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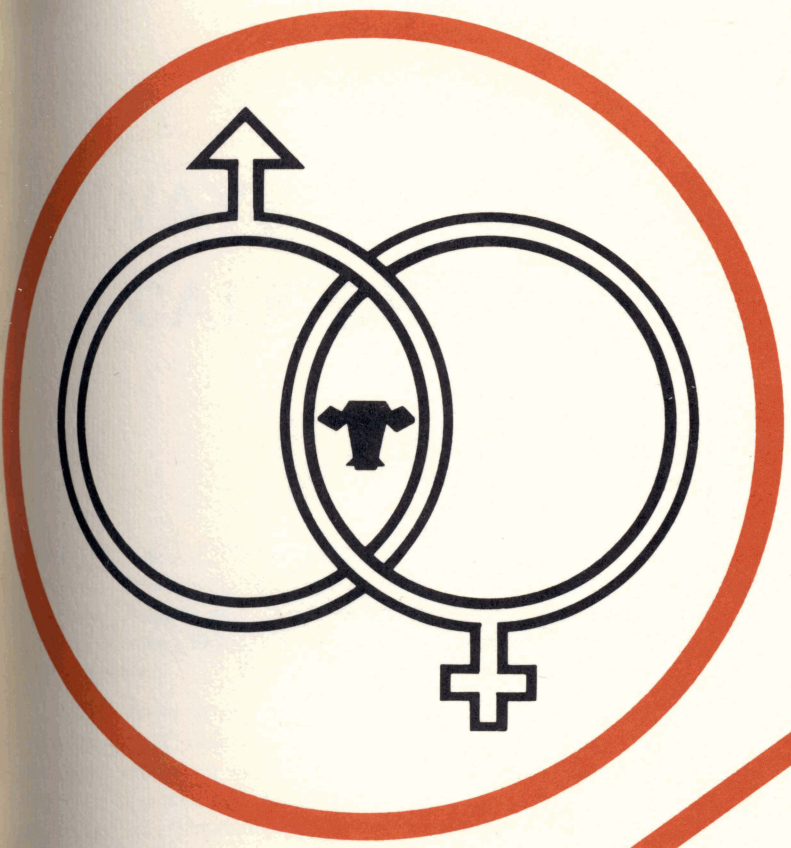

WAYS TO INCREASE PERCENT CALF CROP IN BEEF CATTLE

TEXAS A&M UNIVERSITY
TEXAS AGRICULTURAL EXTENSION SERVICE
J. E. Hutchison, Director, College Station, Texas

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WAYS TO INCREASE PERCENT CALF CROP IN BEEF CATTLE

John R. Beverly
Extension Animal Reproduction Specialist
Texas A&M University

PERCENT CALF CROP weaned is the most important factor in determining the profitability of a cow-calf program. "Percent calf crop" refers to calves weaned from all breeding females in the herd at the start of the breeding season.

Data from throughout Texas indicate a marked variation in calf crop percentages. Many herds have as low as 50 percent to as high as 90 percent or over. The variation in percentage spells the difference between profit and loss. Depending upon the annual cow maintenance charge, one non-pregnant cow consumes the profit from three to five weaned calves.

To reduce losses, cattlemen must accept change. Many traditional practices need to be revaluated and modified as research findings dictate.

RETURNS FROM LARGER CALF CROPS

There are several means of increasing returns through improved management practices. Increased market price, weaning weight and percent calf crop offer the three most promising avenues of approach. For maximum profit, cattlemen need all three. Increases in percent calf crop offer the fastest means to increased profit. Often little cash input is necessary, while more managerial output is the factor. Through improved breeding herd management and selection for efficiency, the reproductive performance of a herd may be increased significantly in a few short years.

Production Cost and Percent Calf Crop

The number of cows giving birth to a calf markedly governs production cost per pound of beef produced. The cost figures for maintaining a cow for one year undoubtedly vary among areas. Once this figure is established, production cost for producing a pound of calf can be projected. Such a figure depends on two factors *weaning weight* and *percent calf crop*. Table 1 shows how weaning weight of the calf and calf crop percentage influence production cost per pound of calf produced.

Table 1. Production cost per pound. (Beef—$95 per cow maintenance cost).

	Weaning weight (lb.)				
Percent calf crop	550	500	450	400	350
100	550*	500	450	400	350
	17.3**	19.0	21.1	23.8	27.1
90	495	450	405	360	315
	19.2	21.1	23.5	26.4	30.2
80	440	400	360	320	280
	21.6	23.8	26.4	29.7	33.9
70	385	350	315	280	245
	24.7	27.1	30.2	33.9	38.8
60	330	300	270	240	210
	28.8	31.7	35.2	39.6	45.2

* Top figures indicate average pounds produced per cow.
** Bottom figures relate the cost per pound of calf, cents.

The table shows that you have invested 19.2 cents per pound of calf if you are getting a 90 percent calf crop and weaning 550-pound calves. At the other extreme, with a 60 percent calf crop and 350-pound calf, the production cost is 45.2 cents per pound. Average price for calves seldom will be this high. In such a situation, the loss is apparent. Increasing percent calf crop and/or weaning weights can reduce this cost.

Another view of this situation is to examine the total cost per calf and net returns as influenced by calf crop percentage. Table 2 shows the net return from a calf at varying calf crop percentages. The table assumes a constant weaning weight of 450 pounds, a market price of 28 cents per pound and a cow operating cost of $95 per year.

Table 2. Effect of calf crop percent on cost per calf and return.

Percent calf crop	Cost per calf	Return per 450-lb. calf
100	$ 95	$ 31
90	106	18
80	119	6
70	136	−7
60	158	−19

The table shows that an 80 percent calf crop is imperative for any profit. With a 60 percent calf crop, it costs the producer $19 for the privilege of being in the cow business. If a cow doesn't produce a calf to weaning, all of the management and feed cost invested in her are lost.

Average Weaning Weight and Breeding Efficiency

In many beef cattle operations, calves are weaned at some given time. At the same time, the age of the calves may vary as much as 2 to 3 months. Since the weaning weight of the calf depends on its growth rate and age at weaning, older calves will weigh more at weaning time. The average weaning weight then is greatly influenced by when the calves were born or how soon the cow was bred during the breeding season. The average weaning weight of calves born to cows bred at various intervals throughout the breeding season is illustrated in figure 1 (1).

For each 20-day interval the cow goes unbred during the breeding season, there will be a decrease in average weaning weight of the calf. In figure 1, cows bred during the last 20-day interval weaned calves approximately 100 pounds lighter than those bred during the first 20 days of the breeding season.

The effects of a delay in breeding and ultimate reduction in average weaning weight can be expressed in dollars and cents (2).

COST IN DELAY OF ONE HEAT CYCLE IN A 100 COW HERD

Assuming:

Calves sold at 31 cents
Calves gain 2 pounds per day
90 percent calf crop

Economic Loss:

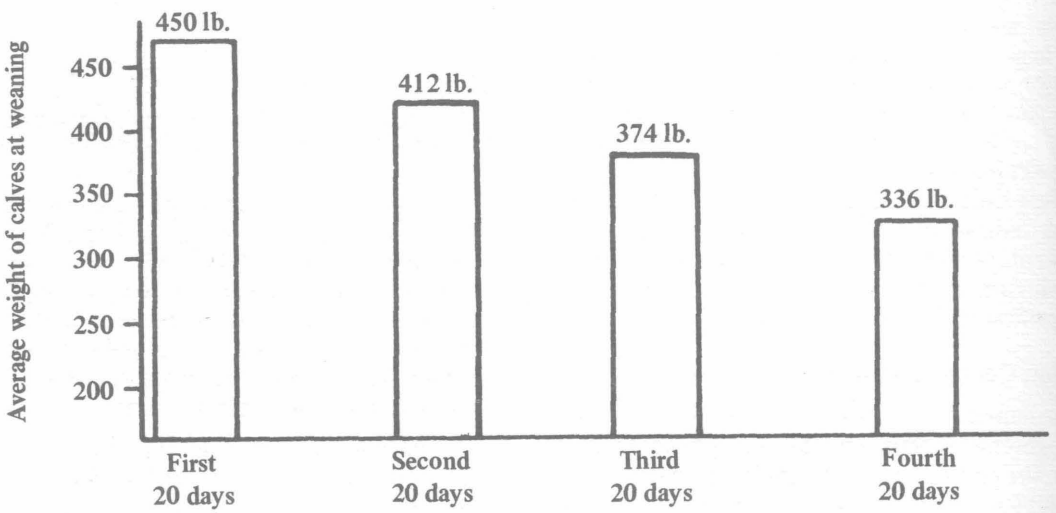
21-day younger calves
38 pounds less per calf
3800 pounds x 31 cents = $1178 total loss

If calves in the example average 500 pounds at weaning this would equal a loss of eight calves. Under these conditions, it costs approximately $12 per cow for each 21-day delay. Cows must be managed and selected to return to estrus shortly after calving.

Average Age and Percent Calf Crop

Percent calf crop influences the average weaning weight; the combined effect of average age of the calf and percent calf crop is shown in Table 3 (1).

The foregoing figures point up two major problems in beef cattle reproduction. First, not enough cows wean a calf. Second, too few cows are bred during the early days of the breeding season.



Average weaning weight of calves conceived at various intervals throughout the breeding season.

Figure 1. Effect of time of breeding upon subsequent average weaning weight of calves (1).

Table 3. Effect of age of calf and percent calf crop on pounds of calf weaned per cow bred (1).

Percent calf crop	Calving 1st 20 days	2nd 20 days	3rd 20 days	4th 20 days
100	450	412	374	336
90	405	371	337	302
80	360	330	299	269
70	315	288	263	235
60	270	247	224	202

FACTORS AFFECTING REPRODUCTIVE PERFORMANCE

Impaired reproductive performance in beef cattle may result from many causes. In most cases, the reason for the success or failure of any breeding program is in one of three areas:

1. Percent breeding females coming into a fertile heat.
2. Number of breeding females conceiving at each heat period.
3. Death loss of calves at or near birth.

High calf crop percentages are possible through the use of improved management practices. To implement these practices, the underlying causes for variation in reproductive performance must be understood.

Percent Cows in Heat and Conception Rate

Many factors govern how soon a cow returns to heat following calving. Many of the same factors also control the number of cows that will conceive successfully at any one heat period. Therefore, it seems practical to discuss these two areas simultaneously. Many scientific publications and books have been written on the subject but the major problems normally are (a) age of breeding female (b) post-calving rest (c) genetic capability (d) nutrition (e) semen fertility and breeding efficiency and (f) disease.

Age of Breeding Females

From the time a cow gives birth to a calf until she returns to heat takes time. Even more time is required for younger cows to return to heat. Table 4 shows the average percent cows in heat at varying intervals following calving (3).

Table 4. Percent cows in heat at varying intervals following calving (3).

Age of cow	Days after calving 40	50	60	70	80	90	100	110
	Percent							
4 years or older	55	70	80	90	90	95	100	100
2–3 years old	15	30	40	65	80	80	90	90

Notice that only 55 percent of the cows are expected to be in heat 40 days after calving. By 60 days, this will have increased to 80 percent and by 70 days, to 90 percent. Younger cows require 80 days before 80 percent will be in heat.

If increased average weaning weights are to be obtained through early-born calves, a larger percentage of the cows must be bred early in the breeding season. To get 90 percent of the herd bred early in the breeding season, cows must calve 45 days before the beginning of the next breeding period. This in turn results in a short calving period giving some uniformity to the age of the calves. It also allows enough time for the cows to return to heat the next year.

First calf heifers. Cattlemen have noted for some time that first-calf heifers tend to have a lower pregnancy rate during their second breeding season. This is particularly true of heifers bred to calve at 2 years of age. Breeding heifers to calve at two years gives a 1 to 1.3 calf increase in lifetime production, but only if the heifer rebreeds in her second breeding season.

As shown in Table 4, the reason many heifers fail to rebreed in their second breeding period is that they take longer to come into heat following calving and as a result may not return to heat before the end of the breeding season. Several factors are responsible for this delay in returning to heat. When the demands put on young heifers are examined, several important considerations become apparent. One of the most important is that the first-calf heifer has to perform all the body functions of a mature cow, while at the same time attempting to grow. This problem is further compounded by the fact that the heifer is shedding incisor teeth and has a limited capacity for grazing.

California studies indicate that milk production is another primary factor limiting the breeding performance of first-calf heifers (4). In their studies on a commercial cow herd, they noted that the average percent calf crop was maintained at 89.64 percent when calves were weaned from heifers at 3 months of age. The workers also concluded that lactation and not gestation was the principal factor contributing to stunting of growth. This seems reasonable in view of the fact that the new-born calf contains only 15 pounds protein and 3 pounds of fat, whereas 65 pounds of protein, 70 pounds of fat and 90 pounds of carbohydrates are in the milk produced by the young heifer during the first 4 months of lactation (5). Weaning calves from heifers or limiting suckling time of calves lessens body stresses and makes nutrients more available for reproduction and growth. Table 5 shows the effects of early weaning of calves on subsequsent calf performance and reproductive performance of their dams (6). It is recognized that the number of experimental animals is low.

Table 5. Effect of early weaning and creep feeding on breeding efficiency in young heifers* (6).

	Control heifers	Heifers-calves creeped	Heifers-calves weaned**
No. Animals	7	7	7
Calf wt. @ 60 days	114lb.	99lb.	134lb.
Calf wt. @ 7 mo.	352lb.	378lb.	376lb.
Gain to weaning	1.54lb.	1.80lb.	1.55lb.
Percent heifers pregnant	29	57	100

* 90-day breeding season
** Calves weaned at 60 days of age

The table shows that creep feeding in young heifers (2 and 3 year olds) partially reduces lactation stress and aids in rebreeding. Complete removal of lactation stress in young heifers shows a marked increase in breeding efficiency. Work at the University of Arizona on rebreeding first calf heifers supports this data. Arizona work showed 79 percent pregnancy rates in heifers with calves early weaned and 46 percent pregnancy rates in normally weaned groups (7). The main limitation to breeding performance was absence of heat or failure to cycle.

From this data several alternatives for increasing the conception rate in first heifers become evident. Breeding virgin heifers 20 to 30 days earlier than the regular cow herd allows the heifers ample time to return to heat during their second breeding period. Second, early weaning of calves removes one of the primary body stresses from the lactating heifer and thus makes available nutrients for other body functions such as reproduction and growth. When heifers calve late their first year, they are more likely to open the next year.

Yearling heifers. One of the main problems in breeding yearling heifers is that they are too young and/or too light in weight. The problem most often is one of size and not age, particularly when attempting to breed them earlier than the regular cow herd. Table 6 shows the result of two different feeding regimes on the age at which heifers first come into heat (8). The low level group was wintered to gain .8 pounds per day and the high, 1.6 pounds daily.

Table 6. Time of first heat in heifers on two levels of feed (8).

Feeding regime	Percent in heat by 11 mo.	12 mo.	13 mo.	14 mo.	15 mo.	16 mo.	17 mo.	18 mo.
Low level								
Angus	0	0	0	33	82	90	100	100
Hereford	0	11	22	33	38	50	100	100
Crossbreed	0	0	12	68	85	100	100	100
High level								
Angus	0	33	58	100	100	100	100	100
Hereford	0	12	50	100	100	100	100	100
Crossbreed	0	18	76	94	94	100	100	100

Setting some arbitrary age at which to breed heifers is not the solution. The outcome would depend largely on how the heifers were fed following weaning. For example, if heifers in both groups in Table 6 had been bred at 14 months of age, the pregnancy rate would have been satisfactory in the high level group and disastrous in the low level. The difference in the two groups was the percent heifers having heat periods.

As shown in Table 6, age is not a satisfactory basis upon which to make judgments regarding the breeding of young heifers. Since growth rate largely determines the time a heifer will reach puberty, *attained body weight* is a good measure of when to breed. The weight at which heifers first show heat is given in Table 7 (9).

To achieve such weights at an early age, weak or light heifer calves cannot be used. Although some of the lighter weight animals will breed successfully, it often costs in terms of calves lost. These losses are discussed in the section on death loss of calves. Since age and weight at puberty are heritable characteristics, cutting back lighter weight heifers is beneficial. Progeny of the earlier maturing heifers can be expected to grow rapidly and reach puberty at an early age. Increased growth from birth to weaning is important in increasing subsequent pregnancy rates in heifers breeding first as 2 year olds. Table 8 shows that calves heavier at weaning had higher subsequent calving percentages at 3 years of age than calves in the lighter weight categories (10).

Table 7. Weight at which heifers reach sexual maturity (9).

Breed	Percent showing heat before 450lb.	500lb.	550lb.	600lb.	650lb.	700lb.	750lb.
Angus	8	8	44	72	84	88	100
Hereford	0	0	0	27	50	62	88
Crossbreed	0	0	18	43	68	78	93

Table 8. Effect of weaning weight on subsequent reproductive performance (10).

Weaning weight (lb.)	Afric-Angus Calving percent	Brangus Calving percent
Under 350	78	60
350–399	73	61
400–449	80	75
450–499	91	84
500–599	100	80

Table 9. Effect of weight at two years of age on subsequent reproductive performance of heifers (10).

Weight (lb.)	Afric-Angus Percent calving	Brangus Percent calving
Less than 550	–	50
550–599	43	70
600–699	73	78
700–799	88	81
800–899	94	75

The data given in Table 9 indicate the weight at 2 years of age also influences subsequent pregnancy rates (10). Most research work shows that as weight increases calving rate increases proportionately. Increased weight as reflected by faster growth rates, *not fattening*, has an important influence on subsequent reproductive performance.

Post Calving Rest

How soon cows rebreed following calving markedly influences conception rates and the number of reproductive problems occuring during gestation and at the next breeding. Studies show that if conception rates are to be maximized and reproductive problems minimized, cows should not breed until 45 to 50 days post calving. Table 10 indicates the results of breeding cows at varying intervals post calving (11).

Note that conception rates are depressed through the fiftieth day. Also 33 percent of the cows bred in less than 50 days post calving experienced some serious reproductive problems. Although a few cows will conceive regularly and wean a calf when bred several weeks following calving, they are the exception.

The most common problem when rebreeding too soon is retained placenta. Such females conceive, give birth to a calf but fail to properly release the placenta. In many instances the cow receives little or no attention. The end result is infection of the uterus. Such problems may inhibit estrus or reduce conception rates to abnormally low levels. Affected cows may be treated but at very best will calve 2 to 5 months later than normal. In some instances the cost and poor prognosis prevent their retention in the herd. Such losses are expensive and unnecessary.

Genetic Capability to Reproduce

Two factors govern how any cow performs–her environment and inherited ability. Environment includes all of the unfavorable effects of climate, disease and nutrition. These are the areas in which we most often concentrate our efforts. The genetic capability of a cow to reproduce has been sadly neglected. For some years, the heritability of reproductive performance was considered low. Thus progress would be slow in herds where reproduction is good. In Texas, the reproduction level is below average. In such a case, the heritability of reproduction is high enough to allow significant progress in this trait when selection is practiced.

A number of reports throughout the United States have shown that culling for reproductive failures can dramatically change average reproductive performance. Selection for regularity of breeding can be used effectively in two ways: (1) total herd selection; and (2) selection of heifers.

Table 10. Effect on reproductive efficiency of rebreeding at varying intervals following calving (11).

Days bred following calving	Percent conceiving on first heat bred	Percent metritis, abortions, retained placenta
Less than 40	45.4	40.0
40–49	47.3	33.3
50–59	66.6	20.0
60–69	63.2	8.3
70–79	60.2	7.3
80–89	74.0	4.4

Table 11. Pregnancy rate in Florida Experiment Station herd before and after establishing the policy of culling non-pregnant females (12).

Breed	Percent cows pregnant	
	1951–1959	1960–1964
Angus (A)	76	92
Brahman (B)	50	78
AxB	73	93
Average	66	88

Table 12. Pregnancy rate in commercial cow herd in Texas after establishing the policy of culling non-pregnant females (13).

Year	Percent cows pregnant
1958	81
1959	89
1960	94
1961	92
1962	92
1963	90
1964	94
1965	90
1966	93

Selection of cows and heifers based on pregnancy status is an effective means of increasing total or overall breeding efficiency in a short time. Such a program is most effective in herds where reproductive performance has been consistently below average. The herd generally is examined for pregnancy 45 days or more after the bulls are removed or when calves are weaned. All non-pregnant females are eliminated from the regular breeding herd. Tables 11 and 12 illustrate the increase in pregnancy rates after adopting the policy of pregnancy testing and culling of non-pregnant females (12, 13).

Increased pregnancy rates shown in Tables 11 and 12 are the result of removing subfertile or "repeat breeder" females and the removal of unthrifty and poorly acclimated cows. Cows need good management

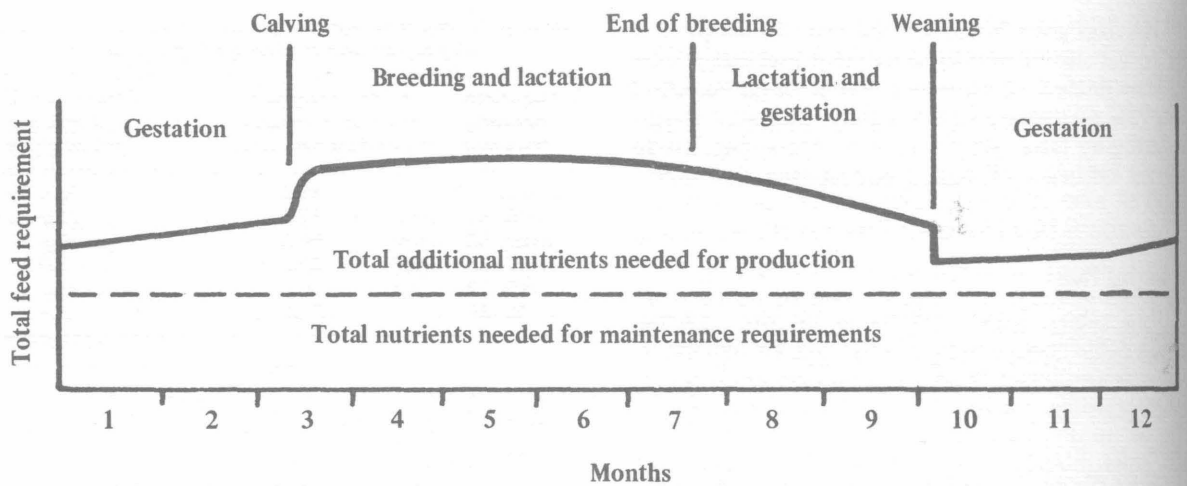


Figure 2. Total annual feed requirement for a cow raising a calf every 12 months

during breeding. If management is lax, such as inadequate nutrition, the female is not given a sufficient opportunity to express her genetic ability to reproduce. In these instances, selection is not effective.

Culling non-breeders seems justifiable since those cows failing to conceive regularly perform poorly when bred at later dates. A Louisiana study on rebreeding such females has shown that of cows exposed for 75 days during spring but failing to conceive and re-exposed for 30 days the following fall, only 33 percent successfully bred (14).

Eliminating slow or nonbreeders also is of benefit through the elimination of cows which create expenses but give nothing in return. A cow must produce a calf every 12 months to pay her way.

In herds with satisfactory reproductive rates, high performance can be maintained by rigid selection of yearling heifers. Studies at the Miles City and Havre, Montana Experiment Stations have revealed interesting results about reproduction in first-calf heifers (15). In one study, 1,589 heifers were bred as 2-year olds to calve at 3 years of age. The heifers were then divided into two groups—those calving after their first breeding season and those not calving. Lifetime records maintained on these groups indicated that average percent calf crop in females calving at 3 years was 86 percent. The females failing to calve as 3-year olds averaged only 54.9 percent throughout their lifetimes. Similar information has been shown in heifers calving as 2-year olds.

Other work has shown heifers that calved early in their first calving season continued to calve early and wean heavier calves throughout their lifetime. Heifers calving late in their first season not only weaned lighter calves but reproductive performance was much more erratic. The most common problem is that of calving in alternative years. Most studies indicate that the first record may be a good indicator of a heifer's lifetime production potential. This points out the feasibility of selection based on pregnancy.

A good breeding program for heifers generally calls for breeding heifers to calve earlier than the cow herd; breeding for 45 to 60 days; pregnancy testing 45 days after removing bulls and culling all open heifers. This plan requires breeding 50 percent more heifers than actually are needed for replacements to allow culling of open heifers.

Culling cows for reproductive failures is essential to correcting poor reproductive efficiency within a reasonable time. The only satisfactory method of testing cows is by palpation. "Eyeballing" is too inaccurate to tolerate and the fact that a cow is in heat is only partial evidence of not being bred. Ten to 12 percent of all pregnant cows come into heat at least once during a normal pregnancy. Testing cows for pregnancy is a sound investment.

Nutrition

Of all the environmental influences that affect reproduction, perhaps the most important to cattlemen is nutrition. Most breeding failures, low percent calf crops and late calves in Texas probably are in some way related to nutrition.

The nutritional requirements of the cow fluctuate considerably throughout the year, depending upon the requirements placed upon her. Figure 2 illustrates when these variations occur and emphasizes the importance of feeding a balanced ration.

A cow requires an extra amount of feed during gestation to nourish the unborn calf and get her off to a good start at calving. After calving, her feed requirement increases tremendously. The increase is attributed largely to milk production, particularly when the cow weans a heavy calf. In such cases, it is not unusual for the feed requirement to nearly double. If extra feed is not provided, the cow will mobilize body fats to compensate and suffer a serious weight loss. If she loses much weight after calving, she may not return to heat. If she does, conception rate will be low. This situation makes it

impossible for cows to rebreed during the early breeding season. The end result is usually a late calf with a 13-to-15 month lapse between calves.

Energy. In recent years, fairly extensive research has pointed up that energy is one of the primary major nutrients influencing reproductive activity. Table 13 shows how energy levels before and after calving can affect reproduction (16). The designation of "high" energy level represents the pounds of energy being supplied as recommended by the National Research Council (17). It is not an abnormally high or large amount. The "low" energy designation indicates that only half the recommended level was being met.

In Table 13, the most striking fact shown is the difference in the percentage of cows showing heat after calving. Cows fed inadequately after calving (high-low and low-low) clearly show a delay in resuming heat cycles. In the group fed low levels before and after calving, the major cause for the breeding failure is cows not coming in heat. Seventy percent of the animals in this group never showed signs of heat.

In groups fed low levels after calving, conception rates are depressed. The data vividly point out that low energy before calving and particularly after calving reduces the percent cows in heat and lowers conception rates. Adequate energy intake is essential for good reproductive performance and getting early bred cows.

Although various analyses are available to determine the energy content of feed, it is impossible to determine accurately what a cow is grazing and the composite energy intake. Since the level of energy consumed is reflected in body weight changes, variations in these weights may be used to determine the adequacy of energy intake. Most work has shown that to get a high percentage of cows in heat and to get the maximum possible number successfully bred, cows should gain ½ to ¾ pound per day after calving throughout the breeding season (9).

Figure 3 shows weight changes on cows producing 90 percent calf crops and weaning 450-pound calves (18). Note that from the beginning to the end of the breeding season, cows were gaining in weight. Such a response characterizes most good beef breeding herds.

Table 13. Pregnancy rate in cows on different levels of energy (16).

Feeding regime		Percent cows pregnant	Percent cows not coming in heat	Percent cows in heat but not conceiving
Before calving	After calving			
High	High	95	0	5
High	Low	77	14	9
Low	High	95	5	0
Low	Low	20	70	10

Cows unusually thin at calving should gain 1½ to 2 pounds per day following calving. Such gains are expensive; the best solution is to have them in good condition at calving and making moderate gains after calving. Do not attempt to economize on feed during the breeding season. If cows do not gain weight after calving, reproductive performance will be poor or cows will breed late in the season.

Phosphorus. Deficiencies of phosphorus definitely have been incriminated in fertility problems. One of the most characteristic symptoms affecting fertility is failure of cows to show estrus. Other problems may include delayed heat periods, above-average incidence of "silent heat" and prolonged intervals between calving and the first estrus period (19).

Phosphorus deficiencies may result from low levels in the soil and the resultant forages or when phosphorus is present but not properly balanced with calcium. When calcium-phosphorus ratios exceed 5:1, utilization of phosphorus by the animal is inhibited. Both problems are corrected by supplying phosphorus free choice.

Phosphorus deficiencies in dry forages are likely throughout Texas. Many means of supplying the phos-

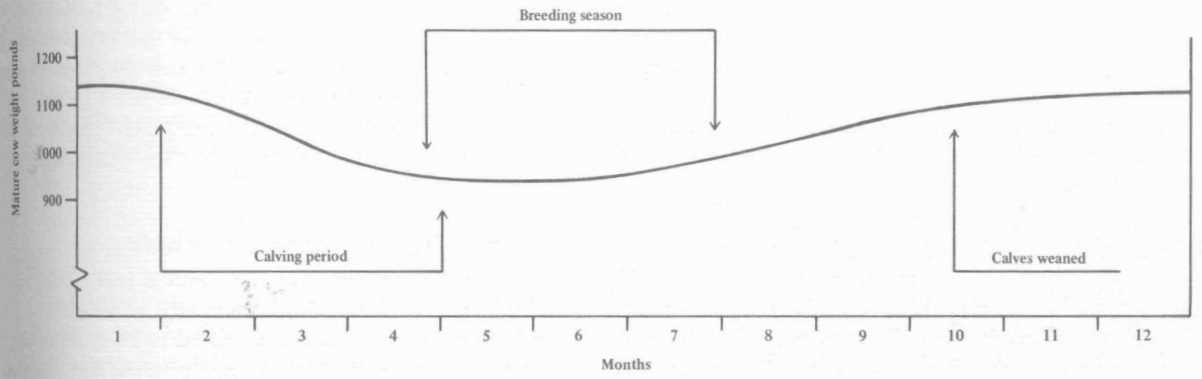


Figure 3. Changes in weight of cows producing 90 percent calf crop (18).

phorus requirement have been studied and reported. The effect of adding additional phosphorus by three different methods in a Texas study are shown in Table 14 (20).

Supplying phosphorus in the form of bonemenal, disodium phosphate in the drinking water or by use of triple superphosphate on the pasture gave good results in normal seasons. Blood phosphorus levels fell to a low level during a prolonged drouth. While most of these supplements are satisfactory, commercial supplements

Table 14. The effects of three methods of supplying supplemental phosphorus to range cattle in south Texas (20).*

Item	Group 1 (no phosphorous supplement)	Group 2 (bone meal in self feeders)	Group 3 (disodium phosphate in drinking water)	Group 4 (range fertilized with triple superphosphate)
Average weaning weight of calves	489	535	542	551
Average number of days between calvings	459	365	367	364
Average annual supplement or fertilizer per cow	—	56	73	376
Average percent calf crop weaned	64	88	92	96

* Data is reported for a 4-year study

containing unusually large amounts of calcium to phosphorus (4:1 to 10:1) should be avoided when given to breeding animals. While economically priced, calcium deficiencies are rare and such imbalances may produce reproductive problems.

Vitamin A. In recent years there has been renewed interest in the vitamin A nutrition of beef breeding animals. One reason is that synthetically produced vitamin A is now very economical; second, several studies have shown beneficial effects on percent calf crop, weaning weight and calf survival from the addition of vitamin A. Many questions remain because for every positive response there appears an equally documented report showing little or no benefit from vitamin A supplementation.

Vitamin A apparently does not cause distorted heat cycles nor inhibit the normal expression of estrus even in the most severe deficiencies, but conception rates at each heat may be markedly reduced. Other common symptoms include weak calves, stillborn calves and retained placental membranes. In bulls, weakness, night blindness, rough hair coat and even prostration may occur before semen quality and fertilization capacity are impaired (19). Deficiencies also may cause a decline in libido and sexual activity in the bull. Young bulls appear more vulnerable to vitamin A deficiency and may mature later than normal for the breed.

Virginia studies on vitamin A supplementation of 353 pregnant cows showed 6.6 percent of those receiving vitamin A had stillborn calves, compared to 8.8 percent for those not being supplemented (21). Postnatal mortality of the calves was 8.1 percent for those receiving supplement and 16.5 percent for those not receiving vitamin A supplement. A similar Oregon study showed no appreciable difference between survival or postnatal mortality in supplemented and non-supplemented calves (22).

Studies in Oklahoma were conducted on 155 pregnant cows for effects of vitamin A supplementation on calf survivial, calf weight and subsequent reproductive performance of the cows (23). Treated cows were injected with 1 million international units of vitamin A just before calving. Calves from cows given supplemental vitamin A showed no appreciable advantage in survival but did show a 14-pound advantage in weight at 112 days of age. Vitamin A supplementation did affect the rebreeding performance with 88.5 percent of the treated animals conceiving as compared to 79.3 percent for the untreated cows.

Several reports and field observations have indicated higher percent calf crops when breeding females were provided supplemental vitamin A at breeding. Such increases have been difficult to understand in that carotene (provitamin A) was in abundance and breeding animals should not be deficient under such circumstances. Two suppositions as to the causes can be offered. First, work has shown that if cows have an inadequate supply of phosphorus they cannot efficiently convert carotene to vitamin A (24, 25). Second, several studies in laboratory animals and in cattle have shown that animals receiving high nitrate levels in the forage have a depressed ability to convert carotene to vitamin A (26, 27).

Nutrition still presents a confusing picture. Nutritional problems are seldom of a singular nature but rather involve multiple deficiencies (28). Varying responses from studies throughout the country indicate the need for further investigation on interrelationships of energy, phosphorus, protein and vitamin A. Although further research is needed, the economy of both vitamin A and phosphorus supplements suggest their usage as insurance against breeding failures.

Semen Fertility and Breeding Efficiency

The expression that the "Bull is half of the herd" is only partially correct. Genetically he constitutes half of the herd, but because he is bred to 20 to 30 cows per season, this makes him far more important than any single cow. This becomes increasingly important in single sire herds.

Data collected at the Miles City, Montana, Station reported conception rates in single-sire herds varied 45.5 to 93.9 percent (29). A Texas study in which 1,369 bulls were examined revealed that 16 percent of all the bulls examined were cull or of questionable fertility (30). Such findings are in agreement with those of commercial cattlemen and emphasize the need for identifying and eliminating subfertile bulls.

Physical fitness of the bull is fully as important as semen quality. The physical examination needs to include the general health of the bull, condition of his feet and legs, age, teeth and abnormalities of the reproductive organs. All these items are important considerations in purchasing bulls as well as in checking existing herd bulls. While not directly related to fertility, the old saying, "no feet, no horse," is equally true for bulls. Bulls with tender feet or partial lameness will not travel to find cows in heat. Abnormalities of the reproductive organs such as adhesions of the penis to the sheath may prevent the bull from making intromission with the female.

Another important consideration is the bull's "libido" or sex drive. Unfortunately, there is no laboratory technique for evaluating sex drive; instead, the bull's libido must be observed when placed with cows in heat. Lack of interest in the presence of humans characterizes some breeds, particularly Brahman, or breeds having Brahman breeding. In such instances, it may be necessary for the observer to remain out of sight or at some distance. Observation of the bull's capability of satisfactorily mounting the cow and making penetration is also important particularly in young bulls.

A bull that is a satisfactory breeder one year may not be so the following year. Annual semen checks are a "must". Important, too, is the fact that a bull may become ineffective during the breeding season as a result of fighting or from injury during mating. Early detection of such damage is essential for a high calving percentage. Bulls purchased and tested at distant locations and then subjected to the stresses of hauling and acclimating to a new area may temporarily cease sperm production. Such bulls should be rechecked after an adjustment period.

The most ideal time to have bulls examined is just before breeding. An infertile bull may mean the loss of an entire calf crop when a group of cows are with a single bull. It also may mean that late calves will be born and too long a time will have elapsed between the time a cow should have calved and when she actually gives birth to the calf.

Disease

Herd health status is an important item in any breeding program. Various types of diseases can cause breeding failures. The list of diseases includes brucellosis, IBR, trichomomiasis, vibriosis, leptospirosis and possibly vaginitis.

The best solution to preventing conception failures of an infectious nature is to have a sound herd health program established by a veterinarian. The veterinarian, however, can succeed only to the extent that the producer cooperates in recommended management practices. A brief guideline for disease management follows:

Proper records. Good records can help your veterinarian diagnose various disease problems.

Close observation of cows. Observation of symptoms can be the key to alerting you and your veterinarian to severe problems. Some of the more important items include:

Abnormal discharges from the vagina—A secretion of pus from the vagina may indicate a condition of pyometra. A secretion of bloody mucus may indicate early stages of fetal resorption.

Abnormal heat cycles—Abnormal heat cycles may indicate malfunctioning of the ovary or some type of reproductive infection.

In commercial operations, time and expense limit extensive treatment of infected animals. The best and most practical approach is prevention.

Death Loss of Calves

Loss of calves at or near the time of birth primarily results from calving difficulties. Table 15 shows that all ages of cows experience some degree of calving difficulties (15). Older cows which possess more growth and capacity for calving have less difficulty than younger cows. Most calving problems occur in heifers calving for the first time. Consequently, most of the calf losses are in young heifers.

Table 15. Calving difficulty summarized by age of dam (15).

Age group	No. of head	Assisted births normal presentation	Assisted births abnormal presentation	Total assisted
		Percent		
Cows				
4 years and older	465	0.8	2.2	3.0
Heifers				
3-year-old	158	15.8	6.3	22.1
2-year-old	287	43.2	2.8	46.0

Size at Calving

While heifer weights are related to puberty, weight or body size also influence calving problems. Although some heifers come into a fertile heat at weights between 450 and 500 pounds, they may not have the ability to produce a calf. Table 16 shows the weights of heifers having their first calves and the percent difficulties in each group (31). Heifers must attain certain growth

Table 16. Heifer weights before calving as related to calving difficulties (31).

Body weight	Percent calves born dead	Percent heifers with calving difficulties
625–774 lb.	16	36
775–924 lb.	6	15
925 lb. and over	4	9

limits before they are bred. Age of the heifer is of little importance in reducing calving problems. Yearling heifers should be bred when they have attained 60 to 65 percent of their mature body weight. By breeding at such weights, heifers will have acquired enough growth at parturition to significantly reduce calving difficulties and deaths.

Feeding of Heifers

Do not confuse the increased weight discussed with fattening. The objective is to grow heifers to heavier weights at an earlier age. As illustrated in Table 17, overfeeding to the point of fattening can increase the problem (9).

Table 17. Degree of finish in heifers as related to calving problems (9).

Degree of finish	Percent calves dead at birth	Percent calves lost 24 hours after calving
Extremely fat (Grade-Choice or Prime)	18	27
Moderate condition (Grade-Good)	9	0
Thin heifers	10	0

Extremely fat heifers experience high losses at calving, but there is little difference between the moderate and thin heifers. This knowledge helps dispel the belief that starving or limited feeding of heifers before calving is of real benefit. Calving losses are not reduced by feeding heifers lower levels of feed before calving. The data in Table 18 indicate also that calving difficulties are changed little by low feeding levels before calving (9).

Care at Calving

Cows should be observed during calving but assistance should be given only when necessary. Some ranchers tend to rush in and "take" the calf at the first appearance of the chorioallantoic membrane or water bag. Such a practice can injure the cow and the calf. While unnecessary help is not advisable the cow should not be allowed to labor until exhausted. If no progress is made toward delivery 2 hours after the beginning of labor, examination and assistance is recommended.

Because heifers experience more difficulty than older females in calving, they warrant special care. When possible, they should be placed in accessible pastures and

Table 18. Effect of moderate and low energy levels fed 120 days before calving on difficulties in yearling heifers (9).

Energy level*	Gain in weight during 120 days feeding	Percent calving difficulties	Percent dead calves at birth	Birth weights
Moderate (8.0 lb. TDN daily)	150	36	8	70lb.
Low (4.3 lb. TDN daily)	35	33	6	63lb.

*Moderate and low level feeding regimes are respectively 8.0 and 4.3 lb., daily.

observed frequently. The economic return to time spent in observations and assistance is difficult to measure, but saving only half of the problem calves can be time profitably spent. Table 19 shows Ohio work which attempted to establish the hourly return to ranchers for time spent in observation and assistance based upon the number of times observed and total time expended (32).

Notice that for only .8 hours invested the return was 4 cents whereas 12 additional minutes or an hour total increased the return some 37 times or brought the return to $1.50 per hour. The work reported was on herds of approximately 50 cows. In larger herds, the returns would be significantly larger in that much of the time reported was spent travelling to and from pastures. The data also tends to indicate that a single check was scarcely worth the effort and at best labor and returns are about break-even. Observation and assistance of cows at calving, particularly heifers, is essential and can help maximize profits when conducted conscientously.

Table 19. Cost and returns for checking of the beef breeding herd at calving time for 50 cow herds (32).

Item	Number times checked each day			
	1	2	3	4
Total hours expended per cow	.8 hr.	.9 hr.	1.0 hr.	1.2 hr.
Returns from additional calves*	$41.64	$83.29	$124.93	$166.58
Total labor cost**	$40.00	$45.00	$ 50.00	$ 60.00
Returns per hour	$ .04	$ .85	$ 1.50	$ 1.78

* Calf value at $104.11 at weaning
** Labor valued at $1.00 per hour

Selection of Sires

Another way to reduce calving problems is to breed heifers to bulls that reportedly produced calves with less calving difficulties. This *does not* mean any particular breed, nor is it necessarily related to the size or age of the bull. *The decision is determined by the type of calves produced by the bull.* Table 20 shows the performance of different bulls used in experimental trials and how calving problems vary with the individual bull (9).

Calving problems can be reduced by breeding heifers to bulls that sire small calves and have little difficulty at birth. While certain bulls, such as those with abnormally large hindquarters, may be eliminated, the only successful means of selection is based upon past performance–not appearance. Obvious, but sometimes overlooked, is the fact that young bulls, while themselves smaller in body size, do not necessarily sire smaller calves. A bull produces the same size calf at puberty as he produces at full maturity.

Table 20. Calving difficulties in heifers as related to sires used (9).

Breed and identification No.	No. calves	Percent calving difficulties
Angus sires		
602	29	41
611	25	36
610	31	19
609	30	13
Hereford sires		
705	35	40
702	29	34
750	34	24
753	22	14

INCREASING REPRODUCTIVE PERFORMANCE

To obtain the maximum pounds of calf weaned per cow bred, a high percentage of cows must conceive and wean a calf. The calves must be born over a short time; and to have cows calving in a short time, they must be bred during a short breeding season.

A plan for improving reproductive performance can be developed. Such a plan is not ideal for all situations, but the major items are essential to all successful breeding programs.

Management of Virgin Heifers

A. FEEDING
1. Feed heifers to gain about 1 to 1.5 pounds daily from weaning to breeding.
2. Feed heifers to a body weight equivalent to 60 to 65 percent of their mature weight before breeding.
3. Avoid fattening–grow heifers to the prescribed limits.

B. BREEDING
1. Breed heifers to begin calving 20 to 30 days earlier than the cow herd to allow more time for the heifer to return to heat.
2. Breed heifers to bulls siring calves with low birth weights and minimal calving difficulties.
3. Breed heifers 40 to 60 days, palpate for pregnancy and eliminate open females.

C. GENERAL
1. Provide approximately 50 percent more replacement heifers for breeding to allow for culling of open heifers.
2. Have heifers in moderate to light flesh at calving.
3. Separate heifers from older cows.
4. Give heifers extra attention at calving.

Management of First Calf Heifers

A. Provide extra feed for growth.
B. Feed to obtain ½ to ¾ pound daily gain during the breeding season.
C. Breed for 80 days, palpate for pregnancy and eliminate open cows.
D. Separate from older cows.
E. Provide at least a 45-day interval from calving to rebreeding.
F. When practical consider early weaning of calves.

Management of Older Cows

A. Have cows in good condition at calving (increase weight 70 to 100 pounds from weaning to calving).
B. Have cows gaining weight from calving to the end of breeding season.
C. Breed for 80 days, palpate and eliminate open cows.

General Management

A. Examine all bulls annually for semen quality and soundness.
B. Increase the interval to rebreeding to at least 45 days for every cow in the herd. This will mean more early bred cows and a shorter calving period with higher average weaning weights. Begin this program with heifers.

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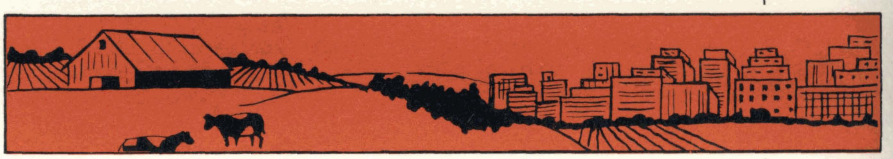

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