2014 - 2016 Potassium Thiosulfate Starter Fertilizer Trial

Purpose: Past university research results and fertilizer recommendations indicate that soybeans are less likely than corn to respond to starter fertilizer. Starter fertilizer trials (2x2 and in-furrow) conducted by the SMaRT program have produced similar results with only seven out of 27 trials showing a positive yield increase. However, a 2x2 starter applied in a trial conducted in 2013 increased soybean yields by 6 bushels per acre on a coarse-textured soil in Kent County. The starter fertilizer contained nearly 50 pounds of actual K_2O per acre. In 2014 potassium thiosulfate starter fertilizer increased yields by 3.2 bushels per acre when averaged over two locations and in 2015, it increased soybean yields at three locations but also decreased yields at one site. The purpose of this trial was to measure the effect of a potassium thiosulfate starter fertilizer on soybean yields when evaluated across many different environments from 2014 through 2016.

Procedure: Potassium thiosulfate (0-0-25-17) applied at planting was compared to an unfertilized control at two locations in 2014, 11 locations in 2015 and four locations in 2016. The potassium thiosulfate was applied at three gallons per acre in a 2x2 band at planting at all locations except the Calhoun site where the starter was dribbled on the surface two inches from the row. A third treatment was added at the Calhoun location in 2016 (potassium thiosulfate plus 6 gallons of 28% UAN). Baseline soil samples (table 2) were collected at all sites and plant tissue samples were taken from both the fertilized and unfertilized strips at all locations at the R1 to R2 growth stages.

Table 1. The effect of a potassium thiosulfate starter fertilizer on soybean yield and income in 2014, 2015, and 2016

Location	Untreated control	Potassium thiosulfate starter	LSD $_{0.10}$	Yield difference
	---------- Yield (bu/ac) ----------			Yield (bu/ac)
Calhoun16	65.4	69.7	5.5	4.3
St. Joseph 15	61.9 b	65.5 a	2.1	3.6
Sanilac 14	24.1	27.6	4.2	3.5
Bay 14	44.6 b	47.5 a	2.6	2.9
Hillsdale 15	40.5 b	42.7 a	1.5	2.2
Lake 15	38.6	40.6	3.7	2.0
Berrien 15	48.3 b	49.7 a	1.3	1.4
Sanilac 15-2	60.5	61.8	1.9	1.3
Van Buren 15-2	53.4	54.2	2.4	0.8
St. Clair 15	53.0	53.4	4.4	0.4
Bay 15	57.1	57.3	4.1	0.2
Sanilac 16	51	50.7	2.4	-0.3
Van Buren 16	59.9	59.3	3.9	-0.6
Cass 16	61.5	60.7	1.6	-0.8
Clinton 15	61.1	59.5	3.1	-1.6
Van Buren 15-1	62.3 a	60.4 b	1.5	-1.9
Sanilac 15-1	53.2	50.1	4.8	-3.1
Average (2014 – 2016)	**52.6 b**	**53.6 a**	**0.6**	**1.0**
	---------- Income ($/ac) ----------			
Average income	**$484**	**$478**		

Potassium thiosulfate cost = $15.00 per acre

Table 2. Baseline soil test levels for the potassium thiosulfate starter fertilizer trials conducted in 2015 and 2016

Location	Organic matter (%)	Phosphorus (ppm)	Potassium (ppm)	Soil pH	CEC (meq/100g)	Sulfur (ppm)
Bay 15	2.7	46	270	7.8	22.2	**8
Berrien 15	1	118	86	6	3.9	**6
Clinton 15	2.5	33	102	6.5	7.9	11
Hillsdale 15	3.1	69	107	6.7	9.5	10
Lake 15	--	14	*52	5.9	7.6	--
Sanilac 15-1	3.7	36	108	6.5	11.2	10
Sanilac 15-2	4.1	25	*102	6.8	11.7	**8
St. Clair 15	3.8	56	180	6.4	10.8	14
St. Joseph 15	1.1	104	107	6.5	3.5	**6
Van Buren 15-1	1.6	72	101	5.8	5.7	**7
Van Buren15-2	2	32	139	5.7	5.3	**8
Cass 16	1.5	65	90	6.5	3.3	10
Calhoun 16	1.8	28	95	6.3	6.2	5
Sanilac 16	--	40	88	6.3	5.8	**8
Van Buren 16	1.8	118	136	5.7	5.7	11

* Potassium soil test levels were below the critical level at these sites

**Sulfur soil test levels were considered low at these sites

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Results: In 2016, the potassium thiosulfate starter fertilizer did not produce significantly higher soybean yields than the untreated control at any of the four locations (figure 1). Adding 28% UAN did not improve the performance of the potassium thiosulfate. When all 17 locations were combined and analyzed, the starter fertilizer increased soybean yield by one bushel per acre, which will not cover the cost of the fertilizer. One possible explanation for the lack of response to the starter fertilizer was that the potassium soil test levels exceeded the critical levels at all four sites (table 2). Once the critical level has been reached, the soil contains enough potassium to produce 95 to 97% of its yield potential. The critical potassium soil test level is easily calculated using the following equation [(2.5 x CEC) + 75]. Plant tissue samples also showed that the potassium and sulfur levels were well above the sufficiency levels for these nutrients in both the fertilized and unfertilized treatments at every location in 2015 and 2016.

This practice may be more beneficial on coarse-textured soils or soils having low potassium and/or sulfur soil test levels.

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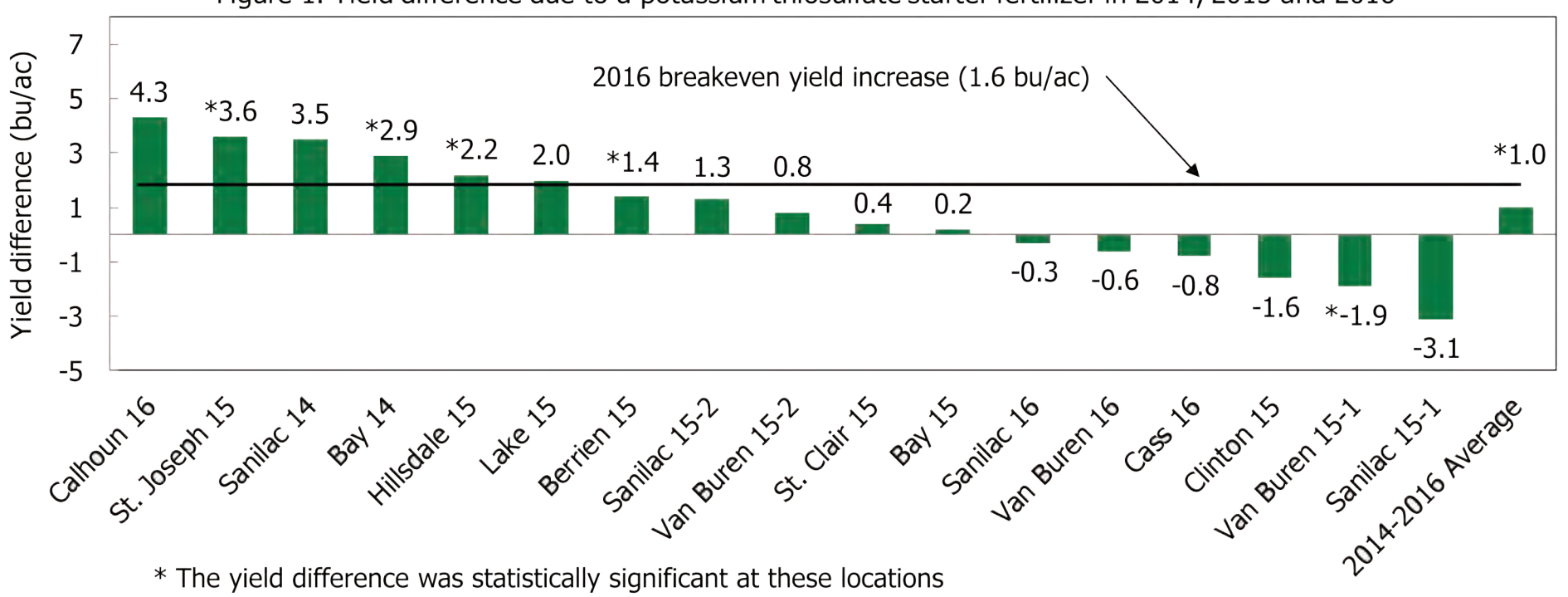
2014 to 2016 Potassium thiosulfate starter fertilizer trial locations

Figure 1. Yield difference due to a potassium thiosulfate starter fertilizer in 2014, 2015 and 2016



* The yield difference was statistically significant at these locations

Table 3. Application dates, application rates and fertilizer analyses for the last broadcast potassium fertilizer applications at the potassium thiosulfate starter fertilizer trials conducted in 2014, 2015, and 2016

Location	Application date	Application rate (lbs./ac)	Fertilizer analysis
Bay 14	Fall 2011	300	0-0-60
Bay 15	Fall 2014	300	0-0-60
Berrien 15	Spring 2015	150	0-0-60
Cass 15-1	Spring 2015	100	0-0-60
Cass 15-2	Spring 2015	150	0-0-60
Clinton 15	Spring 2015	242	9-23-31
Hillsdale 15	Fall 2014	*120 & 188	0-0-60
Lake 15	Spring 2015	160	0-0-60
Sanilac 14	Fall 2013	200	0-0-60
Sanilac 15-1	Fall 2013	*75 – 341 (field average was 114)	0-0-62
Sanilac 15-2	Spring 2015	200	5-26-31
St. Clair 15	Fall 2014	150	0-0-60
St. Joseph 15	Spring 2015	150	0-0-60
Cass 16	Spring 2016	150	0-0-60
Calhoun 16	Spring 2015	2 tons of chicken manure	--
Sanilac 16	Spring 2016	200	7-11-36-4.6S
Van Buren 16	Spring 2016	100	0-0-60

* Variable rate application