Effective Use of Artificial Insemination in Beef Cattle
Beef and Cow Management

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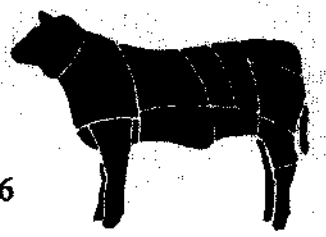

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Introduction

Artificial insemination (A.I.) provides the cow-calf producer an opportunity to use bulls possessing superior genetics. Depending upon the needs and goals of an individual's breeding program, A.I. offers an economically feasible means of increasing productivity over a wide range of traits. In spite of this enormous potential to improve production levels, many beef producers have not taken advantage of the benefits offered by A.I.

The missing or limiting ingredient in implementing a successful A.I. program is often management. The use of A.I. necessitates a sound management program.

An effective A.I. management program is best established one step at a time. Factors to be considered are: 1) implementation of an efficient recordkeeping system; 2) well-designed, strong cattle-handling facilities; 3) a sound nutrition program; 4) a sound, effective herd health program; 5) accurate heat detection; 6) a knowledgeable, well-trained A.I. technician.

Records

Accurate and complete records are essential to any intensive management system. For an A.I. program to be successful, a manager must know both the present reproductive status and reproductive history of each individual cow in the herd. Statistics such as calving date, date of first postpartum estrus, actual length of a cow's estrus cycle, consistency of estrus cycle length, number of services required per pregnancy, incidence and severity of dystocia, and individual cow ages all help a manager to operate and to pinpoint weaknesses in the system. Only after management deficiencies have been identified can appropriate solutions be devised and implemented.

Individual cow identification is part of a successful recordkeeping system. There are a number of ear tags on the market which provide an effective, economical means of individual identification for the cow herd. In purebred herds, it is necessary to also use a permanent form of identification such as an ear tattoo. Brands (hot or freeze) are also effective.

Table 1 shows some sample record forms. Form A is a sample calving record. Form B records data needed in an A.I. program.

Facilities

To efficiently sort and restrain individual cows, A.I. facilities need not be elaborate or unduly expensive. It is essential, however, that they be strong and solid. They should be designed and constructed to minimize stress to the cow. Excessive stress and excitement can markedly reduce conception rates. Although an alleyway may be sufficient in which to A.I. cows, a chute and headgate is a wise long-term investment. For practical cattle handling facilities, refer to Beef Housing and Equipment Handbook (MWPS-6), Midwest Plan Service, Iowa State University, Ames, IA 50011.

Nutrition

Nutrition can have a profound effect on the fertility of the cow herd. Nutritional requirements are dependent upon the physiological state of the individual cow. Lactation, growth, pregnancy, and events surrounding and including parturition exert high demands upon a cow's metabolism. When feed intake is insufficient to meet the demands of the cow's various physiological states, nutrients are diverted toward those functions most essential to the survival of the cow and her calf. When this happens, the cow's abilities to cycle regularly and to conceive and maintain a pregnancy are often impaired.

Critical times in most beef cow operations are the last 60 days prior to calving and the first 60 days following calving. Research has shown that during the late prepartum period, cows receiving an insufficient level of energy to maintain their body condition experience a prolonged postpartum anestrus period. Because of the demands exerted by the initiation of lactation, the postpartum period is also critical. Figure 1 illustrates the relationship between body condition, feeding level (energy intake), and number of days to estrus following calving (postpartum internal).

Feed requirements of cows in

Table 1. Cow Herd Record Forms

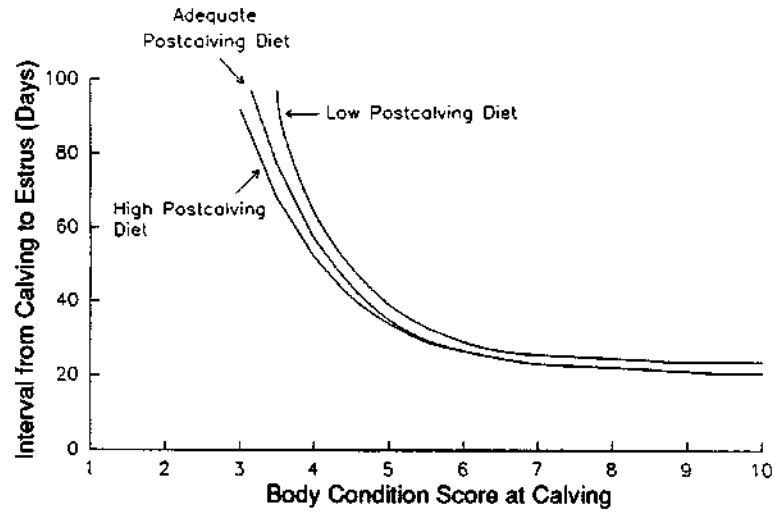
Form A -- Calving Record

Calf I.D.	Cow I.D.	Calf Sire	Calf Birth Weight	Birth Date	Calving Ease Score	Comments

Form B -- A.I. Record

Cow I.D.	Calving Date	1st P.P. Estrus	A.I. Sire	1st Serv. Date	2nd Serv. Date	3rd Serv. Date	4th Serv. Date

Figure 1. Postpartum Diet Effects



Interval from calving to estrus and body condition score as affected by levels of postpartum diets (Short et al., 1990)

different physiological states and cows with different production potentials can vary greatly. It is therefore advantageous to separate and feed cows based upon their age, lactational status, pregnancy status, and production potential. This can help eliminate the economic losses produced by both underfeeding and overfeeding of cows. Several potential sorting schemes are presented in Table 2. Which of these schemes a manager chooses to implement is dependent upon feed, labor and facility resources.

Classes of nutrients that are important are energy, protein, vitamins and minerals. Adequate energy intake can be effectively estimated by monitoring changes in body condition. Deficiencies in other nutrients are more difficult to detect.

In general, protein deficiencies are rare in beef cows. Dry cows require approximately 8 percent crude protein, lactating cows about 12 percent.

Cows on green growing forages rarely experience vitamin deficiencies. However, several vitamins become inactive under prolonged storage conditions and in some ensiling processes. Vitamins A, D and E are important in maintaining the integrity of the reproduction tract, synthesis of steroids and normal cyclicity. Therefore, injections of vitamins A, D and E prior to parturition may be beneficial for cows wintered on poor quality forage.

Several minerals can be deficient in the brood cow's diet. Calcium and phosphorus are essential for both milk production and reproduction. Another mineral of particular importance is selenium (Se). Se supplementation significantly increases overall fertility in certain areas of the nation. Additionally, Se has been implicated in the immune system. Table 3 presents a free-choice mineral mix which provides adequate levels of minerals and vitamins for Michigan beef cow herds.

Table 2. Sorting Schemes for Feeding the Beef Cow Herd

By Physiological Status				
Sorting Scheme	Greatest Feed Requirements	→		Least Feed Requirements
1	Preg. Yrlng. Heifers	Preg. 2-3 Yr. Old Cows	Preg. Cows >3 Yr. Old Cows	Open Females
2	Preg. Females < 3 Yrs. Old	Preg. Females > 3 Yrs. Old	Open Females	
3	All Preg. Females and All Females with B.C. <5		Remaining Open Females	
4	Thin Females (B.C. <5)		Fat Females (B.C. >5)	
5	Lactating Females		Nonlactating Females	

Table 3. Free-choice Mineral Vitamin Mix[a]

Ingredients	Concentration
Salt (NaCl)	28.15%
Calcium	8.22%
Phosphorus	8.27%
Magnesium	11.60%
Manganese	.769%
Zinc	.991%
Iron	.161%
Copper	.251%
Selenium	.006%
Iodine	.022%
Cobalt	.008%
Vit. A (I.U./lb)	298,051
Vit. D (I.U./lb)	30,985
Vit. E (I.U./lb)	1,134
Soy or coconut oil	1.4%
Sweetening agent	0.125%

[a]Approximate daily consumption rate = .15 lb/hd/day

Herd Health

Reproductive performance and the ultimate success of an A.I. program can be greatly affected by the health status of the cow herd. Table 4 lists the important diseases that affect reproductive performance and the vaccination schedules which are most effective against them. Michigan law

requires that all replacement females between the ages of 4 and 8 months of age be calfhood vaccinated for brucellosis (Bangs) by a licensed veterinarian. Bangs vaccination laws vary from state to state. The other vaccinations should be administered under the advice of a veterinarian. Certain modified live virus vaccines should not be used on pregnant cows because of risk of abortion. Based upon a producer's herd history and area, a veterinarian can establish a safe and effective vaccination and overall herd health program.

Table 4. Immunization Program

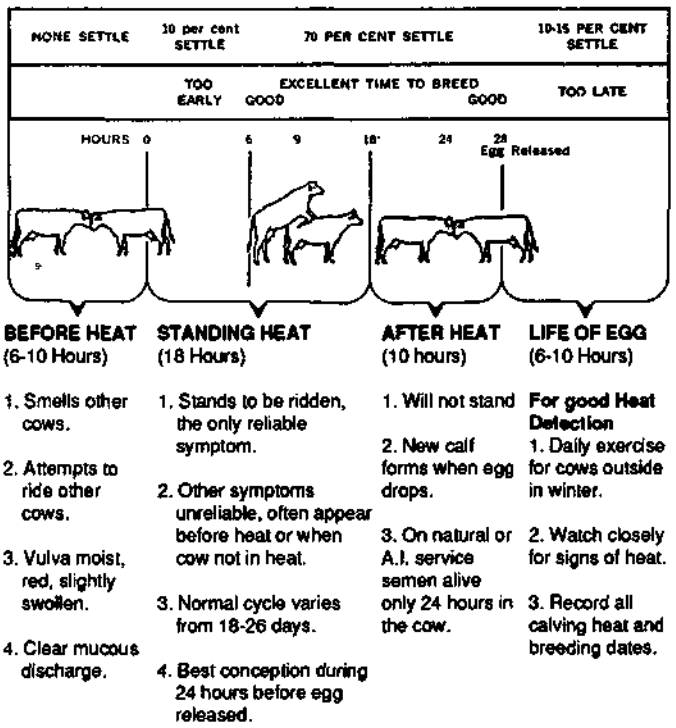
Disease	Timing	Number of Doses	Interval Between Doses	Interval Between Boosters
Brucellosis	4-8 mo. (Mich.)	1	None	None
IBR - PI[3]	Pre-weaning	2	2-3 weeks	annually 1 dose
BVD	Pre-weaning	2	2-3 weeks	annually 1 dose
Leptospirosis (5-strain)	Pre-breeding	2	2-3 weeks	6-12 mo. 1 dose
Clostridium (7 strains)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

Heat Detection

Figure 2 outlines the timing of events surrounding estrus. Conception is dependent upon proper timing of insemination with ovulation. Insemination 10 to 14 hours following standing heat is the best way of ensuring this. Accurately identifying the period of standing estrus or heat is often the most difficult and limiting aspect of an A.I. program. Heat detection is difficult for two reasons. First of all, it requires a serious commitment of time. Good heat detection involves careful observation of the cow herd at several times during the day. Each period of observation should last for a minimum of 15 to 20 minutes. Furthermore, a successful estrus detection program involves 3 to 4 observation periods per day.

The second requirement of accurate estrus detection is a

Figure 2. When to Breed – Events Surrounding Estrus



practical understanding of the cow's behavioral responses and physical reactions around and including estrus. Signs that indicate a cow is approaching estrus include: 1) increased activity, nervousness, and restlessness, 2) riding or mounting of herd mates, 3) swelling and moistness of the vulva, 4) presence of a clear mucous discharge on the tail, vulva, and/or rump, and 5) standing to be mounted by herd mates. Generally speaking, standing to be mounted is the best sign of estrus to use for scheduling insemination. Insemination 12 hours following standing heat will result in maximum conception rate. Using the signs of approaching estrus usually results in insemination too far ahead of ovulation for sperm to survive.

A.I. Technician

The final ingredient in a successful A.I. program is a properly trained and knowledgeable A.I. technician. Effective training sessions are conducted by most A.I. organizations. Areas which require the most proficiency are semen handling and proper placement of the semen in the female's reproductive tract.

Extreme caution must be exercised when handling semen. The first procedure which requires care is the thawing process. Semen is stored in liquid nitrogen (approximately -240°F.). Any rise in temperature prior to thawing can kill sperm cells. This can present obvious problems in cold weather. Careful adherence to thawing instructions and insemination techniques will minimize these hazards. Secondly, water is lethal to sperm. Careful drying of the semen straws and cleaning of the equipment will minimize this problem. The use of new clean dry paper towels is important.

Palpation of the reproductive tract and good A.I. technique are skills which require practice and repetition to achieve proficiency. Research shows that even experienced A.I. technicians have difficulty depositing semen at the desired location within the uterine body. Table 5 shows the results of one such study. Using radiography, inseminating syringe tip placement and inseminate distribution was measured for 40 A.I. technicians. Results of this trial and others indicate that approximately 25 percent of all A.I. attempts result in semen deposition in the cervix. Other studies show that cervical deposition of semen during A.I. results in near-zero conception rates. More recent studies show that A.I. technicians can be trained so that more than 90 percent of inseminations will result in uterine body or uterine horn deposition (McKenna et al., 1989).

A.I. provides many advantages to beef producers for genetic improvement. It also requires improved management techniques that parallel the potential improvements. Although not a "free lunch," A.I. can provide significant return on investment when implemented within carefully planned and conducted management programs.

Table 5. Syringe Tip Placement by Inseminators[a] (adapted from Peters et al., 1984)

	1st radiograph[b]			2nd radiograph[c]		
Syringe Tip Location	Profes-sional	Herds-men	All Insem-inators	Profes-sional	Herds-men	All Insem-inators
# of radiographs	264	322	586	307	359	666
Uterine Body	41%	37%	39%	39%	29%	34%
Cervix	21%	29%	25%	33%	40%	37%
Uterine Horns	38%	36%	36%	28%	31%	29%

[a]Values are average percentages for 20 professional and 20 herdsmen for placement of the syringe tip in various regions of reproductive tract.
[b]1st radiograph from each pair described the placement of the syringe tip before semen deposition.
[c]2nd radiograph from each pair described the position of the syringe tip immediately following semen deposition.

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