**Farm Journal Climate Smart Commodities Pilot Project**

# ALTERNATIVE PRACTICE STANDARD

# FJ100 CLIMATE-SMART GENETIC INTERVENTIONS FOR TERMINAL BEEF PRODUCTION

## DEFINITION

Climate-smart genetic interventions are differentiated genetics and mating plans[1] that enhance the sustainability of livestock production by improving the environmental impact, animal health and welfare, and profitability of the herd. This practice standard focuses on using climate-smart terminally[2] focused genetics as part of a comprehensive mating plan to reduce greenhouse gas (GHG) emissions in native beef cattle.

## PURPOSE

This practice enhances the sustainability of the beef supply chain by using genetic interventions to improve environmental impact, animal health and welfare, and profitability of terminal beef animals.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to cow-calf operations that are:

- using natural service only to breed their cows and heifers
- using artificial insemination (AI) and want to incorporate climate-smart genetics into their mating plan

## CRITERIA

There are two main criteria for using climate-smart genetic interventions: breeding via AI and collecting data. Breeding via AI is preferred because climate-smart genetics are most effectively administered through AI after the estrous cycles of the cow herd has been synchronized. Data collected over the lifetime of terminal animals informs the calculation of GHG emissions.

To meet these two criteria, the process for using terminally focused climate-smart genetic interventions entails developing a mating plan, implementing the mating plan using reproductive technologies to create terminal animals, and collecting data through the terminal animals' lifetime from birth to harvest, and finally using this data to calculate lifetime GHG emissions.

The steps to prepare a herd for AI with climate-smart genetics and data collection for GHG emissions are as follows:

1. Rancher works with breeder to define breeding goals and develop a mating plan based on breeding goals.

2. Breeder advises rancher on synchronization protocols, and the rancher implements the chosen synchronization protocol (e.g., administering timed hormonal shots and inserting controlled intravaginal drug release devices).

3. Optional: Rancher tracks when females come into estrus using heat detection indicators (e.g., patch adhered to tail head that changes color due to other animals mounting the female).

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[1] A mating plan is the strategic pairing of males and females to create the next generation of offspring.

[2] Terminal traits focus on growth and carcass value (e.g., weaning weight, average daily gain, carcass weight).

4. Breeder artificially inseminates a portion of females with semen from maternally[3] focused bulls and the remaining portion of females with semen from terminally focused bulls. The relative proportion of females bred using semen from maternally vs. terminally focused bulls depends on the rancher's breeding goals and whether they are expanding or shrinking their operation.

5. Rancher exposes females to a terminal trait-focused cleanup bull to breed females that did not conceive from the AI breeding.

6. Optional: Veterinarian checks cows and heifers for pregnancies at least 28 days post conception via trans-rectal ultrasound, trans-rectal palpation, or a blood test.

7. After calves are born, rancher tags each calf with an electronic ID and obtains an ear punch sample for genotyping to verify sire (and if possible, dam) identification and breed. If possible, rancher weighs calves and records birth weight and birth date.

8. As the calf moves from the cow-calf operation to the stocker/backgrounder and feedyard, each respective producer records data points required for GHG emission estimation. Because measuring emissions directly from animals is cost-prohibitive, emissions will be estimated using the dry matter intake expected from the animals' daily liveweight gain per the IPCC methodology applied to life cycle assessment (LCA) (IPCC, 2019). Complete life cycle data includes following data points for at least 10% of animals resulting from terminal matings at each growing phase (i.e., weaning, rearing, stocker/backgrounding, finishing):

   a. In and out weights and dates to estimate daily liveweight gain

      i. This includes birth date and birth weight, if possible

      ii. Out weights of one growing phase are equivalent to in weights of the subsequent growing phase, so only one of these equivalent weights is required

   b. Dates that animal is on each diet

   c. Composition, dry matter percentage, digestible energy, and crude protein percent of diet(s) fed at each growing phase

   d. Carcass weight e. Climatic zone of the operation, as defined by the IPCC f. If possible, individual feed intake per day for at least 50 days in the growing phase

These data points will feed into a LCA to estimate the emission reductions per unit of carcass weight achieved using climate-smart genetic interventions.

**CONSIDERATIONS**

Thoughtful management allows producers to realize the full potential of climate-smart genetic interventions. Management suggestions for ranchers to maximize benefits of genetic interventions include:

- Keeping an inventory of the cow herd to monitor reproductive efficiency, mothering ability, and longevity. Ranchers can collect the following data points:
    - Unique identifier of female o Breeding date(s)

[3] Maternal traits focus on the heifer or cow and her ability to produce healthy calves over her lifetime (e.g., mature weight, calving ease, docility, fertility, longevity).

  - Type of breeding: AI or natural service o Result of pregnancy check: pregnant or open
  - Calving date
  - Sex of calf
  - Weaning date
  - Calving ease
  - Udder conformation
  - Foot and leg score
  - Body condition score (BCS) and date of scoring: BCS of the cow at time of calving is strongly correlated with rebreeding performance (i.e., if she will come into estrus when rebred ~80 days after calving). Ranchers can use records of the above data points to inform their selection and mating decisions
- Tailoring the mating plan to the different needs of groups of animals within the herd (e.g., breed heifers to bulls with lower birth weight EPDs to prevent dystocia)
- Meeting the nutritional needs of the cows so they can in turn meet the nutritional needs of their calves

Management suggestions for stockers/backgrounders and feedyards are similar: feeding cattle based on their nutritional requirements, adhering to vaccination protocols, and keeping records for feeding and health events.

Additional benefits of estrus synchronization, using AI, and climate-smart genetics aside from reduced emission intensity include:

- Increasing the rancher's profit margin by optimizing the resource use of their cow herd and producing more valuable feeder calves
- Faster genetic progress because ranchers can select from a the most genetically superior bulls every breeding season instead of every time a natural service bulls is culled and replaced
- Ranchers can simultaneously breed for maternal and terminal traits instead of compromising both breeding goals
  - Breed the most genetically elite females to sexed semen to create replacement heifers and breed the remaining females to genetics that have been differentiated for terminal traits
- In addition to optimizing timing of AI relative to expression of estrus and consequent reproductive efficiency, estrus synchronization leads to downstream benefits from synchronization of conception, gestation, and calving
  - Synchronization enables ranchers to manage their cows uniformly relative to their stage in gestation, maximizing the utility of nutrition and vaccines
  - Synchronization shortens the duration that cows are calving and increases the portion of calves born earlier in the calving season. Front loading the calving season results in calves that are older, heavier, and therefore more valuable at weaning. Synchronizing also leads to calves that are closer in age, which allows for more precise management of the calves, including timing of vaccinations and feeding, which leads to a healthier and more profitable feeder calf
- Pairing differentiated terminal genetics with appropriate management practices at the ranch also creates animals that continue to perform well and become increasingly valuable downstream for stockers/backgrounders, feedyards, and packers

**PLANS AND SPECIFICATIONS**

Plans and specifications for ranchers adopting climate-smart genetic interventions include:

- Description of breeding goal(s), prioritization of terminal vs. maternal traits, and goals for growth or reduction of the operation
- Mating plan and how the mating plan relates to the rancher's breeding goals, including subsets of animals that have different breeding goals
- Protocols for synchronization, breeding, (if relevant) pregnancy check, and calf processing
- Records of breedings (date and to which bull) and calvings for the cow herd
- Identification of the breeding technician and genetic services technicians who helped the rancher develop the mating plan.
- Suggested frequency of updating and revising the mating plan

**OPERATION AND MAINTENANCE**

The rancher is responsible for working with the breeder to define breeding goals and a corresponding mating strategy. The breeding service is responsible for providing chute service if needed, advice for estrus synchronization, and breeding animals via AI. The rancher will maintain breeding and calving records on site and share records with the genetic service and, if applicable, an external data steward.

Operation and maintenance activities include:

- Ranchers: Review mating plan every breeding season to update selection and mating decisions based on performance of the cow herd and available bulls
- Genetic services provider: Routine genotyping of all progeny sired by climate-smart genetics for sire verification

To enable estimation of emission reductions achieved through climate-smart genetic interventions, the following data points listed above for each animal at each growing phase should be collected by the stocker/backgrounder, finisher, and packer through the animals' life:

- Sire and dam identifier and breed
- In and out weights and dates to estimate daily liveweight gain
- Dates that animal is on each diet
- Digestible energy and crude protein percent of diet(s) fed at each growing phase
- Carcass weight
- Climatic zone of the operation, as defined by the IPCC
- If possible, feed intake per day for at least 50 days in the growing phase

These data points will feed into a LCA to estimate the GHG emissions reductions achieved through climate-smart genetics per unit of carcass weight.

**REFERENCES**

IPCC. 2019. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10: Emissions from Livestock and Manure Management.