FEEDING MANAGEMENT OF THE BEEF COW

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INTRODUCTION

The feeding management of the beef cowherd must necessarily be based on economy of production. A sufficient return must be obtained to offset any added input. Generally there is a relatively small increment of variation in productive performance when feeding levels are varied from sub-optimum to optimum to super-optimum levels. This does not imply that there are no significant differences in performance at different nutritional levels, however, the level of performance and the level of nutrition are not in exact relative proportions.

The beef cow has the ability to adapt to widely variable feeding regimes. This ability is probably the reason such variations exist throughout the industry. It is not uncommon for two different cowherds to have similar production performance while maintained at considerably different nutritional levels. Some cowherds are maintained on high quality forage and considerable concentrate supplementation at maximum daily consumption during the wintering phase. The other extreme is that of cows receiving minimal amounts of poor quality forage as the only source of winter nutrients.

There is as much variation in cowherd management as there is in feeding management. For instance, there are fall-calving and spring-calving cowherds. There are cows grazing rangeland requiring 10 - 20 or more acres per cow and calf while there are other cowherds on tame pasture, with intensive management, requiring very few acres per cow and calf. The non-uniformity in cowherd management precludes the feasibility of an attempt to summarize all the recent research which has been conducted in the feeding management of beef cows.

A majority of the beef cows in the United States are on a spring-calving program and are maintained throughout the year on native rangeland at the allocation of 10 to 25 acres per cow and calf. These cows usually have only natural occurring protection from climatic conditions for most of the year. Since this type of cowherd operation is the most common, particularly in the cow-country of the true prairie and great plains, it will be the primary subject of this report. However, brief mention will be made concerning some feeding management aspects of other common cowherd management practices.

The Basic Ration of the Beef Cow

The beef cow is primarily a forage consumer. She can utilize forage of practically any quality in producing animal protein, in the form of a calf, and at the same time maintain her own body in a functionally reproductive state.

This ability is the direct result of micro-organismic action in the cows rumen whereby cellulose and other carbohydrates are broken down to short chain or volatile fatty acids (VFA's). These VFA's are then used by the microbes, in combination with nitrogen from either a protein or non-protein source, to synthesis their own protein.

As the ingesta passes from the rumen to the omasum and abomasum some of the micro-organisms are carried with it. The micro-organisms are digested by the cow and yield high quality protein for the cow's assimilation. The quality of the microbial protein is such that no response to date has been obtained by the addition of essential amino acids to the ruminant diet.

According to Annison and Lewis (1959), the VFA's produced by the microbes in cellulose digestion are the main energy source for the cow. This assumption is based on the fact that the less complex carbohydrates, as well as cellulose, are readily attacked by the rumen micro-organisms.

Realizing that the diet of the beef cow is predominantly forage and that most of this consists of native grasses, it is appropriate to point out that the quality and quantity of the forage varies considerably due to seasonal changes. Forage quality and quantity varies from year to year depending on prevailing climatic conditions.

During part of the year, specifically late spring and the first three-fourths of summer, the available forage is usually all the cow needs to meet her nutritional requirements. However, at other times there must be adequate supplementation to insure a ration adequate for her requirements. During years of below average rainfall, the volume of forage may be deficient throughout the year.

In a New Mexico study it was found that the calf crop was reduced by 15 percent in a drouth year compared to years of average rainfall (Knox and Watkins, 1958). Calf crop was reduced 14 percent by heavy grazing as compared to light grazing in a Montana investigation (Marsh et al, 1959). In a trial with steers on native pasture, Kansas workers noted that late summer gains were depressed and that energy supplementation was beneficial in maintaining gains (Smith and Cox, 1953).

When beef cows received sufficient amounts of dry-cured native grass in an Oklahoma trial, it was found that they did not respond significantly to added energy during the wintering period (Zimmerman et al, 1959). It was also pointed out by these workers that the cost of winter supplemental feed is usually the largest cash out-lay in a cow-calf enterprise.

Effects of different levels of winter feeding of a spring-calving cowherd can best be measured by variations in percent calf crop, regularity of breeding, longevity of the cow, calving date, birth weight of calves, weaning weight of calves and calf survival rate from birth to weaning. These performance traits can logically be separated into reproduction traits and production traits. The reproduction traits would include; percent calf crop, regularity of breeding, calving date (influenced by the interval length from calving to rebreeding), and longevity or productive lifetime of the cow. The production traits include; birth weight, weaning weight and survival rate of the calves and mature cow weight.

EFFECTS OF WINTER FEEDING LEVEL ON REPRODUCTION TRAITS

The immature beef female, up to about four years of age, has nutritional requirements for growth. This requirement is in addition to the requirements for maintenance and reproduction. Winter nutrition of the young beef cow deserves separate consideration because of this additional requirement.

Pinney et al (1960), investigated the effects of different levels of winter supplementation on reproductive performance for; first, second, and third calving cows. Three levels of feeding were used to establish predetermined body weight changes. The period of supplementation was from November 1, to April 18, and included parturition with its accompanying weight loss.

The feeding levels were designated as; low, medium and high. The body weight losses desired were; 20 percent, 10 percent and none, for the low, medium, and high levels respectively. In all cases the losses were slightly greater than anticipated. Changes in body weights were calculated, using November and April weights.

In this study it was found that young beef cows on the low level had; longer calving intervals, lower conception rates, and later average calving dates than the medium or high level cows. This difference was most pronounced in first calf heifers and diminished as the cows approached maturity. The nutritional requirements for growth of the first-calf heifers was undoubtedly responsible for this trend.

The cows on the high level tended to encounter more calving difficulties, especially the two-year-olds calving for the first time. As the cows approached maturity and by the time of third calf the variation between groups in percent calf crop declined considerably. The low level cows continued to have the lowest percent calf crop and the longest interval between calving and rebreeding.

The period between weaning and first breeding, at about 13 months of age for heifers calving at two years of age, is critical to the growing and developing beef heifer. Not only must nutritive demands for growth be met, but the heifer must reach puberty and start cycling regularly before the start of the breeding season.

In order to determine the effects of varying levels of nutrition during the two winters between weaning and first-calving on reproduction traits, an experiment was conducted by Smithson et al (1964) at the Oklahoma Station. Three levels of winter nutrition based on desired body weight changes were used. The feeding levels were designated as low, moderate and high. Desired weight changes during the first winter as weaner heifers were; no gain, approximately 100 pounds gain and approximately 168 pounds gain for the low, moderate and high groups respectively. During the second winter, after a summer of grazing good pasture, the desired weight changes were; 150-175 pounds loss, 50 pounds loss, and no weight change for the low, moderate and high groups respectively.

Following the first two winters all heifers were maintained on the moderate level. The data concerning body weight changes are presented in Table 1. When all of the heifers received the moderate level, the winter weight losses were inversely proportional to previous weight losses. This suggested that if heifers are given the opportunity, compensatory growth can practically offset early growth repression.

The results of the experiment were somewhat inconclusive since no large variations in traits measured occurred. However, it appeared that the average calving date and percent calf crop were improved as the winter nutritional level was increased. Birth weights and weaning weights for the first calf crop were also improved by additional winter nutrition.

Table 1. Effect of Winter Feed Level for Beef Females on Weight Change.*

Feed Level	Low	Moderate	High
Av. Wt. Change, lbs.			
Initial Weight	438	438	438
8 to 18 Months of age			
Winter gains	-26	97	147
Summer gains	355	314	277
Net yearly change	329	411	424
19 to 30 Months of age			
Winter gains	-193	-128	-67
Summer gains	237	187	141
Net yearly change	44	59	74
31 to 43 Months of age			
Winter gains	-120	-166	-207
Summer gains	205	251	257
Net yearly change	85	85	50
Fall weight			
43 Months of age	991	1000	1022

*Smithson et al (1964)

The second calf crop followed the winter of all moderate level feeding. The calves from the original low level cows had the heaviest birth and weaning weights, indicating again compensatory effects. Table 2 includes the summary of the reproduction data from this trial.

Probably the main effect of the first winter at a low level of nutrition is to delay the onset of puberty and, as a result, delay conception and average calving date as two-year-olds. Compensatory gains on good summer pasture can offset the winter losses. The summer gains are usually inversely related to preceding winter gains.

Table 2. Effect of Winter Feed Level on Reproductive Performance.*

Feed Level	Low	Moderate	High
Average calving date			
First calf	4/3	3/19	3/12
Second calf	4/6	3/26	3/1
Percent calf crop			
First calf	65	70	72
Second calf	73	76	62
Average birth weight (lbs.)			
First calf	65	71	72
Second calf	81	79	76
Average weaning weight (lbs.)			
First calf	388	408	412
Second calf	444	424	425

*Smithson et al (1964)

Bedrak et al (1969) observed an emaciated condition and low reproductive performance in beef cows grazing pastures low in protein during the winter in Florida. A supplement of cottonseed meal improved the condition and reproductive performance in these cows. An experiment was designed to investigate the effect of varying levels of supplemental protein on performance of beef cows.

Four groups of cows were fed rations having the crude protein content as the only variable. All other nutrients were estimated to be adequate for a daily gain of 0.75 to 1.00 pound. The cows were two-year-old heifers being bred to calve at three years of age. The rations supplied the following pounds of crude protein per cow daily; 1.34, 1.06, 0.71 and 0.62 for groups 1, 2, 3 and 4, respectively. Groups 1 and 2 gained 0.75 and 0.52 pound and group 3 and 4 lost 0.07 and 0.23 pound per day respectively.

Prior to the experiments, the heifers were on feeding trials where they were offered adequate levels of protein and energy over periods of 90 to 120 days and checked for estrus twice daily. During the breeding period, which began on the 113th day of the experiment, all heifers were bred at next estrus. Heifers which did not return in estrus were slaughtered 44 days following breeding. Those which returned in estrus following the first mating were rebred a second time and slaughtered after 44 days if they did not return in estrus. Heifers bred at the third estrus period were killed three days following the last breeding. Heifers which did not show estrus were slaughtered at random times with other experimental animals.

Reproductive performance for groups 1, 2 and 3 were not significantly different. However, group 4 appeared to have a depressed reproductive performance as indicated by a longer interval to first estrus and fewer estrus cycles.

Rumen filtrate was sampled at slaughter and it appeared that the level of protein intake had a direct effect on cellulose digestion. Those cows consuming higher levels of protein had increased feed utilization as compared to those on low protein intake.

From the results of this trial it appears that supplemental protein will help maintain gain and condition. However, it is doubtful if any reproductive response was exhibited in this experiment to added protein in the diet of these cows. A summary of the daily gain data is presented in Table 3.

Mature cows do not have the growth requirements for nutrients of young beef females. Growth has essentially been completed by four or five years of age in the beef cow.

Table 3. Effect of Protein Intake on Average Daily Gain of Two-Year-Old Beef Heifers.*

Group No.	Daily Crude Protein Intake (lb.)	Average Initial Weight (lb.)	Average Final Weight (lb.)	Average Daily Gain for 168 Days (lb.)
1	1.34	654	793	0.75
2	1.06	660	750	0.52
3	0.71	686	674	-0.07
4	0.62	697	640	-0.23

*Bedrak et al (1969)

Wiltbank et al (1962) studied the importance of energy in reproduction of mature cows. An experiment was designed to test the effect of feeding two levels of energy either before or after calving on reproductive performance. Protein, calcium, phosporous, and vitamin A were supplied in excess of the National Research Council (1963) recommendations. The cows were placed on experiment approximately 140 days prior to calving.

The cows were divided into four groups referred to as; high-high, high-low, low-high and low-low. The first designation refers to the relative amount of feed provided before calving and second to the feeding level after calving. The high level ration before calving contained approximately 9.0 pounds of T.D.N. and 1.43 pounds of digestible protein, while the low level contained 4.5 pounds of T.D.N. and 0.93 pounds of digestible protein. After calving the high ration had 16.0 pounds of T.D.N. and 1.90 pounds of digestible protein and the low had 8.0 pounds of T.D.N. and 1.76 pounds of digestible protein.

The level of energy intake both before and after calving had significant effect on reproduction. The reproductive traits noted as being affected were; interval between calving and first estrus, conception rate, number of services per conception, and number of cows bred which did not conceive.

As shown in Table 4, the cows on the high-high regime had the fewest number of services per conception and a larger percent of cows conceiving on first and second service. The low-high group was next in reproductive performance, the high-low group was third and the low-low group had the poorest reproductive performance. There were significantly more of the "low-low" cows that failed to exhibit estrus and they had the largest number of services per conception.

Table 4. Effect of Energy on Occurrence of Estrus and Conception Rate.*

Feeding Level	Interval Calving to First Estrus (days)	Not Showing Estrus (%)	Bred Not Conceiving (%)	Conceived (%) (service) 1st	2nd	3rd
High-high	48	0	5	67	95	95
High-low	43	14	10	42	74	84
Low-high	65	5	0	65	75	100
Low-low	52	78	33	33	50	67

*Wiltbank et al (1962)

With the results of all possible combinations of these various energy levels, it appears that energy supplementation is more critical than protein for mature cows. The period after calving, until ample grass is available, is the most critical. Heaviest supplementation should occur after calving for best reproductive performance. Flushing cows (cows gaining weight) after calving improved reproductive performance.

In a subsequent trial, Wiltbank et al (mimeo) studied the effect of level of energy intake after calving on reproductive performance. The rations used in this experiment were calculated to equal; 0.75 the N.R.C. maintenance requirements, total N.R.C. maintenance requirements, and full feeding. It was found that cows receiving higher levels of nutrition gained body weight faster and had improved reproductive performance. The reproductive traits showing improvement were; conception rate, interval from first calving to estrus and occurrence of estrus. A summary of the reproductive performance data from this experiment is presented in Table 5.

Table 5. Influence of Postpartum Energy Intake on Reproductive Performance of Hereford Cows.*

Ration	Showing Estrus Days After Calving				Not Showing Estrus	Cows Diagnosed Pregnant	Cows Not Pregnant	
	50 (%)	70 (%)	90 (%)	110 (%)	(%)	(%)	No Estrus (%)	Bred (%)
3/4 Main.	7	43	64	71	21	72	21	7
Main.	57	78	93	93	7	79	7	14
Full-fed	15	46	77	92	8	92	8	0

*Wiltbank (Mimeo)

The results indicate a close correlation between body weight gain and reproductive efficiency in beef cows. In the Year Book of Agriculture (1939) Friedman and Turner state that reproductive performance appears to be closely related with adequate nutrition for good growth in the young and general good health in mature animals. Any nutrient deficiency which causes reduced growth or poor general health will cause reproduction problems.

In a beef breeding herd where less than one calf is marketed per cow each year a large portion of the feed intake goes for maintenance of the cow and calf and is not returned in product. Through research it has been shown that the maintenance requirements for an animal is related to its size. Also, it has been shown that the effect of winter body weight change on reproductive performance depends to a degree on the condition or fatness of the cow going into the winter. The National Research Council (1963) has expressed the nutrient requirements of mature, pregnant cows on the basis of an average weight of 477 kg. for the major beef breeds.

Research was conducted by Klosterman et al (1968) and Kress et al (1969) to determine the effect of cow size and condition upon maintenance requirements and efficiency. It was found that a direct relationship exists between a weight-height ratio (W/H ratio) and the degree of fatness in beef cows. When this W/H ratio principle was applied to the feeding management of winter supplemental feed it was found that some adjustment might be necessary in N.R.C. recommendations according to the condition of the cow.

Cows that had a high degree of finish tended to gain weight while thin cows lost weight when the amount of energy fed was based on their metabolic body size. These experiments indicate that an accurate description of the amount of feed needed for the maintenance of an individual mature beef cow should be based on a measure of condition in addition to body weight. The concept of a simple ratio of weight to height would appear to be a relatively accurate method for determining the degree of condition in beef cows.

Kiracofe et al (1969) at the Kansas station designed an experiment to determine the effect of varying levels of winter nutrition on the reproductive traits of beef cows. The cows were maintained year-round on native bluestem pasture with three pounds of alfalfa per day from November 1, to May 1, as the basic ration. They were divided into four groups according to treatment. Rations consisting of; three pounds cracked milo and 1.5 pounds of soybean oil meal, or three pounds of cracked milo, or 1.5 pounds of soybean oil meal for groups 1, 2, and 3 respectively. Group 4 served as the control and received no supplementation in addition to the alfalfa hay.

The winter rations were formulated so group 1, the high energy and high protein ration, would approximately maintain the cows weight from November 1, to May 1. All other rations were designed to cause varying amounts of weight loss. As would be expected, the low energy and low protein content of the basal ration caused group 4 to encounter the greatest weight losses. No attempt was made to estimate the amount of winter pasture consumed.

The results of the trial indicate that conception rate was lowered and the interval from calving to conception was lengthened by low energy and low protein during the wintering phase. Table 6 shows the effect of the winter feeding levels on postpartum conception. Conception rate was highest for group 2. The interval between calving and conception was shortest for group 1 with group 2 and 3 intermediate and group 4 the longest.

It was noted in this trial that late calving cows having access to early growth of forage were less likely to exhibit differences in the reproductive traits. This may be a reason that Oklahoma and Nebraska work mentioned earlier in this report had some contradiction. The growing season in Oklahoma starts earlier in the spring and extends later into the fall than in Nebraska.

Table 6. Effect of Wintering Level on Reproductive Performance of Beef Cows.*

Winter Ration	Conception Rate (%)	Days from Calving to Conception
3.0 lb. Milo and 1.5 lb. SOM	92	52.0
3.0 lb. Milo	100	58.0
1.5 lb. SOM	91	59.2
Control	73	69.2

*Kiracofe et al (1969)

Theoretically, the maintenance of beef cows on native range during the entire year should be considered the natural environment. Even if this is true, it is not unreasonable to assume that sub-optimum range conditions could develop in years when climatic conditions are other than normal. Rainfall is a climatic factor that varies considerably and has much influence over quantity and quality of forage produced in a given year.

In addition to energy and protein, the amount of carotene (vitamin A precurser) in range forage is affected by drouth. Pope et al (1958) in Oklahoma found no advantage in favor of vitamin A supplementation. However, even though there was no response in reproductive performance, it was noted that the blood and liver stores of vitamin A in the calves was drastically low at the end of three months. It was felt by these workers that extremely high levels of vitamin A had to be fed to the cow for any of it to pass to the calf via the milk.

Above average rainfall after the forage has matured in the fall tends to leach nutrients, especially minerals, from the winter feed supply. However, when Tillman et al (1959) fed weathered range grass to cows in dry lot for 172 days no benefit was found with mineral supplementation. Their speculation was that when energy and protein were adequate, using grain as a source of the supplemental nutrients, the mineral requirements were met.

EFFECT OF WINTER FEEDING LEVEL ON PRODUCTION TRAITS

The amount of feed required for maintenance of the cow and calf results in a relatively small return in product (pounds of calf weaned) from the annual feed consumed. The cow-calf operation is probably the least efficient of all livestock enterprises. Any practice which will result in returns above the cost of implementing the practice should be given a due amount of consideration by the producer.

The production traits which have been shown to be affected by wintering level are; calf birth weight, calf weaning weight, longevity of the cow and mature cow weight. All of these traits have a direct influence on the profit realized from a cow-calf operation. "Efficiency" seems to be the key word in industry today and the cow-calf operation is no exception.

The work of Kress et al (1969) at Wisconsin showed that the estimates of production efficiency used in the trial were negatively related to the ratio of weight to height at the withers, an estimate of fatness. The estimates of efficiency of production used here were the units of weaning weight equivalent per unit of TDN consumed by the cow and calf and units of actual weaning weight produced per unit of TDN.

If a portion of the variation in efficiency due to differences in fatness could be controlled by feeding practices, economy of production should be improved with less intense feeding of fleshy cows. Indications were that skeletally large and small cows are approximately equal in efficiency, provided they have equal weight to height ratios, with a possible advantage for the large cow. The fact was also pointed out that the calf from the larger cow has the genetic potential for more efficient post-weaning gains.

Ludwig et al (1967) reported a summary of performance of spring-calving cows wintered at different levels from weaning through seven calf crops. The experimental treatments employed were designed to result in selected winter weight change patterns as follows:

Low - No gain the first winter as calves, with a loss of approximately 20 percent of fall weight during subsequent winters as bred females.

Moderate - Gain of 0.5 lbs. per head daily the first winter as calves, with a loss of 10 percent of fall weight during subsequent winters as bred females.

High - Gain of 1.0 lb. per head daily the first winter as calves, with less than 10 percent loss of fall weight during subsequent winters as bred females.

Very High - Self-fed a 50 percent concentrate mixture during the first winter as calves and during subsequent winters as bred females.

It should be noted that these weight change patterns were changes from November to mid-April and included weight loss at calving and post-calving loss until green grass is ample in the spring.

As shown in Table 7, these workers found that cows on the low level produced calves with lighter birth and weaning weights than those on the medium or high levels. The very high regime resulted in birth weights lower than the moderate or high levels and equal to the low level. However, due to a shorter longevity and lower percent calf crop, the very high level caused a drastic reduction in total pounds of calf weaned for the seven calf crops.

It was also noted in this study, that even though the low level cows lost more weight during the winters, the compensatory gain during the summers resulted in similar mature weights between the low, moderate and high groups. The lower weaning weights in the very high group were probably due to a depression in milk production caused by fat deposition in the mammary glands.

Table 7. Performance of Beef Cows Wintered at Different Levels Through Seven Calf Crops.*

Treatment	Low	Moderate	High	Very High
Cows remaining after seven calf crops (%)	83.4	86.7	80.0	73.3
Percent calf crop weaned per treatment	86.3	88.3	85.9	83.7
Average birth weight (lbs.)	75	77	79	75
Total pounds of calf weaned	69,546	79,410	73,616	33,461

*Ludwig et al (1967)

Young cows appeared to show more pronounced response to the different levels of winter nutrition than mature cows. However, for the duration of the life-time study it seemed that the moderate level was most desirable under the conditions existing in Oklahoma.

In several trials conducted by Wiltbank, in Nebraska, to determine the effect of varying levels of winter nutrition on reproductive performance it was noted that low energy and low protein intake was accompanied by lighter birth and weaning weights. This feeding regime also caused greater winter weight losses in the cows but was compensated for by greater summer gains.

In the winter and during drouth years, forage intake is limited. Even when adequate quantity of forage is available, the quality is often low.

A study was conducted by Speth et al (1962) in southern Nevada to determine if dietary supplements could increase productivity of cows under adverse seasonal and climatic conditions. The cows in this experiment grazed semi-desert range during the entire year. The supplements were fed from November to May and the trial was of five year duration.

The treatments consisted of the following supplements: None (control), 1 pound of barley daily, 1 pound of either soybean or cottonseed oil meal daily, or 3 pounds of alfalfa. All supplements were pelleted. All cows were exposed to the same bull or bulls for any given year.

The cows receiving the control diet lost considerably more weight during the winters, had a much lower percentage of calves produced and lower calf weaning weights than cows in any of the other treatment groups. However, the cows receiving the commercial protein had a much higher incidence of calves born dead. Knox and Watkins (1958) reported calf losses at birth were increased when cows were fed a commercial protein supplement on range. Neither of these investigators attempted possible explanations for this phenomenon.

Cows receiving 3 pounds of alfalfa or 1 pound of barley had greater production per cow in pounds of calf weaned than either the control or protein supplemented groups. Annual weight changes of the cows due to treatment were not significant because cows having lost the most weight during the winter gained the most the following summer. A summary of this study is presented in Table 8.

Conner (1962) observed, by sampling range forage with rumen fistulated steers, that cattle change the relative amounts of grass and browse in the diet late in the summer. The browse tends to be higher in protein at this time. This may partially explain the lowered response to protein supplementation in favor of energy supplementation that has been noted by several researchers.

Table 8. The Effect of Dietary Supplements on Mature Cows and Weaning Weights of Their Calves.*

Supplement	None	Barley 1 lb.	Commercial Protein, 1 lb.	Alfalfa 3 lb.
Cows per treatment	60	58	61	59
Daily weight changes				
Winter (171 days)	-.21	0.03	0.14	0.09
Summer (184 days)	0.54	0.25	0.01	0.13
Yearly (355 days)	0.18	0.12	0.07	0.11
Cows calving, %	48.2	72.5	63.9	66.7
Calves born dead, %	3.3	0.0	16.7	1.7
Weaning weights, 6 mo.	264	298	289	288
Production per cow, lbs.	119	216	136	187

*Speth et al (1962)

Lighter weaning weights (caused by reduced milk flow), shorter productive life, and a reduction in pounds of calf weaned during a cows lifetime have been shown to accompany very high nutritional levels during development of beef heifers.

Pope (1965), noted an inverse relationship between very high nutrition during heifer development and longevity in the cowherd. On the other hand, it has been shown that a most critical period in the cows productive life is at time of first-calving. This is particularly true when first-calving occurs at two years of age. Limiting energy at this time has caused lighter birth weights, reduced milk production and lighter weaning weights, as well as delaying rebreeding. Also, since first estrus occurs at about 600 pounds of body weight, sufficient nutrition during the heifers first winter is mandatory if breeding for two-year-old calving is desired.

As cows mature the response to supplementation, on range providing adequate forage intake, is less pronounced. However, the quality of weathered forage is usually reduced to the point where at least a low to moderate level of supplementation would be desirable.

Supplementation of minerals or vitamins for beef cows under range was not considered in any of the experiments reviewed by the author. Calcium, phosphorous and vitamin A have been included in several dietary studies with no consistent or significant responses being observed. Tillman (1959) observed that cows on weathered range forage appeared to have glossier haircoats when supplemented with steam-bone meal but found no other measurable response.

FEEDING MANAGEMENT OF FALL-CALVING BEEF COWS

The nutritional requirements for cows suckling calves are considerably greater than for dry cows in gestation. The quality and quantity of range forage, the basic ration for most beef cows, is generally reduced in the winter compared to the summer. Fall-calving cows lactate during the winter and undergo the non-lactating phase of gestation in the summer. When all of these facts are combined they suggest that fall-calving is an unnatural reproductive schedule. Perhaps this is the reason the number of fall-calving cows compared to spring-calving cows is relatively small.

Usually fall-calving cows are losing body weight, due to lactation and lower available nutrition, at the time of rebreeding which occurs in early winter. It has been shown that better conception rates are associated with increasing body weight at breeding time (Wiltbank, mimeo). This might suggest fall-calving cows, compared to spring-calving cows, would have a lower percent calf crop. This is strictly speculation as none of the reviewed material compared calving percentage of spring-calving and fall-calving cowherds.

The effect of two levels of winter supplementation of fall-calving beef cows on productivity was studied by Furr et al (1959). The effect of creep-feeding when superimposed on these different levels of cow nutrition was investigated in the same experiment.

Two levels of winter feeding were used. The low level supplied 1.5 pounds of cottonseed meal and the high level provided 2.5 pounds of cottonseed meal and 3.0 pounds of ground milo per head daily. All of the cows received the supplemental rations from October 30, to April 18. The supplement was fed in bunks every other day, at twice the daily amount.

The creep-feed mixture consisted of 55 percent rolled milo, 30 percent whole oats, 10 percent cottonseed meal, and 5 percent cane molasses. One-half of the calves from both the low and high cows had access to the creep. This trial was continued for four years and then the results were averaged.

The cows on the high level of winter supplementation had the least body weight loss during the winter and their calves had heavier weaning weights compared to the low level group. However, the yearly change in cow weight did not differ significantly between groups. The heavier weaning weights in the high group did not offset the cost of the additional feed consumed by the cow. If the average calving date is used as an indicator, this study suggests that winter feeding levels had no effect on reproductive performance. This is shown by a summary of the results of the study in Table 9.

Creep-feeding the calves caused an increase in weaning weights of the calves but had no effect on the birth weights of subsequent calves. The cost of creep-feeding resulted in less profit per cow than those not creep-fed.

The results of this rather thorough investigation showed that the high level of cow supplementation and creep-feeding of the calves resulted in heavier weaning weights. In years of sub-normal range condition or higher market prices for the calves this practice might be profitable. Nevertheless, in this experiment the low level of supplementation and non-creep-feeding was the most economically desirable.

The experimental data indicate that wintering fall-calving cows at a low level of supplementation and creep-feeding the calves results in more economical gains for the calf than the gains from feeding high levels of supplementation to the cow. Reproductive and productive performance in the fall-calving cowherd is only slightly improved by a high level of winter supplementation if adequate forage is available.

Table 9. Effect of Level of Supplemental Winter Feeding of Beef Cows and Creep-Feeding Fall Calves. (Four year average).*

Cow Treatment Creep-fed	Low No	Low Yes	High No	High Yes
No. of cows raising calves	69	62	69	69
Av. weight per cow (lbs.)				
Initial	1080	1119	1098	1124
Spring	835	828	873	885
Winter change (198 days)	-245	-291	-225	-239
Weaning	1053	1074	1076	1103
Change to weaning	-27	-45	-22	-21
Yearly change	20	18	28	31
Average weight per calf (lbs.)				
Birth	76	76	77	76
Spring	261	322	293	344
Weaning	469	556	516	568
Average birth date	10/27	11/6	10/31	10/29

*Furr et al (1959)

SUMMARY AND CONCLUSIONS

The feeding management of the beef cow is a broad and complex subject. Regardless of how scientific the approach may be to solving the problem, there is no way to remove "man" from management. The art of caring for livestock can never be entirely replaced with scientific facts. The old quote, "The eye of the master fattens the cattle", can also be applied to cowherd management. The ability to diagnose and correct problems which arise can only be developed by personal association with the cattle under many different conditions.

The season of the year when cows have their calves is probably the biggest variable in the breeding management of cowherds. Spring-calving is the most common practice. The other common season for calving is in the fall, but this involves a much smaller portion of the total cowherd population. Spring-calving cows usually calve during February, March and April, while fall-calving occurs during September, October and November.

Spring-calving cows and fall-calving cows are in different phases of the reproductive cycle in any given season of the year. For this reason, the two systems should be viewed differently as far as winter feeding levels. Thus, the discussions concerning the feeding management of the two systems have been separate in this report. The winter feeding of spring-calving beef cows has been the primary subject.

The feeding of the cowherd in the summer is relatively uncomplicated. Due to the composition of range forage and to the nutrient requirements of the beef cow, good summer grazing usually furnishes an adequate diet. In fact, most cows will regain winter weight losses during a summer on normal pasture. The only supplement usually required during the summer is salt.

In the case of drouth and in certain geological areas other supplements are required but this is exceptional.

The reproduction traits which influence the income from a cowherd are; percent calf crop, calving date, regularity of calving, and interval length between calving and rebreeding. It appears that the level of winter supplementation affects all of these traits to some degree. This is especially true with young cows and the effects are less pronounced after maturity.

The period from weaning to first breeding is a critical time as far as the feeding management of replacement heifers. If young heifers are limited in their nutrition during their first winter it results in delayed puberty with lower conception rates and later calving dates. The lack of gain during the first winter does not have a lasting effect if adequate nutrition is provided thereafter. Compensatory summer gains on pasture result in near normal yearly gains and mature weights. However, a late first-calving date is difficult to overcome in future reproductive life.

The production traits of economic importance to the cowherd are; birth weight of calves, weaning weight of calves, longevity of the cow, and mature cow size. Overfeeding of the cow can be as detrimental to productivity as underfeeding with the added disadvantage of increased feed costs.

The wintering phase of the cow-calf operation is the most costly and any feed costs which are not offset by sufficient returns should be avoided. Overfeeding results in lighter weaning weights and increased calving difficulties accompanied by higher death losses at birth. Overfeeding shortens the productive life of the cow resulting in higher replacement costs. Even though mature cow weights are heavier with very high feeding levels, the salvage value of the extra weight can never pay for the additional feed consumed.

On the other hand, low levels of winter nutrition cause lighter birth and weaning weights of the calves and a longer interval between calving and rebreeding with subsequent later calving dates. Longevity of the cow favors a lower plain of nutrition but reduced reproductive and productive performance more than offset this slight advantage.

Some differences in response to supplementation have occurred depending upon the geological area in which the experiment was conducted. Variations in the length of the growing season, amounts and distribution of precipitation, and ambient temperature from one area to another results in differences in quantity and quality of the range forage.

Some trends were consistent in all investigations reviewed. Any condition or set of conditions which limits the intake of energy or protein will result in lowered reproductive and productive performance. Ultra-high levels of nutrition, particularly in the developmental stages of the young beef female, will cause reproductive problems, a shorter longevity, and higher production costs.

The available research data indicates that a moderate level of winter supplementation is the most desirable for the beef cow. The developmental years in the life of the beef cow are more critical than after maturity as far as nutrition requirements.

The National Research Council recommendations appear to be fairly accurate estimates of the nutritional requirements of the beef cow. Desirable winter weight changes have been achieved with mature, pregnant cows with daily intakes of 18 to 20 pounds of feed having 50 percent TDN and 7.5 percent crude protein. Young cows and cows weighing less than 1000 pounds, because of lack of condition, should receive 15 to 20 percent more daily feed to support consistently regular rebreeding and sufficient lactation to produce heavy calf weaning weights. Proper feeding management of the beef cow includes an estimate of the cows nutritional needs, based on her current condition and reproductive phase, with maximum economic returns as a goal.

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FEEDING MANAGEMENT OF THE BEEF COW

by

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Proper nutrition of the beef cow is essential for maximum reproductive and productive response. Determination of the proper nutritional level for a cowherd requires that certain factors be taken into account. Those which influence and partly determine the nutritional requirements of the beef cow at any given time of the year are; age of the cow, calving season, stage of reproductive cycle, and condition of the cow.

Adequate amounts of range forage of average quality during the summer provide sufficient nutrition for the beef cow. Supplemental feeding becomes necessary when the quantity or the quality of the pasture becomes deficient. The nutrients most often deficient and requiring supplementation are energy and protein.

Research workers have shown that adequate nutrition for normal growth in young cows and general good health in mature cows is necessary for satisfactory reproductive and productive performance. Heifers deficient in energy or protein encounter delay of puberty. Young cows ceased normal estrus cycling and exhibited anestrus when energy and protein were severely restricted. Low levels of nutrition resulted in lower conception rates, lower calving percentages, lighter calf birth weights and later calving dates.

Investigations have shown that heifers and young cows on extra high levels of winter nutrition had more calving difficulties. When cows were maintained on high levels of nutrition it resulted in shorter productive life of the cows, lower survival rate of the calves and lighter weaning weights of the calves.

Mature cows are not as seriously affected by a low plain of winter nutrition as young cows. The degree of condition (fatness) of the cow going into the winter appears to influence supplementation requirements. Cows in fleshy condition exhibited no ill effects with body weight losses of 20 percent from fall through calving. Thin cows, in vigorous condition, had lower reproductive and productive performance when body weight losses from fall through calving exceeded 5 to 10 percent.

A ratio of weight to height (W/H ratio) has been shown to be a reliable measure of condition for beef cows. Cows in fleshy condition have larger W/H ratios than thin cows. Based on W/H ratios, fleshy cows gained weight and thin cows lost weight when their rations were formulated using their metabolic weight requirements as set forth by the National Research Council. An adjustment for cow condition should be applied to requirement estimates when wintering levels of supplementation are established for beef cows.

Recent research indicated that moderate levels of winter supplementation resulted in desirable body weight changes in beef cows. It has been shown that optimum reproductive and productive performance is associated with desirable body weight changes. Moderate levels of winter nutrition were not always more economical than low levels in the research reviewed. Very high levels of winter feeding caused no improvement in reproduction or production and were always the least economical. Continuous overfeeding caused reduced reproductive and productive performance.

When adequate summer pasture was available the need for winter supplementation of any nutrients other than energy and protein, except salt, was not demonstrated. There was no response to vitamin A or phosphorous supplementation to cows having access to normal range in the research reviewed.

Fall-calving cows having access to adequate range forage have shown no improvement in reproduction when supplemented with energy. Feeding the fall-calving cow sufficient energy to increase calf gains by increasing milk flow has not been found to be economical. Creep-feeding of the calves was found to be a more economical means of improving weaning weights of fall calves.