ESTIMATING CANOLA (*BRASSICA NAPUS* L.) YIELD POTENTIAL AND NITROGEN REQUIREMENTS USING OPTICAL SENSORS

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ABSTRACT

The challenge in nitrogen (N) management in dryland crop production is choosing fertilizer application rates that are appropriate for the specific soil-crop environment. Optical sensors such as the GreenSeeker™ (www.ntechindustries.com) have potential to improve our ability to match N fertilizer rates with crop requirements by providing an objective means of estimating both yield potential and potential crop response to additional N inputs. Two separate experiments were completed with canola (*Brassica napus* L.) to determine if normalized difference vegetation index (NDVI) could be used to estimate canola yield potential and to assess if sensor-based N management for canola is feasible relative to conventional practices. In the first experiment, completed at Indian Head, Scott, Swift Current, Brandon, and Ottawa, the NDVI of each plot was measured with handheld GreenSeeker™ sensors repeatedly over the growing season. Data collected between the five-leaf stage and the started of flowering from selected site-years were combined and then used to determine the relationship between NDVI and canola yield. While the NDVI-yield relationship was significant (R^2=0.45), it was improved by dividing the NDVI by various normalizing factors such as the number of heat units accumulated between planting and sensing or days from planting. For practical purposes, all of the heat units performed similarly (R^2=0.528-0.562) and all were an improvement upon days from planting to sensing (R^2=0.474). The second experiment included nine large, on-farm trials at various locations in Saskatchewan where sensor-based N management was compared to placing the entire, fixed rate of N in the soil at seeding. The sensor-based approach involved comparing NDVI measurements of canola at the mid to late-bolting stage that received reduced rates of N at seeding with those from a high N reference crop and surface-banding urea ammonium nitrate (UAN) at variable rates calculated according to the estimated difference in yield potential between the crop being fertilized and the high N reference. Nitrogen fertilizer use was reduced using the sensor-based approach at 66% of the trials and the total rates ranged from 33 kg N ha^{-1} less to 10 kg N ha^{-1} more than for the benchmark treatments at each site (10 kg N ha^{-1} less than the benchmark treatment on average). Grain yields in the two treatments were only different from one another at two sites and in both cases the variable rate treatment had the higher yield. Economic margins were calculated assuming \$375 Mt $canola^{-1}$, \$1.00 kg N^{-1}, and a fixed technology / application cost of \$15.00 ha^{-1} for the VRA treatment. While we typically reduced N-use without affecting yield, the reductions were not usually sufficient to cover the cost of the post-emergent (PE) N application under the given economic assumptions. Sensor-based N management was more profitable only in the cases where this treatment also had the higher grain yield. While this approach to managing N appears to be agronomically feasible in western Canada, it will require further refinement to consistently provide increased economic returns for producers.