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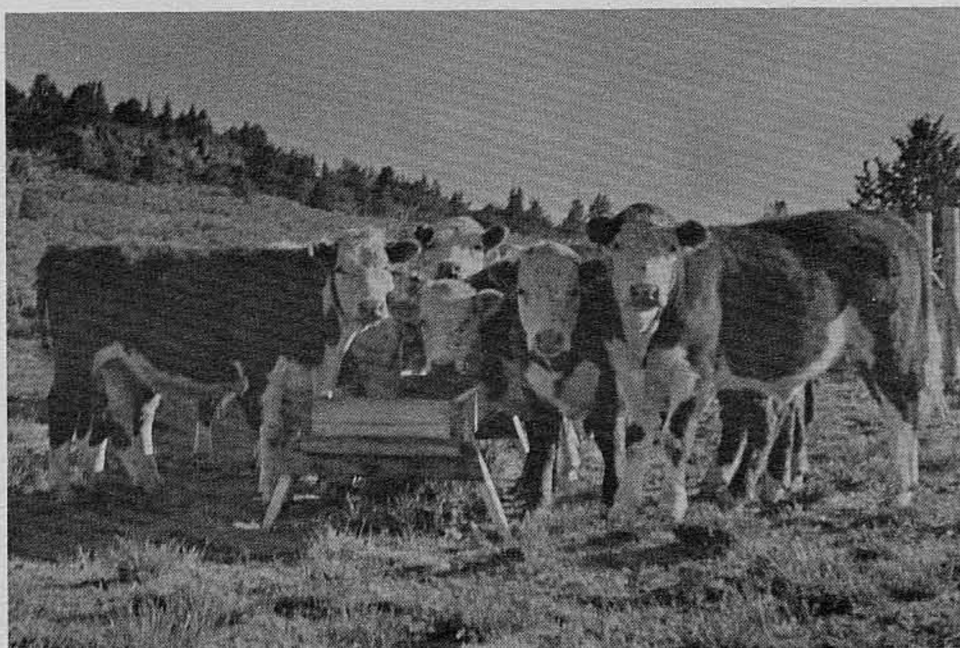
Supplementation Considerations for Beef Cattle



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SUPPLEMENTATION CONSIDERATIONS FOR BEEF CATTLE

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To maximize profits from the sale of beef, cattlemen must continually strive for more efficient utilization of basic winter and summer feed resources. Supplementation under western range conditions is usually centered around feeding a minimum amount of concentrates to supply nutrients deficient in the hay, pasture or range forage to obtain acceptable levels of animal performance. This paper presents data collected at the Squaw Butte Experiment Station and discusses the benefits of supplementation and some of the problems associated with the various methods.

The data represent a given set of circumstances and it must be emphasized that everyone's situation is different. It is important that each individual evaluate his forage resource and develop a supplement program around it. This paper will not cover all classes of animals or management situations.

SUMMER SUPPLEMENTATION

Forage, on semi-arid ranges, decreases in quality with forage maturity so that by mid-June both protein and energy become limiting for economical yearling gains. Protein decreases steadily from a high of about 20 percent in early spring to 2 or 3 percent in late fall and digestibility of this protein declines from 65 to less than 30 percent. Digestible energy follows this same pattern, ranging from a high of about 65 percent to a low of about 40 percent as the season progresses.

Yearling steers on range forage alone will gain 2.0 pounds or more per day during May and June, about 1.5 pounds during July, less than 1.0 pound in August, with little or no gain after September 1. Based on the chemical analyses of range forage and the above information, a supplemental feeding program for yearlings on range was developed. The digestible protein and energy intake of yearling cattle on range were plotted along with the nutrients required to make a desired gain of 2.5 pounds per day. The difference was calculated and a supplement was designed to make up this difference.

An example of a typical daily supplement schedule is shown in Table 1. An increased supplement level above that shown did not prove to be economically sound, primarily because of decreased forage intake and subsequent diminishing returns from the supplement. These supplements were hand fed on a daily basis and a typical gain response with continuous grazing and high pasture utilization is shown in Table 2. By grazing half or less of the available forage, typical gains have been 2.6 to 3.2 pounds per day. The cow herd can then follow the yearlings and utilize the remaining forage.

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Table 1. Daily supplementation schedule

Date	Barley	Cottonseed meal
	lb/hd	lb/hd
Turnout	1.00	--
6/1 - 6/7	0.75	--
6/8 - 6/14	0.50	--
6/15 - 6/21	0.25	0.25
6/22 - 6/28	0.25	0.50
6/29 - 7/5	0.25	0.70
7/6 - 7/12	0.35	0.85
7/13 - 7/19	0.45	1.00
7/20 - 7/26	0.65	1.10
7/27 - 8/3	1.10	1.20
8/3 - 8/9	1.20	1.35
8/9 - 8/15	1.50	1.50

Table 2. Daily gain of yearlings on different supplement treatments

Period	None	Half season 6/12-8/12	All season 5/10-8/12
	pound	pound	pound
5/10 - 6/11	2.29	2.31	2.73
6/12 - 7/12	1.94	2.02	2.10
7/13 - 8/12	1.03	2.07	1.96
Average	1.76	2.13	2.29

Response from energy supplementation in early spring, despite forage nutrient values being very high in early spring, may be attributed to the relatively high moisture content of the forage, which tends to limit dry matter consumption, or an imbalance of protein and energy. Data indicate that because of decreasing forage quality it is impractical to supplement for economic production beyond the middle of August. Beyond this point an increased supplement level inhibits forage intake. Selling these animals or putting them on better feed, such as bunched hay, irrigated pasture, higher elevation ranges, etc., is recommended. Increasing the grain, eventually to a full feed with the range providing roughage so a slaughter grade animal can be produced directly off range, is a possibility that has been investigated and shows considerable promise.

Gains on summer range vary considerably, depending on forage quality, quality of cattle, previous winter gain, management and many other factors. Over the years, yearlings on Squaw Butte have had average gains of 1.2 to 1.8 pounds per day during the summer without supplements and 2.0 to 3.0 with daily supplements. In the above examples, supplemental protein was provided from cottonseed meal and energy from rolled barley. However, as long as protein and energy are provided, many different feedstuffs can be used with similar results. Non-protein nitrogen sources, such as urea and biuret, under proper conditions have resulted in gains approaching or equaling those with cottonseed meal, as long as the energy lost by not feeding cottonseed meal was replaced by barley or other energy sources. However, care should be taken when urea is fed because of palatability and toxicity problem. Urea supplements should be thoroughly mixed and precautions taken to insure that some animals do not get more than their share. Level of urea in the diet is also critical.

Creep feeding on summer range has been marginal. Under certain conditions it will pay but often does not. Supplementation of the cow herd has not been practical or profitable under range conditions.

In general, unless in a specific deficiency area, minor nutrients are adequate. However, salt and a good phosphorus source should be available to animals at all times regardless of the management program.

WINTER SUPPLEMENTATION

Much of the roughage used for wintering beef cattle in eastern Oregon and in much of the west is a low quality native meadow hay. Factors contributing to this quality are low levels of crude protein, low digestibility and bulk. Date of harvest or maturity of plants at harvest probably contributes more to the quality of this hay than any other single factor. The earlier this hay is harvested the more available the nutrients are for animals. When cut at a proper time, the crude protein ranges from 7 to 9 percent. Older animals with the capacity for more feed can meet their requirements for performance provided adequate amounts are available. Younger animals do not fare so well since they cannot consume adequate quantities. Weaner calves do little more than maintain themselves and in some cases may not do that.

Many studies reporting the effect of winter gain on summer gain have been conducted with the idea of obtaining inexpensive gains on grass and selling long yearlings as feeders in the fall. High rates of winter gain together with number of days on feed have a significant negative effect on subsequent summer gain. However, calves restricted to limited winter gains for long time periods (100+ days) are considerably lighter at the end of the summer grazing period. In short grass years when growing stock must be sold in the spring to maintain the cow herd, there is a considerable economic loss from the restricted winter feeding program.

Total digestible nutrients required during the winter per pound of gain accumulated during both the winter and summer periods reach a minimum when animals gain 1.2 pounds per day during the winter with the greatest return over feed costs occurring at about 1.6 pounds. Steers should be fed to gain 1.5 to 1.8 pounds per day when feed cost - cattle price relationships appear favorable and 1.0 to 1.4 pounds per day under less favorable conditions. Calves can gain up to 1.6 pounds per day in the winter without substantially affecting summer gain as long as the animals are supplemented during the summer for gain at a maximum rate. Size of the calf entering the winter period also affects the economics of the optimum winter gain.

Supplemental protein and energy must be fed with native floodmeadow hay to provide economical gains for wintering weaner calves and yearling cattle. A combined supplement of 1 pound of cottonseed meal plus 2 pounds of barley, or their equivalent, with a full feed of good meadow hay provides a well-balanced growing ration for weaner calves. Table 3 presents a typical gain response and cost per pound of gain with and without supplements. Supplements are fed on a daily basis. Gains on hay alone have varied from no gain at all to 0.6 pounds per day, depending on the quality. Supplemented calves on the ration (Table 3) have gained 0.9 pounds per day to 1.7, again depending on quality of hay and calves. Supplementing above this level will cause a decrease in hay intake and often an increase in cost/pound of gain. Salt and a phosphorus source should be available on a free choice basis.

Table 3. Winter daily gain and cost of gain for weaner calves with and without supplement1/

Treatment	Feed intake: Hay	Barley	Cottonseed meal	ADG	Cost/lb of gain
	lb	lb	lb	lb	¢
Hay alone	10.2	--	--	0.27	94
Hay & 2 lb barley & 1 lb CSM	10.3	2	1	1.32	35

1/ Hay valued @ $50/Ton, barley @ $100/Ton and CSM @ $200/Ton.

Under carefully controlled conditions, non-protein nitrogen products such as urea and biuret can be used in place of cottonseed meal as a protein source. Gains will approach those of cottonseed meal as long as the energy lost from the removal of the cottonseed meal is replaced by barley or some other energy feed. In a properly balanced and well-mixed ration, urea can increase efficiency and lower cost of production. Increased frequency of feeding will increase performance with urea supplement. However, under less controlled conditions, palatability and toxicity problems arise when feeding urea. Results from urea with low energy, high roughage or limited feeding programs can be disappointing. Biuret is more palatable and acceptable to the animal and it is not toxic, making it a more desirable source of nitrogen under these circumstances. Increased efficiency can often be realized by supplying the supplemental nitrogen with both a natural and non-protein source.

Condensing meadow hay bulk through different processing methods offers some opportunity for greater consumption and, consequently, an improvement in calf performance. Chopping or wafering hay does not seem to offer much improvement. Pelleted hay can increase intake by 25 percent or more and roughly double gains over long hay. The main disadvantages of processed hays are added costs of grinding and pelleting along with transportation costs to and from the feed mill or the cost of equipment to do it in place. Supplements, in most cases, are probably a cheaper way of improving performance.

High quality alfalfa hay alone often will provide adequate winter gains on growing animals. Average to poor quality alfalfa does require an energy supplement. In fact, poor alfalfa hay is not much better than average quality meadow hay. Whereas, chopping did not improve performance with meadow hay, calves on chopped alfalfa consumed more and gained considerably more than those on long hay.

Alfalfa also can be used effectively as a protein supplement for meadow hay. Two to three pounds of alfalfa will provide as much protein as a pound of cottonseed meal and fed with an energy level similar to the standard supplement in Table 3, will give similar gain responses.

In many livestock operations, supplements are used primarily in the winter for maintenance. In general, mature pregnant cows on a full feed of meadow hay or limited alfalfa do not need additional nutrients. However, lactating cows, first calf heifers and replacement heifers do on occasion need supplemental nutrients. The overall objective of most wintering programs is to get cows through as economically as possible in condition to calve, milk well and re-breed in the spring.

Grass-straw, a by-product of the grass seed industry, may provide beef producers with a cheap source of roughage for maintenance purposes and help grass producers recover the cost of removing the straw. Cows have been successfully wintered on grass straw-alfalfa mixes and on grass straw plus 0.7 pounds of cottonseed meal and 1.3 pounds of grain. Depending on straw quality and cattle condition going into the winter, ratios of 4:1 to 1:1 of grass straw to alfalfa will adequately maintain pregnant cows. Lactating cows require about a 1:2 ratio.

CONVENIENCE FEEDING

The supplement programs described to this point have involved daily feeding of animals by hand. They are not always practical or possible, particularly on the large expanses of western range land. For one reason or another, many producers cannot or will not feed a supplement unless it can be fed free choice at infrequent intervals. Supplemental programs based on free choice with controlled consumption of the supplement are desirable. Many vehicles for feeding supplement *ad lib* have been tried, including blocks, pellets, salt controls, liquid feeds, etc., but none has been totally satisfactory in terms of controlling intake at the desired levels.

Alternate Feeding

Every other day and every fourth day supplement regimes have been tested against daily supplementation and compared to no supplement on range. Yearling steers were utilized for these trials and the supplement schedules followed the one presented in Table 1. Those receiving supplements every other day and every fourth day received the same total amount of supplement as those fed daily.

Table 4 presents gain data from alternate feeding trials started in late May. Steers fed daily outgained either those fed every other day or every fourth day. Gain data between every other and every fourth day are variable with little difference between the two.

Table 4. Gain data

Treatment	Initial wt 5/25	ADG Accumulative 6/24	7/22	8/19	Last period 7/22 - 8/19
	lb	lb	lb	lb	lb
Control	604	3.03	2.40	1.93	0.96
Daily	587	3.13	2.76	2.38	1.61
Every other day	598	3.00	2.64	2.03	0.79
Every fourth day	623	3.03	2.62	2.15	1.18

In conjunction with these trials, steers were put on these same supplement treatments, except supplements were started July 15. These animals gained 1.75, 0.93 and 0.93 pounds per day on daily, every other and every fourth day supplemental feeding, respectively. Controls gained 0.96 during this time (Table 4). These data show that early supplementation did not adversely affect gains on animals supplemented later in the summer, and that daily supplementation was far superior to alternate feeding. In fact, late in the summer alternate feeding did not appear to improve gains over those receiving no supplement. This would likely hold true for winter supplementation. Daily supplemental energy during the winter probably would be more critical in terms of animal performance than it is on range. These data indicate that a method of feeding supplements must be devised so that animals receive their supplements daily.

Salt Control

Salt has been used to control intake of supplements since the early 1930s with varying success. In general, to regulate daily consumption of calves for a supplemental level of 2 to 3 pounds, it takes about 20 percent salt mix and for older animals 25 to 35 percent. However, more salt is required as the grazing season advances and also as the animals become more tolerant of the salt. With decreasing forage quality and quantity, salt level has to be increased to regulate intake. Salt concentrations frequently need to exceed 50 percent to adequately control intake. The cost of salt and the handling and mixing of it can be prohibitive in a supplement program.

Salt control offers a possible benefit over other supplemental methods. Aggressive animals do not consume all the supplement, which allows the more timid and smaller animals an opportunity to eat. Extremely high levels of daily salt levels can be tolerated by animals without affecting health, as long as an adequate water supply is available. Daily intake of salt has exceeded 2 1/2 pounds per day without ill effects in feedlot animals and cows.

Despite the lack of ill effects healthwise, the use of salt to control intake seems to consistently reduce daily gains of animals as compared to hand feeding. The lack of absolute control of the supplemental intake is part of it, but animals penned each day or fed a set amount of supplement in lots with and without salt also indicate that the amount of salt necessary to control intake reduces daily gains. One exception, when salt seems to improve daily gains slightly, is in early spring when grass is very lush.

Adding various ingredients such as urea, bonemeal, fat, etc., to salt to help regulate feed intake has not proven satisfactory. Intake is reduced for a short period, but as soon as animals become accustomed to the new mix their intake increases. This is similar to what is found with salt alone.

Biuret offers some unique possibilities for salt control in that it is neither liked nor disliked by livestock. This means that intake can be controlled by mixing it with another material which is consumed at a given rate and adjusting the biuret level accordingly to fit the needs of the animal. Therefore, in situations where salt consumption is recorded or can be predicted, a salt-biuret mix may offer an alternative to hand feeding when a protein source alone is required. However, there are not many situations where a protein supplement is needed without an energy source.

In most cases, nitrogen alone does not provide a very good response from supplementation. Also, salt consumption is hard to predict with any great accuracy. It varies from year to year, day to day, pasture to pasture, animal to animal, etc., and depends on forage quality, quantity, type, maturity and other factors such as previous salt consumption and weather. Salt content of the feed and water also have an effect. Adjustments on these types of supplement programs have to be made frequently and it is very difficult to get a constant daily intake of supplement at the levels desired. Although salt does work in some situations, it certainly is not the answer to controlling intake.

Liquid Feeds

Feeding molasses as a supplement to cattle has been practiced since 1850, and urea with molasses since about 1950. Liquid feeds offer many benefits, including improved feed palatability and masking of undesirable flavors, consistent distribution of urea, high phosphorus availability, less waste, convenience, animal accessibility and for mixing of top dressings, improved feed penetration, improved feed texture and reduced dust and wind loss. Liquid feeds also serve as a vehicle for feeding medicaments, vitamins, minerals, antibiotics and other feed additives. Liquid supplements are easily mechanized with materials being handled by pumps from tanks, which allows rapid dissemination with little hand labor.

Problems connected with liquid feeds include controlling the consumption level on a herd basis, uniform consumption by individual animals, difficulty in maintaining uniformity of product, equipment cost and weather changes, particularly cold weather, which disrupt intake patterns. Overconsumption of urea-molasses products caused by lack of feed, ice or snow covered feed, insufficient water, letting cattle have access to liquid feed prior to feeding hay, etc., can be a major problem and cause digestive disturbances, diarrhea, inefficient animal performance and possibly death. Calcium can be a problem ingredient, particularly in feedlots, because it is not soluble and is difficult to suspend in liquids. High levels of phosphoric acid or salt, used for intake control, may result in corrosion of metals, particularly in conjunction with water condensation and subsequent dilution.

Total energy intake also can be a problem with liquid feeds. Molasses is a good source of energy (about 88 percent of the energy value of barley), however, most liquid feeds contain only 50 to 70 percent molasses. This low level of energy restricts urea utilization, particularly in high roughage situations, and leads to poor animal performance. In supplement schedules that call for 2 to 3 pounds of barley, it would require 3 to 7 pounds of liquid supplement to supply equal energy. In general, when a supplement exceeds 3 pounds, roughage intake is reduced. Also, liquid supplements become very expensive at these levels. Fats, both animal and vegetable, and alcohols, both ethyl and propylene glycol, have been added to liquid supplements as a way to increase energy in liquid supplements. The price of these additions is often prohibitive to wide scale use.

Results of a limited number of trials on range, irrigated pasture and meadowland pasture have not been very encouraging. In one trial, yearling steers were grazed on crested wheatgrass range during May, June and July on a 15 percent protein liquid (urea-molasses) supplement provided free choice in a lick wheel feeder. Intake of the supplement was variable, ranging from 0 to 5.6 pounds per head per day. Daily intake averaged 2.1 pounds. Steers receiving liquid feed gained 2.70 pounds per head per day, which was less than those receiving no supplement at all. Daily hand-fed supplemented animals gained 3.00 pounds per head per day on an average intake of 0.84 pounds.

In another trial with steers grazing on native meadowland, steers receiving no supplement from May 22 to July 21 gained 2.07 pounds per day as compared to 2.25 pounds on a hand fed dry feed supplement similar to that shown in Table 1. Steers on a liquid (molasses-urea) supplement gained only 1.93 pounds. Consumption of the liquid was very sporadic and steers maintained a very loose scours-like condition.

Gains from steers on a clover-fescue irrigated pasture on various supplement regimes are presented in Table 5. This trial ran for a period of 102 days. All forms of supplementation resulted in increased gains over controls. The propylene glycol increased gains over controls by 30 percent, barley increased gains 10 percent and vegetable oil 6 percent. However, intake was quite high on the propylene glycol and costs of this supplement would not put it in a favorable position.

Table 5. Steer gains on clover fescue irrigated pastures

Energy supplement	No.	Average daily gain	Daily supplement consumption
		Pound	Pound
Control - no supplement	11	1.69	0
Molasses + 20% vegetable oil	11	1.79	2.5
Barley	11	1.86	2.2
Molasses + 20% propylene glycol	11	2.19	4.9

Gains on a 30 percent glycol-molasses supplement also looked promising on a range trial with steers on crested wheatgrass. Animal numbers were low and the trial only lasted 63 days, so it is difficult to draw conclusions. But the propylene glycol group gained 2.92 pounds per day as compared to 2.73 pounds on a stabilized fat-molasses mix and 25 percent propionate. A barley-biuret hand fed group on the standard supplement shown in Table 1 gained only 2.81 pounds per day and those receiving no supplement gain 2.76. There were only 4 animals per treatment. However, a propylene glycol addition to molasses does seem to improve animal performance. Intake has been higher than is desirable and this product is very expensive.

Most of the winter trials using molasses supplements have been conducted with mature cows on ryegrass straw. However, one trial was conducted using weaner calves over 177 days with 35 calves per treatment. A control ration of 3.3 pounds of a barley-biuret mix was compared to a molasses-vegetable oil liquid supplement. Both supplements contained about 30 percent protein. Control animals gained 0.83 pounds per day and those on liquid supplement gained only 0.23 pounds. Intake of the liquid was low, starting at about 0.34 pounds per day and approaching 1.00 pound by the end of the trial. The overall average was 0.62 pounds per head per day. Cold weather severely reduced intake, due to thickening of the liquid, early in the trial. This problem was finally solved by formulation. These calves were on bunched hay during most of the trial and were forced to clean it up which explains their relative low gains. Calves without a supplement probably would have gained about the same as those on the liquid.

Results of a trial conducted with spring calving cows wintered on ryegrass straw are presented in Table 6. The trial ran for 84 days. All supplements contained 20 percent protein. The barley-biuret supplement was hand fed daily while the liquid supplements were fed free choice from lick-wheel feeders. Intake of the molasses supplement was extremely erratic (0.5 to 9.5 pounds per day) and had to be controlled. Some wheel adjustments were made, such as reducing wheel numbers and width, but in the case of the molasses-vegetable oil group it was necessary to hand feed it towards the end of the trial. It became thick and viscous on cold days, and would not work in the lick wheels. Using an open container created gross over consumption.

Table 6. Data on cows fed ryegrass straw plus supplements

Treatment	No.	Intake: Ryegrass	Intake: Supplement	Average daily gain
		lb	lb	lb
Barley-biuret	28	19.8	2.2	0.42
Standard molasses-urea	28	12.9	3.4	0.10
Molasses+propylene glycol	28	13.4	3.1	0.29
Molasses+vegetable oil	28	15.0	4.3	-0.14

All molasses supplements reduced straw intake, which is reflected in the daily gains. Controls gained more on less supplement. Cattle on the molasses supplements were attempting to graze stubble, which was not available to the control group, so their ryegrass consumption may be misleading.

In general, gains were acceptable on straw with a modest supplement for this class of animal. To get satisfactory results from straw feeding, it is important that no picking from the meadows be available.

A study involving 18 head of spring calving cows and 30 replacement heifers was conducted to test protein level (urea) as a means of limiting liquid intake from lick wheels and to test it with varying qualities of hay. Urea was used to provide supplemental protein levels of 30, 45 and 60 percent.

Protein levels (urea) were effective in limiting liquid supplement intake without affecting the roughage intake (Table 7). Intake of the 30 percent supplement may have been high enough to reduce roughage intake slightly. Higher supplemental intake would have reduced roughage intake. These data also point out how much quality of roughage affects intake of liquid feeds. Intake of liquid feed was low on the improved hay and more than doubled when cows were put on meadow hay. Intake of liquid feed increased another 1 1/2 times when cows were switched to ryegrass straw. Then, when cows were put back on the improved hay, supplemental intake dropped back down to the levels at the start of the trial, with the exception of the 30 percent level which went well below that.

Table 7. Roughage + liquid supplement intake of cattle on varying levels of protein (urea) in liquid supplements

Roughage	Protein content of roughage	Days	Roughage-liquid supplement intake Protein level of supplement 30%	 45%	 60%
	%		lb	lb	lb
Improved hay	10	14	21.4-1.0	22.8-0.4	22.3-0.1
Meadow hay	7	14	20.5-2.3	22.4-0.8	21.7-0.4
Ryegrass straw	5	56	19.6-3.2	20.0-1.3	20.0-0.8
Improved hay	10	7	24.9-0.2	26.4-0.2	26.1-0.1
Combined		91	20.4-2.6	21.3-1.0	21.1-0.6

Gain data in Table 8 show that animals performed better on the 30 percent supplement than either 45 or 60 percent, which were about equal. The mature cows were in good condition going onto the trial and were still in thrifty condition at the end of the trial. For this type of animal, straw plus any of these supplements for this period of time would be adequate. The heifers did not grow the way they should. This type of diet would not be advisable for growing animals.

Table 8. Gain data

Class of animal	No.	Protein level of supplement 30%	45%	60%
		Average daily gain		
		lb	lb	lb
Pregnant cows	18	0.52	-0.13	-0.06
Replacement heifers	30	-0.31	-0.55	-0.61
Combined	48	-0.05	-0.42	-0.39

Other trials have been conducted utilizing straw for wintering the cow herd. Fall calving cows fed on one part alfalfa and two parts ryegrass straw consumed 16.7 pounds of straw and 8.7 pounds of alfalfa hay and replacement heifers fed two parts alfalfa to one part ryegrass straw all wintered well and bred back in a normal manner. Other trials with spring calving cows utilizing ryegrass straw plus 4 pounds of alfalfa or 2 pounds of a concentrate have been successful. Straw can be effectively used for wintering cattle during the winter, particularly those on a maintenance diet. Liquid feeds create some problems but do offer some potential in this area.

Properly used with the right class of animals, liquid supplements can be as effective as any other supplement type as long as needed nutrients are provided. Some managerial and nutritional problems must be worked out, particularly continual availability of hay, regular feeding, intake control and energy level, before their optimum value is reached. Liquid supplements are not always the best buy in terms of nutrients or cost and any supplement containing urea should be used with caution.

Blocks

Blocks of various types offer many of the same advantages and disadvantages as liquid feeds. Blocks can serve as a vehicle for non-protein nitrogen, medicaments, antibiotics, vitamins, minerals and other feed additives in addition to masking undesirable flavors, cutting waste, reducing dust and providing a certain amount of convenience. As with other supplementation methods, with the exception of hand feeding, controlling intake, both on a group basis and between individual animals is the biggest problem with blocks. Intake control measures in blocks are primarily through the ingredients and/or the physical characteristics of the block.

Results from range studies utilizing blocks have not been encouraging. A block study was attempted on range with yearling steers to replace the hand feeding of the standard supplementation schedule in Table 1. Three types of blocks were used, a high energy-low protein, a 50-50 energy-protein block and a high energy-high protein block for early, middle and late season grazing, respectively. Intake over the 77-day trial of blocks was much higher than desirable: 2.38 pounds per day as compared to 0.84 pounds on the hand fed supplement. Gains of steers on blocks were only 2.70 pounds per day as compared to 3.00 pounds on the standard supplement.

In a block study similar to the one described above, paper-wrapped blocks were compared to unwrapped blocks and moved various distances from water, in an attempt to control intake. Wrapping had no effect and distance from water did not effectively reduce intake to the desired levels, even one mile from water. Block intakes on this study exceeded 4 pounds per day per head until the blocks were moved four-fifths of a mile from water and then only reduced to 3.6 pounds. At one mile from water, intake of the blocks was 2.9 pounds. This study was strictly consumption study and no comparison to hand fed supplements was made. Daily gains over 66 days were only 1.28 pounds per head per day. The animals appeared to spend too much time working on the blocks and, therefore, reduced their grazing time and the areas grazed. Consistency of these blocks was poor as length, weight and density varied considerably from block to block.

High protein (100 percent) - vitamin - mineral blocks were tested and compared to the supplement described in Table 3 for wintering weaner calves and yearling heifers. No difference was seen in the daily gain of animals fed the blocks or no supplement, with both gaining 0.40 pounds per head per day. The hand fed group gained 1.09 pounds per head per day. These data point out that growing animals on meadow hay need additional energy as well as nitrogen. Intake of the block varied from 0 to 0.25 pounds per day. Daily intake was extremely variable and quite low.

Weaner calves (102) were put on a 177-day study to compare a crystallized molasses-combination animal and vegetable fat block in which cattle eat the container as well and a molasses-combination of animal and vegetable fat soft blocks to a standard barley-biuret hand fed supplement. Protein content of the standard supplement and soft block was 30 percent and 17 percent on the crystallized molasses block. Table 9 presents intake and gain data. Control animals were fed 3.3 pounds daily and gained 0.83 pounds. Daily gains were lower than usual because these calves were on rake bunched hay most of the trial. This class of animal does not do well on the rake-bunched hay when forced to clean it up. The animals on the soft blocks started out consuming 1.36 pounds per head per day and ended up at more than 7 pounds. Average consumption was 4.4 pounds and daily gain 0.58 pounds per head per day. Average intake of the crystallized molasses blocks was 1.5 pounds per day, starting at 1 pound and going to 2.3. Daily gains were 0.23 pounds per head per day.

Table 9. Intake and gain data on a winter block study

Treatment	Initial weight	Supplement intake	Average daily gain
	pound	pound	pound
Barley-biuret mix	328	3.3	0.83
Crystallized molasses fat block	330	1.5	0.23
Molasses-fat-soft-block	326	4.4	0.58

The crystallized molasses block does offer some promise for intake control. It may look more encouraging when used under proper circumstances and with a mix that fits the class of animal being fed. In this case, consumption was too low and the calves spent too much time at the blocks, rather than eating hay. The cold weather caused the block to be quite hard. Also, the protein level was too low in this block for this class of animal. Performance was poor and probably no better than calves with no supplement.

The soft block was consumed too easily and readily. Intake values were high enough to reduce roughage intake and performance was very poor for this level of intake.

Blocks can be an effective supplement method when properly produced and utilized. However, as with all the other free choice supplement methods, intake is still a major problem and more work needs to be done on this.

SUMMARY

This paper presented a wide array of studies conducted on the Squaw Butte Station with various supplements. It was not the intent to go into great detail on each study or method of supplementation. In some cases, the supplements were not being used in a manner which would give the best results. However, these studies do point out some of the problems encountered and things that have to be considered when feeding supplements by any of these methods.

Daily hand feeding of supplements is still the preferred method, where possible. However, this doesn't fit into all management schemes or situations. Cost, ease of handling, mixing and feeding facilities all have to be considered along with the manager's abilities. Mechanics and cost of supplementation have to be determined in each individual situation. Salt control, blocks, liquids, pellets, etc., all offer alternatives to hand feeding in specific instances.

The relative advantages of each kind of supplement need to be evaluated to determine where it fits into the livestock program. Final costs of production are more important than out of pocket feed costs. Consider the feeds available, the nutrients required by the animals and compare the supplements available which will supply the proper nutrients at the best price. The supplement which is cheapest may not be the most profitable to feed in terms of animal performance per unit of cost. Safety, nutrient adequacy and management must be considered along with cost before making the decision to feed one type of supplement or another.