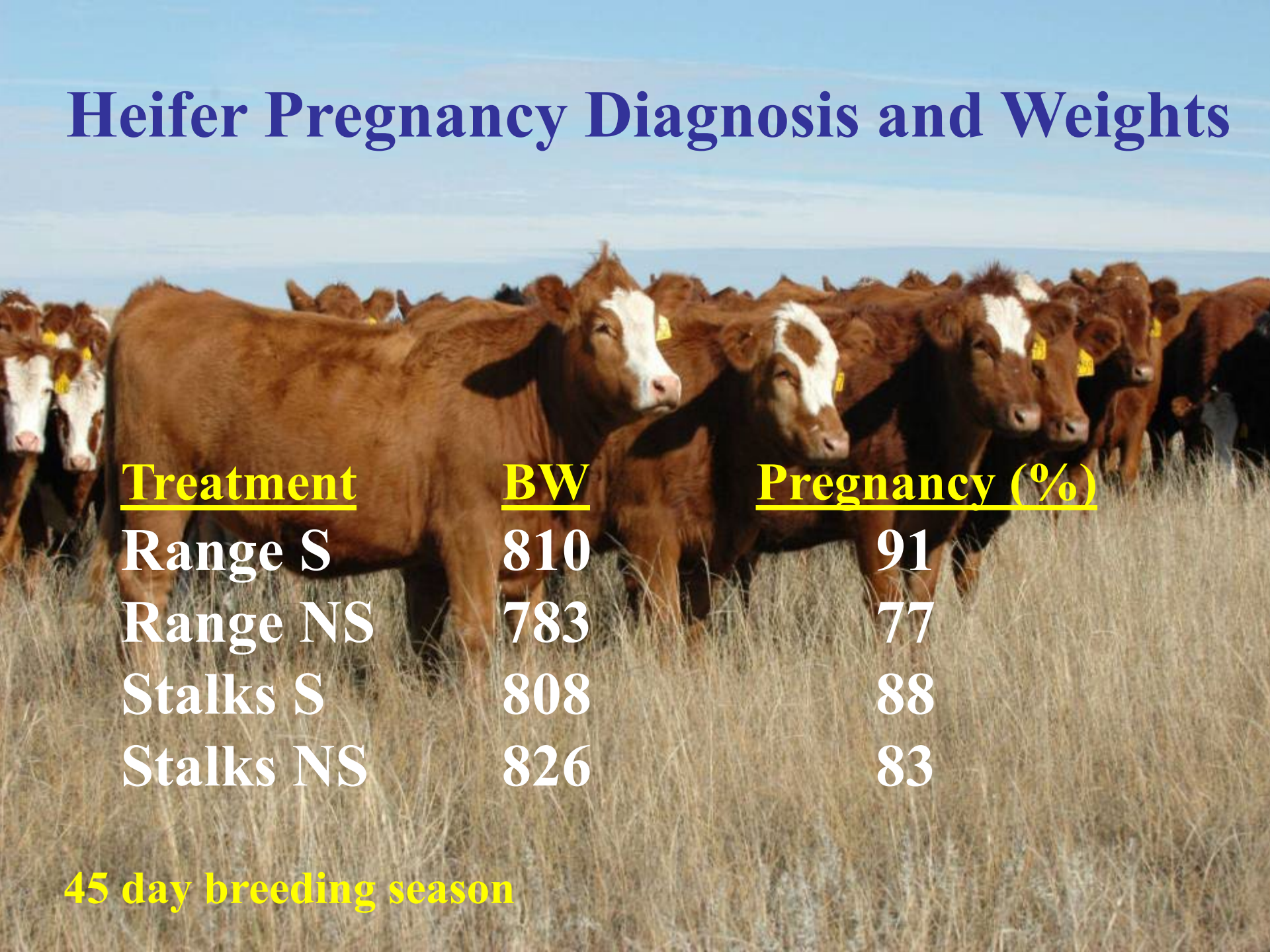
Effect of Protein Supplementation on Cow BCS



P<.0001

	WT	BCS	PG
RS	1142	5.2	96
RNS	1058	4.8	94
SS	1204	5.4	98
SNS	1184	5.2	95

Heifer Pregnancy Diagnosis and Weights



Treatment	BW	Pregnancy (%)
Range S	810	91
Range NS	783	77
Stalks S	808	88
Stalks NS	826	83

45 day breeding season

Final Live Weight and ADG

RS	1371	829	3.77
RNS	1303	787	3.66
SS	1343	811	3.73
SNS	1354	818	3.66

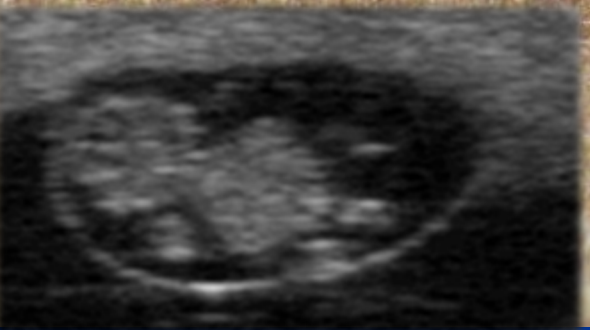
Quality Grade (% Choice)

RS	85	43	PS	86
RNS	77	27	NS	71
SS	88	35		
SNS	65	15		


1240

The consequences of nutrient restriction must be considered not only for individual animal performance…

The consequences of nutrient restriction must be considered not only for individual animal performance…



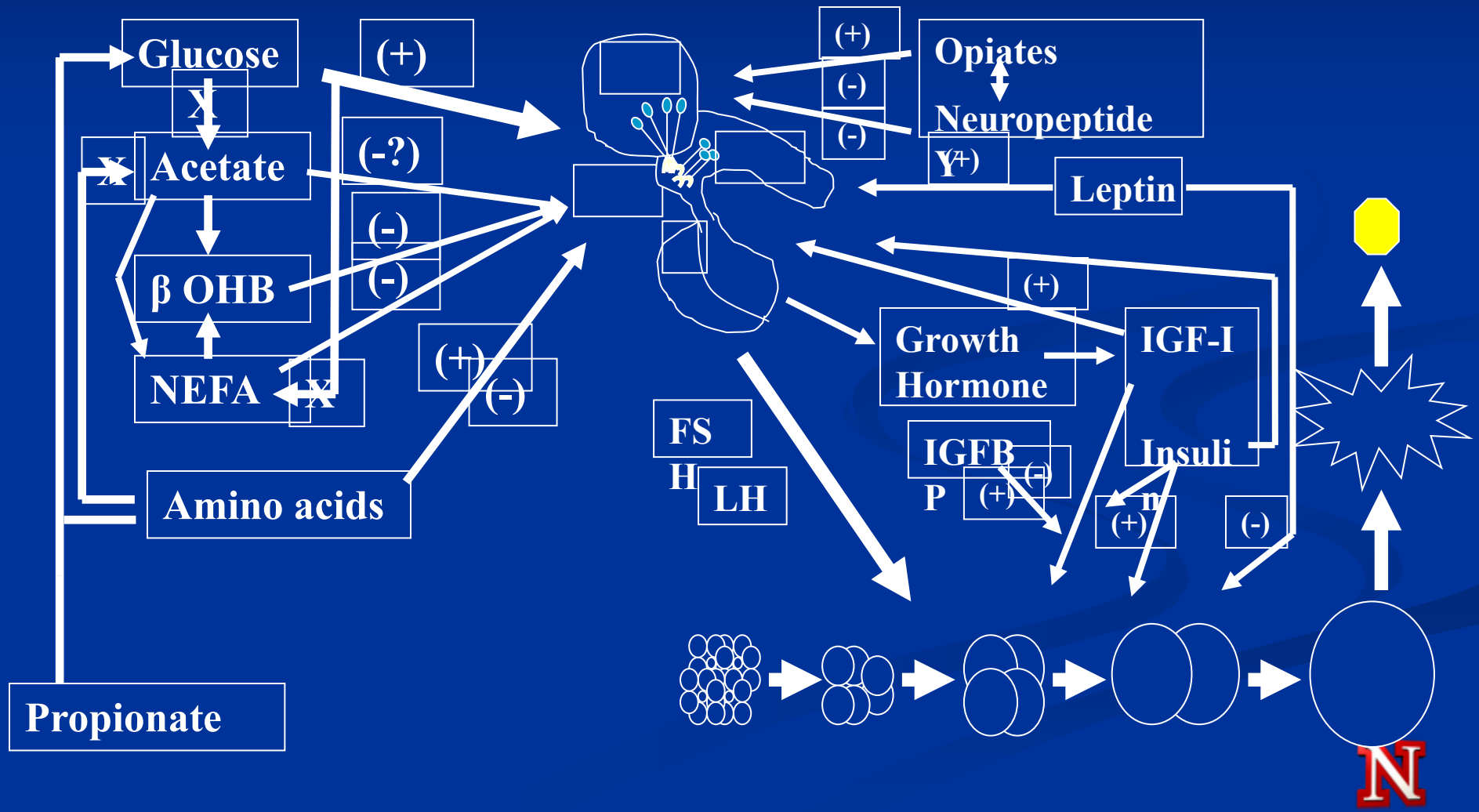
but also for the developing fetus.

Fetal Programming: Stimuli experienced during fetal development may impact postnatal growth and physiology

Factors that Affect Estrous Response & Conception Rates

- ✓ Body Condition Scores
- ✓ Age
- ✓ Postpartum Intervals
- ✓ Percent Cycling in Herd
- ✓ Nutrition
- ✓ Weather
- ✓ Correct Application of Protocols

Nutritional Mediation of Reproduction is Extremely Complex



Closing Thoughts

- Focus on high percentage pregnant early
- Begins with heifer development
- Consider synchronization
- Supplementation, what, when, timing
- Segregate high risk animals
- BCS at calving
- Sound herd health program
- Genetics that fit the environment
- Heterosis

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- Reports

Grazing Corn Stalk Residue

Seems that annual cow costs get higher each year, or at least they can potentially increase each year. This year is no

Educational Programs

Beef Profit Tips - Holt County
Dec 7, 1:00 PM , Holt County Courthouse Annex

Beef Profit Tips - Boyd County
Dec 7, 7:00 PM , Boyd County Courthouse

Beef Profit Tips - Neligh
Dec 8, 1:00 PM , Antelope County Courthouse

Beef Profit Tips - Center, NE
Dec 8, 6:00 PM , Center

Beef Profit Tips - Norden
Dec 12, 11:00 AM , Keya Paha County Fairgrounds

More events...

Beef Home Study Course

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