More from Less: Improving Beef Genetics

Introduction

Beef cattle can convert feeds such as grasses and leftover food waste (e.g. produce from the grocery store) that are unusable to humans into protein that humans are able to use. However, some beef cattle can do this much better than others. This process of comparing how well animals convert feed to their own weight gain is called feed efficiency. Feed efficiency is controlled, in part, by genetics that are passed from parent to offspring. Given different scenarios of feed and environmental conditions, you must decide what genetic traits will most likely yield increased feed efficiency for your herd of cattle.

Prompt 1:

Different traits have different heritability. Heritability is a measure of how variety in cattle's genes account for differences in their traits. The remaining portion often comes from environmental conditions. Review the table below that compares estimated heritability on certain important traits then respond to the questions below.

Trait	Estimated Heritability
Weight of baby calf at birth	0.45
Weight gain of calf, birth to weaning	0.25
Feed efficiency	0.45
Height of calf	0.82
Percent pounds of meat yielded per animal	0.45
Size of ribeye (a cut of meat) per hundred pounds of weight of the animal	0.70
Thickness of the fat on the meat	0.45
Tenderness of the meat	0.60

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Trait	Estimated Heritability
Retail product, percent	0.30
Retail product, pounds	0.60

Estimated Heritability	Category of Heritability
≤ 0.30	Low
0.31-0.49	Medium
≥ 0.50	High

Which trait(s) are considered of low heritability? What challenges might manage for a low-heritable trait pose to a producer of livestock trying to make improvements over time to this trait with his group of cattle?

Which trait(s) are considered highly heritable? How might a producer of livestock use this information to help make improvements from one generation to the next with his or her group of beef cattle? Use evidence to support your claim.

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What is the heritability of feed efficiency? What other factors besides parent's genetics could contribute to an offspring being better or worse at converting feed into weight gain? Use evidence to support your claim.

How does knowledge of the heritability of traits help a producer of livestock improve traits in his or her animals through selective breeding? Use evidence to support your claim.

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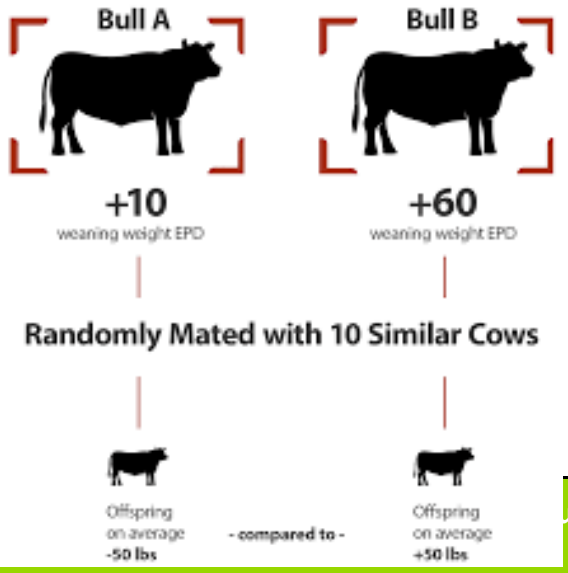
Prompt 2

Many producers of livestock use a set of statistics called Expected Progeny Difference (EPDs) to help make management. EPDs allow for the comparison of animals within a breed for their genetic potential as parents for a given trait. EPDs are tracked on economically important traits, such as weaning weight, because they impact how much money a producer of livestock may earn. Interpret Figure 1 below that compares Bull A to Bull B on the predicted weight of offspring at a moment in time called weaning (or weaning weight).



What difference was there b ld a producer of livestock select for this trait?

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What does the figure credit for the difference in weight between the two sets of offspring? What other factors may have contributed to the differences in weight between the two populations of cattle?

What evidence is there that certain characteristics are passed from the bull to the offspring for the desired outcome of additional weight gain?

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Prompt 3:

Evaluate the following table comparing two steers (castrated male beef animal). The two steers were fed the same feed for the same number of days in the same conditions. The primary difference between the steers was the genetic potential passed down from parents.

NOTE:
Dry Matter is a type of feed for cattle, typically called hay.

Feed Conversion Ratio is a measure of feed use efficiency and compares the pounds of feed given to the animal compared to the pounds of weight gained.

Ration is the amount of feed given to the animal in one day.

Characteristic	Steer A	Steer B
Starting Weight (lbs)	900	900
Growth Rate (lbs/day)	3.5	3.5
Dry Matter Intake lbs/day	21	28
Feed Conversion Ratio	6:1	8:1
Ration Cost ($/lb DM)	0.085	0.085
Days on Feed	200	200
Cost per Day ($)	$1.79	$2.38
Total Feed Cost ($)	$357	$476

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What similarities and differences do you find between these two steers on the characteristics outlined above?

Which steer is more profitable to the producer?

Think back to the first prompt. How heritable is feed efficiency? What effects were there in feeding steers with two different genetic profiles for feed efficiency?

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Based on this information and the information in Prompt 1, what recommendations would you give to the producer hoping to make improvements to the genetics affecting feed efficiency of his or her steers?

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Prompt 4:

Feed efficiency is an important trait to producers of cattle. Feed is expensive so cattle that convert feed into weight gain less efficiently are not as profitable to the producer. Also, raising these less efficient cattle is less sustainable to the planet. Cattle producers must weigh several considerations when making decisions that impact their future offspring.

Assume you are a cattle producer in central New York trying to decide between two bulls that will potentially be used to create cattle offspring in the next year. Read the table below that uses EPDs to compare the two bulls on important characteristics. Assume this producer is focused on balancing feed efficiency and weight gain in his calves.

Animal	**Yearling Weight** Expected Weight of Offspring at Birth (HINT: Lower number is generally better as it indicates an easier birth)	**Weaning Weight** Expected Weight of Offspring When Weaned (HINT: Higher number is generally better as it indicates heavier calves at the time of weaning)	**Yearling Weight** Expected Weight of Offspring at One Year of Age (HINT: Higher number is generally better as it indicates heavier calves when they reach one year of age)	**Feed : Gain Ratio** Expected Ratio of feed consumed to one pound of weight gained in offspring (HINT: Lower number is generally better as it indicates a more efficient use of feed to adding weight to the animal)
Bull A	1.2	37	73	-0.18
Bull B	8.2	54	91	.75
Breed Average	2.0	46	83	.04

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Decide which bull you would advise the cattle producer to use. Compare the two bulls on the criteria and make an argument using several pieces of evidence from the EPD table above to justify your decision. What effect(s) will this decision likely have on future offspring (calves) for this producer? Use evidence to reinforce your claims.

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