

A Brief Story of Artificial Insemination in Agriculture/Cattle

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Modern agriculture uses many technologies that were developed over a period of time. Artificial insemination (AI) is one of these technologies that we take almost for granted.

Artificial insemination (AI) is a process by which sperm are collected from the male, processed, stored and artificially introduced into the female reproductive tract for the purpose of conception. AI has become one of the most important techniques ever devised for the genetic improvement of farm animals. It has been most widely used for breeding dairy cattle and has made bulls of high genetic merit available to all.

Some documents indicate that the first attempts to perform artificial insemination or breeding are dated around 1322 A.D. when an Arab chieftain wanted to mate his mare to a stallion of his enemy. He used cotton containing the scent of the female to excite the stallion, causing him to ejaculate. He placed the released semen in the reproductive tract of the mare, leading to conception.

It took centuries of experimenting with different animal species but the breakthroughs came when scientific approaches were applied. The invention of a microscope opened the door to a deeper understanding of reproduction per se. In 1678, the Dutch tradesman and scientist Leeuwenhoek first observed spermatozoa under a microscope with 270 times magnification and named them 'animalcules'. More than a century later, in 1784, an Italian priest Spallanzani first documented successful insemination in a dog. The female whelped three pups 62 days later. At the end of the 19th century reports on AI in rabbits, dogs, and horses were recorded in England, Russia, and other countries.

The beginning of the 20th century became a focal point of AI research as a practical and economical procedure in animal breeding, but the 1930s and 40s marks the spread of AI throughout the western world.

Russian scientist Ivanov began conducting AI on cattle, horses, birds and sheep. He was the first person recorded to have accomplished successful artificial insemination in cattle. He developed semen extenders or diluting liquids, he trained technicians, and established breeding programs for sheep and cattle. Because Ivanov was so successful at animal artificial insemination Russians bred approximately 19,800 cows by 1931.

Ivanov's studies sparked an interest outside Russia. The Japanese scientist Ishikawa who studied with Ivanov began an AI program in horses in Japan in 1912. This program developed into sheep, cattle, goats, swine and poultry. Other Japanese researchers became involved. Unfortunately, their work went almost unknown to western scientist until 1958 as too few westerners knew Japanese. Freezing semen procedures and procedures for the successful use of frozen bull sperm were originally developed in Japan and was a major contribution to the development of AI.

Some AI was performed on horses during the early 1900s in Denmark, but it was not until 1936 when the scientist Sorensen, who was familiar with Ivanov's work, organized the first cooperative dairy AI organization which enrolled 1,070 cows. The conception rate of 59% was better than a natural service (use of a bull) in the same herd and stimulated the development of AI in dairy cattle in the US and other Western countries.

In 1938, New Jersey native E. J. Perry established the first AI cooperative at New Jersey State College of Agriculture based on the Danish model. In the following two years, seven AI cooperatives, according to the Denmark and New Jersey models, appeared in New York, Minnesota and Wisconsin. During the same time, Swedish scientist Lagerlöf conducted research on fertility problems in bulls. He established a group with worldwide influence in training veterinarians in various aspects of AI.

In the 1940s, the Bureau of Animal Industry registered the Santa Gertrudis cow, a new breed that represented the direct results of artificial insemination in cattle. Despite this significant breakthrough in cattle breeding, it would take 13 years to improve this process. During that time, scientist realized that collected bull semen could be saved by placing them in egg solution containing antibiotics and chemicals and freezing it for later use. Pennsylvania and Cornell universities conducted genetic tests in which they learned how to distribute genetic material. Since these universities didn't patent their processes, other places adopted their techniques of artificial insemination which eventually led us to the practices we use today.

Like with all technologies, there are advantages and disadvantages to AI. The advantages include maximum use of superior sires. Natural service limits the use of one bull to 100 matings per year. Artificial insemination usage enables one dairy sire to provide semen for 300-1000 services just from one ejaculate.

AI also reduces the danger of spreading infectious genital diseases from bull to cow during a natural service. Other advantages include early detection of infertile bulls, the use of old or crippled bulls and the elimination of danger from handling unruly bulls.

The disadvantages of AI appear to be associated with management, or simply put, human factor. Human detection of heat is required to determine whether the female is ovulating. Success or failure of AI depends on how well this task is performed. AI also requires more labor, facilities, and managerial skill than natural service. Proper implementation of AI requires special training, skill, and practice.

Artificial insemination of farm animals is very common in today's agricultural industry in the developed world. More than 75% of all dairy cattle, up to 85% of swine and 100% of turkeys are bred using AI. The overall impact of artificial insemination is its ability to improve animal productivity and increasing the food supply.

Sources: David Foote, History of AI, Cornell University;
Richard Cecily, History of AI in Cattle, U Florida;
D.W. Webb, Artificial Insemination in Dairy Cattle, U Florida