
# Agriculture & Agri-Food Canada's Bioeconomy Research Initiatives

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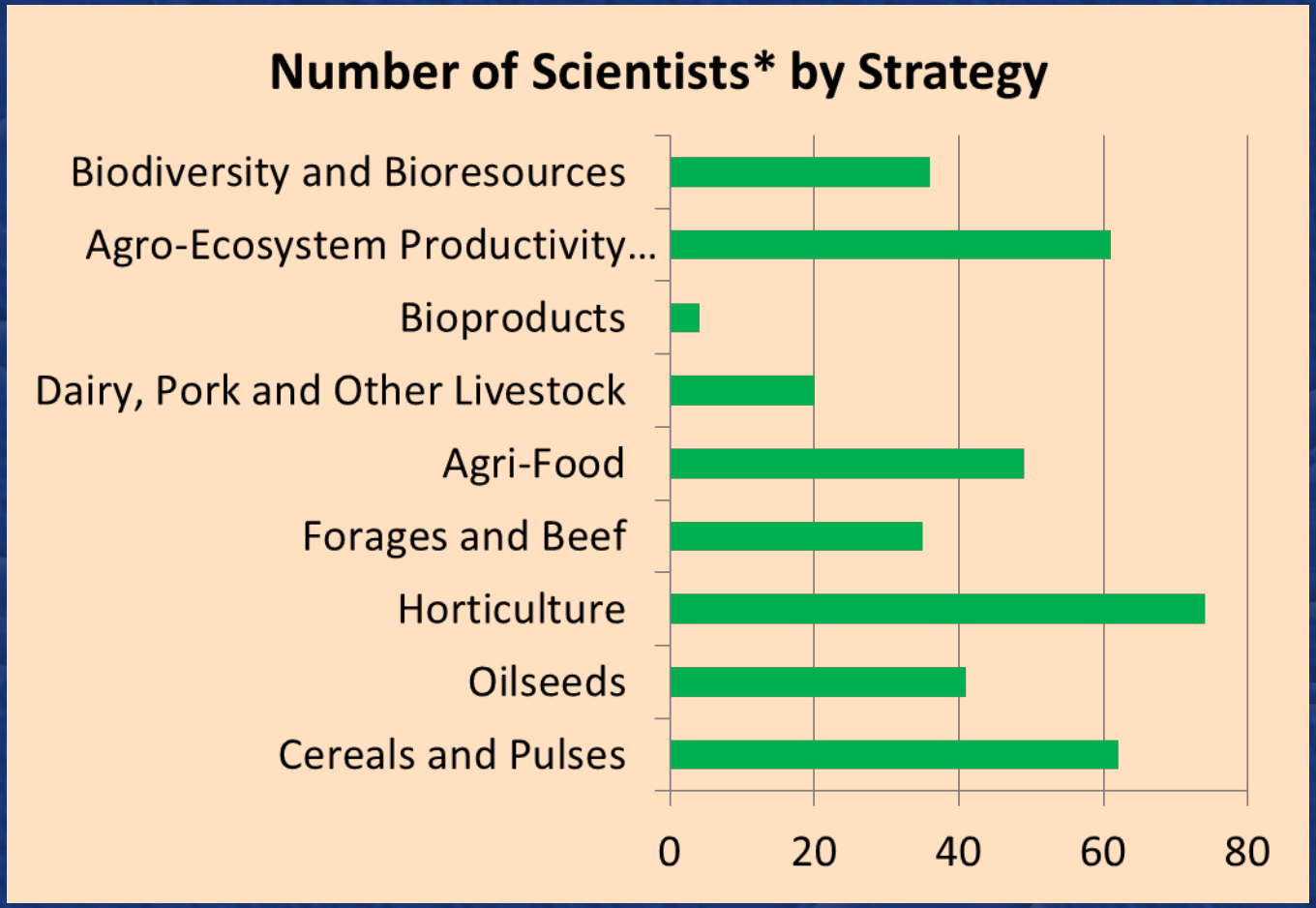
# Bioproducts in STB Strategy Matrix – 9 X 4

| STRATEGIC OBJECTIVES | SECTOR STRATEGIES | | | | | | |
|---|---|---|---|---|---|---|---|
| | Cereals & Pulses | Oilseeds | Horticulture | Forages & Beef | Dairy, Pork, Poultry and Other Livestock | Agri-Food | Bioproducts |
| *Increase agricultural productivity* | | | | | | | |
| *Enhance environmental performance* | | | | | | | |
| *Improve attributes for food and non-food uses* | | | | | | | |
| *Address threats to the value chain* | | | | | | | |
| | Biodiversity and Bioresources | | | | Agro-Ecosystem Productivity and Health | | |

Areas of Focus

# AAFC's Scientists Deliver on Nine Sectoral Science Strategies




*Based on 385 scientists

# *Bioproducts Strategy Objectives and Projects*

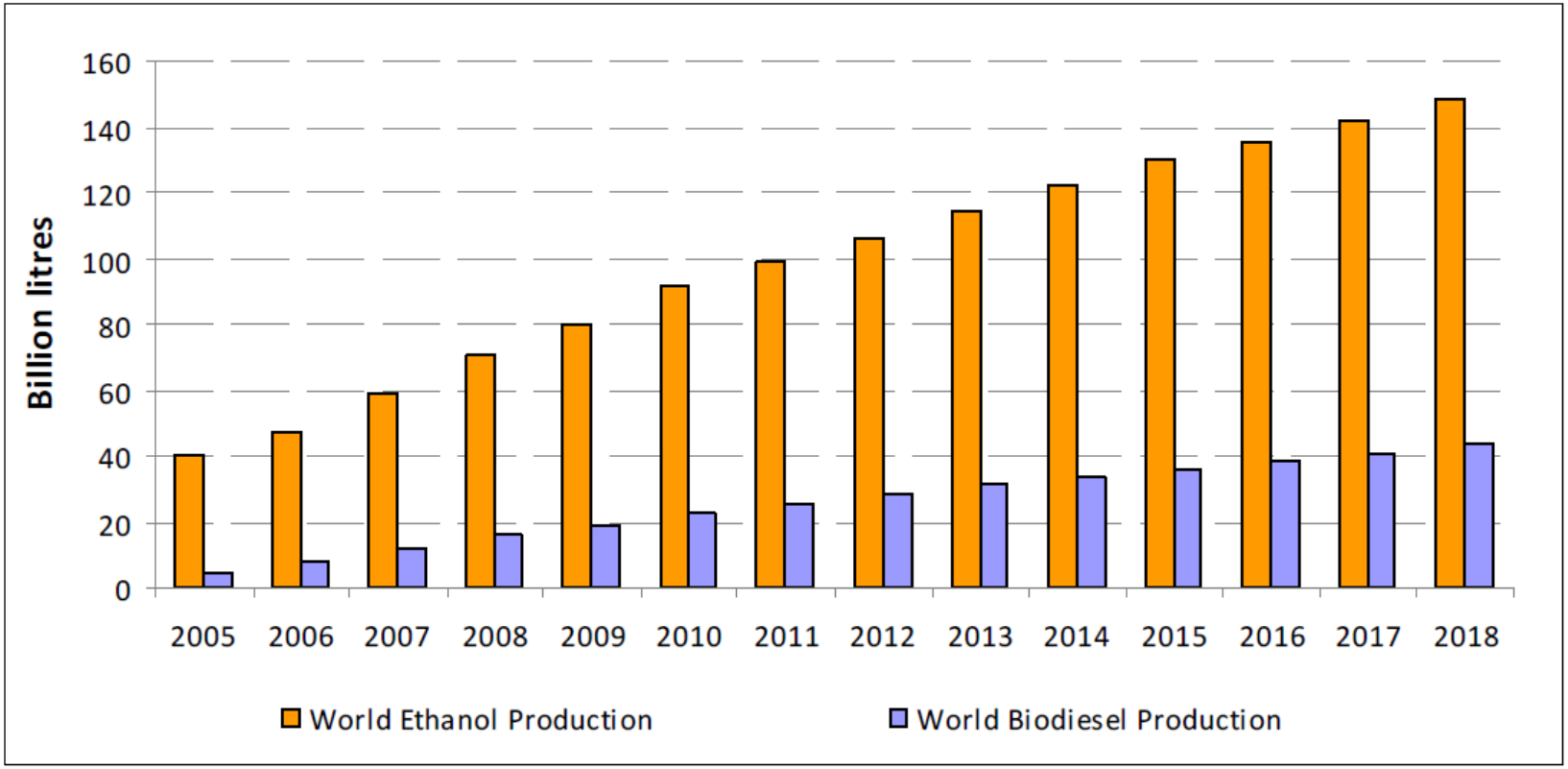
1. Increase biomass yields and improve feedstock productivity, quality & availability
   - Perennial forages (alfalfa, switchgrass and reed canary)
   - Oilseeds, flax, carinata and camelina, cereals, corn

2. Improve sustainability of feedstock production and develop quantitative measures to support the development of sustainability metrics
   - Agroforestry
   - Corn stover

3. Identify components and properties in existing crops and livestock for value added industrial applications, and develop new purpose grown biomass crops
   - Plant-made industrial, pharmaceutical and vaccine products
   - Biopesticides
   - Total plant utilization and co-products
   - Biodigestion

4. Mitigate emerging biotic and abiotic threats to bioproducts feedstock

World ethanol and biodiesel projections, 2005-2018




Source: FAO-OECD Outlook (2009)

# *Biomass Supply to Bio-products*

Several Initiatives partially funded through the AAFC Agri-Innovation Program

- Regional Assessment of Supply
- Field Trials (Demonstration and Research)
- Laboratory Analysis (Stover)
- Economic assessment
- Sector Readiness
- Sustainability

AAFC Strategic Policy Branch
Bioeconomy Policy Group

FPT Bioproducts Working Group

Project: Bioproduct Value Chain Analysis (M. Wellisch)

- Define Status and Identify Gaps

Agricultural Biomass suitable for bioproducts

| Type | Examples |
|---|---|
| New Crops (annual) | Carinata, Camelina |
| Crop Residues | Corn stover, Flax straw, Hemp stalks |
| Perennials | Switchgrass, Miscanthus, Jerusalem artichoke |
| Wastes (livestock) | Manure |
| Wastes (processing) | Screenings, off-spec |

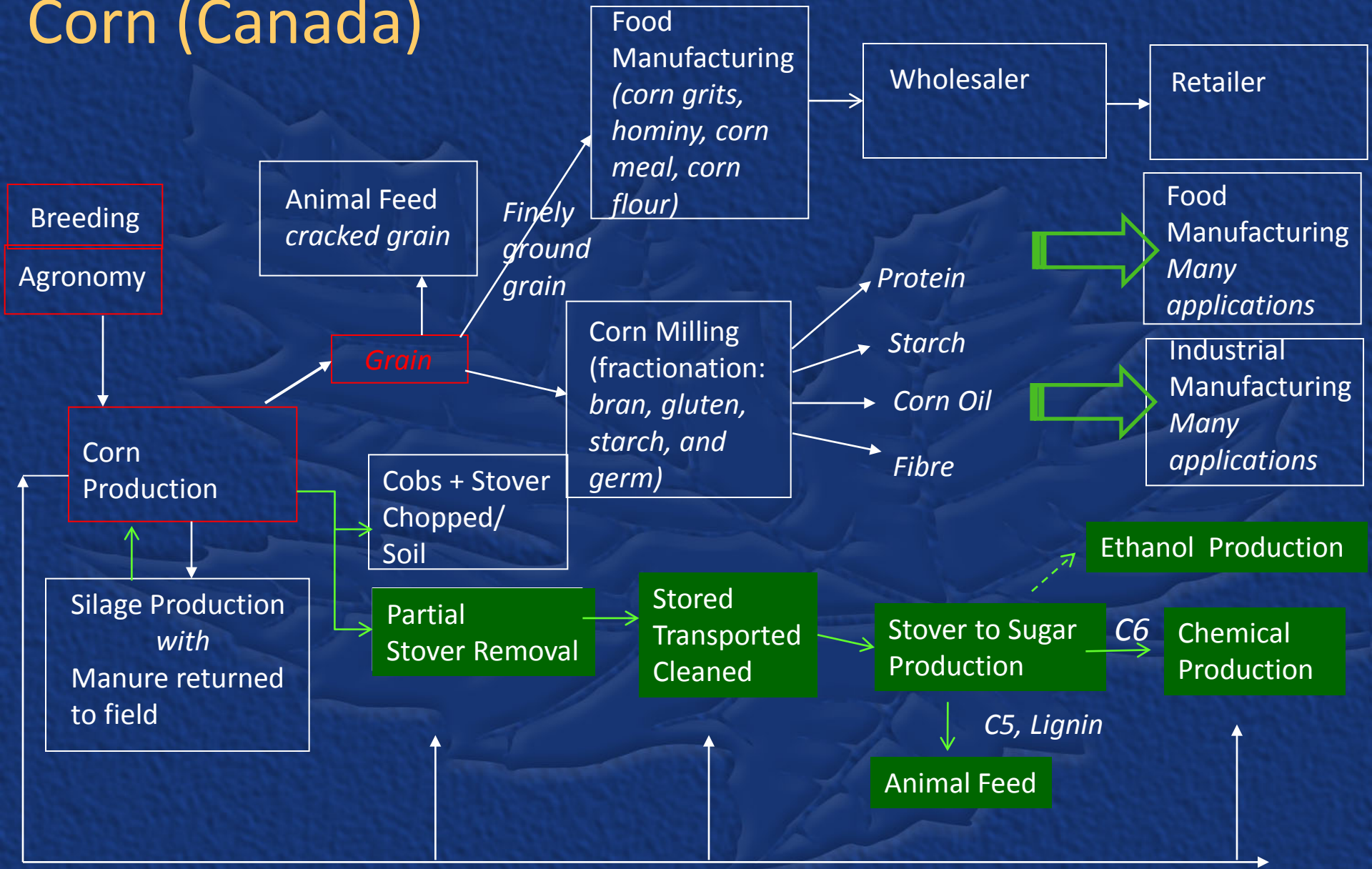
Stover Production

Conversion

Product Use
- C6
- C5
- lignin

Value Chain

# Corn (Canada)


Food Manufacturing (corn grits, hominy, corn meal, corn flour)
Wholesaler
Retailer
Breeding
Agronomy
Animal Feed cracked grain
Finely ground grain
Grain
Corn Milling (fractionation: bran, gluten, starch, and germ)
Protein
Starch
Corn Oil
Fibre
Food Manufacturing Many applications
Industrial Manufacturing Many applications
Corn Production
Cobs + Stover Chopped/ Soil
Silage Production with Manure returned to field
Partial Stover Removal
Stored Transported Cleaned
Stover to Sugar Production
C6
Chemical Production
Ethanol Production
C5, Lignin
Animal Feed
Inputs (energy, fuel, chemicals, recycled materials, etc.)

# *Economic Assessment of Stover Harvesting & Removal*

- 250,000 t per year bio-refinery model
- Cellulosic material converted to sugars for green chemistry products
- Value of corn stover based on cellulose, hemi cellulose and lignin
  - C6 sugar
  - C5 sugar and lignin as co-products
- Value of a tonne of stover $80/t

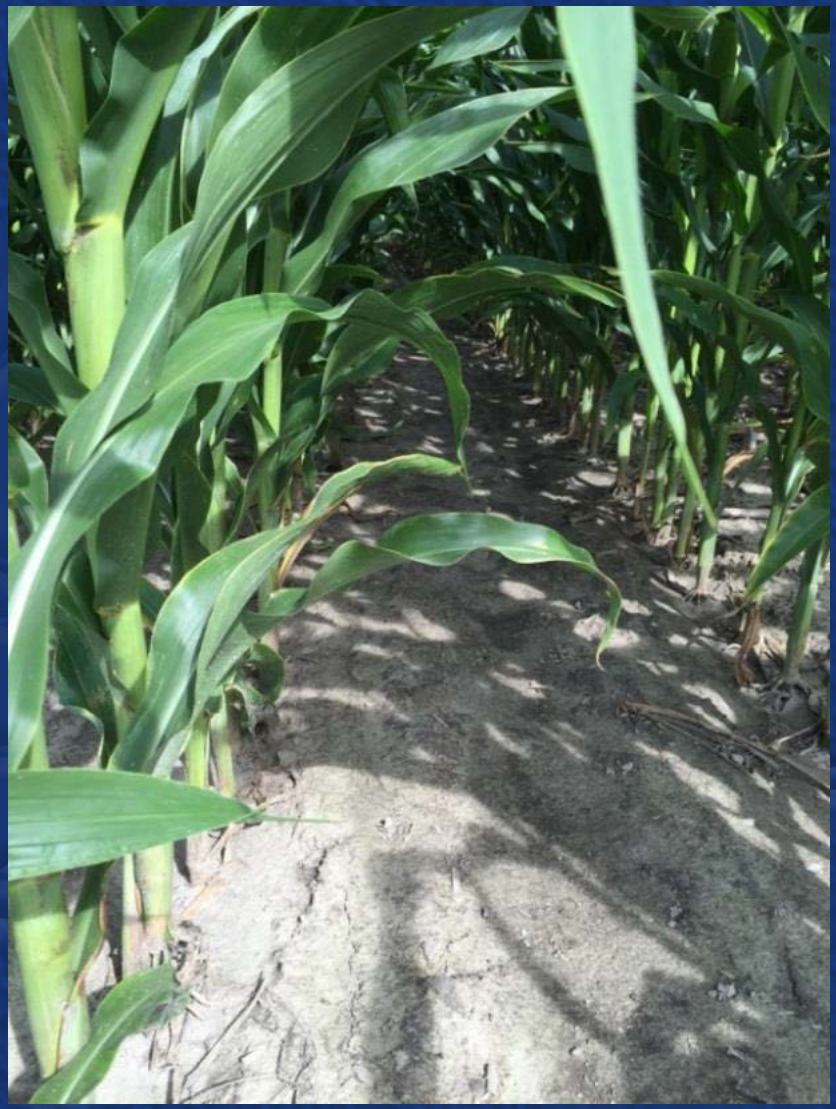
# *Corn Stover Harvest & Baling Demonstrations at the Outdoor Farm Show*

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

# *Harrow Research & Development Center*
# *AAFC, Ontario, Canada*

# Corn Stover Research Trials

# *Surface Residue – Mid Season*



# *Stover Removal Project Research Design*

## *Objectives:*

To determine the optimal rate of corn stover removal that would be sustainable

## *Treatments:*

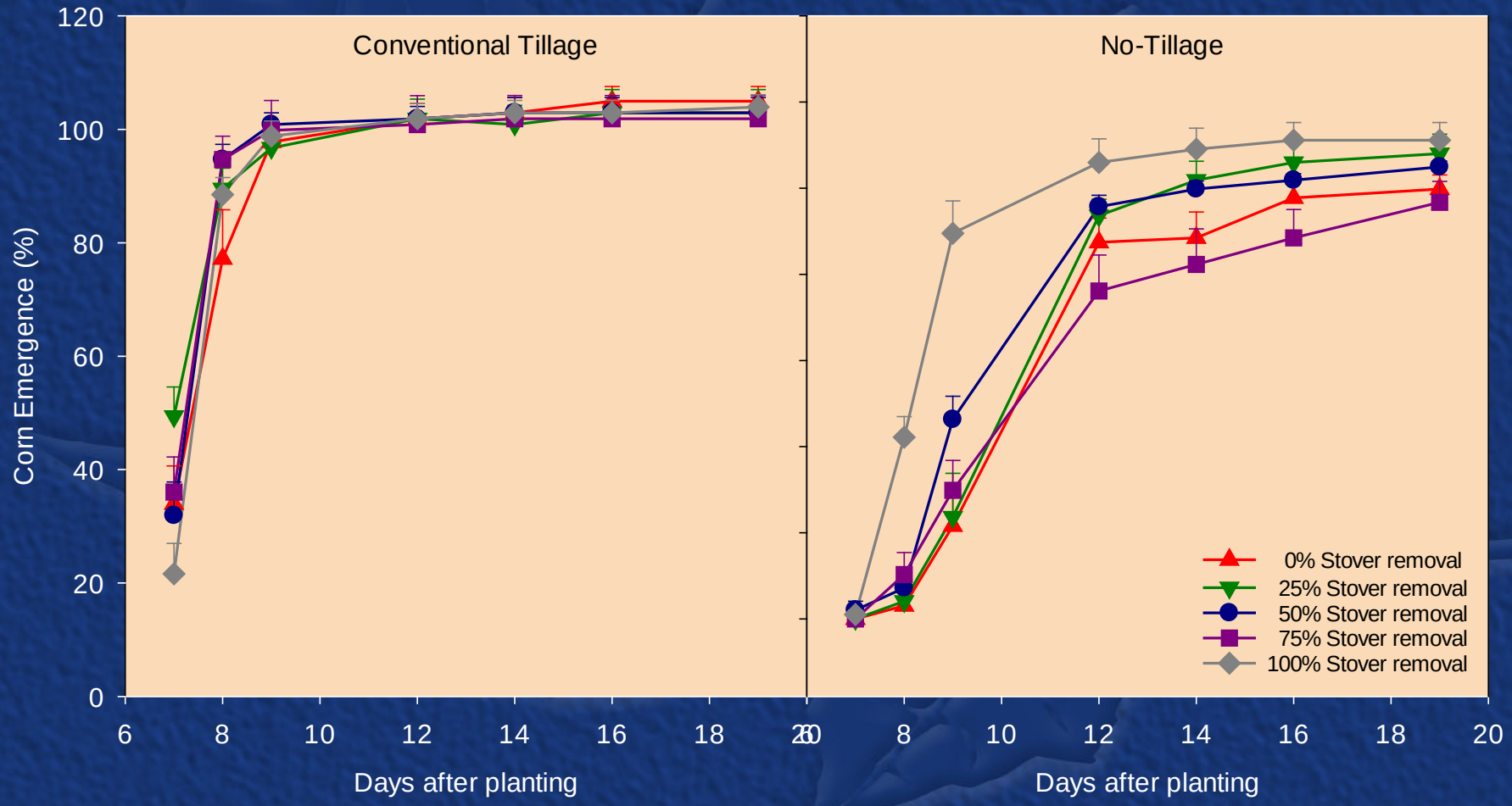
- Corn stover residue removal rates:
  - 0, 25, 50, 75 and 100% removal

- Conventional tillage and no-tillage

## Soils:

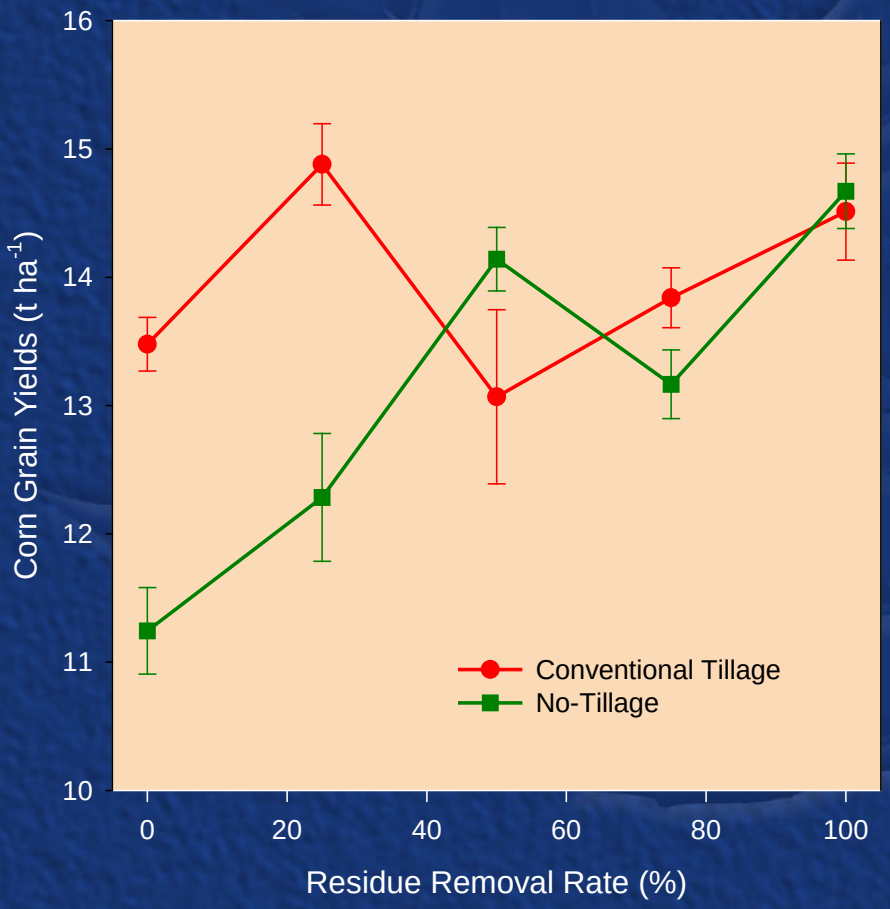
- Brookston clay loam
- Fox sandy loam

# Corn Emergence
# Harrow sandy loam 2015

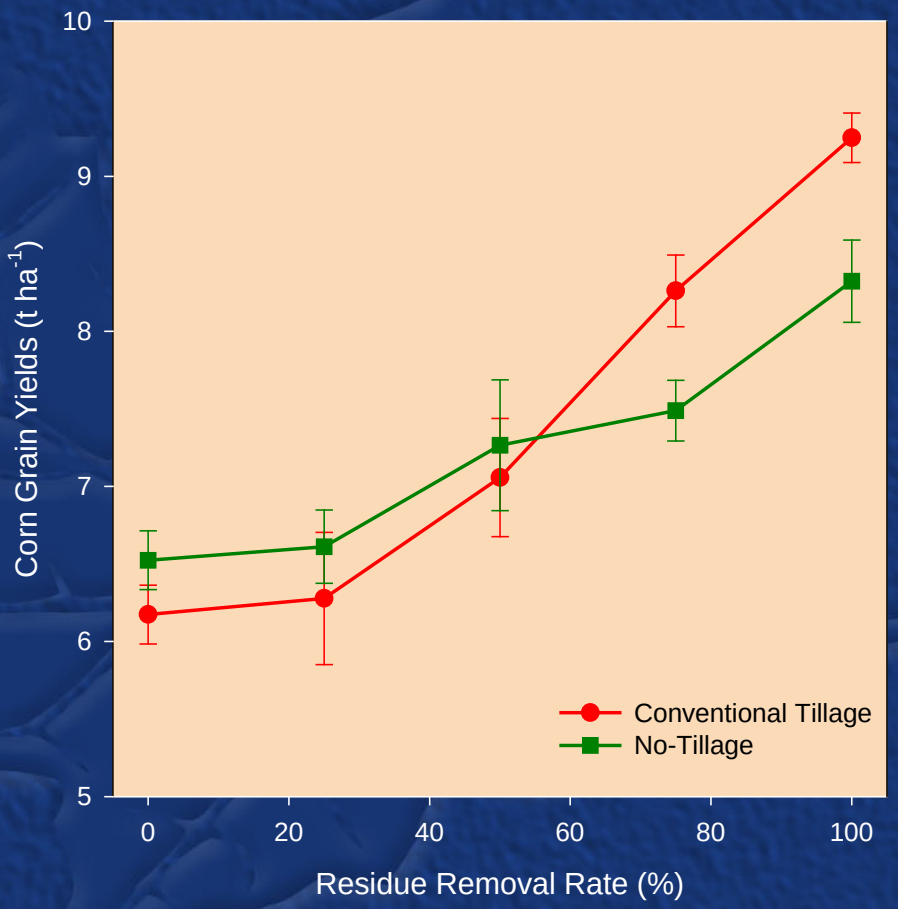


# *Corn Grain Yields – 2015*

## Harrow sandy loam

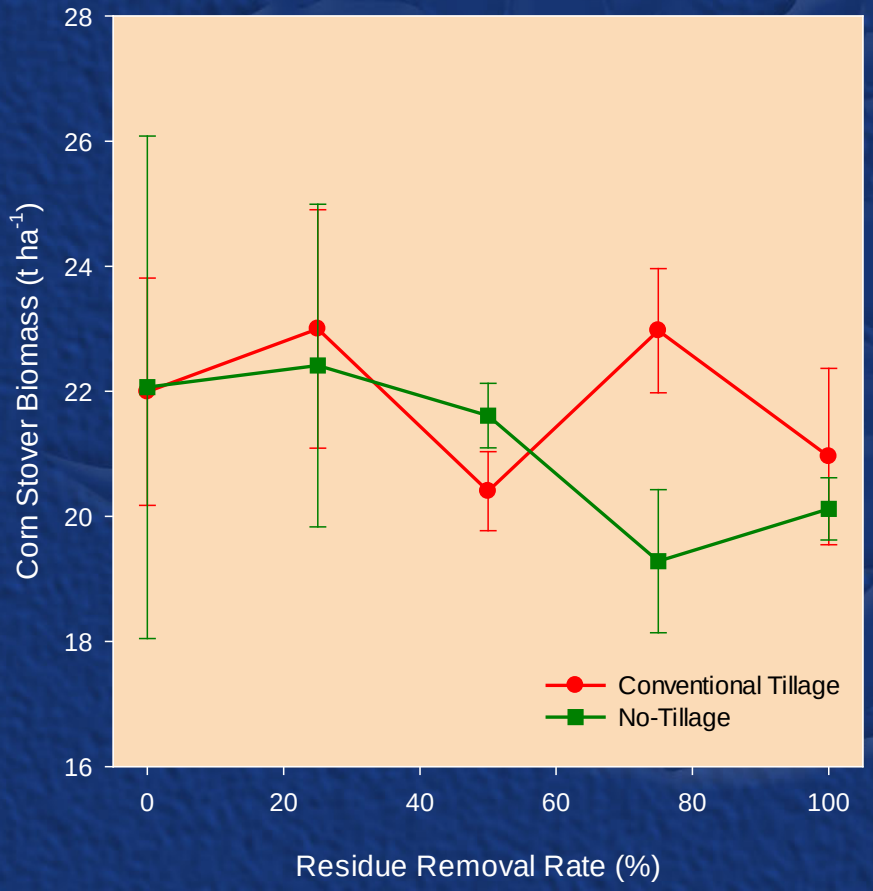



## Brookston clay loam

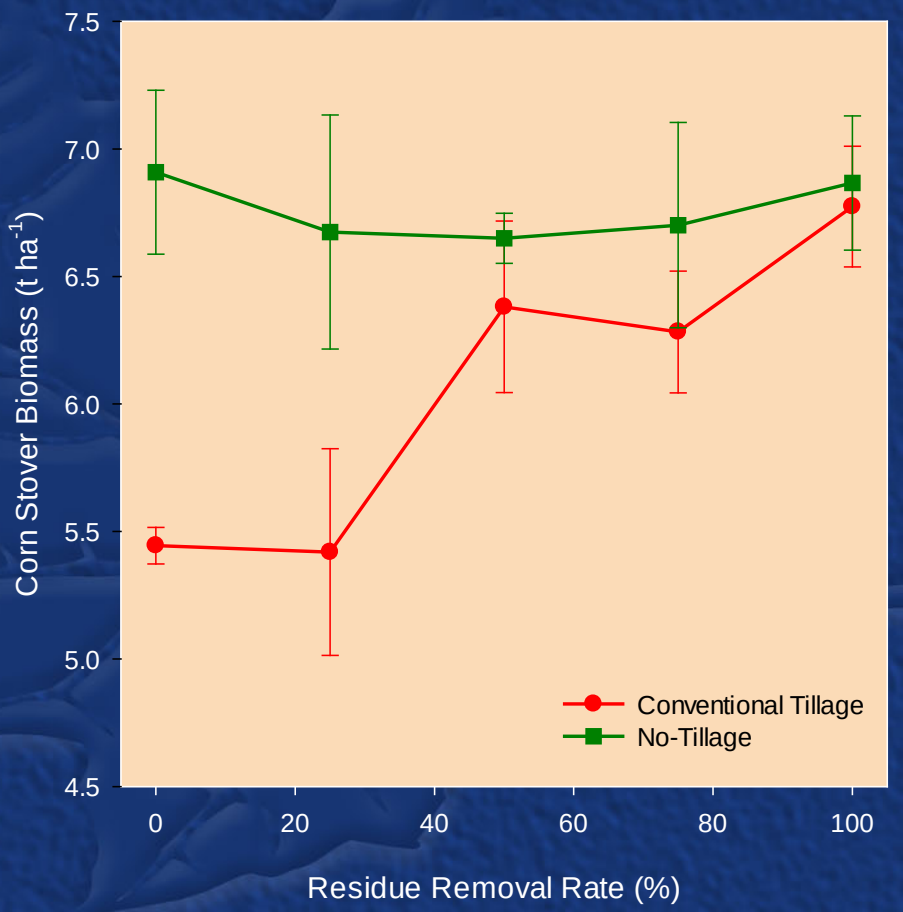


# *Corn Stover Biomass – 2015*

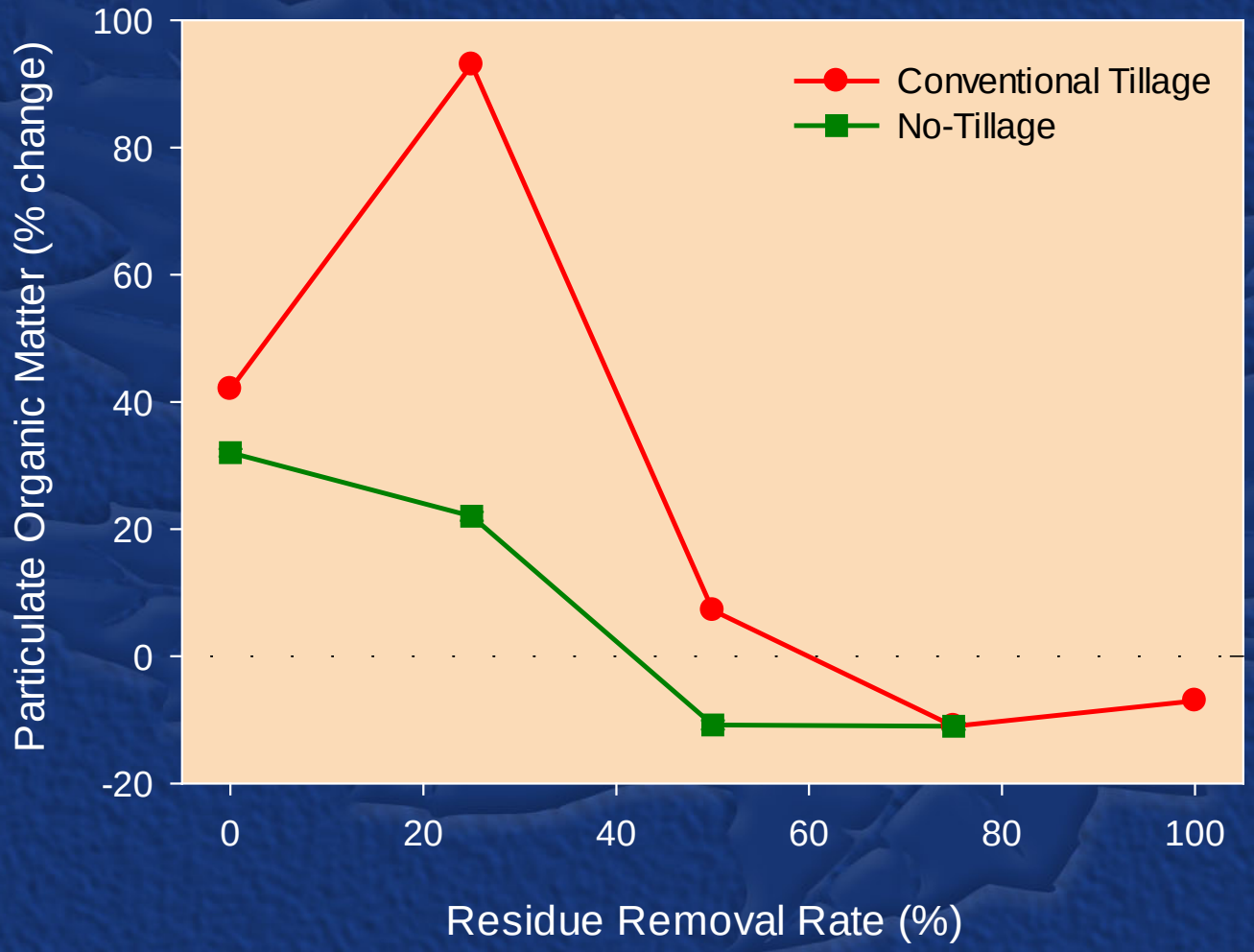
## Harrow sandy loam



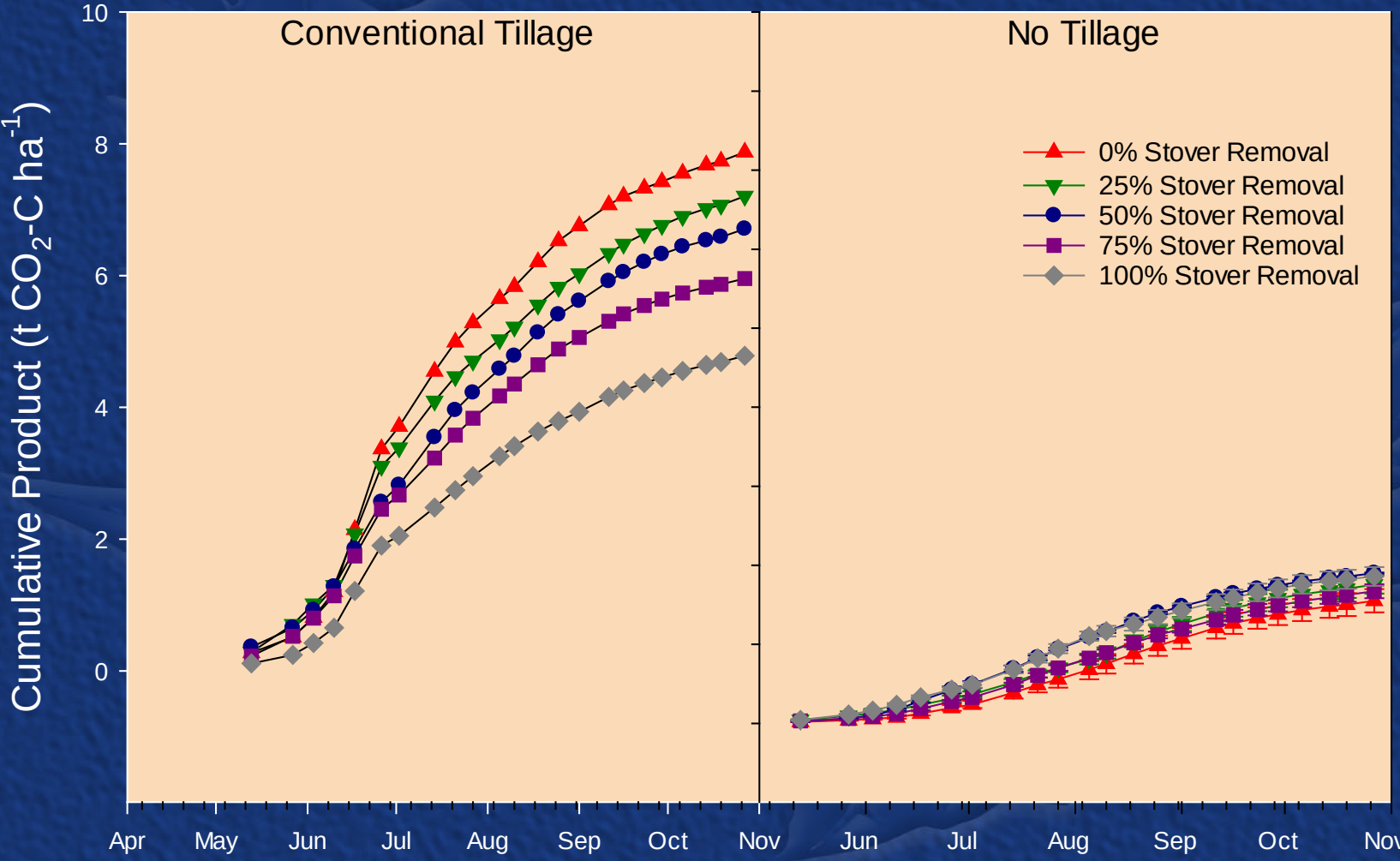

## Brookston clay loam



# *Particulate Organic Matter*
# *Harrow sandy loam- 2015*



# *Carbon Dioxide Emissions*
# *Harrow sandy loam – 2015*



# *Highlights/Successes*

- Preliminary results indicate that corn grain yields and corn stover biomass can increase with corn stover removal. This is due in part to the improved soil conditions in the spring especially for no-tillage treatments.

# *Highlights/Successes*

- *Soil microbial processes were impacted by stover removal and conservation tillage as demonstrated by the:*

  - *Stover removal was associated with a reduction in $CO_2$ emissions with conventional tillage whereas there was no effect with no-tillage*

  - *Stover removal increased POM at:*
    - *0 to 50% removal rates for conventional tillage*
    - *0 and 25% removal rates for no-tillage*

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# *Acknowledgements*

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Thank you!