ARTIFICIAL INSEMINATION CONSIDERATIONS FOR BEEF CATTLE

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Artificial insemination (AI) offers tremendous potential for the beef cattle industry and for individual operators, but also offers an opportunity for disastrous results. Both of these ideas will be explored throughout this paper.

With natural breeding you may expose 100-300 cows to a sire and this usually occurs in a given locality over a period of a few years. However, with AI 100,000-200,000 exposures are possible and this may occur throughout the United States as well as being used world wide. Semen can be stored almost indefinately so a sire may be used for an indefinate number of years.

So with AI if you have superior sires and the semen is disease free, the potential is staggering. On the other hand, if the sires selected are not so good, as was the case with some of the dwarf carries during the "comprest" cattle cycle, or the semen is not clean the problems have been magnified. Tuberculosis, brucellosis, trichomoniasis, vibriosis, leptospirosis, foot and mouth disease and other diseases can be transmitted in the semen. However, the reputable breeding companies are extremely careful in both their selection of sires and in their health programs.

Many benefits are accredited to AI, such as shortened breeding season, uniform calf crops, facilitating cross breeding, improved records, increased production, etc. Some of the benefits are due to AI, but much of it is because of intensified management which AI forces you into to have a successful program. Most of these improvements are possible without an AI program.

Even though AI has some drawbacks it does offer fantastic potential. So why don't more cattlemen AI? Over 50% of the dairy herds do, but only 2% of the beef herds. Obviously there are some problems.

Before going into an AI program an individual has to train himself, hire someone, or work through a breeding association to attain the expertise necessary to run the program. It is time consuming and takes a dedicated effort to have a successful program.

Heat detection is one of the major problems. We really have no viable alternative to visual observation. The labor and time required and difficulty of heat detection is one of the major reasons only 2% of the beef cattle are artificially bred. There are aids available such as vasectomized bulls with chin ball markers and mounting devices which are stuck on the backs of cows and change color with the pressure of mounting. These all help but they don't replace visual observation. Synchronization has not been satisfactory on a practical basis. Prostaglandins do offer some possibilities, if and when they are cleared for use. With prostaglandins it is possible to inject

twice, about 12 days apart, and then breed about 80 hours after the second injection. This eliminates the need for heat detection. Research data indicate that results are comparable and often superior to the normal AI routine with heat detection. Like most of the tools available, it is not a cover up or cure all for poor management. If the cow herd is not in condition to come into estrus and breed, prostaglandins will not help. It is still imperative that the cows have enough rest from calving, proper nutrition, and free of reproductive diseases before they can be bred.

Artificial insemination requires intensified management and good facilities. It is important that the physical set up allows for quiet and efficient handling of these animals. In some cases this may mean building of lanes, alleys or drift fences into the breeding facilities. The pastures or fields must be close enough and convenient enough so that a good job of heat detection can be accomplished. Once the cows are identified, they need to be brought into the breeding areas as quietly as possible. Once there, the holding pens, corrals and chutes need to be designed for quiet and easy handling. Poor fences, poorly designed facilities, inadequate chutes or chutes that are too wide all lead to harassment and excitement of the animals. The use of a trained gentle "gopher" cow put into the chutes ahead of the cows to be bred often makes them easier to get in and calms them while they are in the chute. Excited upset cows do not breed well and without the proper facilities, results are likely to be disappointing.

Individual identification of the animals, along with records, is an aid to a successful AI program. These records will help keep track of cows that have been bred, heat cycles, breeding problems and other valuable information. It may also be beneficial to further identify cows that have already been bred, such as with colored tape on the tail or long lasting markings on the animals, for field identification. In beef cattle 5 to 10% will exhibit estrus after they have conceived. So when breeding cows (AI) the second time it is advisable to deposit the semen at the mouth of the cervix rather than into the cervix. Penetration of the cervix after conception will terminate that pregnancy. The records from individual identification can also provide this information, but it is handy to have them marked for field identification and at the time of breeding. Good records not only aid an AI program, but are a valuable management tool for any cow herd, particularly for making selection and culling decisions.

An area close to the breeding facilities for the semen storage tank and AI equipment is also necessary. If the two locations are too far apart it makes it difficult to protect the semen until ready for use. It is also beneficial, in the case of straws, to have a warm water source and thermometer so as to thaw at the proper rate. In the case of straws or ampules, when breeding in cold weather, it is necessary to protect semen from cold shock. This is usually done by carrying the unit inside of a coat or shirt.

The size of range or pasture the breeding is being done on is also an important consideration. In Eastern Oregon the average carrying capacity of the ranges is 10 acres/AUM. This means on a 45-day breeding program, 15 acres would be required per cow. A 300 head cow herd then would require 4500 acres. Areas of this size would add considerable to the problems of heat detection described earlier. Cross fencing is an alternative, but expense can be prohibitive. High quality ranges, introduced grasses or improved pastures may be necessary to cut down the size of the area for breeding. This is one of the areas where AI forces you into a more intensive system, but smaller breeding pastures would also facilitate natural breeding.

How long should the AI breeding season be? Table 1 presents expectations from various AI exposures. The number detected in heat and conception rate per exposure listed here are pretty good performance levels. So in general you could expect about 50% of your herd bred AI after 21 days or one heat cycle and 75 and 90% after 42 and 63 days. The most common system used is about a 42 day AI season with a 21-day period using clean up bulls. If you have confidence in your AI program, there may be some merit to going a full 63-70 days and eliminating the need for clean up bulls. In any event the goal should be to limit the breeding season to about 3 heat cycles or around 60 days.

Table 1. Expectations from various AI exposures.

Days	Detected in heat	Conception rate/exposure	Total bred
	%	%	%
21	70	70	50
42	90	70	75
63	95	70	90

Table 2 presents some effects of using higher quality bulls on sale weight and income. These data assume there are 100 calves to sell each year, bulls are turned over every four years, calves are weaning at 400 lb. and selling at 40¢ per pound. It is also assuming that the improved sires are adding 5% to the calf weights and calf weights are improved 15% with F_1 cows. It is obvious that the maximum return on the initial investment is slow and will take 10 to 13 years under natural breeding. Artificial insemination would speed it up considerably. With AI you would reach year 4 in calves from the improved sires in the first year and by heavier than normal culling and replacement selection, the number of calves from the F_1 cows could be increased considerably. The time to maximum returns from

the improved breeding could be realized in 6 to 7 years. The cost of breeding may not differ too much between AI and natural. Cost of natural breeding, including cost of the bulls, feed, net return for replacing him with a cow, etc., are estimated to be $17-19 per calf. It appears that we may be able to approach this figure with AI.

Table 2. Effect of improved sires on added sale weight and income.

Year	Calves from improved sires	Calves from improved dams	Added sale wt.	Added income
	No.	No.	lb	$
1	25	0	500	200
2	50	0	1000	400
3	75	0	1500	600
4	100	14	2600	1040
5	100	28	3200	1280
6	100	42	3800	1520
7	100	56	4400	1760
8	100	70	5000	2000
9	100	84	5600	2240
10	100	98	6200	2480

The critical aspect of the effect on income is if in fact the bulls are of higher quality. Just because the weaning or yearling weights are heavier does not mean that efficiency has been improved or net income increased. The larger animals and heavier milk producing animals may require enough more feed to more than offset the gain in weight. Without adequate feed both added size and milk production can cause reproductive problems. There is no evidence showing that one size of cow is any more efficient than another. So when we talk about improved quality in cattle it refers to cattle that are productively efficient and produce more pounds of beef for each unit of feed. This is what improves net income.

Table 3 presents some actual data from trials on cow size efficiency. Because of the increased feed requirements of the larger cows, 123 small cows could be fed for the same amount of feed as 100 large ones. To be equally efficient the large cows would have had to of weaned calves 90 lb. heavier, assuming equal reproductive rate in each. In this case the large cows' calves only weighed 13 lb. more at weaning. Increased size does not mean increased efficiency.

Table 3. Cow size efficiency.

Item	Large	Small
Dam weight, after calving, lb	1155	924
Total TDN, maintenance & lactation, lb	4208	3423
Carrying capacity/unit of feed, %	100	123
Actual 205 day calf wts., lb	508	495
Wt. of calf required for equal efficiency, lb	585	495

Size can also be important in reproductive performance. Table 4 presents about the average net calf crop experienced in cattle. A good portion of the 15% that fail to conceive and 6% that are lost at birth are due to calving difficulties. Loss of a calf represents a cow's total production for that year and the expenses connected with her, but on top of that, next years' calf is also jeoparidzed. In cows having calving difficulty, we find conception rate is 10 to 15% less and calves are about 45 lb. lighter at weaning. The lighter weaning weights are due to cows that require assistance at birth and need two weeks to a month longer rest from birth to breeding. In another study it was found that 85% of the cows experiencing no calving difficulty bred back compared to only 64% that required assistance. So 21% of the next year's calf crop was lost.

Table 4. Net calf crop.

Item	Percent
Failed to conceive	15
Lost during gestation	5
Calves lost at birth	6
Calves lost after birth	5
Weaned	69

Dystocia or calving problems are primarily due to large birth weights and larger birth weights are highly correlated with larger mature size of the bull. The optimum birth weight for 1000 to 1100 pound cows appears to be around 80 lb. for maximum weaning weight produced per cow. Heavier birth weights increase weaning weights but decrease weaning percentage. So larger weaning weights did not result in more weight produced per cow. It has been estimated that for each pound of increased birth weight, calving difficulties are increased by 1% in mature cows and 3% in first calf heifers. Large cows have large pelvic areas but also large claves. First calf heifers present special problems because they are about 75% of their mature size and has a calf 90% of normal size. It is beneficial to breed first calf heifers 2 to 3 weeks early to give them an opportunity to breed back with the rest of the herd the following year. Mature cows require a minimum of 45 to 60 days rest, whereas heifers require 60 to 75 days from birth to breeding.

Artificial insemination does facilitate cross breeding. It allows access to breeds that may be difficult to purchase in some locations and eliminates the need to separate herds during breeding. Unfortunately, it also leads to more abuse of sire size. Table 5 presents some data on bull size in relation to cow size. A bull of equal size, genetically, will be 40 to 50% larger in actual size than a cow. In general, bulls can be 25% larger genetically or 75 to 88% larger in actual size before a calving problem would be expected. However, when breeding the British breeds to some of the exotic breeds it is common to have bulls 50 to 75% larger, genetically and 110 to 155% larger in actual size. Calving problems can be guaranteed with these differences, with the possible exception of Jersey cows bred to larger bulls. With first calf heifers the genetic difference should be zero or less. Many of the reproductive problems connected with heifers are due to calving difficulty and too often nutrition of the animal is blamed. When comparing bull size to cow size the animals need to be in equal condition or adjusted to an equal condition. We can have the same bull a thin 1500 lb or fat 2500 lb.

Table 5. Bull size in relation to cow size.

Cow size	Bull size	Larger in weight	Genetically larger
lb	lb	%	%
1000	1400-1500	40-50	0
1000	1750-1875	75-88	25
1000	2100-2250	110-123	50
1000	2380-2550	138-155	70

Artificial insemination does offer some tremendous potential, even though some problems do exist. For AI to be widely used in beef cattle an improvement in heat detection methods will have to be made.