

# Effect of Soybean Variety, Glyphosate Use, And Manganese Application on Soybean Yield

**Carrie Laboski, Todd Andraski, Shawn Conley, John Gaska**

**Wisconsin Crop Management Conference  
January 10-12, 2012**



**DEPARTMENT OF  
SOIL SCIENCE**  
University of Wisconsin-Madison

**UW  
Extension**

# Background

- Soybean Mn deficiency a problem in 2007
- Greatest concentration of deficiency
  - Eastern Waupaca Co. south to Jefferson Co.
  - Primarily east of Lake Winnebago
  - Also western Dane Co. and Sauk Co.
- Most, but not all cases, glyphosate resistant (GR) soybean varieties
- Typical soil conditions
  - OM > 4% and pH > 7

# Previous Wisconsin research and Mn guidelines

- UWEX Mn guidelines based on research conducted in early 1970s
  - $OM \leq 6\%$  use soil test
  - $OM > 6\%$  and  $pH > 6.9$  Mn is low
  - For crops with a high relative Mn need (soybean) and low soil Mn
    - Apply 5 lb Mn/a as starter in sulfate form
    - Apply 1.25 or 0.2 lb Mn/a (sulfate or chelate) foliar
      - Foliar applications most effective at R1 or R3
      - Multiple applications sometimes needed



# Objective

- To quantify the effect of glyphosate on Mn availability and yield in GR soybean systems
- To develop new Mn management guidelines for GR soybean systems

# Locations

Information	Walworth 2008	Dodge 2009	Jefferson 2009	Outagamie 2010
Soil	Sebewa sil	Granby fsl	Wacousta sicl	Shiocton sil
Soil drainage	Poorly	Poorly	Very poorly	Somewhat poorly
Soil group	B	E	B	D
pH	7.2	8.1	7.8	7.2
OM, %	3.1	5.2	6.1	2.6
Mn, ppm	16 (O)	2 (L)	4 (L: OM >6% & pH > 6.9)	14 (O)
Previous crop	Corn grain	Corn grain	Corn grain	Corn grain
Fertilizer (non-treatment)		5-64-60 lb/a N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O	0-0-60 lb/a N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O	0-0-90 lb/a N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O
Tillage	No-till	No-till	Spring chisel plow	Spring chisel plow

# Locations Lost

- Outagamie 2010 - 2<sup>nd</sup> site
  - Late season flooding
- Jefferson 2008
  - Early season flooding



# Treatments

- Variety/weed management (main plot)
  - Conventional variety, conventional weed control (Conv/Conv)
  - GR variety, conventional weed control (GR/Conv)
  - GR variety, glyphosate weed control (GR/Gly)
- Foliar Mn application (split plot)
  - 0
  - 1.25 lb Mn/a as  $\text{MnSO}_4$  at R1
  - 1.25 lb Mn/a as  $\text{MnSO}_4$  at R3
  - 1.25 lb Mn/a as  $\text{MnSO}_4$  at R1 and R3
- Mn in starter fertilizer (split split plot)
  - 0
  - 5 lb Mn/a as  $\text{MnSO}_4$

24 total  
treatments;  
Split-split  
plot design

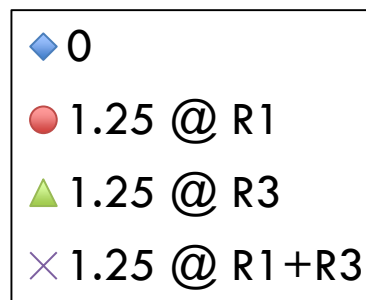
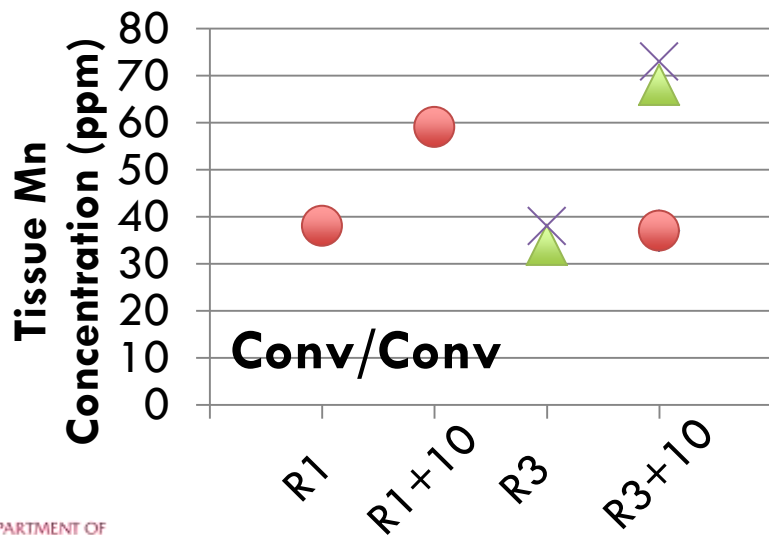
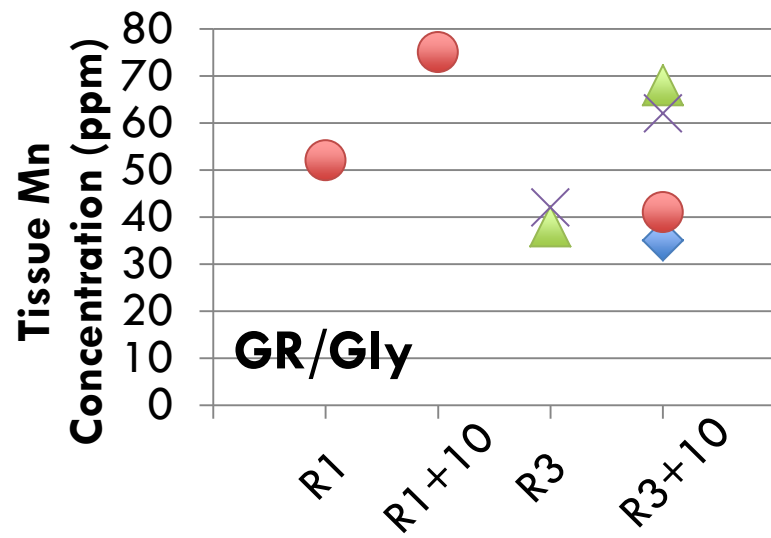
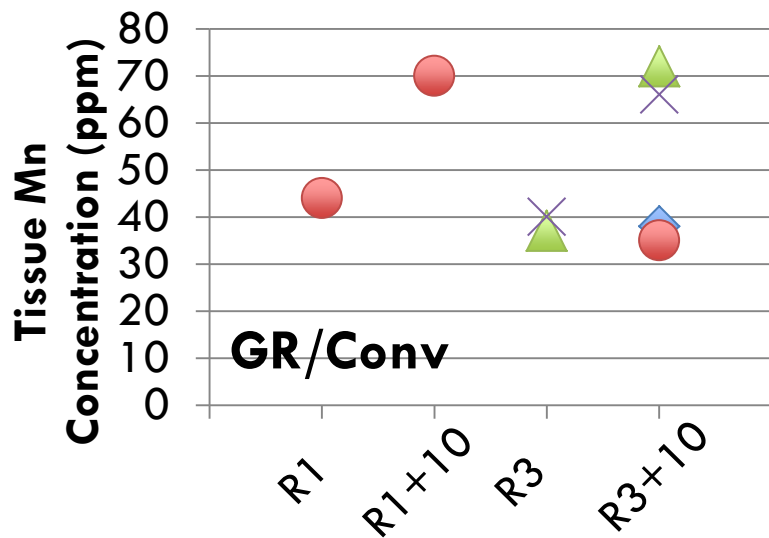
# What did we learn?



# Visual observations

- Visual Mn deficiency symptoms observed at 2<sup>nd</sup> Outagamie site only
  - For some treatments at R1 only
  - Could not be harvested because of flooding

# Effect of foliar Mn application on tissue Mn concentrations (averaged over starter Mn rates) at Dodge in 2009



# Summary of tissue Mn at R1

- For all treatments & locations, tissue Mn was less than the sufficient range (54-300ppm)
- No effect of starter fertilizer
- 10 days after 1.25 lb Mn/a was applied foliarly
  - Tissue Mn concentrations were greater compared to R1
- Conv/Conv had significantly lower tissue Mn GR/Conv or GR/Gly at Dodge and Jefferson
  - Opposite trend occurred at Outagamie
  - Not significant at Walworth

# Summary of tissue Mn at R3

- No effect of starter fertilizer
- Tissue Mn at R3 were generally less than at R1 for plots that had not received any foliar Mn application at R1 at all locations except Outagamie
  - At Outagamie, tissue Mn increased from R1 to R3
- Where Mn was applied foliarly at R1, tissue Mn was lower at R3 compared to 10 days post R1 application at all locations
  - Except Outagamie where R3 tissue Mn was greater
- Tissue Mn concentrations at Outagamie were about double the concentrations at the other locations

# Summary of tissue Mn

- At 10 days post R3, tissue Mn was significantly lower where foliar Mn was applied at R1 only compared to applications at R3 or R1+R3
- Outagamie often showed trends in tissue Mn that was not consistent with other locations
  - May be the result of
    - Soil test Mn being optimum S
    - Somewhat poorly drained soil compared to other sites with poorly or very poorly drained soil

# Yield



# Effect of Mn applications on yield at Walworth

Variety/herbicide:	Yield	Starter Mn	Yield	Foliar Mn	Yield
	bu/a	lb/a	bu/a	lb/a	bu/a
Non-GR/Conventional	31	0	36	0	37
GR/Conventional	38	5	37	1.25 @ R1	37
GR/Glyphosate	41			1.25 @ R3	38
				1.25 @ R1 & R3	35

No effect of Mn on yield

# Effect of Mn applications on yield at Dodge

Variety/herbicide:	Yield	Starter Mn	Yield	Foliar Mn	Yield
	bu/a	lb/a	bu/a	lb/a	bu/a
Conv/Conv	49	0	49	0	49
GR/Conv	49	5	48	1.25 @ R1	49
GR/GLy	48			1.25 @ R3	49
				1.25 @ R1 & R3	48

No effect of Mn on yield

# Effect of Mn applications on yield at Watertown

Variety/herbicide:	Yield	Starter Mn	Yield	Foliar Mn	Yield
Non-GR/Conventional	47	0	47	0	47
GR/Conventional	47	5	48	1.25 @ R1	48
GR/Glyphosate	48			1.25 @ R3	47
				1.25 @ R1 & R3	47
	<b>Foliar Mn rate/timing, lb Mn/a</b>				
Variety/herbicide	0	1.25 @ R1	1.25 @ R3	1.25 @ R1 and R3	<i>p</i>
	----- yield, bu/a -----				
Non-GR/Conventional	47	49	48	46	0.25
GR/Conventional	46 b †	50 a	45 b	49 a	<0.01
GR/Glyphosate	49	46	48	47	0.42

# Effect of Mn applications on yield at Outagamie

Variety/herbicide:	Yield	Starter Mn	Yield	Foliar Mn	Yield
	bu/a	lb/a	bu/a	lb/a	bu/a
Non-GR/Conventional	54 b	0	55	0	56
GR/Conventional	56 a	5	56	1.25 @ R1	55
GR/Glyphosate	56 a			1.25 @ R3	56
				1.25 @ R1 & R3	55

No effect of Mn on yield

# Conclusions

- A tissue Mn sufficiency concentration range of 54 to 300 ppm may be too high
  - All sites had R1 tissue Mn concentrations below this range but did not respond to Mn
- On soils where Mn deficiency has the potential to be a problem (low Mn soil test or pH over 6.9 on soils with OM greater than 6.0%)
  - If no visual deficiency symptoms are apparent, then application of Mn is likely not economical

# Thanks for your support

- Wisconsin Fertilizer Research Program
- Wisconsin Soybean Marketing Board
- Joe Bollman, Peg Reedy, & Paul Knutzen for assistance in identifying cooperators

- Carrie Laboski

Extension Soil Fertility Specialist

608-263-2795

laboski@wisc.edu

<http://www.soils.wisc.edu/extension/>

Connect with me on **LinkedIn**

