Soil sampling fields with banded fertilizer

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In-soil banding of nitrogen (N), phosphorus (P) and potassium (K) fertilizers has long been recognized to increase nutrient efficiency in the Prairies, but such bands may offer challenges to soil sampling
These observations were taken to assess the consequences of such concentrated fertilizer bands
In 2 of these cases, such soil sampling was done to complement the educational value of summer soils tour of the Manitoba Soil Science Society (MSSS)

Strip tillage fertilization for row crops

In 2017, the MSSS tour featured the Almasippi soils west of Portage on the farm of Dean Toews

- nitrogen (N) and phosphorus (P) fertilizer had been placed into a 10” wide strip tilled band prior to seeding dry beans (Figures 1 and 2).
- On August 2, soil samples were taken 0-6” deep in the crop row (IR, in the fertilized strip) and between row middles (BR), between the 30” wide rows.
- Soil test results are shown in Figures 3-4.

Figure 1-2. Strip till application of nutrients prior to seeding in 10” wide bands on 30” row spacing.

Results:

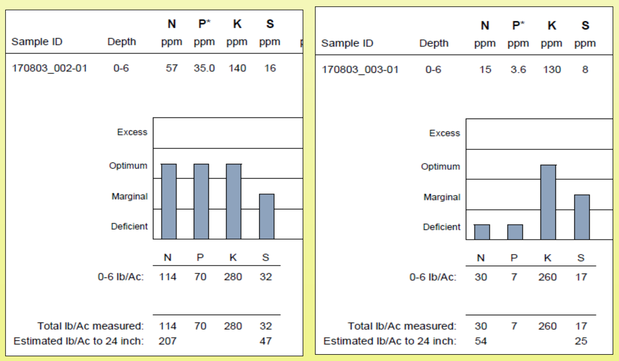

Figure 3-4. Soil analysis from the IR (left) and BR row (left) positions.

- Nutrient concentrations were 4 and 10 times greater in N and P, respectively in the IR than BR positions.
- The implications are that random or oversampling bands may lead to extremely variable soil test results, especially if strips are placed in same areas each year. This grower rotates with other narrow seeded crops like wheat and tends to alternate strip positions, so long-term concentration in this band is not expected.

- When fall soil sampling such fields, the sampler is advised to use a sampling ratio of 1:3 of IR to BR to provide a good estimate of field soil fertility[1]. In this instance it would have suggested a true mean of 11 ppm P.

Narrow row cropping with high P fertilizer bands

The 2021 MSSS soil tour featured Newdale clay loam soils and were hosted at the farm of Adam Gurr, north of Brandon.

- P bands were applied in a sideband while seeding wheat in 2018, at rates of 35 (standard), 175 (Med) and 350 (High) lb P_2O_5/ac.
- P was applied as MAP (mono ammonium phosphate 11-52-0) side-banded with a Seed-Hawk air-drill at about 4” deep.
- A controlled traffic farming approach is used, meaning wheel tracks are in the same place, but rows are moved about 6” to the side each year to be planted between rows of the previous crop (Figures 5-6).

Figures 5,6. Seeding and sideband fertilization (left). Note fertilizer placement to the side and below the canola seed (right).

- Soil samples were taken with a hand probe using a template placed over the previous rows. Each value represents 8 pokes.
- Soil P values are reported in Table 1 for 0-6” sampling depth and Table 2 for 0-2” sampling depth (suggested to assess environmental risk).
- A cross-section volume 12” wide x 6” deep X 1” thickness was sampled

Figures 7-9. Soil sampling template (left), 3 pails (middle) and cross-section sample (right).

Results:

Table 1 and 2. Olsen P values (ppm) according to original P rate and band position for the 0-6” depth (left) and the 0-2” depth (right)

Position	Standard	Med	High
Band	6	14	29
3” to side	5	10	23
Row middle	5	8	14
“X-section”	9	14	26

Position	Standard	Med	High
Band	13	23	59
3” to side	13	23	40
Row middle	10	18	36

- The Med and High P rates had about 2 and 5 times the P concentration of the standard practice, respectively, and could be sufficient to taint results if included when field sampling.

- Researchers[2] suggest using the formula S = 8(BS/30 cm), where S is the number of samples to be taken between the bands for each core from the “in-band” to obtain the true mean, and BS = band spacing in cm.
- Using such an approach would have produced “true mean” values of 5 ppm P, 9 ppm P and 16 ppm P, for Standard, Med and High P rates, respectively.
- Cross-section sampling had higher values than “true mean” in all cases so did not appear useful
- 0-2” P values were approximately double, the P concentration of 0-6” values, indicating nutrient stratification near the soil surface..

Nutrient variability in bands in a dry year

- In very dry years even mobile nutrients may remain concentrated in application bands
- The following observations were noted by farmers and agronomists after the very dry summer of 2021.

Observation 1

- In September volunteer canola growth was noted to be growing more aggressively over the mid-row band (MRB) where N, P and S had been applied during seeding operations (Fig 10-11).

Figures 10-11. Greener, more vigorous volunteer canola growing over spring placed fertilizer in MRB.

Table 3. Soil nutrient concentrations in and between MRB

Analysis	Between MRB	In MRB
Nitrate-N lb/ac		
0-6”	2	17
6-24”	9	18
P ppm	12	18
K ppm	146	135
S lb/ac 0-24”	80	102

Observation 2

- Agronomist observed partially dissolved fertilizer granules when doing fall soil sampling.
- The granule on left is the polymer coating of an ESN pellet, which urea should have diffused out from.
- The granule on the right is MAP, and it is likely that if sampled in the soil core could cause inflated P values.

Figure12. Spring applied fertilizer granules in fall 2021 when soil sampling (A. Knaggs)

Summary:

- Concentrated application of fertilizer such as P in bands is often recommended for agronomic benefit but may confound soil sampling results
- If band locations are known, they should generally be avoided, or included only if using one of the referenced sampling strategies
- If band locations are not known, >20 samples is recommended.
- Cross-section sampling did not appear to be helpful

References:

[1] Fernandez, F. and D. Schaefer. 2012. Soil Sci. Soc. Am. J. 76:1090-1099.
[2] Kitchen, N., J. Havlin and D. Westfall. 1990. Soil Sci. Soc. Am. J. 54:1661-1665.