UNIVERSITY OF CALIFORNIA

Beef Cattle Day - Sierra Foothill Range Field Station Open House*

April 29, 1971

Morning Program

10:00 Registration

W. J. Clawson, Chairman

The SFRFS, Its Function..... Joe Guild, Superintendent, SFRFS
Why Feed Salt Anyway?..... Jim Morris
Beef Cattle Behavior and Management.. Ken Wagnon
Rice Straw for Cows??..... Al Mitchell
Dark-cutting Beef..... Bob Ashmore

12:00 LUNCH

J. T. Elings, Chairman

Brush to Beef..... Jack Owens, Cattleman, Tehama Co.
How Fat is Our Meat?..... Bill Garrett
Ranching and Recreation..... Maynard Cummings

Afternoon Session

1:30 Charles B. Wilson, Chairman

Irrigated Pasture, Forage Resource... Roy Hull
or Range Supplement
Animals, Forage and Water in the..... Charles Raguse
Foothills
Perrennial Grasses for Range Use..... Jim Street
Rangeland Microclimates..... Bud Kay
Future Range Cattle Research..... Magnar Ronning, Chairman
An. Sci. Dept., UCD

3:30 Adjourn

*The Sierra Foothill Range Field Station is located 19 miles east of Marysville off Highway 20.

SIERRA FOOTHILL RANGE FIELD STATION

The Sierra Foothill Range Field Station was originally acquired by the University for research on beef cattle production and range improvement practices. In recent years the station has added new dimensions in studying resource management--recreation, open spaces, watersheds and populations of wild game and plants.

The Station's 5,800 acres range in elevation from less than 300 feet, along the scenic Yuba River, to nearly 2,000 feet in steep woodland-brush foothills. The climate, soils, rough terrain and variety of vegetation types are representative of several million acres of California foothill lands.

Administered by the Field Station Branch of the Division of Agricultural Sciences, the Station's programs are guided by a Research Advisory Committee composed of members of the Agricultural Experiment Station and the Agricultural Extension Service. Ideas for new research from University staff, other public agencies and other supportive groups are reviewed by the committee with the aim to develop broadly-based cooperation in research activities, thus achieving more efficient use of facilities and funds.

WHY FEED SALT ANYWAY?*

James G. Morris
Associate Professor of Animal Science
University of California, Davis

Man's use of salt in his diet goes back at least 3,000 years. The ancient Greeks entolled the virtues of salt for promoting fecundity and milk secretion of animals. The feeding of salt to cattle has become an accepted practice through the centuries, and like many practices which have been accepted because of tradition, the evidence to support them is meagre. Salt supplies two nutrients which are essential for the body - sodium and chlorine. The chlorine content of naturally occurring feeds appears to be adequate, but under certain conditions sodium could become limiting nutrient.

Experiments conducted by Babcock in 1905 demonstrated that lactating dairy cows required supplemental salt and in 1957 Aines and Smith showed that sodium was the limiting nutrient rather than chlorine. To our knowledge, there is no experimental evidence to indicate that the feeding of salt to grazing beef cattle is beneficial. Sodium is certainly an essential element for beef cattle, but their quantitative requirements have not been determined, nor has it been established that grazing cattle need a supplemental source of sodium.

Experimental

In April 1970 an experiment was commenced at the Sierra Foothill Range Field Station to investigate the effect of withholding salt from breeding cows. Two groups, one of 21 and the other of 22 mature pregnant Hereford cows, were selected; one group was given salt free choice at all times while the other group received no salt. To reduce the effect of field differences, the two groups were alternated between fields at monthly intervals. Over the winter period the cows were supplemented with rolled barley grain and cottonseed meal 3:1 (4 lb/head/day) but no salt was included in this supplement.

Body weight was measured at monthly intervals and blood and parotid saliva samples were taken at intervals throughout the year and analyzed for sodium and potassium.

Results

All cows in both groups calved between late October and late January. One calf in each group died, but the death of the calf in the salt-free group did not appear to be related to the treatment.

The ratio of sodium to potassium (Na:K) in the parotid saliva from the cows receiving salt ad lib was maintained throughout the year at about 20 to 30:1. The ratio in the group not given salt was similar during pregnancy, but during lactation, ratios as narrow as 1:1 were recorded; especially near the end of the first year's observation where cows had been lactating for about 4 months. The ratios of Na:K in saliva samples collected on March 23, 1971 from fourteen of the salt-free cows were less than 2:1 for seven of the cows, and less than 3:1 for a further four cows. However, 2 weeks later when saliva samples were collected from all 21 salt-free cows, the ratio of Na:K had increased to a mean of about 10:1 with only one animal with a ratio as narrow as 2:1 and all the rest were wider than 6:1. The plasma sodium and potassium concentrations were similar in

*Prepared for UC Beef Cattle Day, April 29, 1971.

samples from both the salt-free and the salt supplemented cows.

Body weight of the cows and calves from both groups at the end of the first year's observations were similar.

Discussion

Sodium deficiency in mammals causes a greater release of aldosterone from the adrenal gland. This hormone besides reducing the loss of sodium in the urine and feces causes the parotid salivary gland of ruminants to substitute potassium for sodium in its secretion. Hence, the earliest clinical sign of sodium deficiency in ruminants is a change of the Na:K ratio of the saliva.

Our results to date indicate that cows grazing on the Sierra Foothill Range Field Station do not require supplemental salt during pregnancy, but may require it during lactation. It will be necessary to continue this trial for at least a further year to confirm this tentative conclusion.

BEEF CATTLE BEHAVIOR AND MANAGEMENT*

Kenneth A. Wagnon
Specialist, Department of Animal Science
University of California, Davis

Most people who have spent considerable time working with and observing our domestic animals are well aware that each species has its own ways of performing certain functions. Most animals have a variety of behavior patterns that in some situations allows them to adapt to different conditions. These traits have aided man in domesticating animals. Even so these animals have rather stable patterns of native behavior that must be considered in our management procedures or we will encounter lowered efficiency of production.

Studying the behavior of free ranging beef cows, on a foothill range with scattered growths of brush and trees, is time consuming and beset with many problems. Even so we have managed to collect some information on their grazing behavior, the effects of social dominance on supplemental feeding, use of different classes of range land by cattle and the use of salt in an attempt to vary the use of these lands. This information has been published so we will only consider it briefly here.

The most laborious and time consuming activities of the lactating cow are grazing and ruminating. About May 1st, when the range forage has completed most of its growth, the cows will be spending about 10 hours grazing and another 8 1/2 hours ruminating each 24-hour period. With the maturing and drying of the forage grazing and ruminating times will each be about 8 hours. At the onset of winter rains there will be a marked increase in grazing time to about 14 to 15 hours daily with another 6 1/2 to 8 hours ruminating. This leaves very little time for the cow to look after her calf and rest. Since the cows are also losing weight the need for supplemental aid is obvious.

We encountered problems when hand feeding a limited daily amount of supplements, to mixed-age breeding herds because of social dominance. Due to this butt order behavior it was found there was an increase in ranking in the herd, to a great extent, from 2-year-old heifers to cows 9 to 10 years of age, when it began to decrease. This resulted in the cows of higher ranks getting more than their share of the feed while those of lower ranks were being deprived of varying amounts of their share. Consequently, newly bred and first calving heifers, for the most part, suffered a reduction in rates of reproduction and growth. Mixing the supplements with salt to regulate consumption, with self-feeding, improved the situation but did not completely remove the problem. It is the responsibility of management to provide conditions whereby these younger cows, at the lower end of the butt order, get their share of needed supplements.

Rough range areas frequently are composed of several classes of land as classified by soil type, degree of slope, exposure and brush cover and their effects on forage production. On a range area comprised of nine different intermixed classes of land we found a direct relationship between the forage production of the different land classes and their use by the cows. Even so the swales and more fertile bottom areas were over utilized. Fencing appears to be the most practical method to control the use of these areas. Placing salt licks in less frequently visited areas did not result in increased grazing of those sites.

In progress at the present time is a study on Management-Stress Interactions In Range Beef Cattle Reproduction. From a phase of this study we have recently obtained some information on the effects of some stresses on the estrous cycle of heifers and the associated problem of heat detection by observational means. The artificial insemination of cows is an increasing popular practice in the beef cattle industry. Those that have been involved with this breeding procedure are well aware that a knowledge of estrous behavior is quite important. The cows must first be detected in heat before they may be properly inseminated. In a range artificial inseminating program the first behavorial problem to be considered is that of the observer. He must not only be well trained in what he is looking for, but he must also be sympathetic towards making the inseminating program a success. If he is one of those individuals that is of the opinion the entire business is a waste of time, and could be better handled by a bull, it would probably be best to get rid of him and get a bull because the problem at hand requires the observer's complete interest and attention in order to do a first rate job.

In range inseminating programs it is common practice to observe the cows twice daily with a minimum observation period of about 30 minutes in the early morning and again in late afternoon. The length of the observational periods is dependant on local circumstances. It should be remembered that even when combined these two daily observational periods give a rather small window into the 24-hour activities of the animals. Thus, it is very important that these observations be made at times and under conditions that will best furnish the needed information for detecting those in heat.

The observations should be made when the cows are at ease, with time to idle, and free from distractions such as being fed or nearby movement of feeding equipment, recently being placed with strange animals or being moved to a strange environment, nervous and excited from recent handling, or the presence of dogs or strange persons. If the cattle are being fed daily, feeding should be done well after the morning observation period, at a regular established feeding time, so that the animals will not be anxiously milling about and bawling to be fed. Range cattle are more distrustful of humans than dairy cattle that are used to being handled, and consequently the observer should be quiet and slow in his movements around them. It is good when the observer and cattle are well acquainted with each other.

With twice daily observations we will briefly be observing cows in all stages of their estrous period. Some individuals may only exhibit a weak manifestation of heat. Thus, we must expect variations in the estrous behavior displayed and the degree to which it is expressed. There will be times when we will encounter difficulty in substantiating a standing heat. A vasectomized marker bull is a great aid in indicating the animals in estrous, or in having marked those that had a short heat period between our observations, but cannot be depended upon completely. There will be times when more than one cow is in heat at the same time and he will completely ignore one. Also, similar behavior exists between females in the attention they give to those in heat. In our studies with heifers about two-thirds were in standing heats when first observed while the remainder were seen in pre-estrous behavior before they came in heat.

RICE STRAW FOR BEEF COWS*

Alva W. Mitchell
County Director & Farm Advisor
Agricultural Extension Service, University of California
Butte County

Why the sudden interest in rice straw as livestock feed? In some areas there is a shortage of roughage and this has led to the development of plastic "roughage" or ruminant stimulators. But the real push is that the industry produces annually over one million tons of rice straw in California and in the past has burned approximately 85 percent of this material. Population pressures and the increased awareness of the need for environmental improvement is the basis for new laws regulating agricultural burning. These guidelines to be developed, adopted and to take effect September 20, 1971, put the pressure for other uses of rice straw.

Rice straw is too low in digestible energy, crude protein, calcium and phosphorus to be used as the only source of nutrients for beef cows or growing cattle. Chemical analysis indicates rice straw is probably low in cobalt, copper, magnesium and sulfur, and further information needs to be developed on suspected other minor element deficiencies such as zinc and iron.

In 1955 Butte County Farm Advisors Eldon F. Azevedo and Al Mitchell conducted two rice straw feeding trials with 4-H members Lorry Dunning of Gridley and Vicki Fields of Biggs. In the Dunning trial four Hereford steers with an average starting weight of 640 pounds were fed 98 days and finished weighing 760 pounds for an average gain of 120 pounds or 1.22 pounds per day. The ration fed ad lib was 70 percent rice straw, 10 percent cottonseed meal, 10 percent alfalfa meal, and 10 percent molasses. The steers consumed 6,250 pounds of the mix or 15.9 pounds per day. Feed conversion was 13 to 1.

In the Fields trial, two steers with an average starting weight of 575 pounds were fed a ration of 78 percent rice straw and 22 percent molasses. At the end of 50 days the steers had lost five pounds apiece. The hair coat of these steers was rough and looked unthrifty at the end of the feeding trial. This trial would be an indicator that protein is one of the major limiting factors, and without a protein balance, cattle cannot utilize rice straw efficiently.

In a series of observation trials in Butte County this winter, aged thin, dry cows gained from 1.2 pounds to 1.9 pounds per day. These were group-fed in a drylot and consumed between 25 and 30 pounds per day (see Ration Table 1).

First calf heifers wintered on ration 1 and switched to ration 2 at calving time are in excellent condition and on the average would have graded low-good. These heifers started calving April 1, now seem to be milking good and are consuming approximately 40 pounds per day of ration 2.

Palatability has not been a problem in the 50 and 60 percent rice straw rations. The addition of at least 15 percent water does increase consumption and palatability.

What about the future for feeding rice straw? Research at the USDA lab in Albany indicates that energy value of rice straw can be greatly increased by several kinds of treatment such as alkali, ammonia gas and heat. Research on the feed-

*Prepared for UC Beef Cattle Day, April 29, 1971.

ing value of treated straw is being conducted on the U.C. Davis campus under the direction of Dr. W. N. Garrett at this time.

The mechanics and the economics of treating rice straw have to be developed. This kind of research takes time and is costly.

Rice farmers in the Butte County area of Richvale have been the stimulators for these rice straw projects. The rice industry statewide is taxing themselves 2½¢ per hundredweight of rice to support rice research projects. Their number two priority is finding alternate methods of rice residue disposal other than burning. One of the key problems is the economics of gathering and storing the straw from the field.

Summary: Untreated rice straw probably has its greatest use for carrying dry pregnant cows. Eighty percent rice straw can be used with proper supplementation. Rice straw fed to dry pregnant cows is 50 percent the value of alfalfa hay. Maximum amount of rice straw fed to growing beef steers or lactating cows in a balanced ration has a value of about 35 percent of alfalfa hay (Clawson & Garrett - Rice Straw Utilization by Livestock - California Agriculture, September 1970).

Rice straw's widespread use will depend upon cost of material delivered to feed plants and an economical treatment to greatly improve its feeding value.

RATION 1

Rice Straw	60%	
Oats & Bur Clover Hay	15%	
Alfalfa Hay	10%	
Almond Hulls	10%	
Molasses	5%	
Urea	½%	
Mineral mix	1½%	- containing calcium, phosphorus, cobalt, manganese, magnesium, zinc, vitamin A

15 to 20 pounds of water was added to this mix.

RATION 2

Rice Straw	49%
Oats & Bur Clover Hay	5%
Alfalfa	8%
Almond Hulls	17%
Masonex	5%
Mineral Supplement (30% urea)	2%
Water	15%

DARK CUTTING BEEF*

C. Robert Ashmore
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University of California, Davis

Most investigations support the concept that dark-cutting beef is caused by undue stress immediately prior to slaughter. Preslaughter handling conditions such as withholding of feed and water, trucking of cattle long distances, crowding, and drastic changes of environment, all seem to contribute to an increased incidence of dark-cutters. Dark-cutters can be readily produced experimentally by administration of adrenaline over a 24-hour period prior to slaughter. Adrenaline is a hormone naturally released in the animal in response to stress. The actual sequence of events appears to be as follows:

1. Stress.

2. Release of adrenaline.

3. Depletion of muscle glycogen (accelerated by adrenaline).

4. High ultimate pH of carcass (the breakdown of glycogen in the carcass is primarily responsible for lowering the postmortem pH).

5. Enhanced activity of enzymes that consume oxygen (due to the high pH).

6. Removal of oxygen from the primary meat pigment myoglobin (myoglobin without oxygen is dark red to purplish, whereas myoglobin with oxygen is bright red).

Items 1-4, and 6 are based on sound experimental data. The relativity of item 5 to dark-cutting beef is unproven, and is the subject of current investigations in our laboratory. Initial experiments have shown no direct effect of adrenaline treatment on the respiratory enzymes in the muscle prior to slaughter. The next series of experiments will examine the respiratory enzymes of the meat of dark-cutters at short intervals following death, and of the influence of pH and other parameters on the activities of these enzymes.

Currently, we accept the hypothesis outlined above, and concur with others that the best cure is prevention, i.e., elimination of undue stress prior to slaughter. Animals should be maintained on feed and water as long as possible, and crowding and trucking long distances without feed and water should be avoided.

An interesting possibility, and one easily tested, is that of beneficial effects of a short period of exercise prior to shipping. It is known that exercise stimulates utilization of glycogen by the muscle, but during a subsequent period of rest, muscle glycogen is restored to levels in excess of the original levels. Such a "super-compensation" of glycogen deposition might help to buffer the stress effects of preslaughter handling. A second possibility for investigation is the introduction of respiratory enzyme "poisons"

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into the animal just prior to death. Presumably, this would terminate the oxygen consumption after death, and maintain the desirable red color of the meat. Although this latter type of experiment would not be feasible commercially (it would render the carcass inedible), it would enable us to test directly the hypothesis that increased respiratory enzyme activity is responsible for the undesirable dark color of the meat. Not until we have definitely identified the direct cause of the dark color can we make valid attempts at prevention.

HOW FAT IS OUR BEEF?*

W. N. Garrett
Professor, Department of Animal Science
University of California, Davis

The intramuscular fat content of beef is of particular interest to some consumers because of an alleged negative role played by animal fat in certain circulatory diseases. Some members of the health sciences suggest that beef consumed by people concerned about cardiovascular disease should not contain more than 5% fat. The information in this report was obtained in an investigation sponsored by the California Beef Council to determine how much fat is present in muscles taken from our common grades of beef.

Five muscles were analyzed from 72 choice and good carcasses with varying degrees of marbling. Both heifer and steer carcasses were used and yield grades of 4, 3 and 2 were equally represented.

Choice carcasses averaged 34% total fat and those from the good grade average 32% fat. Heifers of the same grade had 2 to 3% more total fat than steers.

The fat content of the different muscles is shown in Table 1. As indicated all samples from the rib, loin or round of carcass with small amounts of

TABLE 1. The fat content of five trimmed beef muscles as related to grade and degree of marbling

	Choice			Good		
Muscle	Moderate	Modest	Small	Small	Slight	Trace
Flat iron	9.7	8.8	7.7	7.4	6.0	5.5
Center blade steak	12.8	11.8	9.0	9.4	8.0	6.6
Rib eye	6.1	5.5	4.4	4.2	3.7	2.8
Top sirloin	5.4	5.1	4.6	4.0	4.0	3.4
Top round	5.2	4.5	4.2	3.9	3.4	2.7

marbling or less, whether from choice or good carcasses, contained less than 5% fat. The muscles from the upper part of the chuck (flat iron and the center muscle from the blade steak) were usually above the 5% level of fatness although a few individual samples from the good grade with trace or slight degrees of marbling were below this figure. The muscles of the top round and top sirloin were typically low in fat content.

Other data indicated that the fat content of beef muscle is not closely associated with yield grade and that comparable muscles from heifer carcasses contained slightly more (0.5 to 1%) fat than those from steers. Degree of marbling (estimated at the 12th rib) was related to fat content of the muscles.

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This indicates that marbling of the rib eye is a good index of intramuscular fat in other muscles of the carcass.

Cooking by broiling to a medium degree of doneness resulted in both moisture and fat loss. Fat loss in cooking averaged about 8%.

These results indicate that much of the beef that is available for consumption contains low amounts of fat if the outside fat is trimmed off. This information, along with that in the literature indicating that about 50% of the fat in beef is unsaturated should result in a reappraisal of the role that beef can play in the diet of those concerned with cardiovascular disease.

Ranching and Recreation

Maynard W. Cummings
Extension Wildlife Specialist
University of California, Davis

Introduction

I wish to confine the recreation subject to that which is wildlife-based. In our Extension Wildlife programs we are not involving details of picnic and camp facilities, boating and marine development, riding and hiking trails and the many other outdoor recreation outlets. Our research projects, public agency liaison and educational and demonstrational programs relate to managing the fish and wildlife resources. However, these other types of recreation often are incorporated in multiple developments.

The Need

The State has been losing wildlife habitat at an accelerated and alarming rate for the past decade. This loss has been due to a number of circumstances, including: urban sprawl, freeway and reservoir construction, cleaner farming practices, and major land use changes such as large ranch and wildlands being turned into recreational homesite subdivisions.

The demands for hunting space by all means have grown. Not only are there more hunters, but they have increased their own opportunity to enjoy such pastimes by having both more time and money and increased mobility. Unfortunately, as the hunter's demands for space have increased, his opportunity to gain access to that space has decreased. He now must not only contend with more individuals in the field, and more trespassing signs, but less land that produces wildlife. Land that was once a home to wildlife and a place to hunt is no longer suited for either.

The Private Landowner's Role

The California Fish and Wildlife Plan states, "... that California, both now and in the future, must depend to a large degree on the private landholders of the State to 'host' the fish and wildlife resources of the people." It is recommended State policy "... to actively encourage the management and utilization of fish and wildlife resources on private lands ...". These statements are based on a careful analysis of projected increasing demands for both appropriative and non-appropriative use of fish and wildlife resources. The plan properly concludes that it is necessary to foster wise use of all available land and water areas of the State, including those in private ownership.

If steps are not taken to enable landholders to obtain an economic return from wildlife on private land, then the wildlife resources will suffer as more and more wildlife habitat will be lost to other land uses. In addition, public hunting access on the private land that continues to support wildlife will become increasingly difficult. Therefore, the hunting public and the landholder will benefit from a program that will provide for (1) an economic return to the landholder from hunting and (2) increase the public hunting opportunity commensurate with the proper management of the wildlife resource.

An ad hoc committee has been studying the regulatory problems facing landowners who plan to utilize and enhance the recreation potential of their land. New legislation will be required to permit effective and economically viable development.

The licensing and regulation of suitable private lands for the purpose of wildlife management is proposed. This differs significantly from our current practice of licensing private or commercial shooting clubs, in that a licensed Wildlife Management Area would be operated for the propagation, management and harvest of wildlife occurring on the area. An area so licensed would operate under special regulations which would allow latitude in management and harvest of wildlife.

The program is designed to offer positive economic and recreational incentives to the landholder who wishes to manage the wildlife occurring on his land. At the same time, the public's interest in these resources is protected. The landholder will be licensed to manage his land for wildlife production based on an individual plan best suited to and acceptable to the Department. The licensee will be exempted from general statewide regulations pertaining to season, bag and possession limits, but will instead be regulated in this regard through his license issued by the Department on the basis of specific laws and Commission regulations. Under his license the landholder would be allowed to profit from his management program to the limits of the productive capacity of his land and the available market for the wildlife product.

The licensing procedure is described in a proposed new section of the Fish and Game Code which will be considered by the legislature.

This private land management proposal would be a radically progressive step in California game management and is one which is enthusiastically endorsed by Departmental, University and private wildlife managers.

Copies are available for your review.

IRRIGATED PASTURE-FORAGE RESOURCE OR RANGE SUPPLEMENT*

J. L. Hull
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University of California, Davis

Forage Resource

One of the quickest ways an irrigated pasture operator can increase his production per unit area is by good management of his forage resource. Good management must consider not only the type, handling and health of the animals but also all cultural practices associated with the pasture from seeding through harvesting. On these will depend not only production per unit area on a daily basis but also on the useful life of the pasture. Several areas of irrigated pasture management, when added together and done properly, can increase yields significantly. Some of the obvious ones are: irrigation, fertilization, weed control, stocking rate; also type, size and health of cattle. The type of grazing management system used and the type of pasture being grazed can also influence total and/or type of production obtained.

Trial 1

Studies at Davis with irrigated pastures seeded to orchardgrass, perennial ryegrass, ladino clover and strawberry clover compared continuous grazing to a five-field rotational grazing over a four-year period, and to a two-field rotation for two years. Beef steers were used for three years and beef heifers for one year. Stocking rates were approximately equal within years for each grazing treatment and were such that forage availability would allow maximal individual animal performance.

TABLE 1. Continuous vs. rotational grazing (two years)

	Continuous	2-field rotation	5-field rotation
Animal days/acre	1501	1550	1501
Ave. daily gain, lb.	1.52	1.48	1.39
Live wt. gain/acre, lb.	961 (1028)*	937 (1034)*	862 (960)*

*Figures in parentheses show an estimate of additional gain per acre made by cattle utilizing pre-trial excess forage.

Yearling beef steers (good to choice grades) were allotted at random to the grazing treatments after number branding and treatment for worms. During the course of the trials the steers were weighed every 28 days after an overnight shrink without feed or water. Where the animals were carried for the entire grazing season (Table 1), it was possible to obtain very good production of beef/acre (approximately 1000 lb.) although the animals were of inadequate finish for slaughter. Continuously grazing consistently resulted in 3-8% higher average daily gains and more beef/acre than rotational grazing.

Changes in botanical composition differed among the grazing management systems. A higher percentage of legumes persisted in the sward under continuous

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grazing, but regardless of the grazing system, there was a trend toward higher percentages of grass over time.

Rates of water infiltration increased progressively during the four years of the experiment in both the continuous and rotationally grazed pastures. However, these experiments were conducted on Yolo clay loam, a soil of generally desirable, physical characteristics, and results may not be the same on poorer soils. It was concluded that the type of grazing management system used should not be determined by the method or timing of irrigation application, but by other criteria such as soil type, temperature and plant growth.

Trial 2

Irrigated pasture composed of cool season forage species (orchardgrass, ryegrass, ladino and strawberry clover) were compared to one consisting of primarily warm season species (Dallis grass and Bermuda grass). This trial was conducted at the Sierra Foothill Range Field Station and was for one growing season. The steers were continuously grazed, allotted, treated and weighed as in trial 1. The trial was started as soon in the spring as forage growth permitted. Here again stocking rates were such as to allow maximal individual animal performance and increased or decreased as forage availability dictated. The cool season pasture was sprinkler irrigated and the other flood irrigated at approximately nine and 14 day intervals, respectively.

The pasture planted to the cool season species outperformed the other in beef produced by almost 20% (Table 2). This is a reflection of more animal days per acre and a higher average daily gain. Even though the forage production of warm season grasses was high during the hot summer months, the apparent lack of growth early in the season and the rapid decline in forage production in the fall resulted in lower total beef/acre.

TABLE 2. Comparison of type of irrigated pasture (191 days)

	Cool season plants	Warm season plants
Animal days/acre	1826	1590
Initial wt., lb.	413	426
Ave. daily gain, lb.	1.64	1.39
Gain/acre, lb.	705	575

Unless the livestock operator is able to adjust his stocking rate to efficiently utilize the short mid-summer flush of growth shown by the warm-season grasses, an accumulation of stemmy, impalatable dry matter can accumulate, lowering both the quality and productivity of the pasture.

Range Supplement

Another way of looking at irrigated pasture could be as a protein source for dry range supplementation. It has been shown that using cottonseed meal and other protein sources as a supplementation of beef cattle grazing dry annual

range will increase beef production per acre, percentage calf crop, weaning weight of calves and general thriftiness of the cattle. Comparative average costs for CSM and for irrigated pasture production indicate that a unit of protein from CSM could cost as much as three-equivalent units from intensively-managed irrigated pasture.

Trial 3

Studies conducted at the Sierra Foothill Range Field Station using the cool season pasture described in trial 2 and an adjacent dry range were conducted over two different summer dry forage seasons. The cattle were weighed and handled as previously described.

TABLE 3. Dry range supplementation
(Ave. 2 year's data, 107 days, 8 head/treatment)

	Dry range			
	Alone	+ 1.5 lb. CSM	+ 3 times per week irrigated pasture	Irrigated pasture
Acres used	30.5	26.0	18.8+1.8	4.2
Animals/acre	0.28	0.28	0.42-8.0	1.9
Initial wt., lb.	655	642	655	613
Final wt., lb.	678	732	770	765
Ave. daily gain, lb.	0.22	0.83	1.07	1.39
Ave. daily gain/acre	0.07	0.25	0.43	2.5

The response to the addition of protein to the dry range diet either as CSM or irrigated pasture was apparent both years. The most striking differences between treatments was in ADG/acre where, by the use of a small area of irrigated pasture a 30% increase in production above that of the CSM supplemented dry range area was obtained. Another item of interest was that even though the cattle had access to the irrigated pasture on three days/week they actively grazed the dry range forage on the other days.

From the data obtained in this trial and preliminary trials at Davis it was concluded that irrigated pasture could be used advantageously to increase the amount or improve the quality of beef production from cattle grazing dry annual-range forage. It can also be concluded that irrigated pasture could compete favorably with CSM as a supplemental protein source for dry annual range forage.

ANIMALS, FORAGE AND WATER IN THE FOOTHILLS*

Charles A. Raguse
Assistant Professor, Agronomy and Range Science
University of California, Davis

The problems involved in achieving economically efficient production of meat under foothill conditions are many and varied. What is biologically attainable may not be economically feasible. The reports and projections of agricultural economists are not encouraging. Still, the land remains, much of it under private ownership. There will be a practical limit to land speculation in anticipation of returns from sub-divisions and recreational development. Millions of agriculturally-productive acres will remain in relatively close proximity to major urban populations.

Perhaps we can take a lesson from the history of agriculture, in its development over time and in its solutions to production problems in other crops. Three guidelines seem logical for adoption if foothill beef production is to remain a healthy member of California's agricultural community:

1) Raise the level and quality of plant production on selected sites, that is, those with greatest potential and uniformity.

2) Intensively manage the production of forage on these selected areas.

3) Select highly efficient systems of utilization, with emphasis on efficiency of conversion from plant to saleable animal products.

The programs of research now underway at this Field Station involve the cooperative efforts of people from many College and University Departments. Experiments will be directed toward the following goals:

I. PLANT

1. Emphasis on allocation and utilization of resources on a year-around basis.

2. Development of new and more intensive production management systems, including attention to comparative efficiencies at different levels of available forage, more efficient nitrogen fixation by introduced annual legumes, more efficient cycling of nutrients, cattle management practices favorable to newly-introduced plant species, and use of alfalfa cube supplementation as a management tool.

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*Prepared for UC Beef Cattle Day, April 29, 1971.

II. ANIMAL

1. Development of beef production systems based on higher stocking rates year-long and on variable stocking pressure (animal intake per unit of forage available).

2. Attention at the animal level to more efficient conversion from plant to animal and on timing of animal production as it relates to feed availability and the market.

III. WATER

1. Achieving greater economic efficiency through use of appropriate irrigated forage species where highly efficient use of the more-costly forage can be justified in a feeding program.

2. Avoidance of possible environmental pollution problems resulting from runoff of winter rains and/or summer irrigation water.

The general approach, then, is to look at the production system as a whole under the assumption that small increments of efficiency in many areas can be additive, with the end result an improved vitality of foothill beef production.

PERENNIAL GRASSES FOR RANGE USE

James E. Street
Agricultural Extension Service

At the Sierra Foothill Range Field Station and in other locations, an intensive program testing 8 varieties of Phalaris plus other items has been underway since 1964. Unlike many "garden-plot" testing programs these experiments are being conducted on rangeland sites. Survival, year after year, and rapid winter growth are the most important characters of a successful perennial range grass. Thus, survival and winter growth are the main items being measured in these experiments.

In these tests the Moroccan-types including Sirocco and Perla have looked best. They go dormant early, for better summer survival. They grow faster in fall and winter, which is what we are after. They also have better seedling vigor which may help during establishment and at least can't hurt anything.

These grasses go dormant in summer but still must have roots in some moisture. Therefore they must be grown where their roots have penetration into deep soils. They don't do well on hardpan or claypan soil. Also, they don't like extremely acid conditions.

A variety called Seedmaster has been grown in some parts of the world but shows poor survival in California. Therefore, if a perennial grass is to be seeded below 4000 feet in California, Sirocco is probably the best available. Seed has to come from Australia so must be ordered five months in advance of planting. But remember, in most cases a good legume is more important than the grass that goes with it.

RANGELAND MICROCLIMATES

B. L. Kay
Agronomy and Range Science

Problems in establishing range seedings have led to studies of the range microclimate. Among the climatic factors currently being measured are soil moisture, soil and air temperature, and light. Measurements are concentrated around the germinating seed and seedling.

All measurements are made once each hour by means of an automatic recorder. Values are recorded on tape in the shelter on the site. The tapes are then mailed to the Agricultural Research Service in Reno where the data is graphed by computer.

In addition to measuring the microclimate on both the north and south slopes, we are comparing the differences between a weed-free environment (obtained by spraying with paraquat when the seed was planted) and the usual high population of plants found on this range. Perlagrass Geraldton subclover, and Hykon rose clover were seeded in all treatments.

This information will help plant scientists develop better seeding and management practices for California rangelands.