

Evaluation of a Preliminary Algorithm for Increasing Fertilizer Nitrogen-Use Efficiency in Canola

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Summary

A field experiment with canola (*Brassica napus L.*) was conducted at Indian Head and Scott, Saskatchewan to evaluate the effects of various nitrogen (N) management strategies on grain yield and profitability. The treatment of greatest interest was a variable rate application where a reduced rate of N was applied at seeding, and N topdressing rates were determined using a preliminary N application algorithm. The algorithm was used to estimate fertilizer N requirements in canola using sensor-based estimates of yield potential and responsiveness to additional inputs of N. The economic and agronomic feasibility of the variable rate treatment was evaluated against the traditional practice of applying the entire quantity of N required for a predetermined yield goal at seeding (referred to as 'farmer practice' treatment). The normalized difference vegetation index (NDVI) of the crop was determined at the early bolting stage using an active, ground-based optical sensor. The sensor emits light in the red and near-infrared (NIR) wavelengths and measures the reflectance of these specific bands. Plots in the variable rate treatment with low NDVI relative to the non-N limited plots were assumed to have low N availability and given additional N fertilizer at a rate determined using the NDVI – yield algorithm. At Indian Head, only minor differences in NDVI were observed between the treatments that had received fertilizer at seeding, indicating that a response to further additions of N was unlikely. Consequently, we applied only 47 kg N ha⁻¹ in total to the variable rate treatment compared with 100 kg N ha⁻¹ on the farmer practice treatment. As expected, the yields of the two treatments were not significantly different from one another. At Scott, the absolute NDVI values were higher than those measured at Indian Head, but the overall trends were similar. The NDVI of the check was significantly lower than that of all the other treatments. While there were some differences between the remaining treatments, they were small. An average of 70 kg N ha⁻¹ in total was applied to the variable rate treatments at Scott compared with 116 kg N ha⁻¹ on the farmer practice treatment. Unlike Indian Head, the variable rate treatment at Scott yielded less than the farmer practice treatment. Profitability of the variable rate treatment ranged widely from plot to plot and between the two sites. On average, as long as canola prices were not too high and N prices too low, the variable rate treatment was more profitable than the farmer practice treatment at Indian Head. At the lowest canola price and highest N price, the mean profit of the variable rate treatment was nearly \$20 ha⁻¹ greater than the farmer practice treatment. At Scott, because of the lower grain yield, the variable rate treatment always had a lower profit than the farmer practice treatment. Currently, the results of this study are inconclusive. The study is scheduled to run for two more years and is expected to provide an improved basis on which to judge if, and under what conditions, this approach to N fertilizer application in canola is economical.

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