

GENETIC CONSIDERATIONS FOR THE COWHERD

Matt Spangler

mspangler2@unl.edu

University of Nebraska-Lincoln

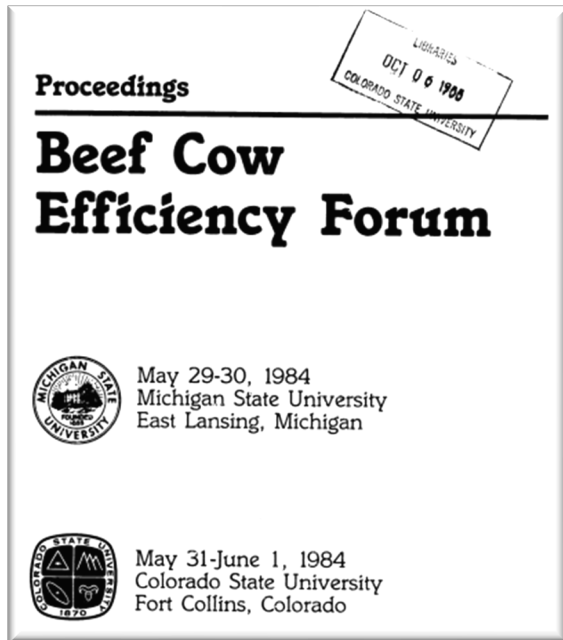
Breeding Objectives

- Identifies economically relevant traits
- Helps ranch become more efficient
- A detailed description of operation goals, including:
 - How replacements will be procured
 - How, and when, animals will be sold
 - Management and environmental constraints
 - Time horizon to consider profit

“Anytime the matter of cow efficiency becomes overwhelmingly complex, we should revert to basics...

$\text{Profit} = \text{Wean. Wt.} \times \% \text{ calf crop} \times \$/\text{lb} \times \# \text{ of cows} - \text{annual cost of cow-calf operation}”$

--Dr. Robert Totusek,
Oklahoma State University



Improving Efficiency

- $[\text{Dam Weight} * \text{Lean Value of Dam} + \text{No. Progeny} * \text{Progeny Weight} * \text{Lean Value of Progeny}] - [\text{Dam Feed} * \text{Value of Feed for Dam} + \text{No. Progeny} * \text{Progeny Feed} * \text{Value of Feed for Progeny}]$.
- By simply increasing number of progeny per dam through either selection, **heterosis from crossing**, or better management, we will increase efficiency of production.

Heterosis

- Hybrid Vigor
- Superiority of a crossbred animal as compared to the **average** of its straightbred parents
- More divergent parental lines = more heterosis
- NOT available from within breed matings

Inversely Related

<u>Trait</u>	<u>Heritability</u>	<u>Heterosis</u>
Reproduction (fertility)	Low	High
Production (growth)	Moderate	Moderate
Product (carcass)	High	Low

What is Heritability?

- Fraction of (adjusted) phenotypic variation due to variation in additive genetics
 - Higher heritability means faster genetic change all else equal
 - Low heritability does not necessarily mean limited genetic variation

Basic Model

$$P = G + E + e$$

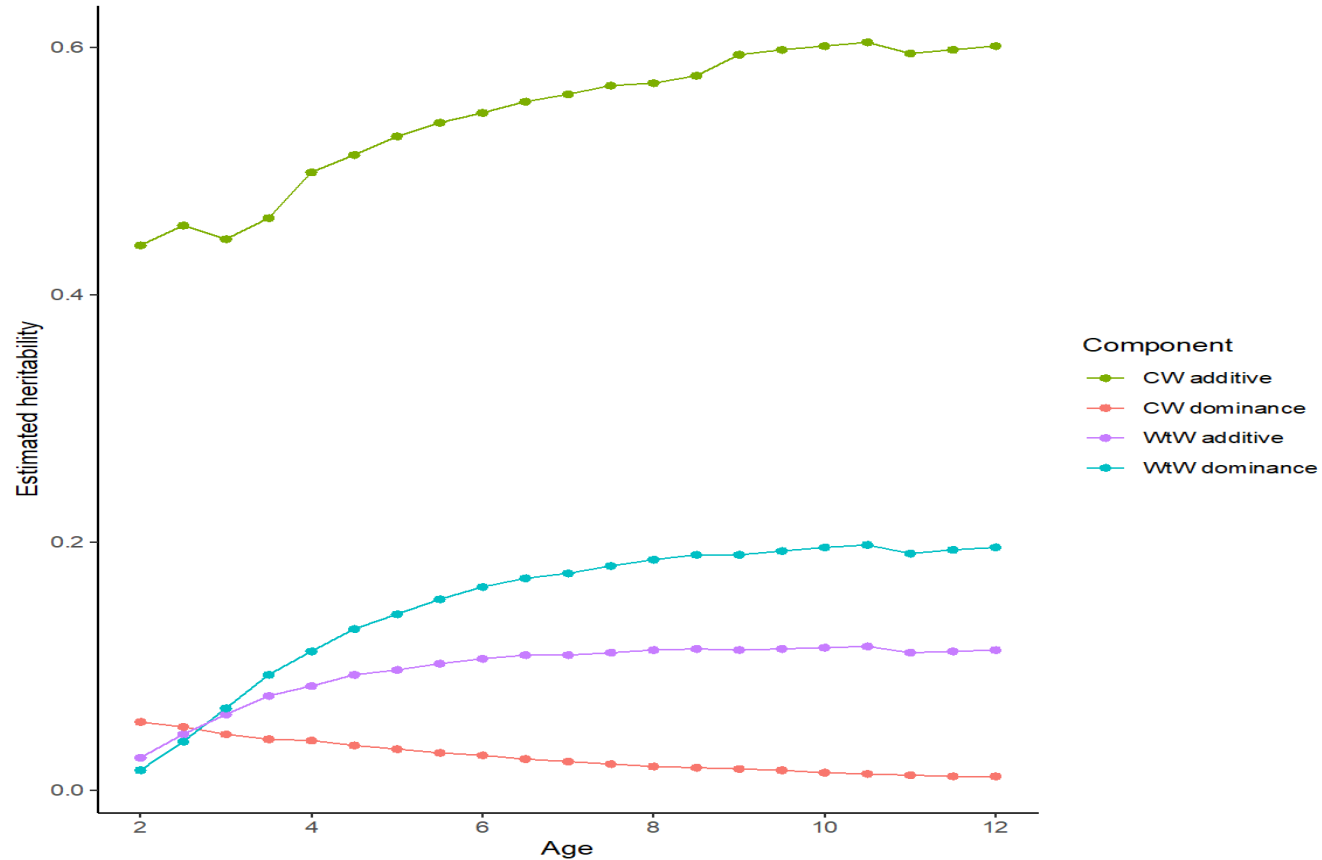
- Most heritability estimates reported have adjusted the “P” for known sources of “E”.
- This means that the heritability is the fraction of variation in what is leftover that is due to additive genetic variation.
- In other words, if h^2 is 10%, this does not mean that “E” explains the other 90%!

Advantages of the Crossbred Cow

Trait	Observed Improvement	% Heterosis
Longevity	1.36	16.2
Cow Lifetime Production:		
No. Calves	0.97	17.0
Cumulative Wean. Wt., lb.	600	25.3

Adapted from Cundiff and Gregory, 1999.

Capture Both Additive and Dominance



Snelling et al., 2022

Life cycle energy intake/kg edible product

- **Efficiency of growth in cows is NOT the target**
- **Maintenance requirement and efficiency are the target**

- Replacement
- Dam maintenance
- Gestation-Lactation
- Progeny maintenance
- Protein
- Fat

0 1000 2000

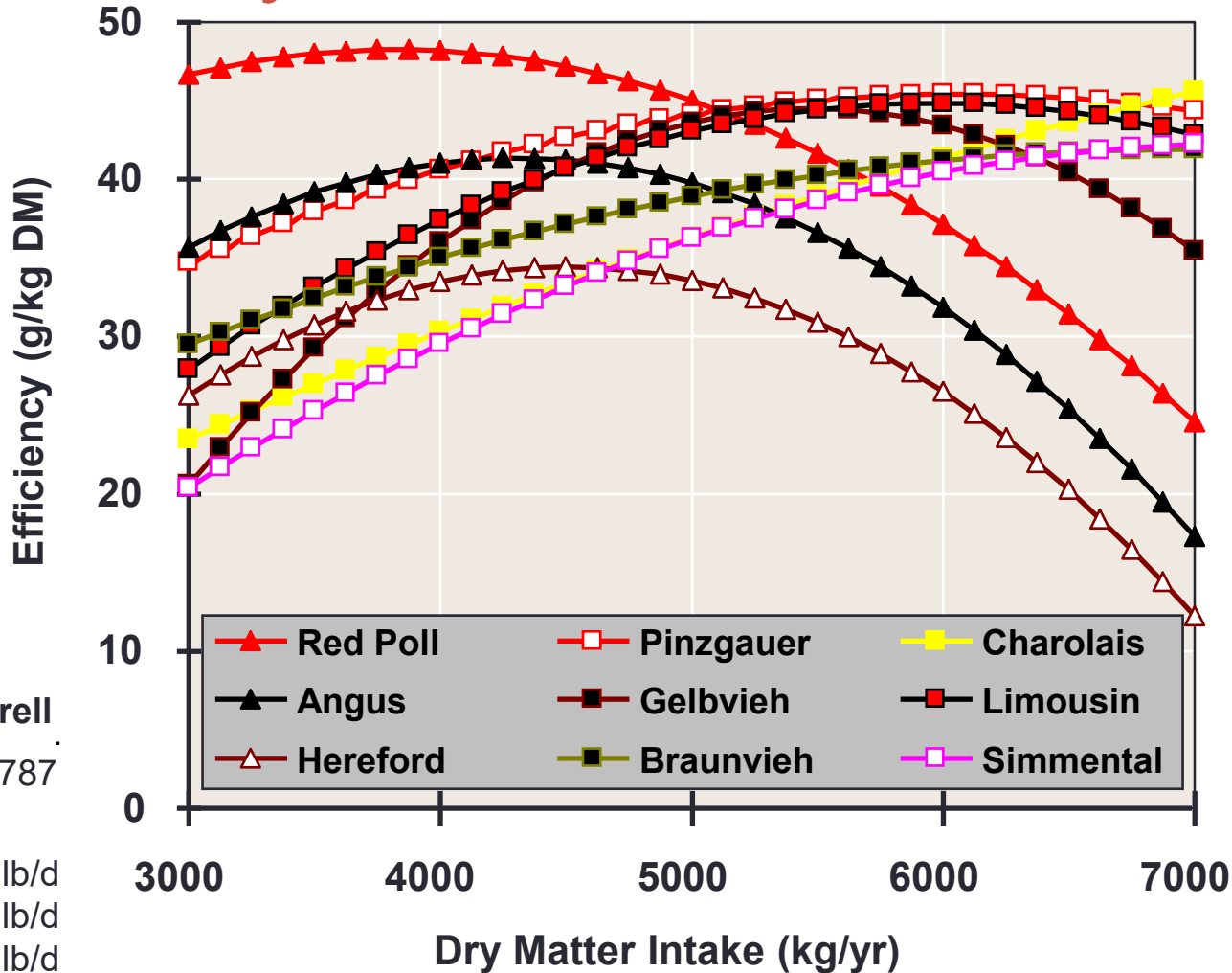
Dickerson, 1978

Economic Efficiency

van Oijen et al. (1993)

	Low	Med.	High
Income			
Weaning	496.40	493.60	501.10
Slaughter	810.1	808.40	789.40
Expense			
Weaning	549.80	553.40	568.80
Slaughter	814.20	837.50	828.30
Econ. Eff.			
Weaning	90.3	89.2	88.1
Slaughter	99.5	96.5	95.3

Cow Efficiency of Breeds Fed at Differing Levels of Dry Matter



Red Poll
 Angus
 Pinzgauer
 Braunvieh
 Limousin
 Hereford
 Charolais
 Gelbvieh
 Simmental

Charolais
 Pinzgauer
 Limousin
 Simmental
 Braunvieh
 Gelbvieh
 Red Poll
 Angus
 Hereford

Jenkins and Ferrell

1994. JAS 72:2787

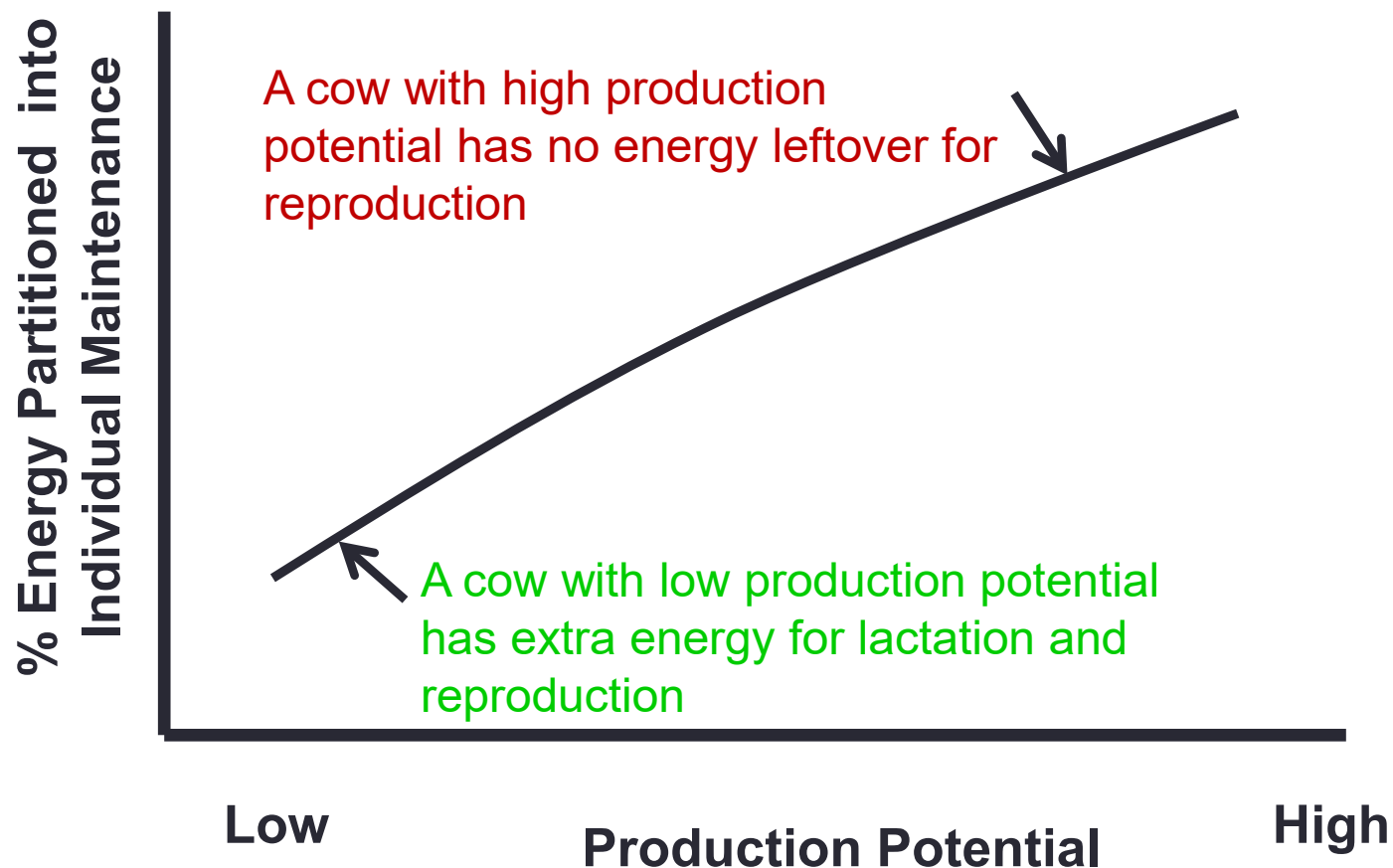
3,000 kg/yr ~ 18 lb/d

5,000 kg/yr ~ 30 lb/d

7,000 kg/yr ~ 42 lb/d

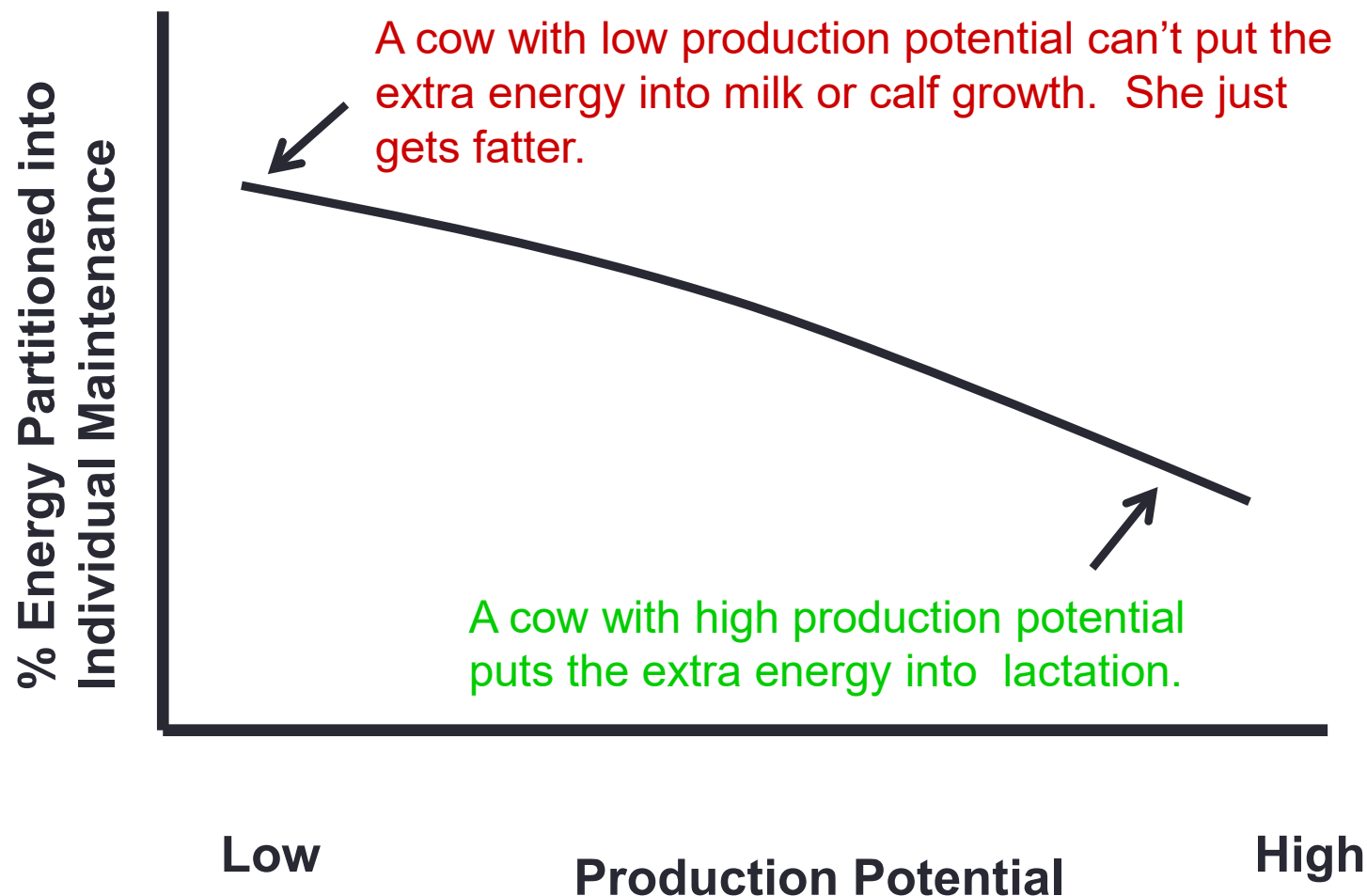
Low Feed Environment

Dunn et al., 2010



High Feed Environment

Dunn et al., 2010



Growth—Related to Mature Size

	BW	WW	YW
MW	0.57	0.62	0.45

Northcutt and Wilson, 1993

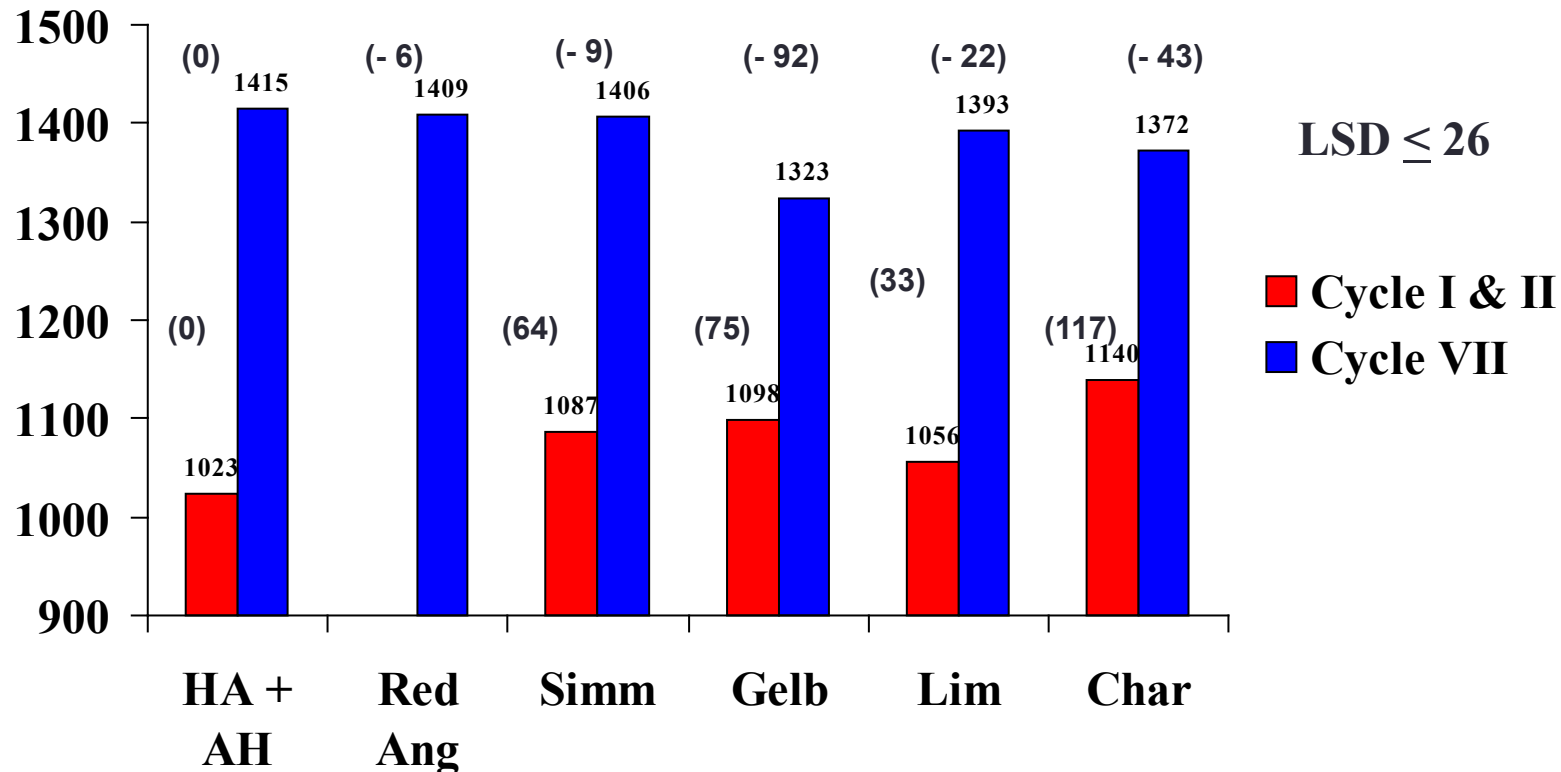
Breed Comparison

**TABLE 2: BREED OF SIRE MEANS FOR 2021 BORN ANIMALS
UNDER CONDITIONS SIMILAR TO USMARC**

Breed	Birth Wt. (lb)	Weaning Wt. (lb)	Yearling Wt. (lb)	Maternal Milk (lb)	Marbling Score ^a	Ribeye Area (in ²)	Fat (in)	Carcass Wt. (lb)
Angus	84.7	540.9	981.3	520.5	6.25	13.72	0.662	921.7
Hereford	87.1	517.9	917.5	509.8	5.34	13.47	0.600	871.7
Red Angus	83.8	520.1	940.6	521.4	5.87	13.44	0.633	884.9
Shorthorn	89.1	499.7	900.7	517.0	5.42	13.67	0.531	864.8
South Devon	87.9	503.5	899.0	521.3	5.42	13.69	0.511	853.9
Beefmaster	86.9	527.8	916.4	510.3				
Brahman	94.3	554.2	918.7	515.3	4.88	13.44	0.507	853.7
Brangus	86.8	527.0	933.3	519.8				
Santa Gertrudis	88.4	528.7	919.3	514.4	5.12	13.27	0.579	870.6
Braunvieh	87.8	508.8	897.3	532.1	5.47	14.36	0.493	846.3
Charolais	89.6	541.0	949.7	515.7	5.32	14.51	0.472	899.5
Chiangus	87.7	506.4	906.0	515.9	5.43	13.99	0.523	874.0
Gelbvieh	86.4	536.9	954.3	522.6	5.29	14.32	0.525	884.6
Limousin	86.1	535.6	938.2	512.8	5.41	14.53	0.534	891.7
Maine-Anjou	86.2	494.9	874.0	506.5	5.18	14.29	0.458	849.5
Salers	85.3	519.9	924.0	521.9	5.32	14.19	0.510	866.2
Simmental	86.8	542.6	961.2	517.4	5.52	14.40	0.511	896.3
Tarentaise	86.3	520.1	888.4	509.2				

^aMarbling score units: 4.00 = S1⁰⁰; 5.00 = S5⁰⁰

BREED GROUP MEANS FOR MATURE WEIGHT OF F1 CROSS COWS IN CYCLES I AND II (BIRTH YEARS: 1970-74) COMPARED TO CYCLE VII (BIRTH YEARS 1999-2000)



Breed Differences in Mature Cow Weight

Breed	Corrected Breed Effect Contrasted to Angus, lb.
Hereford	-30.4
Red Angus	-47.7
Charolais	14.3
Gelbvieh	-71.1
Limousin	-76.1
Simmental	-16.9
Brahman	20.9
Brangus	-44.9
Beefmaster	-75.9
Santa Gertrudis	-33.0

MATERNAL ECONOMIC VALUES

Traits	Economic value (\$/trait unit)	Genetic SD	Relative economic value
<hr/>			
Maternal Objective			
CDd, %	-1.28	1.64	-2.11
CDm, %	-1.39	1.10	-1.53
WWd, kg	1.63	11.35	18.49
WWm, kg	1.14	9.89	11.28
MW, kg	-0.96	34.94	-33.46
HP, %	2.68	0.45	1.19

Stayability would be a driver if it had been considered



Raising Replacement Heifers

Small Herds

- Fact is these herds produce a large fraction of all calves in the U.S.
- It seems logical that these herds could increase profit if they purchased replacement females
 - Females bred for 2nd (or later) calf
 - Composite females (or F₁)
- Bulls selected for terminal traits and cows selected for maternal traits
 - True complementarity
 - Stayability, moderate weight, moderate milk, total maternal calving ease, and convenience traits (e.g., docility, udder/teat)

Advantages

- Heavier calves and more product from smaller cows
 - Benefit of terminal producer
 - Reduce industry-wide feed intake by smaller cows
- Less calving difficulty industry-wide
 - Maternal producers are the only ones calving heifers
- Increased uniformity industry-wide
 - Common objectives
- Focus objectives
 - Only trying to do one thing

Calving Ease

- Total maternal calving ease
 - No assistance needed at calving

Calving Ease Score	Decrease in Conception*
2	3%
3	11%

* 90 days post-partum

Spangler et al., 2006

Terminal or General Purpose?

Terminal

- \$B, \$F, \$G (Angus)
- TI (Simmental)
- CHB\$ (Hereford)
- MTI (Limousin)
- EPI and FPI (Gelbvieh)
- Charolais
- GridMaster (Red Angus)
- \$T (Beefmaster)
- \$F (Shorthorn)

General Purpose

- \$M, \$C (Angus)
- API (Simmental)
- BMI\$, BII\$ (Hereford)
- HerdBuilder, ProS (Red Angus)
- \$Cow (Gelbvieh)
- \$M (Beefmaster)
- \$CEZ, \$BMI (Shorthorn)

Example

- Profitability per exposure
- All-Purpose Index (API; Simmental)
- Bull A 170
- Bull B 146

- 30 cows/yr. over 4 yrs. = 120 exposures
- 120 exposures X (170-146) =
- **\$2,880 profit difference**
- **If you follow the assumptions of the index!**

Sire Selection

- The most effective means of generating response in all traits, even those that are sex-limited.
- Happens, at most, once per year.
- “Value” is largely determined ad hoc, and purchase price is sometimes (often?) a function of available cash flow (not necessarily from the cattle enterprise)
- Selection criteria contemplate breed, breeder (provider), and individual bulls.

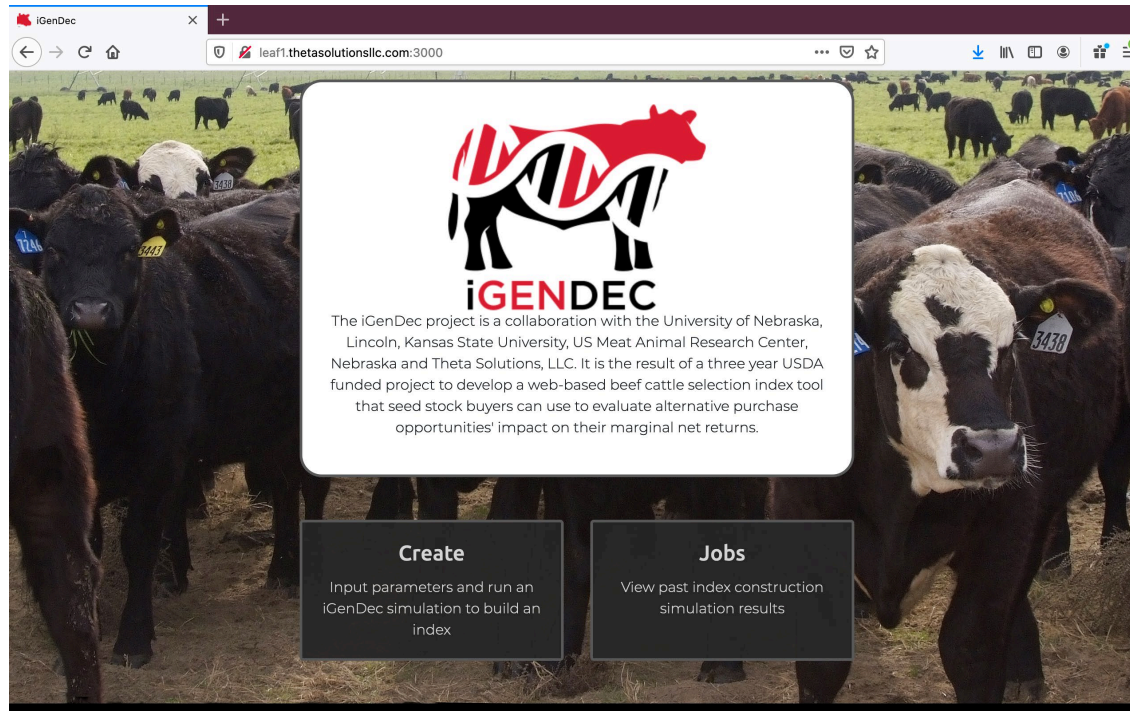
Optimization game

- Objective needs of the cowherd
- Desires of the decision maker
- Financial resources
- Allocation of time to sire selection activity/chore

Investment Thought process


- Producers face the problem of obtaining the best bulls for their operation in that given setting.
- 'Best' is a relative concept.
- A 'less desirable' bull may become the preferred choice over a 'more desirable' bull if his sale price discount is larger than the differential in value between the two bulls.

Proposed Solution



iGenDec

leaf1.thetasolutionsllc.com:3000



iGENDEC

The iGenDec project is a collaboration with the University of Nebraska, Lincoln, Kansas State University, US Meat Animal Research Center, Nebraska and Theta Solutions, LLC. It is the result of a three year USDA funded project to develop a web-based beef cattle selection index tool that seed stock buyers can use to evaluate alternative purchase opportunities' impact on their marginal net returns.

Create
Input parameters and run an iGenDec simulation to build an index

Jobs
View past index construction simulation results

<https://beefimprovement.org/resource-center/igendec/>

Breeding objective

The screenshot shows a web browser window with the URL `leaf1.thetasolutionsllc.com:3000/create`. The page has a navigation bar with 'Home', 'Create', and 'Jobs' on the left, and 'Profile' and 'Sign Out' on the right. The main content area is split into two panels. The left panel, titled 'Create A New Index Job', contains three dropdown menus: 'Sale Endpoint' (set to 'weaning'), 'Index Type' (set to 'Creates own replacements'), and 'Target Database' (set to 'None'). A 'Build' button is at the bottom. The right panel, titled 'Edit An Existing Index Job', contains a 'Select Job' dropdown (set to '03252021_test_output_2'), a 'Job Comment' text area (containing 'Test with targeted database'), and two buttons: 'Edit' and 'Run'. The background of the page is a faded image of a farm with cows.

Create A New Index Job

Sale Endpoint:
weaning
Specifies the sale point for calves. This will define what default values you get and how the job is executed.

Index Type:
Creates own replacements
Specifies the type of index to be constructed.

Target Database:
None
Will provide suitable defaults for the chosen database. Leave set as none for general defaults.

Build

Edit An Existing Index Job

Select Job:
03252021_test_output_2
Choose a job to re-run. You can change everything except the sale endpoint of a previous job. To change the sale endpoint a new job must be created.

Job Comment:
Test with targeted database

Edit Run

Edit the job's details and then re-run under a different name. Run this job again without modifying. The result will overwrite the current job. May take a couple of minutes.

Privacy Policy | iGenDec © 2020 | Disclaimer

Web interface: Cow Cost

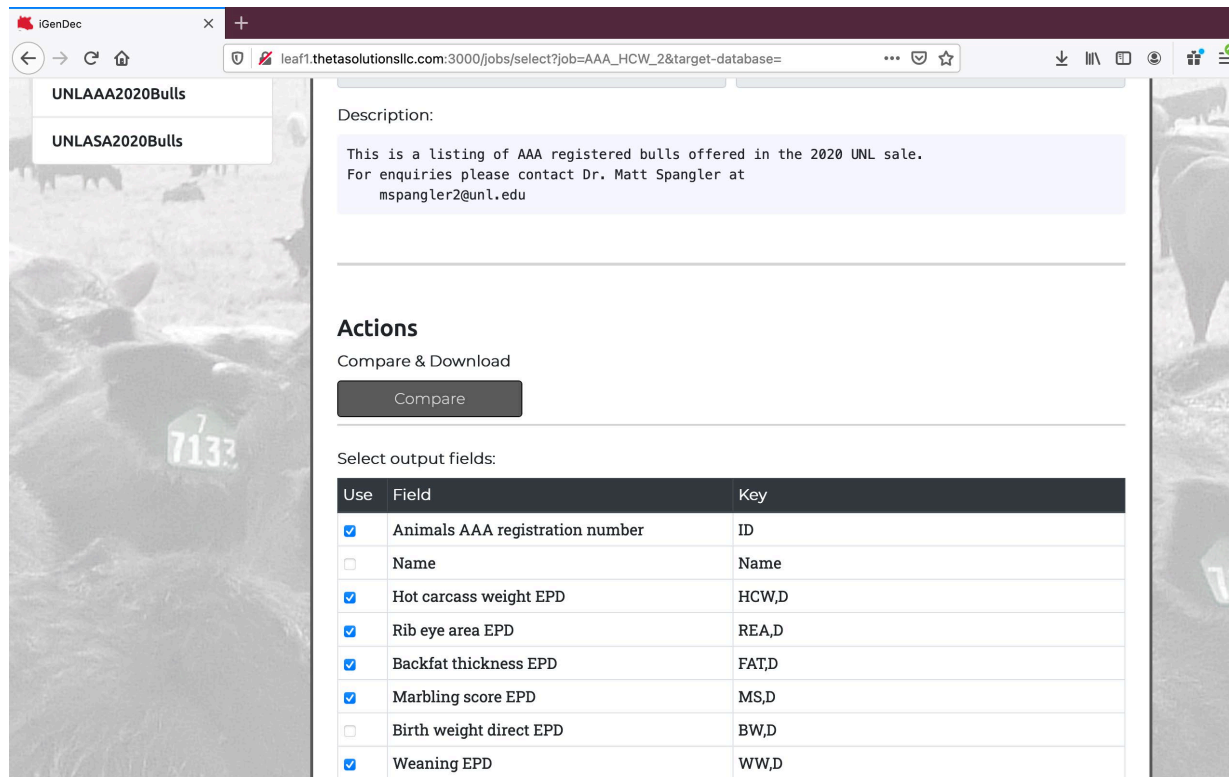
The screenshot shows a web browser window with the URL `igendec.beefimprovement.org/create/build?job=ASAS_1`. The page is titled "Herd Costs Per Animal" and features a sidebar menu on the left under the heading "Tasks". The sidebar includes sections for "General", "Herds", "Cow Age Distribution", "Breed Composition" (with sub-items "Herd Composition", "Bull Composition", and "Calf Composition"), "Sale Price", "Costs" (highlighted), "Other Settings", and "Create".

The main content area displays "Annual Per Cow Cost:" with a dropdown menu set to "288". Below this is a table with two columns: "\$ per Cow" and "\$ per Backgrounded Calf". The table lists months from January to December, with each cell containing a text input field with the value "\$ 24" and a small dropdown arrow icon.

At the bottom of the main content area, there is a "Save & Next" button. The browser's address bar shows a zoom level of 80% and various navigation icons.

Month	\$ per Cow	\$ per Backgrounded Calf
January	\$ 24	\$ 24
February	\$ 24	\$ 24
March	\$ 24	\$ 24
April	\$ 24	\$ 24
May	\$ 24	\$ 24
June	\$ 24	\$ 24
July	\$ 24	\$ 24
August	\$ 24	\$ 24
September	\$ 24	\$ 24
October	\$ 24	\$ 24
November	\$ 24	\$ 24
December	\$ 24	\$ 24

Comparing Bulls



UNLAAA2020Bulls

UNLASA2020Bulls

Description:

This is a listing of AAA registered bulls offered in the 2020 UNL sale. For enquiries please contact Dr. Matt Spangler at mspangler2@unl.edu

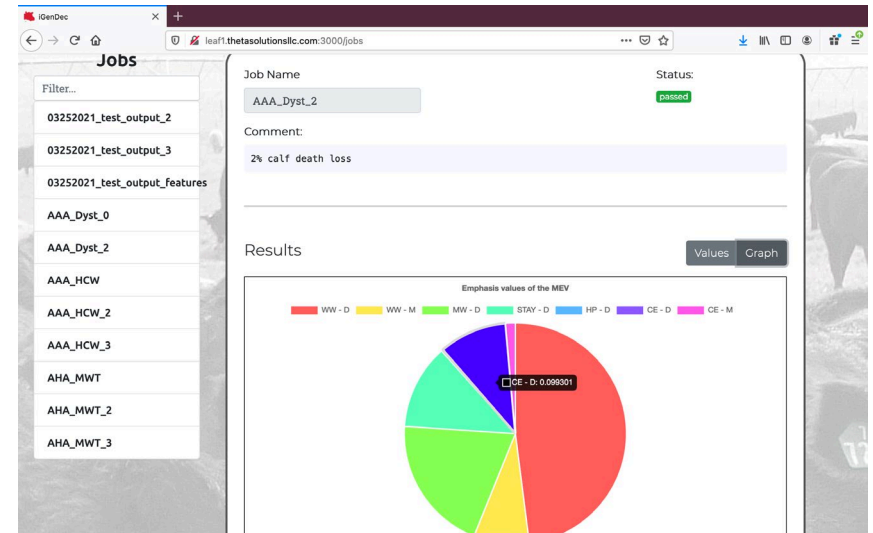
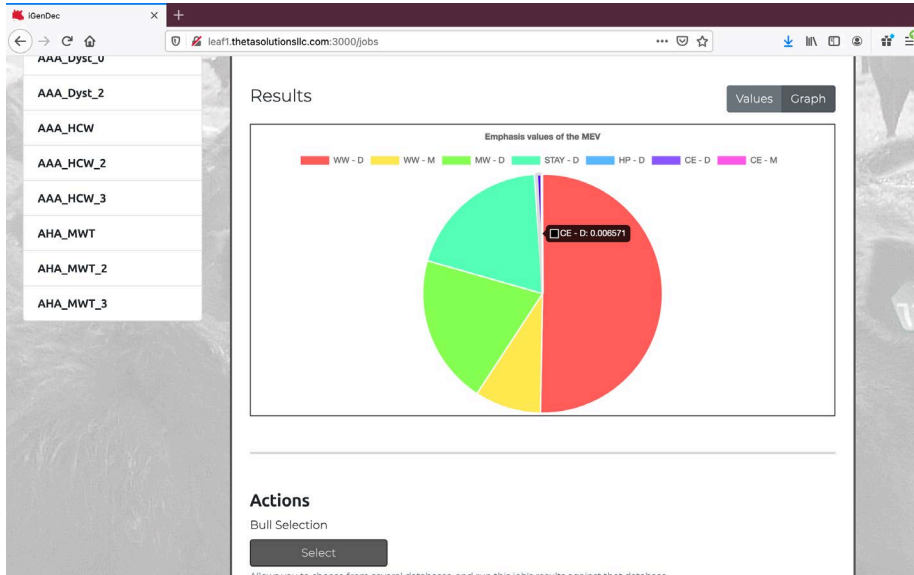
Actions

Compare & Download

Compare

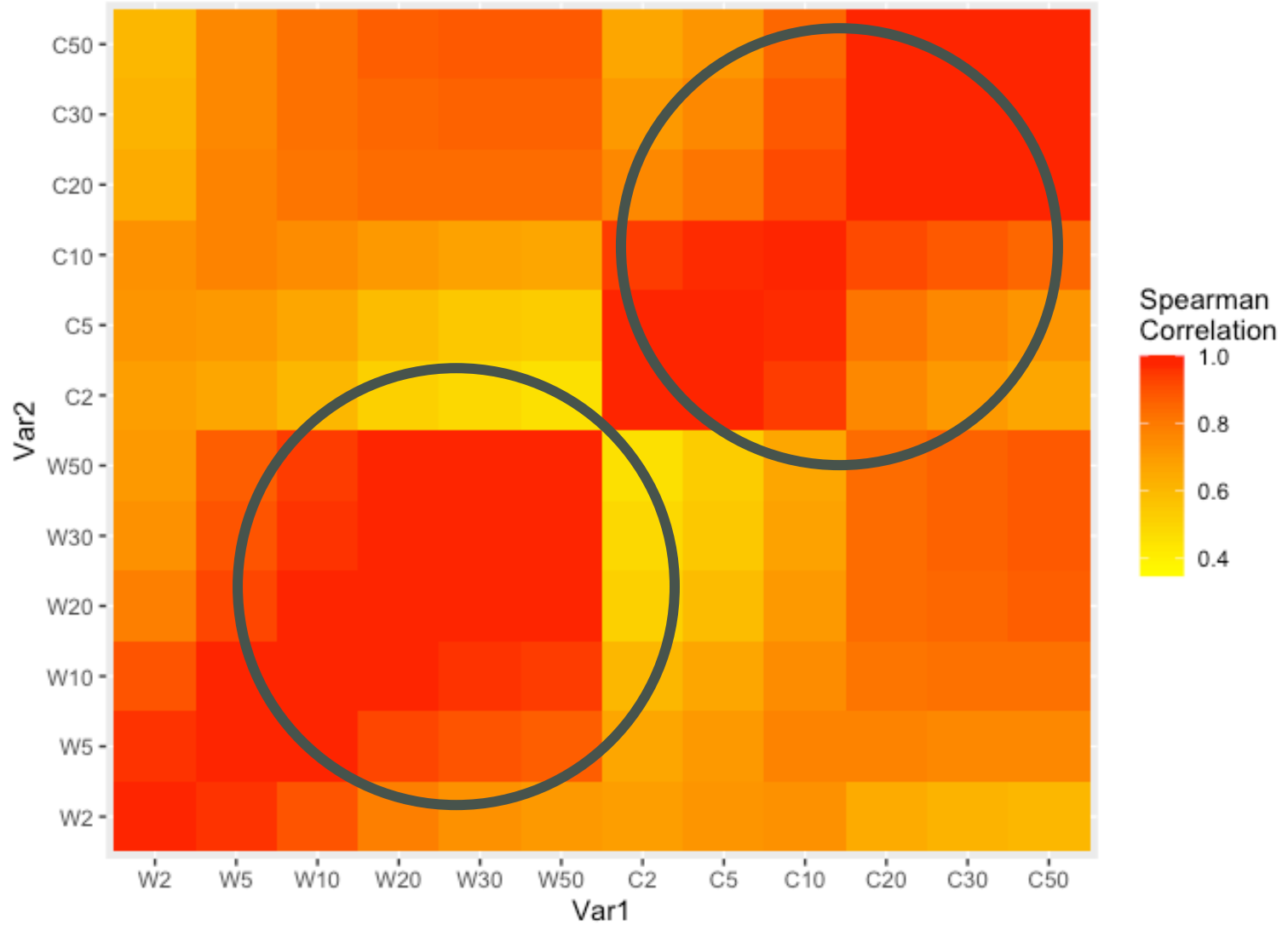
Select output fields:

Use	Field	Key
<input checked="" type="checkbox"/>	Animals AAA registration number	ID
<input type="checkbox"/>	Name	Name
<input checked="" type="checkbox"/>	Hot carcass weight EPD	HCW,D
<input checked="" type="checkbox"/>	Rib eye area EPD	REA,D
<input checked="" type="checkbox"/>	Backfat thickness EPD	FAT,D
<input checked="" type="checkbox"/>	Marbling score EPD	MS,D
<input type="checkbox"/>	Birth weight direct EPD	BW,D
<input checked="" type="checkbox"/>	Weaning EPD	WW,D

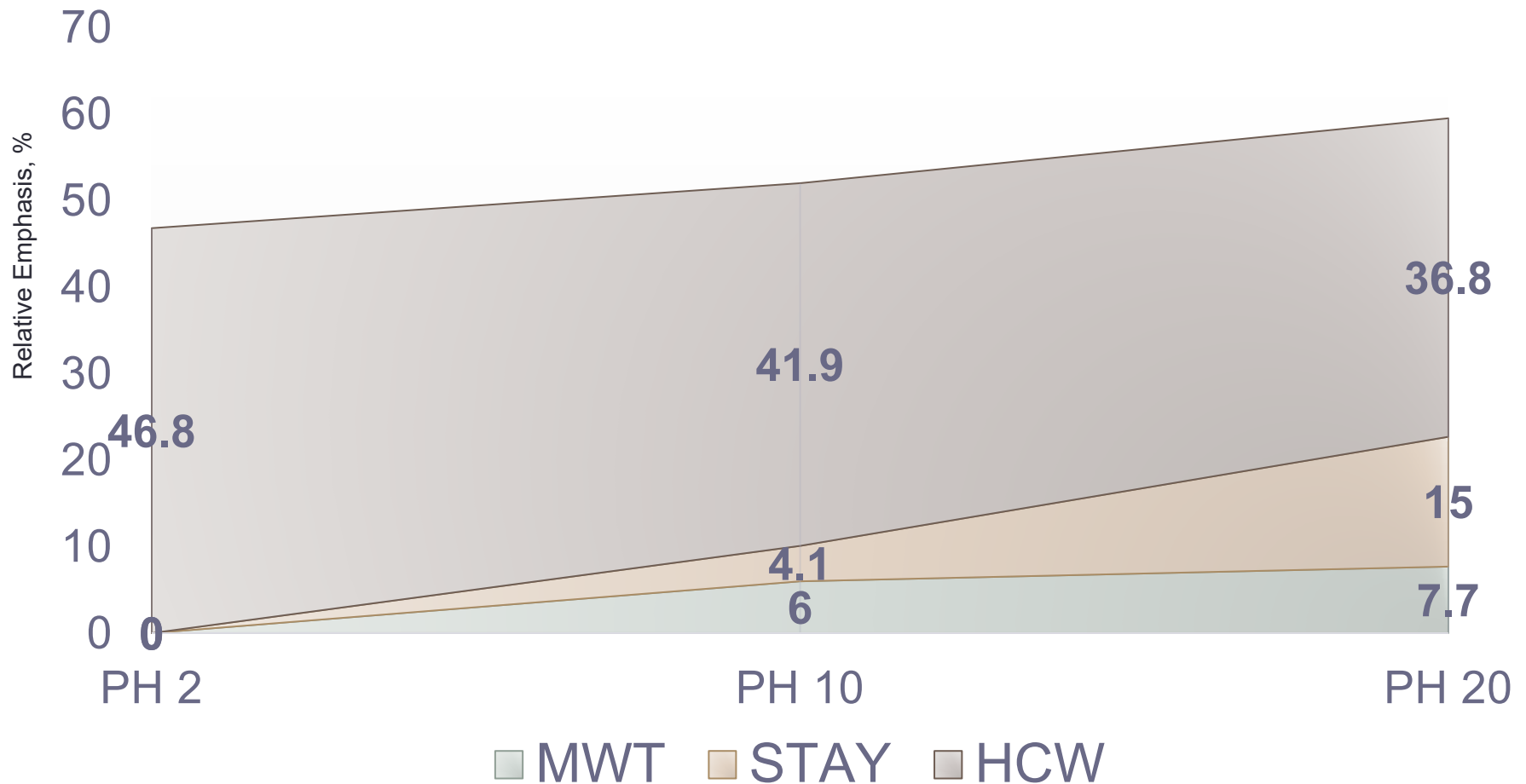


Change from ~0% to ~10% relative emphasis on CED going from 0% to 2% calf death loss due to dystocia

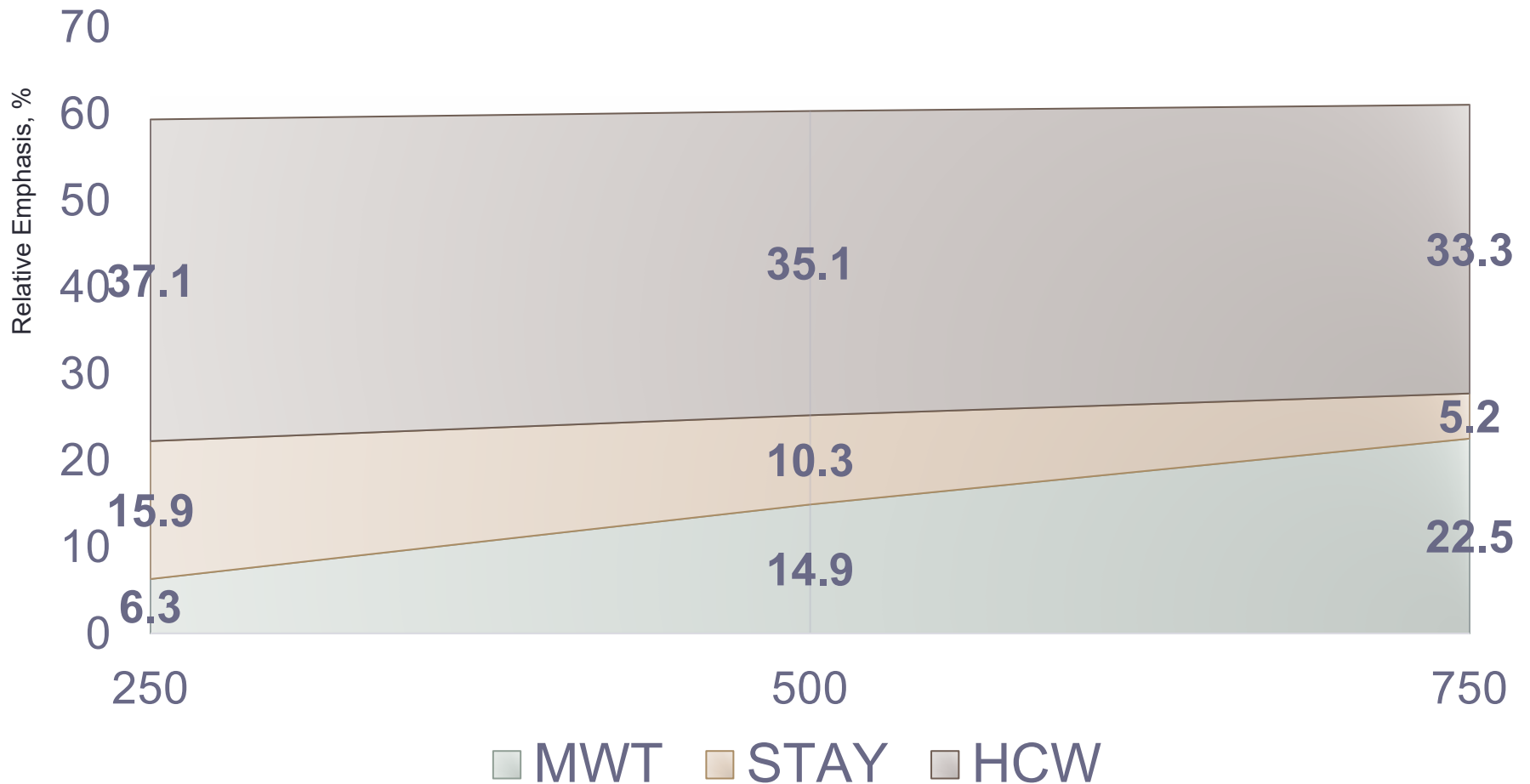
Comparing Ranks of Bulls

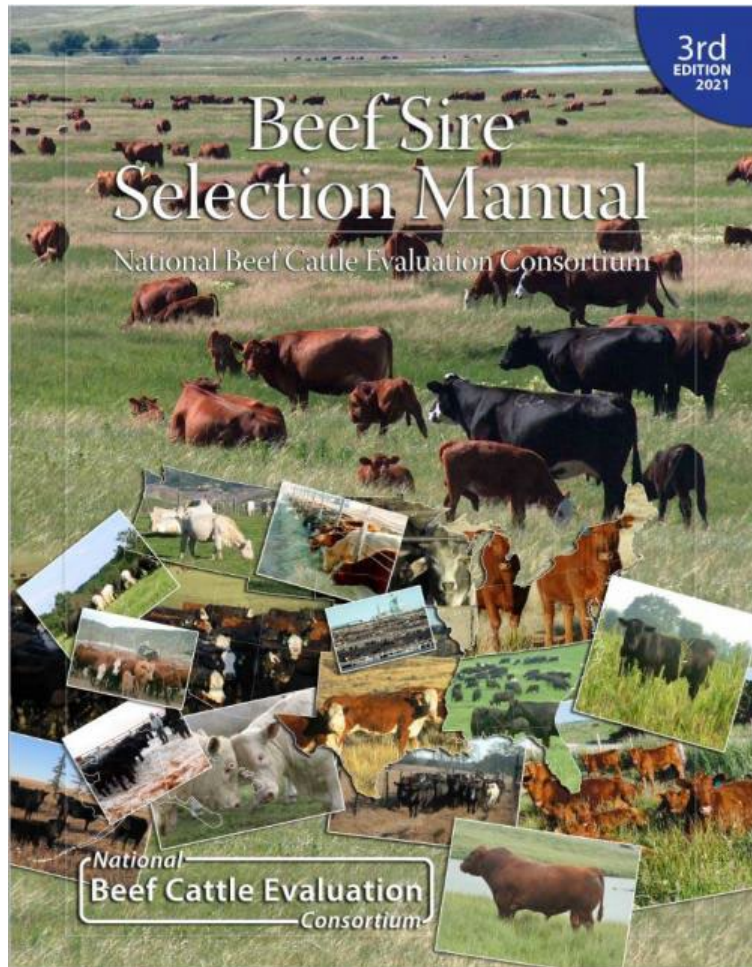


Changes in Relative Emphasis by Planning Horizon (PH) Length for Mature Cow Weight (MWT), Stayability (Stay) and Hot Carcass Weight (HCW)



Changes in Relative Emphasis by Annual Variable Cow Costs (US \$) for Mature Cow Weight (MWT), Stayability (Stay) and Hot Carcass Weight (HCW)





- <https://ebeef.ucdavis.edu/2021-nbcec-beef-cattle-sire-selection-manual>

Genomics for Commercial Ranches

- Increases the accuracy of EPD
 - Buy bulls that have been tested
- Can enable parent verification/determination
 - Choice of replacement females in some circumstances
 - Choices relative to culling bulls
- Can detect carriers of undesirable traits (e.g., horns, coat color, genetic defects)
 - Should be resolved at seedstock level
- Could improve management decisions IF:
 - Testing has a ROI—both accuracy and cost
 - Accuracy can be variable across breeds and in unrelated populations
 - Buyers are willing to pay for increased knowledge

Summary

- Know your costs
 - Select on PROFIT not just revenue
- Concentrate on Economically Relevant Traits (ERTs)
- Understand the differences between sources of information
- Know that EPDs and Economic Index values are more valuable than actual records or ratios
 - EPD 7-9 times more effective in generating response to selection than actual measurements

Thank You

- <http://beef.unl.edu>
- www.nbcec.org
- www.eBEEF.org
- www.beefimprovement.org

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