

# Effect of Tillage and N Fertilizer Rate on Sugar Beet Production

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- Roundup Ready sugar beet seed.
- Strip tillage becomes an option.
  - Reduced tillage costs.
- How will sugar beet produce under strip tillage systems?
- Is N management different in a strip tillage system compared to conventional tillage systems?
  - Different residue management.

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Why Do This Research







- 3-year study (2008-2010)
  - Data from 2008 and 2010 used in analysis
- Tillage System (Spring and Fall)
  - Strip Tillage
  - Moldboard Plow
  - Chisel Plow
- N Rate (Supply)
  - $\approx$  0, 50, 100, 150, 200 lbs applied N/acre + Residual inorganic N in soil.
- Experimental Design
  - Split plot design
  - Treatment Replicates - 3 (2008) and 4 (2010)

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# Materials and Methods

Tillage System	Fall	Spring
Strip Tillage		Strip Tillage
Moldboard Plow		Moldboard Plow Roller Harrow Bed
Chisel Plow	Offset Disk	Chisel Plow Tandem Disk Bed

## 2008 Tillage System Descriptions

Tillage System	Fall	Spring
Strip Tillage		Strip Tillage
Moldboard Plow		Moldboard Plow Roller Harrow Roller Harrow Bed
Chisel Plow		Offset Disk Offset Disk Chisel Plow Tandem Disk Tandem Disk Tandem Disk Bed

## 2010 Tillage System Descriptions



- **Soil Samples**
    - From each tillage system prior to planting and fertilization
    - 2008 – 0-1 and 1-2 ft. – Root restricting layer at  $\approx$  20 inches. = **93 lbs N/acre**
    - 2009 - 0-1, 1-2, and 2-3 ft. = **60 lbs N/acre**
  - **Planting Dates**
    - 2008 – April 25
    - 2010 - April 27
  - **N Fertilization**
    - 2008 – April 25 (after planting); surface UAN with Agrotain
    - 2010 – June 2 (2 to 3 leaf stage); UAN banded between rows.
    - Fertilizer was irrigated into the soil shortly after application.
  - **Glyphosate was applied as needed and according to the label to control weeds**
  - **Irrigation was applied 2 to 3 times/week to match estimated crop water requirements (Kimberly-Penman Reference Evapotranspiration Model)**
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# Materials and Methods

- **Beet harvest**

- Mid October
- 2 rows × 30 ft.
- 2 sample locations per plot
  - rows 2-3 and 6-7 (center 2 rows of each 4 row planting pass)



30 ft.

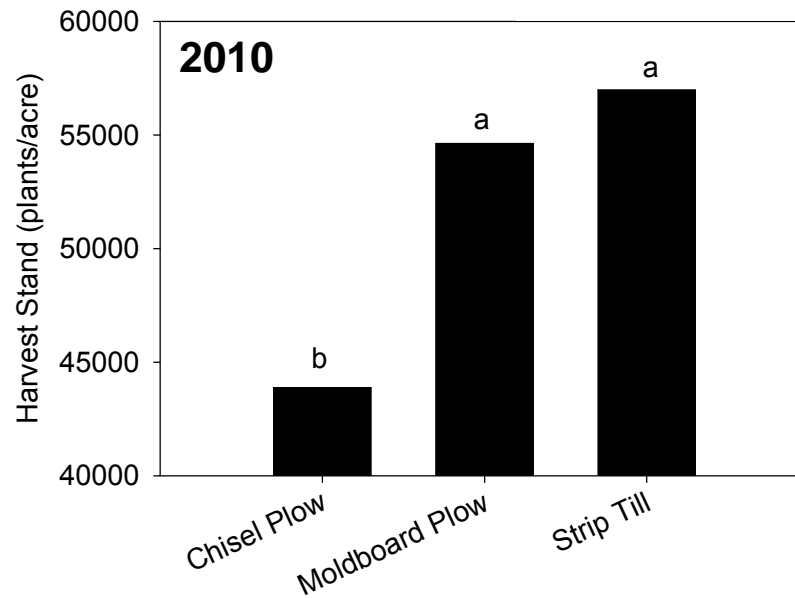
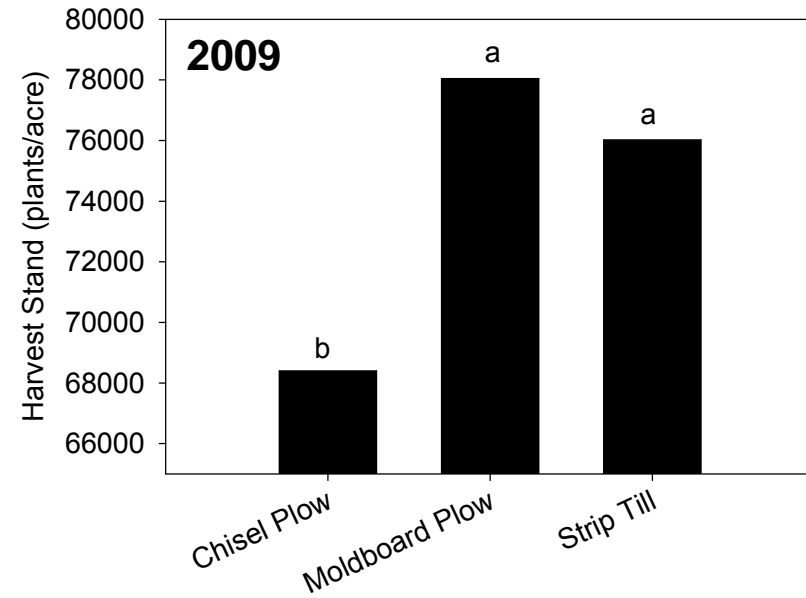
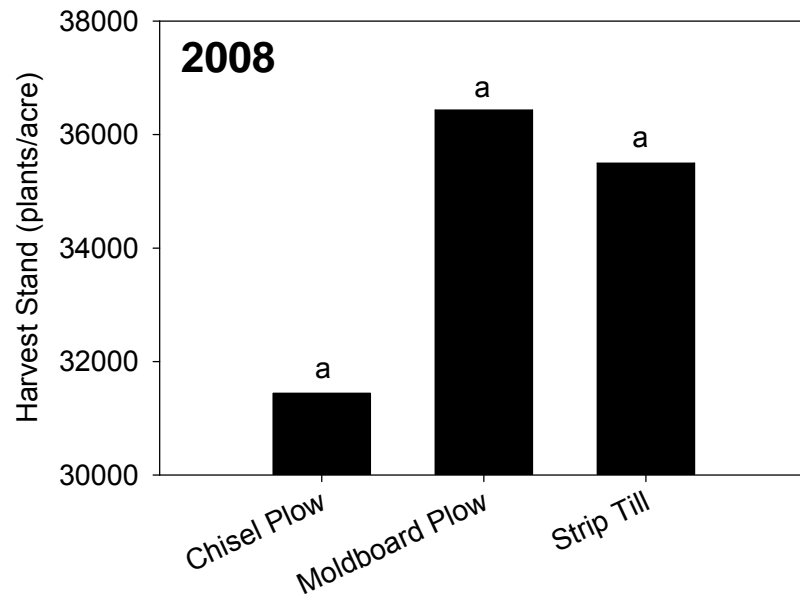
1 2 3 4 5 6 7 8



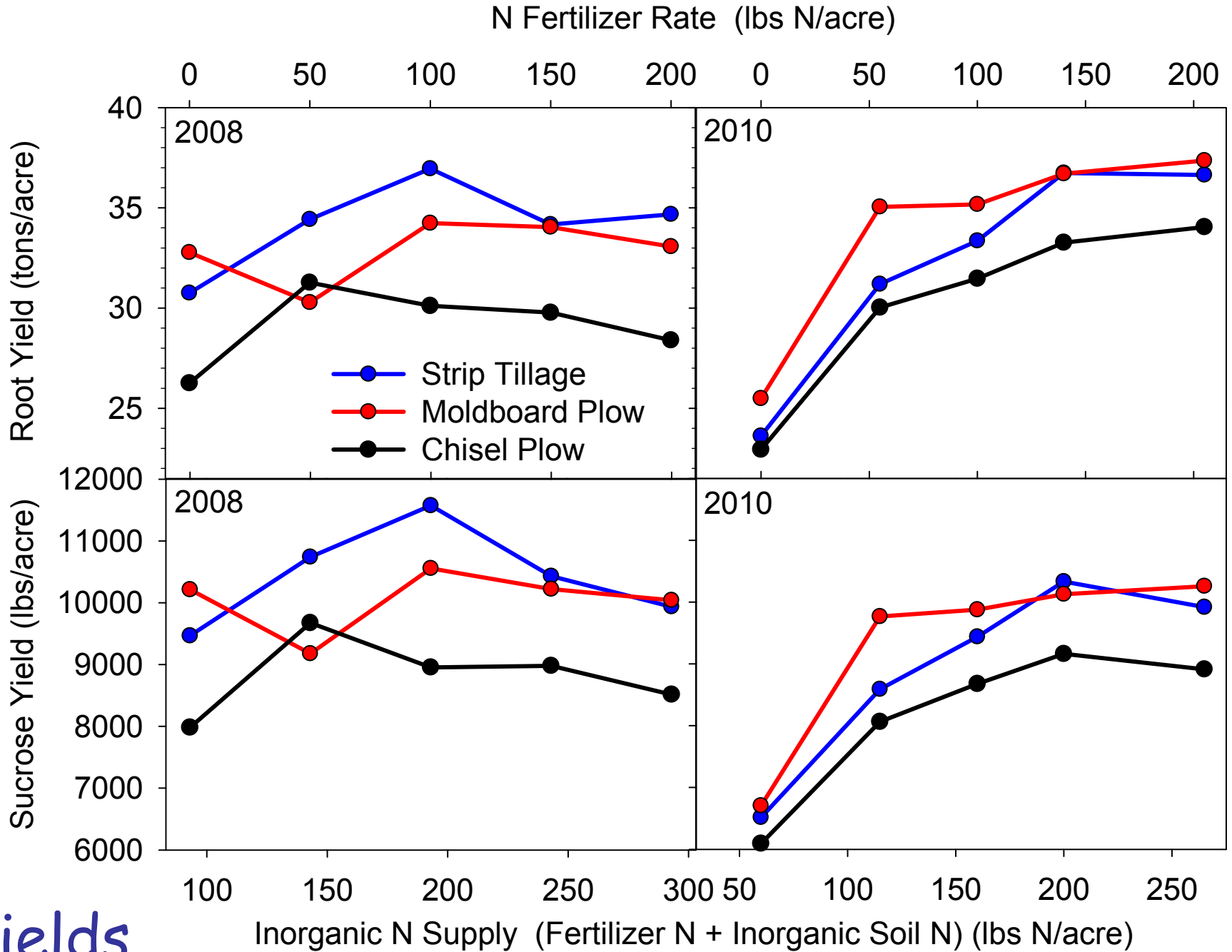
- Beet harvest cont.
  - Root Yield (tons/acre)
  - Sugar analysis
    - 2 – eight beet samples sent to tare lab
  - Total N analysis
    - 1 – eight beet sample



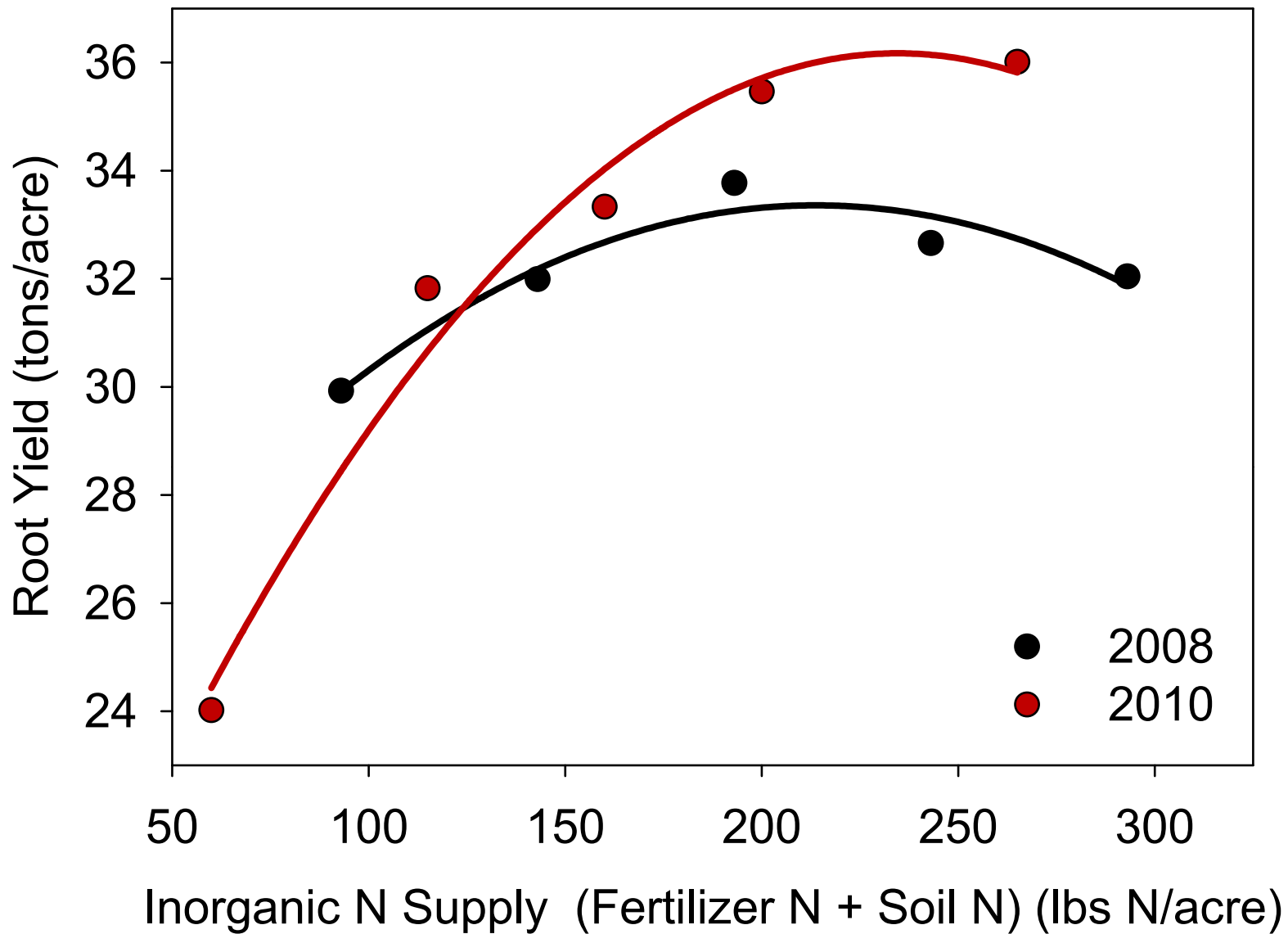
# Methods Cont.



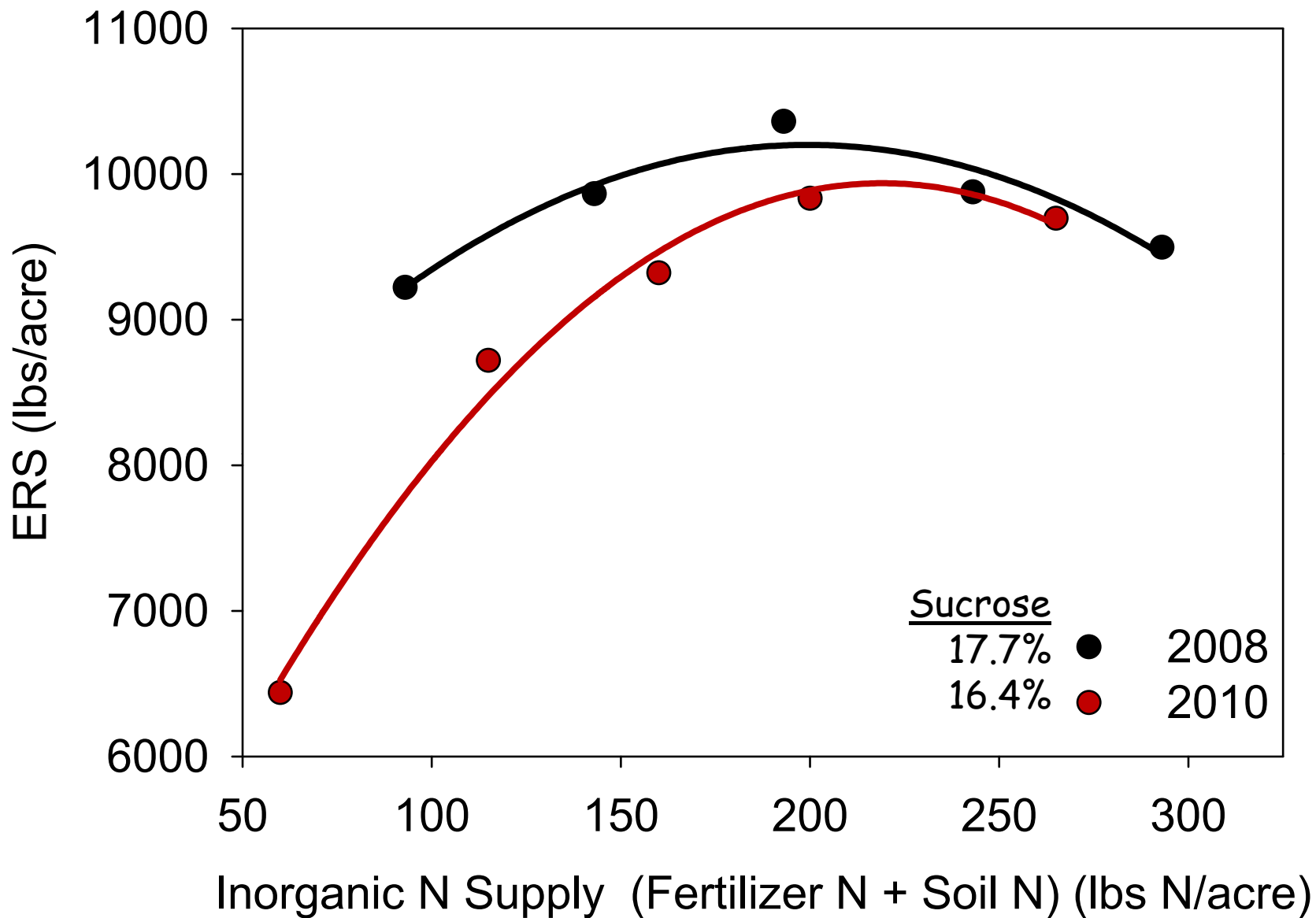
# Harvest Stand



Yields



## Root Yield



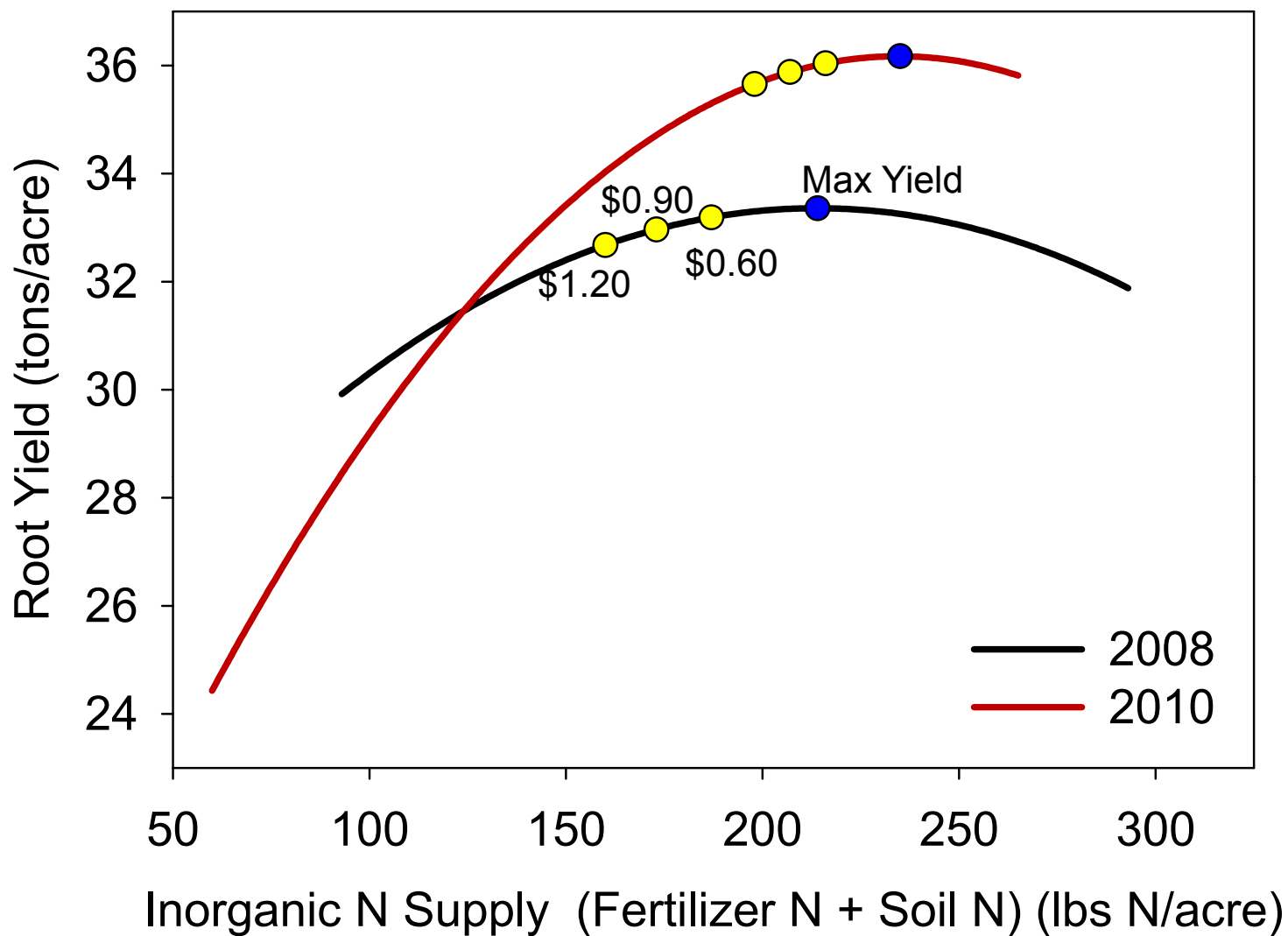
# Estimated Recoverable Sucrose

- Calculated Net Return from applying N fertilizer
  - ❑ \$ return associated with applying a given amount of N fertilizer
  - ❑ = Gross return of beets with N fertilizer applied – Gross return of beets with no N fertilizer applied – N fertilizer cost
    - ❑ Calculated for every 1 lb increase in N as predicted using the regression model
  - ❑ N Supply corresponding to maximum \$ return = EONS
- N Fertilizer Price
  - ❑ \$0.60, \$0.90, and \$1.20/lb N fertilizer
- Sugar Return
  - ❑ Base price = \$45/ton at 17.0% sugar
  - ❑ Adjusted from base price =  $\pm$  \$0.33/ton for every  $\pm$  0.1% sugar

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## Economic Optimum N Rate (Supply)

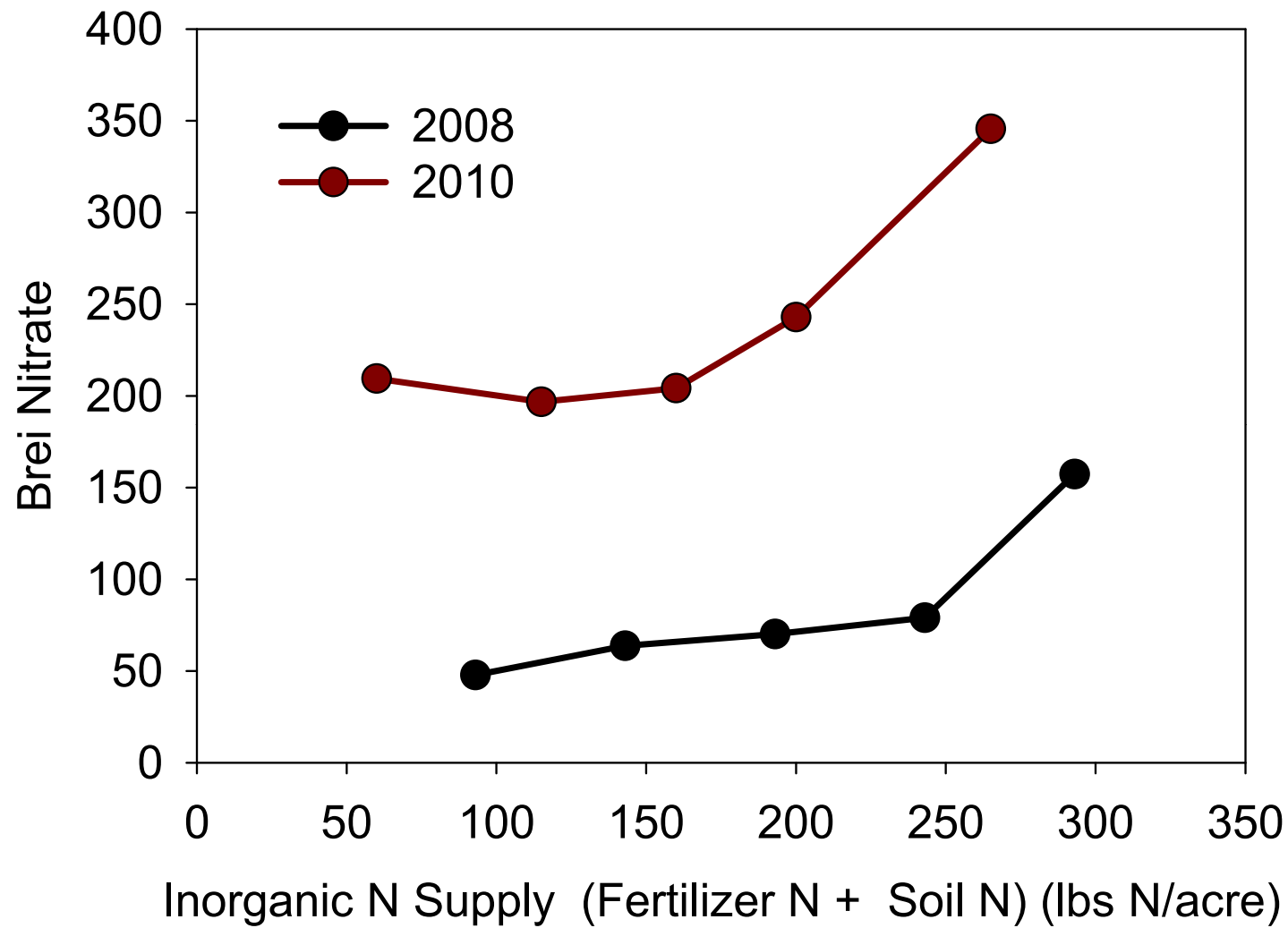




## Economic N Rate (Supply)

<b>2008</b>					
<b>N Fert. Price (\$/lb N)</b>	<b>EONR-fertilizer (lbs/acre)</b>	<b>EONS-total supply (lbs/acre)</b>	<b>Yield at EONR</b>	<b>RTN at EONR (\$/acre)</b>	<b>Nr (lbs N/ton beets)</b>
0.60	94	187	33.2	98	5.6
0.90	80	173	33.0	72	5.2
1.20	67	160	32.7	50	4.9
<b>2010</b>					
0.60	156	216	36.0	406	6.0
0.90	147	207	35.9	360	5.8
1.20	138	198	35.7	317	5.5

Historical Nr:  
 Recent: 8 lbs N/ton beets  
 Past: 11 lbs N/ton beets



# Brei Nitrate

- Strip tillage had similar production factors compared to conventional moldboard plow system.
- Chisel plow had reduced harvest stands and trends for lower yields compared strip tillage and moldboard plow.
- N requirement per ton of beets lower than historic 8 lbs N/ton beets.
- N Mineralization in soil still the great unknown.

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## Conclusions

Thank You!

Questions?