Integrating Perennial Grasses for Sustainable Agricultural Systems to Maximize Farm Profitability

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Outline

• Background and introduction
  – Grassland agriculture
  – Multifunctional agriculture
  – Limitations in adapting perennial grasses
• Agronomy of perennial grasses
  – Establishment
  – Management
• On-farm application and economics

A Permanent Agriculture

OUR GOAL is permanency in agriculture: an agriculture that is stable and secure for farm and farmer, consistent in prices and earning; an agriculture that can satisfy indefinitely all our needs of food, fiber, and shelter in keeping with the living standards we set. Everybody has a stake in a permanent agriculture.

P.V. Caudle, 1948
Our Grassland – Tallgrass Prairie

"Grassland is a good way to farm and to live, the best way I know of to use and improve soil, the very thing on which our life and civilization rest." Clinton P. Anderson (1948)

Problem Statement

- Grasslands lost to row crops
  - 99% of tallgrass prairie lost
  - 3.1 million acres in South Dakota from 2001 to 2010
  - Temperate grassland the most-altered biome globally, but the least protected

- Lost of benefits
  - Ecological services: nutrient cycling, C storage, soil erosion, hydrologic cycle, biodiversity
  - Economic service: Livestock, recreation

Grassland nesting birds declining faster than any other bird group in N. America (Peterjohn and Sauer 1999)

Back to the Future in U.S. Agriculture

- We, the people, need to care for the earth
  enrich our living environment; clean and plentiful water; fertile, vibrant, and productive soils, abundance and diversity of plants and animals, renewable energy, sustainable food and products
- Our future management choice should promote these goals

Historically managed our grassland agriculture can reduce/slowdown climate changes, desertification, soil erosion, flooding, and other ills
Multifunctional Agro-ecosystem

The future agricultural system could include a **perennial grass-based sustainable agriculture** that would encourage:

- Increased soil organic matter and microbial life
- Decreased use of fossil fuels
- Sustainable nonpolluting capture of energy
- Reduced use of toxic products
- More soil protected with living cover
- Greater diversity of plants and animals
- Maximize producer resources

Biodiversity on the Landscape will Promote Productivity and Sustainability of Our Agriculture

**FOOD, FEED, FIBER, FUEL**

*No Single Silver Bullet*
Opportunities with Perennial Grasses

**Income Streams**
- Native grass hay
- Native plant seed (upland and wetland)
- Specialty meat (e.g., grass-fed beef)
- Conservation payment
- Carbon credit
- Cellulosic biofuels
- Recreation (ecotourism, fee hunting)

Limitations in Adapting Perennial Grasses

- Selection of species and cultivars
- Seed sources
- Cropping system design
- Establishment
- Weed control
- Fertilization
- Harvest management
- Market value/availability

Agronomy of Perennial Grasses

Source: J.W. Voigt
Growing Our Food, Feed, Fiber, and FUEL

Integrating Perennial grasses
Cropping Landscape Design

- Environmental
- Multifunctional = Sustainable
- Economic
- Social

PERFORMANCE
- Ecological Functions
- Production Functions
- Cultural Functions

Perennial Grasses from Our Tallgrass Prairie

- Indiangrass
- Big Bluestem
- Switchgrass

Native Mixtures
- Warrior
- Chief
- Goldmine
- Bonanza
- DK-IL
- Kanlow
- CIR
- IN/BB
- BB/IN/SW
- IN/SW/SO
- BB/IN/SO
- MxG

Biomass yield (Mg ha⁻¹)

- Urbana, IL

Management Practices
Species selection

- Species selection

Growing Our Food, Feed, Fiber, and FUEL
**Management Practice**

* Cultivar selection

![Graph showing biomass yield (kg ha⁻¹) for different cultivars]*

**Management Practices**

* Establishment – three dominant species*

![Image of a field with text: Planted in May, 2012]*

**Management Practices**

* Fast germination – Prairie cordgrass*

![Graph showing germination (%) over time (Day) for different types of Prairie cordgrass seed]*

![Image of Prairie cordgrass seed types with text: Whole seed, Caryopsis]*

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(Graphics and images are not transcribed.)
Management Practices
Weed control

Without pre-emergent
Planted May 25, 2009
7 inch spacing
10 lb/ac seeding rate

With pre-emergent
Planted May 25, 2009
7 inch spacing
10 lb/ac seeding rate

Management Practices
Fertility and Harvest – switchgrass

EcoSun Prairie Farms Inc.

Goal to demonstrate economic viability of “commercial” grassland grown on croplands

- 640 acres of cropland and former CRP land converted to native grassland and restored wetlands
- Started in 2008
- Seed production: ~70 acres
  - 60 acres switchgrass
  - Prairie cordgrass, wedgegrass, sedge
- Hay and pasture: ~260 acres
  - Warm season/forbs
  - Warm/cool/forbs/legumes
- Croplands
EcoSun Prairie Farms Inc.

Economic challenges
- Achieving planned production and cost levels
- Marketing to obtain premium prices
  - Marketing costs?
- Transitioning to get through the establishment period
  - Cost-share sources on seed and seeding costs
  - Maintaining an income stream during transition years
- Generating income as soon as possible on newly establishment (without jeopardizing stand)

Courtesy of Dr. Carter Johnson

EcoSun Prairie Farms Inc.

Products
- Native grass hay
- Native plant seed
- Custom grazing
- Grass-finished beef
- Cellulosic biofuel feedstock
- Recreation (ecotourism, fee hunting)
- Ecosystem services

Courtesy of Dr. Carter Johnson
Ecosystem services

Farm level economic decisions do not include the value of ecosystem services, which could make grasslands more attractive.

Ways that producers might be paid for ecosystem services?

- Conservation payments
- Environmental markets (e.g., carbon credits)
- Branding (e.g., grass-fed beef)
- Marketing environmental amenities (e.g., ecotourism, hunting)

EcoSun Prairie Farms Inc.

Income

Promote Productivity and Sustainability of Our Agriculture

FOOD, FEED, FIBER, FUEL