More than **one third** of Wisconsin soils may have **yield-limiting nickel**

Essential but Unmeasured: A Survey of Mehlich III Extractable Nickel in the Soils of Wisconsin and Illinois

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INTRO

- Nickel is the most recently defined essential nutrient for plant growth (Brown et al., 1987)
- Little work has been done to assess soil nickel levels via readily available extraction techniques
- Less work has been done to calibrate a soil test for Ni
- Nikoli et al., 2016, appear to have done the most work in this direction and their critical deficiency levels are used in this data analysis

METHODS

- **38,000** commercial soil samples were collected across WI and northern IL for routine soil fertility testing over the sampling period 04/24/2020 -10/01/2020
- Nickel was determined via Mehlich III (1:10) ICP-OES
- Results were compared to three Mehlich III Ni critical levels for ryegrass (*Lolium perenne L)* outlined by Nikoli et al., 2016 (*Table 1*)

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Figure 1: Cumulative frequency plot of Mehlich III extractable Ni content in soil samples, segregated by state of origin

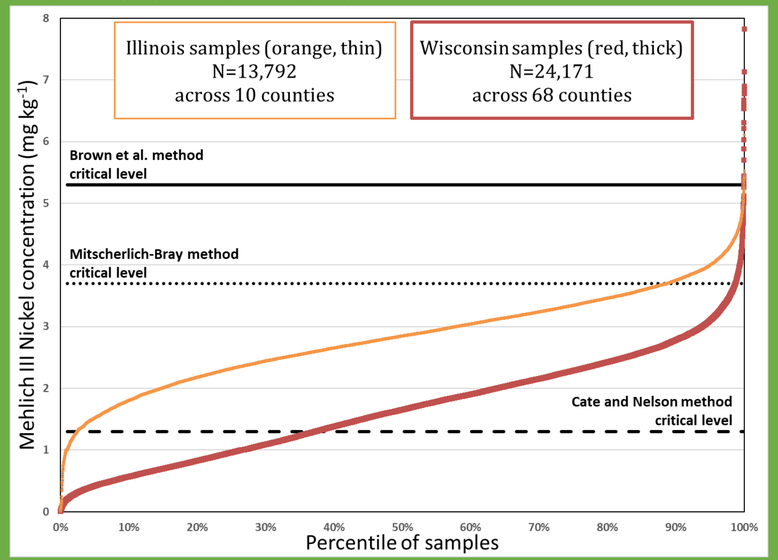

Table 1: Three critical levels of Mehlich III extractable Ni and percentage of samples in each state that fall below (Nikoli, et al., 2016)

Critical deficiency level mg kg^{-1}	Calibration technique	WI percent below	IL percent below
1.3	Cate and Nelson	37.3	2.4
3.7	Mitscherlich-Bray	98.7	88.7
5.3	Brown et al.	99.9	99.9

RESULTS

- WI samples have a significantly different Ni distribution than IL samples (*Figure 1*)
- 37.3% to 99.9% of WI samples and 2.4% to 99.9% of IL samples are below the critical deficiency level (*Figure 1*, *Table 1*), depending upon calibration technique

CONCLUSION

Mehlich III shows promise as a routine analysis method for soil Ni. Further work is needed to develop more conclusive critical levels for a diversity of crops and soil types, investigate correlations to other soil properties, and assess plant tissue Ni levels.

References cited:

- Brown, P.H., R.M. Welch, and E.E. Cary. 1987. Nickel: A Micronutrient Essential for Higher Plants. Plant Physiology 85(3): 801–803.
- Nikoli, T., T. Matsi, and N. Barbayiannis. 2016. Assessment of nickel's sufficiency critical levels in cultivated soils, employing commonly used calibration techniques. Journal of Plant Nutrition and Soil Science 179(4): 566–573.

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