Report to Washington Oilseeds Commission Research Proposal 2019: Nutrient Management of Winter Canola

Project Title: Nutrient Management of Winter Canola
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Cooperators: collaborating farmers

Objectives of this study are to (1) quantify macro-and micro-nutrient uptake and biomass accumulation at various growth stages of winter canola (WC) to determine the right rate and timing of fertilizer applications for these nutrients in the different rainfall zones; (2) Investigation how nitrogen (N) application rate and timing effect uptake of other essential nutrients.

Methodology:

Seven site-year trials on N rate and timing, and four trials on a cocktail of Zn, B, and Mo were conducted in 3 different rainfall zones in dryland and irrigated systems and in Washington and Oregon in the 2016-2017 and 2017-18 years. Sites were approximately 1 to 2 acres consisting 36 to 64 plots (9.15 m by 12.2 m) in a randomized complete block design. In 2016-2017 crop year, N rates were determined based on WSU recommendations and varied at each site. The rates included control, 50% recommended rate, recommended rate, and 150% recommended rate. 2017-2018 crop year, treatments consisted of 5 rates from 45 to 225 kg N/ha increasing by 45 kg N/ha with a zero control in each block. All treatments were replicated four times except at the Latah and Echo sites, which were replicated three times due to limitations caused by size, slope, streams, and/or roads. All sites were established on an area of field with minimal slope. Either granular urea or liquid urea ammonium nitrate (UAN) fertilizer was applied in the fall; only granular urea was applied in the spring. Rate was crossed with three timing treatments of fall, spring and split application with split being 50% in spring and 50% in fall.

Uniform sulfur rates were applied in fall at each site. Other than the treatments, the sites were managed by growers. Sites differed widely in precipitation and soil type, as described in Table 1. Specific site locations and associated soil conditions, crop rotations, WC cultivars, and planting and harvest dates are summarized in Table 2.

Soil samples were collected post-planting and prior to fall fertilization and again in the spring between February and March prior to spring fertilization. In the fall post-plant, one sample consisted three subsamples were taken from each main plot for baseline soil testing. The samples were sent to a commercial soil testing lab (Best Test Analytical Services, Moses Lake, WA) for general fertility analysis (Table 2).

Above-ground plant tissue samples were collected at spring green up, flowering, and harvest. The plant tissue samples were weighed immediately after being brought back to lab. Tissue samples were then dried at 50 °C for 24 hours and re-weighed for dry weight to determine

biomass production. All samples were ground to 1mm using Wiley Mill and sent to commercial lab for essential nutrients analysis. Winter canola was harvested using a plot combine with 1.5 m header width (Wintersteiger Nursery Master). An area of 5 x 1.5 m was harvested in each subplot. Seed was air dried for > 48 hours to consistent weights in a greenhouse that reached >50°C during the day. All seed was thoroughly cleaned using a 2-mm sieve and a blower, then weighed to determine yield. Seed oil and protein concentrations were analyzed using near infrared spectrometry (FOSS Analytical XDS Rapid Content Analyzer with a type XM-1000 Monochromator, Eden Prairie, MN 55344).

Results

The soil and plant tissue samples were all analyzed. Data analysis is under progress. We conducted a preliminary analysis to evaluate how total N uptake affect uptake of other essential nutrients. We found that total N uptake significant affect uptake of P, Mg, Cu, and Zn. The more N uptake, the more uptake for P, Mg, Cu, and Zn, as illustrated by the positive linear relationship between plant tissue N concentration and plant tissue P, Mg, Cu, and Zn concentrations (Figures 1-4).

Further data analyses include:

(1) Total nutrients uptake for P, Ca, Mg, K, S, B, Fe, Mn, Cu, Zn, Mo.
(2) Statistical analysis on how N treatments affect nutrients uptake.

Extension article will be focusing on nutrients uptake of winter canola, and how the nutrients uptake are affected by N management practices including rate and timing of N applications. We plan to submit this article before May, 2020, and published by December, 2020.

We greatly appreciate the support from WA Oilseeds Commission. With the support of this funding, we were able to pay the cost of tissue analysis and hourly salary for students involved.

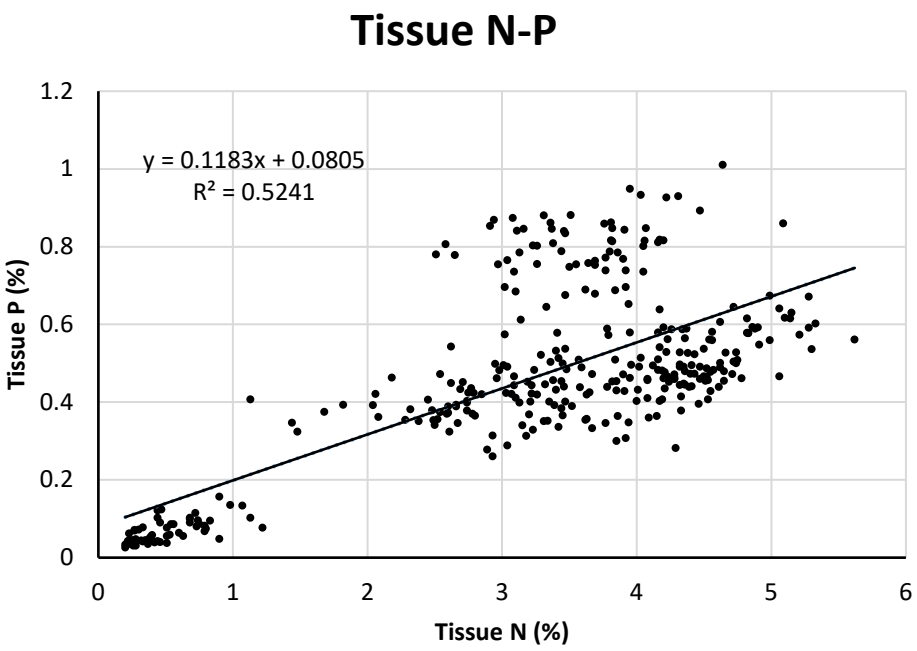

Figure 1. Relationship between plant tissue N and P concentrations.

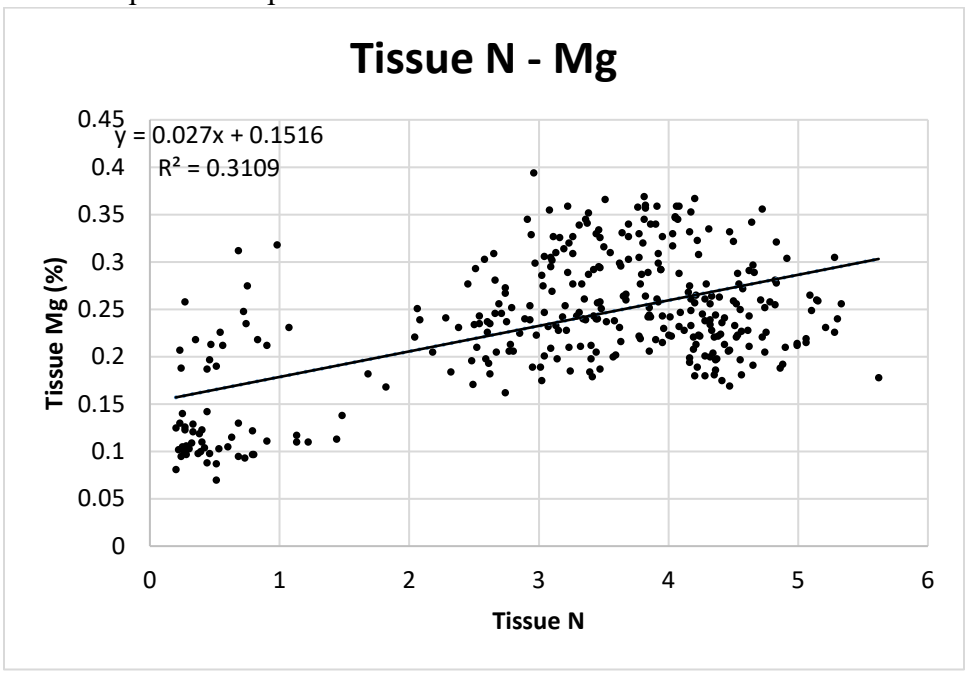

Figure 2. Relationship between plant tissue N and Mg concentrations.

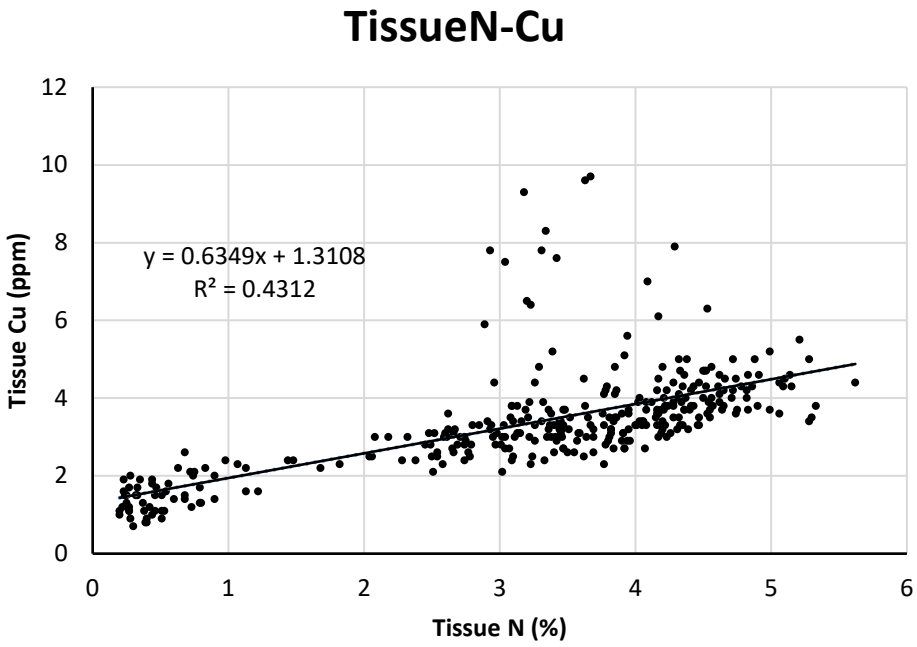

Figure 3. Relationship between plant tissue N and Cu concentrations.

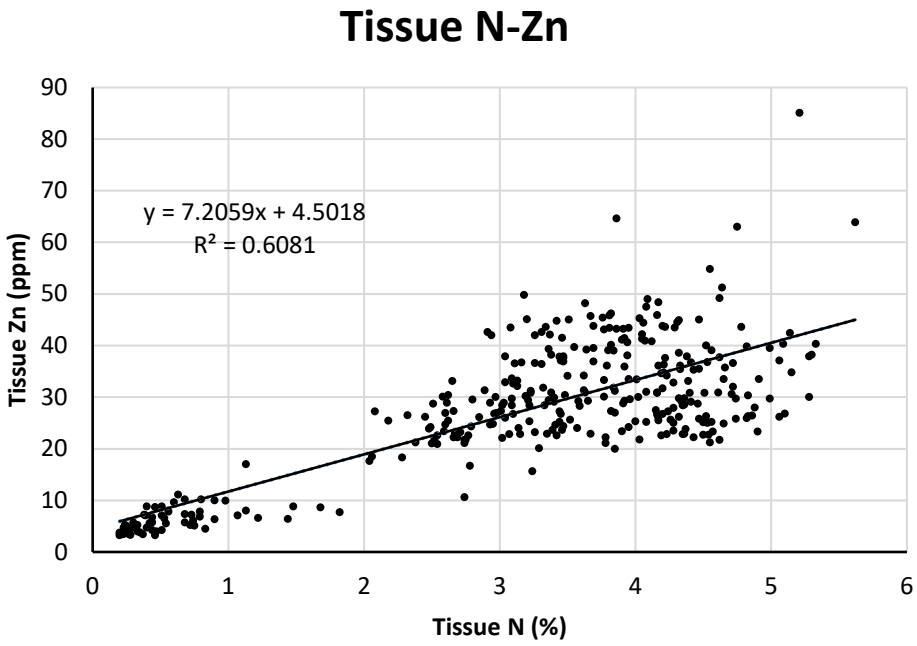

Figure 4. Relationship between plant tissue N and Zn concentrations.