EASTERN CANADA
OILSEEDS DEVELOPMENT ALLIANCE

Lead Researcher:
Dr. Bao-Luo Ma, AAFC ORDC

Activity 14 Factsheet
Canola Nutrient Management

Objectives

The three main objectives of this activity are to 1) identify nutrient deficiency through plant and soil determinations with consideration of genotype-by-environment-by-management interactions for improved nutrient use efficiency (NUE) and canola crop productivity; 2) determine a threshold level of micronutrient B deficiency and nutrient balance for canola production; and 3) develop improved guidelines for canola site-specific nutrient management.

Methodology

Three field experiments were conducted to determine the response of canola (*Brassica napus*) crop to nitrogen (N), sulphur (S) and boron (B) fertilizers at six locations in Eastern Canada (Ontario – 3 sites, Quebec – 2 sites and Nova Scotia – 1 site). The two canola cultivars used in these experiments were InVigor 5440 (LL) and InVigor L150 (LL). Invigor L140P replaced the L150 for the last two years, due to its better resistance to lodging. Urea (46-0-0) was the N source and ammonium sulphate (21-0-0 with 24% S) was the S source. Depending on the site, either Alpine Boron (10% B), Solubor (20.9% B) or Granubor (10% B) was the B source. The planting dates, planting rates, size of plots and herbicide treatment varied for each site. The following experiments were conducted, all arranged in randomized complete block design with four replications per site:

Experiment 1** - **Canola Nitrogen Fertility Experiment. Tested the responses of two canola hybrids (InVigor 5440 and L150/L140P) to preplant and sidedress N fertilizer at a total of 8 treatments (0, 50, 100, 150, 200, 50+50, 50+100 and 50+150 kg N ha^{-1}).
***Experiment 2** - **Canola Sulphur Fertility Experiment**.* Conducted to determine the optimum rate of sulphur (S) required for growing canola in Eastern Canada. This study tested the responses of a newer canola hybrid InVigor L150/L140P) to 4 levels of S (0, 10, 20, and 40 kg S ha^{-1}) at 3 levels of N fertilizer (0, 75 and 150 kg N ha^{-1}) in a factorial arrangement.
***Experiment 3 - Canola Boron Fertility Experiment**.* Similar to Experiment 1, but focused on the responses of canola hybrids to boron (B) application. Two hybrids InVigor 5440 and L150/L140P were treated with 3 levels of B (0, soil applied at 2 kg B ha^{-1} and foliar applied B at 500 g ha^{-1} at the early flower stage).

Results

1) In the N study, there was a strong correlation between yields and N rates applied both at preplant and sidedress.
2) Split N application (50+50, 50+100, 50+150 kg N ha^{-1}) often produced higher yields (> 5%) than the same amount of N applied at preplant (more analysis needs to be done). Canning 2013, and McGill 2014 & 2015 and Laval 2015 did not show a positive response to sidedressed N and actually had lower yields in the sidedressed plots.
3) At early flowering, plant biomass, height and leaf area all significantly increased with increasing N rates, with the plots that received preplant N at 200 kg ha^{-1} having the largest biomass and leaf area and tallest plants of all the treatments.
4) At all site-years, number of branches and pods per plant and seeds per pod increased with increasing N levels, sometimes significantly.
5) In most site-years, the application of different rates of N did not have any effect on 1000-seed weight as they did not increase linearly with increasing N rates. Other than at Canning 2016, adding sidedressed N did not significantly affect 1000-seed weight, compared to the plots that received the same amount of preplant N.

6) For some sites and years, N did not display any effect on harvest index (HI). In most cases, sidedressing N did not significantly increase HI, compared to the plots that received the same amount of preplant N.
7) The average of the most economic rate of nitrogen (MERN) for Eastern Canada was estimated at 179 kg N ha^{-1} for preplant application and 198 kg N ha^{-1} for sidedress application, both with large ranges among sites-years. When N fertilizer is applied at the MERN value, the average achievable yield would be 3.27 t ha^{-1} for preplant, and 3.40 t ha^{-1} for sidedress application.
8) The Greenseeker and Cropscan instruments were not sensitive at differentiating N treatments before the GS16, but at the GS50 stage, they detected 0N plots from plants in the N treated plots. At 20% flowering, NDVI values significantly increased with increasing amounts of preplant N application.
9) The SPAD chlorophyll reading was able to distinguish N treatments as early as the GS15-GS16 stages.
10) Greenseeker and CropScan measurements at the 7-leaf stage (GS17) and at 20% flowering were strongly correlated to final seed yields. There was also a very strong correlation between SPAD readings at the GS16 stage and final yields.
11) Monitoring the leaf N content at an early growth stage could be helpful in determining the amount of N applied at a later stage.
12) Increasing N application significantly increased seed protein concentration, but decreased oil concentration ($p \leq .001$). Both seed oil and protein yields increased with increasing N application.
13) Preplant S treatment increased seed yields at all sites and years. Plant S uptake for canola appears to be optimized when there is a N : S ratio of 10 at early flowering stage and of 2.1 (straw) or 11.4 (seed) at harvest.
14) At harvest, the seed accumulated about 60 g ha^{-1} of boron (B). The lack of difference in yields between B treatments may indicate that the test fields could provide sufficient B to meet plant growth and yield potential of the current hybrid varieties in eastern Canada.
15) A cover crop (CC) study conducted at St-Augustin-de-Desmaures (SA) and Normandin (NO) between 2013 and 2015 indicated that the clover CC was more valued in the light soil of SA where additional N input was more beneficial compared to the fine textured soil of NO with high mineralization which already provides substantial N supply.

Data collected clearly indicates that crop requirements for nutrients are dependent upon environments, cultivars and growth stages. Basic and applied research on site-specific nutrient mineralization and cycling, and timely testing for cultivar-specific nutrient requirements and crop nutrient balance are of critical importance in sustainable crop (including canola) production. This would help meet the profitability required by the producers, and create for the general public safe, nutritious food, clean air and water, and an environment with minimum nitrogen and carbon footprints.

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