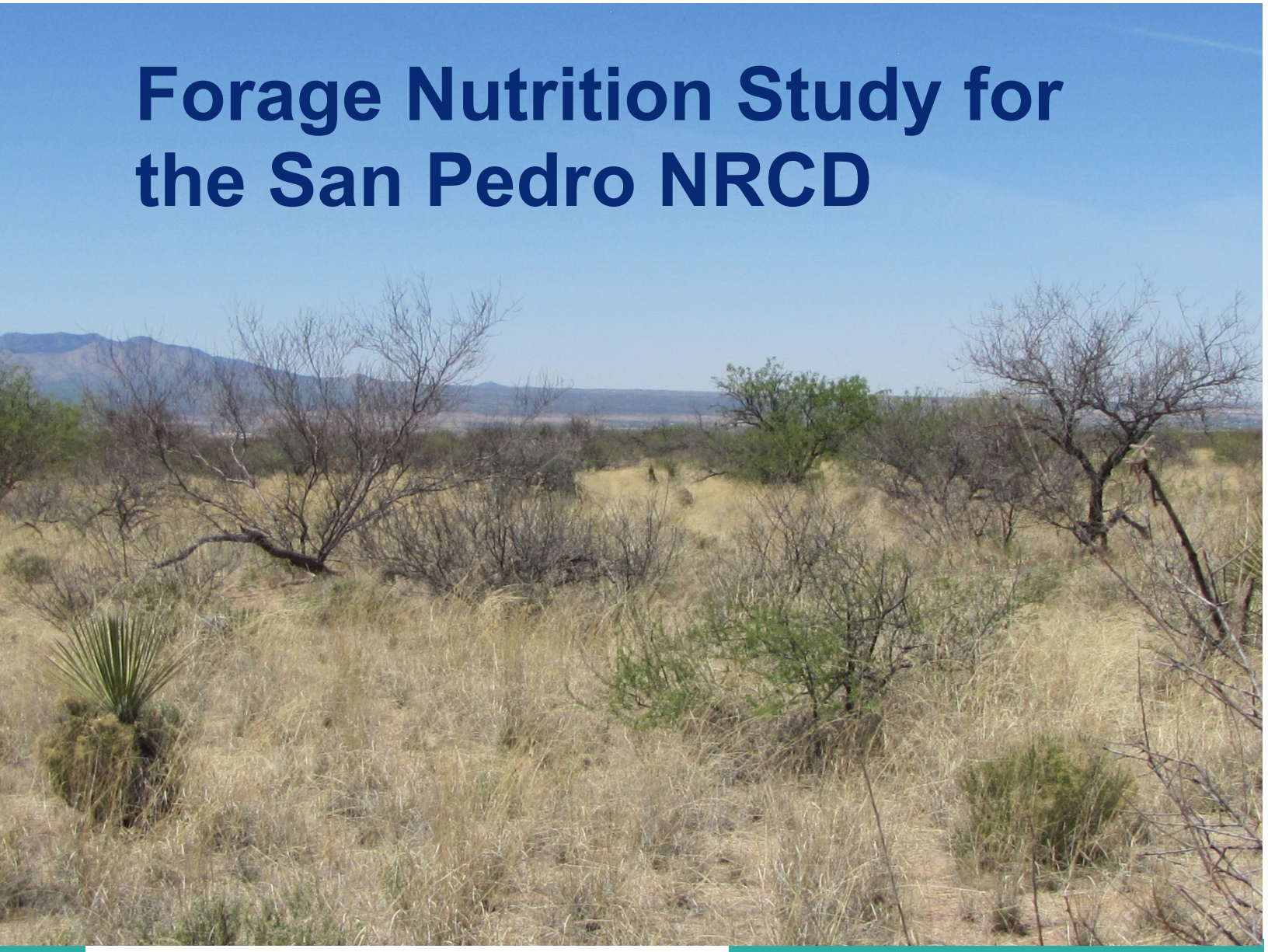
Forage Nutrition Study for the San Pedro NRCD



JUNE 1, 2021

The University of Arizona Cooperative Extension and
Natural Resources Conservation Service

THE UNIVERSITY OF ARIZONA
Cooperative Extension

USDA United States Department of Agriculture
Natural Resources Conservation Service

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Acknowledgments:

The authors would like to thank Paul Kartchner for the use of his ranch to conduct this study, his assistance in locating the study sites, and spending time in the field with us. Dustin Hancock also assisted in gathering some of the forage samples and measuring rainfall.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Jeffrey C. Silvertooth, Associate Dean & Director, Extension & Economic Development, Division of Agriculture, Life and Veterinary Sciences, and Cooperative Extension, The University of Arizona.

List of Acronyms

CP – Crude Protein

DM – Dry Matter

ESD – Ecological Site Description

FDA – Food and Drug Administration

HCPC – Historic Climax Plant Community

LRU – Land Resource Unit

MLRA – Major Land Resource Area

NRC – National Research Council

TDN – Total Digestible Nutrients

Study Overview

Geology and the associated weathered soils can be tied to some of the mineral deficiencies in forage plants. For example, Arizona rangelands that consist of granitic or volcanic derived soils most likely have a selenium deficiency in the forage. Previous studies in central Arizona tested forage on these types of soils resulting in 30 to 50% of the minimum amount required. The studies in central Arizona also showed that Copper and Selenium vary with the amount of rainfall on a given year. This study examines the major forage species found in much of the San Pedro Natural Resource Conservation District (SPNRCD), looking for significant differences and fluctuations of the important macro- and micro-minerals for cattle health.

Four study locations representing the most common ecological sites found in the SPNRCD were selected based on their soils and associated ecological sites. At each site, the key forage species present were sampled for protein, TDN, and mineral content. Sites were sampled for three years at two critical times: in the late spring/early summer when forage quality was likely to be low, and in the fall following the monsoon season when forage quality was likely to be high. This strategy intended to get an idea of the amount of fluctuation in protein, TDN, and minerals throughout the year, and between years of varying rainfall.

The minerals of most importance in this study include several macro- and micro- minerals. Macro minerals are present in large amounts in the body, and the National Research Council (NRC) has identified minimum recommended levels for seven of them: sodium, chlorine, calcium, phosphorous, magnesium, potassium, and sulfur. The ten microminerals (also called trace minerals) are required in lower quantities, but are no less important. These include iron, manganese, copper, zinc, selenium, cobalt, and iodine. For the purposes of this study, the minerals most likely to be deficient in Arizona include: Calcium (Ca), Phosphorous (P), Potassium (K), Magnesium (Mg), Sulfur (S), Copper (Cu), Iron (Fe), Zinc (Zn), and Selenium (Se).

Total Digestible Nutrients (TDN) were examined as a base measure of the overall quality and digestibility of the forage. This is a common measurement used when developing cattle diets for the feedlot industry, and takes into account the crude protein (CP), the digestible crude fat, the digestible portions of the plant cell walls, and the digestible non-structural carbohydrates. Forages that are higher in protein and lower in lignin and other non-digestible carbohydrates will have a higher TDN, while those lower in protein and less digestible (higher indigestible plant wall components) will have a lower TDN.

Finally, the role of crude protein was considered. As cattle are ruminants, they primarily ferment the forages they consume in their bacteria filled rumen and utilize the byproducts of fermentation (volatile fatty acids). This allows them to take moderate to poor quality forages and turn them into high quality protein. However, the protein content of the forages can play a key role in their ability to do this effectively. As dietary protein drops below 6.25%, the numbers and activity of the rumen microbiota starts to rapidly decline. This reduces the cow's ability to effectively ferment the forage she is intaking - the forages take longer to ferment, which means she must reduce her daily dry matter (DM) intake. This is a bit of a double hit: she is both processing lower quality forage, and she's not able to process as much of it each day. Previous research has shown the benefits to providing a protein supplement (minimum 22% crude protein) when forage protein content drops below 6.25%. This raises the protein in the overall diet and allows the rumen microbiota to more effectively process these low-quality forages. This

study looked at the seasonal and year to year fluctuations in protein content of these major forage species.

It is important to note that supplementation of range cattle with a mineral product is not an exact science. There is variability in the bioavailability of different minerals/mineral complexes, differing consumption levels among individual animals, and fluctuations in rainfall and forage species abundance from year to year. However, arming producers with the knowledge about what minerals are likely to be deficient on their rangelands is the first step in helping them develop a more targeted approach to their supplement program.

Study Location

The Box K Ranch is located southeast of St. David, Arizona in Cochise County. The lowest elevations (3700 ft.) on the ranch are located just east of Town and State Highway 80 and the highest elevations (4300 ft.) are just under 5 miles to the east where the ranch borders the Dragoon Mountain Ranch equestrian community.

Major Land Resource Area (MLRA), Land Resource Unit (LRU), and Ecological Site Description (ESD): The Box K Ranch lies entirely in MLRA 41, Southeastern Arizona Basin and Range. There are two LRU's represented on the ranch including 41.2 Chihuahuan Desert Shrub (8 – 12" precipitation zone) and 41.3 Southern Arizona Semidesert Grassland (12 – 16" precipitation zone). Typically, the general landscape view of LRU 41.2 is a desert shrub – grassland and an open grassland for LRU 41.3. There are over nine different Ecological Sites on the ranch, each site having its' own potential to produce and support different plant communities. There are five ecological sites represented in this Forage Nutrition Study. Sample Sites were selected that produce a substantial amount of perennial forage species for cattle on the Box K Ranch.

Figure 1. Box K 1 Sample Site - Sandy Loam Upland.

The Box K 1 Sample Site was established on a 41.3 Sandy Loam Upland Ecological Site, these sites have deep soils (> 20" depth) with a sandy loam surface horizon greater than 4 inches deep laying over a clayey textured horizon. Plant and soil conditions are considered to be excellent as infiltration rates are relatively high and the clayey subsurface captures and holds water well making it readily available for shallow rooted plants. These sites can have subsurface calcic horizons which will support limy liking shrubs and half shrubs. The Historic Climax Plant Community (HCPC) on these sites can produce up to 1000 lbs. per acre annual production which primarily comes from warm season grasses. Lehmann Lovegrass (*Eragrostis lehmanniana*), a warm season grass and Mesquite (*Prosopis velutina*) leaves were the forage species selected for this study on this site.

Figure 2. Box K 2 Sample Site - Loamy Upland.

The Box K 2 Sample Site was established on a 41.3 Loamy Upland Ecological Site, these sites have deep soils with a clayey textured horizon close to the surface (< 4 inches). These sites tend to support shrubby grasslands and the HCPC can produce 1000 lbs. per acre annual production, 85 percent of which is from warm season grasses. These sites can also have calcic horizons at depth which will support limy liking shrubs and half shrubs. Three warm season grasses were selected for the study on this site, they are Black Grama (*Bouteloua eriopoda*), Spidergrass Three Awn (*Aristida ternipes*) and Lehmann Lovegrass.

The Box K 3 Sample Site has characteristics of both a 41.3 Sandy Wash and 41.3 Sandy Loam Upland, Deep Ecological Sites. The main difference between the two sites is that the Sandy Wash experiences periodic flooding and the Sandy Loam Upland Deep site is not subject to flooding. Both sites have deep soils that are mostly course textured and a clayey or argillic horizon is absent. The HCPC for Sandy Wash sites is generally more productive due to the additional moisture received from offsite, annual production can be as high as 1800 lbs. per acre of which 55 percent is derived from grasses. The HCPC for the Sandy Loam Upland Deep site can produce 1000 lbs. per acre with 85 percent coming from grasses. Three warm season grass species were sampled from this site for this study, they are Black Grama, Spike Dropseed (*Sprobolus contractus*) and Giant Sacaton (*Sporobolus wrightii*).

Figure 3. Box K 3 Sample Site – Sandy Wash/Sandy Loam Upland Deep.

Figure 4. Box K 4 Sample Site - Loamy Swale.

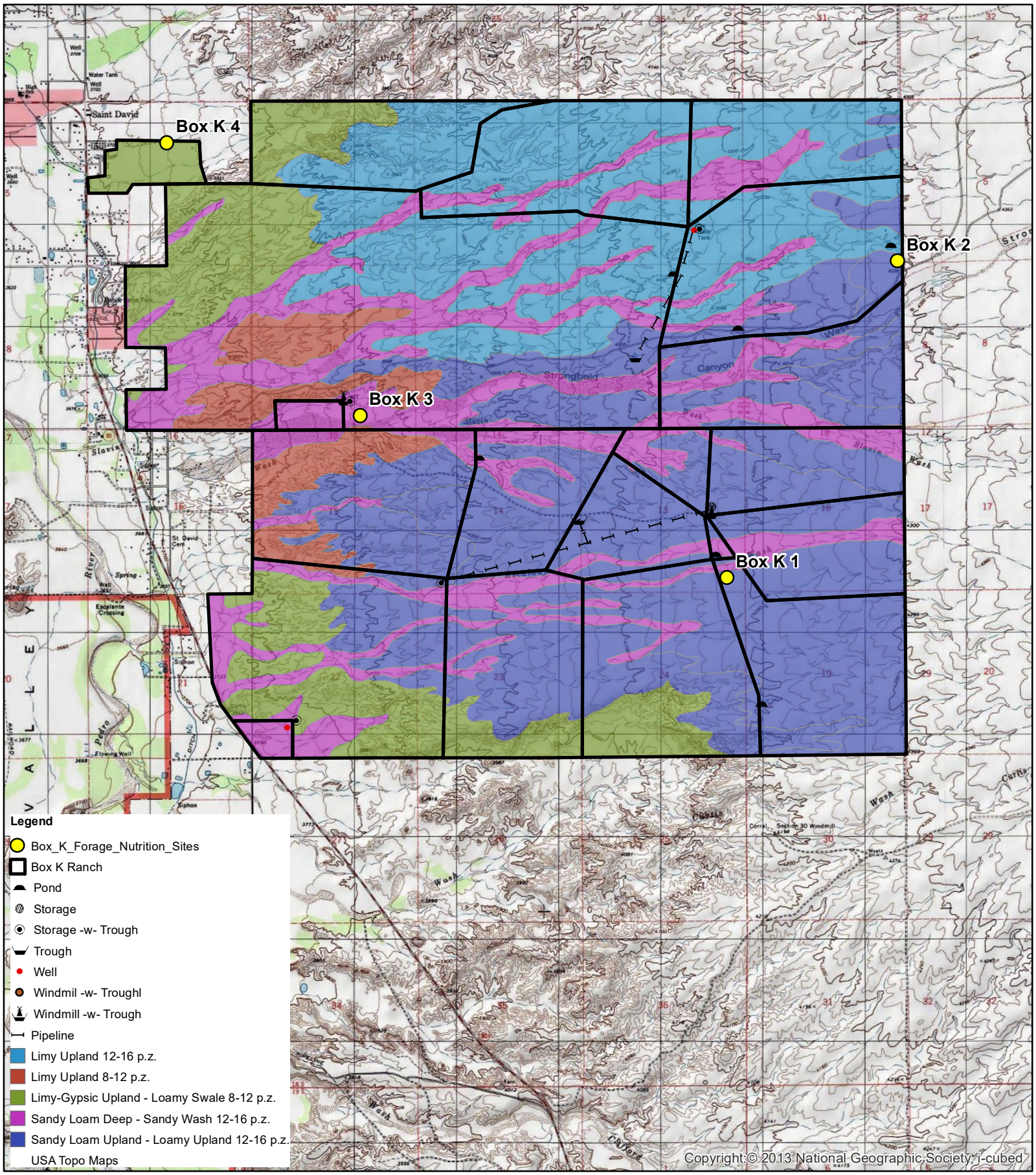
The Box K 4 Sample Site was established on a 41.2 Loamy Swale Ecological Site. These are floodplain sites with deep soils derived from loamy or clayey alluvium. Study participants suspect that the soils on this site contain gypsum and possibly calcium carbonates in the soil profile. The gypsum is highly soluble in water and tends to be highly erodible when subsurface soils are exposed. The calcium carbonates located at depth in the soil profile can support limy liking shrubs. The HCPC for this site is very productive, supporting up to 2000 lbs. per acre annual plant production with 75 percent of that coming from grasses. Tobosa (*Pleuraphis mutica*), a warm season perennial grass is the forage species sampled from this site for this study.

Table 1. Summary of Sample Site Information.

Study Site	Location (UTM NAD 83)	Elevation (ft.)	Ecological Site Description	Forage Species Sampled
Box K 1	12R 0580604 3525559	4204	41.3 Sandy Loam Upland	Lehmann Lovegrass, Mesquite (leaves)
Box K 2	12R 0582340 3528650	4272	41.3 Loamy Upland	Black Grama, Spidergrass Three Awn, Lehmann Lovegrass
Box K 3	12R 0577089 3527160	3840	41.3 Sandy Wash/Sandy Loam Upland, Deep	Black Grama, Spike Dropseed, Giant Sacaton
Box K 4	12R 0575167 3529787	3735	41.2 Loamy Swale	Tobosa

Box K Ranch Forage Nutrition Study Map

Date: 4/21/2021
Field Office: WILLCOX SERVICE CENTER
Agency: USDA-NRCS
District: San Pedro NRCD



Legend

- Box_K_Forage_Nutrition_Sites
- Box K Ranch
- Pond
- Storage
- Storage -w- Trough
- Trough
- Well
- Windmill -w- Troughl
- Windmill -w- Trough
- Pipeline
- Limy Upland 12-16 p.z.
- Limy Upland 8-12 p.z.
- Limy-Gypsic Upland - Loamy Swale 8-12 p.z.
- Sandy Loam Deep - Sandy Wash 12-16 p.z.
- Sandy Loam Upland - Loamy Upland 12-16 p.z.
- USA Topo Maps

0 0.5 1 1.5 2 Miles

N

USDA

Prepared with assistance from USDA-Natural Resources Conservation Service

Methods

Once the study sites and key forage species were selected, a 24" white PVC pipe rain gauge was established at each site. Rain gauges were read twice a year at the same time that forage samples were collected. One inch of oil was added to the gauges to keep precipitation from evaporating before the next reading. Samples were collected around May and October for three years, beginning in late April, 2018.

Box K 1 – The forage species selected were Lehmann Lovegrass and Mesquite. Lehmann Lovegrass was collected both times of the year, but Mesquite was collected only in May. Each was collected in a separate bag.

Box K 2 – The forage species selected at this site were combined into one bag for analysis. The amount of each species was determined using the ESD for the site. The mix of grasses collected by amount was: Black Grama (60%), Lehmann Lovegrass (20%), and Spidergrass Three Awn (20%).

Box K 3 – The species at this site were also combined into one bag for analysis and the amount determined by the ESD. The mix of grasses collected by amount was: Black Grama (60%), Spike Dropseed (20%), and Giant Sacaton (20%).

Box K 4 – Tobosa grass dominates this ESD as the main perennial forage species and was the only species collected at this site.

Rainfall amounts were logged on myRAINge Log for tracking over time and comparison to PRISM data, and forage sample were sent to Utah State University Analytical Labs for analysis.

Precipitation

Table 2. Summary of Precipitation Data.

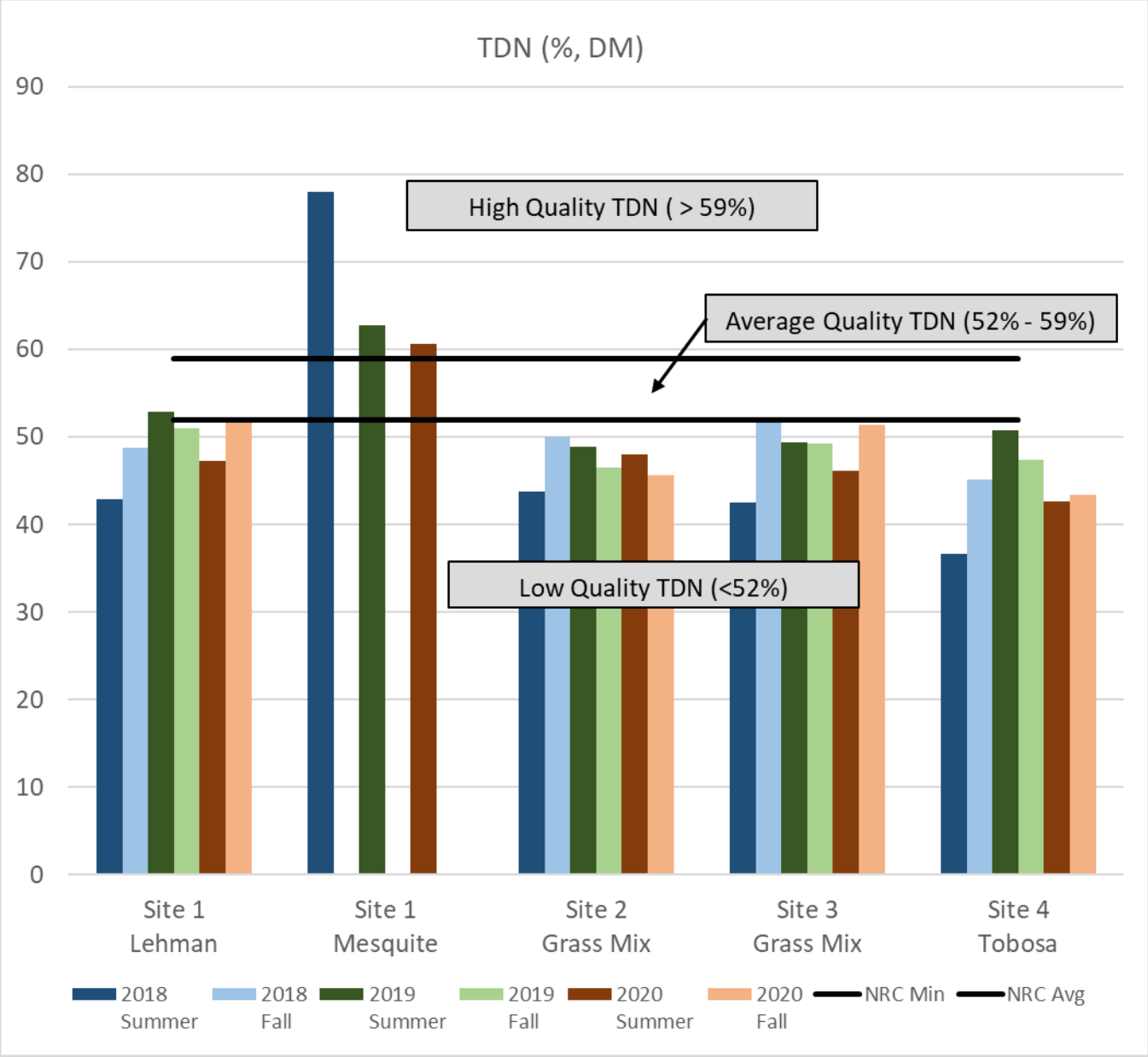
Reading Date	Ppt. Amount (")			
	Box K 1	Box K 2	Box K 3	Box K 4
4/25/2018 *	0	0	0	0
9/27/2018	5.88	5.88	5.5	5.6
5/17/2019	7.5	7.5	7.5	8.25
10/14/2019	6.75	7	8.5	11.5
5/26/2020	5	6	9	5.75
10/15/2020	2.63	2	2.88	3
5/10/2021	2.13	2	2.63	1.63

* Date the rain gauge was established.

For all Sample Sites the period from 4/2018-5/2019 and 5/2019-5/2020 were near expected totals according to PRISM models (previous 30-year average) for each gauge location. However, the period from 5/2020-5/2021 is in the Extremely Dry category according to the PRISM model for each gauge location. This last period put the total rainfall in the 2nd lowest percentile, meaning it only gets this dry once in a hundred years, statistically speaking.

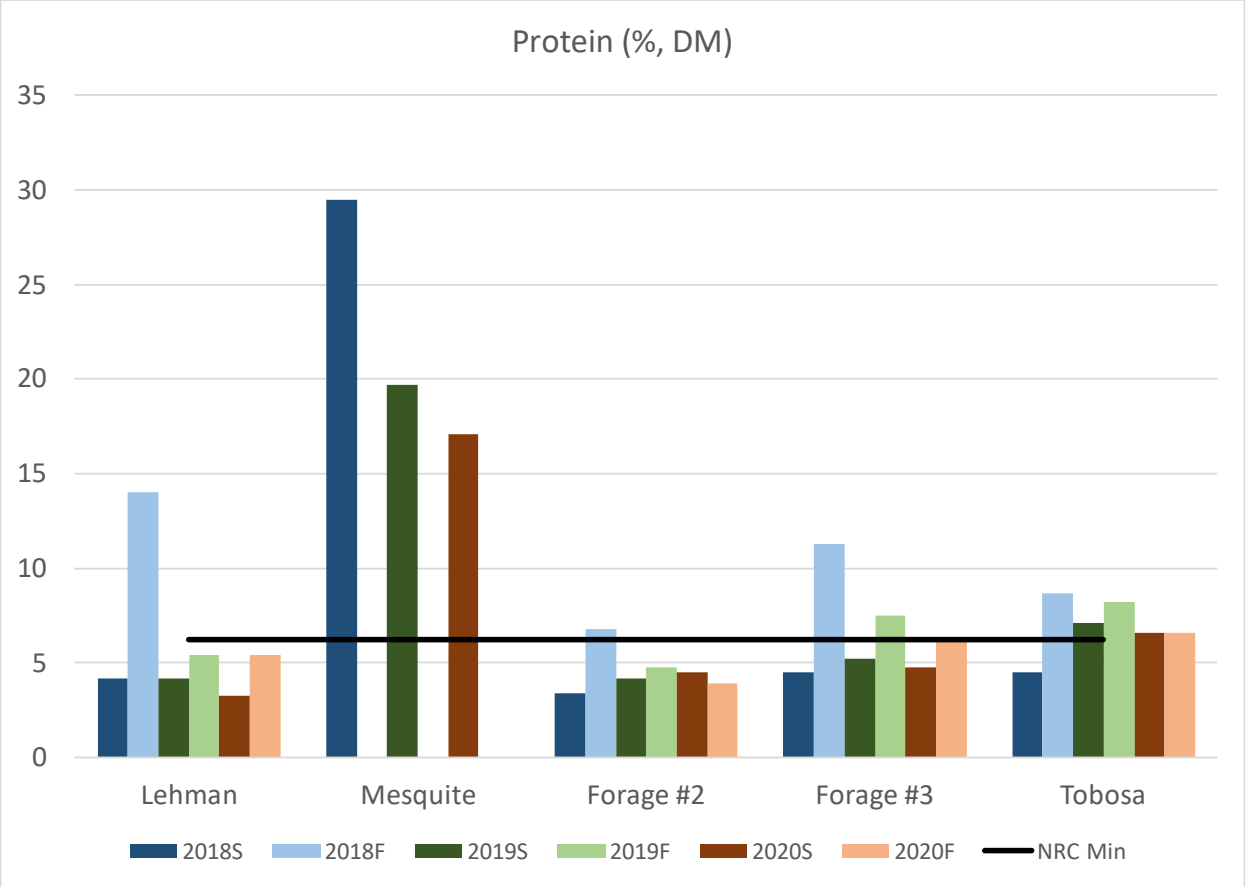
Forage Analysis

Total Digestible Nutrients (TDN)



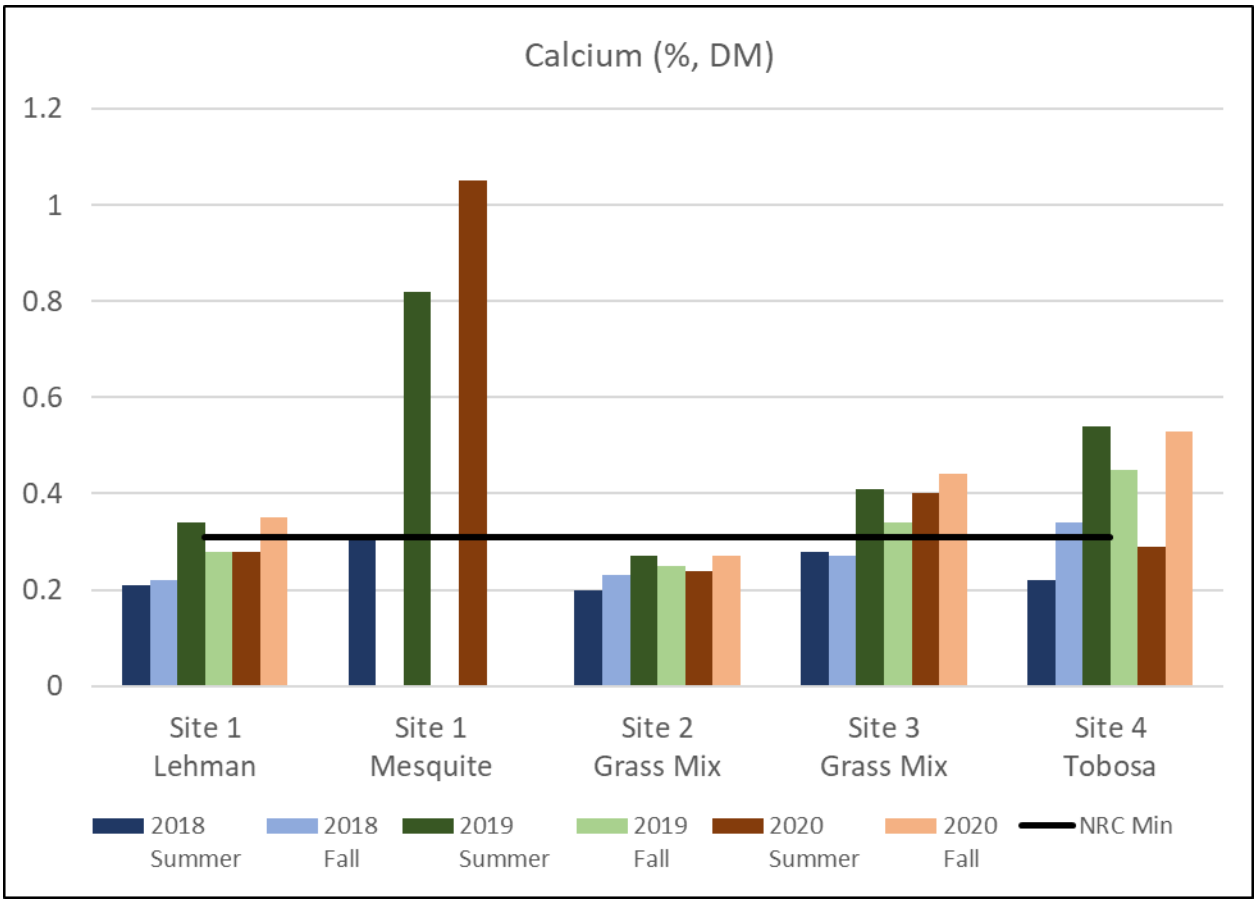
TDN represents the total quality of the forage present, taking into account the digestibility. Generally, low quality forages have a TDN of less than 52%, average quality forages have a TDN between 52% and 59%, and high quality forages have a TDN over 59%. Nearly all forages sampled throughout the study fell into the “low quality” TDN range (with the exception of Mesquite).

Protein



Forages were frequently deficient in protein, falling under the minimum 6.25% necessary to sustain adequate rumen function. The fall of 2018 was the exception, possibly due to the timing of that year's rainfall and our sampling dates. Tobosa grass did appear to maintain its higher protein, across most sampling dates, however its poor palatability limits its usefulness. Mesquite, as a browse species, was high in protein however it has a short-lived window of usefulness. It could potentially help offset lower protein in forages during that time.

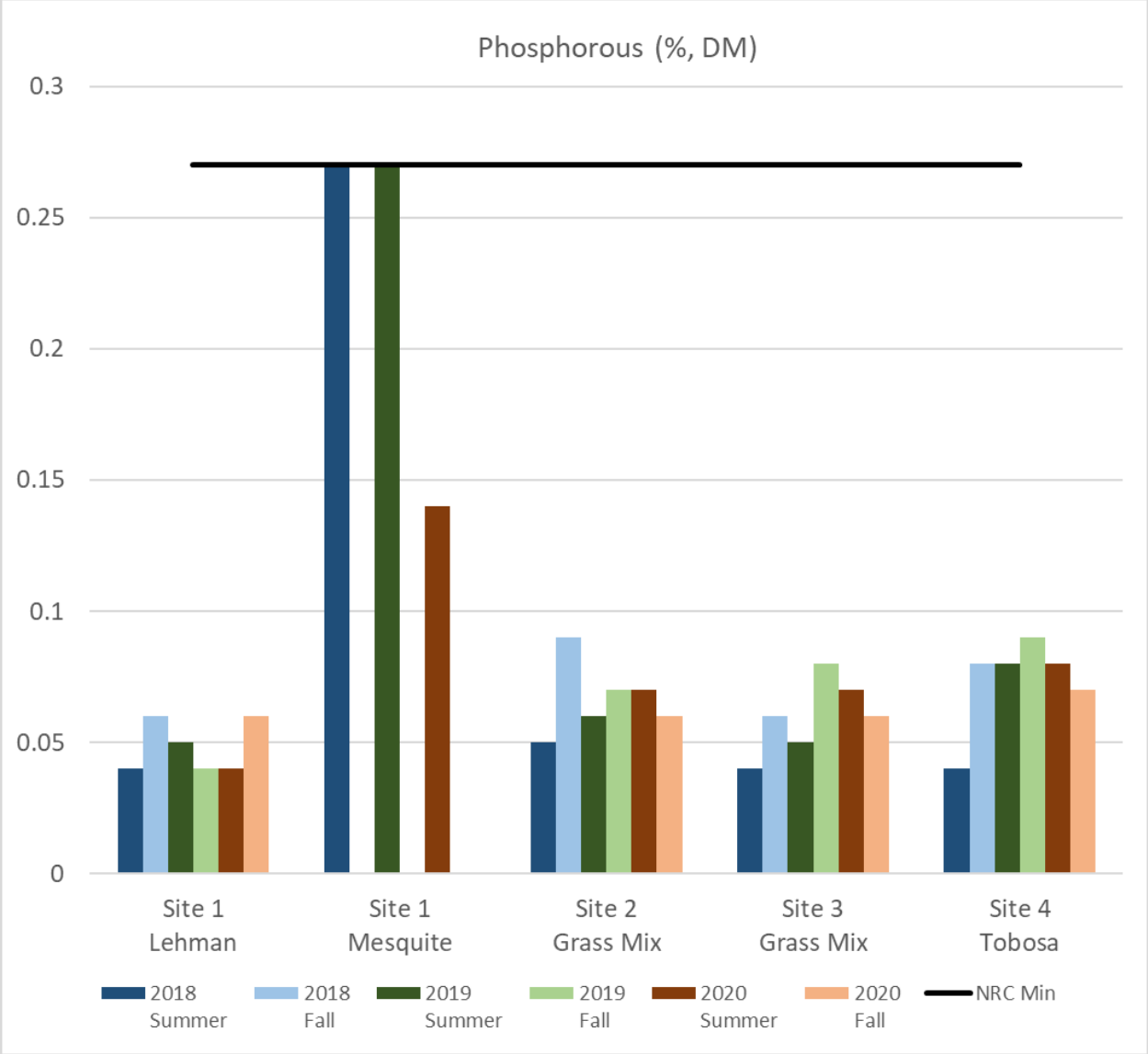
Calcium



Calcium is one of the most abundant minerals in the body. It's the major structural component of bones, and has several other important functions including muscle contraction and cardiac regulation. Calcium's presence in relationship to Phosphorous is very important and should ideally be a 2:1 ratio (calcium: phosphorous).

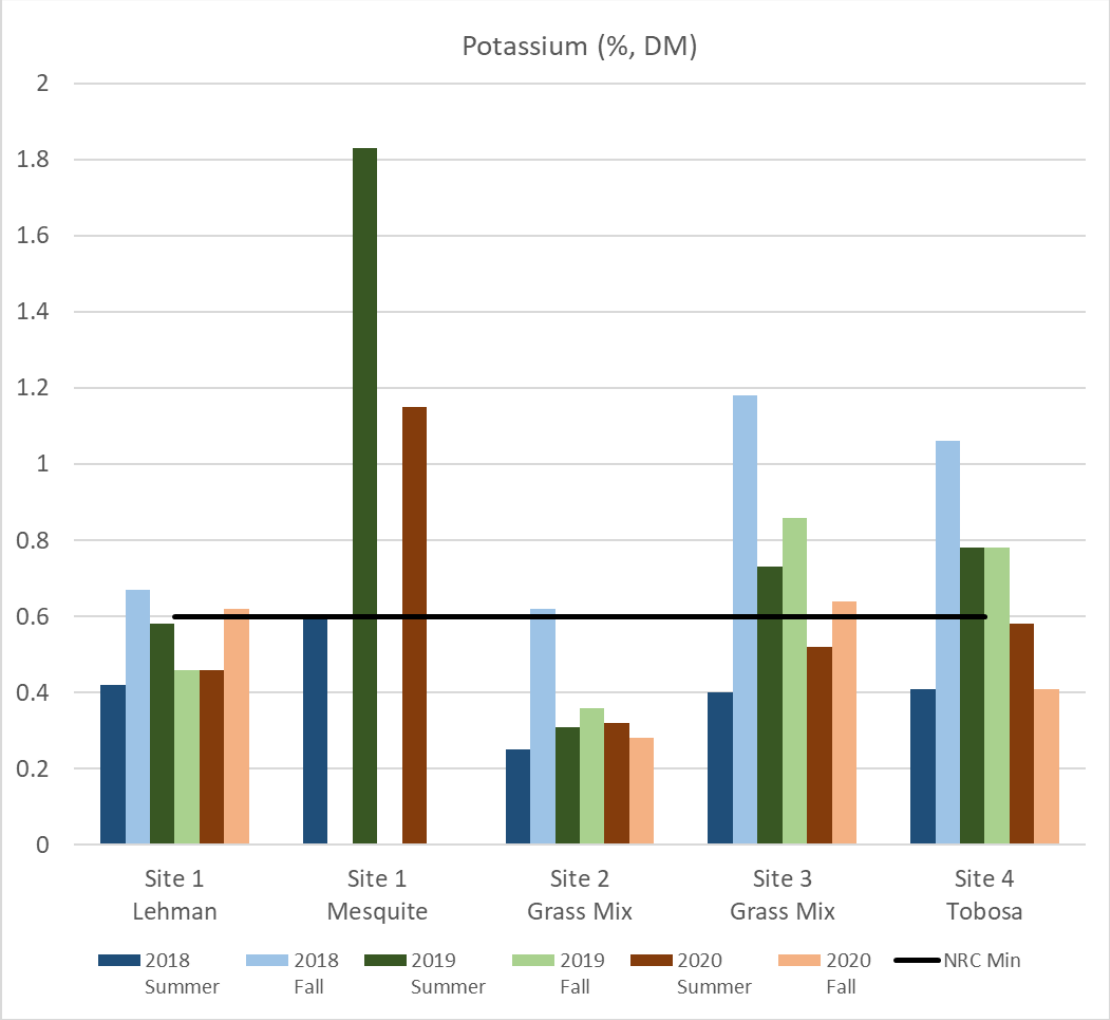
Many of the samples were well under the necessary calcium levels most of the time. During the last two years of the study, Sites 3 and 4 did show slight increases in calcium, bumping them just over the minimum recommendations by the NRC. Surprisingly, Tobosa was above adequate in calcium for most of the samples, however its poor palatability limits its usefulness to range cattle.

Phosphorus



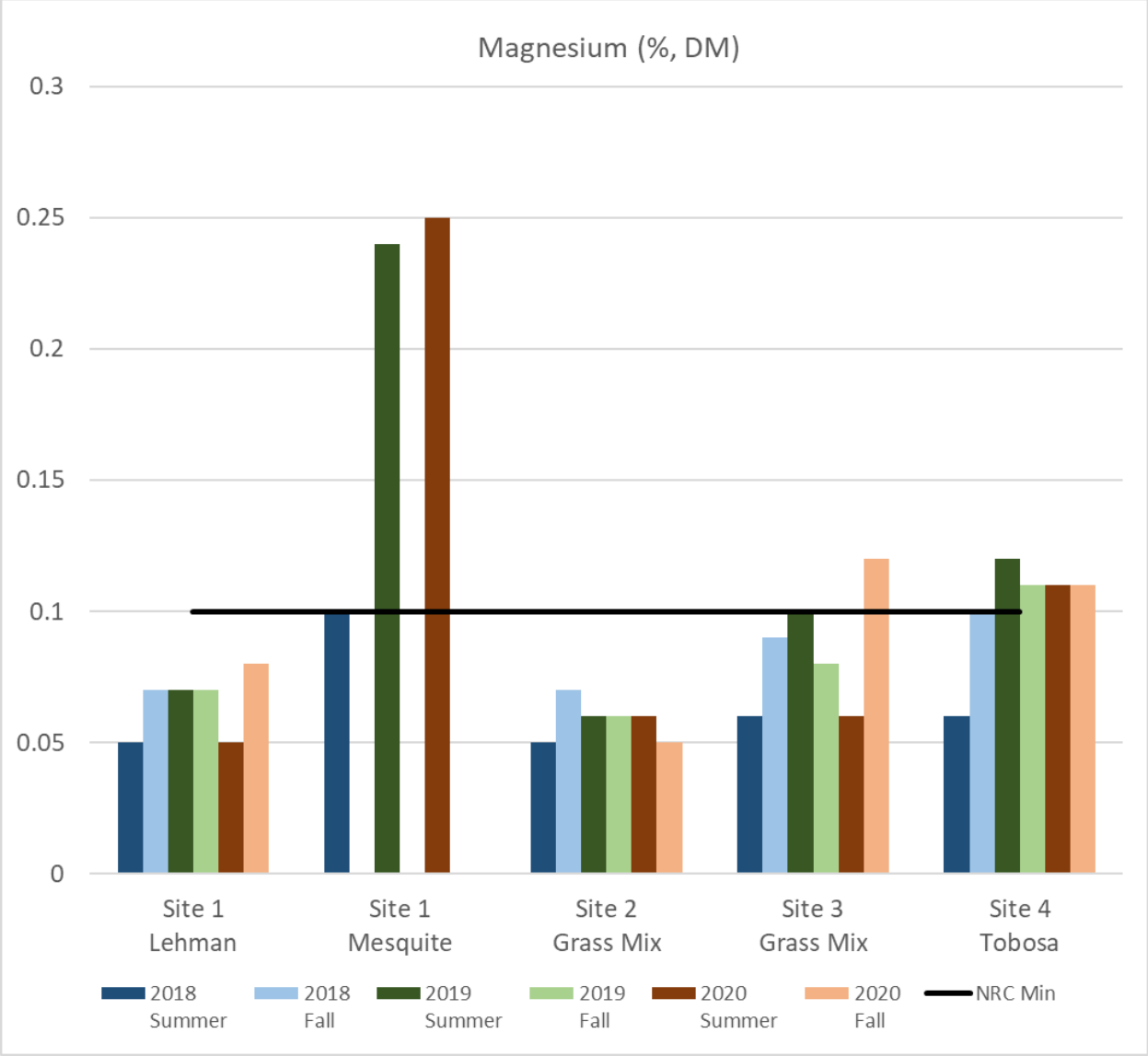
Phosphorous is the other major structural component of bone. It also works in tandem with Calcium and must remain in balance. This mineral is highly water soluble and there is often significant leaching and decreased levels in mature/weathered forages, however corn by-products and other grains are good sources. All of these samples were well below the recommended levels.

Potassium



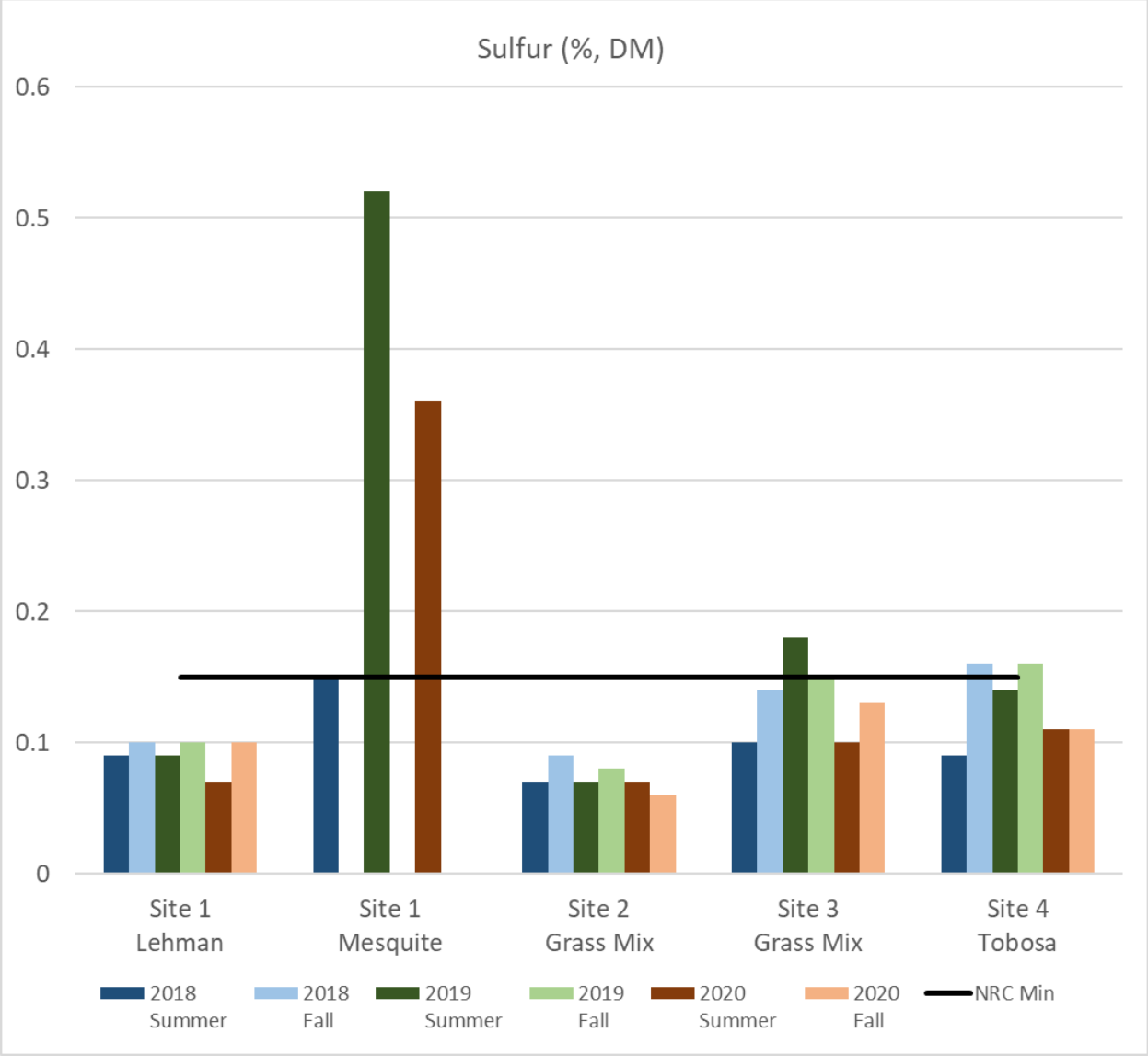
Potassium maintains electrical potentials across nerve endings (allowing nerves to stimulate muscle contraction for movement). It also plays a key role in the regulation of osmotic pressure and water balance. Potassium fluctuated quite a bit, but was deficient or borderline deficient in most samples. Sites 3 and 4 were less deficient to adequate for several of the collection dates, possibly due to the soil type.

Magnesium



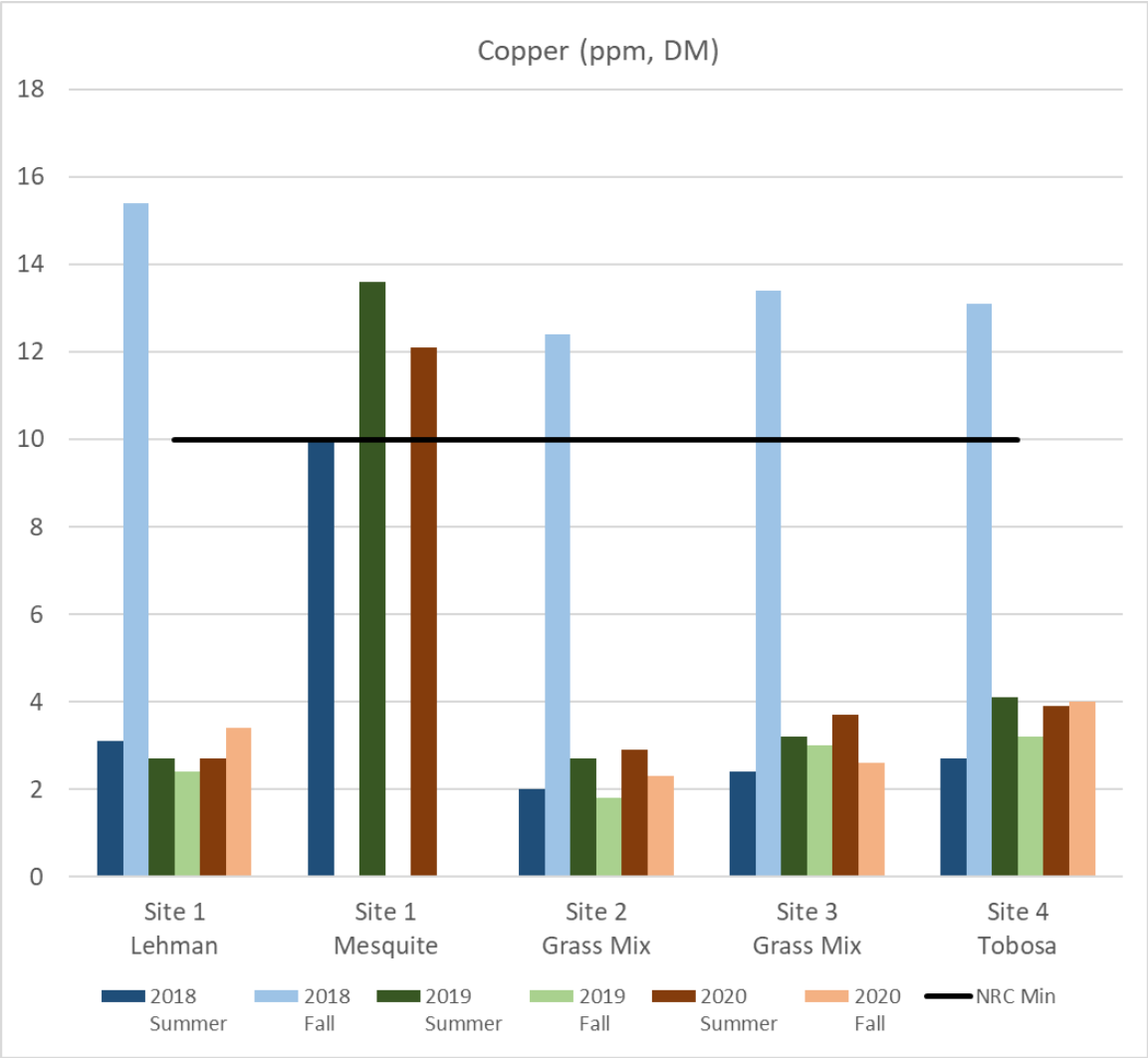
Magnesium works opposite potassium to maintain electrical potentials across nerve endings. A magnesium deficiency often seen with lush, green growing grass (especially coupled with high potassium), can lead to grass tetany. Sites 1 and 2 were especially deficient in all years, sites 3 and 4 were less consistently deficient, but still not ideal. While mesquite was much higher, as a browse species utilized for only a short period, supplementation would still be recommended.

Sulfur



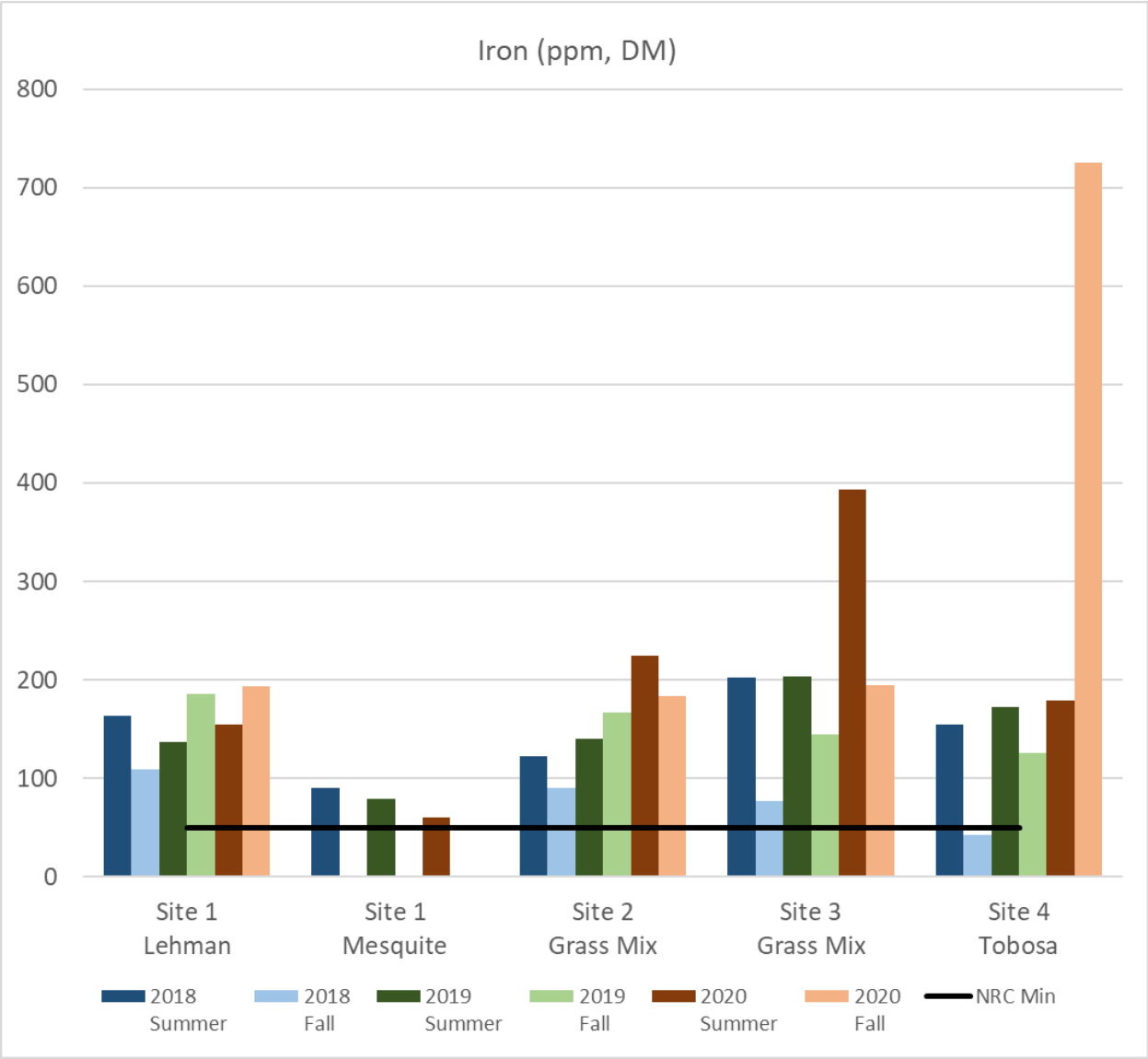
Sulfur is an essential component of amino acids (proteins). While high sulfur can also be a major issue (polio + interference with absorption of copper), sites 1 and 2 were deficient across all three years in the grass species. Sites 3 and 4 were less deficient, but not ideal. While Mesquite was quite high, as a browse species utilized for only a short period of time it is unlikely to cause a problem.

Copper



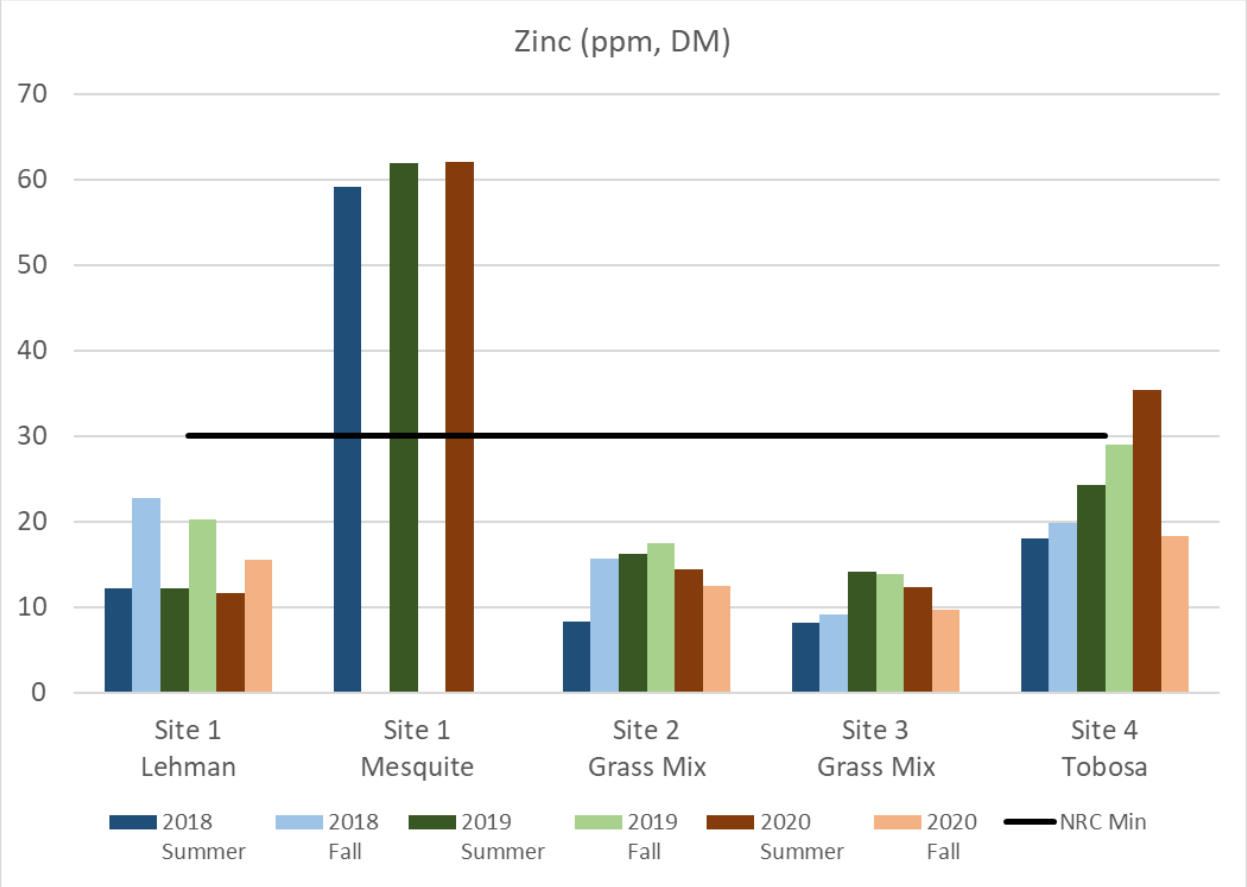
Despite being the copper state, Arizona's forages are nearly always deficient in copper. The exception being mesquite, however as a browse species its utilization window is limited. Also, fall of 2018 saw a large spike in copper across all sites and species. This could be influenced by a recent rainfall event around the time of collection. Copper is known to fluctuate with rainfall, however the association with wet years/low copper and dry years/high copper was not as clearly defined here. Copper deficiency is often exacerbated by other antagonistic minerals: Zinc, Iron, Selenium, Phosphorous, Molybdenum, and Sulfur.

Iron



Iron was only deficient in one sample during this study period. The most likely problem with iron in Arizona is its antagonistic effect on the absorption of other minerals. Current literature estimates that problems with absorption of other minerals can begin to occur when Iron reaches around 300ppm, which a few of the samples did exceed. The use of Chelated minerals in a supplement can help mitigate this effect.

Zinc



Zinc is an important component of enzymes and plays a key role in immunity, male reproduction, and skin/hoof health. Cattle have a much more limited ability to store zinc compared to other minerals, and most samples in this study were deficient. Mesquite was quite high in zinc, but as previously mentioned its utilization window is fairly small.

Selenium

Selenium was extremely deficient, with every sample tested yielding undetectable levels. This has been true across most of southern Arizona. Selenium deficiency impairs reproduction, causes white muscle disease in newborn calves, and increases the rate of retained placentas and uterine prolapse. It's important to note that many "national" brand mineral mixes that are sold across the country, as well as nearly all the trace mineral blocks, contain no selenium at all. In other parts of the country, selenium is present in high quantities in the soil, and selenium toxicity is a potential concern. The NRC recommends a minimum of 0.1 ppm selenium in cattle diets, and levels approaching 2.0 ppm are considered the maximum tolerable concentration. Be sure to read the label of any mineral product you choose for your cattle to ensure it contains selenium.

Conclusions

In general, forages were deficient in nearly all minerals sampled most of the time. While mesquite was adequate when sampled, it is a browse species and intake is more limited (and short lived) than grass species.

Supplementation is not an exact science. There are a multitude of factors that lead to a clinical deficiency that shows up as symptoms in a cow herd.

- The status of the animal (is she open, pregnant, lactating?).
- The interactions between the different minerals (and vitamins), which can be exceptionally complex.
- The type of supplement being used also plays a role. Different mineral complexes are absorbed differently in the body, some are more bioavailable than others. Chelated minerals may be absorbed more readily, but are also more expensive.

The key takeaway is to look at the overall trends of each mineral across ecological sites found in the area of interest. Understand what minerals are most important, and most likely to be deficient some or most of the time and select a mineral supplement product that fits your needs. The majority of the minerals (selenium is the exception) have a fairly wide window of safety, supplementing in normal amounts (such as from a mineral mix formulated by a nutritionist) should not cause a problem even if forage levels on the range are adequate in that particular mineral. Selenium does have a narrower window of toxicity, however the significant deficiencies noted on southern Arizona rangelands indicate a need for supplementation. The FDA limits supplementation of selenium in livestock feed to 0.3 ppm maximum per head per day.

Finally, don't underestimate the usefulness of a protein supplement product, especially if your forage is of poor quality. Arizona's forages are often right at or under 6.25% protein (especially over the winter, and in the late spring/early summer). A supplement of at least 22% crude protein can improve a cow's ability to effectively utilize the resources on the range.

Further Reading

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Sprinkle, J. E. 2013. Beef Cattle Mineral Supplementation on Arizona Rangelands. Arizona Cattlelog, December, pp. 25-27.

Appendices

USUAL Analysis Reports

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/18/2018
Date Completed	6/22/2018

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-0863
Identification:	Box k #1 Lehmann
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	3.6	
Dry Matter	%	96.4	100
Protein	%	4.06	4.2
ADF	%	50.1	52.0
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	41.4	42.9
Net Energy Lactation - NEL	Mcal/lb	0.40	0.42
Net Energy Maintenance - NEM	Mcal/lb	0.31	0.32
Net Energy Gain - NEG	Mcal/lb	0.08	0.08
MINERALS:			
Calcium	%	0.20	0.21
Phosphorus	%	0.04	0.04
Potassium	%	0.40	0.42
Magnesium	%	0.05	0.05
Sodium	mg/kg	37	39
Sulfur	%	0.09	0.09
Aluminum	mg/kg	132	137
Boron	mg/kg	3.1	3.2
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.5	0.5
Copper	mg/kg	3.0	3.1
Iron	mg/kg	157.9	163.8
Manganese	mg/kg	29.1	30.2
Molybdendum	mg/kg	0.3	0.3
Nickel	mg/kg	0	0
Lead	mg/kg	0	0
Strontium	mg/kg	16.1	16.7
Zinc	mg/kg	11.8	12.2
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

- The sampling technique used to obtain this sample will determine if the sample represents the lot.
- A value of "0" indicates that the value was below detection limits.
-Nitrate-Nitrogen values < 1100 mg/kg - should be safe for all animals.
>1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/1/2018
Date Completed	11/16/2018

Name	KIM MCREYNOLDS
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-2764
Identification:	BOX K#1
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	7.8	
Dry Matter	%	92.2	100
Protein	%	12.9	14.0
ADF	%	44.9	48.7
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	44.9	48.7
Net Energy Lactation - NEL	Mcal/lb	0.45	0.49
Net Energy Maintenance - NEM	Mcal/lb	0.38	0.42
Net Energy Gain - NEG	Mcal/lb	0.16	0.17
MINERALS:			
Calcium	%	0.21	0.22
Phosphorus	%	0.06	0.06
Potassium	%	0.62	0.67
Magnesium	%	0.06	0.07
Sodium	mg/kg	10	11
Sulfur	%	0.09	0.10
Aluminum	mg/kg	79	86
Boron	mg/kg	3.4	3.7
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.5	0.6
Copper	mg/kg	14.2	15.4
Iron	mg/kg	100.5	109.0
Manganese	mg/kg	33.0	35.8
Molybdendum	mg/kg	0.4	0.4
Nickel	mg/kg	1	1
Lead	mg/kg	0	0
Strontium	mg/kg	18.9	20.5
Zinc	mg/kg	21.0	22.8
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	5/20/2019
Date Completed	5/30/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-2027
Identification:	Box K Site #1 Lehman Lovegrass
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	8.2	
Dry Matter	%	91.8	100
Protein	%	3.89	4.2
ADF	%	41.1	44.8
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	48.6	52.9
Net Energy Lactation - NEL	Mcal/lb	0.49	0.53
Net Energy Maintenance - NEM	Mcal/lb	0.44	0.48
Net Energy Gain - NEG	Mcal/lb	0.21	0.23
MINERALS:			
Calcium	%	0.31	0.34
Phosphorus	%	0.04	0.05
Potassium	%	0.53	0.58
Magnesium	%	0.07	0.07
Sodium	mg/kg	10	11
Sulfur	%	0.08	0.09
Aluminum	mg/kg	94	102
Boron	mg/kg	6.0	6.5
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.4	0.4
Copper	mg/kg	2.5	2.7
Iron	mg/kg	126.2	137.4
Manganese	mg/kg	30.6	33.4
Molybdendum	mg/kg	0.4	0.4
Nickel	mg/kg	0	0
Lead	mg/kg	0	0
Strontium	mg/kg	23.3	25.3
Zinc	mg/kg	11.1	12.1
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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  >2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/17/2019
Date Completed	10/29/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-4158
Identification:	Box K 1
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	6.7	
Dry Matter	%	93.3	100
Protein	%	5.00	5.4
ADF	%	42.8	45.9
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	47.6	51.0
Net Energy Lactation - NEL	Mcal/lb	0.48	0.51
Net Energy Maintenance - NEM	Mcal/lb	0.42	0.46
Net Energy Gain - NEG	Mcal/lb	0.19	0.21
MINERALS:			
Calcium	%	0.26	0.28
Phosphorus	%	0.04	0.04
Potassium	%	0.43	0.46
Magnesium	%	0.06	0.07
Sodium	mg/kg	39	42
Sulfur	%	0.09	0.10
Aluminum	mg/kg	166	178
Boron	mg/kg	3.3	3.5
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.5	0.5
Copper	mg/kg	2.2	2.4
Iron	mg/kg	173.4	185.9
Manganese	mg/kg	36.6	39.2
Molybdendum	mg/kg	0.4	0.4
Nickel	mg/kg	0	0
Lead	mg/kg	1	1
Strontium	mg/kg	29.2	31.3
Zinc	mg/kg	18.8	20.2
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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  >2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/8/2020
Date Completed	6/18/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	2002-1612
Identification:	Box K 1 -Lehmann
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	5.8	
Dry Matter	%	94.2	100
Protein	%	3.09	3.3
ADF	%	44.5	47.2
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	46.3	49.1
Net Energy Lactation - NEL	Mcal/lb	0.46	0.49
Net Energy Maintenance - NEM	Mcal/lb	0.40	0.42
Net Energy Gain - NEG	Mcal/lb	0.17	0.18
MINERALS:			
Calcium	%	0.26	0.28
Phosphorus	%	0.04	0.04
Potassium	%	0.43	0.46
Magnesium	%	0.05	0.05
Sodium	mg/kg	15	16
Sulfur	%	0.06	0.07
Aluminum	mg/kg	117	124
Boron	mg/kg	6.6	7.0
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.2	0.2
Chromium	mg/kg	0.3	0.3
Copper	mg/kg	2.5	2.7
Iron	mg/kg	146.1	155.1
Manganese	mg/kg	22.7	24.1
Molybdendum	mg/kg	0.4	0.5
Nickel	mg/kg	0	0
Lead	mg/kg	1	1
Strontium	mg/kg	19.9	21.1
Zinc	mg/kg	10.9	11.6
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/19/2020
Date Completed	11/2/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	2002-3566
Identification:	Box K #1
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	6.4	
Dry Matter	%	93.6	100
Protein	%	5.03	5.4
ADF	%	41.7	44.6
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	48.9	52.2
Net Energy Lactation - NEL	Mcal/lb	0.50	0.53
Net Energy Maintenance - NEM	Mcal/lb	0.44	0.47
Net Energy Gain - NEG	Mcal/lb	0.21	0.22
MINERALS:			
Calcium	%	0.33	0.35
Phosphorus	%	0.06	0.06
Potassium	%	0.58	0.62
Magnesium	%	0.08	0.08
Sodium	mg/kg	0	0
Sulfur	%	0.09	0.10
Aluminum	mg/kg	172	183
Boron	mg/kg	4.6	4.9
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.2	0.2
Chromium	mg/kg	0.6	0.7
Copper	mg/kg	3.2	3.4
Iron	mg/kg	181.3	193.7
Manganese	mg/kg	52.9	56.6
Molybdendum	mg/kg	0.5	0.6
Nickel	mg/kg	1	1
Lead	mg/kg	1	1
Strontium	mg/kg	25.5	27.3
Zinc	mg/kg	14.5	15.5
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/18/2018
Date Completed	6/22/2018

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-0864
Identification:	Box k #1 Mesquite
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	4.7	
Dry Matter	%	95.3	100
Protein	%	28.1	29.5
ADF	%	18.5	19.4
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	74.3	78.0
Net Energy Lactation - NEL	Mcal/lb	0.77	0.81
Net Energy Maintenance - NEM	Mcal/lb	0.81	0.85
Net Energy Gain - NEG	Mcal/lb	0.54	0.56
MINERALS:			
Calcium	%	0.78	0.82
Phosphorus	%	0.26	0.27
Potassium	%	1.75	1.83
Magnesium	%	0.23	0.24
Sodium	mg/kg	41	43
Sulfur	%	0.50	0.52
Aluminum	mg/kg	39	41
Boron	mg/kg	15.4	16.1
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.4	0.4
Copper	mg/kg	12.9	13.6
Iron	mg/kg	86.0	90.2
Manganese	mg/kg	61.3	64.4
Molybdendum	mg/kg	0.5	0.5
Nickel	mg/kg	1	2
Lead	mg/kg	0	0
Strontium	mg/kg	42.2	44.3
Zinc	mg/kg	56.4	59.2
Arsenic	mg/kg	0.22	0.2
Selenium	mg/kg	0.0	0.0

NOTES:

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Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	5/20/2019
Date Completed	5/30/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-2026
Identification:	Box K Site #1 Mesquite
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	34.6	
Dry Matter	%	65.4	100
Protein	%	12.9	19.7
ADF	%	21.1	32.3
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	41.0	62.7
Net Energy Lactation - NEL	Mcal/lb	0.42	0.64
Net Energy Maintenance - NEM	Mcal/lb	0.41	0.63
Net Energy Gain - NEG	Mcal/lb	0.24	0.37
MINERALS:			
Calcium	%	0.69	1.05
Phosphorus	%	0.09	0.14
Potassium	%	0.75	1.15
Magnesium	%	0.16	0.25
Sodium	mg/kg	12	18
Sulfur	%	0.24	0.36
Aluminum	mg/kg	20	31
Boron	mg/kg	14.5	22.2
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.2	0.4
Copper	mg/kg	7.9	12.1
Iron	mg/kg	51.6	78.9
Manganese	mg/kg	42.2	64.6
Molybdendum	mg/kg	0.2	0.4
Nickel	mg/kg	0	1
Lead	mg/kg	0	0
Strontium	mg/kg	41.4	63.3
Zinc	mg/kg	40.5	61.9
Arsenic	mg/kg	0.07	0.1
Selenium	mg/kg	0.0	0.0

NOTES:

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Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/8/2020
Date Completed	6/18/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	2002-1611
Identification:	Box K 1 -Mesquite
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	5.5	
Dry Matter	%	94.5	100
Protein	%	16.2	17.1
ADF	%	34.2	36.2
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	57.3	60.6
Net Energy Lactation - NEL	Mcal/lb	0.59	0.62
Net Energy Maintenance - NEM	Mcal/lb	0.57	0.60
Net Energy Gain - NEG	Mcal/lb	0.32	0.34
MINERALS:			
Calcium	%	1.17	1.24
Phosphorus	%	0.11	0.12
Potassium	%	1.15	1.22
Magnesium	%	0.28	0.29
Sodium	mg/kg	19	20
Sulfur	%	0.35	0.37
Aluminum	mg/kg	22	23
Boron	mg/kg	37.0	39.1
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.2	0.2
Chromium	mg/kg	0.2	0.3
Copper	mg/kg	11.4	12.0
Iron	mg/kg	57.3	60.6
Manganese	mg/kg	51.9	54.9
Molybdendum	mg/kg	0.5	0.5
Nickel	mg/kg	1	1
Lead	mg/kg	0	0
Strontium	mg/kg	89.4	94.6
Zinc	mg/kg	58.6	62.0
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/18/2018
Date Completed	6/22/2018

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-0865
Identification:	Box k #2
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	3.2	
Dry Matter	%	96.8	100
Protein	%	3.25	3.4
ADF	%	49.3	50.9
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	42.4	43.8
Net Energy Lactation - NEL	Mcal/lb	0.42	0.43
Net Energy Maintenance - NEM	Mcal/lb	0.33	0.34
Net Energy Gain - NEG	Mcal/lb	0.09	0.10
MINERALS:			
Calcium	%	0.19	0.20
Phosphorus	%	0.04	0.05
Potassium	%	0.24	0.25
Magnesium	%	0.04	0.05
Sodium	mg/kg	48	49
Sulfur	%	0.07	0.07
Aluminum	mg/kg	103	106
Boron	mg/kg	4.0	4.1
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.4	0.4
Copper	mg/kg	2.0	2.0
Iron	mg/kg	118.9	122.8
Manganese	mg/kg	33.9	35.0
Molybdendum	mg/kg	0.8	0.9
Nickel	mg/kg	0	0
Lead	mg/kg	0	0
Strontium	mg/kg	9.7	10.0
Zinc	mg/kg	8.1	8.3
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

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  >2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

2018 Certified Chemistry by NFTA — Excellence in Forage Testing

Date Received	10/1/2018
Date Completed	11/16/2018

Name	KIM MCREYNOLDS
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-2765
Identification:	BOX K#2
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	7.6	
Dry Matter	%	92.4	100
Protein	%	6.30	6.8
ADF	%	43.7	47.3
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	46.2	50.0
Net Energy Lactation - NEL	Mcal/lb	0.46	0.50
Net Energy Maintenance - NEM	Mcal/lb	0.40	0.44
Net Energy Gain - NEG	Mcal/lb	0.17	0.19
MINERALS:			
Calcium	%	0.21	0.23
Phosphorus	%	0.09	0.09
Potassium	%	0.57	0.62
Magnesium	%	0.06	0.07
Sodium	mg/kg	0	0
Sulfur	%	0.09	0.09
Aluminum	mg/kg	60	65
Boron	mg/kg	7.1	7.7
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.4	0.4
Copper	mg/kg	11.4	12.4
Iron	mg/kg	82.9	89.8
Manganese	mg/kg	35.9	38.8
Molybdendum	mg/kg	0.9	1.0
Nickel	mg/kg	1	1
Lead	mg/kg	1	1
Strontium	mg/kg	11.6	12.5
Zinc	mg/kg	14.5	15.6
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	5/20/2019
Date Completed	5/30/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-2028
Identification:	Box K Site #2
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	7.4	
Dry Matter	%	92.6	100
Protein	%	3.86	4.2
ADF	%	44.7	48.3
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	45.3	48.9
Net Energy Lactation - NEL	Mcal/lb	0.45	0.49
Net Energy Maintenance - NEM	Mcal/lb	0.39	0.42
Net Energy Gain - NEG	Mcal/lb	0.16	0.17
MINERALS:			
Calcium	%	0.25	0.27
Phosphorus	%	0.06	0.06
Potassium	%	0.28	0.31
Magnesium	%	0.06	0.06
Sodium	mg/kg	26	28
Sulfur	%	0.07	0.07
Aluminum	mg/kg	100	108
Boron	mg/kg	6.2	6.7
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.5	0.6
Copper	mg/kg	2.5	2.7
Iron	mg/kg	130.1	140.5
Manganese	mg/kg	48.9	52.9
Molybdendum	mg/kg	0.9	0.9
Nickel	mg/kg	0	1
Lead	mg/kg	0	0
Strontium	mg/kg	11.0	11.8
Zinc	mg/kg	15.0	16.2
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/17/2019
Date Completed	10/29/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-4159
Identification:	Box K 2
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	6.1	
Dry Matter	%	93.9	100
Protein	%	4.52	4.8
ADF	%	46.8	49.8
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	43.7	46.5
Net Energy Lactation - NEL	Mcal/lb	0.43	0.46
Net Energy Maintenance - NEM	Mcal/lb	0.36	0.38
Net Energy Gain - NEG	Mcal/lb	0.13	0.14
MINERALS:			
Calcium	%	0.23	0.25
Phosphorus	%	0.07	0.07
Potassium	%	0.34	0.36
Magnesium	%	0.05	0.06
Sodium	mg/kg	39	41
Sulfur	%	0.07	0.08
Aluminum	mg/kg	138	147
Boron	mg/kg	6.0	6.4
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.4	0.5
Copper	mg/kg	1.7	1.8
Iron	mg/kg	156.8	167.0
Manganese	mg/kg	51.8	55.1
Molybdendum	mg/kg	1.1	1.1
Nickel	mg/kg	0	0
Lead	mg/kg	1	1
Strontium	mg/kg	14.1	15.0
Zinc	mg/kg	16.4	17.5
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

- The sampling technique used to obtain this sample will determine if the sample represents the lot.
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-Nitrate-Nitrogen values < 1100 mg/kg - should be safe for all animals.
  >1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
  >2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/8/2020
Date Completed	6/18/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	2002-1613
Identification:	Box K 2
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	5.3	
Dry Matter	%	94.7	100
Protein	%	4.29	4.5
ADF	%	45.5	48.0
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	45.5	48.0
Net Energy Lactation - NEL	Mcal/lb	0.45	0.48
Net Energy Maintenance - NEM	Mcal/lb	0.39	0.41
Net Energy Gain - NEG	Mcal/lb	0.15	0.16
MINERALS:			
Calcium	%	0.23	0.24
Phosphorus	%	0.06	0.07
Potassium	%	0.30	0.32
Magnesium	%	0.06	0.06
Sodium	mg/kg	11	12
Sulfur	%	0.06	0.07
Aluminum	mg/kg	158	166
Boron	mg/kg	6.8	7.2
Cadmium	mg/kg	0.1	0.1
Cobalt	mg/kg	0.2	0.2
Chromium	mg/kg	0.4	0.4
Copper	mg/kg	2.8	2.9
Iron	mg/kg	212.8	224.7
Manganese	mg/kg	45.2	47.8
Molybdendum	mg/kg	0.8	0.9
Nickel	mg/kg	0	0
Lead	mg/kg	1	1
Strontium	mg/kg	10.4	11.0
Zinc	mg/kg	13.6	14.4
Arsenic	mg/kg	0.10	0.1
Selenium	mg/kg	0.0	0.0

NOTES:

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>1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/19/2020
Date Completed	11/2/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	2002-3567
Identification:	Box K #2
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	5.5	
Dry Matter	%	94.5	100
Protein	%	3.72	3.9
ADF	%	47.6	50.4
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	43.1	45.6
Net Energy Lactation - NEL	Mcal/lb	0.43	0.45
Net Energy Maintenance - NEM	Mcal/lb	0.35	0.37
Net Energy Gain - NEG	Mcal/lb	0.12	0.12
MINERALS:			
Calcium	%	0.26	0.27
Phosphorus	%	0.06	0.06
Potassium	%	0.26	0.28
Magnesium	%	0.05	0.05
Sodium	mg/kg	0	0
Sulfur	%	0.06	0.06
Aluminum	mg/kg	168	178
Boron	mg/kg	5.2	5.5
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.5	0.5
Copper	mg/kg	2.2	2.3
Iron	mg/kg	173.8	183.9
Manganese	mg/kg	59.0	62.4
Molybdendum	mg/kg	0.8	0.9
Nickel	mg/kg	0	1
Lead	mg/kg	2	2
Strontium	mg/kg	11.8	12.5
Zinc	mg/kg	11.8	12.5
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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- A value of "0" indicates that the value was below detection limits.
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  >2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/18/2018
Date Completed	6/22/2018

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-0866
Identification:	Box k #3
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	3.2	
Dry Matter	%	96.8	100
Protein	%	4.36	4.5
ADF	%	50.4	52.1
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	41.1	42.5
Net Energy Lactation - NEL	Mcal/lb	0.41	0.42
Net Energy Maintenance - NEM	Mcal/lb	0.30	0.31
Net Energy Gain - NEG	Mcal/lb	0.07	0.07
MINERALS:			
Calcium	%	0.27	0.28
Phosphorus	%	0.04	0.04
Potassium	%	0.39	0.40
Magnesium	%	0.06	0.06
Sodium	mg/kg	46	47
Sulfur	%	0.10	0.10
Aluminum	mg/kg	169	175
Boron	mg/kg	5.4	5.6
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.5	0.5
Copper	mg/kg	2.4	2.4
Iron	mg/kg	196.0	202.5
Manganese	mg/kg	67.9	70.1
Molybdendum	mg/kg	2.4	2.4
Nickel	mg/kg	0	0
Lead	mg/kg	1	1
Strontium	mg/kg	12.4	12.8
Zinc	mg/kg	7.9	8.2
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/1/2018
Date Completed	11/16/2018

Name	KIM MCREYNOLDS
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-2766
Identification:	KARTCHNER#3
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	8.6	
Dry Matter	%	91.4	100
Protein	%	10.3	11.3
ADF	%	41.9	45.8
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	47.5	52.0
Net Energy Lactation - NEL	Mcal/lb	0.48	0.52
Net Energy Maintenance - NEM	Mcal/lb	0.43	0.47
Net Energy Gain - NEG	Mcal/lb	0.20	0.22
MINERALS:			
Calcium	%	0.25	0.27
Phosphorus	%	0.06	0.06
Potassium	%	1.08	1.18
Magnesium	%	0.09	0.09
Sodium	mg/kg	77	84
Sulfur	%	0.13	0.14
Aluminum	mg/kg	51	56
Boron	mg/kg	8.7	9.5
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.5	0.6
Copper	mg/kg	12.3	13.4
Iron	mg/kg	70.1	76.7
Manganese	mg/kg	39.9	43.6
Molybdendum	mg/kg	2.0	2.1
Nickel	mg/kg	0	0
Lead	mg/kg	0	0
Strontium	mg/kg	11.1	12.1
Zinc	mg/kg	8.3	9.1
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	5/20/2019
Date Completed	5/30/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-2029
Identification:	Box K Site #3
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	7.5	
Dry Matter	%	92.5	100
Protein	%	4.79	5.2
ADF	%	44.2	47.8
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	45.7	49.4
Net Energy Lactation - NEL	Mcal/lb	0.46	0.50
Net Energy Maintenance - NEM	Mcal/lb	0.40	0.43
Net Energy Gain - NEG	Mcal/lb	0.17	0.18
MINERALS:			
Calcium	%	0.38	0.41
Phosphorus	%	0.04	0.05
Potassium	%	0.67	0.73
Magnesium	%	0.09	0.10
Sodium	mg/kg	28	30
Sulfur	%	0.17	0.18
Aluminum	mg/kg	159	172
Boron	mg/kg	6.4	7.0
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.5	0.5
Copper	mg/kg	2.9	3.2
Iron	mg/kg	187.9	203.2
Manganese	mg/kg	90.4	97.7
Molybdendum	mg/kg	2.0	2.1
Nickel	mg/kg	0	0
Lead	mg/kg	0	0
Strontium	mg/kg	16.1	17.4
Zinc	mg/kg	13.0	14.1
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/17/2019
Date Completed	10/29/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-4160
Identification:	Box K 3
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	7.1	
Dry Matter	%	92.9	100
Protein	%	6.97	7.5
ADF	%	44.4	47.8
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	45.7	49.2
Net Energy Lactation - NEL	Mcal/lb	0.46	0.49
Net Energy Maintenance - NEM	Mcal/lb	0.40	0.43
Net Energy Gain - NEG	Mcal/lb	0.17	0.18
MINERALS:			
Calcium	%	0.31	0.34
Phosphorus	%	0.08	0.08
Potassium	%	0.80	0.86
Magnesium	%	0.08	0.08
Sodium	mg/kg	91	98
Sulfur	%	0.14	0.15
Aluminum	mg/kg	115	124
Boron	mg/kg	11.5	12.3
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.4	0.5
Copper	mg/kg	2.8	3.0
Iron	mg/kg	134.3	144.5
Manganese	mg/kg	58.9	63.4
Molybdendum	mg/kg	2.3	2.5
Nickel	mg/kg	0	0
Lead	mg/kg	1	1
Strontium	mg/kg	18.2	19.6
Zinc	mg/kg	12.8	13.8
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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  >2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/8/2020
Date Completed	6/18/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	2002-1614
Identification:	Box K 3
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	5.6	
Dry Matter	%	94.4	100
Protein	%	4.54	4.8
ADF	%	47.2	50.0
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	43.5	46.1
Net Energy Lactation - NEL	Mcal/lb	0.43	0.46
Net Energy Maintenance - NEM	Mcal/lb	0.35	0.37
Net Energy Gain - NEG	Mcal/lb	0.12	0.13
MINERALS:			
Calcium	%	0.38	0.40
Phosphorus	%	0.06	0.07
Potassium	%	0.49	0.52
Magnesium	%	0.07	0.08
Sodium	mg/kg	17	18
Sulfur	%	0.10	0.10
Aluminum	mg/kg	327	347
Boron	mg/kg	9.6	10.2
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.3	0.3
Chromium	mg/kg	0.5	0.5
Copper	mg/kg	3.5	3.7
Iron	mg/kg	371.5	393.5
Manganese	mg/kg	74.4	78.8
Molybdendum	mg/kg	2.3	2.4
Nickel	mg/kg	1	1
Lead	mg/kg	1	1
Strontium	mg/kg	15.3	16.2
Zinc	mg/kg	11.6	12.3
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/19/2020
Date Completed	11/2/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	2002-3568
Identification:	Box K #3
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	5.9	
Dry Matter	%	94.1	100
Protein	%	5.79	6.2
ADF	%	42.4	45.1
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	48.4	51.4
Net Energy Lactation - NEL	Mcal/lb	0.49	0.52
Net Energy Maintenance - NEM	Mcal/lb	0.43	0.46
Net Energy Gain - NEG	Mcal/lb	0.20	0.21
MINERALS:			
Calcium	%	0.42	0.44
Phosphorus	%	0.06	0.06
Potassium	%	0.60	0.64
Magnesium	%	0.11	0.12
Sodium	mg/kg	37	40
Sulfur	%	0.12	0.13
Aluminum	mg/kg	170	181
Boron	mg/kg	9.9	10.5
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.2	0.2
Chromium	mg/kg	0.6	0.6
Copper	mg/kg	2.4	2.6
Iron	mg/kg	183.1	194.6
Manganese	mg/kg	71.2	75.6
Molybdendum	mg/kg	2.0	2.1
Nickel	mg/kg	0	0
Lead	mg/kg	2	2
Strontium	mg/kg	21.0	22.3
Zinc	mg/kg	9.1	9.7
Arsenic	mg/kg	0.13	0.1
Selenium	mg/kg	0.0	0.0

NOTES:

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>1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/18/2018
Date Completed	6/22/2018

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-0867
Identification:	Box k #4 Tobosa
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	3.1	
Dry Matter	%	96.9	100
Protein	%	4.32	4.5
ADF	%	55.6	57.4
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	35.6	36.7
Net Energy Lactation - NEL	Mcal/lb	0.34	0.35
Net Energy Maintenance - NEM	Mcal/lb	0.21	0.22
Net Energy Gain - NEG	Mcal/lb	-0.02	-0.02
MINERALS:			
Calcium	%	0.21	0.22
Phosphorus	%	0.04	0.04
Potassium	%	0.40	0.41
Magnesium	%	0.05	0.06
Sodium	mg/kg	44	46
Sulfur	%	0.09	0.09
Aluminum	mg/kg	153	158
Boron	mg/kg	1.6	1.7
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.6	0.6
Copper	mg/kg	2.6	2.7
Iron	mg/kg	149.4	154.2
Manganese	mg/kg	110.7	114.2
Molybdendum	mg/kg	0.5	0.5
Nickel	mg/kg	0	0
Lead	mg/kg	1	1
Strontium	mg/kg	12.9	13.3
Zinc	mg/kg	17.4	18.0
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

2018 Certified Chemistry by NFTA — National Forage Testing Association — Excellence in Forage Testing

Date Received	10/1/2018
Date Completed	11/16/2018

Name	KIM MCREYNOLDS
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1802-2767
Identification:	KARTCHNER#4
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	9.1	
Dry Matter	%	90.9	100
Protein	%	7.90	8.7
ADF	%	48.1	52.9
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	41.0	45.1
Net Energy Lactation - NEL	Mcal/lb	0.41	0.45
Net Energy Maintenance - NEM	Mcal/lb	0.33	0.36
Net Energy Gain - NEG	Mcal/lb	0.11	0.12
MINERALS:			
Calcium	%	0.31	0.34
Phosphorus	%	0.07	0.08
Potassium	%	0.96	1.06
Magnesium	%	0.09	0.10
Sodium	mg/kg	33	36
Sulfur	%	0.14	0.16
Aluminum	mg/kg	26	29
Boron	mg/kg	3.2	3.6
Cadmium	mg/kg	0.1	0.1
Cobalt	mg/kg	0.0	0.0
Chromium	mg/kg	0.4	0.5
Copper	mg/kg	11.9	13.1
Iron	mg/kg	39.1	43.0
Manganese	mg/kg	159.2	175.1
Molybdendum	mg/kg	0.4	0.4
Nickel	mg/kg	0	1
Lead	mg/kg	1	1
Strontium	mg/kg	20.4	22.4
Zinc	mg/kg	18.0	19.8
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

- The sampling technique used to obtain this sample will determine if the sample represents the lot.
- A value of "0" indicates that the value was below detection limits.
-Nitrate-Nitrogen values < 1100 mg/kg - should be safe for all animals.
  >1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
  >2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	5/20/2019
Date Completed	5/30/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-2030
Identification:	Box K Site #4
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	10.2	
Dry Matter	%	89.8	100
Protein	%	6.34	7.1
ADF	%	43.0	47.9
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	45.6	50.8
Net Energy Lactation - NEL	Mcal/lb	0.46	0.51
Net Energy Maintenance - NEM	Mcal/lb	0.41	0.45
Net Energy Gain - NEG	Mcal/lb	0.18	0.20
MINERALS:			
Calcium	%	0.48	0.54
Phosphorus	%	0.07	0.08
Potassium	%	0.70	0.78
Magnesium	%	0.11	0.12
Sodium	mg/kg	23	26
Sulfur	%	0.13	0.14
Aluminum	mg/kg	150	168
Boron	mg/kg	4.9	5.4
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.6	0.6
Copper	mg/kg	3.7	4.1
Iron	mg/kg	154.5	172.0
Manganese	mg/kg	230.6	256.8
Molybdendum	mg/kg	0.5	0.6
Nickel	mg/kg	0	0
Lead	mg/kg	0	0
Strontium	mg/kg	28.3	31.5
Zinc	mg/kg	21.8	24.2
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

- The sampling technique used to obtain this sample will determine if the sample represents the lot.
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-Nitrate-Nitrogen values < 1100 mg/kg - should be safe for all animals.
>1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/17/2019
Date Completed	10/29/2019

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	1902-4161
Identification:	Box K 4
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	6.8	
Dry Matter	%	93.2	100
Protein	%	7.65	8.2
ADF	%	46.0	49.4
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	44.2	47.4
Net Energy Lactation - NEL	Mcal/lb	0.44	0.47
Net Energy Maintenance - NEM	Mcal/lb	0.37	0.40
Net Energy Gain - NEG	Mcal/lb	0.14	0.15
MINERALS:			
Calcium	%	0.42	0.45
Phosphorus	%	0.08	0.09
Potassium	%	0.73	0.78
Magnesium	%	0.10	0.11
Sodium	mg/kg	66	71
Sulfur	%	0.14	0.16
Aluminum	mg/kg	126	135
Boron	mg/kg	3.6	3.9
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.1	0.1
Chromium	mg/kg	0.4	0.4
Copper	mg/kg	3.0	3.2
Iron	mg/kg	117.3	125.8
Manganese	mg/kg	159.1	170.7
Molybdendum	mg/kg	0.8	0.8
Nickel	mg/kg	0	1
Lead	mg/kg	1	1
Strontium	mg/kg	35.4	37.9
Zinc	mg/kg	27.0	29.0
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>1100mg/kg but <2300 mg/kg - use caution; dilute with other feeds; do not feed to pregnant animals.
>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	6/8/2020
Date Completed	6/18/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE

Lab Number:	2002-1615
Identification:	Box K 4
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	5.6	
Dry Matter	%	94.4	100
Protein	%	6.20	6.6
ADF	%	50.3	53.3
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	40.2	42.6
Net Energy Lactation - NEL	Mcal/lb	0.40	0.42
Net Energy Maintenance - NEM	Mcal/lb	0.30	0.32
Net Energy Gain - NEG	Mcal/lb	0.07	0.08
MINERALS:			
Calcium	%	0.27	0.29
Phosphorus	%	0.08	0.08
Potassium	%	0.55	0.58
Magnesium	%	0.10	0.11
Sodium	mg/kg	34	36
Sulfur	%	0.11	0.11
Aluminum	mg/kg	162	171
Boron	mg/kg	3.7	4.0
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.2	0.2
Chromium	mg/kg	0.4	0.4
Copper	mg/kg	3.7	3.9
Iron	mg/kg	169.8	179.8
Manganese	mg/kg	122.2	129.4
Molybdendum	mg/kg	0.8	0.8
Nickel	mg/kg	0	1
Lead	mg/kg	1	1
Strontium	mg/kg	19.0	20.1
Zinc	mg/kg	33.4	35.4
Arsenic	mg/kg	0.0	0.0
Selenium	mg/kg	0.0	0.0

NOTES:

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>2300 mg/kg - DO NOT FEED!

Feed Report

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)

Date Received	10/19/2020
Date Completed	11/2/2020

Name	Kim McReynolds
Address:	450 S HASKELL AVE STE A
	WILLCOX AZ 85643 COCHISE
Lab Number:	2002-3569
Identification:	Box K #4
Feed Material:	Forage

		AS SAMPLED:	DRY MATTER BASIS:
Moisture	%	5.4	
Dry Matter	%	94.6	100
Protein	%	6.28	6.6
ADF	%	49.6	52.4
NDF	%		
Unavailable Protein	%		
Ash	%		
Nitrate-Nitrogen	mg/kg		
Total Digestible Nutrients - TDN	%	41.1	43.4
Net Energy Lactation - NEL	Mcal/lb	0.41	0.43
Net Energy Maintenance - NEM	Mcal/lb	0.31	0.33
Net Energy Gain - NEG	Mcal/lb	0.08	0.09
MINERALS:			
Calcium	%	0.50	0.53
Phosphorus	%	0.07	0.07
Potassium	%	0.39	0.41
Magnesium	%	0.10	0.11
Sodium	mg/kg	22	23
Sulfur	%	0.10	0.11
Aluminum	mg/kg	918	970
Boron	mg/kg	3.8	4.0
Cadmium	mg/kg	0.0	0.0
Cobalt	mg/kg	0.5	0.5
Chromium	mg/kg	1.4	1.5
Copper	mg/kg	3.8	4.0
Iron	mg/kg	686.6	725.8
Manganese	mg/kg	124.8	131.9
Molybdendum	mg/kg	11.9	12.6
Nickel	mg/kg	1	1
Lead	mg/kg	3	3
Strontium	mg/kg	21.9	23.1
Zinc	mg/kg	17.3	18.3
Arsenic	mg/kg	0.13	0.1
Selenium	mg/kg	0.0	0.0

NOTES:

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