The HIGH Nitrate Soil Test Works! (or your $ back)

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Introduction

Every year a proportion of MB soil test results indicate high to very high residual soil N (as nitrate). Growers may not believe the low N recommendation they receive, and dismiss the soil test out-of-hand. They consider the risk of underfertilizing to be greater than trusting the test.

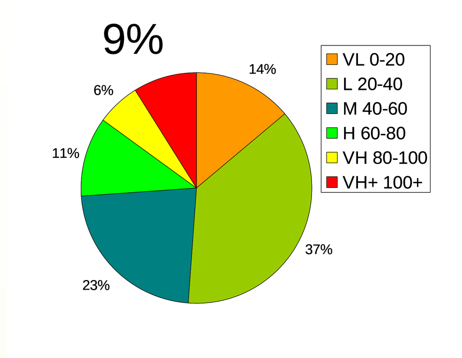

Figure 1. Fall 2000 soil nitrate-N distribution following wheat and oilseeds in Manitoba (AgVise Labs)

The Deal

Agreement was made that if following the soil test recommendation resulted in **lower crop yield or quality**, that the difference would be covered with a **cheque** - through the GreenHouse Gas Mitigation Program.

(similar to a pilot project in Minnesota where Crop Insurance would make up any shortfall when following the soil test)

Methods

Cooperating growers were obtained through word of mouth or contact through their consultants, industry agronomist or ag rep (Figure 2).

Fields with fall 2003 or spring 2004 residual soil N exceeding 100 lb were selected (Table 1).

Figure 1.

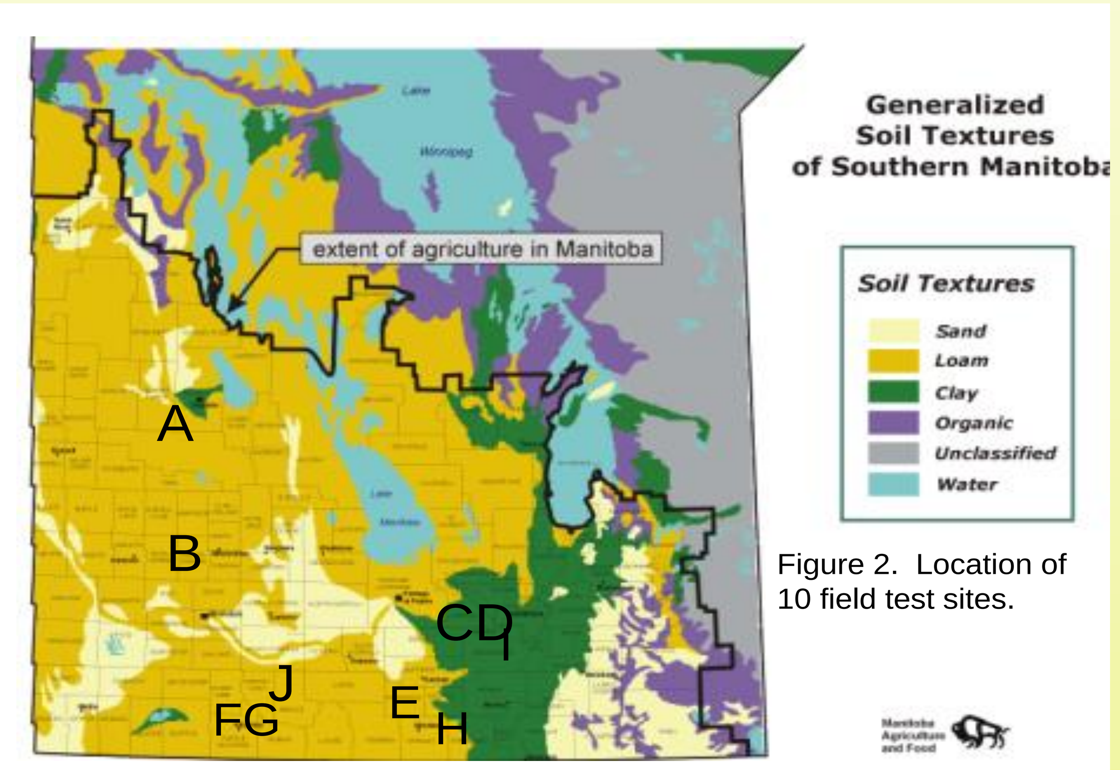

Figure 2. Location of 10 field test sites.

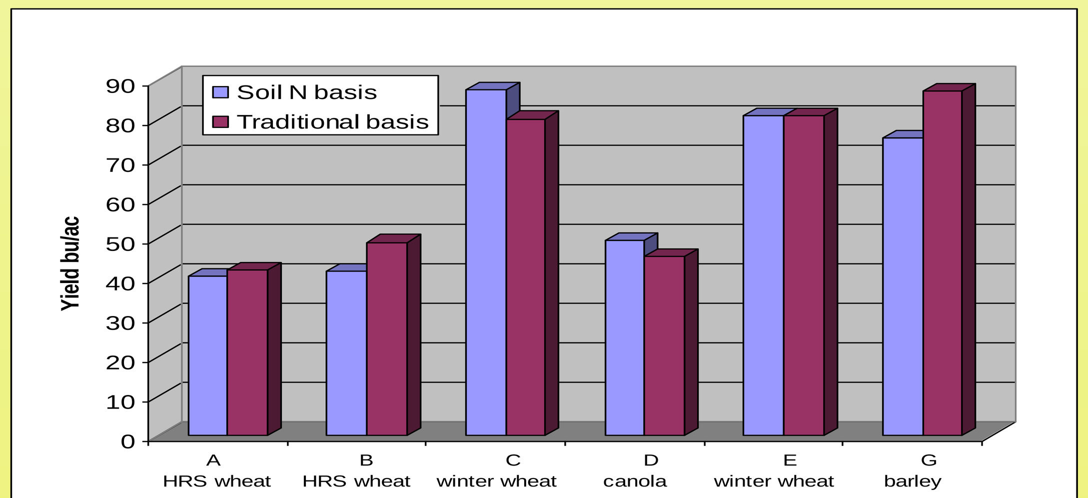

Figure 2. Soil nitrate-N levels in 10 Manitoba fields (fall 2003 and spring 2004)

Upon site identification, spring soil samples were taken in transects across the field (Figures 3-11) according to the position of proposed strips.

Cooperators were encouraged to use 2 strips within the field as an on-farm-test so results could be statistically analysed (Table 2).

Crop was seeded and either left unfertilized with N or fertilized with a rate different than the remainder of the field (in most fields the strips were

Table 3. Sites with fall N levels and suspected cause.

Site Code	Crop	OFT design	Field rate Lb N/ac	Strip rate Lb N/ac
A – Keld clay loam	S wheat	Single strip	80 N MRB	8
B – Newdale clay loam	S wheat	2 strips	80 Fall band NH3	0
C –Osborne clay	W wheat	2 strips	90 UAN dribble	0 – then 120
D – Osborne clay	canola	2 strips	80 Fall band NH3	0
E – Chortitz clay loam	W wheat	2 strips	110 AN broadcast	20
F – Waskada clay loam	barley	Single strip	35 UAN at seeding	70
G - Waskada clay loam	Corn silage	Single strip	50 UAN at seeding	100
H – Neuenburg sandy loam	Grain corn	Single strip	90 urea	40

In crop measurements included leaf N content, chlorophyll content (using the SPAD meter) and for corn the pre-sidedress N test (PSNT) and post harvest stalk nitrate test.

Grain yield and where possible straw yield and N content was determined.

Residual soil N content was measured following harvest.

Results

- In 9/10 fields, spring nitrate-N levels were lower in the transects than the previous whole field soil test results.
- 2 growers were unable to continue the study (I based on spring N results, J due to delayed spring seeding)
- Field C tested low, so the 2 zero N strips were fertilized with 120 lb N/ac according to Manitoba winter wheat fertility guidelines.

Harvest was not completed on corn sites due to frost and immaturity. Yields and grain N content of cereals and canola are reported in Table 5. The residual soil N levels N and uptake and removal by crop is reported in Table 6.

•Soil nitrate levels were reduced by an average of 40 lb N/ac but ranged from 1-144 lb N/ac.

•Uptake of N (based on a hand-harvested sample of straw and grain) was greater in the high N treatments, when determined.

•The post harvest corn stalk nitrate test indicated normal N level in the low N corn but excessive amounts in the high N corn

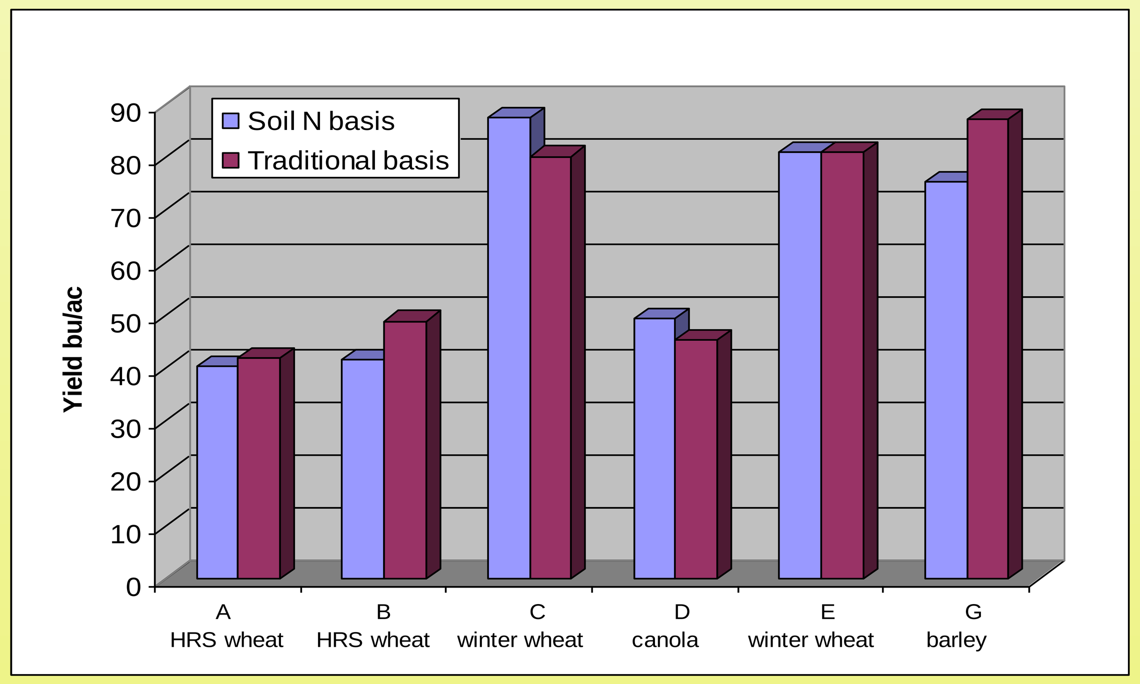

Figure 4. Crop yields from N rates based on the N soil test versus traditional rate.

Discussion

It is apparent that considerable variation was present between thefall field composite soil samples and those taken in the transects in spring.

Possible reasons are:

•Temporal - considerable rain and snowfall in the spring may have contributed to nitrate leaching or denitrification.

- Spatial - the fall sampling of the field composite may have sampled some falsely high testing areas - in at least 2 instances due to manure application (C and F) and in-field livestock feeding (F). Even draghose injection of liquid manure can result in gross misapplication patterns (C in Figure 12).
- Imposed field variability - a rented field (A) had a 2 distinctly different areas of the field in responsiveness to applied N, presumably due to past cropping practices (Figure 13).
- Sampling procedure - perhaps the original fall soil sampling consisted of insufficient samples. Field C had been manured in 40 acre parcels, yet an entire 200 acres was included in one composite sample.

Figure 5. Infra red aerial photo of field C.

Note the pattern of alternating green and white strips due varying biomass and maturity resulting from misapplication of manure applied in Fall 2002 (2 years previously).

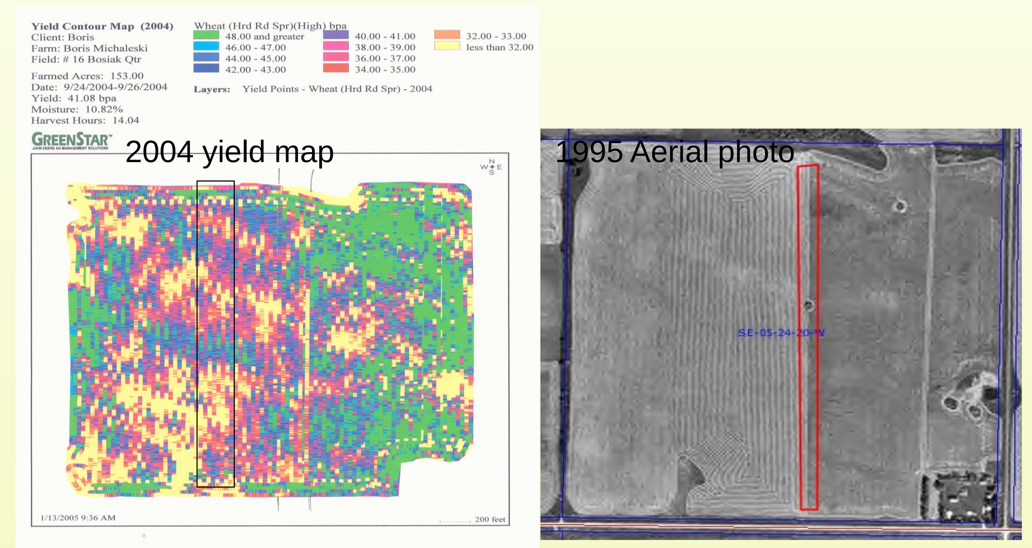

Figure 6. Historic photo indicates field was previously cropped as 2 different fields. Note distinctly higher yields on east side.

The field observations did adequately indicate N sufficiency in the crop. Where SPAD readings were not different, yields were the same (Miami).

Fall soil nitrate levels did indicate a drawdown in levels where lower rates were applied.

Employing OFT principles permitted statistical segregation of several in-crop measurements, but it appears that 2 replicates are insufficient to differentiate yield responses.

Yields and quality (protein) were less in the low N areas of fields B, C and F although statistics did not indicate significant differences. Payment equivalent to 33 bu of CWRS wheat (on 4.5 ac) and 24 bu of malt barley (on 2 ac) will be made to growers B and F, respectively.

At 2 sites (A, E) yields were identical (within 1.5 bu/ac) and at 1 site (D) the low N strip yield was significantly greater (at the 10% probability level).

Where high soil nitrate levels are unexplained, growers should consider a spring retest and applying a low, not zero, rate of N.

Summary

Growers should critically assess a soil test indicating high levels of nitrate N. Steps to take include:

- **retesting before seeding if fall and spring conditions are wet and conducive to nitrate losses via leaching or denitrification**
- **traveling with the soil sampler to ensure that areas receiving past manure are sampled more intensely. The field size should be determined by the area manured.**
- **Use a modest N rate if the high N test cannot be explained by past practices.**
- **Use test strips to develop confidence**

References

AgVise Labs
Cargill AgHorizons
Greenhouse Gas Mitigation Program
MB Zero Till Research Association
MB Agriculture, Food and Rural Initiatives staff
Producer cooperators