ESN Fertilizer Evaluation on Corn, Barley and Potatoes
ThunderBay SCIA

Purpose:

The purpose of this experiment is to determine if there are environmental and/or economic benefits in the use of Enivronmentally Smart Nitrogen (ESN) fertilizer on silage corn, barley, and potatoes.

There are several different crops grown in the Thunder Bay area, including potatoes, barley, and silage corn. Area farmers are continually looking for new technologies that can help increase yields, increase farm economics, and decrease environmental impact.

ESN fertilizer has a unique semi-permeable polymer coating that allows water to enter the urea granule and dissolve the nitrogen. The nitrogen release rate is controlled by soil temperature and moisture, which similarly determines plant growth and nutrient demand. By slowing the rate of nitrogen release, this technology will help plants obtain nitrogen later in the growth cycle, when nitrogen demand is higher. This ultimately should increase nitrogen efficiency which would increase crop yields. Similarly, by releasing the nitrogen slower and at times when the crops are uptaking more nitrogen, less nitrogen will be lost to the environment, thus decreasing the risk of environmental damage.

Methods:

The procedure for each crop is very similar, but in the following section each crop (corn, barley, and potatoes) will be divided separately.

Corn

The corn trials were laid out and planted on May 21st, 2008 and May 25th, 2009. The length of the field in year one was 288m (945 feet) and year two was 366m (1200ft). The planter was a six row planter with three fertilizer boxes (one for every two runs). Each fertilizer box represented a different treatment; Urea fertilizer, ESN fertilizer, no fertilizer (control). The two fertilizer blends were mixed prior to the trial and are as follows (Note for the ESN treatment, ESN was simply substituted for Urea):

Urea/ESN	160kg/ha	(143lbs/acre)
19-19-19	99kg/ha	(88lbs/acre)
Ammonium Sulphate	99kg/ha	(88lbs/acre)
Total	**358kg/ha**	**(319lbs/acre)**

At the time of planting a soil sample and two nitrogen soil samples (one 0 30cm, one 30-60cm) were taken.

There were four repetitions of each treatment, which equalled two passes up and down the field. The repetitions were laid out as shown in the following diagram;

1	1	2	2	3	3	3	3	2	2	1	1	1	1	2	2	3	3	3	3	2	2	1	1

1	Urea
2	ESN
3	Control

Ear leaf tissue samples were taken on August 18th 2008 and sent for analysis, but were not taken in 2009. Mid-season Nitrogen samples were taken on July 14, 2009, but were not taken in 2008. The corn was harvested on Oct 2nd, 2008 and Sept 28th 2009 with the two rows of each treatment being harvested together. Each treatment was weighed as it came off the field. Post-harvest nitrogen soil samples (both 0-30cm and 30-60cm) were taken on Oct. 15th, 2008, but were not taken in 2009.

Barley

The barley trials were laid out and planted on May 29th 2008, and June 3, 2009. The length of the field for year 1 was 242m (794 feet) and year 2 was 457m (1500ft). At the time of planting a soil sample and two nitrogen soil samples (one 0 30cm, one 30-60cm) were taken. The barley was sown with a 30' air seeder and was laid out with four repetitions of each of the ESN and Urea mixes, but only one control. The plots were all one width of the seeder, 9.1m (30'). Therefore, the plots were laid out as follows;

ESN
Urea
ESN
Urea
Control
ESN
Urea
ESN
Urea

The fertilizer blends were mixed prior to planting and for 2008 are as follows:

Urea/ESN	127kg/ha	(113lbs/acre)
11-52-0	184kg/ha	(164lbs/acre)
0-0-60	64kg/ha	(57lbs/acre)
Total	**375kg/ha**	**(334 lbs/acre)**

In 2009 the fertilizer mixtures were changed slightly to the following:

Urea/ESN	115kg/ha	(106lbs/acre)
11-52-0	38kg/ha	(35lbs/acre)
21-0-0-24	48kg/ha	(44lbs/acre)
Total	**201kg/ha**	**(185lbs/acre)**

At the time of planting, the fertilizer was applied both using the air drill and using a broadcast spreader. The broadcast spreader was needed because the calibration on the air drill would not go high enough.. One hundred twenty two kg/ha (109lbs/acre) was applied with the drill the remainder was applied using the broadcast spreader. The broadcast spreader drove down the same tracks as the seeder and was set to spread 30'.

Flag leaf tissue samples were taken on July 15th, 2008 and sent for analysis, but were not taken in 2009. Mid-season Nitrogen soil samples were taken on July 3, 2009 but were not taken in 2008. The barley was harvested on Sept. 8th, 2008, and Sept 22nd, 2009 with an 18' wide straight cut header combine. A single swath was cut down the centre of each treatment was weighed, and a bushel weight and feed sample taken. Post-harvest nitrogen soil samples (both 0-30cm and 30-60cm) of each treatment were taken on Sept. 15th 2008, but were not taken in 2009.

Potatoes

The potato trial was laid out and planted on May 27th 2008, and was not planted in 2009. The length of the field was approximately 488m (1600ft). At the time of planting a soil sample and two nitrogen soil samples (one 0-30cm, one 30-60cm) were taken. The potatoes were planted with a four row planter, and the width of each treatment was 12.2m (40'), which accounted for about 12 rows per treatment. The trials were laid out similar to those of the barley trial, with only one control treatment and four treatments of both the ESN and Urea mixtures as follows:

ESN
Urea
ESN
Urea
Control
ESN
Urea
ESN
Urea

The fertilizer was mixed and applied prior to planting with a 3m (10') spreader. The fertilizer mixtures are as follows:

Urea/ESN	245kg/ha	(219lbs/acre)
11-52-0	194kg/ha	(173lbs/acre)
0-0-60	112kg/ha	(100lbs/acre)
Total	551kg/ha	(**492 lbs/acre)**

Tissue samples were taken on August 6th 2008, and sent for analysis. The potatoes were harvested on October 2nd, 2008. Eight rows out of the centre of each treatment were harvested and weighed. Post-harvest nitrogen soil samples (both 0-30cm and 30-60cm) of each treatment were taken on October 29th 2008 and sent for analysis.

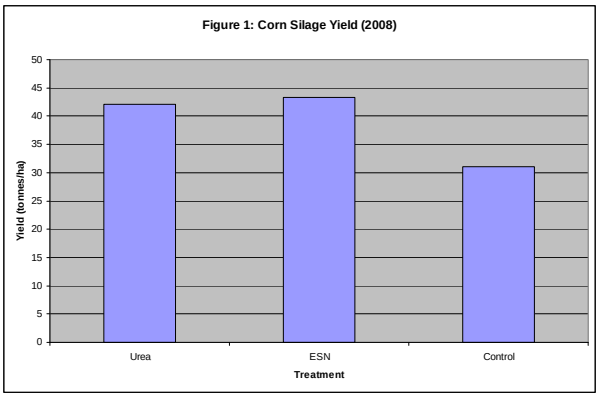
Results:

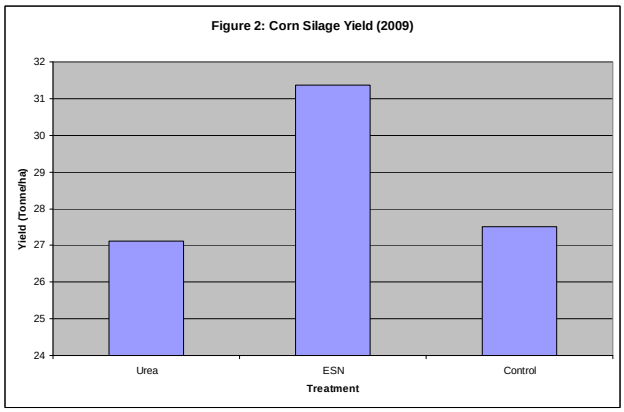
In the following section, the results of each crop (corn, barley, and potatoes) will be presented separately.

Corn

Mid season tissue analyses revealed no significant difference in N, P, K, Mg, and Ca, between the three fertilizer mixes.

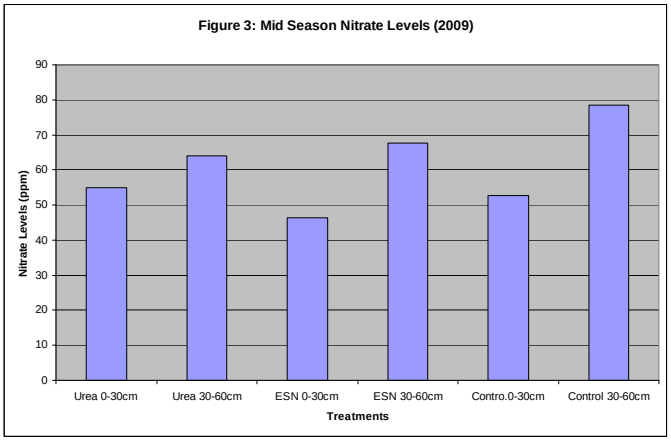
Figure one demonstrates the average yield in tonnes/ha of the three treatments in year one (2008). Figure two shows the average yield for year two (2009). Note that there is

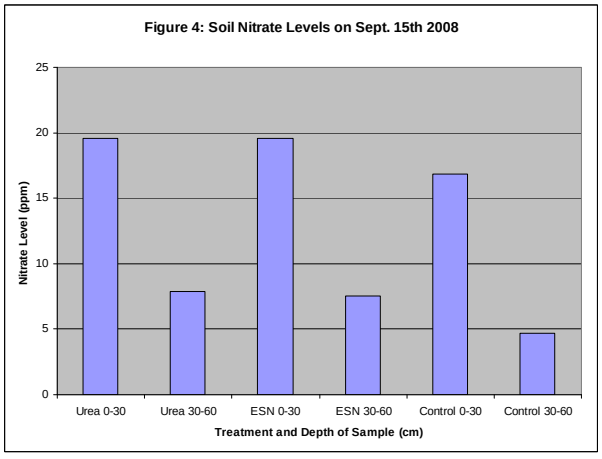




no significant difference in yields between treatments in both years one and two.

Figure three indicates mid season soil nitrate levels in year two (2009). Figure four indicates post-harvest nitrate levels in year one (2008).



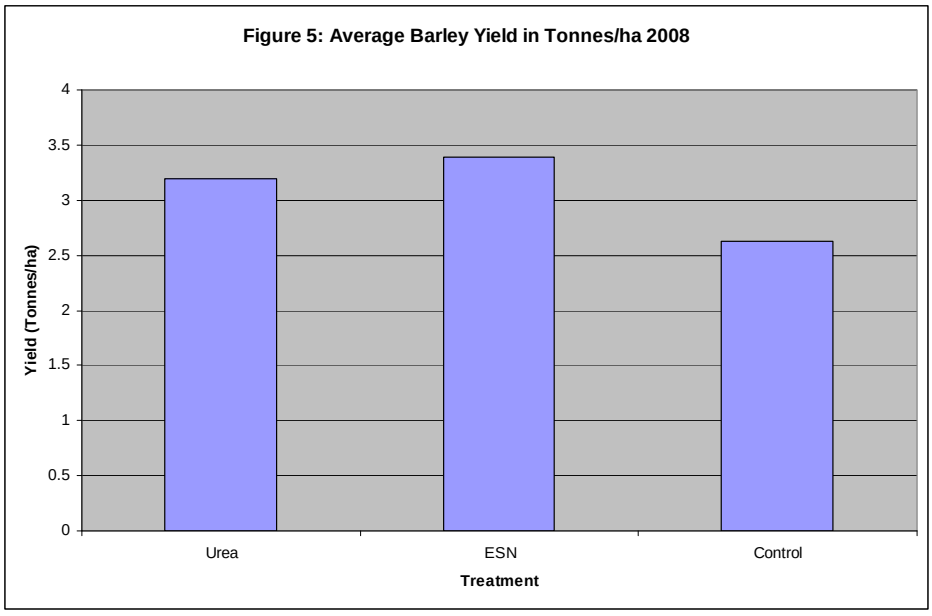


Barley

Note that there was only one control treatment in comparison to the four repetitions of each other treatment, which means that the control data may not be statistically representative of a true control treatment.

Mid season tissue analyses revealed no significant difference in N, P, K, Mg, and Ca, between the three fertilizer mixes.

Figure 5 shows the average yield in tonnes/ha of the three treatments in year one (2008). There was no data for 2009 due to a breakdown with the combine which prohibited proper harvesting of the treatments. Note that there is no statistical difference in yield between the treatments.



There was no statistical difference in the bushel weight between treatments. Figure 6 shows the average protein content for the barley in year one (2008). Note that there is no statistical difference between the Urea and ESN treatments, but if the control treatment were representative than it is statistically lower than the other two.

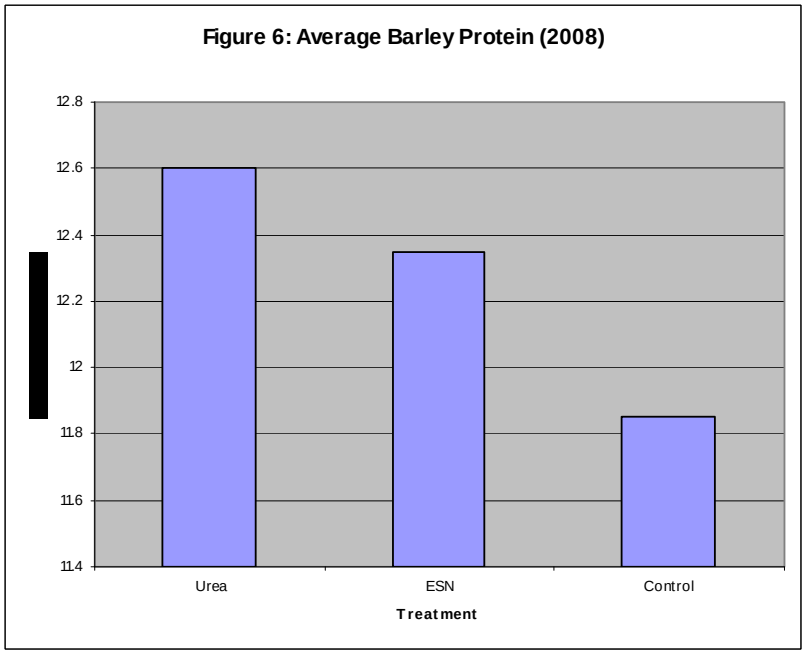
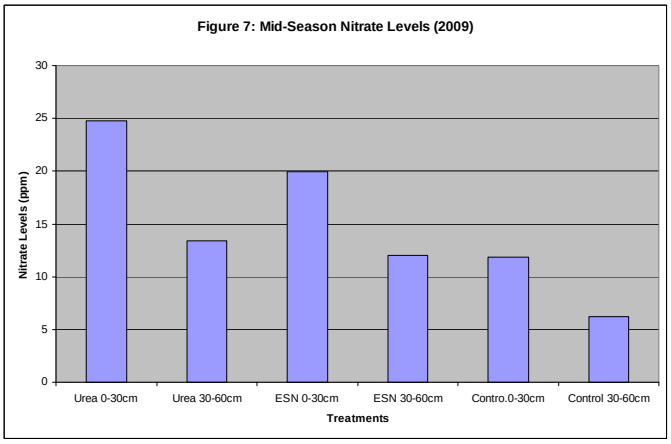
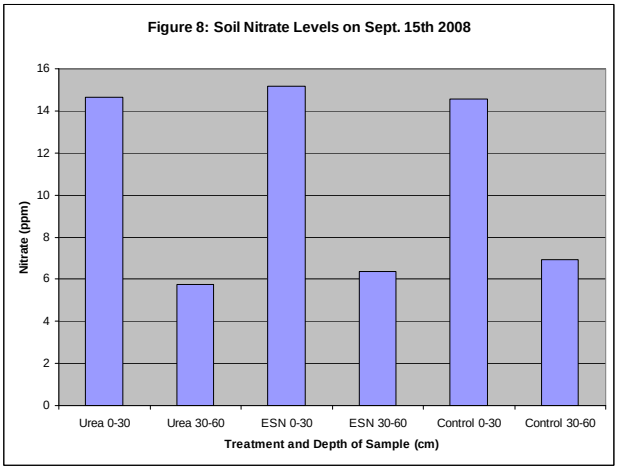


Figure 7 illustrates the mid season nitrate levels for year two (2009). Figure 8 shows the post harvest soil nitrate levels for year 1 (2008).





Potatoes

Note that there was only one repetition of the control treatment versus the four repetitions of the other two treatments.

Mid season tissue analyses revealed no significant difference in N, P, K, Mg, and Ca, between the three fertilizer mixes.

Figure 9 demonstrates the average yield of each treatment for year 1 (2008). Again, there is no statistical difference between treatments.

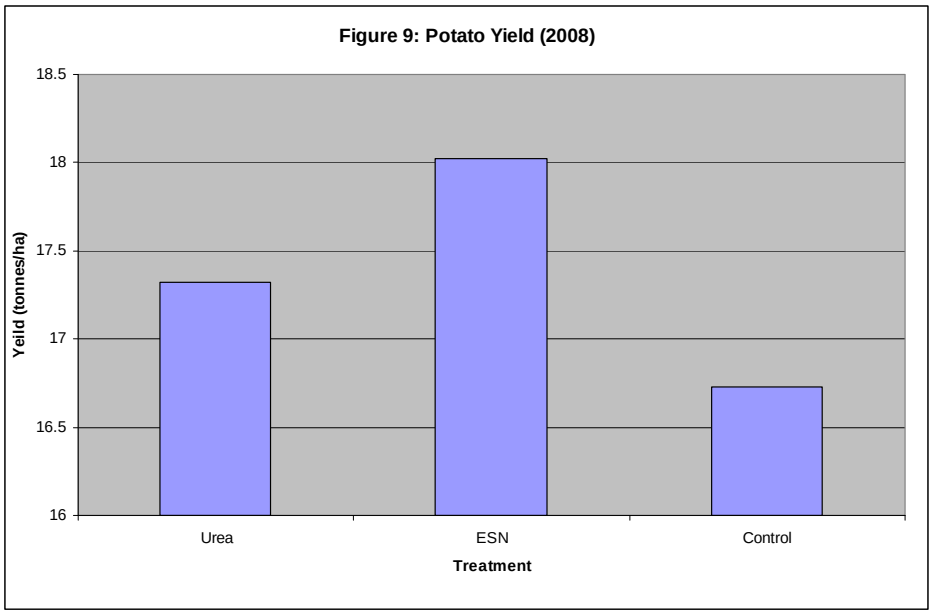
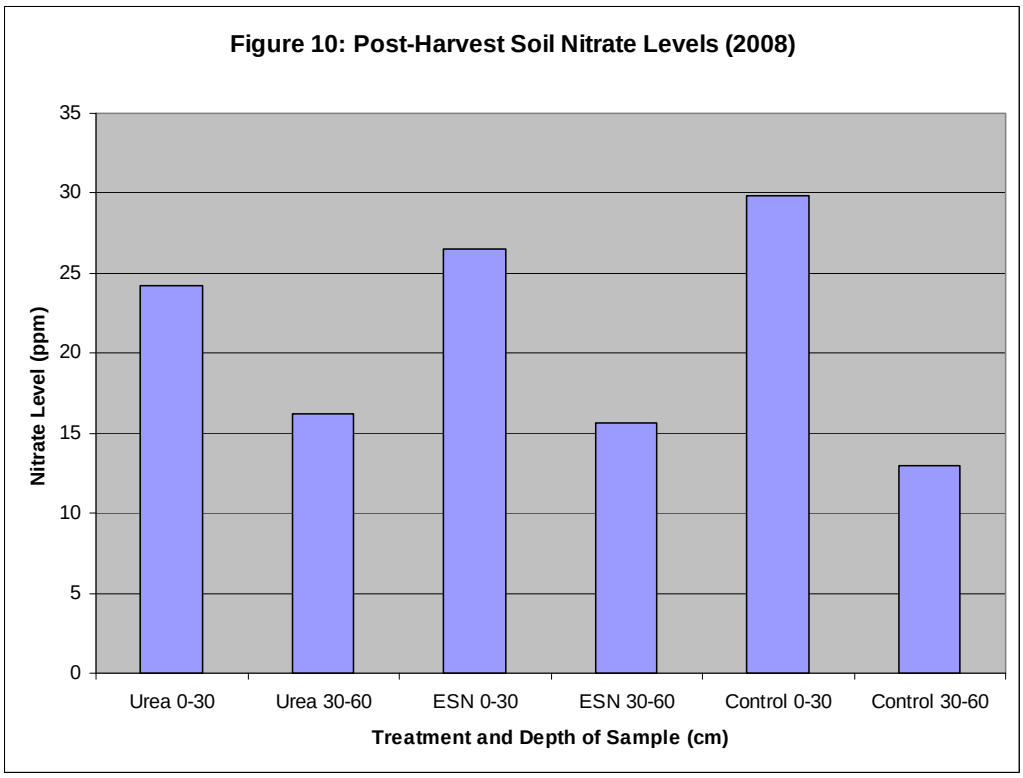


Figure 10 demonstrates the post-harvest soil nitrate levels. There was no statistical difference between treatments.



Summary:

There are some trends which are common amongst all three crops and some which are quite difference based on the same three treatments.
The ESN fertilizer increased plant tissue nitrate levels in all of the crops, but on varying degrees. Both the corn and potatoes showed a greater increase in tissue nitrogen than

barley for the ESN treatment. This increase and discrepancy in tissue nitrogen levels may be due to a variety of factors including the timing and release of the nitrogen, previous years nitrate build up, nitrate banding in the field either due to previous nitrate applications or manure applications, or statistical/sampling error.

Although there are slight differences in the treatments, the differences are not statistically significant.

The results from the 2008 ESN trials demonstrate that ESN is not a good economical choice for barley, silage corn, and potatoes in the Thunder Bay area. Further conclusions can be made following the second year of research in 2009.

Next Steps:

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We would like to thank the OSCIA for their assistance in this project and their guidance and advice in setting up the project protocols. We would like to thank OSCIA and the Northwest Grant, OMAFRA, and the University of Guelph for the financial assistance necessary for completing this project. We would like to thank all of our co-operators in the Thunder Bay area for their assistance and labor in helping to complete this project.

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