Welcome to Session 4



2024

Future-proofing Beef Selection Decisions





Session 4-Part 1 Beef Industry Research Innovations

New Energy at USMARC

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New Energy at USMARC! 2024 eBEEF Brown Bagger Webinar Series

October 23, 2024

United States Meat Animal Research Center





- Originally Hastings Naval Ammunition Depot (NAD)
 - Central location in the USA
 - Originally covered 76 sq miles 48,600 acres
 - Over 11,000 employees on site
 - Commissioned on July 14, 1942 First ordnance July 1943
- Land transferred to USDA: 34,500 acres







USMARC History of the location



110 Federal Employees

Scientists
Technicians
Center Operations/Support

110 UNL Employees

Animal CareFarmingMaintenance













Annual Budget FY24:

- \$24.5M Appropriated
- \$9M Farm/Ranch Receipts
- \$2-3M in Grant Funds

Animal Production Enterprise:

- 7,600 cows
- 2,100 ewes
- 500 sows
- 6,400 head feedlot capacity



Large Agriculture Enterprise:

- 34,500 acres farm/ranch
- 24,000 dry land grazing

Irrigated Production:

- 7,300 acres/56 pivots +
- Corn grain and silage
- Alfalfa & Irrigated pasture
- Soybeans
- Rye ryelage
- Annual forage/cover crops

Beef Cattle Production United States Meat Animal Research Center



USMARC Research Units & National Programs

Five Research Units:

- 1. Genetics and Breeding (Kuehn) Food Animal Production
- 2. Meat Safety & Meat Quality (Wheeler) Food Animal Production Human Nutrition Food Safety
- 3. Nutrition, Growth and Physiology (Lindholm) Food Animal Production
- 4. Livestock Bio-systems (Lents) Food Animal Production Soil and Air
- 5. Animal Health Genomics (Vacant Boggess) Animal Health Joint research unit with UNL - GPVEC





Germplasm Evaluation Project Population Structure

AI Sires:

Dams:

1085 Highly Influential Industry AI Sires Evaluated



One of the most valuable beef genetic data sets in the world!



40,000 Calves Produced Since 2006 with DNA and Tissue Samples and Extensive Economically Important Traits Measured



Effects of Different Environments on Production



Texas A&M AgrilLife Station Beeville, TX



ARS Grazinglands Research Laboratory El Reno, OK





Calculating Scientific Impact?

These scientists are Beef Improvement Federation award winners:

> Gary Bennett Larry Keuhn Mark Thallman Warren Snelling



Example Recent Accomplishments for USMARC?







Genetics and Genomics!

- Trio binning and T2T
- GPE herd and others
- Pangenomes
- C-IV Sheep program

• Animal Health!

- Gene editing projects BVD
- Bovine Congenital Heart Failure
 Novel vaccines "Pinkeye"

• Meat Safety and Meat Quality!

- Instrument grading
- Salmonella assays, biofilms, and more
- Instrument grading and meat trim sampling
- Antimicrobial resistance

• Our Environment!

- Wastewater lagoon monitoring and contaminant treatments
- Feedlot pen surfaces and distiller's grains
- Heat stress monitoring systems

• Reproduction and Growth!

- Bovine follicle counts/heifer development
- Developmental physiology
- Gilt development reproductive physiology
- Genomic markers reproduction
- Energy metabolism, feed efficiency, gut/rumen microbiome, genomic markers

Programs and Energy!

Growing USMARC!

Changing Agriculture!

Focus on complex production systems

Genetics Environment Management Socio-economic

New and Emerging Focus:

- Complex production system optimization and resource use efficiency w/economic impacts
- Genetics and genomics, including diverse microbiomes
- Explosion of "AI", precision agriculture and precision management AND research
 - Machine learning, Deep Learning, Neural NetworksData Science, etc.
- Climate variability-extremes, resiliency, GHG, LCA
- Nitrogen and carbon cycles
- Soil ecology and biodiversity

Opportunity for Beef Production?



Grand Challenges = Great Opportunity?

- Population growth & climate adaptation must have meat animal production!
 - ✓ 13.5 M square miles of rangelands on earth
- Extraordinary opportunity on the horizon

Embracing Complexity – GEMS as a roadmap:

- **G = Genetic** Genetic and genomic factors
- **E = Environmental** External environmental factors
- **M = Management** Internal/measurable factors
- **S = Socio-economic** Societal/economic factors
- Systems approaches are critical, incredible complexity and must address evolving societal priorities...





- Beef Systems Research Consortium/UNL Beef Innovation
- Nitrogen2.0
- USMARC 2034 Strategic Plan
- Others:
 - Global Methane Hub Genetics
 - Salmonella Grand Challenge
 - Precision Animal Management/NRCS
 - Data Science Working Group

New Energy.....

• Focus on three initiatives:

- Beef Systems Consortium (All species)
- Nitrogen2.0
- 2034 Strategic Plan

• A core program focus:

- Focus on circular bioeconomies associated with meat animal production
 - Galvanize, simplify, and focus on our mission
 - Leverage existing resources, expertise, and "energy"
 - Focus on evolving industry and societal priorities
 - Best leverage and "market" USMARC programs and resources

2034 USMARC Strategic Plan

- 2034 Strategic Plan:
 - Staffing Plan Evolution Focus on People
 - GEMS on the ground
 - Describing USMARC as a "Living Lab"
 - Describing the future research portfolios
 - Vision for the resource
 - Programs built around integrated themes
 - Precision ag, data science, "AI"
 - Re-envisioning our vision, mission, and values
 - Managing complexity

USMARC Research Theme #1:

Genetic Improvement and Systems Based Optimization



• - - • Secondary interaction – single example

USMARC Research Theme #6:

Soil Ecology and Environmental Sustainability





ARS Beef Grand Challenge







Organizational Structure and Research Management

- Complements and integrates UNL Beef Innovation programs
- Proposed Organization:
 - 1. Pasture and rangeland forage systems
 - 2. Soil, water, and ecosystem services
 - 3. Beef cattle genetics and nutritional efficiency
 - 4. Beef cattle nutrition and physiology
 - 5. Beef cattle health, well-being, and lifetime productivity
 - 6. Beef product quality, safety, and nutritional value
 - 7. Precision agricultural systems and on ranch implementation
 - 8. Complex system integration and optimization
 - 9. Beef system economic analyses and economic system modeling
 - 10. Socio-economic factors and implications for beef systems

Nitrogen2.0

- Goal: Reduce N use in agriculture by 40-50%
 - Improved efficiency and less waste
 - Focus on circularity and recycling

• Three components:

- Nitrogen2.0 CERCA Circular Economies to Reimagine Corn (Maize) Agriculture
- Nitrogen2.0 Manureshed Manure and Nitrogen Recycling
- Nitrogen2.0 SUNRISE
 - Sustainable Utilization of Nitrogen in animal agriculture through Research on Innovative Systems and circular Economies

Initial focus on CERCA

- Potential funding in the FY25 federal budget
- Large group of stakeholders
- National meeting at the Banbury Institute in April 2024
 - "A Vision for the Next Generation of Nitrogen Management in Food Production Systems"
 - Scoping paper and funding efforts in place

Nitrogen2.0



Figure 1. Leveraging circular economies to reduce agricultural GHGs by 80%

The agricultural sector contributes 11% of total US GHGs.

EPA 2019 Green House Gas Inventory

FY25 Implementation.....

- Stakeholder Engagement
 - Beef, Sheep, and Swine Focus Groups
 - New USMARC communications program
 - New! External Stakeholder Group:
 - USMARC Livestock Industry Advocacy Council
- Building the "Living Lab" model circular bioeconomies
 - "Laser" focus on GEMS!
 - Agriculture Bio-ecological Laboratory
 - Embracing research opportunity Nitrogen2.0
 - Engaging research partners Beef Systems
 - Driving our 2034 Strategic Plan for research
 - Marketing, Outreach and Advocacy



•Thank you for this opportunity! •Questions?