2023

Spring Forage Conference

PROCEEDINGS & BIOS

39th ANNUAL SW MISSOURI SPRING FORAGE CONFERENCE
Tuesday, February 21, 2023

AGENDA & ROOM ASSIGNMENTS

(SEE MAP ON BACK)

8:00 - 8:45 am - CHECK-IN & VISIT TRADE SHOW

SESSION A (8:45 AM - 9:30 AM)	ROOM	SPEAKER
(A1) Cow Size: Where do we go from here? **REPEATED AT 1:45 PM**	East Grand	Dr. Amanda Holder, Assistant Professor, College of the Ozarks
A2) What does hay really cost? **REPEATED AT 1:45 PM**	Maui	Dr. Darrell Peel, Charles Breedlove Professor of Agribusiness Extension Livestock Marketing Specialist, Oklahoma State University
(A3) Could custom grazing stockers be an option to compliment my cow calf operation?	Coco	Jason Salchow, DVM - Grazier, Veterinarian & Teacher
(A4) Importance of Phosphorus and Potassium for Pasture Systems	Fiji	Dr. Will McClain, Associate Professor, Missouri State University
(A5) Adding Value to Sheep & Goats; Marketing Directly to Consumers	Kalahari	Jennifer Lutes, Ag Business Specialist, MU Extension

9:30 - 10:15 am – BREAK & VISIT TRADE SHOW

SESSION B (10:15 AM - 11:00 AM)	ROOM	SPEAKER
(B1) Living with Tall Fescue **REPEATED AT 2:45 PM**	East Grand	Dr. Ken Coffey, Professor, University of Arkansas
(B2) Producer Panel: Managing the Spring Flush and Forage Platform **REPEATED AT 2:45 PM**	Maui	Robert Salmon, Salmon Ranch & Steve Freeman, Woods Fork Cattle Company
(B3) Tapping into Your Clover's Potential	Coco	Tim Schnakenberg, Agronomy Specialist, MU Extension
(B4) Annual Cost of Keeping a Cow and Raising a Calf	Fiji	Dr. Joe Horner, Agricultural Economist, University of Missouri
(B5) Producing Sheep Adapted to Your Environment	Kalahari	Jeremia Markway, Owner & Operator of Markaway Ranch

11:00 - 11:30 am – BREAK & VISIT TRADE SHOW

11:30 AM - LUNCHEON - Grand Ballroom
Welcome -- Jamie Johansen, Emcee

Keynote Address

Connecting the dots. Putting it all together in the pursuit of profit.

John Locke, Managing Partner of Locke Division, J.D. Hudgins, Inc.

1:15 - 1:45 pm -- BREAK & VISIT TRADE SHOW

SESSION C (1:45 PM - 2:30 PM)	ROOM	SPEAKER
(C1) Q & A with John Locke	Grand	John Locke, Managing Partner of Locke Division, J. D.. Hudgins, Inc.
(C2) **(Repeat)** What does hay really cost?	Maui	Dr. Darrell Peel, Charles Breedlove Professor of Agribusiness Extension Livestock Marketing Specialist, Oklahoma State
(C3) **(Repeat)** Cow Size: Where do we go From Here?	Coco	Dr. Amanda Holder, Assistant Professor, College of the Ozarks
(C4) Low Stress Livestock Handling Facilities	Fiji	Shawn Deering, Field Specialist in Livestock, MU Extension
(C5) Market Outlook for Sheep & Goats	Kalahari	Jennifer Lutes, Ag Business Specialist, MU Extension

2:30 - 2:45 pm – BREAK

SESSION D (2:45 PM - 3:30 PM)	ROOM	SPEAKER
(D1) **(Repeat)** Living with Tall Fescue	Grand	Dr. Ken Coffey, Professor, University of Arkansas
(D2) **(Repeat)** Producer Panel: Managing the Spring Flush and Forage Platform	Maui	Robert Salmon, Salmon Ranch & Steve Freeman, Woods Fork Cattle Company
(D3) Ideal Calving Season for Southern Missouri	Coco	Dr. Jordan Thomas, Assistant Professor, University of Missouri
(D4) What Do Cattle Buyers Really Want	Fiji	Skyler Moore, Owner of Joplin Regional Stockyards
(D5) How to Graze Sheep Year Round	Kalahari	Jeremia Markway, Owner & Operator of Markaway Ranch

3:30 pm ADJOURN

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Choosing cow size for your cattle herd

Dr. Amanda Holder, Assistant Professor, College of the Ozarks

Bio:

Dr. Amanda Holder is an assistant professor of animal science at College of the Ozarks. Dr. Holder graduated from College of the Ozarks in 2015 with a double major in agronomy and agriculture business and is now in the middle of her first year teaching at her alma mater. She earned a Master of Science degree from the University of Arkansas in Fayetteville where her research focus was genetic resistance to fungal pathogens in wheat before continuing her education at Oklahoma State University where she earned her PhD in ruminant nutrition. Her doctoral research evaluated the impact of diet quality on intake, greenhouse gas emissions, gene expression, and production measures in mature beef cows.

Summary of Presentation:

Several factors influence the overall maintenance requirements of a mature beef cow including age, gain, lactation, pregnancy status, environment, and fleshing ability among others. In an effort to estimate forage needs for a herd, mature cow size is typically used as an indirect measure of forage required per cow. The benefit of using mature weight as an indicator of feed intake is the ease of data collection. Mature weight is much easier to determine than direct measurement of forage intake on pasture. However, there isn't always a strong correlation between cow mature weight and calf weaning weight. Simply put, in any herd there will be small cows that wean a large calf and large cows that wean a small calf, and the opposite is true as well due to individual differences in efficiency. Setting these individual efficiency differences aside, there is a weak positive relationship between mature size and weaning weight of calves as well as a stronger correlation between mature size and feed intake. Previous research has determined that for each additional 100 pounds of mature weight, calf weaning weight increased by 6.7 pounds. In 2016, Beck et al. indicated that this relationship was 19 pounds for each 100 pounds of additional cow weight and more recent data from North Dakota (Ringwall, 2017) documented a 28-pound increase in calf weaning weight. Climate and management practices likely have substantial impact on this relationship. Based on these results, we assume that cows in a limiting environment will wean less calf weight per added 100 pounds of cow weight. In less restrictive environments the relationship will likely be at the upper end or closer to 28+ pounds per 100 pounds of added cow weight. "Less restrictive" can be interpreted as higher quality, more abundant forage throughout the growing season, lower stocking rate (allowing the cattle to select a better-quality diet), more harvested forage feeding, more supplementation, more winter annual grazing, less heat or cold stress, less parasite exposure and so on.

What does hay really cost

Dr. Derrell S. Peel
Charles Breedlove Professor of Agribusiness
Agricultural Economics Department
519 Ag Hall
Oklahoma State University
(405) 744-9816

Derrell Peel is the Charles Breedlove Professor of Agribusiness in the Department of Agricultural Economics. He has served as the Extension Livestock Marketing Specialist since he came to Oklahoma State University in 1989. He has B.S. and M.S. degrees from Montana State University and a Ph.D. from the University of Illinois. He previously served as the Superintendent of the Southeastern Colorado Range Research Station in Springfield Colorado. His main program areas at Oklahoma State University include livestock market outlook and marketing/risk management education for livestock producers.

Derrell also works in the area of international livestock and meat trade with particular focus on Mexico and Canada and the North American livestock and meat industry. He lived in Mexico on sabbatical in 2001 and has developed an extensive knowledge of the Mexican cattle and beef industry and the economics of cattle and beef trade between the U.S. and Mexico.

Could custom grazing stockers be an option for me as a compliment to my cow calf operation?"

Jason Salchow DVM - Grazier, Veterinary & Teacher

Dr. Jason Salchow grew up on beef farm in Christian County, Missouri. He earned an Animal Science degree from Southwest Missouri State University in 1996. He then graduated from the University of Missouri, College of Veterinary Medicine in 2001. After graduation, he returned home to work in a mixed animal practice and to establish a grass farm. His start in custom grazing was in 2001 with contract dairy replacement heifers. In the fall of 2003, he left mixed animal practice to devote more time to his family and to develop several agriculture enterprises. Jason also teaches the Veterinary Science course at Missouri State University, and facilitates a hands-on lab for Animal Science students at Four State Stockyards, at Exeter. His family uses various grazing systems on owned and leased ground to be very flexible with class of livestock and seasonality. Recently, most custom grazing has been on stocker calves, replacement heifers, and forage developed breeding bulls. Their goal is to continue to improve the soil and forages the Lord has given them to steward and to develop and cultivate relationships with livestock owners and investors. His wife Sharon tries to keep Jared (21), Jenna (19), Josie (16), Jeremiah (9), Jonathan (7), and the entire operation held together to the best of her ability.

Importance of Phosphorus and Potassium for Pasture Systems

Dr. Will McClain, Associate Professor, Missouri State University

Will McClain, PhD
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Sheep and Goats:
(1) Adding value by direct marketing
(2) Market Outlook

Jennifer Lutes
Field Specialist in Agriculture Business
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Jennifer Lutes is a Field Specialist in Agricultural Business & Policy with the University of Missouri (MU) Extension. While located in McDonald County, Missouri, her work extends across the state. With a background in Agricultural Economics and Animal Sciences, Mrs. Lutes works with farms and agricultural businesses to improve their economic outlook and thus improve their families for generations to come.

Jennifer has a deep understanding of sheep and goat production practices and how they relate to farm profitability. In addition to farm level production, Mrs. Lutes also studies state, national, and international sheep and goat markets to provide market expectations for local producers.

In addition to her work with sheep and goats, Mrs. Lutes is the team lead for MU Extension's Value-added Meats team that works closely with farmers and meat processors to expand local meat options in Missouri. The work of expanding the local processors is a new passion for Mrs. Lutes.

She understands typical profit margins for livestock producers and expanding local meats is one way to improve these margins; diversifying the farm with multiple livestock species is another. Combining livestock diversification and multiple marketing streams helps to provide financial resilience to Missouri's livestock farmers.

Market Outlook for Sheep and Goats

The sheep and goat markets experienced all time highs this past year. The market outlook session will provide insight to where the markets might go based on market trends. Will we record new all time highs this year? Come find out!

Adding Value to Sheep & Goats; Marketing Directly to Consumers

Sheep and goats have more to offer than meat, milk and fiber! This presentation will discuss how sheep and goat producers might add value to their products by using 4 Ps of marketing. We will discuss: picking the right products to sell, pricing your products, how to choose a market, and how to promote your brand and products. Lastly, we will talk about what skills you might need to be successful and how to develop those skills.

Living With Tall Fescue

Dr. Ken Coffey, Professor, University of Arkansas
Professor
Undergraduate Program Coordinator
(DREX)-Director Experiment Station
(ANSC)-Animal Science
Phone: 479-575-2112
Email: kcoffey@uark.edu

Education & Degrees
PhD degree in 1986 from the University of Missouri – Research emphasis - Ruminant Nutrition

MS degree in 1983 from the University of Kentucky – Research emphasis - Ruminant Nutrition

BS degree in 1980 from the University of Tennessee – Major, Animal Science

Much of the tall fescue in the US contains a fungus that produces compounds that are toxic to livestock. There are many "solutions" to tall fescue toxicosis that look promising in one way or another. Unfortunately, most of these have not proved effective when evaluated in actual research trials. Tall fescue containing fungii that do not produce the toxic compounds are available commercially, but many producers are reluctant to renovate because of expense, topography, or uncertainty about persistence. In those instances, producers can assess where tall fescue is costing them the most based on a large amount of research, and piece together multiple management and supplementation options to reduce the impacts of the toxins.

Robert Salmon, Salmon Ranch

Bob and Susan Salmon, own and operate Salmon Ranch in northern St Clair County, Missouri. Out of necessity in 1987 Bob embarked on a journey to improve his grass management. The goal being consistent profitability with the main input being labor. "We have no money therefore we must THINK". After over 30 years of diligent observation and a willingness to change and adapt to various situations caused by weather, markets, etc he has developed a management style that is flexible, sustainable, and most importantly, always PROFITABLE.

This operation consists of a fall calving cow herd and a spring lambing ewe flock. Bob also raises and trains Border Collies in his "spare time".

As well as the income to raise four children, this operation has afforded Bob the opportunity to be active in his community. He has served on the local school board, church council, State and county cattlemen's association boards, Partners in Pasture grazing group, and is currently serving as St Clair County Presiding Commissioner.

Steve Freeman, Woods Fork Cattle Company

Steve Freeman and his wife, Judy, are the owners and managers of Woods Fork Cattle Company LLC, a 200 cow/calf and stocker operation in Wright County, Missouri. Steve has been active in agriculture since 1978 when he and Judy purchased their first farm and handmilked 30 dairy goats in a grade C dairy along with training Border Collies for stock work. They moved to their present farm in 1987 where they implemented one of the first managed grazing systems in the county. Over the last thirty years they have grazed different classes of livestock including sheep, goats, stocker cattle and cow/calves, and evolved the grazing system to the present one which usually consists of once a day moves of varying stock densities with cow/calf pairs, retained stockers and breeding heifers. Steve has been a board member and past president of the Missouri Forage and Grassland Council and is a proud member of the Top of the Ozarks Grazing Group, a grassroots organization of graziers in South Central Missouri. Steve also enjoys his once-a-week geezerball (old man basketball) games, coaching baseball and reading.

Steve Freeman - Proceedings
Four Season Pasture Management

In most of Southern Missouri, managing forage for a cow/calf operation means managing KY31 endophyte infected fescue. KY31 fescue is not a native grass to the Ozarks - but it sure thinks it is! Since we no longer make hay, our challenge in managing forage year round is how do we graze to best utilize what grows on our place without a lot of added inputs. The cow/calf business is rarely so profitable as to allow a lot of money to be thrown at problems, so the challenge is to work with what forages the farm produces - and a lot of that forage is KY31 fescue. Our forage management plan is to breed and graze animals that fit the farms' grass and climate, and to learn to manage the grazing so the cattle are able to utilize those forages well enough to be profitable.

Since having a calf to sell every year is a cow's most important trait for profitability it's necessary for the cows to calve and breed back quickly every year on the forage we grow under our grazing management. Our yearlings are kept to utilize the spring flush of grass and take advantage of the compensatory gain available before selling them as feeder cattle to be grass finished elsewhere. The stockers need to grow well, but they are not on forage that has them growing to their maximum potential (annuals, alfalfa, etc.) but rather excess grass that varies in quality according to the year. We don't look for "holy cow" weaning and yearling weights but optimal and adequate weaning and yearling weights that can be accomplished with nothing more than good grass and good management and will vary from year to year depending on growing conditions.

Twenty years ago, when we ceased to put up hay on our farm, we saw my greatest fear and enemy rear its ugly head - seed heads - as well as out of control grass growth! We had always managed with the idea to keep the forage vegetative and seed head free for as long as possible. However, once we quit making hay on our farm and despite using practices geared to give us more mouths to graze in spring, we found we still couldn't control the excess growth. With so many more acres to graze we found ourselves grazing many paddocks the second time through in the spring that were much taller than we were accustomed to seeing. What was really odd is the train didn't come off the tracks when the cows grazed this taller forage - in fact they seemed to prefer it, and showed this preference with the contentment we often lacked when grazing shorter, tighter rotations where the cows often met me at the gate, bawling, to be moved. This observation led us to question our grazing management, and with time, to reset our idea of what pasture should look like when we turn cows into graze.

What we found necessary was to change our "grass eye" and become used to working with a different height and growth level of grass. When one is used to turning in livestock at 6-8" tall and pulling them out at 2-3", it becomes a bit of a shock to wait until the forage is 10-20" tall to turn them in, and to move them off the grass at the height at which you are used to turning them in to graze. It's a reset, and both our eyes and our minds have difficulty with changes like this. With time, we began to see some real benefits from this "taller grazing" and now strive to be grazing grass tall and leaving plenty of grass behind. The benefits we've seen are not only to the cows, but to the grass, soil and wildlife on the farm. Benefits include:

- Moisture retention: Not only capturing and keeping more rainfall, but when it's dry, it's amazing how much the shading of the soil and retention of heavy dews by tall grass helps to keep soil moist.
- Digestion: Cows rarely have the high protein "rocket blast" type of manure we used to see in spring grazing. Cattle are content.
- Wildlife: Birdlife has increased dramatically - even on fescue based pastures, we see prairie birds like Dicksessels, Bobolinks and Meadowlarks.

- Diversity: We don't know all the variables that go into creating a diverse paddock, but do know that since we went to taller grazing, the diversity has increased.
- Longer Growing Season: The pastures seem to stay much greener going into winter and begin growing earlier in the year than they used to do. This may be because the taller grazing is beneficial to the soil biology and allows it to stay active later and earlier in the year with its protective cover.

We find a combination of leaving plenty of residual grass behind and moving cattle every day are the keys to keeping our grass growth humming. Our motto is, "it takes grass to make grass"

Season by season grazing. You will notice I use the word "strive" quite a bit in the following description of our grazing. We always start the year with the "perfect plan" - then manage the reality of a business that has a lot of variables throughout the year.

Spring:

This is the time of year that we have the least control of the forage and also the time of year that often makes the most difference in the financial results for our farm, as most of the pounds gained by stockers and the pregnancy rate of the cows is determined by how well we manage the spring flush of grass.

We strive to manage the abundant spring growth so that cows put on weight before and after calving and into the breeding season, to ensure a high breed back percentage in a short breeding season. We also want to put as much weight on stocker calves as possible, using only the spring flush of grass and grazing management, before we hit the usual flattening forage growth curve of summer.

Early spring we always hope to have the cattle grazing forage stockpiled from the year before. We also aim to set up a sequence for spring grazing with a grazing plan in the fall that allows both good fall tillering and a remaining height (6-12") that allows the grass to grow quickly in the spring. We then graze taller plants (8-12") as we move through the paddocks in the spring.

Our cows calve in a short window between mid-April and the end of May, and during this time we continue to move the herd daily, but at fairly low densities (20-30,000# per acre per day). This allows the cows to graze the upper part of the grasses but also leaves a fairly large amount of grass behind. Grazing in this lax manner gives the cows the very best nutrition and allows them to gain weight even after calving and going into breeding season. We are also grazing the stockers at similar densities during this period which allows them to "cream" the best. We are trying to take advantage of the high quality grass and move the cattle quickly over the whole farm before the grass goes to reproduction.

We also wonder if the increase we see in summer annual forbs and grasses, as well as orchard grass, brome and other cool season grasses, may be because they are better able to compete against the KY 31 fescue if given a chance to grow taller, rather than when we grazed much shorter and tighter. However, there are times, either by plan or error, where we will graze shorter, and we think this may help seeds of other plants, besides fescue, to germinate and compete. If planned this will be done in the early part of the grazing season before the heat and sun of summer will dry out soil without enough protective cover.

When we first started grazing the whole farm after we quit haying, and we had so much grass ahead of the cows in the spring, we found if we didn't graze all the acres at that time, the grass we missed went into reproduction and produced poorly, and was, of course, of very poor quality. So while we graze taller, we do want the first grazing of the grass in each paddock to be well before it reaches reproduction. As we

transitioned to taller grazing, we saw unexpected accelerated growth and lack of seed heads in certain pastures that we couldn't explain. While reading a chapter in Jim Howell's book "For Love of Land", I came across Dr. Lewellyn Manske's 30 years of research on cool season grass growth.

Dr. Lewellyn Manske research (https://www.grassfednetwork.com/manske-july-2011/) indicated that taking 25-30% of the leaves on first grazing (after grasses reaches 3 1/2 leaf to flowering) stimulates new tillers and compensatory growth as well as suppressing seed head production and gave us some answers to what we observed in our own paddocks..

Dr. Manske calls this **"Defoliation Resistance Mechanisms"**

"The compensatory physiological processes within grass tillers are activated following partial defoliation at phenological growth stages between the three and a half new leaf stage and the flower stage

Grass plants are known to exudate sugars, amino acids, glycosides, and other compounds through the roots into the soil. Partial defoliation at vegetative growth stages causes greater quantities of grass plant exudates to be released into the narrow zone of soil surrounding living roots. I have discovered that when grass tillers were partially defoliated between the three and a half new leaf stage and the flower stage, the rhizosphere volume increases greatly."

Further, my understanding of this concept is defoliating a third or less of the plant at this stage of spring growth allows the plant to increase it's new tillers by reducing the amount of a hormone, auxin, in the lead tiller, which allows the growth hormone cytokinin to activate and stimulate new tillers and helps to delay the plant from going to reproduction. At the same time, this increases the rhizosphere activity that helps to feed and allow more growth for the new tillers.

Summer:

We turn bulls in for 42 days in July-August and expect 90-95% of the cows to breed at this time. If we were grazing strictly infected KY31 fescue and clover in July and August, those expectations would be unrealistic. Though we have selected for heat and fescue tolerant cattle for almost 25 years, we have found it takes both adapted cows and alternative grasses and forbs to help dilute the effects of fescue for this summer breeding management practice to work well. We rely a lot on diversity growing in our cool season pastures for summer grazing and we refer to our summer grazing as "grazing fescue without grazing fescue". Moving the herd daily ensures matching cows to acres so the cattle don't have to eat much fescue - instead grazing the diversity of grasses and forbs in the sward and more or less trampling the fescue. It's not hard to keep them from eating fescue as it's always on the bottom of the list of preferred eating at this time of year. We think our cattle learn to eat bitter or high tannin forbes because when the choice is midsummer toxic fescue or a weed high in tannin, they *learn* to like tannins.

The diversity of forages in our paddocks will include:

- Johnsongrass - We love it almost as much as the cows! Seems to thrive in our fescue based pastures. We have had no problems with it in the ten years since it began showing up in our paddocks.
- Red Clover
- Lespedeza
- Giant Ragweed - A native in the sunflower family and is much different than the Lanceleaf or Common ragweed. Giant Ragweed is a good forage to have in the summer.

- Bromegrass - We never overseeded or planted brome but it's showing up regularly in some of our pastures.
- Chicory - Ours is native and in some of our grazing cells it's abundant. Very palatable before flowering and can provide a lot of grazing. High in vitamins and minerals.
- Broadleaf Plantain - Native herb with very large leaves in the spring. First thing cows will graze in a new paddock. Much bigger than the Buckhorn plantain (toe stubbers).
- Matua Bromegrass - when we overseed red clover and lespedeza we often include Matua Brome. It's an extremely palatable grass, greens up early and makes lots of seed. Also helps control the flow of the smaller seeds through the broadcast seeder.

We're not sure what management practices have had the biggest effect on the diversity we often see in the summer pasture, but it seems all of them may contribute. We don't apply fertilizer, and consider our hay purchases as our added fertility program. We graze taller and think this may be allowing other grasses/forbes to compete well with KY31 - but then at times, when we go a long time on a paddock without ever taking it down shorter, we see KY31 come back to dominating the mix. The challenge for a grazier is that because we are dealing with biology and there are so many variables, it's difficult to ever be set in one's conclusions.

Native Warm Season grasses- Natives would seem to be an answer for much of our toughest management problems, those being summer and early fall. While we have about 40 acres of natives and are converting another 70 acres, it really is something we wish we had done years ago. Running high stocking rates has made it difficult to pull acres out of production for the conversions, and yet we think the long term return from native grasses would offset the short term loss of revenue from lower sales during the time of conversion. A case of short term goals overriding long term goals and vision.

Fall:

Early fall is often our toughest grazing season and we have not had great success with any of our management decisions. Often, the annual warm season grasses and forbs are finished growing and the fescue, along with its endophyte and ergovaline, is starting to come to life again and dominate the mix making it tough for the cows to find much diversity. On top of that, if it rains and the fescue and other cool season grasses become very lush, we see cows doing poorly on what looks like perfect, lucious fall grass, which may be caused by too much non-protein nitrogen.
https://forages.oregonstate.edu/regrowth/how-does-grass-regrow/management-scenarios/can-pastures-be-too-lush

Something we have recently tried is to full feed hay during the early fall season, sometimes for all of September. We hope to avoid some of the problems mentioned before - high levels of the ergovaline in the fescue and NPN. But we think most importantly, by feeding hay during this time we are allowing fall grasses to grow as much as possible for both increased forage in the late fall and winter and to ensure the grasses have a chance to tiller well heading into winter. This also allows us a better opportunity to start a fall grazing wedge that will then become the spring grazing wedge by having adequate fall regrowth. We want to have plenty of grass for spring grazing so that we are not grazing short, new growth grass, but instead grazing a mix with taller, higher quality, better balanced (protein to energy) forage with at least 6"-12" of leaves already in place.

Winter:

In an ideal world, we would be grazing stockpiled fescue all winter. It's fairly easy to do in the Ozarks if you have enough stockpile and flexibility in your stocking numbers. When we leased ground, we managed at least one winter with no hay fed at all. However, we find on owned ground we often make more net income by running a higher stocking rate and buying hay for winter to offset and even out the ups and downs of a grazing year. However, purchased hay is our largest expense and one we really need to keep in balance with the higher stocking rates in order to be profitable. This expense definitely has a tipping point where, if wrong decisions are made, it can wipe out profitability.

We plan for most of the stocker cattle to be gone by August, which lowers our fall stocking rate and allows longer rotations. We drop some of the paddocks out of the rotations completely, and, as mentioned previously, have recently been feeding hay in September to allow more fall growth for stockpiling. If we have sufficient early fall rains, this works well. Come December when fall growth slows down, we calculate how much stockpile/grazing we have for winter and early spring and feed hay accordingly. We try to avoid grazing until we run out of grass. So, in December if we calculate we have 60 days of stockpile, we will feed hay in January/February, even with 60 days of stockpile left, in order to save the stockpile for February through March and early April. It seems cattle almost always do better grazing than they do eating hay, so we would prefer to feed hay early and have the cows grazing stockpile in March and April, when their nutritional needs are higher.

Our winter grazing is highly dependent on fickle fall rains and in 5 out of the last 6 years we have missed early fall rains, which has cut back our stockpiled winter feed and forced us to feed more hay than budgeted- decreasing our net income. Since this seems less like happenstance and more like a pattern, we are making some adjustments in stocking rate - lowering our cow numbers and bringing in more stockers in late winter to run with our home raised yearlings to graze through July and August before being sold. We are also thinking we may need to begin dropping paddocks out of the rotation earlier to begin stockpiling. Maybe even start stockpiling in June instead of waiting for August - which may lower the quality of the stockpile for winter grazing but our cows don't begin calving until the 2nd week of April, so their winter nutritional needs are lower. We are more interested in quantity than quality in January and February.

A new practice we have been trying for the last few years is bale grazing. Our stockpile is low this year so we will feed one half to one third of the needed DM for the cows as hay, while the rest will come from grazing the stockpile. It's an attempt to stretch out our grass and better balance either low quality hay or low quality stockpile. If the stockpile is high quality, we feed our lower quality hay and vice versa.

So in the end our goals are pretty simple - to breed animals adapted to our farm and forage, and for us to be constantly trying to learn how best to manage the grazing so the cows can utilize the forages well enough to be profitable.

You'll find more information on some of these topics at the following links.

Dr. Lewellyn Manske
https://www.ag.ndsu.edu/dickinsonrec/grazing-handbook-files/4015-part-3-web.pdf

Abe Collins - grazing taller -
https://rodaleinstitute.org/blog/grazing-taller/

Jim Howell = For Love of Land. https://www.goodreads.com/book/show/10794746-for-the-love-of-land

Non Protein Nitrogen causes problems in lush cool season grasses.
https://aces.illinois.edu/news/lush-green-grass-presents-nutritional-challenges-cattle

Tapping into your Clover's Potential

Tim Schnakenberg, Agronomy Specialist, MU Extension

University of Missouri Extension; Stone County Extension Center
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Galena, MO 65656
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Tim Schnakenberg serves as University of Missouri Extension field specialist in agronomy specialist based in Stone County. He is one of three field specialists in agronomy serving the southwest region of Missouri. He has worked as a field specialist in agronomy since 1991 and currently focuses on pasture and hay management, forage development and improvement, crop production, pest management, pesticide training, soil fertility and health and soil conservation. Ongoing educational efforts include Livestock and Forage Conferences, regional hay production schools, regional grazing schools, farm tours, on-farm demonstrations and pesticide applicator training.

Annual Cost of Keeping a Cow and Raising a Calf

Dr. Joe Horner, Agricultural Economist, University of Missouri

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Columbia, MO 65211-6200
573-882-9339 (Office)
HornerJ@missouri.edu (email)

Joe Horner is an agricultural economist for University of Missouri Extension. In his position he assists producers in analyzing farm finances, creates informal adult educational opportunities and assists in projects that strengthen Missouri's dairy and beef industry. Horner has worked for extension for 34 years and is originally from Southwest Missouri.

Annual Costs of Keeping a Cow and Raising a Calf

- Joe Horner
- Agricultural Economist
- MU Extension

Extension
University of Missouri

What does it cost you to take care of a beef cow for a year?

Survey Question

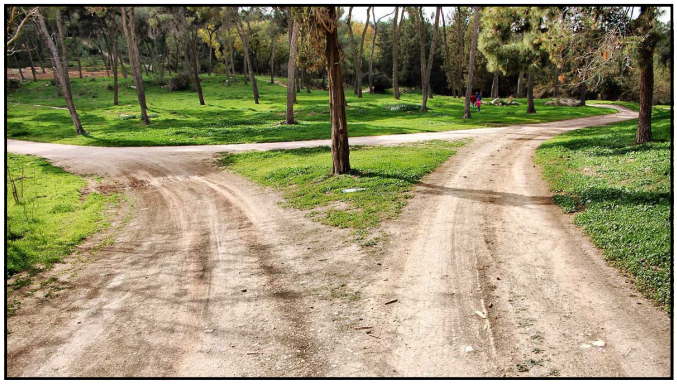
A. Less than $500
B. $500 to $750
C. $750 to $1,000
D. Greater than $1,000

What does it cost you to take care of a beef cow for a year?

The Average Answer is….

$939.85

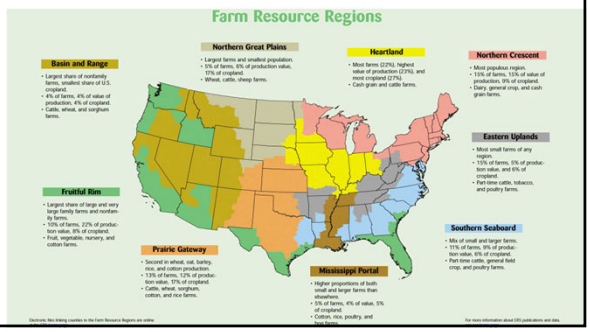
Source FINBIN, total direct & overhead expenses, multiple states, 199 actual farms.



Who collects this info?

USDA - Economic Research Service	• *ARMS survey for cost of production estimates*
Extension Services	• *Enterprise budgets estimated for states*
Farm Business Management Associations (FBMA)	• *Enterprise costs collected from member farms. Portion of data utilized by FINBIN*
FINBIN	• *Database that summarizes FBMA data across the country*

USDA cow-calf estimates



Operating costs per cow, 2021

Income/Cost Category	Eastern Uplands Region (Southern Missouri)	Heartland Region (North Missouri)
Purchased feed cost	93.58	102.36
Homegrown harvested feed	261.81	274.88
Grazed feed	88.41	116.31
Total feed costs	443.80	493.55
Total operating costs (excluding labor)	**642.64**	**630.37**
Income over operating costs	42.35	43.40
Beef cows on the Farm	**75**	71

Source: USDA, Economic Research Service using data from USDA's Agricultural Resource Management Survey and other sources

Cow-calf allocated overhead per cow, 2021

Allocated Overhead Cost Category	Eastern Uplands Region (Southern Missouri)	Heartland Region (North Missouri)
Hired Labor	34.75	23.63
Opportunity cost of unpaid labor	660.36	487.75
Capital recover of machinery	353.84	359.20
Opportunity cost of land	2.04	3.51
Taxes and insurance	27.63	30.96
General Farm Overhead	45.13	51.48
Total, allocated overhead	1,123.75	956.53
Total Operating & Allocated Overhead	1,766.39	1,586.90

Source: USDA, Economic Research Service using data from USDA's Agricultural Resource Management Survey and other sources

University Extension Services

Enterprise budgets by state

Missouri cow/calf enterprise per cow, 2023

Extension
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Item	South Missouri Fall calving	South Missouri Spring calving
Income		
Steer calf sales	535.55	519.55
Heifer calf sales	446.25	433.14
Cull cow sales	120.00	140.00
Total income/cow	**1,101.80**	**1,092.69**

Note: Steers weigh 590 pounds, heifers 550 pounds, 88% calf crop. Steers Fall Calving $206.30, Heifers $184.40

Source: University of Missouri Extension (https://extension.missouri.edu/g679)

Missouri cow/calf enterprise per cow, 2023

Extension
University of Missouri

Item	South Missouri Fall calving	South Missouri Spring calving
Operating Costs		
Pasture (rental rate)	168.32	168.32
Hay, mineral and purchased feed	372.86	314.86
Labor (8 hours/cow)	143.36	143.36
Veterinary, drugs, supplies	37.50	37.50
Marketing	27.55	27.32
Utilities/machinery/facility repair	128.32	118.36
Cow replacement/breeding stock	240.50	277.50
Other operating expenses	81.02	78.82
Total operating costs	**1,197.76**	**1,166.04**

Source: University of Missouri Extension (https://extension.missouri.edu/g679)

Missouri cow/calf enterprise per cow, 2023

Item	South Missouri Fall Calving	South Missouri Spring Calving
Total operating costs	1,199.43	1,166.04
Total ownership costs	182.10	184.87
Total costs	1,381.53	1,350.91
Income over operating costs per cow	(97.63)	(73.35)
Income over total costs per cow	(279.73)	(258.22)

Source: University of Missouri Extension (extension.missouri.edu/g679)

Kansas cow/calf enterprise per cow, 2023

Item	Per cow
Gross income	1,286.56
Operating costs	1,268.01
Ownership costs	190.00
Total costs	1,458.01
Income over operating costs per cow	**18.55**
Income over total costs per cow	**(171.45)**

Source: Kansas State University (www.agmanager.info)

Arkansas cow/calf enterprise per cow 2019

Item	Produce hay Fall Calving	Produce hay Spring Calving
Gross income	625.33	633.78
Operating costs	280.04	280.38
Ownership costs	377.23	377.23
Total costs	657.26	657.60
Income over operating costs per cow	345.29	353.40
Income over total costs per cow	(31.94)	(23.83)

Source: University of Arkansas (https://www.uaex.uada.edu/farm-ranch/economics-marketing/farm-planning/budgets/livestock-budgets.aspx)
Note: Operating costs include no charge for labor
Ownership costs include no charge for land rent

Oklahoma cow/calf enterprise per c 2022

Item	Spring calving per cow
Gross income	775.03
Operating costs	901.00
Ownership costs	188.08
Total costs	1,089.08
Income over operating costs per cow	**(125.97)**
Income over total costs per cow	**(314.05)**

Source: Oklahoma State University (http://agecon.okstate.edu/budgets/)

Missouri Farm Business Management Analysis (FBMA), $ per cow

	2021	2020	2019
Number of farms	19	18	20
Direct expenses			
Feed	471.32	408.12	363.26
Veterinary	4.86	6.65	12.07
Fuel and oil	46.50	32.89	24.33
Repairs	59.44	46.71	44.24
Hired labor/contracting	29.47	15.69	9.86
Total direct expenses	**591.60**	**516.16**	**459.30**
Overhead expenses	**183.12**	**144.21**	**143.44**
Labor and management charge	**118.95**	**108.35**	**83.66**
Net return	**(161.68)**	**(176.48)**	**(120.89)**

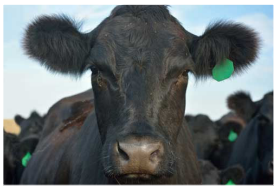
Source: FINBIN (https://finbin.umn.edu/FinB.dll/generate?RecId=816510)

FINBIN Actual records, multiple states, by herd size

Direct Expenses	Average Farm	Up to 50 Cows	50-100 Cows	100-200 Cows	200-500 Cows	>500 Cows
Protein & Mineral	33.17	48.99	40.63	41.52	21.47	21.80
Corn	18.24	24.88	15.57	20.77	10.95	28.84
Silage	50.12	39.76	43.56	70.91	36.82	58.82
Hay	194.78	296.10	233.34	183.44	172.91	133.39
Pasture	102.56	56.35	73.59	87.08	144.18	109.51
Other feed stuffs	62.67	61.38	51.04	51.66	80.79	56.83
Veterinary	32.22	33.86	30.22	32.16	32.05	33.99
Supplies	13.14	26.24	17.51	11.60	8.30	11.09
Fuel & Oil	25.35	38.11	25.70	27.53	22.32	17.13
Repairs	56.60	69.35	53.28	48.52	59.55	58.95
Hired Labor	20.07	3.60	12.85	17.42	28.95	27.29
Total Direct Expense	**639.77**	**748.76**	**622.19**	**635.17**	**642.17**	**573.78**
Total Direct & Overhead	**805.82**	**952.07**	**805.89**	**802.85**	**803.09**	**694.17**

https://finbin.umn.edu/FinB.dll/generate?RecId=816513

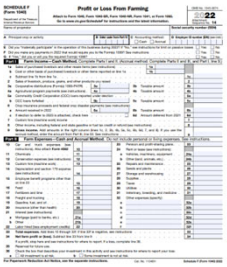
Who do you believe is right?



Survey Question

A. USDA – Economic Research Service
B. University Extension Services
C. Farm Business Management Association
D. FINBIN

Best Source



1 minute effort
Divide line 33 by herd size

15 minute effort
Divide line 10 thru line 30 by herd size

1 hour effort
Divide each cost in your records by herd size, calves sold, pounds of beef sold

How do you figure your costs to keep a cow?

Survey Question

A. In my head
B. Analyze tax records
C. Record keeping software
D. I don't know, care or plan to track my costs

How should we figure costs?

Survey Question

A. Per cow
B. Per calf sold
C. Per pound of calf sold

Summary

YOUR numbers are your farm's best resource!

Southern Missouri Beef Cow-Calf Planning Budget

Using this planning budget, beef cow-calf farmers may estimate their costs and returns for 2023. Table 1 presents estimates for a cow-calf operation (50-cow herd size and purchased replacements) in Southern Missouri with either a fall or spring calving season. Assumptions were based on price forecasts as of September 2022. Detailed assumptions and feed requirements are summarized in Tables 2, 3 and 4. The production practices used to develop these cost estimates are common in Missouri beef farms. Use the "Your estimate" column to plan your operation's costs and returns for 2023.

Table 1. Southern Missouri beef cow-calf planning budget for 2023.

	Fall calving per cow[1]	Spring calving per cow[1]	Your estimate
Income			
Steer calf sales	535.55	519.55	
Heifer calf sales	446.25	433.14	
Cull cow sales	120.00	140.00	
Total income	1,101.80	1,092.69	
Operating costs			
Pasture (rental rate)	168.32	168.32	
Feed, mineral and stored forage	372.86	314.86	
Labor	143.36	143.36	
Veterinary, drugs and supplies	37.50	37.50	
Marketing	27.55	27.32	
Machinery and utility costs	128.32	118.36	
Livestock facility repairs	8.50	8.50	
Cow replacement	240.50	277.50	
Bull cost	35.00	35.00	
Professional fees (legal, accounting, etc.)	1.00	1.00	
Miscellaneous expense	6.00	6.00	
Operating interest	30.53	28.33	
Total operating costs	1,199.44	1,166.04	
Ownership costs			
Depreciation on facilities and equipment	9.10	9.10	
Interest on breeding stock, facilities and equipment	134.58	136.99	
Insurance/taxes on breeding stock and capital items	38.41	38.78	
Total ownership costs	182.10	184.87	
Total costs	1,381.53	1,350.91	
Income over operating costs	**-97.63**	**-73.35**	
Income over total costs	**-279.73**	**-258.22**	

[1] Totals may not sum due to rounding.

Written by
Wesley Tucker, Field Specialist, Agricultural Business; **Joe Horner**, State Specialist, Agricultural Business and Policy Extension

Table 2. Income assumptions used in Southern Missouri beef cow-calf planning budget for 2023.

Category	Percent	Weight (pounds)	Price per cwt	Calf crop (percent weaned)	Dollars per cow
Fall calving					
Steer	50	590	206.30	88	535.55
Heifers	50	550	184.40	88	446.25
Cull cows	12	1,250	80.00		120.00
Spring calving					
Steer	50	590	207.20	85	519.55
Heifers	50	550	185.30	85	433.14
Cull cows	14	1,250	80.00		140.00

Abbreviations: cwt = hundredweight

Table 3. Other assumptions used in Southern Missouri beef cow-calf planning budget for 2023.

Selected input quantities	Per unit	Selected input prices	Dollars per unit
Labor, hours per cow	8	Labor cost, per hour	17.92
Fall calving cows replaced, percent	13	Heifer replacement value, per head	1,850.00
Spring calving cows replaced, percent	15	Bull value, per head	3,500.00

Table 4. Feed requirements in Southern Missouri beef cow-calf planning budget for 2023, on a per cow basis.

	Cost per unit	Cow (units)	Calf (units)	Bull[2] (units)	Total units	Total cost per cow[3]
Fall calving						
Pasture, per animal unit equivalent	16.00	10.0[1]		0.5	10.5	168.32
Harvested forage, per pound	0.06875	3,660.0	425.0	200.0	4,285.0	294.59
Protein supplement, per pound	0.15	180.0		7.2	187.2	28.08
Salt and mineral mix, per pound	0.55	91.3			91.3	50.19
					Total	**541.18**
Spring calving						
Pasture, per animal unit equivalent	16.00	10.0[1]		0.5	10.5	168.32
Harvested forage, per pound	0.06875	3,445.5		200.0	3,645.5	250.63
Protein supplement, per pound	0.15	90.0		3.6	93.6	14.04
Salt and mineral mix, per pound	0.55	91.3			91.3	50.19
					Total	**483.18**

[1] Cow and calf requirements are combined for pasture animal unit equivalents.

[2] Bull feed units are based on 4 percent of its total need being allocated to cow-calf enterprise.

[3] Totals may not sum due to rounding.

Farmers can also customize this budget to fit their own operations by using the Missouri Beef Enterprise Tool (extension.missouri.edu/media/wysiwyg/Extensiondata/Pro/Beef/Docs/MissouriBeefEnterprise.xlsx). Download the spreadsheet tool to keep an electronic copy of your cost and return estimates for a cow-calf (spring or fall calving), heifer or backgrounding (drylot or pasture) operation in Missouri.

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Beef Backgrounding Planning Budget

Using this planning budget, beef backgrounders may estimate their costs and returns for 2023. Table 1 presents estimates for steer calves purchased and backgrounded in Missouri. Assumptions were based on price forecasts as of September 2022. Detailed inputs, feed requirements and machinery investments are summarized in Tables 2, 3, 4 and 5. The production practices used to develop these cost estimates are common in Missouri beef farms. Use the "Your estimate" column to plan your operation's costs and returns for 2023.

Table 1. Missouri beef steer backgrounding planning budget for 2023.

	Winter backgrounding per steer[1]	Pasture backgrounding per steer[1]	Your estimate
Income			
Market steer sales	1,585.01	1,511.64	
Less death loss (1 percent)	15.85	15.12	
Total income	1,569.16	1,496.52	
Operating costs			
Purchased steer	1,084.54	1,265.26	
Pasture (rental rate)	0.00	38.22	
Feed, mineral and stored forage	230.79	94.00	
Labor	44.80	26.88	
Veterinary, drugs and supplies	20.00	17.00	
Marketing and hauling	39.63	37.79	
Machinery and utilities	73.27	31.86	
Livestock facility repair	4.00	1.00	
Professional fees (legal, accounting, etc.)	1.00	1.00	
Miscellaneous	4.00	4.00	
Operating interest	23.85	25.69	
Total operating costs	1,525.87	1,542.70	
Ownership costs			
Depreciation on livestock facilities	3.87	0.62	
Interest on livestock facilities	3.87	0.62	
Insurance and taxes on capital items	4.49	3.65	
Total ownership costs	12.23	4.89	
Total costs	1,538.10	1,547.59	
Income over operating costs	**43.29**	**-46.18**	
Income over total costs	**31.06**	**-51.07**	
Pounds of gain per steer purchased	216.85	177.25	
Feed cost per pound gain	1.06	0.75	
Breakeven steer price per pound	1.91	2.02	

[1] Totals may not sum due to rounding.

Written by
Wesley Tucker, Field Specialist, Agricultural Business; **Joe Horner**, State Specialist, Agricultural Business and Policy Extension

Table 2. Input assumptions used in beef steer winter backgrounding planning budget for 2023.

Selected input quantities	Per unit	Selected input prices	Dollars per unit
Steer purchase weight, pounds	590	Steer purchase price, per hundredweight	183.82
Market steer sale weight, pounds	815	Market steer sale price, per hundredweight	194.48
Labor, hours per head	2.5	Labor cost, per hour	17.92
Feeding period, days	105		
Average daily gain, pounds	2.14		

Table 3. Input assumptions used in beef steer pasture backgrounding planning budget for 2023.

Selected input quantities	Per unit	Selected input prices	Dollars per unit
Steer purchase weight, pounds	590	Steer purchase price, per hundredweight	214.45
Market steer sale weight, pounds	775	Market steer sale price, per hundredweight	195.05
Labor, hours per head	1.5	Labor cost, per hour	17.92
Feeding period, days	105		
Average daily gain, pounds	1.76		

Table 4. Feed and stored forage in beef steer backgrounding planning budgets for 2023, on a per steer basis.

		Winter backgrounding[1]		Pasture backgrounding[2]	
Feed description	Cost per unit	Pounds	Dollars	Pounds	Dollars
Mixed hay, per ton	150.00	1,221	91.58		
Corn, per bushel	8.00	754	107.71		
Protein supplement, per ton	300.00	107	16.05	525	78.75
Salt and minerals, per ton	1,100.00	27	14.85	27	14.85
Limestone, per hundredweight	10.00	6	0.60	4	0.40
Total		**2,115**	**230.79**	**556**	**94.00**

[1] Winter backgrounding ration assumes 105 days on feed and 2.14 pound average daily gain for a steer.
[2] Pasture backgrounding ration assumes 105 days on feed and 1.76 pound average daily gain for a steer

Table 5. Machinery assumptions used in beef steer backgrounding planning budgets for 2023.

		Winter backgrounding[1]		Pasture backgrounding[2]	
Description	Cost per hour	Hours	Dollars	Hours	Dollars
Tractor; 105 MFWD	57.25	25	1,431.25		
Truck	40.00	20	800.00	10.0	400.00
Livestock trailer	30.00	8	240.00	8.0	240.00
4-wheeler	12.00	40	480.00	52.5	630.00
Total			**2,951.25**		**1,270.00**
Total per steer			**70.27**		**28.86**

[1] Machinery needs for winter backgrounding budget are based on 42 steers.
[2] Machinery needs for pasture backgrounding budget are based on 44 steers.
Abbreviations: MFWD = mechanical front-wheel drive tractor

Farmers can also customize this budget to fit their own operations by using the Missouri Beef Enterprise Tool (extension.missouri.edu/media/wysiwyg/Extensiondata/Pro/Beef/Docs/MissouriBeefEnterprise.xlsx). Download the spreadsheet tool to keep an electronic copy of your cost and return estimates in Missouri.

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Beef Heifer Planning Budget

Using this planning budget, farmers raising beef heifers may estimate their costs and returns for 2023. Table 1 presents estimates for calves purchased and sold later as bred replacement heifers in Missouri. Assumptions were based on price forecasts as of September 2022. Detailed inputs, feed requirements and machinery investments are summarized in Tables 2, 3 and 4. The production practices used to develop these cost estimates are common in Missouri beef farms. Use the "Your estimate" column to plan your operation's costs and returns for 2023.

Table 1. Missouri beef heifer planning budget for 2023.

	Per heifer sold[1]	Your estimate
Income		
Bred heifer sales (0.875 head)	1,618.75	
Cull heifer sales (0.05 head)	85.00	
Yearling heifer sales (0.075 head)	98.44	
Less death loss (1 percent of heifer sales)	18.02	
Total income	1,784.17	
Operating costs		
Purchased heifer calf	1,019.15	
Pasture	130.73	
Feed, mineral and stored forage	247.59	
Labor	89.60	
Veterinary, drugs and supplies	35.00	
Marketing costs	54.07	
Breeding costs	40.00	
Machinery and utilities	117.94	
Livestock facility repairs	8.50	
Miscellaneous	6.00	
Operating and calf interest	92.39	
Total operating costs	1,840.97	
Ownership costs		
Depreciation on livestock facilities	9.75	
Interest on livestock facilities	10.15	
Insurance and taxes on capital items	16.83	
Total ownership costs	36.73	
Total costs	1,877.69	
Income over operating costs	**-56.80**	
Income over total costs	**-93.53**	
Total cost per head per day (excluding calf price)	2.26	
Total cost per pound of gain	2.02	
Bred heifer breakeven price per head	1,958.68	

[1] Totals may not sum due to rounding.

Written by
Wesley Tucker, Field Specialist, Agricultural Business; **Joe Horner**, State Specialist, Agricultural Business and Policy Extension

Table 2. Input assumptions used in replacement beef heifer planning budget for 2023.

Selected input quantities	Per unit	Selected input prices	Dollars per unit
Heifer purchase weight, pounds	550	Heifer purchase price, per hundredweight	185.30
Yearling cull heifer sale weight, pounds	750	Yearling cull heifer sale price, per hundredweight	175.00
Heavy cull heifer sale weight, pounds	1,000	Heavy cull heifer sale price, per hundredweight	170.00
Bred heifer sale weight, pounds	1,000	Bred heifer sale price, per head	1,850.00
Labor, hours	5	Labor cost, per hour	17.92
Pasture, animal unit months	8.17	Pasture, per animal unit month	16.00

Table 3. Feed and stored forage requirements in replacement beef heifer planning budget for 2023, on a per heifer basis.

		November to May[1]	May to October[2]	October to December[3]		
Feed description	Cost per unit	Pounds	Pounds	Pounds	Total pounds	Dollars[4]
Mixed hay, per ton	150.00	1,250			1,250	93.75
Processed corn, per bushel	8.00	240		90	330	47.14
Protein supplement, per ton	300.00	240		90	330	49.50
Salt and minerals, per ton	1,100.00	49	39	16	104	57.20
Total		**1,779**	**39**	**196**	**2,014**	**247.59**

[1] Beginning weight of 550 pounds and ending weight of 750 pounds after a 170 day feeding period.
[2] Beginning weight of 750 pounds and ending weight of 925 pounds after a 150 day feeding period.
[3] Beginning weight of 925 pounds and ending weight of 1,000 pounds after a 60 day feeding period.
[4] Totals may not sum due to rounding.

Table 4. Machinery assumptions used in replacement beef heifer planning budget for 2023.

Description	Cost per hour	Hours	Total dollars[1]	Dollars attributed to total heifer operation[2]	Dollars per replacement heifer[3]
Tractor; 105 MFWD	57.25	50	2,862.50	372.13	49.62
Truck	40.00	15	600.00	78.00	10.40
Livestock trailer	30.00	24	720.00	93.60	12.48
4-wheeler	12.00	180	2,160.00	280.80	37.44
Total			**6,342.50**	**824.53**	**109.94**

[1] Total machinery costs are based on combined cow-calf and replacement heifer operation.
[2] 13 percent of the total machinery costs for the beef herd are attributed to the heifer operation.
[3] An average of 7.5 replacement heifers are assumed to be raised yearly in a 50 cow herd.
Abbreviations: MFWD = mechanical front-wheel drive tractor

Farmers can also customize this budget to fit their own operations by using the Missouri Beef Enterprise Tool (extension.missouri.edu/media/wysiwyg/Extensiondata/Pro/Beef/Docs/MissouriBeefEnterprise.xlsx). Download the spreadsheet tool to keep an electronic copy of your cost and return estimates for a cow-calf (spring or fall calving), heifer or backgrounding (drylot or pasture) operation in Missouri.

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Jeremia Markway ranches with his family at Markway Ranch, located in central Missouri, where they raise hair sheep, cattle and Quarter hourses. Most recently he managed research farms at Lincoln University in Jefferson City for eight years. With family roots in farming and a love of agriculture from a young age, his interest in managed grazing took off when his parents built the first electric fence in 1983. Since then, it has been a never-ending quest to learn and improve. He enjoys sharing what he has learned from the best in the business, along with his own experiences, to help others become successful.

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A sixth-generation member of the JD Hudgins Inc ranching operation on the Texas Gulf Coast, you might say John Locke has taken a conventional path into unconventional agricultural practices. Growing up on a registered Brahman seedstock operation known for sharing genetics across the southern United States and around the World, everything appeared to be on a path of "business as usual" after graduating from Texas Tech and returning home in 2001. That was until a 200-year drought and a major family succession event forever changed the way Locke looked at the family business.

Forced to start over with less than half the cow herd on ¼ of the land mass, but with many of the same expenses of the previous business model, has a way of bringing about inevitable change. It can be a blessing in disguise that almost makes it impossible to "do things the way we have always done them." Along the way Locke met Dave Pratt, attended the Ranching for Profit School, and joined the Executive Link program. These experiences forced him to look deep into the business dynamics and ultimately into life itself.

On the surface, much of the six decades old core business model of Locke Division of JD Hudgins still looks the same. But looking deeper you realize change is constantly occurring. While embracing innovative practices, like ultra-high density grazing, the main focus has become learning and applying principles. For instance, making sure you are doing the right things before obsessing over doing things right. Identifying and focusing on a clear business purpose that aligns with personal goals. Learning how to see the economic picture of the business and using that lens to build resiliency. Understanding the whole and striving to balance ecological improvement, livestock performance, profit, and human resources in a way that focuses on quality of life for everyone involved. In short, putting fun and financial reward into ranching, while working to build a legacy with a lasting impact independent of the physical assets the business leaves behind, has become the Locke family priority.

Working side by side with his father, Coleman, in the day-to-day management of their operation, Locke has also been blessed to be selected and trained as the sixth individual to become an instructor of the Ranching for Profit Schools. When he's not too busy with the ranch or family commitments with his three beautiful daughters Lauryn, Lyndsey, Lylee, and wife Salina, John teaches several of RFP week-long schools each year, helps facilitate Executive Link meetings, and consults producers across the US.

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Shawn Deering, a native of Northwest Missouri, attended Northeastern Oklahoma A&M College and received an Associate's Degree in Agriculture there in 1989. He obtained his Bachelors of Science and Masters of Science Degrees in Animal Science from Oklahoma State University in 1991 and 1994 respectively. He was a member of the National Champion Livestock Judging Team at both schools. From 1994 to 1999 he was employed with the Oklahoma Cooperative Extension Service as an Agriculture Agent in Nowata County and as a 4-H Agent in Rogers County. Since January 1999 he has worked for University of Missouri Extension as a Field Specialist in Livestock headquartered in Gentry County. His primary work focus has been on improving forage management and production and utilization of by-product and alternative feedstuffs for beef cattle producers.

Ideal Calving Season for Southern Missouri

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Jordan Thomas is an Assistant Professor in the Division of Animal Sciences at the University of Missouri. Dr. Thomas is a Missouri native and University of Missouri alumnus, having earned his Ph.D. in Animal Sciences with an emphasis in Reproductive Physiology in 2017. Dr. Thomas maintains an active applied research program in reproductive management of beef cattle, coordinates the breeding program for cattle across the University of Missouri Agricultural Experiment Station Research Center herds, and serves as program advisor to the Show-Me-Select Replacement Heifer Program. The primary research focus of the Thomas lab is control of the bovine estrous cycle, specifically to facilitate use of reproductive technologies such as timed artificial insemination and embryo transfer.

Extension
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Beef Cow Nutrition Through the Year: Managing for Efficient Reproduction

Profitable cow-calf operations manage so that a large proportion of the cow herd calves in the early portion of a short calving season. In order to maintain this level of reproductive performance, cows need to conceive on approximately a 365-day calving interval. To do so, a cow must rebreed within 85 days of calving. Length of the postpartum period of anestrus varies considerably among cows and as a function of management; however, most research estimates that a cow does not cycle for six-weeks post calving on average. Thus, a cow has roughly two estrous cycles in which to become pregnant again. Body condition and the plane of nutrition play outsized roles in keeping cows on a 365-day calving interval.

Importance of body condition at calving

Body nutrient reserves at calving and energy balance between calving and breeding affect when a beef cow will be ready to breed again. Table 1 (Houghton et al., 1990) relates postpartum interval to body condition score (BCS; 1–9 scale) at calving. In general, the postpartum interval is longer in thin cows (BCS ≤ 4) than cows in moderate (BCS 5–6) condition. For more information on body condition scoring beef cows, see MU Extension publication G2230, Body Condition Scoring of Beef Cattle (https://extension.missouri.edu/publications/g2230).

On average, a body condition score (1–9 scale) is 84 lb of weight (NASEM, 2016; pg 203). It is important to understand that body condition scoring is a subjective process. For the average beef farm, it may be more useful to identify cows as thin, moderate, and fleshy at calving. If possible, separate the thin cows from the rest of the herd and provide a higher quality diet. Specific interventions for thin cows are discussed below. However, a more proactive management strategy is recommended to ensure adequate BCS prior to calving.

Table 1. Body condition score (BCS) at calving and the number of days from calving until resumption of normal estrous cycles.

BCS	Description	Postpartum interval
3	Thin	89 days
4	Borderline	70 days
5	Moderate	59 days
6	Good	52 days

Adapted from Houghton et al., 1990. J of Anim Sci 68:1438–1446.

Calving in sync with nature

The importance of allowing your forage base to absorb increases in nutrient requirements by beef cows cannot be overstated. For too long, beef cattle operations have filled nutritional deficits with purchased and/or raised feedstuffs. This type of management intervention is a drain on profitability. A recent MU Extension planning budget publication (https://extension.missouri.edu/publications/g679) estimates that 23% of annual operating costs ($210 out of $908) are purchased and raised feeds. A more thoughtful approach to reducing feed costs is to calve "in sync with nature" — in other words, at a time when a large quantity of high-quality forage is available at low cost in the production system.

A beef cow production cycle can be broken down into four phases, based on nutrient requirements: postpartum/pre-pregnancy, gestating and lactating, gestation, pre-calving (Figure 1). Peak nutrient requirements coincide with the critical postpartum/pre-pregnancy phase. Calving when forage is dormant often creates a nutritional deficit that must be filled to maintain BCS between calving and breeding.

Often herds in Missouri that are referred to as "spring-calving" are actually managed such that calving occurs in the winter (January and February) rather than in the true spring (April and May). There are multiple environmental challenges associated with true spring calving in Missouri. For example, March, April and May

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are the wettest months of the year, and mud and pasture conditions can present a challenge. Likewise, calving in the true spring then necessitates breeding in the heat of summer (July and August). This can be detrimental to both female and male reproductive capabilities, particularly if this heat stress is exacerbated by fescue toxicosis.

Perhaps a more reasonable form of calving in "sync with nature" in Missouri is not to align with the spring flush of forage but with the timing of fall regrowth in cool-season (e.g., fescue) pastures. The considerations involved in moving to a fall-calving season are discussed in the MU Extension publication G2029, Calving Season Considerations for Commercial Beef Operations (https://extension.missouri.edu/publications/g2029). The University of Tennessee Extension publication Fall Versus Spring Calving: Considerations and Profitability Comparison (PDF) (https://extension.tennessee.edu/publications/Documents/W419.pdf) is also an excellent resource for the response to calving seasons in various production settings. In the Fescue Belt, it is common to see greater weaning weights and calving rates as well as reduced calf death loss when comparing a fall calving season to a spring calving season.

The fall growth period common to cool-season perennial forages facilitate lower-input fall-calving systems than is possible in warm-season forage systems. Figure 2 describes the growth curve of tall fescue in Missouri. Fall calving coincides with the fall flush of fescue growth, and quality grazeable forage is often available through peak nutrient requirements of early lactation and into the early part of the breeding season. Producers entertaining the switch from spring to fall calving are encouraged to enhance your farm's ability to stockpile tall fescue in the fall.

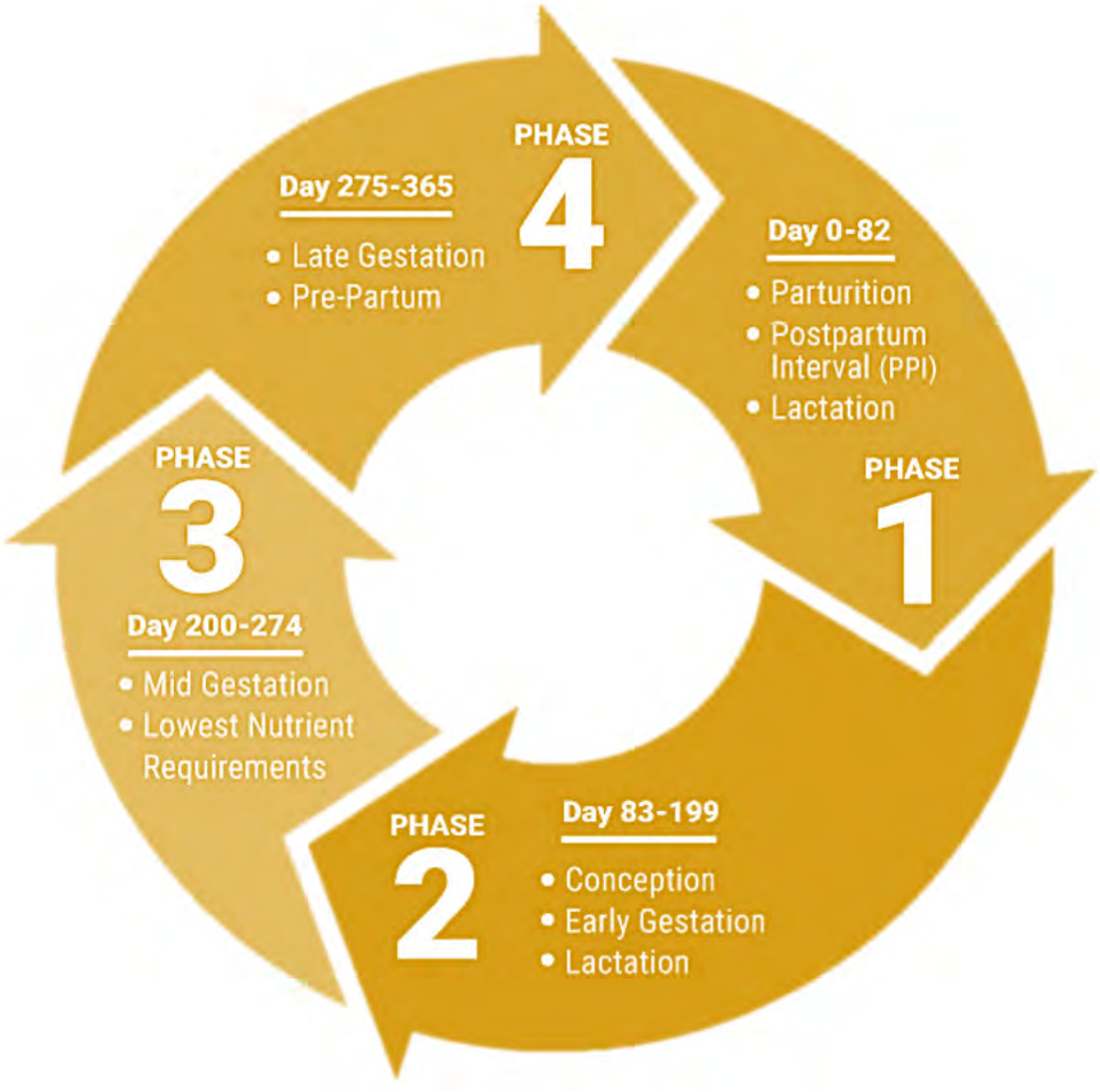


Figure 1. Phases of production in an annual beef production cycle. Adapted from Beef Cattle Research Council.

Troubleshooting deficits in your herd

Troubleshooting losses in body condition in the cow herd can be a frustrating task. Identifying the limiting nutrient can be a challenge, as often the limiting factor is overall feed availability, not a nutrient concentration deficiency, per se. Many farmers stock farms based on a desired number of cows to manage, rather than based on the carrying capacity of the land. Also, with the advent of round hay baling equipment and the convenience that it provides, hay production and hay feeding has become an unquestioned standard practice for many producers despite significant costs associated with hay-intensive winter-feeding strategies. Likewise, many producers pursue tonnage (i.e., cut and bale late) from tall fescue hay fields rather than quality. As a result, it is common to run into a situation where a producer feeds hay for 4–5 months per year, yet the hay is insufficient to meet the nutrient requirements of a beef cow.

When forage quality is lacking, many producers around the country supplement protein. This is done because of extensive promotion of the positive associative effect that occurs when feeding supplemental crude protein to cattle consuming low-quality (<7% crude protein) forages. However, while this management strategy is effective in many parts of the country due to the type of forage present in different regions, providing supplemental protein in Missouri forage cool season forage systems is generally ineffective. Authors rarely find crude protein in dormant tall fescue samples less than 7% crude protein. Also, the literature (Mathis et al. (2000), http://dx.doi.org/10.2527/2000.781224x; Bohnert et al. (2002), https://doi.org/10.2527/2002.80112967x) does not show the same magnitude of response to protein supplementation when cattle graze low-quality cool-season perennial forages.

Generally, forage analyses of tall fescue forage indicate energy is the limiting nutrient, not crude protein. Energy supplementation to beef cows is difficult in practice because of the need to supplement energy daily. While many feed companies promote high-energy supplements (e.g., lick tubs), these are often intended to be consumed at <5% of expected daily dry matter intake. Thus, it is difficult to conceive how providing high-energy supplements in this manner could meaningfully impact the energy status of a mature beef cow.

If BCS is declining, first ensure that the cattle have enough to eat. When the average forage height across a pasture is <4", it is likely that forage intake is limited. This rule of thumb works because every "acre-inch" (an inch of forage evenly grown across an acre) equates to 300–400 lb of dry matter in tall fescue pastures. In practice, this rule of thumb is difficult to conceptualize because patchy grazing leads to unreliable estimates. Be conservative in your estimates and intervene by rotating pasture or providing supplemental forages. The Noble Foundation (PDF) (https://www.noble.org/globalassets/images/news/ag-news-and-views/2014/10/pdf/rules-of-thumb.pdf) in Oklahoma uses the following rules of thumb for estimating the TDN requirement of beef cows: 55% TDN for pregnant cows, 60% TDN for late-gestation cows, and 65% TDN for lactating cows. The authors have used these rules of thumb extensively and found good success.

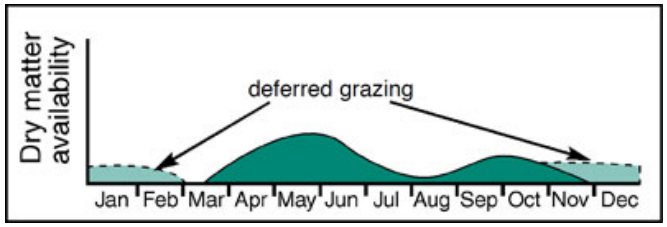


Figure 2. Yield curve of tall fescue in Missouri, as well as opportunities for winter forage availability (stockpile) through deferred grazing.

Supplementation strategies for Missouri beef cow herds

Figure 3 is a supplement decision guide put together by Dr. Clay Mathis a number of years ago. The ideas put forth in Figure 3 are fleshed out below.

When forage quantity is limiting

In a scenario in which forage quantity is limiting, being mindful of feeding supplemental forage is critical to keep feed costs from spiraling out of control. The authors prefer to feed stored forages daily as a strategy to reduce waste. Conventional wisdom is to feed 3 days' worth of feed in hay rings, because it basically does a better job creating space in the hay ring for cows. Feeding scenarios where several days' worth of hay is put out for cattle at once leads to significant wastage, regardless of bale feeder design.

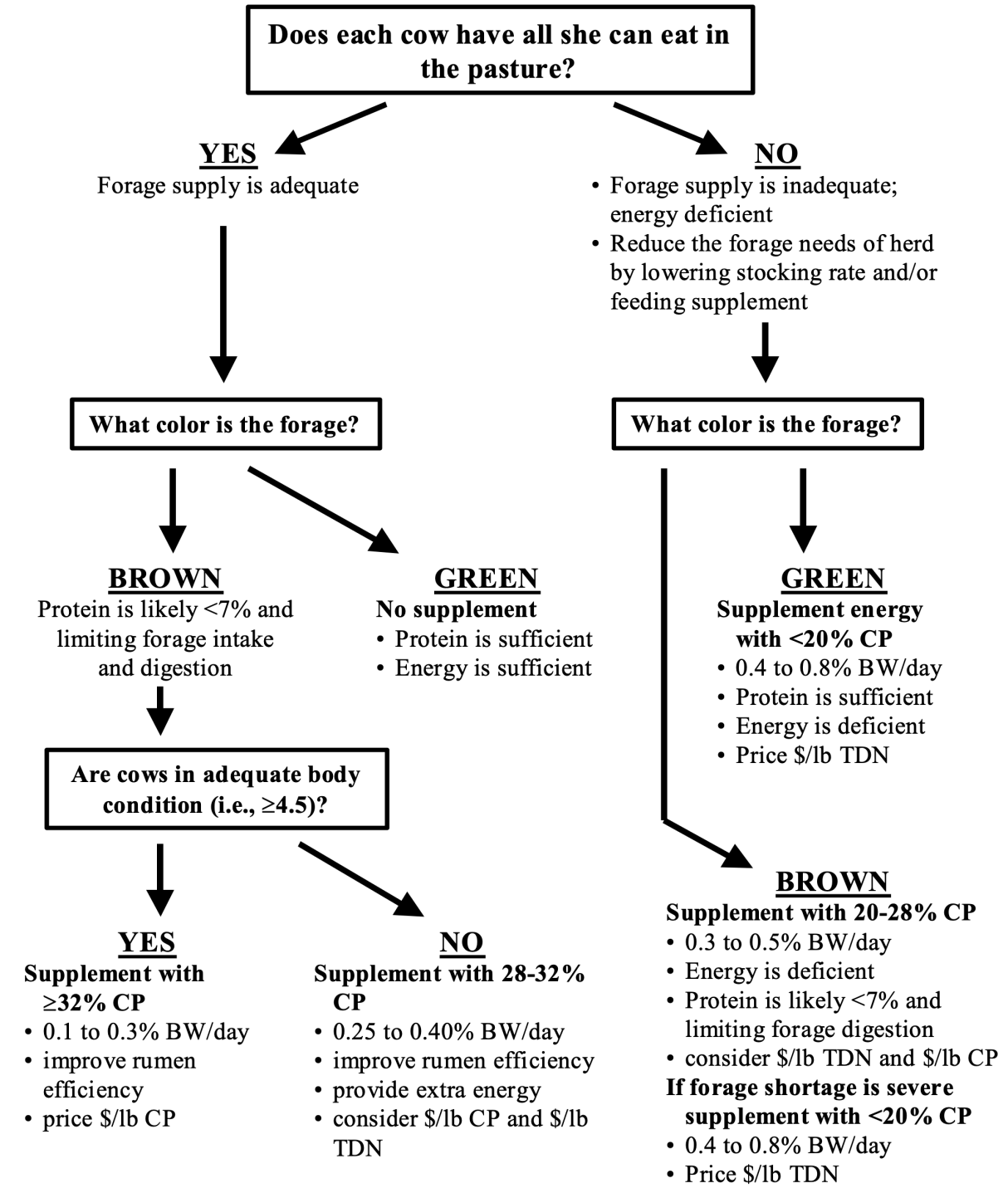
A good rule of thumb to use when planning for stored forage needs is that a 1,000 lb bale of hay will provide a days worth of feed for 30 cows. A 5' x 5' round bale of normal density should weigh roughly 1,000 lb. When working through a hay feeding budget, the authors usually plan for roughly 33 lb of hay per cow per day. Assuming the bale is 10% moisture, then the cow has access to 30 lb of dry matter. Assume that 15% of the 30 lb is wasted, leaving a cow to consume ~25.5 lb of dry feed per day, which is roughly 2% of body weight for a 1,200 lb cow.

When energy is limiting

If it is determined that that energy is the limiting nutrient in the diet but forage intake is not limiting,

Beef Cow Supplement Decision Guide*

Clay P. Mathis, New Mexico State University



**This decision tree is a general guide and is not as accurate as measuring actual forage quality and quantity to develop a strategic supplementation program for a specific class of cattle.*

Figure 3. Beef cow supplement decision guide. Courtesy Clay Mathis, New Mexico State University.

a good place to start supplementation is 0.5% of body weight, fed daily. The energy concentration and price of various commodity feedstuffs are constantly in flux, so price supplements per lb of TDN to identify the most economical supplemental feed source for your cows.

When protein is limiting

In cases where forage crude protein is well below 7% or if cows are consuming dormant warm-season forages, it is wise to provide 1 lb of crude protein per cow per day. If the supplement used is 20% crude protein, then you would need to feed 5 lb of supplement (5 lb supplement * 0.2 crude protein factor) = 1 lb of supplemental crude protein. Protein does not need to be supplemented daily to be effective. It can be supplemented as infrequently as 2x/week without impacting the response to supplement, so long as a week's worth of supplement is prorated into the two feedings.

Price supplements on a price per lb of nutrient (TDN or protein) basis

If you are in the market for supplements, one effective strategy to reduce supplement costs is to price them per pound of nutrient required. Example: Feed A is 20% crude protein (CP) feed costing $200 per ton versus Feed B which is 40% CP feed costing $350 per ton. If you had previously calculated you need to feed 1.0 lb of CP per cow per day, you would need to feed 5 lbs of the 20% CP feed or 2.5 lb of 40% CP feed to provide 1 lb of CP. Feed A costs $0.10 per pound and Feed B costs $0.175 per pound, yet when priced per pound of crude protein, Feed A costs $0.50 per lb of CP and Feed B costs $0.44 per lb of CP. If you feed a cow for 90 days, Feed B will save $5.40 per cow, assuming that equipment and labor costs associated with feeding either feedstuff are similar. Bear in mind that feed companies make a profit selling convenience. Producers selling commodity beef cattle (non-value added) with modest profit margins need to reduce use of purchased and raised feeds to improve chances to be profitable.

Stockpiled fescue is quality winter feed

Stockpiled tall fescue (Figure 4) is as good of a feed as any available, with the benefit that it is grown on your farm with minimal input. With good yearlong planning and good grazing management during the winter, stockpiled tall fescue can serve as an excellent winter feeding program well into the winter months. Many producers in the transition zone of the United States have reduced or eliminated the need for hay feeding during the winter months through use of stockpiled fescue.

Figure 4. Stockpiled tall fescue is an excellent winter feed resource for cow-calf operations in Missouri, particularly with good grazing management (e.g., strip-grazing as shown here).

The nutrient profile of stockpiled tall fescue is outstanding and, when forage intake is not limiting, will meet the nutrient requirements of even lactating beef cows. No additional hay or other macronutrient supplement (energy or protein) will be needed. However, it is a good idea to keep minerals and vitamins available. The University of Arkansas conducted on-farm surveys from 2002 to 2006 (PDF) (https://www.uaex.edu/publications/pdf/FSA-3133.pdf) and showed that the TDN (total digestible nutrients; energy) of stockpiled fescue was adequate to support a lactating cow from October through February. Protein was never limiting in this demonstration.

A concern with stockpiled tall fescue is inconsistency in growth from year to year. The development of an adequate stockpile is dependent on two factors: 1) deferred or minimal grazing of the area during the fall growing period (September through first frost) and 2) precipitation, which is not under your control. August nitrogen application (current MU Extension recommendations are 40 lb of N per acre) can increase the amount of stockpile grown, but a fall growth period with inadequate rainfall will produce less stockpiled forage than is desired.

Conclusions

Take a systems-based approach to nutritional management of the cow herd, basing supplementation and feeding decisions on forage quality, cow body condition, and an understanding of cow requirements in the various stages of the production cycle.

Extension
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Calving Season Considerations for Commercial Beef Cattle Operations

Managing the time of year in which cows calve can have significant implications for the profitability of a cow-calf operation (Figure 1). Cow-calf herds with no defined calving season are labor-intensive and potentially very inefficient, with significant management and marketing challenges due to widely varied cow requirements and calf age. Meeting the nutritional requirements of lactating cows is far more expensive during certain times of the year due to a lack of high-quality forage available for grazing. Likewise, some portions of the year present challenges for newborn calf survival without significant investments in facilities and labor for intervention. Management for a short, defined calving period is therefore a major opportunity to reduce costs and optimize productivity of the cow herd.

Figure 1. Managing the length of the calving season has significant implications for the profitability of a commercial cow-calf operation.

Spring versus fall versus winter calving

Traditionally, cow-calf enterprises with a defined calving season have made management decisions to ensure that calving occurs during the spring of the year. Spring calving ensures high quality forage is available at calving and throughout peak lactation. Because this is similar to seasonal breeding patterns of many wildlife species, this management strategy is sometimes referred to as "calving in synch with nature." Available forage often requires little to no supplementation of protein or energy, and calving can generally occur on pasture rather than in calving barns or pens. Therefore, spring calving seasons are inherently lower cost.

However, other factors should be considered when selecting a calving season. In Missouri, for example, calving in the true spring (e.g., April and May) results in the breeding period occurring in the summer. Reproductive rates during summer months can be severely reduced because of heat stress. Additionally, vasoconstrictive effects of alkaloids produced by endophyte-infected tall fescue can have a compounding effect, further reducing reproductive performance of cattle grazing predominately fescue pastures in the summer months. For this reason, calving in the late winter (e.g., January and February) has become popular to ensure the subsequent breeding period can be completed before peak summer heat. Another increasingly popular option is to calve during the early fall months (e.g., September and October), when cool season forages are beginning to enter a "second spring" of active regrowth. This is an attractive option for many producers in Missouri and much of the Mid-South, although it does involve carrying lactating cows and calves through the winter months.

Market considerations, lifestyle, and other enterprises of the farm or ranch all affect decisions about when cows are managed to calve (Table 1). For example, seedstock producers may wish to calve earlier than commercial producers because of considerations related to age of bulls at the time of marketing. Producers with integrated cow-calf and stocker operations may choose to calve at such a time of year as to ensure forage availability for the stocker enterprise. Likewise, diversified operations

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Table 1. Pros and cons associated with winter calving, spring calving, and fall calving systems in Missouri.

	Winter Calving	Spring Calving	Fall Calving
Pros	• Allows for the breeding period to occur in the spring, prior to summer heat and prior to peak concentrations of toxic alkaloids produced by endophyte-infected tall fescue • Opportunity to market weaned calves at greater weights and/or prices compared to spring-born calves • May avoid overlap of calving season and planting seasons in diversified cattle and row-crop operations	• Reduced need for calving facilities • Potentially reduced calf mortality and morbidity • Forage available after calving may reduce cost of meeting cows' nutritional requirements during early lactation • Winter feeding and supplementation costs may be reduced due to lower nutritional requirements of non-lactating cows	• Reduced need for calving facilities • Potentially reduced calf mortality and morbidity • Forage available after calving may reduce cost of meeting cows' nutritional requirements during early lactation • Potentially higher calf prices at weaning • Spring forage availability may provide flexibility for later weaning or for adding additional weight to calves
Cons	• Potentially higher rates of calf mortality and morbidity unless facilities and labor are available for calving assistance and intervention • Greater feed costs in order to meet nutritional requirements associated with early lactation	• Breeding period must occur during summer, creating potential for heat stress to reduce reproductive performance • Reproductive performance during the summer may be further reduced for cattle grazing predominatly endophyte-infected tall fescue pastures • Market prices for calves are often lowest in the fall when spring calves are weaned	• Lactating cow-calf pairs are carried through the winter months when feed costs are typically higher • Potentially higher feed costs in order to meet nutritional requirements associated with late lactation • Heat stress may present a challenge for newborn calves if calving occurs very early in the fall

This list of pros and cons is not exhaustive, and significant regional variation exists in calving season preferences and management opportunities. When selecting a calving season or if considering switching calving seasons, a thorough economic analysis is encouraged. Consult a regional Livestock Field Specialist through University of Missouri Extension.

with crop enterprises may wish to avoid calving during planting, harvest, or other busy seasons. Some operations managing multiple separate herds may strategically calve different herds in slightly different seasons to make better use of labor or facilities shared across herds. Regardless of the desired time of calving, managing overall length of the calving season is critical for the productivity and potential profitability of a herd.

Length of the breeding period

Traditionally, managing timing and length of the calving season has been accomplished by managing the timing and duration of bull exposure. For example, bulls would be introduced into the herd approximately 283 days prior to the desired start of the calving season, and bulls would be removed approximately 283 days prior to the desired end of the calving season. In this case, the length of time for which cows were exposed to bulls effectively dictates the potential length of the calving season. When planning the length of the breeding period, however, length of the previous calving season should be carefully considered. Gestation length, postpartum anestrus, length of the estrous cycle, and incidence of early embryonic pregnancy loss all impose biological limitations on potential length of a practical breeding period.

Gestation length and postpartum anestrus

Gestation length in cattle is approximately 283 days, although there is some variation based on breed, sex of calf, and history of selection for birth weight or calving ease within the herd. Gestation length limits the length of the breeding period that may be practical, depending on length of the previous calving season (Figure 2). Very long calving seasons will extend into the subsequent breeding period and result in fewer cows having an opportunity to become pregnant early in the next breeding period. For example, if a 90-day breeding period is used in order to manage cows to calve over a 90-day period, the latest-conceiving and therefore latest-calving cows will not even have calved when the next year's breeding period is already beginning.

For a period of time following calving, cows do not have normal estrous cycles and are not receptive to mating. This period of time, known as postpartum anestrus, varies in length based on age, genetics, body condition, nutrition, presence of the suckling calf, and a

multitude of other factors. As with length of gestation, length of postpartum anestrus also places a limitation on the length of the breeding period that may be practical. Later-calving cows may not be cycling and therefore may not be capable of becoming pregnant early in the subsequent breeding period. Additionally, a proportion of cows will have an abnormally short luteal phase after the first estrus following calving. As a result, breeding that occurs on the first postpartum estrus will result in lower conception rates on average.

Given that limitations imposed by the length of gestation and the length of postpartum anestrus, it may appear that long breeding periods are simply a necessity to achieve high pregnancy percentages in cow herds. However, the opposite is true. Long breeding periods perpetuate a vicious cycle of poor reproductive performance in the cow herd, resulting in long calving seasons that in turn result in a need for long breeding periods. Instead, managing for a short breeding period ensures a short calving season. This in turn ensures that all cows in the herd have calved prior to the next breeding period and are afforded time postpartum to resume cyclicity.

Estrous cycle length and early embryonic loss

Although short breeding periods can be highly effective, there are some biological limitations for how short the breeding period can be. Cows are only receptive to mating during behavioral estrus or "standing heat." Estrus occurs for a period of approximately 18 hours only once during an estrous cycle. The estrous cycle in cattle ranges from 18 to 24 days in length. Therefore, if all cows are cycling normally and no synchronization of estrus is used, it would take a minimum of a 24-day breeding period to ensure that all cows are serviced at least once. However, not all cows that are serviced will conceive, in large part because of naturally occurring embryonic loss. Although fertilization rates after estrus have been observed to be in excess of 95% in many studies, a significant proportion of embryos fail to establish pregnancy. Because the majority of this loss occurs prior to day 17 of pregnancy, females exhibit no obvious signs of early embryonic loss and simply return to estrus on a normal interval. With this understanding, breeding periods that only afford cows a single opportunity to be serviced are discouraged, as this would result in pregnancy percentages that are impractically low for commercial production

Short breeding periods

To give cows multiple opportunities to conceive but also limit the number of cows calving late in the calving season, use of breeding periods of 45 to 60 days are encouraged. In most cases, this would result in cows having two to three opportunities to conceive during the breeding period. Use of estrus synchronization

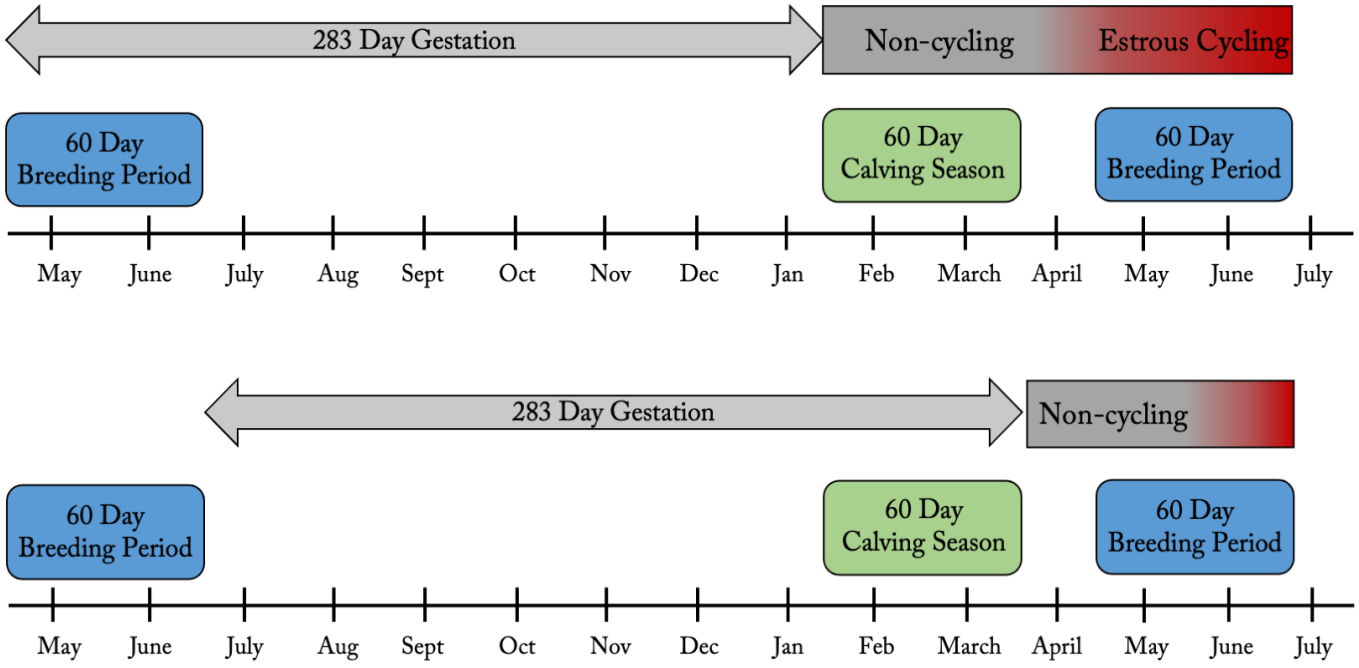

Figure 2. An example of early conception (top) and late conception (bottom) within a typical winter-calving production calendar. Note that even when managing for a defined and relatively short calving season of 60 days in this example, data of conception within one breeding period impacts potential reproductive performance in the following breeding period. Length of gestation and length of postpartum anestrus results in late-conceiving females potentially being non-cycling for a portion of the next year's breeding period, leaving fewer opportunities to become pregnant.

protocols should be considered in order to afford cows the maximum number of opportunities to conceive within a short breeding period. When synchronization is used, occurrence of the first estrus can be managed to occur around the first day of the breeding period. This results in cows having an opportunity to conceive earlier on average, and this also affords all cows the maximum number of total opportunities to conceive during the breeding period. Use of progestin-based estrus synchronization protocols is especially encouraged, as progestins can induce earlier resumption of normal estrous cyclicity among anestrous cows. For more information on estrus synchronization prior to artificial insemination or natural service, see MU Extension publication g2024: Estrus Synchronization Recommendations for Artificial Insemination of Beef Cows and MU Extension publication g2027: Estrus Synchronization Recommendations for Natural Service Bull Breeding.

Considerations for heifers

Unless all late-conceiving heifers can be profitably marketed as bred heifers or as young cow-calf pairs after calving, very short breeding periods are strongly recommended for commercial replacement heifers. Compared to mature cows, two-year-old cows or "first-calf heifers" undergo a longer period of postpartum anestrus, on average 3 to 4 weeks longer than typical cows. Length of anestrus is further extended if heifers were underdeveloped prior to calving or if post-calving nutrition is limiting. From a systems perspective, therefore, reproductive performance of the young cow herd is largely dependent on reproductive management and selection criteria used among replacement heifers.

It is imperative to select early-conceiving heifers in order to achieve acceptable reproductive performance in young cows. Heifers that conceive later in their first breeding period calve later in their first calving season. As a result, they are more likely to conceive later in their next breeding period or fail to conceive at all. Long-term research efforts have made it clear that heifers conceiving early in their first breeding period stay in the herd longer, wean more total calves due to their longer productive life in the herd, and wean older and therefore heavier calves each year. For more guidance on breeding management and selection criteria for replacement heifers, see MU Extension publication g2028: Selection of Replacement Heifers for Commercial Beef Cattle Operations.

Breeding periods of 30 days for heifers are becoming increasingly common for commercial operations. Likewise, breeding programs that involve heifers having only one or two opportunities to conceive to artificial insemination are effective for some operations. Additionally, some producers elect to begin the breeding period for heifers 2 to 3 weeks prior to the beginning of the breeding period for cows. This provides first-calf heifers with additional time postpartum prior to the start of their next breeding period, mitigating the longer period of postpartum anestrus among first-calf heifers. Although this strategy involves breeding heifers at a slightly younger age, this is usually not a limitation for heifers of early-maturing breeds or crosses. An additional benefit of calving first-calf heifers prior to cows is that labor or facilities for calving can be better focused on first-calf heifers, which may be more likely to require more calving assistance or other intervention.

Reducing length of the calving season

When shortening length of the breeding period, operations risk reducing the pregnancy percentage obtained in the cow herd. As a result, short-term cash-flow considerations often make aggressive shortening of the breeding period impractical in a herd in which the previous calving season was very long. In such cases, it is necessary to shorten the length of the breeding period progressively over successive years. Other strategic steps can also be taken to manage the length of the calving season, however. As an alternative to shortening length of the breeding period or as a complementary management practice, commercial cow-calf operations should carefully evaluate strategic marketing opportunities for underproductive females.

Marketing underproductive cows

When developing replacements, heifers need to reacA simple strategy to begin reducing the length of the calving season is to simply market underproductive cows after the calving season. In this case, cows that have not calved by a desired date can be marketed as bred cows or, if non-pregnant, as open cows. Additionally, later-calving cow-calf pairs can be sold prior to the start of the breeding period as open pairs, or after the breeding period as exposed or pregnant "three-in-one" packages.

Another strategy is to market later-conceiving females on the basis of a pregnancy determination. In most cases, pregnancy determination is suggested to be performed, ideally via ultrasound, within 90 days from the start of the breeding period. This allows for an accurate determination of fetal age in order to identify early-conceiving females. At this time, females that are non-pregnant or not-detectably pregnant can be identified for sale. Additionally, pregnant females that conceived after a decided cutoff point in the breeding period should also be considered for sale. Sale of later-conceiving females is especially encouraged if a longer breeding period was used and/or if marketing opportunities for bred females are strong. Heifers determined to be

non-pregnant could be sold immediately or enter a stocker or finishing program. Cows determined to be non-pregnant or not-detectably-pregnant at the time of pregnancy determination could be sold, either as cow-calf pairs or as open cows after weaning the calf at side. Underproductive late-conceiving females may or may not be sold immediately after pregnancy determination; however, these females should be identified or sorted off for planned sale. In some cases, early weaning calves of open cows or late-conceiving cows may be prudent in order to market these underproductive cows as quickly as possible.

Compared to simply marketing underproductive cows after the calving season, marketing cows based on pregnancy determination allows for forage or feed resources to be allocated more profitability. Rather than carrying underproductive cows through calving, breeding, or weaning, consider the potential margin that could be generated if forage or feed resources were instead used for productive cows or for other enterprises. Of course, market value of animals at the time of sale can also differ substantially based on the stage of production or pregnancy status. Therefore, considerations related to when underproductive cows are sold should be reevaluated regularly based on market conditions and other strategic opportunities of the farm or ranch.

Calving distribution and profitability

The benefits of managing for a short calving season are numerous. These may include reductions in labor costs associated with calving observation, decreases in calf mortality or morbidity, and opportunities for simplified herd management due to more uniform stage of production among cows. Additionally, although reproductive traits are lowly heritable, management for an early-conceiving cow herd does maintain selection pressure for fertility. Aside from the immediate commercial production value, this selection pressure has long-term genetic value if replacement heifers or herd sires are retained from within the operation.

The calving distribution (Figure 3), or the proportion of calves born in 21-day intervals of the calving season, is valuable information in assessing the productivity

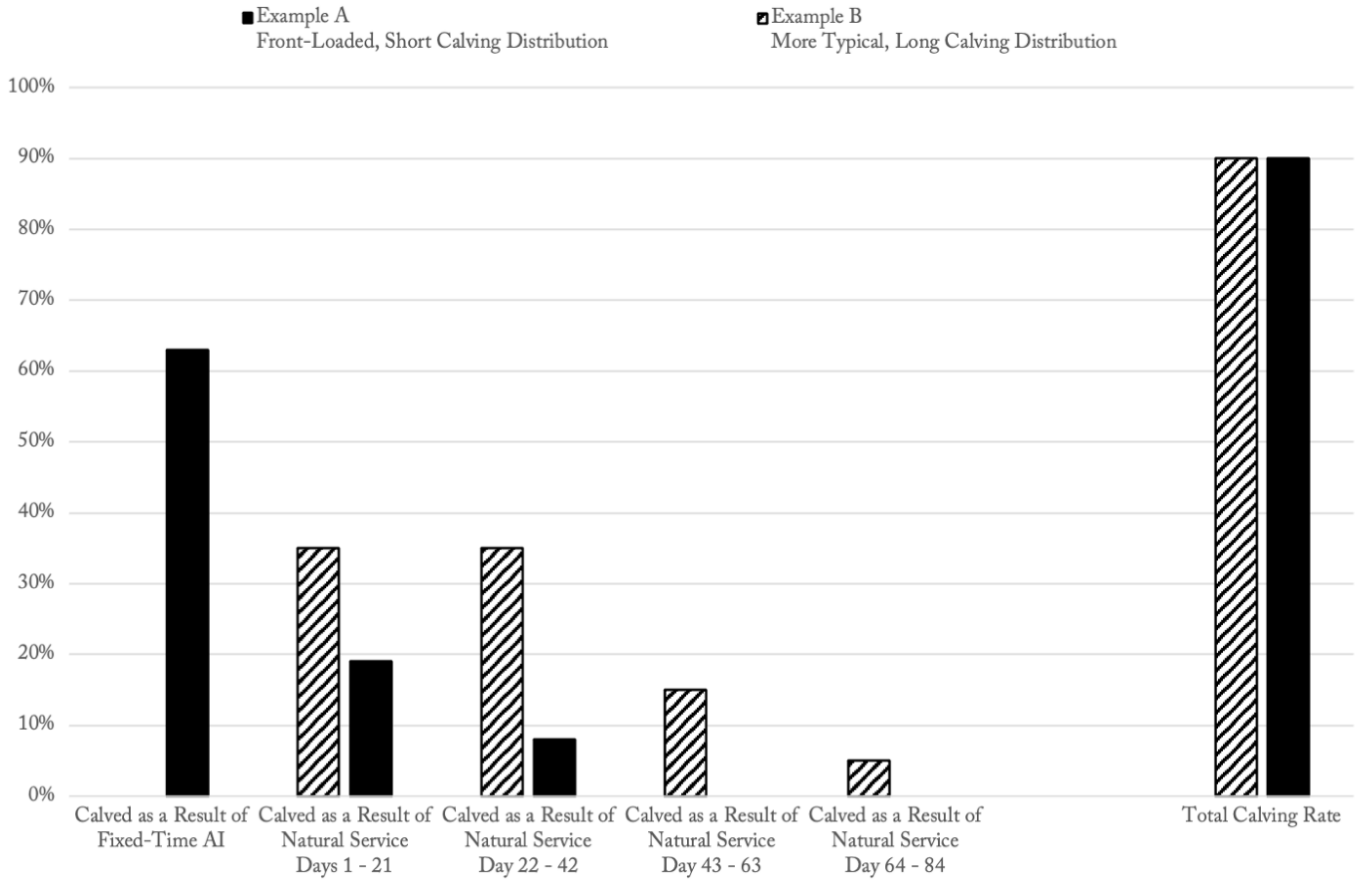

Figure 3. This illustration compares the calving distribution produced by two herds in which the breeding period had been managed differently. In Example A, all cows received a fixed-time artificial insemination on Day 0 of the breeding period, followed by exposure to natural service bulls for two full estrous cycles after AI. In Example B, all cows were exposed to natural service bulls from Day 1 to Day 84. In both examples, the same final pregnancy percentage or calving rate of 90% is assumed. However, the calving distributions illustrate herds with very different levels of reproductive performance.

Table 2. Illustration of the impact of calving distribution on age and weight of calves at weaning.

	Calving Period	Number of Calves	Age at Weaning	Weaning Weight	Pounds of Calf Weaned
Example A Front-Loaded, Short Calving Distribution	Calved as a result of fixed-time AI	63	220 days	510 lbs	32,130 lbs
	Calved as a result of natural service, Days 1 - 21	19	199 days	468 lbs	8,892 lbs
	Calved as a result of natural service, Day 22 - 42	8	178 days	426 lbs	3,408 lbs
	Overall	**90**	**212 days**	**494 lbs**	**44,430 lbs**
Example B More Typical, Long Calving Distribution	Calved as a result of natural service, Days 1 - 21	35	210 days	490 lbs	17,150 lbs
	Calved as a result of natural service, Day 22 - 42	35	189 days	448 lbs	15,680 lbs
	Calved as a result of natural service, Day 43 - 63	15	168 days	406 lbs	6,090 lbs
	Calved as a result of natural service, Day 64 - 84	5	147 days	364 lbs	1,820 lbs
	Overall	**90**	**191 days**	**453 lbs**	**40,740 lbs**

This illustration compares the age and weight at weaning for the calf crops produced by the two herds presented in Figure 3. Herd size is assumed to be 100 cows for each example. In Example A, cows conceiving to natural service are assumed to have conceived at the end of each 21-day period, as estrus was synchronized in this example to occur prior to fixed-time AI on Day 0. In Example B, cows conceiving to natural service are assumed to have conceived at the midpoint of each 21-day period on average, as no estrus synchronization was used. These calculations assume a 70 lb birth weight and an average daily gain of 2 lbs from birth to weaning. Weaning was assumed to have occurred on Day 220 after the start of the calving season. Despite identical pregnancy percentages obtained overall, the front-loaded, shorter calving distribution from Example A produces nearly 10% more total pounds of calf weaned.

and potential profitability of a commercial beef cattle operation. Front-loaded calving distributions, in which the majority of calves are born in the first 21-day interval, are inherently more efficient and maximize metrics like pounds of calf weaned per cow exposed or percentage of cow body weight weaned (Table 2).

Managing the length of the breeding period and marketing late-conceiving cows are two key strategies in moving toward a more front-loaded calving distribution. Likewise, estrus synchronization is effective tool to front-load the calving distribution, as this affords the maximum number of cows an opportunity to become pregnant as early as possible in the breeding period. Figure 3 and Table 2 illustrate the clear advantages of a front-loaded, short calving distribution achieved through use of estrus synchronization and a short breeding period. While some benefits are realized even in the first year of use, the most substantial improvements are often realized after successive years of systematic use of synchronization.

Finally, managing for a short, front-loaded calving season is critical for cow-calf profitability from both a revenue and cost standpoint. The calving distribution of an enterprise dramatically impacts gross margin (revenue minus cost of goods sold) per cow. Later-conceiving females wean younger and therefore lighter weight calves. For example, because a modern beef calf can often gain 1.7 to 2.2 lbs per day from birth to weaning, a 45 to 60-day difference in calf age could equate to a difference of 100 lbs in weaning weight. This results in later-conceiving cows generating substantially less weaned calf value (i.e., revenue) in spite of similar year-long cow carrying costs. Because calves are often sold in groups or load lots, younger and lighter-weight calves can also impact value of the older and heavier calves due to the reduction in uniformity among the calf crop. Additionally, later-conceiving females not only wean lighter calves annually but wean fewer total calves over their shorter productive lifespan in the herd. This results in fewer weaned calves per over which to spread the cost of replacement females required by the operation. With this understanding, long calving seasons that allow for later-conceiving females simply are not profitable for commercial beef cattle operations.

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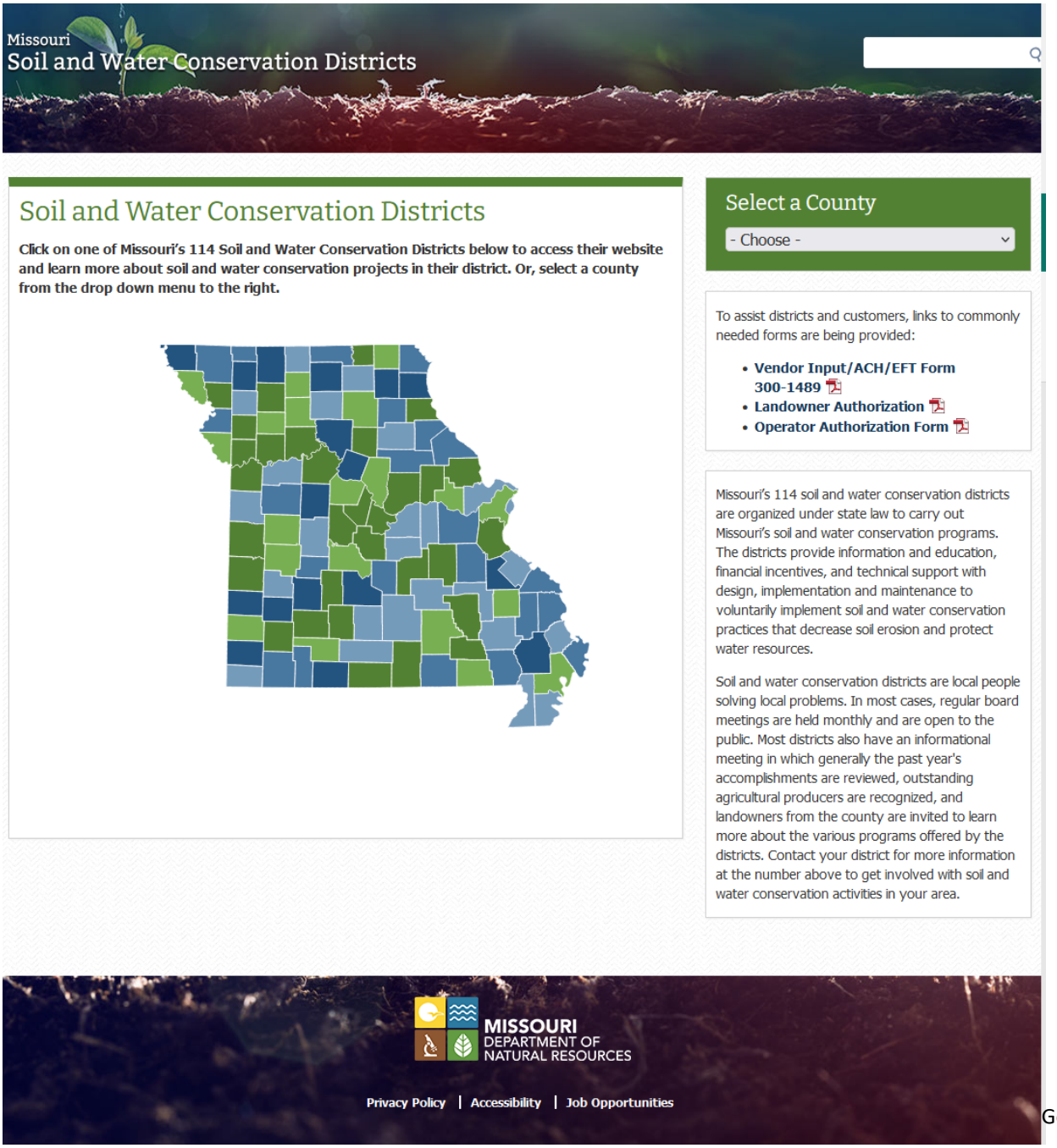

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