INCORPORATING ARTIFICIAL INSEMINATION INTO THE BEEF MANAGEMENT SYSTEM

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INTRODUCTION

Minnesota has almost 17,000 beef producers who rely on leadership from the University beef faculty and extension staff. This leadership should be directed towards enhancing the profitability of beef cattle operations by encouraging producers to produce a uniform, quality product.

In 1977, the national average per capita consumption of beef was approximately 95 pounds. In 1999, we are projected to consume an average of 63 pounds of beef per person. The result is a 34% (or 22 pound) decrease in consumption in 22 years! A Beef Quality Audit survey in 1991 and 1995 indicated that 25% of beef eaten in that survey gave an "undesirable experience". There are few products that can endure a 25% failure rate. Therefore, it is not surprising that beef consumption is declining. The beef industry's major competitors are the poultry and pork industries, which have redefined traditional agricultural production systems at the expense of small-scale farmers. Nonetheless, these two industries have excelled in producing meat that is predictably consistent and uniform. Because the beef industry has lagged behind in establishing criteria for consistency and quality in their products, the poultry and pork industries have consumed a portion of beef's market share.

The use of artificial insemination (AI) is one of the most effective methods to enhance the profitability of most beef cattle production systems. Unfortunately, even with the known advantages of AI to any production system, only 7.1% of all beef cattle females are inseminated artificially annually. In contrast, greater than 80% of all dairy females are inseminated artificially on a yearly basis.

Table 1. Change in Milk Production for Dairy Cows Before (1945) and After (1985) the Extensive use of Artificial Insemination

Parameter	1945	1985	Change
Dairy cows (number)	25 million	11 million	-56%
Milk production (kg)	55 billion	64 billion	+16%
Milk/cow (kg)	2,200	5,773	+265%
Total feed			-30 %
Feed costs			-$3 billion

(adapted from Niswender, 1999)

A study depicting the effects of AI on the dairy industry is summarized in Table 1. When used on a large scale, AI allowed reliable progeny testing of dairy bulls. Dairymen used the resulting information to identify those bulls whose daughters were proven to be excellent milk producers. Semen from identified bulls was used to AI large numbers of cows. As a result, in the 40 years following introduction of AI with frozen semen, milk production increased 265% per cow. Furthermore, United States dairymen are producing 16% more milk with 56% fewer dairy cows!

Alas, the extensive nature of most beef cattle operations and labor intensity associated with reproductive technologies, such as AI, embryo transfer and cloning tends to drive people away from utilizing this technology, yet, the financial and genetic advantages have been extensively documented. To encourage the use of AI in beef operations, researchers have spent years in developing estrous synchronization protocols that producers can use to incorporate AI as an effective management strategy to enhance profitability in their operations. Our failure as researchers has been to develop a system that can consistently result in acceptable conception rates with minimal input costs and reduce costs associated with labor and time. In recent years, many resources have focused on developing synchronization systems that have eliminated heat detection. Tremendous progress has been made in this area. Our current challenge is to disseminate our recent reproductive technology developments to as many Minnesota beef cattle producers as possible and perhaps stimulate a trend for higher quality Minnesota beef.

This article will address critical steps to incorporating a successful AI program into beef cattle operations, without compromising fertility.

MANAGEMENT

The single largest reason for the failure of an AI program is due to poor management. In other words, use synchronization to enhance the profitability of a well-managed operation; don't use synchronization to obtain a well-managed operation!! There are several management factors to consider before deciding whether synchronization will work in your operation.

Nutrition. When focusing on any reproductive management program, nutrition is the single most important factor that could dictate the success or failure of that program. The body condition that cows calve at determines the rate at which those cows initiate their estrous cycles after calving. Therefore, it is essential to ensure that cows calve at a body condition score of 5. Waiting until after calving to feed your cows extra feed is usually too late. To give a synchronization system a chance to work for you, ensure that cows are in good condition at calving and this will give more cows an opportunity to cycle by the beginning of the breeding season. Briefly, between 25 and 70% of beef females in most herds have not yet started their estrous cycles by the start of the breeding season. A solid precalving nutrition plan can reduce the number of anestrus cows and allow synchronization to work in your favor.

Record Keeping. Maintaining a sound recording keeping system is a key to success in any reproductive management system. For synchronization to work, producers need to know when their cows calved, whether the cow had a difficult birth, and what the birth weights of all calves were. We aim at starting a synchronization protocol when cows are greater than 45 days from calving; however, if your cow had a difficult birth or large calf, perhaps it would be wise to wait an extra few weeks. Without accurate records, these decisions can be extremely subjective.

Facilities. With synchronization, you can expect many more females to be in heat at a single time than without synchronization. Plus, females will need to be pushed through the chute for injections more frequently than usual; therefore, working facilities need to be able to accommodate the extra work. Not only should you consider reliable holding and sorting pens, but also a good solid alley and chute system. Anticipating an increase in facility use will certainly ensure a successful synchronization program.

Labor. Reliable labor is an issue that many people neglect to consider when planning a synchronization program. Detecting when cows are in heat is important for the success of a synchronization program. Any labor associated with this process needs to know exactly how cows act when they are in heat. In many cases, this is often when a program fails. A producer feels that they have more important things to do than spend time heat checking. They will often leave for the "more important" job or leave the heat checking to a less than competent individual. The end result is poor estrus response or poor conception rates.

Many more factors need to be considered, such as using a proficient AI technician. Regardless of the system that you use, be sure to follow the directions on the drug label and don't take short cuts, believing that it will be more simple and save time. Invariably this is when results are at their poorest.

SYNCHRONIZATION SYSTEMS

In recent years, several different synchronization systems have been developed. We will address some of these systems, concentrating on which group of females these systems appear to suit, and when to use them. Firstly, a brief introduction to some of the products used for estrous synchronization is listed in Table 2.

We can use the products in Table 2 to control the timing of onset of estrus by controlling the length of the estrous cycle. The choice of approaches for controlling cycle length are: 1) to regress or "kill" the corpus luteum of the animal before the time of natural luteolysis, and thereby shorten the cycle (the PGF products are used to regress the CL), or 2) to administer exogenous progestins (MGA, NORG, IPI) to delay the time of estrus following natural or induced luteolysis that may extend the length of the estrous cycle. A further approach is to "select" the ovulatory follicle by an injection GnRH which should cause premature ovulation of that follicle. Using these concepts, the remainder of the update will address a few of these systems.

Table 2. Products, commercial names, and doses for synchronization products.

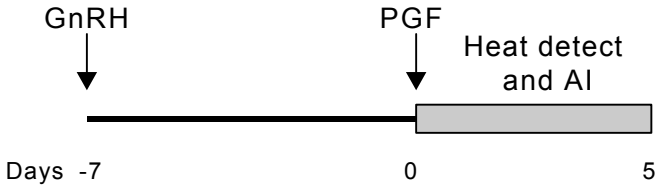
Product	Commercial name	Abbre-viation	Administration	Dose
Prostaglandin F_{2a}	Lutalyse®	PGF	i.m. injection	5 mL
	Estrumate®	PGF	i.m. injection	2 mL
Progestins	Melengestrol Acetate	MGA	Feed	0.5 mg/hd/d
	Synchro-MateB® (implant only)	NORG	Ear implant	1 implant
	Intravaginal Progesterone Insert	IPI	Vaginal implant	1 implant
Gonadotropin Re-leasing Hormone	Cystorelin®	GnRH	i.m. injection	2 mL
	Facterel®	GnRH	i.m. injection	2 mL
	Fertagyl®	GnRH	i.m. injection	2 mL

2×PGF. The 2×PGF system was one of the initial systems developed and continues to be an effective synchronization system for females that have attained puberty or initiated their postpartum estrous cycles. The primary advantage of this system is cost; however, the disadvantage is that PGF does not initiate estrous cycles in cows that are not cycling. Therefore, if your cows are anestrus this system will not benefit your program.

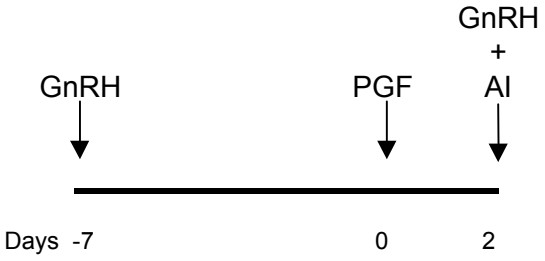
MGA-PGF. The MGA-PGF system continues to be the most effective synchronization system for beef heifers, especially if cost is an issue. If producers are prepared to detect heat, success is usually high using this system. Of added importance is the opportunity to "kick-start" or trigger heifers to start cycling that have failed to reach puberty yet. Unfortunately, the duration for the whole treatment is approximately one month; therefore, preparation needs to be initiated earlier than most systems. An additional disadvantage of this system is that females need to receive MGA in feed; this area of the program is often where many failures occur.

For producers who desire a little flexibility in a synchronization program, this is an ideal system. Both the duration of MGA feeding and the interval from MGA to the PGF injection can be altered with little effect on response. However, before altering any part of the protocol, be sure to understand the possible consequences.

Select Synch. Select Synch is one of the latest estrous synchronization systems to enter the market. As drug costs decline, this is becoming one of the most frequently used systems to synchronize postpartum beef cows. This system does initiate estrous cycles in postpartum cows that are not cycling. In addition, the duration of the system only requires one week from the start of synchronization until cows begin showing signs of estrus. For producers who utilize this system, heat checking at least three days before the PGF injection and inseminating cows then will increase the heat detection rate by up to 20%. For cows that are inseminated before the PGF injection, there is no need to inject those cows with PGF on day 0.



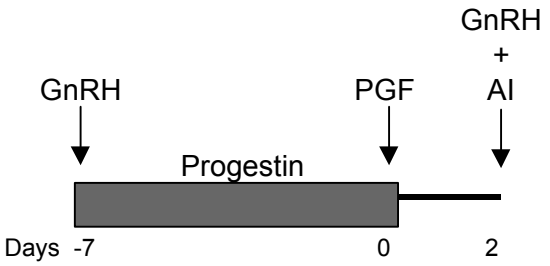
CoSynch. In beef cattle operations that are fairly extensive, or would like to incorporate an AI program into their operation, and feel that labor and time associated with heat detection are limiting opportunities for AI use, then using the CoSynch protocol is a good option. Pregnancy rates of around 50% can be achieved in well-managed herds that use this system. Unfortunately, in many areas, cost is a limiting factor, but the benefits of AI usually out-weigh the cost factor. Keep in mind that every female that is synchronized is inseminated at a fixed time between 48 and 54 hours. Very few heat detection programs achieve a point at which every cow has an opportunity to become pregnant. CoSynch does give every cow an opportunity to become pregnant.



As with the Select Synch program, several cows will come into heat before the PGF injection. If at all possible, inseminate those females and then time inseminate the remainder of the cows at a fixed time.

This system has not been effectively tested in beef heifers; therefore, limit the use of this system to postpartum cows.

Cosynch+Progestin. The most effective system for synchronizing postpartum beef cows without heat detection is the CoSynch+Progestin system. Preliminary data reports have indicated conception rates as high as 68% in suckled beef cows. The general protocol is similar to CoSynch except that an implant is inserted when the first GnRH injection is administered. The implant is removed at the time PGF is injected. The progestin implant prevents cows from coming into heat between GnRH and PGF administration. A certain advantage is that cows that are anestrus before this system is used, usually will initiate their estrous cycles shortly after removal of the implant.



For producers that would like shift their calving date to a date earlier in the year, this system is extremely effective. Additionally, cows that have just calved with their first calf (first calf heifers) are traditionally the most difficult females for producers to get pregnant during the breeding season. The added cost in using a system like this may pay dividends in increased pregnancy rates.

SUMMARY

Most beef herds in the mid-western United States initiate the breeding season with between 25 and 70% of their cows in an anestrus state. For most AI programs to work, a sound nutrition program is essential. Synchronization does decrease the labor associated with AI programs; however, the added benefits include a shorter breeding season and consequently a shorter calving season. In essence, the value of progeny is greater due to a more uniform calf crop.

Synchronization can be an effective tool for enhancing beef cattle reproductive management techniques. For producers interested in utilizing synchronization in their operations, be sure to understand the pros and cons of each system and consult with a reproductive specialist who can specifically answer questions that you may have.

ADDITIONAL LITERATURE

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