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IDF Reproductive Technology: Reproductive Hormones

Scientific excellence
Industry applicability
Strategic networking
Global influence

Background

Since the domestication of cattle for milk and meat purposes over 6,000 years ago, farmers have used reproductive technology to improve their cattle. In the beginning, farmers used simple breeding programs selecting a desired male to mate with their cattle for each successive generation of animals. Today, a variety of reproductive technologies are used by dairy farmers to perpetuate the next generation of cattle to enhance milk quality and productivity, improve animal health and welfare, and increase the sustainability of the dairy industry.

This IDF Reproductive Technology Fact Sheet (part of an IDF series of factsheets on reproductive technology) examines the use of reproductive hormones as a technology that can contribute to dairy sustainability.

Definitions

- Oestrus cycle: The oestrous cycle is the reproductive cycle of a cow, which averages 21 days in duration.
- Oestrus: Also known as a cow's "heat," is when cow displays behavioural signs being receptive to insemination by the bull and that ovulation is imminent.
- Corpus luteum: The remnant cells of the ovulated follicle become luteinized ("yellow body") and produce progesterone to support pregnancy. Luteal regression refers to the degradation of the corpus luteum when pregnancy is not established (or recognized).

Types

Reproductive hormones refer to various products that mimic those hormones naturally produced by a cow. Reproductive hormones fall into three general types:

- prostaglandins (fatty acid derivative) (1)
- gonadotrophins (protein compound) (2)
- progesterone (steroid) (3)

Additionally, one other hormone, oxytocin, a 9-amino acid peptide naturally produced by the cow's pituitary gland, may be used at the time of birth to help a cow if needed to expel the placenta and uterine contents. It also may be used to stimulate the milk let-down reflex by contracting cells around the alveoli pushing milk down the ducts towards the teat end (4).

Uses

Reproductive hormones are administered either by injection or hormone releasing intravaginal device to treat individual females diagnosed with a reproductive disorder such as not having normal oestrus cycles (prepubertal, postpartum anovulation and cystic ovaries). Reproductive hormones may also be administered to modulate the oestrus cycle (often in conjunction with artificial insemination) in individual females or in groups of females to improve the ability to detect oestrus and enable breeding/artificial insemination at predictable time intervals.

Oestrus synchronization programs apply reproductive hormones following a strict protocol to all eligible cows in the herd that the farmer wants to get pregnant. As a result, oestrus is sychronised in groups of cows, thus improving overall oestrus detection, facilitating the use and effectiveness of artificial inseminations and thus pregnancy rates (5).

Safety

Reproductive hormones have been rigorously studied and have been safely used for decades. They are administered in extremely low doses, and the hormone levels in cows receiving these products remain within normal ranges found in cows naturally at various times in their oestrus cycle (6). Reproductive hormones are metabolized naturally and quickly, and milk and meat from cows that receive those hormones do not have higher levels of hormones than milk and meat from other cows.

The use of reproductive hormones in cattle is highly regulated by national authorities (7). Whole herd oestrus synchronization programs can be used widely in some countries, while restricted or prohibited in other countries. Herd reproduction management, including application of reproductive hormones, should follow national legislation and be specified under the guidance of herd veterinarians.

Importance of Technology

Dairy cows must conceive and give birth to produce milk. If they cannot conceive, they will be culled from the herd. Reproductive hormones are an important tool for farms and can increase reproductive efficiency through increased heat detection, timed artificial insemination, and reduced duration in the nonpregnant or nonlactating state days (8). Using reproductive hormones can also increase the service and conception rate on farms (8, 9). All these factors result in optimizing reproductive performance (better oestrus detection and conception rates) have been modelled to reduce greenhouse gas intensity of milk production (10). Thus, prudent use of reproductive hormones and other technologies (reference fact sheet on sensors) can improve reproductive performance and have a positive impact on dairy farm sustainability.

Table of estrogenic activity for various foods:

Food	Estrogenic Activity (ng/3 ounces)
Soy Flour (defatted)	128,423,201
Tofu	19,306,004
Pinto Beans	153,087
White Bread	51,029
Peanuts	17,010
Eggs	94

The numbers above are based on the nanograms of estrone plus estrodial for animal products and iisoflavins in plant products per 3 ounces (0.085 grams) of food (11, 12, 13, 14).

Below are two examples of the oestrus cycle graphic series with indications on how reproductive hormone use changes cycle:

US Food and Drug Administration:

- The Cattle Estrous Cycle and FDA-Approved Animal Drugs to Control and Synchronize Estrus A Guide for Producers

EU Legislation:

- Directive
- Veterinary medicines and medicated feed

About this series

In 2017, the IDF Standing Committee on Farm Management and Standing Committee on Animal Health and Welfare identified a need to produce fact sheets on reproductive technology use in the dairy industry to provide information to dairy farmers and interested stakeholders. This is the second fact sheet in the series.

References

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