



# Yield Report

# Corn

Location: Dewitt, MI (2015)

Crop: Corn

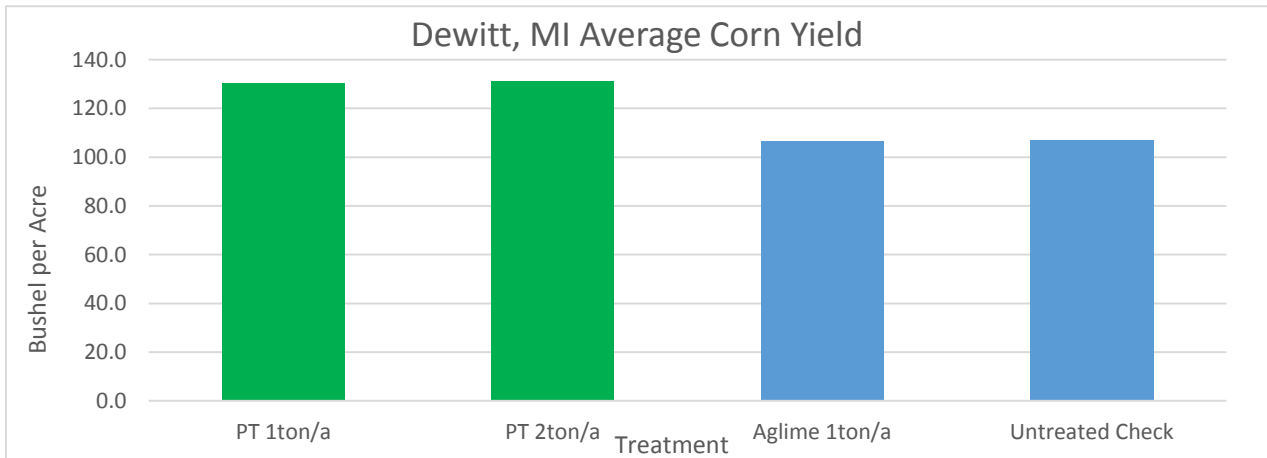
Crop Variety: Pioneer 0216

Yield Data:

Treatment	Application Rate	Average Yield
<b>Plant Tuff</b>	<b>1 ton/a</b>	<b>130.1</b>
<b>Plant Tuff</b>	<b>2 ton/a</b>	<b>131.1</b>
AgriLime	1 ton/a	106.5
Untreated Check		107.0

Yield Represents averages of 4 replications

Average Silicon (Si): **28 ppm**



Location: Lapeer, MI

Crop: Corn

Yield Data Field 1:

**Treated: 126 Bushels per Acre**

Control: 118 Bushels per Acre

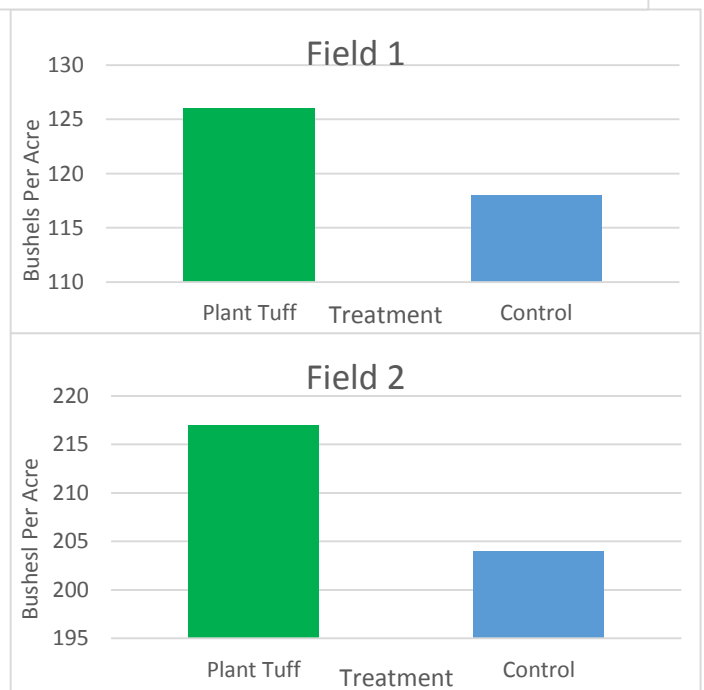
Percent Change: **6.8% Increase**

Yield Data Field 2:

**Treated: 217 Bushels per Acre**

Control: 204 Bushels per Acre

Percent Change: **6.4% Increase**



# Wheat

Location: Bay Port, MI (2011)

Crop: Wheat

Yield Data:

Treated: **99.1 Bushels per Acre**

Untreated: 87.0 Bushels per Acre

Percent Change: **13.9% Increase**

Location: Dewitt, MI (2015)

Crop: Winter Wheat

Crop Variety: Shirley

Yield Data:

Treatment	Application Rate	Average Yield
<b>Plant Tuff</b>	<b>1 ton/a</b>	<b>107.6</b>
<b>Plant Tuff</b>	<b>2 ton/a</b>	<b>106.9</b>
AgriLime	1 ton/a	98.0
Untreated Check		95.4

Yield Represents averages of 4 replications

Average Silicon (Si): **29 ppm**

Full Mid-Michigan Agronomy Study in Appendix A

Location: Pigeon, MI (Year 1)

Crop: Wheat

Yield Data Year 1\*:

**Treated: 92.3 Bushels per Acre**

Control: 78.4 Bushels per Acre

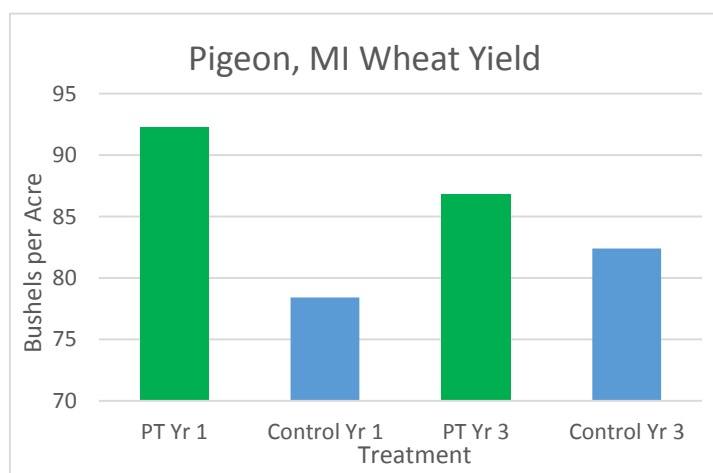
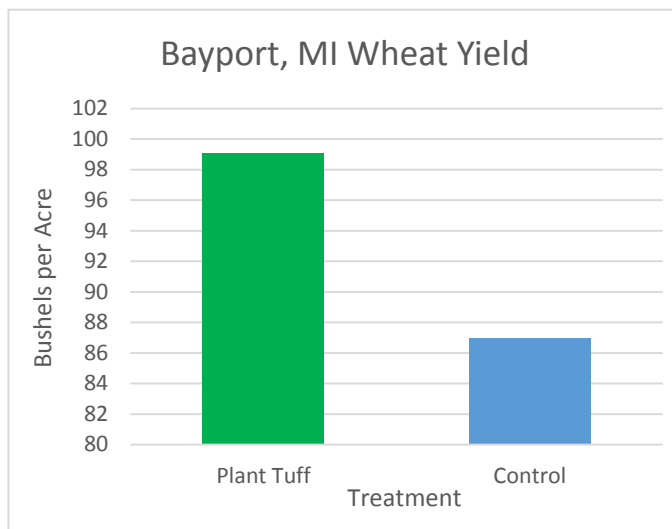
**Percent Change: 17.7% Increase**

Yield Data Year 3\*:

**Treated: 86.8 Bushels per Acre**

Control: 82.4 Bushels per Acre

**Percent Change: 5.3% Increase**



\*Single Application showing yield increase over 3 years

## Soybeans

Location: Pigeon, MI

Crop: Soybeans

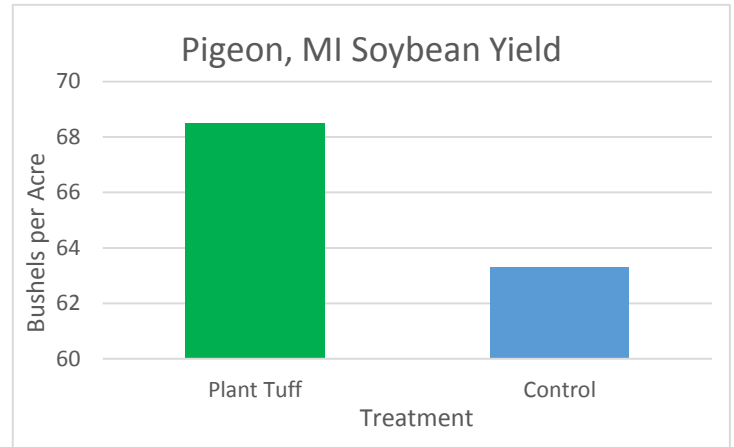
Yield Data:

**Treated: 68.5 Bushels per Acre**

Control: 63.3 Bushels per Acre

**Percent Change: 8.2% Increase**

\*Single Application showing yield increase over 3 years



Location: 4 Fields around Bayport, MI (2013)

Location	Treated w/ Plant Tuff	Untreated	Difference
Field 1	<b>45.83</b>	44.96	0.87
Field 2	<b>40.95</b>	35.38	5.57
Field 3	<b>62.89</b>	61.92	0.97
Field 4	<b>69.39</b>	63.20	6.19
Averages	<b>54.765</b>	51.365	3.40

# Alfalfa

Location: Hastings, MI

10 acres treated with Plant Tuff

10 acres treated with Cheney limestone lime

Crop: Alfalfa

Total Cuttings = 3

1 <sup>st</sup> cut	Bails P/Acre	1000 lb round Bails	Acres
<b>Plant Tuff -</b>	<b>3.5</b>	<b>26</b>	<b>7.5</b>
Cheney-	3.4	17	5
2 <sup>nd</sup> cut			
<b>Plant Tuff-</b>	<b>2.1</b>	<b>16</b>	<b>7.5</b>
Cheney-	2.2	11	5
3 <sup>rd</sup> cut			
<b>Plant Tuff</b>	<b>1.3</b>	<b>10</b>	<b>7.5</b>
Cheney	1.2	6	5
Total Bails P/Acre			
<b>Plant Tuff</b>	<b>6.9</b>		
Cheney	6.8		
<b>Percent Change =</b>	<b>1.5% Increase</b>		

Location: Lancaster, WI

Full Report in Appendix B

# Potatoes

Location: Sturgis, MI

Full Mid-Michigan Agronomy Study in Appendix C

# Appendix A

Winter Wheat Trial Evaluating Plant Tuff Silicon pHertilizer™  
Mid-Michigan Agronomy, LLC

**Objective:** To evaluate the effect of Plant Tuff Silicon pHertilizer on the growth and yield of winter wheat.

The variety Shirley was planted which is a disease susceptible winter wheat cultivar. Shirley was selected because it would be sensitive to the biotic stress that a fungal disease would cause. Silicon fertilizer has been shown to decrease the impact of stress. Treatments were broadcast over plots at the desired use rates after planting but before wheat emergence. Wheat canopy green area measurements were recorded twice, June 15 and June 30, 2015. This measurement estimates the density of the wheat canopy and would be an indication of the level of light interception and photosynthetic activity. Wheat yields were taken on July 25, 2015.

**Location:** Dewitt, MI  
**Soil Type:** Silty Clay Loam

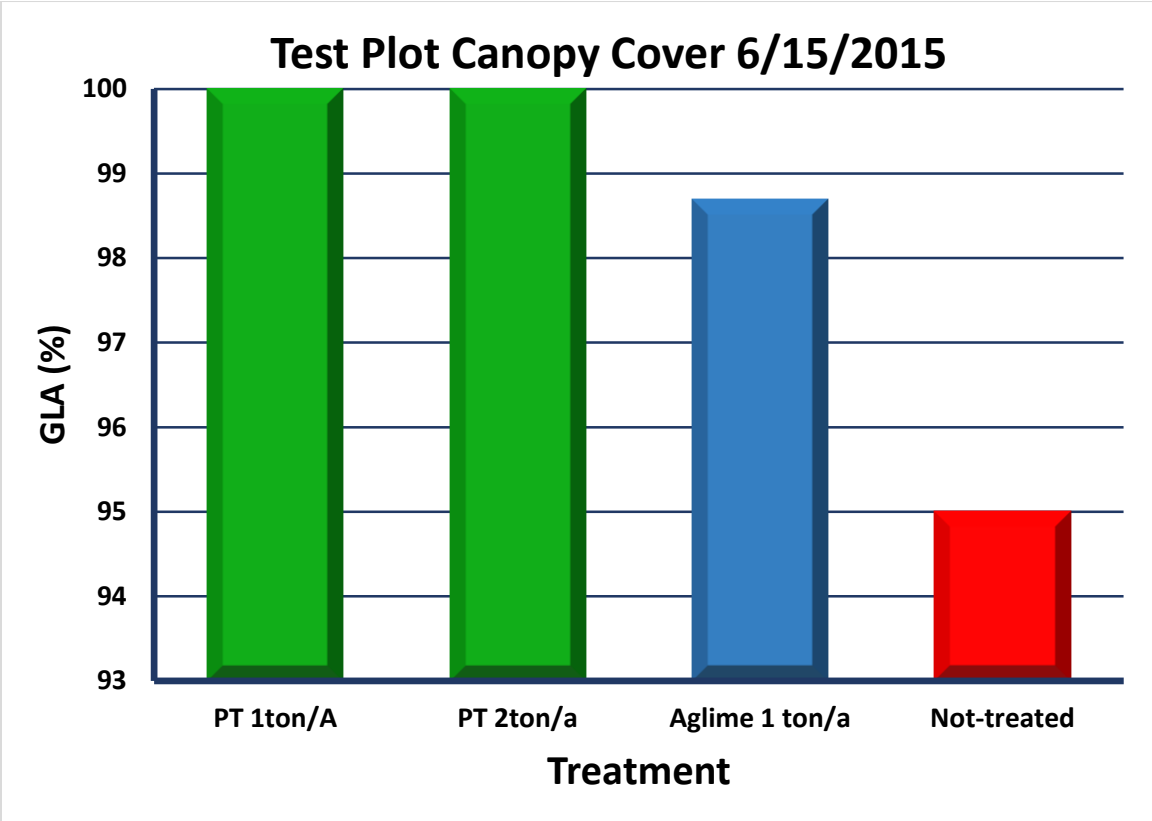
**Planting Date:** 10/18/2014  
**Emergence Date:** 10/28/2014  
**Harvest Date:** 7/25/2015  
**Variety:** Shirley

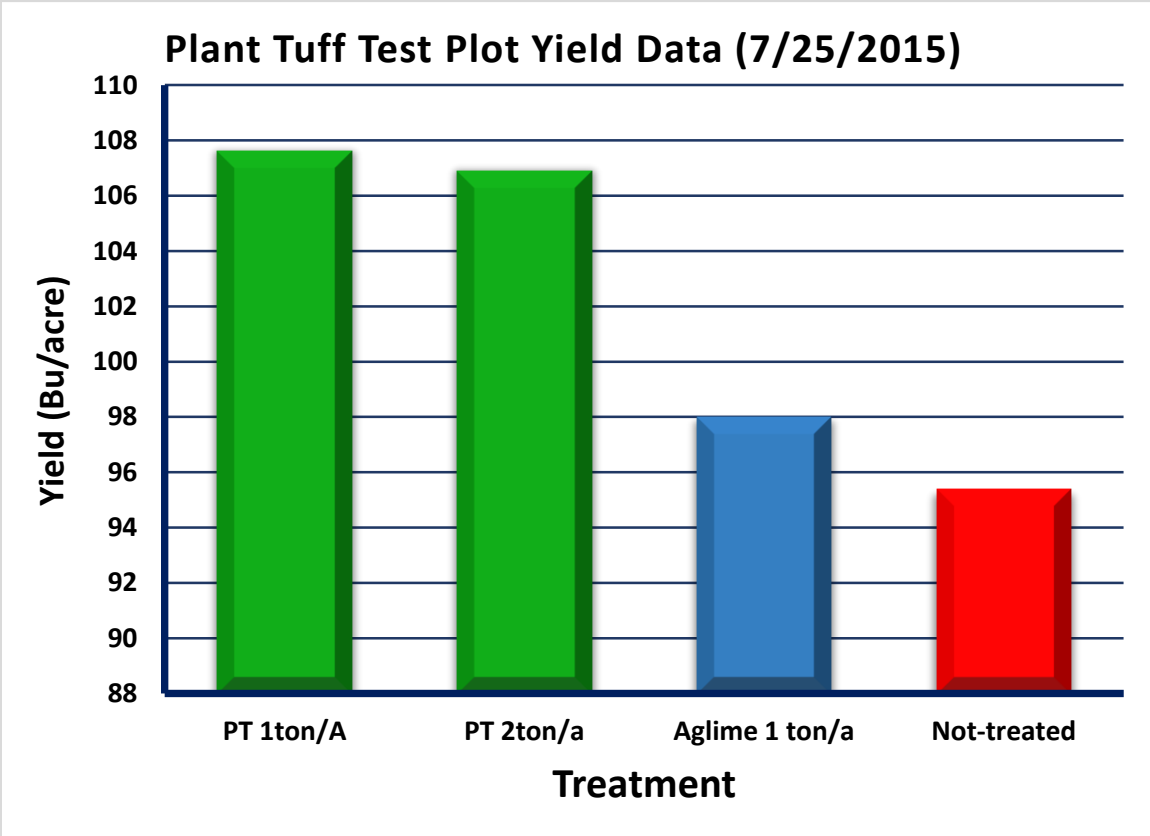
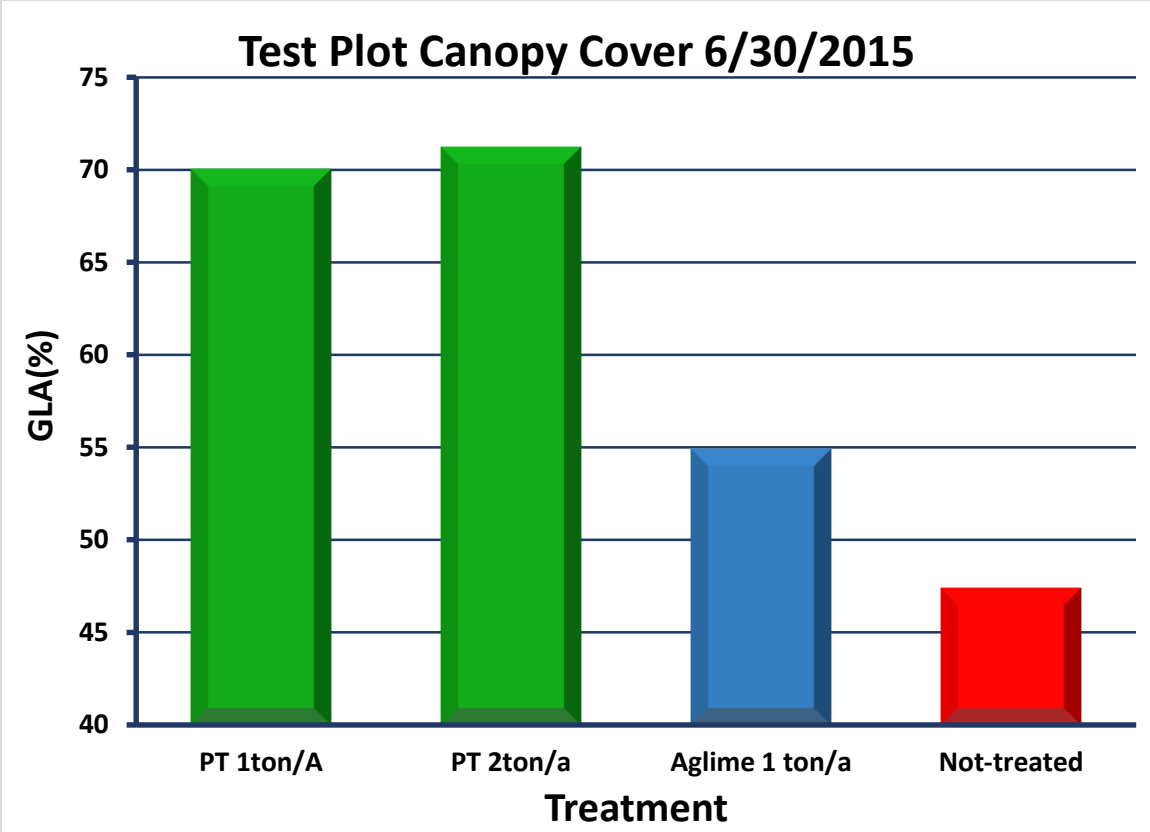
## **Treatments:**

<u>Material</u>	<u>Rate</u>
Plant Tuff Silicon pHertilizer	1 T/A
Plant Tuff Silicon pHertilizer	2 T/A
Ag Lime	1 T/A
Untreated Check	---0---
Average Silicon (Si):	<b>28 ppm</b>

<b>Treatment</b>	<b>Rate (T/A)</b>	<b>Canopy Green Area (6/15)</b>	<b>Canopy Green Area (6/30)</b>	<b>Yield (Bu/A) (7/25)</b>
Plant Tuff	1	100 a	70 a	107.6 a
Plant Tuff	2	100 a	71.2 a	106.9 a
Ag Lime	1	98.7 ab	54.9 b	98.0 b
Untreated	0	95 b	47.4 c	95.4 b

Means followed by the same letter do not significantly differ (P=.05 LSD)





Results:



Fall applications of Plant Tuff Silicon pHertilizer (Plant Tuff) on winter wheat were evaluated for the effect on wheat growth and yield. Plant Tuff was compared to the commercial standard, Ag lime, and an untreated check. Plant Tuff applied at 1 and 2 tons per acre had a significantly greater green canopy at both evaluation dates when compared to Ag lime and the untreated check. This would suggest that wheat treated with Plant Tuff had more tillering and greater leaf area than either Ag lime or the untreated check. The greater leaf area caused by the Plant Tuff would enable the wheat plant to intercept more sunlight and have a greater level of photosynthesis. The enhanced photosynthesis would produce more plant carbohydrates that would contribute to greater wheat yields.

Plant Tuff applied at 1 and 2 tons per acre also significantly increased wheat yields when compared to Ag lime and the untreated check. Yields increased by 8 and 9.6 bu/A for Plant Tuff applied at 2 T/A and 1 T/A respectively. The increase in wheat yield from Plant Tuff may be related to the increase in green area of the wheat canopy. Yield and Canopy Green Area increases may also be related to the ability of the wheat plant to deal with the biotic (disease or insect) stress and abiotic (high temperature or drought) stress that the wheat was exposed to during the growing season.

## Appendix B

### **Alfalfa Yield and Quality Trial with Plant Tuff**

**Trial Conducted By Hanson and Associates**

**Trial Location: Lancaster, Wisconsin.**

**Alfalfa Planted On 4/25/2013**

**Soil Type: Palsgrove Silt Loam**

**O.M.: 1.8%**

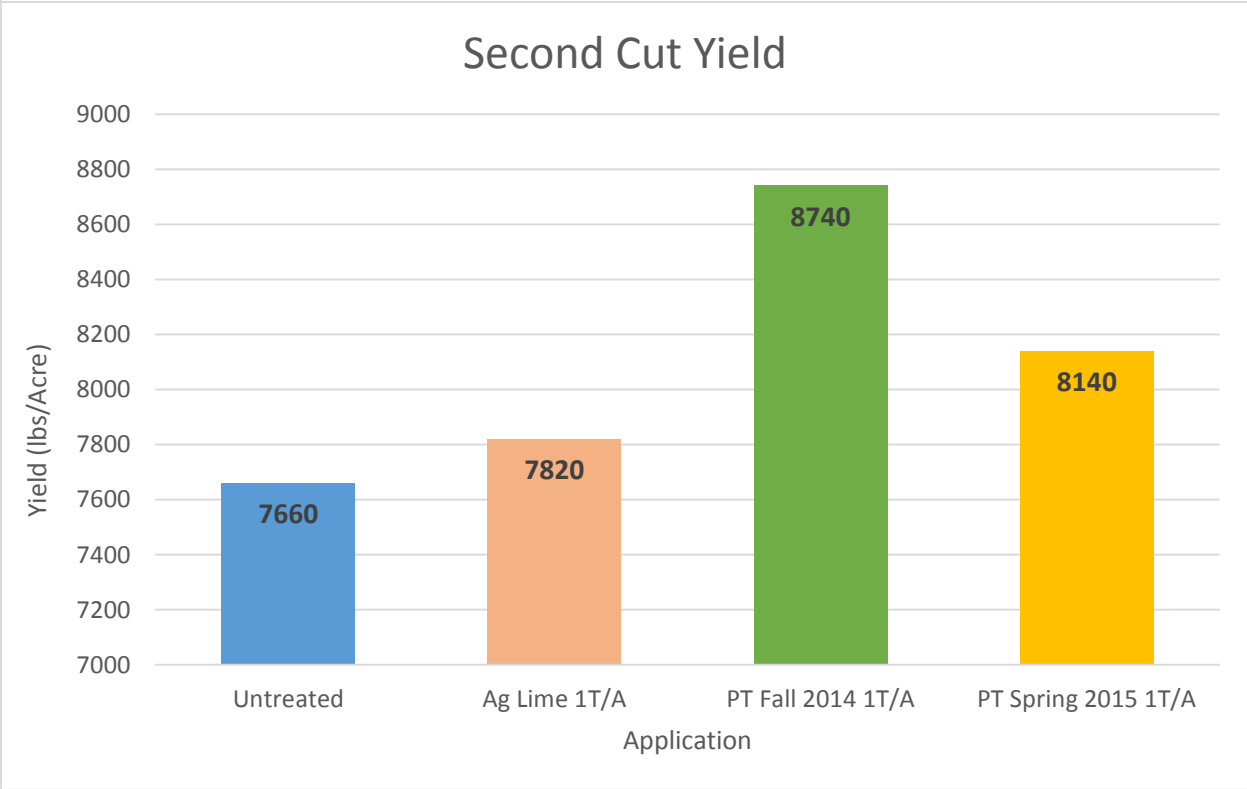
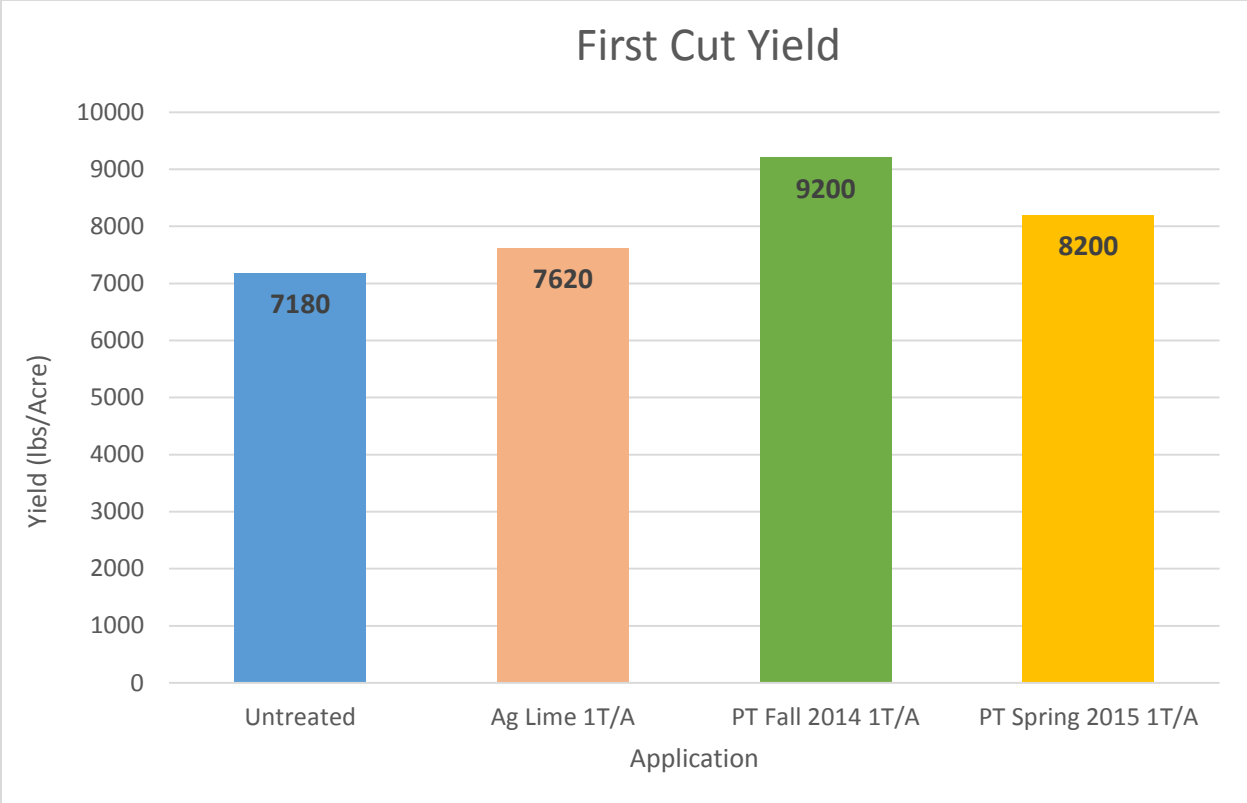
**Soil Si: 150 ppm**

**Soil pH: 6.82**

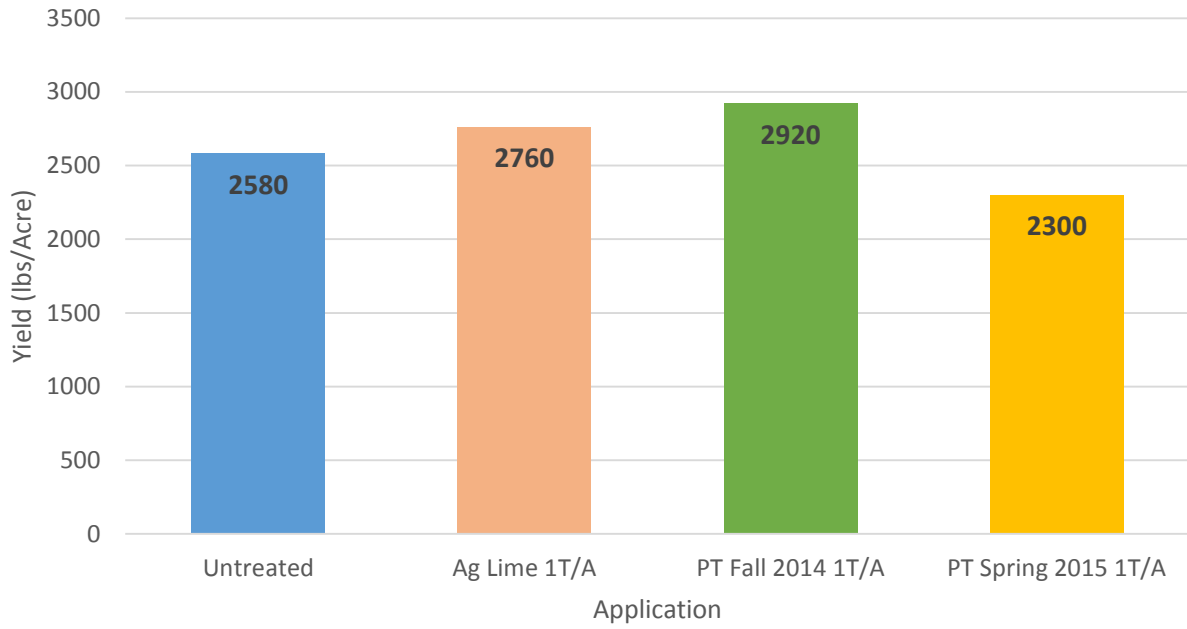
The alfalfa was harvested 4 times in 2015. Plot yields were measured after each cutting. Cumulative yields from the four cuttings were calculated for each treatment. Nutritional parameters were evaluated for the alfalfa following the fourth cutting.

### **Plant tuff Treatments Evaluated on Established Third Year Alfalfa**

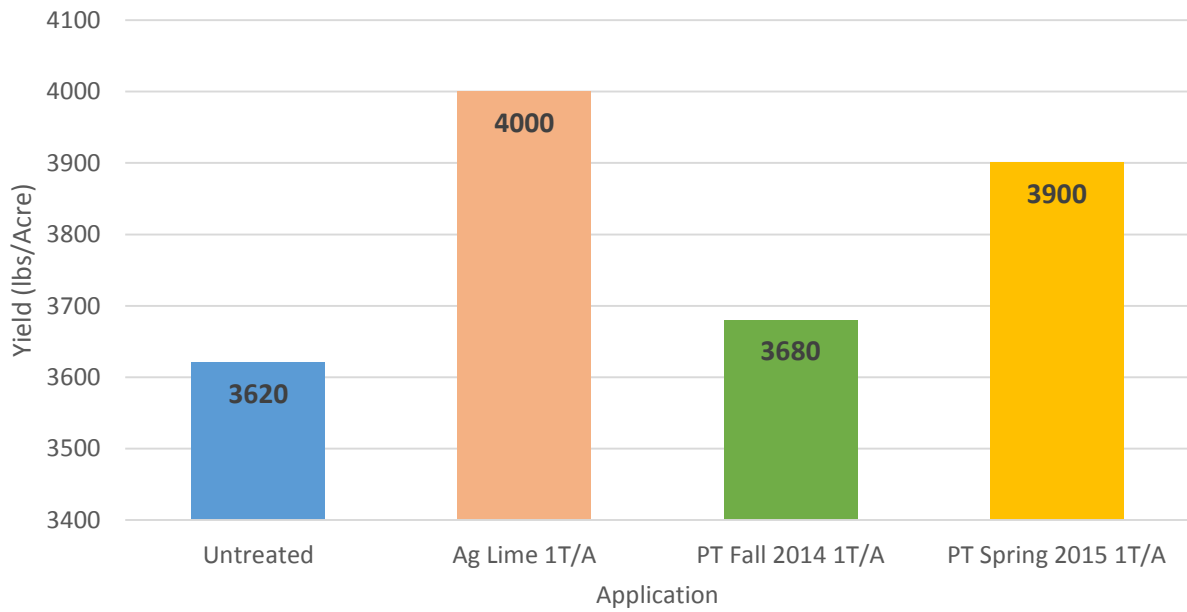
Trt No.	Type	Treatment Name	Description	Rate	Rate Unit
1	CHK	Untreated Check	not treated		
2	FERT	Ag Lime fall 2014		1	TON/A
3	FERT	Ag Lime fall 2014		2	TON/A
4	FERT	Plant tuff Fall 2014 app		1	TON/A
5	FERT	Plant tuff Fall 2014 app		2	TON/A
6	FERT	Plant tuff Fall 2014 app		1	TON/A
	FERT	Plant tuff Spring 2015 app		1	TON/A
7	FERT	Plant tuff Fall 2014 app		2	TON/A
	FERT	Plant tuff Spring 2015 app		2	TON/A
8	FERT	Plant tuff Spring 2015 app		1	TON/A
9	FERT	Plant tuff Spring 2015 app		2	TON/A

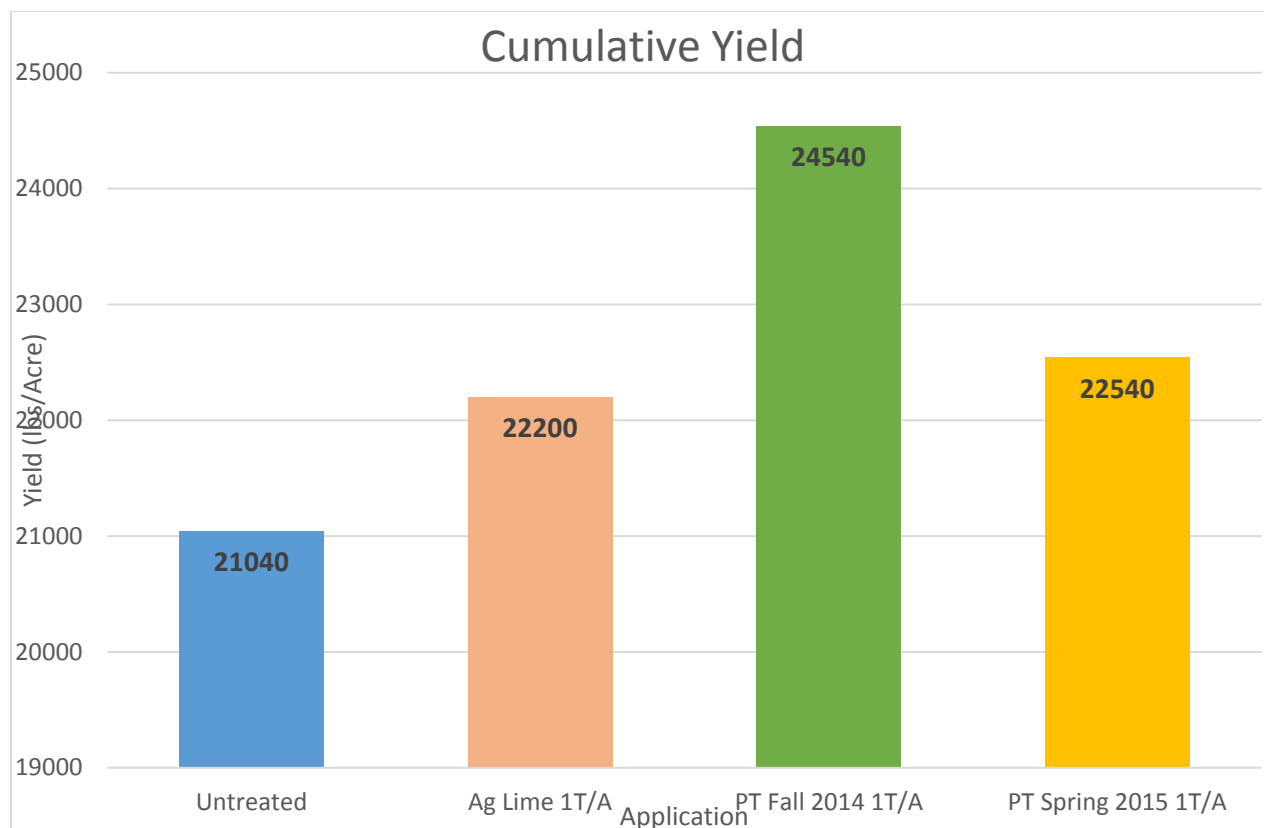


### Third Cut Yield



### Fourth Cut Yield





The application of Plant Tuff applied in the fall or spring at 1 T/A and 2 T/A, significantly increased the tonnage yield of alfalfa over the untreated check and the aglime treatment. Cumulative annual yield from four alfalfa cuttings for 1 T/A of Plant Tuff yielded 10% more lbs/A than the 1 T/A Aglime treatment. Tonnage yields from Plant Tuff applied at 1 T/A or 2 T/A were not significantly different from each in cumulative yield.

Fall applications of Plant Tuff to the established alfalfa were more effective than spring applications in this trial.

## The Effect of Plant Tuff on Nutritional Parameters

Treatment	CP	RUP	RDP	TDN	DM
Untreated	28.05	17.80	82.20	70.33	93.02
Aglime 1T/A Fall	27.98	17.92	82.08	70.75	93.36
Plant tuff 1T/A Fall	28.66	16.81	83.19	71.37	93.51
Plant tuff 2T/A Fall	29.26	17.31	82.69	70.48	93.42
Plant tuff 1T/A Spring	29.10	16.48	83.52	71.27	93.22
Plant tuff 2T/A Spring	28.43	17.42	82.58	70.91	93.30

CP = Crude Protein

RUP = Rumen Undegradable Protein

RDP = Rumen Degraded Protein

TDN = Total Digestive Nutrient

DM = Dry Matter

The application of Plant Tuff at the rates tested, 1 T/A and 2 T/A, did not have a significant effect on any of the alfalfa nutritional parameters measured. Feed quality and feed palatability will not be affected by applications of Plant Tuff fertilizer.

# Appendix C

Plant Tuff Potato Trial  
Mid-Michigan Agronomy

**Objective:** To evaluate the effect of Plant Tuff Silicon fertilizer on the growth, yield and quality of two potato varieties of potatoes.

This trial was established as a Complete Split-Block design and the ANOVA was run using that design. Two potato cultivars were planted in a 4-row plot. The first two rows were planted to Russet Norkotah and the second two rows were planted to a Frito Lay variety, FL2137. The treatments were applied to the plot uniformly using a handheld broadcast spreader. Treatments were randomized and replicated four times. The potato emergence was evaluated on 6/01/2015, forty-seven days after planting.

Plots were harvested on 9/8/2015 and yields were determined. Yields (CWT/Plot) for the two varieties, Russet Norkotah potato and FL2137 potato weights were measured for each treatment. Potatoes were sized for quality and weights for US-1 (10 oz-14 oz.) and B size (< 8 oz.) was measured. Total weight per plot was also determined. Premiums are paid for US-1 size potatoes. Numbers of potatoes for the two potato varieties were measured to determine the number of potatoes per plot that were US-1, the number that were B grade and the total number of potatoes per treatment.

<b>Location:</b>	Sturgis, MI
<b>Soil Type:</b>	Silty Clay Loam
<b>Planting Date:</b>	04/15/2015
<b>Treatment Date:</b>	04/15/2015
<b>Harvest Date:</b>	09/08/2015
<b>Variety:</b>	Russet Norkotah FL2137 (Chipping Variety)

<b>Parameters Measured:</b>	Total Yield (CWT/Trt) Weight of US-1 and Grade B Total Number of Potatoes (#/Trt) Number of US-1 and Grade B Emergence
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<b>Treatments:</b>	
<b>Material</b>	<b>Rate</b>
Plant Tuff	0.5 T/A
Plant Tuff	1 T/A
Plant Tuff	2 T/A
Ag Lime	1 T/A

Untreated Check                      ---0---  
 Average Silicon (Si):                **65 ppm**

**Table 1. Emergence and Yield for Russet Norkotah (CWT)**

Treatment	Rate (T/A)	Stand % (6/1)	Yield US-1 (Lb./Plot)	Yield B (Lb./Plot)	Yield Total (Lb./Plot)
Plant Tuff	0.5	86.2 a	514.3 a	70.7 a	585.0 a
Plant Tuff	1	92.4 a	521.2 a	69.2 ab	590.4 a
Plant Tuff	2	89.5 a	535.0 a	69.2 ab	604.2 a
Ag Lime	1	90.2 a	521.2 a	72.3 a	593.4 a
Untreated	0	88.1 a	528.9 a	67.6 a	596.5 a

Means followed by the same letter do not significantly differ (P=.10 LSD)

**Table 2. Yield for Russet Norkotah (Number/Trt.)**

Treatment	Rate (T/A)	Yield US-1 (#/Plot)	Yield B (#/Plot)	Yield Total (#/Plot)
Plant Tuff	0.5	165.0 a	38.8 a	203.8 a
Plant Tuff	1	145.5 c	38.8 a	184.3 a
Plant Tuff	2	162.3 bc	40.5 a	202.8 a
Ag Lime	1	149.3 c	41.0 a	190.3 a
Untreated	0	154.8 c	35.0 a	189.8 a

Means followed by the same letter do not significantly differ (P=.10 LSD)

**Table 3. Emergence and Yield for FL2137 (CWT)**

Treatment	Rate (T/A)	Stand % (6/1)	Yield US-1 (Lb./Plot)	Yield B (Lb./Plot)	Yield Total (Lb./Plot)
Plant Tuff	0.5	82.7 a	565.8 a	58.4 cd	624.2 a
Plant Tuff	1	86.5 a	600.4 a	56.1 d	656.5 a
Plant Tuff	2	83.1 a	607.3 a	53.0 d	660.3 a
Ag Lime	1	91.8 a	538.9 a	61.5 bcd	600.4 a
Untreated	0	78.8 a	566.5 a	55.3 d	621.9 a

Means followed by the same letter do not significantly differ (P=.10 LSD)

**Table 4. Number of Potatoes per Treatment for FL2137 (#/Trt.)**

Treatment	Rate (T/A)	Yield US-1 (#/Plot)	Yield B (#/Plot)	Yield Total (#/Plot)
Plant Tuff	0.5	193.5 a	31.8 a	225.2 a
Plant Tuff	1	201.3 a	31.8 a	233.0 a



Plant Tuff	2	209.3 a	29.0 a	238.3 a
Ag Lime	1	195.5 ab	38.3 a	233.8 a
Untreated	0	194.3 ab	27.3 a	221.5 a

Means followed by the same letter do not significantly differ (P=.10 LSD)

**Results:**

Broadcast soil applications of Plant Tuff Silicon fertilizer were evaluated on two potato varieties, Russet Norkotah, a variety popular in the fresh market and French fry market, and a Frito Lay variety FL2137, which is used in the chip market. *Treatments* included Plant Tuff applied at 0.5, 1.0 and 2.0 tons per acre, Ag lime applied at 1 ton per acre and an untreated check.

The data was statistically analyzed as a complete strip-block design with the potato variety as the strip factor. Potato emergence was not significantly affected by any of the treatments. This may be mainly due to the soil type and environmental conditions following planting.

Difference in yield for the two varieties, while not statistically significant for CWT of US-1, Grade B and total weight per treatment as well as number of US-1, Grade B and total number per treatment, there were some trends that were observed. In the case of the chipper variety, FL2137, the total yield per plot and the total number per plot trended upward as the rate of Plant Tuff was increased. All three treatments of Plant Tuff produced more CWT when compared to Ag lime. Numbers were not different between Plant Tuff and Ag lime, which indicates the Plant Tuff treated potatoes were larger than the Ag lime treated potatoes, which is indicated in the data.

In the case of the Russet Norkotah variety, there was also a positive trend in total yield as the rate of Plant Tuff increased. As in the data for the FL2137 variety, there was not a positive trend in number of potatoes, which suggests Plant Tuff increased the weights and size of the US-1 grade potatoes. This trend is supported by the data that shows CWT's increasing as the rate of Plant Tuff increases.

Statistically the LSD P=0.10 was used in the analysis. I have asked Rob to analyze the data at LSD P=0.15 to see if any of the results will be statistically significant.

This is the first replicated trail we have in potatoes treated with Plant Tuff. The results suggest we should continue to evaluate Plant Tuff in potato production. Application timing and Plant Tuff application rate needs to be evaluated on a variety of soils where potatoes are grown in Michigan. Potatoes set the number of tubers during in a specific range of growth. The positive response of Plant Tuff applied to two different potato varieties suggests that the product may have a good fit in Michigan potatoes. There are other varieties grown for specific quality and use that need to be evaluated with Plant Tuff.



Potato trial planted on April 14, 2015 in Sturgis, MI.