The Case for Static Range Nitrogen Management in Idaho Sugarbeet Production

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Introduction and Objective

Historically a yield goal N management (YGNM) approach has been utilized to determine the N supply recommendations for sugarbeet grown in the Idaho. Average annual root yields have increased at higher rates in the last decade compared to the past (Figure 1). This caused current research-based N recommendations surpass needed N to reach maximum yields. Therefore, alternative N management practices needed to be evaluated. **The objective** of this evaluation is to use current and past research and production data to determine if a static range N management (SRNM) approach can improve N management recommendations.
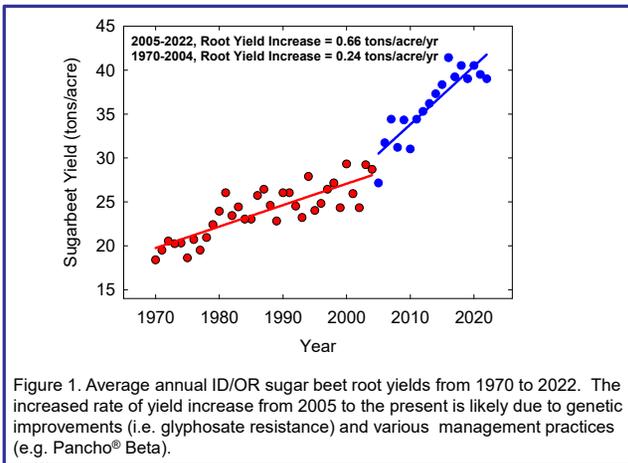

Figure 1. Average annual ID/OR sugar beet root yields from 1970 to 2022. The increased rate of yield increase from 2005 to the present is likely due to genetic improvements (i.e. glyphosate resistance) and various management practices (e.g. Pancho® Beta).

Materials and Methods

- 1977-1996 Research derived yield goal N management Nr Factors (kg N/Mg root)
- 2005-2021 Research data collected by USDA-ARS and Amalgamated Sugar Company (ASCO)

Site	Year	ID City, County	Soil Texture	Tillage	Irrigation System
1	2005	Jerome, Jerome	sandy loam	conventional	wheel line
2	2006	Jerome, Jerome	sandy loam	conventional	wheel line
3	2006	Minidoka, Minidoka	sandy loam	conventional	wheel line
4	2008	Kimberly, Twin Falls	silt loam	strip, conventional	solid set sprinkler
5	2008	Acequia, Minidoka	silt loam	conventional	hand line
6	2008	Glenns Ferry, Elmore	silt loam	conventional	pivot
7	2009	Heyburn, Minidoka	sandy loam	strip	wheel line
8	2009	Heyburn, Minidoka	sandy loam	strip	wheel line
9	2009	Glenns Ferry, Elmore	silt loam	conventional	pivot
10	2010	Jerome, Jerome	sandy loam	conventional	pivot
11	2010	Burley, Cassia	clay loam	conventional	pivot
12	2010	Glenns Ferry, Elmore	silt loam	conventional	pivot
13	2010	Kuna, Ada	clay loam	conventional	pivot
14	2010	Kimberly, Twin Falls	silt loam	strip, conventional	solid set sprinkler
15	2018	Jerome, Jerome	silt loam	conventional	wheel line
16	2018	Kimberly, Twin Falls	silt loam	conventional	solid set sprinkler
17	2018	Payette, Payette	silt loam	conventional	furrow
18	2019	Fruitland, Payette	silt loam	conventional	furrow
19	2019	Kimberly, Twin Falls	silt loam	conventional	solid set sprinkler
20	2019	Paul, Minidoka	silt loam	conventional	wheel line
21	2020	Jerome, Jerome	loam	conventional	wheel line
22	2020	Nampa, Canyon	silt loam	conventional	drip
23	2020	Fruitland, Payette	silt loam	conventional	furrow
24	2021	Burley, Minidoka	silt loam	conventional	wheel line
25	2021	Jerome, Jerome	silt loam	conventional	wheel line
26	2021	Nampa, Canyon	silt loam	conventional	drip

Table 1. 2005-2016 research site information. Sites 1-14 used to revise yield goal recommendations from 8 lbs N/ton roots (1977-1995) to 5.5 lbs N/ton roots. Sites 15-26 were used to evaluate shift from yield goal N management approach to static range N management approach.

Results

Study Years	Study Source	Mean Maximum Root Yield Mg/ha (tons/acre)	Mean N Supply at Maximum Yield kg/ha (lbs/a)
2005-2010	Tarkalson et al. (2016)	77 (34)	202 (180)
2018-2019	Tarkalson et al. (2023)	99 (44)	203 (181)
2020-2021	Olsen et al. (2023)	108 (48)	216 (193)

Table 2. Average maximum sugarbeet root yields, N supplies at the maximum root yields for site-year collections found in Table 1.

Mean Comparison Method: SRNM range from comparison of adjacent means using ANOVA and mean separations = 180-193 lbs N/a.
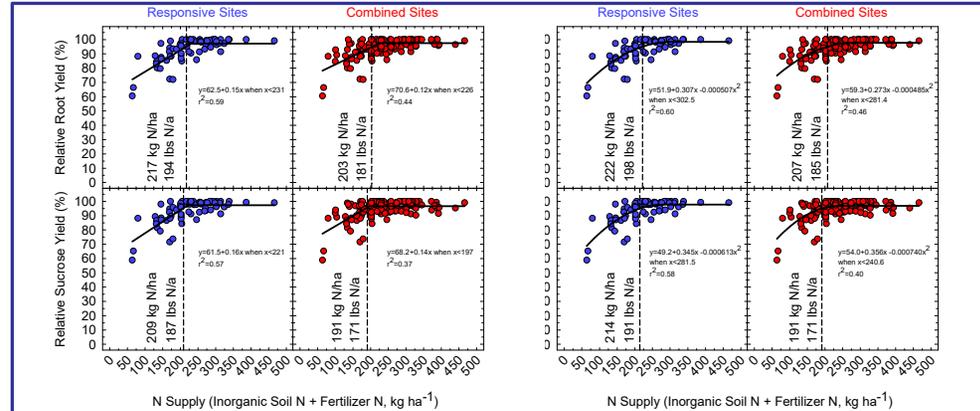

Figure 2. Relationships (linear plateau and quadratic plateau regression) between relative root and sucrose yields, and N supply (inorganic soil N, 0 - 0.9 m + fertilizer N) for N responsive site-year data and the combined (N responsive and N nonresponsive) site-year data. The CNS's (N supplies that maximized yields) are labeled for each graph are listed and designated with dashed lines. The CNS's were calculated at 95% of relative yields.

Regression Method: SRNM range from linear plateau and quadratic plateau models from responsive sites = 187-198 lbs N/a. SRNM range from linear plateau and quadratic plateau models from responsive sites = 171-185 lbs N/a.
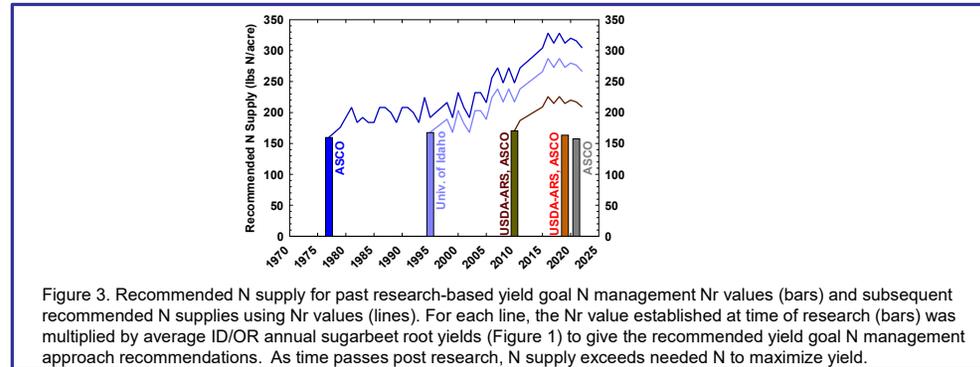

Figure 3. Recommended N supply for past research-based yield goal N management Nr values (bars) and subsequent recommended N supplies using Nr values (lines). For each line, the Nr value established at time of research (bars) was multiplied by average ID/OR annual sugarbeet root yields (Figure 1) to give the recommended yield goal N management approach recommendations. As time passes post research, N supply exceeds needed N to maximize yield.

Conclusions

Data suggests that the continued use of a YGNM approach can lead to oversupplying N, and a SRNM approach was valid for the Idaho growing area. A maximum N supply of between 180-200 lbs N/acre is recommended.

Acknowledgements