Lentil Response to Soil Residual Nitrogen and Rhizobial Inoculation

Objective:

- Demonstrate the responses of small red and large green lentil to rhizobial inoculant and varying soil residual nitrogen.

Trial Design:

- Sites included Indian Head (IHARF), Scott (WARC), and Swift Current (WCA). Swift Current suffered from a hail event on July 22, 2023.

Table 1. Treatment list for "Lentil Response to Soil N and Inoculant" in 2023 at Scott, Indian Head and Swift Current.

	Fall Applied N Rate (soil + fertilizer)	Granular Inoculant*	Lentil Class
Low N	0 lbs N /ac (Soil N Only)	No/Yes	Small Red/ Large Green
Elevated N	100 lbs N /ac	No/Yes	Small Red/ Large Green
Extreme N	200 lbs N /ac	No/Yes	Small Red/ Large Green

*Granular inoculant was applied at the label rate

Results:

- Both Scott and Indian Head displayed a significant effect of lentil class on plant density, with green lentil having a higher plant density compared to small reds.
- At Swift Current, the elevated and extreme N levels (2817-2890 lbs/ac) increased biomass production compared to the low residual levels (2587 lbs/ac)
- At all three sites green lentils took longer to mature than red lentils. Increased residual N rates had a minor effect on maturity, especially green lentils.
- At all sites, red lentils yielded higher and had higher protein values than green lentils.
- An interaction between lentil class and residual N (P=0.049) on yield at Indian Head suggested: 1) green lentils may be more sensitive to high residual N than small reds, and 2) that small red yields trended higher at higher residual N but minimal.
- At Swift Current, yields were affected by residual N ($P < 0.001$) and class ($P < 0.001$). Yields were significantly reduced at the low N level (15 bu/ac) compared to the elevated or extreme levels (17.5 bu/ac).
- Protein concentrations at Swift Current were affected by residual N ($P < 0.001$) and class ($P < 0.001$) with a significant interaction ($P = 0.041$) between them as well. Protein concentrations increased from 24.7% in the low N treatment to 25.3% and 26.1% at the elevated and extreme residual N levels, respectively.
- For the large green class, seed protein concentrations significantly increased with each subsequent increase in residual N. For the small red lentils, each incremental increase in residual N led to a substantial and statistically significant increase in seed protein.

Conclusions:

Our results suggest that planting lentils into high residual N soils is likely to be a relatively low risk practice. The residual N by class interaction for yield at Indian Head suggested that green lentils might be more sensitive to high residual N than red lentils; however, the effect was small. At Swift Current, the effects of higher residual N were positive for both seed yield and protein. There were no signs of excessive vegetative growth or delayed maturity associated with the high residual N at Indian Head or Scott and the tendency for higher biomass yields with elevated N at Swift Current was coupled with significantly higher yield and protein. If anything, our results suggest that if residual N levels are extremely low in the coarse-textured, low organic matter soils, starter N would likely be recommended. While we did not observe any benefits to granular inoculant in this project, we hesitate to suggest that this input is not required. Biological N fixation is simply too critical in lentil production to comfortably recommended excluding this input and native Rhizobium populations may vary across the landscape or from year-to-year. While it makes sense that biological N fixation might play less of a role when residual N levels are extremely high, completely eliminating inoculant could be risky.

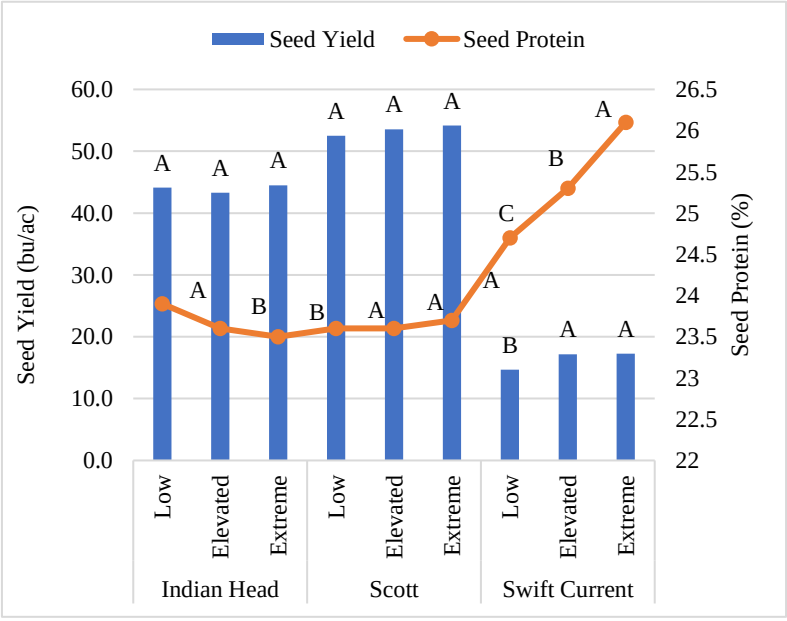

Figure 1. Seed yield (bu/ac) and protein (%) at low, elevated and extreme soil residual N at Indian Head, Scott and Swift Current in 2023.

The full report is available at www.warc.ca. Ministry of Agriculture, the Canadian Agriculture Partnership (for projects approved between 2017 and 2023) and the Sustainable Canadian Agriculture Partnership (for projects approved between 2023 and 2028). This project was supported by the Saskatchewan Pulse Crop Development Commission.
WARC Project # 1-23
February 2024