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MSU Extension
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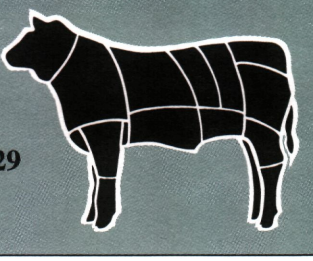


Getting the Cow Herd Bred

David Walker, Harlan Ritchie and David Hawkins, Department of Animal Science;
Charles Gibson, Department of Large Animal Clinical Sciences

INTRODUCTION

One measure of the reproductive efficiency of any cow-calf operation is the percent annual calf crop. The national average is approximately 75 percent, compared to the 90 to 95 percent attainable with the application of sound reproductive management. The 25 percent "infertility" rate that many producers experience in their cow herds results from several factors, including genetics, nutrition, environment, herd health status and production potential of the cow herd. Minimizing the negative effects these factors often exert on fertility is compounded because they do not act independently of each other. Deficiencies in one area often result in, or increase, deficiencies in other areas, which in turn result in decreases in overall production and reproductive performance levels.

Improving the "fertility" of the cow herd by selection is difficult. Reproductive traits and their heritability estimates are listed in Table 1. The low heritability of these traits showed that improvement through genetic selection is limited.

Many of the factors that affect these traits can be controlled to varying degrees by management. Sound reproductive management, therefore, offers the best way to improve fertility and achieve the accompanying increase in productivity.

Establishing goals for reproductive performance, cow productivity levels, and merchandising is important in analyzing and identifying reproductive management deficiencies. Realistic goals relating to reproductive performance are: 1) 95 percent calf crop; 2) calving season $\leq$ 60 days; 3) calving interval $\leq$ 365 days; 4) post-partum interval $\leq$ 45 days; and 5) first service conception rates $\geq$ 50 percent. Increases in production levels result in parallel increases in management requirements. Likewise, merchandising goals will affect management decisions such as calving dates and desired cow production levels.

An understanding of how the demands imposed by varying physiological states affect a cow's nutrient, health and shelter requirements is essential when analyzing a management program.

Table 2 outlines the different physiological stages a cow experiences and the metabolic demands that take priority during each stage.

A reproductive calendar (Fig. 1) can help analyze a reproductive management program by defining critical stages in a cow's reproductive cycle (one calendar year). Identifying periods when nutrition and environmental conditions are potentially limiting helps a producer schedule management procedures designed to meet the cow's physiological needs. The most difficult periods to manage include the prepartum period, the postpartum period and the breeding season. Poor nutrition and excessive stress can cause delayed reproductive cycles following calving, low conception rates, high embryonic mortality, and decreased milk production. After the breeding season, poor management conditions will result mainly in decreased milk production and poor calf performance.

Table 1. Heritability Estimates for Fertility Traits	
Trait	Heritability
Calving interval	0.1
Days between calving and first breeding	0.05
Days open	0.03
Number of inseminations per conception per cow	0.03
(Raheja et al., 1989)	

Table 2. Physiological Stages and Metabolic Priorities	
Stage	Priority
Prepubertal	Growth; initiation of estrus cycle
Prepartum period	Fetal growth and development; mammary gland development; growth for cows younger than three years
Parturition	Energy required for calving; initiation of lactation
Postpartum period	Initiation and maintenance of lactation; uterine involution; resumption of cyclicity
Breeding season	Maintenance of lactation; reproduction
Breeding - weaning	Maintenance of lactation and pregnancy
Dry period	Maintenance of pregnancy

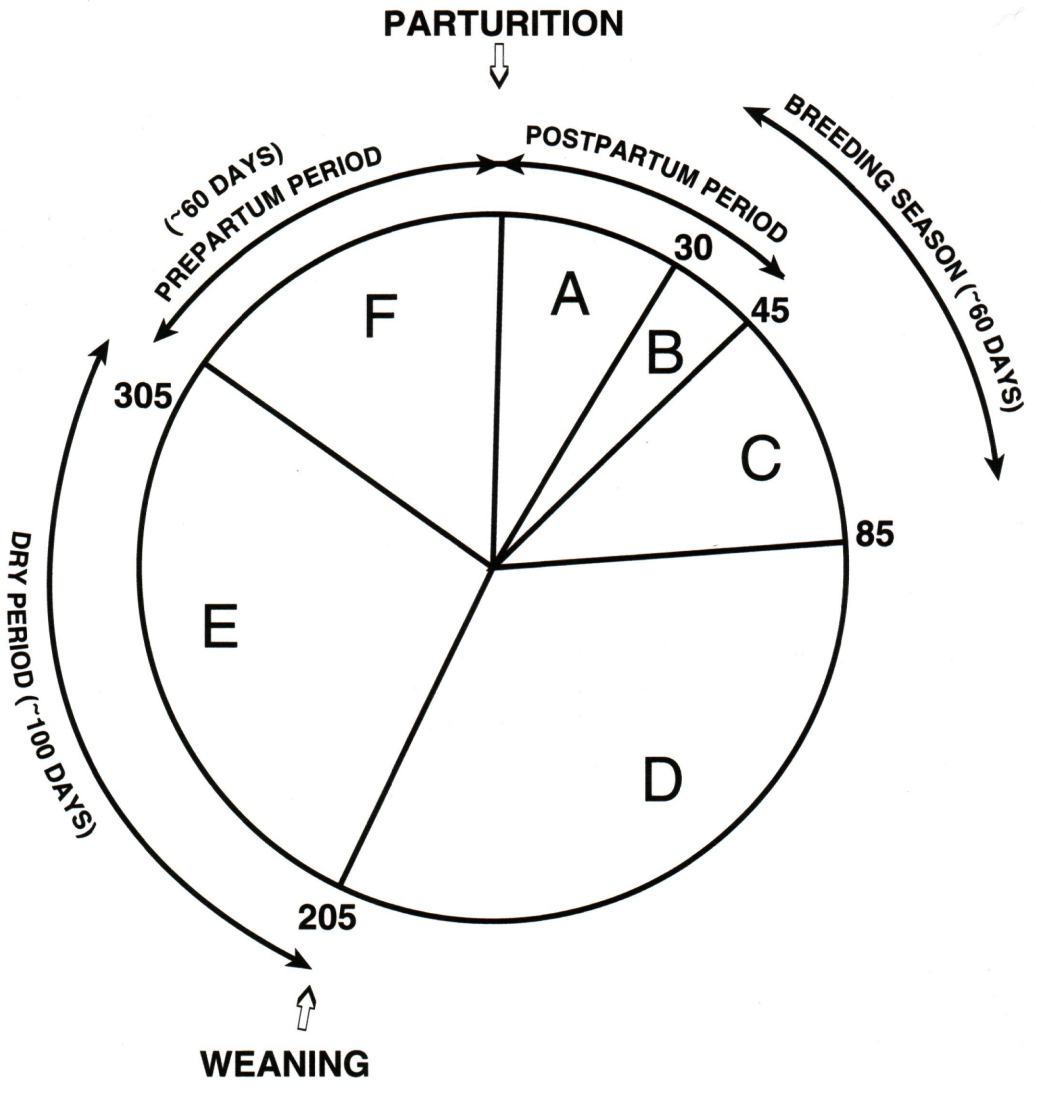
Table 3. Pregnancy Rates for Heifers Bred at Pubertal and Third Estrus		
	Pregnancy Rate	
Classification	No.	%
Pubertal (First) estrus	36/63	57%
Third estrus	35/45	78%

Effects of Nutrition on Fertility

Nutrition is potentially the most critical factor affecting reproduction. In most management systems, it also represents the most common limiting factor. The effects of poor nutrition can first be seen in prepubertal heifers. Underfeeding heifers results in delayed puberty. A high percentage of underfed heifers will not reach puberty until after the beginning of the breeding season. As Table 3 shows, conception rates on the pubertal (first) estrus are significantly lower than at third estrus. In addition, delayed skeletal maturity resulting from underfeeding can result in decreased pelvic width (and overall area) and increased calving difficulty. Dystocia is in turn related to increased postpartum interval and decreased conception and pregnancy rates. Due to the differences in size and body composition existing both between and within beef breeds, it is difficult to provide exact recommendations for feeding levels for growing heifers. In general, however, feeding to maintain an average daily gain of 1.25 to 1.75 lb/day and a body condition range of between 5 and 7 will be adequate. Be aware, however, not to overfeed heifers. Studies conducted with dairy heifers show that feeding for maximum gains limits lifetime potential for milk production.

The reproductive calendar (Fig. 1) indicates the stages when nutrition is most critical for the bulk of the cow herd. During the last 60 days prior to calving, the two major priorities are growth and development of the fetus and

Figure 1. Reproductive Calendar



Metabolic Demands Receiving High Priorities During Each Period of Cow's Reproductive Cycle.

Period AB	(0-45 Days)	–	Lactation, Uterine Involution, Repair of Reproductive Tract, Return to Normal Cyclicity
Period BC	(30-85 Days)	–	Lactation, Conception, Maintenance of Pregnancy
Period D (Post Breeding Season)	(85-205 Days	–	Lactation, Maintenance of Pregnancy, Embryonic Growth
Period E (Dry Period)	(205-305 Days)	–	Maintenance of Pregnancy, Fetal Growth
Period F (Prepartum Period)	(305-365 Days)	–	Rapid Fetal Growth, Mammogenesis

the mammary gland. Oklahoma research shows that the cow has biological mechanisms that ensure normal growth of the fetus even when nutrition is limiting. This occurs at the expense of other metabolic priorities necessary for the cow's health and well being. These effects are compounded in first- and second-calf heifers due to the demands of growth of the dam herself. Research shows that low-energy levels during the prepartum period are associated with increased rates of dystocia (Fig. 2) and decreased pregnancy rates during the next breeding season (Fig. 3).

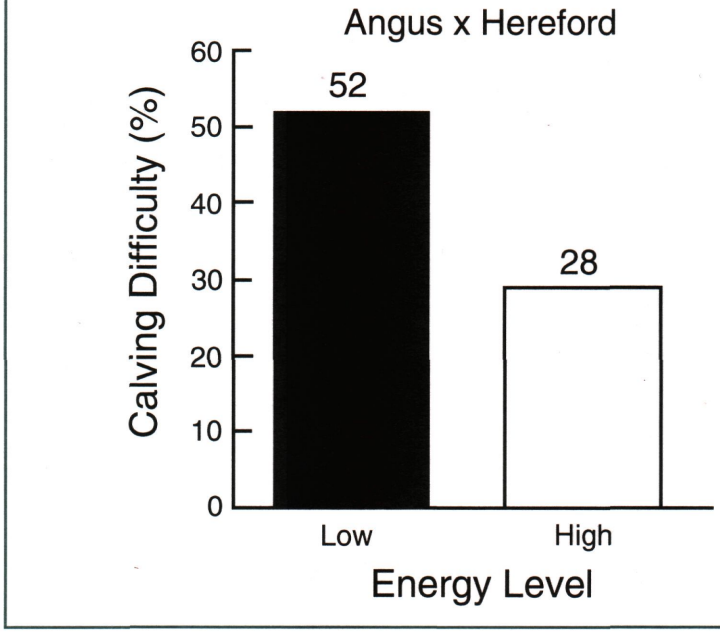
The next critical stage when nutrition is often limiting is the postpartum period. This includes the first 45 days following parturition. The cow's nutritional needs during this period are high. In addition to the initiation and main-tenance of lactation, which receives top priority, the cow must repair her reproductive tract (involution) and resume normal estrus cycles (P.P.I.). These two independent functions must occur simul-taneously if pregnancy is to occur. In adequately fed beef cows, these processes are completed by 30 to 45 days postpartum. Because conception rates on the first postpartum estrus are low, it is recommended that feeding levels be high enough to allow one or two complete estrus cycles to occur before the beginning of the breeding season. This is referred to as the voluntary waiting period, and in some instances, may not be practical. Again, the growth requirements of immature cows exaggerate the effects of underfeeding.

The breeding season must be completed by approximately 85 days postpartum if a 365-day calving interval is to be maintained. This reinforces the need for good pre- and postpartum nutrition. The normal lactation curve in Fig. 4 shows the demands for milk production peak during the breeding season. If these or higher demands are not met, conception will not occur. Obviously, the greater the potential production levels of the cow, the greater the effects of low feeding levels. High-producing cows may require supplemental feed even under good pasture conditions. Following the breeding season, pasture will meet the needs for lactation and maintenance of pregnancy until weaning time, except under drought or overstocking conditions.

It is important to note that the potential health risks due to obesity from overfeeding exist for cattle as in other species. Although this rarely occurs under most management systems (due mainly to high feed costs), producers should take precautions to prevent obesity. The days following weaning and before the prepartum period are an ideal time to adjust body condition of the cow herd. Since lactation has ended and the demands of the fetus are minimal during this period, overfat cows can safely lose weight. Alternatively, thin cows should be sorted and fed separately, because the cheapest, most efficient gains in body condition can be made now, when physiological demands are minimal.

Under commercial cow-calf management systems it is impossible to measure the individual feed intake of each cow in the herd. An effective way to ensure adequate intake is to monitor changes in body condition and adjust feeding levels accordingly. Research shows that maintenance of body condition during critical periods is

Figure 2. Breed x Energy Interaction for Proportion of Heifers Requiring Calving Assistance (Patterson, 1988)



necessary to maintain acceptable reproductive performance. Figs. 5 and 6 demonstrate the effects of loss of body condition on some measures of reproductive performance during critical stages.

While group feeding systems and varying cow production levels make it difficult to prescribe exact rations for beef cows, it is possible to fulfill the general requirements. By carefully monitoring changes in body condition, you can adjust total intake amounts, or feeding levels, to meet the needs of individual herds. The main nutrients to be aware of are: 1) energy (TDN); 2) protein; 3) minerals; 4) vitamins. Fig. 7 shows the changes in TDN requirements for an 1100-lb cow by stage of production. The requirements increase steadily from 60 days prepartum until the end of the breeding season, when they are at maximum.

The needs for protein parallel the needs for energy. Be careful, however, not to provide more than an 18 percent protein ration. Although high protein rations are associated with high milk production levels, giving more than 18 percent protein can decrease overall pregnancy rates and is not cost-effective.

A 12 percent crude protein ration is adequate for even the heaviest milking beef cows.

There is great demand for minerals during fetal development, lactation and the breeding season. Minerals that can most easily become deficient are phosphorous and selenium. Providing a free-choice salt and mineral mix will usually meet the requirements of the cow herd.

Figure 3. Breed x Energy Level x Weight Group Interaction for 45-Day Pregnancy Rate (Patterson, 1988)

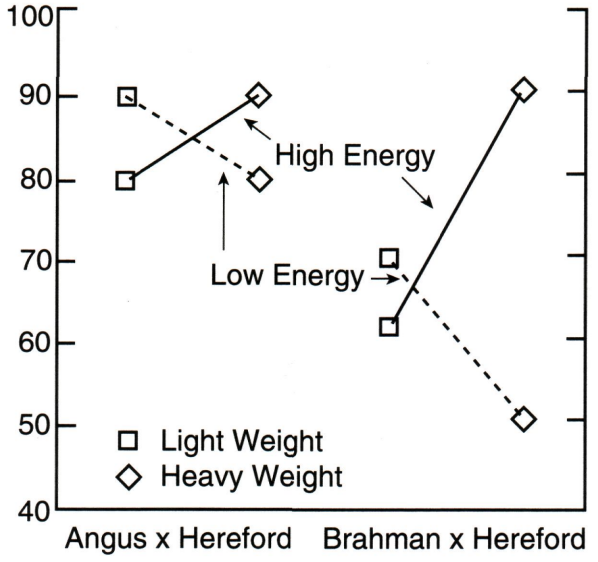


Figure 4. Lactation Curve

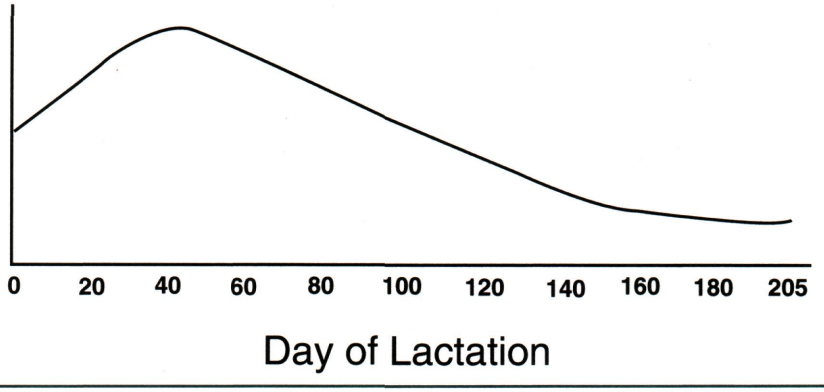
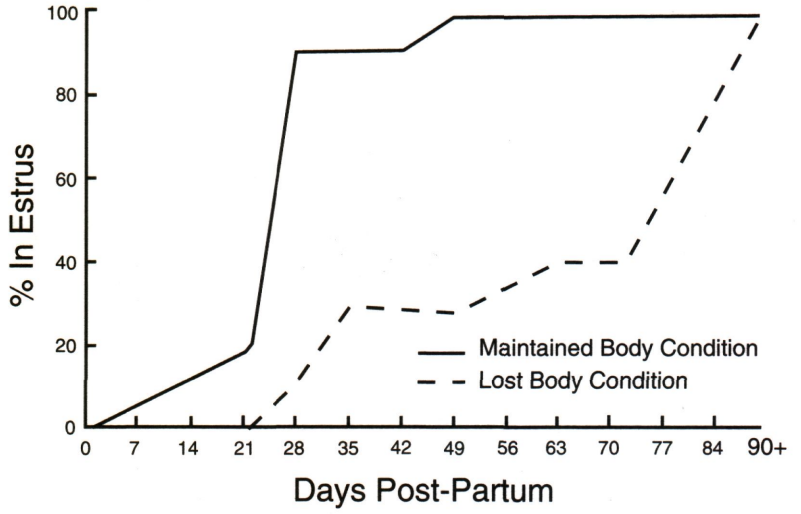


Table 4 lists a mineral-vitamin mix suitable for conditions in the north central states.

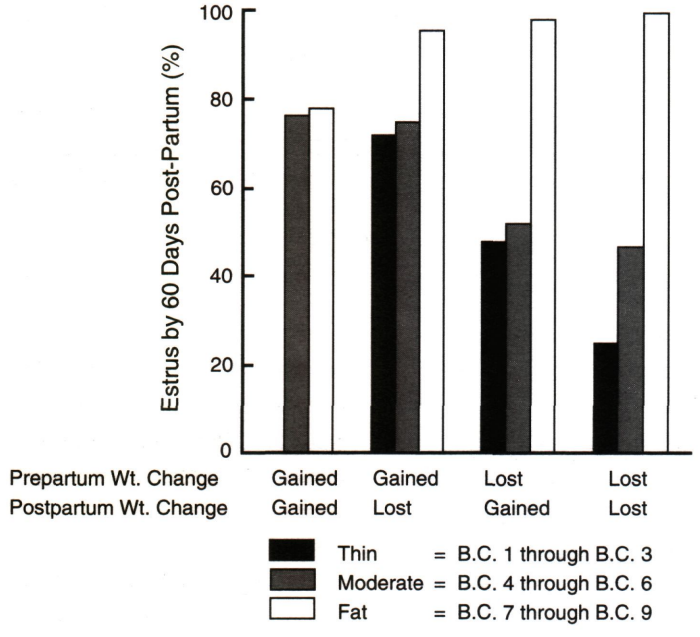
Vitamins are either produced in the rumen or are abundant in green growing forages. Therefore, vitamin deficiencies usually occur only after long periods of feeding harvested feedstuffs. Long periods of feed storage result in declines in vitamins A, D, and E. Furthermore, a cow's body stores can also be depleted during this same period. Therefore, during winter feeding it may be necessary to supplement these vitamins. This can be accomplished cheaply and efficiently through diet (see tables) or intramuscular injections. If you suspect deficiencies of either minerals or vitamins, have blood and feed samples analyzed. This will help identify deficiencies and implement appropriate solutions.

Figure 5. Effect of Loss of Body Condition Score on the Post-partum Interval to First Estrus



(Rutter and Randell, 1986)

Figure 6. Effects of Prepartum and Postpartum Body Condition Change on the Number of Days to First Postpartum Estrus (Whitman, 1973)



Environmental Effects

Extreme environmental conditions such as temperature and humidity can decrease reproductive performance. Changes in the cow's body temperature of 1.5 to 2 degrees F can result in embryonic mortality and abortion (Florida and Arizona research). Providing access to shade and fresh water will minimize the effects of heat stress during summer. During winter, extreme cold increases feed requirements. Each 1 degree F drop below the critical temperature for beef cows (30°F) results in a corresponding 1 percent increase in required energy levels to meet maintenance requirements. High humidity and wet, muddy spring conditions exaggerate the effects of cold temperature.

Table 4. Michigan Beef Cow Herd Free-Choice Mineral-Vitamin Mix[a]

Ingredient	Concentration
Salt (NaCl)	28.15%
Calcium	8.27%
Phosphorous	8.27%
Magnesium	11.60%
Manganese	.33%
Zinc	.67%
Iron	.41%
Copper	.17%
Selenium	.006%
Iodine	.022%
Cobalt	.008%
Vit. A. (I.U./lb)	298,050
Vit. D (I.U./lb)	30,985
Vit. E (I.U./lb)	1,133
Soy or coconut oil	1.25%
Natural dried licorice	0.10%

[a]Approximate daily consumption rate = 0.15 lb/hd/day.

Herd Health

A sound herd health program is an essential part of any reproductive management system. Cattle are susceptible to a variety of diseases that may affect reproduction. Vaccination regimes exist for many of these diseases. Table 5 lists the most common reproductive diseases and recommended vaccination procedures. All herd health programs should be implemented under the supervision of a qualified, licensed veterinarian. Note that there is a relationship between poor nutrition and increased incidence of herd health problems. Several vitamins and minerals are necessary for the proper functioning of the cow's immune system. Deficiencies in these areas can make cows more susceptible to disease.

Body Condition Scores

Due to the importance of nutrition in reproduction and the difficulty of measuring actual feed intake, a body condition scoring (BCS) system can help producers monitor changes in body condition of the cow herd and make appropriate diet adjustments. The BCS system scores cows from 1-9. A BCS of 1 is for extremely thin cows, while a score of 9 is for extremely fat cows. As illustrated in Figure 8, it is recommended that cows be maintained in the range of 5 to 7. While loss of condition is most damaging to reproduction, fleshier cows (BCS 6 & 7) can temporarily offset the effects of poor nutrition by utilizing their own body stores. On the other, hand, BCS of 8 or 9 can lower fertility and increase calving difficulty.

Figure 7. TDN (Energy) Requirement for a 1,100-lb. Beef Cow by State of Production

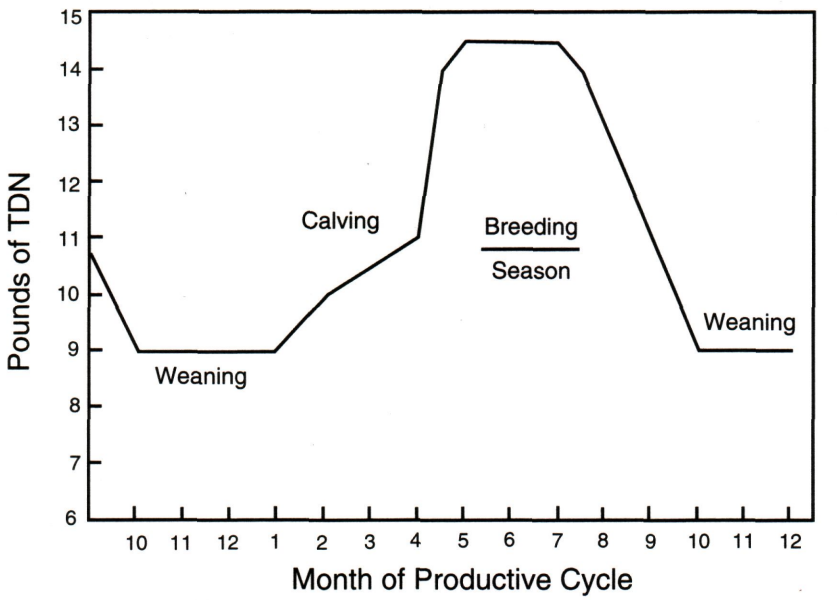


Figure 8. Prepartum Calving Body Condition vs. Percent Pregnant

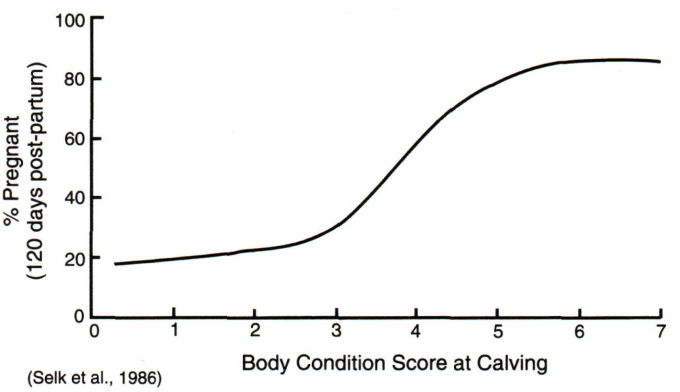


Table 5. Immunization Program

Disease	Timing	Number of Doses	Interval Between Doses	Interval Between Boosters
Brucellosis	4-8 mo. (Mich.)	1	none	none
IBR	Pre-weaning	2	2-3 weeks	annually 1 dose
BVD	Pre-weaning	2	2-3 weeks	annually 1 dose
Leptospirosis (5-strain)	Pre-breeding	2	2-3 weeks	6-12 mo. 1 dose
Clostridium (7 strains)	Pre-weaning	2	2-3 weeks	annually
OPTIONAL				
BSRV	Pre-weaning	2	2-3 weeks	annually 1 dose
Haemophilus somnus	Pre-weaning	2	2-3 weeks	annually 1 dose
Campylobacter (vibriosis)	Pre-breeding	2	2-3 weeks	annually 1 dose
Rota/Corona and E. coli	Pre-calving	2	2-3 weeks	annually 1 dose

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