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SIERRA FIELD STATION FIELD DAY

APRIL 22, 1989

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UTILIZATION OF BY-PASS PROTEIN IN LIQUID SUPPLEMENTS

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INTRODUCTION:

Supplementation during the winter months (November to February) and to some degree in the dry feed season (July to October) is common practice among California beef producers to improve the performance of grazing animals. It is during these periods that nutrients, particularly protein, are in short supply or of poor quality.

There are a number of different feed supplements available which vary in content, cost and the method with which they are fed. These supplements are usually high in nonprotein nitrogen sources such as urea. Urea is a relatively inexpensive source of nitrogen but is poorly utilized by the animal.

Research indicates that a large portion of dietary protein, especially non-protein based nitrogen sources such as urea, are utilized by the microbes within the rumen for replication and fiber digestion. The supply of protein to the small intestine is the sum of the dietary protein that escapes ruminal degradation and the microbial protein synthesized within the rumen. This protein is then digested and absorbed for tissue growth of the animal or excreted in the feces.

Klopfenstein and coworkers have studied various types of dietary proteins called by-pass or escape proteins which survive microbial degradation in the rumen and are made available postruminally to the animal. Research in Nebraska (Geodeken, et al, 1986; Anderson, et al, 1987) has shown that calves confined to the feedlot and fed supplements containing bypass protein performed superior to calves fed urea based supplements.

Distillers grains, meals (bone, meat, feather) and corn gluten meal are among those sources classified as by-pass protein. These proteins differ in their digestibilities and in regard to the balance of amino acids they supply during metabolism. Which by-pass protein or protein combination to utilize as a nitrogen source also becomes a question of availability and cost.

Molasses based liquid supplements have grown in popularity as a means of supplying range cattle with the additional nutrients necessary for adequate performance. New suspension technology utilizing xanthan gums and clay have made it feasible to test various protein sources in liquid supplements without the problem of sedimentation.

In an effort to determine the utility and cost effectiveness of by-pass protein supplementation on California native range, a 3 year study was undertaken to evaluate various protein combinations on stocker steer performance. As a second objective, post-supplementation gain information will be collected to determine if compensatory gain does occur and to what economic end.

To better understand the effect stocking density has during supplementation, an additional factor (high vs. low stocking rate) was incorporated into the design of this trial. The resulting two by two factorial design (protein supplement by stocking density) is outlined in Table 1.

MATERIALS AND METHODS:

English and English cross stocker steers averaging 500 pounds were obtained from local auctions. Each of the 8 treatments was replicated for a total requirement of 144 head per year. All calves were processed and randomly allotted to one of the 16 groups.

Table 1. Experimental design.

Stocking density:	Low (5.33 ac/hd)	High (2.67 ac/hd)
Treatment:		
Control	6 head	12 head
Liquid Supplement, Urea	6 head	12 head
Liquid Supplement, Bypass	6 head	12 head
Liquid Supplement, U + BP	6 head	12 head

Corn gluten meal was the bypass protein selected for use in this trial. Corn gluten has been successfully suspended in liquid supplements and is readily available. Gains from corn gluten were comparable to other sources of bypass protein (Geodeken, et al, 1986).

Five hundred and twelve acres of cleared native range was divided into 2 blocks of 8 fields per block (16 total fields at 32 acres per field). Each block represented high or low stocking density. All steers were placed in drylots over night, weighed and rotated to a new field within their respective blocks every 28 days.

Supplements were commercially formulated and mixed and fed in lick tanks at the rate of 2 pounds per head daily. All tanks were weighed weekly for consumption data.

RESULTS & DISCUSSION:

As of this report, one and a half years of data has been collected and preliminarily analyzed by two way analysis of variance.

Initial consumption was lower during the first month on test (Table 2). Consumption increased as the animals became accustomed to the lick tanks.

Table 2. Supplement consumption by month. (pounds per head per day)

	1987-88	1988-89
November	1.51[a]	1.48[a]
December	1.78[ab]	1.77[ab]
January	1.94 [b]	1.90 [b]
February	1.89 [b]	1.91 [b]

[a,b] Means in the same column with different letters are significantly different ($P < 0.05$).

Consumption among treatments was lower ($P < 0.05$) for the urea supplemented steers as compared to the other two groups in 1987-88. However 1988-89 showed no significant differences between groups (Table 3).

Table 3. Supplement consumption by treatment. (pounds per head per day)

	1987-88*	1988-89*
Urea	1.51[a]	1.63
Bypass	1.86 [b]	1.88
U + BP	1.97 [b]	1.78

*Duration of supplementation in 1987-88 =141 days, 1988-89 = 111 days.

[a,b] Means in the same column with different letters are significantly different ($P < 0.05$).

Stocking density had no effect on supplement consumption in either 1987-88 or 1988-89. However, the level of stocking did effect ($P < 0.0001$) average daily gain (Table 4).

Table 4. Average daily gain by stocking density. (pounds per head per day)

	1987-88	1988-89*
High density (2.67ac/hd)	0.81[a]	0.59[a]
Low density (5.33ac/hd)	1.15 [b]	0.89 [b]

*March gain data not included in 1988-89 figures.

[a,b] Means in the same column with different letters are significantly different ($P<0.0001$).

The overall performance (cummulative average daily gain) of the steers during the supplemental feeding period is summarized in Table 5. Stockers fed the bypass protein tended to gain more rapidly than the controls. Data reported for 1988-89 does not include the March weigh day as does the 1987-88 data.

Table 5. Average daily gain by supplemental treatment. (average daily gain in pounds)

Treatment	1987-88 (11/2-3/23)	1988-89 (11/3-2/22)
Control	0.78[a]	0.44[a]
Urea	0.90[ab]	0.67 [b]
Bypass	0.97 [bc]	0.79 [bc]
U + BP	1.06 [c]	0.87 [c]

[a,b,c] Means in the same column with different letters are significantly different ($P<0.01$).

Table 6 reports the average daily gain which occurred between weigh periods. Because of the short time interval between weights, this data has more variation than Table 5 (cumulative ADG). The data in Table 6 does not eliminate the effect individual fields may have on ADG. Steers are on the same field for the entire 28 day period. Table 5 eliminates field bias by reporting cumulative ADG which has occurred over a five field rotation.

Table 6. Average daily dain by month. (average daily gain in pounds)

	1987-88	1988-89
November	0.86	0.35
December	0.53	0.92
January	0.26	0.56
February	1.27	0.94
March	1.75	NA

Tables 7 and 8 report the overall performance and economics of the trial by year. These figures cover the period of supplementation only.

Table 7. 1987-88 Performance and economics of supplementation. (141 days on supplement)

	Control		Urea		Bypass		U+BP	
	High	Low	High	Low	High	Low	High	Low
ADG:	0.65	1.05	0.78	1.13	0.94	1.30	0.89	1.16
Daily Consumption (lb/hd/d)	----	----	1.38	1.63	1.78	1.93	1.98	1.95
Supplement Cost/head($)	----	----	13.29	15.70	24.57	26.64	26.97	26.56
Return over Supp. ($)/hd	78	126	80	120	88	129	80	112
Return per acre ($)	29.21	23.60	30.07	22.45	33.03	24.22	29.89	21.09

[a] Price of calves valued at $85/cwt
[b] Cost of supplement/ton : Urea= $136.60, BP= $195.80, U+BP =$193.20

Table 8. 1988-89 Performance and economics of supplementation. (111 days on supplement)

	Control		Urea		Bypass		U+BP	
	High	Low	High	Low	High	Low	High	Low
ADG:	0.34	0.64	0.55	0.91	0.74	1.11	0.74	0.90
Daily Consumption (lb/hd/d)	----	----	1.60	1.67	1.93	1.84	1.67	1.89
Supplement Cost/head($)	----	----	12.17	12.70	21.42	20.42	19.46	22.03
Return over Supp. ($)\hd	32	60	40	73	48	84	50	63
Return per acre ($)	12.03	11.32	14.90	13.72	18.15	15.81	18.89	11.79

[a] Price of calves valued at $85/cwt
[b] Cost of supplement/ton : Urea= $137.00, BP= $200.00, U+BP =$210.00

Cost of supplement used in this analysis does not consider labor expense.

Return over supplement costs were higher for the low stocking rate fields on a per head basis because of higher average daily gains. However, returns per acre favored the higher stocker densities. Higher cumulative average daily gains in 1987-88 resulted in superior returns as compared to the 1988-89 trial. This is due in part to year differences in residual dry matter of the test fields at the onset of the trial.

CONCLUSIONS:

Steers consuming the bypass protein supplements gained the most weight and returned more dollars over supplement cost. It is not yet clear what added benefit, if any, the combination of urea and the corn gluten meal may have.

Steers in the low stocking density groups (5.33 acres/hd) gained more weight than the high stocking density groups (2.67 acres/hd) across all supplement treatments. As a result, the lower stocking density groups returned more dollars per head. Dollar return per acre favored the high stocking density groups.

Variations in overall average daily gains between years may be a reflection of residual dry matter differences at the onset of each trial.

Due to the drought which affected most of the United States during the 1987-88 feed year, compensatory gain could not be collected under range conditions. Cattle were moved to the UCD feedlot in late March, 1988 where subsets of each group were fed identical rations and weighed for gain comparisons. This data is currently being analyzed. The post-supplementation period for the 1988-89 feed year in presently underway.

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49ER FIRE REVEGETATION ACTIVITIES

Douglas D. McCreary

Introduction

In September, 1988 a fire swept through Western Nevada County, destroying 200 homes and burning over 35,000 acres of land. In terms of property loss, the 49er Fire was one of the most destructive in California history. It was also tremendously damaging to native vegetation, which was predominately oak trees.

The fire burned to the very edge of the Sierra Field Station on the east side of Engelbright reservoir. On the third day of the fire, several California Department of Forestry and Fire Protection crews (CDFFP), supported by large cats, established outposts adjacent to Station property to attack any spot fires that might jump the reservoir or the Yuba River. However, the winds finally subsided and the fire was contained in Nevada County.

Revegetation and Oak Replanting Efforts

Soon after the fire was extinguished, efforts began to revegetate burned areas. The Soil Conservation Service, the CDFFP, and the County shared the cost of an aerial seeding program for the most critical areas, including firebreaks and sensitive watersheds. A mixture of grasses and legumes were seeded including orchardgrass, wheatgrass, blando brome, vetch, and rose clover. Altogether 400 acres of firebreak were reseeded, as well as 2500 acres of watershed.

Other groups also became involved in revegetation. The local Rotary Club initiated the "Green Again Project", which raised money for the County's share of the aerial reseeding costs. This Project also distributed over 50,000 pine trees donated by the Louisiana Pacific Corporation. The U.S. Forest Service and Pacific Gas and Electric worked with the Resource Conservation District to also give away thousands of pine and fir trees.

Another project based at the Sierra Field Station and the U.C. Cooperative Extension Office in Grass Valley focused on re-establishing native oak trees. "Project Acorn" began with a call for volunteers to collect acorns from the five native oak species affected by the fire. There was some urgency to this request since no acorns were available in storage and if the current crop was not collected within 2 months of the fire, it would be another year before an oak planting operation could get underway. It was also felt that the conditions favoring oak seedling establishment would be much better immediately following the fire than they would be at any time later. Flyers requesting help, as well as an information leaflet describing how to collect and store acorns were published and distributed.

Public response was overwhelming. Over 1000 pounds of acorns were collected by a variety of groups, including scouts, school classes, church groups and families. A drop-off center was established at the Grass Valley Extension Office. Acorns were sorted and placed in cold storage at the Field Station.

Around the first of the year, the planting phase of the project began. Four training sessions were held to show people the best techniques for planting, protecting and maintaining acorns and seedlings. In addition, there were several feature articles in local newspapers and radio interviews encouraging people to join in the planting effort. Bags of acorns were kept in a refrigerator at the Extension Office for people to pick up whenever they wanted to go planting. Planting tools including trowels, shovels, and acorn holding aprons were also available to check out.

Conclusion

By mid-March, nearly 800 pounds of acorns had been planted. While it is still too early to evaluate the success of Project Acorn in terms of oak tree establishment, the project was certainly successful in educating the public about the important values of oaks and in generating public interest, awareness, and participation.

RANGE COW MANAGEMENT

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The overall objective of a management system for range cows is to maximize net income in relation to the investment in cows, land and resources. As net income is the difference between gross returns and costs, we should first examine the determinants of gross income from a cow-calf operation. Gross returns are maximized when a high percentage of calves are weaned in relation to cows breed, and calves are weaned at a heavy weaning weight. A high percentage of calves at weaning requires a high conception rate. In the absence of reproductive diseases, nutrition of the cow in the period immediately prior to, and after calving is a prime determinant of cows coming into estrus and conceiving. Weaning weight of the calf is a function of milk production of the dam, which can only reach its genetic potential if there is a high plane of nutrition. Profitability of the operation depends on the costs of achieving high pregnancy and weaning rates, and high milk production in the cow.

The nutritive value of range forage varies greatly throughout the year. Supplementation of cows on range can provide nutrients deficient in the forage, but often this incurs considerable financial outlay. The effect of five levels of supplementation of the range cow on reproduction and weaning weight of the calves was measured over six seasons at the Sierra Foothill Range Station. Cows were given supplements of alfalfa cubes corresponding to 0, 200, 400, 600 and 1000 kg /cow /year. Results showed that conception rate of the cows was poorly related to level of supplementation (r^2 = 0.35) whereas weaning weight of the calves was linearly related to level of supplementation (r^2 = 0.97). The low level of response in pregnancy rate of the cows at the Sierra Foothill Range Field Station (SFRFS) to supplementation was at variance with results reported by Wagnon and co-workers some fifty years earlier at the San Joaquin Field Station. Besides a difference in location of the experiment, the type of supplement was different; Wagnon used cottonseed meal and barley and we used alfalfa cubes.

EXPERIMENT NOW IN PROGRESS

An experiment was initiated at the SFRFS to measure the effect of supplementation of the cow and creep feeding of the calves on reproduction and weaning weight. A 2 x 2 latin square design was used: two groups each of approximately 40 cows were supplemented and two groups received no supplement. The supplement was 1 kg of cottonseed meal (CSM) /day beginning August 15, which was then increased to 1.5 kg at calving and on November 1, 1.0 kg of rolled barley was added to the 1.5 kg of CSM. Calves from one of the supplemented and one of the non-supplemented groups were given a creep of CSM ad libitum. All calves were weaned at the same time in May.

In the first year of the study, lack of forage due to low rainfall necessitated that all cows be given a supplement and consequently the true response to the different levels of supplement may have been minimized. However, weaning weight of the calves from the two groups of cows that were supplemented was higher than that of the non-supplemented groups.

Effect of supplementation on pregnancy rate

No apparent pattern has emerged in relation to the effect of the supplement on pregnancy rate, despite the supplemented cows being on the average 56 kg heavier at the beginning of mating. These results are consistent with those of the previous long term trial in which only a small response in reproduction to supplementation was found.

Table 1 Pregnancy percentages of cows according to whether the cows were supplemented or the calves creep fed by years.

Group	Cows supp- lemented	Calves creep fed	Year 86/87	Year 87/88
1	0	0	89	94
2	0	+	89	86
3	+	0	100	94
4	+	+	89	91

Weaning weight of calves

The weaning weight of the calves presented in table 2 show that supplementation of the cow results in heavier weaning weight. The heavier weaning weight of the calves from the supplemented cows was related to a greater milk production of these cows as shown in table 3.

Table 2. Weaning weight of calves (kg) according to treatments and years (combined sexes)

Group	Cows supp- lemented	Calves creep fed	Year 86/87	Year 87/88	Mean
1	0	0	172	145	158.5
2	0	+	174	170	172.0
3	+	0	191	182	186.5
4	+	+	207	181	194.0

Creep feeding of the calves

Creep feeding increased weaning weight of calves from non-supplemented cows by a mean of 13.5 kg and calves from supplemented cows by a mean of 7.5 kg. For the calves weaned in 1988 there was no response in the weaning weight of calves from supplemented cows to creep feeding, even though 63 kg creep/ calf disappeared. Calves from non-supplemented cows ate considerably less creep feed than calves from supplemented cows. Presumably the lower intake of the calves from the non-supplemented cows was due to the cows not bringing the calves into the area where the creep was available. The 1987/88 calves from non-supplemented cows ate 19 kg cottonseed meal supplement /head. The efficiency of feed conversion to gain was approximately 1.4 kg creep feed / 1 kg calf gain.

Effect of supplementation of cows on milk production

Milk production of the cows was measured twice in the 1986/87 lactation and three times in the 1987/88 lactation. For the calves weaned in 1987, the group mean weight gains from birth to both 12/13/86 and 2/11/87 were highly correlated (r = +0.98) with the group mean milk yields measured on 12/12/86. This is interpreted to as showing the supplement had its main effect on early weight gains of the calf through increasing milk production of the cows.

Table 3. Milk production of cows according to treatments (kg /cow/24 hours)

Group	Cows supp-lemented	Calves creep fed	Year 1 Dec 86	Year 1 Mar 87	Year 2 Dec 87	Year 2 Feb 87	Year 2 Apr 87
1	0	0	6.36	6.06	5.32	3.76	5.50
2	0	+	6.68	4.73	4.24	5.20	2.28
3	+	0	3.28	3.74	6.24	6.92	3.12
4	+	+	4.58	4.05	6.10	5.54	5.32

Does it pay to supplement range cows and creep feed calves?

In this experiment, for which preliminary results are being presented, and in the previous experiment at this field station using alfalfa cubes, straight Hereford cows were used, the level of management was high, and stocking rates were conservative. Therefore, the results should be interpreted in this context. For both experiments, the response in reproductive performance to cows was either very low or non-existent. Therefore, for supplementation to be cost effective the whole response has to be borne by the increase in weaning weight of the calves. In the alfalfa supplementation experiment, there was a highly significant linear response in weaning weight to level of alfalfa supplementation. However, the efficiency of conversion of alfalfa to weight gain was 33 kg alfalfa/kg increase in calf weight gain. In order to cut even on such a program, a pound of alfalfa as fed to the cows would have to cost less than 1/33 the return on one pound of weaned calf.
In the experiment in progress, the mean response in weaning weight to supplementation of the cows was 25 kg, which was took 275 kg cottonseed meal and 133 kg of rolled barley. At cottonseed meal costs of $0.14/lb and barley at $0.065/lb the cost of one pound of additional gain due to supplementation of the cows was $ 1.90. Obviously, this is not economically viable on today's weaner prices.
Calves from the supplemented cows gained a mean of 7.5 kg due to creep feeding. Creep intake in 1987/88 was 63 kg cottonseed meal/ calf which did not result in a positive financial return. In contrast, calves from non-supplemented cows gained and additional 13.5 kg and in 1987/88 ate only 19 kg creep feed. Costing the cottonseed meal at $0.14/lb the cost of the additional gain to creep was $0.20, which was highly favorable.

Creep feeding calves from non-supplemented cows is the only practice that can be recommended from these experiments. However, results from supplementation in a different locality, with a breed of cow with a higher milk production than those which we used, or at a higher stocking rate may warrant a different set of conclusions.

IRRIGATED PASTURES: FIRST-YEAR EXPERIENCES WITH "CONTROLLED GRAZING"

Charles A. Raguse

Introduction

This article will summarize our first-year experiences with "short duration" (or "controlled") grazing with beef cattle on a perennial grass-legume irrigated pasture. A more complete report will be published later this year in California Agriculture.

The site had been in irrigated pasture for a number of decades and during most of that time was wild flooded. Drainage problems, especially at the south end, were common and still exist although to a lesser extent following concreting of the irrigation water supply ditch and installation of a (solid-set) sprinkler system.

Pasture establishment

Early in 1986 a permanent irrigation system was installed that permitted independent and successive irrigation of the 24-acre site in four individual blocks of six one-acre sub-fields or paddocks (Fig. 1). The pasture was sown in mid-October, 1986 with 20 lb/ac of a mixture consisting of 2 lb ladino clover, 3 lb 'Salina' strawberry clover, 2 lb birdsfoot trefoil, 6 lb orchardgrass, 4 lb perennial ryegrass and 3 lb of annual ryegrass. The annual ryegrass was added to provide for a vigorous, well-rooted cover to stabilize the soil against erosion caused by winter storms.

Fencing first divided the 24-acre area into the four six-acre fields already described. The area was rotationally grazed by cattle as necessary. Following design and approval of a controlled grazing experiment fencing was completed in April 1988 and the experiment was begun June 1, 1988.

Fertilizer applied

Fertilizer applications were guided by previous management experience at the Station and by specific objectives, such as the fall 1988 use of P and S without N to encourage legume growth.

1986, fall: 400 lb/ac 10-36-0-12
1987, spring: 200 lb/ac 21-0-0
1988, early May: 200 lb/ac 16-20-0 (block I only)
" June 7-29, following the grazing rotation: 160 lb/ac equivalent concentrated on the upper 3/4 of the paddocks.
" early November: 300 lb/ac of 0-36-0-19

If funding support becomes available, a long-term nutrient cycling and fertility management research study will be added to present research in pasture management and utilization. Last year a funding proposal was submitted to the new UC Davis Sustainable Agriculture Program, but funding was not awarded. We will continue to search for funding support of a long-term study of pasture-range livestock systems.

Objectives and design of the experiment

The first objective (most experimenters won't admit to this) was to figure out how to run the experiment and get all parts of the system to work together. Next, to find out whether the often-referred to S-shaped regrowth production curve (Fig. 2) could be demonstrated under actual pasture conditions, and, finally, to compare results of two forage accumulation and use treatments based on assumptions derived from the regrowth curve. We arbitrarily set three days as the grazing use interval and 21 days as the pasture regrowth interval. We also estimated that from six to ten paddocks would be adequate for a grazing rotation cycle, depending on time of season and other factors. For simplicity we used the 3-day/21-day cycle for both accumulation-use (A-U) comparisons.

Animal management. Lacking sufficient information to accurately and precisely set stocking rates, we used the so-called "tester-grazer" approach. Tester animals are those continuously on the pasture for the duration of the experiment. Their performance customarily is used to also estimate the performance of the grazer animals, which are added to (or removed from) paddocks as required to attain the desired level of forage removal. In this experiment tester animals (and most of the grazers) were weaned heifers, initially weighing 425 to 450 lb, from the Station herds. Some larger, 1000-lb two-year olds, and cows, also were used as grazers. The unit of grazing use was an animal hour, regardless of class or weight. The tester animals were weighed (after overnight drylot) at the beginning of the experiment (June 1) and at the end. At the experiment's conclusion (September 5, four complete grazing cycles), the animal product yield for a given paddock was the total grazing hours for that paddock multiplied by the average performance (average daily gain, or ADG) of the tester heifers for that treatment.

Setting the accumulation-use treatments. It would have been desirable to base treatment stocking conditions on forage weight accumulated, consumed by grazing, and remaining at the end of a grazing interval. Not having a monitoring capability sufficient to establish these values and also allow us to change stocking rates quickly to avoid under- or overgrazing, we used forage height classes to define the two treatments and field height measurements to monitor changing conditions. We began by averaging heights of both grasses and clovers, then used heights only of orchardgrass, which was widely distributed. The beginning and end (of the 3-day grazing period) heights for the two A-U treatments are given below.

	"High" treatment	"Low" treatment
In:	12 to 14"	8 to 10"
Out:	4 to 6"	3 to 4"

A New Zealand-made (Design Electronics, Ltd.) single probe pasture meter was used to collect numerical data which gave an indication of forage weight present. We attempted to calibrate the meter using standard double-sampling procedures.

Irrigation management. The pastures were sprinkler irrigated following these rules:

1. No irrigation when cattle were in the paddocks.
2. Irrigation was done not less than 3 days prior to entry of livestock.
3. The non-irrigated interval to not exceed 7 days unless rule 1. or 2. was compromised.

Irrigation was carefully done and pasture water management was close to ideal, taking into account limitations of terrain and soil conditions. Amounts applied were based on evaporation pan measurements at the Station.

Results

Botanical composition, including weeds (Table 1). As a result of plant species changes related to establishment of a newly-sown pasture and a general response to grazing management the proportion of orchardgrass increased and ladino clover decreased following one season of legume dominance (1987). Perennial ryegrass varied between about 5 to 10 percent and strawberry clover remained an almost vanishing small proportion (less than one percent). An important increase in weedy species occurred over this time, from less than one percent in September 1987 to eight percent in March 1989. Of these, the most widely distributed broadleaf was *Rumex crispus* or curly dock and the potentially most troublesome summer grassy weed was *Setaria lutescens* or yellow foxtail. The percentages of curly dock were not different between the grazing treatments when measured in March of this year, but if sorted according to irrigation block the average for blocks I and II (Fig. 1) was 6.0% as compared to 1.7% for blocks III and IV. It is possible that seed of this species may have entered by being carried along with irrigation water at a time when seed-ripening and seed-fall occurred along the irrigation supply ditch. Contamination from surface water supply ditches is well-known. On 28 February this year an application of 3/4 lb/ac A.I. of 2,4-D amine herbicide was applied to reduce the population of curly dock. This treatment would have also stressed the legumes.

Pasture regrowth responses to grazing. Figure 2 shows the theoretical basis for one objective of this experiment, to demonstrate the regrowth curve under field conditions. Figure 3 shows the actual responses, when regrowth was monitored using orchardgrass height as an indicator. Four points are of interest: First, it could be inferred that regrowth during cycle 1 was on the linear portion of the theoretical curve while cycles 2 to 4 were on the upper, rate-slowing portion. Second, mathematically, the regrowth-rate response was almost identical between the two grazing level treatments. Third, these two treatments were clearly separated. Visual differences between the pasture treatment pairs were obvious. Fourth, we would not have wanted to have grazed more closely at the end of the 3-day grazing period than was the case for the "low" treatment. Concern was expressed by several persons that these pastures should not be grazed harder. During the fall, lighter grazing permitted the clovers to again fill in and visual differences between treatment pairs disappeared. A fall application of about 50 lb/ac P and 60 lb/ac S was also made in order to restore vigor of the legumes.

Livestock gain responses. Tester heifers in the "high" treatment gained an average 1.40 lb/day and those in the "low" treatment gained 1.44 lb/day. These numbers were not statistically different. When multiplied by total grazing hours to give an estimated lb/acre yield the "high" treatment yielded an estimated 533 lb and the "low" treatment yielded 614 lb/acre. This difference was significant at the 5% level. The "low" treatment consistently had a higher stocking rate and this, together with the same ADG, resulted in a higher gain per unit area.

In addition to providing a basis for estimation of the stocking rates needed to remove a given amount of forage in 3 days, the change in grass height from beginning to end of a grazing period was well-related to liveweight gain per acre (Fig. 4). The upward-curving nature of the "low" treatment response reflects the heavier stocking rates used.

Other. No plant diseases of consequence were noted, but an early fall (1988) infestation of army worms caused damage to the clovers.

Probably the single greatest deficiency of management was not being able (due to lack of suitable equipment, terrain, and the presence of concrete sprinkler guards) to remove excess forage during late April and early May when too few cattle were available to effectively graze the pastures during their period of rapid growth. The consequence was primarily in an accelerated movement toward patchiness, and an increasing clumpiness of the orchardgrass. As a result, the pastures "became old before their time." It also is possible that the original seeding rate had a higher percentage of ladino clover than was appropriate.

Conclusions

1. The pattern of pasture regrowth did not differ between the two grazing treatments. In part, this led to higher stocking rates and higher animal product yield from the "low" treatment, since ADG were the same for both treatments.

2. The grazing level treatments by themselves did not result in shifts in pasture plant species composition. Weeds, however, are becoming a problem.

3. Animal grazing hours and orchardgrass heights were successfully used to form a stocking rate estimator.

4. Irrigation according to some basic pasture management rules was successfully done with this pasture and irrigation system design.

5. Once the pasture rotation sequence was set up, and the ability to monitor pasture regrowth and estimate stocking rate accomplished, this 8 to 10-paddock rotation scheme worked well. Its value was substantially in being able to manage pastures according to plant growth rather than a time schedule.

6. We were not able to successfully use the single-probe pasture meter to make pasture management decisions during this first year of use. Animal weight gain per acre was better related to net change in plant height than to net change in meter readings.

7. This first year's experience sheds doubt on the applicability of a theoretical growth curve to practical pasture management, unless much more accurate and sensitive means of monitoring conditions are found. In any event, our opinion is that we could not have grazed more intensively without pasture damage, nor allowed more regrowth without suffering excessive forage wastage losses.

Acknowledgements

Much of the credit for success in making this complex system work must go to Ken Taggard (Agronomy & Range Science SRA), Cindy Daley (Animal Science SRA), and Don Springsteen (Sierra Station). Superintendent Mike Connor, other members of the Station crew, and summer students Jennie Mohler and Paul Wallace also contributed. We wish also to thank Roy Hull and the UC Davis Department of Animal Science for making available a sufficient number of animals and supporting costs of pasture fertilization.

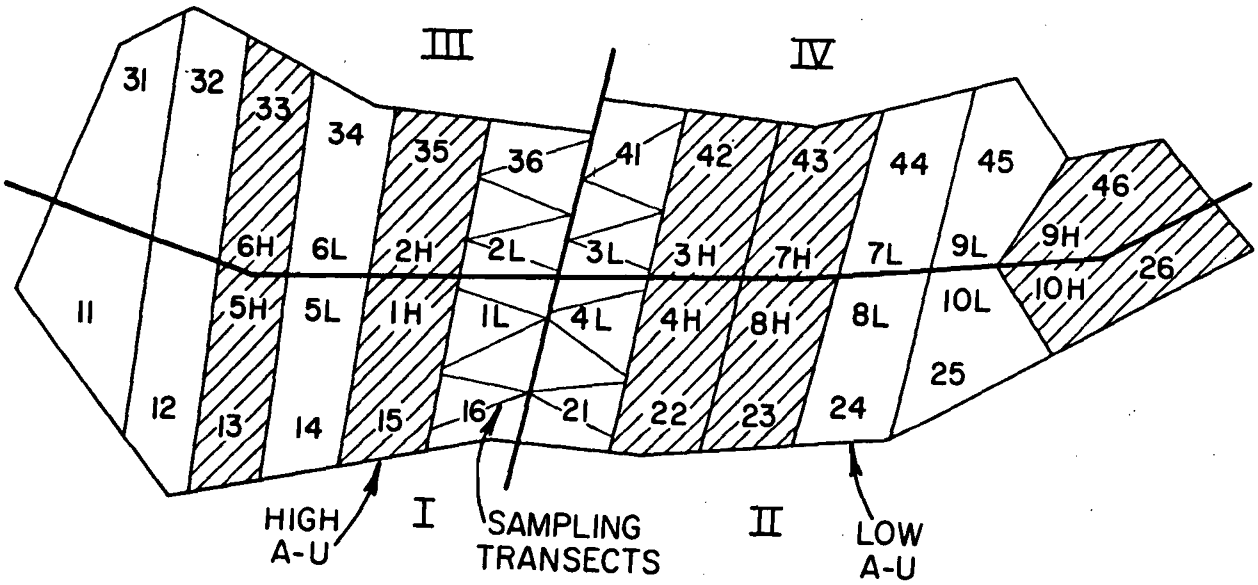

Figure 1. Diagram of the UC SFRFS Haworth research irrigated pasture showing its division into four 6-field irrigation blocks, and the grazing sequence for high (H) and low (L) forage accumulation-utilization (A-U) treatments. The four paddocks at the center illustrate sampling line transects.

Table 1. Botanical composition averaged for eight paddocks in the high and low accumulation-utilization treatments.

Treatment	Orchard-grass	Per. rye-grass	Ladino clover	Strawberry clover	Other species
		% September 1987 (pre-experiment)			
High	19	7*	71	1.2	0.9
Low	17	12	69	1.7	0.5
Mean	18	10	70	1.4	0.7
		% September 1988 (post-experiment)			
High	51	5.0	40	1.0	3.5
Low	47	5.4	44	0.8	3.5
Mean	49	5.2	42	0.9	3.0
		%, March 1989			
High	51	10	30	0.7	8.3
Low	53	9	30	0.4	7.6
Mean	52	9.5	30	0.5	8.0

*Values for high and low treatments differ at P < 0.05.

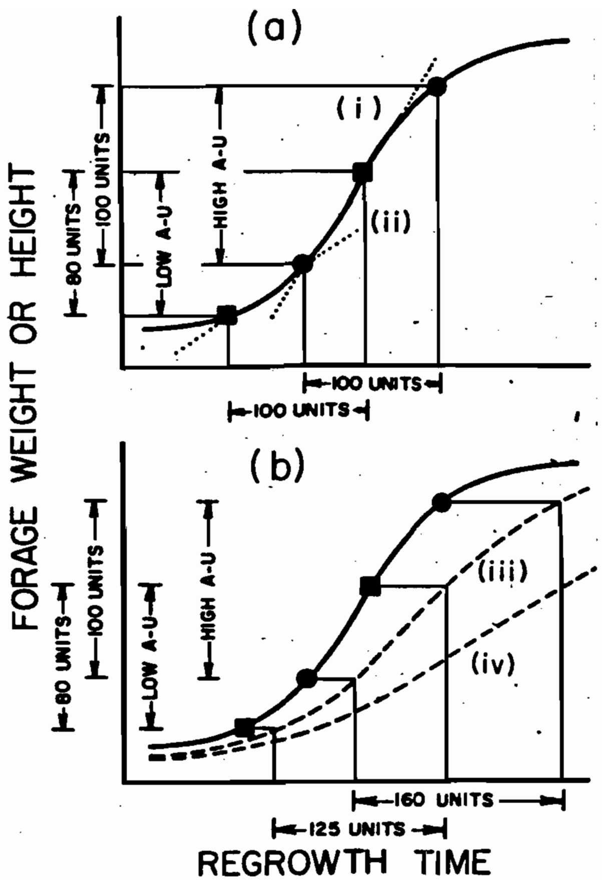

Figure 2. Theoretical pasture forage growth-regrowth curve showing relationship between (a) length of regrowth time and amount accumulated, and (b) variation in both as a result of change in slope and amplitude of the curve.

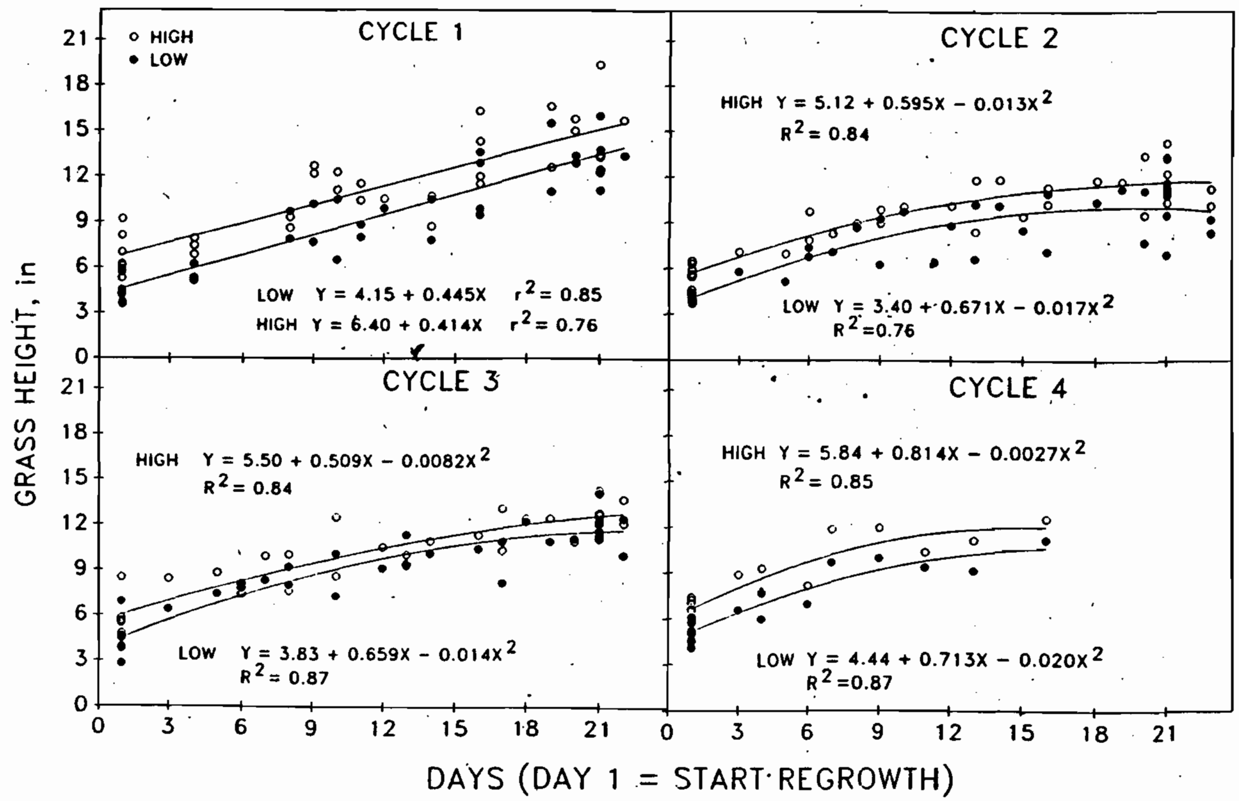

Figure 3. Regression of grass regrowth following grazing over four cycles on eight paddocks, comparing "High" and "Low" accumulation-utilization treatments.

Table 2. Animal unit months (AUM) and liveweight gain per acre (LGC) averaged for eight paddocks for four grazing cycles and the 96-day total.

	Cycle				
	One	Two	Three	Four	Total
			Low A-U Treatment		
AUM	2.5	2.0	1.2	1.3	7.0
LG*, lb./ac.	200	195	108	111	614+
			High A-U Treatment		
AUM	2.0	1.8	1.2	1.1	6.1
LG**, lb./ac.	164	168	108	94	533

* Based on a seasonal average daily gain of 1.44 lb.
** Based on a seasonal average daily gain of 1.40 lb.
\+ Total LG are significantly different for low and high accumulation-utilization treatments.

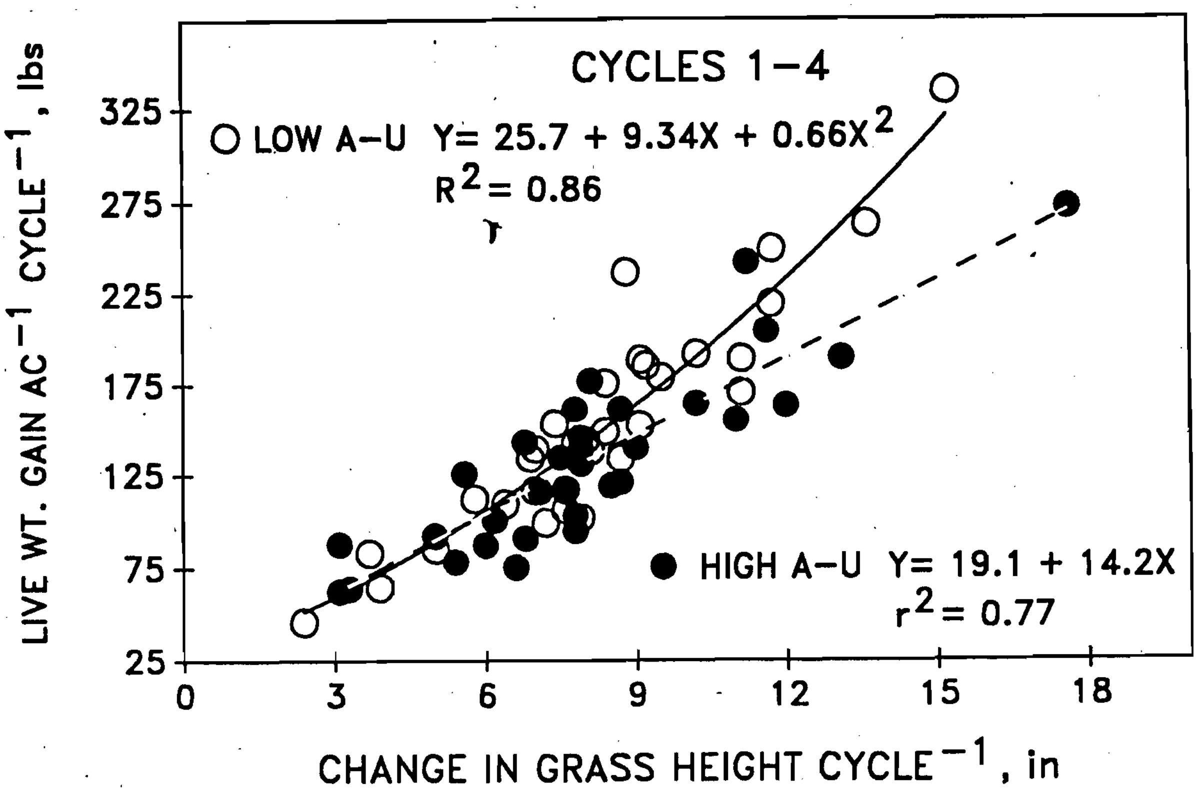

Figure 4. Relationship of liveweight gain per acre (LG) to grass height removed (height in - height out). Data were combined over four grazing cycles on eight paddocks for the high and low accumulation-utilization treatments.

PINKEYE (INFECTIOUS BOVINE KERATOCONJUNCTIVITIS - IBK)*

Ben B. Norman, DVM, Ph.D
Extension Veterinarian

What is Pinkeye?

This is a widespread, highly contagious eye disease of cattle. Up to 45% of calves may develop pinkeye during a summer season. Calf weight losses of 35 lbs. (one eye) and 47 lbs. (both eyes) per animal have been reported. Other costs include drugs and labor needed to treat the disease.

What Causes Pinkeye?

Moraxella bovis, a bacterium, is the cause of pinkeye in cattle. This is a Gram negative blunt-ended, rod-shaped organism. It has specific characteristics and can be identified by a microbiology laboratory, usually within 48 hours. Calves, cows and bulls may be "normal" carriers, with M. bovis being isolated from the tears of normal-looking eyes. Fox tails, Red Nose, and malignant catarrhal fever may look like pinkeye.

Why is Pinkeye Usually Worse in the Summer?

Levels of solar ultraviolet light (UV), plant pollens, and face flies are higher in the summer and have been shown to be related to increased pinkeye. The UV causes changes in the cell-mediated immune response of the calf and causes damage to the corneal epithelium (clear skin over the eye). This gives M. bovis a chance to attach, grow and multiply on the cornea. Plant pollen levels may cause irritation to the eye favoring bacterial growth. Face flies carry the organism from the highly infective tears of "sick" eyes to healthy eyes.

What's Known About the Relationship of Pinkeye and IBR (Infectious Bovine Rhinotracheitis or "Red Nose")?

IBR causes a conjunctivitis with some tearing but no corneal or red eye lesions. When IBR virus and M. bovis are given at the same time, the pinkeye is much worse than without the virus. The use of IBR modified live virus vaccine appears to increase pinkeye problems, and should probably be given only when there is low occurrence of pinkeye (this includes intranasal vaccines).

Tell Me About Vaccinating to Prevent Pinkeye.

A number of vaccine preparations have been tested including pili-vaccines, formalin-killed bacterins, and ribosome-containing products. Some commercial vaccines have been removed from the market. There have been problems with adverse vaccine reactions and lack of protection; however, some ranchers have reported good results. Because the immunity from the actual disease is not complete and recovered animals may have the disease again, it may be difficult for vaccines to completely prevent pinkeye under some field conditions. When using a pinkeye vaccine it is best to be prepared for an adverse reaction (a good practice with any vaccine) by having epinephrine and corticosteroid solutions available at chute-side (see your veterinarian for products and dose recommendations). Watch for new vaccine releases.

What are the Clinical Signs of Pinkeye?

Within three to five days after infection, signs are: photophobia (animals seek shade for the eyes), excessive tearing (a dirty wet face below the eye), much blinking and the eye is kept closed. There is obvious pain. By five to seven days ulcers from 1/8 to 3/4 inches across may be seen with careful inspection. There is edema of the cornea and reddening of the conjunctiva (white part of the eyeball). Fiery red rings with white or yellow opaque centers may be seen. Healing can occur at any stage of the disease.

By 14 to 16 days blood vessels grow to the ulcers in the center of the eye. Rupture of the eye may occur, causing permanent blindness, but this is infrequent (may be seen more with concurrent IBR). Most eyes heal within 60 days, with a permanent white macula or "star" remaining in some eyes throughout adult life.

Treatment and Management of Pinkeye:

There is a wide range of antibiotics available with good efficacy against M. bovis. (Note that chloramphenicol is prohibited in food animals and must not be used.) Normal eyes produce about 1 oz. of tears per day, pinkeyes water profusely, washing out local medication. Powders cause even more tearing and are not the preferred form of medicine if better products are available. High pressure sprays may also be irritating.

Your veterinarian may prefer to prescribe an ointment, either in the form of an ophthalmic preparation (very expensive) or an intramammary infusion product. None of these products carry FDA approval and may be used only on valid veterinary prescription. Several different products, including oil-based antibiotics, are available. Advantages for the intramammary or cattle mastitis infusion syringes are: 1) relatively inexpensive; 2) right size for treating numbers of animals; 3) the syringe is easy to handle in the field; and, 4) by putting a small ribbon of ointment on the eye without letting the tip touch it, there is no transmission with the syringe.

What About "Injecting Eyes" for Treating Pinkeye?

This is a poor name for the job, since the needle actually goes under the membrane of the eyelid and not in the eye. Your veterinarian can show you how to do this if you have not already learned. Many different products have been recommended. Some drugs are not compatible and should not be mixed in the bottle or syringe. Follow your vet's recommendations. He may prescribe kanamycin or amoxicillin, since they have been shown to maintain relatively high tear levels and are usually effective against M. bovis. Good head restraint is necessary. Treat both eyes. Note that if you wrestle the calf and get tears on your clothes, these tears infect the eyes of the next calf or the "good" eye of the calf being treated. A plastic apron and heavy "dish washing" gloves, both disinfected between calves, is the best way to prevent the treatment crew from spreading the disease between eyes and calves (you may not like this, but it works, and it's not that expensive). It is an important part of the nursing.

What About Systemic (Intramuscular or Subcutaneous) Treatment of Pinkeye?

It has been shown that injection of a long-acting oxytetracycline (Liquamycin™ LA-200) at 9 mg per pound of body weight has reduced the severity of pinkeye in experimental animals and has eliminated the pinkeye carrier state in apparently normal animals. The preferred treatment would be two intramuscular injections two days apart. Several other antibacterial products have the same theoretical potential and you should check with your veterinarian for the latest recommendations. This is a relatively fast way to treat many animals in a short period of time, since individual head restraint may not be necessary. Anaplasmosis carriers may become clean.

What Other Things Can I Do to Help Solve the Pinkeye Problem?

Controlling face flies with eartags (where they still work), or reducing fly numbers with sprays or dust bags can cut down the spread between calves with pinkeye and normal calves. Check with your veterinarian or local U.C. livestock farm advisor for suggestions. Separating pinkeye calves from normal calves can cut down the degree of local contamination. Your vet may also instruct you in the use of atropine and corticosteroids for supportive therapy for pinkeye.

Eye patches are commercially available or can be made from old jeans or tarp material and can be attached to the skin around the eye (leave the bottom open for drainage and air circulation) with back tag glue. They reduce the pain from exposure to sun and flies. The problem is that you can't see how the eye is healing, so watch them closely if you use them.

What About "Sewing" the Eye Shut?

A third eyelid flap can be done with local anesthesia of the upper and third eyelids. Using heavy chromic gut suture the third eyelid is mattress-sutured to the upper lid, covering the ulcerated area with the third eyelid. An alternate procedure (tarsorrhaphy) with local anesthesia of the lids is to use two or three mattress sutures to close the lids. If gut is used, the sutures don't have to be removed. Care must be used to prevent the suture material from touching the eye. The third eyelid flap has some advantages. Your veterinarian can do these procedures or may choose to train you in the proper use. Remember that you can load up a few calves with really bad eyes and pickup haul them to the vet and they can be quickly sutured at the clinic (this may be the time to learn and to get the appropriate anesthetics, sutures, needles and holders).

What Pinkeye Work has been Going on at U.C.D.?

Dr. Lisle George, at the School of Veterinary Medicine, has an extensive program in pinkeye research, including treatment regimes, basic research on the pathology of *M. bovis*, vaccine problems and the anatomy of the organism. Extension and Station personnel have done field trials on pinkeye at the Sierra Field Station which will be discussed.

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RESULTS FROM BREEDING YEARLING HEIFERS TO BULLS OF THREE BREEDS: 1. DYSTOCIA AND CALF PRODUCTION MEASURES

J. M. Connor, C. B. Wilson, J. L. Hull, S. L. Berry, C. A. Daley

Introduction

Texas Longhorn bulls have become popular for breeding to first calf heifers because the calves produced are thought to be smaller at birth with a resulting reduction in dystocia or calving difficulty. The objectives of this study are to evaluate calving ease for Longhorn sired calves compared to calves of other sires, to examine gains and livability of these calves and to determine whether any calving ease improvements are offset by lower calf growth rates. The study will also evaluate feedlot gains and carcass quality of the crossbred calves.

Methods

Sire breeds selected for comparison were Angus, representing a medium frame breed, and Gelbvieh, representing a large frame type. All bulls used are purebred and are registered in their respective breeds. Angus and Gelbvieh bulls were selected to be representative of their breed with reasonably good body conformation, a growth rate somewhat better than the average of their herdmates, and birth weight average or slightly below average of their herdmates. Longhorn bulls were selected for reasonably good conformation for the breed. An attempt was made not to select "modern" body types which may have moved away from the traditional Longhorn characteristics that presumably affect ease of calving.

Bulls were selected from several herds representing each breed. Three bulls of each breed were used each year. The data presented here relating to calving ease represent 203 births, the result of matings with one of five Angus, five Gelbvieh or six Longhorn sires.

Yearling Polled Hereford heifers were bred to calve at 22 to 24 months of age in the fall of 1986, 1987 or 1988. Heifers were exposed to single sires; bulls were rotated at 21-day intervals. Except during the 60-day breeding period, the heifers were run together on native range or irrigated pasture with supplemental feeding as necessary. Heifers' average weight just prior to calving was 804, 925 and 997 pounds in 1986, 1987 and 1988, respectively.

Results

Calving Ease. Birthweights were lighter for Longhorn cross calves than for Angus or Gelbvieh crosses (Table 1). Angus crosses appeared to be midway between the two, but were not statistically different from Gelbvieh crosses.

Results for dystocia scores were similar; scores for births resulting from Longhorn sires were the lowest (i.e., less difficult and fewer pulls necessary), those from Angus sires apparently in the middle and Gelbvieh crosses the highest (Table 2). Births of Longhorn cross heifer calves resulted in scores that differed statistically from Gelbvieh scores but not from Angus. Longhorn cross bull calves were different from both the other crosses.

TABLE 1. AVERAGE CALF BIRTHWEIGHT
(POUNDS)

Sire breed	Longhorn	Angus	Gelbvieh
Number of births	59	73	64
Heifers	59.3(a)	64.9(b)	68.9(b)
Bulls	63.0(a)	73.7(b)	74.8(b)

Means for heifers and bulls within breeds are significantly different (P>.05).

Means in the same row followed by different letters are significantly different (P>.05).

TABLE 2. AVERAGE DYSTOCIA SCORES*

Sire breed	Longhorn	Angus	Gelbvieh
Number of births	59	73	64
Heifers	1.20(a)	1.34(ab)	1.69(b)
Bulls	1.25(a)	2.17(b)	2.79(b)

Means for heifers and bulls are significantly different for Angus and Gelbvieh sires (P>.05).

Means in the same row followed by different letters are significantly different (P>.05).

*Dystocia scoring system: 1 = no assistance; 2 = aid given, may not have been necessary; 3 = moderate difficulty; 4 = difficult pull; 5 = fetotomy or C-section.

As mentioned above, heifer precalving weights increased significantly from year to year during this trial. Calf birthweights also increased significantly for Angus cross calves (from 63.1 to 74.8 pounds) and Gelbvieh crosses (63.2 to 74.2 pounds). Dystocia scores also significantly increased for Angus crosses (1.46 to 2.44), and there was an apparent, non-significant increase for Gelbvieh cross calves. No changes were shown for Longhorn crosses for birthweight or dystocia scores although year to year precalving weight increases for the dams were comparable to those for dams of Angus and Gelbvieh crosses.

Table 3 presents the percent of heifers requiring assistance and shows death losses. Longhorn cross calves were weaned at the rate of 98%, followed by 91% Angus cross and 88% Gelbvieh cross calves.

TABLE 3. FREQUENCY OF CALVING ASSISTANCE, DEATH LOSS, CALVES WEANED

Sire breed	Longhorn	Angus	Gelbvieh
Number of births	59	76	68
Requiring assistance	12%	34%	50%
Calves died at birth*	0	9.2%	10.3%
Heifers dead due to calving	0	1.3%	4.4%
Calves surviving to weaning	98%	91%	88%

*Includes calves dead within 48 hours due to calving complications.

Preweaning gain. Several parameters of preweaning gain were studied. Results were similar among them, so the most common, weaning weight, is presented here (Table 4). Weaning weights were adjusted for age at weaning. Angus crosses were significantly heavier than Longhorn crosses. Gelbvieh crosses did not differ significantly from either of the other crosses.

TABLE 4. WEANING WEIGHT
(Adjusted for age at weaning)

Sire breed	Longhorn	Gelbvieh	Angus
Number of calves	35	32	47
Weaning weight, pounds	374(a)	397(ab)	412(b)

Means followed by different letters are significantly different ($P > .05$).

Economic comparisons. Table 5 offers an example of an economic comparison of the value of the three breeds for use with two year old first calf heifers. Weaning weights and rates and death losses are actual averages from this study. Calving assistance labor is an estimate and will vary among operations as will hourly wage rates. A substantial reduction in the necessity for calving assistance should result in less labor being required for checking calving heifers. An estimated reduction of two hours per day per 100 head of calving heifers was assumed for this comparison. This estimate is admittedly variable, but it is an important factor. It is included in the comparison as "Calving labor savings".

Many Longhorn cross calves will return a lower price per pound than Angus or Gelbvieh crosses. The size of this price dock is difficult to estimate. Depending on their appearance, some Longhorn crosses will receive no cut in price and others will be docked up to $10.00 or $15.00 per 100 pounds. Thus, we have used three prices for comparison in Table 5. They represent average price docks of $5.00, $2.00 or $10.00 per 100.

TABLE 5. ECONOMIC CONSIDERATIONS

	Angus	Gelbvieh	Longhorn	Longhorn	Longhorn
Av. weaning wt, pounds	412	397	374	374	374
% weaned	91	88	98	98	98
Av. price per pound	$0.95	$0.95	$0.90	$0.93	$0.85
Value of production per cow	$356.17	$331.89	$329.87	$340.86	$311.54
Calving assistance labor cost (1)	-$3.08	-$5.32	0	0	0
Heifer death loss (2)	-$7.80	-$26.40	0	0	0
Calving labor savings(3)			+$8.40	+$8.40	+$8.40
Relative value of production per cow	$345.20	$300.17	$338.27	$349.26	$319.94

(1) Additional heifers needing calving assistance x 2 hours labor per incidence. Labor + benefits at $7.00 per hour.

(2) Angus 1.3% heifer death loss x $600 heifer = $7.80.
Gelbvieh 4.4% heifer death loss x $600 heifer = $26.40.

(3) Assume reduced calving checks could save 2 hours per day per 100 head heifers for 60 days. 1.2 hours per head x $7 labor = $8.40.

RESULTS OF BREEDING YEARLING HEIFERS TO BULLS OF THREE BREEDS; 2) FEEDLOT AND CARCASS PERFORMANCE

C.B. Wilson, J.M. Connor, J.L. Hull,
S.L. Berry, C. Daley

This trial was designed to test calving difficulties (Dystocia) and rebreeding problems of Hereford heifers breed as yearlings, to bulls of different frame size. Bulls used were: Large frame= Gelbvieh; Medium frame = Angus; and Small frame = Longhorn.

With selection towards heavier weaning weights of calves, etc., we have seen birth weights increase, with increasing calving problems with heifers bred as yearlings to calve at two years of age.

To alleviate the calving problems, some cattlemen have been using small framed bulls such as Longhorns and Jerseys on their yearling heifers. The resulting Crossbred calves, primarily Longhorns, at times are being discounted by the buyers. To compliment the Dystocia trial, we are following the calves from this trial thru the feedlot at UCD and thru the commercial packing houses, to obtain feedlot and carcass data. This data should give an indication if discounts are warranted.

Presently, we have two years of feedlot and carcass data. In 1987/88, the calves were feed 153 days. This past year the calves were feed 112 days. Reduction of feedlot time was because the calves the first year, were excessively fat.

According to the feedlot data, Table 1, there is a significant difference in total gain and average daily gain (ADG) by breeds. The 1987 Angus and Gelbvieh crossbred heifers were not significantly different together, but were significantly different from the Longhorn crosses with greater weight gains. The 1988 Angus cross steers and heifers were significantly larger in gain and ADG than both the Gelbvieh and Longhorn crosses. For the 1987 steers, there was not a significant difference in total gain or ADG.

Across all breeds with both years and both sexes, there was not a significant difference in feed efficiency (pounds of feed per pound of gain).

In conclusion the feedlot data indicates a slight advantage to the Angus cross feeders in weght gain only. The numbers are to few to make definite conclusion.

In comparing the carcass data Table 2, the quality grade differed by approximately one score, with the first year having the highest score. One score equals a difference of one third of a quality grade (ch- to sel+). This difference can be attributed to the fact the first years calves were feed 41 days longer than the second years.

Comparing the quality grade by breed, we find in both years and both sexes, the Angus and Longhorn crosses were approximately the same - 12.49 and 12.53 (ch = 13; ch - = 12) respectively. The Gelbvieh crosses graded on the average 11.40 (sel + = 11).

Combining the Yield Grades for both sexes and years, the Angus crosses averaged 3.39, Longhorn crosses 2.91 and Gelbvieh crosses 2.70. Indicating the Longhorns were carrying less fat than the Angus at the same quality grade.

Overall the Longhorn crosses were approximately 100 lbs. lighter than the other two breeds. The Longhorn steers were 629 lbs. and the others were - Angus 753; Gelbvieh 724. The Longhorn cross heifers averaged 548 lbs. as compared to the Angus - 677 and Gelbvieh - 637 lbs. The Longhorn crosses carcass' were light, but still desirable weights.

In conclusion, the carcass data indicates the Longhorn crosses will grade equally to the Angus crosses. They may have a slight advantage because of lesser total fat, as their Yield Grade was approximately one half a Yield Grade lower. Again, numbers are small, therefore it is difficult to make strong conclusion.
This trial will have two more years of feedlot and carcass data to be analyzed.

TABLE 1

CROSSBREED FEEDLOT DATA

YEAR	NO.	BREED	WEIGHT INITIAL	WEIGHT FINAL	GAIN	ADG	FEED EFFICIENCY
Steers							
1987	12	A	635	1129	494	3.23	7.18
	9	G	656	1149	493	3.22	7.37
	*2	L	636	1035	399	2.60	8.43
1988	8	A	866	1242	377 a	3.36 a	7.84
	6	G	845	1170	325 b	2.90 b	8.03
	13	L	745	1041	296 b	2.64 b	8.29
Heifers							
1987	11	A	600	1064	464 a	3.03 a	7.46
	7	G	572	999	427 a	2.79 a	7.59
	8	L	524	874	350 b	2.29 b	8.11
1988	16	A	747	1083	337 a	3.01 a	7.88
	10	G	731	1015	284 b	2.53 b	8.51
	11	L	635	894	259 b	2.32 b	8.30

Entries that are followed by the same letter are not significantly different from each other.

TABLE 2

CROSSBREED CARCASS DATA

YEAR	NO.	BREED	CARCASS WEIGHT	*QUALITY GRADE	FAT THICKNESS	RIBEYE AREA	KHP %	YIELD GRADE	RIBEYE AREA $in.^2$/cwt
Steers									
1987	12	A	727	12.75	.65	12.69	1.88	2.86	1.75
	9	G	728	11.56	.52	12.37	2.11	2.64	1.70
	2	L	631	14.00	.68	11.00	3.50	3.13	1.75
1988									
	8	A	778	11.75	.71	12.80	2.13	3.17	1.65
	6	G	721	10.67	.45	13.17	2.45	2.20	1.82
	13	L	628	11.23	.39	11.15	2.77	2.35	1.78
Heifers									
1987	11	A	678	13.45	.78	11.59	2.73	3.86	1.71
	7	G	644	12.00	.51	11.60	2.86	3.09	1.80
	8	L	548	13.00	.56	10.44	3.25	3.28	1.91
1988	16	A	676	12.00	.86	11.31	2.53	3.65	1.67
	10	G	629	11.40	.62	11.71	2.40	2.90	1.78
	11	L	549	11.91	.55	9.86	3.36	2.87	1.80

*Quality Numeric Score:

Ch+ = 14	Sel+ = 11
Ch = 13	Sel = 10
Ch- = 12	Sel- = 9

TABLE 3

FEEDLOT RATION CROSSBRED TRIAL
1987 & 1988

%	INGREDIENTS
11.0	Alfalfa Hay
5.0	Oat Hay
70.0	Corn
10.5	Molasses
2.0	Fat
0.5	Limestone
0.5	TM Salt
0.5	Urea