# Irrigated Pasture for Beef Heifers to Be Bred as Yearlings

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# IRRIGATED PASTURE FOR BEEF HEIFERS TO BE BRED AS YEARLINGS

J. L. Hull and C. A. Raguse[1]

*University of California*[2], *Davis 95616*

## SUMMARY

Irrigated pasture grazing trials were conducted during three grazing seasons (years) to investigate systems for rearing early-breeding replacement beef heifers. Seven- to 8-month-old weaner beef heifers grazing irrigated pasture were supplemented with barley. Supplemental treatments were (1) none, (2) three times per week (MWF), (3) daily (fed weekly-intake limited by salt to be consumed over 7 days) and (4) same amount as (2) and (3) would consume in 4 weeks but hand fed to be consumed in 2 weeks. The third year one treatment was supplemented only during the last 56 days of the grazing trial.

Data collected included supplement consumption, weight gains, pasture composition and height as well as "*in vitro*" digestibility of the forage and the grazing, eating barley, ruminating and idling times for the grazing heifers.

Supplementation increased ADG and supplementing for 2 weeks followed by no grain for 2 weeks in general increased ADG more than other supplemental treatments. The heifer grazing, eating supplements and ruminating patterns and the forage data indicate that supplements were consumed at times normally spent in grazing and not in addition to grazing.

The results suggest that all phases of management, genetics and nutrition must be considered if rearing replacement heifers for early-breeding is to be successful.

(Key Words: Irrigated Pasture, Supplementation, Replacement Heifers, Grazing Behavior, Behavioral Studies.)

## INTRODUCTION

Breeding beef heifers as yearlings to calve as 2-year-olds has been an accepted practice for many years (Withycombe *et al.*, 1930; Albaugh, 1948). The problems and advantages have been documented at many experiment stations (Withycombe *et al.*, 1930 [OR]; Albaugh, 1948 [CA]; Bennett *et al.*, 1949 [UT]; Zimmerman *et al.*, 1958 [OK]; Bergland *et al.*, 1959 [MT]).

In the system of fall calving (October-November) used in the lower-elevation, annual grassland range areas of California, 8-month weaning weights of heifer calves from the predominantly English breeds of cattle range from 175 to 200 kilograms. To get good results in an early breeding system these heifers should reach at least 275 kg by 14 to 15 months of age (Albaugh, 1972). To reach this breeding weight requires an average daily gain of more than .5 kilograms. As the calves are weaned at the end of the spring range forage season, either heavy supplementation on the residual dry forage or transfer to irrigated pasture is necessary to obtain the desired growth rate.

Many studies have shown irrigated pasture to be a good growing ration, however, some investigators (Hull *et al.*, 1967, 1974; Utley *et al.*, 1973; Bellows and Thomas, 1976) have also shown better results with grain supplementation on irrigated pasture and have pointed out that light calves require energy concentrates along with irrigated pasture for good gains. In preliminary trials conducted by the authors, beef calves fed barley supplemented on irrigated pasture at the rate of 20% of their expected total dry matter intake (approximately 1 kg/day) did not show significantly improved gains but the energy supplementation permitted a marked increase in stocking rate.

The present paper reports further investigations of systems for rearing early-breeding replacement beef heifers on irrigated pasture.

## EXPERIMENTAL PROCEDURES

Studies were conducted during three grazing seasons at the University of California Sierra Foothill Range Field Station, Browns Valley, California, at an elevation of approximately

[1] Department of Agronomy and Range Science.
[2] Department of Animal Science.

137 m and 39° latitude in the foothills of the Sierra Nevada Mountains. The climate is Mediterranean with cool, wet winters and hot, dry summers. Rainfall, generally restricted to the period October 15 to April 15, averages about 60 cm annually.

The irrigated pastures were on soils of the Wyman and Sobrante series, both classified as members of the mollic haploxeralf sub-group of the fine loamy, mixed thermic family. The fields were seeded in November 1970 with a mixture of annual and perennial rye grasses (*Lolium multiflorum* Lam. and *L. perenne* L.), Orchard grass (*Dactylis glomerata* L.), Ladino clover (*Trifolium repens* L.) and 'Salina' strawberry clover (*T. fragiferum* L.), using 20 kg/ha of the grasses and 10 kg/ha of the legumes.

Irrigation of the fields during the grazing season was by surface flow, with an irrigation frequency of 7 to 10 days. A two-field system of grazing management, in which the cattle were rotated weekly, was used. Each year the pasture was grazed in the early spring to remove excess forage and this production was not credited to the trial. Three weeks pre-trial the pasture was clipped and fertilized with 70 kg/ha ammonium sulfate (20% N) and not grazed until initiation of the experimental grazing season.

Each year good to choice weaner (7 to 8 months of age), predominately Hereford, replacement heifers were selected for these trials. The heifers were vaccinated against leptospirosis, bovine virus diarrhea, infectious bovine rhinotracheitis and brucellosis, treated for intestinal parasites and individually number branded. After weaning and treatment they were allowed to adjust from 2 to 3 weeks before being allotted at random to the experimental treatments. They were without feed and water overnight before the initial and final weights were taken. During the experimental periods they were weighed individually every 28 days.

During the third grazing season, pasture height and botanical composition were determined weekly on either the third or fourth day of the 7-day grazing period by a modified step-point procedure (Evans and Love, 1957). At monthly intervals, also during this third grazing season, midway through the weekly grazing period, two esophageal fistulated steers were used to collect morning and afternoon ingested forage samples. Dry matter digestibility of the forage samples was determined *in vitro* (Tilly and Terry, 1963). Each month a 24-hr behavior observation period was started at 4:00 in the afternoon on the third day of a grazing period. During the third observational period the trials were started at noon of the third day. The purpose was to determine the relationship between grazing, ruminating, and idling times and supplement consumption. Observations of all animals in a treatment were made at 15-min intervals throughout the 24-hr period and the number of animals grazing, eating supplement, ruminating, idling; standing or lying, as well as drinking water were recorded. It was assumed that the number of animals observed in a given behavior group continued in that behavior until the next observation (Hull *et al.*, 1960).

Analysis of variance was used to determine within-treatment differences with Duncan's New Multiple Range test used to indicate significance among means. The Student *t* test was used for determining significance in the behavior trial.

*Grazing Season I.* (1974; June 18 to Sept. 10) Animals in four supplementation treatments were fed ground barley at the rate of .8% of live body weight. The treatments were: (1) none, (2) three times/week (MWF), (3) daily (fed weekly – intake limited by salt to be consumed over 7 days), and (4) same amount as (2) and (3) would consume in 4 weeks but hand fed to be consumed in 2 weeks. The amount to be fed was adjusted every 28 days when the cattle were weighed. The irrigated pasture was stocked, based on previous experimental data from these same pastures, at the rate of 12.4 heifers per hectare for the supplemented treatments and 9.9 heifers per hectare for the non-supplemented treatment.

*Grazing Season II.* (1975; June 24 to Sept. 30) All treatments and supplements were the same as in grazing season I except that the ground barley was fed at the rate of 1.0% of live body weight and the stocking rate was 9.9 heifers per hectare for the supplemented treatments and 7.4 heifers per hectate for the non-supplemented treatment.

*Grazing Season III.* (1976; June 15 to Oct. 5) The supplemented treatments were: (1) none, (2) same as the previous treatment 4, i.e., fed the amount of supplement to be consumed in 28 days over a 2-week period, (3) same amount of supplement as treatment 2, but fed only during the last 56 days of the trial. Supplements were fed at the rate of 1.0% of live body weight, adjusted monthly, but rolled, instead of ground, barley was fed. All treatments were stocked at the rate of 9.9 heifers per hectare.

## RESULTS AND DISCUSSION

The influence of supplementation during the three grazing seasons is presented in table 1. In 2 of the 3 years, the feeding of the barley supplement significantly increased average daily gain (ADG) between 10 to 20%. It also appeared that increasing the rate of supplementation from .8 to 1.0% of body weight was beneficial as an increase in daily gain of .12 kg was obtained over corresponding previous treatments. In most cases, however, the feeding of the barley supplement, although significantly increasing ADG, did not give the desired level of performance, i.e., at least .5 kg ADG.

Supplement fed heavily for 2 weeks followed by no grain for 2 weeks increased ADG over the other supplemental methods within years. It is postulated that with this method of supplementation, while supplying extra energy in the form of barley supplements, the heifers still maintained a high level of forage intake, and thus, a higher ADG.

The heifers supplemented only during the last half of the experimental period did not gain as rapidly as those supplemented for 2 weeks followed by no grain for 2 weeks. It took until approximately halfway into their 56-day supplemental period before consumption of the supplement stabilized. From this time on, although receiving more supplement per day, gains were only equal to the other treatments. In using this treatment, where supplementation was initiated midway through the grazing season, it was felt before the start of the trial that the heifers might be more efficient as they would be larger and thus consume more total dry matter. Slow forage growth later in the season would then be offset by supplement, thus maintaining a high ADG. This, however, did not occur.

Forage heights (figure 1) and species composition (table 2) show that adequate forage was available. Approximately 45% of the other grasses category consisted of velvet grass (*Holcus lanatus*) a native species considered a desirable forage in California (Sampson *et al.*, 1951) with another 45% consisting of Dallis grass (*Paspalum dilatatum*). Pasture heights were lower for the unsupplemented treatment and for the time that the "half" supplemented treatment received no barley. A change in sward height was noted during the latter part of the grazing season for all treatments. This was not unexpected as the same stocking rate was

TABLE 1. INFLUENCE OF SUPPLEMENTATION METHOD DURING THREE GRAZING SEASONS ON GROWTH RATE OF WEANER BEEF HEIFERS

| Treatment | Method of supplementation | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No supplement | | | Daily | | | 3X/week | | | 2 weeks | | | Last 1/2 | | |
| Year | 1974 | 1975 | 1976 | 1974 | 1975 | 1976 | 1974 | 1975 | 1976 | 1974 | 1975 | 1976 | 1974 | 1975 | 1976 |
| Length of trial | 84 | 106 | 112 | 84 | 106 | ... | 84 | 106 | ... | 84 | 106 | 112 | ... | ... | 112 |
| No. of animals | 8 | 6 | 8 | 10 | 8 | ... | 10 | 8 | ... | 10 | 8 | 16 | ... | ... | 8 |
| Animals/ha | 9.9 | 7.4 | 9.9 | 12.3 | 9.9 | ... | 12.3 | 9.9 | ... | 12.3 | 9.9 | 9.9 | ... | ... | 9.9 |
| Initial wt, kg | 172 | 201 | 191 | 170 | 199 | ... | 172 | 200 | ... | 177 | 199 | 189 | ... | ... | 189 |
| Final wt, kg | 197 | 233 | 237 | 202 | 243 | ... | 198 | 237 | ... | 210 | 247 | 253 | ... | ... | 237 |
| Gain/ha, kg | 247.5 | 236 | 455.4 | 393 | 435.6 | ... | 320 | 366.3 | ... | 406 | 475.2 | 633.6 | ... | ... | 475.2 |
| ADG, kg | .30 | .30[b] | .41 | .38[a] | .41[a] | ... | .31[b] | .35[ab] | ... | .39[a] | .45[a] | .60 | ... | ... | .43[b] |
| Supplement/head/day, kg | ... | ... | ... | 1.50 | 2.23 | ... | 1.50 | 2.18 | ... | 1.41 | 2.23 | 2.18 | ... | ... | 3.14 |
| Total supplement fed, kg/head | 0 | 0 | 0 | 126 | 236 | ... | 126 | 231 | ... | 118 | 236 | 244 | ... | ... | 175 |

[a,b]Treatment means on the same line having different superscripts differ significantly ($P<.05$) within years.

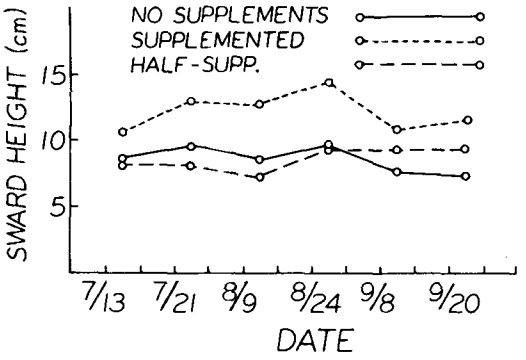


Figure 1. Average height of pasture sward mid-way during 5-day grazing period.

used for both the unsupplemented and supplemented treatments throughout the trial and seasonal effects were noted as forage growth slowed in the latter part of the grazing season. In the treatment where supplement was fed only during the last 56 days an increase in average sward height occurred midway through the grazing trial.

The *in vitro* analyses of dry organic matter digestibility (OMD) of the pasture forage as obtained by esophageal fistulated steers at monthly intervals are presented in table 3. Although significant differences were found between *am* and *pm* samples, when those data were pooled there were no differences in OMD between treatments. The selection of lower digestibility forage in the *am* sampling could be due to the animals being more hungry at this time as it was necessary to hold them from feed the night previous to sampling in order to obtain a sufficiently large morning sample. This was not the case for the afternoon sampling. A comparison of the digestibility of these esophageal pasture samples to known digestibility of alfalfa showed the pasture forage to be equivalent to 90% of the energy value of a 21% crude fiber alfalfa indicating that the forage available was of very good quality.

Calculations were based on the California New Energy System (Lofgreen and Garrett, 1968) assuming an energy value for the pasture forage of 63 megcal for maintenance and 36 megcal for gain (90% of the value of 21% CF alfalfa). A daily consumption of 2.2 kg barley, with an ADG of .56 kg, gave a daily intake of 4.54 kg of forage DM for a 221 kg heifer. Assuming the same daily consumption of barley but with an ADG of .75 kg, a heifer would need to consume 5.07 kg of forage DM, a 12% increase in daily forage DM consumption equivalent to an additional 1.0 kg of barley. This would then give the desired ADG to obtain the 275 kg weight generally accepted as needed by breeding time (Shoop and Hyder, 1976). Total intake therefore is the major factor limiting the performance of the growing heifer.

The grazing behavior of the supplemented versus non-supplemented heifers showed considerable variation (table 4). As previously noted, the heifers supplemented only during the last half of the experiment did not consume supplement in an established pattern during the mid-season observation period and data for this treatment during this observational period were not used. Animals supplemented with barley had a significantly shorter grazing period, with the total feeding time (grazing and eating barley) being shorter than that of the non-supplemented control animals. For ease of statistically testing, both standing and lying times, whether idling or ruminating, were combined. Total ruminating time decreased markedly for the supplemented treatments, while idling time increased compared to the control

TABLE 2. COMPOSITION OF IRRIGATED PASTURES (PERCENT COVER) DURING THE THIRD GRAZING SEASON

| Item | No supplement | Supplemented, 2 weeks | 1/2 supplemented |
|---|---|---|---|
| | | (%) | |
| Seeded grasses | 28.4 | 36.5 | 36.4 |
| Seeded legumes | 13.8 | 15.3 | 14.6 |
| Other grasses | 45.4 | 39.7 | 35.4 |
| Weeds, forbs | 6.7 | 4.7 | 5.5 |
| Litter, bare ground and manure | 5.7 | 3.8 | 8.1 |

TABLE 3. *IN VITRO* DIGESTIBILITY DURING THREE SAMPLING MONTHLY PERIODS

| Date | Sampling period | | | Mean |
|---|---|---|---|---|
| | July | August | Sept-ember | |
| | (%) | | | |
| AM | 46.9 | 57.1 | 53.5 | 51.9[a] |
| PM | 55.9 | 58.3 | 53.9 | 56.5[b] |
| Mean | 51.4[a] | 57.7[b] | 53.7[ab] | 54.2 |

[a,b]Treatment means on the same line or column having different superscripts differ significantly (P<.05).

treatment. It is generally considered that ruminating time is related to the amount of fiber in the diet; if so, this indicated a much lower intake of forage for the supplemented treatments. When the actual daily times of grazing and eating supplements are plotted (figure 2) similar patterns of either grazing or eating supplements and/or grazing occurred. Barley consumption tended to occur at the two peak times of grazing—dawn and dusk with little consumption during the night. From the observed behavior patterns and the changes in sward height with the start of supplementation it is concluded that the supplemented animals did not eat barley in addition to grazing, but instead, ate supplements at a time normally spent grazing. Bellows and Thomas (1976) also found that high grain feeding reduced grazing time and subsequent forage intake. They concluded that high grain supplementation served as a substitute for range forge rather than as a supplement; however, they did not report times of grain consumption.

As the heifers used in this study were from University herds, performance data prior to, and following the grazing season were available. The heifers were allotted at random according to their pre-grazing trial ADG, e.g., on the basis of above or below average ADG from birth to weaning. These data show that 80% of the heifers showing above average ADG at weaning time, and supplemented during the pasture season, made sufficient weight gains to reach a minimum of 275 kg by breeding season, 60 days following the end of the pasture trial. This is comparable to only 60% of the heifers of

TABLE 4. BEHAVIOR DATA – TOTAL ACTIVITY IN HOURS (%/24 HR)

| Treatment | Month | Activity | | | |
|---|---|---|---|---|---|
| | | Grazing | Eating barley | Rumi-nating | Idling |
| No supplement | July | 8.40 | ... | 5.03 | 10.22 |
| | August | 8.44 | ... | 5.56 | 9.78 |
| | September | 7.75 | ... | 5.71 | 10.40 |
| | Mean | 8.20[a] | ... | 5.43[b] | 10.13 |
| Supplemented | July | 5.06 | .70 | 3.01 | 14.78 |
| | August | 5.96 | 1.09 | 3.19 | 13.45 |
| | September | 6.19 | .86 | 2.79 | 12.75 |
| | Mean | 5.61[b] | .88 | 3.00[a] | 13.66[b] |
| 1/2 supplemented | July | 9.45 | ... | 4.94 | 8.72 |
| | August | 8.35 | .28 | 3.47 | 11.69 |
| | September | 5.06 | 1.69 | 5.00 | 11.81 |
| | Mean | 7.62[ab] | .98 | 4.47[ab] | 10.74[ab] |

[a,b]Treatment means in the same column having different superscripts differ significantly (P<.05).

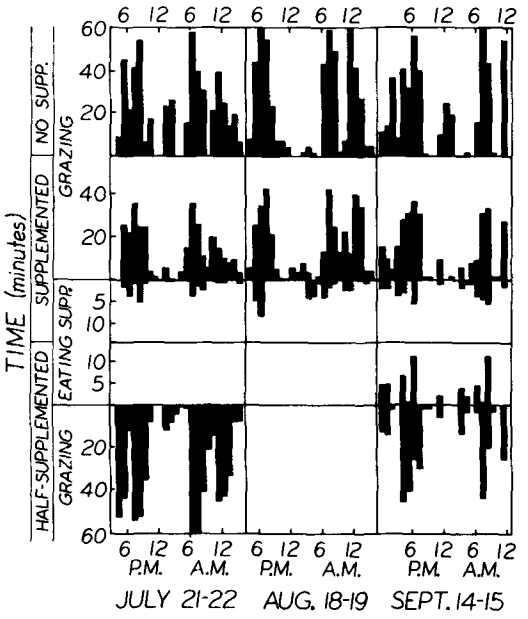


Figure 2. Time spent in grazing and eating supplements by beef heifers under three management treatments.

average or below average ADG up to weaning obtaining 275 kilograms.

From these studies and other studies it is evident that although supplementation of growing heifers may be economically marginal when interpreted solely on the basis of weight gains, other considerations such as presupplemental ADG, increased stocking rate of irrigated forage and specific breeding weight and time goals would determine the most appropriate management practice to be used during the growing phase. The data reported indicate that although irrigated pasture is a very good growing diet, energy supplementation will increase ADG; however, an optimal system of supplementation such as the one presented should be employed. The increased gain from supplementation is partially offset by decreased forage consumption and stocking rate should be increased to ensure optimal forage utilization and season-long maintenance of forage quality.

In conclusion, the use of currently available technology to improve beef forage production systems must be employed (Hodgson, 1977). It is suggested that if replacement heifers are to be managed for early breeding (bred as yearlings to calve as 2-year-olds) a good preweaning diet is necessary to insure optimal weaning weights. Only the heifers exhibiting above average ADG at weaning should be selected for replacements and fed a diet for continued rapid growth if they are to reach 275 kg by 14 to 15 months of age. All phases of management, genetics and nutrition must be considered if rearing replacement heifers for early breeding is to be successful.

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