# Soil Nitrogen and Water Relations with Winter Canola Nitrogen Use Efficiency

Marissa Porter, Isaac Madsen, William Pan, William Schillinger, and Haiying Tao

Nitrogen (N) losses from fertilizers are an abundant pollutant in agricultural regions world-wide. Maximizing nitrogen use efficiency (NUE) is critical to reduce adverse environmental effects of fertilizer and obtain an economic return on inputs. Winter Canola (*Brassica napus* L.) has an N requirement higher than wheat (*Triticum aestvum* L.) but has demonstrated limited responses to N fertilizer in the inland Pacific Northwest (iPNW). Nitrogen rate and timing trials were conducted at four sites during the 2017-18 crop year. Nitrogen was applied as surface granular urea at three timings of fall, spring, and split application, with split being 50% applied in fall and 50% in spring, in five rates from 0 to 240 kg N ha$^{-1}$. Soil samples were collected in the fall and spring prior to fertilization and post-harvest, then analyzed for N and moisture content. Spring plant samples and harvest yield and biomass data was collected, with plant and seed components analyzed for N content. Nitrogen use efficiency calculations for each season determined that NUE declined with increased rates of fertilizer. Maximum yield and nitrogen use efficiency (NUE) both increased with increased available water, whereas unit N requirement, the inverse of NUE, diminished with increased water availability. Ideal unit N requirements are between 0.05 and 0.09 kg Ns kg seed yield$^{-1}$. Our research findings suggest that residual N measurements to 180 cm soil depth and considering the local water regime are the most important factors to consider when making N management decisions for winter canola.

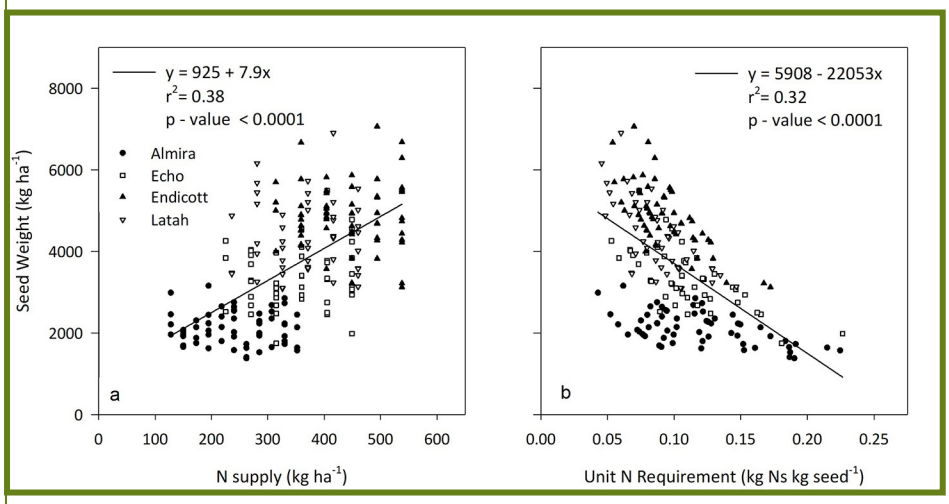


**Figure 1. Seed weight in relation to (a) N supply (fall residual N + spring fertilizer N + mineralized N) (b) unit N requirement (N supply/ seed weight) at 2017-18 winter canola sites .**

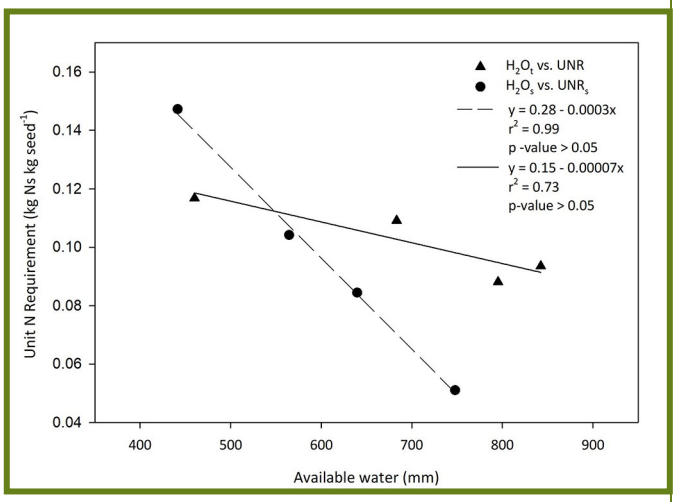


**Figure 2. Mean fall and spring unit nitrogen requirements (Ns/Gw; Nss/Gw) in response to total available water ($H_2Ot$; fall soil water + total season precipitation) and spring available water ($H_2Os$; spring soil water + spring precipitation) for 2017-18 winter canola sites. Data points represent averages across different nitrogen treatments across sites.**