UNIVERSITY OF CALIFORNIA SIERRA FOOTHILL RANGE FIELD STATION

BEEF & RANGE FIELD DAY

APRIL 4, 1985

BROWNS VALLEY CALIFORNIA

University of California
Sierra Foothill Range Field Station Field Day
April 4, 1985
Agenda

			Text of material presented on page
	Contents		i
	Participating Speakers		ii
9:00	Registration and coffee. Posters and demonstrations are available in and near meeting room. These are present for viewing and discussions at this time, during the noon break, and at the end of the meeting.		
	Morning M.C	J. M. Connor	
9:30	Welcome	H. R. Myers	
9:45	Ivermectin and other controls for internal parasites of cattle	N. F. Baker	1
10:15	Energy balance of grazing beef cows	J. G. Morris	4
10:45	Bull breeding performance evaluation	E. O. Price	8
11:15	The effects of multiple selenium rumen pellets in feeder cattle	C. B. Wilson	12
11:45	Computerized pasture inventory program	M. R. George	13
12:00	Lunch		
	Afternoon M.C	F. L. Bell	
	Speaker: Ken Fitzgerald, Vice President, Bank of America - "Ag Properties"		
1:45	The Forbes Hill range fertilization experiment	C. A. Raguse	17
2:00	Tour of research areas	C. A. Raguse	
	Demonstration and discussion of fertilization results		
	Status of horn fly control with ear tags	E. C. Loomis	20
	Effects of rangeland clearing on a watershed	M. J. Singer	
3:30	Return to headquarters End of formal meeting Refreshments - opportunity to view posters and demonstrations		

List of Posters and Demonstrations:

Ralgro for replacement heifers	R. E. Delmas	23
Managing beef heifers for rarly breeding	J. L. Hull	24
Blue oak regeneration	J. W. Bartolome	26
Computerized pasture inventory program	M. R. George	
Warm season grasses; demonstration near the dormitory	C. B. Wilson	
Annual legumes; demonstration at the plot located southeast of main meeting room	M. R. George	
Station facilities; corrals, A. I. chute	N. L. Martin	

Participating Speakers

N. F. (Norm) Baker - Professor, Veterinary Medicine - University of California, Davis.

J. W. (Jim) Bartolome - Associate Professor, Forestry - University of California, Berkeley.

F. L. (Monte) Bell - Livestock Farm Advisor, Glenn-Colusa Counties - University of California Cooperative Extension, Orland.

J. M. (Mike) Connor - Superintendent Sierra Foothill Range Field Station - University of California. Browns Valley.

R. E. (Rick) Delmas - Livestock Farm Advisor, Modoc County - University of California Cooperative Extension, Alturas.

K. W. (Ken) Fitzgerald - Vice President, Special Resources Administration, Bank of America, Sacramento.

M. R. (Mel) George - Cooperative Extension Specialist, Agronomy and Range Science - University of California, Davis.

J. L. (Roy) Hull - Specialist, Department of Animal Science - University of California, Davis.

E. C. (Ed) Loomis - Cooperative Extension Specialist, Program Director - University of California Cooperative Extension, Davis.

N. L. (Nancy) Martin - Staff Research Associate - Department of Animal Science - Sierra Foothill Range Field Station, Browns Valley.

J. G. (Jim) Morris - Professor, Department of Animal Science - University of California, Davis.

H. R. (Harold) Myers - Director of University of California Agricultural Field Stations - University of California, Davis.

E. O. (Ed) Price - Professor, Department of Animal Science - University of California, Davis.

C. A. (Charlie) Raguse - Professor, Department of Agronomy and Range Science - University of California, Davis.

M. J. (Mike) Singer - Professor, Land, Air and Water Resources - University of California, Davis.

C. B. (Chuck) Wilson - Livestock Farm Advisor, Sutter-Yuba Counties - University of California Cooperative Extension, Yuba City.

IVERMECTIN AND OTHER CONTROLS FOR INTERNAL PARASITES OF CATTLE

Norman F. Baker

Introduction

In California, as in essentially all temporate regions of the world, the middle stomach worm (Ostertagia ostertagi) is the most important of those roundworms parasitizing the stomach and/or intestines of cattle. Prior to the 1960's this worm along with other species ravaged the cattle industry in California and efforts at its control were at best successful in reducing rather than preventing losses. In the early 1960's thiabendazole, levamisole, Haloxon and other anthelmintics were introduced. These anthelmintics were highly efficient against the adult parasite and their acceptance and extensive use by cattlemen resulted in great reductions in the losses due to parasitism. Significant losses did continue despite anthelmintic use and in some instances even where the highly efficient anthelmintics were used animals still continued to become sick. About this same time workers in Scotland described a condition known as winter Ostertagiasis. This condition occurred in late winter to early spring in cattle which had been pastured during the fall, dewormed and placed in confinement where continuing infection with the middle stomach worm Ostertagia ostertagi, would not take place. Study of this condition revealed a pattern wherein the infective larvae on herbage during spring and summer developed directly to adult worms in the usual 18 to 21 days, whereas infective larvae ingested in the fall entered the lining of the stomach and stopped their development. These larvae in the lining of the stomach remained quiet until late winter and early spring when they resumed their development, and in so doing, produced the condition known as winter Ostertagiasis. Of further importance, none of the anthelmintics available prior to the late 1970's was active against these nondeveloping, immature worms. It is apparent that two quite different scenarios might result in disease due to the middle stomach worm; that resulting from the ingestion of large members of larvae over a short time with immediate maturation, and that resulting from the ingestion of large numbers of larvae which accumulate in the lining of the stomach and produce disease at some later date when development is resumed. As noted, the accumulation of these larvae and the resumed development has been found to occur in fall and in late winter,respectively, in the northern temperate regions. These regions include the Northern tier of states and a portion of Oregon. In the sun belt states and California the sequence of events differs, in California studies at Elk Grove, Sattley, Susanville and the University of California Sierra Foothill Range Field Station has shown very low numbers of infective stages on herbage during summer months. At this time the middle stomach worm is largely present in the stomach lining as non-developing larvae. In the fall, these larvae begin to develop and if in sufficient numbers disease will result initially in heifers and in cows which were pastured during the previous mid to late spring. Even if numbers are not sufficient to produce disease, enough will become egg laying adults to heavily contaminate the pastures with eggs at this time. These eggs will develop, and from them the infective larvae will develop and appear on herbage. When these are ingested during fall, winter and early spring they will develop directly to adults and further contaminate the pastures. Such infection and contamination will continue during the winter and a peak number of infective stages will appear on forage in the spring. In mid to late spring a large percentage of ingested larvae remain in the stomach lining as non-developing stages.

Methods and Results

It was hypothesized that the administration of an anthelmintic which would prevent the fall contamination would have a significant effect on winter and spring infection potentials and might well eliminate the need for further treatments. Two possible approaches now exist. One, tested in 1982-83, is the administration in late summer or early fall of an anthelmintic such as morantel sustained release bolus (Paratect®) which provides a continuous 60-90 day action against the mature and maturing worm population. A second approach is the use of an anthelmintic with high efficiency against all stages of parasites during summer months. As noted previously, anthelmintics with high efficiency against the non-developing larvae did not become available until the late 1970's.

To test the first hypothesis, Paratect® boluses were administered to cows on September 7, 1982. Fifteen treated cows were placed in one pasture (North Haworth) and 15 untreated cows were placed in another pasture (South Haworth). Weight gains of calves and worm free tracer calves were used to assess the effect of this treatment.

Table 1 presents an analysis of the weaning weights of calves from the two groups. Table 2 presents the infectivity of the pastures as measured by worm counts in stomachs of tracer calves grazed for 3 week periods.

Table 1 - Weaning weights* of calves from control and Paratect® treated Hereford cows (1982-83)

Group	No.	Female(kg)	No.	Male(kg)	No.	Total(kg)
Control	8	171.3	6	182.8	14	176.2
Treated	8	165.6	7	173.3	15	169.2
t-test		<0.01		<0.01		<0.01

* Corrected 205 day weaning weights. Beef improvement federation damage factors applied.

Table 2 - Average worm counts and stage of development obtained in tracer calves.

		Ostertagia		
Grazing Period	Group	Adult	Non-Developing larvae	Total
9-7 to 9-28	C	186	0	186
	T	149	0	149
11-9 to 11-30	C	7169	30	7199
	T	1000	2	1022
1-4 to 1-28	C	16,357	2845	19,202
	T	520	0	520
3-18 to 4-4	C	1408	2246	3654
	T	550	1043	1593
5-13 to 5-27	C	1114	585	1699
	T	738	1518	2256

During the current year, the second approach was tested. In this instance the same pastures and similar cows were employed. The experiment differed in 3 respects: (1) the treated cows received subcutaneous injections of ivermectin (an anthelmintic highly efficacous against non-developing larvae) on September 2, 1983; (2) the treated cows were placed in the South Haworth pasture (control pasture 82-83) and the control cows in the North Haworth pasture (treated pasture 82-83); and (3) the cows and calves were removed from the irrigated pastures for the period of December 1, 1983, to March 30, 1984. While off irrigated pasture, the treated cattle were on native pastures not used since the preceding spring and control cattle were on native pastures which were used by cattle similar to the controls.

Table 3 presents weaning weights of calves in the invermectin trial.

Table 4 presents worm counts in the stomachs of worm free tracer calves grazed for 3 week periods.

Table 3 - Weaning weights* of calves from control and ivermectin treated cows (1983-84).

Group	No.	Female(kg)	No.	Male(kg)	No.	Total(kg)
Control	8	192.9	8	206.3	16	199.6
Treated	7	186.4	8	226.3	15	207.7
t-test		<0.01		<0.05		<0.01

* Corrected 205 day weaning weights. Beef improvement federation dam age factors applied.

Table 4 - Average worm counts and stage of development obtained in tracer calves.

Grazing Period	Group	Ostertagia Adults	Non-Developing larvae	Total
10-6 to 10-25	C	442	0	442
	T	115	0	115
12-15-83 to 1-7-84	C	34,833	18,469	55,475
	T	3684	1007	4574
4-3 to 4-19	C	1048	4424	5472
	T	297	265	562

Discussion

Examination of tables 1 and 3 reveal that in 1982-83 both female and male calves from control cows in the South Haworth pasture had significantly higher weaning weights while in 1983-84 the values for male calves from treated cows in the South Haworth pasture were significantly higher. The values for female calves in the control (North Haworth pasture) in 1983-84 were significantly higher. In both years, the weaning weights of all calves (male and female) were significantly higher in the South Haworth pasture. These data suggest a bias toward higher weaning weights in the South Haworth pasture which overrides the effects of parasitism. Nevertheless, the number of infective larvae of middle stomach worm on herbage was again reduced by a factor greater than 10 on pasture grazed by the cattle treated in accordance with the previous discussed hypotheses.

Conclusion

The reduction of contamination of pastures in California through residual treatment to remove developing worms in the fall, or by single treatment to remove all stages of worms from cattle in summer, will greatly reduce infection rates on pastures in the following winter and spring. Whether or not this single treatment will be adequate to protect against performance losses in all instances during winter and spring has not been determined. Where it is possible to utilize such a treatment, this certainly must be considered the cornerstone to a successful control program. Such programs will require modification when cattle are brought in from Northern States or from regions where the epidemiology of the parasites have been found to differ from that described.

References

Baker, N. F., Fisk R. A., Bushnell, R. B., and Oliver, M. N.: Seasonal Occurrence of Infective Nematode larvae on irrigated pasture by Cattle in California. Am. J. Vet. Res. 42(1981) 1188-1191.

Baker, N. F., Fisk, R. A., Rimbey, C. W.: Seasonal occurrence of infective nematode larvae in California High Sierra pastures grazed by cattle. Am. J. Vet. Res. 45(1984) 1393-1397.

ENERGY BALANCE OF GRAZING BEEF COWS

James G. Morris

The energy balance of grazing cows on range is the difference between energy intake and energy expenditure. When energy intake from feed exceeds energy expenditure, the cow is in a positive energy balance and gains body tissue by depositing the extra energy as protein or fat. Periodic weighing of cows can give an indiction of whether an animal is in positive or negative energy balance, but does not indicate whether the change is due to a change in intake or expenditure or both parameters.

The objective of this study was to measure feed (energy) intake and energy loss by cows grazing on range so energy balance could be calculated. Two measurements are required: 1) energy expenditure and 2) energy intake.

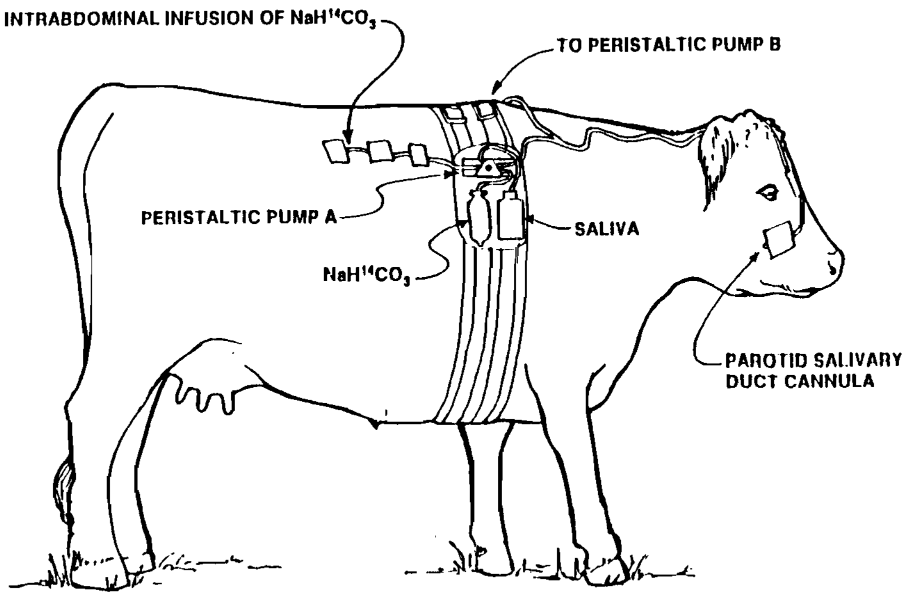

FIGURE 1. Technique of infusion of $NaH^{14}CO_3$ and saliva collection.

Energy Expenditure

Energy expenditure was calculated from the measurement of carbon dioxide production. For this measurement cows were infused with a solution of sodium bicarbonate labelled with radioactive carbon (Na $H^{14}CO_3$). This labels the body pool of bicarbonate which is in equilibrium with the carbon dioxide produced in metabolism. In order to find the dilution of the tracer in the bicarbonate pool a bicarbonate rich fluid is continuously sampled--parotid saliva. Figure 1 is a schematic drawing of a cow equipped with a harness, infusion pump and infusion and sampling tubes. Figure 2 shows how energy expenditure varied throughout the year from a minimum in the summer to over twice the value in early lactation.

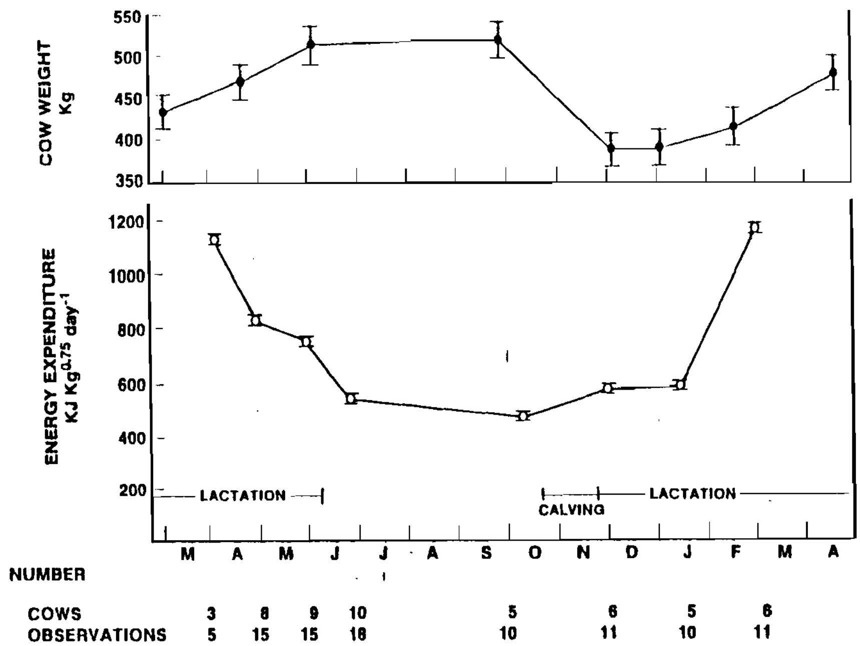

FIGURE 2 Energy expenditure (KJ $kg^{-0.75}$ day^{-1}) and body weight (kg) of beef cows during the year.

Energy Intake

The feed energy intake of grazing cows was calculated from the measurements of fecal output and the *in vitro* digestibility of forage samples collected by steers with esophageal fistulae and collection bags. Fecal output was measured by continuous infusion into the rumen of inert rare earth markers. These markers are neither digested nor absorbed and the total quantity appearing in the feces equals the quantity infused. By knowing the quantity of marker infused (g/day) and the concentration in the feces (mg marker/g feces) fecal output can be calculated.

Figure 3 shows that fecal organic matter output varied widely throughout the year being highest when the pasture was actively growing (February - March, 1984) and lowest during the summer 1983.

The *in vitro* digestibility also varied markedly throughout the season as shown in Figure 4. Note that the digestibility of organic matter is highest in the period March to May and lowest in the summer. Feces represent the indigestible components of the food. As a percentage of the food ingested, feces approximate 100-*in vitro* digestibility. The product of these two curves - fecal output and 100-*in vitro* digestibility can be used to calculate digestible organic matter intake (shown in Figure 5) and hence energy intake. Taking an average energy value for digestible organic matter in Figure 5 and taking away the values for energy expenditure in Figure 2 an energy balance can be calculated as shown in Figure 6.

Note that the greatest difference between energy intake and expenditure (shaded area) occurs in the green season when the cows gain in body tissue. During the summer, intake and expenditure almost coincide. Not included in these curves are the energy losses of the cow in milk production and the products of conception--fetus, fetal membranes, etc. When these two energy losses are added to the energy loss measured as CO_2 production, the energy expenditure curves more closely approximate the energy intake curve.

These data show the importance of matching the cows' energy expenditure with the availability of forage and the remarkable elasticity of the cow to reduce energy expenditure in periods of low feed availability.

Further Reading:

Sanchez, M. and Morris, J. G. 1984. Energy expenditure of beef cattle grazing annual grassland. Can. J. Anim. Sci. 64 (Suppl) 332-334.

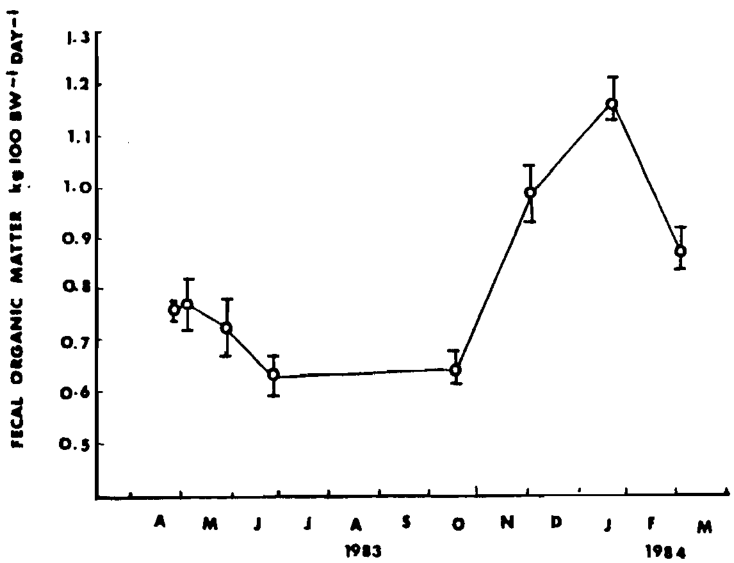

FIGURE 3. Organic matter fecal output in kg per 100 kg of body weight per day of beef cows grazing annual rangeland.

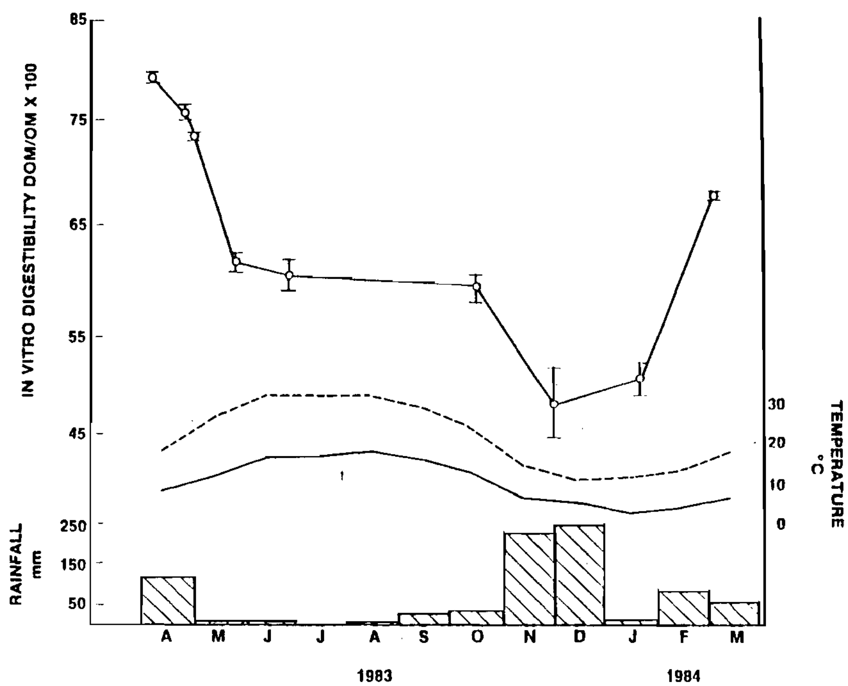

FIGURE 4. In vitro digestibility of fistula samples, average high temperature (----), average low temperature (——) and monthly rainfall.

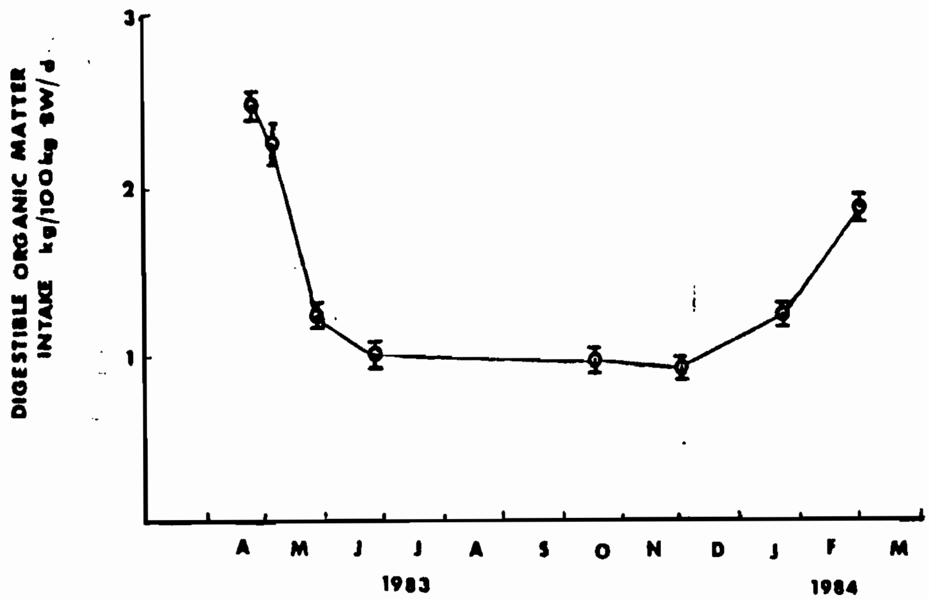

FIGURE 5. Digestible organic matter intake (Kg per 100 Kg body weight per day) of beef cows grazing annual rangeland from April 1983 to March 1984.

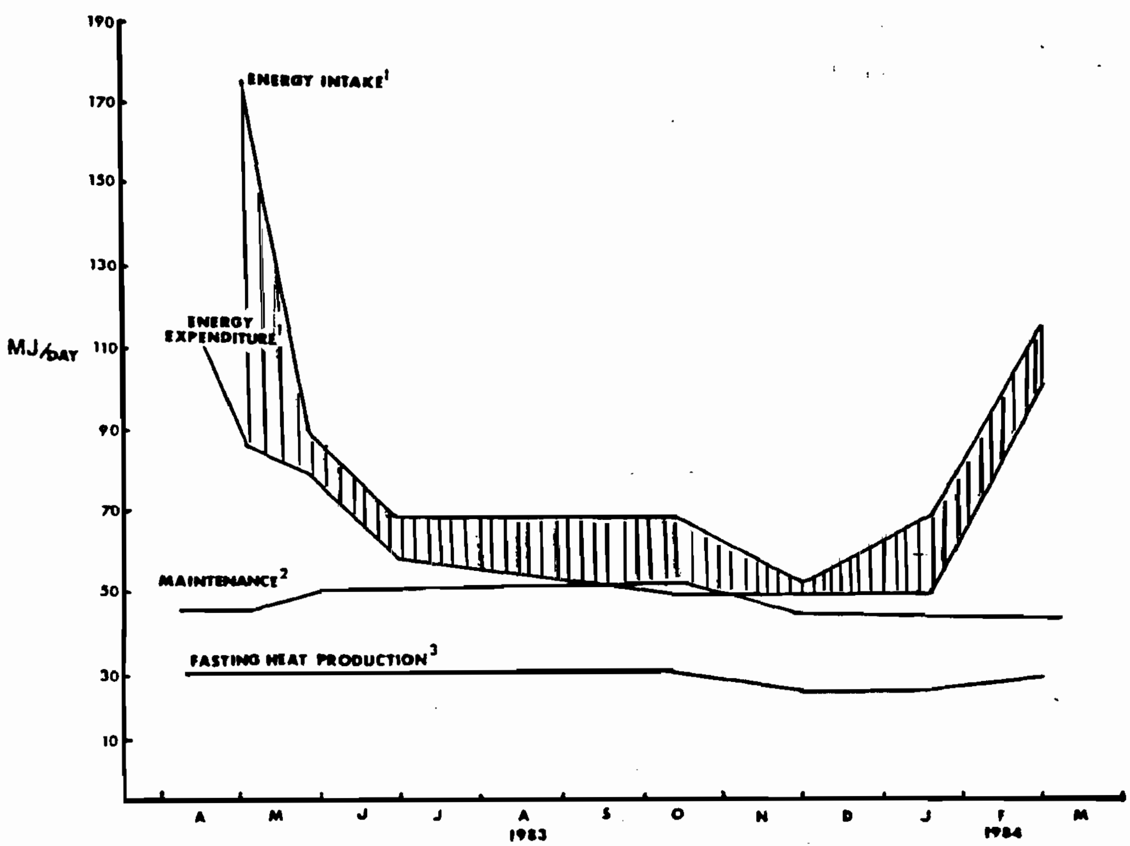

FIGURE 6. Energy transactions during the year of beef cows grazing annual rangeland.
1.-This work. 2.-NRC, 1984. 3.-ARC, 1980.

BULL BREEDING PERFORMANCE EVALUATION

Edward O. Price

A 1984 UC Cooperative Extension Livestock Research and Education Questionnaire indicated that 86% of 420 beef producers from California consider the measurement of breeding performance in bulls to be important (54%) or very important (32%). At present the mating ability of beef bulls is typically ignored in breeding soundness exams.

Studies in the U.S. and Australia have revealed that the sexual performance of bulls can be quite variable. Bulls with relatively poor libido impregnate cows at a slower rate and leave more cows open. This fact has been clearly demonstrated by Michael Blockey, an Australian researcher. In one study Blockey (1978a) counted the number of services bulls achieved in a 7.5 hour pasture mating test and then compared these results with their ability to impregnate heifers over a 6 week period (two estrous cycles). After 3 weeks (one estrous cycle), bulls that had exhibited relatively high levels of sexual performance in the pasture mating tests had impregnated a significantly greater percentage of heifers (77.3%) than bulls that had exhibited lower (moderate) levels of sexual performance (58.8%). After 6 weeks (two estrous cycles) the difference between high and moderate performing bulls was negligible (90.5 and 88.2%, respectively). The moderate performing bulls had done their job: it just took them longer.

In another study Blockey (1978b) recorded the number of services attained by bulls (serving capacity) when exposed to restrained females for a 40 minute period. He then related their sexual performance in this barnyard serving capacity test to their performance when exposed to 35 to 40 heifers over a 10 week period (Table 1). Bulls that did poorly in the barnyard test were slower to impregnate females. In fact the bulls that scored lowest in the barnyard test were clearly unacceptable for use as breeding stock.

Table 1. Relationship of Serving Capacity to Herd Fertility

Serving Capacity Rating*	First Estrus Pregnancy Rate**	Final Pregnancy Rate***
0 - 2	19.2%	32.5%
3 - 5	59.0%	91.3%
6 - 8	68.2%	94.5%
9 - 11	73.2%	95.5%

* Based on number of services in a 40-minute test with a restrained female.
**When placed with 35 to 40 heifers for 10 weeks.

Libido refers to the sexual motivation or sexual interest of the male. If a bull has poor libido he will not do well in a breeding program and should be culled. On the other hand, not all bulls with high libido are competent breeders. They may have locomotor problems (e.g., lameness, arthritis) or genital abnormalities (e.g., broken penis, premature spiral deviation of the penis) that inhibit their ability to service females. Blockey (1976) reported that of 548 bulls tested for mating ability, 113 (20.7%) were considered unsound for breeding. Of these 113 bulls, 54 (47.8%) were rejected because of locomotor problems and 42 (37.2%) were culled due to genital abnormalities. The remaining 17 animals were rejected because of behavioral deficiencies (poor serving capacity). Blockey also pointed out that of the 113 bulls culled, 48 (42.5%) could be determined unfit as breeders only as a result of being observed in a test of mating behavior. If these 48 bulls had been used for breeding the reproductive success of the herds in which they were placed would likely have been depressed.

Serving capacity tests have been administered to 37 Hereford bulls at the Sierra Foothill Range Field Station immediately prior to the last three breeding seasons (in November of each year). Twenty-two of these 37 bulls were tested first as yearlings. Eight bulls have been tested for 2 years and 15 males have been tested for 3 years in succession. Two 15 minute tests, spaced a week apart, have been administered each year.

Bulls are placed in a corral adjacent to the test arena either the night before or the morning of the day of testing. Yearlings are held in a separate pen adjacent to the older bulls. Two nonestrous females, preselected for ease of handling, are restrained in portable stanchions (Fig. 1), approximately 30 feet apart, in the test arena. Females are given IM injections of 0.4 to 0.6 cc of Xylazine (20 mg/ml) which serves as a tranquilizer and analgesic and mineral oil (about 30 cc) is used to lubricate the vagina and vulva.

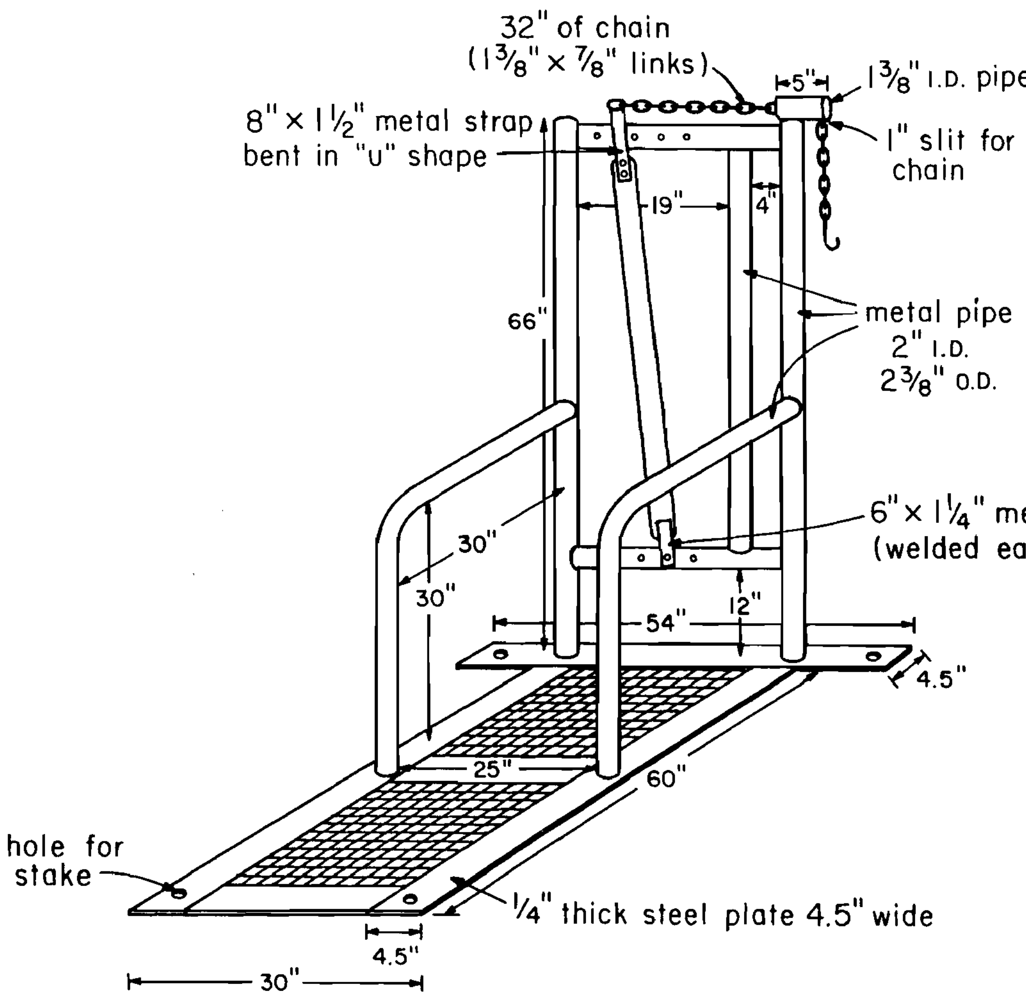

FIGURE 1. PORTABLE RESTRAINING STANCHION

Bulls are introduced into the test arena in pairs with each bull directed to a different female. A rider on horseback is stationed nearby to keep the bulls from moving from one female to the other. This is especially important to prevent fighting when testing bulls 2 years of age and older. During the 15 minute test period the observer records the number of mount attempts (usually very few of these occur), number of mounts without ejaculation and number of services for each bull. The observer also watches for locomotor problems and genital abnormalities that influence sexual performance.

Rough handling prior to testing and prolonged fighting between bulls can inhibit sexual performance. Also, if the bulls have seldom been worked and/or appear fearful of people, it may be necessary for the rider on horseback and observer to position themselves far enough away from the test animals to not inhibit their sexual performance. Groups of people talking and laughing may also inhibit bulls that are not used to being in close proximity to humans. (The SFRFS bulls do not appear to be influenced by the presence of people in the test area).

Pre-test sexual stimulation will increase the serving capacity of bulls exposed to restrained females by 70 to 80 percent and is important if bulls are to demonstrate their potential in serving capacity tests (Blockey, 1981; Mader and Price, 1984). This is achieved by allowing the bulls to observe other bulls mounting. Thus, it is important for the animals in the holding pen to have a relatively clear view of the animals in the test arena.

Females should be changed after every three to five tests depending on the length of the tests and the number of services received.

Pack your bags if the temperature gets over 95°F.

Serving capacity tests administered at SFRFS over the last 3 years have provided an excellent opportunity to observe the mating behavior of herd bulls prior to their use in the breeding pastures. Mean number of services attained per 15 minute test are summarized by bull age in Table 2. From these data it is evident that under these test conditions yearlings (12 months) and bulls 4 years and older attain fewer ejaculations than bulls 2 or 3 years of age.

Table 2. Mean Number (± S.E.M.) of Ejaculations Attained by Bulls in 15 Minute Serving Capacity Tests Based on Age of Bulls at Testing

	Age (Years)				
	1	2	3	4	5
N	22	18	18	9	5
$\overline{X}$	1.16	2.67	2.83	1.39	1.40
S.E.M.	±0.28	±0.38	±0.38	±0.47	±0.55

The serving capacity of adult bulls (2 years or older) tested in 1982 did not correlate significantly with their performance in 1983 ($r=0.28$, $df=7$) but the number of ejaculations attained by adult bulls in 1983 correlated significantly with their performance in 1984 ($r=0.69$, $df=13$, $P<.01$). The reason for this disparity is not clear. Correlation coefficients were consistently lower when yearling bulls were included in the samples. This is due to the failure of many bulls to attain ejaculations at 12 months of age (probably a maturational phenomenon).

Number of services attained by bulls in the first 15 minute test correlated significantly ($P<0.001$) with their sexual performance in the second test in each year ($r=.62$, $.81$ and $.76$ for 1982, 1983 and 1984, respectively).

Administration of two tests per year is more informative than one test. For example, correlation coefficients between 1983 and 1984 sexual performance data were higher ($r=0.69$) when the mean of two tests were used to describe individual performance than when only first-test performance was used ($r=0.48$).

Locomotor problems and genital abnormalities were noted in each year of testing. For example, bull #113 was first tested as a 3 year old in 1982 and then retested in 1983 and 1984. In 1982 he exhibited premature spiral deviation (corkscrew) of the penis (interferes with gaining intromissions) during only 2 of 12 (17%) mounts in which ejaculations were not attained. In 1983 the percentage of corkscrew erections had increased to 25% (4 of 16 mounts) and in 1984 spiraling of the penis was observed 78% of the time (14 of 18 mounts). Blockey (1984) has also observed that the incidence of premature spiraling increases with age.

In summary, mating behavior tests provide an opportunity to gain valuable information on the breeding soundness of bulls before they are exposed to females. Many reproductive problems in bulls can be identified in serving capacity tests that would otherwise go unnoticed in routine semen checks.

References

Blockey, M.A. 1976. Value of a serving test in the breeding soundness examination of beef bulls. Victoria Vet. Proc. 1976, p. 21.

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Blockey, M.A. 1984. Observations on spiral deviation of the penis in beef bulls. Austral. Vet. J. 61:141-145.

Mader, D.R. and E.O. Price. 1984. The effects of sexual stimulation on the sexual performance of Hereford bulls. J. Anim. Sci. 59:294-300.

THE EFFECTS OF MULTIPLE SELENIUM RUMEN PELLETS IN FEEDER CATTLE

C.B. WILSON, D.J. WILSON, B.B. NORMAN, J.R. DUNBAR

Fifteen head of hereford steers from a herd with known low selenium were assigned to five treatment groups of three steers each. The groupings were 0, 2, 4, 6, and 8 pellets. The selenium rumen pellets consists of 10% selenium and 90% iron. These steers were fed low selenium alfalfa and irrigated pasture hay in amounts to gain approximately one pound per day.

Whole blood samples and weights were taken every 28 days for the 1st 84 day post-treatment. During the next 206 days to slaughter, blood samples and weights were taken every 14 days. At each weighing and blood sampling, the following observations were made and scored: attitude, body condition, hair coat and scouring. In addition, temperature, pulse and respiration were monitored to give us an indication of any animal health disorder. At slaughter the following samples were obtained: whole blood: kidney, kidney fat, body fat, liver, diaphram muscle, neck muscle, heart, reticulum and rumen content.

Toxic blood levels for cattle have been established to be 3.0 ppm or greater. At no time did any steers' blood level exceed 0.30 ppm. Thus the steers' blood levels were well below the toxicity level by a magnitude of 10. Blood levels increased markedly the 1st 56 days after which they slightly declined until slaughter at 290 days.

Tissue samples were within the safe ranges indicated by Jenkins and Hidiroglou--except for the kidneys of the 8 pellet group which were 0.30 ppm higher (7.9-7.6 ppm), however, even higher values have been observed in normal cattle in California.

The differences in the average daily gains were not significant between groups. The 2, 4 and 6 pelleted groups gained 0.24 to 0.32 lbs. per day over the controls, while the 8 pellet grou gained 0.11 lbs per day over the controls.

There was no detection of any animal health problems indicated by our scores and vital signs.

In conclusion, pelleting up to 8 selenium rumen pellets showed no harmful effects to the cattle. The higher blood samles were in the magnitude of 10 less than the toxic levels. All tissue samples were within the safe range except for the kidney, which was only 0.3 ppm above the stated safe maximum of 7.6 ppm. There was no animal health problems that could be attributed to selenium levels. There was no significant difference in ADG between groups.

This information is part of an Masters in Preventive Veterinary Medicine (MPVM) thesis in the School of Veterinary Medicine, UC Davis, by Dennis J. Wilson.

COMPUTERIZED PASTURE INVENTORY PROGRAM

Melvin R. George, Leanne Lasarow, and Jim Clawson

Introduction

Many ranchers keep animal or herd performance records but do not keep pasture performance records. The pasture inventory program was developed to provide ranchers with an easy method of keeping pasture records. The program can provide summaries of pasture use and animal performance. With these summaries, the rancher can monitor seasonal and yearly pasture performance.

The pasture inventory program stores information in a ledger file called a database. Each movement of an animal group becomes a record in the ANIMALS database (Table 1), much like an entry in a ledger. A record in the ANIMALS database contains pasture used, date moved, and group weight. There are two more databases; the PASTURE database (Table 2) keeps track of the names and acreages of the pastures on the ranch and the KINDS database (Table 3) is a list of the kinds of animals.

A Pasture Inventory Data Sheet (Table 4) for field record keeping purposes can be used to record normal ranch activities including moving animals in and out of pastures and noting facts such as births, purchases, and sales. This data can be entered into the Pasture Inventory Program using options 1 and 2 in the main menu.

Main Menu

1 = Move animals into a pasture

2 = Move animals out of a pasture

3 = Generate reports

Option 1 represents movement of a group of animals into a pasture. First, a list is displayed of pastures already catalogued during previous runs of the program. Then, the pasture is selected:

a. Are you moving a group into one of the pastures listed?

   If yes, then:

   1. Enter the record # of the pasture:

   If no, then:

   1. What is the name of the new pasture?
   2. What is the acreage of the new pasture?

The animal database is comprised of records, each describing a group of animals rather than an individual animal. The following questions are asked about a group entering the pasture:

b. What kind of animal?

c. Date of entry?

d. How many head?

e. Added by (B)irth, (P)urchase, or (T)ransfer?

f. Did you actually weigh the group?

   If yes, then:

   1. What is the actual group weight?

Table 1. Structure of Animals database.

FIELD	NAME	TYPE
001	P:NAME	C
002	P:ACRES	N
003	IN:TRANS	C
004	IN:DATE	C
005	IN:WT	N
006	IN:USE	C
007	OUT:TRANS	C
008	OUT:DATE	C
009	OUT:WT	N
010	T:KIND	C
011	T:NUM	N
012	TOT:DAYS	N
013	RES:UNIT	C
014	RESIDUE	N

Table 2. Structure of Pasture database.

FIELD	NAME	TYPE
001	PAST:NAME	C
002	PAST:ACRE	N

Table 3. Structure of Kinds database.

FIELD	NAME	TYPE
001	AN:KIND	C

Table 4. Pasture Inventory Data Sheet

Today's date: __/__/__

Pasture name: ______________________________

Pasture acreage: _______

Animal kind name: __________________________

Head: _______

Move into pasture:

Date moved: __/__/__

Added by (B)irth, (P)urchase, or (T)ransfer (circle one)

Actual group weight: __________
or estimate of individual weight: ________

Move out of pasture:

Date moved: __/__/__

Deleted by (S)ale, (D)eath, or (T)ransfer (circle one)

Actual group weight: __________

or estimate of individual weight: ________

Residue:

Standing forage left in pasture: ________

Units of forage (IN.) or (LBS.) (circle one) if no, then:

2. What is your estimate of individual animal weight?

Selection of **option 2** would generate a list of all the animal groups still in pastures and available to move out. If there aren't any groups in pastures, the program will return to the main menu.

a. To move a group from a pasture, enter the record # of the group.

Once the animal group has been selected, the following questions need to be answered:

b. Date moved out?

c. Did you actually weigh the group?

if yes, then:

1. What is the actual group weight?

if no, then:

2. What is your estimate of individual animal weight?

d. (S)ale or (T)ransfer? (DEAD ANIMALS SHOULD BE TRANSFERRED TO A BOGUS PASTURE TO KEEP A SEPARATE RECORD OF LOSSES.)

To establish whether the rancher is in the habit of noting residue in pastures, this question is asked once per session:

e. Do you keep track of residue in pastures?

if yes,

1. Did you estimate forage in LBS. or IN.?

This question is asked when a group is moved out of the pasture:

2. How much standing forage was left in the pasture?

if no, then the residue question is not asked.

The record of that animal group is updated with this information, allowing calculation of head days, AU, and AUM as shown in the reports.

Option 3 generates reports. The program reminds the user of the last date an animal group was moved in or out of a pasture, then asks:

a. Do you want the report as of the last update or another date, like today's date?

The program uses that date to head the reports and to calculate the head days, AU and AUM of groups still in the pastures. Once the date of the report is selected, the program will display the Report Menu.

Report Menu

1 = Animal use: all pastures

2 = Animal use: one pasture

3 = Pasture use: one kind of animal

4 = Display list of pastures

5 = Display list of animal kinds

The first report (Table 5) displays the status of every pasture on the ranch. Each pasture will have a listing of all the animal groups that have been supported on the pasture, head, days in the pasture, head days, AU, AUM, residue, and whether the group is currently in the pasture. The second report (Table 5) has the same information for a single pasture.

The third report (Table 6) displays information for an animal group and shows the rotation of the group through the pastures. The information includes pasture, group weight upon entering the pasture, group weight upon leaving the pasture, group gain, average daily gain, date entering the pasture, date leaving the pasture, days in the pasture, head, head days, AU and AUM.

The fourth and fifth reports list pasture names and animal kind names.

The pasture inventory program includes a tutorial which introduces the concepts of pasture inventory and shows step by step how to use the program. After using the tutorial, the rancher will be ready to start an actual ranch inventory. The program is currently being tested at the Sierra Foothill Range Field Station. Newer versions will be documented and released as they are developed to meet the needs of the ranching community.

Table 5. Animal group use of all pastures.

STATUS AS OF: 04/30/84
****

ANIMAL KIND	HEAD	DAYS	HEAD DAYS	AU	AUM	RESIDUE	UNITS	IN USE
* PASTURE A								
COW	50	31	1550	50	51	1000	LBS	
CALF	25	46	1150	1	2	0		*
** SUBTOTAL **								
	75		2700	51	53	1000		
* PASTURE B								
COW	50	30	1500	50	50	0		*
** SUBTOTAL **								
	50		1500	50	50	0		
** TOTAL **								
	125		4200	101	103	1000		

Table 6. Pasture use by animal kind.

PAST.	KIND	WT IN	WT OUT	GROUP GAIN	ADG	DATE IN	DATE OUT	DAYS	HEAD	HEAD DAYS	AU	AUM
A	COW	50000	50000	0	0	84/03/01	84/03/31	31	50	1550	50	51
B	COW	50000	50000	0	0	84/04/01		30	50	1500	50	50
** TOTAL **								61	100	3050		101

THE FORBES HILL RANGE FERTILIZATION EXPERIMENT

Charles A. Raguse, Roy Hull, Milton B. Jones, James G. Morris
Melvin R. George, and Kenneth L. Taggard

Introduction.

Reasons for doing the experiment and details of the experimental design were given in the Proceedings for the 1983 Beef Cattle Field Day. A brief explanation of the experiment is available today as a separate item for those wishing more complete information.

Figure 1 shows how the experiment is laid out on the 520-acre Forbes Hill research site and Figures 2 and 3 show first-year (1982-83) results. Table 1 gives a first-year economic analysis (prepared by Dr. Melvin R. George, Agronomy & Range Science Cooperative Extension). Each person will have to decide whether the cost/return assumptions used will fit their operation under current resource cost and market return

Table 1. Preliminary analysis of first year economic returns.

Treatment	Treatment Cost[2/]	Extra Gain Needed[3/]	Beef Produced First Season 06/16/83	Net Return From Treatment 06/16/83[4/]
	$/ac	lb/ac	lb/ac	$/ac
Control	--	--	88	--
40N[1/]	17.00	27	126	6.00
80N	28.00	47	153	10.00
40N+30P+33S	32.00	51	195	34.00
80N+30P+33S	44.00	71	215	34.00
30P+33S	15.00	24	128	9.00
60P+66S	25.00	41	175	28.00

1/ Nitrogen ws applied as urea; phosphorus and sulfur were applied as single superphosphate.

2/ Includes costs of fertilizer materials, plus $4.25/ac application costs ($8.50 for N + PS treatments), and interest charges at 12% for eight months. Values founded to nearest whole dollar.

3/ Lb/ac beef over control at $0.62/lb. Values rounded to nearest pound.

4/ Rounded to nearest whole dollar.

conditions. Using the stated assumptions we could conclude 1) Costs were recovered from all fertilizer treatments by end of the first grazing season (we must acknowledge that 1982-83 was an exceptionally good weather year), and 2) Up to $30 per acre return was realized from fertilized fields (as compared to the non-fertilized controls) due to a) higher stocking rates, and b) better animal (stocker steer) performance (daily gains). We underestimated the forage production response from the PS-only treatments; the fields were somewhat understocked and so the gains from those treatments were lower than they could have been. Improved animal performance on fields fertilized with single superphosphate (with or without nitrogen) seems to be maintained in the current (third) year. Average daily gains as measured on January 17, 1985 (see below) seem to indicate a quarter-pound advantage for the four treatments which included phosphorus and sulfur. We would not expect to see positive results from the fields treated with nitrogen alone in the third year, especially following the high-rainfall first season (about 45 inches), therefore we can include them along with the controls.

	ADG 1/17/85		
Control A	1.43	1.56	1.54
Control B	1.70		
40N	1.67	1.52	
80N	1.36		
40N+PS	1.96	1.90	1.80
80N+PS	1.84		
30P33S	1.68	1.78	
60P66S	1.87		

General Conclusions

We can summarize the significant general results of this experiment so far as outlined below.

A. Normal costs of fertilizer materials and application were recovered in the first grazing season (in a good year) following fall application.

B. Best results, under conditions of the experiment, were from the multiple-element (NPS) treatments. This was in part a reflection of the higher stocking rates employed in those treatments, but also because these soils are significantly lacking in all three nutrients.

C. An extremely important element in recovery of fertilization benefits is the ability to properly adjust stocking rates to reflect the sometimes large seasonal changes in levels of forage production.

D. In spite of reasonably comparable levels of grazing pressure (units of animal weight per unit weight of available forage) across treatments, stocker steer average daily gains were higher for fertilized fields, indicating significant benefits of fertilization to forage quality.

E. Experience thus far suggests that in a growing season with normal length and weather conditions, the most important yield-limiting (at the animal level) factor is ability to adequately transfer the additional forage produced from fertilization to livestock which can efficiently convert it to gain.

References

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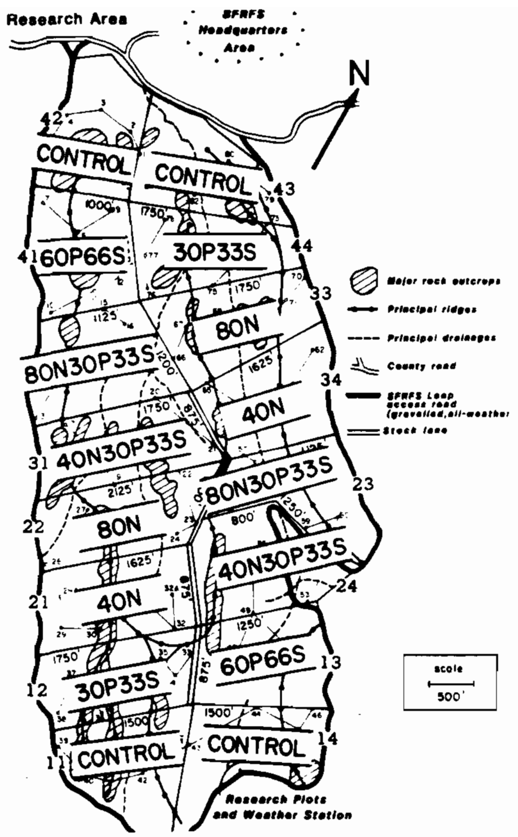

Fig. 1. Diagram of the field layout.

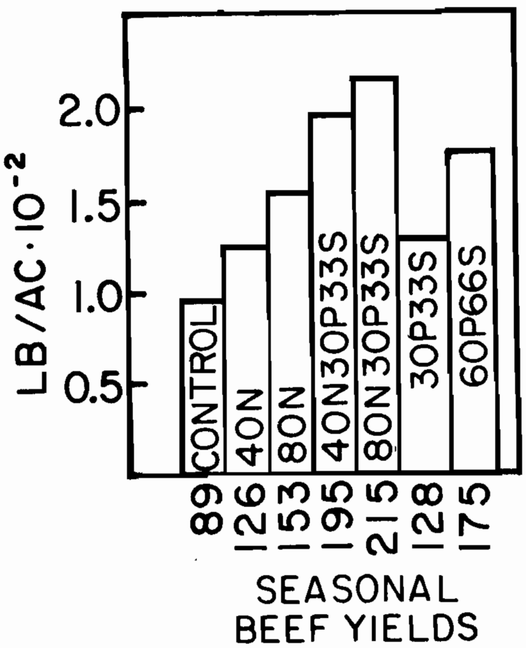

Fig. 2. First-year (1982-83) beef yields (based on stocker steer gains).

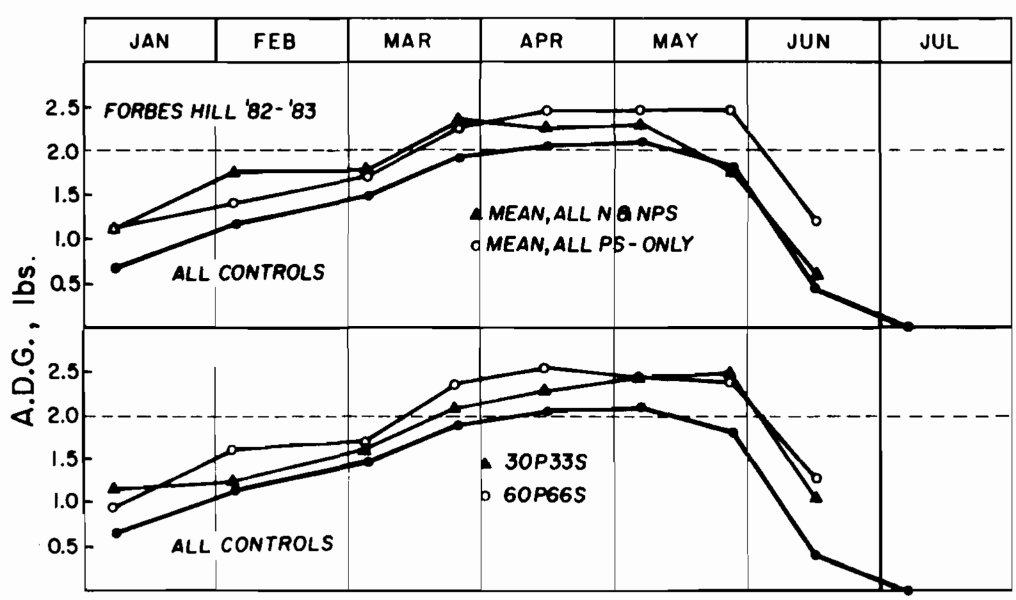

Fig. 3. Average daily gains for selected treatments and treatment combinations.

STATUS OF HORN FLY CONTROL WITH CATTLE EARTAGS

L. L. Dunning and E. C. Loomis
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Horn fly resistance to chemically-charged cattle eartags was suspected in south central Florida in 1982. Tests by USDA scientists in 1983 proved the actual existence of fly resistance. Similar tests conducted the same year in other southeastern states proved that flies were resistant in certain areas of Georgia, Alabama, Mississippi, Louisiana, Texas and Oklahoma. In 1984, USDA tests detected fly resistance in certain herds in Kansas, Nebraska, Tennessee, Kentucky, California and Hawaii. Horn fly resistance to chemically charged cattle eartags now has been confirmed in 13 states (Fig. 1).

In 1983, California cattlemen and livestock farm advisors in some counties reported that "eartags did not seem to work as well as they did in past years." Extensive field tests were conducted in 1984 using the USDA test procedure as well as a labor- and time-saving test designed by the authors.

Results from both the USDA and UC Davis test procedures showed that horn fly resistance occurred in Shasta County (1 herd with 4-year history of pyrethroid cattle tag use), in Tehama County (in 2 herds with from 3 to 4 years tag use and 1 herd with no evidence of resistance since cattle exposed to OP-charged dustbags in previous years), and in Sacramento and Sutter counties (1 herd each with 3 to 4 year exposure to cattle eartags). No resistance was found in flies sampled from herds in Inyo County (at 4500 feet elevation with short summer season but cattle exposed to eartag use for past 4 years) and in Solano County (herd not treated with any pesticides). Also, verbal reports were received of suspected fly resistance in certain herds in Merced, Sonoma and Yuba counties (Fig. 2).

Fly resistance to pyrethroid chemicals in eartags should be no great surprise to U.S. cattlemen. In 1983, the Australians published data indicating pyrethroid tolerance by their species of horn fly ("buffalo fly") after three years of overspray with cypermethrin and permethrin. This first report served as a warning of the eventual appearance of fly resistance.

Originally, cattle eartags used in the U.S. contained organophosphates (OP), such as those under the tradenames of Rabon and Dursban. These tags were very effective from 1976 through 1981, without any reports of horn flies developing resistance to the chemicals. However, pyrethroid chemicals began to replace organophosphates in eartags in late 1980, a change thought to offer more residual effects for longterm seasonal fly control. Entomologists did not believe then that the horn fly could detoxicy pyrethroids and therefore become resistant to their chemical action.

Two extrinsic influences contribute to the development of resistance in flies:

(1) The number of generations a fly population can produce in a season: 15-18 generations per year in the hot, arid conditions of California's Central Valley, but only one-half that number (7-9 generations per year) in the more temperate climates and shorter summers of high elevations and some coastal areas.

(2) The history of insecticide use, especially repetitive insecticide treatments. Cattle eartags impregnated with pyrethroids have been used repeatedly over a period of several years, although under different tradenames (Ectrin, Permectrin, Guardian, etc.).

What can the cattle grower do to control flies this year?

(1) In areas where eartagging cattle for several years has resulted in good fly control, owners should continue to apply new tags in late spring. If management allows frequent roundup, the entire herd may be sprayed in the spring (with an organophosphate such as Co-Ral, Delnav, Ciodrin, etc.) and then eartagged in mid-summer. Areas where this procedure "fits" are those in high mountain regions where cooler weather and short summers are common.

(2) In areas where eartagging cattle for several years has now resulted in no evidence of fly control, sprays or dustbags charged with OP chemicals must be used repeatedly. These areas include the hot, arid Central Valley, where long summers are common.

(3) In the coastal regions--particularly the relatively cool, wet northern areas, but also the warm, arid central and south-central areas--conditions may parallel those in (1) and (2).

(4) In areas where cattle have not been eartagged, tags can be applied, but owners should be aware that fly control may decline after tags have been used two or three years. Inspecting the herd frequently should reveal whether tags continue to be effective.

(5) All cattle in a herd should be double-tagged in areas where both horn and face flies occur.

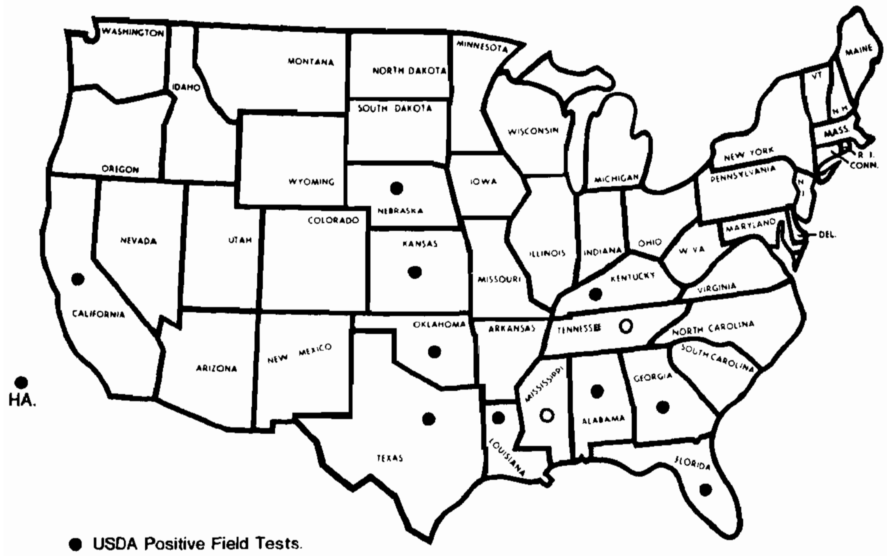
(6) Tags should be removed from both ears at the end of one season.

It should be emphasized that very often the fly season in the Central Valley extends from April through October (8 months). The slow release of insecticide from eartags has been sufficient to provide nearly 100% fly control for 5-6 months. A slight rise in the horn fly population has been observed in some areas, indicating sub-lethal insecticide exposure, probably due to nearly complete loss of the active chemical from the tags. When such an increase in flies is noticed, the animals should be sprayed (with an OP insecticide) when eartags are removed. Otherwise, some of the flies may survive the season, develop a low level of resistance, and consequently slightly more flies may be seen on tagged animals the following year. The pattern continues in succeeding years until the fly population becomes totally resistant.

There is no proof yet that face flies have become resistant to pyrethroid-charged cattle eartags. Since data collected in California show a wide range in effectiveness of eartags for face-fly control on cattle, in 1985 research will consider field testing face fly populations for possible resistance.

Fig. 1

PYRETHROID CATTLE EAR TAG RESISTANCE BY HORN FLIES IN UNITED STATES, 1983-84

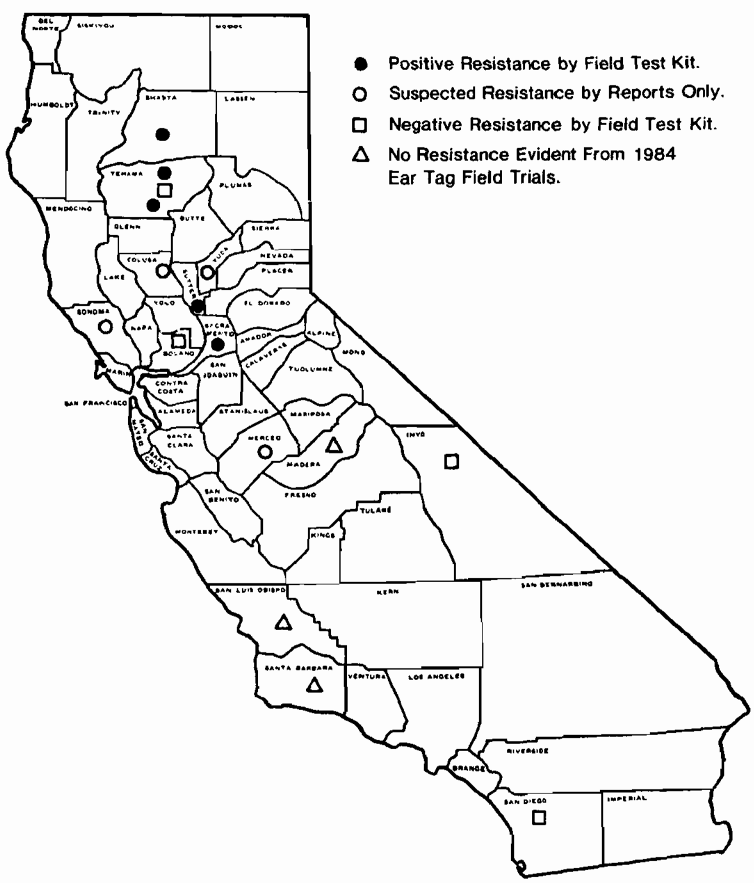


● USDA Positive Field Tests.

O State Report Only.

Fig. 2

STATUS OF PYRETHROID CATTLE EAR TAG RESISTANCE BY HORN FLIES IN CALIFORNIA, 1983-84



RALGRO FOR REPLACEMENT HEIFERS

R. E. Delmas[1]

Growth promoting implants on young animals has proven to be a sound practice over the years. In general, you can expect a 10% greater gain from implanted versus non-implanted animals. Also, implants along with feed additives can increase your gain and feed efficiency by 20% or more. The effect is accumulative rather than antagonistic. There has been a great concern over the effect of implants on replacement heifers. Because many people implant replacement heifers with Ralgro, a study was initiated in 1983 on heifers at the UC Sierra Foothill Range Field Station. Heifers were implanted with Ralgro in February, June, and October. All heifers were fed the same throughout the trial.

Preliminary results indicate that Ralgro did not improve the ADG of heifers between any of the weigh dates. By combining data between weigh periods, the data indicates that Ralgro slightly depressed the average daily gain rather than enhanced it: June - Controls 1.75 vs Ralgro 1.66, October - Controls 1.52 vs Ralgro 1.42, January - Controls 0.63 vs Ralgro 0.61

HEIFER PREGNANCY & CALVING DATA

	#Preg/#Bred	% Pregnant	% Anestrus	% Live Calves
Control	5/9	56%	11%	44%
R - Feb	18/28	64%	14%	46%
R - Feb,June	11/20	55%	15%	40%
R - Feb,Oct	9/17	53%	29%	41%
R - Feb,June,Oct	7/19	37%	53%	31%

Breeding Season: 49 Days

The data indicates that Ralgro implants effect reproduction. The heifer group implanted with Ralgro in February, June and October had a 37% pregnancy rate compared to the other four groups with an overall 58% conception rate. The number of animals reaching sexual maturity was also significantly lower in heifers receiving Ralgro in October. The average for the three groups not receiving Ralgro was 14% versus 29% and 53% for the Ralgro February and October group and the Ralgro February, June and October group. The percent live calves was 31% in the group implanted with Ralgro in February, June and October compared to the other four groups which averaged 43% live calves.

Data is continuing to be collected on this group of heifers and another group of heifers which will be calving next fall. Preliminary results from this trial indicate that 1) Implanting heifers with Ralgro at 2-4 months of age produces variable results; 2) Implanting heifers with Ralgro after weaning showed no beneficial effect; and 3) Implanting heifers with Ralgro prior to the breeding season inhibits sexual maturity (estrus) and lowers the pregnancy rate.

[1] University of California Cooperative Extension - Modoc County

MANAGING BEEF HEIFERS FOR EARLY BREEDING

J. L. Hull

Introduction

In the system of fall calving (October-November) used in annual grassland range areas of California, seven- to eight-month weaning weights of heifer calves from predominantly English breeds range from 400 to 450 pounds. For heifers to reach an ideal breeding weight of 650 pounds or more by 14 to 15 months of age, the average daily gain required is more than 1.25 pounds per head per day.

TABLE 1. Comparison of Expected Results from Three Hypothetical Management Regimes for Rearing Replacement Beef Heifers for Breeding as Yearlings*

Management	Below average†		Average†		Above average†	
Birth weight (Oct.)	75		75		75	
ADG (225 days)	1.55		1.61		1.70	I
Wean weight (June)	424		437		457	
ADG (120 days)	0.90	O	1.10	S	1.25	S+R
End pasture-season (Oct.)	532		569		607	
ADG (75 days)	0.75		1.00		1.00	
Breeding season (Dec.) (14 mo)	588	O	644	S	682	I,S+R

NOTE: Expected gains based on management regimes from previous trials at Sierra Foothill Range Field Station.
*Yearlings 14 to 15 months of age, weight 650 to 700 pounds.
†I = implant; O = nonsupplement; S= supplemented; S+R = supplement plus Rumensin.

To take advantage of the high productivity and low production cost of an irrigated pasture, the use of high-energy supplements (grain) and monensin sodium in the diet of grazing heifers is recommended. Even with their use, however gain has not always been in the recommended range of 1.25 pounds per day or better. This variable performance on irrigated pasture led to our investigation of various levels of protein and energy supplementation as a means of increasing average daily gain to produce heifers of adequate breeding weight.

Recent studies concerned with the growth and development of replacement beef heifers bred to calve as two-year-olds have shown that protein-energy supplementation for such heifers grazing irrigated pasture will enhance average daily gain over conventional energy supplementation and Monensin was additive.

TABLE 2. **Influence of Protein-Energy and Monensin Supplements on Growth Rate of Weaner Heifers Grazing Irrigated Pasture**[1]

	#1 (L-L) 82% GB 18% CSM	#2 (L-H) 100% GB	#3 (H-L) 8% GB 92% CSM	#4 (H-H) 50% GB 50% CSM	#5 (L-H+) (plus monensin)	#6 (H-H+) (plus monensin)
Initial wt., lb	444	446	446	445	417	403
Final wt., lb	580	588	595	619	587	610
ADG, lb	0.97	1.01	1.06	1.24	1.21	1.47
Supp Cons/h/da., lb	2.83	4.26	3.25	4.71	4.27	4.77
Total Supp Cons/kg/b	400	597	457	664	598	669

[1]140 day grazing season.
Supplements ground barley (GB) and cottonseed meal (CSM) fed in various combinations to produce low or high protein and low or high digestible energy.

Conclusions

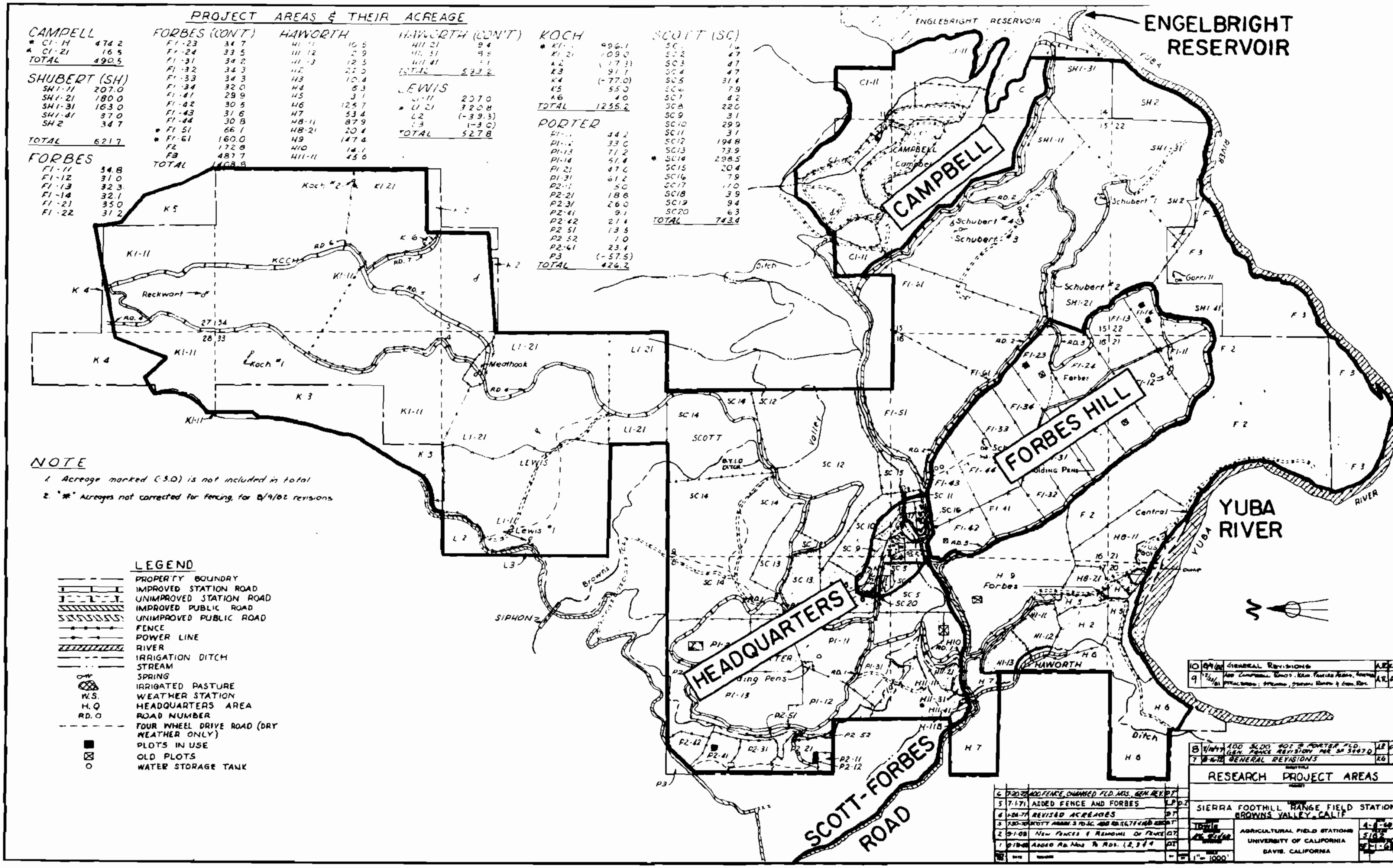
It seems evident that, although supplementation of growing heifers may be economically marginal when evaluated solely on the basis of weight gains, other considerations, such as preweaning ADG increased pasture stocking rate, and specific breeding weight and time goals would determine the most appropriate management practice to be used during the growing phase. The data indicate that energy protein supplementation of irrigated pasture increase ADG. In these studies, the addition of Rumensin further increased ADG by 16 percent.

In conclusion, all phases of management, genetics and nutrition must be considered to rear replacement heifers successfully for early breeding. A good preweaning diet is necessary to ensure optimal weaning weights. Only the heifers with above-average ADG at weaning should be selected with replacements and fed a diet for continued rapid growth to reach 650 pounds by 14 to 15 months of age.

BLUE OAK STAND AGE STRUCTURE

J. W. Bartolome and M. P. McClaran

Stand age structure, vertical growth rates, fire dates and fire free periods were measured for blue oaks in the Campbell and Koch pastures. Eleven fires 1891, 1905, 1914, 1919, 1929, 1934, 1936, 1939, 1954, 1958, and 1968 were documented in the Campbell, and 20 fires were documented in the Koch 1681, 1708, 1733, 1741, 1773, 1803, 1852, 1856, 1865, 1868, 1871, 1879, 1890, 1900, 1905, 1914, 1919, 1936, 1941 and 1948. The 1968 fire in the Campbell was a controlled burn done by Station personnel. The length of the fire-free period was not different between the Koch and the Campbell from 1890 to the present. The length of the fire-free periods decreased significantly after the goldrush in the Koch. The Campbell fire history does not go back as far as the Koch largely because trees older than 175 years were not in the sample. Tree establishment, or age of the aboveground portions of the tree, is clearly associated with past fires. In the Campbell, 71% of the trees established after 1890 had established within one year of a recorded fire. In the Koch, 81% of the trees established after 1681 had established within one year of a fire. The observed pattern of establishment probably resulted when trees sprouted from roots of top-killed trees. The vertical growth rate from 0-60 cm and 0-135 cm (browseline) is faster for sprouts (34 cm/yr and 16.5 cm/yr) than seedlings (18 cm/yr and 11.3 cm/yr). The faster vertical growth rates for sprouts is probably related to the greater success of establishment from sprouts compared to establishment from seedlings because it reduces the period of time that terminal buds are within the reach of browsing deer and livestock.



SIERRA FOOTHILL RANGE FIELD STATION

P.O. Box 28
Browns Valley, California

5,800 Acres - 300 to 2,000 ft. Elevation