Area 4 SCD Cooperative Research Farm

A Legacy for the Future

A Legacy for the Future

Area 4 SCD Cooperative Research Farm

Presentation overview…

- Context
- The Area 4 Farm
- An Exciting Future

Pre-1980s Agriculture

- Tillage
- Fallow
- Low crop diversity
- Farm crisis

The Area 4 SCD Cooperative Research Farm

Established from a 'Bottom Up' effort

1950 - Nelson Family farm established southwest of Mandan, ND

Timeline

1981 – Mr. Roy Nelson proposes leasing his entire farm to the local Soil Conservation District (SCD) for the purpose of supporting long-term research

June 17, 1983 - A formal proposal to establish a Cooperative Research Farm was made at the annual Area 4 SCD meeting

December 1, 1983 - Original lease was signed between the Area 4 SCD Research Advisory Committee and the Nelson Family

The Area 4 SCD Cooperative Research Farm

Original purpose and research themes

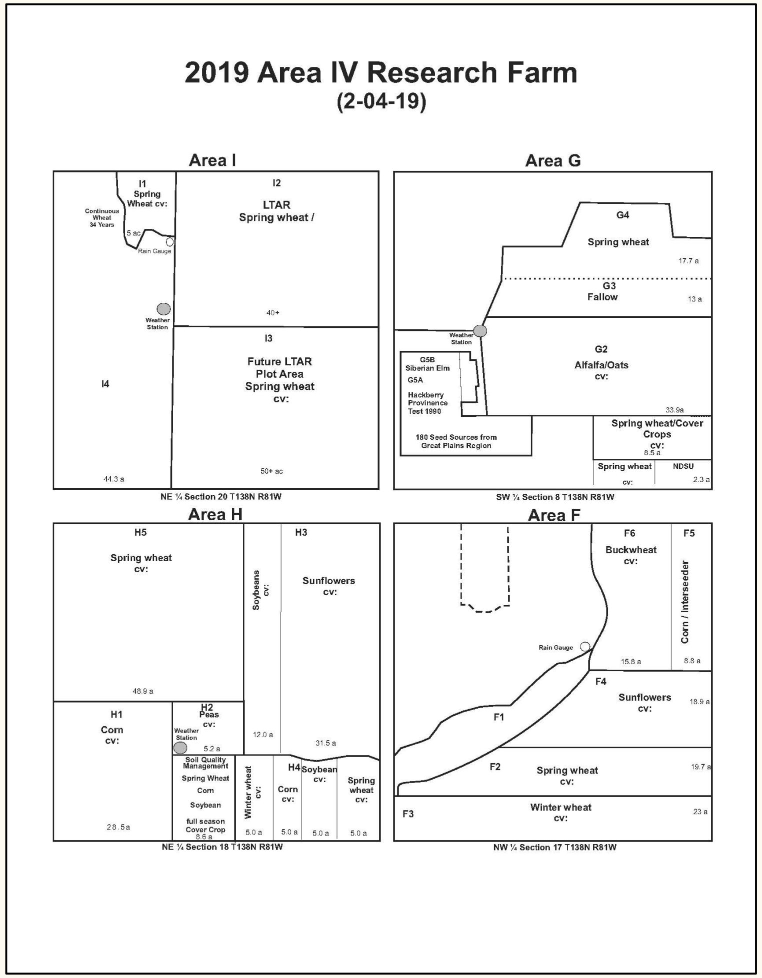
Provide land for conducting large-scale, long-term research on conservation tillage and dryland cropping systems

- ✓ Field scale
- ✓ Soil & water conservation systems/technology
- ✓ Promote the adoption
- ✓ Understandable terms
- ✓ Responsive to stakeholders

The Area 4 SCD Cooperative Research Farm

Location, land attributes, and field layout

- Located southwest of Mandan, ND
- Gently rolling landscape
- High quality soils (CPI = 90 for dominant soil series)
- 22 fields (5-50 acres)
- Fields spread across four quarter sections



Research Cooperation

Northern Great Plains Research Laboratory

Established by Congress on August 8, 1912 to respond to the needs of farmers and ranchers of the Northern Plains.

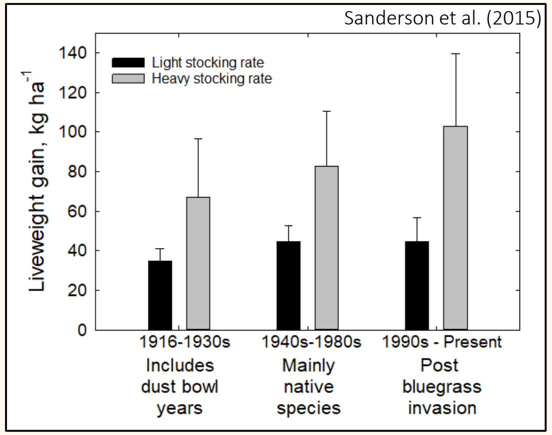
<u>NGPRL Mission</u>: To develop adaptive and integrative practices for sustainable crop, livestock, and rangeland systems.

Northern Great Plains Research Laboratory

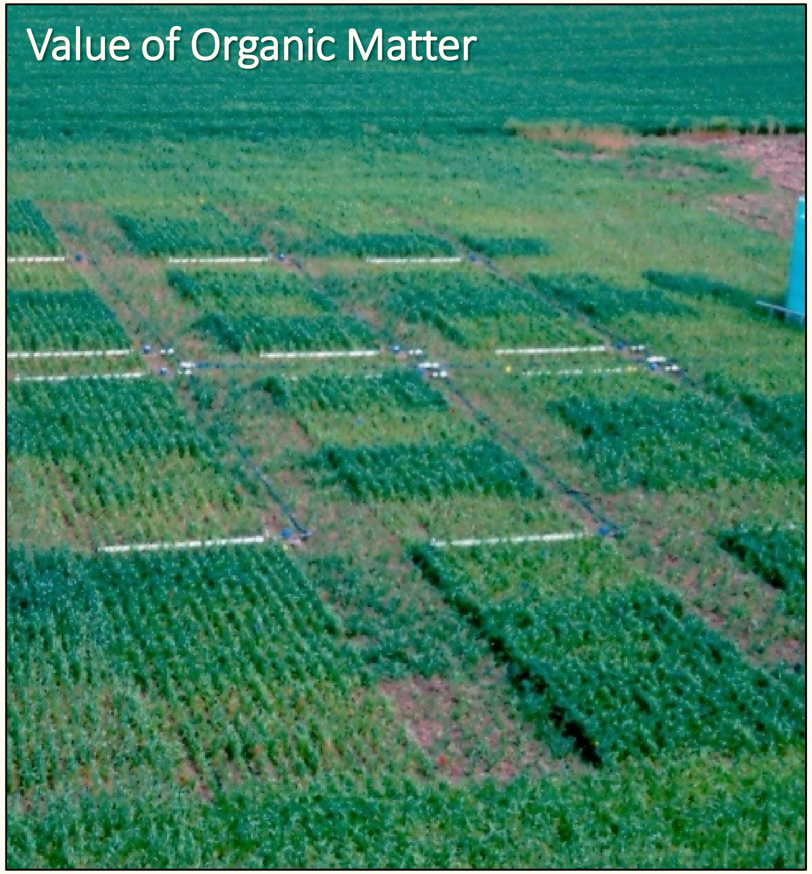
People, Place, & Purpose

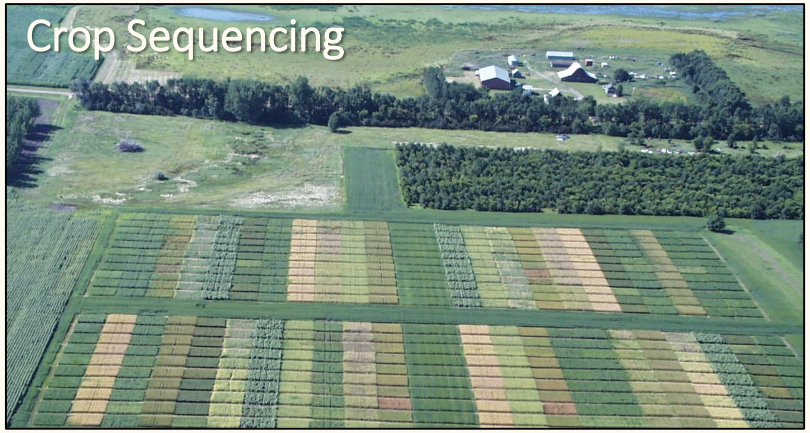
System integration and design…

- Understand the "Why?"
- Quantify long-term system impacts
- Document outcomes following review by producers and the scientific community
- Develop user-friendly tools to help producers manage more sustainably



Sanderson et al. (2015)





The Area 4 SCD Cooperative Research Farm

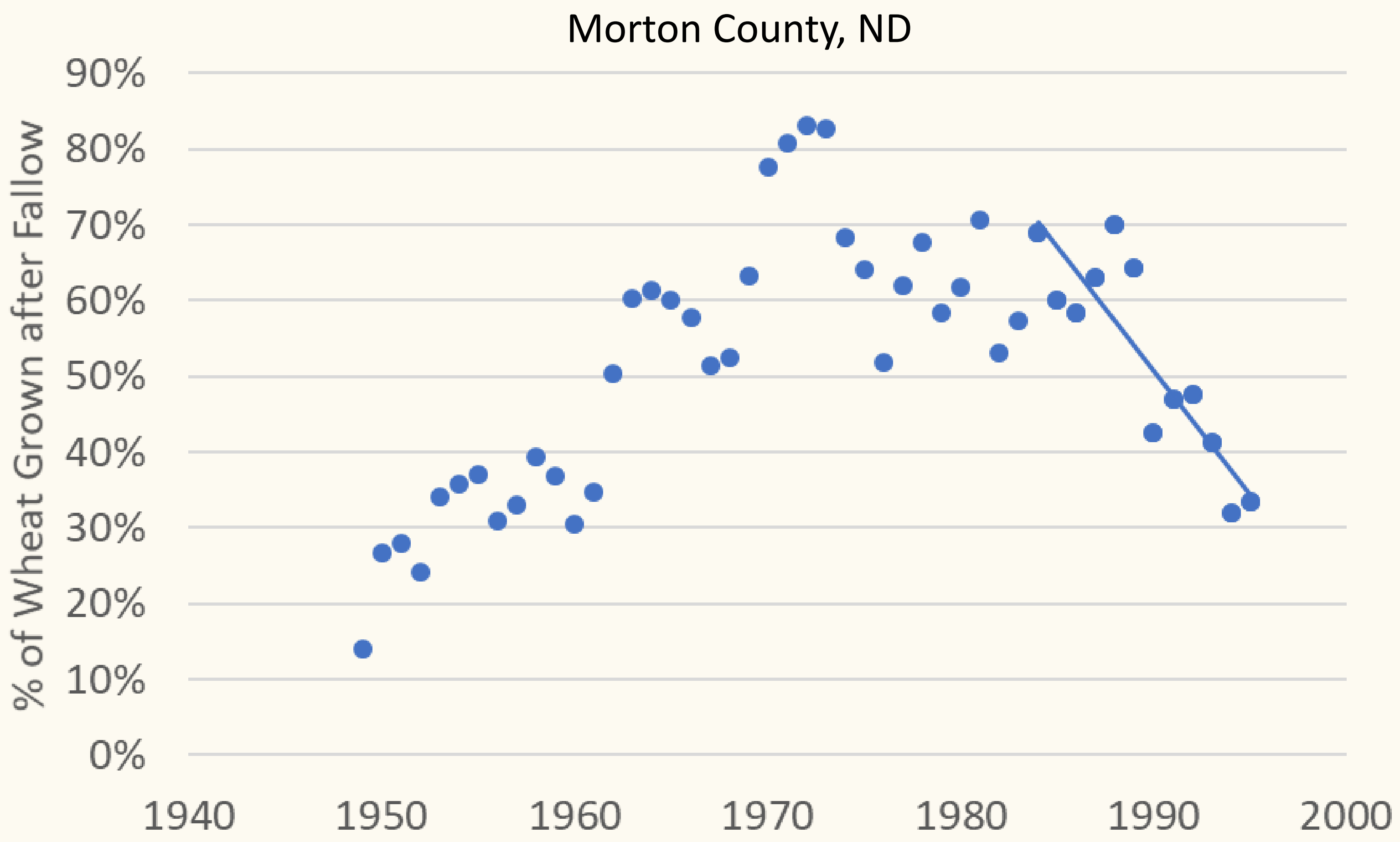
Previous research

Recognition of the Value of Soil

- **1 ton/ac Soil Organic Matter = 31.4 lb/ac spring wheat grain yield**

Bauer and Black (1994)

Decreased Fallow

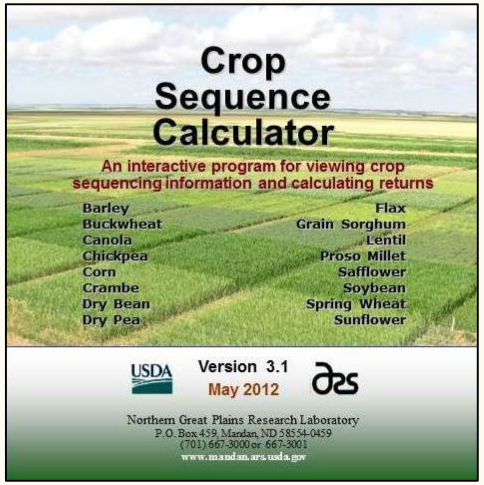


The Area 4 SCD Cooperative Research Farm

Developing practical decision tools

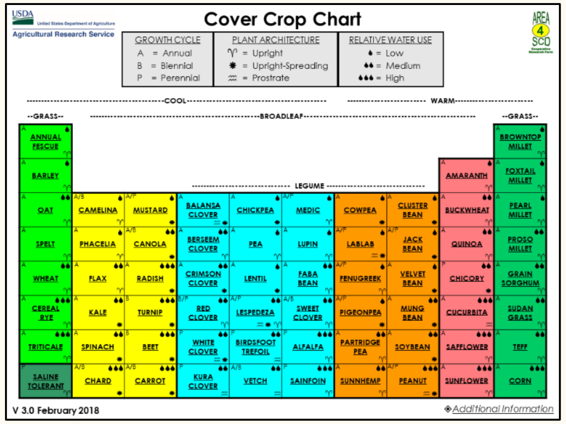
Crop Sequence Calculator

- Designed to help plan profitable crop rotations.
- >14,000 copies distributed worldwide.



Cover Crop Chart

- Information resource to help select cover crops for crop and forage production systems.
- Used throughout the U.S. and in over 50 countries.



High Quality, Impactful Science
> 100 Journal Papers

Published March, 1990

Stubble Height Effect on Winter Wheat in the Northern Great Plains: I. Soil Temperature, Cold Degree-Hours, and Plant Population

Armand Bauer* and A. L. Black

Published March, 1990

Stubble Height Effect on Winter Wheat in the Northern Great Plains: II. Plant Population and Yield Relations

A. L. Black and Armand Bauer*

Soil coverage by residue as affected by ten crop species under no-till in the northern

D.L. Tanaka, and R.L. Anderson

Conservation Tillage Affects Root Growth of Dryland Spring Wheat under Drought

S. D. Merrill,* A. L. Black, and A. Bauer

Soil Wind Erosion Hazard of Spring Wheat–Fallow as Affected by Long-Term Climate and Tillage

Stephen D. Merrill,* Alfred L. Black, Donald W. Fryrear, Ali Saleh, Ted M. Zobeck, Ardell D. Halvorson, and Donald L. Tanaka

Tillage and cropping effects on soil quality indicators in the northern Great Plains

M.A. Liebig[a,*], D.L. Tanaka[a], B.J. Wienhold[b]

[a] USDA-ARS, Northern Great Plains Research Laboratory, P.O. Box 459, Mandan, ND 58554, USA

Published August 28, 2015

Agronomy, Soils & Environmental Quality

Short-Term Soil Responses to Late-Seeded Cover Crops in a Semi-Arid Environment

M. A. Liebig,* J. R. Hendrickson, D. W. Archer, M. A. Schmer, K. A. Nichols, and D. L. Tanaka

Tillage, Nitrogen, and Cropping System Effects on Soil Carbon Sequestration

Ardell D. Halvorson,* Brian J. Wienhold, and Alfred L. Black

Dynamic Cropping Systems: An Adaptable Approach to Crop Production in the Great Plains

D. L. Tanaka,* J. M. Krupinsky, M. A. Liebig, S. D. Merrill, R. E. Ries, J. R. Hendrickson, H. A. Johnson, and J. D. Hanson

Renewable Agriculture and Food Systems

cambridge.org/raf

Crop diversity effects on productivity and economics: a Northern Great Plains case study

David W. Archer, Mark A. Liebig, Donald L. Tanaka* and Krishna P. Pokharel

Crop Sequencing to Improve Use of Precipitation and Synergize Crop Growth

D. L. Tanaka,* R. L. Anderson, and S. C. Rao

Dynamic Cropping Systems for Sustainable Crop Production in the Northern Great Plains

D. L. Tanaka,* J. M. Krupinsky, S. D. Merrill, M. A. Liebig, and J. D. Hanson

The Area 4 SCD Cooperative Research Farm

Evolving research to address customer needs

Theme / Related Publications	1984	1987	1990	1993	1996	1999	2002	2005	2008	2011	2014	2017	2020
Using conservation tillage and crop residue management to reduce soil erosion													
Black and Bauer (1983); Tanaka and Hofman (1994); Merrill et al. (1999)													
Developing improved management recommendations for wheat production													
Black and Bauer (1990); Frank and Bauer (1996); Halvorson et al. (2000)													
Improving precipitation-use efficiency													
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Understanding soil organic matter dynamics													
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Tanaka et al. (2002); Krupinsky et al. (2006); Hanson et al. (2007); Archer et al. (2018)													
Enhancing soil quality/health													
Wienhold et al. (1998); Wienhold et al. (2006); Merrill et al. (2013); Liebig et al. (2014)													
Mitigating greenhouse gas emissions													
Frank et al. (2006); Phillips et al. (2009); Phillips et al. (2012); Saliendra et al. (2018); Liebig et al. (2019)													

Challenges Remain

- Feed a Growing Population, *and*
- Protect the environment
  - Maintain grasslands & natural areas
  - Provide environmental benefits on ag. lands
  - Reduce negative effects on environment
- Provide opportunities for producers
  - Ability to earn a living
  - Good quality of life

AREA 4 SCD Cooperative Research Farm








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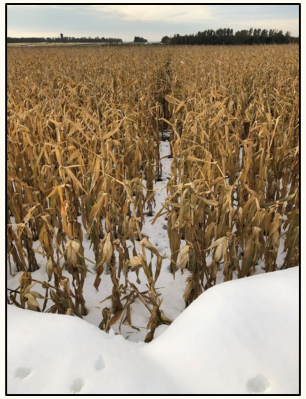
Farming in the Northern Plains is Challenging…

Taking a long-term view is important

- Short-seasons, high weather variability, and variable land suitability
- Natural resources are especially sensitive to management perturbations
- Previous catastrophic events have underscored the value of conservation



Essential Role of Long-Term Agricultural Research

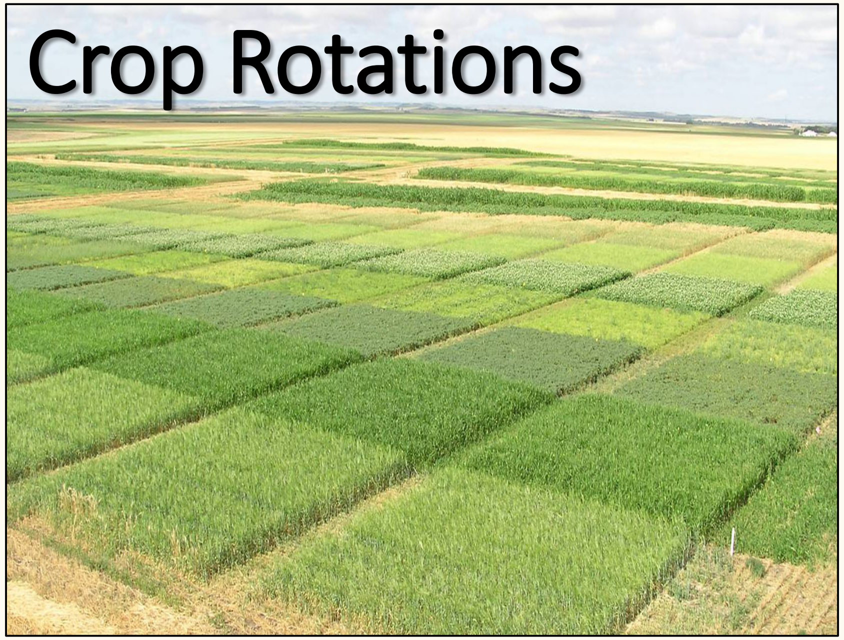
Case Study:
Long-term effects of no-till

Differences in yield & soil moisture required **15 years or longer** to generate consistent results.

Short-term trends produced misleading results **between 20-50% of the time**

Cusser et al. (2020)

Wildlife
Pollinators
Yield
Soil Health
Resilience



The Area 4 SCD Cooperative Research Farm

Ongoing research

AREA 4 SCD Cooperative Research Farm

Friends and Neighbors Day (July)

AREA 4 SCD Cooperative Research Farm

Translating science to practice through effective outreach

>1200 attendees annually

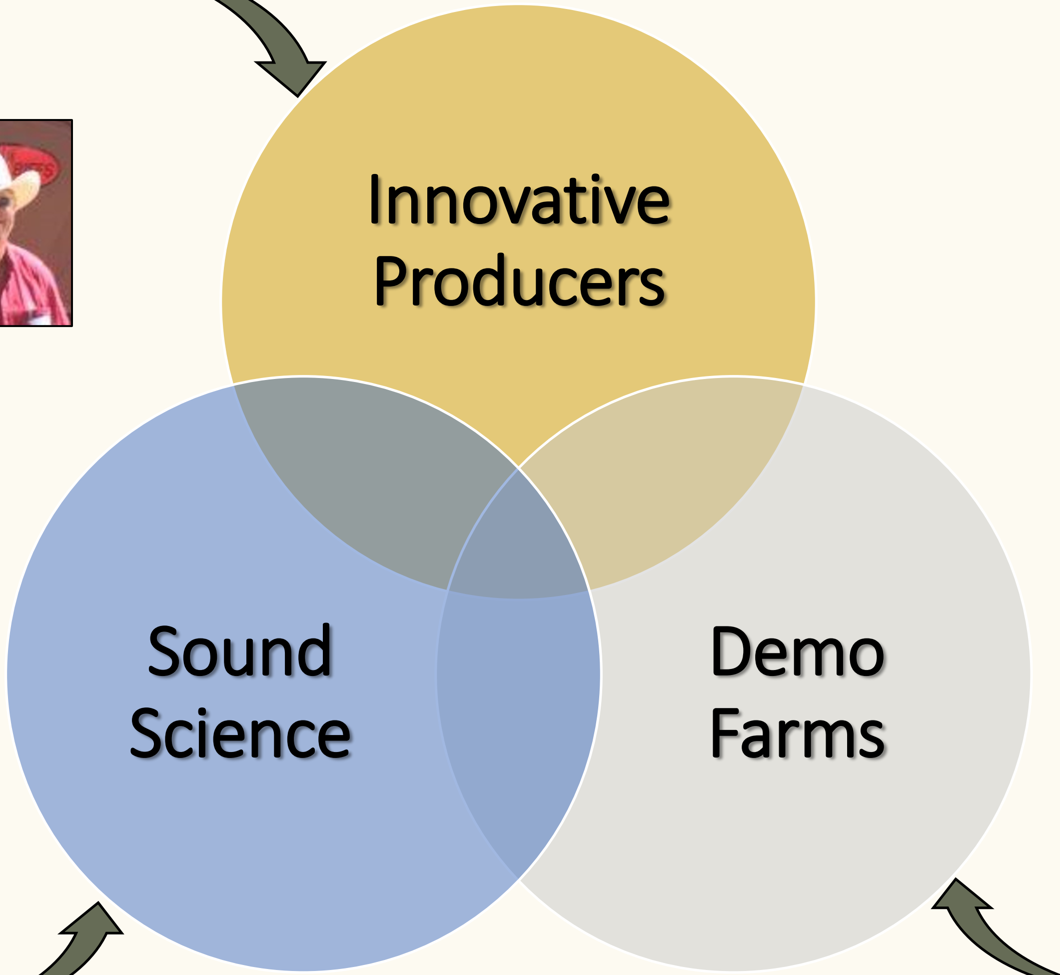
Winter Workshop (February)

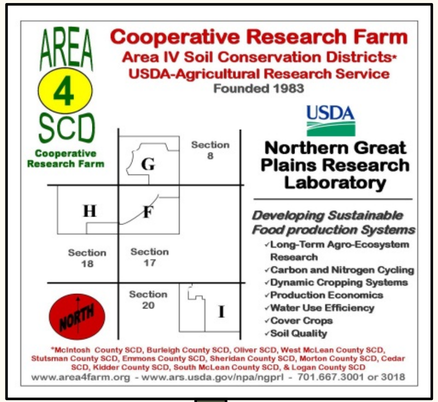
Engaging the agricultural community

Online Resources

www.area4farm.org

Incubator for Transformative Solutions





Established conservation-based systems

Cover Crops

Livestock Integration

Perennials

DYNAMIC CROPPING SYSTEM

Ecosystem service assessment framework

Can future systems…

PRODUCTION

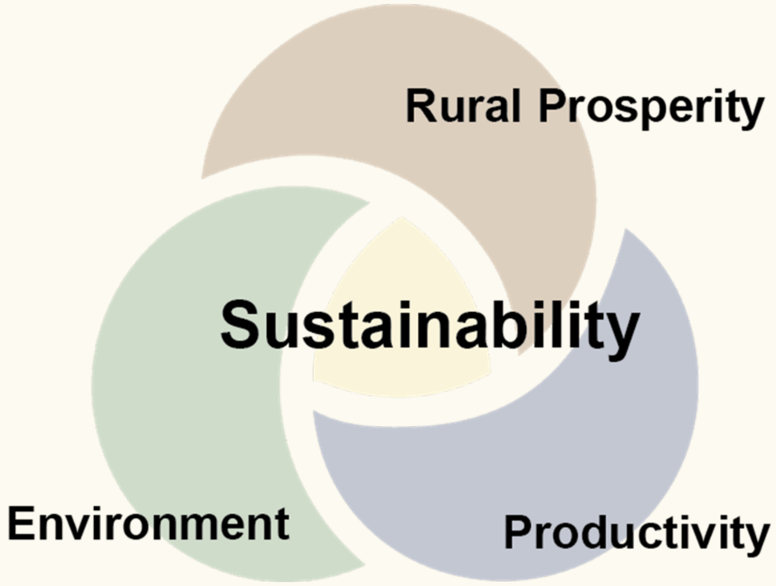
- Increase production of food, feed, fiber, fuel?
- Improve nutritional quality of agricultural products?

ENVIRONMENT

- Improve soil, air, and water quality?
- Increase resistance/resilience to stress?
- Improve pollinator resources?

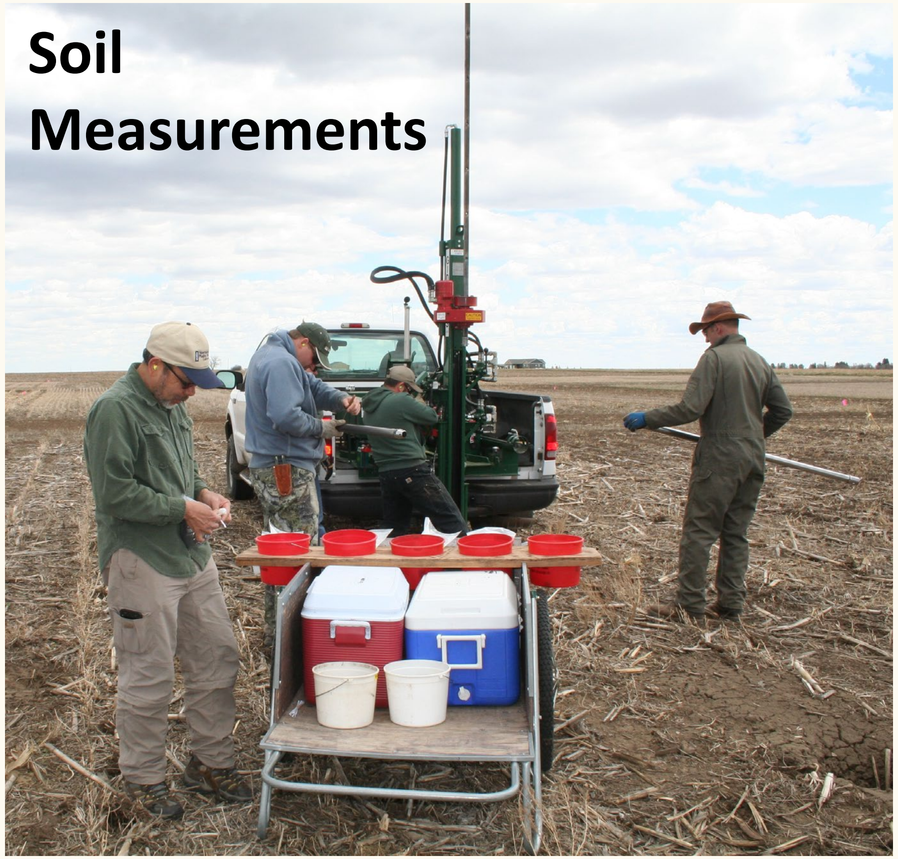
SOCIETY

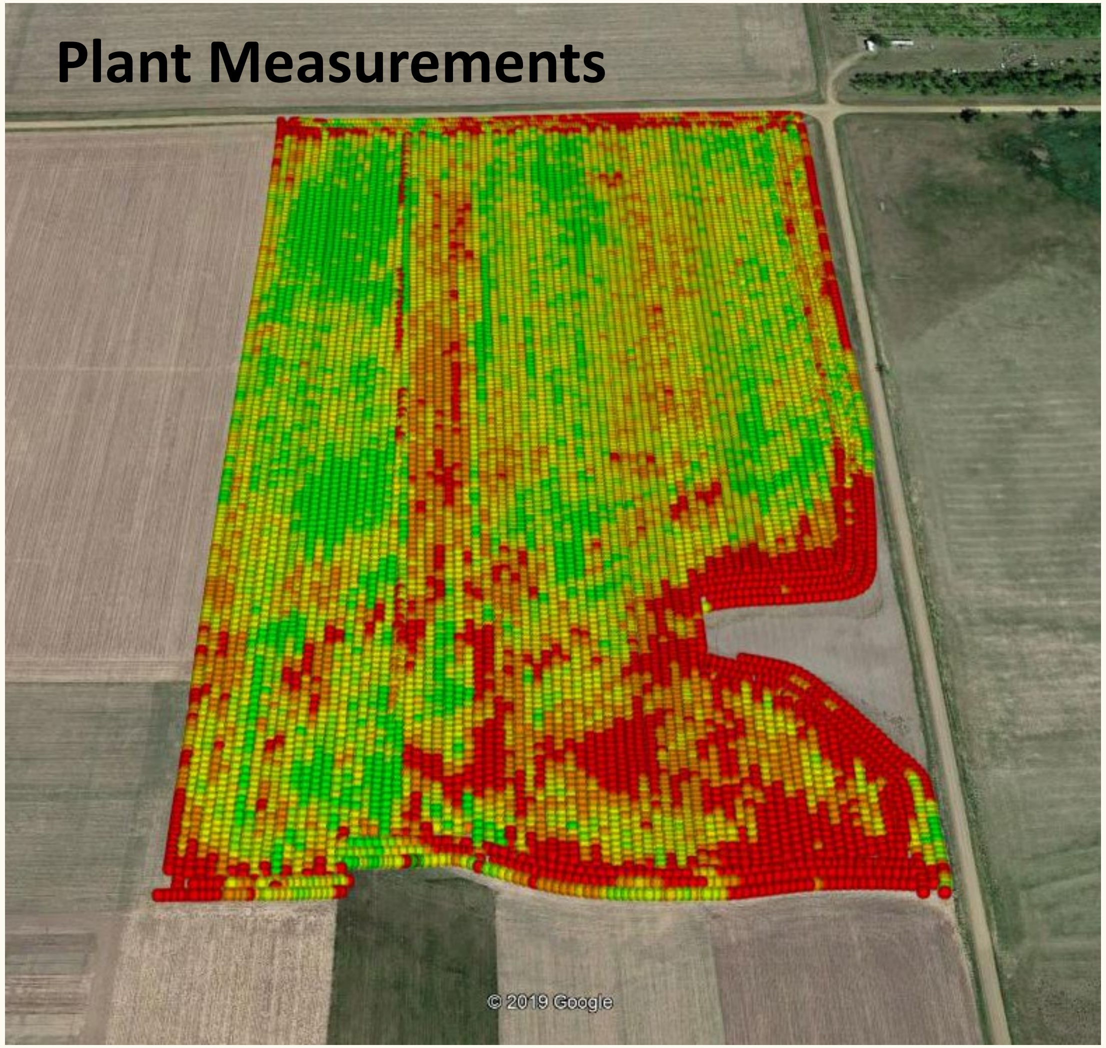
- Increase farm/ranch profitability?
- Improve rural economies?
- Improve rural landscapes?



35+ Years of Investment in the Area 4 Farm

Investment of labor and $





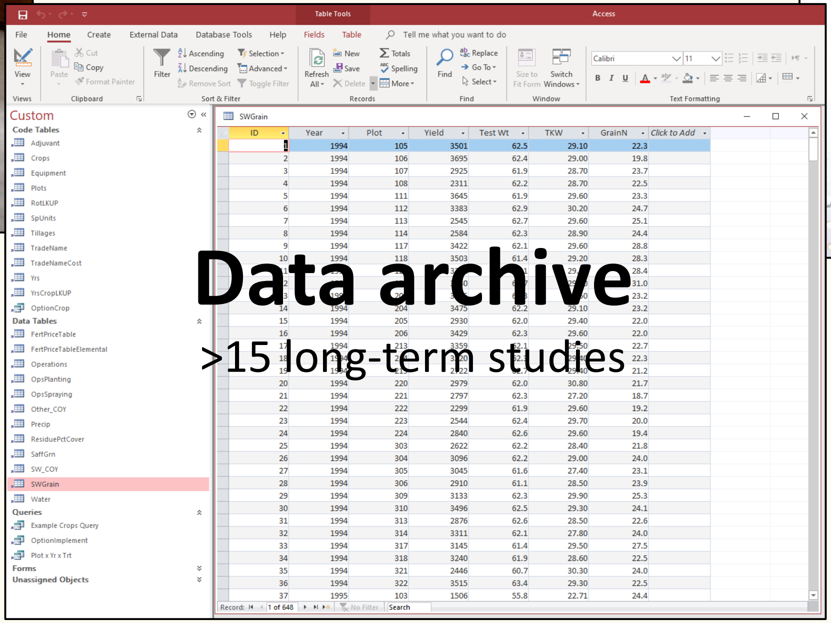
35+ Years Investment in the Area 4 Farm

Extensive archives to explore long-term impacts

Plant archive

Diverse grain/forage collection

>3000 samples



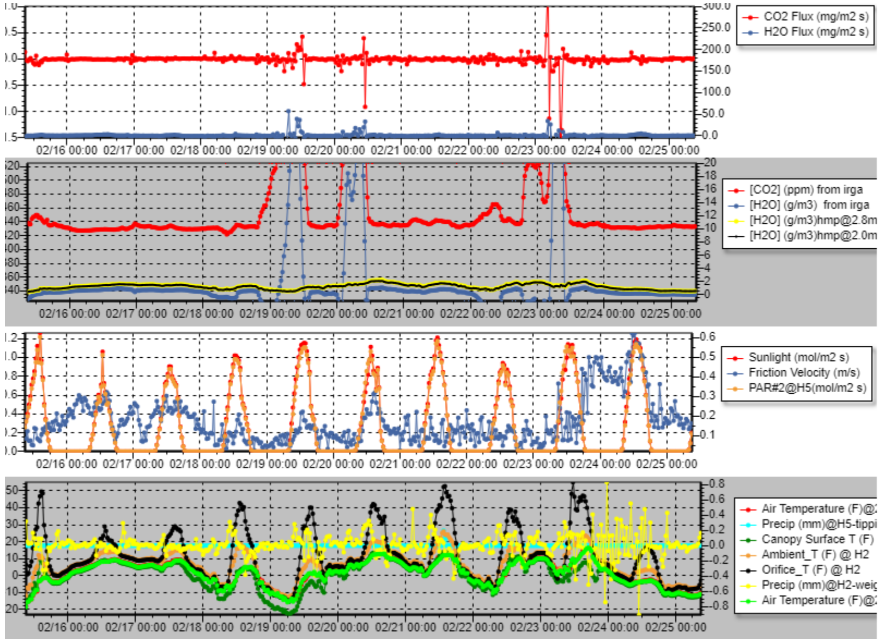
Data archive

>15 long-term studies

Soil archive

>5000 samples

1-103 years old



An Exciting Future for the Area 4 Farm

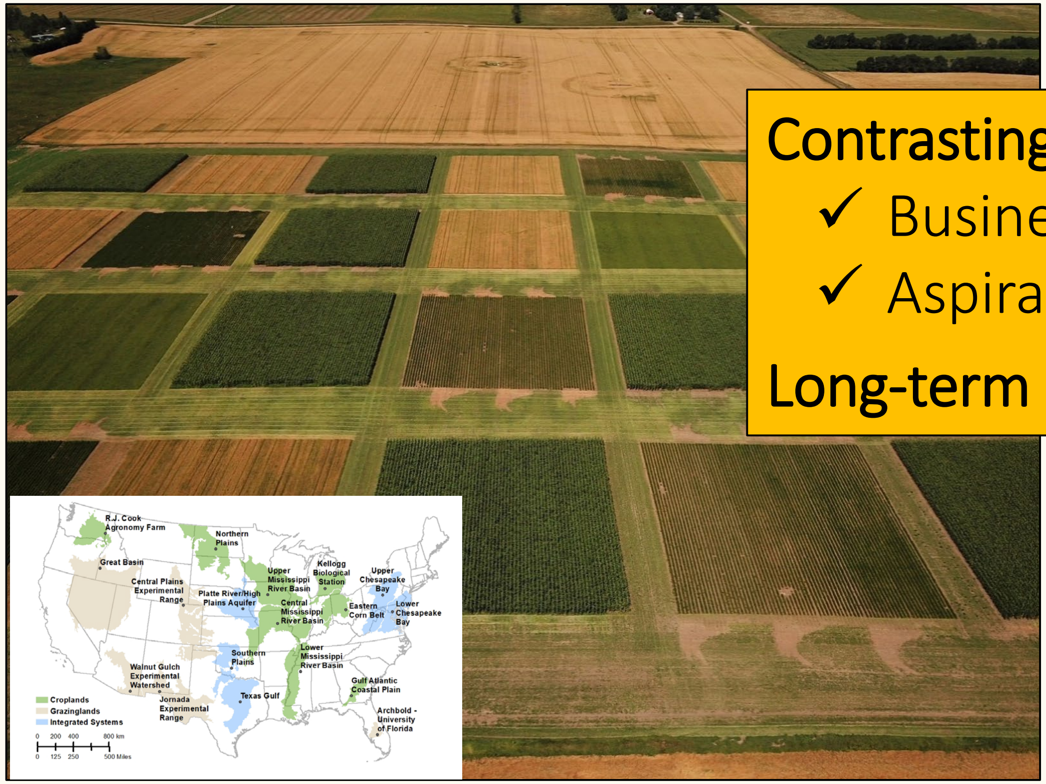
Application of precision technologies

Aligning data streams in real-time to facilitate adaptive management

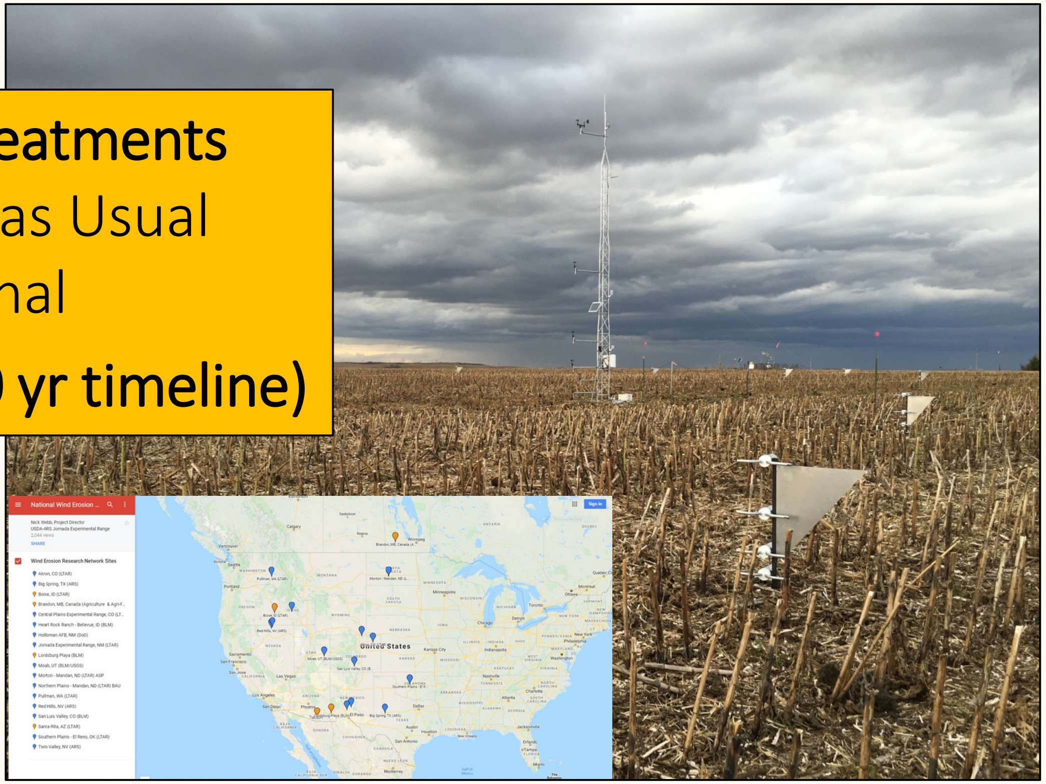
An Exciting Future for the Area 4 Farm

Engagement in national research networks

Long-Term Agroecosystem Research Network



National Wind Erosion Research Network



Contrasting treatments

- ✓ Business as Usual
- ✓ Aspirational

Long-term (30 yr timeline)

An Exciting Future for the Area 4 Farm

Health Soil – Healthy Food – Healthy People

Assess long-term management impacts to:

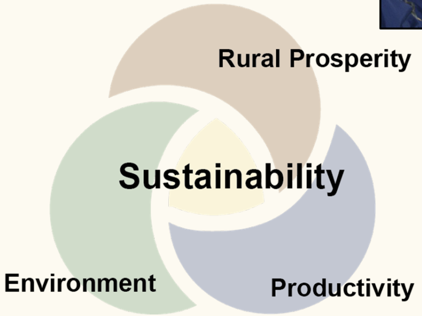
- Soil health
- Nutrient content of foods
- Human health

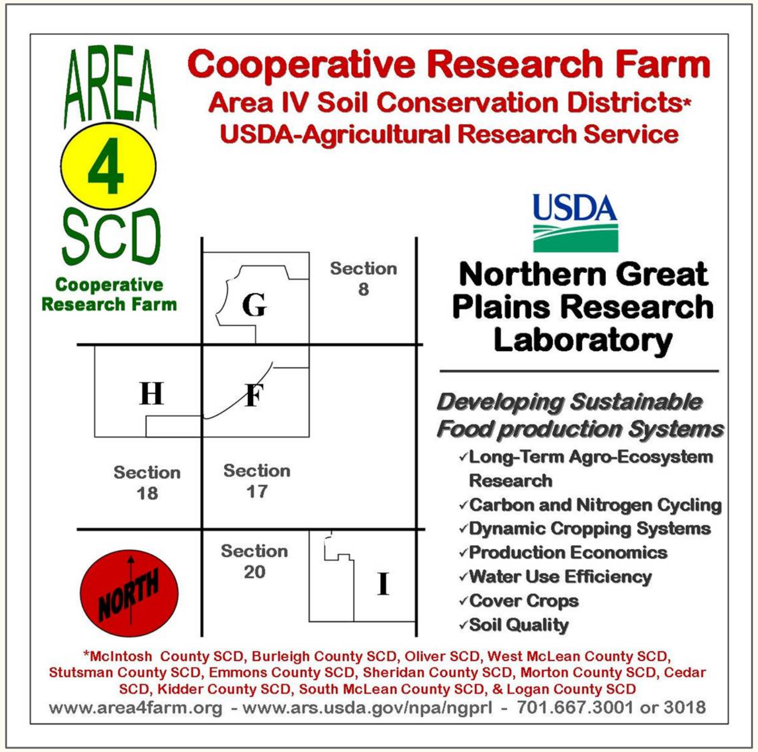
A Legacy for the Future

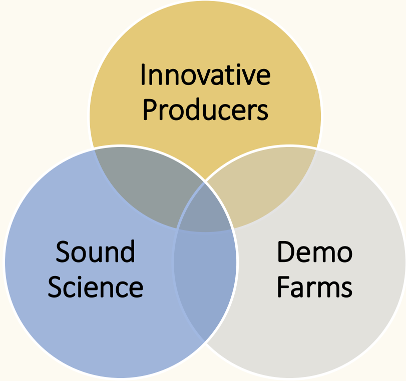
Long-Term Agricultural Research and the Area 4 SCD Cooperative Research Farm

Sustainable Intensification of Agro-ecosystems

- ⬆ Production
- ⬆ Economic Viability
- ⬆ Ecosystem Services







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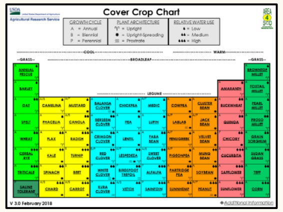

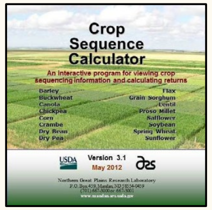


Thank you for your attention
Questions?
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