

Considerations for A.I. in the Cow/Calf Herd

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Justin Rhinehart; Beef Cattle Specialist, UT Animal Science

Excerpts taken from “Economic Impact of Artificial Insemination vs. Natural Mating for Beef Cattle herds” by John Anderson, Justin Rhinehart and Jane Parish (MSUES 2486)

Artificial insemination (AI) has been commercially available as a viable technology since the 1940’s. It has been used extensively in the dairy cattle industry over the last several decades, and has totally changed the genetic structure of the national dairy herd. This technology also has the potential to dramatically affect the beef cattle industry. Currently, only about six percent of all beef cattle producers utilize AI and/or estrus synchronization in their beef herds. The vast majority of this use is in the purebred segment. One of the primary deterrents for beef cattle producer adoption of AI is the perceived cost.

Keep in mind that of pounds of calf weaned per cow exposed to breeding is the true measure of production efficiency for commercial cattlemen. Results from a management practice that improve this measure are characterized as benefits. So, one of the most impactful benefits of synchronization and AI is increased pregnancy rate. Improvements in pregnancy rate likely come from a combination of increased opportunities for the cows to breed in a restricted season and induction of anestrous cows to a fertile estrus.

The distribution of pregnancies within that limited breeding season is also skewed such that cows conceive and calve earlier. This results in a heavier and more uniform calf crop with more opportunities for aggressive marketing. Shifting calving distribution forward also results in more productive and long-lived cows and heifers by providing a longer postpartum interval prior to the next breeding season.

In the following scenario, the producer manages a herd of 85 mature cows and plans to retain 15 heifers as replacements. Cows are synchronized using the CoSynch estrus synchronization protocol. This timed AI protocol involves giving the cows a gonadotropin releasing hormone (GnRH) injection on Day 0, a prostaglandin F_{2α} (PGF_{2α}) injection on Day 7, and then a second GnRH injection on Day 9. All cows are time inseminated following the second GnRH injection. Heifers are synchronized using the MGA-PGF_{2α} protocol. In this protocol, heifers are fed a diet containing MGA for 14 days. On Day 15, MGA is removed from the diet. A PGF_{2α} injection is given on Day 33, and heifers are bred based on visual observation of heat. Table 1 explains the per head costs for estrus synchronization drugs, semen, and AI technician. It also illustrates the expected pregnancy rate to AI (one service), and the number of cattle workings required for synchronization and AI.

Table 1. Artificial Insemination Program Example Description

	Protocol	Drug Cost/Head	Pregnancy Rate	Required Workings	Semen Cost/Straw	Technician Cost/Head
Cows	CoSynch	\$8	50%	3	\$20	\$7.50
Heifers	MGA-Lutalyse	\$10	50%	3	\$20	\$7.50

Table 2 contains the budget assumptions for the above example herd. The overall expected pregnancy rate (AI + cleanup bulls) is 80 percent for cows and 75 percent for heifers. These expected pregnancy rates may seem low to some, but data on actual Mississippi beef cattle herds validates this assumption. The average weaning weight is assumed to be 550 pounds, with the calves selling for an average of \$105/cwt. Four bulls are required for adequate breeding in a natural service situation. Each bull is assumed to cost the producer \$2,500.00, and will be used for three breeding seasons. Annual bull maintenance costs will average \$600.00, with a salvage value at the end of the three year useful period of \$850.00/bull.

Table 2. Budget Assumptions for Natural Service

Number of cows	85
Pregnancy rate (cows)	80%
Number of heifers	15
Pregnancy rate (heifers)	70%
Average weaning weight of calves	550 lbs
Average calf value	\$105/cwt
Bulls required for natural service	4
Average purchase price of bulls	\$2,500/head
Salvage value of bulls	\$850/head
Useful life of bull	3 years
Annual bull maintenance expense	\$600/head

Annual ownership costs attributed to each bull are illustrated in Table 3. Purchase costs minus salvage value show that the producer spends \$550.00 per year on ownership costs alone. When coupled with the \$600.00 per year maintenance costs, plus a “risk of bull loss” factor (\$335.00/year), then the producer spends an average of \$1485.00 per year to own a bull.

Table 3. Bull Ownership/Maintenance Costs

	\$/bull	Total
Annual Ownership Cost ^a : $(\$2,500 - \$850)/3$	\$550	\$2,200
Annual Maintenance Cost	\$600	\$2,400
Risk of Bull Loss ^b : $0.2[(\$2,500 + \$850)/2]$	\$335	\$1,340

^a Annual ownership cost represents the average annual decline in the bull’s value. It is calculated as the difference between the bull’s original value and his salvage value divided by his useful life.

^b Risk of bull loss represents potential financial loss due to a bull becoming incapacitated through death, injury, infertility, etc. It is calculated as the difference between the bull’s average value and his salvage value, multiplied by the probability of such a loss occurring.

A comparison of the costs involved in utilizing AI versus natural mating follows. In Table 4, a partial budget compares increased costs of AI to the increased revenue generated from AI-produced calves. Total costs for the AI (including drugs, semen, technician, and labor) are \$4,012.00. This includes the 85 cows and 15 heifers. On the revenue side, the example assumes that the use of genetically superior AI sires would increase average calf weaning weight by 25

lbs/head. If calves are sold at weaning at a value of \$105/cwt for 550 pound calves, the value of the additional weaning weight would increase gross receipts by \$2,061.00. Because estrus synchronization and AI require enhanced management, and increases the number of cows bred early in the breeding season, the expected increase in calving percentage is 5.0 percent. The value of the additional calves at weaning is \$2,756.00. This results in a total increase in revenue of \$4,817.00 over the use of natural service alone. Utilization of AI also allows for a reduction in costs in the number of bulls required for cleanup breeding and lowered bull ownership/maintenance expenditures. A total of four bulls are required for adequate breeding with natural service alone. With AI, bulls are needed for cleanup breeding purposes only. Based on the expected AI conception rates, only three bulls are required for cleanup breeding (one bull could serve a dual purpose by breeding both the 6 remaining heifers and then be available for use in the cow herd). This reduction in costs through the use of AI is estimated to be \$1,485.00 for the scenario herd. Comparing the increased costs of AI with the increased revenue/reduced costs, the use of AI results in an additional net change in profit of \$1,440.00.

Table 4. AI vs. Natural Service: Partial Budget 1

Increased Costs		Increased Revenue	
Drug costs	\$830	Additional Weaning Weight	25 lbs/head
Semen Costs	\$2,000	Value of Additional Weight	\$2,061
Technician Fees	\$750	Change in Calving Percentage	+5%
Additional Labor ^a	\$432	Additional Calves	\$2,756
Total Increased Costs	\$4,012	Total Increased Revenue	\$4,817
Reduced Revenue		Reduced Costs	
Reduced cull bull sales	\$850	Cleanup bulls required	3 bulls
		Lower bull ownership/maintenance	\$1,485
Total Decrease in Profits	\$4,862	Total Increase in Profits	\$6,302

Net Change in Profits = \$1,440

^aFor budgeting labor costs, it is assumed that 100 head of cattle can be worked in 4.5 hours using four hired workers at a \$8/hour wage rate. This is separate from the technician fee.

Table 5 is similar to Table 4 with the exception of the assumptions in the increased revenue section. In this scenario, more calves are expected to be born early in the calving season due to concentration of breeding through utilization of estrus synchronization and AI (all cows would be mass inseminated the first day of the breeding season). These calves would be older and heavier at weaning time and would add an additional 25 pounds per head to the average weaning weight. This, coupled with the additional weaning weight increase (25 pounds) due to improved sire genetics, would result in a total additional weaning weight of 50 pounds per head. The value of this increased weaning weight would be \$4,121.00. The increased management required for an effective AI program would result in an increased calving percentage of 8.0 percent. This

would return additional revenue of \$4,620.00. In this scenario, the net change in profit resulting from the use of AI would be \$4,862.00.

Table 5. AI vs. Natural Service: Partial Budget 2

Increased Costs		Increased Revenue	
Drug costs	\$3,580	Additional Weaning Weight	50 lbs/head
Semen Costs	\$2,000	Value of Additional Weight	\$4,121
Technician Fees	\$750	Change in Calving Percentage	+8%
Additional Labor ^a	\$432	Additional Calves	\$4,620
Total Increased Costs	\$4,012	Total Increased Revenue	\$8,741
Reduced Revenue		Reduced Costs	
Reduced cull bull sales	\$850	Lower bull ownership/maintenance	\$1,485
Total Decrease in Profits	\$4,862	Total Increase in Profits	\$10,226
Net Change in Profits = \$5,364			

^aFor budgeting labor costs, it is assumed that 100 head of cattle can be worked in 4.5 hours using four hired workers at a \$8/hour wage rate. This is separate from the technician fee.

Note that the increased costs of drugs, semen, technician services, and additional labor exceed the savings associated with reducing bull requirements. For most beef cattle producers, these items are the most obvious considerations in evaluating the decision of whether or not to implement an AI program. This may help to explain some producers' reluctance to try using AI in their herds.

As these budgets show, however, consideration of costs alone provides an incomplete picture of the financial impact of AI adoption. Even when very conservative figures are used, the additional revenue attributable to the use of AI systems more than compensates for the additional costs of the system.