# IRRIGATED PASTURE

# LIGHT BEEF


Young lightweight beef calves can be grazed on irrigated pasture with gains comparable—on a metabolic body size basis ($wt^{3/4}$)—with those for yearling cattle. When all or part of their diet was from irrigated pasture, more individual variation in average daily gain (ADG) occurred in calves as compared with yearling cattle. A high stocking rate can compensate for lower per head gain with calves. Steer calves gained approximately 10% more than heifer calves. Supplementation with rolled barley at 20% of expected dry matter intake did not improve gains but permitted a marked increase in stocking rate. Alfalfa cubes can be a successful supplement to calves on pasture when fed three times per week at a high stocking rate.



J. L. HULL


THE HIGH COST of alfalfa hay and concentrates has renewed interest in the use of irrigated pasture for growing out young cattle, especially light (200- to 300-lb) calves. Yearling beef steers gain well when irrigated pasture is their sole feed. In contrast, light calves are generally thought to require concentrates when grown on pasture.

Stocking rate and supplementation trials were conducted at Davis and at the Sierra Foothill Range Field Station (SFRFS), Browns Valley, with early weaned (5 to 6 months of age) lightweight steer and heifer calves (250 to 300 lbs) of known birth date and previous history. All calves were wormed, vaccinated for IBR (infectious bovine rhinotracheitis), Lepto (leptospirosis, and BVD (bovine virus diarrhea) before the start of the trials and randomly assigned, with the same number of steers and heifers per treatment. The calves were weighed each year every 28 days after an overnight shrink without feed or water. Pasture management included weekly irrigation and two-field rotation with week-long grazing and regrowth intervals. No fertilization of the pasture took place at either location.

Ninety-four calves were assigned at three stocking rates on irrigated pasture with no supplement and to three different drylot feeding regimes. All of the pasture treatments were replicated three times, with two replications at Davis and one replication at the SFRFS. The drylot treatments were conducted at Davis. At the SFRFS, the pasture was a third year stand of orchard grass, rye grass, Ladino and 'Salina' strawberry clovers. At Davis, an eight-year-old stand of the same four species was used.

Botanical composition data (step point analysis) of the Davis pasture indicated

TABLE 1. PASTURE HEIGHT CLASSES AT LATE SEASON AS INFLUENCED BY STOCKING RATE

| Height on Sept. 21, 1972 | Animals carried per acre | | |
|---|---|---|---|
| | 3.55 | 4.3 | 7.1 |
| (Inches) | % | % | % |
| 0–2 | 9.0 | 10.6 | 60.2 |
| 2–4 | 9.6 | 8.7 | 29.0 |
| 4–6 | 19.9 | 16.8 | 8.6 |
| 6–8 | 28.9 | 37.3 | 2.1 |
| 8–10 | 19.9 | 16.8 | — |
| > 10 | 12.6 | 9.9 | — |
| Mean | 7.5 | 6.8 | 2.3 |

TABLE 2. RESPONSE OF CALVES GRAZING IRRIGATED PASTURE TO STOCKING RATE AND LOCATION (142-DAY TRIAL)

| | Davis | | | Sierra Foothill Range Field Station | | |
|---|---|---|---|---|---|---|
| Animals/acre | 3.55 | 4.3 | 7.1 | 2.55 | 3.55 | 5.0 |
| No. of calves | 16 | 16 | 16 | 5 | 7 | 10 |
| Age in mo at start | 6.0 | 5.8 | 5.8 | 6.4 | 6.1 | 6.1 |
| Initial wt, lb | 311 | 306 | 311 | 301 | 326 | 302 |
| Final wt, lb | 405 | 391 | 386 | 480 | 445 | 423 |
| Av. daily gain, lb | 0.66a* | 0.62a | 0.57a | 0.84b | 0.84b | 0.86b |
| Standard deviation of gain | 0.20 | 0.15 | 0.18 | 0.21 | 0.13 | 0.17 |
| Gain/acre, lb | 335 | 380 | 514 | 302 | 320 | 611 |

* Figures on the same line having the same superscript do not differ significantly ($P < 0.01$).

TABLE 3. RESPONSE OF BEEF CALVES TO SUPPLEMENTATION WHILE GRAZING IRRIGATED PASTURE (168-DAY TRIAL)

| | Calves (Av. age at start = 6.2 mo.) | | | | Yearling heifers |
|---|---|---|---|---|---|
| | No Supplement | Alfalfa cubes | 50% alfalfa + 50% barley | Rolled barley | No Supplement |
| No. of cattle, initial only | 11 | 11 | 11 | 11 | 8 |
| Initial wt., lb | 286 | 276 | 289 | 265 | 575 |
| No. head/acre | | | | | |
| 1st 56 days | 5.9 | 9.9 | 9.9 | 9.9 | 2.8 |
| 2nd 84 days | 4.8 | 8.0 | 8.0 | 8.0 | 2.8 |
| 3rd 28 days | 3.7 | 6.3 | 6.3 | 6.3 | 2.8 |
| Amt. of supplement fed/hd/day, lb | | | | | |
| 1st 56 days | 0 | 2.8 | 2.3 | 1.8 | 0 |
| 2nd 84 days | 0 | 3.6 | 2.9 | 2.2 | 0 |
| Av. daily gain, lb | | | | | |
| 1st 56 days | 1.48 | 1.29 | 1.38 | 1.36 | 0.80 |
| 2nd 84 days | 1.01 | 1.02 | 1.08 | 0.62 | 1.10 |
| 3rd 28 days | 1.19 | 1.11 | 1.02 | 0.02 | 1.18 |
| ADG overall (7hd) | 1.17ab* | 1.20a | 1.09bc | 0.91d | 1.01c |
| Final wt, lb | 466 | 463 | 486 | 399 | 743 |
| Gain/acre of pasture, lb | | | | | |
| 1st 56 days | 489 | 715 | 765 | 754 | 121 |
| 2nd 84 days | 407 | 685 | 726 | 417 | 259 |
| 3rd 28 days | 123 | 196 | 180 | 35 | 92 |
| Gain/acre/supplement fed, lb. | 0 | 581 | 656 | 191 | 0 |
| Total 168 days, gain/acre | 1015 | 1596† | 1671† | 1206† | 477 |
| ADG/wt $^{3/4}$, lb | 0.013§ | — | — | — | 0.008 |

* Figures on the same line having the same superscript do not differ significantly ($P < 0.05$).
† Includes gain from supplements.
§ Unsupplemented heifers only.

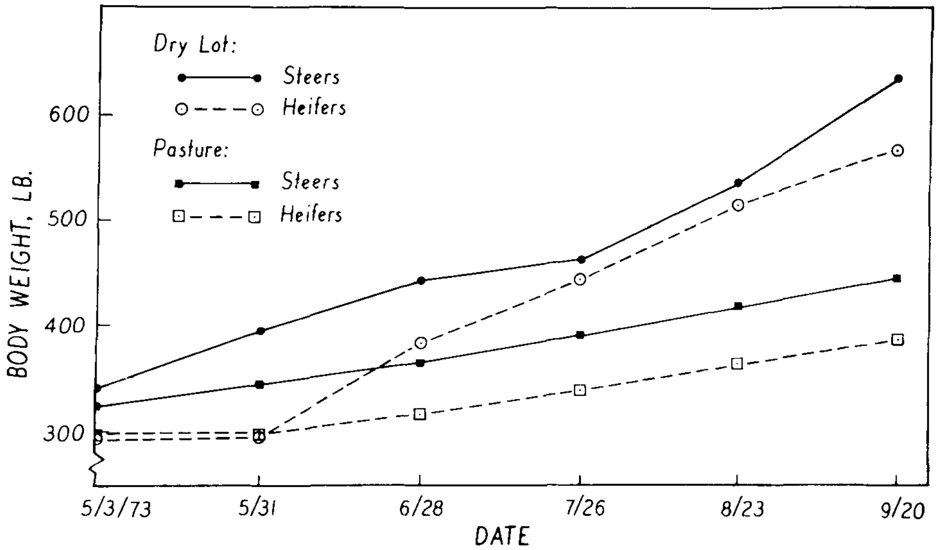
# *for*

# WEIGHT CALVES

C. A. RAGUSE

Calves on irrigated pasture.

SEASONAL BODY WEIGHT CHANGES OF STEERS AND HEIFERS IN DRYLOT AND IRRIGATED PASTURE.




no change in per cent species for the light or medium stocking rates from mid to late season. During the latter part of the grazing season the heavy stocking favored legumes, as there was a change of 20% from mid to late season. The average pasture height during the later part of the grazing season (table 1) can be considered a measure of stocking pressure, since the higher stocking rate showed a much larger percentage of the forage at the end of the growing season in the shorter height classes.

No significant difference in average daily gain (ADG) between the three stocking rates was observed at either location (table 2). ADG at all stocking rates was significantly greater ($P < .05$) at the SFRFS than those obtained at Davis. However, when calculated on a gain-per-acre basis, the SFRFS results were comparable with those obtained at Davis.

Significant differences ($P < .01$) in ADG between steers and heifers (figure 1) occurred. This difference, 0.78 lb for the steers and 0.67 lb for the heifers, is within the normal range for these ages and weights. Overall the steer calves appeared slightly more efficient with an ADG/$wt^{3/4}$ of 0.009 compared to 0.008 for the heifer calves.

Calves showed an ADG of 0.57 to 0.96 lbs in comparison with yearling cattle, where a gain of 1.2 to 1.5 lb per day can be expected. However, if calculated on a metabolic size basis ($wt^{3/4}$), the gains of heifer calves were comparable with those for yearling heifers (table 3). As an example, a 400 lb heifer calf gaining 0.8 lb per day was equivalent in ADG/$wt^{3/4}$ to a 600 lb yearling heifer gaining 1.1 lb per day.

Gains of calves on the drylot treatments (graph) reflected the energy content of the ration. These gains were significantly different from each other ($P < .01$), with calves on a high concentrate ration showing the greatest ADG (2.23 lbs). Those fed the 50% concentrate ration were intermediate (1.96 lb), and those fed straight alfalfa cubes were somewhat less (1.85 lb). Feed intake of the calves was the reverse, with those on alfalfa cubes consuming 16.6 lbs per day, 14.3 on 50% concentrate, and 13.0 on the 92% concentrate ration. As these calves were randomly allotted from the same group as those on the stocking rate trial, calves were obviously not making maximal gains on pasture and should have responded to supplemental feed.

Forty-four calves were assigned to four irrigated pasture supplementation treatments at Davis: (1) rolled barley, (2) 50% alfalfa hay and 50% barley cube, (3) plain alfalfa cube, and (4) no supplementation. In addition, one group of non-supplemented yearling beef heifers was grazed in an adjoining pasture.

Calves were supplemented at 20% of their total predicted dry matter intake on an equal digestible energy basis. The amount of supplement needed on a weekly basis was divided equally, to be fed on Mondays, Wednesdays and Fridays. At each 28-day weighing of the calves, the amount of supplement to be fed during the next period was adjusted for change in calf weight.

Stocking rate was based on that needed by yearling cattle for the type of pasture being grazed, and adjusted for the expected lower dry matter intake of the lighter calves and for supplementation. As seasonal growth of the forage declined, an equal number of animals was removed from each treatment. This occurred 56 and 140 days after the start of the trial, on June 15 and September 7.

Supplementation results (table 3) seem to indicate no advantage in ADG for either alfalfa-barley or straight alfalfa cubes over the pasture-only treatment at the levels fed. Supplementing three times per week with rolled barley (approx. 0.7 of body weight), however, resulted in a significant decline ($P < 0.05$) over either the pasture-only group or those supplemented with alfalfa cubes. This lower gain, while unexpected, might be explained as a disruption of the rumen flora of calves fed only three times per week, as this would be 40% of their diet as supplement on the day fed. No evidence of digestive upset was apparent, as the weight gains of the calves early in the season were comparable. An alternative explanation would be less rumen fill, since cattle on a high concentrate diet have less rumen fill than those on a high roughage diet.

Forage availability (as measured by height) indicated that the calves receiving supplements consumed less pasture. Even at the high stocking rates for the supplemented calves (9.9 animals per acre at the start of the grazing trial, decreasing to 6.3 animals per acre at the end of the grazing season), the pasture height remained equal for all supplementation treatments and was comparable with that of the yearling heifers (table 3) at the considerably lighter stocking rate (2.8 animals per acre). It was concluded that in all cases forage availability was not a limiting factor. Differences in per cent legume probably did not significantly influence either ADG or carrying capacity of the pastures.

Supplementation of young calves at 20% of expected dry matter intake, while not warranted by increased ADG of young calves, did permit an increase in stocking rate from 3.7 to 6.3 animals per acre.

Steers and heifers differed significantly in ADG in a manner similar to that found in the stocking rate trial. Sex of the calf did not influence the responses to supplementation.

No mid-season worm treatment was necessary. Pink eye occurred both years at orchardgrass flowering and seed set. It was greatly reduced when orchardgrass flower and seed stalks were clipped with a sickle-bar mower just above the vegetative part of the forage canopy.

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# MOTH RESISTANCE ARMORED-LAYER SUNFI

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Sunflower varieties having plants with armored-layer seeds resulted in a high reduction of seed damage caused by larval feeding of the sunflower moth, **Homoeosoma electellum** (Hulst). Several sunflower lines were significantly more resistant to seed damage when the plants had armored-layer seeds than when the same lines had non-armored-layer seeds. The association of the armored layer with moth resistance was also shown by its significant reduction in the number of emerging adults. However, the same lines having plants with no armor still retained some resistance (compared with the check), which indicated that some chemical factors were also involved. Laboratory tests also indicated that the nature of resistance was partially chemical.

RECENT INVESTIGATIONS (1971) showed for the first time that some sunflower lines have an armored layer. The presence of this phytomelanin layer correlated with those lines having the least damage from sunflower moth larval feeding in open pollinated heads. Sunflower research in 1972 and 1973 was intensified in an effort to correlate the armored layer on sunflower seeds with resistance to larval feeding of the sunflower moth, *Homoeosoma electellum* (photo 1).

Field plantings of many sunflower lines and crosses were made in 1972 and 1973 to supply plants, heads, seeds, and pest animals for our investigations. Emphasis was placed on those lines that had been shown to exhibit an armored layer (photo 3), that had the least moth damage, and that were from available selfed seed from the 1969, 1970, and 1971 plantings.

## Culture and method

A satisfactory culture and method was devised for laboratory rearing of the pest insect (photo 4). To obtain data on the resistance of sunflower lines to sunflower moth larvae, first instar larvae were transferred onto and in field-bagged heads. Six to 24 of these very small larvae were transferred from pint jars (kept cool) onto each selfed head, which was then re-bagged. This had to be done carefully and slowly to allow the larvae time to get a foothold in the small disc flowers. Many bagged heads were available, so two heads per line were used per introduction date.

Considerable data on head and seed injury and amount of damage due to sunflower moth larval feeding were also obtained from the open field-pollinated heads. A few heads at a time were cut and brought into the lab at several intervals, portions of which were then cut off and the seeds checked for light (scarring only) damage, severe damage (holes eaten through the seed coat and into cotyledons), and total number of seeds.

## Laboratory experiments

Laboratory petri dish experiments were conducted on seeds from heads collected in the field, and subjected to first instar larval feeding. Several varieties having armored-layer seeds were tested using whole seed (florets + seed + pulp), seed + pulp (floret scar sealed with nail polish), florets alone, and seed alone. The whole seed obtained was cut carefully in groups of 15–24 from a head in order to preserve the florets on the seeds and to leave them intact in the pulp, since excised seeds left a crown scar and a slight hole at the apex. The laboratory cultured first instar larvae were able to search out these injuries and enter them instead of boring through the seed coat. The various types of seed used from each strain were placed on dry filter paper in the petri dishes, larvae were introduced, and all replicates were left about a month—or until adult moths had time to emerge (after larval feeding and pupation). The florets and seeds left alone were subjected to larval feeding in this manner for only two days, after which whole seed of fresh UC5 (the check) was added to insure survival of the remaining live larvae.

Table 1 contains a summary of the data obtained in 1972, separated according to presence or absence of the armored