

## Fertility Options for Soybean Production

### (Interim Report)

#### Purpose:

Traditionally in Ontario, soybeans have been grown without added fertilizer. Nitrogen is provided by fixation in the nodules of soybean roots, and phosphorus and potassium was only supplied if soil test levels were low. In recent years, yields have increased and crop rotations have shortened between soybean crops; this short interval is leading to nutrient deficiency symptoms being observed more often.

This project is designed to assess if fertilizer, in a variety of blends and placements, can increase soybean yields. The project is also evaluating what soil types would have the greatest responses based on the existing soil test levels.

#### Methods:

Five field scale trials were established in 2012. The five trials were established at Lucan, Varna, Kenilworth, Orangeville and Canfield. Of these five locations, two were planted using conventional tillage methods, while the other three were planted in no-till conditions. Each plot within the trial was 20 feet wide by at least 1000 feet long. There were eight treatments randomized and replicated three times. Trials were planted with a Kearney 15" vacuum planter. All fertilizer treatments were applied by the planter at the time of planting. Yields were measured using a calibrated weigh wagon.

**Table 1. 2012 Trials included the following treatments:**

Treatment	Description
Untreated	No fertilizer added.
25P + 40K (Bcast and Incorp.)	Fertilizer blend broadcast and incorporated to apply 25 lbs P <sub>2</sub> O <sub>5</sub> and 40 lbs K <sub>2</sub> O.
25P + 40K (2x2 Band)	Fertilizer blend banded 2" down and 2" over from the seed to apply 25 lbs P <sub>2</sub> O <sub>5</sub> and 40 lbs K <sub>2</sub> O.
25P (In Furrow)	MAP granular fertilizer applied in row with the seed to provide 25lbs actual P <sub>2</sub> O <sub>5</sub>
25P + 5Mn (In Furrow)	Same as above, with the addition of 5lbs of Manganese.
3 gallons 2-20-18	Alpine liquid fertilizer applied in row with seed.
3 gallons 2-20-18 + Inoculant	Same as above, with the addition of Optimize liquid inoculant mixed into fertilizer tank.
50N + 28S (Bcast and Incorp.)	Fertilizer blend of Ammonium Sulphate and ESN broadcast and incorporated to apply 50lbs N and 28 lbs S actual.

**Results:**

The 2012 growing season produced fantastic soybean yields. Early planting was achieved in most areas; however many areas also experienced a prolonged period without moisture after planting which negatively affected yields. Differences between fertilizer treatments were visible early in the season, with nitrogen showing the greatest visual response (Figure 1). The latter half of the growing season proved to be good for soybeans growth, as temperatures stayed warm and timely rains were received in a wide area of the soybean growing region.



**Figure 1. Soybeans on the right treated with nitrogen fertilizer appear to have a lush, dark green canopy. The soybeans on the left are untreated.**

Table 2 shows the existing soil fertility and tillage method for the sites used in this study.

**Table 2: Soil Test Values for Fertility Trials (2012)**

Location	Soil test values		Soil Fertility Level	Tillage
	P	K		
Lucan	31	157	“High”	No-Till
Varna	7	52	“Low”	Conventional
Kenilworth	7	80	“Low”	Conventional
Orangeville	16	86	“Medium”	No-Till
Canfield	32	189	“High”	No-Till

Yield responses to added fertilizer were relatively small. Results from 2012 are shown in Table 3. The table also shows the increase in yield for each treatment, or ‘advantage,’ over the untreated check.

**Table 3: Average Yield Summary for 5 Field Scale Fertility Trials (2012)**

Treatment	Average Yield (bu/ac)	Advantage (bu/ac)	LSD (5%)
Untreated	47.1	-	a
25P + 40K (Bcast)	47.6	0.5	a
25P + 40K (2x2 Band)	47.1	0.0	a
25P (In Furrow)	47.2	0.1	a
25P + 5Mn (In Furrow)	46.7	-0.4	a
3 gallons 2-20-18	46.3	-0.8	a
3 gallons 2-20-18 + Inoculant	46.2	-0.9	a
50N + 28S (Bcast and Incorp.)	47.0	-0.1	a

Table 3 demonstrates that none of the fertilizer treatments had an impact on yield when all the sites were averaged together.

Table 4 shows the results for the site with the “lowest” values from the soil tests. At the Varna site there was a significant response to fertilizer. Most of the starter treatments responded with a yield increase. Specifically, at this site treatments with granular P responded significantly. There was a statistical yield increase with three treatments; 25P + 40K (bcast), 25P+40K (2x2) and 25P + 5Mn (In Furrow).

**Table 4: Varna Fertility Trial Yield Summary (2012)**

Treatment	Average Yield (bu/ac)	Advantage (bu/ac)	LSD (5%)
Untreated	46.1	-	b
25P + 40K (Bcast)	51.2	5.1	a
25P + 40K (2x2 Band)	50.5	4.4	a
25P (In Furrow)	48.7	2.6	ab
25P + 5Mn (In Furrow)	51.0	4.1	a
3 gallons 2-20-18	45.4	-0.7	b
3 gallons 2-20-18 + Inoculant	48.8	2.7	ab
50N + 28S (Bcast and Incorp.)	45.7	-0.4	b

**Summary:**

- 1) No soybean yield gains were observed for any of the fertilizer combinations tested if soil tests were adequate.
- 2) Response to fertilizer can be significant where soil tests are considered “low”, up to 5 bushels/acre, in this study.
- 3) Nitrogen and sulphur fertilizer showed no response.

**Next Steps:**

A similar study will be conducted in 2013.

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