CLIMATE CHANGE ADAPTATION PROGRAM

Fertilizer Placement, Variable Rates & Nitrogen Losses

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Fertilizer Placement, Variable Rates & Nitrogen Losses

Monitor in Rod's tractor to set & monitor variable rates of fertilizer during seeding.

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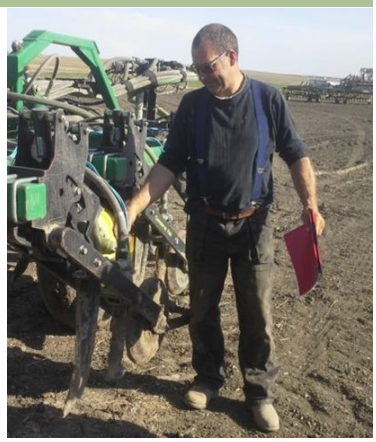
www.peaceforage.bc.ca

Initial Questions

This forage fact is part of the project "Innovative Management Practices for Resiliency". The project works with farmers and ranchers to identify and evaluate nutrient or cropping management practices that will be more resilient to climate change extremes.

Cooperator Rod Strasky's questions were: "Can nitrogen losses be reduced by placing fertilizer and using variable rate technology?" The following is a description of a field scale demonstration plot in 2015 to find answers to this initial question and other questions evolving out of the study.



Rod Strasky seeding May 2015.

Seeding Methods & Variable Rates of Fertilizer

Seeding was done on May 27 & 28, 2015 using a Conservapak seed drill. The openers on this drill are configured to place the seed 2" below and in between the paired seed rows.

Two sets of plots were seeded: one in the west side of the field and one set in the east side.

In each set of plots there was a 3 way comparison:
B = Broadcast fertilizer
SR= Placed fertilizer, set rate
VR= Placed fertilizer, variable rates.

Variable rates were set at:
Low rate of 120 lb/ac blend
High rate of 160 lb/ac blend
Fertilizer blend was 17-21-21-0 based on soil tests fall 2014.

These 2 fertilizer rates were set with Glynn Evans, Agritrend in consultation with Rod. They are using Power Zone mapping technology *(see page 3 for more description of this technique)*. The zone or yield maps were entered into the tractor computer *(see photo to left)* and the 2 rates were adjusted as the seeding unit passed from one zone to another.

Openers on Conservapak seed drill place fertilizer 2" below & between 2 paired seed rows.

Peace River Forage Association of British Columbia

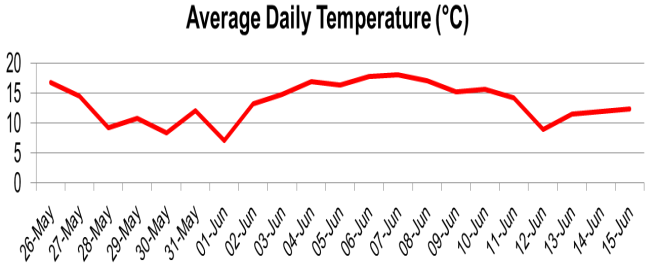
Source for Weather Data Graphs:

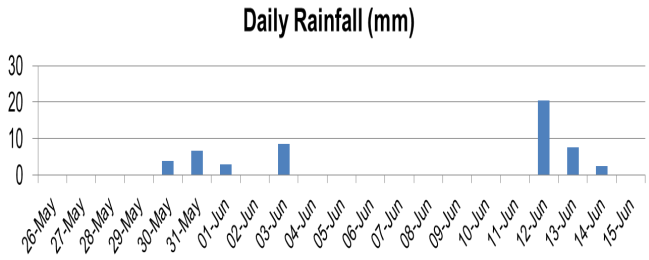
(First 3 graphs on right) WeatherFarm reports current local weather conditions and providing information that is relevant to agriculture. The program is run by Weather INnovations Consulting LP (WIN). Data is collected from over 1,100 weather stations throughout western Canada. providing localized real-time weather data to farmers, industry, and the public. For more information see: www.weatherinnovations.com

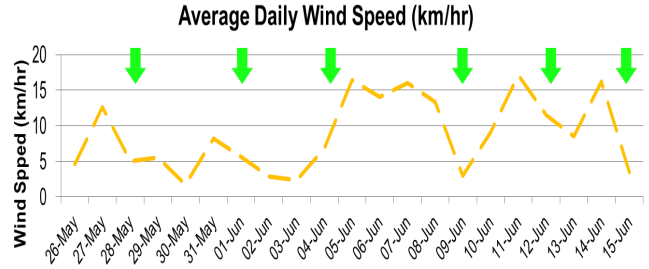
Weather Factors

Loss of nitrogen in NH_3 or ammonium form can be quite significant with broadcasting urea based fertilizers and spreading raw manure. Weather conditions play an important role, so data was compiled from the Parkland Farm Weatherbug that is part of a Western Canadian weather monitoring network. Daily averages for air temperature, daily rainfall and wind speed were summarized *(see first top 3 graphs to the right).*

Green arrows in the 3rd graph indicate sampling dates for monitoring NH_3 loss. Surface soil temperature and crop growth stage were collected at the time of reading the dosimeters for nitrogen losses.







West side benchmarks.

Vented chamber.

Dositube close up.

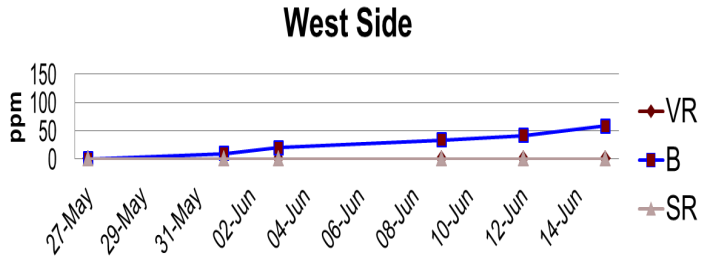
Measuring N Losses

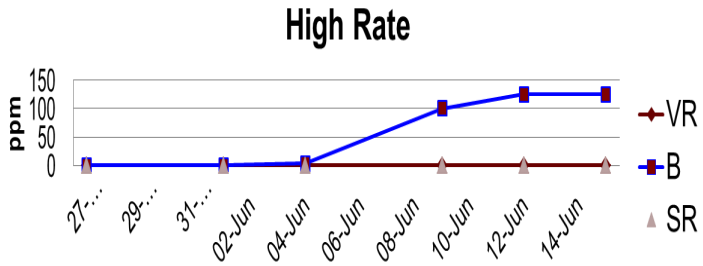
Benchmarks were set up across in 3 different areas of the field referred to in graphs titles as:
West Side
High Rate (on east side)
Low Rate (on east side)

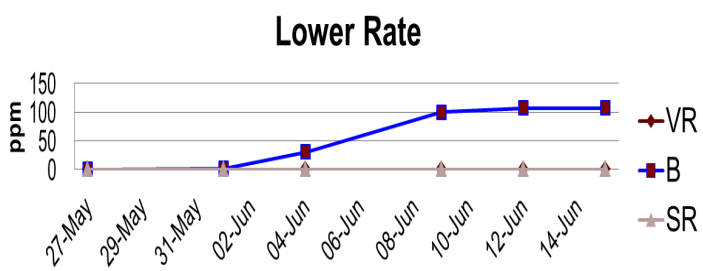
There were 3 benchmarks set up for each treatment in each of these areas, resulting in 3 x 3 x 3 readings per sampling day. Vented chambers were set up at each benchmark covering a dositube. Each dositube was fastened onto a stick to position it 6" above the paired seed rows.

Sampling started on the day of seeding and was done every 3 to 4 days, until crop outgrew the chambers. Dositubes and chambers were reinstalled after each rainfall.

The purple (sulphuric acid) in the tube turns yellow as it reacts with NH_3 *(see photo to the left).* The readings are summarized in the 3 lower graphs to the right.



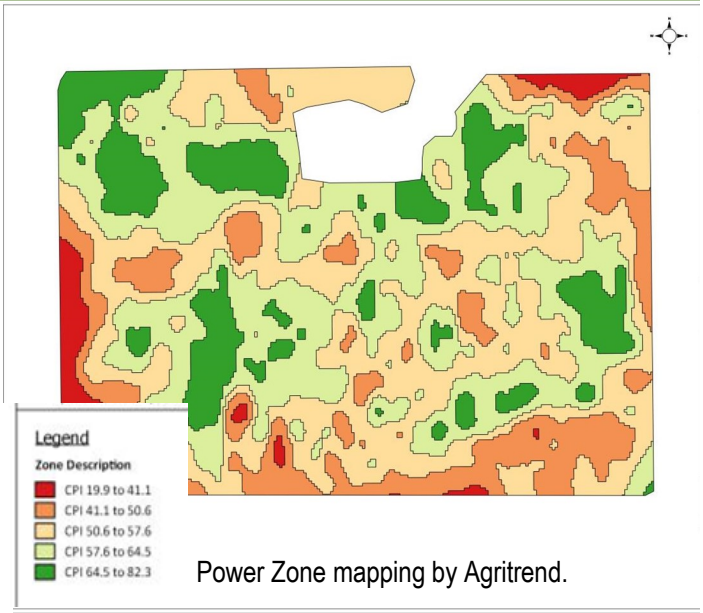




Power Zone Mapping by Agritrend

Power zone mapping takes the best or the available years of air photo images from the last 20 years and overlays them to produce a digital summary. The image to the right is a summary of the growing potential of the Straskys' field, where the study was located.

Agritrend consultants chose 5 classes to summarize the growing potential of the quarter section. The classes start from the poorest growing areas or **Red** areas, and range to the **Green** areas or the best growing areas. For Rod's first year with variable rate fertilizing he chose to group his field into 2 main growing classes, rather than 5. Red and dark orange zones were grouped and received the lower rate of 120 lb/ac of the fertilizer blend. Light orange, light green and dark green were grouped and received the higher rate of 160 lb/ac.

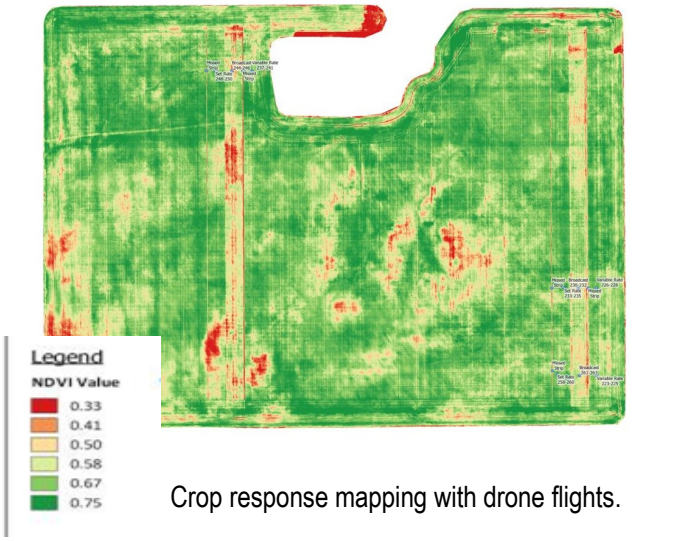


Power Zone mapping by Agritrend.

Crop Response Mapping by Blackbird

As the season progressed, the crop growth stage was consistently lower (i.e. crop maturity was behind) in both broadcast treatment strips. To understand the spatial extent and variability of this crop response we utilized drone mapping technology. Matthias Loeseken with Blackbird Environmental acquired near-infrared imagery of the growing crop, which was then calculated into a Normalized Differential Vegetation Index (NDVI). The NDVI is closely correlated to photosynthetic activity and ultimately crop yield (please compare to the yield map below), and was used to objectively assess and document crop health at a very high resolution.

Red represent poorer and slower grower areas, ranging to darkest **green** for better and more advanced areas of the field.

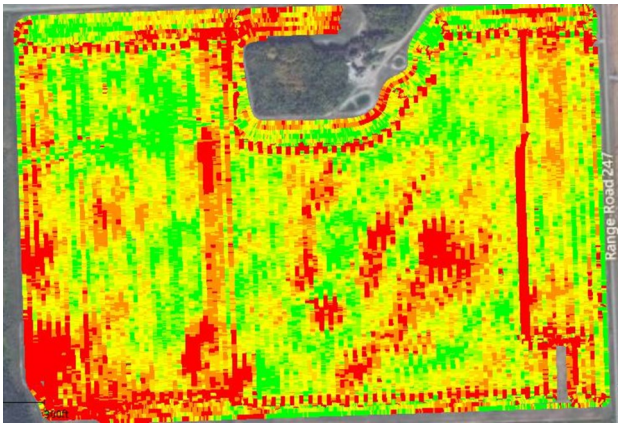


Crop response mapping with drone flights.

Yield Mapping with Straskys' Combine

Last fall, Rod took the time to set up his combine yield monitor and got the data inputting into a live map as he harvested his field. It was calibrated using a bushel box, so that barley seed yields could be measured specific to areas in his field. The colors range from **Red** for the poorer yielding areas to **green** for the better areas.

Comparing the 3 field maps, they each have strengths as tools for further understanding nutrient status and crop variability across this field. Rod now has a way to compare actual yield to the power zone map and variable rate fertilizer plan map. Integrating these tools with variable rate fertilizing and drone mapping technology, he can manage (and he hopes mitigate) the red or poor areas.



Yield mapping from combine; red = poor, green = good.

Sourcing Equipment

Anemometers:
To record wind speed at 12" height above soil surface, anemometers are available from:
Forestry Suppliers
1 800 752 8460
sales@forestry-suppliers.com

Dosimeters:
To record NH_3 gas losses we ordered dositubes through Bill McGill at UNBC but they can be ordered directly from:
Fischer Scientific
http://www.fischersci.ca
1 800 234 7437
The tubes were called DeTubes Ammonia 20/aD 2.5 to 188 ppm
The dositubes cost $10/ tube in 2015, but the cost may be higher for 2016.

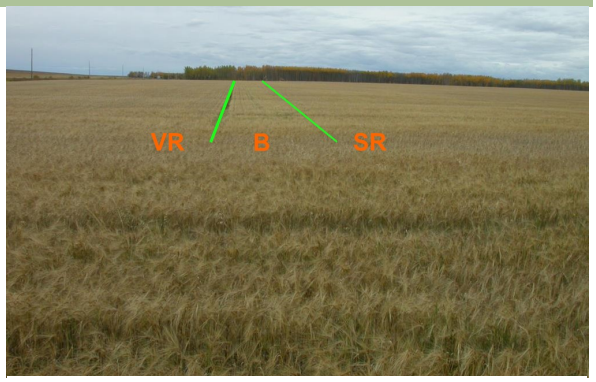
Yield Monitor:
Straskys' combine yield monitor is a New Holland Intelliview.

"Remote sensing techniques like UAV imagery are a great way to objectively assess crop health over large areas."
Matthias Loeseken
Blackbird Environmental
www.blackbird.ca

Barley Crop Yields

The barley crop was harvested on October 22, 2015. Rod combined the same area for each treatment and used his combine monitor to record the yields.

The broadcast treatments in both the west and east set of demo plots were 2 weeks behind in maturity. Crop stage maturity was similar between the set and variable rates plots.



Barley crop one month before harvest in east side plots. Broadcast treatments were 2 weeks behind.

From the table here, there was clearly a 10 bu/ac advantage to placing fertilizer 2" into the soil. In terms of quality, the barley from the broadcast strips was lighter in weight and had more green kernels.

Table 1: Barley Crop Yields by Fertilizer Treatment from Combine Monitor & GPS calculated areas.

Demo Treatment	West plots Bu/ac	East plots Bu/ac
Broadcast N	59.2	63.3
Placed N, Set Rate	69.7	72.3
Placed N, Variable Rate	74.9	72.7

Where To Next? Questions For Year 2 of N Loss Study

1. How many bu/ac and $/ ac are lost if we get in a hurry and broadcast the nitrogen before seeding? Working with George Geldart, Ag Economist.

2. Is there a soil quality difference in the power zones, yield maps or NDVI maps that can be measured with the Soil Quality Field Kit e.g. poor drainage & slower infiltration? Working with Bill McGill, University of Northern BC.

3. Is there more potential for the drone flight imagery for crop response monitoring several times in a season? Working with Matthias Loeseken, Blackbird Environmental.

Compiled by: Sandra Burton, Rod Strasky & Matthias Loeseken in February 2016.
With Contributions from: Julie Robinson, Kim Strasky & Glynn Evans.
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