John Lee
Soil Scientist

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Soil Test Trends in Manitoba

Region served by AGVISE Northwood ND Laboratory

AGVISE Northwood Laboratory
40,000 sq. feet - New in 2007

Trends in Soil Test Levels in Manitoba

- Immobile Nutrients
  - P, K, Zn, Cu, Cl
- Soil Properties
  - Soil pH
  - Salinity
- Nitrogen

Trends in Soil Test Levels in Manitoba

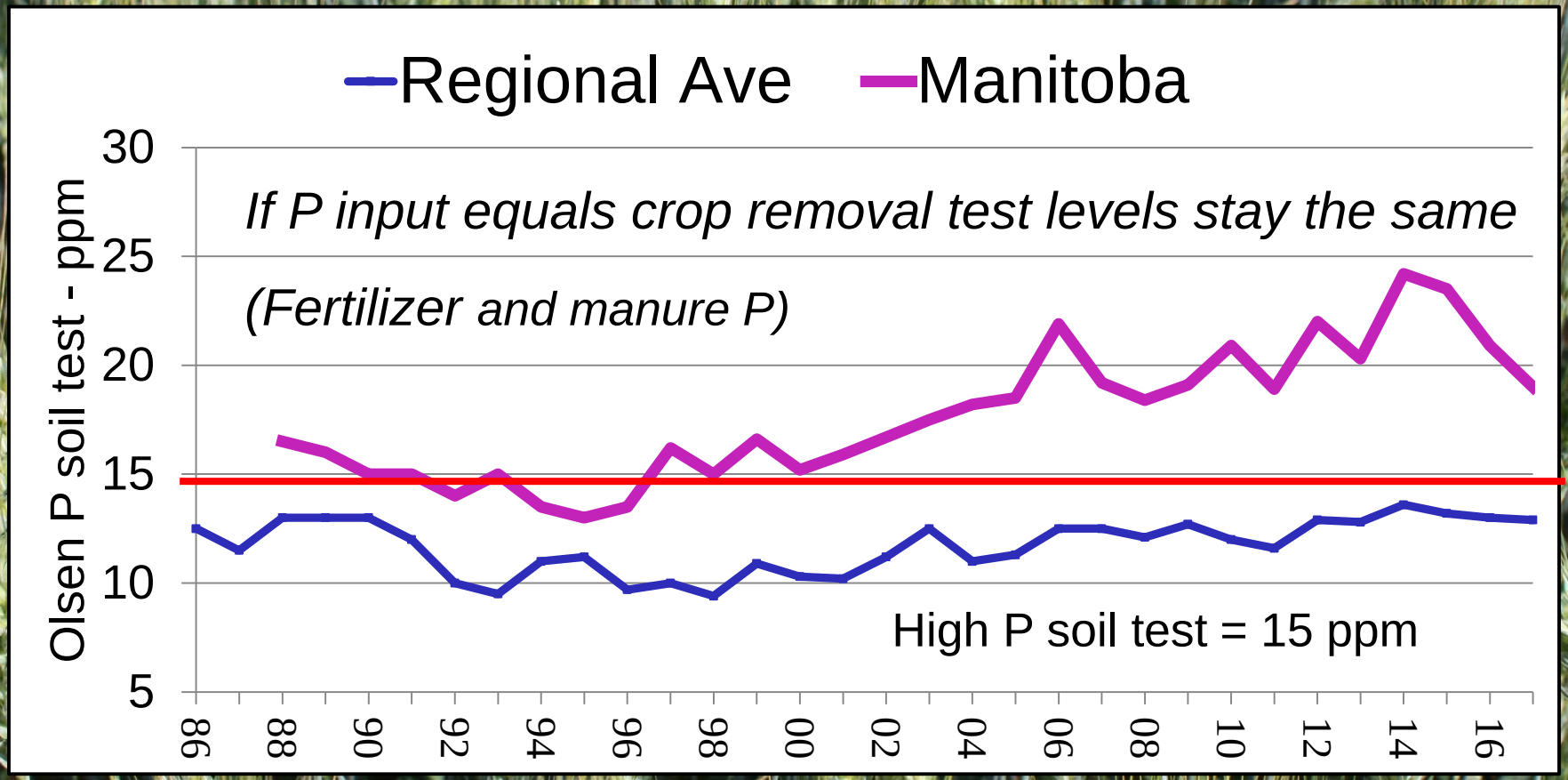
- Immobile Macro Nutrients

  Phosphorus

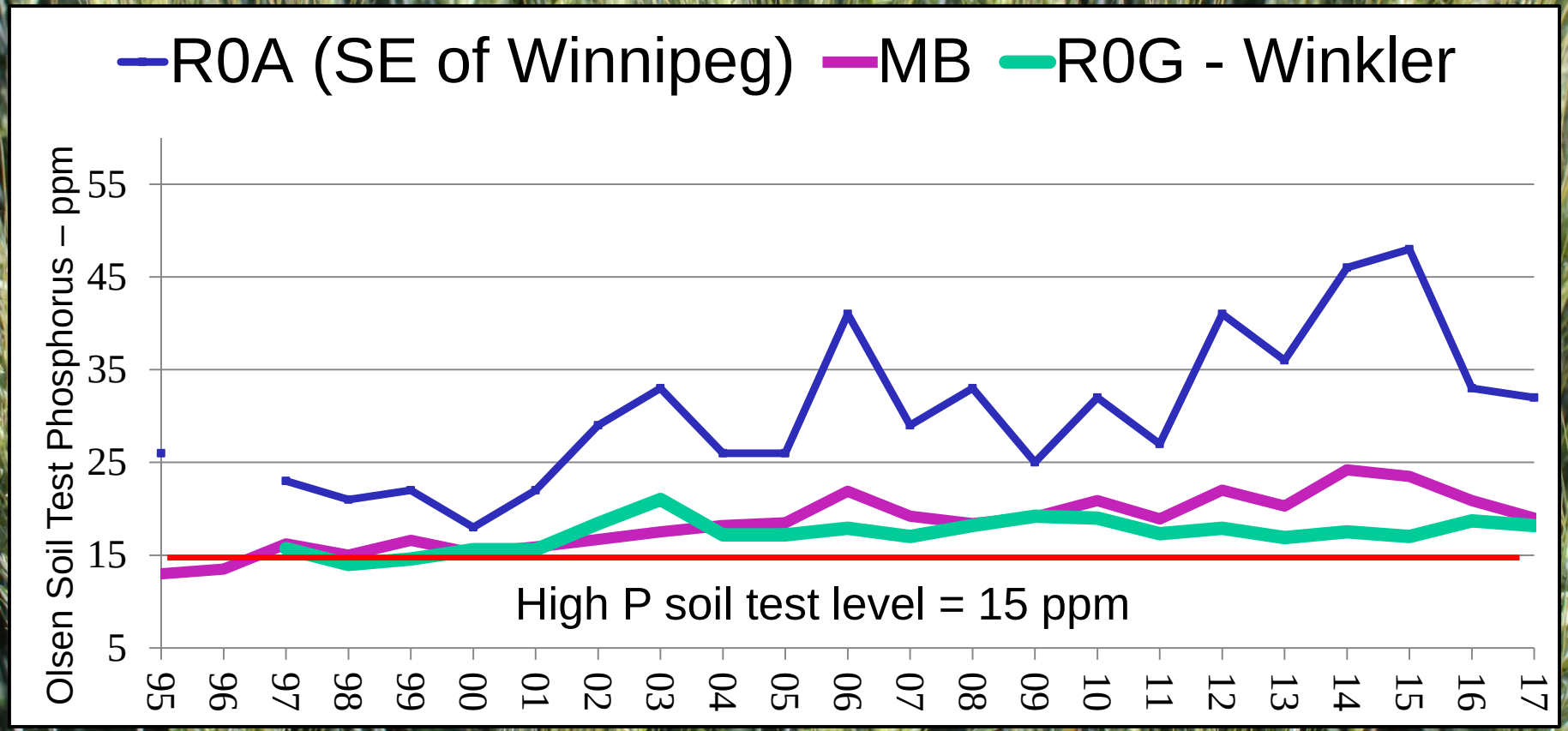
  Potassium

Immobile Nutrients don’t move with water and soil test levels are relatively stable.

Soil Phosphorus (P) Test Trend
Ave. Olsen P test 1986-2017



Soil Phosphorus (P) Test Trend
R0A and R0G Postal Code
1995-2017



Average P ppm soil test 2017

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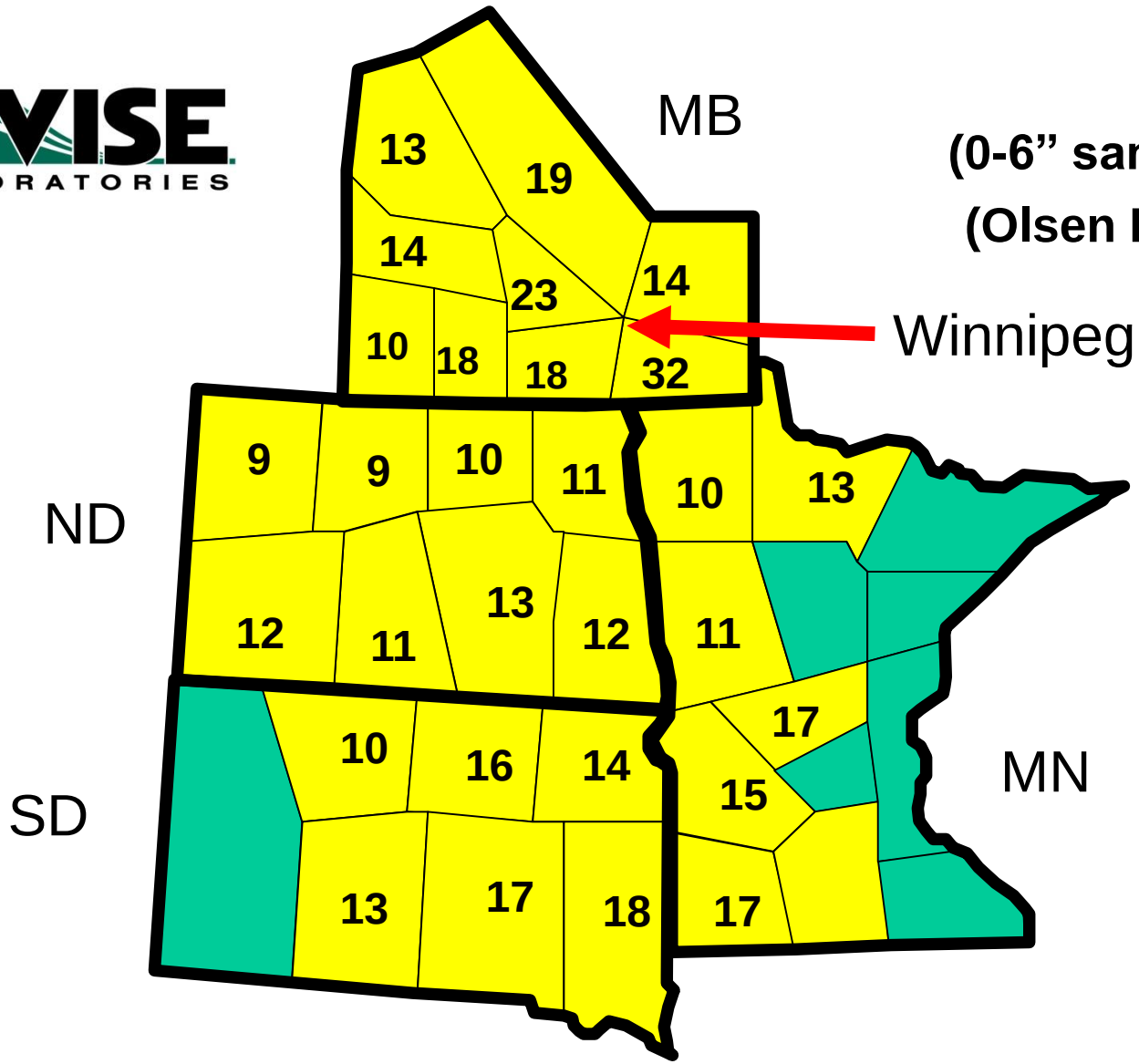
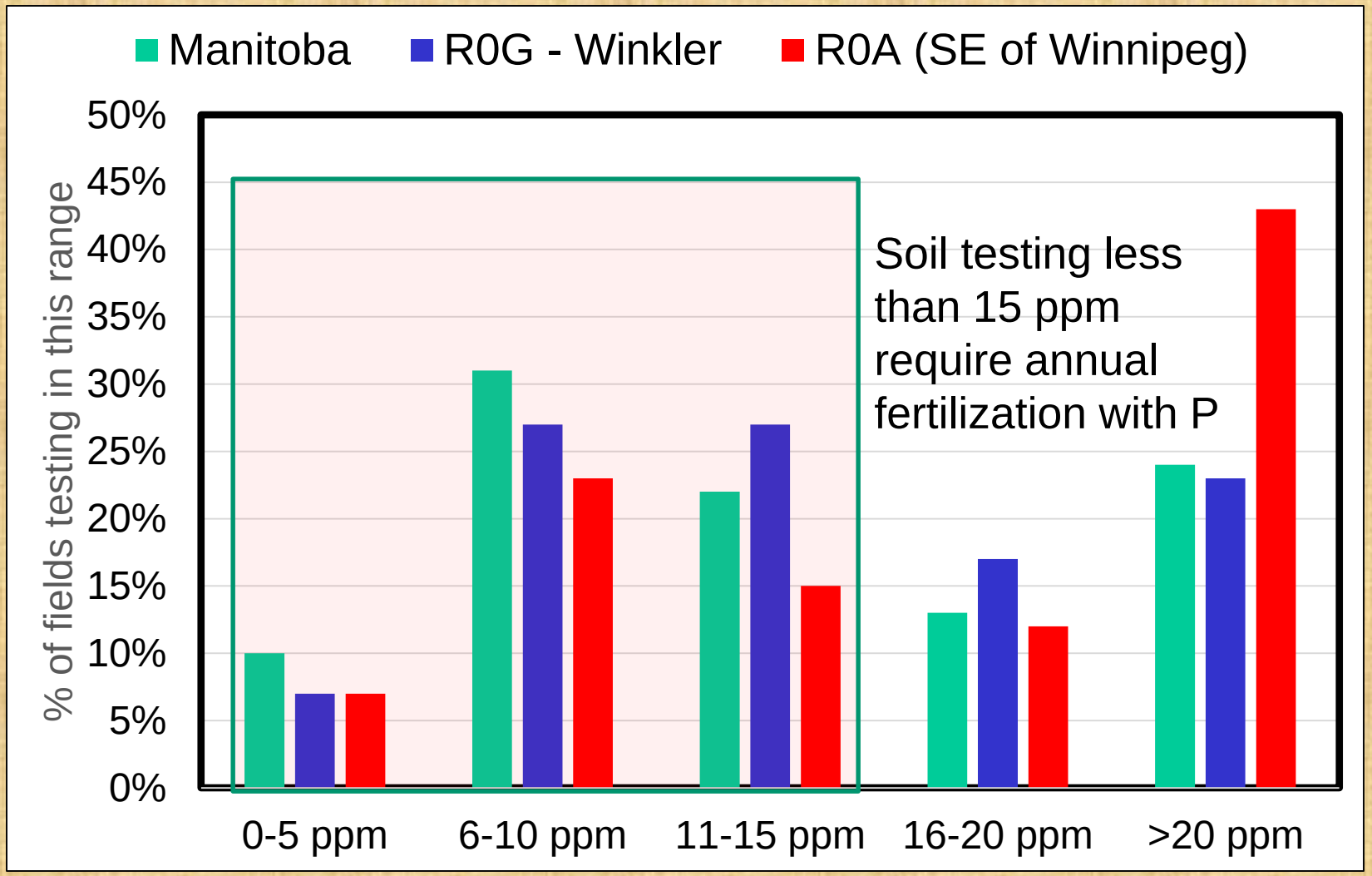
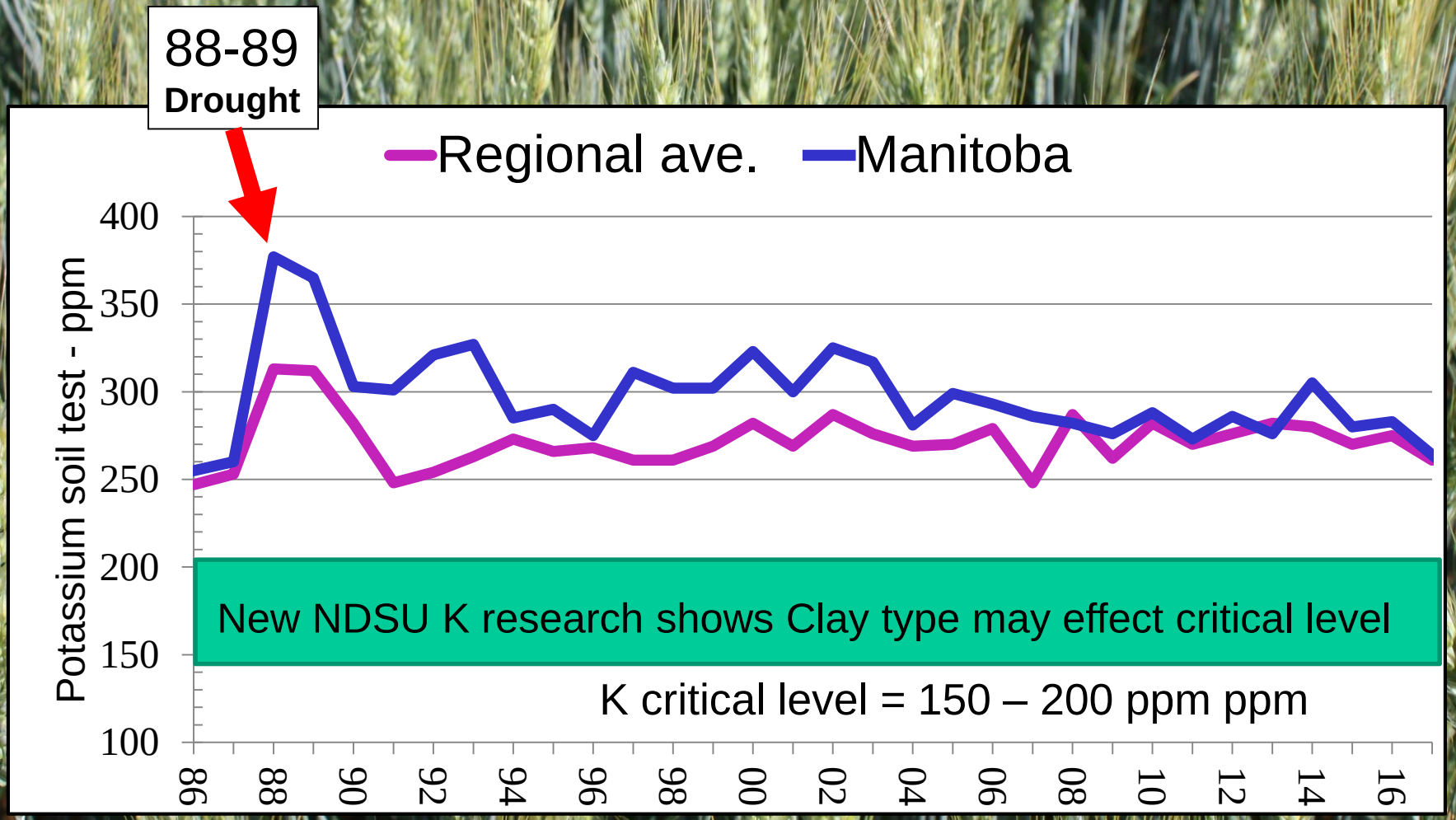


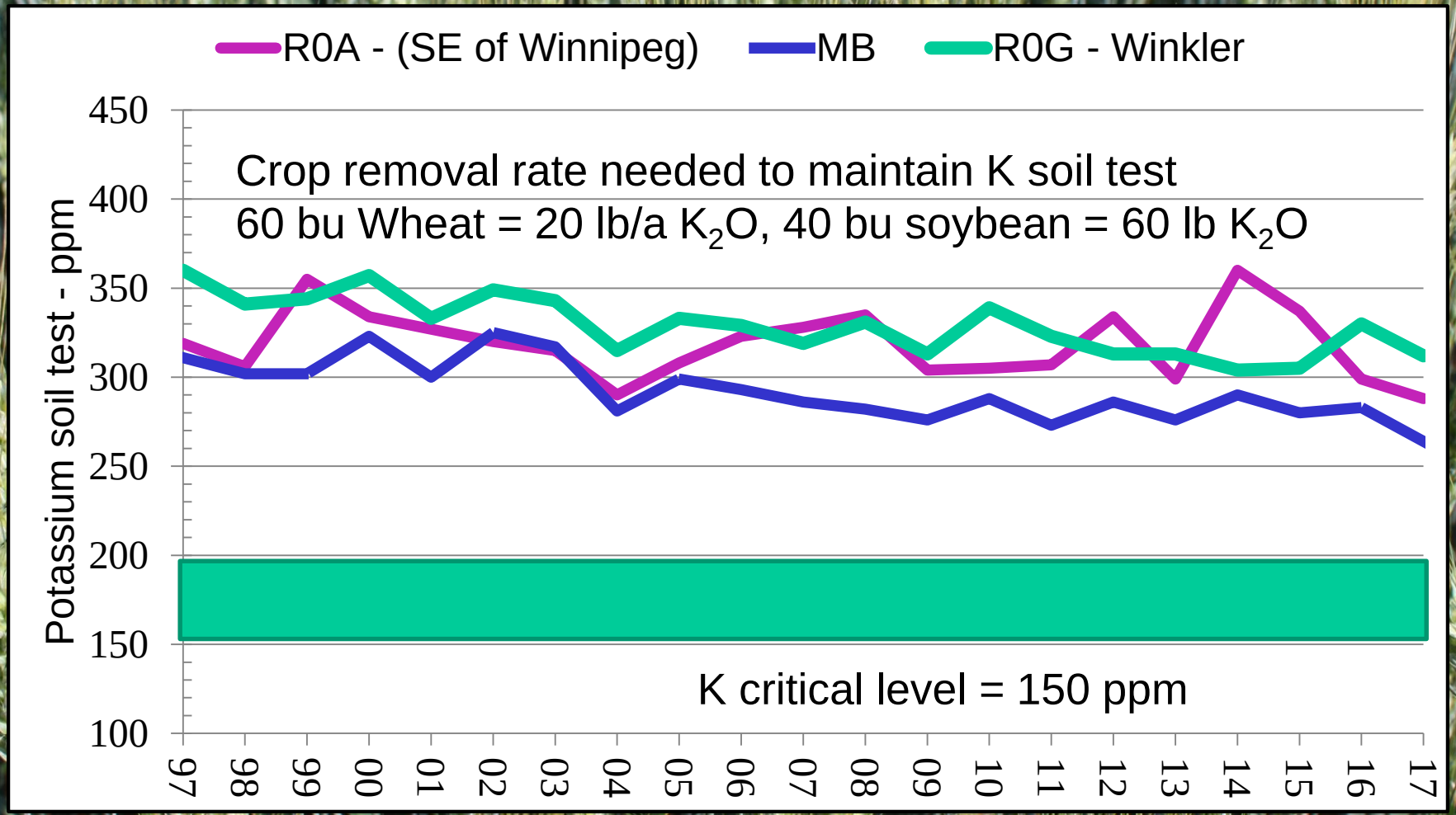
% samples in P Test Categories Wheat fields – Fall 2017



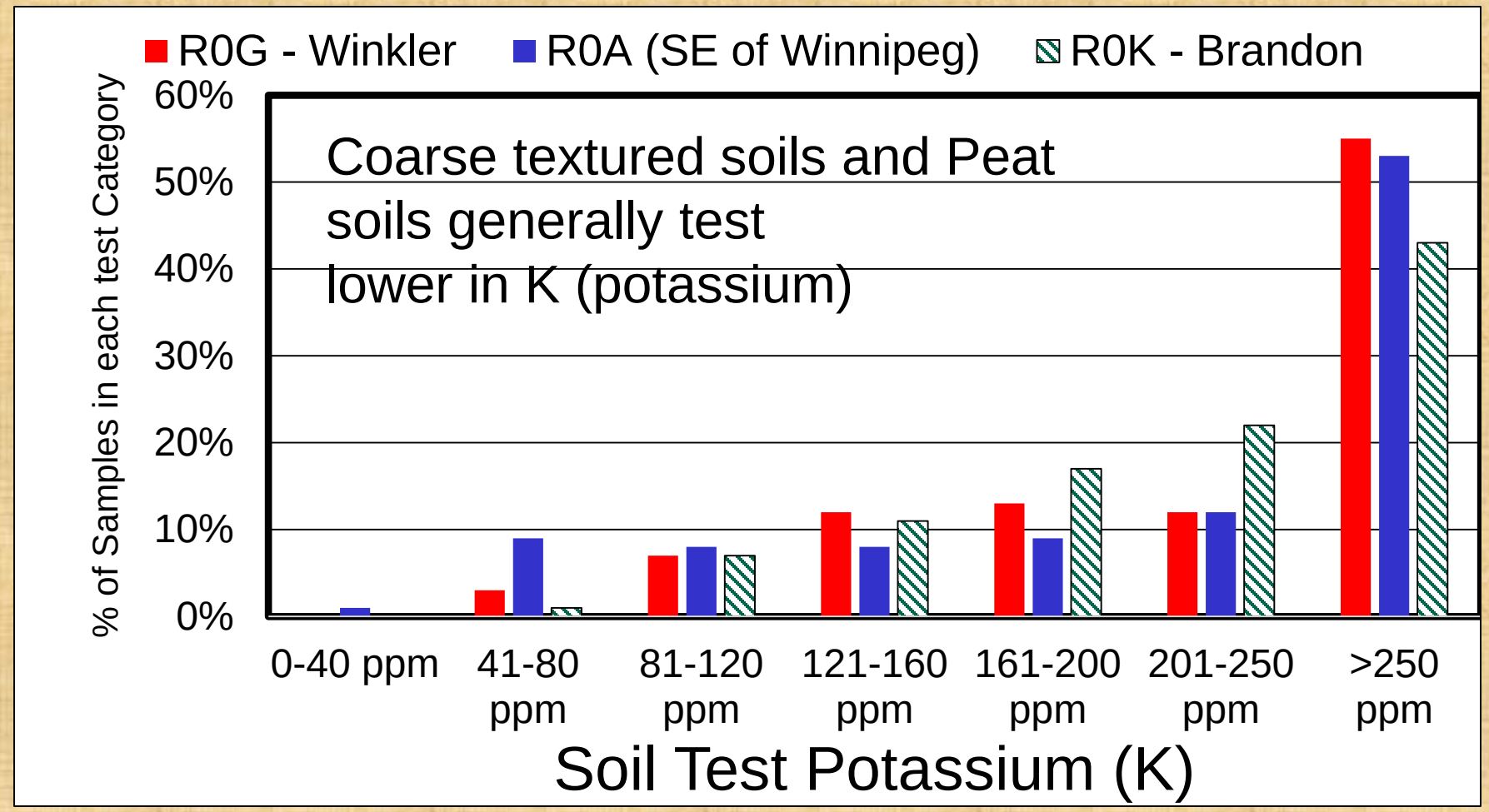
Soil Potassium (K) Test Trend
Ave. K test 1986-2017



Soil Potassium (K) Test Trend
R0A and R0G 1986-2017



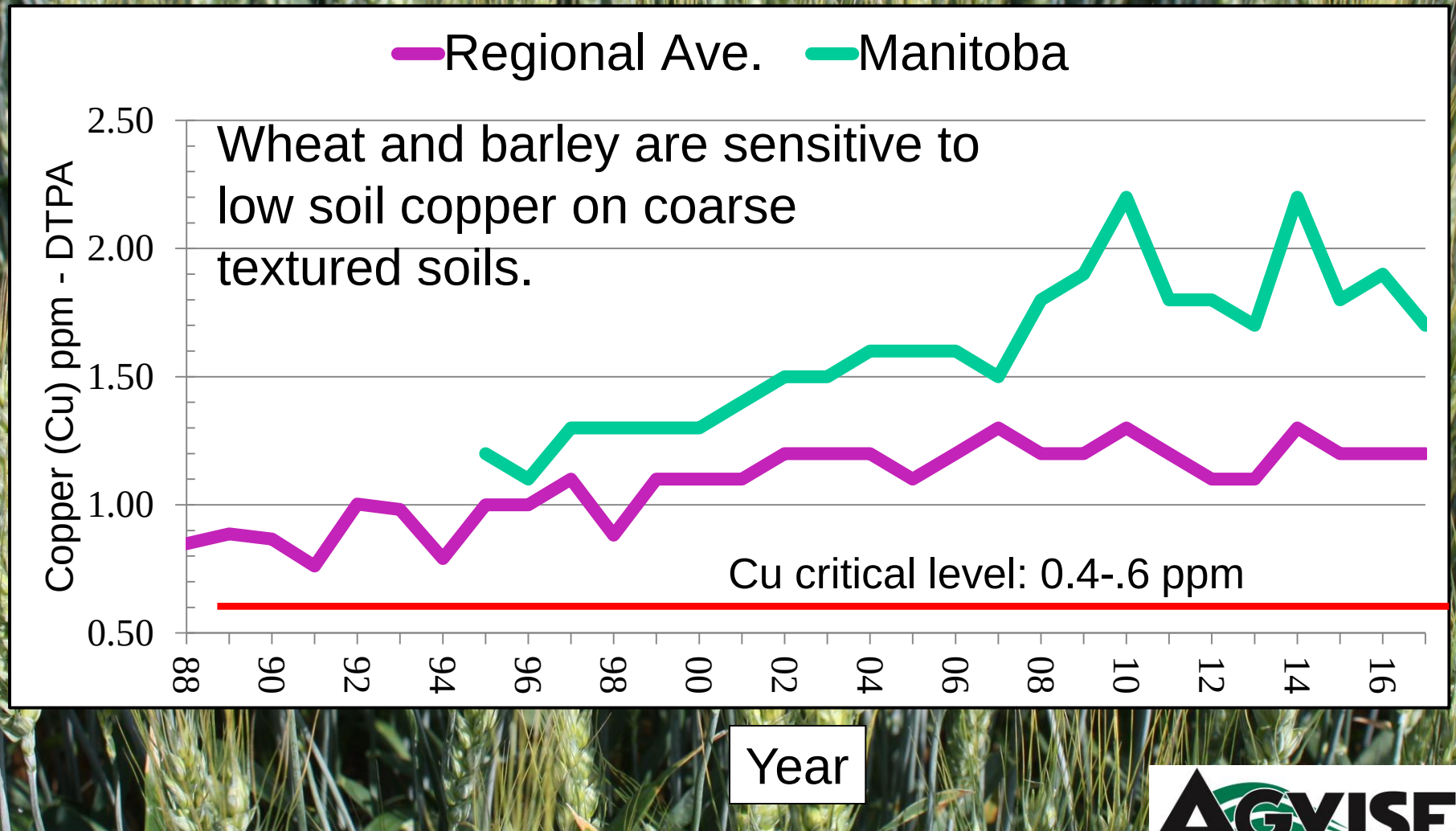
% samples in K Test Categories Wheat fields – Fall 2017



Trends in Soil Test Levels in Manitoba

- Micronutrients
  - –Copper
  - –Zinc
  - –Chloride

Soil Copper (Cu) Test Trend 1988-2017



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% Soil Samples with Copper less than 0.5 ppm

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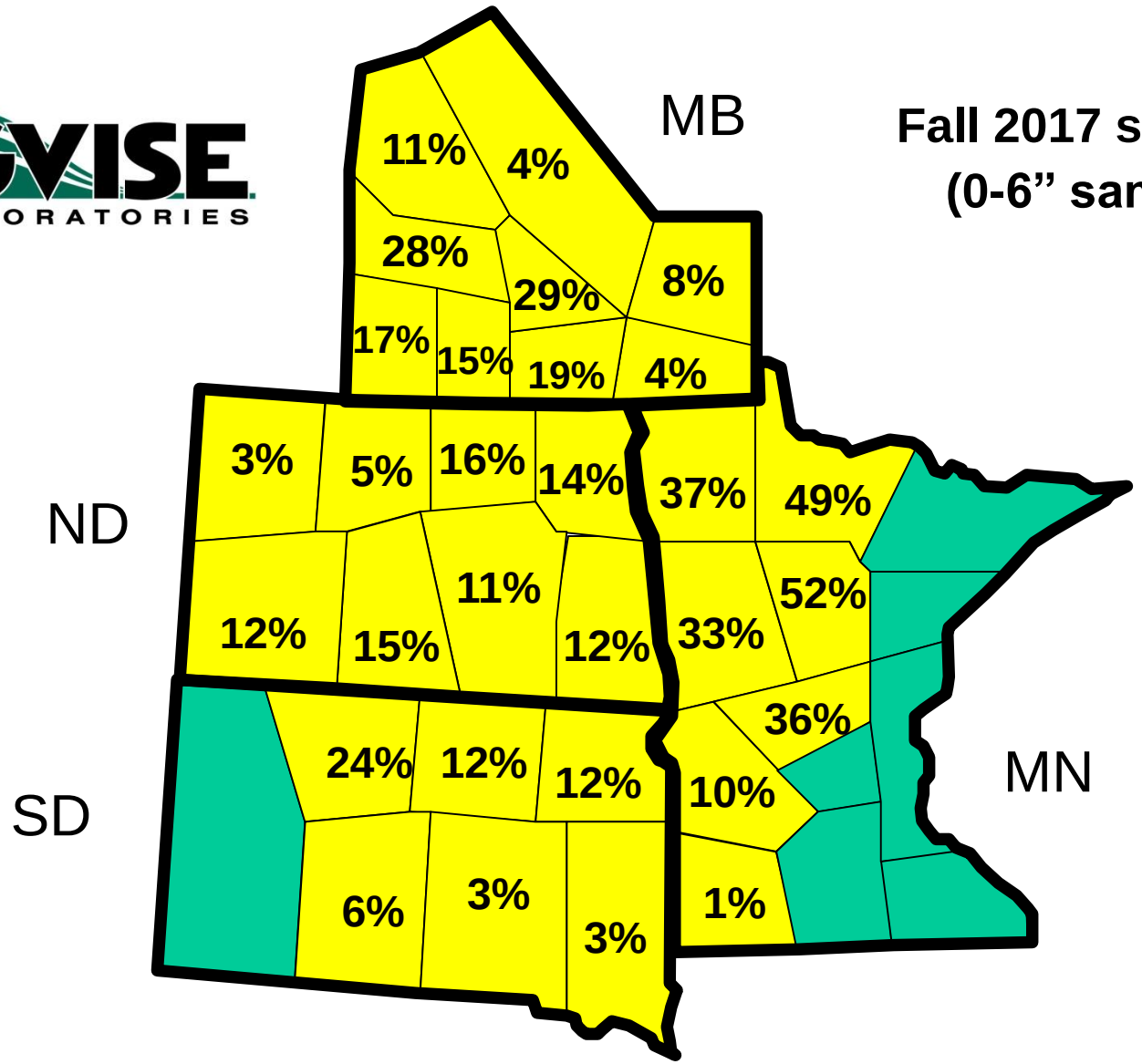
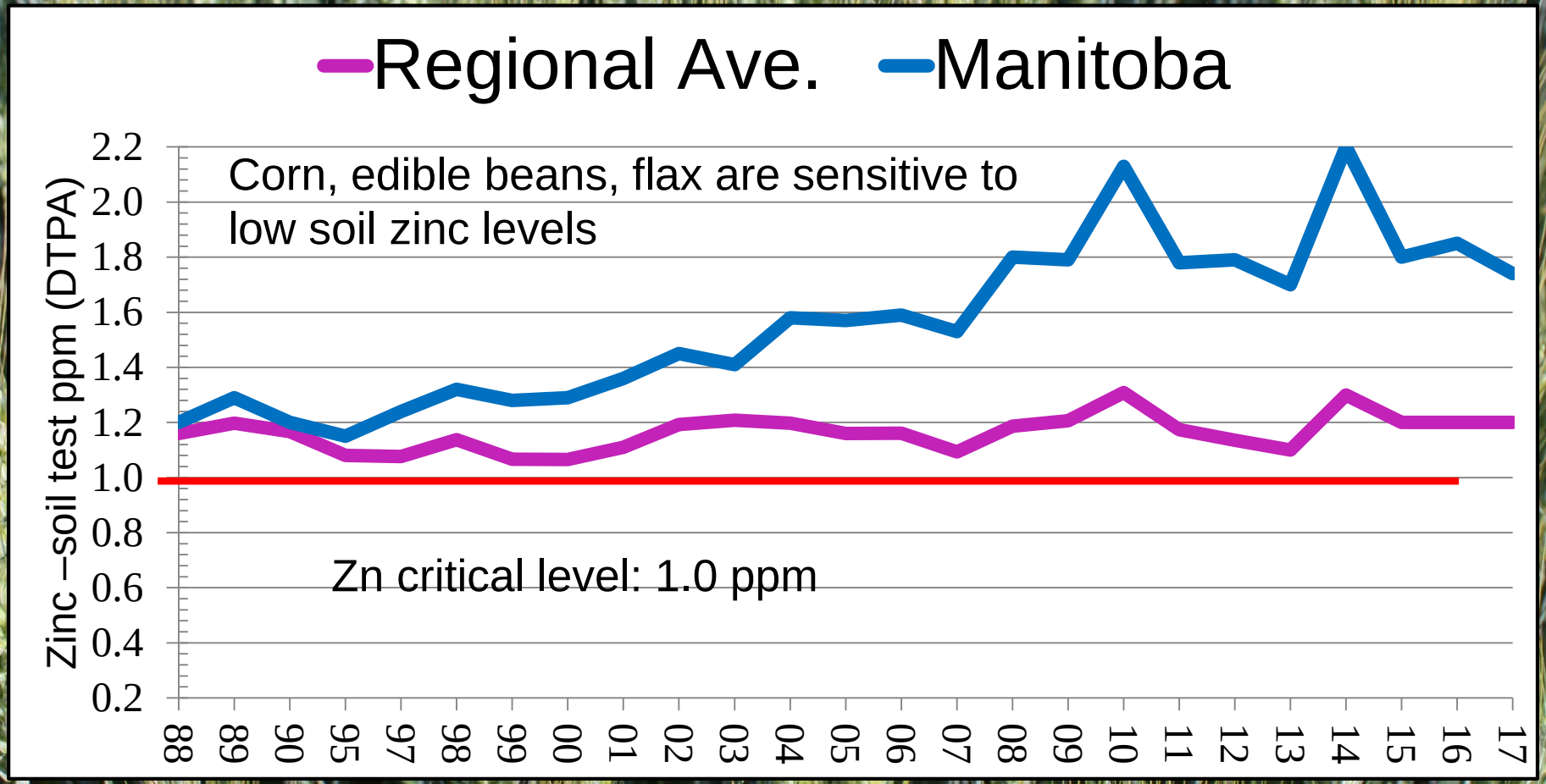
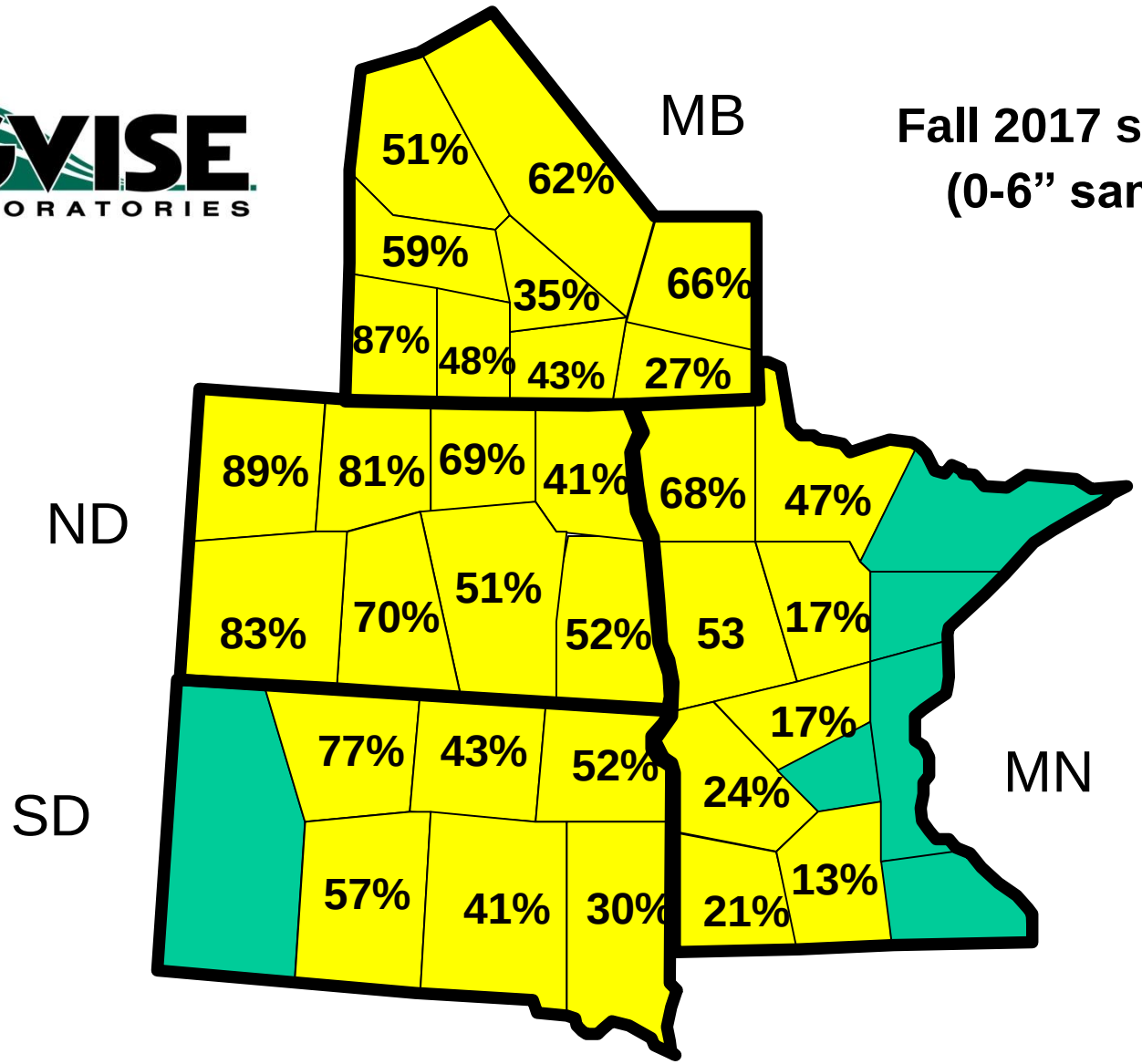


Fall 2017 samples
(0-6” samples)

Soil Zinc (Zn) Test Trend 1988-2017



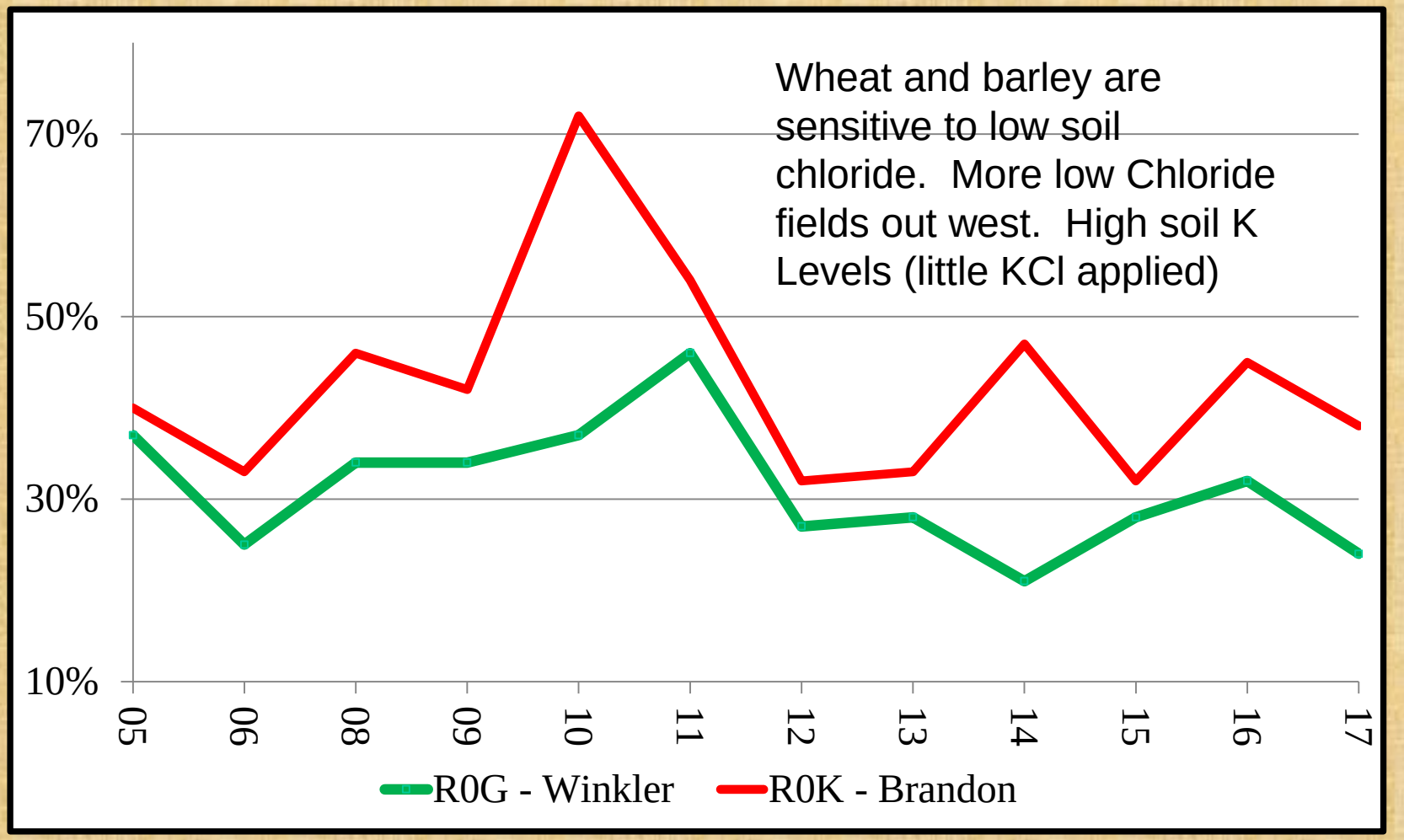
% Soil Samples with Zinc less than 1.0 ppm



Fall 2017 samples
(0-6” samples)

Chloride Soil Test Trends

%Samples Testing lower than 40 lb/a in 0-24”



*Missing 2007 data – Chloride testing lost fall 2017 Northwood tornado

% Soil Samples with Chloride less than 40 lb/a

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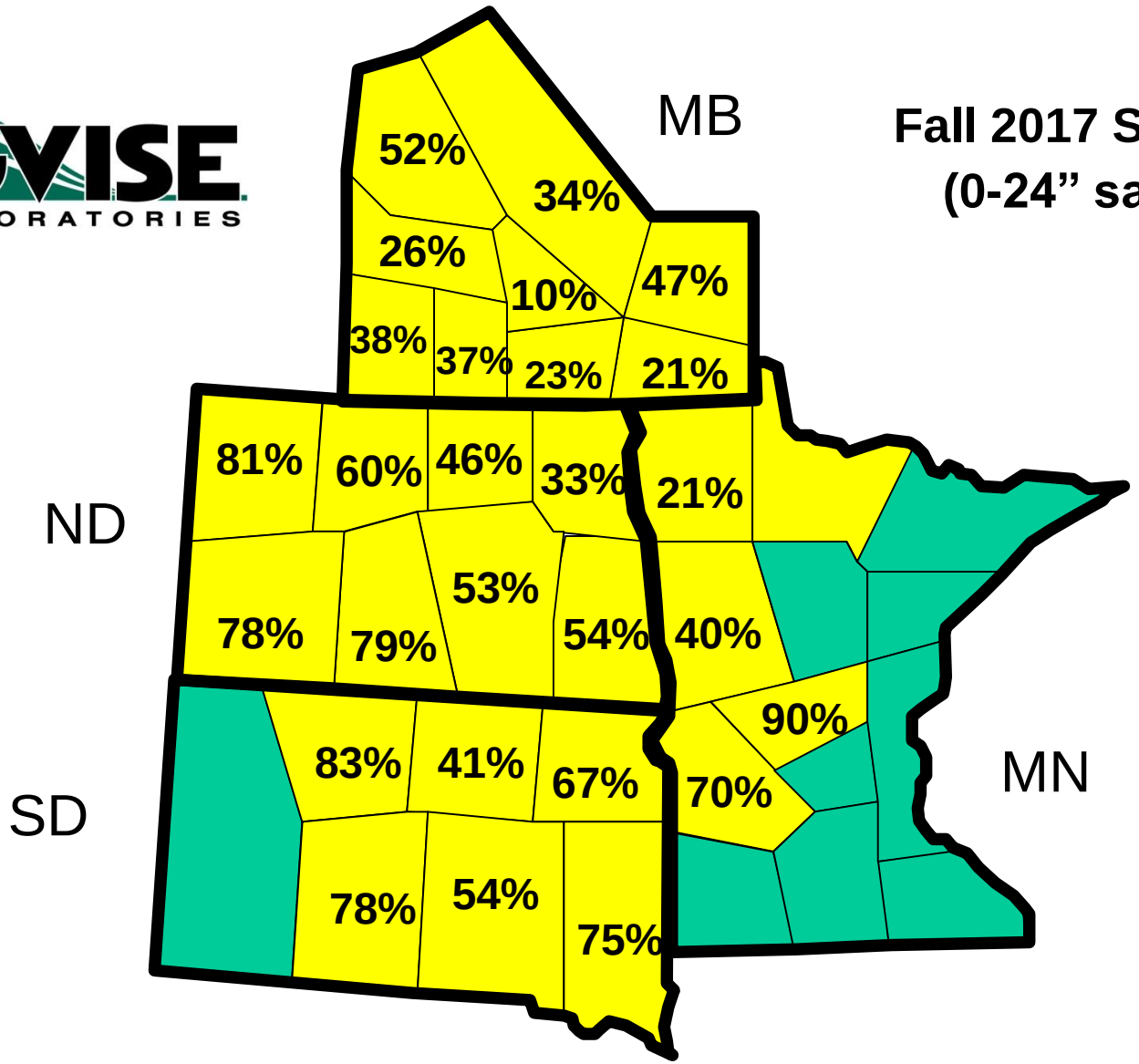
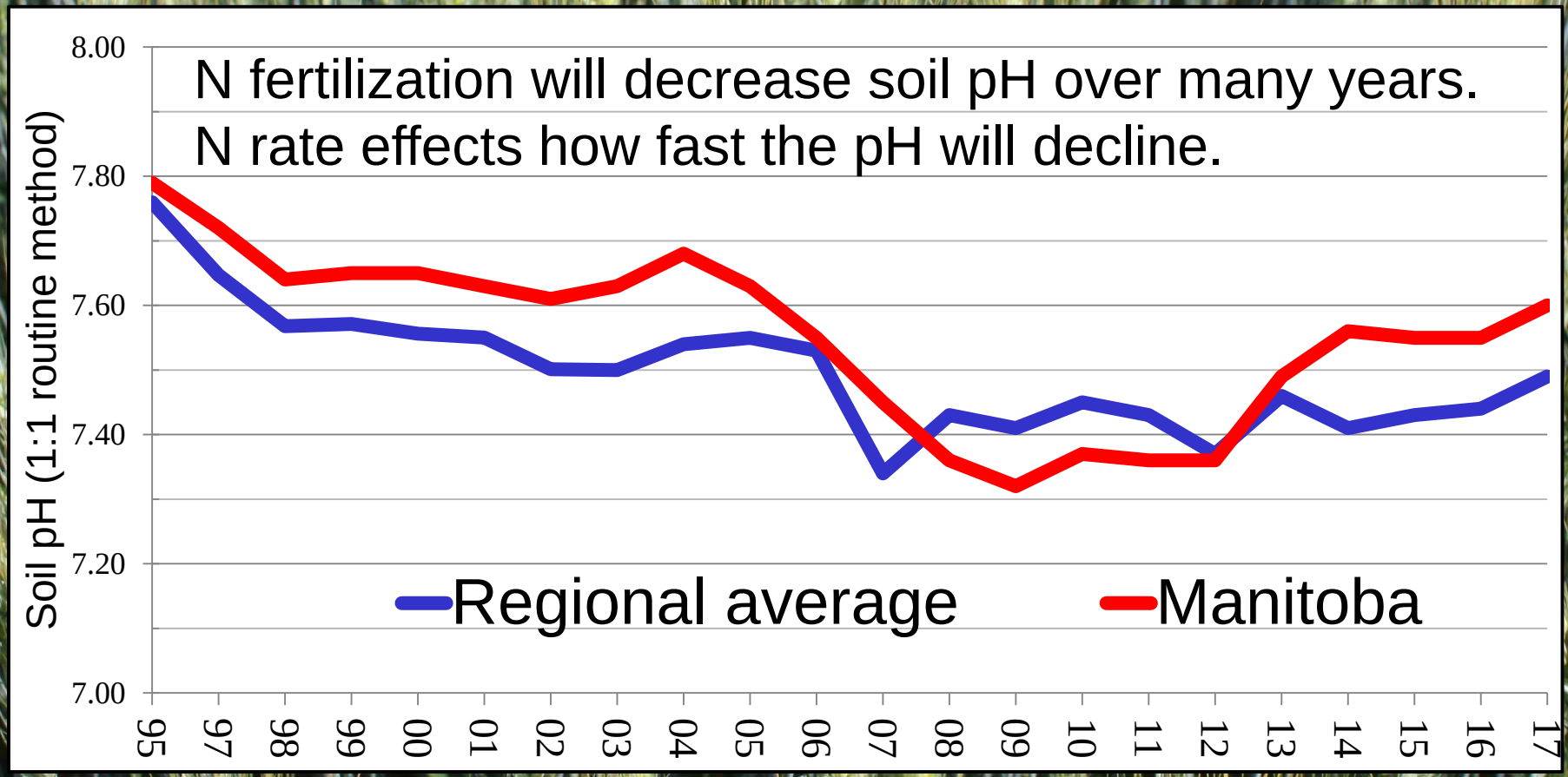


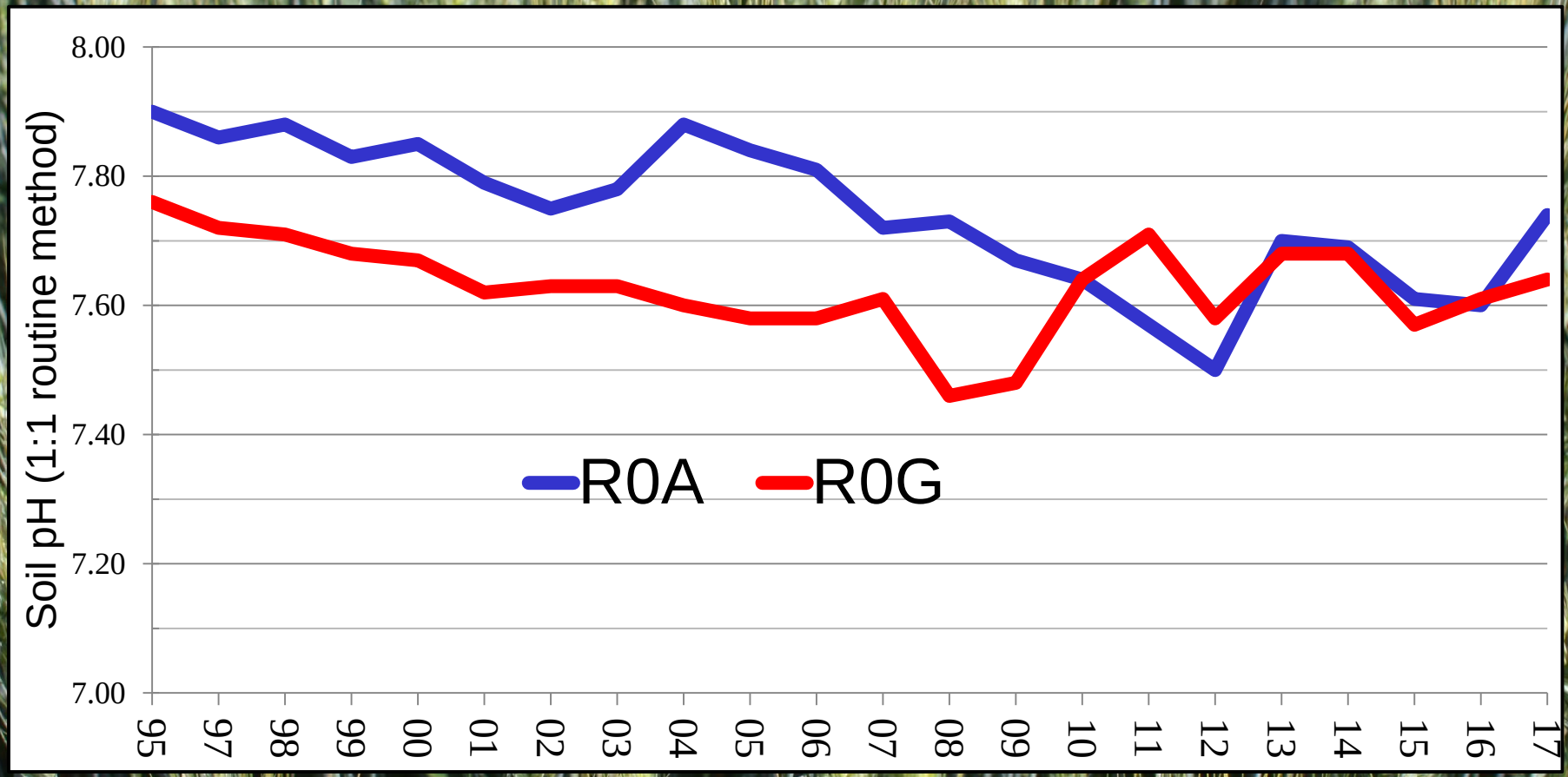
Trends in Soil Test Levels in Manitoba

- Soil Properties
  - –Soil pH
  - –Salinity (salts, e.c same)

Soil pH Trend (0-6”) 1995-2017



Soil pH Trend (0-6”)
R0A and R0G 1995-2017



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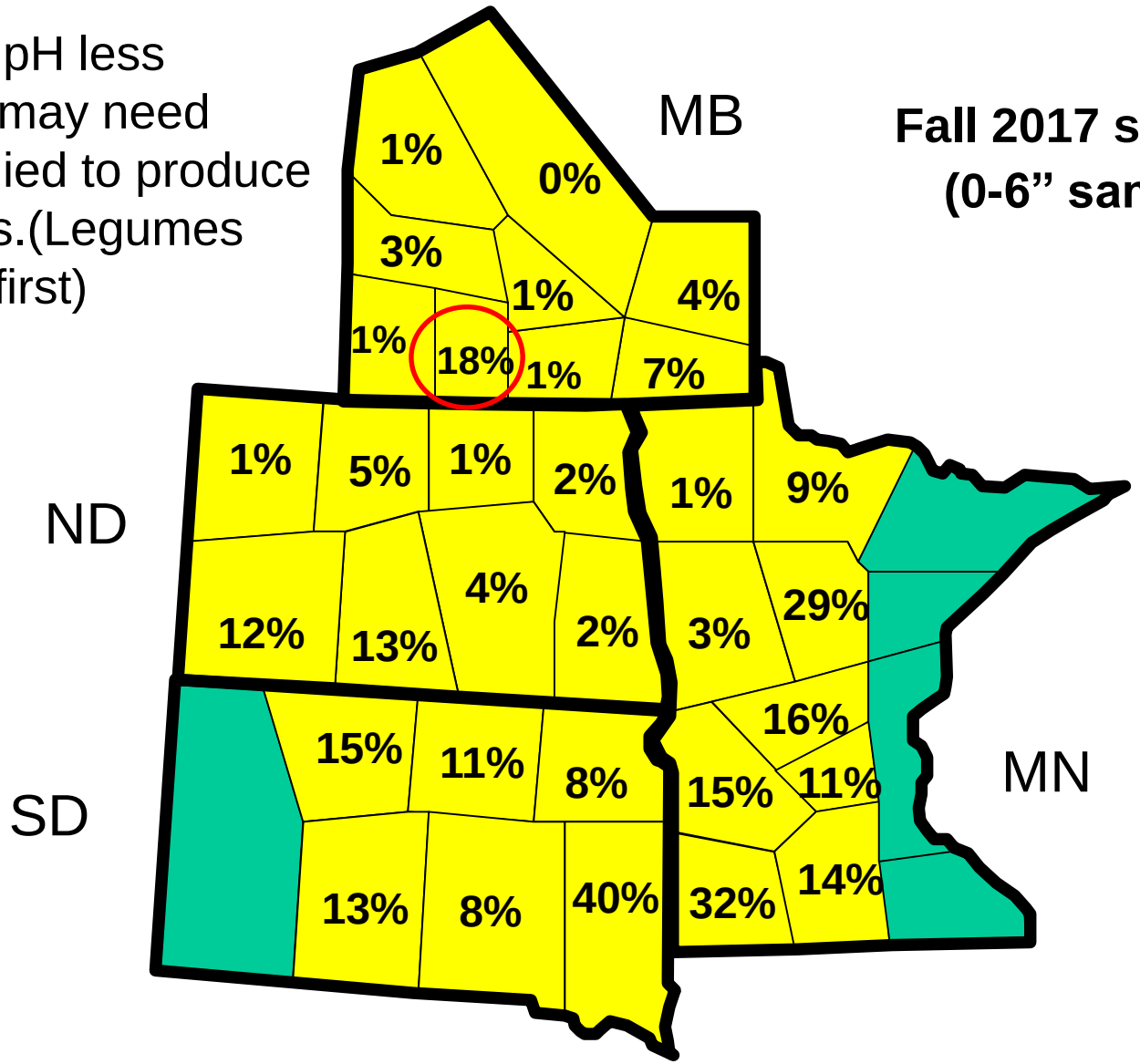
% Soil Samples with Soil pH less than 6.0

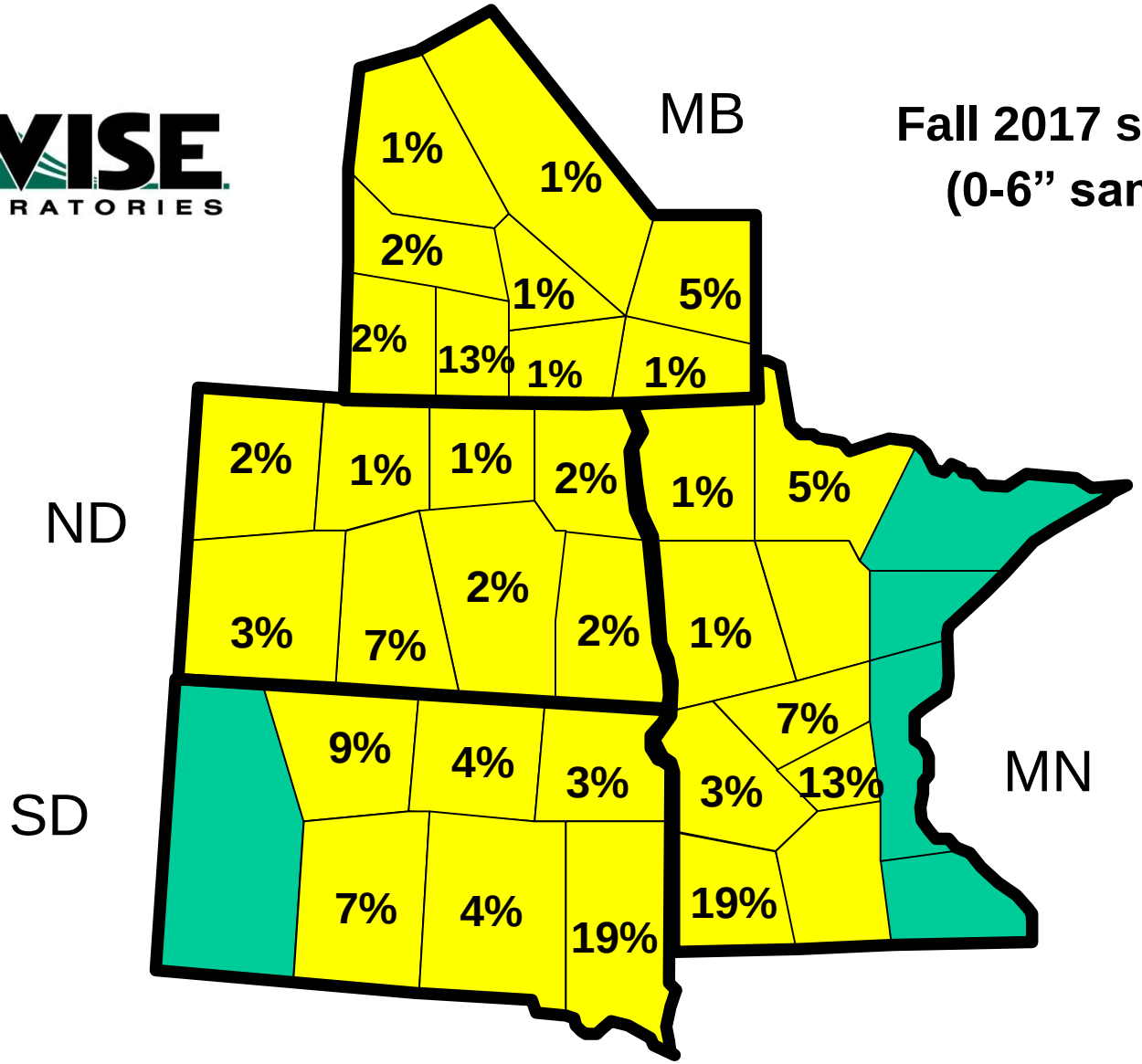
Soil with pH less than 6.0 may need lime applied to produce top yields.(Legumes affected first)

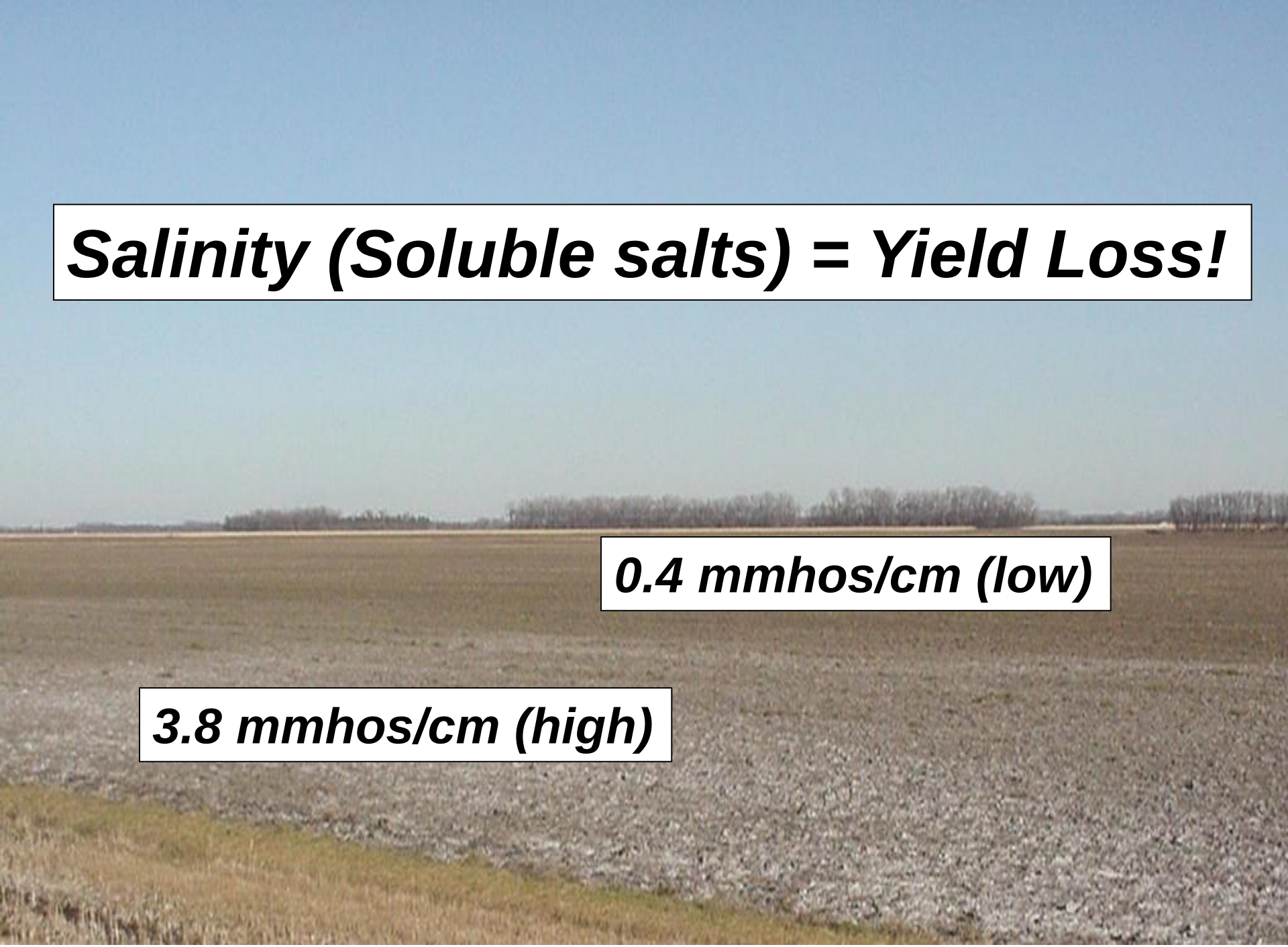


Fall 2017 samples (0-6” samples)

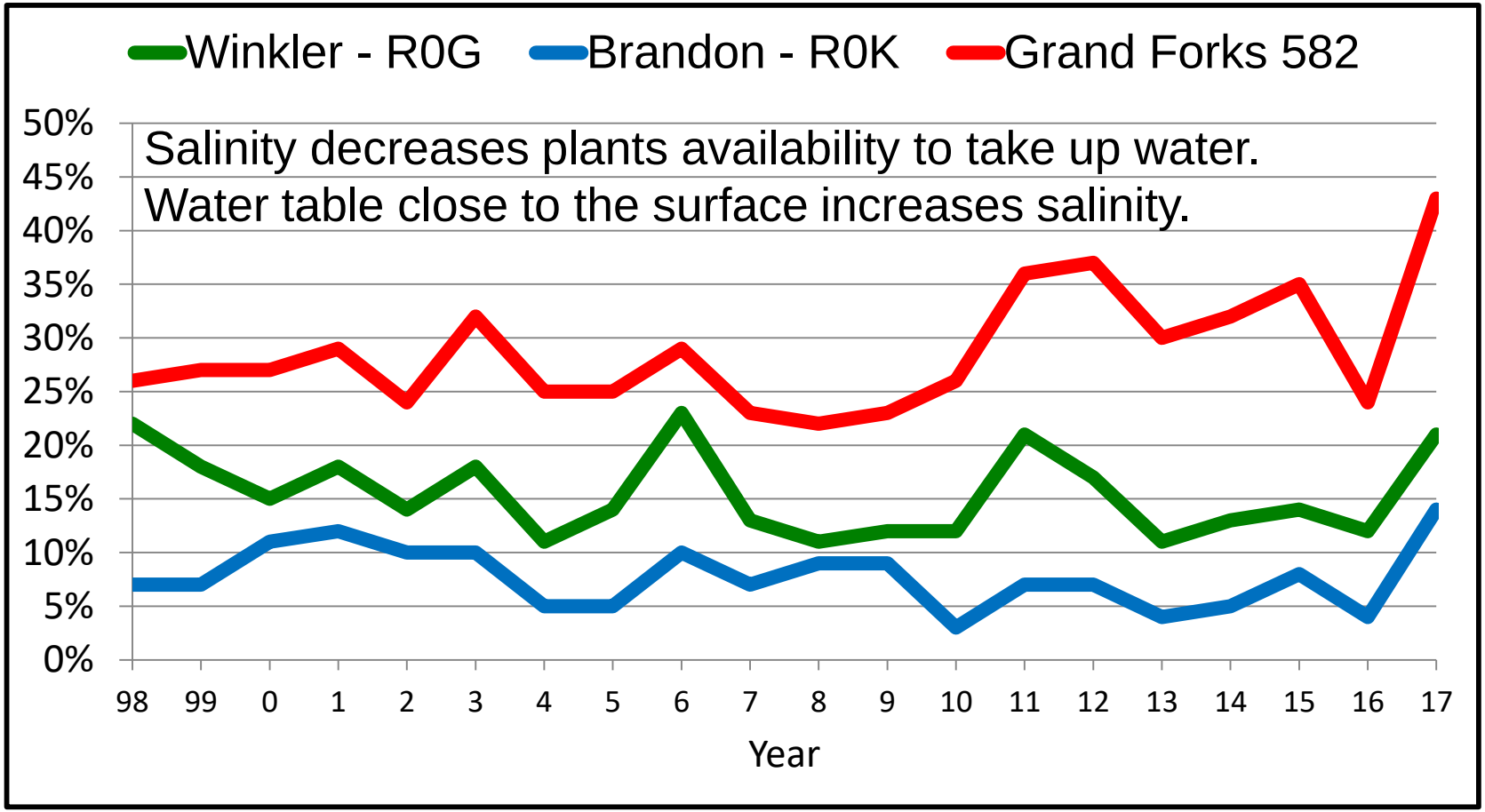
% Subsoil Samples with pH less than 7.0

If subsoil pH is higher than 7.0 yield response to lime is unlikely




Salinity (Soluble salts) = Yield Loss!
0.4 mmhos/cm (low)
3.8 mmhos/cm (high)

Manitoba - % Samples Testing with Salts greater than 1.0



1:1 routine salt method – expressed as mmhos/cm

% Soil Samples with Salts greater than 1.0

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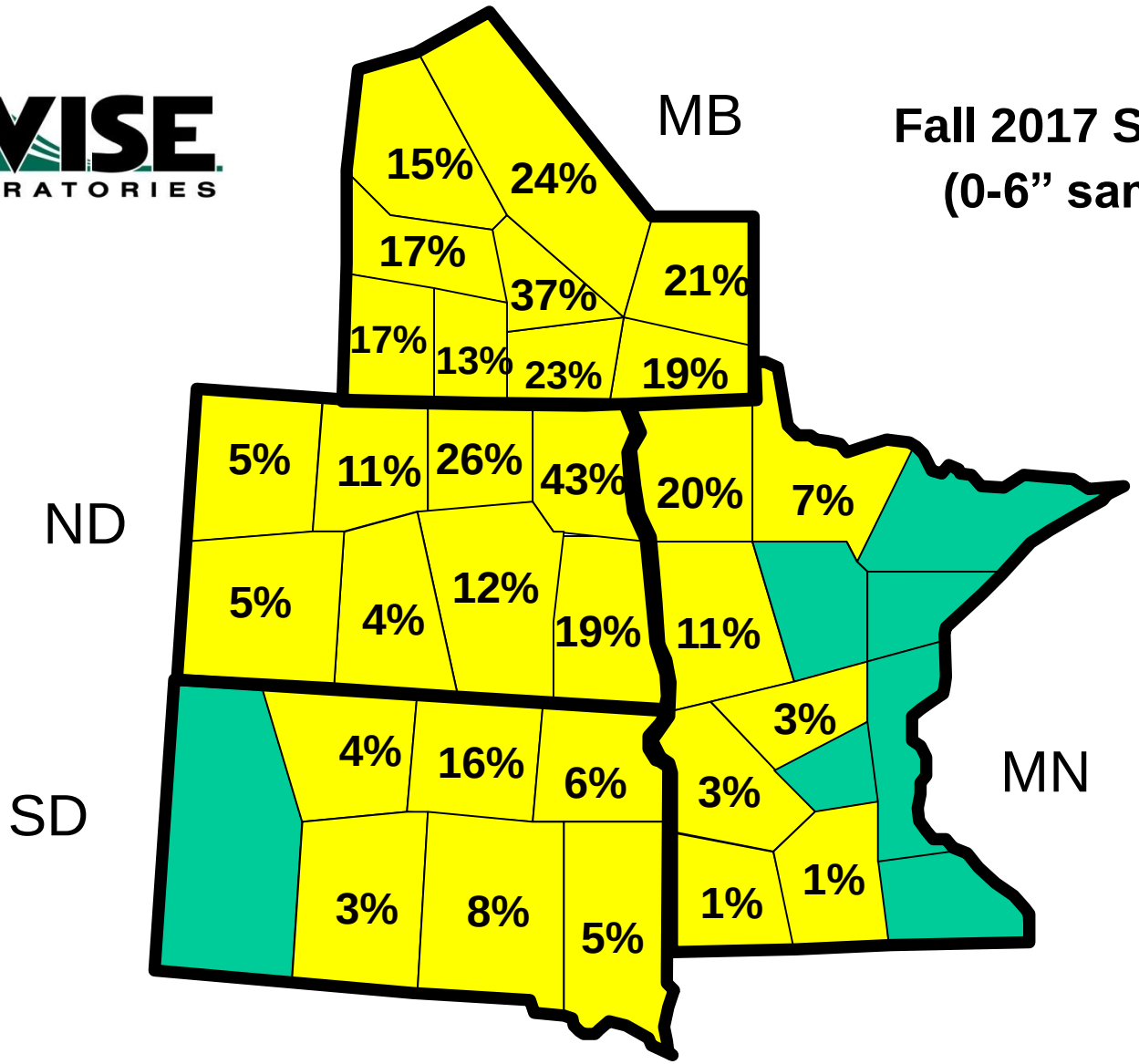
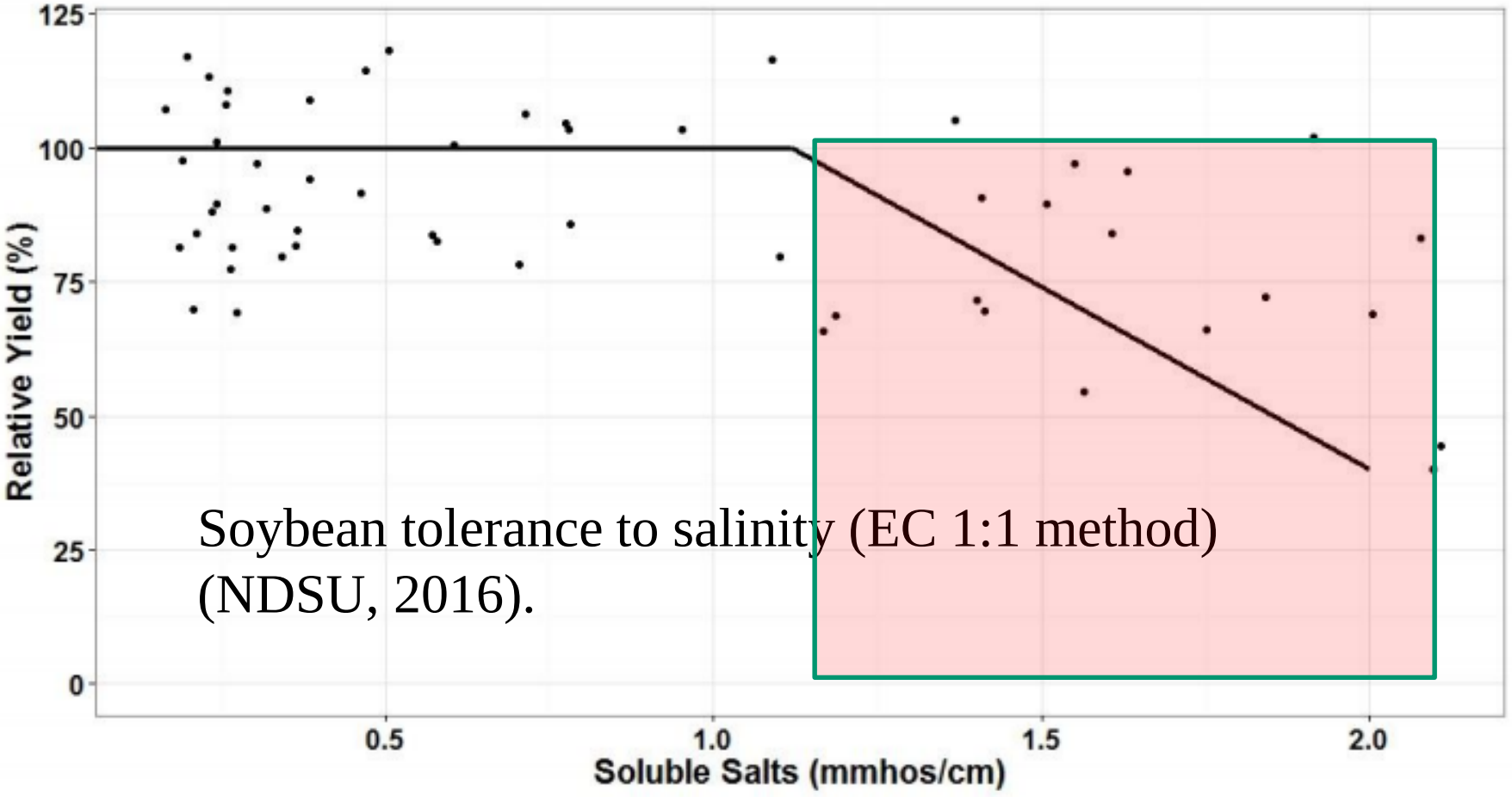


Fall 2017 Samples
(0-6” samples)

High Salinity Reduces Soybean Yield



Soybean tolerance to salinity (EC 1:1 method) (NDSU, 2016).

Increasing Salinity in Manitoba?

- Why?
  - Wet years bring water table closer to the soil surface
  - Water wicks to surface through capillary action, evaporates and leaves salts on surface (white crust)
- What is Fix?
  - Use more water (corn, sunflowers, forages)
  - Surface drainage and tile drainage
  - Lower the water table!!!

Trends in Soil Nitrate Levels

- Residual Fall Nitrate
  - 0-24” (or deeper)
  - Need for deep sampling for nitrate is based on university research in Canada and the US for the past 35 years.
  - Wet and dry years on Prairies can have large impact on residual soil nitrate and greatly effect need for N fertilizer next year

Residual Nitrate Trends (0-24”)
(what’s left in the soil after harvest)

- Yield (high or low)
- Rate of N applied
- N losses to excessive rainfall
  - Leaching and Denitrification
- N mineralized by soil

  (warm moist season = more N mineralized)
- N losses to improper placement of fertilizer

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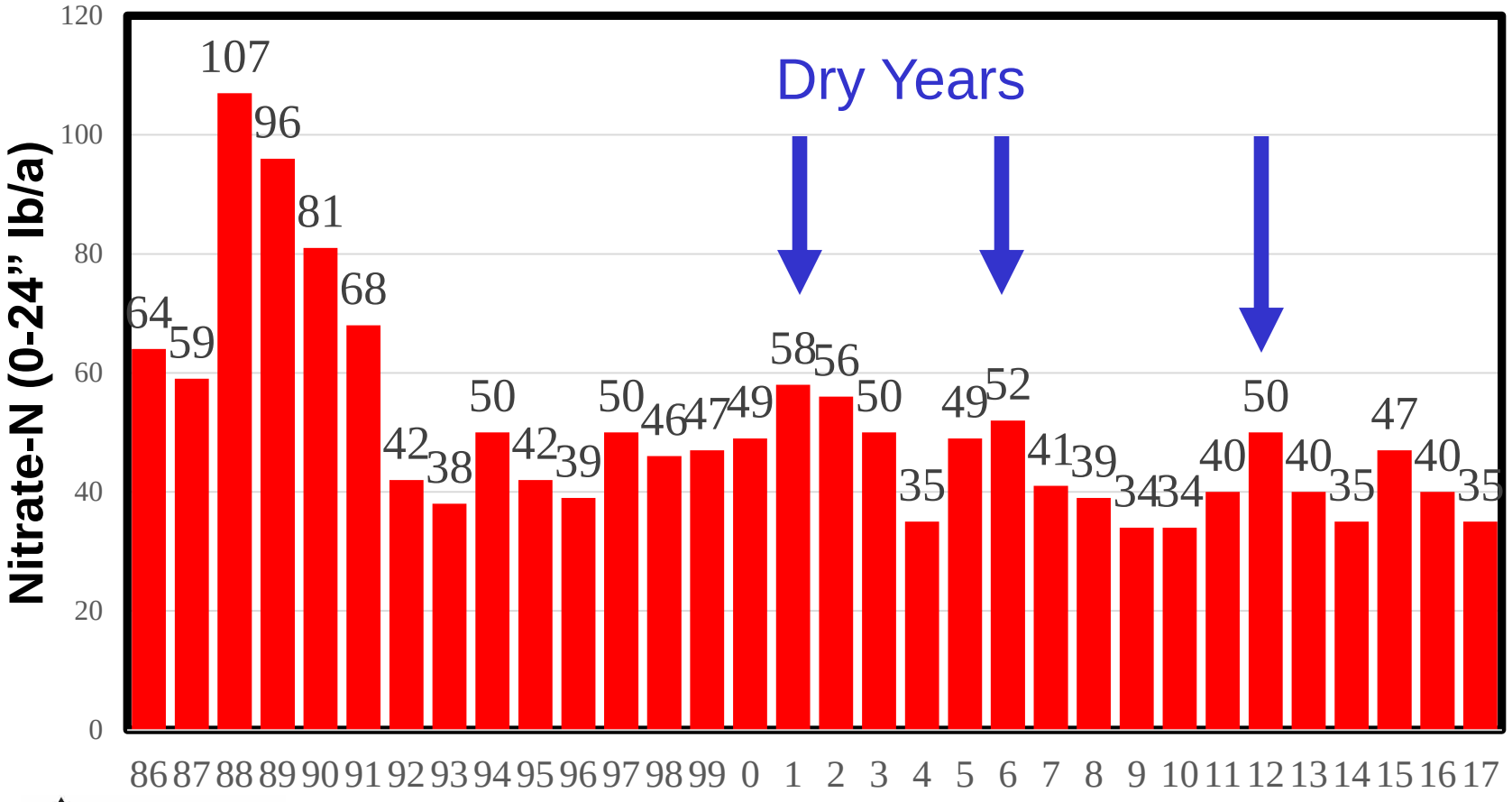
Average Soil Nitrate Following "Wheat" in Manitoba 1986 - 2017



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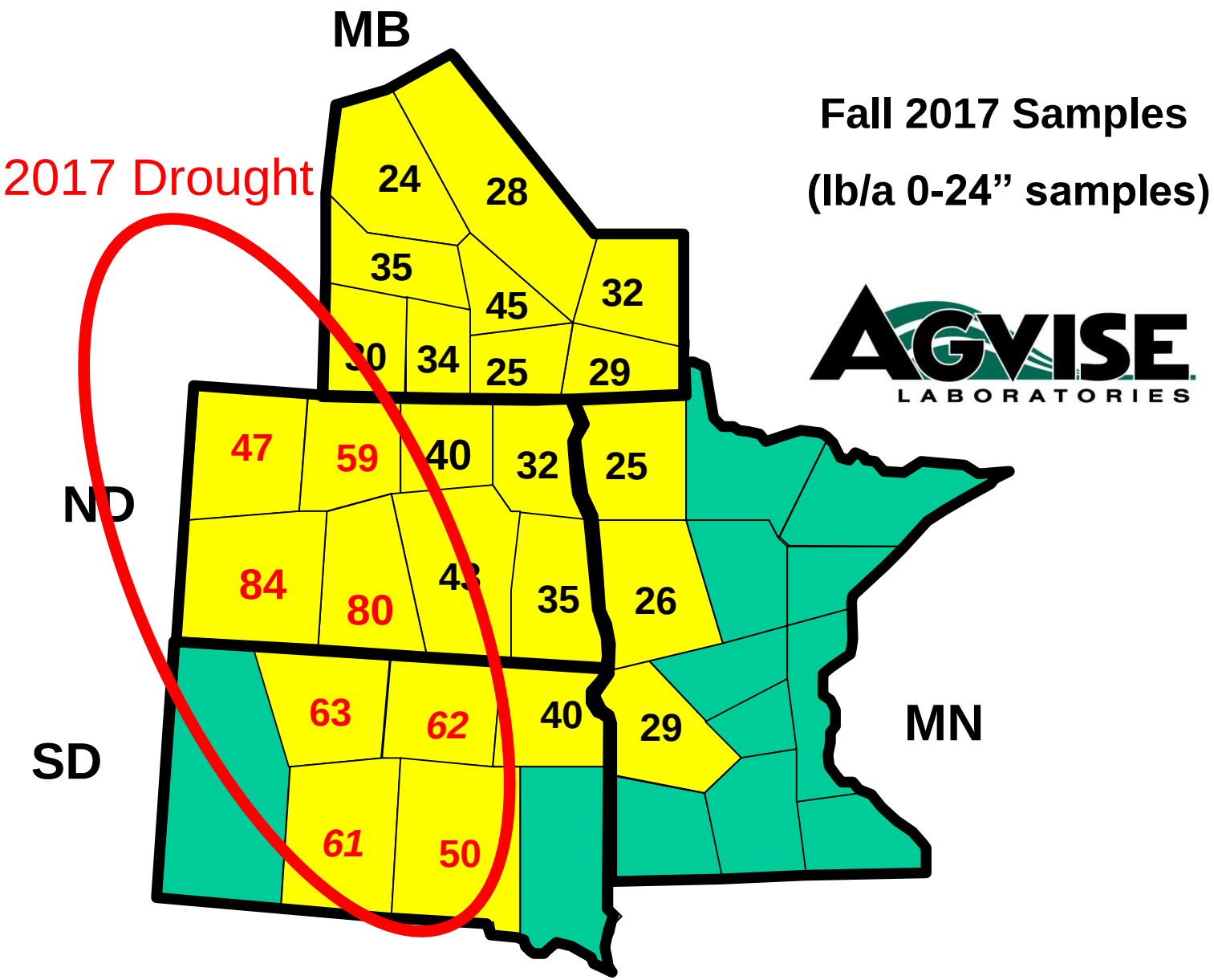
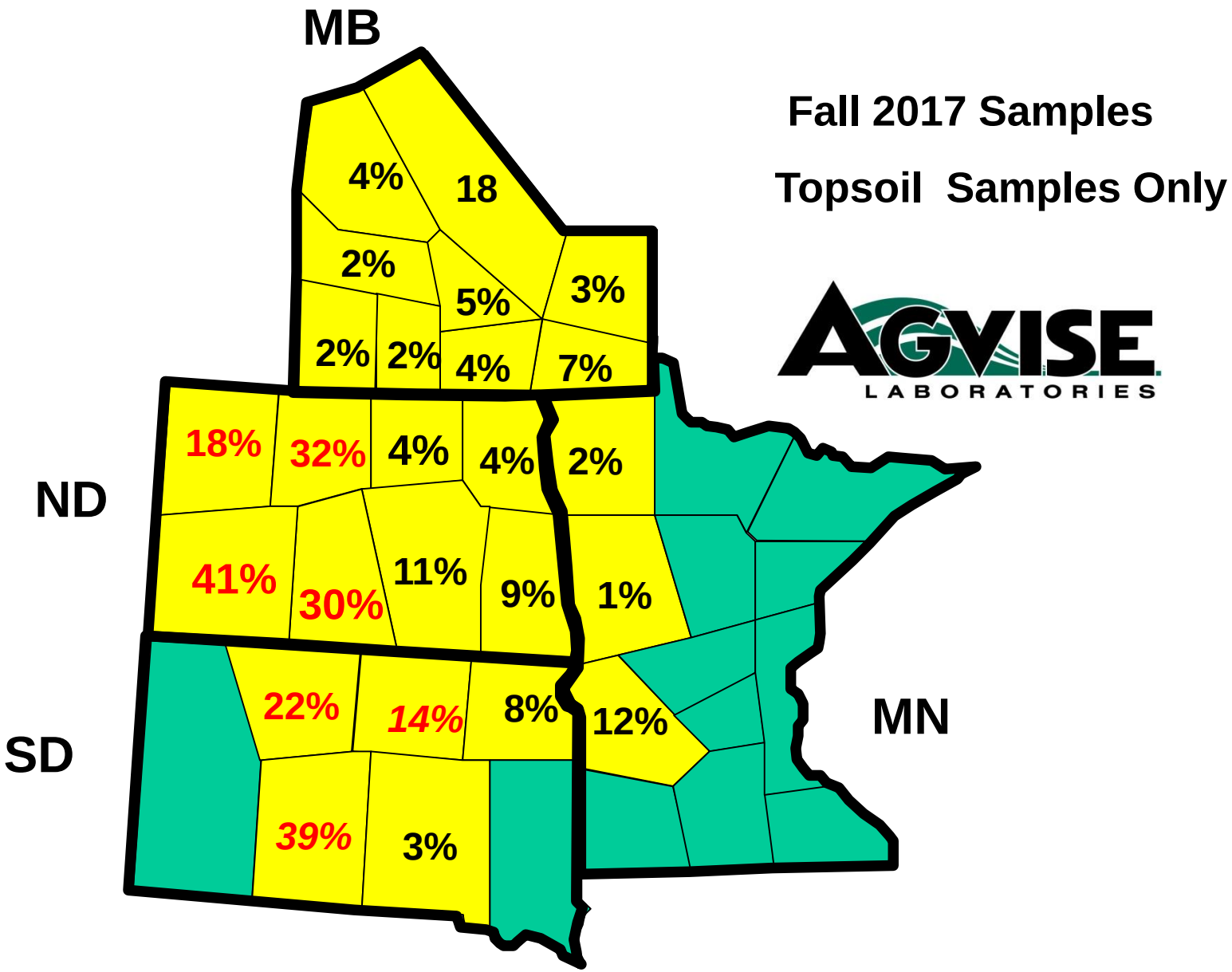
Median 0-24” Soil Nitrate following Wheat in 2017



% of samples with topsoil >40 lb/a (following wheat)



Fall 2017 Samples

Topsoil Samples Only

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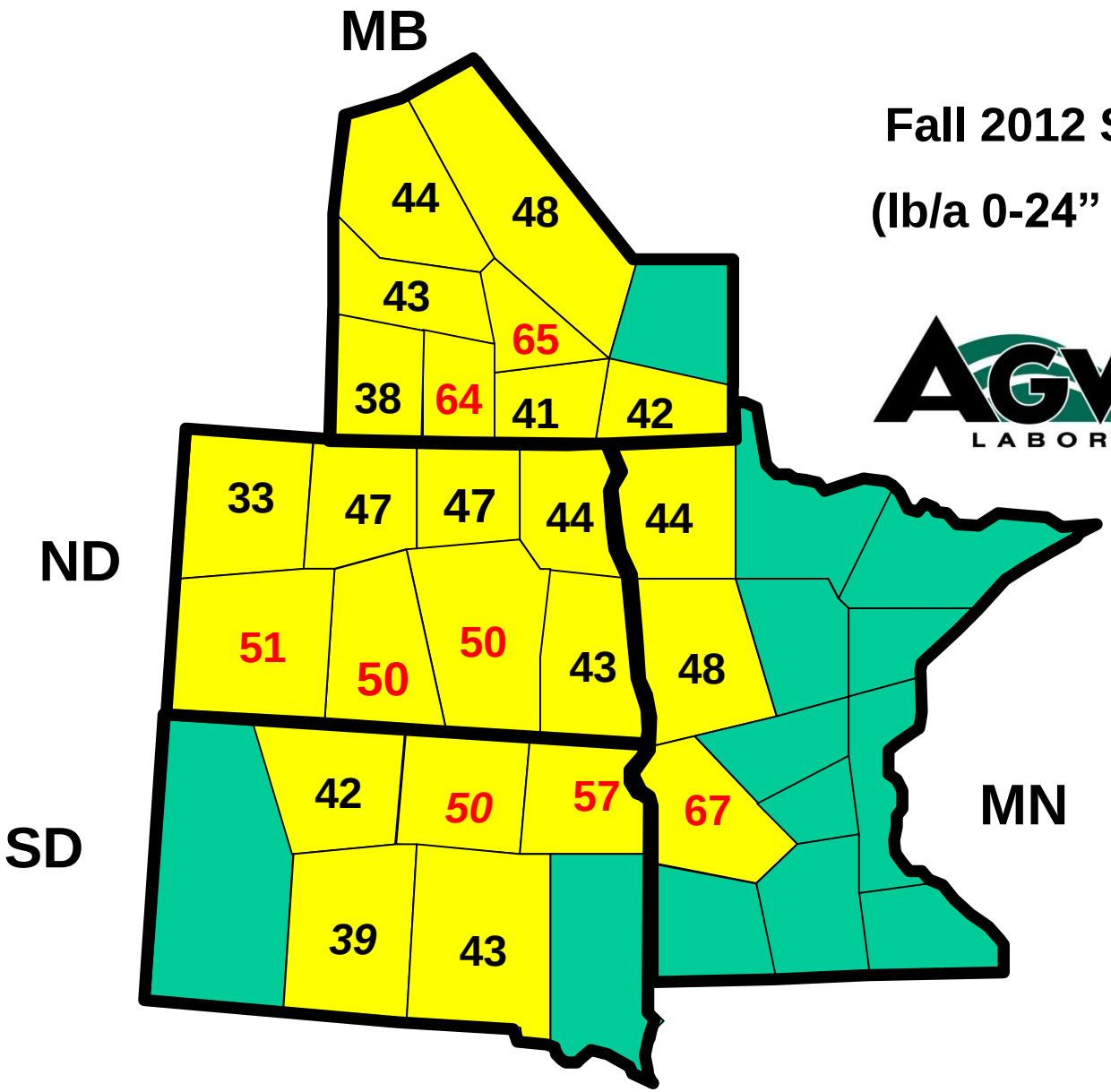
Average Soil Nitrate following Wheat in 2012



Fall 2012 Samples

(lb/a 0-24” samples)

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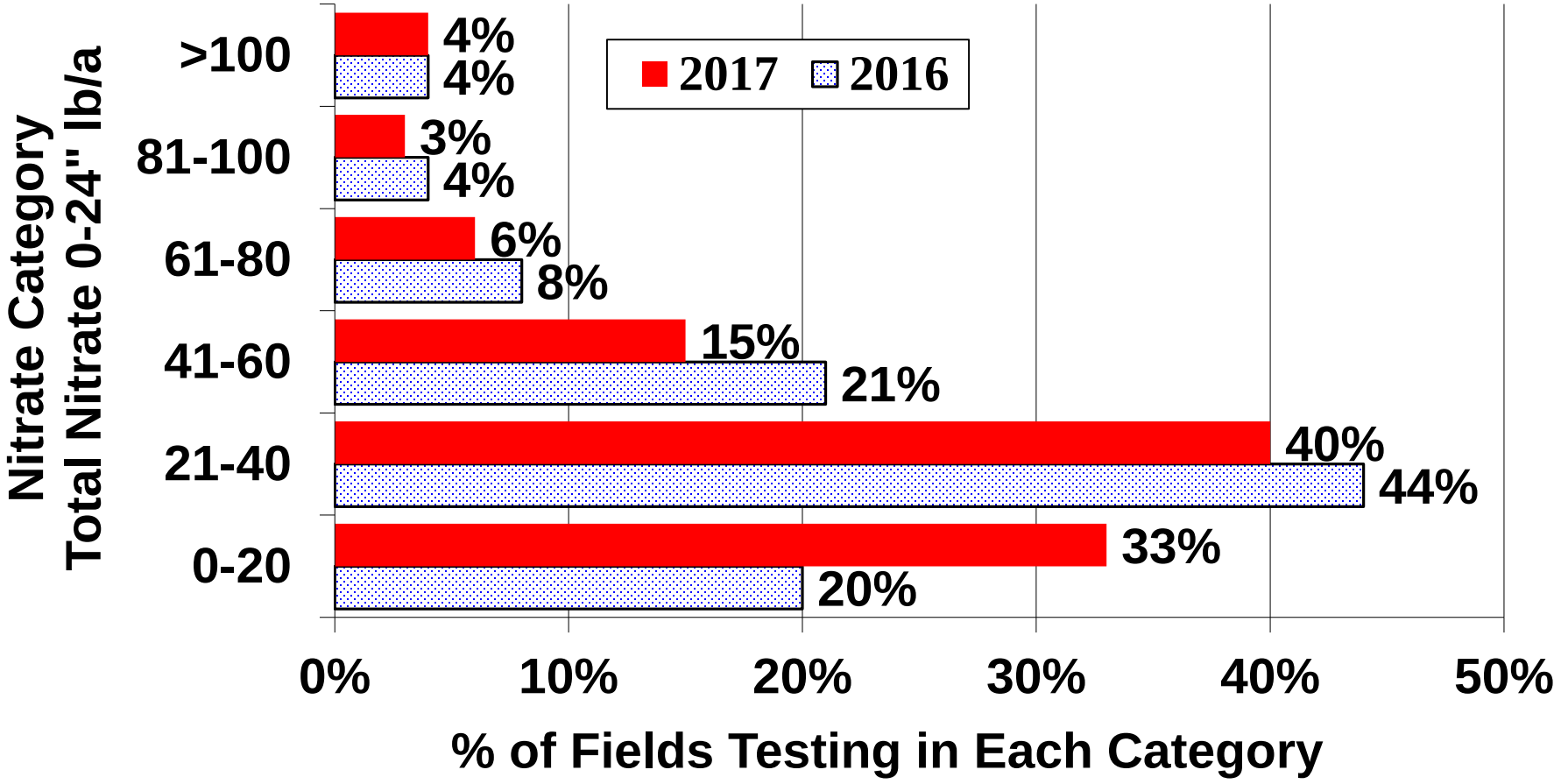
Soil Nitrate Variability Between Fields

Following "Wheat" in Manitoba 2016 & 2017



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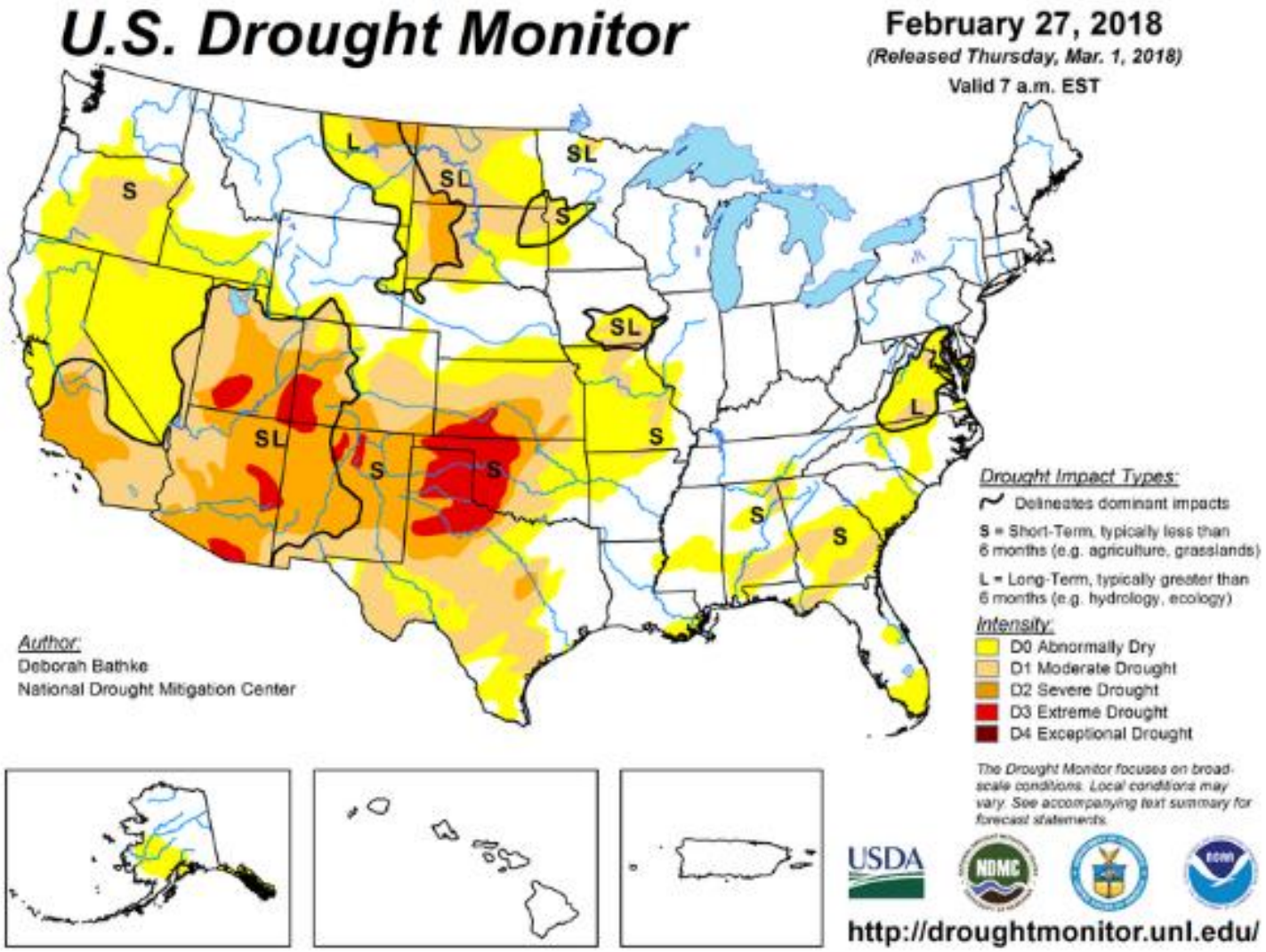
"Good Yields" - High Nitrate in Topsoil?

- Topsoil Got Dry early- Fewer active roots in topsoil
- Crop rooted deep to find water (found water and some N too below 24")
- Rooting maybe down to 4-5 feet!
- Some N fertilizer Stranded in the topsoil
  - Too dry for uptake

No in-season N losses

  - No Denitrification or Leaching

Palmer Drought Severity Index Febraury 23, 2018



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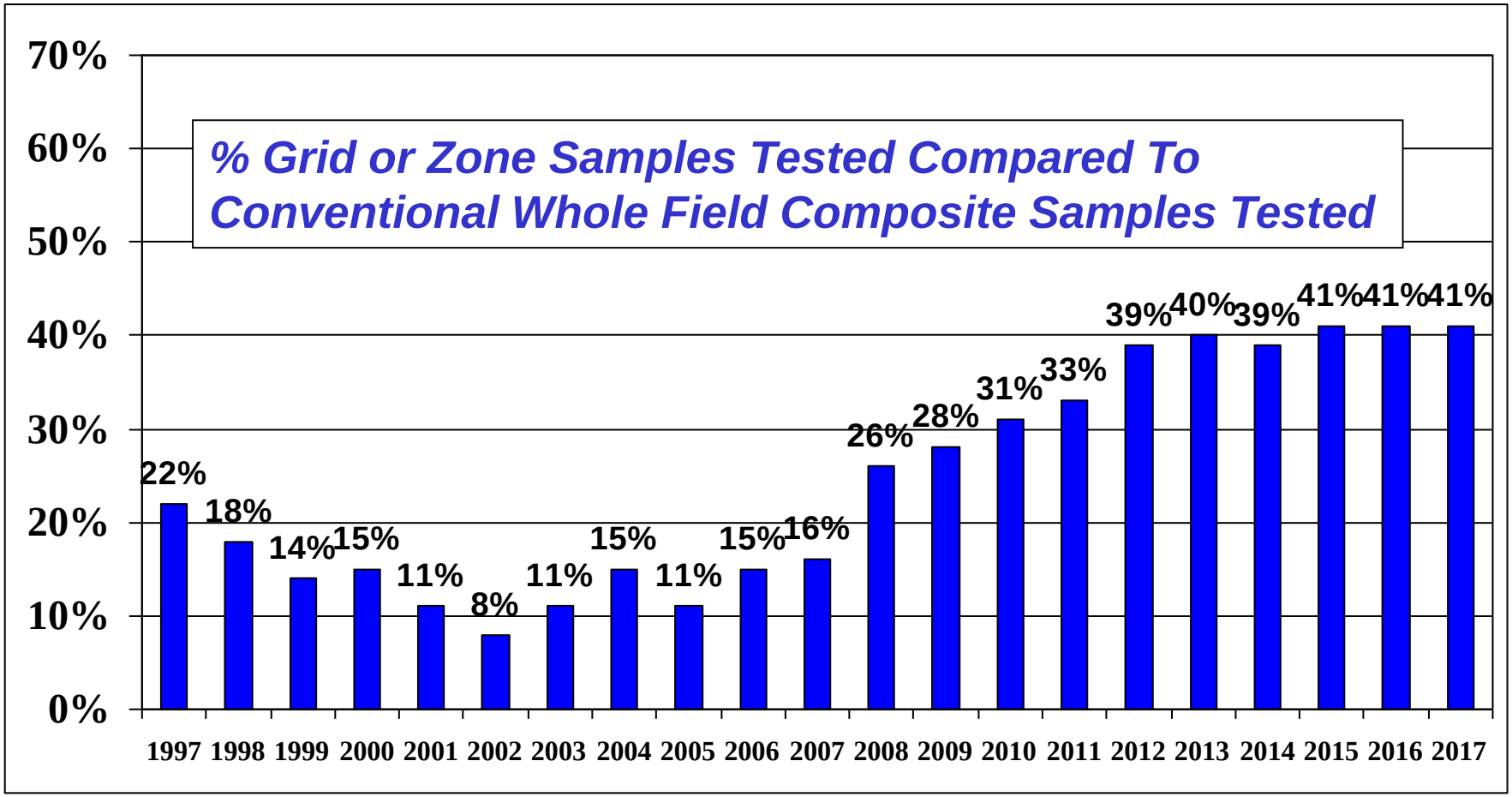
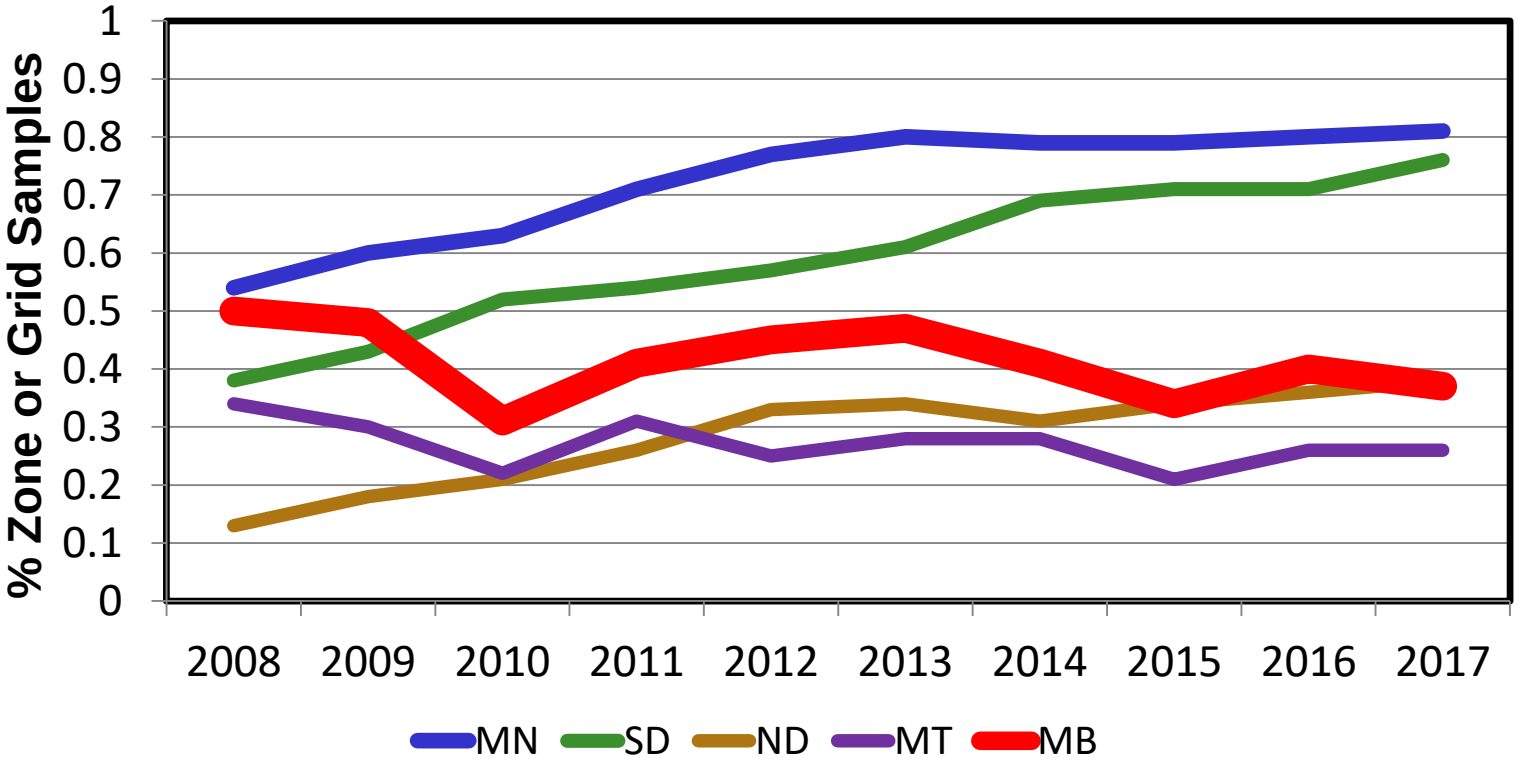
More Precision Soil Samples

Northwood laboratory 1997 - 2017



More Zone and Grid Soil Sampling

% Zone or Grid Samples Tested compared to Composite Samples



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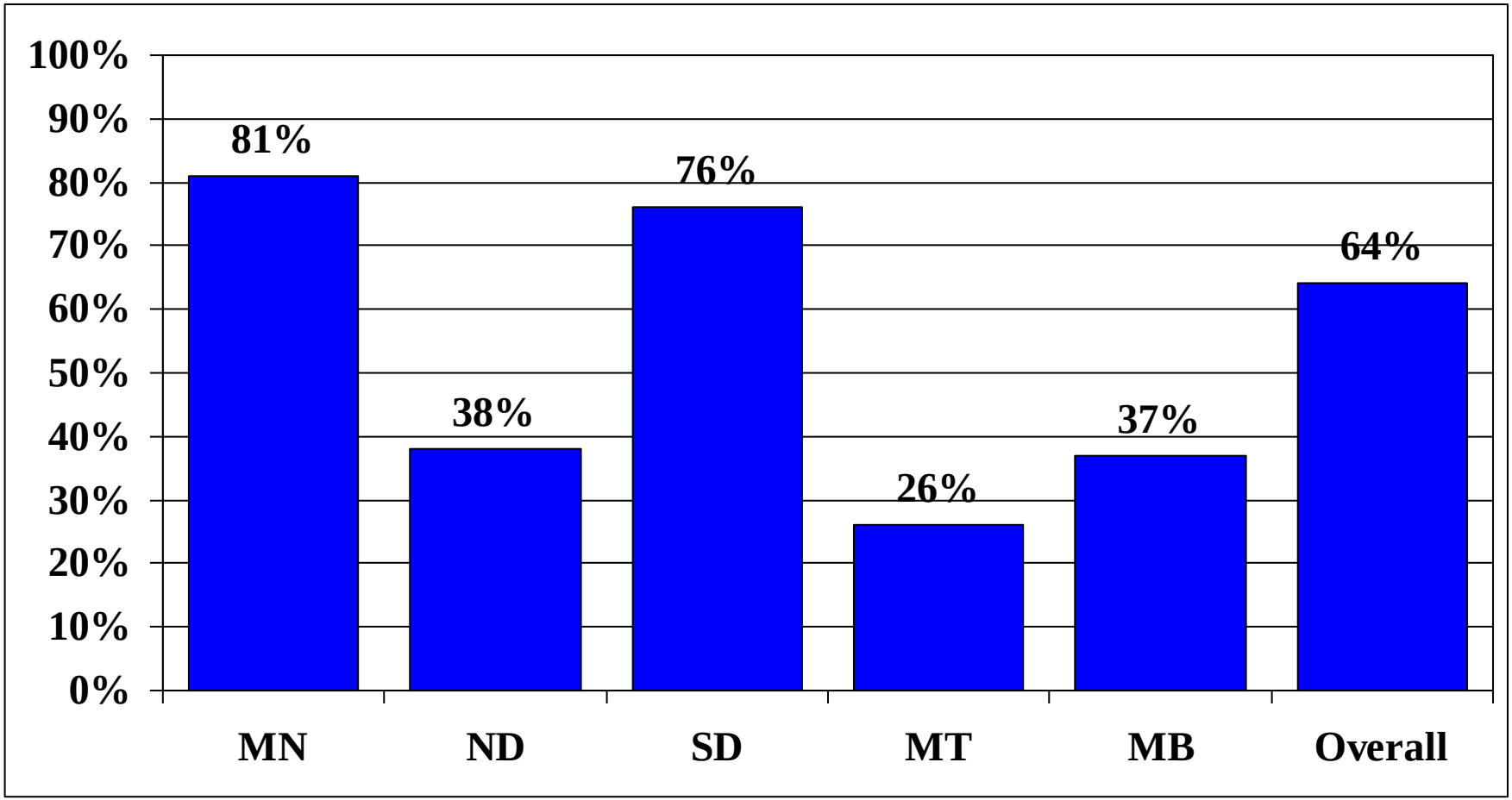
%Zone or Grid Samples Tested Compared to Conventional Whole Field Composite Samples in 2017



Soil Testing Trends Summary

- Soil Testing is Critical
  - Immobile nutrients don't change much (P,K, Zn) year to year (Crop removal is important)
  - Soil Nitrate levels can change a lot year to year.
  - Soil Salinity has been increasing since early 1990's (wet cycle) – major yield factor!!
  - How to reduce salinity?
    - More high water use crops in rotation (corn sunflowers, need water use after cereals!)
    - Surface drainage
    - Tile drainage

Soil Testing Trends Summary

- Soil testing moving towards more zone testing based on productivity as VR technology becomes easier.