When Is A.I. Profitable?

By Ben McDaniel
Animal Science Department
North Carolina State University
When Is A.I. Profitable?

By Ben McDaniel
Animal Science Department
North Carolina State University

The answer to the question posed by the title is actually quite simple. The truth is that AI is profitable almost all the time that heifers are to be retained as future replacements. The remainder of the paper will be devoted to documenting this bold statement and the few exceptions to it.

One of the few exceptions to the superior profitability of AI would occur if replacements of equal quality can be purchased cheaper than yours can be reared. Whether AI should be practiced in such a situation would depend on its effect on sale price of calves a few days old compared to any extra costs of AI over natural service.

Another caveat is that common sense is used when buying and using semen. Buying semen from the currently "hot" and usually overpriced bulls to breed ordinary grade cows is not sensible. Despite the hype that usually surrounds such bulls, few if any will sire the most profitable commercial replacements.

Using expensive semen to inseminate cows that are likely to be culled before they calve again does not fall within my definition of common sense either. Breeding heifers to bulls known to cause a high percentage of difficult births is in the same category.

One of the false ideas used to support natural service is that it is practically free. All direct costs of using bulls are rarely considered, let alone the indirect and opportunity costs. Research several years ago at the University of Wisconsin by Shook showed that the direct costs in a typical herd averaged $18 per service. With the larger herds typical today, this may be a few dollars too high, but natural service is still costly. Low conception rates and diseases may also be obtained from such bulls.

For AI to be profitable, management adequate to detect accurately at least 40 to 50 percent of true heats is essential. Without this minimum level of accuracy, a high percentage of cows will be missed until their lactation is advanced.

A common misconception is that 70-80% of heats must be detected to use AI successfully. Actually, only the best managed herds reach that level. Studies by Blake and colleagues at Cornell showed that increasing accurate heat detection rates beyond 50% was often unprofitable. This occurred when costs to obtain the extra accuracy amounted to more than a few dollars per additional cow detected.

Accurate identification of individual cows is also essential. Otherwise, cows may be misclassified as in heat when they are not. Inaccurate identification of the cows truly in heat has drastically unprofitable effects. Results will be unnecessary costs without additional pregnant cows. Breeding cows not in heat may also be harmful to the future reproductive success of a cow.

Consequences of inadequate or inaccurate heat detection will be costly. Long calving intervals will be common. Yields of many cows will decrease to unprofitable levels before they
become pregnant. Combined, these may negate many of the favorable aspects of AI.

Limitations of facilities may affect the profitability of AI. When it is expensive to catch and restrain cows for breeding, costs per pregnancy increase. If catching and restraint upsets cows, conception rate can be reduced. This may reduce the pregnancies resulting per AI service, thereby increasing their cost. New Zealand, which has one of the lower fixed costs per cow in the world, breeds nearly 70% of its cows by AI. This shows that adequate facilities for AI need not be expensive.

Another common misconception is that conception rate to AI service must be over 50% for AI to be profitable. At 40% conception, only 34% of cows will require three or more services. Only 10% will need more than four inseminations. The realistic upper limit of conception rate is only 65-70% with natural service to a highly fertile bull. For example, pregnancy rate is rarely more than 80% in cycling cows exposed to a fertile bull for 50-60 days. Usually higher conception rates will make AI more profitable, but an outstanding conception rate is not necessary to make AI more profitable than natural service.

The opportunity costs of using natural service are well known. The USDA summaries released after every sire summary show that the net value of the extra milk of an AI-sired cow is worth at least $25 over feed costs in each of her three or more lactations. This occurs because feed costs for maintenance and fixed costs are nearly the same for every cow of the same age and body size. The total additional net of $75 per cow over her life should be mostly profit because costs of AI can be kept near that of natural service by good planning and management.

How much one can profitably pay per unit of semen over the cost of natural service has been the subject of much research and discussion without an answer that satisfies everyone. General agreement has been reached that the expected net financial return from the resulting heifers is the best method of computing how much can be paid. Disagreement still remains on details of some of the minor costs and returns to include.

The main factors affecting expected or predicted income are:

1. Expected additional lactation yield of a cow resulting from the semen of a particular bull.
2. Future values of milk and its components.
3. Expected length of a resulting cow's life.
4. Conception rate of semen.
5. Values of any traits such as mastitis resistance, milking ease or speed, calving difficulty, etc., that reduce costs over that of an average cow.

The main factors affecting variable costs are:

1. Expected future feed cost per unit of milk and components.
2. Minimum cost of getting a cow pregnant by AI minus cost of pregnancy from natural service.
3. Extra cost of semen from a particular bull necessary to obtain a milking heifer, discounted for the time value of money.
4. Opportunity costs from any milk lost due to calving intervals longer than those from natural service.
You may note that only the additional cost of semen is affected by conception rate. Whether the cow will be kept to calve, calf liveability, and all other costs affect AI and natural service equally.

Comparing Profitability Of AI And Natural Service For A Herd

A simple but reasonably accurate comparison of the relative profitability of AI and natural service breeding may be obtained by the following steps. Estimate or compute the following:

1. Expected value of milk and its components in your future milk market for a lactation from an average daughter of the AI bulls available, minus the values for an average natural service daughter. Multiply by 3.0 for lifetime value.

2. Add in the value of superiority for additional traits of the AI bulls, including udders, feet, and longevity. Multiply by 3.

3. Compute value for feed cost for the extra milk, which usually varies from 35 to 40% of the milk value.

4. Compute the costs of getting an AI-sired heifer minus the cost of a naturally sired one.

The approximate profitability of AI for your herd is simply:

* Number of replacements per year x (1 + 2 - 3 - 4), or * Number of replacements x (milk $ + $ value of other traits
- feed cost for extra milk
- extra cost of AI daughter)

For example, suppose the following costs and returns are appropriate for your herd:

a. Daughters of first-proof AI young bulls average about 400 lb more milk than those of first-proof natural service bulls from USDA summaries. This is worth at least $40.00. For a lifetime this equals $120.

b. Suppose superiority in other traits adds $15 per cow.

c. Suppose feed costs are 40% of milk, or $48.

d. Suppose the extra cost of obtaining an AI daughter is $50. This would include the extra labor and supplies over natural service costs.

The net value of AI is now $120 + $15 - $48 - $50, for an advantage of $37 per cow. For 100 replacements the total would be $3700. This does not include any additional value the AI
daughter might have if sold as a replacement.

Because our example is based on only using young AI bulls, the semen cost per service would not be more than $5. Other AI costs could total as much as $12 to $15 per insemination to obtain the $50 if the cost of the natural service bull is $12 per service. Given the rates charged by AI technicians, these values are excessive if it costs less than $5 per cow to check for estrus.

In my opinion this simple example justifies my beginning statement that AI will practically always be more profitable than natural service if replacements are to be saved.