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# Artificial Insemination Of Dairy Cattle

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The use of artificial insemination (AI) in dairy and beef cattle is increasing. In 1971, 44.3% of Idaho dairy cattle and 2.3% of beef cattle were bred artificially (Table 1). This represented 86,476 dairy and 14,633 beef cows and heifers of breeding age. In the United States, percentage use of AI in dairy cattle has increased from approximately 1% in 1945 to 50% in 1973 (Fig. 1). Hawaii, Alaska and Florida led the nation in percent dairy cows bred by AI with 97, 92 and 77%, respectively.

Only 3.4% of the nation's beef cattle were bred artificially in 1971, but the total number bred has increased rapidly (Fig. 2). Pennsylvania had the highest percentage bred AI (22.6 in 1971). Texas and Montana artificially bred the most cattle with 77,148 and 69,658 head, respectively. Montana leads the West in percentage bred.

With the increased interest in general herd and breed improvement, crossbreeding and the introduction of exotic breeds, beef cattle AI will probably increase more rapidly in the future.

## Results Expected for AI

While the use of AI in the beef industry is expected to increase as it has in the dairy industry, advances in productivity in the beef industry should also parallel those in dairy. Increased productivity generally is expected from use of performance tested bulls and from effective crossbreeding programs. AI allows the average breeder to take more efficient advantage of these programs. It also increases use of superior animals since a single bull may sire as many as 50,000 calves in one year by AI compared to 25 per year by natural service.



Table 1. Dairy and beef cows and heifers bred artificially in 1971.

| State | DAIRY | | | BEEF | | |
|---|---|---|---|---|---|---|
| | No. bred AI | No. breeding age | % bred AI | No. bred AI | No. breeding age | % bred AI |
| | | (000) | | | (000) | |
| Arizona | 31,962 | 60 | 53.3 | 3,805 | 363 | 1.0 |
| California | 675,523 | 969 | 69.7 | 30,235 | 990 | 3.1 |
| Colorado | 42,746 | 124 | 34.5 | 34,070 | 1,188 | 2.9 |
| Idaho | 86,476 | 195 | 44.3 | 14,633 | 633 | 2.3 |
| Idaho (1970) | 84,431 | 200 | 42.2 | 10,581 | 646 | 1.6 |
| Idaho (1969) | 80,674 | 169 | 47.7 | 8,549 | 588 | 1.5 |
| Montana | 11,515 | 48 | 24.0 | 69,658 | 1,700 | 4.1 |
| Nevada | 8,170 | 17 | 48.1 | 2,031 | 354 | 0.6 |
| New Mexico | 25,408 | 42 | 60.5 | 7,214 | 716 | 1.0 |
| Oregon | 71,487 | 130 | 55.0 | 14,171 | 716 | 2.0 |
| Utah | 62,450 | 104 | 60.0 | 28,546 | 369 | 7.7 |
| Washington | 146,815 | 228 | 64.4 | 20,871 | 395 | 5.3 |
| Wyoming | 5,647 | 20 | 28.2 | 22,413 | 769 | 2.9 |
| Western States | 1,168,199 | 1,937 | 60.3 | 247,647 | 8,193 | 3.0 |
| United States | 7,285,171 | 14,976 | 48.6 | 1,357,918 | 40,123 | 3.4 |

(From Dairy Herd Improvement Letter 48(4). June-July 1972.)

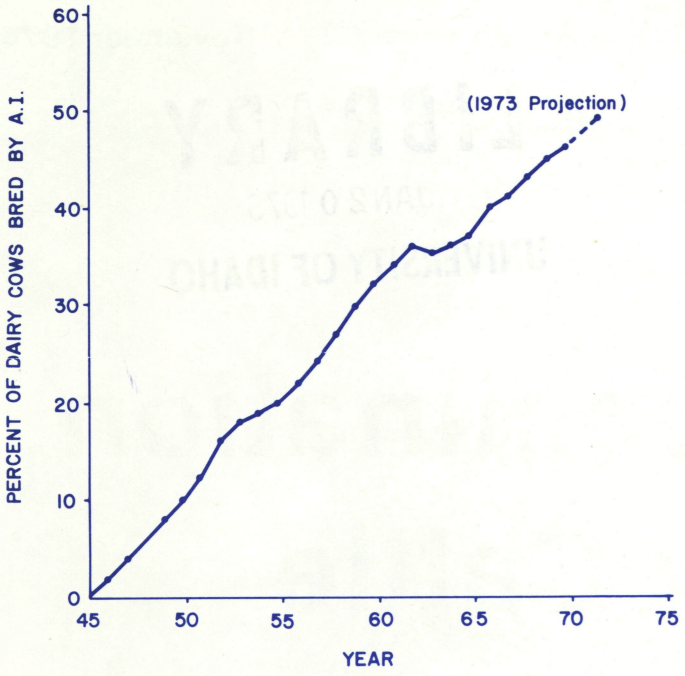


**Fig. 1. Percentages of U.S. dairy cows bred by A.I. annually since 1945.**

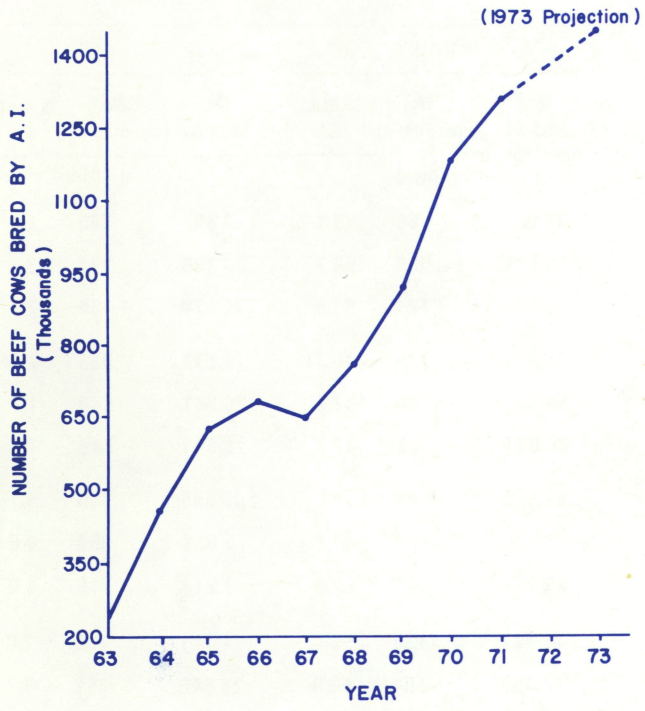


**Fig. 2. Number of U.S. beef cows bred by A.I. annually since 1963.**

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## *Advantages and Disadvantages Of AI Programs*

Advantages of AI include:

1) Extensive use of superior sires at reduced cost, thus adding genetic improvement to the herd.

2) Rapid proof of young potential sires.

3) Rapid increase in production potential within herds or breeds.

4) Less spread of various diseases and infection among cows and bulls.

5) Encouragement of record-keeping systems.

Disadvantages of AI are:

1) Undesirable genetic traits can be disseminated rapidly.

2) Inseminators must be experienced and well-trained to achieve the same conception rate as natural service.

3) Detecting heat in all cows is difficult.

4) Labor requirements are higher than for natural service.

## *Conception Rate of Cows in AI Programs*

AI should produce the same conception rate as natural service. Artificial breeders should expect approximately 65, 20 and 7% of all cows to conceive after the first, second and third service, respectively. This totals to 92% conception, or 8% open cows after the herd has been allowed time for three breedings (approximately 65 days). At these conception rates, 1.5 ampules of semen per cow are required during the 65-day period. This is an average value and can be improved by better management.

Gregory (1966) reported an average conception rate of 66% on first service for 23 Nebraska ranches. In a 36-day breeding season, conception rates among ranches ranged from 40 to 95% with an average of 74%.

## *Calculation of Reproductive Performance*

Several ways of expressing performance are used in the dairy and beef cattle industries. The best and most accurate is to calculate calving rate based upon the live calf:

$$\%\ \text{calving rate} = \frac{\text{number of calves born alive}}{\text{number of services}} \times 100$$

In the example in which conception required 1.5 ampules of semen, 92 of 100 cows would conceive in 65 days. If all embryos were carried to term, the percent calving rate would be

$$\frac{92}{150} \times 100 = 61.$$

As many as 5% of the embryos could be lost. Therefore an average percent calving rate would be 56 to 61%. Through proper AI management, this percentage can be increased.

Some beef breeding programs involve breeding cows one time by AI and then exposing them to clean-up bulls for natural service. The following formula can be used to evaluate the AI breeding program:

$$\%\ \text{first service calving rate} = \frac{\text{number of first service calves}}{\text{number bred once}} \times 100$$

The number of first service calves can be estimated by subtracting 283 days from the day when calving occurred. If the resultant date was during the AI breeding period, you can assume AI conception. Accurate breeding and calving records must be maintained. A first service calving rate of 60 to 65% is expected since 65% of the cows conceive to first service and 5% of the embryos could be lost.

Often AI stud services measure breeding success as a 30- to 60-day or 60- to 90-day nonreturn rate. In this case, nonreturn means technicians were not called back to rebreed the cow within the designated time period. For the latter, the formula is:

$$\%\ \text{60- to 90-day nonreturn} = \frac{\text{total bred once - those rebred within 60 to 90 days}}{\text{total bred once}} \times 100$$

Many studs have a 60- to 90-day nonreturn rate of 70 to 75%. This is higher than the calving rate percentage since much information about the cows is not reported to AI stud personnel. For example, the stud service considered the animal pregnant when in fact she may have died, been sold, been rebred by another service or a bull, been anestrus several months, aborted, etc. Therefore, the nonreturn rates does not equate to production of live calves. This figure is of value, however, to evaluate AI technician performance and the fertility of semen from various bulls.

Calving interval is another index of reproductive efficiency. The interval in days between the birth of one calf and the next calf are added for all cows in the herd and divided by number of cows:

$$\text{calving interval} = \frac{\text{sum of calving interval for all cows in days}}{\text{number of cows}}$$

A value of 365 days or a calf every 12 months from each cow is desirable.

## Cost of AI

Information about the cost of AI compared to natural service is not readily available. However, the Nebraska study on 23 ranches showed an average sire cost of $7.92 for each artificially sired calf. Only 4 of the 23 ranchers used commercial technicians. These ranchers reported an average cost of $4.36 (range $1.15 to $10.00) per insemination. This cost included labor, heat detection equipment, insemination equipment and corrals, but did not include the cost of semen.

In the same study, the estimated cost per calf for natural service was $8.82 when sires cost $565 each with an additional $1.12 per calf for each $100 increase in bull cost.

It is impossible to evaluate dollar returns from one method of breeding over another. However, superior sires that are more readily available through AI will return more, overall, to the cattle and dairy operations.

### Equipment and Supplies

Costs cannot be estimated for every situation. However, prices of individual items listed in Table 2 can be used in estimating the cost of an AI program. Prices were obtained from the catalog of a reputable farm supplier. In addition to these items, ranchers and dairymen must consider the cost of AI training and construction of breeding facilities. Training schools are offered periodically throughout the state by artificial breeding services. For information on location and time, contact local AI technicians.

Semen prices vary considerably depending upon the bull desired. For example, one breeder service offers semen from dairy breeds at $2.50 to more than $25, European beef breeds at $2.50 to $10, and exotic breeds at $10 to $25 per ampule.

**Table 2. Price of items needed for an artificial insemination program**

| | |
|---|---|
| Plastic sleeves, disposable, per 100 | $ 4.00 |
| per 1000 | 38.00 |
| Thaw box, for semen | 3.95 |
| Insemination tubes, plastic, per 100 | 1.75 |
| per 1000 | 11.00 |
| Syringes, for expulsion of semen, 3 ml, 12 @ 16c | 1.92 |
| Rubber tubing, for syringe to inseminating tube adaption, 10 ft. @ 12c/ft. | 1.20 |
| Insemination rods for straws, per 100 | 1.98 |
| per 1000 | 18.20 |
| Reusable insemination rod plungers, per 50 | 5.00 |
| Towels, paper, pkg. of 250 | .77 |
| Polyethylene pail | 1.20 |
| Liquid soap, 1 gal. | 1.98 |
| Soap dispenser, 16 oz. bottle | .45 |
| Heat mount detector, each | .75 |
| lot of 50 | 22.50 |
| lot of 1000 | 400.00 |
| Semen storage tank (two possible ones are listed) | |
| (1) 16 liters capacity, 252 1 ml semen ampules, 780 1/2 ml straws, one level and 1560 1/2 ml straws, 2 level, 50-60 day holding time, needs filling approximately 6 times per year. | 205.00 |
| Yearly nitrogen refills at approximately $6. | 36.00 |
| (2) 25 liter capacity, 360 1 ml semen ampules, 1110 1/2 ml straws, one level, and 2220, 2 level, 60-70 day holding time, needs filling 6 times per year. | 295.00 |
| Yearly nitrogen refills at approximately $8-$10. | 48.00 to 60.00 |

## Heat (Estrus) Detection

Heat detection is the biggest problem facing the artificial breeder. Research from the University of Idaho dairy herd indicated 26% of cows in heat were not observed in standing heat even though heat was checked twice daily. This was reduced to 5% through proper training and more careful and more frequent observation (5 per day) of animals by herdsmen. The experimental data demonstrate the importance of careful animal observation. Most successful observations are made at times other than during feeding. It is best to move cows around when observing their behavior and pay special attention to animals that stop to watch an observer or act different from normal.

The most obvious sign of estrus is standing for other animals to mount. This is referred to as standing heat or standing estrus. The standing estrus period averages 18 hours. However, some animals stand for short periods (less than four hours) and some have silent heats and do not stand at all.

Because of silent heats or short periods of standing heat, artificial breeders and herdsmen should be aware of other signs of heat. These include excessive bawling, roaming, nervousness, reddened and swollen vulva, and the presence of a very thin, clear mucus discharge from the vulva (as opposed to thick cloudy, milky or bloody discharge seen at other times) which is often smeared on the tail and hind quarters. Some animals will discharge a small amount of bloody mucus 3 days after ovulation. When this occurs for an animal that has not been observed in heat, record the date and observe closely 18 days later for the next heat. This may be a cow with silent estrus or short standing estrus. This record will more than pay for the time required in keeping it.

There are several techniques available to help detect estrus in a herd of cows, but no matter what techniques are used, good animal identification and record keeping systems are necessary. Animals still must be observed often. These aids should not be used as a crutch.

Heat detection can be aided by use of a "heat mount detector." This device is glued to the tail head of each cow and contains a red dye capsule. When the cow is mounted by another animal, the dye capsule is broken and the detector pad appears red. Red pads are readily observed.

Surgically modified bulls running with cows may be a desirable means of detecting heat. These animals can detect heat much better than a person relying only on visual observation. Vasectomized bulls are infertile but may spread disease. To overcome this, you may use bulls with the penis removed or surgically displaced so that impregnation is impossible. Chin-ball, marking halters placed on these bulls help locate cows in estrus.

Spade heifers or cows treated with estrogen work well as heat detector animals. Depending upon the management operation, these animals can be used very successfully. The treated cows also have a persistent, longer lactation period than normal pregnant animals and thus can pay for their own keep.

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