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CORONA RANGE AND LIVESTOCK RESEARCH CENTER

NEW MEXICO STATE UNIVERSITY

PROCEEDINGS

FROM

THE 1997 FIELD DAY

October 10, 1997

INTRODUCTORY REMARKS

Bobby J. Rankin

Welcome to the Corona Range and Livestock Research Center. This Field Day program is presented by the College of Agriculture and Home Economics of NMSU to acquaint you with our progress in research at this location to benefit the livestock industry of New Mexico.

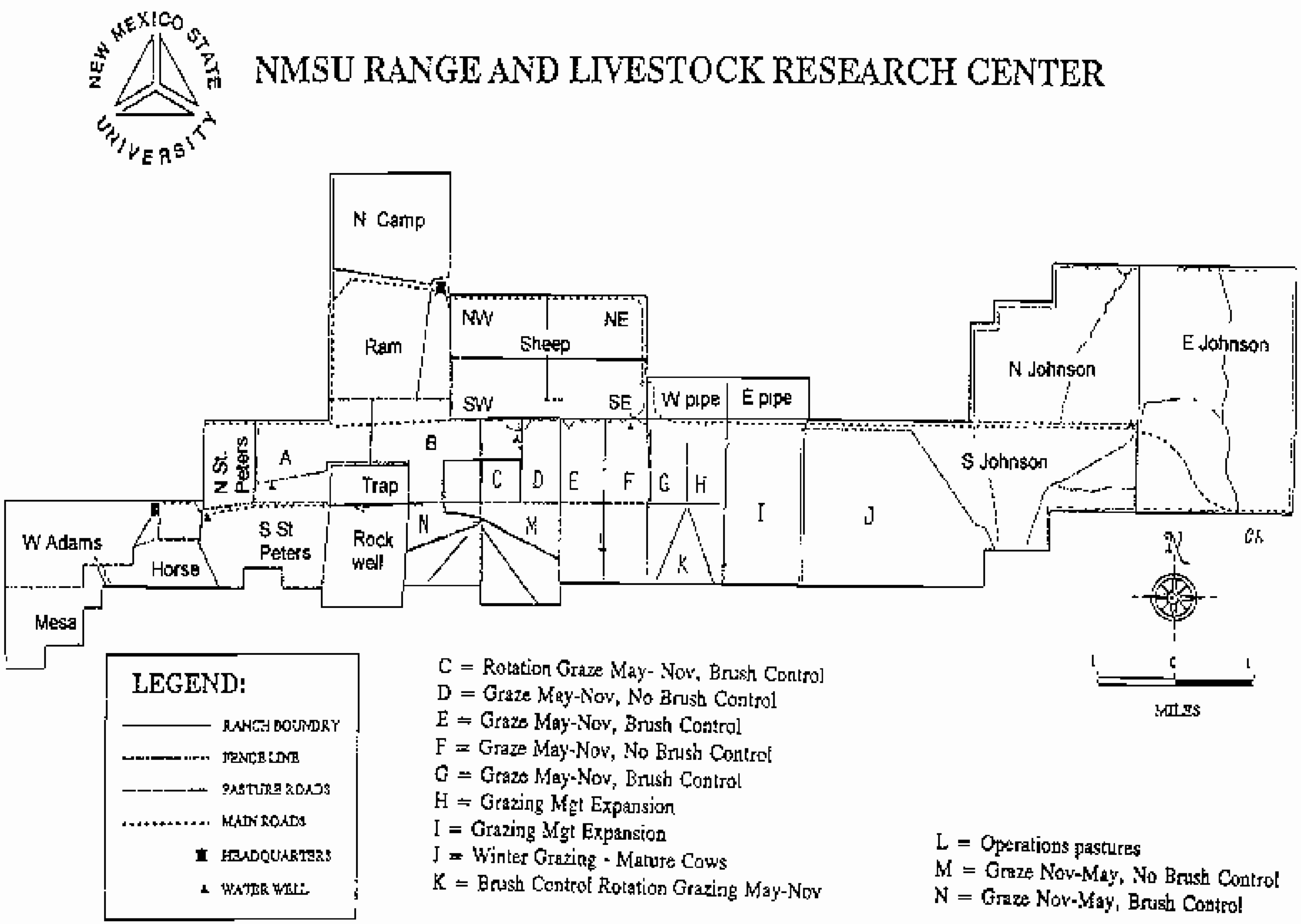
Development of the CRLRC (Corona Ranch) was begun in 1989 following a search to replace the research capability lost when our Fort Stanton Research Ranch was vacated due to the development of a regional airport there. The selection committee included Gary Donart, John Fowler, V. W. Howard, Bob Jones, Gene Parker, Ron Parker, Rex Pieper, Jerry Schickedanz, Felicia Thal, Joe Wallace, Bruce Street, Jim Sachse and myself. Approximately 30 proposals were received and 16 ranches were visited. We finally purchased the John Nalda Ranch and an adjoining part of the Adams Ranch (total acreage 28,166).

The next objective was to create a range research center on land that had been parts of two ranches. Gene Parker, superintendent of the center, has been a tremendous asset in planning and supervision of this effort, drawing on his years of experience at Fort Stanton, and previously at Texas A&M's research ranch near Throckmorton, Texas. We have completed about two-thirds of the developments needed and have initiated research projects related to brush control, grazing management, mule deer population, beef cattle nutrition and reproduction, sheep nutrition and reproduction and Boom Snakeweed control. In addition, we have developed a unique range ram performance test for evaluating offspring from some of the leading sheep flocks in the state.

The ranch operational plan includes a Angus X Hereford rotational cross cow herd of around 250 head, a registered Angus herd of around 25 head, a fine wool flock of ewes of around 300 head, and around 150 outside yearlings for summer grazing only. A resident herd of around 500 mule deer occupy the ranch and around 25 bucks are harvested annually under a fee hunting contract. Income from sales is used for ranch operations, maintenance, and further improvement of the research center. Plans are underway to build corrals and pastures on the east end of the ranch to carry out more intensive research with the mature cow herd. Often a hypothesis is tested under less than practical conditions working with individual animals, then later, under more typical ranching conditions. A number of faculty and graduate students from the NMSU campus travel frequently to do research at the Corona Ranch. Occasionally, graduate students may stay for the entire semester or summer at the Center to conduct more intensive studies. Small plot work may be done in numerous exclosures set aside for that purpose.

We encourage ranchers, county agents, high school groups, tour groups from industry organizations, colleges, international guests, etc., to visit the center during the year. We will be happy to help you plan such a visit. Of course, our neighbors are always welcome. Thanks for coming today and let us know if you have suggestions or comments. Our primary purpose here is to do research that will ultimately benefit the New Mexico livestock industry.

NMSU RANGE AND LIVESTOCK RESEARCH CENTER



NEW MEXICO STATE UNIVERSITY
CORONA RANGE & LIVESTOCK RESEARCH CENTER

FIELD DAY

FRIDAY, OCTOBER 10, 1997

9:00 a.m.	**North Headquarters**
	REGISTRATION - Coffee and donuts supplied courtesy of Roswell Wool and Mohair
10:00 a.m.	**Dr. Tim Ross** - Discussion On Supplementation Research/Display of Ewes & Lambs used in Research Studies
10:30 a.m.	**Tour of Research Plots** - Personal vehicles will be needed to travel approximately 2 miles south of North Headquarters here vans will be used for tour and discussion of grazing and brush control efforts. Participants will then return to their vehicles to travel to the South Headquarters for lunch
12:00 noon	**LUNCH** - catered by the Crown Cowbelles and supplied courtesy of HiPro Feeds - Friona, Texas
1:00 p.m.	**South Headquarters**

Dr. Clint Krehbiel - Implications of Range Cattle Diets in Central New Mexico
Neil Burcham - Management of the NMSU Angus Cow Herd
Dr. Dean Hawkins - Development of Replacement Heifers with Limited Supplementation of Bypass Protein
Dr. Mark Petersen - Limiting Supplemental Feeding of Young Cows and Use of Bypass Protein
Richard Spencer of NRCS - Experience with Brush Control on the Claunch-Pinto Soil Conservation District
Dr. V. W. Howard - Brush Control and Its Effect on Mule Deer Habitat and Hunting Success
Gary Wilcock of HiPro Feeds - The Producer's Edge Program and What We Have Learned From It

Personnel will be available to receive lambs for the 1997-98 Range Ram Test beginning at 8:00 a.m. at the North Headquarters. Rams from the previous test can be picked up after the afternoon program.

Directions to the North Headquarters, Corona Range and Livestock Research Center. Go two miles northeast of Corona, NM on US Hiway 54, turn east on county road, and follows signs approximately 10 miles east-and 2 miles north.

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SUPPLEMENTING RANGE EWES FOR OPTIMUM LAMB PRODUCTION

Tim Ross, Gene Parker, Shad Cox,
Beth McFadin, and Shawn Ramsey

Introduction

The goal of the New Mexico sheep producer is to profit from the production of lamb and wool. At this time, lamb production has the greatest income generating potential. New Mexico currently weans between a 70% to 80% lamb crop yearly. This is below the national average of just over 100%. Sheep production in New Mexico depends upon the forage produced on the rangelands. However, at certain times of the year this forage may not meet the nutrient requirements of the ewes. When this occurs, a supplement should be offered to the ewes to meet the deficiencies.

During the yearly reproductive cycle of the ewe, three critical nutritional periods can be identified. The first is the flushing period. This extends from 21 days before introduction of the rams until 17 days after introduction of rams. The objective of a flush is to increase ovulation rates which may result in a higher lamb crop percentage. Previous work on New Mexico ranches suggest that flushing with .5 lb. of a 22% CP cube will increase lamb crop by 5 to 10 %. Research at other universities suggest that feeding ruminally undegradable protein can increase ovulation rates while others suggest that increasing serum levels of the branch-chain amino acids will improve ovulation. The second critical nutritional period is the last trimester of pregnancy. Fetal growth is exponential during this period accounting for as much as 60 to 70 %. Failure to provide the ewe with sufficient nutrients to meet her needs and the needs of the fetus will result in decreased birth weight, weak lambs at birth and higher neonatal death. The third period is early lactation. The ewe will reach peak lactation between 28 to 35 days postpartum. Lactation has the highest nutrient requirement. Obviously, meeting lactational requirements is most important during the first weeks of lactation for improved lamb survival and optimal growth and development of the lamb. However, some question if supplementing during lactation will have a significant impact on weaning weights especially if forage quantity and quality is available. If the range forage is not depleted then the lambs will begin to consume more forage at an earlier age and can compensate for lower growth rates earlier. However, the ewe must provide enough milk in the first 4 weeks to provide colostrum (first 24 hours) to meet the antibody needs of the lamb and sustain the lamb until they can function as a ruminant.

Therefore, several research projects have been conducted at the Corona Range and Livestock Research Ranch to determine optimal supplementation programs for western white-face ewes.

Experimental Protocol

Shawn Ramsey (1995) supplemented primiparous ewes during a flushing period and the last trimester of gestation. He used three feeding programs: control --no supplement; degradable intake protein (DIP,23% CP) fed at .33 lb/day; undegradable intake protein (UIP, 43 % CP) fed at .25 lb/day. Differences in levels were used to balance energy and degradable protein levels. Twenty-one days after initiation of breeding, five ewes from each pasture (30) underwent laparoscopy to determine ovulation rates. Ultrasound data were not collected on these ewes due to equipment failure. Prior to expected lambing dates, 11 ewes from each pasture (22/treatment) were removed from their respective pastures and placed in a trap near headquarters for intensive data collection on milk production and lamb growth. Only ewes lambing within a 5 day period were used (42 ewes). All ewes gave birth to single lambs. Lamb weights and milk production were taken on days 4, 14, 24 and 34. Milk production was measured in ewes with a modified weigh suckle weigh method. Lambs were separated from ewes and ewes were milked out by hand following a 1 mL injection (iv) of oxytocin and milk was discarded. After 3 hours, the process was repeated and the milk volume was recorded. Weaning weights for all lambs were taken on approximately 150 days postpartum.

Beth McFadin (1997) used the same feeds but supplemented only during late gestation at the levels described previously. Near the expected lambing dates, eight ewes form each pasture (48 ewes) were removed from their pastures and placed in a trap for intensive measurements similar to that described above. Ewes in this intensive study were diagnosed with twin feti via ultrasonography. Lamb weights and milk production were taken on days 4, 14, 24, 34 and 50 postpartum. Milk production was measured as previously described. Weaning weights for all lambs were taken at approximately 150 days postpartum.

In 1996 and 97, two trials were conducted to determine the optimal time of supplementation for improved lamb survival. Four pastures were used with approximately 50 ewes per pasture each year. Supplemental treatments were: no supplement, supplement during late gestation, supplementation during lactation and supplementation during both late gestation and lactation. The supplement provided was a 28% CP block and fed at .5 lb/head/day. Late gestation feeding began after shearing (April 27) and continued to beginning of lambing (May 19). Lactational feeding began at the onset of lambing and continued until June 22. Supplementation began for the pasture receiving supplement at both times on April 21 and continued until June 22. Only weaning weights of lambs were recorded for 1996 along with ewe weights and body condition scores (BCS). In 1997, weights of lambs and ewes were taken at marking and body condition score of ewes recorded. We will get lamb weaning weights and ewe weights and body condition scores at weaning in October for the 1997 sheep. Ewe weights and BCS are not reported in this manuscript.

Results And Discussion

Flushing did not influence ovulation rates (Table 1). However, first cycle conception rates were higher in control ewes and ewes flushed with UIP. These data are interesting in that Meza (1996) suggested that flushing with high protein supplements (same as used by Ramsey and McFadin) may increase embryonic mortality by decreasing the pH of the uterine secretions. However, the advantage of the controls were lost in subsequent matings during the 34 day breeding season. Control ewes weaned significantly fewer lambs than the flushed ewes. Therefore, overall nutritional level of the ewes improved pregnancy rates in the supplemented ewes. I should note that the flush ended after the first estrous cycle of the breeding season. So, any adverse effects of the high protein supplements on first service was removed in subsequent cycles.

Supplementing ewes during late gestation had little effect on milk production of the ewes and lamb growth (Tables 2 and 3). In these tables, I have dropped the UIP means because they did not differ from the control or DIP supplements and subsequent studies did not include UIP supplements. McFadin's study indicated heavier lambs from ewes supplemented during late gestation at 50 days postpartum. The trend was for faster growth from day 14 through day 50. In neither year did supplementation significantly increase weaning weights. However, in both years, the lambs from supplemented ewes had numerically heavier weaning weights.

Table 4 indicates lamb weights for 1996 and 1997. We have not subjected these data to statistical analysis because the 1997 lambs are not weaned. However, in 1996 the ewes supplemented during both late gestation and lactation had numerically higher weaning weights than the other treatments. The improvement was worth an additional $5.40/ewe gross and after feed costs ($3.15/ewe) the margin is $2.25/ewe which would have to pay labor and other associated costs. In 1997, lambs from ewes supplemented during lactation and at both times were heavier at marking. I anticipate this advantage to continue through to weaning.

One question I asked about this data was 'Did the previous treatments (1996) influence the number of ewes with twins in 1997?' Surprisingly, the answer is no. I did not find any trend to suggest previous treatments affected subsequent productivity. However, this is based on one year. I will examine this question again after this year's breeding season.

Implications

Under the conditions of the NMSU Corona Ranch which could be described as good, supplementation of ewes did not significantly influence ewe productivity. Therefore, when forage is not limiting, supplementing protein will not improve weaning weights or rebreeding efficiency of range ewes. However, this may change for conditions of limited forage availability. More research is needed on the efficacy of supplementation of ewes grazing rangelands in poorer conditions that represented in the studies at the Corona Ranch.

Literature Cited

McFadin, E. L. 1997. Effects of Different Diets On Ewe And Lamb Performance. M.S. Thesis. New Mexico State University, Las Cruces, NM.

Meza-Herrera, C. A. 1996. Nutritional Status and Short-term Protein Supplementation Effects On Ovulation Rate And Mediators Of Maternal recognition Of Pregnancy In Sheep. Ph.D. Dissertation. New Mexico State University, Las Cruces, NM.

Ramsey, W. S. 1995. Finewool Range Ewe And Lamb Production Under Different Protein Supplementation Regimes. Ph.D. Dissertation, New Mexico State University. Las Cruces, NM.

Table 1. Effect of supplementation of yearling ewes before breeding and during breeding on ovulation, first cycle conception and weaning percentage (Ramsey, 1995).

Item	Treatments[a]			
	Control	DIP	UIP	SE[b]
Ovulation[c]	1.1	1.2	1.3	.27
First cycle conception[d]	78.2[e]	64.5[f]	73.2[e]	2.4
Adjusted weaning percentage[g]	65.6[e]	84.3[f]	82.2[f]	1.7

[a]Control = no supplement; DIP = 23% CP at .33 lb/head/day and UIP = 43% CP at .25 lb/head/day.
[b]Standard error.
[c]Average corpus lutea per ewe (10 ewes/treatment).
[d]Percentage of ewes not returning to estrus.
[e,f]Mean within row with different superscripts differ ($P < .01$).
[g]Weaning percentage is adjusted to confirmed predator 1055.

Table 2. Effects of supplementation of yearling ewes during the last trimester of pregnancy on milk production and lamb growth (Ramsey, 1995).

Days postpartum	Treatment[a]			
	Control		Supplement	
	Milk[b]	Lamb wt[c]	Milk	Lamb wt.
14	270	20.1	267	19.5
24	286	29.4	276	28.0
34	244	37.1	301	35.6
Weaning[d]	---	100.3	---	104.5

[a]Control = no supplement.
Supplement = 23% CP at .33 lb/head/day.
[b]Milk production (mL) after 3 hours without suckling.
[c]Lamb weight (lb).
[d]Weaning occurred at approximately 150 days postpartum. Milk production was not measured.

Table 3. Effects of supplementation of mature ewes with twins during the last trimester of pregnancy on milk production and lamb growth (McFadin, 1997)

Days postpartum	Treatment[a]			
	Control		Supplement	
	milk[b]	Lamb wt[c]	Milk	Lamb wt.
4	327	13	318	12.8
14	368	18.3	274	18.1
24	353	24	255	25.9
34	284	30.3	279	31.8
50	238	40.4[d]	240	43.5[e]
Wean[f]	---	90	---	95

[a]Control = no supplement
Supplement = 23% CP at .33 lb/head/day.
[b]Milk production (mL) after 3 hours without suckling.
[c]Lamb weight (lb).
[d,e]Lamb weights differed ($P < .05$).
[f]Weaning occurred at approximately 150 days postpartum. Milk production was not measured. This is the flock averages (single and twin births).

Table 4. Effects of supplementing ewes during different times on lamb growth for two consecutive years.

Supplementation period[b]	Weaning weight 1996	Marking weight 1997
Control	88.9	41.1
Late gestation	84.6	42.8
Lactation	88.8	44.9
Late gestation and lactation	94.8	44.0

[a]Supplementation was with a 28% CP block at .5 lb/head/day. No statistical analysis has been performed on this data.
[b]Late gestation - April 21 to May 19
Lactation - May 19 to June 22
Late gestation and lactation - April 21 to June 22

GRAZING TRIALS

Gary B. Donart, Eugene Parker, and Rex Pieper

Rotational grazing programs that will provide improved animal performance while improving ecological status of the site can provide desirable managerial alternatives.

Introduction

Rotational and/or seasonal grazing has been recognized as a possible means to enhance forage conditions on rangeland. Generally livestock performance can also be enhanced using grazing strategies, provided the animals are not stressed in the grazing process. Most grazing research has been conducted using the cow-calf pair under year-long conditions. Little work has been conducted using the stocker (growing) animal. To accomplish these objectives a winter grazing trial and a summer continuous and summer rotational grazing trial were established.

Methods

Winter pastures were established with and without juniper control. Weaned calves were placed on the pastures in early November and grazed until May 1. Weight gain from the cattle was collected. The primary response of the trials is vegetation change, as measured by ground cover, species composition and production. The rate of change in this strategy will be compared to changes that occur in the summer grazed pastures.

Summer grazed pastures are stocked with the heifers from the winter grazed trials, starting about May 15, and are grazed until November 1. The grazing trials include continuous grazing for that period of time with and without juniper control. The continuous grazing is compared to a three pasture rotational grazing plan where cattle are moved monthly. At the start of the grazing period each year, the rotational grazing is shifted forward by one pasture to insure that the pastures are used at different times and to allow for optimum growth of forage species. Cattle are weighed every 28 days to assess performance. Forage production, utilization, and species composition are measured at the end of the grazing season.

In 1997 all summer grazing treatments were stocked at a rate of 16 acres per yearling for a six month grazing period.

Results and Discussion

During the initial years of the study drought conditions prohibited adequate stocking of the pastures to obtain meaningful data. During this time animals were grazed in a manner to lightly graze the pastures and to even out the forage differences. 1997 was the first year in which the summer grazed pastures were fully stocked and animal performance collected. The 1996-1997 winter was the first season for the winter pastures to be grazed.

While vegetation data are still being collected on the winter grazed pastures, it appears that winter grazing followed by summer rest has stimulated forage production. Release of desirable forage species also appears to occurring in the juniper treated pastures. Winter grazing was terminated about 4 weeks early because of limited forage in the brush treated pastures. The dry summer of 1996 did not provide for adequate growth in this pasture. Vegetation data has not been collected in the summer grazed pastures, but fence line contrasts indicate differences in forage available between the rotationally grazed and juniper treated pastures and the continuously grazed pastures with no juniper treatment.

Animal performance data for 1997 favored the rotational grazing program. Heifers grazing in this strategy gained an average of 2.17 lbs/day from May 22 through August 27 (97 days). Cattle in the continuously grazed pastures which were treated for juniper gained an average of 2.0 lbs per day, and cattle performance in pastures without brush control and continuously grazed showed the lowest performance at 1.79 lbs /day. All animal performance data are preliminary and will be subjected to further testing and statistical analyses.

The grazing trial pastures are also available as a laboratory for numerous studies. For example, the winter grazing trials are divided so that three winter supplemental treatments can be evaluated as replicates and provide a split plot design for the grazing trials. The summer grazing trials are being used to collect forage quality, animal diet and animal behavior information.

Implication

Rotational grazing programs that will provide improved animal performance while improving ecological status of the site can provide desirable managerial alternatives.

JUNIPER CONTROL

Gary B. Donart, Eugene Parker, Kirk McDaniel, and David Gay

An understanding of undisturbed understory following juniper density reduction will allow for better interpretation of ecological opportunities for the grassland community, and how it may be managed.

Introduction

Increasing densities of juniper trees in woodland areas and encroachment of juniper into open grasslands are well documented. Treatment possibilities, including mechanical, chemical and fire have been studied. In this trial a chemical maintenance treatment was applied to reduce juniper stand density and encroachment while minimizing the understory component of the vegetation. The maintenance treatments were applied to existing grazing treatments to concentrate the influence of grazing management on the understory response.

Methods

An aerial application of tebuthiuron pellets at the rate of 1.2 lbs/ac were applied to 2400 acres of juniper woodland in late September, 1995. The application was applied in a manner to treat one of the winter grazing pastures, two of the continuously grazed summer pastures and the two rotationally grazed summer grazed pastures. Pastures were selected so as to provide a mosaic of treated and untreated pastures. Pastures and treatments are identified on the pasture map of the ranch. This mosaic was developed to provide blocks of juniper for deer cover and potential feed. The mosaic of treated pastures is within a larger block of juniper woodland on the ranch.

Results and Discussion

The tebuthiuron pellets were applied in the fall. One light shower occurred two weeks following the application. No appreciable snow occurred during the winter, and no rain occurred until July 1996. These dry conditions resulted in a delay of the effectiveness of the tebuthiuron on the juniper. Little response of the juniper trees to the tebuthiuron was observed until early spring 1997. Classical repeated needle fall has been delayed and limited, and only now are trees showing a strong impact to the chemical. Preliminary mortality data are being collected on the juniper trees in the treated pastures at this time.

Juniper tree density is variable through the different pastures, but preliminary data indicates averages of over 165 trees per acre. Approximately 70% of the trees were over 8 feet in height. Approximately 80% of the trees currently show some effect from the herbicide. Preliminary data indicate that 50% of the trees have 25%, or less dead material in the crown, and just over 25% of the trees showed more than 75% dead canopy. While casual observation appears to show more young trees affected, initial results show the rate of kill is not substantially different for mature and juvenile trees.

Tree mortality and understory vegetation response will continue to be monitored.

Implication

An understanding of undisturbed understory following juniper density reduction will allow for better interpretation of ecological opportunities for the grassland community, and how it may be managed.

NMSU CORONA EXPERIMENTAL RANCH
VEGETATION COMMUNITY DESCRIPTIONS

D. L. Anderson, L. R. Hart, and K. C. McDaniel

Vegetation Community #I: Cholla-yucca/blue grama-feathergrass-creeping muhly

This community covers approximately 54 ha and is characterized by limestone sinkholes (Karst topography). This type of topography is best developed at only two locations on the ranch. One is in the northeast corner of the East Johnson Pasture and the other one in the northeast corner of the Pipeline Pasture. Mean elevation is 1811 in. Vegetation at tile bottom of the potholes is dominated by *Bouteloua gracilis*, *Mulilenbergia repens* and in some cases also *Sporobolus cryptandrus*. *Opuntia imbricata* and *Ceratoides lanata* are prominent while *Marrubium vulgare* and *Gutierrezia sarothrae* are locally abundant. Some bare-ground due to rodent activity is evident in the bottoms of the sink-holes. The slopes and crests are characterized by the abundance of *Stipa neomexicana*, *Bouteloua curtipendula* and *B. gracilis* with scattered *Yucca glauca* and *Artemisia bigelovii*.

Vegetation Community #2: Yucca/blue grama-feathergrass-sideoats Grama

This community type covers approximately 1806 ha (20% of the ranch) and occurs principally on limestone outcrops on tops of ridges in rolling topography. This vegetation type and variants extend part way down slopes in thin, rocky soil and is the dominant type on the eastern third of the ranch. It is also found in the Oil Well, South House and South Barn Pastures. Mean elevation is 1811 m. The dominant grasses are *Stipa neomexicana*, *Bouteloua gracilis* and *B. curtipendula* with *Lycurus phleoides*, *Aristida purpurea*, *Schizachyrium scoparium* (on sandy soils), *Sporobolus cryptandrus* and *Bouteloua hirsuta* becoming prominent in some sectors. *Yucca glauca* commonly occurs throughout the community with *Nolina microcarpa*, *Opuntia imbricata*, *Artemisia bigelovii*, *Dalea formosa* and *Gutierrezia sarothrae* varying from low to high prominence. Bare soil averages about 5% on this type and surface rock about 6%.

Understory vegetation averages about 20 cm in height.

Vegetation Community #3: Blue grama-black grama

This community type covers approximately 396 ha (4.6% of the ranch) at Piedmont or drainage bottoms entirely on the east side of the ranch. The mean elevation is the lowest of any community on the ranch at 1765 m. The only pastures with this type are the East and South Johnson Pastures. The most prominent species is *Gutierrezia sarothrae* with scattered *Yucca glauca* and *Opuntia imbricata*. *Ceratoides lanata* is also conspicuous. The most important grasses are *Bouteloua gracilis* and *B. eriopoda*. Other prominent grasses are *Bouteloua curtipendula* and *Aristida purpurea*. *Lycurus phleoides* and *Aristida divaricata* are found scattered throughout the community in varying degrees. The aspect dominant is *Gutierrezia sarothrae*.

Vegetation Community #4: Cholla/blue grama-poverty threeawn

This community type covers approximately 218 ha (2.5% of total ranch surface) on slightly hilly or rolling topography overlapping onto flat plains at piedmont. This type is found entirely on the eastern side of the ranch in the East Johnson and North Johnson Pastures. Mean elevation is 1791 m. The dominants among the grasses are *Bouteloua gracilis*, *Aristida divaricata*, *A. purpurea*, and *Lycurus phleoides*. Scattered patches of *Bouteloua curtipendula* are also evident. *Gutierrezia sarothrae* is a common aspect and true dominant with co-dominance of *Opuntia imbricata* and *Yucca glauca*. Scattered patches of *Artemisia bigelovii* are present.

Vegetation Community #5: Cholla/galleta

This community type covers less than 5 ha in one playa in the East Johnson Pasture. This ephemeral lake is found near the old wagon road close to the northern boundary of the ranch at an elevation of 1783 m. Smaller playas may be present in the area but were not sampled. The dominant species is *Hilaria jamesii* followed closely by the aspect dominant *Opuntia imbricata*. Hilaria forms a uniform unbroken mat on the playa. Other prominent species are *Bouteloua gracilis*, *Aristida divaricata* and *Gutierrezia sarothrae*.

Vegetation Community #6: Prairie coneflower/buffalograss

This community type covers less than 5 ha in one playa in the North Johnson Pasture at an elevation of 1789 m. This variant is surrounded by the Cholla/blue grama-poverty threeawn Community just as is Community #5. *Buchloe dactyloides* is almost an exclusive dominant forming a dense uniform unbroken mat across the playa. Some *Muhlenbergia repens* is interspersed. *Ratibida tagetes* is abundant throughout the *Buchloe* mat.

Vegetation Community #7: One seed juniper/beargrass/blue grama

This community type covers approximately 673 ha (8% of the ranch) and averages 1806 m elevation. This is the ecotone between dense Pinyon-Juniper communities and Grassland communities stretching as a narrow band from east to west across the ranch. Besides the continuous band, isolated patches are found in the North Johnson, South Johnson, and South Barn Pastures. Mule deer take refuge in this type after feeding in open grassland. Topographically, this community is found on rolling hilly terrain on high ground or ridge tops. Limestone or sandstone outcrops are common and the vegetation varies accordingly. The number of grass species is diverse in this ecotone and number at least 20. The most common woody species are *Juniperus monosperma* and *Brickelia laciniata* plus *Yucca glauca*. *Nolina microcarpa* is an aspect dominant along with *Juniperus monosperma*. The most common grasses are *Bouteloua gracilis*, *B. hirsuta* and *B. curtipendula* on limestone outcrops whereas *Bothriochloa springfieldii*, *Schizachyrium scoparium* and *Lycurus phleoides* dominate on sandstone outcrops.

Vegetation Community #8: One seed juniper-pinyon pine/cholla-yucca/blue grama-wolftail

This community type is the largest of the ranch covering approximately 2732 ha (31.6% of the ranch). Elevation varies from 5950 m in the East Generator Pasture to 6200 m in the Ortiz Pasture. This type forms a continuous band south of the ecotone described under Community type #7 and is characterized by dense stands of *Juniperus monosperma* and scattered *Pinus edulis*. *Opuntia imbricata* and *Yucca glauca* are prominent in openings and the understory is generally dominated by *Bouteloua gracilis* and extensive patches of *Lycurus phleoides*. Other common grasses are *Aristida purpurea*, *A. divaricata*, *Bouteloua curtipendula* and *B. hirsuta*. *Gutierrezia sarothrae* is constant but not abundant. Sandy blowouts within this vegetation type are dominated by *Schizachyrium scoparium* and *Sporobolus cryptandrus* as well as *Juniperus monosperma* and *Quercus undulata*. *Pinus ponderosa* appears on these sandy sites.

Vegetation Community #9: Bigelow sagebrush/blue grama-wolftail

This is the second largest community type on the ranch covering approximately 1871 ha (21.6% of the ranch). The average elevation is about 6100 m. Pastures containing this type are the Pipeline, Oil Well, South House, North and South Barn, and Ortiz, all located on the western half of the ranch. *Bouteloua gracilis* and *Lycurus phleoides* are the dominant species in this grassland type with *Bouteloua curtipendula*, *Aristida purpurea*, and *A. divaricata* as secondary species. *Artemisia bigelovii* and *Gutierrezia sarothrae* are co-dominants while *Opuntia imbricata* and *Ceratoides lanata* occur in patches.

**Combination of Communities #2 and 4:

An area covering approximately 896 ha (10.4% of the ranch) is a mosaic of Vegetation Communities #2 and 4. The topography is rolling hills with Community #2 on limestone ridge tops or crests and Community #4 dominated by *Gutierrezia sarothrae* in the swales or valley bottoms.

POACEAE SPECIES LIST

SPECIES	COMMUNITY TYPES FOUND IN
Andropogon hallii	7,8
Aristida purpurea	
var. fendleriana	2,3
var. nealleyi	8,7
var. purpurea	1,2,3,4,7,8
Aristida havardii	2,3,4
Aristida divaricata	2,3,4,5,7,8
Aristida adscensionis	7,8
Bothriochloa springfieldii	4,7,8
Bouteloua gracilis	1,2,3,4,5,7,8
Bouteloua curtipendula	1,2,3,4,7,8,9
Bouteloua eriopoda	1,2,3,4,7,8
Bouteloua hirsuta	1,2,7,8
Buchloe dactyloides	6
Cenchrus incertus	8

Elymus smithii	6
Elymus longifolium	6,9
Eragrostis intermedia	1,2
Eragrostis secundiflora	8
Eragrostis erosa	7
Erioneuron pilosum	1,2
Hilaria jamesii	3,4,5,9
Lycurus phleoides	1,2,3,4,7,8,9
Muhlenbergia pungens	7,8
Muhlenbergia repens	1,2,3,4,5,6,7,8
Muhlenbergia torreyi	2,3,4,8,9
Munroa squarrosa	1
Oryzopsis hymenoides	2
Panicum obtusum	1,2,3,4,5,7
Panicum hallii	1,2,3,4
Piptochaetium fimbriatum	8
Schedonnardus paniculatus	9
Schizachyrium scoparium	7
Schizachyrium neomexicana	1,7,8
Setaria leucopila	7
Sporobolus contractus	1,2,8
Sporobolus cryptandrus	1,2,3,4,5,7,8,9
Stipa neomexicana	1,2,3,4,7,9
Tragus berteronianus	2,7,8,

OTHER PLANTS IDENTIFIED

SPECIES	COMMUNITY TYPES FOUND IN
Artemisia bigelovii	1,2,3,4,7,9
Berberis haematocarpa	2,8
Brickelia laciniata	7
Ceratoides lanata	1,2,3,4,9
Cirsium ochrocentrum	1,2,3,4,7
Commelina dianthifolia	7
Dalea formosa	2,7
Ephedra torreyana	1,2
Grindelia squarrosa	6
Gutierrezia sarothrae	1,2,3,4,5,7,8,9
Hymenoxys richardsonii	2,4,7,9
Juniperus monosperma	2,4,7,8
Kramaria parvifolia	1,2
Marrubium vulgare	1,2
Mentzelia laciniata	4
Nolina microcarpa	1,2,4,7,8
Opuntia imbricata	1,2,3,4,5,8,9
Opuntia polycantha	1,2,4,5,7,8
Paronychia sessilifolora	2
Pinus edulis	7,8
Pinus ponderosa	8
Quercus undulata	8
Ratibida tagetes	6
Rhus trilobata	1,2,3,7

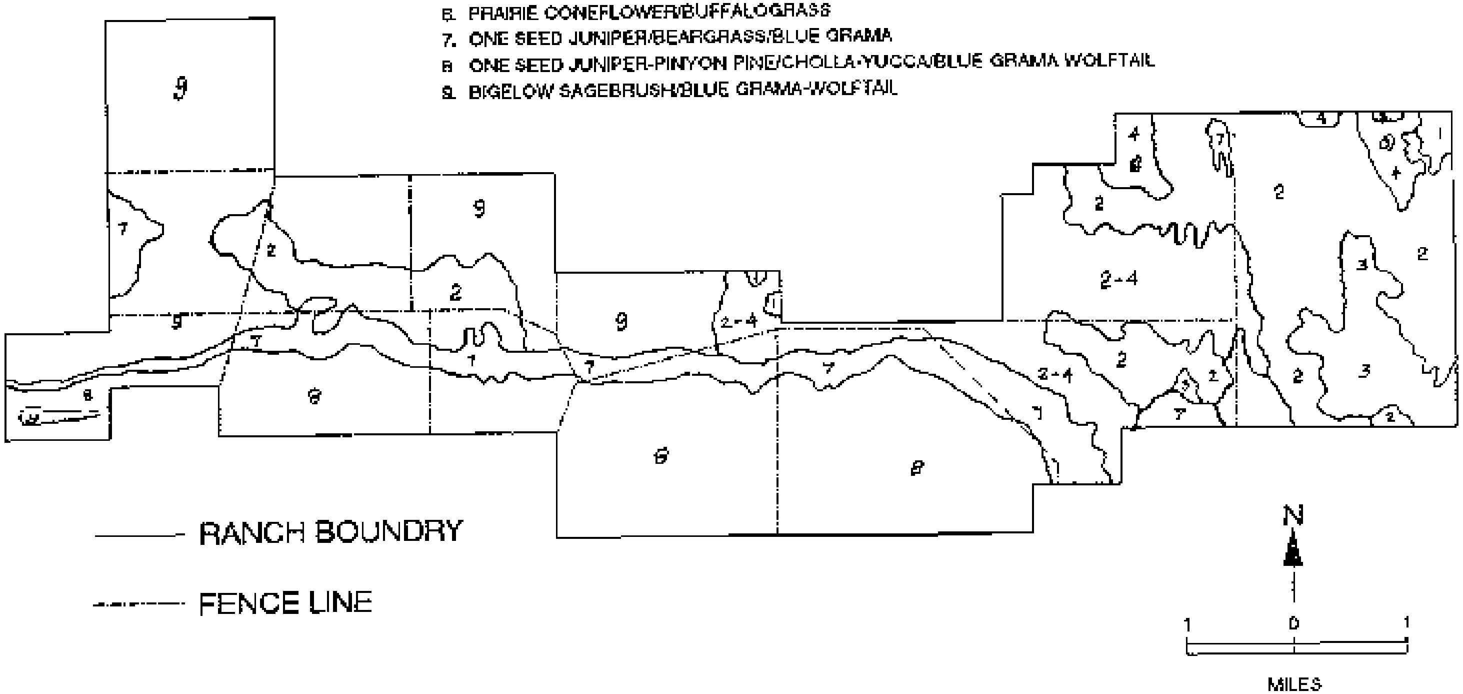
Senecio riddellii	2,4
Senecio longilobus	2,3,4,7
Solanum eleagnifolium	1,3,4,7,8
Thelesperma megapotamicum	4
Yucca baccata	8
Yucca glauca	1,2,3,4,7,8,9

NoteThis is a preliminary list of plants identified in December 1989 and includes only those species which could be properly identified at that time.

NMSU CORONA EXPERIMENTAL RANCH

VEGETATION COMMUNITIES

1. CHOLLA-YUCCA/BLUE GRAMA-FEATHERGRASS-CREEPING MUHLY
2. YUCCA/BLUE GRAMA-FEATHERGRASS-SIDEOATS GRAMA
3. BLUE GRAMA-BLACK GRAMA
4. CHOLLA/BLUE GRAMA-POVERTY THREEAWN
5. CHOLLA/GALLETA
6. PRAIRIE CONEFLOWER/BUFFALOGRASS
7. ONE SEED JUNIPER/BEARGRASS/BLUE GRAMA
8. ONE SEED JUNIPER-PINYON PINE/CHOLLA-YUCCA/BLUE GRAMA WOLFTAIL
9. BIGELOW SAGEBRUSH/BLUE GRAMA-WOLFTAIL



IMPLICATIONS OF RANGE COW DIETS IN CENTRAL NEW MEXICO

C. R. Krehbiel, J. E. Sawyer, L. A. Knox,
G. B. Donart, and M. K. Petersen

Range beef cattle production depends on the nutritional quality and amount of the major forage species eaten by the animal. Throughout the year, ranges typically have a period during which grazed forage is of poor nutritional quality or low availability. During these periods, cows lose weight unless supplemental feed is provided. The cow-calf production system can be optimized if the cow's nutrient requirements are synchronized with feed quality and availability. Recent evidence suggests that efficiency of energy and nitrogen retention is increased when cows are allowed to lose and later gain weight, which is typical in cows consuming native range. The increased efficiency of nutrient utilization by cows allowed to fluctuate in weight offers the potential to develop feeding strategies that improve grazed forage utilization and reduce supplemental feed costs. Understanding relationships that exist between diet quality, intake and nutrient utilization may provide a better understanding of the nutritional status of grazing beef cattle and other information fundamental to proper range management and efficient livestock production.

Introduction

Supplemental feeding of range livestock is intended to supply nutrients that may be limiting in the diet. Nutritive value of the diet, as measured by chemical composition, varies with season of the year, stage of plant maturity, temperature, and rainfall patterns (Krysl et al., 1987). In New Mexico, protein is often supplemented to cattle consuming dormant forage. Effective and efficient supplementation depends on providing the cow with proper nutrients at a level that meets her needs. Since diet quality changes over time, a knowledge of the dynamics of these changes may allow producers to supplement livestock more efficiently. This study is ongoing at NMSU's Corona Range and Livestock Research Center to describe changes in diet quality over a year.

Materials and Methods

<u>Site Description</u>

Vegetation on the Corona Range and Livestock Research Center is dominated by blue grama (*Bouteloua gracilis).* Pinyon-Juniper (*Pinus edulis* Engelm) - (*Juniperus* spp.) occurs in moderate to dense stands. Common plants found throughout the ranch besides blue grama include wolftail (*Lycuris Pheloides* Kunth), sporobolus spp. (*Sporobolus* spp.), and three awn (*Aristida* spp.). Elevation of the ranch is 6200 ft.

<u>Animals</u>

Diet samples have been periodically collected on the Corona Ranch since 1991. Ruminally fistulated cows were used to obtain representative diet samples from the pasture being grazed by the herd. Diet samples were taken during the spring and summer, when forage quality changes most rapidly (April-August) and then after dormancy (late October) and late winter (December-January). Fistulated cows were penned without feed or water the night before sampling. The next morning ruminal contents were removed and cows were allowed to graze freely for thirty minutes to an hour. The grazed forage was removed from the rumen as the diet sample, and original ruminal contents were replaced. Diet samples were composited between animals, air dried, and ground in a Wiley Mill through a 2 mm screen. Diet samples from each period were subsampled and analyzed to determine crude protein and neutral detergent fiber. Crude protein was determined by the AOAC (1984) method, and NDF was determined as outlined by Goering and Van Soest (1970).

Results

Neutral detergent fiber (NDF) represents most of the plant cell wall material available in the diet. Plant cell walls contain cellulose, hemicellulose and lignin, which are the major structural carbohydrates. In diet samples collected in the Adam's pasture in 1993, NDF was 10% greater in December (70.9%) versus May (60.6%) and then increased in June (66.5%) and August (68.1%). In general, NDF content of plants increases with increasing plant maturity which is supported by this data. Neutral detergent fiber has been shown to be negatively correlated with dry matter intake. In other words, as the NDF in forages increases, animals will be able to consume less forage. Therefore, intake by beef cows consuming native range is lower during periods when forage quality is low (i e., NDF values are high).

In general, dietary crude protein (CP) levels (% nitrogen x 6.25) were higher during periods of active growth when compared with periods of plant dormancy. Crude protein levels ranged from 7 5 in the spring (April-May) to a high of 13.5 during summer (July-August) and declined to a low of 4.2 in winter (December-January). Figure 1 illustrates the changes in CP level in cow diets in 1996, and also provides monthly rainfall data for the area during the same year. It is generally accepted that a pregnant beef cow in the last third of pregnancy needs no additional protein if dietary CP is approximately 7.5 to 8% (1.6 lbs of CP/day for a 1,000 lb cow). Therefore data from this ranch would indicate that no supplemental protein was needed for pregnant cows in early to mid spring in 1996. However, cows with an average milking ability and nursing calves require approximately 10% CP (1.8 lbs/day) in the first 3 to 4 months after calving. Therefore, producers who calve in February and March probably need to supplement protein for the period between calving and the start of rebreeding (i.e., March through June). For example, supplementing 1 lb of a 32% CP supplement per day will increase the protein in the diet by .32 lbs/day. If the cows are getting 1.1 to 1.3 lbs of CP from the forage, feeding supplemental protein will get the level of CP closer to her estimated requirement. The time when supplementation can cease will depend on rainfall and forage availability. As shown in Figure 1, in 1996 CP levels reached above the 10% mark in June, but this may vary from year to year. Whether animals should be supplemented during winter dormancy with adequate forage availability is a management decision. Earlier research at Fort Stanton (Bellido et al., 1981) has shown that winter supplementation of mature cows is economically beneficial only during drought years. If cow body condition going into the winter is extremely poor (i.e., 2 or 3), producers may also want to consider supplementation.

Summary

In general, dietary CP begins to increase in the spring and peaks in mid to late summer (12 to 14%). As expected, crude protein is low during dormancy in the winter

(4 to 7%). Data from this research suggests that supplemental protein may benefit beef cow producers during critical periods such as rebreeding.

Implications

Knowledge of the dynamics of diet quality and periods when protein levels may be rapidly changing may allow producers to match supplemental feeds more effectively to animal needs. For example, this data demonstrates the importance of supplementing cows in the period between calving and rebreeding when quantity of protein in forage may limit the cows ability to become pregnant during the same time she's peaking in milk production.

Literature Cited

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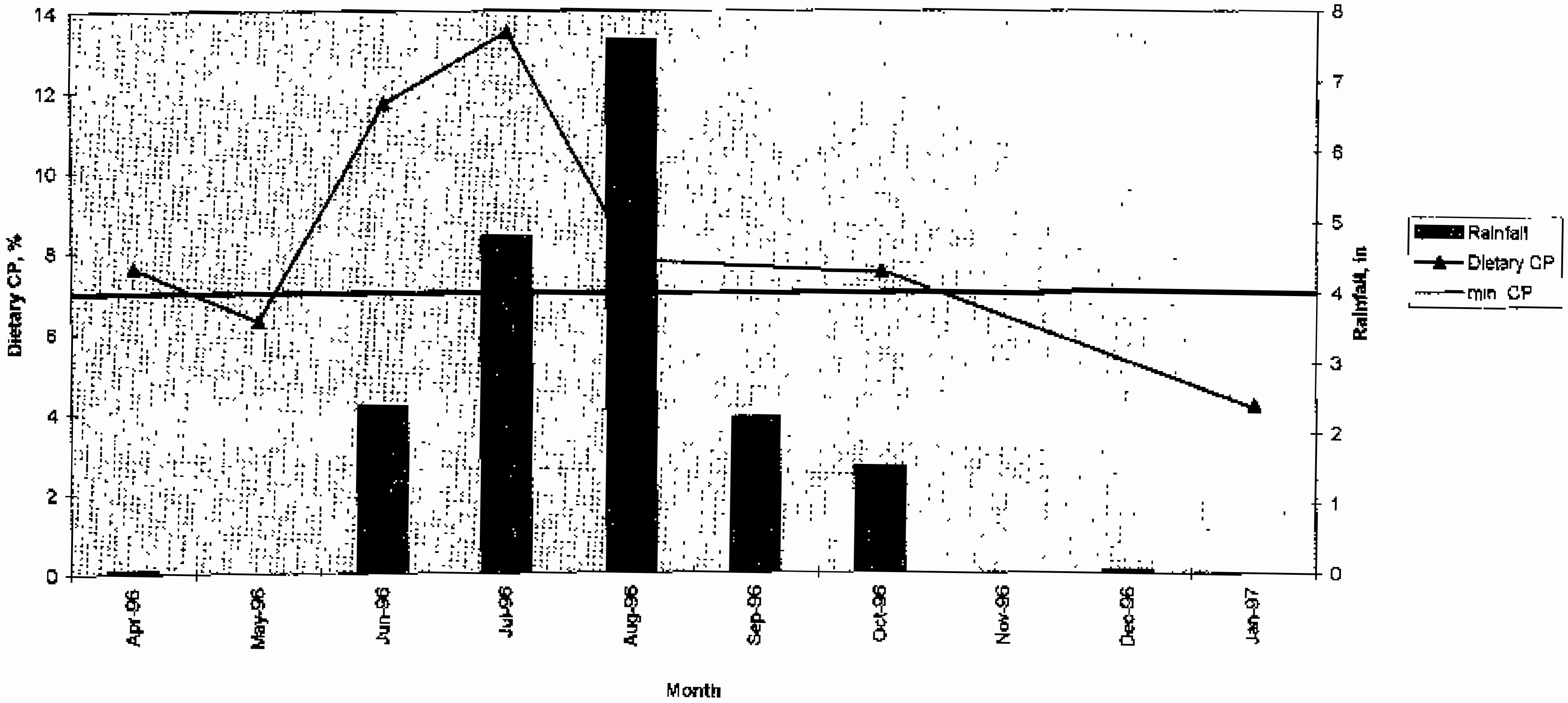
Krysl, L. J., M. L. Galyean, J. D. Wallace, F. T. McCollum, M. B. Judkins, M. E. Branine, and J. S. Caton. 1987. Cattle nutrition on blue grama rangeland in New Mexico. New Mexico State Univ. Agric. Exp. Sta. Bull. 727.

Figure 1. Rainfall and dietary CP in cow diets by month at the Corona Range and Livestock Research Center



NMSU ANGUS HERD

Neil Burcham

A group of 25 angus cows are maintained at the Corona Range and Livestock Research Center to produce bulls for our cow herd. The bulls that are developed should be well adapted for the ranch.

This herd was started to produce bulls for the research herds. The goals of this herd are: **Number 1** a 100% calf crop with no labor. Secondary goals are: growth rate to fit the environment. This means limited supplemental feed. The conservative stocking rate sure helps. Also, a carcass that will meet industry standards is part of the secondary goals. As for the number one goal, only 6 Angus have been open from 1990-1997. This is with a breeding season at 45-65 days. Artificial insemination is done before the clean up bulls are turned in. In the period of 1990-1997, 13.5% of the two year old cows have been helped with the birth process.

To keep the herd fertile the following criteria must be met by the dam of each herd bull that is kept for the purebred herd.

1. Calve before 25 months of age.
2. Never open
3. Never had a calf get sick at any time
4. Never helped with the birth process
5. Each calf must show outstanding vigor at birth

All of the above information can not be obtained on A.I. sires. I like A.I. sires that possess as many Pathfinder cows as possible in the pedigree. This proves both reproduction and growth rate in the herd environment.

NMSU has produced 4 Pathfinder cows. This is good considering the fact that the herd is only 25 cows.

The growth rate as determined by EPSU's are listed below.

Year	Birth wt.	Weaning wt	Milk	Yearling wt.	Scrota cir.
1987	+1.8	+7	0	+10	
1990	+.7	+15	+2	+22	
1993	+1.3	+18	+8	+31	
1996	+.2	+19	+8	+31	+.29
1997*	+.4	+20	+11	+33	+.03
The entire cow herd is:					
	+.9	+19	+10	+30	-.05

*Pedigree information only.

Cow weights were taken on 7 September 97 and are listed below.

Age yearlings	Average Wt. (lbs.)
2 yr old	942
3 yr old	1006
4 yr olds +	1261

Some people would want these numbers to be higher. I want the rainfall to be higher.

During the summer of 1997, 36 steers from the Corona commercial herd were fed for 112 days. This feeding was done at our feedlot at the Clayton Research Center. These steers were born in the spring of 1996 and weaned in October. Then they were wintered at the Tucumcari Research Center. They gained about .5 pounds per day until they were placed on feed.

The performance data are listed below.

Average daily gain: 5.10 lbs

Feed efficiency (dry matter): 4.79

Feed efficiency (as fed): 5.46

Yield grade	Number steers	Quality grade	Number steers
1	2	Choice	11
2	20	Select	23
3	14	Standard	2

1997 Born Calves

Angus

Calf No.	Calf DOB	Sire	Dam	Actual BW of calf	Actual WW of calf	Wt. of Dam
				----------	lbs.	----------
721	25 Feb	526*	608	70	465	1100
722	8 Apr	302**	529	61	435	1115
723	16 Mar	302	447	70	385	985
725	6 Feb	526	065	51	475	1205
726	1 Feb	1489***	415	72	665	1045
727	2 Feb	526	265	64	480	1375
728	2 Feb	1489	431	70	585	1025
729	3 Feb	526	247	59	450	1380
730	2 Feb	1489	401	86	625	1080
731	3 Feb	526	901	52	500	1165
732	2 Feb	526	261	78	655	1295
733	2 Feb	B3R****	417	51	475	1130
734	3 Feb	B3R	445	81	610	1075
736	2 Mar	302	435	63	515	970
737	10 Feb	B3R	543	60	470	985
738	17 Feb	526	361	80	630	1220
739	12 Feb	526	8304	70	510	1220
740	16 Feb	302	433	68	560	1205
741	14 Feb	B3R	537	71	450	980
742	17 Feb	526	811	64	520	1240
743	4 Mar	302	527	65	440	1065
744	1 Mar	526	239	71	580	1230
745	17 Feb	526	207	80	540	1470
746	2 Mar	302	545	71	475	890
749	26 Feb	526	135	74	dam died	

*NMSU 526
**NMSU 302
***GAR Traveler 1489
****B3R 602 RITO 8611

DEVELOPMENT OF REPLACEMENT HEIFERS WITH LIMITED SUPPLEMENTATION OF BYPASS PROTEIN

D. E. Hawkins, S. Cox, G. Parker,

A. M. Encinias, K. K. Kane, and M. K. Petersen

Heifer development represents a significant cost to beef cattle producers. The primary cost associated with developing heifers is purchased feed which goes to a young female who provides no return until her first calf is weaned. Currently most producers attempt to maximize growth and reproductive performance in heifers by beginning supplementation soon after weaning. This strategy results in acceptable pregnancy rates in heifers. However, strategies which optimize growth and reproduction may provide more financial benefit to producers. Use of feeds which effect metabolic and hormonal function provide alternatives to heifer development. These feeds include bypass proteins which exit the rumen and are utilized by the lower GI tract. By delaying the time supplementation begins, costs associated with purchased feed is reduced. This provides the producer with the option of investing dollars into to heifers which are subsequently diagnosed pregnant instead of the entire heifer herd. Studies have been conducted at Corona to determine effects feeding bypass protein and delaying the start of supplementation on growth and pregnancy rates of yearling heifers.

Material and Methods

Studies were conducted in 1995 and 1997 using Corona ranch raised crossbred heifers. In 1995 heifers (n = 67) were fed cake containing bypass protein, bypass protein and fat or a cottonseed meal control. Supplements were fed three times per week. In 1997 supplements were fed to heifers (n = 82) in a 40 lb block delivered twice per week. Supplements used in 1997 were either bypass protein or cottonseed meal control. Heifers were assigned to treatments by date of birth so that each treatment had an equal age distribution. All supplements were similar in crude protein (approximately 40%).

Supplementation for 95 and 97 did not begin until late January following an October weaning. The feeding period lasted until early May. Heifers were synchronized and those which came into heat were AI'd. Cleanup bulls were turned in for a 60 day (1995) or 40 day (1997) breeding period. Heifers were palpated for pregnancy 60 days after the end of the breeding season which was confirmed (1995) by calving date.

Results

1995

Body weights at the end of the trial (May) are presented in Table 1. Body weights did not differ among treatments. However, backfat (measured with ultrasound) was the greatest in heifers fed the bypass protein supplements. This indicates that although weights were not different fat deposition was altered by bypass protein. Pregnancy rates (Table 1) were greatest for heifers fed the bypass protein or bypass and fat supplement. Also number of heifers bred in the first 21 days of the breeding season was greatest for the heifers fed bypass protein supplement (Table 1).

1997

As in 1995 body weights going into the breeding season were similar (Table 2) among treatments. Pregnancy rates which were lower than 1995, were greatest in bypass supplemented heifers. Data regarding when heifers were bred will be confirmed at calving (1998).

Summary

It may be possible to achieve optimum pregnancy rates (not maximum) by limited use of bypass protein. Trials are scheduled which will evaluate using bypass protein fed early (October) versus late (late January).

Table 1. Data from 1995[a].

	Control	Bypass	Bypass + Fat
Initial weight - October	506	519	515
Final weight - May	560	583	592
Pregnancy 1st 21 day of breeding season (%)	43	56	45
Overall pregnancy rate (%)	77	100	86

[a]60 day breeding season.

Table 2. Data from 1997[a].

	Control	Bypass
Initial weight - October	494	494
Final weight - May	564	563
Overall pregnancy rate (%)	60	67

[a]40 day breeding season.

THE USE OF LIMITED SUPPLEMENTATION IN 2 AND 3 YEAR OLD COWS

Mark Petersen, Lee Knox, Lisa Appeddu, Dean Hawkins,
Gene Parker, Shad Cox, and Gary Donart

During the last 3 years we have conducted a series of experiments to test different types of supplements. These supplements have contained different sources of protein and/or fortified with fat. We have measured their effectiveness in promoting pregnancy in young cows after they have calved for the first time. Our purpose is to devise a nutritional management plan that will insure that 92% of all two year cows get pregnant in sixty days. We would like to do this with our purchased feed costs (mineral and protein supplement) at $30 or less per cow per year.

Introduction

One of the threats to ranching profitability is the bred back of first calf two years old cows. These cows are challenged since they need to produce milk, repair and rebuild tissue after calving, begin reproductive cycling and do all of this while the range forage is mostly dry and brown.

We know that after calving a cow usually will not begin cycling while she is losing weight. She will begin cycling a few weeks after body weight and condition starts to improve. So the question we have asked is "How can we get these young cows to lose weight in a shorter period of time?" Obviously we can feed more cubes or hay and replace any range forage they might eat. However this solution is too costly. We then thought about the possibility of "tricking" the cow's metabolism to reduce the amount of body weight (nutrients) released for milk production during weight loss after calving.

The control of the direction of body weight or condition score change is by hormones. These important hormones are familiar to a lot of people. The first one is insulin. This is the hormone that is in low supply in people that are diabetics. Insulin is important because it permits nutrients to flow into tissues. The second hormone is growth hormone. During milk production, growth hormone is important because it signals the body to use body nutrients for milk production. It also tells the body to ignore insulin. So one of the reasons cows lose weight when they have a suckling calf is due to high growth hormone and low insulin concentrations in the blood.

On campus we have conducted a series of experiments. The purpose of these experiments were to determine if different types of protein sources used in range cubes have different effects on the amount of growth hormone or insulin found in the blood. The results of these experiments showed that some protein sources were more effective at stimulating insulin release than other protein sources. Feather meal was the protein source that caused the greatest insulin release.

So we had an idea, if feather meal was included in cubes fed after calving then would insulin increase in the blood and more of the nutrients go to recovery of cow's body condition. Would this also cause a cow to start cycling and get pregnant sooner?

Materials and Methods

The study conducted in the spring of 1997 will be described. We had conducted similar studies in 1995 and 1996. In this study we used 2 and 3 year old black baldie cows. Two year old heifers started calving the middle of January. After the heifers calve they were moved into the West Adams pasture adjacent to the head quarters. In that pasture we have some working facilities built with a chute that has a series of 8 stalls. Each cow is fed her supplement when she is in a stall. By feeding in this way we avoid the problems of running cows in different pastures. If we ran cows in different pastures we would not be able to determine the cause for differences in animal performance. Were the effects do to the different supplements or due to the different pastures the cattle were in?

We fed two supplements at a rate of 2 lb per head per day. The supplements were fed 2 days per week (Monday and Friday) at 7 lbs per feeding. The cows were gather before noon and brought to the central working facilities. We tried to feed them late enough in the morning so not to disturb the cows normal grazing time. The supplements were formulated to contain 36% crude protein. Our control supplement was composed of mostly **cottonseed meal** and the treatment supplement also contained **cottonseed meal plus fish meal and blood meal**. We added the fish and blood meals because they may rise insulin in the blood. These protein sources are also known as bypass proteins. Bypass proteins are not altered by any of the four stomachs found in the cow. They are absorbed in the intestines in nearly the same form they were fed. A salt mineral mix was available at all times. This mix contains 8% phosphorus and fortified with trace minerals.

Once a week we collected a blood sample while the cows were eating their supplement. This sample was analyzed for progesterone. We analyzed for progesterone because its concentration indicates when a cow starts cycling or becomes pregnant.

On May 7 the cows were moved into the Mesa pasture. This pasture had not been grazed since the previous spring in 1996. Three Angus bulls were turned in with the cows at this time. The bulls were removed on July 10 and the cows were moved out of the Mesa pasture to a fresh pasture. On October 15 and 17 calves will be weaned, cows will be pregnancy tested.

Results

The cost of supplementation per head was similar between the two formulations of supplement. The cottonseed meal supplemented cows required $24.44 (2 yr old) or $19.75 (3 yr old). Those that were fed the cottonseed, fish and blood meal supplements required $25.00 (2 yr old) or $20.41 (3 yr old). The difference in cost was less than $1 per head between the two supplements. We also had spent approximately $6 on salt and mineral for the year.

The two year old cows seemed to benefit more from the fish and blood meal than the three year old cows. The 2 years fed cottonseed meal lost 163 lbs while those fed cottonseed, fish and blood meal lost only 144 lbs from February 22 to April 11.

The three year old cows fed the cottonseed meal supplements lost 138 lbs and the cows fed the cottonseed meal with the fish meal/blood meal lost 149 lbs from February 2 to May 7.

Calf weights from cows fed the cottonseed, fish and blood meal supplement weighed 5 lbs heavier on July 10 than cows fed the cottonseed meal supplement.

The results of the reproductive measures are still preliminary. We will have a better idea at pregnancy testing on October 15. The progesterone data indicates that an overall pregnancy percentage of 83%. There was a trend for the two years olds fed the cottonseed, fish and blood meal to have a higher pregnancy.

Implications

The two year old cows lost less 20 lb less body weight when fed the combination supplement (cottonseed, fish and blood meal). This additional body weight maybe important in the breed back in these cows. The combination supplement cost $0.61 per cow more over the after calving period. At the rate of 5 lbs more calf per cow (as measured on July 10) the supplement shows potential to increase productivity.

Performance of 2 and 3 year old cows after calving fed supplements containing cottonseed meal (CSM) or cottonseed, fish and blood meal (CFB).

	Two year old		Three year old	
Item	CSM	CFB	CSM	CFB
Body weight (lb)				
Feb 2			957	961
Feb 2	923	918		
April 11	760	774	848	838
May 7	716	734	819	812
Calf weight (lb)				
July 10	285	290	313	318
Estimated[a] pregnancy %				
July 10	73	91	83	83
Cost supplement				
$/head	$24.44	$25.00	$19.75	$20.42

[a]These values are estimated from blood progesterone. More reliable results will come from pregnancy detection and calving in 1998.

BRUSH CONTROL AND ITS EFFECTS ON MULE DEER HABITAT AND HUNTING SUCCESS

V. W. Howard, Jr. and Samuel T. Smallidge[1]

Trophy mule deer bucks are produced in areas that have herds with relatively high numbers, good forage quality, light hunting pressure and good genetic stock. Numbers of deer and hunting pressures can be manipulated with seasons and bag limits, quality forage and predator densities. Forage quality may depend upon habitat manipulation and livestock grazing, but also is dependent upon weather patterns. We can influence the first two but the latter currently is not a management option.

Introduction

Mule deer (*Odocoileus hemionus*) on the Corona Range and Livestock Research Ranch (CRLRR) were subjected to a fee-hunting operation prior to New Mexico State University's acquisition of the area. We have continued the fee-hunting operation with 15 to 30 individuals hunting each year. Data are collected to estimate mule deer numbers, sex, and age ratios, home range size and trophy quality of hunter-harvested males, and abundance and changes of vegetation on CRLRR. These data allow us to make decisions regarding hunting pressure and overall health of the mule deer herd. Additionally, these data will provide long-term insight for recommendations on managing mule deer and livestock when these animals jointly use areas.

Materials and Methods

The mule deer population is estimated biannually from reading 36 pellet group transects. Readings are made in April and October to estimate fall-winter and spring-summer populations, respectively. There are 2 vegetation transects located in conjunction with each pellet group transects. These are

[1]Authors are Professor and Graduate Research Assistant, Department of Fishery and Wildlife Sciences, New Mexico State University, Las Cruces.

read biennially in September to detect major changes in vegetation.

The sex-ratio and age-ratio of the mule deer herd is determined from counting and classifying mule deer observed along a 24.8 mile route. This route is run east-to-west in the morning and west-to-east in the evening for 2 consecutive days in November, December, and January. Mule deer are classified as females, males or fawns. Yearling mule deer are not separated from older animals. These routes generally require 2 hours to complete.

Hunters are required to check their harvested mule deer out before leaving CRLRR. Numerous antler and body measurements are recorded along with the date of kill, hunter's name and location of the kill. An incisor is extracted from the mule deer that are 2 years or older. This tooth is labeled by hunt (1, 2, or 3) and number (1 to 15). Later it is cross-sectioned, partially decalcified, stained and annuli are counted with the aid of a microscope (100x) to determine actual age of the animal.

Results

There generally are more mule deer on CRLRR during fall-winter than during spring-summer. Fall-winter populations generally are 25 to 40 percent above those of the preceding summer. Additionally, the areas with a piñon-juniper commonly have 1.8 to 1.9 times as many mule deer as the grassland. Grasslands are used extensively as feeding areas, particularly the first 600 yards adjoining the woodlands, but do not provide security cover or insular cover from sun, snow, wind, etc. Additionally, a previous study of mule deer diets (Joseph 1995) indicated that they rely heavily upon oneseed juniper (*Juniperus monosperma*) as a food source, particularly during late fall and winter. Therefore, excessive control (removal) of juniper will be detrimental and cause a decline in mule deer numbers.

Vegetation data indicate the obvious differences between the woodlands and grasslands. Canopy cover and litter are higher while bareground is lower in the woodlands. Grasses, forbs, and bare ground are higher in the grasslands.

Trend route data indicate a relatively stable composition for mule deer on the CRLRR. The ratio of antlered bucks to adult does has varied between 40 and 56 bucks for each 100 does with 43 to 48 per 100 being the more common occurrence. Fawn to doe ratios have varied from a low of 43:100 in 1994 to a high of 86:100 in 1995. Commonly, we count 50 to 65 fawns per 100 does. These are good fawn to doe ratios considering that yearling does are classified as adults and very few of these would produce a fawn as a yearling. December appears to be the best month for conducting trend route surveys. The highest number of antlered bucks can be observed at this time because of breeding activities.

Originally, these were 15 hunters split between the second (5) and third (10) hunts. We increased to 25 hunters in 1993 after we purchased 10 sections of the Adams property. We allowed 30 hunters to participate in 1995 with 5 on the first hunt, 9 on the second hunt and 16 on the third hunt. Hunter success rates have varied between 88 and 100 percent since 1989. Some hunters mainly are trophy hunting and have chosen not to take a deer during some years. These all had many opportunities but did not find a true "wall-hanger".

Mule deer bucks on CRLRR reach skeletal maturity at 3 years and achieve trophy quality at 4 years. They maintain these characteristics until 8 or 9 years when antlers show obvious regression at older ages. Some hunters have barvested 1 or 2 year bucks, after having passed on larger bucks, because they hoped they would find even bigger ones. In order to not go home empty handed, they killed a younger, smaller deer on the last day of their hunt. During any given year the quality of antlers grown by mule deer bucks is dependent upon forage quality and availability from May through mid-September. Forage production is related directly to timing and amounts of precipitation, particularly rainfall in late spring and early summer.

Modifications of habitats, particularly in the piñon-juniper woodlands, have provided some short-term benefits to the CRLRR mule deer herd. These include fence and pipeline right-of-ways, prescription fire, and mechanical clearing. A recent chemical treatment to 2400 acres may also be beneficial, but this treatment has only begun to show the effects of the aerial application of chemical. An additional 3 to 5 years will be needed to determine the overall response of the mule deer in the treated areas. The major benefit of these treatments has been an increased production of forbs in those areas. As the areas evolve toward perennial grasses they become less beneficial to mule deer for forage.

Conclusions

Mule deer numbers are abundant on the CRLRR.

Fawn to doe ratios generally are above the statewide average.

Buck to doe ratios generally are 2 to 3 times the statewide average.

Mule deer bucks reach maximum skeletal growth at age class 3 and have trophy quality antlers at age class 4.

Precipitation timing and amounts directly influences antler growth through quality and availability of vegetation.

Juniper is an important food source for mule deer on the CRLRR.

Piñon-juniper modification, if done properly, has a positive effect on mule deer numbers on the CRLRR.

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Table. Ratios of buck and fawns per 100 does, by year, on CRLRR.

Year	Ratio (doe:buck:fawn)	# Deer Classified
* 1990 - 1991	100:52:63	273
* 1991 - 1992	100:48:71	127
* 1992 - 1993	100:38:56	131
* 1993 - 1994	100:56:44	287
** 1994 - 1995	100:46:43	818
1995 - 1996	100:43:86	1169
1996 - 1997	100:50:53	854

*Berry 1992, Moore 1994.

**Trend route relocated and expanded in 1994.

Table. Population estimate ± standard error for mule deer on CRLRR from pellet group data, by season, 1989 - 1996.

Year	N	Spring/Summer			N	Fall/Winter		
1989	--	--			17	765		
*1990	17	844	±	77	18	1020	±	77
*1991	17	883	±	84	28	950	±	75
*1992	28	1056	±	164	36	1008	±	152
*1993	36	618	±	88	36	1064	±	137
1994	36	805	±	82	36	1147	±	132
1995	36	642	±	87	36	1067	±	137
1996	36	489	±	81	36	754	±	92

*Berry 1992, Moore 1994.

MINERAL STATUS OF WEANED CALVES AND ITS RELATIONSHIP TO THEIR HEALTH

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There is a perception within the cattle industry of New Mexico and the Texas Panhandle that copper deficiency in area weaned calves exists and that the deficiency contributes to health problems in the calves if they enter feedyards at or soon after weaning.

Data to substantiate this perception is generally not available. However, feedyard managers and veterinarians who treat feedyard cattle and develop health programs for the feedyards believe that calves from Eastern New Mexico and West Texas present unusual health problems as they enter the feedyards following a short ranch weaning period of 45 days or less. Copper deficiency has been implicated as a possible factor involved with health problems during the early part of feedyard growing and finishing among calves originating from this geographic area. This has been identified conversationally as "The New Mexico Calf Problem".

Is the "Problem" Real or Imagined?

There is scientific evidence that mineral deficiencies may contribute to immune insufficiencies of weaned calves. The apparent insufficiency, if it exists, may be observed most frequently when calves enter a confined environment where they are confronted with disease challenge.

Miller (1984) suggests the ability of animals to cope with infection may be influenced by mineral nutrition, in particular magnesium and phosphorus of the macro-elements and zinc, iron, copper and selenium of the micro-elements. Miller indicates deficiencies of zinc, iron, copper and selenium have resulted in lowered resistance to disease through an impaired immune response or faulty leukocyte function. The role of selenium in bactericidal action of the phagocytes is associated with oxidative functions believed important for killing phagocytized bacteria. (1)

Nockels, in a literature review describing nutrient modulation of the immune system, cites interrelationships between vitamin E and selenium that impact immune function. (2) Physiological actions and interactions of minerals are described frequently in the literature. Other work by Nockels, et. al. not covered specifically in her literature review has shown that weaned calves respond to elevated trace mineral levels, especially some of the organic trace mineral sources, during the early weeks of confinement feeding. These responses are measured in terms of improved immune status and improved health as opposed to improved gain or feed efficiency.

J.H. Cline cited Australian work describing the color pigmentation in sheep associated with copper status (3). The Australian work suggests that dietary molybdenum and sulfate could block pigmentation in sheep within two days and probably the biochemical defect occurs within hours of ingestion of molybdenum and sulfur. Cline states that fertility problems have been recognized in a number of species associated with copper deficiency. Cline continues, "the complexity of copper nutrition in the animal has been demonstrated for many years and it is an excellent example of involvement with other minerals".

Molybdenum has been known to interact with copper affecting its availability. Cline indicates that sulfur was demonstrated in the 1950's to be intimately involved with copper and molybdenum. In the mid 1970's it was shown that sulfur alone, without the presence of molydenum, would also interfere with copper availability and that increasing sulfur content of a diet from 0.1% to about 0.3% would significantly reduce copper absorption.

Cline, citing California, Nevada and New Zealand work, indicates molybdenum levels as low as 0.5 ppm to 1.5 ppm are biologically significant in antagonizing copper. · Corah et. al. indicated diet molybdenum levels above 3 ppm are significantly antagonistic to copper utilization as is diet iron levels above 400 ppm (4). Cline further states, not only the presence of each trace mineral in cattle diets but their ratios and possibly their chemical form may have influence on total mineral status and even health status as it relates to the animal's ability to defend against disease challenge.

What Is the Mineral Content of Area Pasture Forage and Water?

The mineral content of area pastures and water sources utilized by cows and calves is not well known to the writer of this paper. However, an effort to discover some of the answers to this question has been made with the following results:

Forage analyses on several Eastern New Mexico ranches, in recent years, reveal high iron levels. Forty-four separate dormant pasture samples indicate dry matter iron levels between 127 ppm and 3858 ppm with a 44 sample mean of 969 ppm. Copper and zinc levels in the same 44 samples ranged from 2.0 ppm to 68.05 ppm and 3.07 ppm to 63.0 ppm with means of 17.55 ppm and 24.47 ppm respectively. Manganese levels in the 44 samples ranged from 6.0 ppm to 141.0 ppm with a mean of 60.15 ppm. Molybdenum was tested in 25 of 44 samples but the 25 samples came from 10 different ranches in five different Eastern New Mexico counties. The molybdenum forage dry matter ranged from 0.11 ppm to 15.0 ppm with a dry matter mean of 2.18 ppm. Three of the 25 samples tested for molybdenum were 10.0, 10.0 and 15.0 ppm respectively and believed to be inaccurate even though the laboratory doing the work was believed to be highly reputable and the analysis was duplicated on each of the three samples in question. All three samples exhibiting the high molybdenum levels were from a ranch where calves were known to have excessive health problems at the feedyard. If the three high molybdenum samples were subtracted from the data base of 25 samples the dry matter molydenum mean was 0.88 ppm for the remaining 22 samples with the highest individual sample being 2.5 ppm.

Within some of the same ranches where forage analyses were completed water samples were also taken. Sulfate levels ranged from 6.5 ppm to 3120 ppm A 35 well sample mean indicated 940.57 ppm of sulfates. A six sample surface water mean indicated 112.83 ppm for sulfates.

Greene and Kasari have indicated molybdenum, sulfur and iron, at elevated levels in the diet, will likely form an insoluble complex with copper (4).

As a further effort to determine the possible relationship of mineral inadequacies, whether manifested as a simple forage deficiency or an antagonistic mineral relationship, some ranch investigations have been conducted by the writer with inconclusive results. Varying mineral levels and mineral sources were fed to cow/calf pairs 84 days pre-weaning and to the calves only 42 days post-weaning to measure the effect of mineral intake on mineral liver storage and subsequent health status during the feedyard feeding period. Total numbers of calves that were tissue (liver and blood) sampled were small and dependable conclusions could not be made. There was a numerical difference in liver storage of copper, zinc and iron. The liver content of calves receiving the higher levels of dietary copper and zinc had higher liver values for these minerals.

Supplemental iron was not included in any of the treatments. Liver iron levels appeared to be lower in calves with the higher liver values for copper and zinc. Blood titer levels for IBR, BVD and BRSV vaccinated calves tended to be higher for calves ingesting the higher mineral levels and having the higher liver values for copper and zinc. The measurements were inconclusive due to small numbers and the fact that blood titers were measured at a date well beyond the time when they would have been expected to peak.

Again, calf numbers where tissue mineral values had been measured were too small to provide conclusive evidence of health status during the feedyard finishing period. As a group, about 55 of the calves on the mineral test were combined with enough non-test calves from the same ranch to make up two pens of approximately 80 head each and were finished at the Friona Industries feedyard at Friona, Texas. General observations were that treatment costs of the calves from this ranch were significantly less during the 1996/97 feeding season than any of the three previous years. A planned effort had been made to increase mineral intake of all ranch cattle which included many cow/calf pairs not included in the test group. In fact, total mineral intake was deliberately increased above NRC requirements in an effort to overcome perceived mineral deficiencies and or antagonisms.

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WHAT DO THE NUMBER SHOW FOR HEALTH STATUS OF NEW MEXICO CALVES VERSUS CALVES FROM OTHER AREAS?
(Please see Tables 1 and 2)

Table 1. Summary Statistics - ProEdge Program New Mexico Cattle vs Texas Cattle. Note: Data is presented as LS Means ± SEM. The means were weighed for the number of cattle. Data was analyzed by ANOVA and linear contrasts using JMP 3.1 for Macintosh (SAS Inst. Cary, NC). 1994 Calf crop.

Observation	New Mexico	West Texas	Texas
Pen weight	555.5 ± 10.6a	577.2 ± 14.4ab	601.7 ± 7.0b
$/CWT	81.74 ± .89	80.16 ± 1.21	80.12 ± .59
Process ($)	8.77 ± .50a	11.38 ± .68b	9.92 ± .33c
Treatment ($)	11.26 ± 1.23a	11.19 ± 1.67a	4.26 ± .81b
Total Med. ($)	20.02 ± 1.43a	22.57 ± 1.95a	14.18 ± .95b
% Treated	58.89 ± 5.90a	47.63 ± 8.04a	20.43 ± 3.91b
% Repulls	12.66 ± 2.35a	12.00 ± 3.20a	2.36 ± 1.56b
% Dead	.74 ± .19a	1.49 ± .26b	.59 ± .13a
Total Health Costs ($)	23.71 ± 2.09a	30.05 ± 2.84a	17.25 ± 1.39b
	Approx. 3000 Calves		Approx. 7000 Calves

[abc]Different (P < 05) within rows.

able 2. Producer's edge closeout summary for 1995 placements.
08/25/96 - Overall summary of sources

	# head	Sex	In date	Out date	In weight	Out weight	Days on feed	ADG	Avg Daily intake	DMC	Feed COG	Total COG	DM Ration	Processing	Treatment	% Death loss	%Railed
verall summary	7794	ST	10/31/95	05/18/96	606	1206	201	2.92	23.62	5.88	$57.38	$61.02	$194.86	$10.71	$6 30	1.26%	0 55%
Feedyards	6754	ST	10/24/95	05/12/96	601	1196	201	2 89	23.29	5.83	$55.93	$59.85	$191.77	$11.12	$7.03	1.23%	0.59%
Pro Feedyards (PE)	1040	ST	12/14/96	06/29/96	640	1272	196	3 13	25 82	6.17	$66.20	$67.17	$214 96	$8.06	$1.60	1.44%	0.29%
xas & Oklahoma Origin	5748	ST	10/28/95	05/0896	615	1209	198	2.95	23.57	5.88	$56 81	$59.81	$192 54	$10.42	$3.56	0.90%	0.56%
ew Mexico Origin	2046	ST	11/20/96	06/16/96	581	1196	208	2.85	23 78	5.87	$58.92	$64.30	$201.40	$11 52	$13.99	2.25%	0.54%
verall summary	6122	HF	11/03/95	05/26/96	558	1084	203	2.49	21.49	6.35	$62.26	$66.38	$195.64	$10.75	$5 94	1.50%	0.82%
Feedyards	5173	HF	10/26/95	05/20/96	555	1081	205	2.47	21.16	6.24	$60.33	$64.75	$193.54	$11.24	$6.72	1 45%	0.81%
i Pro Feedyards (PE)	949	HF	12/17/96	06/28/96	578	1096	192	2 58	23.27	6.99	$72.96	$75.37	$207.08	$8.04	$1.71	1.79%	0.84%
xas & Oklahoma Origin	4609	HF	10/29/95	05/22/96	568	1093	205	2.5	21.5	6.4	$62.50	$65.92	$194.87	$10.31	$3.67	1 22%	0.69%
ew Mexico Origin	1513	HF	11/18/95	06/09/96	530	1055	197	2 47	21.48	6.22	$61.54	$67.76	$97.99	$12 07	$12.87	2.38%	1.19%

APPENDIX

OTHER RESEARCH

IMPROVING RANGE EWE PRODUCTIVITY

T. T. Ross, G. Parker, and S. Cox

Several studies have been conducted on the NMSU Corona Range and Livestock Research Ranch investigating effects of supplementation programs on ewe productivity (Ramsey, 1995 and McFadin et al., 1996). These studies revealed no real benefits of supplementing ewes during the last trimester with a 25% CP supplement (.33 lb/day) or a 42% CP supplement (providing ruminal bypass protein and fed at .25 lb/day). In both studies, stocking rates were moderate and forage availability would be considered good. This past year, another study was initiated to compare the timing of supplementation. Ewes, 225, were divided into four pastures and pastures were allotted to treatments. Treatments were: no supplement control, supplement during late gestation only, supplement during early lactation only, supplement during late gestation and early lactation. Ewes were supplemented with 25% CP fed at .33 lb/head/day. The average weaning weight and estimated lamb crop percentages are presented in Table 1. The 6 lb advantage for the ewes supplemented during late gestation and early lactation resulted in $5.40 additional gross income. Feed costs were $3.50 per head. So, if cost of feeding (vehicle and labor) was included, no advantage was realized in the supplementation program. We will repeat this experiment during the spring and summer of 1997.

Literature Cited

McFadin, E. L., T. T. Ross and R. A. Renner. 1996. Effects of different protein diets on ewe and lamb performance. Proc., West. Sec., Amer. Soc. Anim. Sci. 47:23-26.

Ramsey, W. S. 1995. Finewool range ewe and lamb production under different protein supplementation regimes. Ph.D. Dissertation, New Mexico State University, Las Cruces.

Table 1. Weaning weights of lambs and percentage lamb crop weaned from ewes receiving four dietary supplemental programs.

Treatment	Weaning weight (lb)	Lamb crop (%)[a]
No supplement	89[b]	100
Supplement late gestation only	85[b]	93
Supplement early lactation only	89[b]	88
Supplement late gestation and early lactation	94[c]	98

[a]Lamb crop percentage is number of lambs weaned per ewe exposed to rams. Data were not statistically analyzed.
[bc]Means with different superscripts differ ($P < .05$).

EVALUATION OF CHOLLA CACTUS AS AN EMERGENCY FEED

J. E. Sawyer, L. A. Knox, G. B. Donart, and M. K. Petersen

Drought situations frequently occur on rangelands in New Mexico. During periods of drought, the lack of available forage for livestock dictates the removal of livestock or the provision of emergency feedstuffs. Hay and grains are often used as emergency feeds, but may be prohibitively expensive. Another alternative in emergency situations is the feeding of cactus with the spines removed by burning.

Cactus has been used as livestock feed for many years. Ranchers in New Mexico have observed cattle consuming cholla cactus in both dry and normal years. Several studies have investigated the nutritive value of prickly pear cactus, but little information is available on the nutritive value of cholla cactus. Knowledge of the nutritive value of cholla may aid in decisions regarding its use as an emergency feed and make other supplementation strategies more efficient and effective.

A study was conducted at the New Mexico State University Corona Range and Livestock Research Center to evaluate the nutritional quality of cholla cactus and the effect of burning on this quality. Two paired samples were collected from each of 25 cholla plants ranging in size from 1 to 6 ft in height. Half of each pair were burned with a propane torch until all spines were removed. Samples were then analyzed for dry matter (DM), crude protein (CP)and neutral detergent fiber (NDF) content. Neutral detergent fiber is a measure used to describe the portion of a feed that is slowly degraded in the rumen. Samples placed into nylon bags were ruminally incubated in two cannulated cows to determine digestibility.

Table 1 reports the results of measurements of DM, NDF, CP and digestibility for unburned and burned cholla. DM and CP levels were similar for burned and unburned samples. Burning significantly reduced the NDF fraction of the cactus, which reduces the fraction of the plant that is slowly degraded or undegradable. Due to this reduction, burning also significantly increased the digestibility of cholla.

The results shown in Table 1 indicate that while cholla cactus is not a high protein feedstuff, it contains adequate protein for maintenance of cows. The low NDF content of cholla indicate a large amount of soluble carbohydrates for energy. When forages are dormant or forage availability is limiting, the supply of rapidly soluble carbohydrates provides additional energy that the animal requires. The high digestibility values indicate that cholla is high in quality when utilized by cattle. The low dry matter content of cholla means that a large quantity of cactus must be provided to achieve a desired level of DM intake. For a range cow to consume 20 pounds of dry matter from cholla she would need to browse 160 pounds on an as fed basis. However, the DM content of cholla may vary widely depending on season and climatic conditions.

Table 2 compares burned cholla cactus to some other feedstuffs commonly utilized in emergency situations as well as important forage species, blue grama grass and winterfat.

Cholla cactus is a high quality feedstuff. It contains protein adequate for maintenance, and is highly digestible. The provision of burned cholla as a livestock feed may be a viable option if it is economically feasible.

Table 1. Crude protein, neutral detergent fiber, dry matter, and digestibility percentages for unburned and burned cholla cactus (dry matter basis).

Item	Unburned Cholla	Burned Cholla	SE
CP, %	10.7	11.0	.60[a]
NDF, %	40.1	31.1	.84[a]
DM, %	12.4	12.7	---
Digestibility, %	67.0	76.8	3.2[b]

[a]n=5
[b]n=4

Table 2. Burned cholla cactus compared to selected feedstuffs.

Feedstuff	CP %	NDF %	DM %	Digestibility %
Burned Cholla	11.0	31.1	12.7	76.8
Winterfat	11.0	----	----	54.0
Alfalfa hay	18.7	47.1	91.0	58.0
Blue grama (dormant)	5.0	67.3	93.8	----
Cracked corn	9.8	10.8	90.0	90.0

DIFFERENT REPRODUCTIVE AND LACTATIONAL RESPONSES TO PROTEIN SUPPLEMENTS BY TWO-YEAR OLD RANGE COWS: 1995 - 1996 TRIAL

L. A. Appeddu, J. S. Serrato-Corona, I. Tovar-Luna, L. F. Gulino, H. Albertini, E. E. Parker, S. Cox, D. E. Hawkins, G. B. Donart, and M. K. Petersen

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Two years of field research (1995 - 1996 and 1996 - 1997) have been conducted at the NMSU Corona Range and Livestock Research Center (Corona, NM) to determine the potential of protein supplements to cause early rebreeding after calving in 2 year-old range cows. Not only can supplementation correct nutrient deficiencies and nutrient imbalances in cattle consuming low protein dormant rangelands, but also may stimulate responses through changes in hormonal release and (or) nerve impulses. Feeding protein which bypasses ruminal degradation can directly provide those amino acids and metabolic precursors needed to improve young lactating cow performance. Sources of ruminally undegradable protein studied in our research include feathermeal, meat and bone meal, and blood meal as opposed to more degradable protein sources (cottonseed meal and soybean meal).

In the 1996 report of the Livestock Research Briefs and Cattle Growers' Short Course, preliminary data from the 1995 trial was presented. To summarize, four protein supplements were individually fed on 3 d/week at a rate of 5.7 lbs/feeding from average 20 to 98 days postcalving to two year-old Hereford x Angus x Hereford cows. Note that the last date was after the first 26 days of the breeding season (allowing a 21-d heat cycle). Supplements consisted of feeding approximately .67 lbs (300 g) per day of ruminally degradable protein, .33 lbs (150 g) or .73 lbs (330 g) per day of ruminally undegradable protein in low versus high bypass protein supplements, and .04 lbs (20 g) or .24 lbs (110 g) per day of hydrogenated tallow in low versus high fat supplements. This resulted in supplement combinations of low bypass/low fat (n = 12 cows); high bypass/low fat (n = 13); low bypass/high fat (n = 12); and high bypass/high fat (n = 13).

Feeding fat with low or high bypass

protein increased cow weight loss during lactation. This effect was especially seen when supplying low bypass/high fat cube, which caused larger losses in cow condition and backfat by the start of the breeding season. It appeared that feeding low bypass/high fat cube stimulated milk production, resulting in heavier calf weaning weights than when feeding high bypass with low or high fat. In contrast, feeding high bypass with low or high fat resulted in positive changes in condition scores and minimized backfat losses by the start of breeding.

Actual calving dates from Spring 1996 revealed similar rebreeding performance across treatments. However, interactions between early and late calving blocks and reproductive performance were found within treatments. Using weekly blood samples to determine return to estrus after calving (progesterone > 1 ng/ml), more high bypass/low fat-supplemented cows had cycled prior to the breeding season overall. No cows fed low bypass/high fat cube that had calved late were cycling by then. By back-calculating day of conception (1996 calving date - 280 d gestation), percent pregnant during the first 26 days of breeding was determined. It appears that feeding high bypass/low fat cube had a negative effect on early rebreeding rates in late-calving cows. Supplementing with low bypass/high fat tended to cause later conception dates. Due to the large variation in gestation lengths, no differences in overall days open were found. Although early calvers appeared to take longer to rebreed, this resulted from the date that the bulls were put into the pasture relative to their calving date.

The results from this first study suggest the ability to redirect nutrients to support increased milk yields or improved cow body reserves via supplementation of high fat versus high bypass protein supplements. Because late-calving cows fed high bypass/low fat supplements were not able to achieve rebreeding rates as high as those fed high bypass/high fat or low bypass/low fat cubes, we suspect that protein was fed in excess. This is supported by observations from the dairy industry, which has found lowered conception rates in cows fed high protein diets. Furthermore, blood urea nitrogen levels were increased (interaction; P=.05) by feeding high bypass/low fat cube to cannulated cows maintained in the same pasture (13.5, 19.0, 14.6, and 15.0 ± 1.02

mg/dl for low bypass/low fat, high bypass/low fat, low bypass/high fat, and high bypass/high fat, respectively). This indicates more protein was degraded in high bypass/low fat cube. Not only have high urea nitrogen levels been associated with lowered reproduction, but also with a lower utilization of protein by both the ruminal microbes and the cow. Adding fat to high bypass appeared to prevent these effects. Similar reproductive performance across treatments suggests we had met the threshold protein requirement and need to feed less ruminally undegradable protein.

Supplement type (calving group)	% cycling before the breeding season	% pregnant in the first 26 days	Days open
low bypass/low fat			
Early calvers	50	67	100
Late calvers	50	100	79
high bypass/low fat			
Early calvers	83	83	96
Late calvers	43	57	81
low bypass/high fat			
Early calvers	67	67	100
Late calvers	0	67	88
high bypass/high fat			
Early calvers	67	83	96
Late calvers	43	86	84

CHANGES IN DIETARY CRUDE PROTEIN IN COWS GRAZING THE CORONA RANGE AND LIVESTOCK RESEARCH CENTER

J. E. Sawyer, L. A. Knox, G. B. Donart, and M. K. Petersen

Supplemental feeding of livestock is intended to supply nutrients that may be limiting in the diet. In New Mexico, protein is often supplemented to cattle when forage is dormant. Effective and efficient supplementation depends on provision of proper nutrients at a level that meets the needs of the animal. Since diet quality changes over time, a knowledge of the dynamics of these changes in quality may allow producers to supplement livestock more efficiently.

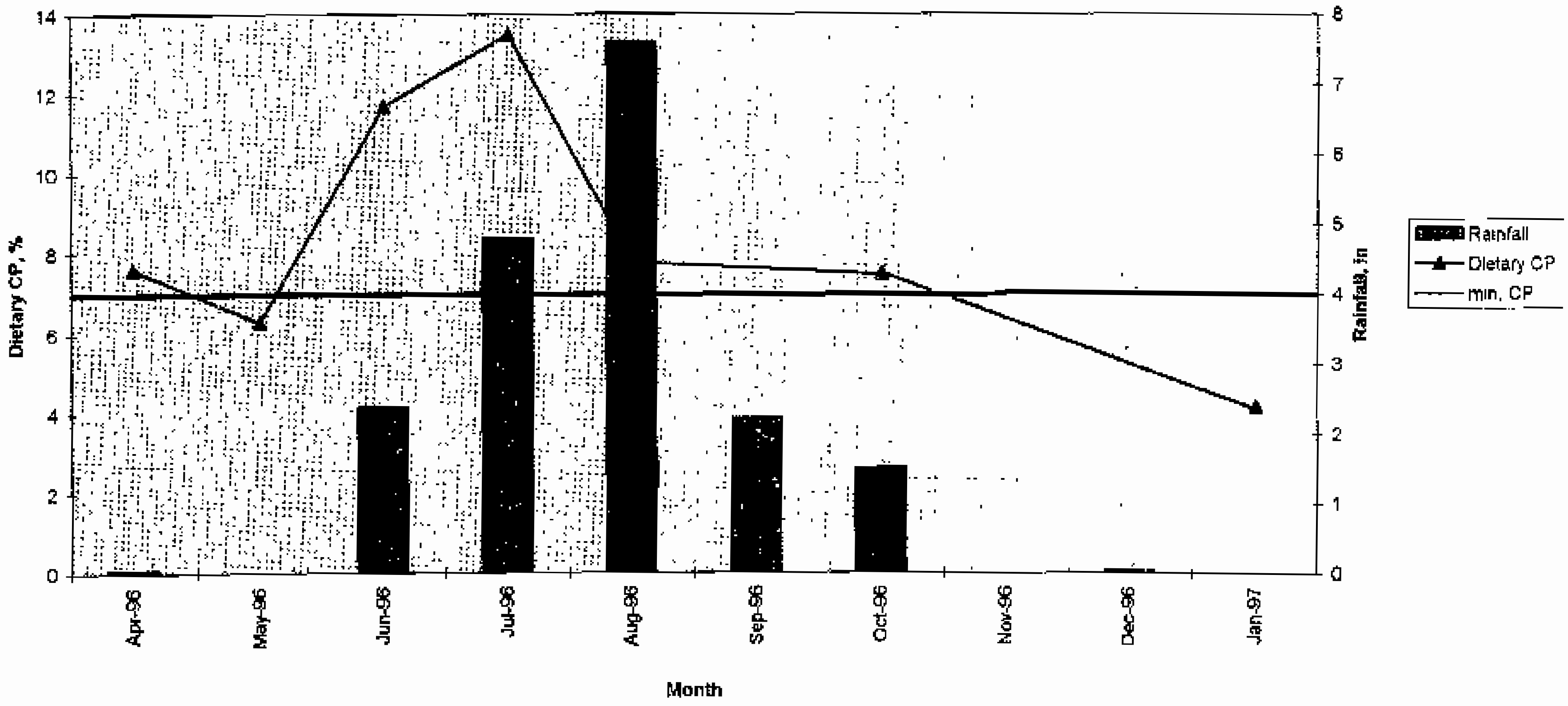
A study is being undertaken at NMSU's Corona Range and Livestock Research Center in order to describe the changes in diet quality over a year. Samples are collected using ruminally cannulated cows grazing Pinon-Juniper rangeland. Elevation is 6200 ft. Pasture consists of some open areas dominated by wolftail and blue grama, and moderate to dense stands of pinon and juniper. (See Brief by Knox et al. for more complete description.) Samples are obtained by completely evacuating the rumen of cannulated cows. Cows are then allowed to graze freely for approximately one hour. The grazed forage is then removed from the rumen as the diet sample, and original ruminal contents are replaced. Diet samples were taken monthly during the spring and summer, when forage quality changes most rapidly (April-August, 1996) and then after dormancy (late October, 1996) and late winter (January, 1997).

The dietary crude protein during these periods ranged from 7.5 in the spring (22 April 1996) to a high of 13.5 during mid-summer (30 July 1996) back to a low of 4.2 in late winter (19 Jan 1997). Figure 1 illustrates the changes in CP level in cow diets over these sampling periods, and also provides monthly rainfall data for the area.

It is generally accepted that a cow needs no additional protein if dietary CP is above ~7%. Furthermore, producers may choose to delay supplementation until a critical period arises such as calving or breeding, depending upon the condition of the animals going into winter. Knowledge of the dynamics of diet quality changes and periods when protein levels may be rapidly changing may allow producers to match supplemental feeds more effectively to animal needs.

In 1996, crude protein levels were adequate in cow diets from April through October.

Figure 1. Rainfall and dietary CP in cow diets by month at the Corona Range and Livestock Research Center



ANIMAL PERFORMANCE AND VEGETATIVE RESPONSE TO CONTINUOUS AND ROTATIONAL GRAZING

L. A. Knox, J. E. Sawyer, G. B. Donart, and E. E. Parker

During the summer of 1996, three permanent transects were set up in each replicated pasture (one per paddocks in rotational systems) to monitor the vegetative response to grazing system. Vegetative response will be measured by changes in species composition and biomass production for each pasture. Animal performance (ADG) will be compared between yearling heifers grazing in either rotational (3 pasture-1 herd) or continuous grazing systems. The trial will start in May 1997 and end in November 1999 and will be conducted at the NMSU Corona Range and Animal Research Center.

The replicated pastures will be grazed from May to November and rested during the winter. Animals will be randomly assigned to treatment by weight. Twenty-four hour shrink weights will be taken at the beginning, and every month until the end of the grazing period to determine animal performance. The transects are located on "key sites" and consist of 100 point readings to determine percent species composition and percent basal cover. Biomass production will be determined by clipping non-permanent exclosures.

THE EFFECTS OF SEASONAL GRAZING ON WINTERFAT IN THE SHORTGRASS PRAIRIE OF SOUTHCENTRAL NEW MEXICO

C. Abernathy and G. B. Donart

Growth patterns of winterfat are being studied on the Corona Range and Livestock Research Center to determine responses of the plant to seasonal grazing by cattle. Two seasonal treatments and one control treatment were established in June 1994 to monitor differences in plant growth throughout the next two growing seasons. The first treatment incudes plants that were grazed in the fall of 1993 and are currently protected from grazing. The second treatment are plants that were grazed during the summers of 1994 and 1995. Portions of the summer treatment plants are being protected from grazing to use for comparison to the grazed plants. The control treatment is an area on the ranch that has not been grazed for several years and these plants will be used to compare the two seasonal grazing treatments.

Monitoring is done by measuring growth increments on specific branches that were identified and marked at the beginning of this study. Measurements were taken every two weeks during the summer and once every month during the fall. The difference in growth increments from each treatment were be compared.

Overall, winterfat plants grew differently in 1995 when compared to 1994. This was attributed to drought conditions. Many treatments with positive growth increments in 1994 lost growth in 1995. Plants subjected to fall grazing in 1995 still had the greatest positive growth.

Initial early data indicate that Fall-only grazing seems to be the best way for winterfat to achieve the most growth and biomass. Fall grazed plants grew an average of 61% more than those plants grazed in the summer or the plants located in the control plots. Protection for more than one growing season did not result in any increased growth on winterfat plants. Management implications for ranchers could be higher amounts of winter forage available for cattle if pastures with high densities of winterfat were deferred until late fall or early winter.

PRELIMINARY RESULTS DIGESTIBILITY AND METABOLIC RESPONSES TO PROTEIN AND FAT SUPPLEMENTS FED TO LACTATING RANGE COWS

L. A. Appeddu, M. K. Petersen, J. Hale, J. M. Sosa, L. F. Gulino-Klein, J. S. Serratos-Corona, and T. May

We evaluated the effects of providing different nutrients in cube supplements when fed to rumen-cannulated, lactating cows grazing winter-spring dormant range (primarily blue grama). Four, three-year old, Hereford x Angus x Hereford cows nursing their first calves were used in three periods to test the supplements fed in another study (Control, Bypass, Fat, and Bypass + Fat cubes). Cannulated cows were kept in the same pasture as those lactating two-year old cows at the NMSU Corona Range and Livestock Research Center in spring 1995. After at least a 10 day adjustment period to supplements, rumen and blood samples were collected from the cannulated cows. This was done simultaneous to incubating nylon bags filled with coarsely ground, supplemented cubes or diet samples in the rumen over a 96 hour period. Samples were taken and bags removed at 0, 3, 6, 9, 18, 32, 48, 72, and 96 hours. Cows were fed the supplements after the 0, 48, and 96 hour collections around noon. Morning (approximately 6- 9 am) and evening (approximately 4 - 9 pm) grazing patterns were observed during collections. Observations of night grazing (9 pm to 6 am) were not conducted.

Diet samples used in the nylon bags were collected at 0700 by evacuating the rumens of the four cannulated cows, allowing them to graze approximately 45 minutes, collecting the fresh material that they selected, and then refilling the rumen with the digesta that had first been removed. Samples collected on April 9, April 30, and May 27 had 16.7, 14.5, and 11.4% crude protein and 82.6, 85.9, and 83.9% neutral detergent fiber (organic matter basis), respectively.

In three periods, the Control, Bypass, Fat, and Bypass + Fat cubes were fed. Each cow received a different supplement in each period. The first period was April 21 to 25, during which a snow storm occurred on April 22 and prevented some sample collections. Forage samples collected on April 30 were used for the second and third periods (May 9 to 13 and May 22 to 26). Low quality hay (8.4% crude protein and 86.3% neutral detergent fiber, organic matter basis) was fed after the 9 (9 pm) and 18 (6 am) hour collections to keep the cows penned and ensure samples could be collected during periods 2 and 3. Other than between 0 and 32 hours, cannulated cows had free access to the range.

Preliminary results from diet samples incubated for 0, 19, 48, and 96 hours during periods 2 and 3 indicate an interaction (P<.01) for forage organic matter disappearance at 19 hours. Cows fed the Bypass or Fat cube had digested the most organic matter (33.1% vs 29.0% disappearance for Bypass and Fat vs Control and Bypass + Fat cubes, respectively). At 48 hours, fiber disappearance was less (P=.02) when Bypass and Bypass + Fat cubes were fed (43.4 and 43.6% disappearance, respectively) than Control and Fat supplements (49.8 and 49.6% disappearance, respectively). A similar trend (P=.12) was found for OM digestibility. Disappearance of OM still tended (P=.12) to be less for high bypass protein treatments (Bypass and Bypass + Fat cubes) at 96 hours. Currently, data are being analyzed for blood metabolites (glucose, free fatty acids, cholesterol, and urea nitrogen), rumen samples (pH, volatile fatty acids and ammonia), and the remaining nylon bag samples (organic matter, cube protein, and forage fiber digestibility). These results will illustrate how the supplemental nutrients are being used in lactating range cows and if they are complementing the native forage.

PRELIMINARY RESULTS

POSTPARTUM REPRODUCTIVE RESPONSES OF TWO YEAR OLD BEEF COWS SUPPLEMENTED WITH PROTEIN AND FAT

L. A. Appeddu, M. K. Petersen, D. E. Hawkins, J. S. Serratos-Corona, L. F. Gulino-Klein, I. Tovar-Luna, G. B. Donart, E. Parker, and S. Cox

We investigated the effects of feeding protein, fat, and energy in postpartum supplements on young cow reproductive and lactational performance. Forty-four Hereford x Angus x Hereford and 12 Angus x Simmental x Hereford, two year old cows grazed dormant winter-spring range (primarily blue grama) at the NMSU Corona Range and Livestock Research Center. To balance for breed type and calf sex, cows were allotted at calving (February 14 to March 24, 1995) to receive the following five supplements (cubes):

Cube	# cows	Total protein	Rumen degradable protein	Bypass protein
Control	12	454 (g/day)	310 (g/day)	144 (g/day)
Bypass	13	655	325	329
Fat	12	456	304	152
Bypass + Fat	13	630	295	335
Energy	6	207	167	40

The Energy cube was made of concentrate grains. Cottonseed meal and wheat middlings made up the ruminally degradable protein fractions of the other four cubes. Feathermeal and meat & bone meal were added to increase the bypass protein amount provided to cows, and hydrogenated tallow (Alifet®, 10.3% of diet, as fed basis) was the fat source. Each cow received the same amount of energy. Starting on March 20, supplements were individually fed at noon on three days/week. Cows received full treatments (5.7 lbs /head/ feeding) from April 5 to June 6, after the first 21 days of the breeding season.

Supplement effects on cow and calf performance are presented in the table following the text. All cows weighed the same at the beginning of the supplementation period. By the beginning of the breeding season (May 11), cows receiving Fat and Bypass + Fat cubes weighed less ($P < .05$) than cows fed the Control and Bypass cubes. Body condition score determined by visual observation suggested that most of the negative effect may have been from feeding fat alone, because cows fed bypass protein alone or with fat had a more ($P < .01$) positive change in condition from March 17 to May 11 than cows supplemented with Control and Fat cubes. Objective measurements of backfat using ultrasound yielded these same results ($P < .05$). By fall weaning, cows that had received Fat and Bypass + Fat cubes in the spring still tended ($P < .20$) to weigh less than cows fed Control and Bypass cubes. Weight loss in cows supplemented with Fat cubes may have resulted from a higher milk production. This is supported by Fat-fed cows weaning the heaviest ($P < .10$) calves than all other treatments, especially being heavier ($P < .05$) than calves having dams fed Bypass and Bypass + Fat cubes. In all other measures, Energy-fed cows did not differ from the other treatments. This similarity may have resulted from the group supplemented with Energy cubes having a smaller number of cows in good condition at the start of the trial. The resulting greater variation may have prevented statistical differences from being detected.

At this time, reproductive data is limited. Results from fall pregnancy testing via rectal palpation showed no differences in pregnancy rates among treatments following a 72 day breeding season, with only one Control-fed cow open. Currently, blood samples are being analyzed to evaluate diet effects on cow metabolism, return to estrus, and conception rates in the first 21 days of the breeding season. Spring 1996 calving data will also be collected. To further evaluate the effects of fat and protein on young cows, a similar trial will be conducted in spring of 1996 by feeding the Control, Bypass, and Bypass + Fat supplements.

Ultimately, these results will provide more conclusive data in searching for the minimal nutrient or nutrient combination which can stimulate an early fertile conception without severely decreasing calf performance.

Cube fed[a]	3/17 Cow weight (lbs)	5/11 Cow weight (lbs)	10/4 cow weight (lbs)	Condition change[b]	Backfat change (in)[c]	24-h Milk yield (lbs)[d]	Weaning weight (lbs)
Control	844	859[e]	1020	.04[g]	-.10[e]	20.3	531[ef]
Bypass	852	857[e]	1029	.28[h]	.00[f]	20.1	515[e]
Fat	841	828[f]	987	-.14[g]	-.13[e]	22.3	551[f]
Bypass+fat	828	830[f]	1000	.30[h]	-.04[f]	18.1	524[e]
Energy	859	863[ef]	1033	02[gh]	-.04[ef]	21 4	526[ef]

[a]Treatments are explained in text.
[b]Difference between body condition score (1 to 10 scale) from March 17 to May 11
[c]Difference between ultrasound measurements from April 5 to May 16.
[d]Daily milk production estimated by milking cows out, separating from calves for 5 hours, and milking again on May 10.
[e,f]Rows with different superscripts differ ($P < .05$).
[g,h]Rows with different superscripts differ ($P < .01$).

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SPATIAL VARIATION OF PIÑON-JUNIPER VEGETATION ON THE CORONA RANCH

R. Ernst, R. D. Pieper, G. B. Donart, and G. M. Southward

A study was conducted at the Corona Range and Livestock Research Ranch (CRLRR) located in central New Mexico to determine the distribution and variation of ecological attributes within the piñon-juniper community of the ranch. To accomplish this, the piñon-juniper type was divided into 40 blocks and then 0.10 ha plots were randomly located within each block. An additional 10 plots of 0.10 ha each (to monitor piñon and juniper encroachment into the grassland community) were located in the transitional area between piñon-juniper woodland and the native grassland community. Tree overstory, herbaceous understory, and understory shrub characteristics were measured and analyzed to determine the distribution, relationship, and variation within each type.

Soil samples were collected and analyzed and topographical features were examined to determine how these features impact the variation and distribution of plant communities within the piñon-juniper type.

The Statistical Analysis System (SAS) was used for all data analysis including *t-tests*, general linear models (GLM), linear regression, and clustering to produce study area attribute dendrograms.

Distribution and structure of ecological attributes at the Corona Ranch piñon-juniper type is highly variable, showing ample evidence of past activities such as old fields, ax cuts, artifacts, and burns. Historical anthropogenic activity (i.e., agriculture and wood cutting) may have ben a major influence on the present landscape at the Corona ranch. The present spatial variation may be attributed to factors including edaphic, terrain, aspect, microclimate, and anthropogenic, but likely involves a combination of factors.

The piñon-juniper community at the Corona ranch is heterogeneous in stand structure, varying from stands of mature, stunted trees to mature vigorous stands of heterogeneous trees. Other stands were relatively young and even-aged. although piñon-juniper stand morphology was heterogeneous, species composition across the study area was not. Few other tree species were encountered on the study area. Apparently a few ponderosa pine (*Pinus ponderosa*) exist on the ranch and a tree form of oak was encountered on 1 study site. But generally the study area follows the same pattern of species composition as mature piñon-juniper woodlands do in other parts of the piñon-juniper region.

Soil attributes were not significantly different between the 2 community types except for N and OM which were greater on the woodland type versus the savanna type. Soil characteristics may explain why piñon and juniper trees exist on the study area but do not seem to explain the distribution and abundance of understory species. Topography, aspect, and slope are variable across the study area and may influence the distribution and density of piñon and juniper trees.

Spatial variation of abiotic and biotic factors on the study area were significant at the scale being used. Heterogeneity in the piñon-juniper type was limited more to distributional characteristics rather than species composition. Piñon, juniper, blue grama, wolftail, prickly pear, cholla, and sumac were widely distributed on the study area but relative abundance and morphological characteristics of these species was variable. Some dominant shrub types (oak, algerita, and winterfat) formed discrete communities on the study area but others (sumac and cholla) were widely distributed.

Climate, topography, and edaphic features may be the most significant reasons why piñon and juniper occupy specific areas and exert ecological dominance in those areas. These habitat characteristics (climate, topography, and edaphic) are more favorable for woodlands than they are for grasslands. The blurring of range types by anthropogenic activities (i.e., fire suppression, range improvements, and grazing) has made separating these range types more difficult.

Recognizing the differences between range types may be important to developing appropriate management schemes for the piñon-juniper type. Areas that are likely to respond favorably to range improvements (ecologically and economically) must be carefully selected. Appropriate post improvement follow-up (removing seedlings released by removal of overstory) must be done to ensure economic success of range improvement practices

The study at the Corona ranch showed

that significant fine scale variation exists across the piñon-juniper type for most of the attributes tested (overstory, understory, and some edaphic factors). Managing this heterogenous area may require fine scale separation of ecological units. The different ecological types include rocky ridges with coarse soils and broken terrain, dune areas with sandy soils, gently sloping areas with fine shallow soils, and large swale areas with relatively deep fine soils.

Mapping the piñon-juniper type with the aid of a GIS (Geographical Information System) would provide a visual presentation of the geographical location and size of individual ecological units. GIS information could be made available in a series of map overlays, each displaying information on separate ecological attributes including soils, topography, overstory, and understory. Individual sites (ecological units) could be rated for their best use or best uses. For example, it may be determined that only swale areas, receiving additional moisture in the form of runoff, would be suitable for range improvements such as clearing or burning. As the landscape changed through natural and anthropogenic processes the GIS system could be updated to monitor the changes. This system may provide the level of management necessary to maximize economic and ecological returns on areas where significant fine scale variation exists. Additional discussion on possible GIS management applications for the piñon-juniper type is contained in the next section on research considerations.

HABITAT PREFERENCE OF CATTLE GRAZING PINYON-JUNIPER GRASSLAND IN CENTRAL NEW MEXICO

L. B. Rogers, G. B. Donart, M. K. Petersen, and E. E. Parker

The application of behavioral research on cattle grazing was to gain a greater understanding and clarity of how cattle utilize piñon-juniper woodlands in comparison to grasslands. During 1994 and 1995 cattle utilized grassland and sparse juniper during the early morning hours. As the day progressed cattle moved into the juniper habitats. Possible reasons for these migrations into juniper could be to avoid absorbing solar radiation from the sun or moving to a cooler microclimate. By utilizing juniper habitats cattle reduce heat load while maintaining grazing and ruminant, which promoted production. The density of juniper preferred during late morning and afternoon hours differed between seasons and years. During 1994 cattle chose to utilize dense juniper during the early season, because of the intense temperatures of that year. During late summer cattle habitat preference shifted and cattle utilized open juniper. Open juniper during late season offered shade preferred by cattle to reduce heat load and solar radiation while providing adequate forage. In 1994, during both early and late summer, cattle utilized open juniper during the late morning and afternoon hours. During 1995 temperatures were typical for the area, however precipitation was low. Therefore, cattle did not utilize the grassland and sparse juniper due to the lack of available forage. In both years cattle chose to utilize the grassland at night for bedding purposes. One reason for this would be to radiate heat collected in their bodies during the day into the atmosphere instead of having it trapped closer to them if they stayed in the juniper. Another reason was if a breeze was present it would help to dissipate the heat collected by their bodies during the day while juniper reduces the breeze. It would seem the sensitivity of juniper preferred by cattle is strongly tied to environmental factors and may vary from time of day, between seasons, and years.

Further behavioral research of cattle

grazing grasslands interspersed with piñon-juniper vegetation may aid in better management of cattle and pastures containing this woodland. By strategically using pastures containing piñon-juniper herd stress due to heat, humidity, and cold weather may be decreased.

With this knowledge it would seem sparse and open densities of piñon-juniper play a positive role in the grazing behavior of cattle.