



Soy1-2011 - Assessing Fertility Options in Soybean Production

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Assessing Fertility Options in Soybean Production

Purpose:

Traditionally, soybeans in Ontario 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 tests 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 was set up to assess if added fertilizer, in a variety of blends and placements, can increase soybean yields. The project also evaluated what soil types would have the greatest responses based on the existing soil test levels.

Methods:

Two field scale trials with three replications were conducted in 2009, three in 2010, and five in 2011. In 2009 both locations were low fertility sites, with one located near Orangeville and the other near Monkton. In 2010 two sites were low fertility (Lucan and Bornholm) and there was also a high fertility site selected near Stratford. In 2011 there were two sites with low fertility, two sites with medium fertility, and one site with high fertility. The sites were located in Fonthill and Bornholm; Monkton and St. Thomas; and Stratford, respectively. Each plot within a trial was either 10' or 20' wide with a length of at least 1000 feet. In 2009 both sites were conventional tillage and in 2010 the Lucan site was conventional tillage while the other two were no-till. All sites in 2011 were planted under no-till conditions. Trials were planted with a Kearney 15" vacuum planter. Yields were measured using a calibrated weigh wagon.

Results:

The 2009 growing season was cool and wet. Above average rainfall during July and August and excellent fall weather occurred at both sites. There was no significant insect or disease pressure, but soybean aphids were present late in the growing season. In 2010 it was a fantastic growing season with many sites achieving above average yields. Due to the excellent season, and soybeans ability to adapt in favorable growing conditions, it is possible that the results of the fertilizer applications may have been diminished. The spring of 2011 was cold and wet, which delayed planting by 2-4 weeks in much of Ontario. However, the July-October period of the growing season was outstanding, and resulted in above average yields for many producers. This outstanding finish to the season may have negated some of the early advantages that the fertilized treatments appeared to display.

Table 2, below, shows the existing soil fertility for the sites used in this study. Table 2 also shows tillage method before planting.

Yield responses to added fertilizer were relatively small. Results from 2009-2010 are shown in Table 3. Note that the fertilizer treatments from 2009 and 2010 are slightly different than those in 2011. The table also shows the increase in yield for each treatment, or 'advantage,' over the untreated check.

Table 1. 2011 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 ₂ O ₅ and 40 lbs K ₂ O.
25P + 40K (2x2)	Fertilizer blend banded 2" down and 2" over from the seed to apply 25 lbs P ₂ O ₅ and 40 lbs K ₂ O.
25P + 40K (2x2) + 50N	Same as above, with the addition of nitrogen fertilizer. A 50-50 blend of ESN and ammonium sulphate broadcast and incorporated, to apply 50lbs actual N.
25P + 40K (2x2) + 50N + Bioforge	Same as above, with the addition of BioForge seed treatment.
25P with seed	MAP granular fertilizer applied in row with the seed to provide 25lbs actual P ₂ O ₅
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.
25P + 40K (2x2) + 50N + BioForge + 3 gallons 2-20-18	A combination of all the various fertility options being studied above.

Table 2: Soil Test Values for Fertility Trials (2009-2011)

Location	Soil test values		Soil Fertility Level	Tillage
	P	K		
Dufferin 2009	25	103	"Low"	Spring Cultivate
Monkton 2009	7	118	"Low"	Spring Cultivate
Lucan 2010	8	147	"Low"	Spring Cultivate
Stratford 2010	47	200	"High"	No-till
Bornholm 2010	19	89	"Low"	No-till
Stratford 2011	46	178	"High"	No-Till
St. Thomas 2011	12	138	"Medium"	No-Till
Monkton 2011	27	137	"Medium"	No-Till
Bornholm 2011	25	81	"Low"	No-Till
Fonthill 2011	9	54	"Low"	No-Till

Table 3: Yield Summary for 5 Field Scale Fertility Trials (2009-2010)

Treatment	Average Yield (bu/ac)	Advantage (bu/ac)	LSD (5%)
Untreated	48.7	-	c
3 gallons 6-24-6	50.8	2.1	b
40 P + 70 K Inc.	51.0	2.3	ab
25 P with seed	51.8	3.1	ab
40 P + 70 K Inc. + 3 gallons 6-24-6	52.3	3.6	a
40 P + 70 K 2X2 Band	52.3	3.6	a

The table below, Table 4, has the treatments from the 2011 season, which are slightly different from the treatments in 2009-2010.

Table 4: Yield Summary of 4 Field Scale Fertility Trials (2011)

Treatment	Average Yield (bu/ac)	Advantage (bu/ac)	LSD (5%)
Untreated	56.0	-	d
20P + 40K (Bcast)	56.5	0.5	bcd
20P + 40K (2x2 Band)	56.4	0.4	cd
20P + 40K (2x2) + 50N	57.7	1.7	ab
20P + 40K (2x2) + 50N + BioForge	57.7	1.7	abc
25 P w/ seed	57.3	1.3	abcd
2-20-18	57.2	1.2	abcd
2-20-18 + Inoculant	57.5	1.5	abc
20P + 40K (2x2) + 50N + BioForge + 2-20-18 + Inoculant	58.3	2.3	a

In 2011, Table #4, many of the treatments offered some response, but most were small. The similarity in response to different treatments likely occurred because of the excellent growing season in the second half of 2011. The treatments with added nitrogen appear

to have the greatest yield responses in 2011. This yield gain likely had more to do with the cool, wet conditions that were experienced early in 2011; the added nitrogen from these treatments seemed to give the soybean plants a visible boost early in the year which likely contributed to the additional yield.

Summary:

- 1) Soybean yield gains were relatively small to applied fertilizer if soil tests were adequate. There was a small advantage to banding fertilizer and to liquids compared to broadcast application.
- 2) Even with very high yields the high fertility site showed no response to fertilizer except for the 2 X 2 band of 40P+70K.
- 3) MAP with the seed (in furrow) and 3 gallons of 6-24-6 were the only economically profitable treatments in 2009-2010. There is concern that MAP with the seed could cause fertilizer burn so caution must be exercised if this approach is used.
- 4) In 2011 there were no treatments that were profitable probably due to the excellent growing conditions. The treatment with the highest yield response was a 2x2 band of 20P+40K, 50 lbs of broadcast N, BioForge seed treatment, 3 gallons/acre mixture of 2-20-18 liquid fertilizer with Optimize liquid inoculant.
- 5) Nitrogen fertilizer showed no economic response.

Next Steps:

A similar study will be conducted in 2012.

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