Nitrogen Rate Calibration Strip Validation in Manitoba

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Background

Nitrogen Ramp Calibration Strips (NRCS)

• A method proposed by Oklahoma State University researchers[1] to assess nitrogen (N) supply from the soil through observations of N sufficiency of the growing crop.

•It may be a suitable tool for crop advisors and extension agronomists in aiding growers to:

1. Determine replacement N value of manure or previous legume crops

2. Quantify in-season N losses due to excess rainfall

3. Assess suitability of new fertilizer management strategies, like zone fertilization or the Manitoba N rate calculator for cereals and canola.

5. Determine the amount of supplemental in-season N required to optimize yield for crops

Method

• Before or shortly following seeding select a non-fertilized, representative area of the field some 10' by 80-120' long (Figure 1).

•Individual 10' by 10' cells in the strip are hand fertilized with N rates increasing from 0 to a high, N Rich rate in "ramped up" increments of 10-30 lb N/ac

• Strips are visually inspected in mid-season to identify the N rate required for maximum biomass production and/or N sufficiency (Figure 2).

•N sufficiency is presumed to be at the lowest N rate producing growth/colour etc. similar to N Rich rate.

Figure 1. An N ramp applied to seedling spring wheat.

Figure 2. An N ramp at timing of mid-season assessment

Assessments

•Strips may be assessed visually but usually N sufficiency determination is aided using one of a number of methods either in-season or at harvest.

Table 1. Potential criteria used to assess N sufficiency

Measurement*	N sufficiency
Biomass	Similar to N Rich
Plant height	Similar to N Rich
Plant N concentration %	Book values
SPAD Chlorophyll Index (Fig. 3)	95-100% of N Rich
Leaf colour (Fig. 4)	Similar to N Rich
Pre-sidedress soil nitrate test for corn (Fig. 5)	100 lb N/ac for corn (0-12" depth)
GreenSeeker NDVI (Fig. 6)	Similar to N Rich
Grain yield	Similar to N Rich
Post harvest residual nitrate-N (lb N/ac 0-24")	Not established
Corn stalk nitrate-N ppm (Fig. 7)	750-2000
Wheat grain protein content %	CWRS >13.5 % W wheat >11.5%

*References on diagnostic methods are available [2].

Figures 3-7. Some of the methods used to assess N sufficiency referred to in Table 1 above.

Field validation

•In 2008 we established 24 NRC Strips in crops of spring and winter wheat, barley, oats, canola and corn

• Many were taken to harvest to evaluate the utility of the N sufficiency tools.

Findings

1.When N fertilizer is pre-weighed, labeled and bagged, it takes 15-20 minutes to measure, stake and apply N to each ramp strip.

2.The most promising in-season measurements in identifying N sufficiency were plant height, SPAD Index, leaf colour and NDVI[3].

3.Figures 8-9 illustrate the yield and N sufficiency observations for N responsive and non-responsive (manured) NRCS sites.

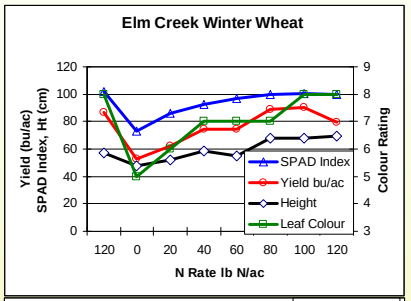

Figure 8. Site with suspected losses from fall applied N. In-season methods identified N sufficiency at 80 lb N/ac or similar to the measured yield.

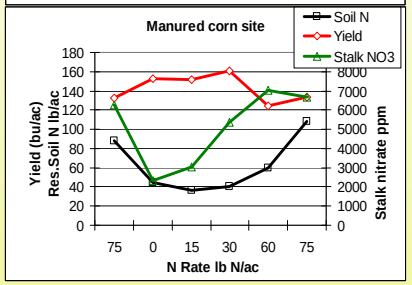

Figure 9. Site where grower mistrusted N contribution of manure. Yields did not increase, but residual soil N and stalk nitrate did.

4. NRC Strips were often useful in identifying and quantifying N supply of soil and needs of the crop

5.They are suitable for a number of extension and N sufficiency verification purposes.

6.Details on conducting NRC Strips are available[2].

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References

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[2] Heard, J. 2009 Nitrogen Ramp Calibration Strips in Manitoba. MAFRI Crop Topics 2009. ttp://www.gov.mb.ca/agriculture/soilwater/nutrient/fnm05s00.html

[3]Heard, J. 2009. Field Validation of Nitrogen Ramp Calibration Strips in Manitoba. MAFRI Agricultural Sustainability Initiative Report # 08-02-01