C
JANUARY 21, 2005

Oregon Department of State Lands

Rangeland Grazing Advisory Committee Meeting

January 21, 2005
Best Western Rory & Ryan
Hines, Oregon

Committee Members Present: John Lilly, Chair (DSL); Joseph Flynn; Martin Andre; Larry Larson; Tom Clemens; George Grier; Dan Nichols; John Tanaka; and Diana Oberbarnscheidt.

DSL Staff Present: Jeff Kroft, John Lilly, Nancy Pustis and Randy Wiest.

Others in attendance: Bill Rainey others present.

Public Present and Providing Comments: Susan Ramsey; Dick Jenkins; Jack Peila; Dale Robertson; Lou Davies.

Welcome and Introductions

John Lilly opened the meeting, welcoming Committee members and attendees. He reviewed the agenda. He indicated public comment opportunity was set for 10AM. The meeting location was chosen to facilitate participation by lessees and the grazing community.

He reviewed handouts, including the summary of the December 1, 2004, meeting; current rangeland Oregon Administrative Rules; summary of other states' grazing fee methods; and a new large packet containing copies of grazing lease contract forms from eight other states and Oregon. John reviewed the purpose of the committee: to review the Secretary of State's audit report findings regarding the grazing fee; analyze whether the current fee reflects at least fair market value rental rate; and to make recommendations to DSL's director concerning the formula.

Members, DSL staff and other attendees introduced themselves.

Review of December 1, 2004 Meeting and Additional Detail on other Western States

Jeff Kroft advised he had followed up on DSL staff research into other states' grazing fees and practices. He distributed and reviewed a memorandum dated January 21 with the subject "Further Analysis of Western States Grazing Fees; Further Information Regarding Other Western States Grazing Programs; and Additional DSL Grazing Program Information." He noted Oregon's rate falls in the middle of the western states. Jeff also reported on other states' use of National Agriculture Statistics Service information. About three-quarters of the western states rely upon the data in one form or another. Jeff detailed information about each state. He

also provided additional details about lessees who play minimum rate. (The information was requested at the December meeting.)

Dan Nichols said he has also been looking at the other states' leases and how their formulas compare. He agreed Oregon is in the middle of the states for formulas and for the fee structure. He noted Oregon is near the bottom for calf prices in the 11 western states. He said he believes the formula should include calf prices.

George Grier restated his preference for using a formula that is "really straightforward, like Colorado's, which is just take something that's a statistic that there is historical data for, that's uniformly available and apply some discount rate to it." George said the Committee is addressing issues similar to the last time the fee was studied. Diana and George said the formula that is used must be able to be justified to the public to explain why the numbers and values are being used.

Members expressed that the Committee is "plowing the same ground" with the study of the fee formula. The formula itself and another issue raised—whether ranchers are being somehow subsidized because they may be paying less that a private lease rate—keeps being revisited.

Tom Clemens said he personally didn't like having the cattle prices involved in the formula because "a majority of private land leases are not based on what you get for your calves." The Committee discussed the methods of including calf pricing. They did not reach a consensus or make a recommendation on the issue.

Nancy Pustis and Randy Wiest, both DSL, provided information about noxious weed control on DSL leased lands.

Public Comment

Susan Ramsey: She is a local business owner, rancher owner in the Princeton area and also has a state land lease. She runs 200 cows; paying for 611 AUM's and uses the lease four of the six months it is available. She said she feels the formula is equitable although the fee has increased 153% over the years. However, she would insert instead of one year's/ the last year's calf sale price, a weighted average of the last five years. The average would offer stability and provide a more steady income to the Common School Fund while being a more manageable figure for the ranchers. She would also change the year from October through September to July through June, which is the state's fiscal year. She said she liked using the calf prices and saw "nothing wrong with using the calf prices."

She also responded to the portion of the minutes from December summarizing Peter Hansen's comments. She explained that she and her husband are a "mom and pop" organization. They own 3,500 acres of private ground and have a state land lease of a similar amount of land. She explained that while ranches can have millions on paper in land and in equity, they are "cash poor" with very limited disposable income. She said raising cattle in the east differs from raising them in the west (Oregon). She also disagreed with Mr. Hansen's view that the lessees are

subsidized. She noted lessees have responsibilities and pay for water pumped in and replacing equipment.

She said she believed a competitive bid process would be divisive and would mean lessees would not know if they would be able to get the land from one year to the next.

Dick Jenkins. Mr. Jenkins is a state land lessee from the Diamond area. He served on the previous grazing fee advisory committee. He noted the previous committee heard and considered similar issues. He feels the current process is working well and urged the committee to continue the formula already in place.

George asked Dick to comment about the auditor's report. Dick said he felt the audit may have placed too much emphasis on trying to get income from livestock and grazing. There are renewable resources like timber and other properties that could generate additional income.

John asked if Dick if he could recall the previous committee's reasons for moving away from a rolling average of calf prices to attaching the fee to the previous year's prices. Dick said they felt it fluctuated more equitably. The market is very volatile, and looking at several years could have prices and fees lagging behind.

Jack Peila. Mr. Peila has a state lease. He and his family have been on the same ranch for 45 years. He said they try to take care of the land and improve it. There is water and fencing on state land. They have also leased private land. Grazing the cattle and maintaining the land takes a lot of work. They have seen wildlife returning to the land that was formerly BLM since they have improved water availability on the land.

Diana asked what private landowners provided to lessees. Jack replied the particular ranch he leased from had hay under the pivot sprinklers; he pays $10 per AUM for crested wheat grass pasture; more under the pivots. Water was available, but the lessee paid for that.

Dale Robertson. Dale leases some state land. He said he liked the grazing fee formula to included the cattle but suggested taking out the calf price. He suggested using the PRIA formula. In general, he didn't think the formula should be changed "a whole lot." He said it may not make sense to pay more or go to a "fair market value" if lands are losing their characteristics because of brush invasions. He said he does a lot of work on state lease without charge. He cleaned 30/40 reservoirs.

Lou Davies. He is a state lands lessee. He provided some personal background on leasing. His land was formerly leased through BLM permits. He described how he reseeded 4,000 acres after the land was burnt by wildfires. He said private landowners would not require the reseeding. During afternoon discussions, he said he believes the lessees are probably already paying more than they should. There may be additional revenue potential for some of the lands other than grazing. He said recent BLM permits sold with ranch land cost about $70 per AUM.

Other Discussions

Nancy Pustis provided background on one sublease that charges greater that the state grazing fee. It is a 700-acre isolated parcel south of Prineville. The lessee is charging for the sublease $10 per AUM. The DSL and lessee split the difference between the state rate and the sublease rate. Nancy and Randy discussed some of the lands DSL currently leases.

During discussions, George expressed concern about how the Legislature might view state lands continuing to lose money. The audit advised the lands have lost money since 1987. Other cost factors, such as bringing in water, were discussed.

Some discussion ensued among the committee and audience over the apparent difference in value between private land leases and state land. Lou Davies said it costs $10/AUM to lease state land and that the Farm Credit Service offered no loan value for his state lease due to its uncertainty. Larry Larson said that a study by Vantassel said it costs about $18.35/AUM to operate on public land. Other ranchers present said the value of their leases was capitalized in the overall value of their ranches; they could not quote a figure.

Larry Larson provided extensive research on the fee formula factors, particularly weight gain and calf survival. He explained data from studies done on the Eastern Oregon Research Station that appeared to validate the factors in the formula. He distributed handouts. He did extensive research on the components of the formula. He said both the leesee's costs and the lessor's costs should be included in a crop share formula. The committee needs to identify the state/owner's costs. John Lilly noted the state's costs would have to be researched.

John Lilly passed out a proposed work plan for the committee to review and discuss. The committee agreed to the work plan.

Next Meeting

The meeting was set for Friday, February 25, in Bend from 10:00 AM to 3:00 PM. Additionally meetings were tentatively planned for March 25 in Bend and April 29, location to be determined.

The committee and DSL staff may draft a preliminary report after the February meeting. The draft could be shared with lessees and interested parties via mail and the DSL website.

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Oregon
Department
of State Lands

For more information: Monte Turner
(503) 378-3805 ext. 247
News releases posted at:
www.oregonstatelands.us

January 6, 2005

05-03

Public Asked to Comment on State Lands Rangeland Grazing Fee

Advisory Committee meets January 21

The public will be asked to comment on the rangeland grazing fee during the January 21 meeting of the State Lands Rangeland Grazing Fee Advisory Committee in Hines.

The meeting runs from 9 a.m. to 2 p.m. at the Best Western Rory & Ryan Inn, 534 Highway 20 North. The public comment portion of the meeting begins at 10 a.m. The committee is seeking comments on whether the current grazing fee formula approximates fair market value. The formula uses a crop share approach. It is adjusted annually based on the average statewide sales price of calves for the preceding year and other factors. The 2004 rate was $4.32 per grazing animal per month.

An audit from the Secretary of State's Audits Division released earlier this year recommended that DSL review the formula used to establish grazing fees at least every three years. Committee members will provide recommendations to DSL Director Ann Hanus and the State Land Board by next summer regarding whether the current formula generates fair market value. If the committee recommends changes, the agency would conduct a public rulemaking process, which includes public meetings and final approval by the State Land Board.

Director Hanus named the eight-member advisory committee in September. The committee includes members with interests or expertise in agricultural economics, rangeland science, public interest, local government and education beneficiaries. Two current rangeland lessees also serve as members.

To receive agendas for meetings of the advisory committee, contact Nicole Kielsmeier, Department of State Lands, Policy & Planning Division, 775 Summer St. NE, Suite 100, Salem, OR 97301-1279. She also may be reached at (503) 378-3805 ext. 239 or e-mail: Nicole.kielsmeier@dsl.state.or.us.

www.oregonstatelands.us

The state-owned rangelands are the largest block of land remaining from a grant of land by the U.S. Congress to support schools when Oregon became a state. The Oregon Constitution dedicated the school lands and their mineral, timber and other resources to the Common School Fund. Twice a year, the State Land Board distributes investment earnings from the fund to counties for school use.

DSL

Department of State Lands
Grazing Fee Advisory Committee

January 21, 2005
9:00 AM to 2:00 PM
Best Western Rory & Ryan Inn
534 Highway 20 North
Hines, Oregon

Tentative Agenda

Introductions/Announcements

Review of December 1, 2004 Meeting

10 A.M. Public Comments
Is the current grazing fee formula approximating fair market value?

Review and Discussion of Current Oregon Grazing Fee Formula

Set agenda/date/location for next meeting

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Oregon
Theodore R. Kulongoski, Governor

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January 21, 2005

TO: Grazing Fee Advisory Committee

FROM: Department of State Lands Staff

SUBJECT: Further Analysis of Western States Grazing Fees; Further Information Regarding Other Western States Grazing Programs; and Additional DSL Grazing Program Information

Following the December 1, 2004 Advisory Committee, DSL staff:

- Reviewed and analyzed the grazing fee methods of the other states;
- Re-contacted some of the other western states to obtain additional information; and
- Compiled additional observations and information about DSL's grazing program

The results of this work are presented in this memo for the review and use of the Advisory Committee.

Analysis of Other States' Methods

Based on our compilation of grazing fee methods from nine western states, including Oregon, the fees ($/AUM) in each of the states sampled compare as follows:

Arizona (2004-2005)	$2.23
Utah (2004-2005)	$2.35
New Mexico (2004-2005)	$4.22
Wyoming	$4.42
Oregon (2005)	**$5.03**
Idaho (2004)	$5.15
Montana (2005)	$5.91 and $6.64
Washington (2004-2005)	$7.76
Colorado (2005)	$8.04 (average of all region-based fees)

Of all the fee formulas, NASS (USDA-National Agricultural Statistics Service) statistics on beef cattle pricing (either for all 11 western states or for the individual state) is used

by four of the states (Arizona, Idaho, Montana, New Mexico). Only Oregon ties its formula to calf prices. Three states (Colorado, Washington and Wyoming) use the NASS statistics on lease fees for private non-irrigated grazing land with a discount made to account for differences between state and private lands.

Of the states using beef pricing, each use a wide variety of variables, constants and ratios to calculate the annual grazing fee. Some of the formulas are difficult to understand and therefore track their rationale. Some include variables/constants that are negotiated between parties (i.e. the legislature or lessees and the agencies).

Colorado (and reportedly North Dakota) contracts with NASS to conduct extensive surveys of cattle producers to obtain private land non-irrigated grazing land lease rates. Colorado discounts the private land rate by 35% to reflect the difference between private and state grazing lands. Colorado's fee also varies according to grazing regions in the state.

Overall, there are wide variations in the methods and results. Considering the similarity of the legal mandates, markets, business and purposes of the land being leased, more consistency would be expected.

More Information from the Other States

As a result of the Advisory Committee's discussions in December 2004, staff contacted a number of the states for more information. We researched two issues more extensively: grazing lease contracts and the Colorado grazing lease survey program conducted by NASS. Colorado's survey was of interest due to the Audit's reference to the NASS data for Oregon; along with Bruce Eklund of Oregon NASS report to the Committee in December. Eklund said that the survey results for Oregon were only applicable as indicators on a statewide basis not for a county. Interest in the lease contracts for other states centers on concern that the comparison of rates/formula needs to also account for differences, if any, in these lease provisions (i.e. comparing apples to apples).

Colorado's Private Grazing Lease Survey (NASS)

The Colorado State Trust Lands Office has contracted with NASS since 1995 and conducts the survey every 4-5 years. The idea to base state grazing rates on the survey came about in 1992-93 as a result of work done by the Colorado Cattlemen's Association and Colorado State Lands. Each wanted to assess objective ways to tie state grazing lease rates to private market rates. The surveys have been done in 1999 and 2004. The state pays about $15,000 for each survey. Over 2800 surveys were sent out in 2004. The survey is confidential; only the results are published. Rates are established by geographic region. Based on the information from the survey on services provided and a Colorado State University study, the State Lands discounts the private land grazing lease fee in order to set the state's rate.

(A copy of the survey and 2004 survey results are attached.)

Other States Grazing Lease Contracts

Lease contracts were obtained from 8 states (Arizona, Colorado, Idaho, Montana, New Mexico, Utah, Washington and Wyoming). Staff compared the contracts with Oregon's standard forage lease. The contracts were very similar in terms and conditions with some notable exceptions. Washington, Idaho and Montana require lessees to control noxious weeds; Montana and Wyoming also requires lessees to prevent and suppress wildfires. All of the contracts limited the use to grazing; they were non-exclusive. All reserved the right of the state to lease or use the land for other purposes (non-interfering). What can be inferred is that while the highest and best use of the rangelands may be grazing, it is not the only income producing use that state's contemplate or allow. Easements, mineral production and communication sites are some non-agricultural uses made of state land.

Additional Information on DSL's Grazing Program

The Committee wanted to know more about the minimum rate paying lessees. There are 31 lessees of the 144 that pay the minimum rate. Based on the 2004 fee, a lessee would make a minimum payment if they had a carrying capacity of 23 AUM or less; these leaseholds are 300 acres or less.

There are 5 current lessees with approved subleases. Only one of these reports additional income from the sublease. The Department's rules require that 50% of the sublease fee over and above the annual lease fee be paid to the DSL.

In 2003-2004 DSL received $301,080 from its 144 grazing lessees. DSL lands under lease for grazing have a carrying capacity of about 70,000 AUM's. In addition easements (26) brought in $289,745 and communication site leases (15) another $32,823. DSL spent about $240,573 in direct expenses to manage all the rangelands (about 632,000 acres), including those not leased.

During 2003-2005, the Department has invested about $46,000 on noxious weed control and $5,500 on juniper control. More work of this type is expected in 2005-2007.

cc: Ann Hanus, Director, DSL
Steve Purchase, Assistant Director, Field Operations, DSL

Attachments

K:\Policy\2004 Grazing Fee Adv Comm\grazing fee adv comm info Jan 21.doc

NASS
FACT FINDERS FOR AGRICULTURE
UNITED STATES DEPARTMENT OF AGRICULTURE
Colorado Agricultural Statistics Service
PO Box 150969
Lakewood CO 80215 303-236-2300 / 1-800-392-3202

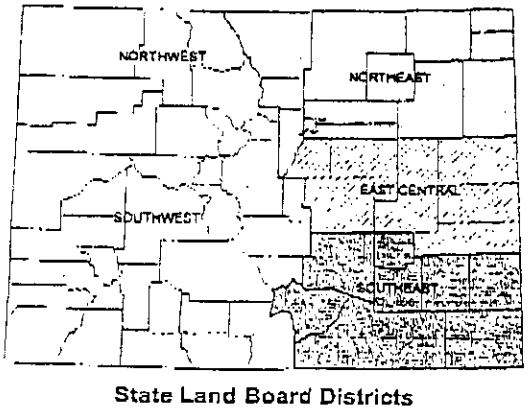
2004 PRIVATE NON-IRRIGATED+ GRAZING LEASE SURVEY COLORADO

Released: August 23, 2004

This report represents the results of a special survey of private non-irrigated grazing land leases in Colorado. The survey was designed and completed by the Colorado Agricultural Statistics Service under a funding agreement with the Colorado State Board of Land Commissioners. The survey was conducted during May and June, 2004. Questionnaires were mailed to 2,870 Colorado farmers, ranchers and landlords. Many of these were identified as having private grazing leases from a Fall 2003 survey of over 10,000 agricultural producers. This sample was combined with a mailing list of landlords and producers obtained from the State Board of Land Commissioners.

The survey was designed to provide non-probability statistical estimates of private non-irrigated grazing lease terms, characteristics and rates at special district and state levels. Survey responses were received from most counties in the state. Straight averages of the reported rates for the three predominate lease rate arrangements were reviewed for each county even though only district and state values are published. Rates published in this report include only leases that were not discounted because of non-cash arrangements with the lessor or because there was an exchange of labor or goods for rent. Leases with non-cash arrangements were excluded because non-cash factors are not reflected in the survey data. Additionally, only leases with at least 100 acres but not more than 50,000 acres are included in the tables on the following pages. Small and large leases were excluded because the lease amounts are generally not representative of the market rates paid by the majprity of cattle producers. No leases over 50,000 acres were reported on the survey.

The 2004 survey showed that 48 percent of the private grazing leases were on a rate per acre basis, 43 percent were on a per head per month basis and 9 percent were on a per AUM basis. The 1999 survey indicated that 47 percent of the leases were on a rate per acre basis, 35 percent were on a per head per month basis and 18 percent were on a per AUM basis. The graphics below show the counties included in each survey district and the survey average rates for each of the survey districts. The district data tables for both the 1999 and 2004 surveys and additional narrative on the survey follow on the next few pages.



State Land Board Districts

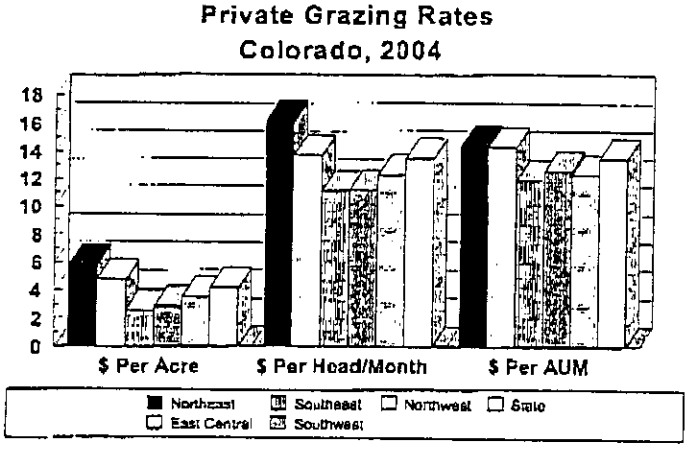


TABLE 1: RATES PAID FOR PRIVATE GRAZING LEASES BY DISTRICT, COLORADO, 1999 and 2004

District	Per Acre Basis	Per Head/Month Basis		Per AUM Basis	
	Average	Average	Length of Season	Average	Length of Season
	$ Per Acre	$ Per Head/Month	Months	$ Per AUM	Months
1999					
Northeast	5.08	12.62	5	14.26	6
East Central	4.70	10.99	5	13.37	6
Southeast	2.89	12.14	5	12.95	6
Southwest	3.59	9.55	5	10.35	5
Northwest	2.88	10.02	4	11.48	5
State Total	4.05	11.12	5	12.67	6
2004 1/					
Northeast	5.82	16.22	5	14.42	5
East Central	4.78	13.68	6	14.27	6
Southeast	2.61	11.11	5	11.88	6
Southwest	2.87	11.25	5	12.58	4
Northwest	3.54	12.33	4	12.33	4
State Total	4.17	13.47	5	13.49	5

1/ Leases that were not discounted because of non-cash arrangements or because of exchange of labor or goods for rent and were 100 acres to 50,000 acres in size.

TABLE 2: PRIVATE GRAZING LEASE SUMMARY BY DISTRICT, COLORADO, 1999 and 2004

District	Leases Reported	Percent of Leases for:			Acres Per Lease
		Cattle	Sheep	Both	Average
	Number	Percent 1/			Acres
1999					
Northeast	295	99	1	–	831
East Central	343	99	–	–	1,237
Southeast	206	98	2	–	1,609
Southwest	218	95	3	2	1,070
Northwest	132	88	11	2	1,386
State Total	1,194	97	2	1	1,188
2004 2/					
Northeast	243	100	–	–	1,034
East Central	228	100	–	–	1,365
Southeast	176	98	–	2	1,877
Southwest	135	99	1	–	1,821
Northwest	72	96	1	3	1,989
State Total	854	99	–	1	1,501

1/ Percents may not add to 100 due to rounding.
2/ Leases that were not discounted because of non-cash arrangements or because of exchange of labor or goods for rent and were 100 acres to 50,000 acres in size.

TABLE 3: PRIVATE GRAZING LEASE SUMMARY BY DISTRICT, COLORADO, 1999 and 2004

District	Reported Carrying Capacity (Acres Per Animal Unit)	Percent of Leases by Type			Percent of Leases by Term		
	Average	Per Acre Basis	Per Head/Month Basis	Per AUM Basis	Month to Month	Annual	Multiple Years
	Acres	Percent 1/			Percent 1/		
1999							
Northeast	16	35	41	24	30	60	10
East Central	19	62	24	14	25	73	2
Southeast	31	68	22	10	18	71	11
Southwest	24	25	48	27	30	56	14
Northwest	14	31	50	18	34	55	11
State Total	21	47	35	18	27	64	9
2004 2/							
Northeast	19	39	48	13	23	62	14
East Central	26	62	33	5	18	67	15
Southeast	39	63	33	5	13	73	14
Southwest	36	35	51	15	16	59	25
Northwest	29	29	63	8	25	48	27
State Total	29	48	43	9	19	64	17

1/ Percents may not add to 100 due to rounding.

2/ Leases that were not discounted because of non-cash arrangements or because of exchange of labor or goods for rent and were 100 acres to 50,000 acres in size.

TABLE 4: PRIVATE GRAZING LEASE SUMMARY BY DISTRICT, COLORADO, 1999 and 2004

District	Percent of Leases With Landlord Provided Services						Hunting and/or Fishing Rights
	Maintenance of:		Animal Mgt. & Oversight	Salt and Minerals	Other Services	No Services	
	Fence	Water					
	Percent 1/						
1999							
Northeast	50	48	10	8	3	38	4
East Central	40	46	9	7	2	44	7
Southeast	31	32	7	7	–	61	8
Southwest	39	30	12	9	2	57	5
Northwest	46	37	16	6	6	46	10
State Total	41	40	10	7	2	48	7
2004 2/							
Northeast	47	54	11	10	5	37	7
East Central	39	47	9	6	4	45	9
Southeast	38	35	17	17	1	61	12
Southwest	27	22	11	8	2	65	3
Northwest	50	47	15	15	4	43	14
State Total	40	43	12	10	3	49	9

1/ Percents may not add to 100 due to landlords providing more than one service.

2/ Leases that were not discounted because of non-cash arrangements or because of exchange of labor or goods for rent and were 100 acres to 50,000 acres in size.

UNITED STATES DEPARTMENT OF AGRICULTURE
COLORADO AGRICULTURAL STATISTICS SERVICE
P.O. Box 150969
Lakewood, CO 80215

OFFICIAL BUSINESS

ADDRESS SERVICE REQUESTED

Both the 1999 and 2004 surveys indicate that virtually all of the leases of privately owned non-irrigated land are for cattle. Exclusive sheep leases accounted for less than 1 percent of the total in 2004 compared with 2 percent in 1999, and most of those are in the western areas of the state. Only one percent of the leases were for both cattle and sheep.

The 2004 average number of acres included in leases was 1,501 acres, up from an average of 1,188 acres in the 1999 survey. These data may not be directly comparable because acreage size limits were applied in 2004 and were not in 1999. Each district had an average exceeding 1,000 acres for both years except the northeast which averaged 831 acres in 1999.

The average reported carrying capacity varied across the state, ranging from 19 acres per animal unit in the Northeastern district to 39 acres per animal unit in the Southeast district. An upper limit of 100 acres was established for each district in both 1999 and 2004 surveys. The state average increased 8 acres per animal unit to 29 acres per animal unit as a direct result of the extreme drought experienced in the State during the past three years. An increase in acres per animal unit represents a decrease in carrying capacity. The Southwest and Northwest districts saw the largest increases of 12 acres per animal unit and 15 acres per animal unit, respectively. The 1999 survey indicated a range of 14 acres per animal unit in the Northwest to 31 acres in the Southeast.

Nearly one half of the leases were on a per acre basis in each survey, averaging 48 percent in 2004 and 47 percent of the total in 1999. Leases on a per acre basis were most common in the East Central and Southeast districts in the 2004 survey, accounting for over 60 percent of the total in each area. In 2004, 43 percent of the leases were on a per head/month basis compared with 35 percent in 1999. In the Northeast, Southwest and Northwest districts, leasing on a per head/month basis was the most common, accounting for 48, 51 and 63 percent of the total, respectively. Nine percent of the 2004 leases were on an AUM basis, down from 18 percent in 1999.

Leasing on an annual basis was the most common term of lease, averaging 64 percent of the total leases in both 2004 and 1999. Annual leases were the most common in each district for both survey periods. Month to month leases represented 19 percent of the total in the latest survey, down from 27 percent in the previous survey. Multiple year leases were least common, averaging 17 percent of the total in 2004 compared with 9 percent in the 1999 survey.

In each of the two surveys, nearly 50 percent of the leases did not include any services by the landlord. However, fence and water maintenance were the most common services provided by landlords in each of the two surveys where at least one service was provided. Each of these services were provided on about 40 percent of the leases. Twelve percent of the leases included animal management and oversight and three percent of the leases included some type of other services. The 2004 survey results for services were very similar to those from the 1999 survey.

Nine percent of leases had hunting and/or fishing rights conveyed with the lease in 2004 compared with 7 percent in 1999. Hunting and fishing rights were the most popular in the Southeast and Northwest districts with 12 percent and 14 percent of leases, respectively.

Agricultural Statistics Service

PO Box 150969
Lakewood CO 80215 (303)236-2300 1-800-392-3202

U.S. Department of Agriculture
Colorado Department of Agriculture

LEASE RATE SURVEY
2004

May 2004

Dear Landowner:

Your assistance is needed to gather information about lease rates in 2004 on privately owned non-irrigated grazing land in Colorado.

A **prompt reply is needed** to represent your area and to ensure that your information will be included in the survey results. Individual reports are kept **strictly confidential** and used only in combination with reports from other operators for area and state totals.

Sincerely,

R. Reneé Picanso
State Director

(Please correct mail address, if necessary)

*** * SECOND REQUEST * ***

This questionnaire was initially mailed in May, but we have not yet received your response. Please complete the appropriate questions for your operation and return this entire form as soon as possible. If you have just recently responded, thank you, and you may ignore this Second Request.

SECTION A: Land Leased (Rented) Determination – (Exclude Federal and State Land)

1. Are you or will you be renting any **Privately Owned,** Non-Irrigated grazing land **FROM OTHERS** for cash during this year? **(Check (√) One)**

☐ **Yes** - (Enter 1 in the 100 box)
☐ **No** - (Enter 2 in the 100 box)

100

2. Are you or will you be renting any **Privately Owned,** Non-Irrigated grazing land **TO OTHERS** for cash during this year? **(Check (√) One)**

☐ **Yes** - (Enter 1 in the 200 box)
☐ **No** - (Enter 2 in the 200 box)

200

INSTRUCTIONS:

If you checked No for both Items 1 and 2, Go to SECTION D on the last page,

OTHERWISE, Complete SECTION B if you reported Yes in Item 1

AND/OR Complete SECTION C if you reported Yes in Item 2.

SECTION B: FOR LESSEES

Please complete the following table **for each separate lease** you have or will have during 2004 where you are/will be renting privately owned, non-irrigated grazing land **FROM OTHERS**:

If you have more than four leases, list only the four with the LARGEST ACREAGE

Report each of the following for each separate lease		Lease # 1	Lease # 2	Lease # 3	Lease # 4
B1. This lease is for: (Check (√) one for each Lease Reported)	Cattle	101	201	301	401
	Sheep	102	202	302	402
	Both	103	203	303	403
B2. Acres in each Lease Reported	Acres	110	210	310	410
(Write in the County Name where each Lease is Located)	County				
	(Office Use)	120	220	320	420
B3. Carrying Capacity of each Lease	Acres per Animal Unit	130	230	330	430
B4. Rental Rate paid for each Lease Reported:					
(Enter the Rental Rate and/or Number of Months for each Lease Reported)	$ Per Acre	140	240	340	440
	$ Per Head/Month	150	250	350	450
	Number of Months	151	251	351	451
	$ Per AUM	160	260	360	460
	Number of Months	161	261	361	461
B4a. Is the rent for this lease discounted because of non-cash arrangements with the lessor or because you exchange labor or goods for rent in addition to money? (Circle only 1 response for each lease)	Yes = 1	162 1	262 1	362 1	462 1
	No = 2	162 2	262 2	362 2	462 2
B5. Term of each Lease Reported:					
(Check (√) the TERM of each Lease Reported) If Multiple Year, also enter number of years.	Month to Month	170	270	370	470
	Annual	171	271	371	471
	Multiple Year	180	280	380	480
	Number of Years	181	281	381	481
B6. Services Provided by Landlord: (Include shared labor/expenses)					
(Check (√) all that apply for each Lease Reported)	Fence Maintenance	190	290	390	490
	Water Maintenance	191	291	391	491
	Animal Maintenance & Oversight	192	292	392	492
	Salt and Minerals	193	293	393	493
	Other (Specify_____)	194	294	394	494
	No Services Provided	195	295	395	495
B7. Are any marketable hunting and/or fishing rights included?					
(Check (√) One for each Lease Reported)	Yes	196	296	396	496
	No	197	297	397	497

Please Continue With SECTION C if you are or will be Leasing Any Privately Owned, Non-Irrigated grazing Land TO OTHERS during this year.

SECTION C: FOR LESSORS

Please complete the following table **for each separate lease** you have or will have during 2004 where you are/will be renting privately owned, non-irrigated grazing land **TO OTHERS:**

If you have more than four leases, list only the four with the LARGEST ACREAGE

Report each of the following for each separate lease		Lease # 1	Lease # 2	Lease # 3	Lease # 4
C1. This lease is for: (Check (√) one for each Lease Reported)	Cattle	501	601	701	801
	Sheep	502	602	702	802
	Both	503	603	703	803
C2. Acres in each Lease Reported	Acres	510	610	710	810
(Write in the County Name where each Lease is Located)	County				
	(Office Use)	520	620	720	820
C3. Carrying Capacity of each Lease	Acres per Animal Unit	530	630	730	830
C4. Rental Rate Charged for each Lease Reported: (Enter the Rental Rate and/or number of months for each Lease Reported)	$ Per Acre	540	640	740	840
	$ Per Head/Month	550	650	750	850
	Number of Months	551	651	751	851
	$ Per AUM	560	660	760	860
	Number of Months	561	661	761	861
C4a. Is the rent for this lease discounted because of non-cash arrangements with the lessee or because you exchange labor or goods for rent in addition to money? (Circle only 1 response for each lease)	Yes = 1	562 1	662 1	762 1	862 1
	No = 2	562 2	662 2	762 2	862 2
C5. Term of each Lease Reported: (Check (√) the TERM of each Lease Reported) If Multiple Year, also enter number of years.	Month to Month	570	670	770	870
	Annual	571	671	771	871
	Multiple Year	580	680	780	880
	Number of Years	581	681	781	881
C6. Services Provided by **YOU** as Landlord: (Include shared labor/expenses) (Check (√) all that apply for each Lease Reported)	Fence Maintenance	590	690	790	890
	Water Maintenance	591	691	791	891
	Animal Maintenance & Oversight	592	692	792	892
	Salt and Minerals	593	693	793	893
	Other (Specify_____)	594	694	794	894
	No Services Provided	595	695	795	895
C7. Are any marketable hunting and/or fishing rights included? (Check (√)One for each Lease Reported)	Yes	596	696	796	896
	No	597	697	797	897

Please Continue on the next Page

SECTION D: Comments

Please provide your comments regarding grazing land (both Public and Private) in your area.

Thank you for your assistance.

Would you like a copy of the survey results? **(Check (√) One)**

- ☐ **Yes ---- 1**
- ☐ **No ---- 2**

Office Use

Reported By:_____ Date: _____

Operation Phone Number:___(_____)_____

KIELSMEIER Nicole

From: LILLY John
Sent: Wednesday, January 05, 2005 10:22 AM
To: HANUS Ann; PURCHASE Steve; PUSTIS Nancy; KROFT Jeff; WIEST Randy
Cc: KIELSMEIER Nicole
Subject: FW: Current Oregon Grazing Fee Formula 'Constants'

fyi
Nicole: please include this memo in the mailout packet to the Committee members..thanks
-----Original Message-----
From: Tanaka, John [mailto:john.tanaka@oregonstate.edu]
Sent: Wednesday, January 05, 2005 9:22 AM
To: LILLY John; Dan Nichols (E-mail); Dianna Oberbarnscheidt (E-mail); George Grier (E-mail); Larson, Larry; Tom Clemens (E-mail)
Cc: PUSTIS Nancy; WIEST Randy; PURCHASE Steve
Subject: RE: Current Oregon Grazing Fee Formula 'Constants'

John,

I've talked to both David Bohnert (EOARC-Burns) and Tim DelCurto (EOARC-Union), both OSU animal scientists, about the 30 pounds per day. Both agree that it is probably about right for the late summer season in the Burns area. As I calculated, the 2 pounds per day gain is an average from birth to sale (weaning), so if they are only gaining a pound a day in late summer, that has to be made up at other times of the year. As Tim told me, there is very little research on seasonal weight gains, but he did publish one that summarizes Burns data. In order to more accurately answer the question, we'd need to know what the typical grazing season is on state land leases. If we knew that, then it might be possible to use the published information from Burns to begin to answer the question of what a reasonable monthly weight gain for calves is while they are on that land.

John Tanaka, CPRM
Eastern Oregon Agricultural Research Center - Union Station
P.O. Box E
Union, OR 97883
(541) 562-5129

-----Original Message-----
From: LILLY John [mailto:John.Lilly@dsl.state.or.us]
Sent: Thursday, December 30, 2004 3:22 PM
To: Dan Nichols (E-mail); Dianna Oberbarnscheidt (E-mail); George Grier (E-mail); Tanaka, John; Larson, Larry; Tom Clemens (E-mail)
Cc: PUSTIS Nancy; WIEST Randy; PURCHASE Steve
Subject: Current Oregon Grazing Fee Formula 'Constants'

We are investigating the 'constants' that appear in the current formula.....Here's what we've found.....

Factor: G = animal gain per month = 30 pounds....this is the amount of weight gain prescribed to each calf while on state land; this factor was established thru group consensus among the ranchers and range professionals.

Factor: CC = marketable calf crop = 80%....this is basically a survival rate for calves while on state land.....this factor was a consensus # based on the best professional judgment of the ranchers and range professionals.

Factor: S = state share (ie the % percent of net livestock weight gain designated to the Dept for the use of rangeland forage) = 20%...all

agreed on the this factor but there was not consensus the # to use; there was wide variation. The idea here is that the state is taking a 'share' of the crop (ie calves) and that S represents the weight gained while the animal was on state land.

I am interested to know if there are any recent studies or statistics concerning these factors.....are the values for G and CC best established by local knowledge and experience of the operators or are there govt or university sources that we can rely on???

Let me know what you think.....

See you on the 21st on Burns...actually Hines, just outside of Burns....the Agenda will be out next week. We are holding the meeting at the Rory and Ryan Best Western Motel in Hines.

Thanks and Happy New Year!

John E. Lilly
Assistant Director
Department of State Lands
775 Summer St NE
Salem OR 97301
503-378-3805 x 281

LILLY John

From: Larry Larson [llarson@eou.edu]
Sent: Monday, January 24, 2005 3:04 PM
To: LILLY John
Subject: Grazing Fee

eoarc.doc

John - On the way home I realized that most people would probably need a little more information to interpret the Burns data on their own. I am attaching a 1 page information sheet that we should forward to the committee members. Thanks - Larry

The following are details to help you interpret the EOARC (Burns) charts:

Cows exposed to bull chart – Between 1966 and 1983 the cattle at Burns were managed in two herds. One herd was managed for spring calving (March) and the other for fall calving (Sept.). After 1983 all the cows were placed on a spring calving cycle. The charts provided (all) only contain spring calving data.

Calves weaned chart – The blue bars (1966 – 1996) indicate an early October weaning date. The red bars (1997 – present) indicate a mid-August weaning date.

Calves weaned per cow exposed chart – This chart gives the calf crop percentage. The increased calf crop percentage associated with the red bars is a function of two factors. The first factor is the change in weaning dates. An August weaning date gives the cow more time to improve her body condition before going into winter. The second factor is diet. The experiment station instituted a program of giving a supplemental diet to 1st and 2nd calf heifers to improve heifer development. These practices are not consistent across the cattle industry.

Calf ADG to weaning chart – This chart gives the average daily gain (ADG) for the calf (Hereford and Angus) from birth (March) to weaning (either mid August or early October). The birth weight for the calves at Burns typically runs between 70 - 80 lbs. Milk production by the cow begins to decline by mid May and forage consumption by the calf increases to a full forage diet at weaning. Average daily weight gains from birth to the end of April should be greater than 2 lbs per day. Maximum weight gains during that period would be expected to be between 2.25 and 2.5 lbs/day. The weight gain during the 60-day period before May elevates the average daily gain value reported in the chart. In addition the establishment of an August weaning date removes the lower weight gains seen during late August and September. This in turn elevates the average daily gain calculation seen in this chart. These numbers do not provide a direct comparison for assessing the average daily gain data reported in appendix 2 for the May to October period. An October weaning weight would be near 400 lbs.

ERROR – In the handout entitled 'Background Information Relating to the 1993 Grazing Fee Formula' there is an error on page 3. The example data set in the cost per AUM column totals to $16.29 rather than the 18.35 reported.

Background Information Relating to the 1993 Grazing Fee Formula

Larry Larson

Crop-Share

The current formula is described as a crop-share approach in the 1993 report and administrative rule 141-110-0020 describes the lease (grazing agreement) as a legal contract for forage rental on a specific leasehold. The 1993 committee unanimously chose a crop-share approach because it isolated the portion of the product attributed to state owned forage and included an equitable sharing of risks by the State and the lessee. Given this intent the crop-share approach contains characteristics found in row crop crop-share lease agreements. See Appendix 1 for an illustration of crop-share leases and the sharing of costs and profits (Seavert, C. 2004. Negotiating new lease arrangements with the transition to direct seed intensive cropping systems. OSU extension. 7p.).

AUM Fee

The 1993 report and recommendation of the grazing advisory committee outlines the following crop-share grazing fee formulation:

AUM FEE = G x CC x S x P x IP

G = 30 lb/mo gain on the calf in the AUM unit

CC = 80% calf crop

S= State share of 20%

P= $0.95 per pound (average sales price)

IP= 15% discount on isolated parcels – this portion of the equation appears to have been replaced by a base charge which is applied to isolated land parcels.

The formula currently contains two types of variables. The G, CC, and P variables are utilized to provide an estimate of the revenue generated by calf weight gains during the operation of the lease. The S variable is used to provide an estimate of the state's contribution to the cost of production and its equitable share of the profits generated.

G, CC & P

Data from the Eastern Oregon Agricultural Research Station (Burns OR.) provide a record of calf weight gains on the sagebrush and crested wheatgrass range in Harney County. Turner and DelCurto (Animal Scientists at the Burns Station) published a management article in 1991 that contained data (10-15 years) of calf weight gains (cow/calf grazing units) on sagebrush and crested wheatgrass range (see appendix 2 - Summary of Weight Gain Values; Turner, H and T. DelCurto. 1991. Nutritional and managerial considerations for range beef cattle production. Veterinary clinics of North America: Food animal practice. 7:95-125.). These data indicate that the average weight gain for a Hereford calf between May and September will be 30 lbs/mo. Personal communication with researchers and extension agents having experience on sagebrush and crested wheatgrass range in Harney, Lake and Malheur counties indicate that the data is accurate and offered the following observations. They indicate that the weight gain on a cross-bred calf on a diet of mostly milk would be slightly higher (1.7 vs. 2.0 lbs/day) but that its weight gain on a grass diet would be similar to the numbers reported by Turner and DelCurto. They also indicate that most successful ranch operations in this region have calf crop rates of 80 to 90% and that a 5 to 10 year average of calf prices would be near $0.95 /lb. These numbers are similar to the numbers (assumptions) currently used in the grazing fee formula.

S

Validating the state share of the lease agreement appeared to be contentious in the 1993 report. Tim Cross, Stanley Miles and Fred Obermiller (Agriculture economists) reported to the 1993 committee that the assessed value of private deeded range in Harney, Lake, and Malheur counties, with no surface improvements, was $40.00 per AUM (I am unaware of any more recent data from this area of the State) and that a low risk interest rate at that time of the report was 6%. These data yielded an expected landowner (State) share based on land valuation alone of $2.40 per AUM. Calculating the weight gain revenue from the grazing fee formula (G x CC x P) yields $22.70. Thus the state share based on land valuation was calculated to be 10.5%. However, the current low risk

interest rate is 4%, which would reduce the State's land valuation to $1.60 per AUM (State land valuation share = 7%).

An article by Van Tassel et al. (1997: See Appendix 3 for article and a list of other publications on the subject) documents the operational costs of grazing leases on Bureau of Land Management, U.S. Forest Service and private rangeland in Idaho, Wyoming and New Mexico. Their data indicates that the average cost of operating a grazing lease is about $18.00/AUM. The costs include:

Costs per AUM

Category	Dollars
Lost Animal	3.23
Veterinary	0.43
Moving Livestock	3.01
Herding	3.86
Misc. labor & mileage	0.52
Salt and feed	1.44
Water	0.27
Horse	0.27
Improvement maintenance	2.70
Development depreciation	0.28
Other costs	0.28
Total costs	$18.35

Most if not all of these costs appear to be paid by the lessee. In addition, if water hauling is required for the operation it is doubtful that any profit will be generated from the lease (see Appendix 4 for extension article and an example calculation of water hauling costs).

Issues

At this point, the C, CC and P variables appear to be representative of existing conditions, while the S variable remains less defined. Given that the grazing fee formula represents a crop-share approach, an equitable agreement should reflect a proportional sharing of

costs and profits by each party. Documentation is needed to clarify the state's share of operational costs and validate the identified lessee costs.

APPENDIX 1

Seavert, C. 2004. Negotiating new lease arrangements with the transition to direct seed intensive cropping systems. OSU extension. 7p.

Negotiating New Lease Arrangements with the Transition to Direct Seed Intensive Cropping Systems

Clark F. Seavert
Extension Economist
Oregon State University

Changes in agricultural production, technology and markets have had a substantial impact on farm business organization and land tenure arrangements. Increased mechanization, better seeds, use of farm chemicals, irrigation improvements and other factors have increased labor productivity dramatically making it possible for one farm family to operate a much larger farm unit. More recently the changing from a summer-fallow winter wheat crop rotation to a continuous cropping system has raised many questions about lease arrangements.

The traditional lease type in the Mid-Columbia region of Oregon has been the crop share lease, as shown in Table 1. The landowner would provide the land, one-third of the fertilizer, herbicide expenses and crop and hail insurance, and pays the property taxes associated with the property. The tenant would provide the machinery and pay all of the other production costs. In return the landowner and tenant would split the receipts on a one-third/two-thirds basis, the landowner receiving the former. One would characterize this lease as equitable because the landowner is providing one-third of the inputs and receiving one-third of the receipts. Each party will share the wheat receipts in the same proportion as their expenditures and gain or lose profits in the same proportion. This is what I would classify as an equitable lease

EQUITY IN A FARM LEASE

The most perplexing question in farm leasing is the appropriate share a landowner and tenant will receive in a certain cropping system. Most agree that a lease should be fair and equitable. An equitable lease is one that compensates the tenant and the landowner in the same proportion as each contributes to the resources of the farming business. Generally, there is a mutual desire by the tenant and landowner to share returns fairly in negotiating a lease agreement. One way of resolving this potential problem is for the tenant and landowner to periodically determine their respective contributions and adjust the lease agreement accordingly.

In calculating an equitable lease, the use of an enterprise budget is a helpful tool. An enterprise budget includes all the costs and returns associated with producing one enterprise in some particular manner. Enterprise budgets determine the cost-of-production of a commodity on a per basis unit. Together a tenant and landowner should complete enterprise budgets to estimate income and decide on the contribution of each. Table's 1 and 2 are examples of enterprise budgets for a summer-fallow winter wheat crop and a continuous cropping system utilizing a minimum tillage production practice. After enterprise budgets are prepared the contributions of each party are estimated.

Most input's that make up an equitable lease are easy to calculate. They are paid by either party and are easily identified. Three determinants that make calculating an equitable lease difficult is that of land, machinery, and operator labor. Land and machinery are difficult to calculate because they depreciate in value over time. The following sections are only suggestions on a few methods to calculate land, machinery, and operator labor. These suggestions may calculate a more equitable lease for the parties involved.

Land Valuation

Land is difficult to calculate because each landowner has their own conception of what the value might be on their property. This value may include sentimental values rather than reflecting true productive values. A tenant rents only the productive value of land. Only the landowner gains from any speculative value above productive value.

Productive value rather than market value is used by assessors in some states for tax purposes. The assessor's value then is a good estimate of the landowner's contribution of land. This productive value multiplied by the interest rate on saving certificates or a similar safe rate could be used to estimate the landowner's annual land contribution. In other states using a fair market value for the land is appropriate to establish its worth in the lease. In Table's 1 and 2 a 6 percent rate of return is used on the landowner's investment in the land multiplied by its market value of $370 per acre.

Machinery Valuation

Machinery is usually provided by the tenant. An estimated value is needed to evaluate the contribution make by the provider of the machinery or equipment. This is a similar problem to that of land contribution. A satisfactory value that can be agreed upon by both parties is needed. The current market value of the machine should be used. This may be estimated by:

1. The landowner and tenant agreeing on a reasonable value. This may be satisfactory if both parties are familiar with used machinery prices in the area.
2. Use of an as is estimate by machinery dealers associations.
3. Estimates from the agricultural extension service or from agricultural experiment stations. 'The Cost Of Owning And Operating Farm Machinery in the Pacific Northwest"; Willett, Gayle; Bob Smathers, PNW Extension Publication, Idaho, Washington, Oregon 346, September, 1997.
4. Use the custom rates paid in your area, subtracting the operators labor and management, as an opportunity cost to the machinery. Publications of custom rates can be obtained from local extension offices. "Custom Rates For Idaho Agricultural Operations - 1986," Miscellaneous Series No. 67, R.V. Withers, Agricultural Experiment Station, College of Agriculture, University of Idaho. "Custom Rates for Oregon Agriculture, 1988." T.L. Cross, Agricultural and Resource Economics, Oregon State University.

The machinery in Table's 1 and 2 were calculated by the third recommendation of using the costs of production studies from Oregon State University and using the estimate of machinery costs for a typical wheat farm in the Mid-Columbia area.

Operator or Landowner Labor Valuation

Both parties should be compensated for their labor involved in a lease. This labor is usually not valued any higher than what a tenant or landowner would pay for a qualified person to perform his or her duties on the farm. This value of labor usually reflects the higher paid farm workers in an area.

EVALUATING LEASES WITH CHANGES IN CROPPING SYSTEMS

Many growers in the Mid-Columbia region have expressed interest in changing from the customary summer-fallow winter wheat crop rotation to a continuous cropping system utilizing a minimum tillage practice. With the help of Sandy Macnab, OSU Extension Cereal Crops agent in Wasco and Sherman counties, we developed an equitable lease arrangement for those growers interested in

changing cropping system. Table 2 shows the results of changing from a one-third/two-thirds share crop lease to a one-fourth/three-fourths lease with the landowner sharing in the same inputs as in the first lease but now only paying one-fourth rather than one-third of those costs. The landowner contributes one-forth of the expenses and receives one-fourth of the receipts. If the estimates of yield and price are correct each party now receives profits and losses in proportion to their financial risks.

RISK ASSOCIATED WITH LEASE ARRANGEMENTS

Today's farmers face greater financial risks than in the past because of the increased size of their businesses, greater use of purchased inputs, greater financial needs and increased dependence upon world markets. Therefore, in selecting lease shares, it is important to recognize that they vary in terms of the relative amount of risk assumed by the tenant and landowner.

Table 3 shows a sensitivity analysis of possible yield or price changes among the equitable lease arrangements for the summer-fallow winter wheat rotation and the continuous cropping system. With expected yield and prices, the landowner and tenant receive negative profits per acre with the one-third/two-thirds crop share lease and not until there is a 10 percent increase in yield or price does the tenant make a positive return on investment. The one-forth/three-forth crop share lease with continuous cropping does allow both parties a positive return on investment except if there is a 10 percent decrease in yield or price. In both situations the landowner and tenant share in the risks of wheat production equally and share in profits and losses in the same manner.

Table 4 shows the affects of the tenant with a one-third/two-thirds crop share lease in a summer-fallow winter wheat rotation changing to the continuous cropping system without changing to a one-forth/three-forth crop share lease. Both parties receive a positive return on investment but the landowner receives a greater share of the receipts than expenses. Of course both parties gain in profits with an increase in yield or price but the downside has tremendous consequences. If there is a 10 percent decrease in yield or price the landowner still receives a positive return on investment (about $6 per acre) but the tenant losses $17 per acre with this lease type.

Lease equity is of great importance. Both parties often assume that reliance on customary leasing terms will result in an equitable lease. Both parties should be compensated for their contributions in a lease, whether it is a cash rent or a crop-share lease.

If an equitable lease is calculated and neither party receives a positive return on their investment the value of their inputs must be evaluated. The landowner might receive a lower rate of return than expected on land to make the lease feasible and the tenant may have to receive a lower rate for equipment use to make the lease equitable as well. Each party must be willing to give and take in constructing an equitable lease arrangement and assessing the equity of the lease periodically is paramount for good landowner-tenant relations.

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Table 1. Winter Wheat, Conventional, Mid-Columbia Area, $/Acre Economic Costs and Returns

GROSS INCOME	Quantity	Unit	$/Bu	*Tenant Percent*	Total	Tenant Share	Landowner Share
Winter Wheat	45.00	Bushels	$ 3.75	*67%*	$ 168.75	$ 113.06	$ 55.69
Total GROSS Income					$ 168.75	$ 113.06	$ 55.69

VARIABLE COSTS	Labor	*Tenant Percent*	Machinery	*Tenant Percent*	Materials	*Tenant Percent*	Total	Tenant Share	Landowner Share
Moldboard Plow (.33x)	$ 0.59	*100%*	$ 1.66	*100%*	$ -	*100%*	$ 2.25	$ 2.25	$ -
Chiesel Plow (.67x)	0.62	*100%*	0.89	*100%*	-	*100%*	1.51	1.51	-
Cultivate (1.5x)	0.87	*100%*	2.00	*100%*	-	*100%*	2.87	2.87	-
Rod Weed (2x)	0.91	*100%*	2.10	*100%*	-	*100%*	3.01	3.01	-
Crop Production									
Fertilizer	-	*100%*	-	*100%*	13.32	*67%*	13.32	8.88	4.44
Drill Seed	0.81	*100%*	3.33	*100%*	9.75	*100%*	13.89	13.89	-
Herbicides	0.32	*100%*	0.85	*100%*	17.97	*67%*	19.14	13.15	5.99
Harvest Operations									
Combine	0.79	*100%*	1.51	*100%*	-	*100%*	2.30	2.30	-
Hauling Costs	1.62	*100%*	1.34	*100%*	-	*100%*	2.96	2.96	-
Other Charges									
Pickup & Trucks	-	*100%*	2.54	*100%*	-	*100%*	2.54	2.54	-
Other Machinery	-	*100%*	1.03	*100%*	-	*100%*	1.03	1.03	-
Miscellaneous	4.47	*100%*	1.00	*100%*	5.00	*100%*	10.47	10.47	-
Interest: Operating Capital	-	*100%*	-	*100%*	1.26	*100%*	1.26	1.26	-
Total VARIABLE COSTS	11.00		18.25		47.30		76.55	66.12	10.43

VARIABLE CASH COSTS	Unit	*Tenant Percent*	Total	Tenant Share	Landowner Share
Machinery and Equipment Insurance	acre	*100%*	$ 4.00	$ 4.00	$ -
Pickups & Truck Insurance	acre	*100%*	0.37	0.37	-
Crop - Hail & Fire Insurance	acre	*67%*	2.50	1.67	0.83
Conservation Practices	acre	*0%*	0.30	-	0.30
Property Insurance. etc.	acre	*0%*	0.10	-	0.10
Property Taxes	acre	*0%*	6.00	-	6.00
Total CASH Costs			$ 13.27	$ 6.04	$ 7.23

NON-CASH Costs					
Machinery and Equipment Depreciation, Interest & Housing	acre	*100%*	$ 41.72	$ 41.72	$ -
Pickups, Trucks & ATV's Depreciation, Interest & Housing	acre	*100%*	6.22	6.22	-
Other Machinery – Depreciation & Interest	acre	*100%*	2.74	2.74	-
Land Charge - 6% of Mkt Value, After Tax	acre	*0%*	44.40	-	44.40
Total NON-CASH Costs			$ 95.08	$ 50.68	$ 44.40
Total FIXED COSTS			$ 108.35	$ 56.72	$ 51.63
Total of All Costs Per Acre			$ 184.90	$ 122.84	$ 62.06
PERCENTAGE THAT EACH PARTY HAS CONTRIBUTED TO TOTAL COSTS:				**66.43%**	**33.57%**
RETURN OVER TOTAL COSTS			$ (16.15)	$ (9.77)	$ (6.37)

Table 2. Winter Wheat, Minimum Till-Continuous Cropping, Mid-Columbia Area, $/Acre Economic Costs & Returns

GROSS INCOME	Quantity	Unit	$/Bu	*Tenant Percent*	Total	Tenant Share	Landowner Share
Winter Wheat	38.00	Bushels	$ 3.75	*75%*	$ 142.50	$ 106.87	$ 35.63
Total GROSS Income					$ 142.50	$ 106.87	$ 35.63

VARIABLE COSTS	Labor	*Tenant Percent*	Machinery	*Tenant Percent*	Materials	*Tenant Percent*	Total	Tenant Share	Landowner Share
Fertilizer	$ -	*100%*	$ -	*100%*	$ 13.32	*75%*	$ 13.32	$ 9.99	$ 3.33
Direct Seed Drill	0.74	*100%*	10.91	*100%*	9.75	*100%*	21.40	21.40	-
Herbicides	0.32	*100%*	0.93	*100%*	11.13	*75%*	12.38	9.60	2.78
Harvest Operations									

Combine	0.79	*100%*	2.69	*100%*	-	*100%*	3.48	3.48	-
Hauling Costs	1.62	*100%*	1.34	*100%*	-	*100%*	2.96	2.96	-
Other Charges									
Pickup & Trucks	-	*100%*	2.54	*100%*	-	*100%*	2.54	2.54	-
Other Machinery	-	*100%*	0.52	*100%*	-	*100%*	0.52	0.52	-
Miscellaneous	4.47	*100%*	1.00	*100%*	5.00	*100%*	10.47	10.47	-
Interest: Operating Capital	-	*100%*	-	*100%*	1.12	*100%*	1.12	1.12	-
Total VARIABLE COSTS	7.94		19.93		40.32		68.19	62.08	6.11

VARIABLE CASH COSTS	Unit	*Tenant Percent*	Total	Tenant Share	Landowner Share
Machinery and Equipment Insurance	acre	*100%*	$ 2.48	$ 2.48	$ -
Pickups & Truck Insurance	acre	*100%*	0.19	0.19	-
Crop - Hail & Fire Insurance	acre	*75%*	2.00	1.50	0.50
Property Insurance, etc.	acre	*0%*	0.10	-	0.10
Property Taxes	acre	*0%*	3.00	-	3.00
Total CASH Costs			$ 7.77	$ 4.17	$ 3.60
NON-CASH Costs					
Machinery and Equipment Depreciation, Interest & Housing	acre	*100%*	$ 22.75	$ 22.75	$ -
Pickups, Trucks & ATV's Depreciation, Interest & Housing	acre	*100%*	3.11	3.11	-
Other Machinery – Depreciation & Interest	acre	*100%*	1.37	1.37	-
Land Charge - 6% of Market Value. After Tax	acre	*0%*	22.20	-	22.20
Total NON-CASH Costs			$ 49.43	$ 27.23	$ 22.20
Total FIXED COSTS			$ 57.20	$ 31.40	$ 25.80
Total of All Costs Per Acre			$ 125.39	$ 93.48	$ 31.91
PERCENTAGE THAT EACH PARTY HAS CONTRIBUTED TO TOTAL COSTS:				**74.55%**	**25.45%**
RETURN OVER TOTAL COSTS			$ 17.11	$ 13.40	$ 3.71

Table 3. Net Projected Returns Per Acre With Equitable Leases for a Summer-Fallow/Winter Wheat Rotation (1/3-2/3 Lease) and Continuous Cropping (25-75 Lease) System.

	Summer Fallow/Winter Wheat		Continuous Cropping	
	Landowner	Tenant	Landowner	Tenant
10% Increase in Price or Yield	$ (0.81)	$ 1.53	$ 7.28	$ 24.08
Projected Price and Yield	(6.37)	(9.77)	3.71	13.40
10% Decrease in Price or Yield	(13.06)	(23.34)	(3.41)	(7.98)

Table 4. Net Projected Returns Per Acre for a Summer- Fallow/Winter Wheat Rotation (1/3-2/3 Lease) But Changing to a Continuous Cropping System without Evaluating the Changes to the Sharing of Inputs.

	Summer Fallow/Winter Wheat		Continuous Cropping	
	Landowner	Tenant	Landowner	Tenant
10% Increase in Price or Yield	$ (0.81)	$ 1.53	$ 19.82	$ 11.54
Projected Price and Yield	(6.37)	(9.77)	15.11	2.00
10% Decrease in Price or Yield	(13.06)	(23.34)	5.71	(17.10)

APPENDIX 2

Summary of Weight Gain Values

Turner, H and T. DelCurto. 1991. Nutritional and managerial considerations for range beef cattle production. Veterinary clinics of North America: Food animal practice. 7:95-125

WEIGHT GAINS

Turner, H and T. DelCurto. 1991. Nutritional and managerial considerations for range beef cattle production. Veterinary Clinics of North America: Food Animal Practice. 7:95-125.

The article documents weight gain on lower elevation (4600 ft) sagebrush-bunchgrass and crested wheatgrass range near Burns, Oregon. The numbers presented below are average weight gain on straight-bred Hereford calves and yearlings over a 12-15 year period at the Eastern Oregon Agricultural Research Center.

		calf		yearling	
Month	15-day period	lbs/day	lbs/mo	lbs/day	lbs/mo
May					
	1st	1.6	48	1.75	52
	2nd	1.75	52	2.6	78
June					
	1st	1.6	48	2.4	72
	2nd	1.5	45	1.9	57
July					
	1st	1.3	39	1.7	51
	2nd	0.75	22	1.1	33
August					
	1st	0.7	21	0.8	24
	2nd	0.4	12	0.6	18
September					
	1st	0.35	10	0.4	12
	2nd	0.2	6	0.2	6
October					
	1st	0.2	6	0.2	6
May – Sept Average			30		40

These calf weight gains may be a little low for crossbred herds. Crossbred calves should be expected to gain 2 lb/day during peak lactation but the drop off in weight gains as the forage cures would be similar.

Calf crop success rates typically range between 80% for low input operations to 90% on high input operations. Operations that fall within this range are sufficiently successful to stay in business.

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Nutritional and Managerial Considerations for Range Beef Cattle Production

Harley A. Turner, PhD and Timothy DelCurto, PhD†*

Rangeland, which covers over 1 billion acres (400 million ha), excluding Alaska, makes up the largest classification of land area in the continental United States. This represents 54% of the land area and consists of grasslands, shrublands, and open forest. This land mass under current management practices is estimated to supply forage for over 200 million animal unit months. This supplies over one third of the total forage required by the nation's beef herd in addition to forage for other domestic and big-game species. Rangelands contribute to the food supply of people in only one way and that is by providing feed for grazing animals. The majority of these rangelands lie in the 17 western states. In addition there are approximately 1 million acres (40 million ha) of native meadow hay in the western United States.

These rangelands and native meadows are extremely heterogeneous in nature and represent the most variable commodity that is encountered in livestock nutrition and management. Soil type and depth, annual and seasonal precipitation, temperatures, altitude, topography, ecological sites and management of these lands all contribute to their variability. Much of the data presented here were collected on the Eastern Oregon Agricultural Research Center, located in southeastern Oregon. This rangeland and meadowland is closely related to much of the ranges and meadows in the western United States. These data and general principles can be extrapolated and applied to grazing animals on forages anywhere in the world.

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Livestock operators can usually tell you the nutritive value of grains, supplements, hay, or other feedstuffs they purchase, but few have a clear understanding of the value of forages they graze and how they change over time. This discussion will identify the nature of range feed, including nutritive value of forages throughout the year, nutrient needs of the livestock and the relationship of these nutrient needs to the nutrients the various classes of cattle can get from the forage base. Discussions will include managerial manipulations that strive for optimum range livestock production and supplemental feed strategies, options beyond economic supplementation, time of calving, time of weaning, producing slaughter animals on range, and other strategies for improving efficiency of range operations. Parasite control, implanting, feed additives, routine herd health practices, and many other factors involved with good animal management are important for optimum production but outside the scope of this article. Obviously, with all of these alternatives we need to practice good "range management" to maintain range condition and consider the effects on wildlife. This discussion will not include range management techniques, such as removing brush, fertilizing, grazing systems, etc., for increasing or improving range forages, or the effects of the management schemes on wildlife.

DESCRIPTION OF THE AREA WHERE THE BASIC RESEARCH WAS CONDUCTED

Grazing regions of the western United States have been divided into three distinct units based on seasonal precipitation patterns.[15] The Great Basin pattern lies between the Rocky Mountains and the Sierra Nevada and Cascade Mountains and is characterized by primarily winter and spring precipitation and moisture-deficient summers. The Southwestern pattern, including Arizona, southern Utah and Nevada, and parts of New Mexico, is biseasonal and is characterized by winter precipitation followed by spring drought and summer precipitation followed by fall drought. The Plains pattern occurs in the area bounded on the west by the Rocky Mountains and on the east by the Appalachian Mountains. Precipitation in this area is greatest in the spring and summer and then tapers off in the fall and winter.

Common ecological units within the Great Basin pattern are the sagebrush-bunchgrass of the lower elevations, where much of the data that will be presented have been collected, and coniferous forest communities in the mountains. There are approximately 20 million acres of sagebrush-bunchgrass rangeland in eastern Oregon alone. This region also contains extensive riparian and flood meadow areas.[30] The northern intermountain region alone contains nearly 1 million acres of native flood meadow bordering local streams and lakes.[7] The Eastern Oregon Agricultural Research Center, Squaw Butte Range, is typical of much of the sagebrush steppe of the Great Basin, and the hay meadows are typical of native meadows throughout the region.

The Squaw Butte Range is in the Payette section of the Columbia Plateau at an elevation of 4600 feet (1400 m). The soils are mostly sandy loams of basaltic origin underlain with a calcium carbonate layer varying from 2 to 4 feet (0.6 to 1.2 m) below the surface.[11]

The climate is characterized by cold winters, hot summers, and low precipitation levels, arriving mainly during the winter. Average annual precipitation is 11.7 inches (29.7 cm). About 60% occurs as snow during the fall and winter and only 25% as rain during the growing season in the spring and early summer.[13] The combinations of late spring and early fall frosts, and limited amounts of precipitation during the warmer months result in short grazing seasons and permit only one growth cycle, resulting in all grass forage species maturing at about the same time with little difference in nutritive value between species.

Shrubs form a major component of desert range vegetation. Woody vegetation is primarily Wyoming big sagebrush (*Artemisia tridentata* subsp. *wyomingensis*), low sagebrush (*Artemisia arbuscula*), and juniper (*Juniperus occidentalis*). Other shrubs found in the region include several other sagebrush species (*Artemisia tridentata* spp.), bitterbrush (*Purshia tridentata*), green rabbitbrush (*Chrysthamnus vascidiflorus*), and gray rabbitbrush (*Chrysthamnus nauseous*). Except for bitterbrush, the shrub species of the basin are not palatable to cattle.

Herbaceous vegetation consists of cool-season grasses, primarily of native species bluebunch wheatgrass (*Agropyron spicatum*), Idaho fescue (*Festuca idahoensis*), sandberg bluegrass (*Poa sandbergii*), squirreltail (*Sitanion hystrix*), thurbers needlegrass (*Stipa thurberiana*), and several other species of stipas. Introduced grass species include crested wheatgrass (*Agropyron desertorum*) and cheatgrass (*Bromus tectorum*).

Elevation of the Harney Basin, which encompasses the native flood meadows, is 4100 feet. This is a wide alluvial plain typical of native flood meadows. Soils of the area are generally silt loams and are mildly calcareous and slightly alkaline. The area is irrigated by wild flooding in the spring for a period from 6 to 12 weeks, usually starting in April. Active growth ceases within 2 to 3 weeks after recession of flooding.

Vegetation consists of as many as 100 species; however, over half of the biomass is made up of rushes (*Juncus* spp.) and sedges (*Carex* spp.).[7] The principal sedge is rusty sedge (*Carex subjunca*) and the dominant rush is baltic rush (*Juncus balticus*). The remaining 25% consists of grass and shrub species. The most abundant grasses are Nevada bluegrass (*Poa nevadensis*), meadow barley (*Hordeum brachyantherum*), meadow foxtail (*Alopercurus pratense*), and beardless wildrye (*Elymus triticoides*). The principle clover species is annual whitetip clover (*Trifolium variegatum*).

TYPICAL GAINS OF CATTLE THROUGHOUT THE GRAZING SEASON ON RANGE

Livestock weight gains on range diminish dramatically as the grazing season progresses and plants mature. With the precipitation pattern

allowing only one growth cycle on forages in the Great Basin, there is only one period of high nutrient value and rapid gain during the year. This occurs in late spring and early summer and essentially dictates a situation in which, without forage or livestock management manipulation, there is a period of 3 months of high forage quality and animal performance and 9 months of poor quality feeds and poor livestock production.

Typical gains of suckling calves and yearlings on range are presented in Figure 1.[18] Gains peak between May 15 and June 10 and exceed 2 pounds (0.9 kg) per day during this time and drop off rapidly over time. Figure 2 presents typical gains of fall- and spring-calving cows, with parturition occurring during October to November and March to April, respectively.[16] The same pattern is displayed, with extremely high weight gain early in the grazing season and eventual weight loss by late summer and early fall. Most of the data were collected on crested wheatgrass seeding, but gain response to grazing is essentially identical on native species. For management reasons, crested wheatgrass seedings need to be fenced off and managed separately from native ranges, primarily because of differences in preference. Native flood meadows provide for somewhat higher gains, but the general trend is the same.[8]

The gain patterns presented in Figures 1 and 2 are simplistic and represent a composite over many years. There are many factors that affect these responses. Previous winter nutrition and management, quality of cattle, yearly climate patterns, condition of animals, etc., will modify the actual gain within a given time frame. Cattle grazed at lower elevations will shift the gain charts to the left and higher elevation vice versa, but the trend remains the same. Management schemes to alleviate poor production over much of the year will be dealt with in subsequent sections.

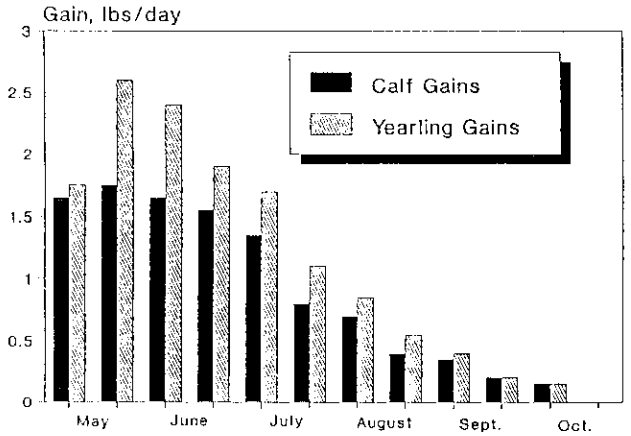

Figure 1. Typical weight gains of sucking spring-born calves and yearlings on sagebrush-bunchgrass range.

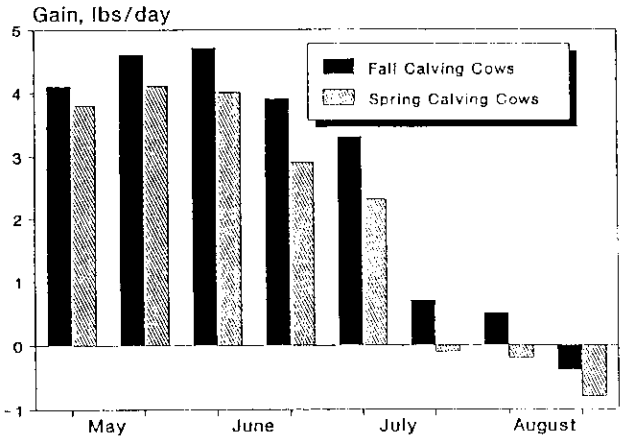

Figure 2. Weight gains of lactating cows on sagebrush-bunchgrass range.

NUTRITIVE VALUE OF RANGE FORAGES THROUGHOUT THE GRAZING SEASON

The gain data presented in the previous section are a direct reflection of the nutrient value of the range forages. These values are dependent on elevation, yearly climatic factors, and diversity of the forage base. As with the gain data, the general trend of forage quality throughout the grazing season will be presented and represents a composite over many years.

Concentration of certain chemical constituents of range forages are shown in Figure 3.[18] The critical nutrients, protein, energy, and phosphorus all decline as the grasses mature and cell wall constituents increase. The precipitation pattern permits only one growth cycle, resulting in all grass species, native or introduced, maturing at about the same time with little difference in quality between species. Supplementing minerals and vitamins will not substantially improve performance. However, if grazing is in a deficient area, then these minerals need to be supplied. Mineral content of plants varies considerably from one area to another. Other than phosphorus, minerals that can be deficient or, in some cases, excesses can occur, are magnesium, potassium, copper, zinc, selenium, and cobalt. Mineral nutrition problems are very localized and need to be evaluated on that basis. Vitamins A and E are the only vitamins of concern. Vitamin E deficiency is not commonly recognized and vitamin A deficiency is only a problem if on dry bleached feed over a period of 6 months or more.

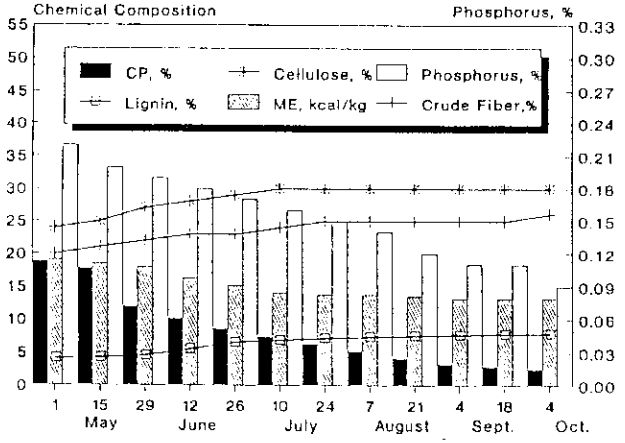

Figure 3. Chemical compositions of range grasses.

In addition to the reduction of nutrient content of the forage, the declining nutritive value to livestock is compounded by declining availability of the nutrients as shown by digestibility values in Figure 4.[18] This slows rate of passage and consequently total forage intake, which leads to poor livestock performance.

Browse, woody-stemmed perennials, and forbs, usually hollow-stemmed annuals, including most weeds, also make up an important component of range feed. Browse is generally higher in protein and

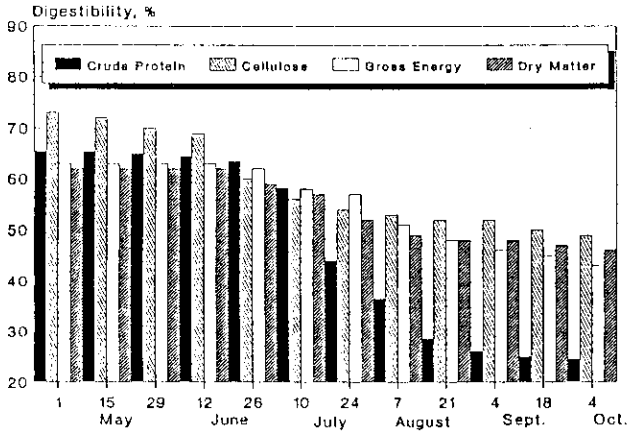

Figure 4. Digestibility of chemical components of grasses in range cattle diets.

lower in energy than grasses, with forbs exhibiting both seasonal and yearly variation, making them unpredictable with regard to availability and quality (Fig. 5). Browse and forbs are much more important in wildlife and sheep diets than in those of cattle, with cattle diets typically containing little to none of these forages. However, under certain conditions of availability and quality of grasses, as compared to the browse and forbs, they can become an important component of the diet.

NUTRITIVE REQUIREMENTS AS RELATED TO ANIMAL CAPABILITY TO OBTAIN NUTRIENTS FROM THE FORAGES

Nutrient requirements of various classes of livestock at different stages and levels of production can be fairly accurately determined from guidelines.[17] This information, in conjunction with the nutrient content and digestibility data presented in the previous section and determining the voluntary intake of grazing animals allows us to estimate the relationship between the animal's needs and what it can get from the forages. Energy expended for travel will increase requirements for range animals somewhat over small pasture or confinement feeding, but this can be calculated. Otherwise requirements are the same. Gathering data to make these needed evaluations involves laborious and expensive techniques such as chemical analyses of forages, digestibility determination either in vitro or in vivo, or fecal output for intake estimates and often employs rumen and esophageal fistulated animals, internal markers, or a wide array of other techniques described in various publications.[5,6,14] The recent development of boluses

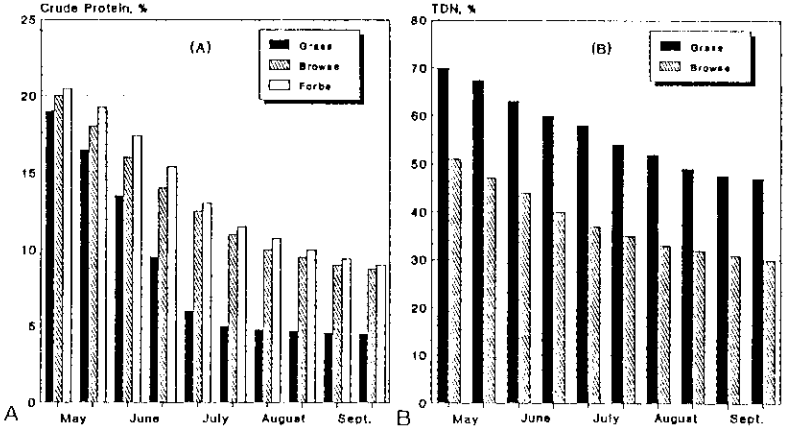

Figure 5. Crude protein content of grasses, browse, and forbs (*A*), and TDN content of grasses and browse (*B*) at various dates during the grazing season.

containing external indicators such as chromic oxide for estimating fecal output will help make gathering of these data more practical. Data of this nature that have been collected in a research unit or other rangelands can be applied to many other situations.

Figure 6 presents the digestible nitrogen and metabolizable energy yearling steers can obtain from range forage and the requirements to gain 2.2 (1 kg) or 1.1 pounds (0.5 kg) per head per day. Protein for either level of gain is becoming limited by late June to early July whereas energy becomes limiting by late June on the higher level and mid July on the lower level.

Digestible nitrogen and metabolizable energy that mature cows can obtain from range forage are presented in Figure 7. The protein deficiencies occur at about the same time as with the growing animals for lactating cows and a little later for gestating cows. Phosphorus deficiencies occur at about the same time as protein for all classes of animals. The lactating cow is short of energy by late July, with the gestating cow capable of meeting her energy requirements throughout the grazing season.

PRESCRIPTION SUPPLEMENTAL LEVELS TO FILL VOID BETWEEN ANIMAL'S REQUIREMENTS AND NUTRIENT INTAKE

Supplemental feed is employed when nutrients from the forage base become insufficient or inadequate for the level of production desired. Due to economic considerations, supplementation under western range conditions is usually centered around feeding a minimum amount of concentrates to supply the deficient nutrients. Substituting

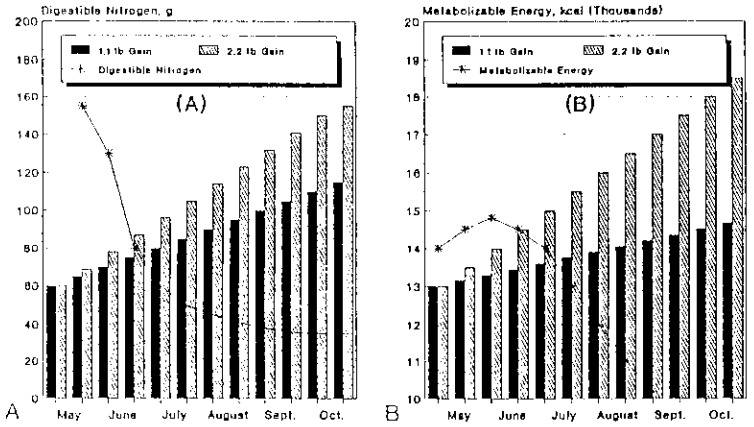

Figure 6. Digestible nitrogen (*A*) and metabolizable energy (*B*) requirements for 550-lb yearling steers and the amount of each derived from range forage.

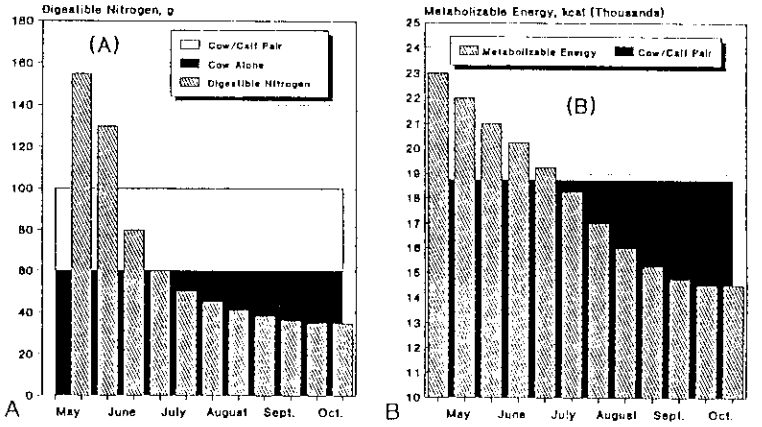

Figure 7. Digestible nitrogen (*A*) and metabolizable energy (*B*) requirements of lactating cows and the amount of each derived from range forage.

supplements for forage is, under most conditions, a costly practice. Forage availability should be adequate to provide maximum intake to negate substituting and also of high enough quality to at least provide maintenance and some gain for growing animals to make the supplement program profitable. In general, the higher the quality of forage, the more efficient and profitable the supplements. Obviously there are situations in which low quality forages must be supplemented to maintain animals.

A typical prescription supplement schedule for yearlings on range is presented in Figure 8.[33] This schedule is derived from the data

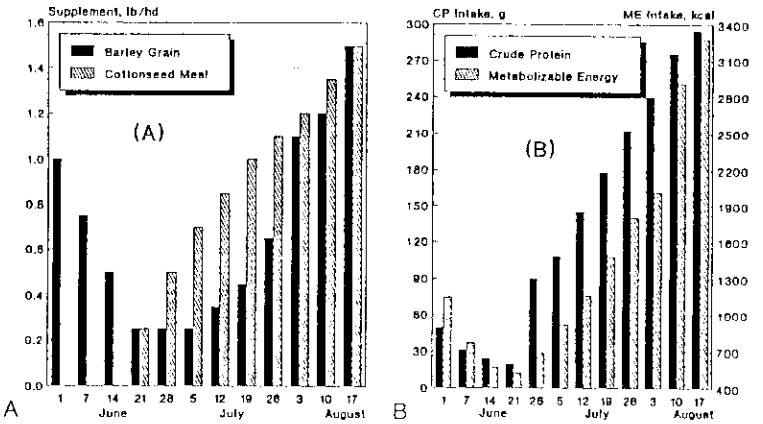

Figure 8. *A*, Supplementation schedule. *B*, Subsequent nutrient intake.

presented in previous figures and is designed to provide for 2 pounds (0.9 kg) daily gain on yearling steers. Increased supplemental levels above those shown have not proved to be economically sound, primarily because of increased costs, decreased forage intake and subsequent diminishing return from the supplement. Supplemental nitrogen is not necessary between turnout date in early May to mid June; however, the barley produces the amounts indicated and is needed for energy.

Previous figures would indicate that supplements are not needed during May and early June to maintain 2 pounds (0.9 kg) or more daily gains on yearling steers. However, if small amounts of nutrients are provided during this time, extremely efficient and profitable gains can be realized and these gains are not negated by compensatory gains later in the season. Figure 9 presents a composite of data where steers were supplemented from turnout in early May as opposed to starting in mid June. Increases of 0.4 pounds (0.2 kg) during this period were realized over those not receiving a supplement and this gain did not affect subsequent gains throughout the summer. Responses from energy supplementation in early spring, despite forage nutrient values being very high, may be attributed to the relatively high moisture content of the forage, which tends to limit dry matter consumption, an imbalance of protein and energy, slowing of rapid passage which decreases digestion and absorption by the host animal, or providing nutrients while adaptation to a new feedstuff via shifting of microbial populations occurs. Most of the protein of immature lush plants is in the form of nonprotein nitrogen and the supplemental energy source may be providing carbon chains for use of this form of nitrogen or the nitrogen contained in the concentrate may be providing by-pass protein. Data indicate that, because of decreasing forage quality, it is impractical to supplement for economic production beyond the middle of August.[33] Beyond this

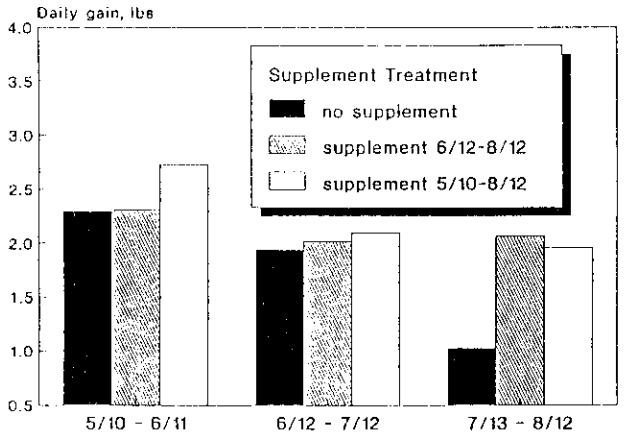

Figure 9. Daily weight gain of yearlings on different supplement treatments.

point, an increased supplement level inhibits forage intake and substitution rather than supplementing nutrients occurs.

These supplements were hand fed on a daily basis with adequate trough space to allow all animals to eat at the same time. For training of animals to the supplement and not reducing grazing time and subsequent forage intake, time of supplementation and setting up of a routine time and method to establish optimum grazing behavior also improves performance.[1] The gain response is under continuous grazing and high pasture use. By grazing half or less of the available forage, typical gains have been 2.6 to 3.2 pounds (1.2–1.5 kg) per day.[9] The cow herd can then follow the yearlings and use the remaining forage.

Gains on summer range vary considerably, depending on forage quality, quality of cattle, previous winter gain, management grazing systems and many other factors. Over the years, yearlings on Squaw Butte have had average gains of 1.2 to 1.8 pounds (0.5–0.8 kg) per day during the summer without supplements and 2 to 3 pounds (0.9–1.4 kg) with daily supplements. In the foregoing examples, supplemental protein was provided from cottonseed meal and energy from rolled barley. However, as long as protein and energy are provided, many different feedstuffs can be used with similar results. Nonprotein nitrogen sources, such as urea and biuret, under proper conditions, have resulted in gains approaching or equaling those with cottonseed meal, as long as the energy provided by feeding cottonseed meal was replaced by barley or other energy sources.[22] Nonprotein nitrogen is not effective with low quality forages unless additional energy is provided. However, care should be taken when urea is fed because of palatability and toxicity problems.[3,4] Urea supplements should be thoroughly mixed and precautions taken to insure that individual animals do not get more than their share. The concentration of urea in the diet is critical. Biuret, a condensation product of urea, essentially two urea molecules hooked together, releases nitrogen more slowly and is less toxic.

Creep feeding on summer range has been marginally effective. Under certain conditions it will pay but often does not. Likewise, supplementation of the cow herd during the traditional grazing period has not been practical or profitable under range conditions. Even in situations in which cows lose weight on range, they recoup losses when moved to meadow aftermath (forage), higher elevation range, rakebunch hay, or other fall feed prior to severe weather conditions of winter.

In general, unless in an area where specific minerals or vitamins are known to be deficient, minor nutrients are adequate. However, a good phosphorus source should be available to animals at all times, regardless of the management program. Two-compartment salt boxes with plain or trace mineral salt on one side and a 50–50 mix of salt and a phosphorus source on the other side have worked well. Intake of the phosphorus is low when forage phosphorus levels are high and high when forage phosphorus levels are low. Care must be taken, though, to monitor intake to provide enough phosphorus, but not allow excess consumption, because phosphorus is an expensive supplement.

The supplement programs described to this point have involved daily feeding of animals. They are not always practical or possible, particularly on the large expanses of western rangeland. For one reason or another, many producers cannot or will not feed a supplement unless it can be fed free choice at infrequent intervals. Supplemental programs based on free choice with controlled consumption of the supplement are desirable. Many vehicles for feeding supplement ad lib have been tried, including blocks, pellets, salt-limiting mixes, liquid feeds, etc., but none has been totally satisfactory in terms of controlling intake at the desired levels. Supplementation at the proper level enhances intake up to mid August, but additional feed decreases forage intake.[25]

Every other day and every fourth day energy supplement regimens have been tested against daily supplementation with gain reduced by one-fourth to one-half pounds (0.1–0.2 kg) per day on the alternative feeding. Late July and August gains were reduced by as much as 1 pound (0.5 kg) per head per day as compared to daily feeding.[33] These data indicate that a method of feeding supplements must be devised so that animals receive their supplements daily. Up to weekly supplementation of adequate amounts of protein, phosphorus and many other minerals and vitamin A has generally been shown to be sufficient. However, energy needs to be supplied daily for the most efficient conversion by the animal.

Salt has been used to control intake of supplements since the early 1930s with varying success. Salt levels have to be continually adjusted and in some cases exceed 50% to adequately control intake. Daily intake of salt has exceeded 2.5 pounds (1.1 kg) per day without ill effects,[26] but the use of salt to control intake seems to consistently reduce daily gains as compared to hand feeding.[33] Also, salt consumption is hard to predict with any great accuracy. It varies from year to year, day to day, pasture to pasture, animal to animal, etc., and depends on forage quality, quantity, type, maturity, and other factors such as previous salt consumption and weather. Salt content of the feed and water also have an effect. Adjustments on these types of supplement programs have to be made frequently, and it is very difficult to get a consistent daily intake of supplement at the levels desired. Although salt does work in some situations, it certainly is not the answer to controlling intake.

Feeding molasses as a supplement to cattle has been practiced since 1850, and urea with molasses since about 1950. Liquid feeds offer many benefits, including improved feed palatability and masking of undesirable flavors, consistent distribution of urea, high phosphorus availability, less waste, convenience, accessibility, and for mixing of top dressings, improved feed penetration, improved feed texture, and reduced dust and wind loss. Liquid feeds also serve as a vehicle for feeding medicaments, vitamins, minerals, antibiotics, and other feed additives. Liquid supplements are easily mechanized, with materials being handled by pumps from tanks, which allows rapid dissemination with little hand labor.

Problems connected with liquid feeds include controlling the consumption level on a herd basis, uniform consumption by individual animals, difficulty in maintaining uniformity of product, equipment cost, and weather changes, particularly cold weather, which can disrupt intake patterns. Overconsumption of urea-molasses products caused by lack of feed, ice or snow covered feed, insufficient water, letting cattle have access to liquid feed prior to feeding hay, etc., can be a major problem and cause digestive disturbances, diarrhea, inefficient animal performance, and possibly death. Calcium can be a problem ingredient, particularly in feedlots, because it is not soluble and is difficult to suspend in liquids. Urea is often used because amino acids and/or natural proteins are difficult to suspend. High levels of phosphoric acid or salt, used for intake control, may result in corrosion of metals, particularly in conjunction with water condensation, and subsequent dilution. Corrosion of galvanized metals can result in zinc toxicity.

Total energy intake can also be a problem with liquid feeds. Molasses is a good source of energy (about 88% of the energy value of barley); however, most liquid feeds contain only 50% to 70% molasses. This lower energy restricts urea use, particularly in high roughage situations, and leads to poor animal performance. In supplement schedules that call for 2 to 3 pounds (0.9–1.4 kg) of barley, it would require 3 to 7 pounds (1.4–3.0 kg) of liquid supplement to be isocaloric. In general, when a supplement exceeds 3 pounds, roughage intake is reduced. Also, liquid supplements become very expensive at these levels. Fats, both animal and vegetable, and alcohols, both ethyl and propylene glycol, have been added to liquid supplements as a way to increase energy in liquid supplements. The price of these additions is often prohibitive to wide scale use.

Properly used with the right class of animals, liquid supplements can be as effective as any other supplement type as long as needed nutrients are provided. Some managerial and nutritional problems must be worked out, particularly continual availability of forage, regular feeding, intake control, and energy level, before their optimum value is reached. Liquid supplements are not always the best buy in terms of nutrients or cost and any supplement containing urea should be used with caution.

Blocks of various types offer many of the same advantages and disadvantages as liquid feeds. Blocks can serve as a vehicle for nonprotein nitrogen, medicaments, antibiotics, vitamins, minerals and other feed additives in addition to masking undesirable flavors, cutting waste, reducing dust, and providing a certain amount of convenience. As with other supplementation methods, with the exception of hand feeding, controlling intake, both on a group basis and between individual animals, is the biggest problem with blocks. Intake control measures in blocks are primarily through the ingredients and/or the physical characteristics of the block. As with liquid feeds, results from range studies using blocks have not been encouraging.[33] Blocks can be an effective supplement method when properly produced and used. However, as with all the other free choice supplement methods, intake is still a major problem and more work needs to be done on this.

Daily hand feeding of supplements is still the preferred method,

where possible. Daily gains have always been reduced with any of the convenience supplement schemes. However, this does not fit into all management schemes or situations. Cost, ease of handling, mixing, and feeding facilities all have to be considered along with the manager's abilities. Mechanics and supplementation cost have to be determined in each individual situation. Salt control, blocks, liquids, pellets, etc., all offer viable alternatives to hand feeding in specific instances.

The relative advantages of each kind of supplement need to be evaluated to determine where it fits into the livestock program. Final costs of production are more important than out-of-pocket costs. Consider the feeds available and the nutrients required by the animals and compare the available supplements that will supply the proper nutrients at the best price. The cheapest supplement may not be the most profitable to feed in terms of animal performance per unit of cost. Safety, nutrient adequacy, and management must be considered along with cost before the decision is made to feed one type or another.

OPTIONS BEYOND ECONOMICAL SUPPLEMENT LEVELS

Data indicate that because of decreasing forage quality it is impractical to supplement for economic production of market animals beyond the middle of August under the range conditions at Squaw Butte. Beyond this point an increased supplement level inhibits forage intake and a substituting of expensive concentrates for relatively cheaper forage occurs.

Sell Market Animals or Move to Better Feed

By removal of salable yearlings from range early, the remaining feed can be used for maintenance of the breeding herd. Along with early weaning, which will be discussed in the next section, additional condition can be put on the cows before the winter.

A viable option is to put yearlings on better feed. This may be meadow aftermath from the haying operation on irrigated meadows, rake-bunched hay, irrigated pastures, higher elevation ranges, etc. However, when cattle are moved to a new feed source it takes a 2 to 4 week adjustment period before efficient gains are realized. Thus, it is important that the feeding period prior to sale of these animals is long enough to warrant moving them as opposed to early sale off range.

Time of Weaning

Traditionally, calves in the Great Basin region have been weaned at about 7 months of age, during late October or the first part of November. However, as shown in previous figures, gains of these calves are very poor by late August. By removing these calves early, they can be put on better feed with the cows remaining on range. Dry cows do well on range feed during the fall and without the suckling calf will come into the winter in better condition. The condition of cows coming into the winter is important, as the total nutrients required to

get the cow through the winter and bred back in the spring are reduced as condition going into the winter is increased.

Figure 10 presents some early weaning data from the Squaw Butte herd. Early-weaned calves were removed from their dams on September 12 and put on meadow aftermath and regrowth plus supplemented with 2 pounds (0.9 kg) of barley and 1 pound (0.5 kg) of cottonseed meal. Late-weaned calves remained on range with their dams until October 12 and then were managed with the early-weaned calves. On November 12 all calves were fed meadow hay and received 2 pounds (0.9 kg) of barley and 1 pound (0.5 kg) of cottonseed meal throughout the winter.

Early-weaned calves outgained late-weaned calves by 20 pounds (9 kg) from September 12 to October 12, despite going through the stress of weaning and adjusting to new feed. During the next period of time, from October 12 to November 12, the early-weaned calves outgained late-weaned calves by 31 pounds (14 kg) and were now 51 pounds (23 kg) heavier. Late-weaned calves compensated somewhat over the remainder of the winter, but were still 24 pounds (11 kg) lighter on April 12.[20]

These results would likely favor early-weaning more if calves were weaned somewhat earlier for the early-weaned group and closer to the traditional mid-November date for the late-weaned calves. The advantage of early weaning depends on the quality and expense of feed available for the early-weaned calves and the options available for the late-weaned calf, such as moving the cow-calf pair to higher elevation range or to better feed, such as irrigated pasture or rake-bunched hay. In many cases early weaning does provide a management tool for increasing productive efficiency off rangelands.

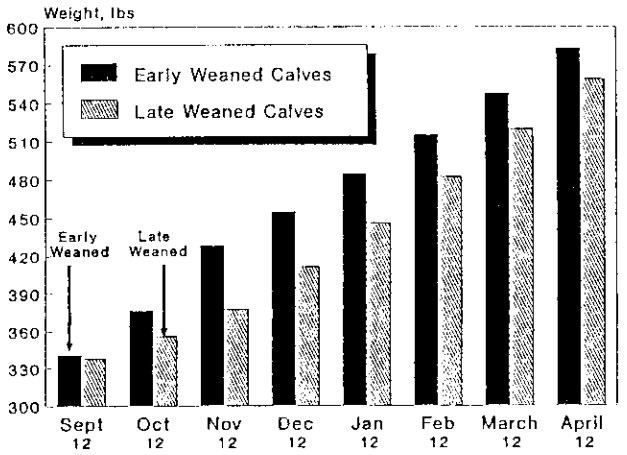

Figure 10. Influence of weaning date on calf weight.

Chemical Curing of Range Forages

Manipulating the forage chemically presents another option for combating poor quality as plants mature. An example of this potential for providing higher quality late-season forage entails growth arrestation of plants while they are high in nutritive value, through application of paraquat (1,1'-dimethyl-4, 4' bipyridinium ion), a bipyridylium herbicide. Crested wheatgrass was treated in mid to late June when the plants were in early anthesis. The chemical was foliar applied at various rates and concentrations with ×77 surfactant employed.[29] A description of treatments and ramifications with various grasses, weather conditions, concentration levels, mode of action, residues, and other information has been reported.[28]

As shown in Figure 11, late-season daily gains of yearlings are increased by over 0.5 pound (0.2 kg) per head per day on chemically cured forage. Chemically cured forage retained higher levels of phosphorus, potassium, lignin, ash, and protein (Fig. 12) and reduced levels of calcium and ether extract, with cellulose being similar. The values in Figure 12 represent change in forage quality due to both maturity and selective grazing. The relative decline of phosphorus between naturally and chemically cured forage closely followed that of protein.[29] Forage intake was increased by about 1 pound (0.5 kg) per head per day on treated forage. The increased quality of forages not only improves daily gains and allows growing animals to be grazed later into the season but also represents a substantial savings in the amount of supplementation needed and improves the efficiency of supplements provided. The addition of 1 pound (0.5 kg) of supplement (barley and cottonseed meal) provided an additional gain of 0.4 pounds (0.2 kg) per head per day.

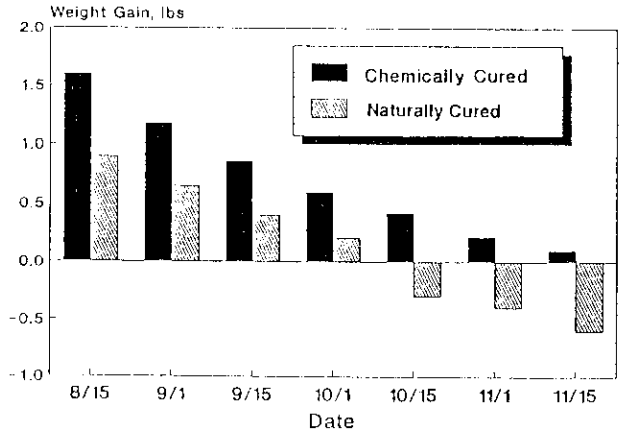

Figure 11. Daily weight gain of yearlings on naturally and chemically cured range forage.

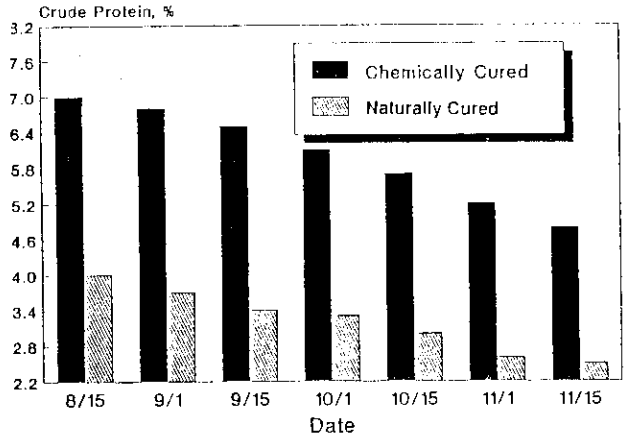

Figure 12. Percent of crude protein content of naturally and chemically cured range forage.

Chemically cured forage appears to have a great deal of potential on perennial grass stands on rangelands. The question with chemicals is whether the potential market is great enough for companies to produce them for this purpose and whether they can be cleared for this use. Paraquat is cleared for other uses in the United States and use on grasses in other countries. Paraquat was used as an example here and, of course, other materials may provide similar results.

Producing Slaughter Animals on Range

Following the supplement schedule described earlier, steers in mid-August are carrying a great deal of condition. It was postulated that by leaving these cattle on range and gradually increasing the concentrate level to a full feed, using the range as a roughage source, steers could be brought to a suitable slaughter grade in about 90 days. There are many alternatives that can be employed. The relationships involved in beef production and marketing need to be considered. Production and growth rate need to be considered from birth through the entire growing phase, with feed requirements, efficiency, and economics all being accounted for in reaching an acceptable goal for slaughtering these steers by mid-November. Beyond this time, requirements accelerate considerably due to cold weather, and animals probably should be removed from range prior to that time. Management considerations to provide for continuous growth need to be employed from birth to slaughter to insure that these animals reach an acceptable slaughter weight.

A typical supplement schedule to bring steers to full feed is presented in Figure 13. The level of concentrate was increased daily as long as the feed was cleaned up each day and held constant or de-

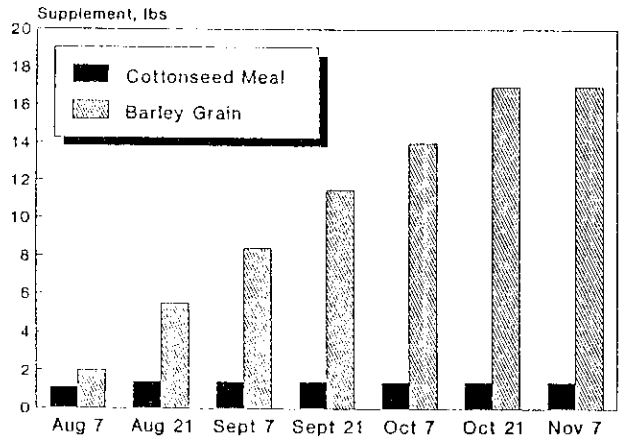

Figure 13. Daily supplement intake of yearling steers during the finishing period.

creased if feed was left. When concentrate levels reached 8 pounds (3.6 kg), the ration was fed twice daily. When full feed, approximately 1.75% of body weight, was reached in mid to late September, feed was presented free choice.

This range regimen (Treatment 1) is compared to four other treatments in Figure 14. Treatment 2 represents feedlot steers to mid November; treatment 3, range to mid-November and then feedlot to early January; treatment 4, feedlot to early January; and treatment 5, irrigated pasture to mid-September then feedlot to early January. All animals were on the prescribed supplement schedule to mid-August.

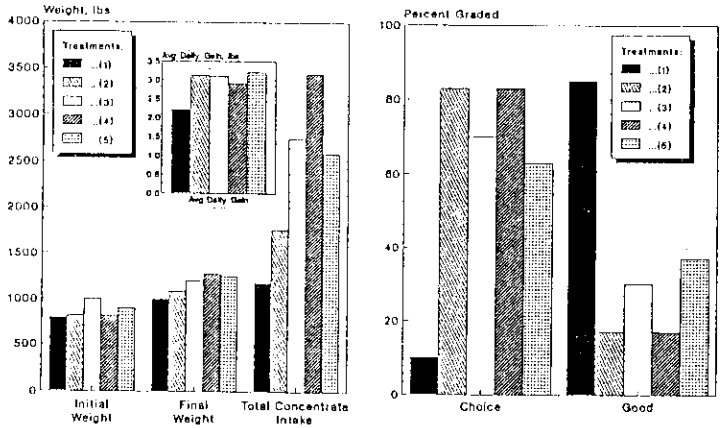

Figure 14. Weight gain, feed, and carcass data during the finishing period.

Steers slaughtered off range weighed less, gained less, and graded lower than steers on the various feedlot systems. However, their total concentrate intake was 34% to 76% of that of the feedlot steers and returned more per dollar invested in feed. Adding yardage, interest on investment, equipment, and environmental preservation costs give the range-fattened steers an advantageous position. Detailed data on treatments, feeding regimens, carcass, and economic evaluation have been reported.[32] Economic evaluations are valid only for a given market and need to be calculated for the price structure or time-frame that exists.

Some consumer preference studies have shown the consumer would buy more of the USDA good grade if it were available.[10] Taste panel work in these trials was somewhat inconclusive. However, these trials and others show that although taste panels detect differences between forage, forage plus limited grain, and feedlot beef, differences were small and all were rated in the favorable zone of the hedonic scale. It has also been concluded that it is important to feed British breeds to slaughter weights of 1,000 to 1,050 pounds (454–476 kg) on limited feed to insure scoring in the acceptable zone.[27]

There are many other alternative systems and management schemes of producing slaughter cattle, including use of irrigated pasture or improved pastures in conjunction with the range feed. A short feeding period at the end of a fairly high grain supplement while still on pasture may be desirable to change color and taste of fat and still provide a substantial savings of grain.

One of the most exciting possibilities in terms of producing an acceptable carcass with a small amount of grain is by using the chemical curing of grasses for late-season grazing as previously described. Acceptable carcasses from range could be produced with as little as 10% of the grain intake of normal feedlot regimens.[32] Many other alternatives, including incorporating straw and other waste products into the systems, calving in the fall and finishing these calves on range, various winter feeding regimens, and different rations have been studied.[10,12,20,24,36]

There are a number of inherent advantages to fattening steers on range or pastures. Because of the low density of cattle in comparison to feedlots, range feeding, in many situations, does not contribute to water and air pollution problems. Less confined conditions also provide for drier, healthier feeding conditions and eliminate the need for manure removal. Range feeding also has less expense in permanent feedbunks and handling equipment. Hauling expense, overhead costs of middlemen and selling expenses may also be less because of retained ownership and keeping the cattle at the same location.

Other factors need to be considered before range finishing can become a large scale industry. One is carrying capacity of available ranges. The previously reported study was conducted on crested wheatgrass ranges with a carrying capacity of about 2.5 acres (1 ha) per animal unit month (AUM). On ranges with a carrying capacity of more than 5 acres (2 ha) per AUM, the distance cattle have to travel for feed could have an adverse effect on rate of gain. Average carrying capacity

of semiarid ranges is about 10 acres (4 ha) per AUM. Thus, opportunities are somewhat limited.

Another consideration is that these ranges are, in general, best suited for cow-calf production. It seems unlikely that production of slaughter animals off range would, or should, increase to the extent that it would adversely affect the number of brood cows that can be carried. Also, limited supplies of grain are produced in these arid regions. Slaughter beef production should probably be limited to higher quality ranges and areas in which grains are readily available.

The possibility that production of slaughter grade cattle from range or grass will replace production from the feedlot is remote. On the contrary, it provides another marketing channel for cattle producers and another choice of meat for consumers. We will undoubtedly always produce feedlot beef in this country. A market will probably always exist for highly finished beef for certain clientele, such as restaurants, hotels, and caterers and for a portion of the population that simply prefers beef with a high degree of finish. However, a tremendous market also exists for those who want a leaner cut of beef, prefer the taste of short fed animals, or would like to buy a cheaper grade of beef. Consumption of imported beef is an indication of preference for this type of product, and we should be competing stronger for a share of this market. One reason these countries can undersell us is that they depend heavily on forages rather than more expensive concentrates for production. However, low land and labor costs also are considerations.

Data suggest that range or pasture supplemented steers can be adequately finished by any one of several systems, depending on many factors including a market for the grade of cattle produced. The overall beef system used ultimately responds to the market place and to profitability.

Time of Calving

Time of breeding and subsequent calving is another management tool for getting optimum production out of a given forage situation. Again, it is important to inventory the forage resource with respect to quality and relate this to nutritional needs of the animals on a year-round basis. Availability of outside feed sources such as hay, grain, irrigated pasture, etc., also need to be considered, along with management preferences and capabilities.

On most desert range operations, parturition occurs during March and April. Problems encountered at this time include poor calving weather, long breeding seasons, and light weaning weights. Problems such as infectious diarrheal and respiratory diseases are compounded by calving on wet muddy flood meadows during the spring before cattle are allowed on the range. Wind is also prevalent at this time of year, and wind-chill can adversely affect calf morbidity and mortality.

By calving during the fall (October and November), a calf is produced that is big enough to efficiently use the early high-quality forage available in the spring; with the cow still producing some milk, make

rapid gains during this period. This program allows calves to stay on the cow longer and continue to make economical gains. Spring-born calves are not big enough during late April to mid June to effectively take advantage of the high quality forage. By the time they are mature enough to use range feed, quality has declined substantially in both protein and energy content. The spring-born calf cannot get much from the forage at this time and the cow's milk production has declined due to the decreased forage quality. Fall calving, while increasing the cost of wintering the lactating cow versus a dry cow, provides a bigger calf to use high quality range feed and increased weaning weights. Wintering cows and creep feeding calves will be dealt with in a subsequent section on winter feeding.

Weaning weights of fall-born calves at Squaw Butte have exceeded that of spring-born calves by 150 to 200 pounds (68 – 91 kg), with over 1,100 calves over 5 years included in the data (Fig. 15). Most of the fall-born calves were creep fed 20 – 100 pounds (9 – 45 kg) of feed. Due to confinement on winter feed grounds, creep feeding of the fall-born calf is more practical than on ranges with spring-born calves. Most of the weight advantage is due to higher gains early in the spring on range, creep feeding, and the additional length of time on the cow. Weaning the spring-born calves later does not appreciably increase their weaning weight, since little gain is made by these calves beyond the first of September, under the existing forage conditions.[18,35]

Conception rates and weaning percentages were also slightly higher in fall-born cows ($P > .05$). Conception rates and weaning percentages represent all cows exposed to breeding. Cows that were

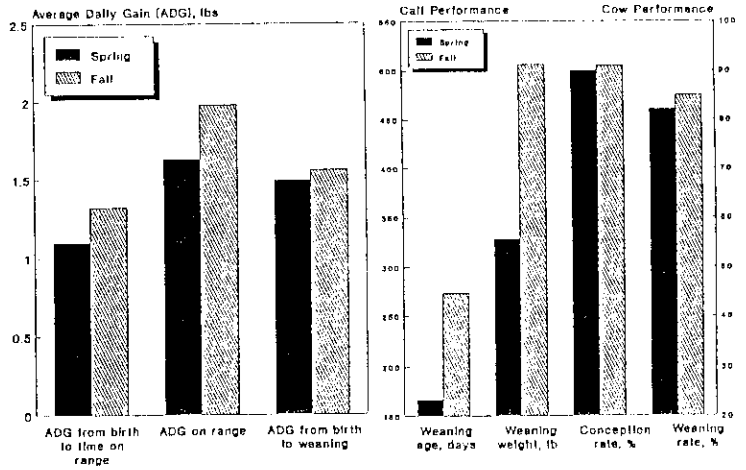

Figure 15. Performance data of spring- and fall-born calves and cows averaged over 5 years.

culled because of pregnancy test results, advanced age, cancer eye, or other reasons prior to weaning were tabulated as not weaning a calf.

Winter management of these fall-calving cow-calf pairs is more conducive for intensive management and nutrition practices to improve efficiency of both production and reproduction. Clinical cases of calfhood diseases, such as scours, and respiratory problems are minimal in fall-born calves, requiring treatment of less than 1%, whereas 10% required treatment in the spring-born calves. Weather conditions are favorable and meadows are bare and dry during October and early November. This same morbidity rate occurred at weaning time with spring-born calves that required considerably more treatment. With cows congregated on hay meadows, the identification and treatment of problems and diseases are also facilitated with the fall calving.

Concentration of the fall-calving cows on winter feedgrounds also facilitates breeding programs. Artificial insemination programs are much easier to accommodate and, with natural breeding, fewer bulls are needed. The advantages of confinement breeding have proved to be beneficial in shortening the breeding season and the calving interval. The data from Squaw Butte do not indicate much of an advantage in conception rates over a 60-day breeding season. However, compared to most range operations, the station cows are on relatively small range pastures, not exceeding 2000 acres (810 ha), and stockwater is hauled, which means animals are more concentrated. The difference in conception and weaning rates would likely be much higher in favor of fall calving on most range operations.

Fall calving offers many advantages, particularly on desert range operations where higher elevation ranges or improved feed resources are not available for cow-calf pairs in late summer and fall. However, a major deterrent to fall calving is the policy of public agencies in charge of public grazing of counting a calf over 6 months of age as a full animal unit on rangelands. This in effect halves the size of the cow herd. This makes it nearly impossible to incorporate fall calving where public rangelands represent a majority of the summer feed. With over 80% of the desert rangelands administered by the Bureau of Land Management or Forest Service, this represents a large deterrent to fall calving. These policies exist despite data showing that the fall-calving cow-calf pair consumes only 25% more forage than the spring-calving pair.[16] In addition, the older calf and cow spread out over the range better, improving distribution and reducing overgrazing in riparian areas, waterholes, meadows, etc. Despite problems with public rangelands, time of calving does provide viable alternatives for many range operations. Producing slaughter grade animals off range from fall-calving cows is discussed in other publications.[9,32]

WINTER FEEDING PROGRAMS

Winter nutritional needs are dependent on managerial goals and subsequent range grazing programs throughout the following grazing season. Winter supplementation programs are simpler and more easily adopted. Harvested hay provides a nutritionally constant feed source and therefore a stable supplement that does not change over time. Also, cattle are in more confined areas, making supplementation easier.

The following discussion will assume hay is being harvested at the proper time, which provides hay with crude protein ranging from 7% to 9%. Date of harvest or maturity of plants at harvest probably contributes more to quality of hay than any other single factor. The earlier hay is harvested the more available nutrients are for production. However, due to spring flooding conditions in many areas, meadows can seldom be cut prior to late June or early July. These dates happen to correspond to near maximal levels of protein and dry matter production on the meadows. Protein and energy content of meadow hay harvested at various dates and digestibility of various nutrients are presented in Figure 16.[21]

Growing Animals

Much of the roughage used for wintering calves and yearlings in most of the west is native meadow hay. Factors contributing to its low quality for growing animals are relatively low levels of crude protein, low digestibility, and high crude fiber values. Young animals simply cannot consume adequate quantities for acceptable performance. Weaner calves on hay alone do little more than maintain themselves and, in some cases, may lose weight.

Many studies reporting the effect of winter gain on summer gains have been conducted with the idea of obtaining inexpensive gains on grass and selling long yearlings as feeders in the fall. High rates of winter gain together with the increased number of days on feed have a

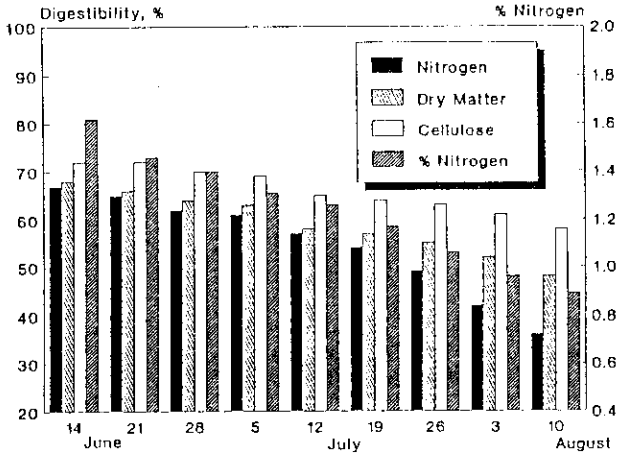

Figure 16. Apparent digestibility of nitrogen, dry matter, cellulose, and nitrogen content of hay harvested at different dates.

significant negative effect on subsequent summer gain. However, calves restricted to limited winter gains for long time periods (100 days or longer) are considerably lighter at the end of the summer grazing period. In short-grass years when growing stock must be sold in the spring to maintain the cow herd, there is a considerable economic loss from the restricted winter feeding program. Total digestible nutrients required during the winter per pound of gain accumulated during both the winter and summer periods reach a minimum when animals gain 1.2 pounds (0.5 kg) per day during the winter, with the greatest return over feed costs occurring at about 1.6 pounds (0.7 kg).[2] Steers should be fed to gain 1.5 to 1.8 pounds (0.7–0.8 kg) per day when feed cost-cattle price relationships appear favorable and 1.0 to 1.4 pounds (0.5–0.6 kg) per day under less favorable conditions. Calves can gain up to 1.6 pounds (0.7 kg) per day in the winter without substantially affecting summer gain as long as the animals are supplemented during the summer to gain at a maximum rate. Without supplementation, the summer gains are drastically reduced with increased winter gain levels. The size of the calf entering the winter period also affects the economics of the optimum winter gain. Other management goals, such as producing range-slaughter animals and target weights for optimum development of replacement heifers also need to be considered for determining desired winter gains.

Supplemental protein and energy must be fed along with native meadow hay to provide economical gains for wintering weaner calves and yearling cattle. Protein is critical here or in any feeding regimen because if protein is deficient and microbial protein needs are not met, then microbial numbers are decreased, digestion of forage is reduced, rate of passage is slowed, and consequently intake is reduced. Energy and other nutrients are shorted as well, due to reduced dry matter intake. A combined supplement of 1 pound (0.5 kg) of cottonseed meal plus 2 pounds (0.9 kg) of barley, or their equivalent, with a full feed of good meadow hay provides a well-balanced growing ration for weaner calves. Figure 17 represents a typical gain response and cost per pound of gain with and without supplements. Feed values used were $50, $100, $200/ton for hay, barley, and cottonseed meal, respectively. Supplements were fed on a daily basis. Gains on hay alone have varied from 0 to 0.6 pounds (0.3 kg) per day, depending on the hay quality. Supplemented calves have gained 0.9 to 1.7 pounds per day (0.4–0.8 kg) depending on the quality of hay and calves. Supplementing above this level will reduce hay intake and often increases cost per pound of gain. A phosphorus source should be available on a free-choice basis.

Under carefully controlled conditions, nonprotein nitrogen products such as urea and biuret can be used in place of cottonseed meal as a protein source. Gains will approach those of cottonseed meal as long as the energy lost from the removal of the cottonseed meal is replaced by barley or another energy feed. In a properly balanced and well-mixed ration, urea can increase efficiency and lower cost of production. Increased frequency of feeding will increase performance with urea supplement. However, under less controlled conditions, palatability and

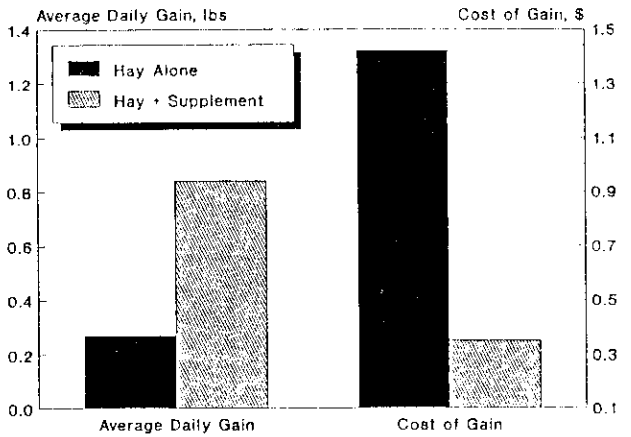

Figure 17. Winter daily weight gain and cost of weight gain for weaner calves with and without supplement.

toxicity problems can arise when urea is fed. Results from urea with low energy, high roughage, or limited feeding programs can be disappointing. Biuret is more palatable and acceptable to the animal and is less toxic, making it a more desirable source of nitrogen under these circumstances. Increased efficiency can often be realized by supplying the supplemental nitrogen with both a natural and nonprotein source.[23]

Condensing meadow hay bulk through different processing methods offers some opportunity for greater consumption and, consequently, an improvement in calf performance. Chopping or wafering hay does not seem to offer much improvement. Pelleted hay can increase intake by 25% or more and roughly double gains over long hay.[19,39] The main disadvantage of processed hays is added costs of grinding and pelleting, along with transportation costs to and from the feed mill, or the cost of equipment to do it in place. Supplements, in most cases, are probably a cheaper way of improving performance.

High quality alfalfa hay alone often will provide adequate winter gains on growing animals. Average to poor quality alfalfa does require an energy supplement. Poor to average quality alfalfa hay does not provide more energy than average quality meadow hay. Whereas chopping did not improve performance with meadow hay, calves on chopped alfalfa consumed more and gained considerably more than those on long hay.[19]

Alfalfa also can be used effectively as a protein supplement for meadow hay. Two to three pounds of alfalfa will provide as much protein as a pound of cottonseed meal and, when fed with an energy level similar to the standard supplement, will give similar gain responses.

Mature Cows

Older animals with the capacity for more feed can usually meet their requirements from meadow hay provided adequate amounts are available. In many livestock operations, supplements are used primarily in the winter for maintenance. In general, mature pregnant cows on a full feed of meadow hay or limited alfalfa do not need additional nutrients. However, lactating cows, first-calf heifers, and replacement heifers do, on occasion, need supplemental nutrients. The overall objective of most wintering programs is to get cows through the winter as economically as possible in condition to calve, milk well, and rebreed in the spring.

Grass straw, a by-product of the grass seed industry, may provide beef producers with a cheap source of roughage for maintenance purposes and help grass producers recover the cost of removing the straw. Cows have been successfully wintered on grass-straw-alfalfa mixes and on grass straw plus 0.7 pounds (0.3 kg) of cottonseed meal and 1.3 pounds (0.6 kg) of grain. Depending on straw quality and cattle condition going into the winter, ratios of 4 : 1 to 1 : 1 of grass straw to alfalfa will adequately maintain pregnant cows. Lactating cows require about a 1 : 2 ratio.

Harvesting and feeding hay is the most expensive practice of a range cattle operation. It costs approximately $30 per ton to produce hay and feed it out. Wintering cows on rake-bunched hay has proved to be a viable alternative. With this system, hay is cut, then raked into small piles, 80 to 120 pounds (35 to 54 kg), and left in the field. Cows are then strip grazed, by using New Zealand type electric fences, throughout the winter. Figure 18 shows the weight gain change of these cattle as compared to traditionally hand-fed cows on harvested feed. Cows grazing rake-bunched hay came out of the winter in better condition than controls and did not receive any supplements or supplemental hay. Conception rates, calving interval, weaning weights, and attrition rates have been equal between control and treatment groups.[31]

Cattle have been wintered on rake-bunched hay now for 10 years and in only 1 year was emergency hay fed. In that year, the bunches were smaller and the high ground was grazed first, leaving the low areas where snow was as deep as 3 feet and a very unusual ice rain put a layer of ice on top of this, making it impossible for cows to find the hay. With higher, more compact bunches being used now and using low ground early, this can be avoided.

The rake bunches appear to emit heat, possibly due to fermentation, and to some extent tend to remain reasonably open, or at least visible, through the snow. They discolor and are not attractive, but have a sweet smell similar to haylage. During the one year when supplemental hay was required, cows would leave the feed ground early and search for rake-bunches, showing a definite preference for them. Bunches have been successfully grazed through long periods of 24-inch snow cover and under 12 inches of water toward spring.

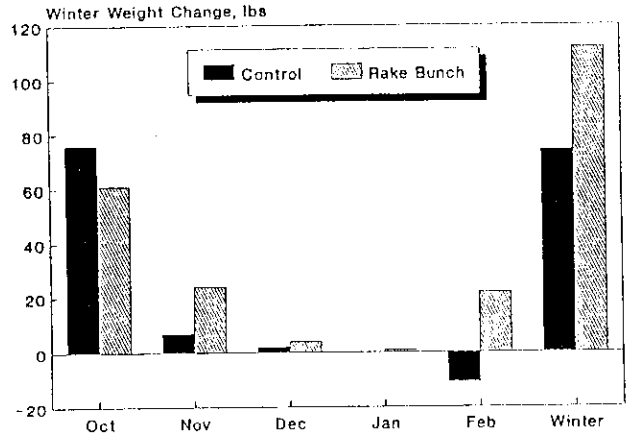

Figure 18. Winter weight change of cows on baled (control) or rake-bunched hay.

Weekly fence movements seem to be near optimum, creating very little waste, in fact less than with traditional feeding.

One of the keys to the increased performance of cows on rake-bunched hay and reductions of waste occurs in the spring when the weather warms and the meadows become wet and muddy. Cows on the rake-bunched hay continue to graze aggressively through this period, whereas the traditionally fed cattle tended to brawl and follow the feed wagon, tramping hay into the ground. They would then leave the feed ground and attempt to graze emerging spring grasses.

The cost of wintering cattle on rake-bunched hay has been $30 to $40 less per head than the traditional feeding of harvested hay. The bunches appear to have little effect on subsequent production and composition of forages produced by the native flood meadows.

Feeding the ionophore, monensin, a biologically active compound produced by *Streptomyces cinnamonensis*, has proved effective in either putting additional weight on cows over the winter or keeping the weight constant and reducing hay intake.[37,38] Cows fed a full feed of meadow hay plus 200 mg of monensin had daily gains of 0.2 pounds (0.1 kg) higher than cows fed meadow hay alone.[34] In studies where cow weights were kept equal between control cows receiving meadow hay and cows receiving meadow hay plus monensin, hay savings of up to 13% were realized. This represents another management tool for improving productive efficiency of range cattle operations. Monensin feeding has also partially alleviated the negative reproductive performance of replacement heifers receiving implants.[34] The use of monensin with very low quality forages can seriously affect weight gains and body condition scores in pregnant cattle.

One of the major nutritional concerns of calving in the fall is the

nutrient requirements during the winter. During cold weather, energy must be provided for maintenance as well as for lactation and conception. An early assumption was that lactating cows on meadow hay and their calves would need additional energy and possibly protein to meet maintenance, productive, and reproductive requirements. For 3 years cows were supplemented at two energy levels with three protein sources, which included cottonseed meal, biuret, and urea. Calves were creeped at two levels, free choice and half of free choice. Calf gains were similar from cows on the two energy levels and pounds of calf weaned actually favored the cows on low energy due to a 4% higher mortality rate in calves from high energy cows. Most of these calf losses were due to respiratory problems, pneumonia, and scours. Cows fed biuret performed considerably lower than those fed the other protein sources. The higher creep level added 11 pounds (5 kg) to the weaning weight and 19 pounds (9 kg) of calf production per cow.[35] Due to these results, the last 7 years of the study, the previous high energy cow supplement was eliminated and the previously low energy ration was compared to hay alone and compared to free-choice creep feeding to no creep and all the interactions. Biuret was retained as a protein source and compared to cottonseed meal. This provided two energy levels and two protein sources.[35]

The addition of protein alone (biuret) to meadow hay did not improve performance. Cows on hay alone produced 16 pounds (7 kg) more calf per cow. On the high energy level cottonseed meal and biuret cows produced with a slight advantage of 9 pounds (0.4 kg) over those receiving cottonseed meal alone. Figure 19 shows summary data from these trials. When calves were not creep fed, all supplements fed to cows produced a negative response in pounds of calf produced per cow. Supplementation of cows produced negative effects in most cases and would not be feasible. However, creep feeding efficiency was increased when cows were supplemented with additional energy. Throughout these trials there was a slight negative effect on cow production and reproduction when calves were creep fed and cows were not supplemented. The larger calf may exert more aggressive nursing behavior, increasing milk flow and nutrient requirements of the cow.

Creep feeding year around as opposed to either summer or winter was compared to no creep for 1 year. Results show that creeping both winter and on range to be inefficient. Either creep in the winter or summer alone provided more efficient gains. It would be more convenient and feasible to creep on the winter feedgrounds than on summer range. Details of creep feeding results have been reported.[35]

The data indicate feeding good quality meadow hay alone may be the most profitable way to winter fall-calving cows and their calves. During times of high cattle prices in relation to feed costs, it may be profitable to supplement the hay with both protein and energy and to also creep feed the calves. Winter creeping of calves without supplementing cows may also pay when price conditions are favorable. Supplementing cows without creeping the calves did not pay under any conditions in these trials. These results are somewhat surprising; however, some of the treatments may have altered hay intake. These conclusions are valid with good quality meadow hay or better forage, but results would be different with poor quality hay. Heavier milking cows would have higher nutrient requirements and may also change results somewhat.

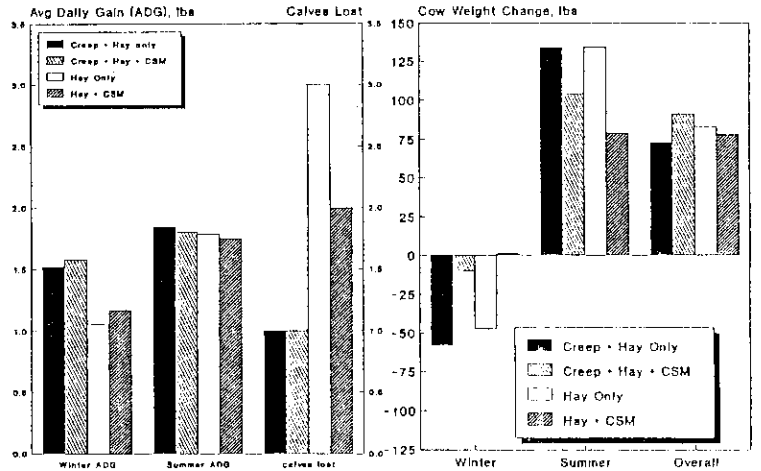

Figure 19. Creep feeding and supplementation influences on calf and cow performance during the winter and subsequent summer feeding period.

One other management consideration that may be beneficial for many range operations is early turnout of the mature cows. This requires saving feed on range from the previous growing season for use early in the spring of the next year. The current year's growth on range is not adequate to maintain cattle until early to mid May, so old feed must be used or harvested feed hauled to range to maintain cattle at an adequate level. By turning out March 1 and calving on range, many of the health problems connected with calving on the wet muddy meadows are negated. Cattle can spread out more on range and the brush and juniper provide excellent thermal cover for young calves. This also facilitates the rake-bunch treatment by getting them off the meadows prior to spring flooding.

SUMMARY

A number of nutritional and managerial schemes have been presented to help optimize range livestock production. Forage quality, animal requirements, and the animals' ability to meet their requirements from the forage is presented. After determining the nutritional value of the forages and animal requirements, prescription supplemen-

tation produces very efficient additional gains. Management alternatives to compensate for poor quality forage on range in late summer and early fall, such as selling market animals, moving to better feed, chemical curing of forages, time of calving, time of weaning, and using the range as a feedlot are discussed. Winter feeding programs using native flood meadow hay as a base were also presented for both growing animals and mature cows. Included were discussions on using rake-bunched hay, an ionophore, and feeding strategies for wintering cows. Material presented illustrates a philosophy of range nutrition with methods and procedures that are adaptable to grazing systems in all parts of the world. It should be noted, however, some data need to be extrapolated to fit local conditions.

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APPENDIX 3

Van Tassel, L., A. Torell, N. Rimby and E. T. Bartlett. 1997. Comparison of forage value on private and public grazing leases. Journal of Range Manage. 50:300-306.

List of grazing fee publications

J. Range Manage.
50:300–306

Comparison of forage value on private and public grazing leases

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Abstract

Federal land grazing fees have been set by a formula that uses a base rate developed from a 1966 study comparing total grazing costs on private and public lands. A similar market comparison was recently conducted in Idaho, New Mexico, and Wyoming. Total grazing costs were gathered through personal interviews from 258 ranchers using 245 public grazing permits and 149 private leases. Public land grazing permit values were also estimated in each state. This study demonstrated that many public land ranchers have been willing to pay more for grazing than the apparent value implied from the private forage market. With the 1992 grazing fee of $1.92/animal unit month (AUM), 34% of Bureau of Land Management (BLM) cattle producers, 62% of U.S. Forest Service (USFS) cattle producers, 60% of BLM sheep producers and 92% of USFS sheep producers paid more for grazing public lands than did those grazing privately leased lands. Estimated forage values averaged $3.63/AUM for cattle grazing BLM land, and were negative for cattle using USFS lands and for sheep using both BLM and USFS allotments. Using a 3.35% interest rate to amortize permit value, the annual value of public land forage was estimated to be from $3 to $5/AUM. Doubts were cast about the standard assumptions that ranchers have profit maximization as their primary goal, that permit value measures only excess forage value, and that sufficient private leases are available for a valid comparison between private and public forage markets.

Key Words: grazing fees, permit value, profit maximization, public land policy, land use

Fees for grazing public lands were first assessed in 1906 by the U.S. Forest Service (USFS) and in 1936 by the Bureau of Land Management (BLM). The authorization to graze livestock on federal lands was controlled by issuing grazing permits to those who could meet the "prior–use" and "commensurability" requirements. To encourage use and private investment on the rangelands the original permits were freely given to ranchers, with grazing fees set at low levels. The difference between the cost of utilizing federal rangelands and the value of the forage was quickly capitalized into the value of the base ranch (Roberts 1963).

Since the first administered grazing fee, numerous attempts have been made to establish a fair market price for public land forage (Kearl 1989). Because federal grazing fees are set by a formula and are not open market transactions between willing buyers and sellers, no direct estimate of market value is obtainable and indirect valuation procedures are necessary. One method frequently used is to compare grazing fees on public lands to private land lease rates. Private land lease rates were used to imply the value of National Forest lands as early as 1915 (Rachford 1924). Recent federal grazing fee studies have relied on market price comparisons to establish forage value. Grazing fee studies conducted during the 1960's (USDA/USDI 1977) and 1980's (Obermiller 1992) compared the total cost of grazing public and private lands. Studies conducted in the 1980's (USDA/USDI 1986) and updated in 1992 (USDA/USDI 1992) used a market rental appraisal of private land leases to imply forage value. LaFrance and Watts (1995) also used the private grazing market to examine forces that influence private grazing fees across western states and draw implications to public grazing policy. A main inference of these studies was that considerable variation exists in forage value both within and between selected areas.

The objective of this study was to examine the value of public forage in Idaho, New Mexico, and Wyoming by comparing the total costs of grazing public and private leases (total cost approach). A further objective was to examine the value of federal grazing permits in each state and compare the capitalized value of permits with the forage value obtained from the total cost approach. This second objective not only provides an estimate of the rancher's "willingness–to–pay" for federal forage, but also provides a verification on the theoretical "correctness" of the total costs approach.

Theoretical Justification

The theoretical justification for using the private forage market to imply equitable federal land grazing fees is founded in economic models developed in the 1960's at Utah State University (Roberts 1963, Jensen and Thomas 1967, Nielsen and Wennergren 1970). The "Utah model" assumes private and public

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land forage are direct substitutes and that the marginal productivity of the 2 inputs are equal (Nielsen and Wennergren 1970). This implies the amount a profit maximizing rancher should be willing to pay for the 2 types of forage would also be equal.

The marginal factor costs of grazing leased land are comprised of fee (FEE) and non-fee (NFEE) costs. Fee costs are the fees paid to the lessor for the forage utilized and services provided. Non-fee costs are supplementary costs incurred by the lessee to utilize the leased forage. Examples of non-fee costs are transportation of livestock to the lease site, maintenance of fences and facilities, and care of livestock while on the lease.

The total cost approach of determining the value of federal forage compares the fee and non-fee costs of grazing both private and public rangelands. Theoretically, it is the marginal factor costs of the forages, or the amount the rancher was willing to pay for grazing the last unit of forage, that should be equated. What is obtainable from ranchers is their current level of production and the total cost of grazing the allotment. Grazing fees derived from the total cost approach have therefore been based on average rather than marginal costs (USDA/USDI 1977).

To apply the total cost method, total costs of grazing public lands (excluding the grazing fee) are subtracted from the total costs of grazing private lands (including the lease rate) to estimate the grazing fee that equates total grazing costs on private and public lands. This is equivalent to equating costs of utilizing public grazing to private grazing costs by adjusting the public land grazing fee. The estimated grazing fee would be

$$FEE_{public} = (FEE_{private} + NFEE_{private}) - (NFEE_{public}). \quad (1)$$

Estimation of the variables defined in equation [1] resulted in the $1.23/AUM base charge established in the Public Rangeland Improvement Act of 1978 (PRIA) fee formula[1]. The estimated difference in total grazing costs ($1.23/AUM) was considered to be the "average" grazing fee that should be charged to equate grazing costs (USDA/USDI 1977).

It should be noted that valuing forage by comparing total grazing costs does not provide a direct estimate of net forage value, but rather an estimate of the net value of public land grazing. Total private grazing costs define the amount willingly paid for the total grazing package, including services. Subtracting non–fee grazing costs on public lands from this amount results in an estimate of the amount that could be paid for public land forage while maintaining total private and public grazing costs at the same level.

The fee charged to graze public land has historically been less than the value of its marginal product and the rancher who had access to federal land grazing realized a surplus economic value known as permit value. Permit value (PERMIT) is said to be the capitalized cost advantage that public land ranchers have over those grazing on private lands or

$$PERMIT_{public} = \frac{(FEE_{private} + NFEE_{private} - (FEE_{public} NFEE_{public})}{r} = \frac{COSTADV}{r} \quad (2)$$

This capitalization formula calculates the present value of a perpetual flow of any cost advantage (COSTADV) that may accrue from grazing on public lands. This formula is sensitive to the capitalization or interest rate, r, that is assumed. The greater the r, the smaller the present value of the perpetual flow. The capitalization formula also assumes the decision maker has an infinite planning horizon and determines the permit value accordingly. A finite planning horizon would suggest a smaller permit value. An infinite planning horizon is typically justified even when a rancher maintains the permit for a finite time since the rancher can sell the rights to utilize the permit. The capitalization formula would not be valid if the rancher anticipated the grazing rights would be appropriated by the federal government without just compensation.

Because access to grazing is embodied in the grazing permit, the surplus value became a marketable item that was transferred when the permit was sold (Nielsen and Wennergren 1970). As the cost differential between grazing public and private lands fluctuates, in the presence of a competitive market, the changing value of the grazing permit theoretically eliminates the cost advantage that public land ranchers have. When a public land rancher buys the grazing permit, total grazing costs are equated and the cost advantage is eliminated (Workman 1988; Torell and Doll 1991).

Obermiller (1992) argued that permit value is not a capitalized cost advantage, but rather the capitalized value of cost savings realized through economies of size when federal grazing permits are attached to the ranch unit. Complementarity between different seasonal forage sources is also cited as a reason for permit value. Some combination of these factors may be appropriate.

Because grazing permits can be purchased and sold[2], a direct estimate of the annual value of public land grazing can be obtained by computing a rate of return on grazing permit investment and adding this to the current grazing fee (Nielsen and Wennergren 1970). This can be seen by rearranging equation [2] as

$$COSTADV = PERMIT_{public} \times r \quad (3)$$

and then adding COSTADV to the current grazing fee to obtain the annual value of public land grazing. This procedure gives a site-specific estimate of forage value while directly considering the costs, forage quality, level of improvement, and characteristics of specific public land ranches. More productive and/or lower cost ranches should theoretically have a higher valued grazing permit, implying a higher forage value.

Theoretical Inference

If permit values arise only because of a capitalized cost advantage for public land grazing, determining the annual forage value from permit values should provide a verification of the forage value determined from the total cost approach. However, if permit values are influenced by factors other than expected livestock returns, valid estimates of forage value will not necessarily be obtained using this method. Jensen and Thomas (1967) found that factors associated with grazing cattle on public ranges explained only 55% of the variation in permit sales value. Similarly, Torell and Doll (1991) found that permit values have not provided a consistent estimate of the value of public land forage. They found that permit values contributed more to the value of the ranch in the early 1980's than the capitalized cost advantage of public land grazing would justify. After 1987, public lands contributed less to the value than the simple capitalization formula would suggest. Thus, permit values may not be a sensitive and consistent indicator of forage value.

Approach

To identify public and private grazing costs, a survey of ranchers in Idaho, New Mexico, and Wyoming was conducted. Non–fee grazing cost data were gathered on the cost items identified in the 1966 grazing fee study (Refer to Table 1 for a listing of cost items. A more detailed variable description of the study design is provided in Torell et al. (1993) and Bartlett et al. (1993)).

Range improvement investments (development depreciation) on public lands were determined from BLM and USFS records and from the interview process. Only the rancher's share of cost was considered and investments on non–federal land were prorated by the percentage of time or use on the federal allotment.

Sampling Procedures

A random sample of public permittees and private lessees in the 3 states were personally interviewed to solicit estimates of fee and non–fee grazing costs. Lists of public land permittees were obtained from BLM and USFS records for each state. Lists of private forage lessees were available from prior grazing lease surveys, from USDA/National Agricultural Statistics Service, stockgrower organizations, and County Extension faculty.

Surveys were conducted in the 3 states during October through December 1992. The grazing cost data were obtained from 77 ranchers in Idaho, 85 ranchers in New Mexico, and 99 ranchers in Wyoming. The three–state data base included information on 173 BLM allotments, 72 USFS allotments, and 151 private leases.

Of the federal allotments surveyed, 44 provided grazing for sheep. Sheep grazing on private rangeland was not common. The survey included only 3 private sheep leases in Idaho, 3 in New Mexico, and 9 in Wyoming. Recognition of limited sample size should be given when interpreting sheep grazing costs and forage values.

Statistical Analysis

Total grazing costs were calculated for each lease using the labor and mileage rates and other assumptions detailed in Bartlett et al. (1993). Total costs were converted to a $/AUM value and non–fee grazing costs were spread over all AUMs on the allotment or lease, regardless of land ownership.

Grazing cost calculations and analysis were completed using appropriate statistical routines found in the SAS statistical program (SAS Institute, Inc. 1988). Variation in grazing costs were analyzed using an unbalanced analysis of variance (ANOVA) with a three-way design and interaction. Differences in the size of leases and sample size between states and classes of livestock were accounted for in the least squares means (LSM) computed with the statistical models. Forage value estimates are presented as mean values followed by 90% confidence limits about the mean. A more complete description of the model used in the analysis is given in Bartlett et al. (1993).

Permit Values

Ranch sales data were collected in Idaho and Wyoming from Farm Credit Services (FCS) for the period 1986 through 1992. Summary statistics were compiled from 129 BLM and 38 USFS permit ranch sales in Idaho, and 290 BLM and 35 USFS sales in Wyoming. Sales data compiled included an appraiser's allocation of the contribution that public and state AUMs made to the market value of recent ranch sales. These estimates of permit value were recorded from FCS sales sheets and averaged over the 1986–92 period. The reported averages were weighted by the number of federal AUMs leased.

A previously developed land value model was used to estimate New Mexico grazing permit values. The model used FCS ranch sales data for 1987 through March 1993. Average 1992 permit values were determined using the estimated regression equation developed from 378 ranch sales (Torell and Kincaid 1996). This was done by estimating the January 1992 market value of a 300 AUY ranch totally dependent on BLM or USFS for grazing capacity. The regression model has historically given permit values consistent with the appraisers values used to obtain permit values for Idaho and Wyoming (Torell and Fowler 1986).

Using the permit value approach, annual forage value was estimated by multiplying average permit values by a capitalization rate of 3.35% and adding this to the 1992 grazing fee of $1.92/AUM. The result is the annual amount that ranchers have paid in the market place for public land grazing (Torell and Doll 1991). The 3.35% capitalization rate is consistent with long–term rates of return realized from western public land ranches (Agee 1972, Madsen et al. 1982, Workman 1986). Obviously, annual forage value will vary considerably depending on the interest rate. This is a limitation of using permit values to imply forage value.

Results

Three-State Average Grazing Costs

Grazing costs were estimated for BLM and USFS allotments, and compared to costs for private leased lands in the 3 states (Table 1). Different cost categories are shown for both cattle and sheep. They were estimated across states after adjusting for differences in lease size through the ANOVA process. Total non–fee grazing costs were estimated to be $15.41/AUM for cattle on BLM, $21.89 for cattle on USFS, $23.23 for sheep on BLM, and $32.68 for sheep on USFS. By comparison, the same costs on private leased lands totalled $19.04/AUM for cattle and $20.46/AUM for sheep, including the private land lease rate.

Nearly all cost categories were significantly higher on public lands than on private leased lands (Table 1). This is consistent with the perception commonly expressed by public land ranchers that non-fee costs for grazing public lands are higher than on private lands. Major cost items for private and public land grazing included lost animals, moving and herding livestock, salt and feed, and range improvement maintenance. The private lease rate averaged $7.71/AUM for cattle producers and $7.18/AUM for sheep producers. The lease rate was a major part of the total cost of grazing on private leased lands, accounting for over 34% of total grazing costs. Total grazing costs were statistically different between private and public cattle producers and between private and USFS sheep producers (Table 1).

BLM vs. USFS

As previously noted, cattle grazing costs were estimated to be higher on USFS land than BLM administered land (Table 1). This is similar to what Obermiller (1992) found for eastern Oregon

Table 1. Average grazing costs per AUM on BLM, USFS, and private leased lands in Idaho, New Mexico, and Wyoming combined (adjusted for differences in lease size), 1992.

	Cattle			Sheep		
	BLM	USFS	Private	BLM	USFS	Private
Sample size (n)	141	60	134	32	12	15
Lost animals	3.09[a]	4.49[b]	2.10[c]	5.16[b]	6.05[b]	2.63[a,c]
	(0.31)	(0.41)	(0.28)	(0.69)	(0.95)	(0.87)
Association fees	0.20[a]	1.07[c]	0.01[b]	0.17[a]	0.00[b]	0.00[a,b]
	(0.08)	(0.10)	(0.07)	(0.17)	(0.24)	(0.22)
Veterinary	0.08[a]	0.12[a]	0.12[a]	0.16[a]	0.37[b]	0.20[a]
	(0.03)	(0.04)	(0.03)	(0.07)	(0.10)	(0.09)
Moving livestock	2.61[a]	4.49[b]	1.93[c]	3.97[b]	5.97[d]	2.51[a,b,c]
	(0.29)	(0.38)	(0.26)	(0.64)	(0.88)	(0.81)
Herding	3.63[a]	5.00[c]	2.94[a]	7.30[b]	13.49[d]	3.05[a]
	(0.37)	(0.49)	(0.33)	(0.83)	(1.13)	(1.04)
Misc. labor and mileage	0.61[a]	0.77[a]	0.18[b]	0.73[a]	1.13[c]	0.34[a,b]
	(0.08)	(0.10)	(0.07)	(0.17)	(0.23)	(0.21)
Salt and feed	1.41[a]	1.12[a]	1.80[a]	1.81[a]	1.06[a]	1.53[a]
	(0.27)	(0.36)	(0.24)	(0.60)	(0.82)	(0.75)
Water	0.47[a]	0.24[b]	0.11[b]	0.51[a,b]	0.38[a]	0.16[a,b]
	(0.07)	(0.09)	(0.06)	(0.16)	(0.22)	(0.20)
Horse	0.22[a]	0.45[b]	0.15[a]	0.34[a]	0.78[c]	0.22[a]
	(0.03)	(0.04)	(0.03)	(0.07)	(0.10)	(0.09)
Improvement maintenance	2.86[a]	3.41[a]	1.84[b]	2.33[a,b]	2.26[a,b]	2.22[a,b]
	(0.29)	(0.37)	(0.25)	(0.63)	(0.86)	(0.79)
Development depreciation						
Federal land	0.30[a]	0.39[d]	0.00[c]	0.14[b]	0.24[a,b,d]	0.02[b,c]
	(0.03)	(0.04)	(0.03)	(0.07)	(0.10)	(0.09)
Private land	0.16[a]	0.07[a]	0.15[a]	0.11[a]	0.02[a]	0.22[a]
	(0.05)	(0.06)	(0.04)	(0.11)	(0.15)	(0.13)
Other costs	0.23[a]	0.50[c]	0.11[a]	1.01[b]	1.89[d]	0.35[a]
	(0.09)	(0.11)	(0.08)	(0.19)	(0.26)	(0.24)
Private land lease rate	—	—	7.71[a]	—	—	7.18[a]
			(0.34)			(1.07)
Total cost	15.41[a]	21.89[b]	19.04[c]	23.23[b]	32.68[d]	20.46[b]
	(0.99)	(1.30)	(0.88)	(2.19)	(3.00)	(2.74)
Forage Value	3.63 ± 2.42	−2.86 ± 2.59		−2.77 ± 6.22	−12.22 ± 6.94	
	(1.47)	(1.58)		(3.71)	(4.07)	

Note: Means on the same row followed by the same letter are not statistically different at P = 0.10. The number in parenthesis is the standard error of the mean. Individual cost items may not add up to the total cost because the mean for each cost item was estimated using an independent linear statistical model and is not the simple average for the cost category. Least-squares or adjusted means are presented which give the average value had there been a balanced design for class variables and with all covariates set at their mean value (SAS 1989, p. 948). Forage value is shown as the mean value with 90% confidence limits about the mean.

where, on average, utilization of USFS land was the most expensive lease, followed by private land, and then BLM. The 1966 grazing cost survey did not find USFS grazing costs to be higher than private land leases when averaged across all forests and BLM districts. Part of the reason for this insignificance was the considerable variation that was found within a forest and region. The 1966 study found the average cost of grazing USFS land was $0.62/AUM higher than BLM land, but again, this difference was not statistically significant (Houseman et al. 1968. Special report on the grazing fee survey. Unpublished Report. USDA/Statistical Reporting Service).

Major cost categories explaining the higher cost of grazing USFS lands included lost animals, association fees, moving and herding livestock, miscellaneous labor, vehicle expenses, and horse costs. Other cost categories, including miscellaneous expenses and development depreciation on federal lands, were significantly higher on USFS administered lands in some cases but contributed little to the higher cost of USFS grazing.

Several explanations are possible for the relatively high cost estimated for grazing USFS lands and the negative estimate of forage value for these lands.

1. Private leases included in the grazing cost survey were considered comparable to BLM and state trust lands with respect to proximity and physical characteristics. However, few leases were found that were directly comparable to USFS lands with respect to vegetation types, climate, and water resources. Had similar substitutes been identified for USFS grazing, the value of private lease costs might have been higher that the non–fee costs of using USFS grazing.
2. If the estimated cost of using USFS lands is correct, USFS permittees are spending more to graze than ranchers who use private lands. This would suggest that USFS permits should have low or zero value. The total cost approach, though, may not capture all elements of value associated with USFS permits. For example, USFS permittees may be willing to pay higher costs to graze in scenic remote areas and maintain a

way of life or accept a below–market wage rate and return on investment (Bartlett et al. 1989, Harper and Eastman 1980, Smith and Martin 1972).

3. In New Mexico, some of the cost increases could be explained by culture and the high value placed on the agrarian way of life. Of the 21 USFS ranchers interviewed in New Mexico, 10 had relatively small herds and were Hispanic ranchers, mostly in north–central New Mexico. Grazing costs, especially the value of unpaid family labor, were higher for these individuals.
4. Market–price comparisons for valuing forage assumes ranchers have numerous alternatives available to them. Private and public forage are assumed to be direct substitutes. In reality, most private forage sources remain leased and federal leases are not accessible to the general public unless transferred with the base ranch. Ranchers are therefore forced to use higher–cost alternatives (e.g., USFS allotments) if they want to be in the livestock business. However, this does not mean that ranchers who utilize USFS forage are losing money or are not profitable, only that their costs are higher on average.

Cattle vs. Sheep

The total cost of grazing sheep on public lands was significantly higher than for cattle. When the values in Table 1 are weighted by the number of AUMs and averaged for federal lands, the total cost of grazing sheep on public land was estimated to average $7.72/AUM more than grazing cattle on public land and $1.42/AUM more for private–land sheep producers compared to private–land cattle producers.

Sheep grazing costs were also the most variable. Because of this variability and the relatively small sample size for sheep producers, especially on private lands, the confidence intervals estimated for sheep forage values are over twice that estimated for cattle production. As shown in Table 1, some of the variability is explained by differences between BLM and USFS.

Permit Value

Table 2 shows estimated permit values for Idaho, New Mexico, and Wyoming and the 1992 forage value implied from these values. Average permit values ranged from $36/AUM for BLM in Wyoming to $89/AUM for BLM in New Mexico. BLM and USFS permit values were significantly different in Wyoming but not in Idaho or New Mexico. Implied forage value using the permit valuation method was highest in New Mexico ($4.90/AUM for BLM and $4.33/AUM for USFS). Forage value was estimated to be from $3.00 to $3.50/AUM for the permits in Idaho and Wyoming. Permits in New Mexico may be more expensive because of their yearlong use compared to the seasonal permits found in Idaho and Wyoming.

If, as economic theory suggests, permit value constitutes a surplus economic value created because the fee charged to graze public land has been less than the value of the marginal product (VMP) of the forage, the forage value obtained from the total cost approach should equal the amortized value of the permit (yearly surplus) plus the federal grazing fee. The theory appears to hold for BLM cattle permits as the forage value obtained from the total cost approach approximates the total value ranchers were willing to pay for the permit while also paying the federal grazing fee. For the remaining public leases, the total cost approach shows that public lands do not have a capitalized cost advantage over grazing on private lands. By comparison, the permit value approach demonstrates that ranchers were willing to pay a premium for federal grazing permits in the land resource market. This dichotomy suggests permit values are comprised of more than a capitalized cost advantage for public land. As previously discussed, cost savings realized through economies of size, complementarity between different seasonal forage sources, or the utility a rancher receives from managing cattle in scenic remote areas may also contribute to permit value.

Table 2. Grazing permit value and forage value implied from average permit values in Idaho, New Mexico, and Wyoming ($/AUM).

State	Permit Value		Forage Value[1]	
	BLM	USFS	BLM	USFS
Idaho	37a	42a	3.16	3.32
	(1.31, 129)	(2.71,38)		
New Mexico	89a	72a	4.90	4.33
Wyoming	36a	47b	3.13	3.50
	(1.01, 359)	(3.47, 43)		

Note: Permit value means in the same row that are followed by the same letter are not statistically different at P = 0.10. Means in the same column are not compared statistically. The numbers in parenthesis are the standard error of the mean and the sample size. The standard error is not shown for New Mexico because the mean value is estimated from a regression model.

[1] Estimated as permit value × 3.35% + $1.92/AUM 1992 grazing fee.

Theoretically, grazing fees equal to the forage value estimates in Table 2 should eliminate permit value. Yet, permit value estimates in New Mexico for state trust lands indicate this may not always be the case. Torell and Doll (1991) estimated that as New Mexico state land grazing fees went from $1.60/AUM in 1986 to $3.13/AUM in 1989 the value of state land grazing permits decreased by about $30/AUM for every $1/AUM increase in the fee. State land permits went from the most valuable permit to the least valuable permit in 6 years. New regression estimates indicate that New Mexico state land permits have recently increased in value relative to BLM and USFS (Torell and Kincaid 1996). This is true even though New Mexico state land fees are nearly double those on federal lands and USFS total grazing costs were estimated to be considerably higher than those on BLM land. Security of lease and certainty concerning fee policy and other public land policies, then, may be important considerations in determining the price paid for a public grazing permit.

Discussion and Conclusions

A comparison to the private forage market has historically been used to estimate the value of public land forage. Results of this study indicate grazing values that equate public and private lease costs fall, with P = .10, between $6.05 and $1.21 for BLM cattle permits, - $0.27 and –$5.45 for USFS cattle, $3.45 and –$8.99 for BLM sheep, and between –$5.28 and –$19.16 for USFS sheep permits.

Theoretical justification for the total cost valuation method comes from the standard economic models and principles that describe the motives of profit maximizing firms (ranches). These methods are justified based on certain limiting assumptions: 1) ranchers are profit maximizers, 2) ranchers have at their disposal numerous alternative forage sources and leasing alternatives, 3) private and public forage are direct substitutes, and 4) rational and profit-motivated livestock producers are willing to pay a

price equal to the value of forage in production. If the competitive forage market were efficient, the capitalized value of the grazing permit would theoretically eliminate any cost differentials, thus equating the total cost of public and private grazing.

If only forage values for cattle grazing BLM land are considered, this economic scenario would appear to hold. Non-fee grazing costs on BLM lands were found to average $3.63/AUM less than grazing costs on private leased lands after adjusting to the same lease size and averaging across all 3 states. Given the 1992 public land grazing fee of $1.92/AUM, an excess value of $1.71/AUM ($3.63/AUM-$1.92/AUM = $1.71/AUM) was apparently capitalized into a grazing permit value and ranchers were paying equal amounts for grazing public and private lands[3]. The implied permit value is consistent with the value found for BLM grazing permits using a capitalization rate of about 4.75% for Idaho and Wyoming, and 2% for New Mexico.

Negative forage value estimates for USFS and BLM sheep allotments do not support the total cost approach whereby grazing permit value is the factor that equates total grazing costs. In these cases, grazing costs were found to be higher, on average, than for private lands. Theoretically, profit-motivated ranchers should not be willing to pay more for grazing public lands if private leases are available at a lower cost. The fact that USFS permits and some sheep permits[4] continue to have a market value furthers the argument that comparison with the private market fails to account for several factors. The total cost approach requires one to make several assumptions that apparently are not valid. First, profit may not be the most important motive of public land ranchers. This is consistent with the results of Bartlett et al. (1989), Harper and Eastman (1980), Young and Shumway (1991), and Smith and Martin (1992). The implication is all livestock producers cannot be treated as profit maximizers since ranch resources generate both production and consumption outputs. Second, private leases may not be directly comparable to public leases in attributes that affect value. For example, the limited number of private leases that were truly comparable to USFS lands leads one to question the validity of the total cost approach in determining forage value for USFS lands. Third, in many areas of the west, private land is in short supply, leaving few economical alternatives to public land forage. Rejecting the total cost approach as a method of valuing forage does not mean that grazing cost comparisons that were made between private and public land ranchers are not useful. The cost differential for public and private leases has changed since the 1966 Western Livestock Grazing Survey. It was estimated that with the 1992 grazing fee of $1.92/AUM, 34% of cattle producers on BLM land, 62% of USFS cattle producers, 60% of BLM sheep producers and 92% of USFS sheep producers paid more for grazing public lands than did those leasing private lands (Bartlett et al. 1993; Torell et al. 1993). Additional investments were also made to buy the grazing permit. The common belief that public land ranchers pay less on average than those leasing private lands is not true.

This study confirms results by Houseman et al. (1968. Special report on the grazing fee survey. Unpublished Report. USDA/Statistical Reporting Service), Obermiller (1992) and LaFrance and Watts (1995) that no singular value exists for federal forage. Results suggest that forage value varies by season of use, type of use, and other variables. As a result, any effort to determine a single value for federal forage is futile. Approaches that allow the value of forage to vary such as competitive bidding have been suggested (Gardner 1963). LaFrance and Watts (1995) recommended the permanent transfer of grazing rights to current permit holders. They suggest privatization of permits would provide incentives for good stewardship and allow permits to be sold to parties who value them most.

Other methodologies such as linear programming or budgeting could be used to determine the value of specific forage types in an area, but results are sensitive to assumptions concerning the rate of return given to other resources used on the ranch. An effort to determine public grazing fees on a site-by-site basis using such modeling approaches would also be very expensive and time consuming.

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Endnotes

1. The PRIA fee formula is:

$$\text{Fee} = \$1.23 \left(\frac{\text{FVI} + \text{BCPI} - \text{PPI}}{100}\right)$$

The $1.23 base forage value is the estimated difference in total fee and non–fee costs of grazing private and public rangeland using data collected by a 1966 Western Livestock Grazing Survey (USDA/USDI 1977, p. 2-22). The base is adjusted by annual changes in private grazing land lease rates (FVI), costs of beef production (PPI) and prices received for beef cattle (BCPI).

2. Gardner (1962) hypothesized that transfer retrictions for grazing permits including commensurate property and priority requirements impeded the market for grazing permits. Nielson and Wennergren (1970) and Torell and Doll (1991) concluded that even given these transfer restrictions a resonable amount of competition exists and that a relatively free market exists for permits to graze public lands.

3. Much variability was found, however, and grazing cost estimates for individual grazing allotments ranged from -$74/AUM to + $20/AUM (Bartlett et al. 1993, Torell et al. 1993). Permit values also vary considerably.

4. It appears that some sheep permits do not have economic value. Vacant sheep allotments exist in nearly all of the western states. The uncertainty about grazing fee policy and other public land policies has reduced permit values (Torell and Doll 1991).

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APPENDIX 4

Summary: Borman, M. and T. Bedell.2001. Livestock water management during a drought. Oregon State University. EM 85588. 2p.

Example calculation of water hauling costs

HAULING WATER

Borman, M. and T. Bedell. 2001. Livestock water management during a drought. Oregon State University. EM 8588. 2p.

Summer water consumption rates in gallons per day
Yearlings watered daily – 8-9
Yearlings watered every other day – 6.5
Cows with calves – 15
Dry cows – 10-12

Watering every other day will reduce daily intake about 25%.

Table 1.—Stock water hauling costs ($ per head per day).*

Round-trip distance (miles)	Cost/ gallon each trip	Water hauled (gallons per head per day)				
		8	10	12	14	16
10	$0.029	$0.234	$0.293	$0.352	$0.410	$0.469
20	0.044	0.349	0.436	0.523	0.610	0.698
30	0.058	0.463	0.579	0.695	0.811	0.926
40	0.072	0.578	0.722	0.866	1.011	1.155
50	0.087	0.692	0.865	1.038	1.211	1.384

*Assumptions: Labor based on driving time @ 15 mph, 1.5 hours loading and unloading time, @ $10 per hour. Using available trucks, @ 76¢ per mile; 1,000 gallons per trip. Estimates by Bart Eleveld, Extension farm management specialist, and Tom Bedell, Extension rangeland resources specialist emeritus, Oregon State University.

Cost of Hauling Water to Livestock on Dry Ranges in Eastern Oregon

There are areas of public land that are part of either federal or state grazing allotments that do not have natural or piped water for either livestock or wildlife. If livestock are to use this range water must be hauled on a regular basis and in sufficient quantity to totally meet the needs of all dependent animals. This can be done using a variety of vehicles from old dump trucks, surplus military vehicles, semis, conventional 2 ½ and 1 ½ ton farm trucks, or heavy duty pickups with large flatbed trailers. Virtually all ranchers have either ¾ or 1 ton pickups so this will be the vehicle used in the analysis. A one-ton pickup can accommodate up to 1,000 gallons of water over pretty rough ground with a three-axle gooseneck trailer.

Distance from the ranch, to the water source, to the tanks can vary from a mile to 50 miles, mostly over gravel roads or two ruts through the sagebrush. Most of the time the trips are slow, over very rough terrain, and can take from several hours to a full day for a round trip. They are hard on equipment, and require the services of a careful driver who knows the territory. 20 miles one way, will be used as a normal, or "average" distance.

A pregnant range cow will consume an average of 15 gallons of water per day depending on how hot it is. Water is usually hauled to dry summer pastures in the desert country where daytime temperatures can range from 70 to over 100 degrees. Assuming consumption of 15 gallons, 1000 gallons of water will provide a minimal supply to 50 cows for about 1½ days. Thus, the pasture will need to be visited every other day at a minimum. A 30 day grazing period will require at least 15 trips with the water truck.

Costs:

Depreciation on truck @ $30,000/ 3 years/ 25,000 miles per year = $.40 per mile	$16.00
Depreciation on trailer @ $9,500/5 years/8,000 miles per year = $ .24 per mile	9.50
Depreciation on tank @ 1000/ 10 years/ 365 days = $ .27 per day	.27
Labor @ $10.00/hour for 5 hours (Including loading, unloading, and travel.)	50.00
Total Cost per Day	$75.77
Cost of 15 Trips	$1,137.55

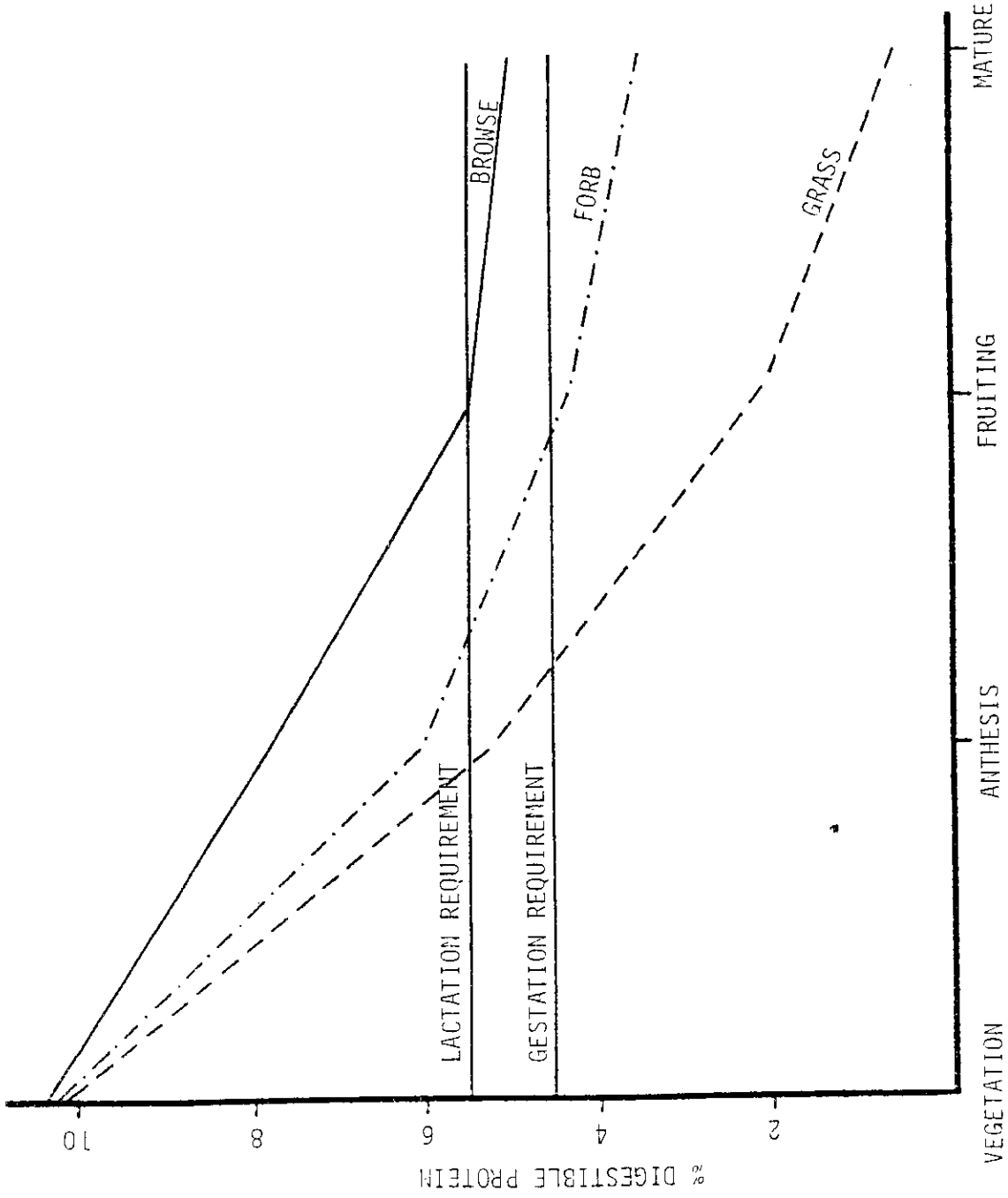


Figure 8. Seasonal content of digestible protein for three forage classes in relation to the nutrient requirements (dry matter basis) of cattle and sheep under range conditions during gestation and lactation.

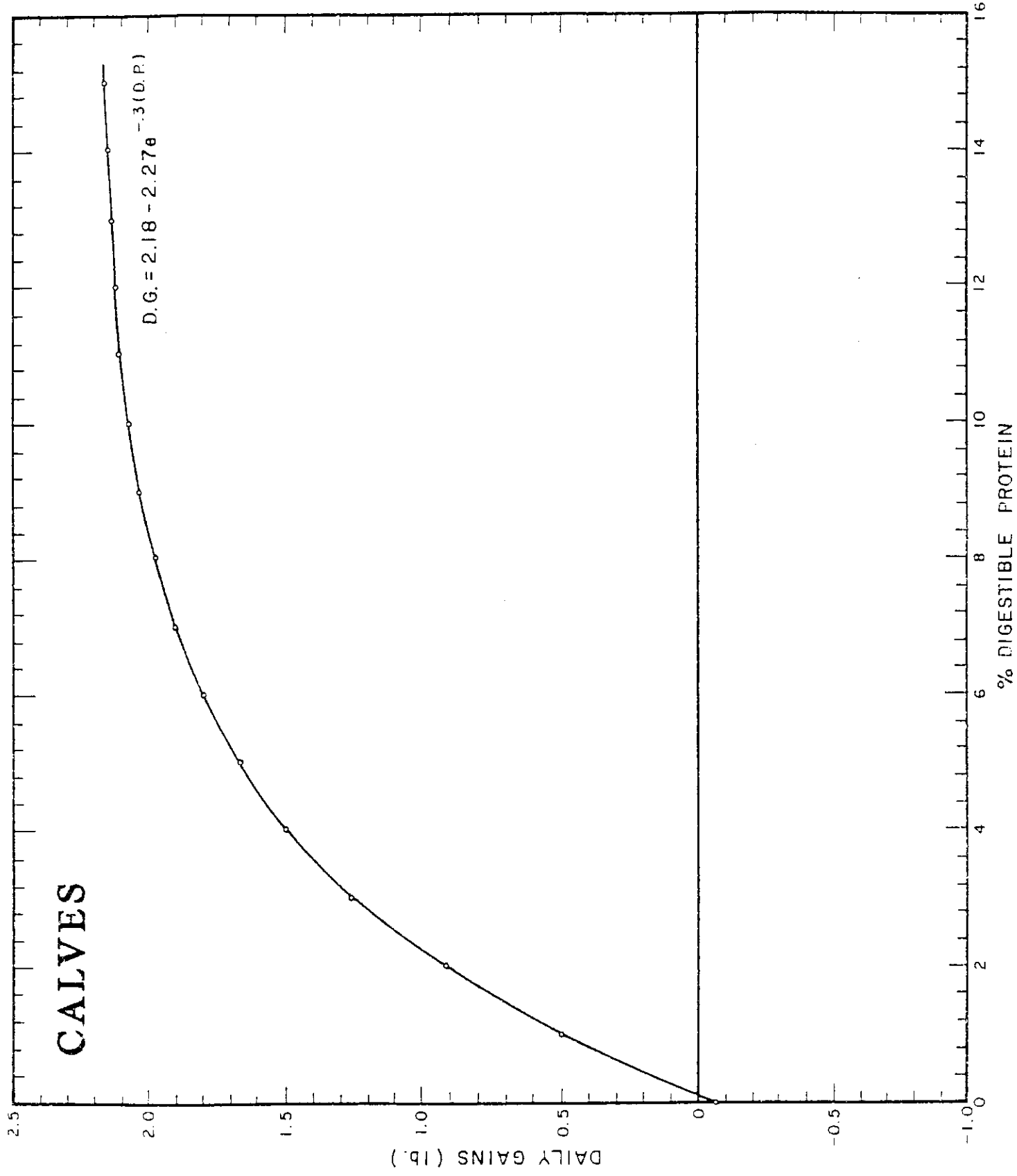


Figure 4. Predicted average daily gain for a typical range calf, during spring and summer, based on the digestible protein content of the diet (dry matter basis).

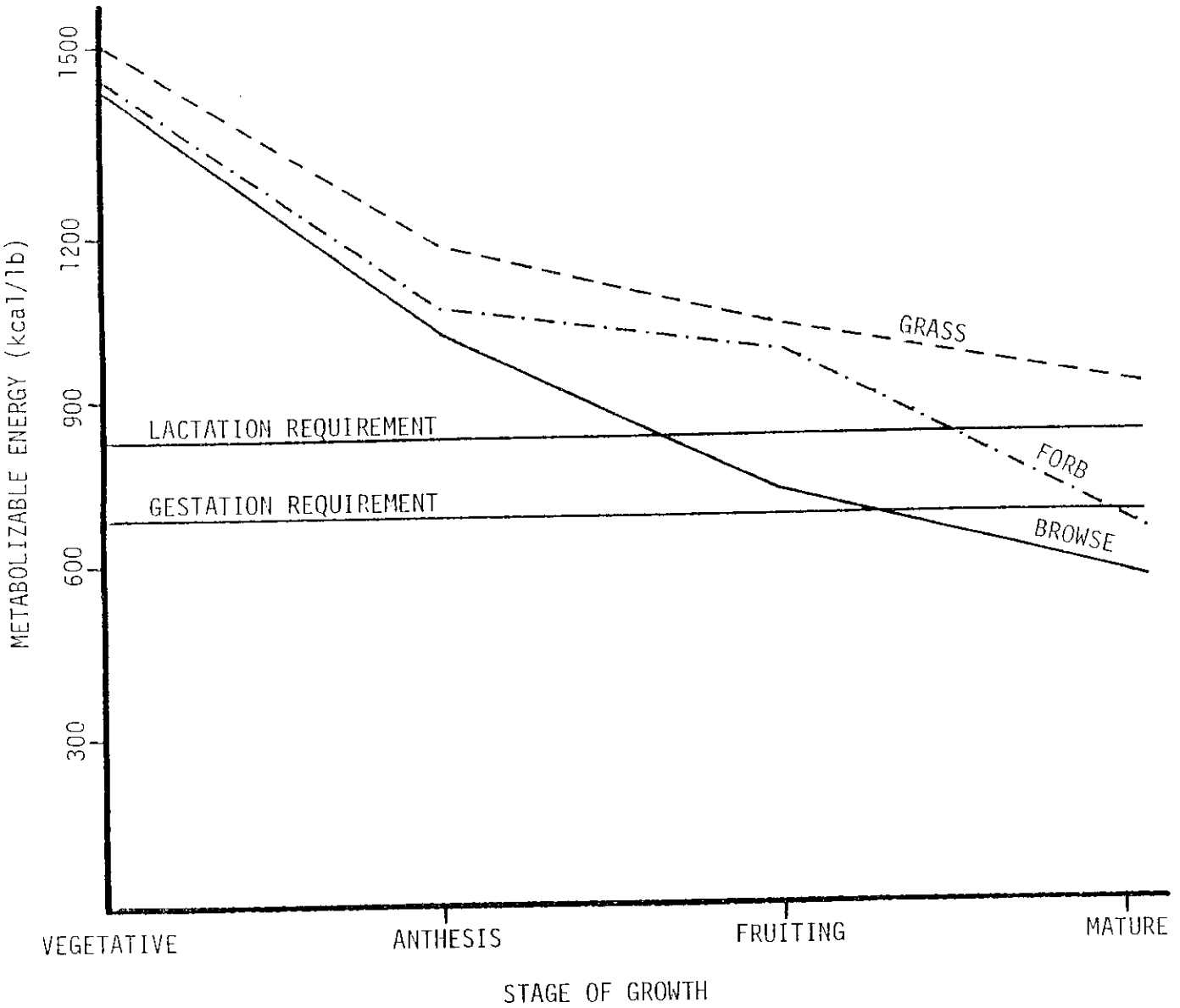
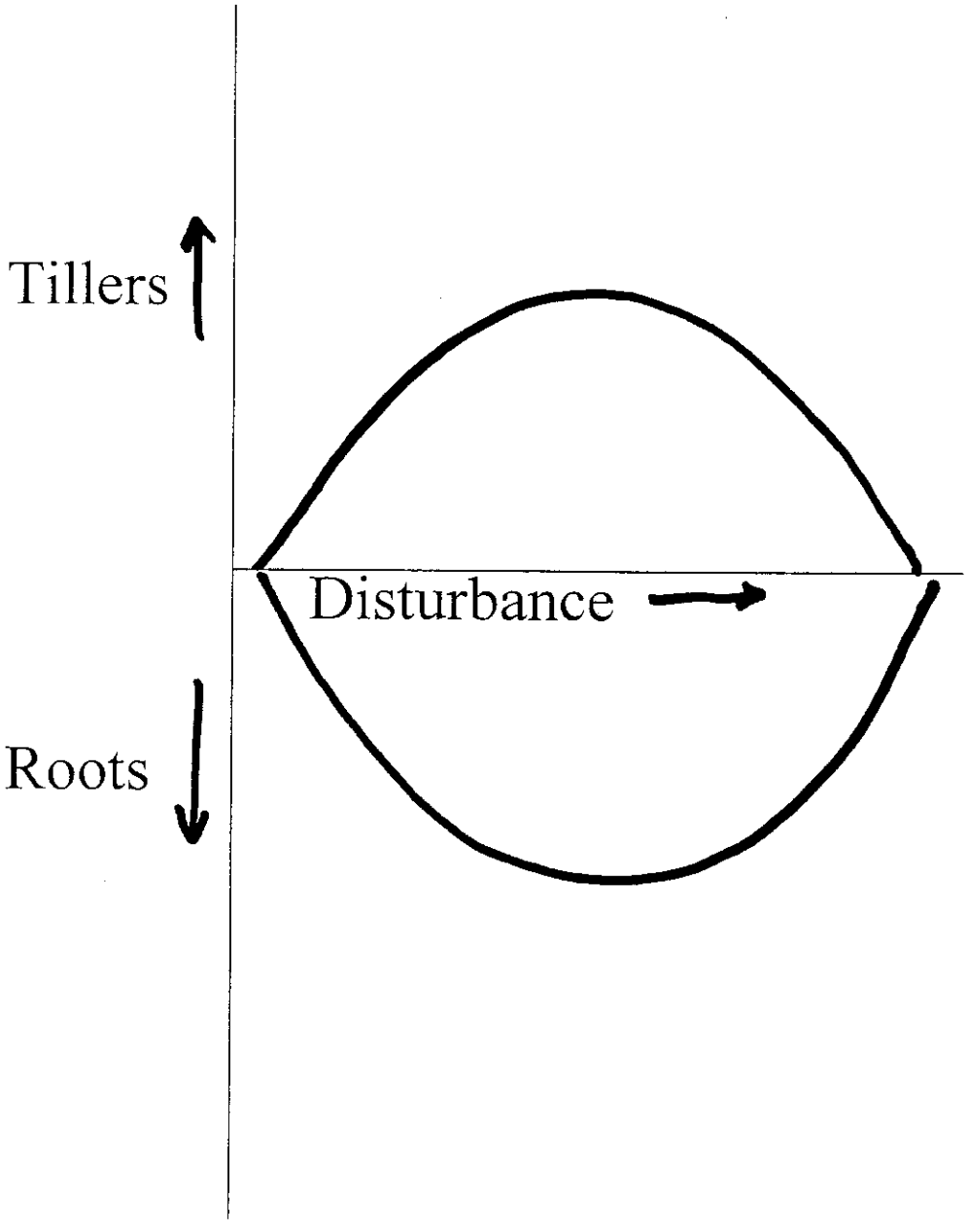
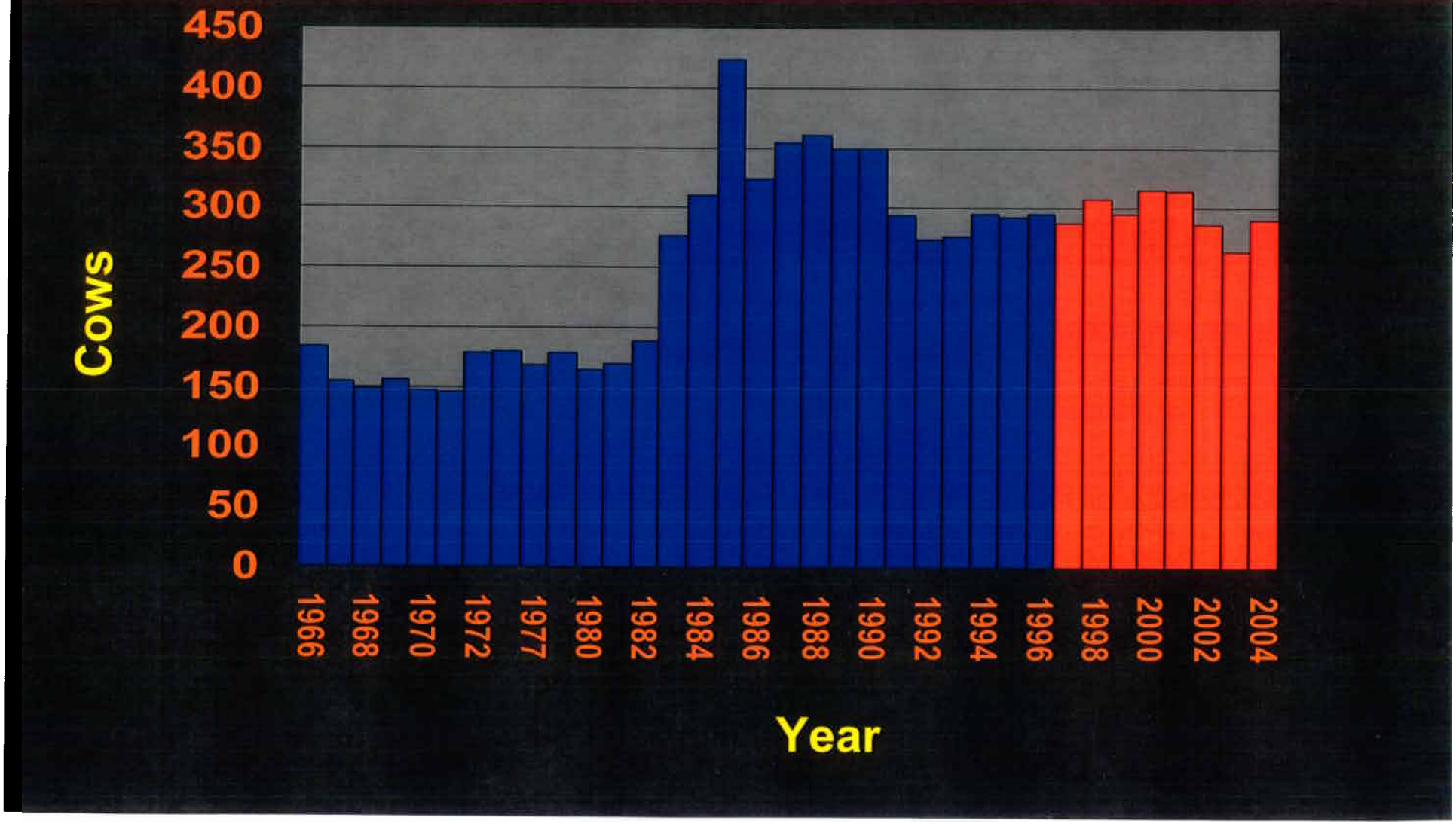


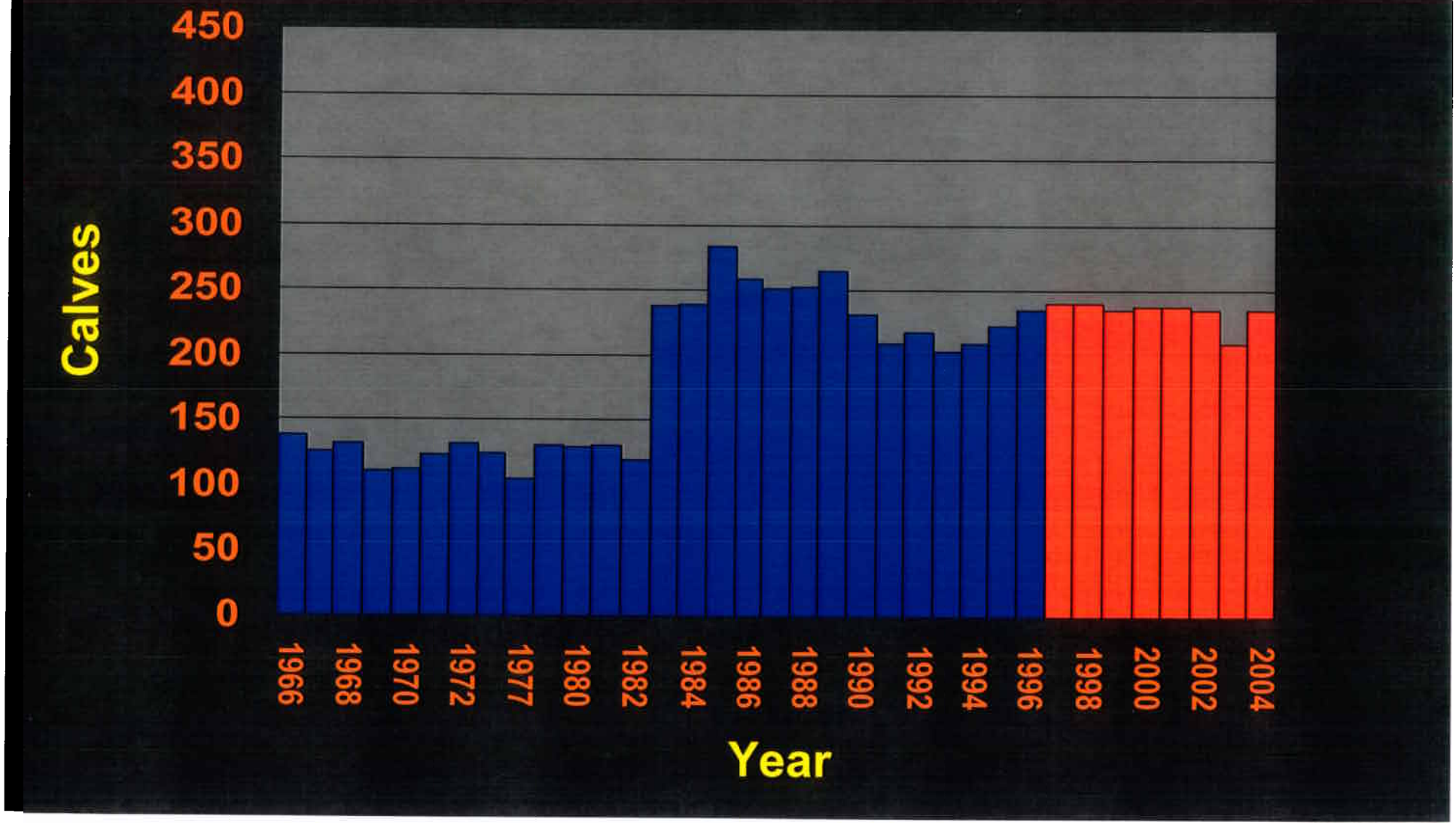
Figure 9. Seasonal content of metabolizable energy for three forage classes in relation to the nutrient requirements (dry matter basis) of cattle and sheep under range conditions during gestation and lactation.


Tillers
Disturbance
Roots

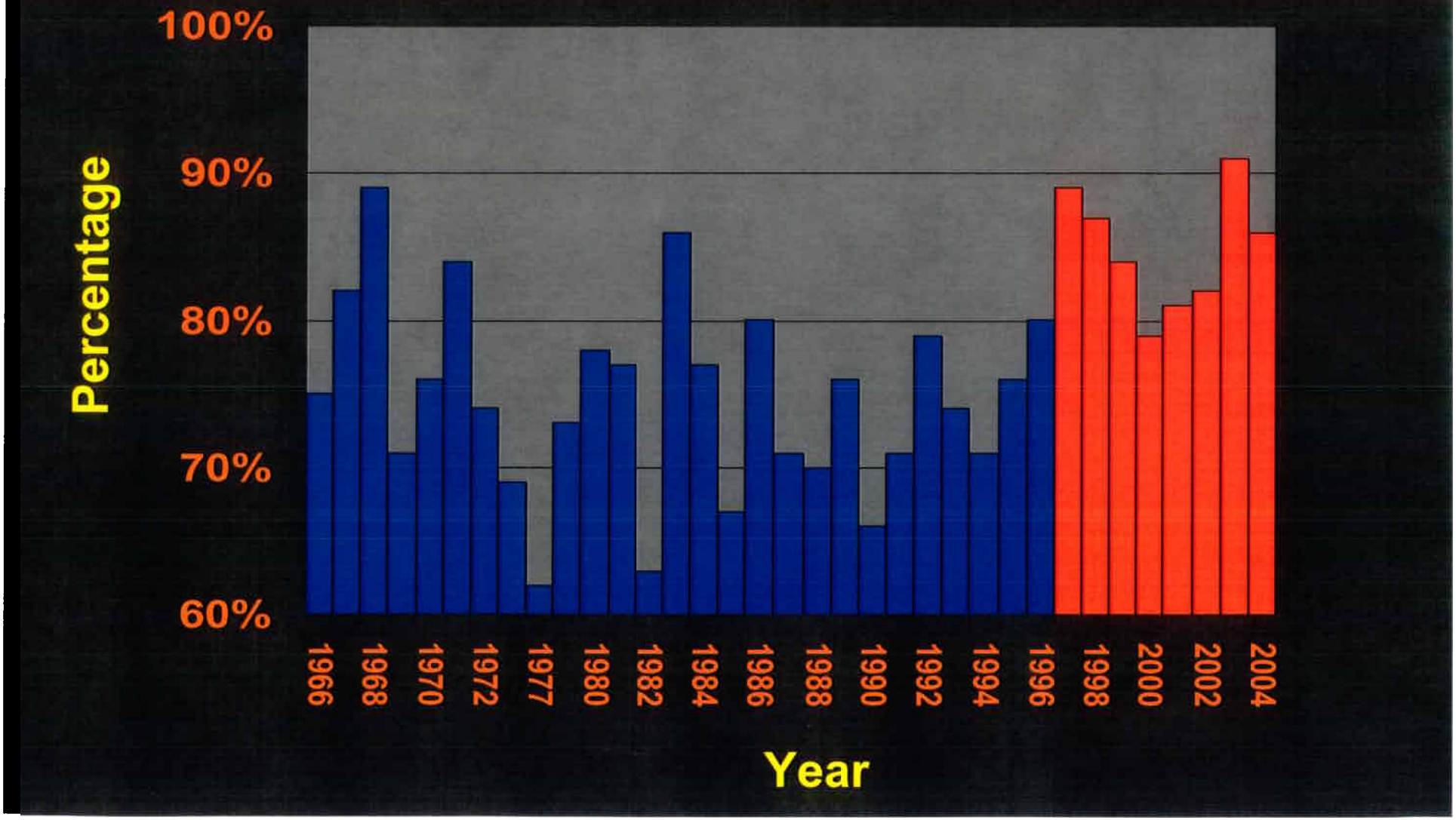
EOARC (Burns) Cows Exposed to Bull



EOARC (Burns) Calves Weaned

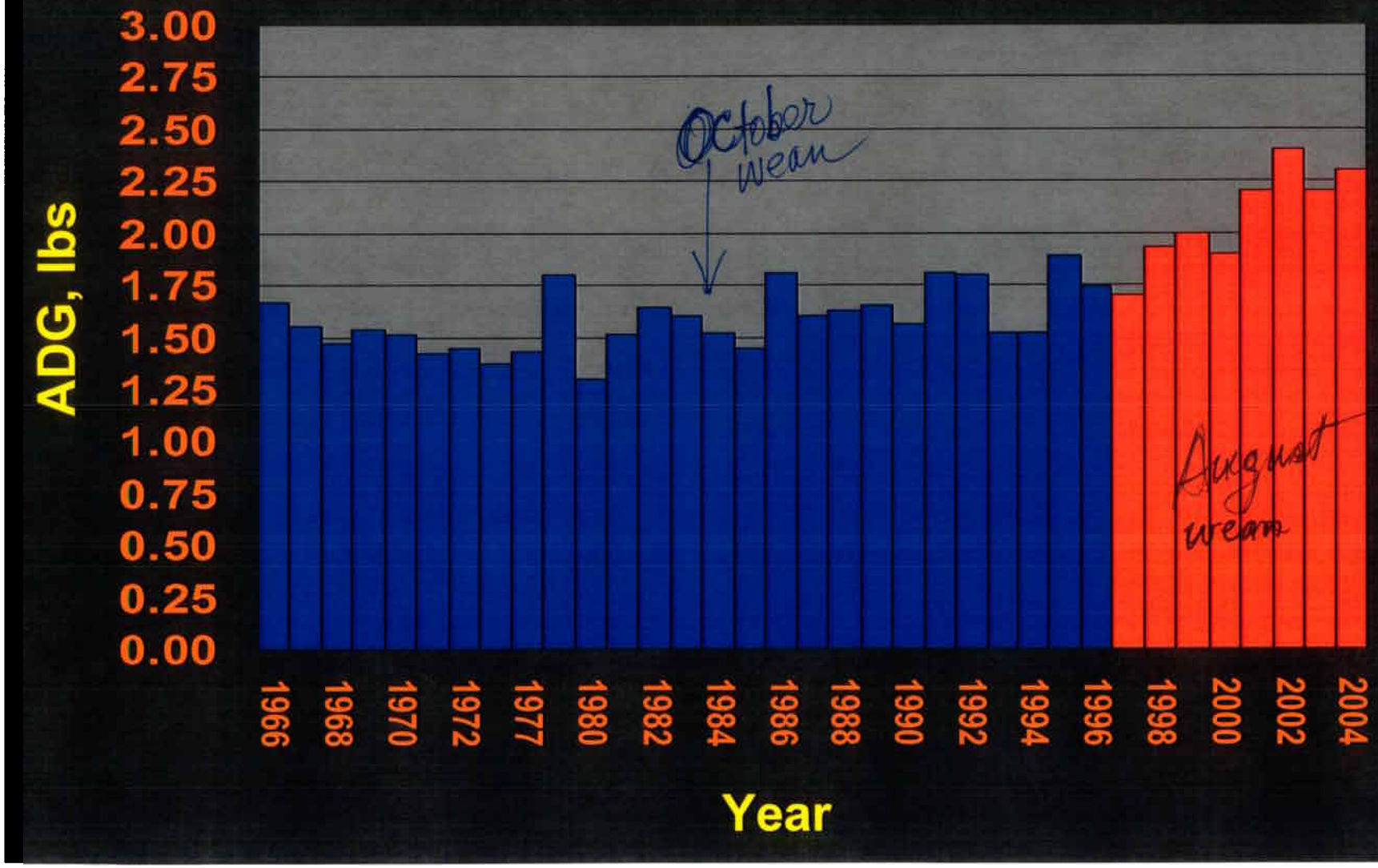


EOARC (Burns) Calves Weaned per Cow Exposed

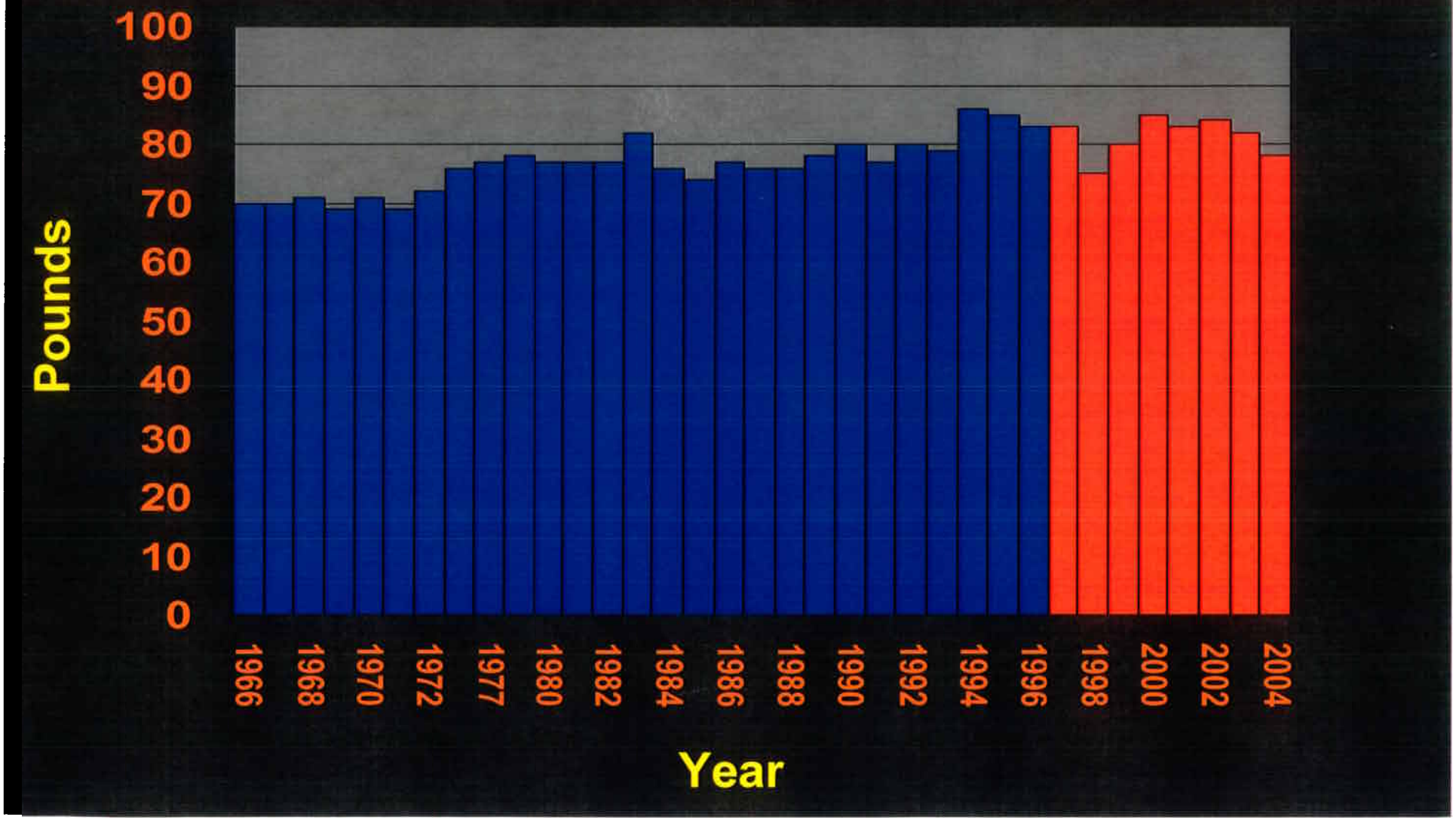


1966-1996 - 74%

EOARC (Burns) Calf ADG to Weaning



EOARC (Burns) Calf Birth Weight



EOARC (Burns) Calf Age at Weaning