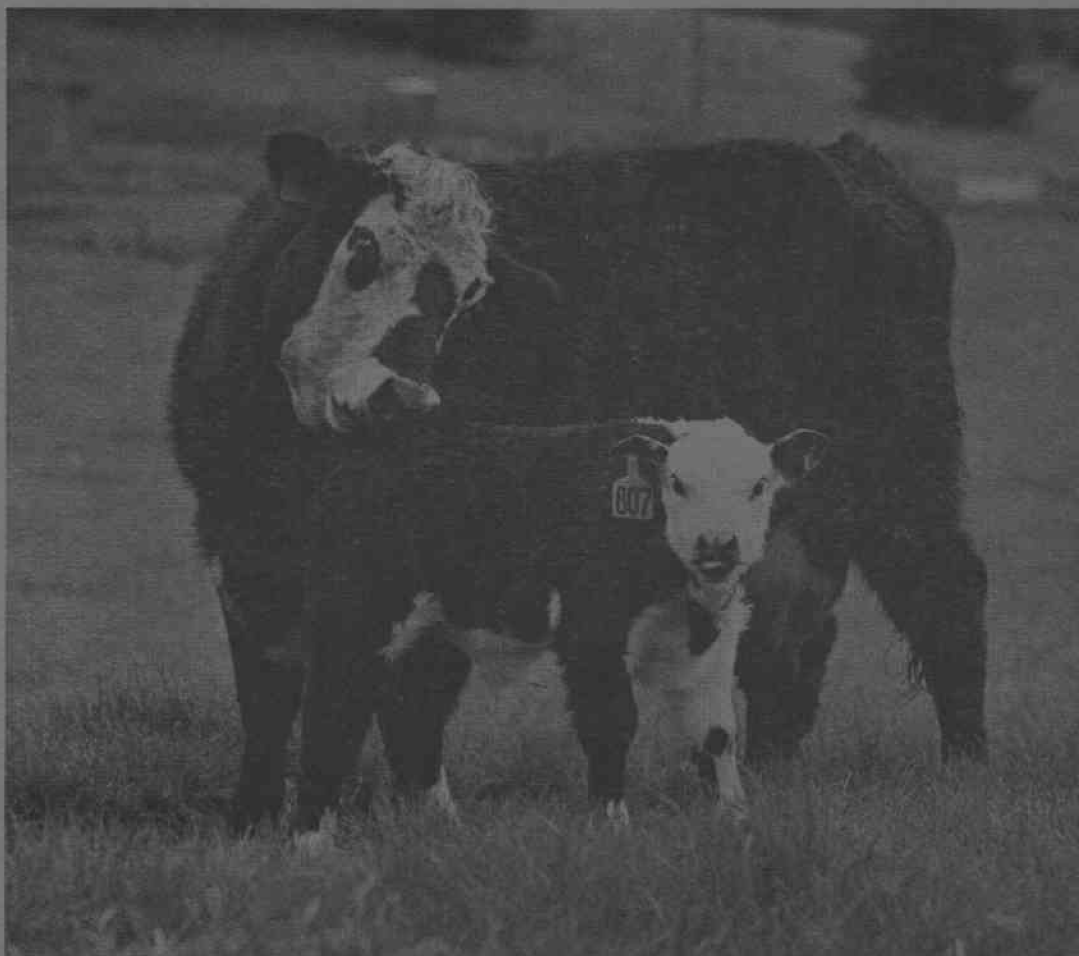
# 19th Annual Beef Cattle Day Report



May 13, 1978

Oregon State University, Corvallis

Special Report 508, Agricultural Experiment Station, Oregon State University

# PROGRAM

## FRIDAY, MAY 12

Best Western Country Kitchen Motel, 800 NW Ninth Street, Corvallis

7:00-8:30 am -- Committee Meetings (Committees may also meet Thursday evening, May 11th)

9:00 am Board of Directors Meetings -- Oregon Cattlemen's Association and Western Oregon Livestock Association; Oregon CowBelles

12:00 Beef Industry Luncheon -- Don Ostensoe, presiding -- Tom Beall: Beef Prices--Where Do We Go From Here?

1:30 pm Business meetings continue

6:00 pm Social Hour (No Host)

7:00 pm Annual Beef Day Banquet -- Dean Frischknecht, presiding -- Jack Davis: Your Stake in Agricultural Research

## SATURDAY, MAY 13

Morning Session held in Withycombe Hall Auditorium, OSU Campus -- Jim Oldfield, presiding

8:30 am Registration -- Withycombe Hall Lobby

9:00 am Welcome -- Bill Ross and Tom Guerin

9:15 am Implant Summary -- Al Ralston

9:35 am How Can You Fit Estrus Synchronization and AI Into Your Beef Program? -- Lloyd Swanson

10:05 am A Review of Range Management Practices for Rangelands With Poisonous Plants -- Bill Krueger

10:35 am Coffee Break (Refreshments provided by WOLA and OCA)

10:50 am College of Veterinary Medicine Progress Report -- Mike Shires

11:00 am OSU Beef Nutrition Research Update:
- -- Dave Church: By-Product Feedstuffs Useful for Beef Cattle
- -- Dennis Daugherty: Feather and Hair Meal as Protein Supplements
- -- Steve Jones: The Use of Fermented Ryegrass Straw as a Ruminant Feed
- -- Wes Kezar: The Use of an Experimental Antibiotic and Sodium Bicarbonate For Prevention of Acidosis

11:45 am Our Beef Cattle Industry: The Past Is Prologue--What About Tomorrow? -- Stewart Fowler

12:30 pm Lunch Break (Lunch served by members of the Withycombe Club)
- -- Greetings from the Oregon Beef Princess, Dava Sayers
- -- Animal Science Internship Program -- Janne Samsom, Dennis Nevin, Dale Weber
- -- Barry Mehr: Opportunities for Internnational Beef Trade

Afternoon Session held at Beef Barn, West Campus Way -- Dale Weber, presiding

1:30 pm Feeder Cattle Grading Demonstration -- Dean Frischknecht

1:55 pm The Use of Rumen Fistulated Steers in Animal Science Research -- Steve Jones

2:10 pm Measuring Backfat Thickness With Ultra Sound -- Dave Church

2:25 pm A practical Cow-Calf Herd and Reproduction Program -- Mike Shires

3:10 pm Announcement: Winner of Market Steer Weight Estimation Contest

SPONSORED COOPERATIVELY BY THE OSU DEPARTMENT OF ANIMAL SCIENCE, THE OREGON CATTLEMEN'S ASSOCIATION AND THE WESTERN OREGON LIVESTOCK ASSOCIATION

# PROGRAM PARTICIPANTS

Beall, Tom -- Cattle-Fax Marketing Agent, Denver, Colorado

Church, Dr. Dave -- Professor, Department of Animal Science, OSU

Daugherty, Dennis -- Graduate Student, Department of Animal Science, OSU (from Chico, CA)

Davis, Dr. Jack -- Director, Oregon Agricultural Experiment Station, OSU

Fowler, Dr. Stewart -- Resident Director of Research, Texas A & M University Agricultural Research and Extension Center, Uvalde, Texas

Frischknecht, W. Dean -- Extension Livestock Specialist, OSU

Guerin, Tom -- President of Western Oregon Livestock Association, Myrtle Point

Jones, Steve -- Graduate Student, Department of Animal Science, OSU (from Springfield, IL)

Kezar, Wes -- Graduate Student, Department of Animal Science, OSU (from Bozeman, MT)

Krueger, Dr. William C. -- Program Leader, Rangeland Resources Program, OSU

Mehr, Barry -- International Trade Director, Canadian Cattlemen, Alberta, Canada

Nevin, Dennis -- Student, Department of Animal Science, OSU (from Eagle Point, OR)

Oldfield, Dr. Jim -- Professor and Head, Department of Animal Science, OSU

Ostensoe, Donald -- Executive Vice President Oregon Cattlemen's Association and Executive Secretary of Oregon Beef Council, Portland

Ralston, Dr. Al -- Professor, Department of Animal Science, OSU

Ross, Bill -- Rancher and President of Oregon Cattlemen's Association, Jordan Valley

Samsom, Janne -- Student, Department of Animal Science, OSU (from Turner, OR)

Sayers, Dava -- Oregon Beef Princess (from Ontario, OR)

Shires, Dr. Mike -- Associate Professor, School of Veterinary Medicine, OSU

Swanson, Dr. Lloyd -- Associate Professor, Department of Animal Science, OSU

Weber, Dr. Dale -- Assistant Professor, Department of Animal Science, OSU

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# IMPLANTS

A. T. Ralston
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Hormones are chemical activators produced in localized areas within the body or found in feeds and certain forage crops. They are transported via the blood stream to the site of action where they regulate growth, metabolism and/or reproduction. Although generally considered specific in their role, their interrelationship with other hormones may be one of synergism, antagonism or of a passive nature. Hormones differ widely as to their chemical composition. The adrenal cortical and gonadal hormones (corticosteroids, testosterone, estrogens) are steroids; thyroxin is an amino acid derivative; pituitary hormones are proteins and epinephrine is an amine. There are now synthetic compounds that have parallel or similar effects. Diethylstilbestrol (DES), the best known of these, has been widely used in the beef cattle industry as a growth stimulant to nursing calves and animals in the feedlot.

Other such compounds would include Synovex S (200 mg progesterone, 2.5 mg estradiol benzoate), Synovex H (20 mg estradiol benzoate, 200 mg Testosterone propionate), Rapigain (120 mg testosterone, 25 mg diethylstilbestrol), Hexestrol (the English counterpart to DES), and Ralgro (zeranol, an anabolic agent).

## Diethylstilbestrol

Implantation of calves at birth with 12 mg of DES significantly ($P<.05$) stimulated early gains (Table 1). This was great enough to carry over an advantage at 205 days. Recovery of implants at 90 days showed only 10% of the original biopotency remained. Because of this, reimplanting at 90-day intervals has been used in subsequent trials.

The level of implant at birth of 12 mg seems to be more effective (Table 2). The 6 mg seems to be too low a level and 15 at birth seems too high (Table 3).

Table 1. Effect of DES implants upon suckling gain and feedlot performance

| | Castration at 205 days of age | | No castration |
|---|---|---|---|
| | Implant at birth | Implant at 3 mos. | Bull to weaning |
| Av. daily gain to 3 mos., lbs. | 2.48[a] | 2.26 | 2.25 |
| Av. daily gain to wean, lbs. | 2.01 | 1.90 | 1.90 |
| Testicle dia., mm. | .32 | .30 | .41 |
| Wean grade[b] | 2.5 | 3.0 | 2.8 |
| Av. daily gain wean to slaughter, lbs. | 2.94 | 2.74 | 2.63 |
| Feedlot efficiency[c] | 5.70 | 6.04 | 6.34 |
| Cost of finish gain, $ | 18.40 | 19.52 | 20.44 |
| Marble score[d] | 7.8 | 8.2 | 9.9 |

[a]Significantly ($P<.05$) greater than other two groups.
[b]1 = fancy, 2 = high choice, 3 = average choice.
[c]Pounds of feed to produce a pound of beef.
[d]6 = traces, 9 = slight, 12 = small.

Table 2. Effects of DES implants upon suckling gain and testis development

| | Group I* | Group II* | Group III* | Group IV* |
|---|---|---|---|---|
| Av. daily gain to 3 mos., lbs. | 2.22 | 2.32 | 2.16 | 2.21 |
| Av. daily gain to weaning, lbs. | 1.90 | 2.04 | 1.87 | 1.94 |
| Weaning grade[c] | 7.15 | 7.50 | 6.93 | 7.20 |
| Seminiferous tubule dia., μ | 114.36[a] | 72.00[b] | 108.81[a] | 123.44[a] |

*(1) birth, 6 mg, in ear, (II) birth, 6 mg ear + 3 mo., 15 mg in ear, (III) 3 mo., 15 mg in ear, (IV) controls, no implants.
[a,b]Values on the same line bearing different superscript letters are significantly ($P<.01$) different.
[c]A score from 1 (least desirable) to 10 (most desirable).

Table 3. Effect of DES implants upon suckling gain and testis development

| | Group I* | Group II* |
|---|---|---|
| Av. daily gain to 3 mos., lbs. | 2.39 | 2.35 |
| Av. daily gain to weaning, lbs. | 1.90 | 1.96 |
| Weaning grade | 7.20 | 7.67 |
| Testis weight, g. | 29.9 | 27.1 |
| Seminiferous tubule, dia., μ | 129.00 | 137.14 |

*(I) birth, 15 mg ear + 3 mos., 15 mg ear, (II) 3 mos., 15 mg ear.

The calves implanted at birth and again at 90 days of age resemble the steer in appearance. They are smaller headed, lack in general masculinity with increased teat development and have significant decreases in testicular development. Implanted intact males also have more subcutaneous fat especially in the scrotal area. In some respects this is not desirable since it makes castration more difficult.

The effectiveness of implanting male calves at 90 day intervals throughout their lifetime and castrating them at about 205 days is shown in table 4. The stress of castration was not great as indicated by a 1.7 lb average daily gain for 10 days following castration. Although this advantage in growth rate becomes smaller at 400 days the implanted castrates graded choice, whereas, the bulls were graded bulls returning less money. If steers in the feedlot were implanted at 90 day intervals, implantation was as effective as either oral or a combination of oral and implant (Tables 6 and 7).

Site of implantation was also studied (Table 5). Problems of infection may nullify any advantage alternate sites may have. At least this was true of scrotal implants.

Table 4. Effect of DES upon feedlot gain and testis development of bulls

| | Group I* | Group II* | Group III* |
|---|---|---|---|
| Av. daily gain to slaughter, lbs. | 3.00 | 2.94 | 2.86 |
| Av. testis weight, g. | 135.75 | 188.56[b] | 290.67[a] |
| Av. seminiferous tubule dia., μ | 244.71[e] | 266.14[d] | 293.67[c] |

*(I) birth, 12 mg, ear + 3 mo., 12 mg ear + into feedlot, 15 mg ear + 110 days, 15 mg ear, (II) 3 mo., 12 mg ear + into feedlot, 15 mg ear + 110 days, 15 mg ear, (III) control, no DES.

[a]Significantly (P<.01) greater than Groups I and II.

[b]Significantly (P<.05) greater than Group I.

[c,d,e]Values bearing different superscript letters on the same line are significantly (P<.01) different.

Table 5. Effect of level and site of implant upon performance and testis development

| | Group I* | Group II* | Group III* | Group IV* | Group V* |
|---|---|---|---|---|---|
| Av. daily gain to 3 mos., lbs. | 2.35 | 2.38 | 2.46 | 2.55 | 2.36 |
| Av. daily gain to weaning, lbs. | 1.92 | 1.97 | 1.90 | 1.97 | 1.84 |
| Weaning grade[a] | 7.55 | 7.58 | 7.54 | 7.50 | 6.86 |
| Av. testis wts. g. | 15.77[c] | 12.71[d] | 15.35[c] | 17.25[c] | 53.61[b] |
| Av. seminiferous tubule dia., μ | 101.85 | 93.90 | 96.00 | 94.20 | 168.15[e] |

*(I) birth, 6 mg, scrotum + 3 mo., 12 mg ear, (II) birth, 12 mg, scotum + 3 mo., 12 mg ear, (III) birth, 6 mg, ear + 30 mo., 12 mg ear, (IV) birth, 12 mg ear + 3 mo., 12 mg ear, (V) control, 0 mg.

[a]A score from 1 (least desirable) to 10 (most desirable).

[b]Significantly (P<.01) different than all other groups.

[c,d]Values on the same line gearing different superscript letters are significantly (P<.05) different.

[e]Significantly (P<.01) different than all other groups.

Table 6. Summary of feedlot performance (reimplant at 90 days)

| Hormonal treatment | ADG to 49 days lbs. | ADG to 141 days lbs. | Feed/lb. of gain lbs. | Feed cost/ cwt. of gain |
|---|---|---|---|---|
| DES oral + implant | 3.45 | 2.82 | 7.48 | $18.03 |
| DES oral | 3.50 | 2.87 | 7.81 | 18.81 |
| DES implant | 3.53 | 3.10 | 7.36 | 17.70 |
| Testosterone + DES implant | 3.72 | 2.73 | 7.85 | 18.91 |
| Testosterone + DES implant + DES oral | 3.47 | 2.88 | 7.60 | 18.36 |
| Average | 3.35 | 2.87 | 7.62 | $18.36 |

Table 7. Summary of delayed feedlot performance (initial implant only)

| Hormonal treatment | ADG to 49 days lbs. | ADG to 141 days lbs. | Feed/lb. of gain lbs. | Feed cost/ cwt. of gain |
|---|---|---|---|---|
| DES oral + implant | 2.92 | 2.92 | 7.56 | $17.50 |
| DES oral | 2.49 | 2.85 | 7.70 | 17.87 |
| DES implant | 2.99 | 2.79 | 7.78 | 17.97 |
| Testosterone + DES implant | 2.85 | 2.49 | 8.46 | 19.50 |
| Testosterone + DES implant + DES oral | 3.11 | 2.88 | 7.55 | 17.49 |
| Average | 2.87 | 2.79 | 7.81 | $18.07 |

Ralgro

A three year comparison of DES and Ralgro (24 or 36 mg) resulted in small differeneces (Table 8).

In 1973 there was no difference in weaning weight of calves due to time of castration or Ralgro implant. However, this is the exception rather than the rule (Table 9).

Table 8. Effect of DES or Ralgro on weaning weights

| Year | Treatments DES | 24 mg Ralgro | 36 mg Ralgro |
|---|---|---|---|
| 1970 | 483 ± 13[1] | 477 ± 18 | 493 ± 18 |
| 1971 | 517 ± 14 | 520 ± 14 | 501 ± 14 |
| 1972 | 518 ± 13 | 520 ± 13 | 492 ± 13 |

[1]Coefficient of variation

Table 9. Effect of Ralgro implants, short scrotum and intact males upon weight

| Year | Treatment 24 + 36 mg Ralgro lb | Short Scrotum lb | Intact lb |
|---|---|---|---|
| 1974 | 482 | 497 | 510 |
| 1975 (low) | 415 | 458 | 472 |
| 1975 (high) | 503 | 503 | 508 |
| | 24 mg Ralgro | 36 mg Ralgro | Intact |
| 1976 (high) | 527 | 524 | 508 |
| 1976 (low) | 508 | 522 | 506 |


Summary

Implanting calves with either DES or Ralgro maintained or improved gains over the castrate or intact calves. Implanted bull calves had more finish at weaning with reduced sexual development. The lack of masculinity eliminated the problems of pregnancy in heifer calves and the male calves did not follow mature cows in heat. Castration at weaning time produced heavier calves with less chance of urinary calculi than earlier castration. Castration at weaning did not stress the calves as much as anticipated.

# HOW CAN YOU FIT ESTRUS SYNCHRONIZATION AND AI INTO YOUR BEEF PROGRAM?

Lloyd V. Swanson
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Corvallis, Oregon

Although the use of artificial insemination (AI) has become widespread in the dairy industry, with about 50% of the dairy cows in the US bred by AI, it has yet to become popular in the beef industry. While the use of AI is increasing in the beef industry, only about 5% of the beef cattle in the US are currently bred by AI.

There are several reasons for this discrepancy. The major reason is probably the inability to identify the cow in heat with a high degree of precision. Failure to properly detect estrus results in a prolonged breeding season and a low conception rate. In addition, many cattle have been moved onto the range and it simply isn't feasible to observe the cows for estrus or to run them through a breeding chute under range conditions. Although most cattlemen cannot afford the quality of sire presently available through AI, such has not always been the case. Until recently, the production testing programs had not evolved to a point where sufficient numbers of superior sires were identified and available for use in AI. So any program to increase the usage of AI must not only make it possible to use AI, but such a program must also demonstrate economic feasibility.

Recent advances in a number of directions should pave the way toward greater usage of AI in the beef industry. An ever increasing number of superior beef sires are being identified and made available for AI. Exotic breeds are available through AI. The purebred associations have eased the restrictions on the use of AI. And recent developments in the use of hormones may make it feasible for more ranchers to avail themselves of the benefits of AI.

The early estrous synchronization hormones had two basic problems. First, fertility was always subnormal following their use. And secondly, the hormones were not very precise in their synchronization ability. Thus estrous detection was still a necessary chore which is, and always has been, subject to considerable management error.

There are obvious advantages to precise synchronization of estrus. These include an increased pregnancy rate early in the breeding season, reducing the time and labor requirements of an AI breeding program, the possibility of eliminating estrous detection altogether and synchronization of cattle (especially heifers) at the following calving.

More recently, hormones have become available which have the ability to synchronize estrus precisely enough to eliminate the need for estrous detection. One of these is prostaglandin. This is a hormone which, upon injection, causes rapid degeneration of the yellow body (corpus luteum). This removes progesterone from the circulation, permitting follicles to develop which secrete estrogen which then causes behavioral estrus and ovulation. One must be careful not to use prostaglandin in pregnant cattle as it will cause abortion. However, this may be a potential use in feedlot heifers or in cattle pasture bred to the wrong bull. There are two prostaglandin products likely to be available in the near future. These are a natural product (Prostin F2 Alpha or Lutalyse) produced by the Upjohn Company, and a synthetic product (Estrumate) produced by Impserial Chemical. Both appear equally effective.

Some characteristics and the use of both prostaglandin products are as follows. Since prostaglandin is effective only when a corpus luteum is present, cattle will respond during days 5 to 18 of the estrous cycle. This also means that prepubertal heifers or anestrous cows will not respond. The synchronization obtained in cattle which do respond is very precise. Most experiments have shown that 80-90% will show estrus during a 3 day period (days 2-4) after administration. Therefore, it has been practical to breed cattle at a single, timed insemination, usually at 80 hr after administration of the hormone.

Table 1 illustrates the effectiveness of Lutalyse. This experiment involved 3,443 beef cows and beef and dairy heifers. Because only 50-70% will respond after a single injection of prostaglandin, two injections were given 11 days apart. All cattle should then be in the middle of their cycle at the time of the second injection. The pregnancy rate was equal among the 3 groups after 15 days of AI.Thus the advantage of prostaglandin, as stated earlier, is the increased pregnancy rate early in the breeding season. Furthermore, a single insemination at 80 hr was equally effective to insemination following estrus detection.

Table 1. Pregnancy rate in cattle synchronized with two injections of Lutalyse 11 days apart and inseminated at detected estrus or at 80 hr after the second injection[1]

| Treatment | Pregnancy rate (%)[2] | | | |
|---|---|---|---|---|
| | Days 2-5 | Day 15 | Day 21 | Day 28 |
| Control, AI at detected estrus for 25 days | 11 | 41 | 53 | 60 |
| Lutalyse, AI at detected estrus | 39 | 47 | 53 | 65 |
| Lutalyse, AI at 80 hr | 41 | 43 | 49 | 63 |

[1]From Moody and Lauderdale, J. Anim. Sci. Abstr. 455, 1977.
[2]Pregnancy rate = Number pregnant X 100 ÷ number per group.

The use of the synthetic prostaglandin, Estrumate, is illustrated in Table 2. This experiment involved 1,136 beef cows. Two injections were given 12 days apart and insemination was either timed or at detected estrus. While the pregnancy rate decreased when a single insemination occurred at 72 hr, it was observed that this was true only for trials conducted in the southern US; the pregnancy rate was the highest in this group for cattle in the northern US and Canada.

Table 2. Pregnancy rate in cattle synchronized with two injections of Estrumate 12 days apart and inseminated at detected estrus or at a timed interval following the second injection[1]

| Treatment | Number of cows | Pregnancy rate (%) | |
|---|---|---|---|
| | | of those bred | of all cows in group |
| Control, AI at detected estrus for 24 days | 283 | 54 | 41 |
| Estrumate, AI at detected estrus | 284 | 54 | 40 |
| Estrumate, AI at 72 and 96 hr | 282 | | 39 |
| Estrumate, AI at 72 hr | 287 | | 33 |

[1]From Schultz et al., J. Anim. Sci. Abstr. 513, 1977.

Another hormone which should become available is Syncho-Mate-B, produced by Searle. This is a progesten which is implanted in the ear for 9 days, then removed. In addition, the implant is accompanied by an intramuscular injection of estradiol valerate and a progesten. This experiment included 2,332 lactating beef cows. Insemination occurred at detected estrus or at 48 to 54 hr (timed) after removal of the ear implant. Calves were removed from cows in the timed AI group at the time of implant removal and were returned after insemination. This experiment was further broken down into herds in which over half or less than half of the cows were exhibiting estrous cycles. The pregnancy rate was again increased early in the breeding season (day 5)(Table 3). The higher pregnancy rate in the group bred at 48 to 54 hr is attributed to calf removal. This concept (calf removal) will be discussed later. This experiment also illustrates the decreased pregnancy rate associated with non-cycling herds.

Table 3. Pregnancy rate in lactating beef cows synchronized with Synchro-Mate-B (SMB) and inseminated at detected estrus or 48 to 54 hr following implant removal[1]

| Treatment | Pregnancy rate (%)[3] | | |
|---|---|---|---|
| | Day 5 | Day 25 | Day 45 |
| Cycling (>50%) herds | | | |
| Control, AI at detected estrus | 12 | 56 | 78 |
| SMB, AI at detected estrus | 39 | 59 | 78 |
| SMB, AI at 48 to 54 hr[2] | 51 | 66 | 83 |
| Non-cycling (<50%) herds | | | |
| Control, AI at detected estrus | 3 | 17 | 54 |
| SMB, AI at detected estrus | 16 | 32 | 61 |
| SMB, AI at 48 to 54 hr[2] | 26 | 41 | 64 |

[1]From Mares et al., J. Anim. Sci. Abstr. 464, 1977.
[2]Calf separated following implant removal to insemination.
[3]Pregnancy rate = Number pregnant X 100 ÷ number per group.

It is apparent that normal fertility results from synchronization with these products. One has the choice of giving intramuscular injections (Lutalyse and Estrumate) or a combination of an intramuscular injection and an ear implant. In addition, cost and availability must be considered. Artificial insemination becomes practical, either during a short period of estrus detection or at a predetermined time. The prostaglandin products can be used in different management schemes. First, two injections followed by timed insemination eliminates estrus detection. Secondly, a 10 day breeding season involves estrus detection and AI for 4 days and the morning of the fifth day; on the fifth day inject prostaglandin into all cows not inseminated, and then inseminate at estrus for an additional 5 days. This program has the advantage that fewer cows are treated and if 20% of the cows failed to come into estrus during the first 4 days, the treatment would not be given because not enough cattle were cycling. And thirdly, if estrus detection were feasible, cows could be inseminated when they come into estrus after the first injection. Cows not inseminated after the first injection would receive a second injection 10 days after the first; insemination at estrus detection would continue.

As noted at the beginning, estrus synchronization is dependent on cycling cattle. Wiltbank has observed that the postpartum interval to first estrus is longer in younger cows. Nutrition is very important; insufficient energy intake prior to or following calving also increases the postpartum interval to first estrus.

The problem of postpartum anestrus is beginning to receive attention. As indicated earlier, calf removal for 24 to 72 hr prior to insemination will increase the number of cows showing estrus and pregnancy rate by approximately 10%. Such treatment doesn't affect weaning weight. Of course, one must have holding facilities and be willing to tolerate some noise with this treatment. Creep feeding calves has also been observed to increase the proportion of cows showing estrus and the pregnancy rate. An experiment utilizing gomer bulls indicated that their presence increased pregnancy rate by approximately 10%. These data present some ideas as to how pregnancy rate might be improved in the postpartum cow.

The problem of synchronizing estrus in anestrous cows is emphasized in a recent report from Australia. There, fertility was very low in prostaglandin-treated cows (about 35%) compared to non-treated cows bred by a bull. The difference was traced to the fact that all the cows were on a sub-maintenance ration. Thus, most of the treated cows were not cycling - and only those cows which were cycling had an opportunity to conceive when inseminated. The non-treated cows, however, were not bred by the bull <u>unless</u> they were cycling. Thus, conception rate was normal (60%) when only determined in cows which had been bred.

But prostaglandin can overcome one major management deficiency which heretofore has prevented the use of AI on a practical scale - that is, estrous detection. Elimination of estrous detection should make AI feasible in the beef industry as it has become in the dairy industry. We have accumulated good evidence that fertility is normal following prostaglandin treatment. And prostaglandin controls ovulation so precisely that normal fertility is obtained when cows are inseminated at a set time period following prostaglandin injection without regard for the estrous condition of the cow at the time of insemination.

We are currently conducting extensive field studies throughout the state, using the prostaglandin, Prostin F2 Alpha. We should have results this fall, indicating how it might fit into management plans under Oregon conditions. Hopefully, this should assist you in making the proper decision when these hormones become available commercially.

# A REVIEW OF RANGE MANAGEMENT PRACTICES FOR RANGELANDS WITH POISONOUS PLANTS

William C. Krueger
Rangeland Resources Program
Oregon State University

Poisonous plants on rangelands cause significant economic losses to ranchers. Direct losses due to death of animals have been estimated at 3-5 percent of livestock grazing on range and the estimates of losses have been similar for about the last 50 years (Marsh, 1924; Agricultural Research Service, 1968). Losses due to decreased production of animals poisoned but not killed and costs of specialized management practices to avoid poisonous plants probably exceed the cost of death losses. Research to define specific toxic agents, prevention and cure of animal poisoning by plants, ecological status and function of poisonous plants, palatability, and other factors which must be understood to eventually alleviate the problem has been conducted for the last 70 years in the western United States. From this research base and from observations of ranchers and scientists we can usually minimize livestock losses from plant poisoning by carefully defining management programs.

Sampson (1952) indicated there were more than 500 species of poisonous plants in the United States, while Stoddart, Smith and Box (1975) suggested that thousands of plants would be poisonous if eaten in sufficient quantity to cause easily identifiable production losses or death of livestock. Poisonous plants must generally be consumed in relatively large quantities to be toxic. It is this fact which allows development of vegetation and livestock management programs to make productive use of rangelands that support poisonous plant species. However, some poisonous plants such as water hemlock and timber milkvetch are toxic in relatively small amounts (Kingsbury, 1964). Management of areas with these highly toxic plants will generally be more specialized than in most other cases.

Vegetation Manipulation to Minimize Livestock Losses

When an entire pasture supports a sufficient amount of poisonous plants to present risk to grazing of livestock, it may be economical to consider overall improvement of the pasture. Poisonous plants are usually minor constituents of good condition rangeland and increase in abundance if grazing is excessive (Stoddart et al., 1949). If the range has not retrogressed beyond a stage where a positive response to grazing management is possible, good grazing management should return the community to a condition where poisonous plants do not present a hazard to livestock. However, it is frequently the case, especially in more arid environments, that a plant community will not respond to grazing management in a reasonable time frame. For example, complete protection from grazing over 20 to 25 years has not resulted in significant changes in certain sagebrush dominated plant communities (Tisdale, et al., 1969). Under these circumstances a type conversion may be necessary to solve the problem of poisonous plants and return the range to its original productivity. Once the stand of improved vegetation is established, the pasture can be grazed profitably but residual poisonous plants may still need to be considered in the grazing program.

Direct control of problem plants is sometimes successful. Most poisonous plants are forbs or shrubs and can be killed by one of the phenoxy herbicides without damage to grasses in the plant community. Response of vegetation to herbicides may vary with the site (Cronin, et al., 1977). Often a second treatment is needed to successfully minimize the density of these plants. Spraying with herbicides will seldom eradicate poisonous plants completely, but coupled with proper grazing management it will often reduce them to a "safe" level. Certain poisonous plants have been successfully controlled by biological agents. The most notable among these are St. Johnswort, which has been successfully controlled by introduction of two Chrysolina beetles, and tansy ragwort which has been locally controlled by larvae of the Cinnabar moth (Vallentine, 1971). Grazing of livestock that are resistant to toxic effects of poisonous plants has also been useful in minimizing grazing hazard for less resistant animal species. For example, sheep have been used to control tansy ragwort and thus improve the range for cattle.

Frequently poisonous plants are localized within a pasture and control or eradication becomes necessary to allow its full use. Localized stands of poisonous plants may result from either natural site differences or developments (usually watering points) and sometimes a relatively small stand of poisonous plants can have major impact on the livestock herd. Nielsen and Cronin (1977) reported results of spot treatment of tall larkspur in Utah. A pasture of 8,000 acres had 344 acres of larkspur which caused an average loss of 33 cows and 10 calves each year. Spot treatment of larkspur in this pasture proved to be an excellent investment which was equivalent to earning interest at a rate from 63% to 72% based on value of livestock saved. While costs of controlling or eradicating poisonous plants may be high on a per acre basis, the impact on the total pasture should frequently make spot treatment a highly profitable practice. When it is not possible or desirable to control spot infestations, they may be isolated from the livestock herd by fencing. This practice has been especially beneficial around water developments.

Where it is profitable to manage the plant community to minimize the hazard to livestock from poisonous plants there are frequently other benefits of value to the rancher or land manager. Control of poisonous plants often will allow greater flexibility in management by increasing the length of time a pasture can be grazed in a season. In turn, this can allow development of grazing programs to make better use of the total range and increase productivity of pastures whose use was previously dependent upon special grazing practices in the pasture with poisonous plant hazards. When poisonous plants are no longer a problem a pasture can frequently be stocked at a heavier rate which will also defray costs of improvement.

Manipulation of vegetation may also introduce certain hazards that need to be considered. Spraying of poisonous plants may increase both their toxicity and palatability (Agricultural Research Service, 1968) and deferring grazing until the plants have dried and other vegetation has grown to provide a substantial forage source is recommended. Usually dead vegetation loses its toxicity, but certain plants like locoweed remain toxic when dried (James et al., 1968).

## Livestock Management to Minimize Poisoning

It is only recently that effective and economical treatment of rangeland has been developed to reduce the dangers of livestock grazing plant communities supporting poisonous plants. For the most part, ranchers have learned to live with poisonous plants and have developed management systems to minimize losses of livestock. Trial and error, in part, based on programs of scientific investigations, have resulted in satisfactory grazing prescriptions for most potentially dangerous situations.

In order to deal effectively with a problem a certain level of basic knowledge is necessary. The manager must be able to recognize the poisonous plants on the range, know how they affect livestock, and the conditions under which they are poisonous. Once it is determined that a problem from a poisonous plant exists, either through identification of the plant or actual livestock losses, a management program specific to the plant in question can be developed.

Good management will usually prevent poisoning of livestock. Poisonous plants generally have three common characteristics: (1) They are usually unpalatable. (2) The toxin within the plant frequently decreases or dilutes as the plant matures. (3) Herbaceous poisonous plants usually begin growth early in the spring and become proportionally less abundant as other vegetation begins its annual growth cycle. Understanding these features in detail for all poisonous plants on a particular range will allow the grazier to make substantial use of desirable forages and minimize losses due to toxins in the vegetation.

Since poisonous plants are usually unpalatable, they do not usually present a problem unless other forage is limited in availability or reduced in palatability. Consequently, on seasonal rangelands of the Northwest, most livestock losses to poisonous plants occur in early spring or fall. Deferment until the better forages have made significant growth will frequently prevent livestock poisoning on spring range. Early removal of livestock in fall may be necessary on some mountain ranges. These simple practices on well managed rangelands may nearly eliminate losses due to poisonous plants. Teratogenic problems from plants like western false hellebore can be avoided with proper timing of grazing (James and Johnson, 1976).

Preference patterns of livestock for different forages will change if they are hungry. This can occur when the range is heavily grazed, livestock are trailed or shipped, water intake is reduced, or when animals have been held off feed. A hungry animal should not be allowed access to poisonous plants since they are prone to eat less selectively until they are satiated. Trailing or driving livestock slowly when moving them, avoiding heavy grazing, and providing sufficient water in areas with poisonous plants should minimize their consumption of poisonous plants. When animals must be fasted, they should be turned onto range free of poisonous plants or provided a sufficient amount of supplemental feed to relieve their hunger. If pastures are infested with large amounts of poisonous plants, livestock should not be held there for long periods since the limited supply of forage can be rapidly depleted. If animals must be held on these areas, an alternative feed, such as hay, should be supplemented.

Some plants are highly toxic such as water hemlock and tall larkspur. Management programs to deal with these plants are usually designed to avoid contact. This may be accomplished with herding or fencing. If the infestation of highly toxic plants is not extensive, the stand may be eradicated to remove the hazard.

Since most poisonous plants must be consumed in relatively large quantities to be damaging, some specialized programs have been developed to maintain individual animal intake below toxic levels. Everist (1974) discussed management of sheep to prevent ingestion of toxic amounts of darling pea. In this instance heavy, short duration grazing of a few days was used to remove the relatively palatable pea before any animals could be permanently affected. Certain sheep are more prone to eat the pea than others. Thus, light grazing over a long period would allow the "pea eaters" to consume enough of this plant to cause permanent brain injury. A similar program of cattle management on locoweed ranges in Idaho has also been successful in allowing use of the forage without loss of livestock. Halogeton has been a major problem for sheep growers and has killed cattle at times in salt desert shrub ranges. However, James and Cronin (1974) indicated sheep could adapt to ingestion of relatively high levels of oxalate from halogeton if gradually introduced to it. Adapted sheep can detoxify 75% more oxalate than sheep not adapted. When sheep are removed from high oxalate-containing feed they lose the adaptation within 2-3 days. Big sagebrush has been shown to be toxic if force fed to sheep at a rate of 3/4 pound per day (fresh weight) for 1 to 3 days. However, sheep were not affected when gradually introduced to the plant with 1/4 pound per day of fresh sagebrush (Johnson et al., 1976).

Frequently lack of salt or other minerals is associated with livestock grazing poisonous plants (James and Johnson, 1976). Most livestock management programs involve providing salt, free choice. If other minerals are known to be deficient, usually phosphorus, they should be provided. Livestock deficient in phosphorus will sometimes develop a depraved appetite and eat abnormally. This can be prevented by proper mineral supplementation. When salt and supplement stations are established, areas within or adjacent to heavy infestations of poisonous plants should be avoided since the supplement station will tend to concentrate livestock and increase the risk of poisoning.

All animals do not exhibit the same forage preferences. In areas of concern, new animals introduced into the herd should be watched carefully for a few days. If they are to be poisoned, it will probably occur soon after stocking (Everist, 1974). Livestock in different reproductive stages may respond differently to poisonous plants, for example dry cows are less prone to be affected by timber milkvetch than lactating cows (Williams, 1970). It is possible this is due to behavioral differences or variation in total daily intake rather than a basic physiological difference. By far the greatest differences in animal responses to poisonous plants are those among animal species. Sheep and black tailed deer are resistant to tansy ragwort while cattle and horses are susceptible (Dean and Winward, 1974). Sheep are relatively resistant to larkspur while cattle are highly susceptible (Kingsbury, 1964). Sheep and cattle are more resistant to locoweed than horses (James et al., 1968). In addition, cattle are seldom lost to halogeton or sneezeweed while these plants are problems for sheep (James and Johnson, 1976). By selecting species of livestock to graze specific areas, poisonous plant problems can be minimized. Sometimes one livestock species can "condition" the range to permit safe grazing by the other.

Toxicity of some poisonous plants varies with the site on which they grow. This has been clearly demonstrated for timber milkvetch (Majak and McLean, 1975 and Majak et al., 1977) in Canada. Milkvetch in shaded, moist timbered sites was lower in miserotoxin than that on open, dry grasslands. Management programs that control seasonal use of these sites could be developed to account for this kind of variation and improve livestock production from these northern ranges.

A few poisonous plants like tall larkspurs are relatively palatable to livestock and others like locoweeds are addictive. It is difficult to prevent losses when these types of plants are present. If any livestock show symptoms of poisoning under these circumstances, all animals should be removed from the range immediately.

Management programs designed to cope with poisonous plants can be expected to work well year after year. However, unusual weather patterns may cause changes in vegetation that present new problems and one should always be alert to special management needs each year. Cyanide-producing plants will produce excessive amounts of hydrocyanic acid when under stress such as drought or frost. Production and composition of range plant communities respond to weather. In a drought year a range may have proportionally more poisonous plants and consequently a risk where none had existed before. Unusual weather patterns may change phenological development of portions of a plant community and poisonous plants may become prominent at unusual times. The winter of 1976-77 was exceptionally dry in eastern Oregon. Observation and limited sampling indicated there was little usable soil moisture until rains began in May. Cattle losses to low larkspur do not normally occur after mid-May in the area but because of delayed growth of larkspur in 1977, losses began to occur in late May.

Most studies of poisonous plants have dealt with direct effects of ingesting toxic amounts of them. Losses are described in terms of death, abortions, photosensitization, and other obvious signs of distress. On the other hand, sub-lethal effects of consumption of toxic plants have not been well documented. Some evidence suggests that animals grazing rangelands with an abundance of poisonous plants are less efficient or produce smaller offspring (Doran and Cassady, 1944). Ewes fed locoweed produce lambs that appear normal but have a shortened life span (Balls, et al., 1973) and reproductive desires and spermatogenesis in the male and estrus in the female are suppressed with loco poisoning (James and Van Kampen, 1971). Indirect losses from consumption of sub-lethal amounts of plants may be important. If the truth of this is confirmed, then management to adapt animals to certain toxins or prevent ingestion of toxic amounts may not be beneficial in the long run.

Treatment of poisoned animals is seldom practical on rangelands (Everist, 1974). Many poisonous plants have no known antidotes or the intoxication may be too far advanced to treat. When poisoned animals are discovered, they should be removed from the pasture if it does not involve great disturbance and kept quiet and away from water for several hours. Everist (1974) has suggested treatments for cyanide (prussic acid) poisoning, nitrate poisoning, and oxalate poisoning. These are effective and should be tried when the nature of the poisoning is understood.

All problems with poisonous plants cannot be predicted or effectively prevented or alleviated by management. In some cases, at least with our present state of knowledge, the producer must accept losses in production or not use the range area where poisonous plants or poisoning conditions occur. However, good range management, understanding of poisonous plants on the range, and common sense animal management can keep losses to a minimum.

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# THE EFFECTS OF UREA SUPPLEMENTATION ON FEATHER MEAL AND HAIR MEAL UTILIZATION BY RUMINANTS

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Recent trends in livestock feeding have been to increase the use of by-products and animal waste as substitutes for the more expensive conventional energy and protein sources. Two promising by-products of the meat processing industry are poultry feathers and hog hair which when subjected to steam hydrolysis under pressure, yield products that are 65 to 85% digestible with crude protein values from 85 to 99%.

Hydrolyzed feather meal (FM) and hair meal (HM) have been available for several years but relatively little work has been done with ruminants utilizing these products. Jordan and Jordan (1955) and Jordan and Croom (1957) found no adverse effects in performance when FM replaced up to half of the supplemental protein in corn-soybean meal diets for lambs. When FM supplied all of the supplemental protein in sorghum rations for lambs, the crude protein digestibility was unaffected but gains were reduced compared to lambs on a diet with soybean meal (SBM) as the supplemental protein (Huston and Shelton, 1971). Thomas and Beeson (1977) found decreased crude protein digestibilities by cattle for FM (59.3%) and HM (55.1%) when compared to SBM (67.7%) in corn-ground cob diets.

These results indicate that FM and HM like many other protein sources are not satisfactorily fed as the total supplemental protein for ruminants. However, when fed in combination with more digestible (soluble) protein sources such as SBM, FM and HM have no detrimental effects on animal performance. Therefore FM or HM could be used to reduce the cost per pound of gain in feedlot rations by replacing part of the more expensive protein sources. FM and HM are also protein sources that are high in sulfur content. The high sulfur content and low solubility of FM and HM indicate that they would be highly suitable to feed in combination with urea, a highly soluble nitrogen source. The high solubility of urea and the high sulfur content of FM and HM provide a favorable environment for protein synthesis by the rumen microorganisms.

The following research was conducted to further study FM and HM as protein sources for ruminants and to investigate the effects of urea and FM or HM in combination on animal performance.

## Digestion Trials

Two digestion trials were conducted with sheep to evaluate FM and HM in high roughage rations (40%) with SBM as a control protein source. Rations were formulated to 15% crude protein (dry basis) with FM or HM replacing 25, 50 or 75% of the SBM protein (Table 1). Twenty-one crossbred wethers were used in each trial with 3 animals per ration. Feed consumption records were kept and the sheep were housed in metabolism cages which facilitated total collection of feces and urine. This procedure makes possible the calculation of crude protein digestibilities. The results of the digestion trials are shown in table 2. In trial 1, yearling wethers (90 lbs) were used to study the digestibilities of FM and HM by sheep under maintenance conditions. There was no difference in total ration dry matter or gross energy digestibility between the 7 diets. However, all levels of FM and HM resulted in lower crude protein digestibilities. The general trend was for decreasing crude protein digestibility with increasing levels of FM and HM. In trial 2, wether lambs (70 lbs) were used to study FM and HM digestibilities under growing conditions. The dry matter and crude protein digestibilities decreased with increasing FM and HM levels. There was no difference between diets for gross energy digestibilities as in trial 1. These results verify earlier work which has shown the low digestibility (solubility) of FM and HM in comparison to SBM.

## Feedlot Trials

One feedlot trial with Hereford and Hereford-Angus crossbred steers has been completed and a second trial is in progress. In trial I, fifteen steers were assigned to one of three rations.

The diets consisted of high roughage (40%) rations formulated to 13% crude protein (dry basis) with either SBM, FM or FM-Urea supplying the supplemental protein (Table 3). Animals were implanted initially with 36 mg zeranol (Ralgro) and again at approximately 800 lbs body weight. Animal weights were taken at 14 day intervals and they were slaughtered upon reaching a minimum of 0.3 inch backfat determined by measurement with an ultra-sonic sound probe. Final live weights were adjusted to 60% dressing percentage to account for the rumen fill of the high roughage rations. The results of this trial are shown in Table 4. Although the number of animals in this trial are limited, the results indicate a favorable increase in performance for the steers on the FM-Urea supplemented ration when compared to the SBM and FM supplemented rations. The steers on the FM ration ate 1.5% less feed then the SBM supplemented steers and ADG was reduced by 6.8%. The FM steers also required 8.9% more feed per pound gain than the SBM steers. The FM-Urea steers ate 2% more feed and ADG was increased by 8.4%. The FM-Urea steers required 9.2% less feed per pound gain than the SBM steers. The carcass grades for the three rations were: SBM, 5 choice of 5 head; FM, 3 choice, 1 good of 4 head (one animal died before slaughter of bloat); FM-Urea, 3 choice, 1 good and 1 standard of 5 head.

Feedlot trial 2 is in progress with 15 steers assigned to 2 rations (32.5% roughage) formulated to 15% crude protein (dry basis) (Table 5). Five steers are receiving the ration with FM-Urea as the supplemental protein and 10 steers the HM-Urea supplemented ration. Animal weights are being taken at 14 day intervals and results to date are shown in Table 6. The steers in this trial are comparing quite favorably to the steers in trial 1. The improvement in feed conversion and average daily gain are due to the lower roughage content of these rations (32.5% vs 40%). A direct comparison between the FM-Urea and HM-Urea diets shows a 2.2% lower feed consumption and a 4.8% improvement in feed conversions for the HM-Urea steers. The HM-Urea steers also have a 2.6% increase in average daily gain over the FM-Urea steers.

Although the number of animals involved in the feedlot trials are small, the results indicate a definite improvement in animal performance when urea is added to rations supplemented with FM or HM. This can be further demonstrated by the cost per pound of gain on these rations. In trial I the cost per pound of gain for the SBM and FM rations were similar at 45.3 and 46.5¢ respectively. However, for the steers on the FM-Urea diet the cost per pound of gain was only 37.0¢. In trial 2 on a lower roughage ration the cost per pound of gain were reduced to 36.3 and 34.6¢ for the FM-Urea and HM-Urea diets respectively.

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Table 1. Diet composition digestion trials

| Ingredients | Diet (%) | | | | | | |
|---|---|---|---|---|---|---|---|
| | SBM Control | FM 25 | FM 50 | FM 75 | HM 25 | HM 50 | HM 75 |
| Barley, rolled | 27.7 | 29.9 | 32.0 | 33.9 | 30.0 | 32.2 | 34.2 |
| Straw, ryegrass | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 |
| Alfalfa, ground | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Beet pulp | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Molasses, cane | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Soybean meal | 14.3 | 10.3 | 6.6 | 3.2 | 10.3 | 6.6 | 3.2 |
| Feather meal | -- | 1.8 | 3.4 | 4.9 | -- | -- | -- |
| Hair meal | -- | -- | -- | -- | 1.7 | 3.2 | 4.6 |
| Limestone | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Salt | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Analysis | | | | | | | |
| Dry matter | 91.2 | 91.4 | 91.5 | 91.9 | 92.4 | 92.3 | 92.5 |
| Crude protein | 15.6 | 15.9 | 14.9 | 14.6 | 14.7 | 14.7 | 14.9 |
| Ether extract | 0.7 | 0.9 | 1.1 | 1.0 | 0.4 | 0.5 | 0.5 |
| ADF | 22.4 | 22.0 | 22.1 | 23.3 | 22.2 | 23.7 | 23.9 |
| ASH | 6.4 | 6.1 | 6.2 | 5.4 | 5.9 | 6.3 | 6.5 |
| Gross energy kcal/g | 4.34 | 4.36 | 4.32 | 4.32 | 4.29 | 4.29 | 4.28 |

Table 2. Apparent digestion coefficients

| | | Feather Meal | | | Hair Meal | | |
|---|---|---|---|---|---|---|---|
| | SBM | 25 | 50 | 75 | 25 | 50 | 75 |
| Trial 1 | | | | | | | |
| Dry matter, % | $71.9_{a}$ | $71.4_{b}$ | $73.2_{b}$ | $70.6_{c}$ | $71.0_{b,c}$ | $72.8_{b,c}$ | $70.5_{b,c}$ |
| Crude protein, % | $76.1^{a}$ | $73.8^{b}$ | $73.5^{b}$ | $70.4^{c}$ | $72.1^{b,c}$ | $72.3^{b,c}$ | $71.1^{b,c}$ |
| Gross energy, % | 72.6 | 70.1 | 73.0 | 70.3 | 71.0 | 70.0 | 70.4 |
| Trial 2 | | | | | | | |
| Dry matter, % | $73.7^{a}$ | $73.6^{a}$ | $73.2^{b}$ | $71.0^{c}$ | $71.9^{b,c}$ | $72.7^{a,b}$ | $71.6^{b,c}$ |
| Crude protein, % | $73.9^{a}$ | $70.9^{b}$ | $66.9^{c,d}$ | $65.4^{d}$ | $68.5^{b,c}$ | $69.7^{b}$ | $66.9^{c,d}$ |
| Gross energy, % | 74.8 | 74.8 | 73.1 | 71.8 | 72.2 | 72.6 | 71.8 |
| | | | FM | | HM | | |
| Digestibility by difference, % | | | 51.9 | | 47.9 | | |

[a,b,c,d] Means in the same line with different superscripts differ significantly ($P<.05$).

Table 3. Feedlot rations, Trial 1.

| Ingredients | Rations, % SBM | FM | FM-Urea |
|---|---|---|---|
| Straw, ryegrass | 38.0 | 38.0 | 38.0 |
| Alfalfa, ground | 2.5 | 2.5 | 2.5 |
| Molasses | 7.5 | 7.5 | 7.5 |
| Wheat, sprouted | 20.0 | 20.0 | 20.0 |
| Barley, rolled | 18.5 | 25.2 | 27.9 |
| SBM | 12.5 | -- | -- |
| Feather meal | -- | 5.8 | 2.1 |
| Urea | -- | -- | 1.0 |
| Limestone | 0.45 | 0.45 | 0.45 |
| Vit. A Premix* | 0.05 | 0.05 | 0.05 |
| Monensin** | 0.05 | 0.05 | 0.05 |
| Salt, TM | 0.45 | 0.45 | 0.45 |
| Analysis | | | |
| Dry matter | 92.3 | 92.3 | 92.4 |
| Crude protein | 13.2 | 12.8 | 13.0 |
| Ether extract | 0.7 | 0.8 | 0.7 |
| ADF | 22.9 | 23.9 | 22.7 |
| ASH | 5.4 | 5.0 | 4.7 |

*Premixed at 30 g/lb
**Premixed at 2,000,000 IU/lb

Table 4. Feedlot performance data, trial 1

| | Ration | | | | | |
|---|---|---|---|---|---|---|
| | SBM | | FM | | HM | |
| No. steers | 5 | | 5 | | 5 | |
| Days on feed | 140 | | 135 | | 135 | |
| Daily feed consumption lbs DM | 19.7 | | 20.0 | | 19.3 | |
| Cost ¢/lb gain | 45.3 | | 46.5 | | 37.0 | |

| Days on Feed | ADG* | Feed Conversion* | ADG | Feed Conversion | ADG | Feed Conversion |
|---|---|---|---|---|---|---|
| 0-28 | 2.47 | 5.63 | 2.84 | 5.12 | 2.67 | 5.38 |
| 29-56 | 2.73 | 5.07 | 2.64 | 5.05 | 2.87 | 4.91 |
| 57-84 | 2.70 | 5.77 | 2.60 | 5.93 | 2.83 | 5.67 |
| 85-112 | 2.72 | 6.51 | 2.65 | 6.68 | 2.95 | 6.14 |
| Final** | 2.49 | 7.91 | 2.32 | 8.61 | 2.70 | 7.18 |

*Expressed as lb/day and feed/lb gain, respectively.
**Final gain calculated by using chilled carcass weight divided by 0.6 rather then live weight. This procedure eliminates some of the variation caused by large gut fill on high roughage rations.

Table 5. Feedlot rations, Trial 2.

| | Ration,% | |
|---|---|---|
| | FM-Urea | HM-Urea |
| Straw, ryegrass | 25.0 | 25.0 |
| Alfalfa, ground | 2.5 | 2.5 |
| Molasses | 7.5 | 7.5 |
| Wheat, rolled | 25.0 | 25.0 |
| Barley, rolled | 34.7 | 34.7 |
| Feather meal | 3.3 | -- |
| Hair meal | -- | 3.3 |
| Urea | 1.0 | 1.0 |
| Limestone | .65 | .65 |
| TM salt | .25 | .25 |
| Vit. A Premix* | .05 | .05 |
| Rumensin Premix** | .05 | .05 |
| Approximate Analysis | | |
| % Crude protein, dry | 15.2 | 15.2 |
| % TDN, dry | 75.0 | 75.0 |
| % Ca | .45 | .45 |
| % P | .30 | .30 |

*Premixed at 30 g/lb
**Premixed at 2,000,000 IU/lb

Table 6. Feedlot performance data, Trial 2 (in progress)

| | Ration | | |
|---|---|---|---|
| | FM-Urea | HM-Urea | |
| | Pen 1 | Pen 1 | Pen 2 |
| No. steers | 5 | 5 | 5 |
| Daily feed consumption lb. dry matter | 19.0 | 18.6 | 18.6 |
| Feed conversion lb. feed/lb. gain | 6.2 | 5.6 (Ave.---5.9) | 6.2 |
| Cost ¢/lb gain | 36.3 | 32.8 (Ave.---34.6) | 36.3 |
| Average daily gain lb./day | 3.07 | 3.29 (Ave.---3.15) | 3.00 |

# THE USE OF FERMENTED RYEGRASS STRAW AS A RUMINANT FEED

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The Willamette Valley of Oregon has been the site of production for thousands of tons of ryegrass straw annually. Increasing pressure from environmental groups has also limited the amount of open field burning. This in turn has created a major problem with straw disposal. One attempt by scientists at this university to alleviate part of this problem, has involved the production of a more palatable feedstuff from ryegrass straw. Recent articles in the popular press have reported a semisolid fermentation process developed by Dr. Y. W. Han and Dr. A. W. Anderson that utilized ryegrass straw for the production of feed for ruminants.

## Experiment Semisolid Fermentation Process

The semisolid fermentation process utilized perennial ryegrass straw which was chopped through a hammermill into lengths of approximately 1/2 inch. Two hundred pounds of the straw were placed in a large steel jacketed pressure vessel equipped with two internal mixing paddles. To the straw was added a solution of .5 N (10%) sulfuric acid at the rate of seven parts acid solution to three parts chopped straw. Steam was used to heat and pressurize the vessel and the straw was hydrolyzed at 121 C for 30 min. The hydrolysis procedure converted the hemicellulose portion of the straw into more soluble sugars. When the straw cooled, ammonia was pumped into the chamber to neutralize the straw to a pH of 5. The vessel was then opened and a culture of yeast (*Candida utilis*) was used to inoculate the straw. The inoculum was thoroughly mixed with the neutralized straw material and the mixture was aerobically fermented. The yeast organisms proliferated by using the ammonia and soluble sugars for a food source. After fementation the straw product was dried by heating the vessel and passing air through the material.

## Animal Digestion Trials

Two products from the semisolid fermentation process were evaluated by using them in a digestibility trial with sheep. The materials used in the studies were: (1) the neutralized straw which was obtained just prior to the fermentation step and (2) the fermented straw that was obtained at the completion of the process.

Initial acceptance of the processed feeds was very poor. Several attempts were made to increase the palatability of the material by adding small amounts of molasses and chopped grass hay. The intake of both materials, however, remained very low. Calculations indicated that the final processed feeds contained approximately 8% sulfates, which was much higher than acceptable levels for sheep. In order to reduce the sulfate content, the processed feeds were mixed with 68% grass hay. The resulting rations were used in the digestibility trials. Two test rations and two control rations used in the trials are presented in table 1.

## Results of the Digestion Trials

The composition and apparent digestibilities of the rations used in the digestibility trials are presented in table 2. The four rations tested contained similar percentages of crude protein, however, all four were not efficiently utilized. The apparent protein digestibility figures indicated that the protein present in the two test rations was digested less efficiently than the two control rations. Furthermore, the ration containing the fermented straw had the lowest protein digestibility. These data demonstrated that even though all four rations were isonitrogenous, the crude protein in the test rations was less available to the animal. The nitrogen retention data was an indicator of protein synthesis and tissue growth by the animal. These data showed that less protein was synthesized by those sheep consuming the processed straw rations. The dry matter digestibility data also indicated that the test rations were digested no better than plain straw supplemented with cottonseed meal and less efficiently than grass hay.

By comparing the data from the digestibility trials, calculated digestibility values were determined for the neutralized and the fermented straw products and are presented in table 3. The data indicated that no benefits were derived from the semisolid fermentation of ryegrass straw as could be measured by these trials. The neutralized straw appeared to be of higher quality for ruminants than the fermented straw, however, both were of lower quality when compared to grass hay or plain straw supplemented with cottonseed meal.

Table 1. Ration formulations for digestibility trials

| Ingredients | Test Rations | | Control Rations | |
|---|---|---|---|---|
| | I GHNS | II GHFS | III GHC | IV SPC |
| Perennial ryegrass straw | --- | --- | --- | 81.4% |
| Grass hay | 68.0% | 68.0% | 92.5% | --- |
| Neutralized straw | 25.0% | --- | --- | --- |
| Fermented straw | --- | 25.0% | --- | --- |
| Cottonseed meal | --- | --- | --- | 11.1% |
| Molasses | 7.0% | 7.0% | 7.0% | 7.0% |
| Urea | --- | --- | .5% | .5% |

Table 2. Composition and apparent digestibilities of rations used in digestion trials[1]

| Item | Test Rations | | Control Rations | |
|---|---|---|---|---|
| | GHNS | GHFS | GHC | SPC |
| Dry matter (%) | 91.40 | 92.24 | 91.19 | 91.30 |
| Crude protein (%) | 11.44[a] | 11.01[a] | 11.24[a] | 11.90[a] |
| ADF (%) | 40.05[a] | 38.88[a] | 36.38[b] | 45.23[c] |
| ADL (%) | 6.67[a] | 6.93[a] | 5.01[a] | 8.79[b] |
| CWC (%) | 64.58[a] | 63.42[a] | 63.99[a] | 77.36[b] |
| Nitrogen retention (g N/day) | 2.45[a] | 1.78[a] | 3.76[b] | 3.34[b] |
| Apparent protein digestibility (%) | 56.94[a] | 52.54[b] | 62.01[c] | 59.59[d] |
| Dry matter digestibility (%) | 54.58[a] | 52.24[a] | 59.30[b] | 53.74[a] |

[1]Means with different superscripts differ (P<.05).

Table 3. Calculated values for semisolid fermentation products

| Item | Product | |
|---|---|---|
| | Neutralized straw | Fermented straw |
| | ------------% | ------------ |
| Dry matter | 92.45 | 93.04 |
| Crude protein | 11.92 | 13.03 |
| ADF | 40.29 | 46.57 |
| ADL | 6.97 | 10.80 |
| CWC | 45.96 | 52.74 |
| Dry matter digestibility | 40.14 | 30.78 |
| Apparent protein digestibility | 44.54 | 28.65 |

# THE USE OF AN EXPERIMENTAL ANTIBIOTIC AND SODIUM BICARBONATE FOR PREVENTION OF ACIDOSIS

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The modern feedlot operator is confronted with the task of feeding his cattle using the most efficient feeds available. This means feeding rations which contain large amounts of "high energy" or "concentrate feeds". In doing so, he also runs the risk of triggering off unfavorable fermentation in the rumen that can lead to financial losses from death or unthriftiness in surviving animals. Terms used to describe this disorder are, grain overload, grain engorgement, acute indigestion and lactic acidosis. The condition may result when ruminants ingest excessive doses of grains or other feeds rich in starches or sugars. The most likely occurrences would be when cattle are first introduced to the high concentrate rations or when some management practice deviates from the normal. Examples of the latter might be missed feedings which could lead to excessive intake when feed is again offered, having unevenly-sized animals in a lot with a resulting hierarchy that affects feeding behavior, or switching abruptly from one grain to another in the ration.

Lactic acidosis results from a sudden shift in the microbial population in the rumen towards micro-organisms which produce lactic acid as their major end product. This causes a drop in the pH of the rumen contents below the normal range (5.5-7) and the normal microbial populations are killed off. Clinical and physiological changes resulting from acidosis might include anorexia (not eating), lameness, depression, increased heart and respiratory rates, rumen lesions and liver abscesses. Death usually occurs when and if the blood pH of the animal drops near 7 because of the increased amount of lactic acid absorbed from the rumen.

While research efforts aimed at the prevention of acidosis branch in many directions, two of the more promising are the use of buffers such as sodium bicarbonate (baking soda) and antibiotics which are specific for inhibiting the lactic acid producing bacteria in the rumen.

## Methods

Four crossbred wethers with rumen fistulas were used to study the effect of 2% sodium bicarbonate (2%), 4% sodium bicarbonate (4%), an experimental antibiotic at .25% (A) and A and 2% given in combination (A + 2), in preventing lactic acidosis when the animals were switched from a grass hay-alfalfa diet to one of ground white wheat. The feeding regimes using the wheat to produce acidosis were determined and each animal had developed acidosis (controls). A minimum time of one month was allowed after the control treatment to allow the animals to readapt to the grass hay-alfalfa diets before subsequent treatments were tested. Rumen samples and pH readings were taken every four hours (7:00 am - 7:00 pm) for five days following the addition of wheat to the rumen. Rumen samples were analysed for volatile fatty acids and lactic acid.

## Results

The lowest pH values obtained in each treatment and the corresponding lactic acid levels are shown in table 1. All of the control diets resulted in pH values below five and lactic acid concentrations greater than 80 mM/l. All four animals went off feed and refused feed for 24-36 hours. The animals became lethargic and preferred to lay down. Respiration rates were elevated at the time the highest lactic acid levels were detected. All of the treatments other than the control prevented the animals from going off feed and no clinical symptoms of acidosis were observed. Lactic acid levels as high as 40 mM/l were detected using the wheat plus antibiotic treatment. These levels of lactic acid caused no symptoms and the levels were elevated for no more than four hours.

While total volatile fatty acids looked very similar for the buffer and antibiotic treatments, analysis showed the antibiotic or antibiotic plus buffer treatments resulted in less acetic and more propionic acid (figures 1 and 2). Average $C_2/C_3$ ratios for the treatments were 2%-2.19, 4%-1.86, A-1.12 and A + 2-0.98.

Table 1. Lowest rumen pH values obtained in each treatment and corresponding lactic acid concentration (mM/l)

| | Treatments | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Control | | 2% | | 4% | | A | | A+2 | |
| Animal | pH | Lactic | pH | Lactic | pH | Lactic | pH | Lactic | pH | Lactic |
| A | 4.52 | 96.84 | 5.46 | -- | 5.42 | -- | 5.24 | 30.18 | 5.13 | -- |
| B | 4.34 | 81.57 | 5.39 | -- | 5.28 | -- | 5.06 | 23.34 | 5.22 | -- |
| C | 4.25 | 85.70 | 5.48 | -- | 5.63 | -- | 5.03 | 23.02 | 5.36 | -- |
| D | 4.36 | 107.46 | 5.84 | -- | 5.89 | -- | 5.24 | 3.03 | 5.48 | -- |

## Conclusions

As this data has not yet been statistically analyzed, no statements will be made comparing the treatments used in this study. Both buffer levels (2 and 4%) were effective in preventing acidosis. While the 4% sodium bicarbonate treatment did not result in higher rumen pH values, the volatile fatty acid analysis shows a trend towards higher gross energy from the volatile acids when the additional sodium bicarbonate was added.

The wheat plus experimental antibiotic treatment resulted in some elevated levels of lactic acid in the rumen but these levels were not maintained for extended periods of time as is the case with acute lactic acidosis.

The antibiotic treatment resulted in a decrease in acetic acid production in the rumen with a corresponding increase in the production of propionic acid. This would be considered a favorable shift for fattening cattle and in fact is how Rumensin$^R$ functions when given as a feed additive. It appears then, that the experimental antibiotic works in two positive directions simultaneously. The initial effect is to prevent a build up of lactic acid and the second is the alteration of fermentation in the rumen which is conducive to more efficient weight gains.

The antibiotic plus buffer treatment resulted in the greatest gross energy from volatile fatty acids. The favorable shift in volatile fatty acids observed in the wheat plus antibiotic treatment was also evident in the antibiotic plus buffer treatment. The pH values tended to be higher than with the antibiotic alone and no lactic acid was detected in any of the four animals. The two compounds certainly appear to work in a very synergistic manner. Additional research under feedlot conditions will be necessary to determine if it is economically feasible to add both antibiotic and sodium bicarbonate as feed additives.

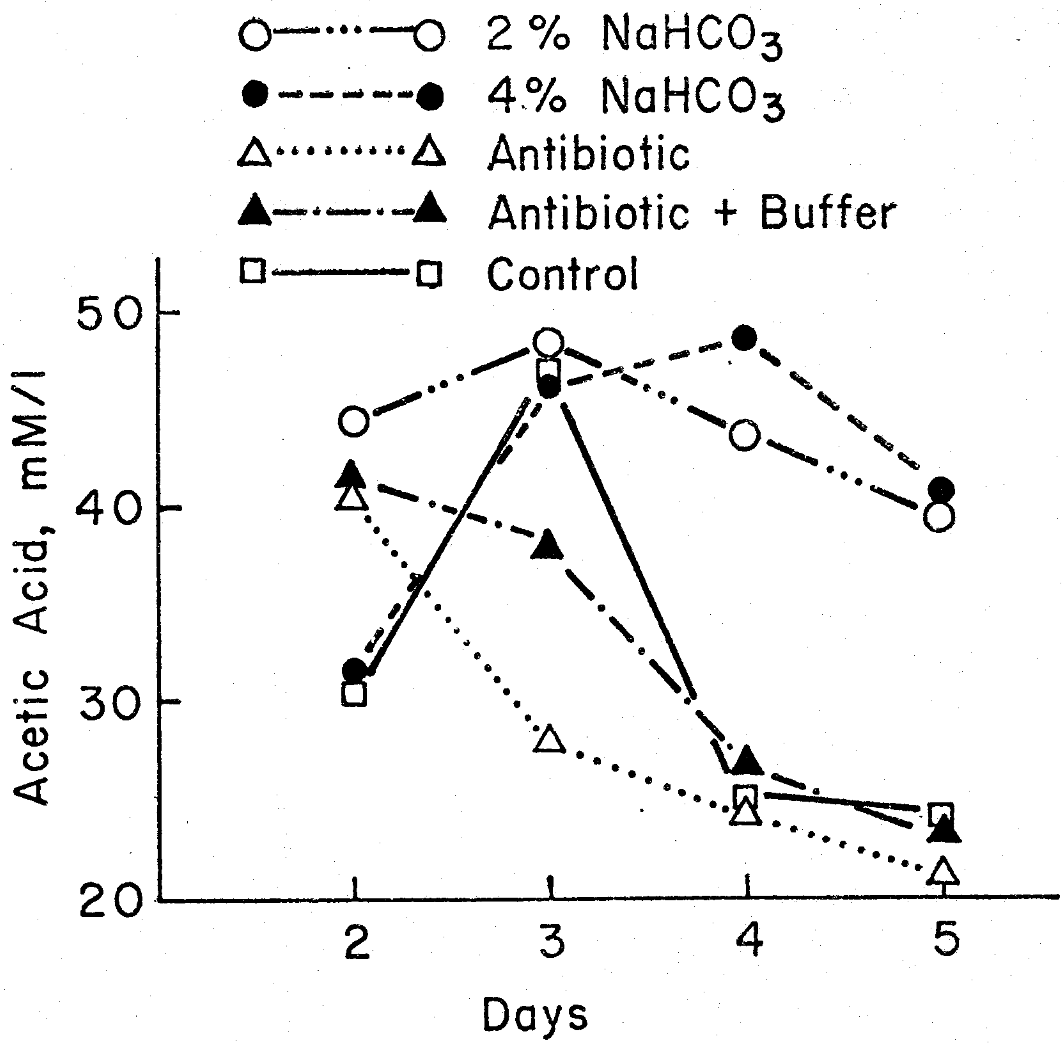


Figure 1. Acetic acid concentrations for the different treatments during the five day collection period.

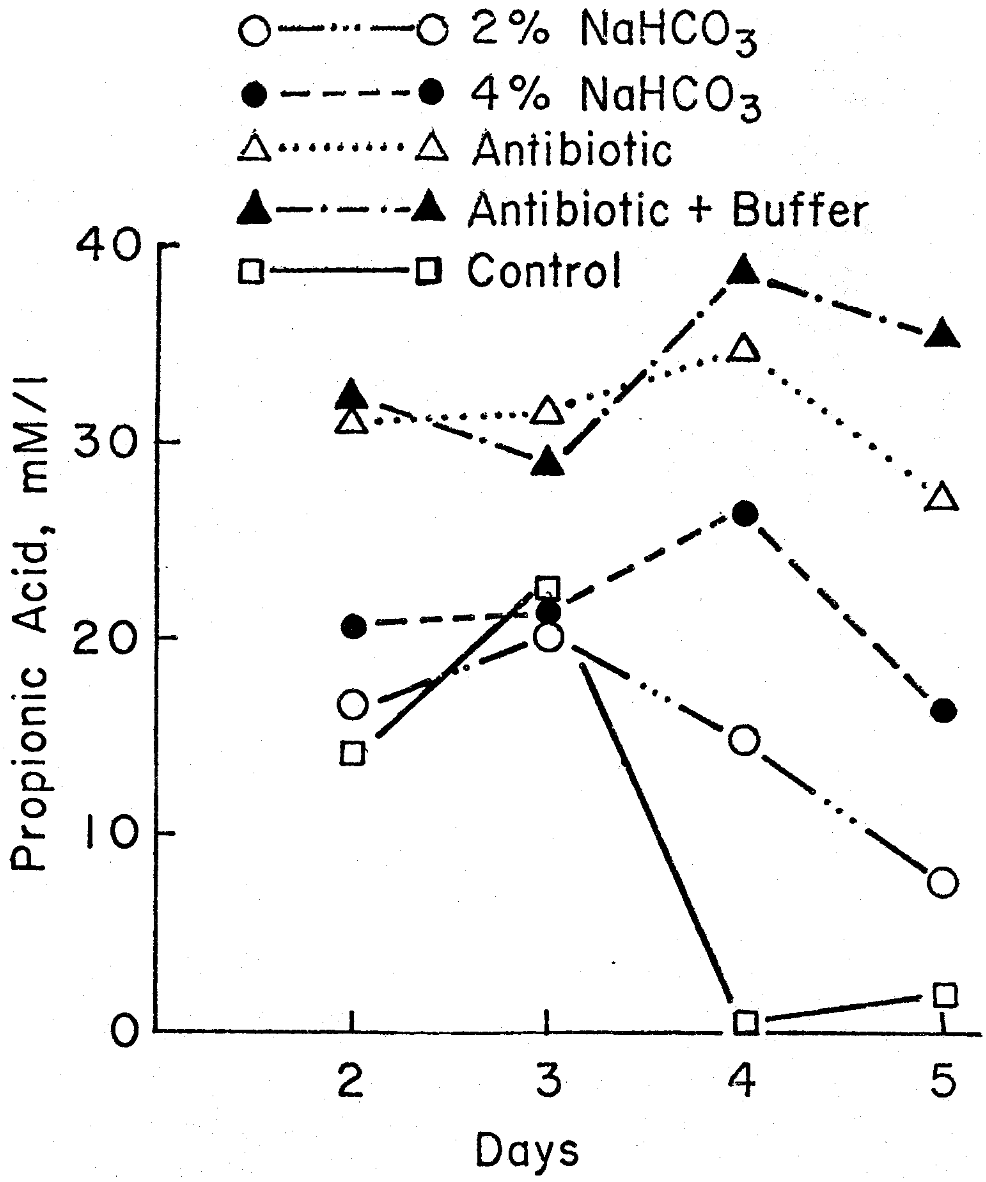


Figure 2. Propionic acid concentrations for the treatments during the five day collection period.

# OUR BEEF CATTLE INDUSTRY:

## THE PAST IS PROLOGUE--WHAT ABOUT TOMORROW?

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I bring greetings from Texas A&M University and from Uvalde, Texas; the Texas A&M University Agricultural Research and Extension Center at Uvalde; and the Hill County of Southwest Texas. It is a distinct pleasure for me to share in your Beef Cattle Day with my good friends Jim Oldfield and Al Ralston, and to renew old and establish new friendships among the fine, progressive cattlemen of the Beaver State. My personal interest in our great Pacific Northwest--its wonderful people with their warm hospitality and its beef cattle industry with such tremendous potential--was initiated in the mid-1950's when I served on the Animal Science staff at Washington State University. This interest and appreciation has been reinforced over the past six years by annual September pilgrimages to Eagle Point, Oregon, to assist with field days and bull sales at Devonacres. From the standpoint of an "adopted Texan," I can assure you that you live in a great state--one that is populated with delightful people who are truly a joy to know.

For the next few minutes, let me share with you some of my thoughts about our beef cattle industry. Let us consider a bit of the past; but, more importantly, let us focus on the future. I want to preface my remarks with an assurance that I don't possess Jean Dixon's psychic "gift." Nevertheless, I am going to predict some things about the future as we review some emerging trends in our beef cattle industry. Hopefully, some thirty years of animal science experience--acquired in sequence in Florida, Alabama, Texas, Maryland, Washington, Louisiana, Mississippi, and back to Texas--will help fortify my predictions with reasonable accuracy. Why? Not because such accuracy will bolster my ego, but because some of the trends, as I see them, could have serious impact on

Animal Science at Oregon State University and on the beef cattle industry of Oregon, Texas, and all of our other beef producing states. Even armed with reasonably accurate concepts of the future, it is still difficult for cattlemen to plan successfully today's production for tomorrow's markets!

Making predictions about the future is risky business-especially when your predictions appear in print! The road of the prophets is strewn with miscalculations; and it is easier to find failures than successes in agricultural predicting and forecasting. Nevertheless, let's "crystal ball gaze" at our beef cattle industry of the future.

One thing for sure, expect some changes. Change is a sign of our times. It has been said, "If you are producing beef today like you were yesterday, you will be out of business tomorrow." The truth of this statement becomes more evident with each passing day!

A brief consideration of "where we have been" may pave the way a bit more smoothly for our understanding and appreciation of "things to come" regarding changes in our beef cattle industry of tomorrow. It is a bit frustrating to know where to begin and what trends and changes to cover in our time today. Perhaps it is logical, however, to start with the cattle themselves.

## Germ Plasm--Old and New

Where do we start? Perhaps with the destruction of the buffalo following the Civil War. Without the buffalo to consume it, the grass on the plains and the rich meadows of the river valleys grew up rank and luxuriant. A vast empire of vacated grass waited for occupancy; and Texas Longhorns were rushed in to occupy our Great Plains, a world left empty by the buffalo. Cattlemen brought their breeding herds north to run on the rich grazing lands of western Nebraska, Wyoming, the Dakotas and Montana. Thus, the Great Plains became stocked largely with these "bovine citizens" from the southwest; and the Texas Longhorns adapted well to their expanding world. They reached their historical heyday, dominating the beef scene of North America like no other cattle breed has done since. However, the romantic Longhorn era ended when their range was fenced in and plowed under, and imported cattle with quick maturing characteristics were brought in to "improve" beef qualities. Intensive crossbreeding had nearly erased the true typical Longhorn by 1900.

Back on our Atlantic Seaboard, Devon cattle arrived with the Pilgrims in 1623 and were probably the first purebred cattle to reach North America. Purebred Shorthorns arrived in 1783. They were followed in 1817 by the Herefords, and in 1849 by the Brahmans. However, it was not until after the Civil War that British breeds were widely imported for beef breeding purposes. The first Angus arrived in 1873.

Traditionally and through the 1950's an almost universal belief prevailed that the conventional English breeds were the ultimate in beef production providing everything desired by the cattlemen. The Shorthorn, Hereford and Angus and the polled varieties of the Hereford and Shorthorn completely dominated United States beef production with the exception of the "Brahman influence" in the South. It was almost sacrilegious to even consider looking to other breeds! Selection among the popular English cattle breeds aimed at compact, blocky, and low-set cattle. Unfortunately, such cattle proved to be highly inefficient converters of feed to beef. Thus, dissatisfaction grew among many commercial cattlemen with the unprofitable production levels of a major part of our existing cattle population. With the growing recognition of the importance of economic traits, the search was on for a source of new genes.

New breeds were developed to meet certain environmental conditions and production requirements. The Brahman-based breeds came first with the Santa Gertrudis recognized as a breed by USDA in 1940 and the Beefmaster in 1954. Starting about 1932, USDA studied the crossing of Brahman and Angus cattle at the Livestock Experiment Station at Jeanerette, Louisiana. And, through the years that followed, the Brangus breed evolved. Brahman blood made these breeds better adapted specifically to the Gulf Coast area, but they are receiving growing acceptance outside of that region partially as a result of the intense new interest in "other" breeds.

More recently, in the early 1970's, excitement over newly imported "exotic" cattle breeds from Europe raged throughout the country. Some cattlemen predicted that the exotics would give profitable beef production a greater boost during the 1970's than anything that had happened to the beef industry since the general adoption of performance testing. Cattlemen in this country soon had a choice of a wide array of "newly arrived" breeds. These breeds included the Simmental from Switzerland; the Limousin, Maine-Anjou, Blonde d'Aquitaine, Normandy, Salers, and Tarentaise from France; the South Devon, Lincoln Red, Welsh Black and Friesian from Great Britain; the Gelbvieh from Germany; the Pinzgauer from Austria and Germany; the Norwegian Red from Norway, the Chianina, Romagnola, and Marchigiani from Italy; the Murray Grey from Australia; and the Hays Converter from Canada.

The French Charolais could be listed among these exotics, but it has been available in the United States for several years. In fact, its fabulous success probably triggered the recent fantastic interest in trying out exotic breeds. Without question, the earlier-introduced Charolais clearly demonstrated the economic importance of growth and cutability to the American beef industry. This, in turn, stimulated interest in locating other exotic breeds that might enhance the production performance of our currently available breeds. Thus, the race was on to find the optimum blend of world bovine germ plasm.

When considering the use of exotic breeds from other countries, cattlemen should carefully consider their adaptability to the new conditions under which they must reproduce and produce. Of course, cattlemen can alter the environmental conditions to a certain extent, but there are economic limitations to such modifications. For example, large differences exist between breeds and cows in the level of nutrition and management required for good reproductive performance and milk production, but the costs of these inputs must be kept at a reasonable level to leave a profit in the enterprise.

Without question, the exotic breeds have made inroads into the original cow herds of North America. However, one of the most important effects of the imports has been direct--the challenge of new breeds made traditional cattlemen "take inventory" and seriously improve the cattle they already possessed. I predict, however, that a few of the exotics, such as the Simmental, are here to stay. They will be unique enough in specific traits to claim a permanent role in the beef industry of this country. Others have "lost considerable steam" (and their promoters considerable money!) and will likely drop out of the beef production scene in the United States.

Although history has a way of repeating itself, it has surprised some cattlemen and animal scientists that a revival of interest has occurred in the historic Texas Longhorn. They question whether it can make a positive genetic contribution to the changing complexion of our cattle industry. In December 1967, I first predicted that Texas Longhorns could be a real "genetic goldmine" in the future of our beef industry. Of course, some folks thought I was setting animal science back a hundred years!

Fashioned entirely by nature right here in North America, the Texas Longhorn became the sound end product of "survival of the fittest." It was shaped by a combination of natural selection and adaptation to the environment. As a result, the Texas Longhorn is the only cattle breed in America which, without aid from man, is truly adapted to America. Texas Longhorns possess a genetic reservoir of genes for high fertility, easy calving, resistance to some diseases and parasites, hardiness, longevity, and the ability to utilize the browse and coarse range material on marginal rangelands more efficiently than most of our other cattle breeds. This genetic reservoir increases in value as our rapidly changing economy forces new needs, handicaps, and demands on our cattle industry. Thus, I predict that, in the years ahead, we will see and hear a great deal more about Texas Longhorns, for it is the one breed of cattle proven over four centuries to excel on the North American continent without the use of high-priced grains.

Being back to the Texas Longhorn, perhaps history does repeat itself. But what about the bison? Our beef industry's economic crisis of the mid-1970's forced cattlemen to consider every angle to remain solvent. Some turned attention to cattle-bison hybrids with 1/8 to 3/8 bison breeding. Maybe history has gone the full cycle! You have heard these hybrids called cattalo or "Beefalo" or perhaps by various other names including the Hybrid Bison Cross of James H. Burnett of Luther, Montana, and the American Breed developed by Art Jones of Portales, New Mexico. Some say this "touch of bison influence" may be the genetic breakthrough needed to increase supplies of desirable red meat at less cost to cattlemen and consumers. The bison hybrids still have to prove themselves in America's beef industry, but results to date indicate that some, such as the American Breed, "have a lot going for them." Some folks say that bison-cattle crosses may be the "super cattle of tomorrow" that will solve many of our beef industry's problems, especially the economic complications of the mid-1970's that restricted feeding grain to cattle. Others say they are just another fad in the cattle business. Only time, testing, and more extensive use in our industry will determine which--if either--is correct. I predict, however, that we will see more of these bison hybrids in the years ahead. In the meantime, other exotic genetic stocks, such as the gaur and banteng, are being considered as potential genetic infusions to produce the "super cattle of tomorrow."

In recent years, the traditional British breeds have been "genetically retooled" to reach market weight more rapidly and with less waste fat than was previously tolerated. Breeding programs stress selection for growth to yearling age, and we see a marked change toward quicker growing animals that are longer bodied and trimmer in the middle and brisket. Accordingly, I predict that our older established purebred breeds, specialized for their combining ability with other breeds, will remain in great demand. Selection within the breeds will concentrate on adapting them to the most effective use of feed and other resources available. Rather than selecting straightbreds for commercial production, purebred cattle will be selected on the basis of the potential performance of their crossbred progeny. In other words, we will be using specific traits and systematic and specialized crossbreeding systems.

Look for the development of more new breeds with unique characteristics to meet specific production requirements--cattle that are better adapted to specific environmental and economic conditions. Similar to the Barzona breed, several breeds may be used to develop these new breeds, which will find their greatest use in systematic and specialized crossbreeding systems in different feed environments and production programs.

Although previously frowned upon, dairy breeds are now being used for crossbred beef production. This is especially true of the Holstein, Brown Swiss, and Ayrshires. Recent feeding trials and carcass studies have revealed that most past discrimination against dairy-cross animals is unjustified. Thus, I would not be too surprised if part of the "mix" in the beef animal of tomorrow comes from a dairy breed for herds that are managed under intensive production conditions.

In the years ahead, additional exotic breeds of cattle will be imported as our cattlemen continue their quest for superior, unique genetic material. Such importations will be facilitated when this country opens its own animal import center at Fleming Key, Florida. A lottery system will be used by USDA for awarding 400 import permits twice per year. I predict that many of the permits will be for additional animals of the exotic breeds that have best survived the collapse of the previous "exotic boom", but a few yet-untried-breeds will be imported. And, I predict one of these will be the Tuli breed, developed by the Rhodesian government from indigenous Bos indicus cattle. My investigations into this breed over the past several years indicated that the Tuli has good potential for making a strong contribution to our beef industry especially in the South and Southwest. Although a Bos indicus breed, Rhodesia cattlemen have found that the Tuli imparts a large measure of hybrid vigor when crossed on other Bos indicus breeds, such as the Africander and the Brahman.

## Shifts in Growing and Finishing

Look for the Okie steer to be replaced with crossbred steers that are genetically engineered for superior performance and carcass merit. Tomorrow's feeders will demand "specification" feeder cattle with known bred-in predictability.

In some areas of the country, the stocker phase of beef production may be completely eliminated as cattlemen aim for a goal of weaning 800-pound calves at 8-months of age. These calves would go directly off their dams to the feedlot, reaching the packing plant at a year of age weighing 1200 to 1400 pounds and arrive at the supermarket as "boxed" beef which has been uniformly cut, sealed in air-tight plastic, and placed in boxes at the packing house for shipment to the retail stores.

Since 1972, rather drastic changes in availability and cost of feed supplies have reversed past trends in our beef industry. From World War II until the mid-1970's, increasing amounts of grain and concentrates were fed to cattle. The main reason for this trend was that grain could be produced cheaply. The inputs used in the production of grain--fertilizer, energy, machinery, and pesticides--were relatively inexpensive. Also important to the production of cheap feed grains were improved hybrids and grain varieties and such cultural practices as higher plant populations, heavier fertilization, early planting, and chemical weed control. Cheap grain became an essential for the beef production system that had evolved in the United States. Without cheap grain the system was vulnerable.

By the mid-1970's, cattlemen and feedlot operators were painfully aware that cheap grain did not last. New demands, mostly foreign, for grain arose and provided a higher economic opportunity for grain than by feeding to ruminants. A combination of increased production costs and increased demand for grain forced prices substantially upward, and the vulnerability of heavy-grain-feeding livestock enterprises became a reality. Despite current surpluses and low prices of grains, most projections indicate strong future export demands for grain and continued upward pressure on feed grain prices. This means that we need to capitalize on the ruminant's unique advantage--its ability to convert organic substances not useable by monogastric animals into human foods of high quality and desirability.

We must increase as rapidly and as far as possible the role that forages and our some 715 million acres of rangeland can fulfill in ruminant livestock production. It is estimated that we are currently realizing only about 20 percent of the efficiency of our forage and grassland potential. However, other estimates indicate a 50 percent increase in the demand for range grazing by the turn of the century. Increased range utilization for livestock production can reduce the drain on future natural energy requirements for meat animals. Livestock grazing of forest and rangeland provides an opportunity to tap the energy of the sun without major alterations of natural ecosystems.

I predict a realignment of our beef industry with the industry becoming more dependent on the use of range, pasture, and roughages and less upon long-term heavy-grain finishing in the feedlot. This means that "cattle of the future" must be well adapted to such a production system. Accordingly, I predict that our cattle of the future will be those that can most effectively and efficiently convert forage into beef and perform well under rangeland conditions. Among the breeds having such potential are the Brahman-based breeds (including the Beefmaster, Brangus, and Santa Gertrudis), Barzona, bison-hybrids, Devon, and Texas Longhorn. As I see it, these breeds will be crossed with the well-established British breeds to produce crossbred cows that are, in turn, bred back to bulls of a third breed, which will likely be selected from among these "rangeland efficient" breeds or from the surviving efficient exotic breeds.

I anticipate a new role for the feedlot: it will be a facility to put a short-term final finish on essentially grass- and forage-fed animals. There will be a sharp reduction, but definitely not elimination, of feeding grain to beef cattle. In fact, with the nation's large feeding capacity, a cheapening of grain prices would place more cattle on feed. However, grains will be fed to cattle in significant amounts only when world supplies and prices make it economically feasible. I see feeder cattle being carried to weights of about 850 pounds on range and pasture with only the final 200 to 300 pounds being added with some supplemental grain on pasture or perhaps in the feedlot under custom feeding contract.

## The Impact of Our "Hamburger Society"

Cattle type, as well as production and marketing methods, may be due for extensive revamping in the foreseeable future to meet emerging changes in consumer demand.

Claims are being made that we are becoming a "hamburger society". Some say this results from the impact of the rapidly expanding fast-service food chains. Since World War II, the growth of the fast-food chains has been phenomenal, increasing from $6.5 million in sales in the late 1940's to $86 billion in 1976. Others say our "hamburger society" is a product of the changing attitudes of Americans regarding meal preparation. People now want to be able to prepare meals quickly and conveniently and yet have variety, consistent results, and economy. Ground beef is the beef industry's best product to meet these requirements. In the past, ground beef has been looked upon as a by-product of our processing industry. Although there will always be a market for Choice (and even some Prime) steaks, roasts, and other beef cuts, present indications are that the bulk of our beef market will be going the ground beef, or hamburger, route. Ground beef now accounts for more than 40 percent of all beef sales. Some beef experts estimate that this figure may exceed 60 percent by 1980. Thus, hamburger may become our most popular way to consume beef, and steaks and roasts may become the by-product of the processing industry! Our beef industry may have to revise production and marketing methods to satisfy the rising demand for ground beef.

If our beef industry is actually launching on a new demand course, we need to begin immediately to make adjustments in our beef-production system to supply what our domestic beef industry wants. We may need to produce an animal specifically for ground beef. A choice boneless carcass contains about 33 percent fat, whereas most manufactured products require beef that is 10 to 15 percent fat. Normally, our manufacturing beef comes from cull cows that are killed each year. High cow kills in recent years have provided a good source. We appear to be entering a period when cow numbers will be down and cows will not be available to kill. If we do not produce a lean animal designed specifically for manufacturing meat, we are faced with the alternatives of increased beef imports from Australia, Argentina, and other producers of the lean product demanded by our hamburger market or by wider acceptance of meat substitutes. The industry will need to develop methods to derive a profit through producing and marketing animals intended primarily for ground beef. There will be changes in growing and finishing procedures, type of cattle, carcass quality, and perhaps in areas of production. More roughage and less concentrates will be used in cattle rations since the demand will be for more muscle and less fat.

## Stress on Reproductive Efficiency

Look for dramatic advances in cattle reproductive physiology in the years immediately ahead. This area offers our greatest opportunity for increasing production efficiency. Look for increased use of estrus synchronization, artificial insemination, and embryo transfer and for the successful development and use of methods to determine the sex of calves prior to matings being made to produce them.

The successful use of estrus control, artificial insemination, embryo transfer, and sex "determination or control" will get superior progeny of the desired sex "on the ground" early in the desired season of birth. This will make it possible to market an increased weight of a more uniform and desirable product. Furthermore, the control of estrus and sex determination will be a boon to systematic and specialized crossbreeding programs.

Embryo transfers will multiply the value of genetically superior cows like artificial insemination does for superior bulls. While a bull can sire thousands of calves during his life, a cow with equally desirable genetic merit can carry only a few calves--usually less than a dozen--during her lifetime. Likewise, cattlemen can buy semen from top bulls of any breed for a relatively low price, but they are limited to using cows in their own herd. Embryo transfers techniques are changing all of this! The transfer of embryos from superovulated genetically superior cows into the uteri of foster cows of lesser genetic value will produce calves of outstanding merit while the genetically superior donor cows are freed from the burden of a nine-month pregnancy. Accordingly, they can be superovulated additional times to produce more "crops" of eggs for additional transfers.

Freezing fertilized eggs at a minus 196$^{0}$ C to suspend animation until they are required is a further development of the technique of embryo transfer that is being perfected. A frozen embryo can be shipped to a buyer in another country where the embryo would be thawed and transplanted into the uterus of a foster mother for the birth of an offspring that previously would have been too expensive to ship by boat or air. Cattlemen can have any cow in his herd deliver a calf of a desired sire and dam breed regardless of the foster mother's genetic makeup by buying a frozen embryo of the required genetic makeup. This potential will likely result in the development of a whole new industry to produce and sell embryos.

With successful sex determination, a few top cows will be bred to produce genetically superior herd sires. Only cows from which replacement females are desired will be bred to produce heifers. All other cows will be bred to produce bull calves since bull calves will average about 40 pounds heavier than heifers at weaning and are about 10 percent more efficient in feed utilization.

## Drugs, Hormones and Antibiotics

On the nutritional side of the beef cattle picture, cattlemen are faced with the strong likelihood of government restrictions being placed upon the use of various drugs, hormones, and antibiotics that have been used extensively to stimulate growth and/or improve the efficiency of feed utilization. Fortunately, some growth stimulant substitutes now show promise, including a non-drug vaginal insert that stimulates heifers naturally to faster and more efficient gains. Additional substitutes will likely be forthcoming from research and industry. We will probably also see greater use made of the ability of bulls to gain faster and more efficiently than steers. With bulls producing leaner carcasses, this trend would also fit the emerging "hamburger society".

Energy Crisis

The growing energy "crunch" is affecting agriculture through shortages and rising costs. Supplies of fossil fuel so essential for transportation, irrigation, machinery operation, and fertilizer production are limited; but the demand for such use is very great. Shortages and increased costs of fertilizers and more costly energy for irrigation can greatly affect the production of grain used to feed cattle and also reduce the use of heavily-fertilized pastures which have been a boon to beef production in the Southeast and some other areas of our country. A large percentage of the grain produced in this country is fed to animals. Therefore, much of the energy used to produce grain crops is used directly to support our livestock industry. Fortunately, ruminants can be produced on non-grain diets. The increased use of such diets would save much of the energy now used to produce grains for livestock. This again would point directly to the increased use of rangelands for beef production.

Improved pastures can continue to play an important role in beef production even if handicapped by a reduced supply of the nitrogen fertilizers through the use of more clovers and other nitrogen-fixing legumes. The average ranch will probably produce high-yielding grasses as abundantly as technology allows on its best soils, and marginal soils will likely be managed for palatable shrubs and improved varieties of cacti for drought insurance. In addition to legumes, atmospheric nitrogen is also biologically fixed by a variety of microorganisms and associations. Our knowledge of the increasing number of organisms that are capable of fixing nitrogen is expanding rapidly. Nitrogen-fixing organisms, for example, have been discovered on roots of grasses, including maize and wheat. I predict that research will enhance our use of biological nitrogen fixation to furnish a part of the nitrogen requirements for the future production of feed, food and fiber crops.

Solar energy, wind energy, and energy from agricultural wastes will partially replace more traditional fossil fuels and provide an increasing share of the energy required on farms and ranches. We will make better use of organic wastes, including urban sludges and animal manures, to reduce the quantities of fertilizers used in this country. Of course, there are limitations and obstacles to the increased use of these materials. For example, the application of animal manures and sewage sludges to agriculture land is influenced by physical, chemical, microbiological, sociological, economic, and political or legal factors. Being a society with limited resources, however, I anticipate that we will quit thinking in the negative terms of waste disposal and shift to positive thinking on appropriate use.

## Water Crisis

Growing signs indicate that many areas of our country may face a water crisis that will overshadow the existing energy crisis. There are problems of supply and quality. Much concern is being expressed in areas that are using irrigation to increase--or even permit--agricultural production. Irrigation systems, such as the drip or trickle type that first began in England and Israel, are being developed which may extend the life of ground water by increasing the efficiency of water use. Where a crop's irrigation need can be met by a properly designed and operated drip system, there is generally a savings of 30 to 50 percent in water used and a 50 to 80 percent savings on energy used.

With the extreme water shortages likely to occur in the future, the restoration of our grasslands becomes increasingly important. Native grasses have been replaced on millions of acres by dense thickets of cactus, mesquite, shin oaks, cedar brakes, and other unproductive plants which sap water and nutrients from the soil. Brush roots reach deep into the soil and intercept percolating water, thereby depriving underground water supplies. Mesquite, saltcedar, and other such trees growing near springs and along waterways draw water from these natural reserves. Grass, in contrast, cushions the impact of rainfall and decreases runoff with a root structure which creates a subsoil that absorbs water like a sponge to hold it in the earth. Accordingly, the reclamation of grasslands will receive increasing attention as one means of helping preserve our water supplies, and native grasses will assume an increasing role of importance in helping make restoration practical.

## Pest Management

Pest management since World War II has relied heavily on pesticides. Despite their essential and effective role in agricultural production, these materials possess some inherent drawbacks when we rely on them as our single line of defense against pests. In addition to some health hazards, including residues in food, it has introduced such problems as pesticide-resistant pests, possible destruction of natural controls, adverse effects on wildlife, and potential environmental contamination. Consequently, it is likely that growing governmental restrictions and bans on the use of certain pesticides will continue to have a serious impact on the cattle industry. Increased emphasis will be placed upon the development of biological controls for pests affecting beef cattle to help hold the pests below damaging economic levels without disrupting the agro-ecosystem. However, no single control method will suffice due to the remarkable adaptive powers of many pests and because of the many variables related to location, climate, and management practices. Thus, I predict that we will see renewed emphasis on breeding cattle that possess genetic resistance to internal and external parasites.

## Marketing Changes

The marketing of cattle and beef has been undergoing constant change. We will see continued revisions in our Federal grading system in response to changes in production methods and alterations in consumer demand. Look for the marketing of more trademark beef from completely vertically integrated operations--it will be "from the sperm to the steak" under one ownership. Most likely, the increased tendency toward marketing cattle by direct sales will continue to increase at the expense of the use of central terminal markets and auction markets. Cattlemen will continue to move toward marketing "specification cattle" at a premium as a result of the effective use of performance testing programs. More beef will go into the wholesale trade as boxed beef rather than carcass beef. There will be further breakdown of the carcasses at the slaughter plants with more fresh and frozen products packaged and shipped ready for use by the consumer. The economics of energy and transportation will force that change. Furthermore, boxed beef enables retailers to buy only those cuts that sell well in their retail stores rather than purchasing entire carcasses. It has been estimated that boxed beef and other forms of precut beef will account for almost 80 percent of the beef entering retail stores by 1980. It now appears that much of the cutting and packaging of beef into retail cuts may take place at retailers' warehouses rather than at the packaging plants. However, the transition to more central cutting of retail cuts will be somewhat slowed because of labor union requirements and the capital investments in existing systems.

A growing demand for ground beef will be at the expense of Choice retail cuts. Meat processors will ask for muscle and protein and will take over from there to electrically, mechanically and/or chemically tenderize it; flake or shred, shape, and mold it; and freeze it to their standards to satisfy the liking and demand of consumers. This will solve one of the existing problems in the beef business--the lack of uniformity of cuts. Also, faster-paced lifestyles of American families will lead to greater demand for more cuts of meat that require less cooking. So, different ways of preparing the traditional cuts of roasts and other large cuts must be found, and the shred-shape-mold-freeze route may be the answer.

A market will remain for Choice beef since many consumers prefer it and will buy it in our top restaurants and at retail outlets. Thus, the industry will need to continue to produce a certain quantity of Choice (and even some Prime) beef to meet the demands from the top income segment of our society. This demand will continue to come from gourmets who have the money to buy, as well as the taste to appreciate, top-quality meat.

In the years ahead, cattlemen will become more concerned with increasing exports by building foreign trade potential rather than worrying excessively about beef imports. The industry is aware that traditional diets of rice, fish, and tea are changing and is looking toward Japan, as well as Europe and the Middle East, as an expanding market for American beef.

## Conclusion: Excitement or Frustration?

Many interesting changes face our beef industry. The devastative price-cost situation of the mid-1970's pinpoints the need for changes in our beef industry. Without land appreciation, mineral resources, and supplemental nonagricultural jobs, many cattlemen could not have stayed in business.

As a starting point, cow-calf producers and feeders should work through their organizations, such as the national Cattlemen's Association, Independent Cattlemen's Association, and state associations like your Oregon Cattlemen's Association, as well as individually, to develop a closer working relationship with packers, wholesalers, and retailers to identify and define the problems and needs of the beef industry. Through the combined efforts of all segments of the "meat chain", the industry can effectively place its production priorities in order to meet consumer demand. Knowing what is wanted is a fundamental first step toward success. No successful large producer of any consumer commodity gears up for production until he has researched the potential market to learn what is needed and wanted. Why should we feel that the beef industry is any different?

Beef production is becoming quite different from what we generally practice today. Cattlemen will need to alter their management techniques to survive the impact of the massive changes. Cattlemen who are flexible to change will be able to survive and make a profit. Decided goals, optimum management, good records, sound breeding programs, and total efficiency will be necessary.

Producing cattle between now and the year 2000 will be exciting and frustrating. Exciting? Yes, it will be exciting for cattlemen who are flexible to change--those who stay atuned to industry needs and handicaps and to consumer demands so as to remain in step with their market and successfully plan today's production for tomorrow's markets. Frustrating? Yes, for those cattlemen who fail to identify their market and then produce efficiently for it.

# NEW FEEDER CATTLE GRADES ARE ON THE WAY

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The present U.S. Standards for Grades of Feeder Cattle were adopted in 1964. These standards were an outgrowth of tentative standards that had first been developed in 1925. Since 1964, the official standards have been used by the USDA as the basis for its feeder cattle market news reports. In recognition of the need for a revision of these standards, the USDA appointed a special task force to review the adequacy of these standards and to recommend any changes that might be needed.

The task force report indicated (1) that the present standards were not widely accepted as a tool for use in trading on feeder cattle, (2) that feeder cattle type had changed dramatically since 1964, and (3) that new standards which better reflected the needs of the feeder cattle industry should be developed.

Frame size and degree of muscling are two of the most important factors affecting value of feeder cattle. Frame size and degree of muscling will be used as the basis for revised standards. A "dual" grading approach is essential since variations in frame size and muscling are basically unrelated. The present "single" grading system resulted in intermediate grades containing animals with varying combinations of frame size and muscling.

Frame size is an inherent characteristic in cattle that is not affected by normal management practices. Frame size at a given age is highly correlated with an animal's mature size. It is highly correlated with the weight at which, under normal feeding and management practices, an animal will produce a carcass of a given grade. An evaluation of frame size is quite a useful tool for segregating animals into groups that are relatively similar with respect to the weight at which they would produce the same grade of carcasses. The present standards do not group feeder cattle according to frame size, and Choice feeder cattle are expected to produce Choice carcasses over a wide weight range. The new revision of the feeder cattle grade standards includes three frame size categories -- Large Frame, Medium Frame, and Small Frame.

Large Frame (L)

Feeder cattle which possess typical minimum qualifications for this grade have large frames and are tall and long bodied for their age. They would be expected to excel in growth rate but steers and heifers would not be expected to produce U.S. Choice beef carcasses until their live weights exceed about 1,200 pounds and 1,000 pounds, respectively.

Medium Frame (M)

Feeder cattle which possess typical minimum qualifications for this grade are the so called middle of the road type. They would be expected to have an average growth rate. Steers and heifers would be expected to produce U.S. Choice beef carcasses at live weights of 1,000 to 1,200 pounds and 850 to 1,000 pounds, respectively.

Small Frame (S)

Feeder cattle included in this grade have small frames and are shorter bodied and not as tall as specified as the minimum for the Medium Frame grade. They would be expected to have a relatively slow growth rate. Steers and heifers would be expected to produce U.S. Choice grade carcasses at live weights of less than 1,000 pounds and 850 pounds, respectively.

The frame size portion of the grade is determined by an evaluation of an animal's skeletal size -- its height and body length -- in relation both to its age and to the overall range in skeletal size at maturity of the entire cattle population. Breeds differ in the general range of their frame size. These standards apply to all breeds so variation in frame among breeds must be taken into account. The largest framed cattle in a small framed breed -- and the smallest framed cattle in a large framed breed -- might both be considered as medium in frame size.

With the elimination of conformation as a factor used in determining the quality grade of slaughter cattle and their carcasses, the "logical slaughter potential" concept of the present feeder cattle grades is no longer valid. This does not mean that differences in muscling are no longer important in evaluating merit in feeder cattle. Variations in muscling do affect carcass yields of lean and are reflected in differences in carcass yield grades. While the cost of gain associated with the production of Choice grade carcasses may not be different for thick or thin-muscled cattle, such differences in muscling could result in a thinly muscled animal having a Choice, Yield Grade 3 carcass, whereas the carcass of a thickly muscled animal might be a Choice, Yield Grade 2 or 1. Such a difference in yield grade is of considerable economic significance and the reason for including muscling as a factor in the standards for grades of feeder cattle. In the revision of the standards, the terms "No. 1:, "No. 2", and "No. 3" have been selected to identify the three categories of muscling.

No. 1 (Heavy Muscling)

Feeder cattle which possess typical minimum qualifications for this grade are heavily muscled throughout. They show lots of muscling over the back and loin, and the rounds are bulging on the sides when viewed from the rear.

No. 2 (Medium Muscling)

Feeder cattle which possess typical minimum qualifications for this grade are medium in muscling. They are not as heavily muscled as those in category No. 1.

No. 3 (Light Muscling)

Feeder cattle included in this grade include animals which are lighter in their muscling than those specified for the No. 2 grade.

The resultant grades of feeder cattle include three separate groupings for the frame size -- Large Frame, Medium Frame, and Small Frame, and three separate groupings for muscling -- No. 1, No. 2 and No. 3. The nine resultant grades are as follows: Large Frame, No. 1; Large Frame, No. 2; Large Frame, No. 3; Medium Frame, No. 1; Medium Frame, No. 2; Medium Frame, No. 3; Small Frame, No. 1; Small Frame, No. 2; Small Frame, No. 3.

There is a provision for one other grade -- U.S. Inferior -- for all "unthrifty" animals. Animals in this grade may have any combination of muscling and frame size. Thriftiness refers to the apparent health of an animal and its ability to grow and fatten normally. An animal's unthriftiness may be attributed to mismanagement, disease, parasitism, or lack of feed.

# A PRACTICAL COW-CALF HERD HEALTH AND REPRODUCTION PROGRAM

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It is not possible to cover all the aspects of this complex subject in the time and space available, but this is an attempt to emphasize the salient, practical and economical goals of any program. The overall objective is to obtain a live, vigorous and healthy calf from each female bred, and that these calves are dropped at the optimum time of the year for your ranch. The next objective is to raise each of these calves to its potential until sale. At the same time, we must aim at the proper preparation of the dam to avoid over conditioning at calving time, with its associated calving problems. On the other hand, sufficient nutrients must be supplied to allow a healthy cow and sufficient milk to rear a healthy calf.

Other important aspects of the reproductive cycle should be aimed at minimizing metritis and the interval between calving and rebreeding. This includes early contraction of the uterus and re-establishment of the estrous cycle for early (50-90 day) rebreeding and conception with minimum breedings/inseminations. Each of these goals includes a huge plethora of disease and management problems.

There are many diseases which may cause problems but which may be controlled by vaccination programs or regulatory controls. The majority of diseases falling into this category are not materially influenced by management practices--eg., Brucellosis, tuberculosis, vibriosis, leptospirosis, blackleg, B.V.D., and others.

Many disease problems, however, do relate to management practices more so than infection--e.g., pneumonia, scours, weak calves, coccidiosis, worms, shipping fever syndrome, foot rot, pink eye, etc.

As the fertile cow is king (queen?) pin of the operation, let's begin there.

Before breeding, she has to cycle regularly (19-21 days) and have a healthy uterus--no discharges. Many factors: age, nutritive state, especially energy (carbohydrate) levels, influence this. If viable semen is introduced at the correct stage of the estrous cycle (6 to 18 hours after estrus is over) conception should take place with one breeding. Multiple breeding of two or more breedings per conception serves to place a heavy load on the bulls which may reduce semen quality and thus compound this vicious cycle. If insemination is part of the management program, the extra labor and semen adds greatly to the operational costs. With artificial insemination, management hinges on efficient estrus detection, good observation, teaser bulls or cows. Heat detection is one of the major management obstacles interfering with efficient breeding programs.

Post calving rebreeding should be timed for between 50 and 90 days post parturition. Between these periods, the cow is at her most fertile stage and should conceive easiest provided that the uterus is healthy and receptive to implantation. Nutrition levels (especially energy) must be high enough to maintain the cow and calf she may be feeding or else she will not cycle.

Veterinary assistance, especially on a regular basis, preferably in the form of herd health, is important in the overall program. Specific areas of most important veterinary assistance are as follows.

Post parturient examination of all cows having other than normal births. Also any cows retaining placentas (not cleaning). Examination of these cows will enable any with metritis to be cleared of infection before breeding time. Finding metritis at rebreeding time may delay rebreeding by 2 to 4 months and foul up scheduling.

Pregnancy confirmation at 60 to 120 days will identify non-breeders and give you the opportunity to eliminate expensive culls before carrying them through a lengthy and expensive feeding period.

Pregnancy checks will also establish the conception rate--if it is a problem it can be identified early and the cause established before a whole season is lost.

Any cow with problems can be identified and individually treated should this be economical. It must be emphasized that a poor breeder may be so year after year, as may her progeny be, so treatment for poor breeding may not be in your best interest unless she represents a valuable bloodline.

Your veterinarian is much better utilized, to your mutual advantage, in a preventative and planned program as opposed to "fire alarm" calls for sick animals. Try to develop a relationship between you which will involve your veterinarian in your farming enterprise--its problems and successes.

Once the cow is pregnant, your aim is to keep her that way until calving. Annual vaccination programs for diseases such as leptospirosis, Brucellosis, and B.V.D. will help to maintain her pregnancy to full term.

Space does not allow discussion on calving problems; however, it cannot be stressed enough that early intervention in a dystocia, by a competent veterinarian, usually will result in a cow able to be rebred on time as well as a live calf if possible. Calling your vet after 3 to 4 hours of tugging, via a variety of methods (tractor, hoist), usually complicates the picture.

Once she has calved and cleaned, most cows should be fit to be rebred in 50 to 120 days.

The calf should have colostrum as soon as possible after birth. This colostrum contains immune bodies against most of the diseases to which the dam has been exposed. These antibodies cannot be manufactured by the calf at this early age and by drinking the colostrum, they will obtain a passive immunity which will help ward off diseases during the first months of life. <u>Early ingestion of sufficient colostrum is probably the single most important factor in maintaining the calf's good health during the first few months of life.</u>

One big problem in calf rearing is scours. By holding the concentration of disease causing organisms (bacteria and viruses) to a minimum via management practices aimed at reducing cow/calf concentration in any one place, the incidence of infection will be reduced. Concentration of animals in barns and paddocks results in a build-up of scours-causing organisms. Mixing yearlings with older cows after calving will help expose them to indigenous organisms and allow them to develop an immunity which they can pass on to their calves via the colostrum and reduce the scours problem.

Introduction of new animals to your herd from strange farms, sale barns, etc., will also introduce new disease producing organisms.

The biggest stress on calves is weaning, and when this is coupled with an assault on the calf due to dehorning, deworming, vaccination, castration, branding, delousing, etc., followed by transportation, the result is usually a respiratory infection called "shipping fever". This syndrome has a mixture of causative agents including I.B.R., B.V.D., $PI_3$, Pasteurella--all of which are able to invade the calf when its resistance is lowered. If possible, these procedures should be done to the calves at least two weeks before weaning (preconditioning). Other factors which should be considered if you wish to present healthy feeders to your buyer, is to train the calves to eat feed and drink from a water tank before weaning. Offer calves fresh, clean water, good quality feed, and a clean, dry place to shelter in.

Bulls are at least half the herd and should be treated as such. Regular semen checks prior to the breeding season will identify problems before they become an expensive drop in pregnant cows and sparse calf crops.

## Some Points to Ponder

Selenium -- In deficient areas supplementation, especially for young calves is required (white muscle disease). Adult supplementation may be a good idea.

Fly control -- Reduction of fly population via manure control, sprays, dust bags, insecticides in licks. Helps pink eye.

Coccidiosis -- Keep concentration of cattle in small, wet areas to a minimum. Coccidiostats in feed may be advisable.

Pneumonia -- Other than shipping fever, is associated with stress, no shelter, exposure to elements, poor nutrition, mixing calves from strange areas and exposing them to new organisms.

Should animals die, it is very important to identify the cause to help prevent further cases. A complete post mortem should be done as soon as possible to reduce secondary changes interfering with a diagnosis. In some cases several samples (blood, serum, organs) might have to be submitted to a laboratory to aid in making a diagnosis. Fresh specimens are essential for any chance of a definitive diagnosis.

Vaccination -- Programs must be varied to fit in with local conditions and intelligent programs should be planned in consultation with your local veterinarian. Both the adult animal and calves must be included in any program, for those you retain as well as those you sell. Calfhood vaccination for most diseases is best done while they are still on their mothers.

Calendar

June - August: Allow calving pasture to grow so at least 6" growth is ready. Bangs vaccination for heifers. Shipping fever vaccination, preconditioning. Fly control. Foot rot.

September - November: Weaning (watching for any sick calves 5 to 14 days post weaning), pregnancy check, cull open cows, may be advisable in a large herd to divide into calving groups, parasite control.

December - February: Supply sufficient nutrition to pregnant cows as well as replacement heifers--don't overfeed. Don't concentrate animals in any one area to cause build-up of diseases, especially in any area to be used for calving.

March - April: Calving--split into two groups. Separate cows and new calves into small groups as soon as possible. Flushing--? value in bovine. Nutrition--both energy and protein as well as trace elements (phosphorus, magnesium).

May - July: Breeding--bull care. Examine any dubious cows. Heat detection. Vaccination for vibriosis. Artificial insemination techniques should be checked. Good management will help in getting most cows bred in a short span. Heifers should be bred earliest, if grown out sufficiently, and culled more particularly than the cows. This may avoid the scours problems in first calves as well as allowing the first-calf heifers a longer time until rebreeding with the rest of the herd. Keep progeny size in mind when selecting bulls, especially with heifers.

For fall calving operations, the same basics apply with some adaptations.

Remember that strict culling often has many rewards--financial savings as well as elimination of time consuming "trouble makers".

Attacking disease problems by treating the sick animals is not usually the most efficient or economical way. Identify the problem with your local veterinarian and together plan a preventative herd health program for your own situation.