

Nitrogen Use By Pacific Northwest Dryland Canola (*Brassica napus*)

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Introduction

Nitrogen (N) fertility recommendations vary widely within canola production regions including the Pacific Northwest.

Canola has a high N uptake efficiency (unit of total plant N per unit of supplied N) but low N utilization efficiency (unit of grain per unit of total plant N) leading to an overall low N use efficiency (NUE) (unit of grain produced per unit of N supplied) compared to wheat (Hocking, et al. 1997).

Problem: Calculations for estimating the N requirement for canola based upon maximum theoretical yields have proven unsuccessful.

Materials and Methods

An experiment was carried out in 2007-2012 in Pullman, WA, and Davenport, WA, with 5 rates of N (urea), replicated 4 times in a randomized complete block design.

Soil series were Palouse silt loam and Broadax silt loam at Pullman and Davenport, respectively. Spring canola (cv Dekalb Genuity RR) was reseeded after winter canola failures in 2008 and 2010, or planted as a spring crop from 2011-2012.

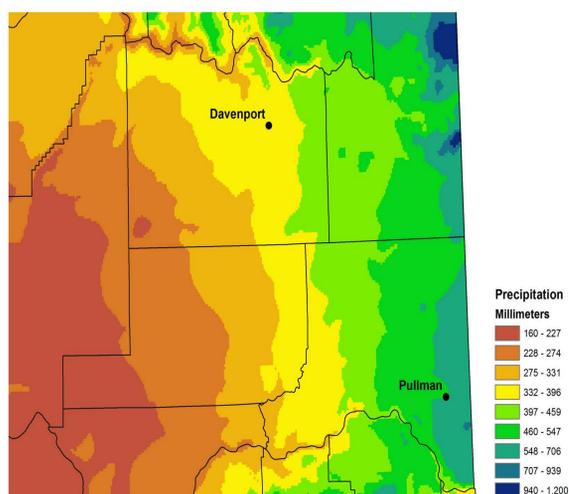
N response data was fitted using the Mitscherlich model for growth factor response.

$$Y = A * (1 - e^{-C(X)})$$

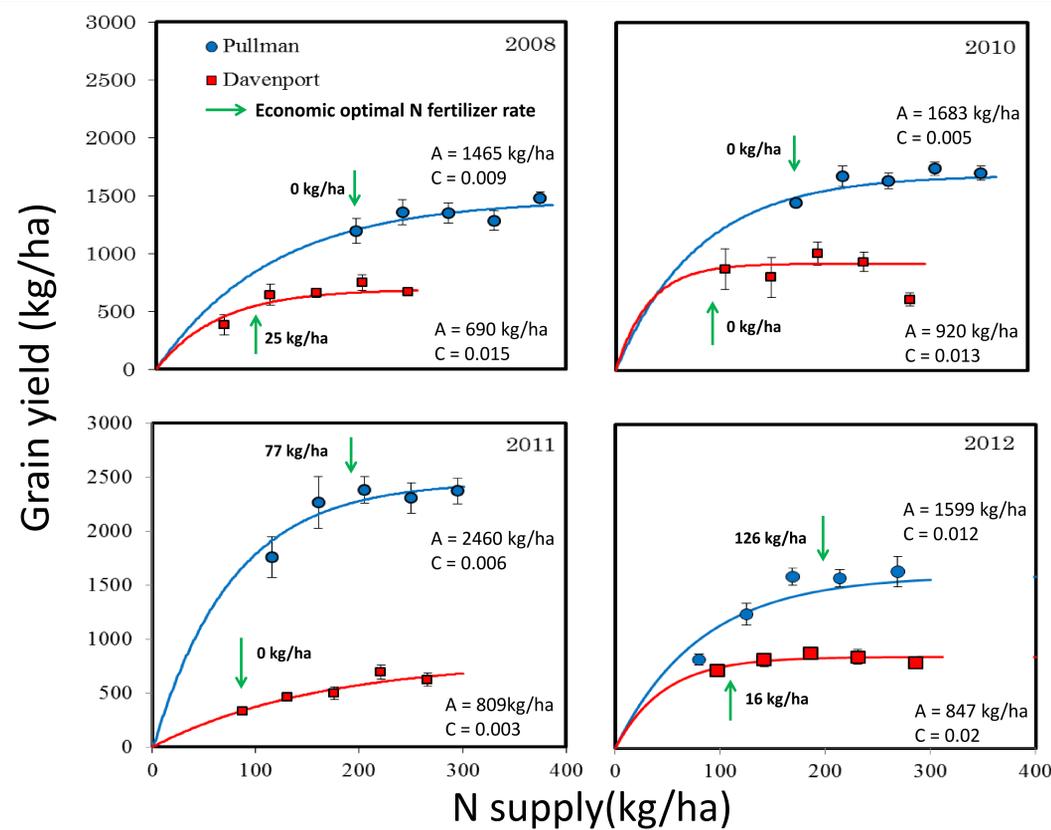
Where:

- Y – yield
- X – applied N + residual soil N + mineralized N
- A – theoretical maximum yield
- C – efficiency factor (initial slope)

Eastern Washington Precipitation Gradient



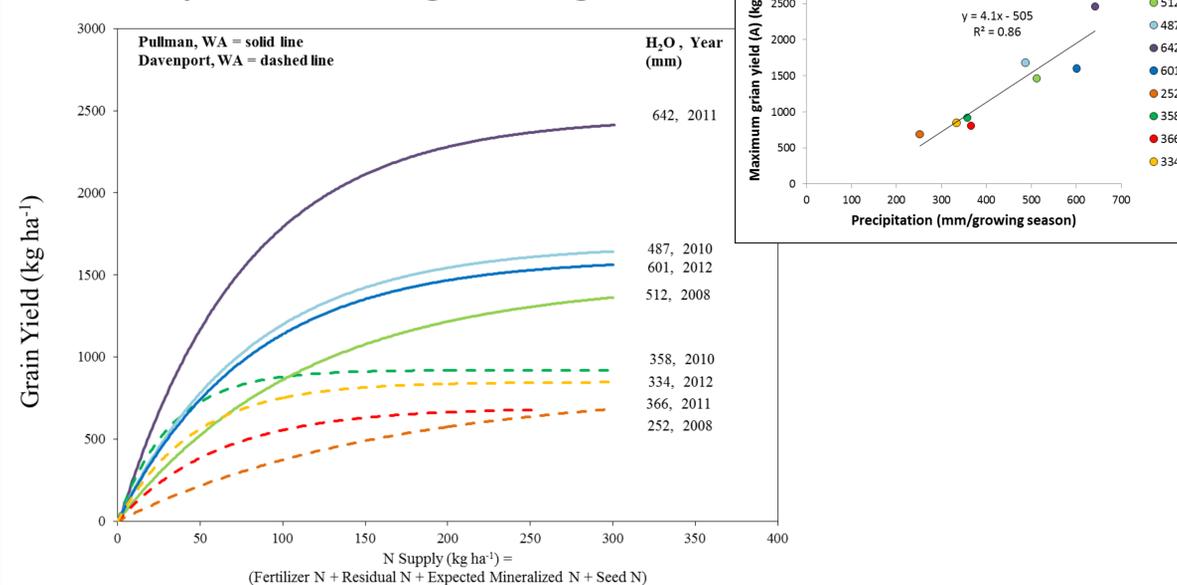
Results



Maximum yields (A) varied among years, particularly at Pullman, WA, and to a lesser extent at Davenport, WA. The efficiency factor (C) also varied among years, and was generally higher in Davenport, WA.

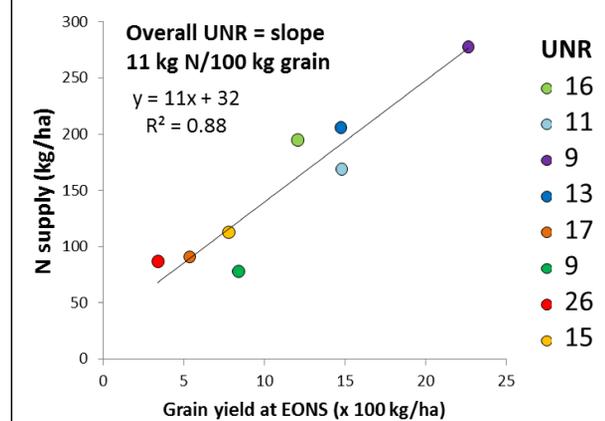
This indicates that maximum yields are lower at Davenport, WA, and are attained at lower N supply.

Yield potentials along rainfall gradients



Study sites fell within the Cascade mountain range rain shadow. Yield potential was enhanced by increasing annual precipitation.

Nitrogen requirement for grain yields at economic optimum N supply



Economic optimal N rate (EONR) varied between 0 and 80 kg N/ha, but was approximately 125 kg N/ha at Pullman, WA, in 2012. Optimal N supplies (EONS) ranged from 75 to 275 kg N/ha.

At EONS, unit N requirement (UNR), and therefore N use efficiency, varied among years at each site.

However, a single UNR can be estimated by considering canola N use over multiple years at both sites.

Conclusions

- Canola efficiently uses high levels of soil residual N, decreasing responses to N fertilizer.
- Rainfall gradient largely determines yield potential of canola in Pacific Northwest.
- Yields at EONS are consistently lower than maximum theoretical yields, and are reached at a relatively lower N supply.
- Although the N requirement of canola at EONS can vary among years, a single UNR can be determined by considering multiple years and locations within a rainfall gradient.

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