



Free State Regenerative Agriculture Challenge

FAQs / Challenge Terminology

1. What is regenerative agriculture for large-scale farming?

Regenerative agriculture at a large scale integrates advanced technologies and data-driven systems to restore soil health and ecosystem functions while maintaining high productivity. It combines precision agriculture, clean energy, and conservation practices to rebuild soil organic matter, reduce input costs, and strengthen climate resilience.

2. What does soil carbon mean, and why is it important for commercial farms?

Soil carbon is the carbon stored in organic matter such as decomposed plant and microbial residues. For commercial-scale farms, maintaining soil carbon is key to productivity, as it enhances soil fertility, water-holding capacity, and crop resilience, while contributing to carbon sequestration and emission reduction targets.

3. What is cover cropping and how can technology support it?

Cover cropping involves growing plants between production cycles to protect and enrich soil. Using sensors, drones, and AI-based monitoring, large farms can optimise seed selection, timing, and moisture retention, improving soil health while reducing fertiliser needs.

4. How does biochar improve soil health and enable circular innovation?

Biochar, produced from agricultural residues using pyrolysis, enhances soil fertility and locks carbon into the soil for decades. Large-scale biochar production integrates renewable energy systems and circular economy models, turning waste into value-added inputs while improving crop yields and reducing emissions.

5. What are microbial inoculants and their role in sustainable farming systems?

Microbial inoculants introduce beneficial bacteria and fungi that enhance nutrient availability, nitrogen fixation, and plant growth. They are a biological alternative to chemical fertilisers, promoting regenerative soil health while reducing operational costs and pollution.



6. What is conservation tillage and how is it implemented at scale?

Conservation tillage reduces soil disturbance to preserve organic matter and moisture. Modern machinery with GPS guidance and sensor systems allows large farms to adopt reduced-tillage methods efficiently, cutting fuel use, improving soil structure, and lowering erosion.

7. What is rotational grazing in a technology-driven system?

Rotational grazing manages livestock movement to allow pastures to recover. Digital tracking, smart fencing, and real-time soil sensors can optimise grazing patterns, enhance grassland regeneration, and support soil carbon accumulation.

8. What are organic soil amendments in large-scale operations?

Organic soil amendments like compost, manure, and green waste improve soil structure and microbial diversity. In large-scale operations, digital traceability and mechanised spreading systems improve precision and ensure consistent nutrient application across vast areas.

9. What is the role of clean energy and digitalisation in modern agriculture?

Clean technologies such as solar-powered irrigation, biogas systems, and smart energy management platforms reduce costs and emissions. Digital tools enable predictive irrigation, automated machinery, and real-time resource optimisation, supporting both profitability and sustainability.

10. What does climate-smart and clean-tech agriculture mean?

It refers to integrated systems that use renewable energy, precision technologies, and adaptive management to build resilience to climate change. Clean-tech agriculture helps farmers reduce emissions, conserve resources, and transition towards sustainable, data-informed food systems.