

IN THE LAB, AT THE FARM, ON YOUR TABLE

1

In the Lab, at the Farm, on Your Table

Taci Leigh Humphries

Arkansas

2024

Statement of Authenticity:

I certify that all materials presented here are of my creation and that any work adopted

from other sources is duly cited and referenced as such. *-Taci Hupli*

In the Lab, at the Farm, On Your Table

What do me and the juicy burger you ate for lunch have in common? Laboratory research! The advancements the agricultural world has seen scientifically in the past 20 years surpasses expectations and leaves the continually growing population fed. GMO's, animal reproduction, aerial imaging and technology, as well as me all stemmed from laboratory research. My mom underwent Invitro Fertilization in order to have me, and my development in the petri dish has been told to me since I was young. This, mixed with my inquisitive nature, has attracted me to the scientific developments of the agricultural world. My dad is the CEO and operator of Humphries Cattle LLC. Growing up on the farm with him, every truck ride to feed cattle was always accompanied by a billion questions and at least a million "but why's?" Now that I am in High School, FFA has allowed me to focus even more on the advancements Agricultural Science has accomplished, and the controversy that some of the advancements have caused. However, of all the intriguing topics in Agricultural Science, the study of genetics and reproduction always attracts me the most. Three key concepts of theriogenology that I will further discuss with you today are artificial insemination, estrus syncing, and spermatic genetic testing.

The first attempts of Artificial Insemination were performed in 1922 by Russian scientist Ilya Ivanov (Beddoes, n.d.). AI is now one of the most popular methods of reproduction in American agriculture, accounting for nearly 80% of Dairy cattle reproduction (Colazo & Mapletoft, n.d.). We mainly see AI used in the beef and dairy cattle industry as a way of maintaining a synched herd while performing safer operations for the recipient cow. AI is performed by placing semen directly into the uterus of a cow in estrus. By using AI, we can

allow more farmers access to higher quality bulls by just purchasing the semen instead of the entire bull. Artificial Insemination also allows us to maintain a healthy herd by limiting venereal disease transfer from contagious bulls such as Trichomonas and Bovine Herpes Virus, which can be detrimental to herds by eliminating calf crop and ruining the health and reproduction of Cows (Anderson, n.d.). When we reduce the cost of production by eliminating the maintenance cost of bulls, and better prodigy of calves to sell, we can see economic benefits to the farmer by using AI.

Even if artificial insemination isn't right for your herd due to infection and financial risks, estrus synchronization can be extremely helpful for a profitable herd. For nearly 25 years farmers and ranchers who choose both natural and artificial insemination have been utilizing estrus synching to maintain a uniform calf crop. Estrous synching is the ability to release hormones into a herd of cattle in order for them to all ovulate at the same period of time (Farmer, n.d.). We release hormones through a device called CIDR's. Controlled intravaginal drug release devices work by releasing the hormone progesterone in order to induce early estrus (*Can I Use a Controlled Intravaginal Drug Release (CIDR) Device to Bring Late-Calving Cows Into Heat?*, n.d.). This process can benefit the farmers by allowing them to perform the same routine for the herd all at the same time throughout the entire reproductive process. It also benefits the economic gains of the farmer by allowing an earlier breed-back time for the cows once they have already calved. It is possible for farmers who utilize CIDR to breed back in as early as 20 days after calving, once the uterus shrinks back to its original size. Efficiency and synchronization go hand in hand in order to make the most profit for our farmers and ranchers. Efficiently handling the drugs and monitoring the herd is vital for this process to work to the best of its ability without

doing harm to the veterinarian (Department of Primary Industries and Regional Development, 2017, 63). If your herd is undergoing estrus synchronizing, it is important to inject cows with prostaglandin f2 Alpha on the seventh and final day of utilizing CIDR in order to ensure LH and FSH hormones spike, allowing ovulation to occur (*Prostaglandins: What It Is, Function & Side Effects*, 2022). While estrus synchronizing can be a vital tool for the dexterity of the farmer and preserving a uniform calf-crop, it's only as strong as its weakest link. It is important for us as future farmers to be aware of the complex nature of reproduction in our herds and deeply understand the cycle in order to better predict and manage wisely.

While it is no doubt that females get the spotlight of reproduction prodigy, advancements have been made to the male side of it, too. Spermatic testing is a breakthrough in the unlimited possibilities of agriculture. Spermatozoa are one of the most complex and distinctive structures known and we now have the ability to analyze and report the sperm to get a more extensive idea of the offspring we will have (Wysokińska, 2022). Many veterinarians and specialists find themselves analyzing semen, alot. One product of this in depth analysis is the ability to sex semen. With about 90% efficiency, sexed semen is produced by either using a flow cytometry or undesired chromosome destruction (Phillips, 2020). This can be helpful for farmers who are breeding for certain purposes such as replacement heifer's. It is also important for us to break down the health of our animals and understand what changes may be affecting the fertility of our animals. We track this by spermatic count. The spermatic count is the number of "live" sperm in a given sample. Healthy sperm is characterized by several moving spermatozoon. However, we can get even more complex than this. A new breakthrough in the reproductive science of agriculture is crypto preservation. By using liquid nitrogen to keep semen samples frozen, we

can keep viable semen that is completely usable and transportable for up to 50 years (Wysokińska, 2022). This has allowed not only an economic boost for the consumer by allowing them to breed back their herd cheaper, it also has improved the economic benefit of seed-stock bull production by allowing them to get more money and uses out of one bull while maintaining health and safety for that bull.

In conclusion, pretty cool things are grown in labs. The advancements and technologies to develop our herds into something productive and efficient are available like never before. Many worry that with the growing age of most farmers, the next generation will lose interest in the trade, and the fight to feed America will sky rocket. However, I believe with the intriguing new processes being developed before our eyes, it is exciting the next generation of Ag. nerds just like me. As the FFA creed proudly states, “I believe in the future of Agriculture”. I too believe in the future of Agriculture *Science*; because I believe in me.

References

- Anderson, J. D. (n.d.). *Economic Impact of Artificial Insemination vs. Natural Mating for Beef Cattle Herds*. The Beef Site. Retrieved October 31, 2023, from <https://www.thebeefsite.com/articles/1453/economic-impact-of-artificial-insemination-vs-natural-mating-for-beef-cattle-herds>
- Beddoes, T. (n.d.). *Artificial insemination history: hurdles and milestones - PMC*. NCBI. Retrieved October 27, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4498171/>
- Can I use a Controlled Intravaginal Drug Release (CIDR) device to bring late-calving cows into heat?* (n.d.). UNL Beef. Retrieved November 16, 2023, from <https://beef.unl.edu/use-controlled-intravaginal-drug-release-cidr-device-bring-late-calving-cows-heat>
- Colazo, M. G., & Mapletoft, R. J. (n.d.). *A review of current timed-AI (TAI) programs for beef and dairy cattle*. NCBI. Retrieved November 4, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4095965/>
- Department of Primary Industries and Regional Development. (2017). *Artificial Breeding in Beef Cattle*.
- Farmer, W. (n.d.). *Synching Their Cycles*. https://docs.google.com/document/d/1LsXPTVH-8ZjkJDLUf2rtDcRwNTMckkbTJXvXudg_TE/edit

Phillips, K. (2020, January 6). *What is sexed semen and how can it be incorporated into your herd?* Progressive Dairy. Retrieved November 7, 2023, from <https://www.agproud.com/articles/53840-what-is-sexed-semen-and-how-can-it-be-incorporated-into-your-herd>

Prostaglandins: What It Is, Function & Side Effects. (2022, November 4). Cleveland Clinic. Retrieved November 16, 2023, from <https://my.clevelandclinic.org/health/articles/24411-prostaglandins>

Wysokińska, A. (2022, October 23). *Animal Reproduction: Semen Quality Assessment - PMC.* NCBI. Retrieved October 31, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9659275/>