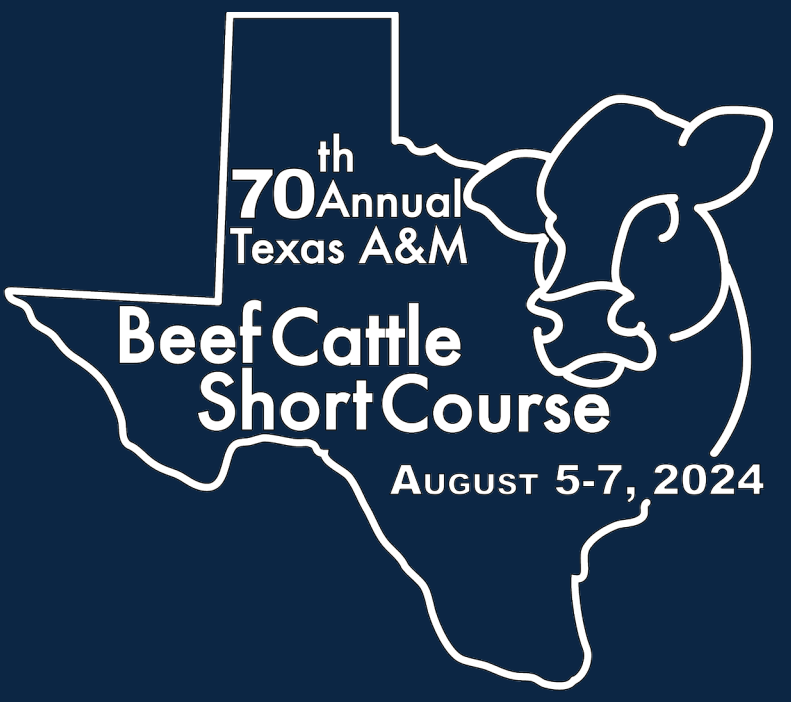
General Session: Rebuilding the Cow Herd

GRAHAM
Land and Cattle Co.

AMERICAN BREEDS COALITION

Moderator: Dr. Jason Cleere



Texas A&M AgriLife Extension

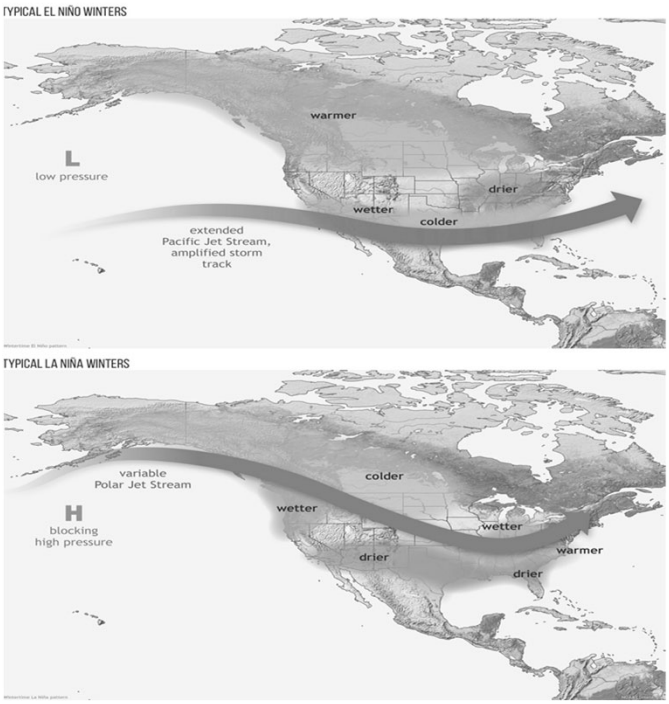
General Session:
Rebuilding the Cow Herd

CAPITAL FARM CREDIT

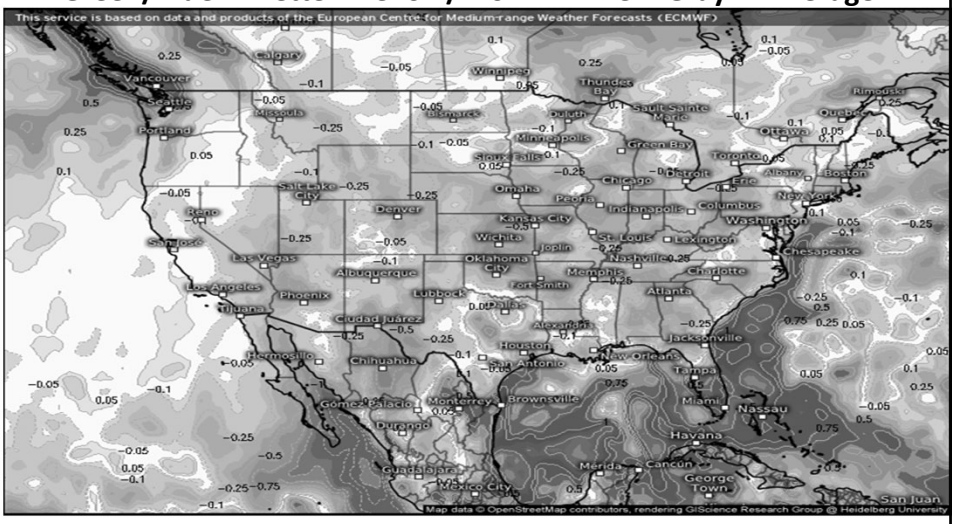
BrianBledsoeWx, LLC

Making The Weather Work for You

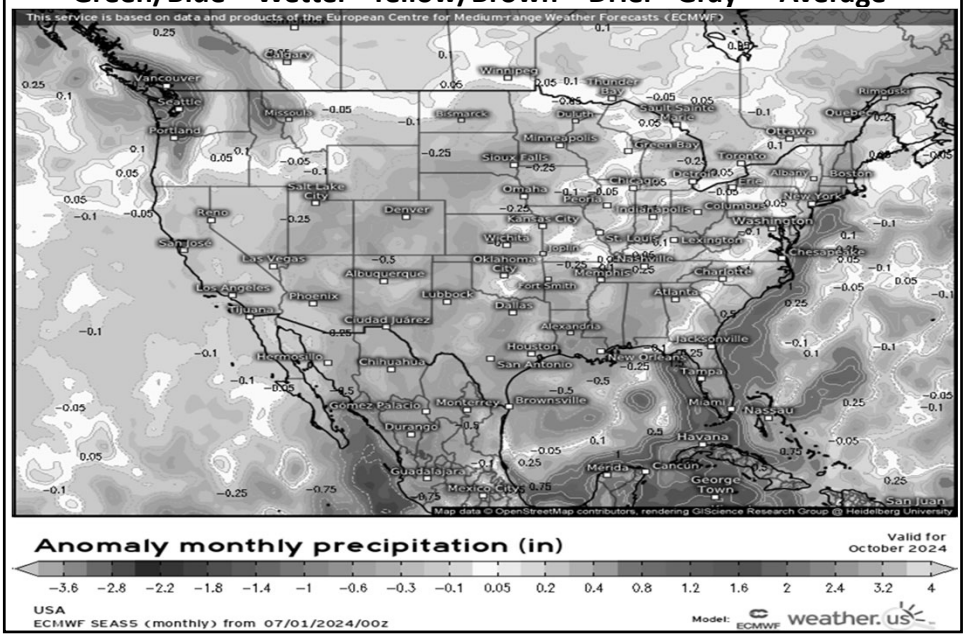
Brian Bledsoe
Chief Meteorologist / Climatologist
719-661-1364
brianbledsoewx@gmail.com



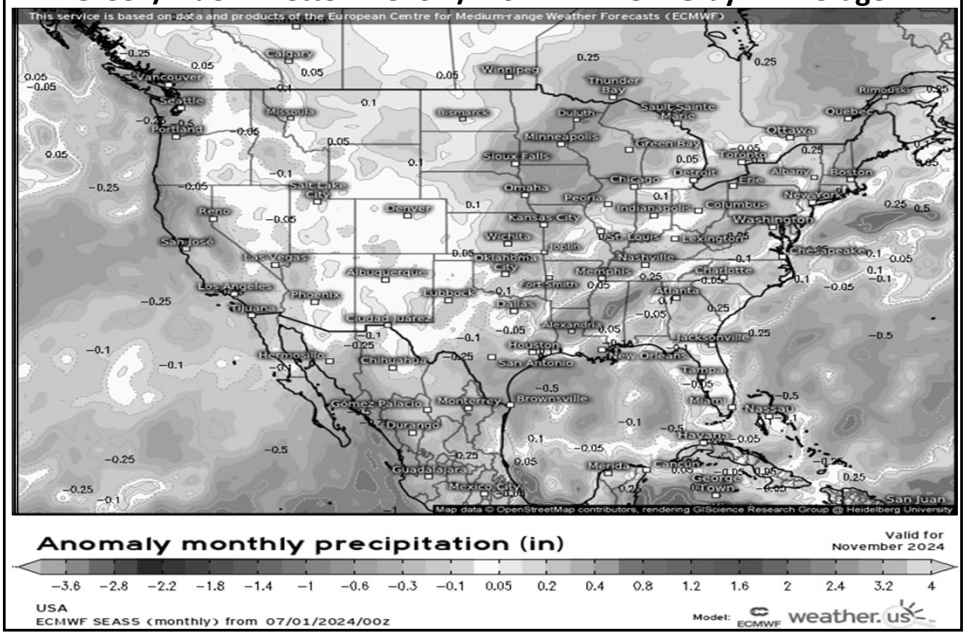
EURO Seasonal Model Precipitation Forecast
Green/Blue = Wetter Yellow/Brown = Drier Gray = "Average"



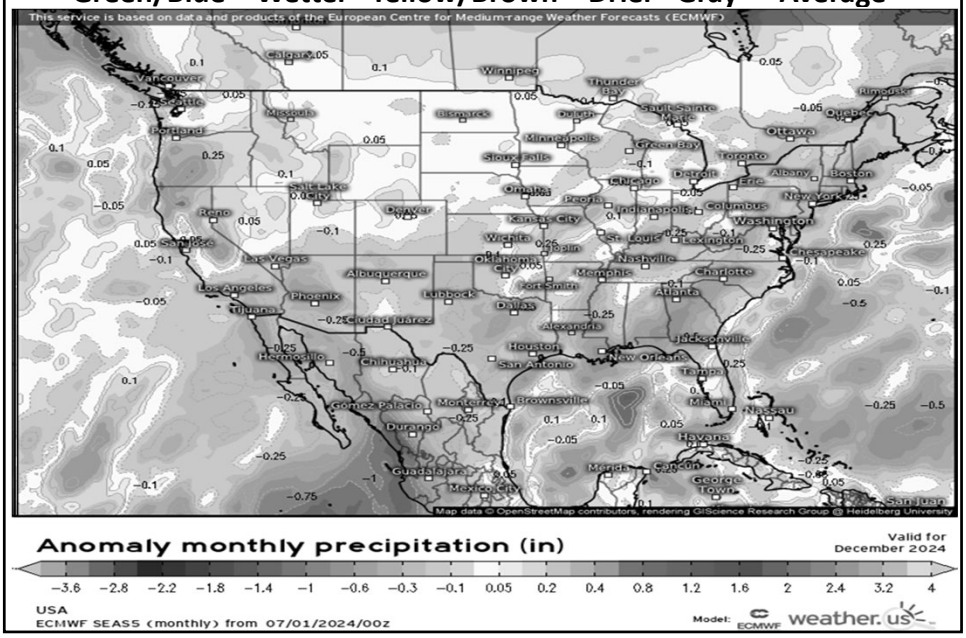
EURO Seasonal Model Precipitation Forecast
Green/Blue = Wetter Yellow/Brown = Drier Gray = "Average"



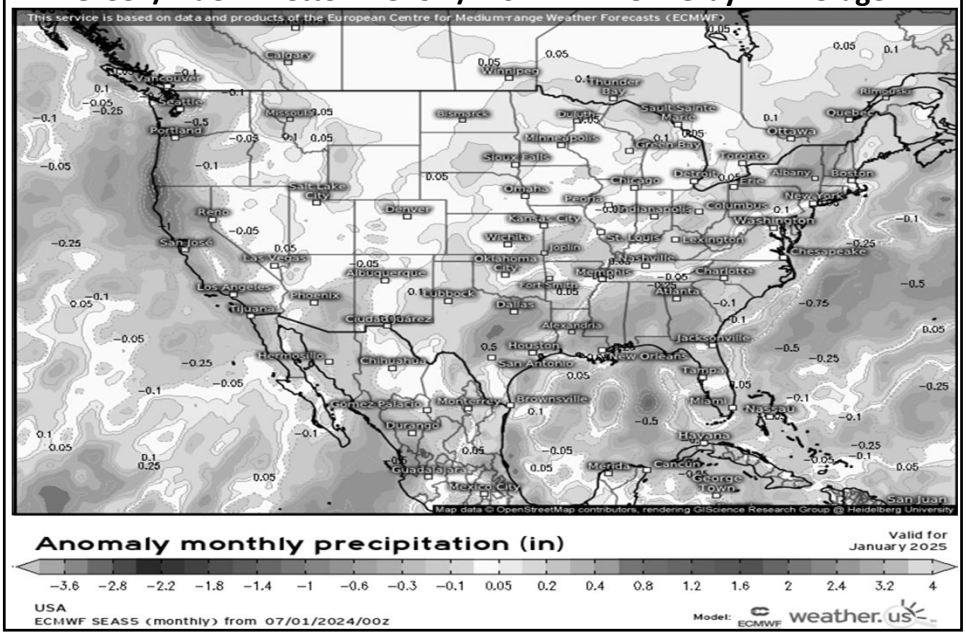
EURO Seasonal Model Precipitation Forecast
Green/Blue = Wetter Yellow/Brown = Drier Gray = "Average"



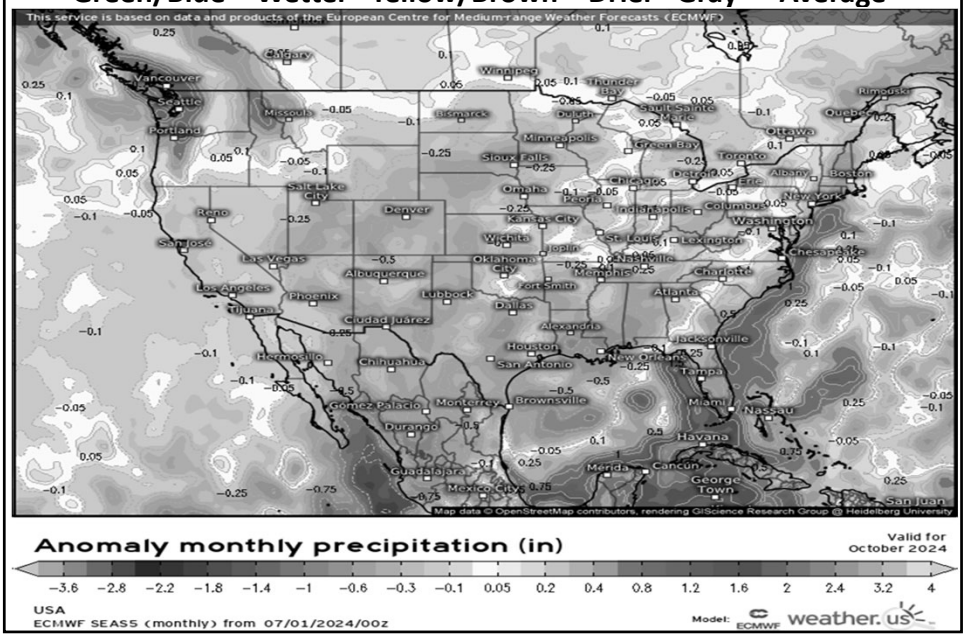
EURO Seasonal Model Precipitation Forecast
Green/Blue = Wetter Yellow/Brown = Drier Gray = "Average"



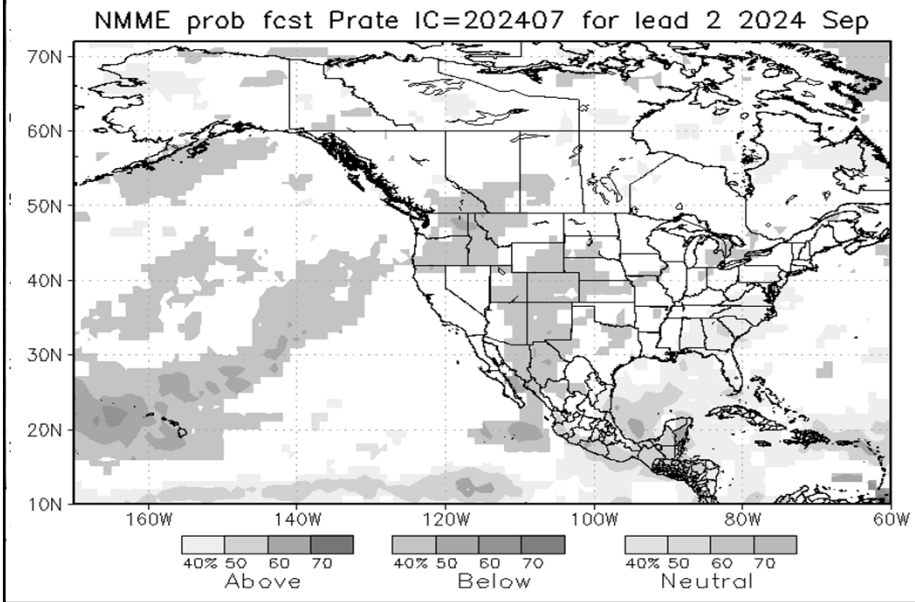
EURO Seasonal Model Precipitation Forecast
Green/Blue = Wetter Yellow/Brown = Drier Gray = "Average"



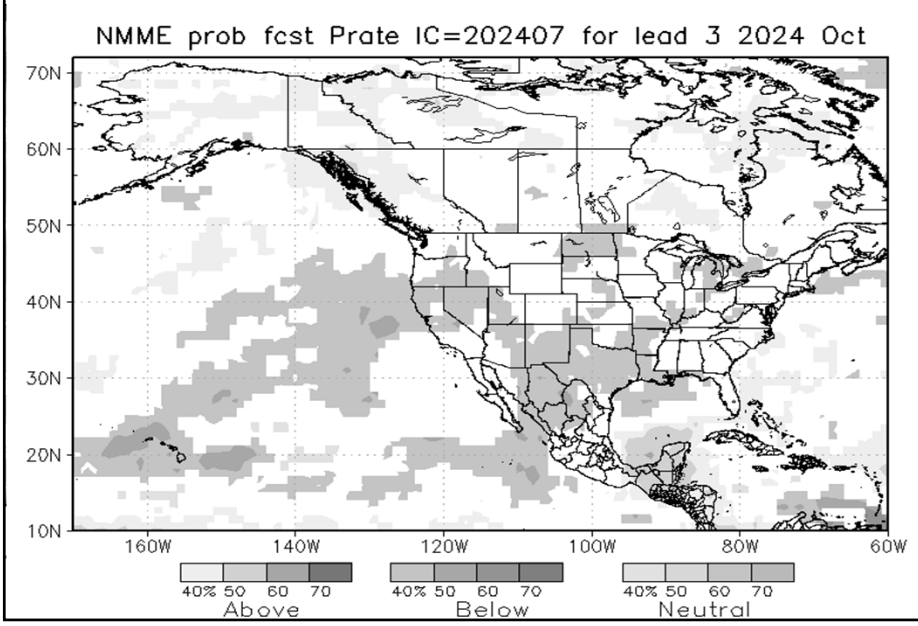
EURO Seasonal Model Precipitation Forecast
Green/Blue = Wetter Yellow/Brown = Drier Gray = "Average"



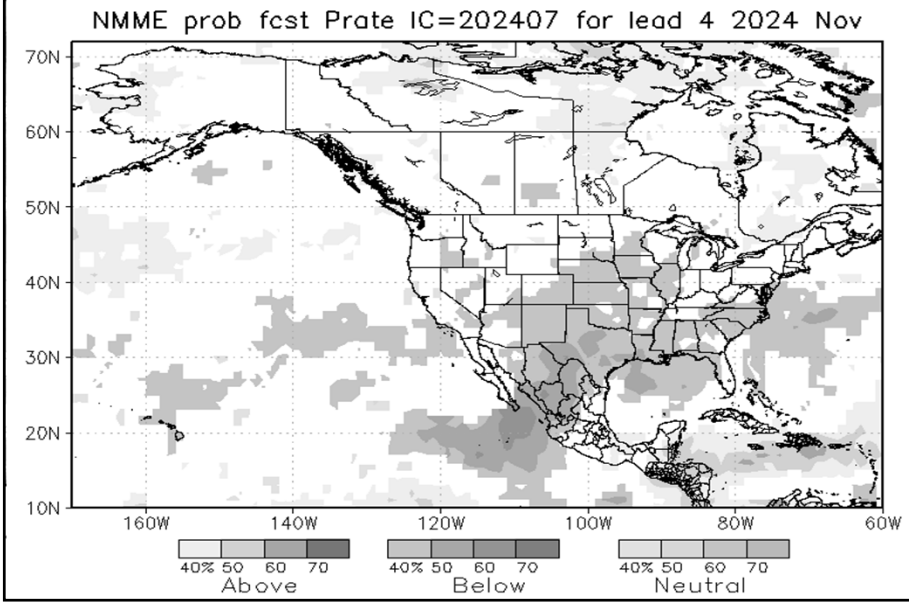
NMME Model Precipitation Forecast
Green/Blue = Wetter Yellow/Red = Drier White = "Average"



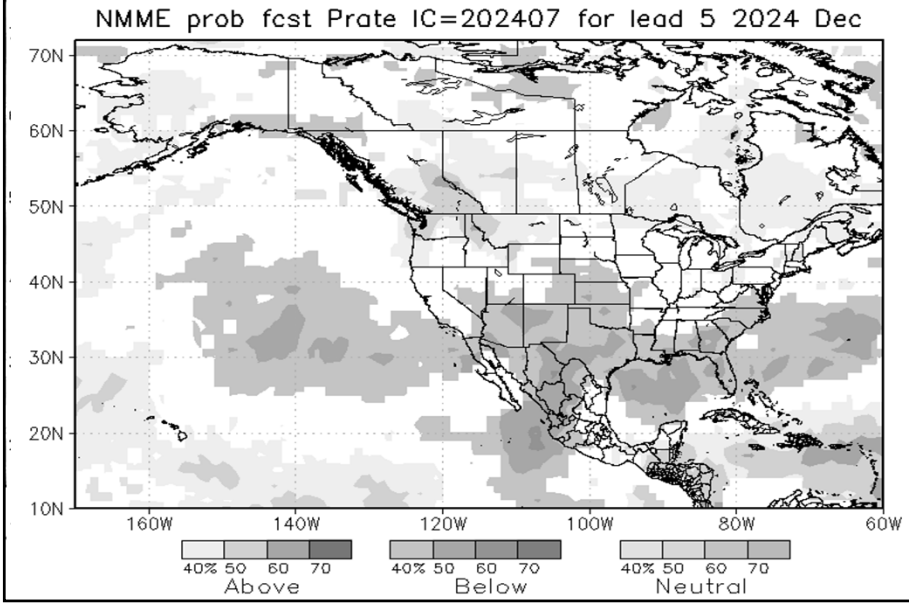
NMME Model Precipitation Forecast
Green/Blue = Wetter Yellow/Red = Drier White = "Average"



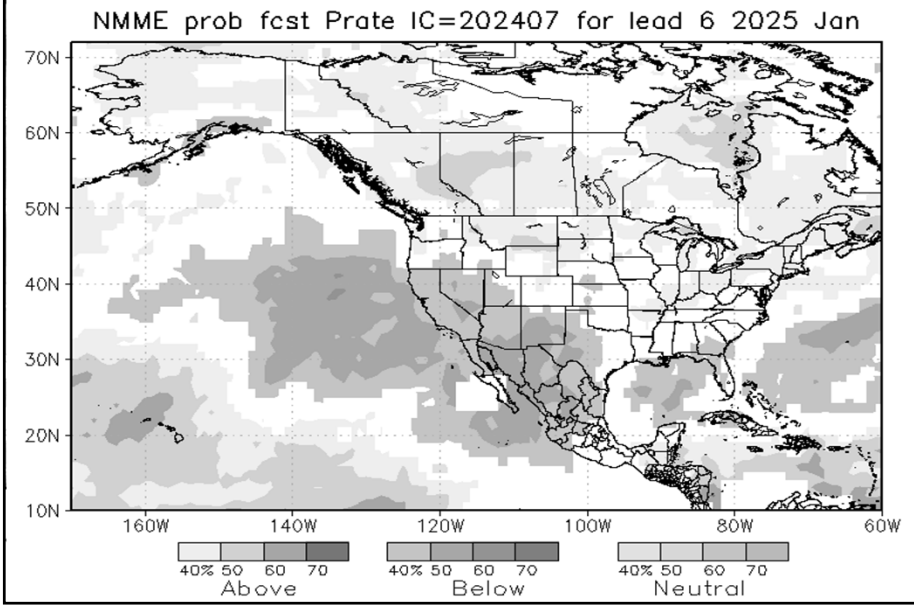
NMME Model Precipitation Forecast
Green/Blue = Wetter Yellow/Red = Drier White = "Average"



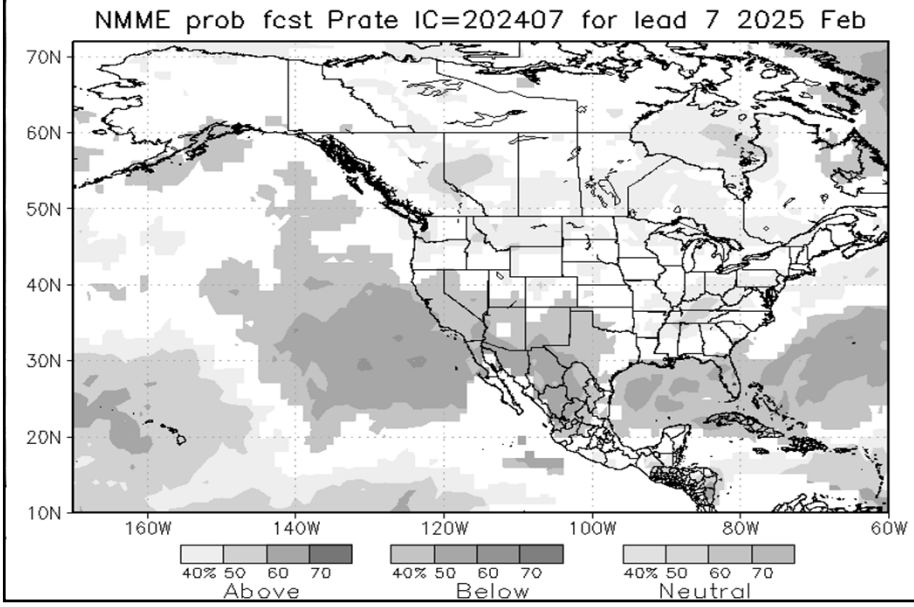
NMME Model Precipitation Forecast
Green/Blue = Wetter Yellow/Red = Drier White = "Average"

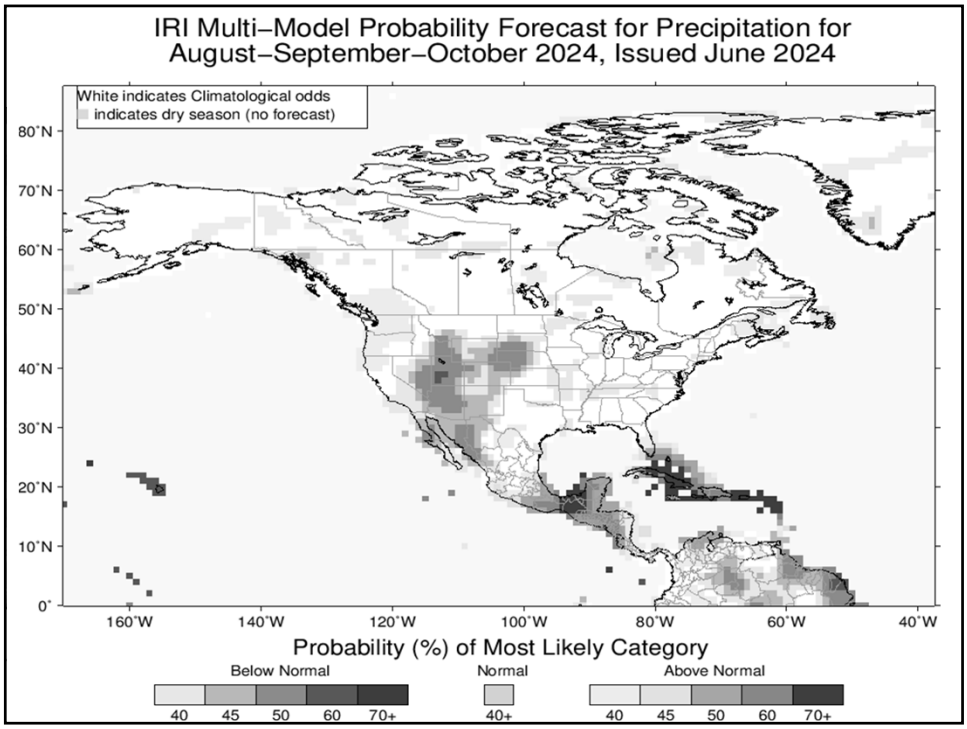


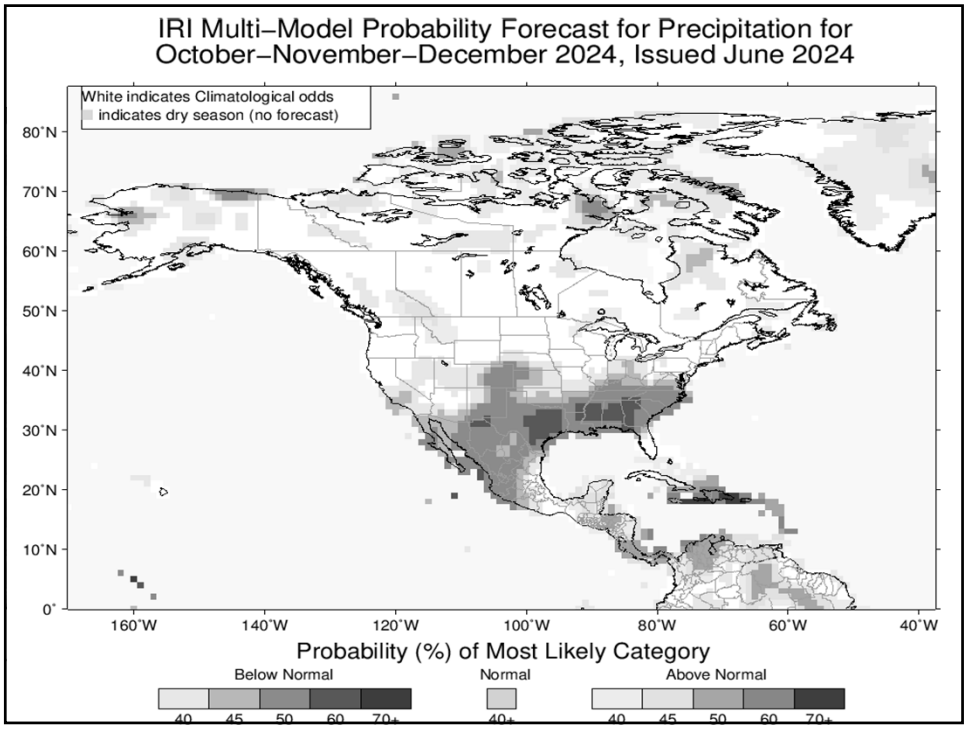
NMME Model Precipitation Forecast
Green/Blue = Wetter Yellow/Red = Drier White = "Average"



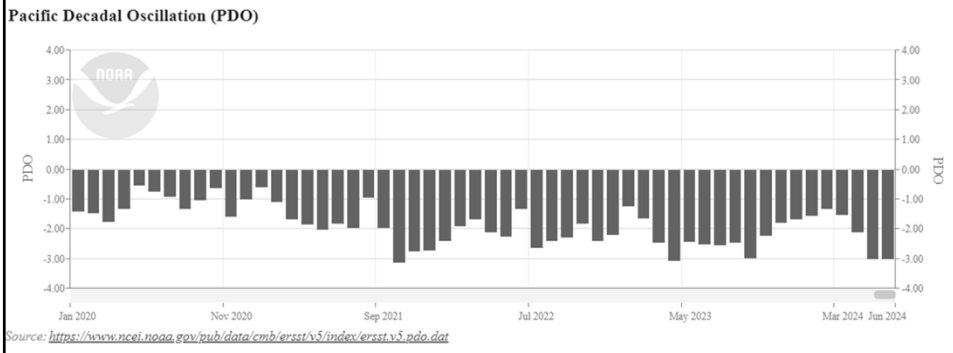
NMME Model Precipitation Forecast
Green/Blue = Wetter Yellow/Red = Drier White = "Average"




IRI Multi–Model Probability Forecast for Precipitation for
August–September–October 2024, Issued June 2024
White indicates Climatological odds
indicates dry season (no forecast)
80°N
70°N
60°N
50°N
40°N
30°N
20°N
10°N
0°
160°W
140°W
120°W
100°W
80°W
60°W
40°W
Probability (%) of Most Likely Category
Below Normal
Normal
Above Normal
40
45
50
60
70+
40+

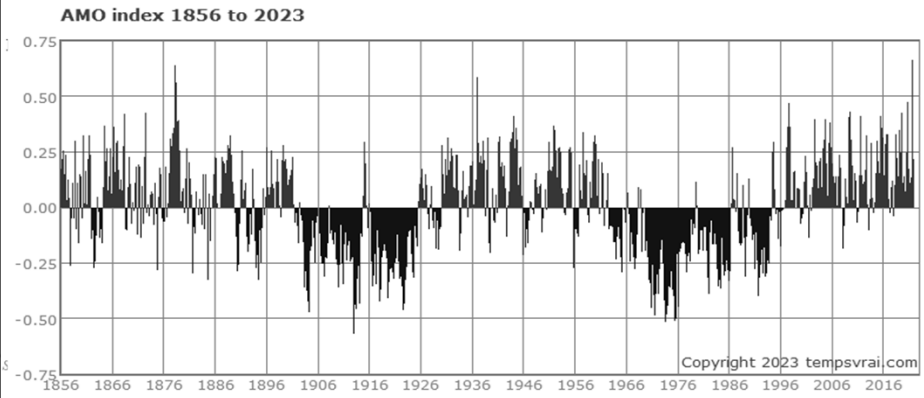

IRI Multi–Model Probability Forecast for Precipitation for
October–November–December 2024, Issued June 2024
White indicates Climatological odds
indicates dry season (no forecast)
80°N
70°N
60°N
50°N
40°N
30°N
20°N
10°N
0°
160°W
140°W
120°W
100°W
80°W
60°W
40°W
Probability (%) of Most Likely Category
Below Normal
Normal
Above Normal
40
45
50
60
70+
40+

Pacific Decadal Oscillation (PDO) Since 2020…

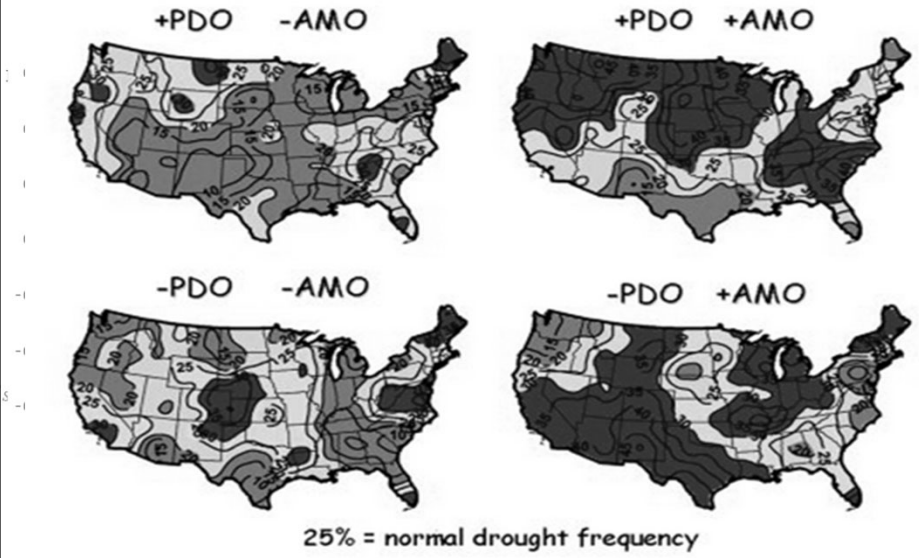


Source: https://www.ncei.noaa.gov/pub/data/cmb/ersst/v5/index/ersst.v5.pdo.dat

Atlantic Multidecadal Oscillation (AMO) Since 1856…

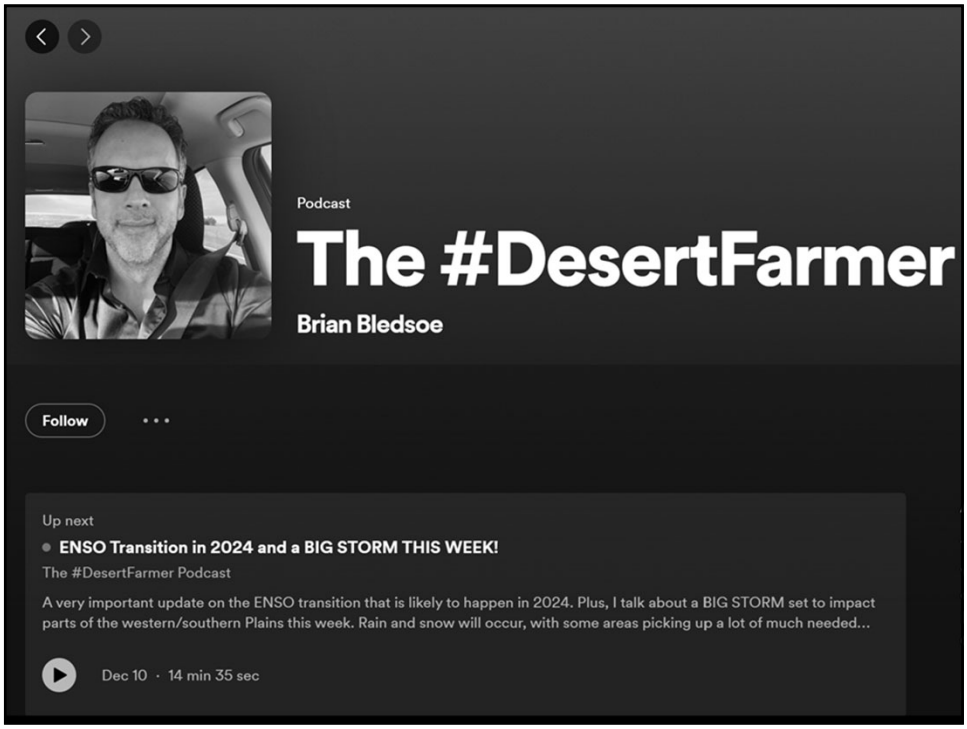


Oceanic Oscillations & Their Impact on Drought Frequency…



My Thoughts…

- La Niña development COULD resume again, as we move into fall. Negative/cold PDO should help to facilitate at least a weak event. But, the lack of universal model support means it bears watching…La Nada???
- La Niña events of any strength coupled with a strongly negative/cold PDO usually spells drought development. This is especially true for west/southwest Texas. Drought eventually expands eastward too…
- IF La Niña develops, it will likely linger into the early part of 2025, before dissipating. This would likely make for a dry start to 2025, possibly lingering into March. Again, it's not a done deal, so it bears watching…
- After we get through the hurricane season, I would plan on drier than average and warmer than average conditions. This is likely the best course of action for fall and winter…possibly spring?


Podcast
The #DesertFarmer
Brian Bledsoe
Follow
Up next
ENSO Transition in 2024 and a BIG STORM THIS WEEK!
The #DesertFarmer Podcast
A very important update on the ENSO transition that is likely to happen in 2024. Plus, I talk about a BIG STORM set to impact parts of the western/southern Plains this week. Rain and snow will occur, with some areas picking up a lot of much needed...
Dec 10 · 14 min 35 sec


BrianBledsoeWx, LLC
Making The Weather Work for You
Brian Bledsoe
Chief Meteorologist / Climatologist
719-661-1364
brianbledsoewx@gmail.com

Evaluating Replacement Female Alternatives[1]

Ranchers should consider each alternative that fits their operation each year.

Selection of replacement females can be one of the most frustrating and risky management decisions ranchers make. Small errors in estimations of production potential, future prices, and annual costs can cause long-lasting financial hardship. To effectively evaluate alternatives, all available strategies need to be considered. An objective approach to evaluation of alternatives and their potential contribution to production efficiency and financial sustainability is essential.

Under normal conditions the most common female replacement decision is whether to retain raised heifers or purchase replacement females from outside the herd. The decision to retain heifers is normally based on: known price and availability of quality females, perceived or real advantages in genetic and production potential, and the total costs of developing retained heifers. Additional consideration should be given to herd biosecurity and predictability of production potential when making the decision to buy versus retain ownership of heifers

Other situations where the purchase of females commonly occurs are during initial stocking of an operation or restocking following drought or financially-forced herd reductions. In these situations, the availability of quality replacement heifers from the existing herd is insufficient to meet immediate stocking demand. Often the situation exists where a ranch realizes that its current genetic base, although predictable, is not capable of producing enough genetically superior females. Therefore, it may be quicker and less expensive to purchase the desired genetics than to change the genetic base of the herd through alterations in the breeding program.

Once the decision to purchase replacements has been made there are roughly 15 alternatives to consider. Each is listed below with a brief description.

1. Heifers less than 700 pounds - open heifers requiring development and breeding for their first calf.
2. Heifers more than 700 pounds - open heifers requiring breeding for their first calf.
3. Bred heifers - heifers palpated pregnant.
4. First—calf pairs - heifers with first nursing calf at side, but not exposed for rebreeding.
5. Three-in-ones, 2 years old - heifers with first calf at side and bred safely for second calf.
6. Bred cows, 3 years old to 6 years old - cows that are palpated pregnant.
7. Pairs, 3 years old to 6 years old - cows with nursing calf at side, but not exposed for rebreeding.

[1]Written by Ron Gill, PhD, Stan Bevers, MS and William Pinchak, PhD. Texas A&M System

8. Three-in-one's, 3 years old to 6 years old – cows with nursing calf at side and bred safely for next calf.
9. Bred cows, 7 years old or older- aged cows palpated pregnant.
10. Pairs. 7 years old or older- cows with nursing calf at side but not exposed for rebreeding.
11. Three-in-ones, 7 years old or older- cows with nursing calf at side and bred safely for next calf.
12. Opens, 2 years old - young females, which may or may not have had a calf.
13. Opens, 3 years old to 6 years old cows in good condition, but not bred.
14. Opens, 7 years old or older cows in good condition, but not bred.
15. Stocker cows - thin cows of unknown pregnancy or age.

Each operation may identify additional alternatives or eliminate any of these to fit its circumstances. In addition to selecting the alternatives, there are at least 11 genetic, economic and management factors to consider within each alternative. Following is a description of the 11 factors outlined in Table 1 below.

Availability of quantity and quality

Within a similar production environment, determine whether sufficient numbers of targeted quality females are available within each alternative to warrant consideration. If not, determine what it would cost to go to additional sources for adequate supplies. Environmental adaptability should be considered when broadening the search for replacements. Lower expectations for production potential if replacements are not adapted to the environment where they will be managed.

Many times there are mismatches of quantity and quality. There may be an adequate supply of heifers (alternatives 1 to 3), but their quality is not desirable, or very good pairs (4, 7 and 10) may be available, but only in limited numbers. After supplies are identified, cost-calculations can begin.

Initial investment expense

Initial investment expense is the total cost for each available alternative delivered to your operation. Consider all costs including travel, commission, trucking, inspection fees, processing fees, permits, health certificates, and finally the actual purchase price.

When considering the 15 alternatives, the classes with the greatest initial investment would normally be pairs (4, 7 and 10) and three-in-one packages (5, 8 and 11), particularly in the younger age classes. Bred females (3, 6 and 9) can normally be purchased in the moderate price range. The exception might be bred heifers (3) of perceived excellent quality, which would be high.
Lowest initial cost would normally be associated with young open heifers (1 and 2) or older open cows (14). Open 3-year·olds to 6-year·olds (13) would be considered in the low to moderate range and are seldom a viable economic alternative unless the origin and culling circumstances are known.

Table 1. Summary of 16 Female Replacement Alternatives and 11 Genetic, Economic and Management Factors for Each[1]

	Q/Q Avail	Initial Invest.	Devel. Phase	Rebrd. Potent.	Market Flex.	Genetic Potent.	Potent. Long.	Dyst/ Death	Wean Wts.	Nutrtn. Reqts.	Cull Rate
Retain Heifers	H	M/H	Long	M	H	H	H	M	M	H	M
1) Heifers < than 700 pounds	H	L	Long	L	H	L	H	H	L	H	H
2) Heifers > than 700 pounds	H	L	M	L	H	M	H	H	L	H	H
3) Bred heifers	M	M/H	None	L	L	M	H	H	L	H	H
4) First calf pairs	M	H	None	L	L	M	H	H	L/M	H	H
5) Three-in-ones, 2 years old	L	H	None	L/H	L	M	H	M	M	H	M
6) Bred cows, 3 to 6 years old	L	M/H	None	M/H	L	M	M/H	L	H	L	L/M
7) Pairs, 3 to 6 years old	L	H	None	M/H	L	M	M	L	H	L	L/M
8) Three-in ones, 3 to 6 years old	L	H	None	H	L	M	M	L	H	L	L/M
9) Bred cows, 7 years or older	M	M	None	M	L	M	L	L	M/H	L	M/H
10) Pairs, 7 years or older	M	M/H	None	M	L	M	L	L	M/H	L	M/H
11) Three-in-one, 7 years or older	M	H	None	M	L	M	L	L	M/H	L	M/H
12) Open, 2 year olds	L/M	L/M	M	M	L	M	H	M	M	M	M
13) Open, 3 to 6 year olds	L	L/M	M	H	M	M	L	L	H	L	M
14) Open, 7 years or older	M	L	M	M	M	M	L	L	M/H	L	M/H
15) Stocker cows	H	L	M	L	M	M	L	M	L	M	H

[1] Unless otherwise stated H=High, M=Moderate and L=Low

Development phase

Considering the development phase is critical. The development phase, as far as this evaluation is considered, is from the time an open, non-lactating animal (1, 2, 12, 13 and 14) is purchased until it is palpated bred for the first time. Any development phase adds to the cost of an animal and increases the reproduction risk (the risk of her not breeding, calving and weaning a calf).

If the development costs are considered, purchasing a higher valued package with no development phase may be more economical. Bred, pairs, and three-in-one alternatives (3 through 11) have greater initial investment cost, but no development phase cost. Replacements with a moderate development phase would be open females ready to be exposed for breeding. Females with a long phase would be those in any open class that require time to grow or time to regain body condition in order to be bred.

Rebreeding potential

The single greatest risk factor after purchases are females that fail to rebreed. Any purchased female under 3 years of age (1 through 5) should be assumed to have a lower rebreeding potential. Any time conception rates are expected to be less than 90 percent, the potential rating should be considered low. Thin cows would also be considered a high risk for low rebreeding.

Cows that have already gone through their second successful breeding can be considered at least a moderate potential for rebreeding. Those that might be considered moderate to high would be the 3-year old to 6-year·old group (6 through 8 and 13).

Flexibility in marketing of extras or culls

Flexibility in marketing is rarely considered in most evaluations; however, it makes a significant difference in the actual cost of those cattle left in inventory. If the extras or culls can be sold for a profit, it decreases the true cost of those remaining in the herd. If the extras or culls are sold for a loss, the expense needs to be allocated to those remaining in order to arrive at their true purchase cost.

This consideration has significant differences within and among classes. Young open heifers (l and 2) have greater resale potential and marketing flexibility than any other class. Those that don't breed can be marketed as feeders or retained through the feedlot. Extra bred heifers can usually be marketed as replacements with increased profit potential.

Nearly all other classes have limited marketing flexibility. Bred cattle that lose a pregnancy or a calf prior to weaning can rarely be disposed of profitably. The loss potential is high. For example, a set of 100 heifers (3) is purchased short-bred (two months to three months). Expected pregnancy loss is around 2 %. Calf-death loss at calving averages between 2 percent and 3 percent in heifers. Death loss on heifers is normally 1 to 2 percent. Calf loss from birth to weaning is usually 2 percent. Rebreeding rates on first calf heifers being exposed for their second pregnancy may be as low as 50 percent or as high as 90 percent. For comparison's sake, use an average conception of 75 percent on purchased bred heifers of unknown genetic background.

In this example, only 94 will wean a calf (2 percent pregnancy loss, 2 percent calf-death loss and 2 percent calf loss, birth to weaning). Two heifers die at calving and only 74 rebreed (98 head x 75 percent).

Assume the heifers were purchased bred for $1,000 dollars. Monetary losses include:

Death loss (2 @ $1,000)	$ 2,000
Lost income due to calf loss (6 @ $550)	$3,300
Loss on sale of opens (24 x ($1000 - $650)	$8,400
Total Loss	$13,700
Average loss per remaining heifer (13,700 / 74)	$185

The true cost of 74 heifers is $ 1,185. This does not include vet bills, medicine, feed, labor, interest or opportunity cost. If pairs could have been purchased for less than the total cost, they should have been seriously considered. Do not get locked into traditional approaches and/or sources. Consider all options.

Predictability of genetic potential

A primary reason to retain heifers is the predictability of their production potential. When purchasing cattle of unknown origin, predicting their genetic potential is difficult. When purchasing cattle already in production, whether it be as bred or pairs (3, 4, 6, 7, 9 and 10), it can be assumed that they are at least capable of conceiving and/or delivering a calf.

On the other end of the spectrum is the purchase of lightweight heifers (1). Their ability to gain weight, cycle, conceive and deliver is unknown, not to mention their ability to rebreed, maintain body condition and milk sufficiently to wean an acceptable calf. Three-in-one packages (5, 8 and 11) are the only class that gives any indication of their total production capabilities.

Purchasing cattle from a known source over an extended period of time can also help in achieving some level of predictability. These relationships should be sought when the decision to purchase replacement heifers is made.

Potential longevity

The potential for longevity in the herd is an important consideration in purchasing decisions. Current economic analyses indicate females with a $1,000 purchase cost will have a five to seven year payout. Potential longevity is difficult to predict in cattle from an unknown origin. The longer a female stays in the herd, the greater the opportunity for her to be profitable.

The greatest potential for longevity is in younger females; however, younger cattle (1 through 5) also have the greatest chance of not rebreeding and/or not weaning a calf, increasing their probability of being culled. The classes with the least potential longevity are the 7-year-old and older females (9 through 11 and 14). These females must be bought realizing they will not remain in the herd for any extended period of time. As such, their purchase value must be nearer to their cull value than in the case of purchasing younger cattle. Moderate longevity is expected in 3-year-old to 6-year-old cows (6 through 8). Similar to genetic potential, ranchers must know why these cattle are being sold.

Dystocia/death loss

Heifers purchased of unknown genetic background or calf sire should be considered to have a greater risk of dystocia and death loss. Older cows (6 through 15) can normally deliver without trouble. The exception might be small cows bred to high-birth-weight bulls. Stocker cows should be considered at moderate risk of experiencing dystocia or death when calved out after grazing lush pastures in the last trimester of pregnancy.

Weaning weight of first calf

Weaning weights should be considered light for most heifers (l through 5) and 3-year-olds when compared to cows. Any females bred to unknown sires or having unknown milking ability should not be considered higher than moderate. Take into account death losses as discussed earlier when projecting average weaning weights and actual head weaned. In addition, lower weaning weights would be expected from thin-condition cows. Calf weaning weights can be up to 60 pounds less for each Body Condition Score below 5, which is average flesh.

Nutritional requirements

Rarely is this adequately considered when budgeting for replacement female purchases. Requirements for quality pastures and supplements will be highest in younger classes (1 through 5), especially first-calf heifers on through their third pregnancy. The additional requirements through the third pregnancy must be budgeted. Moderate levels of nutrients will be needed for open 2-year-olds (2) and stocker cows (15). Most other classes can be considered low except when purchased in a thin condition. Requirements in this situation may range from high to moderate depending upon the amount of time to their next breeding season.

Cull rate

Cull rates will be highest for cattle under three years of age (l through 5 and 12) and stocker cows (15). Normally, the lowest cull rates would be for mid-aged cows (6 through 8 and 13) and moderate rates for cows more than 7 years of age (9 through 11 and 14). Cull rates are one of the most difficult numbers to estimate for use in budgeting options.

Most projections grossly underestimate cull rates of purchased females. In most cases, only 50 to 60 percent of the cattle purchased will remain in the herd after three production years. Initial cull rates of 25 to 30 percent should be expected in the first year. This will include cows culled for failing to rebreed, poor udders, structural unsoundness, health-related problems, disposition and any possible death loss.

Cull rates of 15 percent to 20 percent should be expected in the second year. In some cases, cows that should have been sold for poor performance will be held for this second year, which ultimately lowers weaning weights again. Structure, udder and rebreeding will remove the bulk of these in the second year. By the third year, normal cull rates of 10 to 15 percent for rebreeding are expected. Now, in the case of older purchased females, age becomes a factor.

Summary

There is no easy answer to the question of what should be bought. Carefully consider all of the factors mentioned above and then build a three-year budget projection for each alternative. This gives the females the opportunity to achieve what will be termed a static production level. Static production is defined as the point in a female's life where her production risk and potential is comparable to the remaining mature females in the herd.

Budgets need to be developed until all cattle are palpated pregnant for at least the third time following purchase. This will allow for inclusion of all the culling factors discussed as well as for reduced weaning weights on the first two weaned calves.

In addition to carrying this through the third pregnancy, the budget analysis for any development phase must be done as accurately as possible. A true reflection of accumulated cost is a must if this type of alternative evaluation is to be successful.

Careful consideration of alternatives and evaluations of all factors in the decision process are critical to arriving at a sound budget projection for replacement females. Due to its complexity, this is not an easily managed problem. Table 1 summarizes each alternative and considerations. Consult with others who have gone through similar scenarios. Capitalize on their experience and rely on sound professional advice.

Do not get locked into one option: consider each alternative that fits your operation every year. Market changes may affect the most feasible scenario from one year to the next year. Once the budget process is in place, quick analyses of options are possible.

Do not hesitate to purchase a seemingly expensive alternative up front if it pencils out to have the greatest potential for long-term economic benefit. Likewise, do not purchase expensive alternatives when they clearly will not produce the desired economic returns and sustainability of the ranching enterprise.

EAN-029 03/21

REPLACEMENT HEIFER SELECTION, DEVELOPMENT, AND REPRODUCTION

Bruce B. Carpenter* and Ronald Gill**

SUMMARY

- Age at puberty influences economic efficiency of beef production through its effects on both age at first calving (2 versus 3+ years of age) and the time that a heifer conceives in her initial breeding season.[1]
  - Heifers of most breeds should have their first calf by 2 years of age.
  - On average, heifers that breed and calve early with their first calf will have higher productivity throughout their lives.
  - Puberty is determined by two things: age, depending on the breed type, and body weight as a percentage of mature weight.
- The risk of re-breeding failure is often highest in 2-year-old, first-lactation cows attempting to breed back for their second pregnancy, especially if their higher nutritional requirements are not met.
  - Nutrient requirements at this age are affected by the interactions of growth, lactation, changing dentition, and a relatively smaller rumen capacity compared to a mature cow.

Age at First Calving (2 versus 3 years) Affects Lifetime Productivity

Heifers that do not calve until they are 3 years old may experience less calving difficulty and wean a heavier calf compared to heifers that first calve at 2 years old.[2] However, total lifetime performance and economic efficiency favor heifers that calve first as 2-year-olds.[2, 3, 4] Also, calving difficulty in heifers of any age can be managed by breeding to lower birth weight bulls. Realize later-maturing Bos indicus—or high-percentage Bos indicus breeds—typically do not reach puberty in time to calve first as 2-year-olds.

*Professor and Extension Livestock Specialist
**Professor, Extension Livestock Specialist – Department of Animal Science

Earliness of Calving Affects Lifetime Productivity

Heifers that become pregnant early in their first breeding season and successfully calve their first calf have been shown to have higher pregnancy rates (Table 1) and weaning weights of calves in later years.[5, 6] Also, early calving heifers have been shown to have increased chances of longevity as cows (Fig. 1) and a higher average lifetime return on investment (Table 2).[6, 7]

Table 1. Calving Period for First-calf Heifers: The Effects on Pregnancy Rates in Later Years[6]

The United States Meat Animal Research Center, 16,549 heifers

Pregnancy	Calving Period 1 n=11,061	Calving Period 2 n=4,372	Calving Period 3 n=1,116
2nd	93	88	84
3rd	93	90	80
4th	94	92	91
5th	94	92	89
6th	94	93	93

Table 2. Period of First Calving: The Effects on Lifetime Average Return on Investment per Female[7]

	1st 21 days	2nd 21 days	3rd 21 days	4th 21 days
Herd 1	14.8%	10.4%	4.7%	8.6%
Herd 2	(-3.2%)	(-10.3%)	(-12.4%)	(-11.2%)
Herd 3	9%	(-1.3%)	(-16%)	(-9%)
Herd 4	18%	9%	3%	(-10%)
Herd 5	14.7%	2%	6%	6%

*Data taken from five commercial herds and includes approximately 1500 calves from females that calved annually throughout their life.
*Prepared by L.R. Sprott, former Professor and Extension Beef Cattle Specialist Emeritus

[1]Day & Nogueria, 2013
[2]Nunez-Dominguez, Cundiff, Dickerson, Gregory, & Koch, 1991
[3]Chapman, Young, Morrison, & Edwards, 1978
[4]Morris, 1980
[5]Lesmeister, Burfening, & Blackwell, 1973
[6]Cushman, Kill, Funston, Mousel, & Perry, 2013
[7]Sprott, n.d.

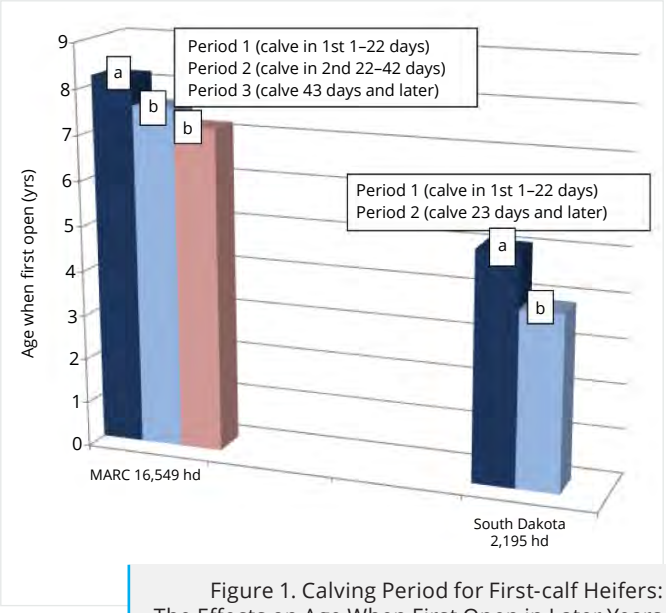


Figure 1. Calving Period for First-calf Heifers: The Effects on Age When First Open in Later Years

Heifer Selection

Most producers select replacement heifers sometime between weaning and the end of their first breeding season. Selection based solely on appearance is not well related to fertility. "Eye appeal" is not related to physiology and is often just one person's opinion.

Selecting heifers at weaning. If heifers are selected at weaning, age is no doubt the most useful criteria. Selecting heifers born in the first half of the calving season results in more mature animals that will require less time to reach puberty when compared to younger herdmates. Thus, calving records—the actual date, or at least the period within the calving season (early, middle, or late)—are the best way to identify these more mature animals. Some producers with extensive or remote pastures may not be able to observe cows during the calving season and may not know the ages of their heifer calves. If they select replacements at weaning, they usually just keep the biggest or heaviest, expecting them to be the oldest, which they often are. However, over time, selecting bigger heifers at weaning can subsequently lead to bigger cows. A correlation of 0.67 to 0.85 between these two traits has been reported.[8] Moderate cow size is necessary for many environments.

Genomic testing of calves to predict their future fertility and overall performance as cows is an emerging technology. Currently, it is limited to the Black Angus breed because of the large database required (GENEMAX®, Zoetis).

Selecting heifers as yearlings. Some producers simply keep a large number (or all) of their heifers at weaning and select replacements from those that get pregnant after their first breeding season. This does add significant cost to development because more heifers than are needed for replacements are being kept and managed. However, the added value of selling surplus heifers that are heavier and/or pregnant as yearlings has the potential to mitigate the extra development cost.[9] This strategy allows pregnancy to be the initial basis for selection.

Selection for puberty and/or early pregnancy. Heifers that have had one or more estrous cycles before, rather than during, their first breeding season have been reported to have higher pregnancy rates both as yearlings and again as 2-year-olds (Table 3).[10] Some strategies used to identify these kinds of pubertal heifers—and to refine the selection process among those that are pregnant—are discussed below.

One strategy is to use a short 45-day breeding season, either with or without artificial insemination (AI). Pregnancy rates will likely be somewhat lower than with longer 60- to 90-day breeding seasons, so plan on retaining an extra 20 to 25 percent more heifers. Heifers that become pregnant are fertile and are set up to begin their reproductive careers as early calvers, the importance of which has been discussed. Open heifers have added value due to older age and heavier weights.

Table 3. The Impact of the Number of Estrous Cycles Exhibited Prior to the Start of Breeding and Reproductive Performance of Heifers[10]

	Number of estrous cycles before the start of breeding				
	0	1	2	3	4
Heifers first season, n	395	205	211	116	249
Weight before start of breeding (lb)	671^{a}	702^{b}	702^{b}	715^{bc}	715^{c}
Age at start of breeding in days	420^{a}	426^{b}	426^{b}	426^{b}	430^{c}
First-season heifer pregnancy percentage	**84^{a}**	**90^{b}**	**88^{b}**	**89^{ab}**	**94^{b}**
Start of breeding to calving, days	300^{a}	296^{b}	295^{b}	295^{b}	296^{b}
Weight of calves at weaning (lb)	396^{a}	411^{b}	414^{b}	416^{b}	405^{b}
2-year-old cows, second season pregnancy percentage	**73^{a}**	**85^{b}**	**79^{b}**	**90^{c}**	**92^{c}**

Means within a row without a common superscript differ (P <.05)

Pregnancy testing shortly after the end of longer breeding seasons by a skilled individual using either ultrasound or palpation is another way to identify and select early breeders. Another alternative is to blood test all heifers 30 to 50 days into the breeding season. Those identified as pregnant by blood test will have been bred in the first

[8]Kaps, Herring, & Lamberson, 1999
[9]Carpenter & Hogan, 2018
[10]Adapted from Roberts, Ketchum, Funston, & Geary, 2013

30 to 40 days. A second pregnancy test of negative heifers is required at a later date to identify both later-bred and open animals.

Using estrous synchronization (ES) at the beginning of their first breeding season, either with AI or natural bull service, identifies pubertal animals because the response to ES treatment is dependent on puberty. Therefore, pregnancy to first synchronized estrus signifies both an animal that was already cycling prior to the breeding season—or very close to it—and an animal that is fertile. That is, she was able to conceive at her first breeding opportunity, and she is now set up to begin her reproductive years as an early calver. Using a blood pregnancy test in first-calf heifers at day 30 post-AI is one way to determine conception to AI versus clean-up bulls. To do this, wait to turn in clean-up bulls until day 14 after a single AI mating. Then, blood test all heifers at day 30 post-AI. Only those that conceived to AI (early breeders) will test positive for pregnancy at this stage. All other heifers testing negative at this stage are either pregnant by clean-up bulls or open. Again, all animals in the negative group will need to be pregnancy tested again at the end of that breeding season.

Not all producers are able to use AI. Still, giving a single shot of Prostaglandin $F2_{\alpha}$ (PG) and using a natural bull service on the first day of the breeding season is a well-known and inexpensive way to group cycling females to calve early, as most cycling females will come into heat within 4 days of the shot. However, a small percentage will be unable to respond to that treatment because they are in a stage of their estrous cycle where they do not have a functional corpus luteum on the ovary. Waiting 4 days after turning the bull(s) in to give PG shots is a strategy that may increase the opportunity to identify all—rather than most—pubertal heifers and, therefore, increase the opportunities for early pregnancy in response to that protocol among all pubertal animals.[9, 11, 12] A word of caution: Do not administer prostaglandin **after** day 4 to 5 of bull exposure, as it can cause abortions after this time. Blood pregnancy testing all animals at day 40 of the breeding season can identify those that conceived to natural bull service in the first 12 days and were, therefore, pubertal before the start of the breeding season. Again, the benefits of early puberty, early conception, and early calving have been described.[5, 6, 10] All animals that tested negative for pregnancy at day 40 will need to be re-tested for pregnancy after the end of the breeding season as would normally be done.

Reproductive tract scoring (RTS) has been used to identify mature and pubertal heifers just prior to their first breeding exposure.[13, 14] Additionally, it might be a useful tool to manage even lifetime reproductive performance.[14] RTS is a heritable trait, with an estimate of 0.32.[14] Heifers with higher RTS just prior to their first breeding season had higher pregnancy rates both as yearlings and again as 2-year-olds. In turn, these heifers calved earlier, and because of that, weaned heavier calves.[14] Age, body weight, and body condition score are all positively associated with RTS, and among these three, age was the most highly associated.[14] The main limitation to using RTS to predict puberty, in many areas, is finding qualified people who can palpate and/or ultrasound and then score the reproductive tract accurately (cervix, uterus, and ovarian structures).

Finally, predicting the number of replacements needed is related to culling rate in the cowherd. Cows are culled for reproductive failure, unsoundness, temperament, old age, drought, and other reasons. Overall cull rate and age makeup of the cowherd will thus be a consideration when estimating replacement heifer needs. Under good management, one might reasonably expect an 85 percent pregnancy rate in yearling heifers being bred for their first calf. Under that scenario, heifer retentions would likely need to be about 15 percent higher than whatever the predicted cowherd replacement rates are.

[11]Whittier, Caldwell, Anthony, Smith, & Morrow, 1991
[12]Larson, Musgrave, & Funston, 2009
[13]Anderson, LeFever, Brinks, & Odde, 1991
[14]Holm, Thompson, & Irons, 2009

Heifer Growth, Development, and Puberty

As stated, heifers of most breeds should have their first calf at 2 years old. Puberty is determined by age and weight in concurrence. After weaning, heifers are grown and developed to reach a "target" age that is based on their breed type and an estimated "target" weight for the first breeding. Research conducted during the late 1960s through the early 1980s indicated that puberty occurs at a genetically predetermined weight. Only when heifers reach their target weight can high pregnancy rates be obtained. Age targets are 12 to 14 months for English breeds such as Angus and Hereford, and 15 to 16 months for Continental breeds, such as Charolais or Simmental, and American breeds like Brangus or Beefmaster. Straight-bred or predominantly Bos indicus breeds typically reach puberty later and are usually not bred until they are 2 years old in order to calve first as 3-year-olds. The target weight is usually 60 to 65 percent of "expected" mature weight. Some research has reported that heifers developed to lighter target weights (50 to 57 percent of mature body weight) or those that were fed restricted diets were able to reach puberty and breed at acceptable rates.[15, 16, 17, 18] It should be noted that in studies that used mature cow weight, these weights were estimated from extensive databases and were essentially a "known" factor. Most producers can only guess what expected mature cow weight is, given the variation in mature cow weight within most herds. Target weight as a percentage of actual expected mature weight can be difficult to predict accurately. Therefore, the 60 to 65 percent rule probably offers some "insurance" when estimates of mature weight may be off.

If producers are interested in measuring and managing weight gain during development, one methodology might be:

1. Obtain individual heifer body weights at weaning;
2. Determine the correct target age and weight at first breeding for puberty;
3. Calculate the number of days between weaning and first breeding;
4. Calculate the needed average daily weight gain needed to reach the target weight (target weight–weaning weight/number of days);
5. Check-weigh heifers midway through the development phase (some might even prefer to weigh heifers every month); and
6. Adjust the feeding program if weight gain is too low.

[15]Funston & Deutscher, 2004
[16]Funston, Martin, Larson, & Roberts, 2012
[17]Roberts, Geary, Grings, Waterman, & MacNeil, 2009
[18]Endecott, Funston, Mulliniks, & Roberts, 2013

Research has shown that it does not matter if heifers grow at an even weight gain (the same amount each day) or at an uneven rate (low to high or high to low), as long as they arrive at the correct target weight for puberty.

Some producers may begin breeding yearling heifers 21 days prior to the start of breeding for their mature cows. In some environments, this may increase the chances of re-breeding as 2-year-olds. The trade-off is that there will be 21 fewer days to reach target weight for their first breeding as yearlings.

In summary, nutritional management of heifers is critical between weaning and the first breeding season. It can also be a factor during pre-weaning as well. Therefore, it is the overarching factor that influences age at puberty in heifers.[1] Nutrition is similarly critical prior to and after the birth of their first calf in order for successful re-breeding to occur.

BIBLIOGRAPHY

Day, M. L., and G. P. Nogueira. "Management of age at puberty in beef heifers to optimize efficiency of beef production." *Animal Frontiers* 3, no. 4, (2013): 6–11.

Nuñez-Dominguez, R., L. V. Cundiff, G. E. Dickerson, K. E. Gregory, and R. M. Koch. "Lifetime production of beef heifers calving first at two vs three years of age." *J. Anim.* Sci. 69, no. 9, (1991): 3467–3479.

Chapman, H. D., J. M. Young, E. G. Morrison, and N. C. Edwards, Jr. "Differences in lifetime productivity of Herefords calving first at 2 and 3 years of age." *J. Anim.* Sci. 46, no. 5, (1978): 1159–1162.

Morris, C. A. "A review of relationships between aspects of reproduction in beef heifers and their lifetime production: 1. Associations with fertility in the first joining season and with age at first joining." *Anim. Breed. Abstr.* 48, no. 10, (1980): 655–676.

Lesmeister, J. L., P. J. Burfening, and R. L. Blackwell. "Date of First Calving in Beef Cows and Subsequent Calf Production." *J. Anim.* Sci. 36, no. 1, (1973): 1–6.

Cushman, R. A., L. K. Kill, R. N. Funston, E. M. Mousel, and G. A. Perry. "Heifer calving date positively influences calf weaning weights through six parturitions." *J. Anim.* Sci. 91, no. 9, (2013): 4486–4491.

Sprott, L. R. Unpublished data.

Kaps, M., W. O. Herring, and W. R. Lamberson. "Genetic and environmental parameters for mature weight in Angus cattle." *J Anim* Sci. 77, no. 3, (1999): 569–574.

Carpenter, B. B., and R. J. Hogan. "Rangeland heifer development strategies." *Proc. Appl. Repro. Strategies in Beef Cattle.* https://beefrepro.org/wp-content/uploads/2020/09/Carpenter-Rangeland-Heifer-Development-Strategies.pdf

Roberts, A. J., J. Ketchum, R. N. Funston, and T. W. Geary. "Impact of number of estrous cycles exhibited prior to start of breeding on reproductive performance in beef heifers." Western Section of Animal Science Proceedings. *J. Anim.* Sci. 64, (2013): 254–257.

Whittier, J. C., R. W. Caldwell, R. V. Anthony, M. F. Smith, and R.E. Morrow. "Effect of a prostaglandin F2α injection 96 hours after introduction of intact bulls on estrus and calving distribution of beef cows." *J. Anim.* Sci. 69, no. 12, (1991): 4670–4677.

Larson M., J. A. Musgrave, and R. N. Funston. "Effect of estrus synchronization with a single injection of prostaglandin during natural service mating." Paper 527. 2009 *Nebraska Beef Report.* (2009): 10–11.

Andersen, K. J., D. G. LeFever, J. S. Brinks, and K. G. Odde. "The use of reproductive tract scoring in beef heifers." *AgriPractice* 12, no. 4, (1991): 19–26.

Holm, D. E., P. N. Thompson, and P. C. Irons. "The value of reproductive tract scoring as a predictor of fertility and production outcomes in beef heifers." *J. Anim.* Sci. 87, no. 6, (2009): 1934–1940.

Funston, R. N., and G. H. Deutscher. "Comparison of target breeding weight and breeding date for replacement beef heifers and effects on subsequent reproduction and calf performance." *J. Anim.* Sci. 82, no. 10, (2004): 3094–3099.

Funston, R. N., J. L. Martin, D. M. Larson, and A. J. Roberts. "Physiology and endocrinology symposium: Nutritional aspects of developing replacement heifers." *J Anim* Sci. 90, no. 4, (2012): 1166–1171.

Roberts, A. J., T. W. Geary, E. E. Grings, R. C. Waterman, and M. D. MacNeil. "Reproductive performance of heifers offered ad libitum or restricted access to feed for a one hundred forty-day period after weaning." *J. Anim.* Sci. 87, no. 9, (2009): 3043–3052.

Endecott, R. L., R. N. Funston, J. T. Mulliniks, and A. J. Roberts. "Implications of beef heifer development systems and lifetime productivity." *J. Anim.* Sci. 91, no. 3, (2013): 1329–1335.

ANSC-PU_043
January 2006

BUYING VS. RAISING REPLACEMENT HEIFERS

Jason Cleere*

Should beef cattle producers raise replacement heifers, or buy them? Many pieces of paper have been scribbled on by producers trying to find the right answer. The problem is that no one answer is right for all producers. Each producer operates under conditions unique to that situation.

When deciding on the best strategy for replacing heifers, producers need to weigh the advantages and disadvantages of raising or buying replacement females as well as consider other economic and general management issues specific to their operations. Factors to consider include:

- Current and future market prices
- Herd size
- Pastures, facilities and management level
- Available labor
- Economics
- Herd health concerns
- Cow genetic base (crossbreeding system)
- Herd quality
- Purchase replacement alternatives

To clarify which strategy is best for a specific operation, producers should develop individualized budgets and management plans for each option.

CURRENT AND FUTURE MARKET PRICES

The beef industry is cyclical, with a series of high and low prices occurring about every 10 years. The law of supply and demand governs these cycles. As in other businesses, when supplies are down and demand is steady, prices tend to rise.

When cattle prices are high, producers begin to rebuild their herds by retaining "high value" heifers or by purchasing replacements. The thinking is that with high cattle prices, it is time to get into beef production or to increase current cow inventories. After the rebuilding phase occurs, supplies increase and prices drop. This is the beginning of the herd liquidation phase of the cattle cycle.

Another explanation of the cattle cycle is that cash flow often determines the number of heifers retained or purchased. When prices are low, producers often must sell more or buy fewer heifers to meet cash flow demands. Conversely, as prices rise, producers are able to sell fewer heifers to meet cash flow demands. Thus, a common joke in the beef industry is "buy high and sell low."

Buying or retaining more replacements when prices are high is contrary to good business principles. Another problem with this practice is that heifers born during periods of high prices will produce calves during the following period of low prices, and vice versa.

To improve cow-calf profitability, producers need to adjust their replacement strategies. A study of replacement strategies by Iowa State University in 2001 examined production and financial data from 1970 to 1999. The strategies that were studied included:

- Maintaining the same number (SS) of heifers each year.
- Maintaining the same cash flow (CF) each year—when calf prices are high, the producer retains or buys more heifers.
- Retaining the same dollar value (DV) of heifers each year—when calf prices are low, the producer retains more heifers.

The researchers found that the return over cash costs for the DV strategy was 55 percent higher than the CF strategy and 33 percent higher than the SS strategy. These findings indicate that it is more profitable to use counter cyclical replacement strategies. That is, they should purchase more replacements when calf prices are low. However, producers using a countercyclical strategy must be able to weather large variations in cash flow.

Assistant Professor and Extension Beef Cattle Specialist The Texas A&M University System

Cycles are affected by changes in consumer demand, environmental conditions that affect production, and other unforeseeable events that can affect the market, such as the cases of bovine spongiform encephalopathy (BSE, or mad cow disease) in Canada and U.S. To make informed decisions, the producer must evaluate the current market situation and develop an individualized budget.

HERD SIZE

One of the first issues to address in deciding whether to buy or raise replacements is operation size. Typically, to maintain herd size, a producer must retain about 30 percent of the heifers in the herd. For a 30-head herd, this means an average over time of five heifers per year.

Is it more economical for a producer to raise these five heifers, or buy replacement females? Usually, small producers find that buying replacements is more cost-efficient because of economies of scale. For this reason, larger producers find that raising replacement females is the more economical choice. However, even some large producers prefer to buy replacements to free up time and resources that could be better used elsewhere.

PASTURES, FACILITIES AND MANAGEMENT LEVEL

Young, growing heifers require more management than do cows. The amount of labor associated with heifer development can be substantial and should always be considered in making this financial decision.

To reach the optimal level of maturity for breeding, heifers must be managed separately from the rest of the herd. The higher level of management required for heifers begins when they are weaned. The first 14 to 21 days post weaning requires good management skills and an extra time commitment because of the increased risk of sickness during this period. Also, heifers must be developed carefully to ensure that they reach puberty and can be bred at about 14 to 15 months old.

Because their nutritional needs are different, additional pastures and facilities are necessary to properly wean and develop replacement heifers. Sound holding pens are required to keep heifers contained during the initial weaning period and to keep bulls away before the breeding season.

The extra management does not stop after the bulls are removed. Heifers need to reach 85 to 90 percent of mature weight by the time of calving to ensure high levels of breed back after calving. The development phase of heifers will affect their lifetime productivity. Taking shortcuts in management will affect the value of the female for its entire productive life.

Buying replacements can free up pastures for about 10 percent more cows in an operation. When making your economic analysis, be sure to factor in this additional income.

NEED FOR ADDITIONAL HEIFERS

Another factor to consider is the need to raise more heifers than will be retained. The average conception rate of heifers is 85 percent. Most producers will cull about 20 percent of heifers because of non-reproductive issues such as structure or poor weight gain. Consequently, raising replacement heifers requires keeping about 45 percent more heifers than needed. This ties up capital for an extra 10 to 12 months before the culled heifers are marketed.

When considering whether to raise or buy replacements, remember to factor in the cost of the additional heifers that will need to be kept. The cost adjustment for culling or death loss is shown in Table 1.

Table 1. Sample budget for raising a replacement heifer from weaning to first calf.

Value of heifer at weaning *(500 lb. × $1.05)*	$525.00
Cost of gain weaning to breeding *($0.45/lb. × 250 lb.)*	$112.50
Cost of bull service	$35.00
Interest	$30.00
Management	$50.00
Grazing and feeding cost to calving	$150.00
Vet costs	$20.00
Cost adjustment for culls and death	$75.00
Total	**$997.50**

ECONOMICS

The decision on whether to buy or raise replacement females involves many economic factors. These include opportunity costs, feed costs, interest, labor, facilities, tax advantages, conception rates, replacement costs, bull costs and cull rates.

The cost of raising replacement heifers from weaning to first calf varies from operation to operation, depending on the resources available. As described previously, be sure to factor in your herd size, pastures, facilities, management and feed costs, which are a substantial

portion of the total cost of developing heifers. Each producer must develop a budget that accurately reflects the individual operation.

In developing an individualized budget, assign a fair market value for weaned heifers as an opportunity cost. Also factor in the labor costs, which are often omitted in replacement heifer cost analyses.

The sample budget in Table 1 can be used as a guide. To make the most informed decision, substitute the data from your operation and add any extra costs based on your situation.

Assumptions:

1. The value of the retained heifers is for example purposes and will vary.
2. Estimated expenses will vary among producers; to make the most educated decision, you will need to develop your own budget.

Most economic analyses indicate that there is a slight advantage in raising rather than buying replacement heifers, especially for larger producers who can take advantage of economies of scale to reduce feed and labor costs. For the small producer with fewer than 50 cows, buying heifers is usually more economical because of feed and labor costs.

For detailed and interactive cow-calf budgets, see the Texas A&M AgriLife Extension Service Agricultural Economics Website at: *https://agecoext.tamu.edu/resources/crop-livestock-budgets/by-commodity/cow-calf/.*

HERD HEALTH CONCERNS

One reason producers choose to raise their own replacement females is to help prevent diseases from being introduced into their herds. Buying cattle from outside sources always carries a risk of introducing diseases into a herd. This is a valid issue because herd health affects profitability.

Taking action to prevent the introduction of disease-causing agents into a herd is called biosecurity. In cattle operations, the highest level of biosecurity is to maintain a closed herd. The lowest level is to introduce animals of unknown health without a quarantine period.

To minimize the risk of introducing disease when buying cattle:

- Buy only cattle that have clean health records and that are from reliable sources. Consult a local veterinarian about the health requirements that purchased females should meet.
- Quarantine new cattle.
- Maintain a sound vaccination program.

COW GENETIC BASE

The U.S. beef industry has changed dramatically in the past 15 years and will continue to do so to satisfy consumer demands for consistent, high-quality beef products. To meet these demands, the industry is shifting toward a production system based on quality.

In the beef industry, quality begins with genetics. In making replacement female selections, cow-calf producers must realize that a cow's genetics can affect herd profitability for 8 to 14 years.

Raising replacement heifers allows producers to use genetic selection criteria to improve production and management. The producer can select cattle for maternal traits, performance traits or carcass traits for sires of heifers.

A major advantage of raising replacements is the opportunity to select heifers that are born in the first 60 days of the calving season and that are heavier at weaning. These heifers are more likely to reach the proper weight needed for on-set of puberty. Also, these older heifers are usually from the most fertile dams that conceived early in the breeding season.

Raising replacement females also allows producers to cull those females that fail to coneive. Field trials in eight Texas herds in 2000 demonstrated that open heifers held over for a second breeding 6 months after first breeding had average pregnancy rates of 58 percent. In another study that year, calving data from five Texas commercial herds (1,500 calving events) was evaluated. This research found that the average lifetime calf weight was highest in females whose first calving date as a heifer occurred the first 21 days of calving.

This does not mean that buying replacement females is not an option for selecting the most fertile and productive females. There are many good replacement female sources that implement strict selection criteria and provide quality genetics. You may want to choose outside sources for replacement heifers if you want to improve the genetics of your herd quickly or if your herd's genetic selection is limited due to heavy culling because of drought or age.

CROSSBREEDING SYSTEMS

When cattle are crossbred, the resulting offspring are often more vigorous or fast-growing than are the parents. This improvement from crossbreeding is called heterosis.

Research has shown that heterosis effects can increase production per cow by about 20 to 25 percent in *Bos taurus* × *Bos taurus* crosses (example: Angus × Hereford) and by 40 to 50 percent in *Bos indicus* × *Bos taurus* crosses (example: Brahman × Hereford). Most commercial beef producers use crossbreeding to take advantage of heterosis and genetic improvement from combining breeds with different characteristics.

For more information on crossbreeding, see *Texas Adapted Genetic Strategies*, a series of 10 Texas A&M AgriLife Extension Service publications available at: *https://agrilifelearn.tamu.edu/s/*.

Another goal for producers is to select cattle that are genetically adapted to the local environment. A producer should match the cow to the environment and then use a bull that complements the cow to produce a calf to fit a specific market. But if the appropriate cow and bull are genetically different, a terminal cross is required. A terminal cross can be defined as a mating that produces progeny that are not suitable as replacement animals. Ultimately, producers strive for excellent maternal traits, longevity and efficiency in a cow that will produce a marketable calf.

In the Southern U.S., producers should choose cattle that are genetically adapted to hot, humid climates. Crossbred females with a combination of *Bos indicus* (typically Brahman) and *Bos taurus* genetics have become the female base for producers in the South. Producers often use *Bos taurus* terminal sires on *Bos indicus* cross females to maximize growth and performance, improve carcass quality and/or decrease the amount of "*Bos indicus* appearance" in the calves. However, when a terminal crossbreeding system is used, the daughters may not be as maternally oriented or environmentally adapted as their dams and are usually not kept as replacements.

The alternative is to use a continuous cross-breeding system that may not maximize growth, performance or carcass quality of the calves but will produce good-quality, marketable calves and females for replacement that are at least as productive as their dams. Producers must decide whether to give up some growth, performance and possibly carcass traits to raise their own replacements or opt to maximize calf performance and buy replacements.

This issue should be factored into the cost analysis. Larger producers can operate a split-herd design in which one group of cows is designated to produce replacement females and the other group is placed in a terminal system or rotational crossbreeding system.

CALVING DIFFICULTY

Studies at the University of Nebraska Meat Animal Research Center and Colorado State University indicate that 2-year-old first-calf heifers are three to four times more likely to have calving difficulties (dystocia) than are 3-year-old cows. The two major causes of dystocia in heifers are small pelvic area in underdeveloped heifers and heavy calf birth weights. Heavy birth weights are most commonly attributed to genetics of the sire and can be reduced by using low-birth-weight or calving-ease sires on heifers.

A major concern when buying heifers is whether they are bred to a calving-ease bull. Producers raising their own replacement heifers decide which bull to use and so have more assurance that the heifers are bred to a calving-ease bull. Buying replacements from a reputable source can help reduce this concern.

The use of calving-ease bulls on heifers does not a guarantee a dystocia-free calving season. Calving problems can also occur because the heifers have not

reached full maturity at calving, because the heifers lack calving experience, or because of improper calf presentation. Thus, producers without the ability, facilities or time to calve heifers may choose to buy second-calf heifers or cows.

CONCLUSION

Decisions on replacing females play an important role in the future profitability of the cow herd and should be considered carefully. Producers should address both economic and general management considerations when deciding whether to raise or purchase replacements. Always base your decisions on the circumstances of your individual operation.

LITERATURE CITED

Cundiff, L. V. "Implications of Breed Type Evaluations." Proceedings, 49th Annual Texas A&M University Beef Cattle Short Course. M-7-M-24. 2004.

ANSC-PU-287, "Avoiding Calving Problems." Texas A&M AgriLife Extension Service, *https://agrilifelearn.tamu.edu/s/*.

Lawrence, J. D. "Profiting from the Cattle Cycle: Alternative Cow Herd Investment Strategies." Iowa State University Beef Research Report.

A.S. Leaflet R1753. 2001. *https://www.extension.iastate.edu/Pages/ansci/beefreports/asl1753.pdf*. Accessed November 4, 2005.

Ritchie, H. D. and P. T. Anderson. "Calving Difficulty in Beef Cattle: Part I—Factors Affecting Dystocia." Beef Improvement Federation. Accessed November 4, 2005.

Sprott, L. R. 2000. "Reproductive Performance in Replacement Heifers has Long-Term Consequences on the Cow Herd." Publication ASWeb-100. Available: *https://animalscience.tamu.edu/wp-content/uploads/sites/14/2012/04/beef-reproductive-performance.pdf*. Accessed November 4, 2005.

Beef Cattle Decision Aids

Overview and Description

A. **Cow-Calf Bid Price and Budgets**
1. Cow Bid Price [PDF description] [Excel spreadsheet]
2. Cow-Calf Costs and Necessary Calf Price for Target ROA [PDF description] [Excel spreadsheet]

B. **Replacement Heifer Budgets**
Replacement Cost and Returns Calculation Decision Aids
Commercial Bred Heifer Buyer's Guide

1. Replacement Heifer Natural Service Budget
   a. Natural Service Projection [Excel spreadsheet]
   b. Natural Service Closeout [Excel spreadsheet]
   c. Bred Replacement Heifers Natural Service and Pairs [Excel spreadsheet]
2. Conventional Artificial Insemination (AI) Heifer Budget
   a. AI Heifer Projection [Excel spreadsheet]
   b. AI Heifer Closeout [Excel spreadsheet]
   c. AI Heifer Contract Breeding Services [Excel spreadsheet]
3. Replacement Heifer SPA Reproduction Performance
   Replacement Heifer Critical Dates and Data

Replacement Heifers Costs and Return Calculation Decision Aids

The purpose of these replacement heifer cost decision aids is to calculate total production costs and return on investment (ROI) to evaluate production, breeding systems and pricing and marketing alternatives. The focus is on feeding and breeding system evaluation including natural service or artificial insemination (AI). This cost can be for heifers going back into the herd or for producing bred heifers for sale. Information can but also be used to negotiate replacement heifer's pricing terms for long term contracting agreements.
To evaluate the accuracy of the budget projection a spreadsheet is provided to do a closeout for the replacement heifers once the heifers are transferred to the cow herd or sold

There are three production alternatives covered by the decision aids including:

Replacement Heifer Costs and Returns Budget and Closeout

1. Replacement Heifer Production – Natural Service
2. Conventional Artificial Insemination Replacement
3. Contract Replacement Heifer Breeding Service
4. Bred Replacement Heifers Natural Service and Pairs

The decision aids include pricing of weaned heifer, and pre-breeding culled heifers and culled open heifers. The initial weaned replacement heifers' cost is the major cost of production (accounts for approximately 50 percent of total bred heifer cost after adjustments for culled heifers that don't breed. A major cost is the inherent inefficiency in replacement heifer reproduction. One can plan that 5-20 percent of the heifers will not breed during the breeding season and have to be culled often at a discounted feeder heifer price that increases the cost of the heifers that breed. When producers are evaluating the alternative to purchase or raise replacements, they often do not take into account only 75-90 percent of the selected heifers will breed and culled heifers sell at a lower value.

The weaned heifer market value is the opportunity cost for not selling the weaned heifer kept for raised replacement heifer production. The first return from a purchased bred heifer will be received approximately a year sooner when her first calf is sold than saving weaned heifers to produce replacements. The time between saving a weaned heifer and her producing a weaned calf is at least two years.

Producers have different breeding alternatives for replacement heifers including natural service or artificial insemination (AI). Replacement heifers bred to produce heifers should have less calving difficulties as birth weights are lower for heifers. If replacement heifers are bred to produce F1 heifers these calves can be more valuable that straight bred calves.

This decision aid calculates the breeding cost for AI Heat Detected to Timed-AI breeding protocols followed by clean up bull's costs. The spreadsheet calculates and reports the breeding cost for all females exposed and bred female. This facilitates comparing alternatives.

Prepared by James McGrann, Professor Emeritus, Economist Management, Texas A&M University, 11/26/ 2018.

For the producer of replacement heifers for sale it is an important production and marketing alternative. To be profitable the bred heifer sales price must cover the added cost, management and the higher risk associated with production and marketing.

Replacement Heifer Production Cost and Returns

The main question addressed with this decision aid is: What is the economics of producing bred heifers to build the herd or to sell bred heifers or pairs? This decision aid combines production and financial data to calculate the cost of a bred heifer as well as cost of a bred heifer and first calf pair. This is a long production cycle that begins when the replacement is weaned and finishes when the heifer is pregnancy tested or in the case of the pair when the calf is born or when the first calf heifers is diagnosed pregnant if sold as a three in one.

Input Data for the Alternative Decision Aids

The first data input form gathers the production data that describes the dates and timing of the production cycle from the time the heifer is weaned until a pair would be available for sale. Heifer value at weaning is input as the base cost as the production cycle is completed and costs are accumulated. Reproduction and culling data is used calculate cull sales and the number of calves available for sale.

The definitions of the Standardized Performance Analysis (SPA) measures will assist in recording the dates recorded and reproduction measures. See these definitions at the end on the definition section.

Two breeding systems are considered for producing bred replacements. Natural service and conventional AI with clean up bulls. Using AI has greater managerial requirement but the increased use of timed AI and greater control over genetics has made this a profitable option when the market pays for this added managerial effort and cost. The AI decision aid option allows switching between natural and AI breeding to quickly evaluate the two alternatives. When using the AI option it is critical to get the breeding protocol and associated cost quantified with the technician doing the AI. As will be noted the breeding cost is pretty insignificant in total cost of producing replacement heifers.

Actual production and cost data generated from actual records is desired. Estimated value and use of "what if" capabilities in the spreadsheet are helpful even if data is limited. Critical numbers are success in getting heifers bred and calving success.

Providing **AI heifer contract breeding service** is a production activity that complements breeding raised or purchased heifers. The methodology is the same for calculating profitability of the management, care, feeding a breeding service provided. The heifer owner provided the heifers to breed and may provide the semen. The contractor normally provides the clean-up bulls. The decision aid calculated the head day fee and calculates the ROI at the daily fee. The full cost of the owner's bred heifer services is calculated.

Where **bred versus pairs** is evaluated natural service is used. Production and cost data is entered is the in the next sheets for the bred replacement followed by the information for the first calf pair. The final page provides a summary to the production and financial information. One can observe the costs and net income associated with the two options.

Decision Aids Operation

These are the steps to follow to up the data in the two decision aids. First run the **Bull Cost Calculator sheet**. The breeding cost per head will be use in the cost decision aid. There are two decision aids. One for when conventional semen is used one for sexed semen because of the difference in calculation of the sex of calves born and difference in gender value and semen cost and expected reproduction difference.

The decision aids allow for quick evaluation of natural service by selection the breeding system desired. The natural system uses the cleanup bull breeding costs as the breeding cost. A separate page is used to set up the bull cost and protocol cost of the AI breeding systems. The annual cost of the bull investment is accounted for in depreciation or the investment minus salvage value divided by years of expected service.

The data convention is items in blue are **user input** data all the black numbers are calculated numbers and are protected cells. Other data is from links in the spreadsheet or calculated values. The breeding costs per heifer are then transferred to the replacement cost calculator. **Weaned to Bred Heifer Cost** is used to calculate the full costs including capital and target returns from the time of weaning to heifer delivery. Note several critical numbers are entered in the first sheet that is carried over to this sheet.

In most cases pricing of bred replacement should be based on consideration of Weaned to Bred Heifer Cost. If priced at breeding time the pricing should reflect the costs to get too breeding age and weight. Cost of production will most likely be higher than increase in market value. This reality is reflective of the low rate of gain and high cost of gain.

When Using the Decision Aids Keep in Mind These Factors in the Analysis

- Two key measures to monitor this activity evaluation are the pregnancy rate and the return on investment (ROI). ROI can be calculated for heifers retained or marketed.

- The economic results of breeding systems evaluation will always show that pregnancy rate and weaning rate is everything from an economic point of view. Period!

- The opportunity cost of an open heifer is large when one compares the market value of the open heifer to the bred heifer. For example difference in the value of a bred and open heifer at pregnancy testing time needs to be calculated. Anything that would cost below this value that result in an additional pregnancy is a cost effective option as added revenue would be greater than added cost. Hiring additional labor to assist during the AI breeding period would be very cost effective if that is a

constraint to implement an optimal breeding system. The economic message is don't save costs on the breeding protocol if it reduces pregnancy rate. In addition don't let saving feed interfere with optimal nutrition programs. It's well known body condition score is highly correlated with pregnancy rates.

- The purchase cost or opportunity cost of the raised heifer accounts for the majority of the bred heifer cost. When pricing weaned heifer calves, recognizing these selected heifers have higher value than the average heifer in the weaned herd. These are the best heifers in the herd. Pricing heifers at steer value is a reasonable approach.

- Pricing the weaned heifer is critical in a negotiated supplier relationship. Tying valuation to the feeder steer future market would allow for an adjustment for a changing price cycle when forming long term plans.

- In calculating costs these are full costs including cash operating costs, depreciation of facilities and equipment, purchased bulls, finance, management and labor and general and administrative costs (overhead). In the accounting system the replacement heifers need to be set up in a separate cost center. Leasing rates can be used for feed and grazing costs when costs are not generated by the accounting system.

- Interest on the weaned heifer cost and operating cost, (one-half of operating costs to reflect an average outstanding capital cost) for the period between initiation of the activity and delivery of bred heifers is accounted for.

- One could compare this retained ownership to selling the heifer at weaning by adding, capital return (return on investment ROI) as the target rate of return, reflected in the interest rate included in finance costs, if the bred replacement was marketed at full cost. Anything over full cost would add the margin over weaned heifer sale.

- When calculating the cost of producing replacement heifers it shows **"genetics is a low cost input".** Good genetics either AI of quality bulls is a good investment.

- It's very important to get breeding costs into proper perspective. Although important, **breeding costs account for less than 10% of total cost of producing replacement heifers when including open value.** One should not be an area to try to reduce these costs if it results in lower pregnancy results.

- There are production and financial inefficiencies when producing replacement heifers. Steer calf mates of replacement type heifers are often lighter and market price is less per pound than terminal cross steers. An example is F-1 Brahman steers compared to Charolais cross steers out of Hereford cows. The straight bred cows designated to produce replacements normally are not as efficient. Cross bred

cows have higher reproduction, weaning weights and longevity than straight bred cows.

- When contracting delivery timing needs to be negotiated. Bred heifers need to be diagnosed as soon as possible and delivered to the buyer. Early pregnancy confirmation using ultra sound technology will allow earlier delivery and reduce carrying cost.

- The focus must be on getting the heifers bred and to produce live calves that are market acceptable and for the heifer to rebreed for the second calf. Using low EPD birth weight bull semen or bulls is of course a good management practice.

- **It's not a breeding cost issue** it's getting replacement heifers bred, weaning a calf and breeding back and first calf heifers where attention needs to be focused. Synchronization can result in more heifers being bred early in the breeding season. This will mean higher average weaning weights and potential for cows to have more productive lives with early calves.

Producing Replacement – Its "Replacement Cows"

For the cow-calf producer one of the most costly activities and most important investment activities is producing replacement heifers. The cow calf activity is a long term investment activity as opposed to retained ownership that is a short term margin investment. Selecting the genetics reflected in the replacement is a decision that hopefully will be a 7-10 year investment decision. There is absolutely no management activity more important from a cow-calf operations perspective than the replacement activity. It's of course miss named as **it's a replacement cow activity**. Success is measured in terms of how many of the weaned heifers selected actually produce a weaned calf after calving as two years of age and are bred back to produce the second calf. Too many times saving costs in efforts to produce "replacement cows" is a poor and costly decision.

The market for replacements is not as efficient as for feeder cattle, a short term margin investment. It is difficult to receive a "proper market price" given the potential of AI bred heifers that will have less difficulty calving, calve early in the season and produce a potential replacement. Of course this is no excuse for not achieving this when a producer is producing their own replacements cows.

A Marketing Note: Why Producers Should Purchase Replacement Heifer

Many beef cattle producers have production and economic incentives to buy replacement heifers rather that raise them. Producing or buying replacement heifers is a long term investment decision. This is especially true for producers using terminal cross feeder calves. An example is using Angus or Charolais bulls on Brangus females. These cows produce feeders that meet market demand and have heterosis advantage reflected in weaning weights. Small producers (less than 200 cows) seldom can economically justify producing their own replacements. The

breeding herd composition and purchasing sires to produce replacements and breed the heifers plus added management makes production very costly.
Large herds can also benefit for purchasing replacements, specializing in producing terminal cross feeders and simplify the production system. Frequently when producers are evaluating the alternative to purchase or raise replacements, they do not consider only 75-90 percent of the selected heifers will breed and culled heifers sell at a lower value. The weaned heifer market value is the opportunity cost for not selling the weaned heifer kept for raised replacement heifer production. The first return from a purchased bred heifer will be received approximately a year sooner when her first calf is sold. The time between saving a weaned heifer and her producing a weaned calf is at least two years.

The purchase cost or opportunity cost of the raised heifer accounts for the majority of the bred heifer cost. Pricing the weaned heifer is critical in a negotiated supplier relationship

There are production and financial inefficiencies when producing replacement heifers. Steer calf mates of replacement type heifers are often lighter and market price is less per pound than terminal cross steers. An example is F-1 Braford steers compared to Charolais cross steers out of Braford cows. The straight bred cows designated to produce replacements normally are not as efficient. Cross bred cows have higher reproduction, weaning weights and longevity than straight bred cows.

The success rate **"pregnancy percentage"** is critical as open heifers sell at a discount that raises the cost of bred heifers. Marketing and purchasing inputs are year round activity and must with finding ways to reduce feed costs. Forward planning has never been a more profitable activity.

The cow-calf sector is poorly supported by benchmarks and cost data. Recall what is measured is managed. Make the numbers do the talking.

Appendix A: Replacement Cost and Returns Calculation Decision Aids

1. Replacement Heifer Natural Service Budget
    a. Natural Service Projection
    b. Natural Service Closeout
    c. Bred Replacement Heifers Natural Service and Pairs

2. Conventional Artificial Insemination (AI) Heifer Budget
    a. AI Heifer Projection
    b. AI Heifer Closeout
    c. AI Heifer Contract Breeding Service

3. Replacement Heifer SPA Reproduction Performance
   Heifer Data Collection
    a. Replacement Heifer SPA Reproduction Calculator

4. Replacement Heifer Budgeting Support Aids
    a. Feed and Grazing Cost Calculator
    b. Replacement Heifer Purchase and Sales Record
    c. Replacement Heifer Monthly Inventory – Hd. Days & AUMs
    d. Replacement Heifer Indirect Cost Calculator, IRS Based Ranch Direct and Indirect Cost Allocation

Definition of Replacement Heifer Economics Terms

Annualized Net Return on Investment ROI is the annualized return on investment (ROI), including net margin objective, and is the net income plus cash interest cost plus the target margin objective divided by annualized capital (asset) requirement to support the enterprise. The reason interest is added back is interest paid represents a return the debt capital. ROI is a return to capital invested irrespective of capital ownership. Capital is adjusted for the time cattle are grazed or on feed. Investment required is estimated by taking one half of the investment is non-cattle costs plus the total payweight cost of the feeder cattle times days on feed divided by 365 days.

Average Daily Gain (ADG) is the net payweight weight gain divided by head days. This weight is adjusted for death loss (deads are in) as only live cattle payweight are counted. Average daily gain is total gain divided by days grazed feed.

Total Production and Breeding Cost or breakeven component divided by the number of bred replacement heifers. The costs included must be defined before a breakeven can provide useful information to a decision maker. **A break-even that does not cover full cost is very misleading.** Feedyards never calculate a "full cost" breakeven. It is a feedyard direct cost breakeven. Producers must add to direct costs full cost of the heifer and the business's general and administrative (G & A) and finance costs. They must have **total unit cost** to have a true measure of profitability. Having G&A and actual interest cost will mean the replacement heifer profitability and TUC is consistent with the total business income statement or profit and loss (P&L) statement.

Depreciation is the value that accounts for the use of a capital asset over time. Depreciation of a bred replacement heifer divided by her productive cost is what the depreciation would be for breeding cows. This is a major cost of production.

Direct Expenses are expense items that are directly related to production activity such as grazing, feed, yardage, health, breeding and heifer cost.

Economic Cost is, in addition to the financial or accounting cost, an opportunity cost that is charged for owned land (what it could be leased for) and owner equity capital (what it would earn in an alternative investment or by how much it would reduce interest if used to repay debt). Opportunity cost represents the return that could be received for a resource in its next best use. Economic cost represents the cost "if all resources" earned their opportunity cost or a use forgone.

Financial Analysis focuses on determining the accounting cost (cash and non-cash), profitability or change in equity, and repayment capacity of the enterprise or business being evaluated.

Financial Costs include cash costs, depreciation, and non-cash adjustments, such as accounts payable, accrued interest, etc. These costs are recorded and reported in the business accounting system. The financial cost does not include opportunity cost of resources like lease equivalent or owned land and interest on equity capital.

Indirect Costs include asset ownership and operating costs. Depreciation and repair and maintenance of improvements vehicles, machinery and equipment, labor and management, and property tax are examples of indirect costs. Indirect costs continue as the number of cattle increase or decrease. **General and Administrative Costs (G&A)** are included in indirect costs to run the business such as bookkeeping, professional fees for accounting and legal services, dues, utilities, general insurance, office supplies and administrative personnel salary and payroll and benefits. There is management time spent on planning, implementation and marketing issues for the cattle custom feeding retained ownership activity. Indirect cost are also referred to as overhead costs or fixed cost**.**

Owner Operator Labor and Management compensation should be included in the production cost calculation at a level equivalent to the salary required to hire a non-family member to provide an equivalent service. Compensation in excess of this amount must be considered capital distributions in order to reconcile the retained earnings and statement of cash flows. Owner manager costs need to be included in production costs. Leaving it out implies the owner works for nothing.

Profit (Loss). Great care must be exercised in reading reports in the cattle sector labeling the value profit or loss. Most frequently in feedyard and other cattle reporting, these numbers are gross margins (gross revenue minus direct costs) and do not include overhead and owner labor and management costs, which are required to calculate a true profit or return to business equity.

Rate of Return on Equity (ROE) measures the rate of return on equity capital employed in the farm business. The higher this value, the more profitable is the business.

Sunk Cost – is used to describe a cost that has incurred or has taken place that cannot be reversed. At the time to harvest a crop the cost of the seed and fertilizer are sunk costs and are irrelevant in the decision the harvest the crop or not. At the weaning time the costs to produce the calf are sunk costs. These costs do not determine if the weaned calves should be retained or not. It's a question will the added revenue be greater than the added costs from retained ownership in greater than just selling the unweaned calf.

Total Unrealized Sales Value (opportunity cost) is the net sales revenue that is projected if the calves are sold at weaning after shrink and marketing costs. The weight, price and marketing costs are critical in determining net payweight and payweight price.

Yardage cost is used as an expression indirect cost including ownership (depreciation, housing, insurance and interest costs) and operating cost of facilities, repair and maintenance of machinery and equipment, fuel, labor, management, utilities, property tax and general and administrative costs. These costs are and charged head days and grazed. The sum of direct costs and yardage combined with financing cost is **total unit cost**. The "yardage concept" is used for grazing cattle as feedyards use for custom fed cattle.

Key Standardized Performance Analysis (SPA) Reproduction Definitions:

1. **A total female exposed at the beginning of the breeding season is** the number of females in the beginning inventory that are exposed either to bulls or in an artificial insemination (AI) program. The number should correspond to the number on the **beginning date** of the breeding season.

2. **Adjusted exposed females including sales, transfers, purchases of pairs and exposed and pregnant females --** is an inventory of exposed females that results from the beginning inventory plus all the adjustments. This is the most critical number that must be generated by the inventory in the reproduction and production performance measures of the cow-calf enterprise. The accuracy of this value will determine the overall accuracy of the productivity analysis. The key is to carefully monitor monthly inventory maintenance and consistency between operating cycles. This number begins with the beginning inventory on day one of the breeding season, subtracts culls not intended to be bred, as well as sales or transfers out of the breeding herd and adds purchases or transfers in. The net result is used to determine the weaned calf percentage and other production measures of performance.

3. **Number of exposed females that are pregnancy tested** will be the base number used to calculate the pregnancy rate after adjustments. Include females, which were pregnancy tested and sold or transferred out after the breeding season.

4. **Number of females diagnosed as pregnant** is the actual number of the exposed females diagnosed as pregnant. The accuracy of the pregnancy rate improves when all females that are exposed are pregnancy tested. Include females, which were diagnosed as pregnant, but sold or transferred out of the breeding herd after the breeding season.

5. **Pregnancy percentage --** expresses the number of females diagnosed as pregnant as a percentage of the number of exposed females that are pregnancy tested.

6. **Number of females diagnosed as open** is the number of females diagnosed as not being pregnant or the total number pregnancy tested minus those diagnosed as being pregnant. Includes females, which were diagnosed as open but sold or transferred out of the breeding herd after the breeding season.

7. **Pregnancy percent based on exposed females is the key SPA measure** and is the number of pregnant females divided by the adjusted number of exposed females.

8. **A pound weaned per exposed female is** a very important measure of performance for producers selling weaned calves. It is calculated by multiplying weaning percent by average weight. Combining weaning weight and reproduction truly measures production.

Reference: Other beef cattle decision aids including SPA
Texas A&M University - Department of Agricultural Economics – Agri-Life Extension
Beef Cattle Decision Aids: http://agecoext.tamu.edu/resources/decisionaids/beef/