PRODUCING NUTRIENT-DENSE LINCOLN RED BEEF HANDBOOK

CONTENTS

Cover photos courtesy Sarah Pedelty.

This handbook was written by Jenifer Morrissey for compliance with a micro-grant from The Livestock Conservancy-.

LETTER FROM NALRA PRESIDENT

Scott McClinchey, Ontario, Canada

The North American Lincoln Red Association has passionate members who truly believe in the value of the genetically protected Lincoln Red cattle breed. A large number of Lincoln Red breeders raise their herd sustainably by finishing their market animals on feed and extending grazing periods for their herd. Our association has now further characterized the superior qualities of Lincoln Reds by assessing the nutrient density of their meat.

The nutrient density data provides information that our association will use to market the meat, attract breeders with similar goals, and maintain and grow the Lincoln Red breed. This project has provided the North American Lincoln Red Association (NALRA) with valuable data that confirms the breed's superb carcass qualities.

I know that the Lincoln Red breed is in good hands with current breeders and their enthusiasm. NALRA will continue to grow the number of breeders who appreciate the strong attributes of the Lincon Red breed.

On behalf of NALRA, thank you for your interest in the nutrient density of Lincon Red beef and how it can promote the strong qualities of Lincoln Reds to new breeders and consumers.

SUMMARY

This handbook describes how to raise Lincoln Red beef that is higher in nutrient content than other beef available. Lincoln Red beef is known to easily grade choice or prime and has carcasses that have high utilization rates and minimal waste. To encourage more people to raise Lincoln Red cattle, the North American Lincoln Red Association (NALRA) wanted to know more about Lincoln Red beef. NALRA had Lincoln Red ribeyes tested for nutrient content and compared to other beef. The tests demonstrated that Lincoln Red beef can be produced in ways that has high nutritional value compared to both grass-fed and grain-fed cattle. The tests validate that Lincoln Red beef can both taste good and be good for us.

Meat from heritage breeds like the Lincoln Red often has better flavor than commercial breeds. Emerging research on unprocessed foods equates flavor to nutrient content. Nutrient density is a measure of nutrient content. A recent study, known as the Beef Study, has been completed, led by Dr. Stephan Van Vliet at Utah State University. The Beef Study furthers the definition of what nutrient density means for beef. NALRA obtained a grant from The Livestock Conservancy to have Lincoln Red beef tested by Dr. Van Vliet's lab for its nutrient density. For more information about nutrient density and the Beef Study, see NALRA's separate document *About Nutrient Density and the Beef Study*.

Three Lincoln Red ribeyes were submitted to Dr. Van Vliet's lab; the ribeyes were from three different steers raised by one Lincoln Red producer. Overall, these Lincoln Red ribeye samples had strong antioxidant values, higher levels of magnesium and potassium, and lower fat compared to both the grass-fed and grain-fed benchmarks in the Beef Study. The Lincoln Red ribeyes also had a more balanced fatty acid ratio than the grain-fed benchmark, and the Lincoln Red ratio was favorable compared to the ratio in the standard American diet.

The purpose of this handbook is to describe how Lincoln Red beef can be raised to produce the favorable results obtained in NALRA's recent tests. This document also suggests opportunities to investigate and possibly improve the nutritional advantages of Lincoln Red beef.

PHOTO COURTESY SARAH PEDELTY.

INTRODUCTION

In his book *Grassfed to Finish: A production guide to Gourmet Grass-Finished Beef*, Allan Nation makes a convincing and well-documented argument that we do not have a tradition in the United States for raising and selling gourmet/artisanal beef. What does he mean by gourmet/artisanal? It's much like what we're discussing here: beef that tastes good and is good for us. Nation says that, instead, ruminant livestock in North America have been raised to add value to excess grain. The development of Lincoln Red cattle as a beef breed could be considered consistent with this view based on their native landscape in England.

Want to raise Lincoln Red Beef that grades high choice or prime? Read on!

Lincoln Red cattle are like most English beef breeds in that they began as multi-purpose animals, with dairy and draft going by the wayside over the years and leaving beef as the focus. Most consumers of American beef will probably have never heard of Lincoln Reds compared to the dominant beef breeds.

LINCOLN RED CATTLE IN LINCOLNSHIRE, ENGLAND. COURTESY JENIFER MORRISSEY

To help more people understand the unique characteristics of the Lincoln Red, the North American Lincoln Red Association (NALRA) undertook testing of Lincoln Red ribeye steaks to enable comparison to other beef that's available. The results were as we hoped and expected: Lincoln Red beef can be raised to higher quality than the average beef, either grain-fed or grass-fed. The goal of this handbook is to describe how to raise Lincoln Red beef to this higher quality.

In the U.S., we are familiar with the terms 'prime,' 'choice,' and 'select' as grades of beef from higher to lower. In 2023, a study was conducted that dove further into what sets one ribeye apart from another. The Beef Study was a collaboration between the Bionutrient Food Association, Utah State University, and Edacious. The Bionutrient Food Association used their previous experiences with other types of food to ask questions about how the nutritional qualities of beef benefit the people who eat it. Utah State did the testing to answer those questions. Edacious took the voluminous data generated by the testing and enabled a complex topic to be presented in an understandable fashion.

Start this venture with the understanding that there are many different strategies to finishing out your own beef. Work with what you have and be aware of realistic expectations.

- Oklahoma State Cooperative Extension (1)

The Beef Study looked at more than 300 ribeyes from around the world and from diverse rearing environments, including grain-fed in feedlots and grass-fed rotated amongst multi-species pastures and numerous situations in between. NALRA chose to work with Utah State and the Beef Study for testing the Lincoln Red ribeyes because it gave us a large database to compare our results against.

The Lincoln Red ribeyes that were tested came from a longtime breeder experienced with marketing Lincoln Red beef direct to consumers. How beef cattle are raised influences the nutritional quality of the beef that they produce. This handbook describes how the Lincoln Red cattle were raised to produce the beef that tested so well and what opportunities exist to improve even further the nutritional quality of Lincoln Red beef.

Want to raise Lincoln Red Beef that's high in health-giving antioxidants and has a nutritious fat profile? Read On!

Consumers have a desire to know where their beef comes from, value the story and are seeking ranchers to purchase beef from. At the same time, ranchers have been seeking opportunities to add value to their cattle and reduce their exposure to market swings.

However, feeding and managing a grain-finished animal is different than managing a cowherd or backgrounding calves. Proper feeding and management is key to capturing extra value and in meeting customer expectations.

-South Dakota Cooperative Extension (2)

1) https://extension.okstate.edu/fact-sheets/an-introduction-to-finishing-beef.html
2) https://extension.sdstate.edu/raising-freezer-beef-how-feed-grain-finished-beef

About Lincoln Reds

History of Lincoln Reds

The Lincoln Red cattle breed was developed in Lincolnshire, a ceremonial county in England on the drier eastern coast. The cattle were mentioned in Gervaise Markham's book *A Way to Get Wealth*, published in 1695, and appeared in the first volume of the Coates Herd Book in 1822. The Lincolnshire Red Shorthorn was a triple purpose breed. Milk and beef continued when draft animals were replaced by machinery. The name was shortened to Lincoln Red in the 1960s when the cattle were specifically selected for polled genes. Registered milking Lincoln Reds were phased out by 1965. Horned Lincoln Reds are still allowed in the North American registry.

In the UK, Lincoln Reds are known as the 'Butcher's Breed' for their quality and yield. It is easy for Lincoln Red meat to grade Prime or Choice, and Lincoln Red carcasses have high utilization rates and minimal waste. Other breed characteristics such as docile temperaments and good mothering and milk harken back to the past uses - draft and dairy - of the breed.

In the UK, Lincoln Reds are known as the 'Butcher's Breed' for their quality and yield.

Lincolnshire Wolds

The Lincolnshire Wolds are a geologic formation and an Area of Outstanding Natural Beauty, a designation of protected landscapes in the UK. While the Wolds lack the rugged, mountainous natural beauty of other areas in England, they are indeed beautiful as a farmed landscape, heavy on grains. As the picture below shows, the grain fields are bordered by hedgerows and uncultivatable land.

A VIEW OF THE ENGLISH COUNTRYSIDE IN THE HOME REGION OF LINCOLN RED CATTLE. PHOTO COURTESY JENIFER MORRISSEY

NOTE THE DOMINANCE OF CULTIVATED FIELDS IN LINCOLNSHIRE. IT'S NO WONDER THAT LINCOLN RED CATTLE THRIVE WITH FEW INPUTS SINCE THEY ARE EXPECTED TO LIVE ON THE EDGES. PHOTO COURTESY JENIFER MORRISSEY

Lincoln Reds have developed to thrive on the edges of grain cultivation, letting most of the harvest go to market and the straw be used for bedding, or increasingly, biomass. These cattle are known for their easy keeping characteristics which derive from their need to do well with few inputs in their home landscape. Their ability to make different, more efficient use of forage relative to other cattle means that they take up nutrients differently and therefore have beef with different nutritional character than other cattle.

The Lincoln Red's ability to make different, more efficient use of forage relative to other breeds means that they take up nutrients differently and therefore have beef with different nutritional character than other cattle.

Heritage Breeds and Flavor

A 2012 edition of The Livestock Conservancy's newsletter included an article titled "Heritage Breeds for Flavor." It was about a side-by-side taste comparison of heritage breed and commercial breed ducks raised in the same production environment. The heritage breed duck meat encouraged second helpings, and the commercial variety lacked that sort of flavor appeal.

On the other hand, the Beef Study concluded that there was not a correlation between type of cattle and nutrient density of the beef produced; breed didn't matter. Instead, nutrient density had more to do with how the cattle were raised and finished.

These contrasting conclusions led to a desire by NALRA members to test Lincoln Red beef's nutrient density.

Another Breed's Story - Wagyu

The Winter 2025 edition of *Acres* magazine included an article about Wagyu beef. It said that Wagyu beef has a healthy fat profile similar to olive oil. (1) In the article, a long-time Wagyu cattle breeder said, "genetics play a 70% role in the final beef product with feeding contributing 30%." The Wagyu cattle at one farm are finished on a 20-component grain blend. The Beef Study indicated that diversity of diet contributes to nutrient density. This story suggests that breed might matter, especially when raised in ways that encourage nutrient density, such as a diverse diet.

> While breed didn't matter in the Beef Study when it came to nutrient density, breed did matter in other formal and informal research.

A 2023 article in the journal *Animals* documented a study of the nutrient profile of beef from three different kinds of steers: Wagyu (24 head), Wagyu-Angus (29 head), and Angus-Charolais-Limousin (ACL, 29 head). It concluded, "In brief, the fat profile and nutritional characteristics of beef depend on the fattening period, breed/crossbred, and cut of meat, with Wagyu and Wangus beef showing a healthier fat profile than ACL animals." (2) Breed did seem to matter in this study, as well as length of finishing time.

The results of NALRA's testing certainly suggest that like Wagyu, Lincoln Reds are a breed that can produce meat with a healthier profile than common beef breeds, especially those reared in feedlots. (Note that neither the Wagyu study nor the Beef Study controlled for age at slaughter. Experienced cattle people have commented that marbling increases with age, and Wagyu are finished later than other breeds, so the results of tests on Wagyu beef may be skewed toward Wagyu for that reason.)

In one very casual side-by-side taste test, Wagyu and Lincoln Red hamburger patties were prepared, seasoned only with salt. The Lincoln Red beef compared very favorably to the Wagyu and was preferred.

1) "Specialty Breed," *Acres Magazine*, New Holland North America, Winter 2025, p. 4.
2) Vazquez-Mosquera, Juan M. et al. "Beef Nutritional Characteristics, Fat Profile and Blood Metabolic Markers from Purebred Wagyu, Crossbred Wagyu and Crossbred European Steers Raised on a Fattening Farm in Spain," *Animals*, 2/27/23 at: https://pmc.ncbi.nlm.nih.gov/articles/PMC10000121/pdf/animals-13-00864.pdf

LINCOLN RED RIBEYE ON LEFT AND WAGYU RIBEYE ON RIGHT. WAGYU BEEF HAS BEEN STUDIED AND FOUND TO HAVE HEALTH-GIVING PROPERTIES AND RESULTANT MARKETING CACHET. LINCOLN RED BEEF IS SIMILAR! LEFT PHOTO COURTESY SARAH PEDELTY. RIGHT PHOTO COURTESY JENIFER MORRISSEY.

2025 TESTING PROCEDURE

The Beef Study has found that the way cattle are raised influences the nutrient density of the beef they provide. It's important, then, to understand how the Lincoln Red cattle were raised that provided the ribeyes that were tested. It's also important to understand how the steers were determined to be ready to harvest, since Dr. Van Vliet has found that younger animals often utilize some of the important nutrients in meat for growth rather than storing them in meat to be passed on to consumers of that meat. It's also worth noting that assessing nutrient density did not include assessing the grade of the meat. Lincoln Red beef usually easily grades to high choice or prime. That grading was done separately on the ribeyes. Finally, how the ribeyes were provided to Dr. Van Vliet's lab for testing is described.

THE CALVES AT WEANING. COURTESY SARAH PEDELTY

HOW THE STEERS WERE RAISED

INTRO

The steers that were tested were bred and raised by Sarah Pedelty in Chatfield, Minnesota. Sarah has been involved with Lincoln Red cattle for most of her life and has been breeding them for more than 30 years. She started selling Lincoln Red beef a few years ago so has as well-tuned a process as possible for her location and her cattle.

However, everyone has different environments in which they raise cattle. This section of the handbook describes how Sarah raised the steers to the quality found in the tests so that others can meet or exceed that quality for their own Lincoln Red beef.

ONE OF THE STEERS ON DAY OF BIRTH MAY 3, 2023. COURTESY SARAH PEDELTY

BIRTH/REARING

The steers were born April/May 2023. They were castrated in September 2023 and weaned October 1.

The steers were on pasture up until weaning. The pasture has some monocrop and some native prairie. It has really good grass in June. Sarah says, "We had extreme drought in 2023 so we started supplementing hay August 15. It was a weird year because it was so dry. The grass loses power at

first freeze, usually the first of October. The calves were never creep-fed; it is too difficult to judge the influence of the mother's milk."

HOUSING

Prior to weaning at five months, the steers were on pasture. Then they went into a dry lot until harvest at 17-18 months.

FEED AND FORAGE

Beginning at weaning in the dry lot and then until harvest, the steers had free choice hay. It was half alfalfa/half grass – timothy and brome.

They were started on 16% calf feed, 3#/day. Three weeks post weaning, the steers were transitioned to cracked corn and a protein pellet. Sarah has found this ration easier to procure, and she thinks they gain better than on whole corn. It took 2-3 weeks to transition the steers to this growing ration. She fed 7# per day through the winter, and saw 2# gain per day. In the spring, she saw up to 3# gain per day.

There are a variety of environmental factors that may hinder or reduce the efficiency of cattle during the finishing period. Excessive heat will limit feed intake and increase water requirements during the summer. During the winter and spring, excessive mud will limit performance as well. A well-designed, dry, shady feeding pen is warranted.

- Oklahoma State Cooperative Extension fact sheet on finishing beef animals (1)

The feed bag tag for the protein pellet is shown in Appendix A below.

- **The goal of any growing or finishing diet is to provide an adequate amount of crude protein and energy to achieve the desired average daily gains and desired carcass quality. As average daily gain increases, crude protein requirements increase, but crude protein requirements decrease as the animal grows and gets closer to slaughter. As it gets closer to slaughter weight, fat becomes a larger part of the body weight gain and muscle becomes less of the weight gained.**
- **It is suggested that finishing calves be fed twice a day to help avoid digestive upset and allow for increased intake.**
- **To maintain rumen health throughout the feeding phase, diets should always contain some form of roughage, such as access to pasture, hay or ingredients such as cottonseed hulls.**

  - Oklahoma State Cooperative Extension fact sheet on finishing beef animals

The last nutrition consideration is to provide a good source of vitamins and minerals. These nutrients easily can be added to the animal's diet by offering a mineral mixture free choice, mixing it in the ration or even top dressing it on the feed.

- Oklahoma State Cooperative Extension fact sheet on finishing beef animals

Salt and Minerals

The steers had continuous access to free choice loose salt and loose minerals.

Feed bag tags for the salt and mineral mix are shown in Appendix A below.

Water

The results of the tests on the Lincoln Red ribeyes confirmed that water should not be overlooked. The Lincoln Red steers watered from a spring that is fed by surface water. Sarah confirmed that the spring receives runoff that is high in some minerals.

Water is the most overlooked nutrient but is the most essential.

- Oklahoma State Cooperative Extension fact sheet on finishing beef animals

Parasite Control and Disease Prevention

Some research suggests that herd-specific parasite control and disease prevention increases rate of gain and profit. In regenerative grazing management, parasite control and disease prevention is often accomplished by active rotation of the herd to fresh grass on a location-specific time-table. Other producers use vaccinations, dewormers, and fly sprays.

The steers that produced the ribeyes that were tested were vaccinated twice, the first time around July 4 and the second 3-4 weeks later. They received Pyramid 5 and Calvary 9. They also received tetanus when they were castrated. They were wormed at weaning with pour-on ivermectin.

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1) https://extension.okstate.edu/fact-sheets/an-introduction-to-finishing-beef.html

DETERMINING HARVEST READY LINCOLN REDS

NALRA President Scott McClinchey makes the following points about determining harvest-ready Lincoln Reds:

- Whether grass-fed, grain-fed, or a combination of both feeding regimes, it is important to take the time necessary to properly finish Lincoln Reds to produce the highest quality grading with appropriate amount of marbling to produce tender beef. Time to slaughter will vary depending on how the animals are fed.
- Quality and consistency of Lincoln Red beef products are enhanced when harvested at the optimal timing.
- Overall management of Lincoln Red cattle's nutrition with a balanced ration, health, and feeding environment also contributes to the production of high-quality beef.

A youtube video by Oklahoma State University Cooperative Extension does a great job describing how to identify a harvest-ready steer or heifer. Here's the link:

https://www.youtube.com/watch?v=HrF5aCEAI-0

Highlights from the video include:

- Cattle deposit fat differently each to the other.
- We're not looking at a single point on the animal but at all the points in aggregate.
    - Tail head (see Figure 2 below): there are deposits of fat on either side of the tail head. On heifers, there's a braided rope appearance below the vaginal area; there's a high correlation of this appearance to low choice quality grade
    - Brisket (see Figure 3 below): this area needs some degree of fatness; from cantaloupe (ready) down to grapefruit. When not finished, this area will be pointy.
    - Rib cage: the fatter they are, the smoother they'll get. See Figure 1 below.
        - It should be smooth like the back of the hand not ridged like the fingers. The ribs can be felt but not necessarily seen; you should feel a layer of fat.
    - Flank: the area between the hind leg and the belly will fill as the animal finishes. See Figure 1 below:
        - It will begin to drop and become relatively thick.
        - We're looking for a flank that has 'fallen down.'
        - It's much more pointed up in an unfinished animal; it's thin outside to inside, not thick as it would be in a finished animal.
    - Spread of legs (see Figure 2 below): they get wider as the animal gets fatter.
    - Dew claws (see Figure 2 below): they will change depending on the degree of fatness.
        - Fat will fill in around the dew claws, so the dew claws will begin to sink down and be less visible.
        - If they point out to the rear, the animal probably is not ready.

FIGURE 1: NOTE THE FLANK AREA BETWEEN THE LEG AND BELLY. IN THE BOTTOM PHOTO THE BELLY HAS DROPPED AND FILLED IN COMPARED TO THE TOP PHOTO. ALSO NOTICE THAT THE FAT COVERING OF THE RIBS HAS INCREASED AND IS BECOMING SMOOTHER. THE TOP PHOTO WAS TAKEN IN AUGUST AND THE BOTTOM PHOTO IN SEPTEMBER. HARVEST WAS IN OCTOBER.
PHOTOS COURTESY SARAH PEDELTY

FIGURE 2: NOTE THE DIFFERENCE IN TAIL HEAD FAT. THE LEFT PHOTO WAS TAKEN TWO MONTHS BEFORE HARVEST. THE RIGHT PHOTO WAS TAKEN AT HARVEST. ALSO NOTE THE INCREASED SPREAD OF THE LEGS AND HOW THE DEW CLAWS HAVE SPREAD OUT AND DOWN.
PHOTOS COURTESY SARAH PEDELTY

FIGURE 3: THE BRISKET AREA SHOULD BE GRAPEFRUIT OR CANTALOUPE SIZE AS THE ONE ON THE LEFT. WHEN NOT READY THE AREA IS MORE POINTED AS ON THE RIGHT. PHOTOS COURTESY JENIFER MORRISSEY

HARVEST

The slaughterhouse for the steers from which the tested ribeyes came was chosen for its proximity to keep stress low. The steers were transported only 20 miles. Carcasses were hung for two weeks.

The steers had hot carcass weights of 699, 674, and 691 pounds. Assuming 60% yield, live weights were 1165, 1123, and 1151 pounds. Sarah wishes they had been over 1200# because that's the weight of the cows. According to Oklahoma State University Cooperative Extension, "A general rule of thumb is that a finished steer's weight will be approximately the same as the dam's weight when she has a body condition score of 6." (1)

GRADE

The steaks were graded from photographs after packaging. They fell in the Choice/High Choice range.

TESTING OF RIB EYES

NALRA contacted Dr. Van Vliet at Utah State when it began working on a grant application to cover the cost of nutrient density testing. Dr. Van Vliet provided instructions on how and when the ribeye steaks should be shipped to his lab. When NALRA received word from The Livestock Conservancy that NALRA had received a grant to pay for the tests, the steaks were shipped. NALRA sent one frozen ribeye steak from each of the three Lincoln Red steers to Utah State University for nutrient density testing. Each test cost $540. The cost of shipping the steaks was donated. The tests completed were:

- metabolomics/antioxidants
- fatty acids
- minerals

1) https://extension.okstate.edu/fact-sheets/an-introduction-to-finishing-beef.html

PHOTO COURTESY SARAH PEDELTY

2025 LINCOLN RED TESTING RESULTS

Three Lincoln Red Ribeyes were tested and the results were averaged. The key findings are summarized below, and then discussed in more detail. The Beef Study results were separated into grass-fed and grain-fed categories, and averages of the results of each category were called benchmarks. The Lincoln Red Ribeye average was then compared to the benchmarks of the grass-fed and grain-fed categories. The following findings were written by Dr. Van Vliet's lab at Utah State University. For more information about nutrient density and the Beef Study, see NALRA's separate document *About Nutrient Density and the Beef Study*.

FINDINGS

The key findings of the testing of the Lincoln Red Ribeyes were:

- **Antioxidants:** The Lincoln Red Ribeye samples had strong antioxidant values compared to both the grass-fed and grain-fed benchmarks when looked at individually and in total concentration. Antioxidants are essential compounds that help protect the body from oxidative stress, which is linked to aging, inflammation, and chronic diseases such as heart disease and cancer.

- **Higher Magnesium and Potassium Concentrations:** The Lincoln Red Ribeyes contained higher levels of magnesium and potassium than the two benchmarks. These minerals are essential for muscle function and cardiovascular health.

- **Lower Total Fat Content:** The Lincoln Red Ribeyes had significantly lower total fat levels compared to grass-fed and grain-fed benchmarks.

- **Balanced Omega-6 to Omega-3 Ratio:** The ratio of the fatty acids omega-6 to omega-3 in the Lincoln Red Ribeyes was intermediate between the Grass-Fed and Grain-Fed benchmarks, maintaining a more balanced profile. The grass-fed benchmark that was lower is considered the healthier level of the two benchmarks.

ANTIOXIDANTS

Introduction

Antioxidants play a crucial role in protecting cells from oxidative stress and supporting overall health. This section evaluates the concentrations of key antioxidants in the Lincoln Red Ribeyes compared to the Grass-Fed and Grain-Fed benchmarks, highlighting variations in bioactive compounds such as flavonoids, phenolic acids, and sulfur-containing antioxidants. By examining these differences, this analysis provides insights into the potential nutritional advantages of Lincoln Red beef and how its antioxidant profile compares to other beef sources. The data-driven comparison allows for a better understanding of how feeding practices influence the presence of these protective compounds in beef.

Overall Antioxidant Findings

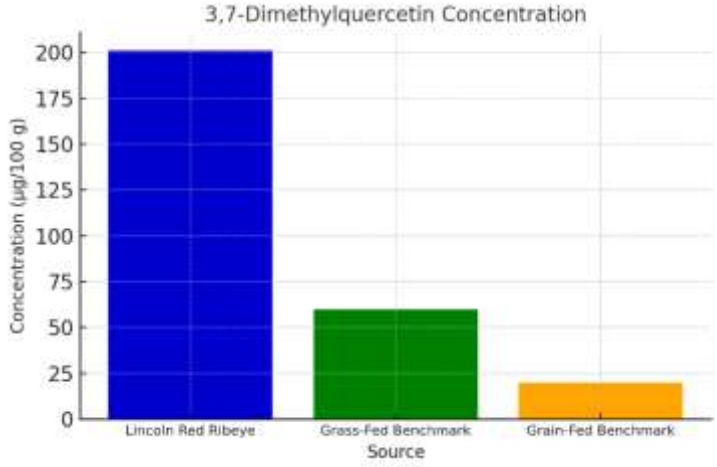
The Lincoln Red Ribeye samples had strong antioxidant values.

Antioxidants are essential compounds that help protect the body from oxidative stress, which is linked to aging, inflammation, and chronic diseases such as heart disease and cancer. In this analysis, grass-fed beef generally contains higher total antioxidant concentrations than grain-fed beef, which aligns with research showing that diets rich in diverse plant forages lead to greater antioxidant content in animal products.

The higher antioxidant levels in grass-fed beef suggest that these animals had access to phenolic-rich forages, which are known to enhance the presence of bioactive compounds such as flavonoids and polyphenols in meat. Greater plant diversity in the diet contributes to an improved antioxidant profile, as these plants contain a variety of secondary metabolites that can be transferred into the meat.

These findings highlight the importance of diet in shaping the nutritional profile of beef, with grass-fed systems offering potentially greater health benefits due to their increased antioxidant content.

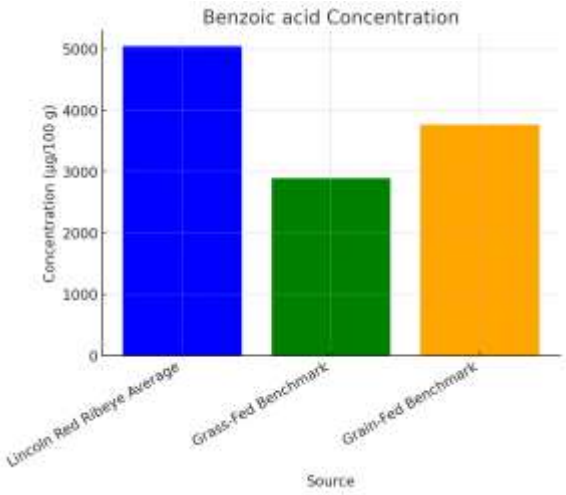
3,7-Dimethylquercetin



The Lincoln Red Ribeyes had a significantly higher concentration of 3,7-Dimethylquercetin compared to both benchmarks, suggesting a potential advantage in flavonoid content.

Health Benefit: 3,7-Dimethylquercetin, a methylated flavonoid derived from quercetin, offers numerous health benefits due to its enhanced bioavailability and potent antioxidant properties. It helps reduce oxidative stress, inflammation, and supports cardiovascular health by lowering LDL cholesterol and improving blood vessel function. Its neuroprotective effects may aid in preventing neurodegenerative conditions like Alzheimer's, while its anticancer potential involves inhibiting tumor growth and promoting cancer cell death. Additionally, it exhibits antimicrobial properties, strengthening immunity and protecting against infections. With improved absorption compared to quercetin, 3,7-Dimethylquercetin is a promising compound for overall health and disease prevention.

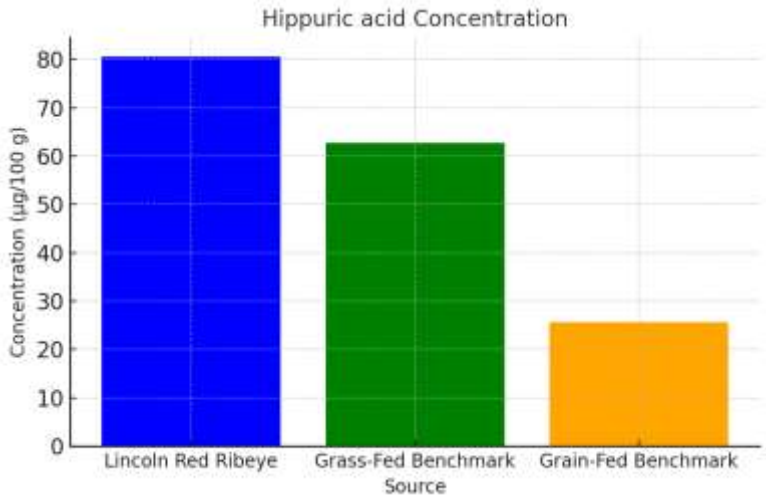
Benzoic acid



The concentration of Benzoic acid in the Lincoln Red Ribeyes was much higher than both benchmarks.

Health Benefit: Benzoic acid, naturally found in plants and fruits, offers antimicrobial, anti-inflammatory, and antioxidant benefits. It helps prevent infections, reduces inflammation, and protects cells from oxidative stress. Commonly used as a food preservative, it also supports detoxification by converting to hippuric acid in the body. Additionally, it promotes skin health by treating fungal infections and acne.

Hippuric acid

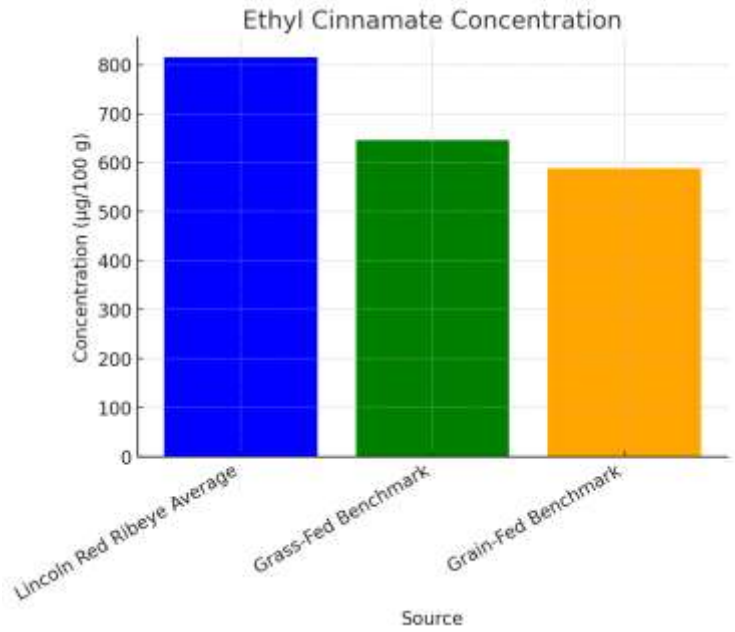


The Lincoln Red Ribeyes had a higher concentration of Hippuric acid than both benchmarks.

Health Benefit: Hippuric acid, a metabolite derived from the breakdown of benzoic acid in the body, plays a key role in detoxification by aiding the removal of harmful substances through urine. It is

commonly associated with the metabolism of dietary polyphenols found in fruits, vegetables, and teas. Hippuric acid exhibits potential antioxidant and antimicrobial properties, supporting overall health by reducing oxidative stress and promoting a healthy gut microbiome.

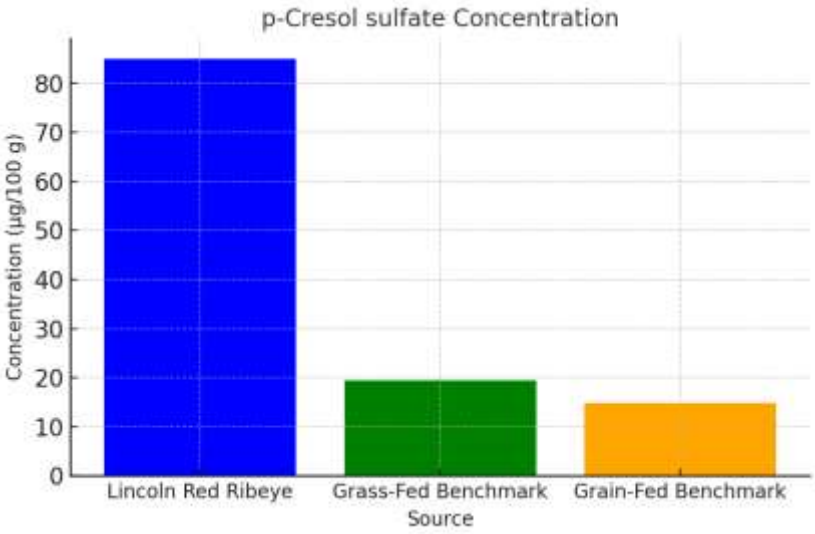
Ethyl cinnamate



The concentration of Ethyl cinnamate in the Lincoln Red Ribeyes was higher than both benchmarks.

Health Benefit: Ethyl cinnamate, a natural ester found in fruits like strawberries and the spice cinnamon, is known for its pleasant aroma and flavor, often used in fragrances and food products. It also exhibits potential health benefits, including antimicrobial, antioxidant, and anti-inflammatory properties, which may help protect cells from oxidative damage and combat harmful pathogens. Additionally, its soothing effects make it a valuable compound in traditional medicine for promoting relaxation and overall well-being.

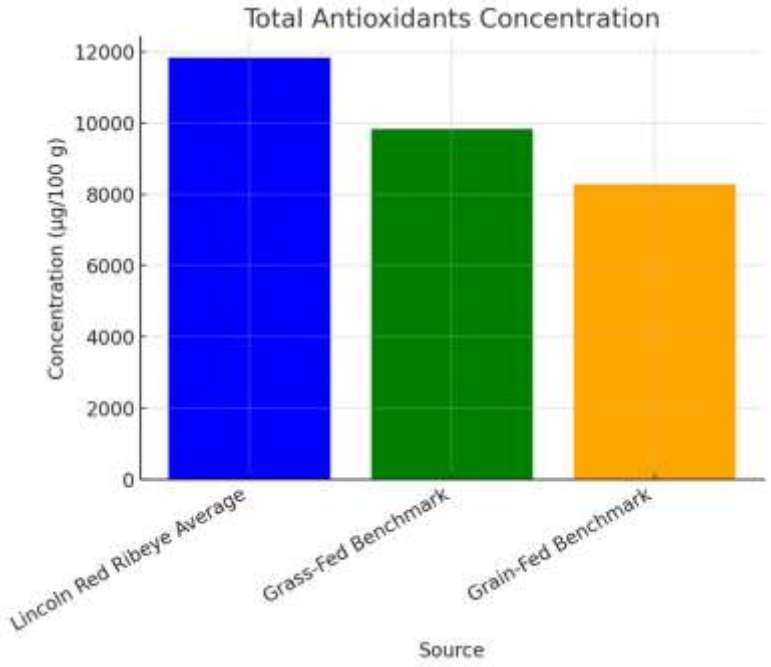
p-Cresol sulfate



The Lincoln Red Ribeyes had a much higher concentration of p-Cresol sulfate compared to both benchmarks.

Health Benefit: p-Cresol sulfate is a metabolite produced by gut bacteria from dietary protein breakdown and is commonly associated with kidney function and gut health. It is a good biomarker for phenolic intake in both humans and other mammals. These data indicate that the animals had access to phytochemical diversity, which benefitted the levels of this antioxidant.

Total Antioxidant Concentration



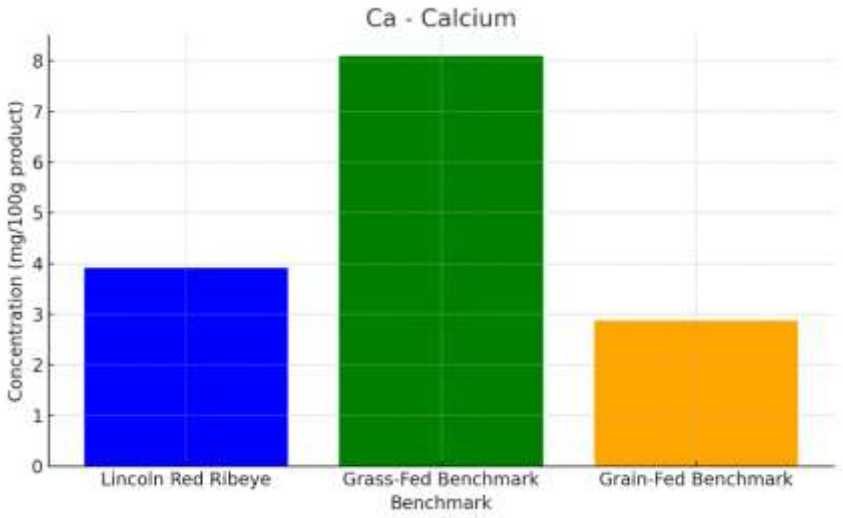
Overall, the Lincoln Red Ribeye samples had strong antioxidant values compared to both the grass-fed and grain-fed benchmarks when looked at in total concentration. These findings highlight the importance of diet in shaping the nutritional profile of beef, especially access to diverse forage. Pasture in grass-fed systems is beneficial, and hay in other systems that includes diverse species also is beneficial. Alfalfa is also called out for its contribution to a higher nutrient profile.

MINERALS

Introduction

Minerals found in ribeye steak, such as calcium, iron, potassium, magnesium, sodium, and zinc, play various roles in body functions, including bone health and muscle function. This analysis compares the Lincoln Red Ribeyes' mineral content with grass-fed and grain-fed ribeye benchmarks. Differences in mineral levels are often due to variations in the animals' diets and environmental conditions, which affect the absorption and deposition of minerals in the meat. In the case of the Lincoln Red ribeyes tested, it is likely that the water supplied to the steers that was high in minerals contributed to some of the mineral levels being elevated.

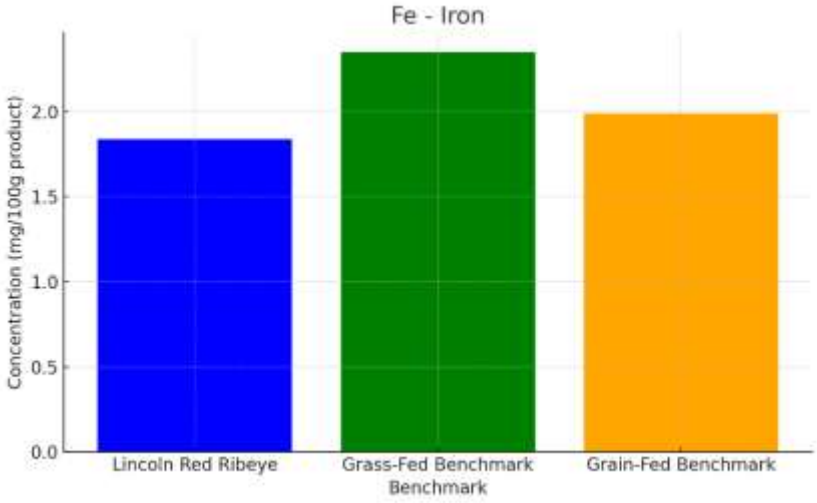
Ca - Calcium



The Lincoln Red Ribeyes had moderate levels of Ca - Calcium, being slightly higher than the Grain-Fed benchmark and significantly lower than the grass-fed Benchmark.

Health Benefit: Calcium is essential for strong bones and teeth, and its presence supports overall skeletal health.

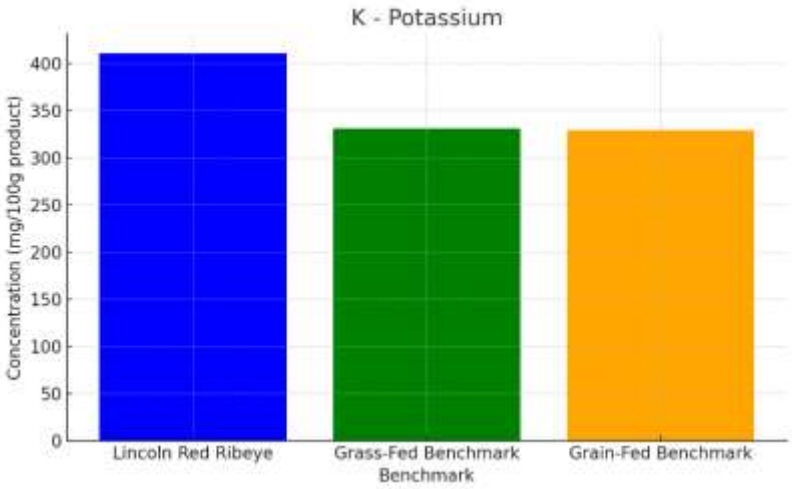
Fe - Iron



The Lincoln Red Ribeyes contained lower levels of iron than the two benchmarks.

Health Benefit: Iron is critical for oxygen transport in the blood, aiding energy levels and reducing fatigue.

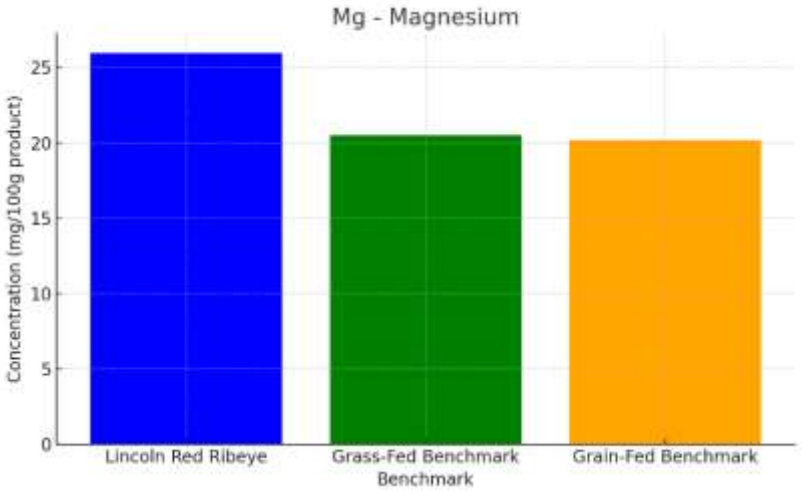
K - Potassium



The Lincoln Red Ribeyes showed higher concentration of K – Potassium compared to both the grass-fed and grain-fed benchmarks.

Health Benefit: Potassium helps regulate blood pressure and supports muscle and nerve function.

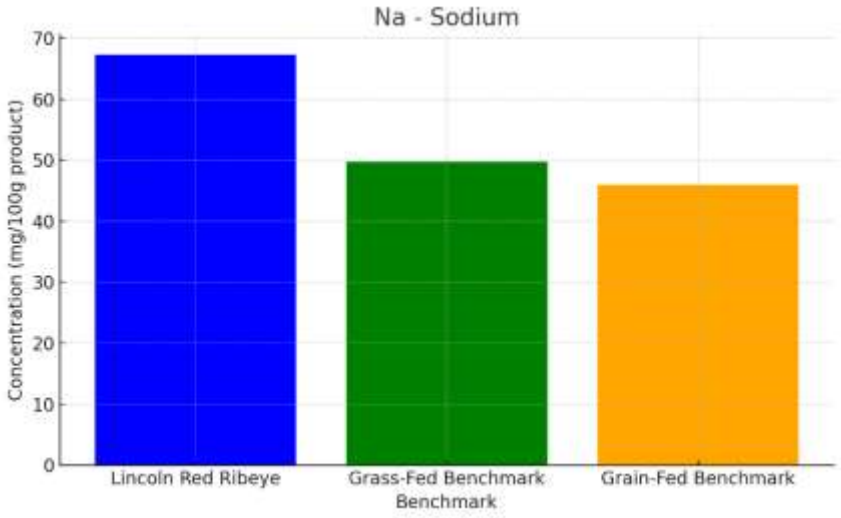
Mg - Magnesium



The Lincoln Red Ribeyes showed higher concentrations of Mg – Magnesium compared to both the grain-fed and grass-fed benchmarks.

Health Benefit: Magnesium is vital for muscle function and energy production, promoting a healthy metabolism.

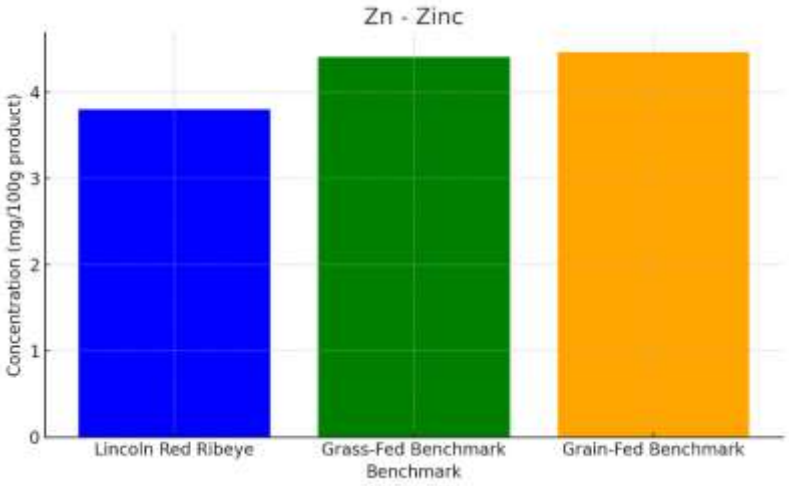
Na - Sodium



The Lincoln Red Ribeyes showed higher concentrations of Na – Sodium compared to both the grain-fed and grass-fed benchmarks.

Health Benefit: Sodium is essential for fluid balance and nerve signaling but should be consumed in moderation.

Zn - Zinc



The Lincoln Red Ribeyes contained slightly lower levels of Zn – Zinc compared to the grass-fed and grain-fed benchmarks.

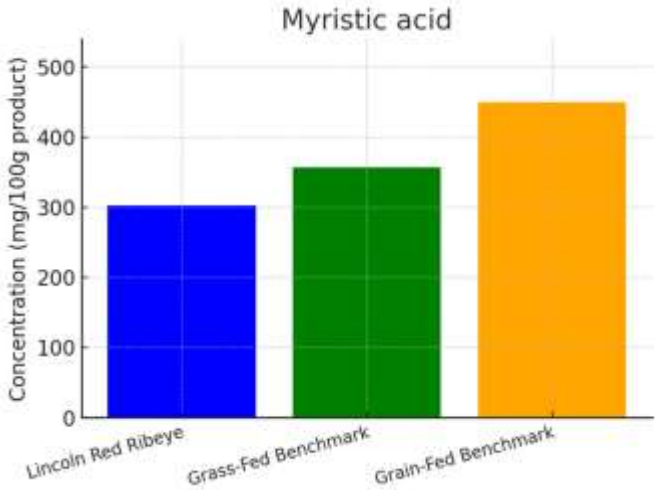
Health Benefit: Zinc supports immune function, wound healing, and overall cellular health.

FATS AND FATTY ACIDS

Fatty acids are important components of the fat found in meat, influencing its texture, flavor, and nutritional properties. In the case of ribeye steak, the fatty acid profile includes omega-6 and omega-3 fatty acids, which can affect heart and brain health. In the following analysis, the Lincoln Red Ribeye averages are compared to two benchmarks, grass-fed and grain-fed ribeye, to assess differences in fatty acid concentrations. Variations in these profiles arise due to the animals' diets, with grass-fed beef typically having different levels of fat and fatty acids compared to grain-fed beef. The comparison highlights how these dietary factors can influence the overall fatty acid content in the meat.

The Lincoln Red Ribeyes had significantly lower total fat levels compared to grass-fed and grain-fed benchmarks. This finding is reflected in the levels of Myristic Acid, Palmitic Acid, Oleic Acid, and DHA. The Lincoln Red Ribeyes had levels of the fatty acids EPA and DPA that were intermediate between the grass-fed and grain-fed benchmarks, indicating a more favorable fat profile than grain-fed beef. The Lincoln Red Ribeyes had a favorable ratio of Omega 6 and Omega 3 fatty acids compared to the grain-fed benchmark. The Lincoln Red O6/O3 ratio was also favorable compared to other small farm/feedlot results despite being raised similarly.

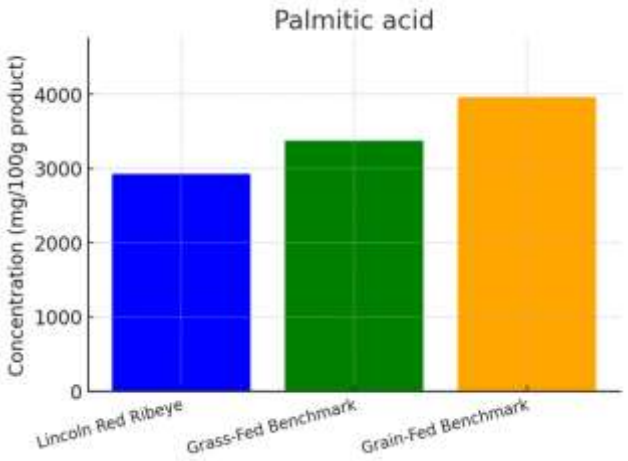
Myristic Acid



The Lincoln Red Ribeyes contained lower amounts of Myristic acid compared to both benchmarks. Grass-fed and grain-fed benchmarks offer higher levels.

Health Benefit: Myristic acid supports energy production and cellular membrane function.

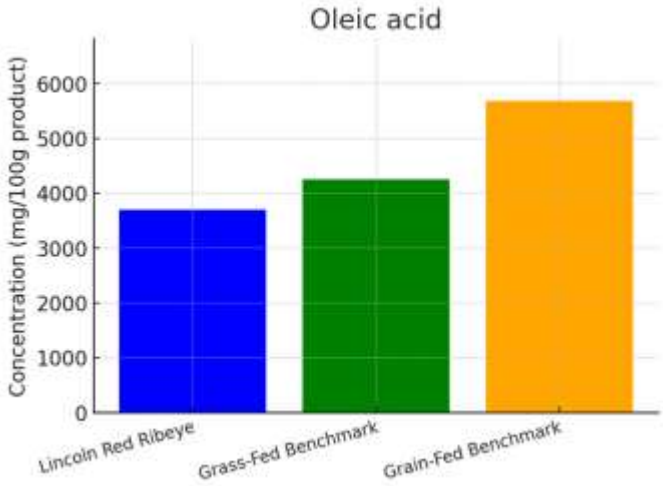
Palmitic acid



The Lincoln Red Ribeyes contained lower amounts of Palmitic acid compared to both benchmarks. Grass-fed and grain-fed benchmarks offer higher levels.

Health Benefit: Palmitic acid is a key component of cell membranes and energy metabolism.

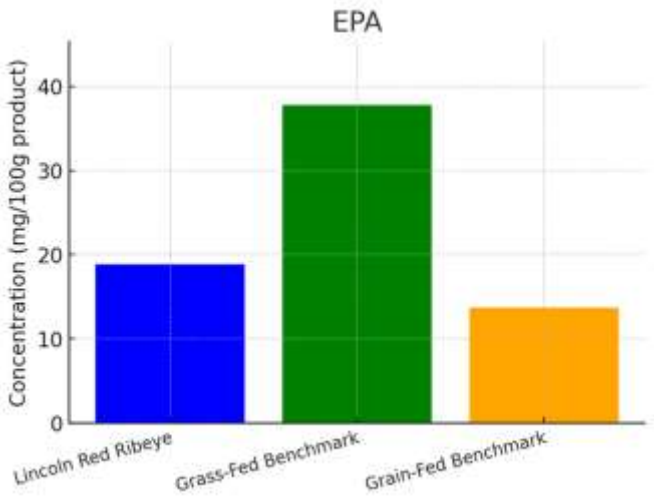
Oleic acid



The Lincoln Red Ribeyes contained lower amounts of Oleic acid compared to both benchmarks.

Health Benefit: Oleic acid supports cardiovascular health and reduces inflammation.

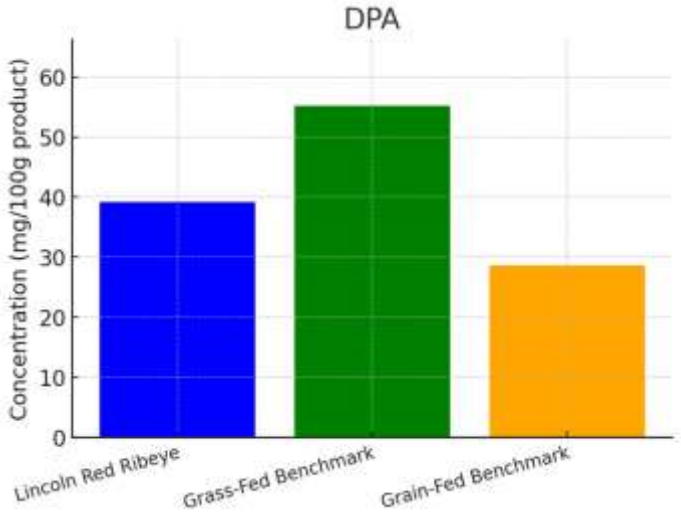
EPA



The Lincoln Red Ribeyes contained intermediate amounts of EPA compared to both benchmarks.

Health Benefit: EPA supports brain and heart health while reducing inflammation.

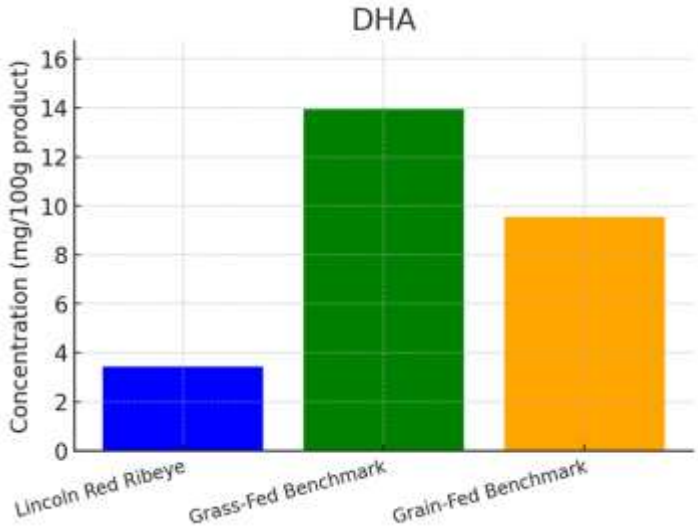
DPA



The Lincoln Red Ribeyes contained intermediate amounts of DPA compared to both benchmarks.

Health Benefit: DPA improves cardiovascular function and supports anti-inflammatory processes.

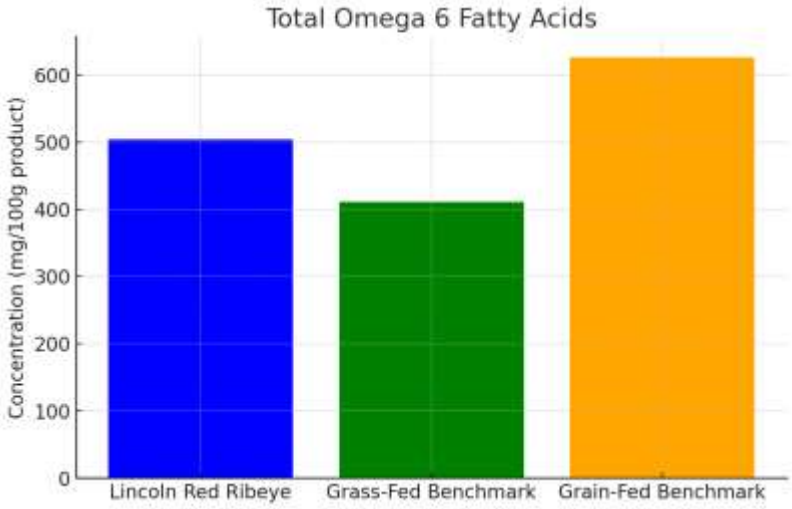
DHA



The Lincoln Red Ribeyes contained lower amounts of DHA compared to both benchmarks. Grass-fed and grain-fed benchmarks offer significantly higher levels.

Health Benefit: DHA is essential for brain health and cognitive function.

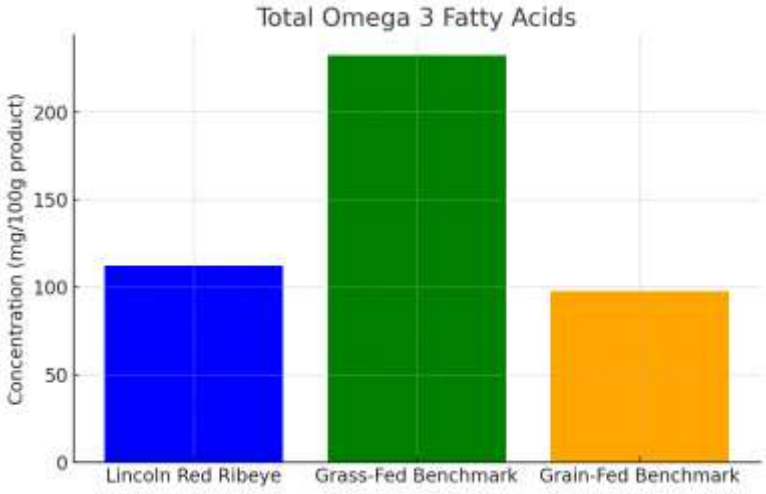
Total Omega 6 Fatty Acids



The Lincoln Red Ribeyes contained higher amounts of Total Omega 6 Fatty Acids compared to grass-fed beef, but lower amounts compared to grain-fed beef, suggesting intermediate levels.

Health Benefit: Omega-6 fatty acids support skin health and hormone regulation.

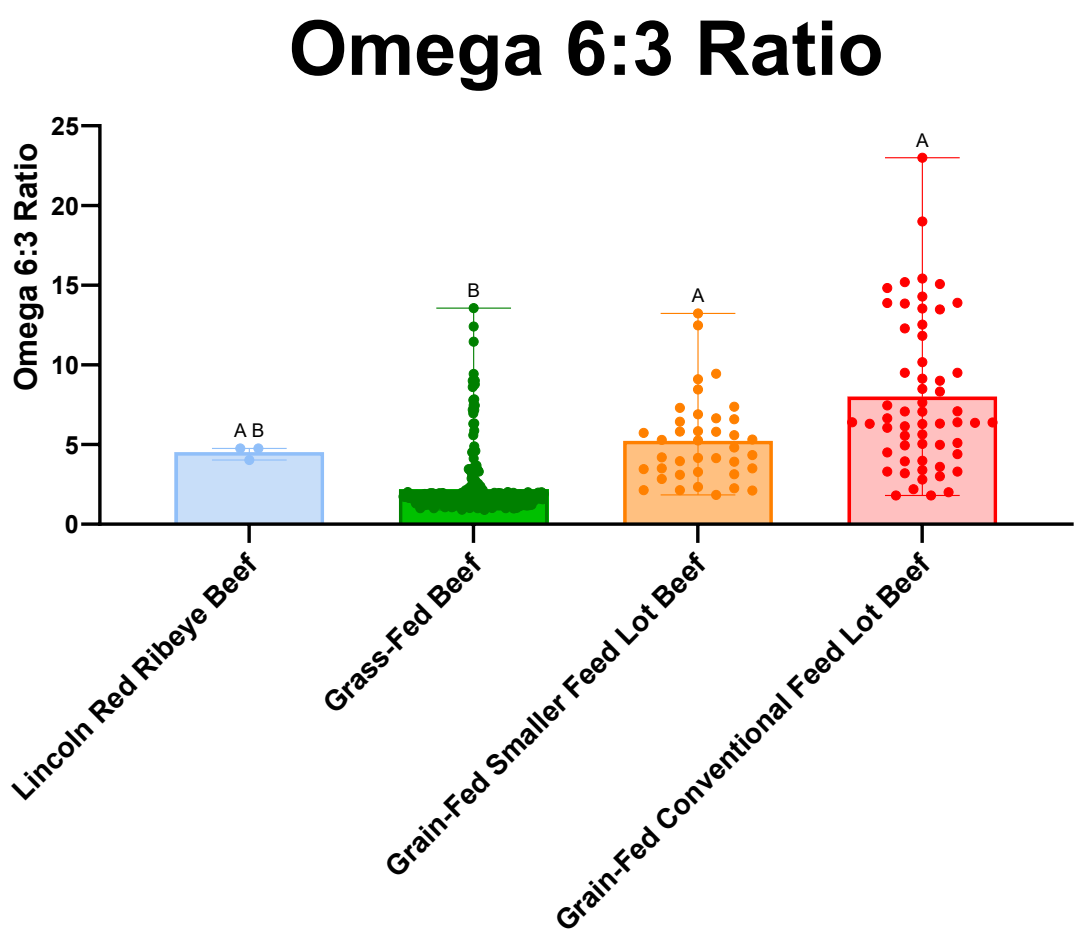
Total Omega 3 Fatty Acids



The Lincoln Red Ribeyes contained lower amounts of Total Omega 3 Fatty Acids compared to grass-fed benchmarks but higher levels than grain-fed benchmarks, further indicating that these samples are intermediate between the grass-fed and grain-fed benchmarks. Feeding more biodiverse forages can increase the omega-3 profile in meat.

Health Benefit: Omega-3 fatty acids are crucial for brain and cardiovascular health.

Total Omega 6 / Omega 3 Ratio



The Lincoln Red Ribeyes showed a level of Total Omega 6 / Omega 3 Ratio that was intermediate and aligned with other smaller feedlots, while being lower than typical conventional feedlot beef, which mirrors the findings of total omega 6 and total omega 3 fatty acids. The Beef Study found that high plant diversity is associated with improved omega 6 / omega 3 ratios. The omega 6/omega 3 ratio of the Lincoln Red Ribeyes was just above 4. That value represents a favorable ratio considering that the Standard American Diet has a ratio of 16 and other small feeding environments had a ratio of 5.

The different letters on the graph above indicate which samples are different in the associated data set. Overall, grass-fed beef is different from both the smaller feed lot beef and the conventional feedlot beef, while the Lincoln Red Ribeyes are more closely aligned with data gathered from smaller feedlots that typically feed less grains.

Health Benefit: A balanced Omega-6/Omega-3 ratio reduces the risk of chronic diseases.

OPPORTUNITIES FOR FURTHER INVESTIGATION AND IMPROVEMENT

The Beef Study found definitively that cattle rotationally grazed on diverse pastures produced more nutrient-dense beef. The cattle that produced the three Lincoln Red ribeyes that were tested were not raised in that sort of environment though still produced favorable results. We in the Lincoln Red community can learn about replicating the recent favorable test results as well as how we might produce even more nutrient-dense Lincoln Red beef by considering the following scenarios:

- Only three Lincoln Red ribeyes were tested, and they all came from the same production environment. Our breed will benefit from testing ribeyes from other production environments and increasing the number of test results that we can compare to each other.
- Produce Lincoln Red beef from cattle raised with a different water supply than those documented in this handbook. How would the mineral levels compare? How would the ribeyes grade?
- Produce Lincoln Red beef from cattle raised with a longer pasture period and shorter grain-fed period than those documented in this handbook. How would the nutrient density measurements compare? How would the ribeyes grade?
- Produce Lincoln Red beef from cattle raised and finished in a grassfed, rotational grazing and diverse forage system. What nutrient density would this beef have compared to the beef documented in this handbook? How would the ribeyes grade?
- Produce Lincoln Red beef from cattle raised in a grassfed system as described by Allan Nation to produce gourmet grass-fed beef. What nutrient density would this beef have compared to the beef documented in this handbook? How would the ribeyes grade?

Ultimately, we need to raise beef that consumers want to buy and buy again. The idea that any given food, such as beef, has variable levels of nutrient density is still not well known by consumers. Flavor, though, is understood and valued (1) and is often correlated with nutrient density. Our focus then can be on raising the most flavorful Lincoln Red beef that we can in our particular environment.

1) Lancaster, Phillip. "Consumer Ranking of Beef Sustainability Attributes," 12/12/23 at https://ksubci.org/2023/12/12/consumer-ranking-of-beef-sustainability-attributes/

ADDITIONAL RESOURCES

Nation, Allan. *Grassfed to Finish: A production guide to Gourmet Grass-Finished Beef*. Ridgeland, Mississippi: Green Park Press, 2005.

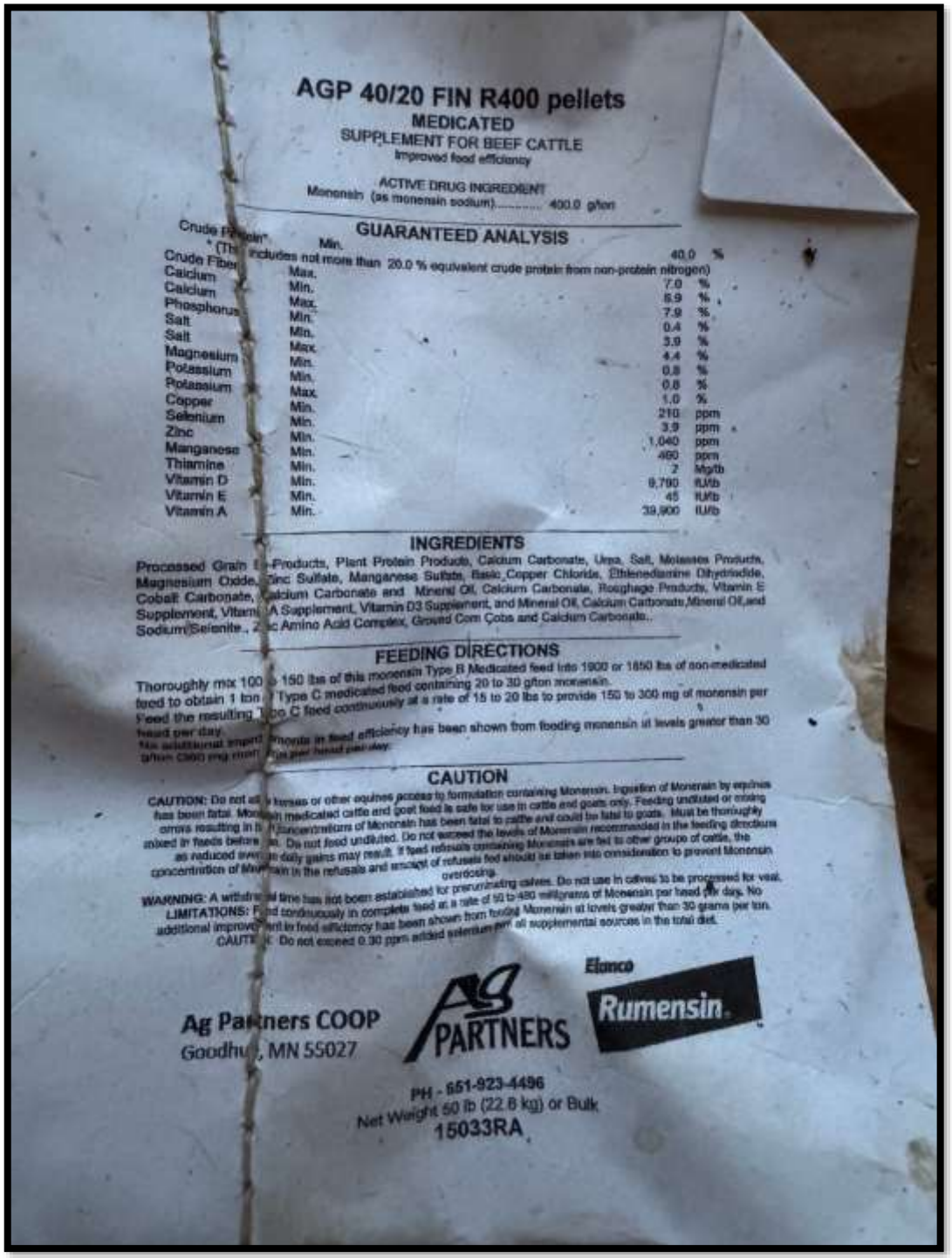
The Stockman Grassfarmer, monthly publication of Mississippi Valley Publishing Corp., Ridgeland, Mississippi. www.stockmangrassfarmer.com

Bionutrient Food Association. Barre, Massachusetts. www.bionutrient.org

https://extension.okstate.edu/fact-sheets/an-introduction-to-finishing-beef.html

APPENDIX A: FEED AND MINERAL TAGS

PROTEIN PELLETS TAG



AGP 40/20 FIN R400 pellets

MEDICATED

SUPPLEMENT FOR BEEF CATTLE

Improved feed efficiency

ACTIVE DRUG INGREDIENT

Monensin (as monensin sodium)..... 400.0 g/ton

GUARANTEED ANALYSIS

Crude Protein*	Min.	40.0	%
* (This includes not more than 20.0 % equivalent crude protein from non-protein nitrogen)			
Crude Fiber	Max.	7.0	%
Calcium	Min.	8.9	%
Calcium	Max.	7.9	%
Phosphorus	Min.	0.4	%
Salt	Min.	3.9	%
Salt	Max.	4.4	%
Magnesium	Min.	0.8	%
Potassium	Min.	0.8	%
Potassium	Max.	1.0	%
Copper	Min.	210	ppm
Selenium	Min.	3.9	ppm
Zinc	Min.	1,040	ppm
Manganese	Min.	460	ppm
Thiamine	Min.	2	Mg/lb
Vitamin D	Min.	9,790	IU/lb
Vitamin E	Min.	45	IU/lb
Vitamin A	Min.	39,900	IU/lb

INGREDIENTS

Processed Grain By-Products, Plant Protein Products, Calcium Carbonate, Urea, Salt, Molasses Products, Magnesium Oxide, Zinc Sulfate, Manganese Sulfate, Basic Copper Chloride, Ethylenediamine Dihydriodide, Cobalt Carbonate, Calcium Carbonate and Mineral Oil, Calcium Carbonate, Roughage Products, Vitamin E Supplement, Vitamin A Supplement, Vitamin D3 Supplement, and Mineral Oil, Calcium Carbonate, Mineral Oil, and Sodium Selenite., Zinc Amino Acid Complex, Ground Corn Cobs and Calcium Carbonate..

FEEDING DIRECTIONS

Thoroughly mix 100 to 150 lbs of this monensin Type B Medicated feed into 1900 or 1850 lbs of non-medicated feed to obtain 1 ton of Type C medicated feed containing 20 to 30 g/ton monensin.

Feed the resulting Type C feed continuously at a rate of 15 to 20 lbs to provide 150 to 300 mg of monensin per head per day.

No additional improvements in feed efficiency has been shown from feeding monensin at levels greater than 30 g/ton (360 mg monensin per head per day).

CAUTION

CAUTION: Do not allow horses or other equines access to formulation containing Monensin. Ingestion of Monensin by equines has been fatal. Monensin medicated cattle and goat feed is safe for use in cattle and goats only. Feeding undiluted or mixing errors resulting in higher concentrations of Monensin has been fatal to cattle and could be fatal to goats. Must be thoroughly mixed in feeds before use. Do not feed undiluted. Do not exceed the levels of Monensin recommended in the feeding directions as reduced average daily gains may result. If feed refusals containing Monensin are fed to other groups of cattle, the concentration of Monensin in the refusals and amount of refusals fed should be taken into consideration to prevent Monensin overdosing.

WARNING: A withdrawal time has not been established for preruminating calves. Do not use in calves to be processed for veal.

LIMITATIONS: Feed continuously in complete feed at a rate of 50 to 480 milligrams of Monensin per head per day. No additional improvement in feed efficiency has been shown from feeding Monensin at levels greater than 30 grams per ton.

CAUTION: Do not exceed 0.30 ppm added selenium per all supplemental sources in the total diet.

Ag Partners COOP
Goodhue, MN 55027

AG PARTNERS

Elanco Rumensin

PH - 651-923-4496
Net Weight 50 lb (22.6 kg) or Bulk
15033RA

SALT TAG


M-N-FINE®
A fine-screened, sodium chloride salt specially sized for blending in animal rations or for free choice feeding of salt to livestock. This salt is suitable for all animal diets, but should not be used for direct human food applications.
GUARANTEED ANALYSIS
SALT (as NaCl) MINIMUM % 95.0 ppm 950,000
SALT (as NaCl) MAXIMUM % 99.9 ppm 999,000
INGREDIENTS
Salt
FEEDING DIRECTIONS
Feed this supplement free choice to cattle, horses, goats and swine.
Provide an adequate supply of fresh water for all animals at all times.
Ensure that average daily roughage meets required levels for all applicable animals.
This product is formulated for consumption by:
Beef Cattle
Dairy Cattle
Horses
Goats
Swine
Sheep
Poultry
other animal feeding uses are not warranted by Cargill, Incorporated.
THIS SALT IS FOR ANIMAL FEEDING ONLY. NOT FOR HUMAN USE.

MINERAL MIX TAG