Nitrogen and Sulfur Fertility Effect On Pacific Northwest Dryland Canola (*Brassica napus*) Production

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Introduction

Nitrogen (N) and sulfur (S) fertility recommendations vary widely within canola production regions including the Pacific Northwest and often have a synergistic effect(Jackson , 2000; Karamanos et al. 2005).

N use efficiency (NUE) (unit of grain produced per unit of N supplied) varies depending on climate, soil conditions, plant genetics, and management (Rathke et al., 2006).

Canola is characterized generally as high in N uptake efficiency (unit of total plant N per unit of supplied N) and low N utilization efficiency (unit of grain per unit of total plant N) leading to an overall low NUE compared to wheat(Hocking, et al. 1997).

Total plant and grain N has been positively correlated to supplied N (Karamanos et al. 2005), suggesting grain protein increases at N rates beyond maximum yield.

The objectives of this research were to provide NUE insight for canola growers to (1) meet current and future biodiesel feedstock demand and (2) incorporate additional options for rotational cropping systems.

Materials and Methods

An experiment was carried out in 2007-2009 in Pullman, WA and Davenport, WA.

Plots were laid out in a randomized complete block design with 5 rate of N (urea), 2 rates of S (ammonium sulfate) and replicated 4 times.

Soil series were Palouse silt loam and Broadax silt loam at Pullman and Davenport, respectively.

Winter canola was seeded into fallow (cv Dekalb DKW 41-10) and in all but one site year (Pullman 2009) the crop failed to establish due low seed zone moisture or winter kill.

Spring canola was reseeded (cv Dekalb Genuity).

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

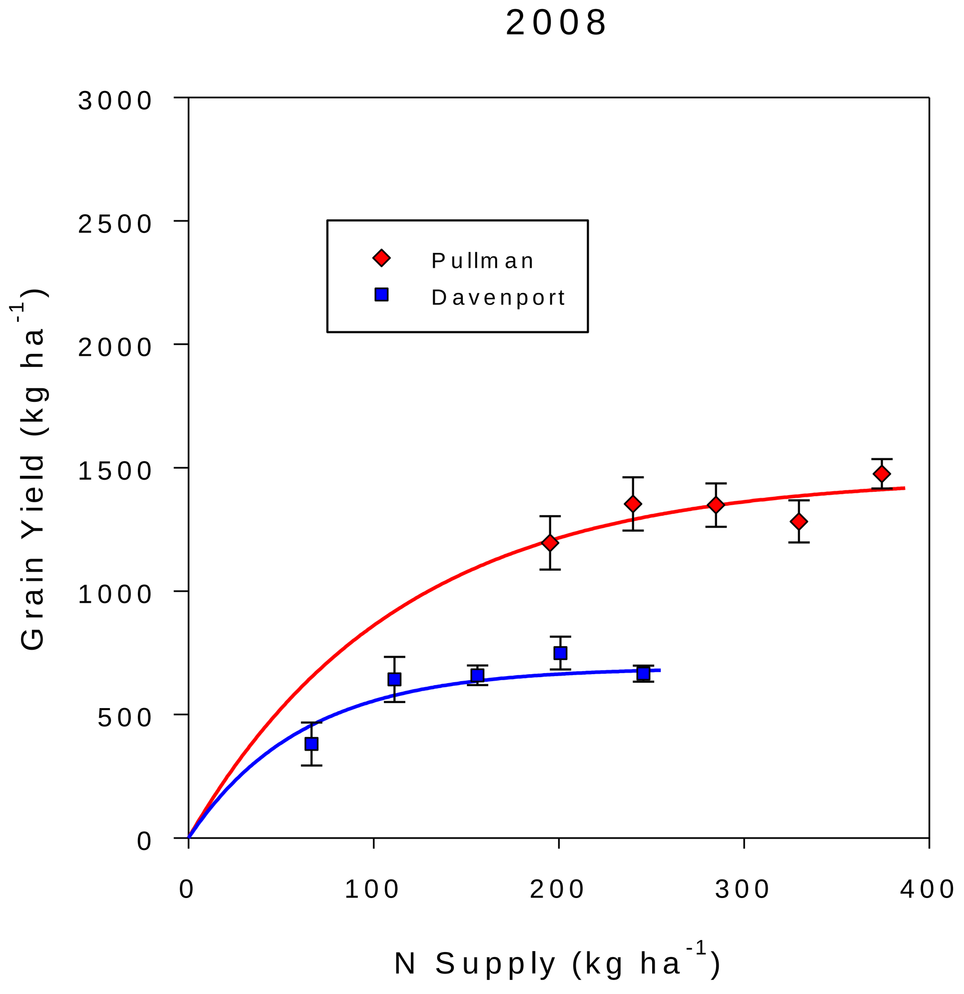
The Mitscherlich Model

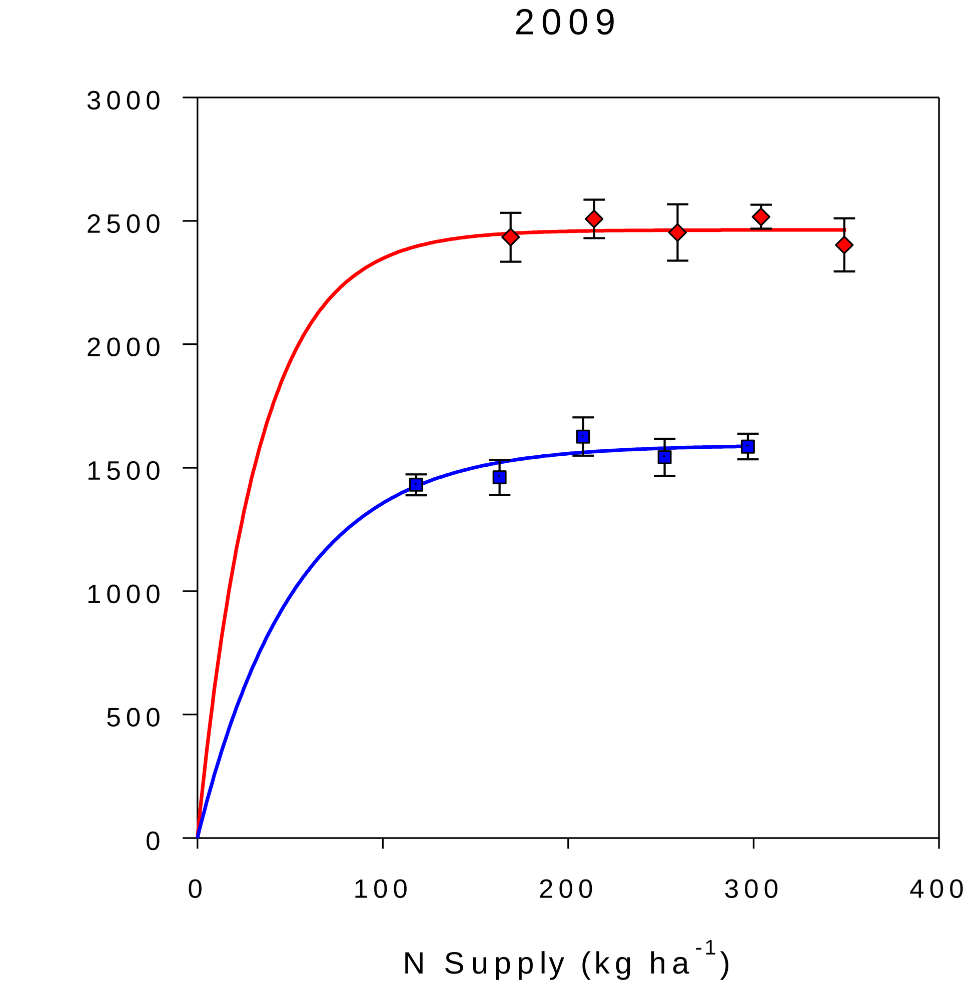
$$Y = A * (1 - e^{-C(X+B)})$$

Where:

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

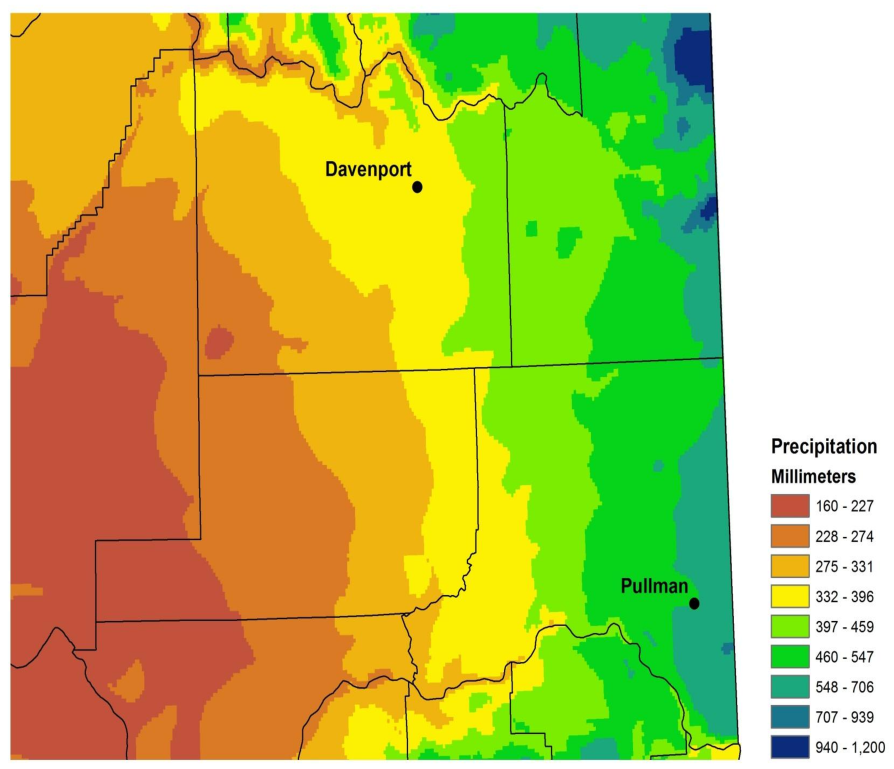
	-------Grain-------	
Site/Year	**A**	**C**
Pullman/2008	1631 b	0.0093 a
Davenport/2008	772 c	0.0146 a
Pullman/2009	2517 a	0.0404 a
Davenport/2009	1615 b	0.0226 a
LSD $_{0.05}$	296	0.0338

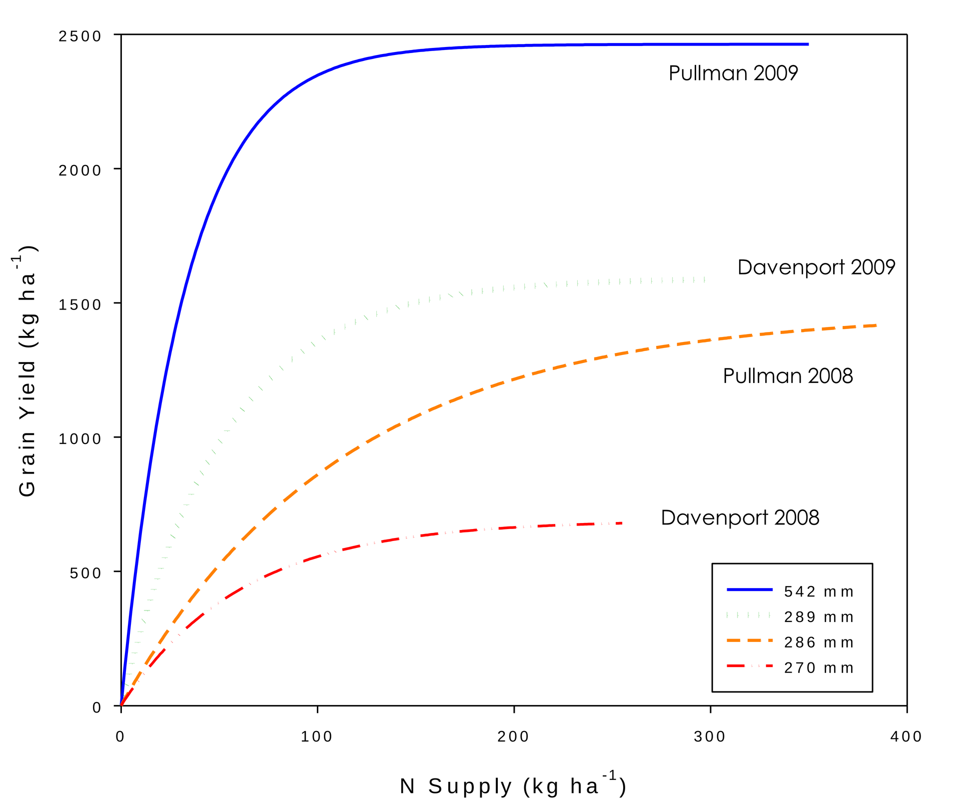




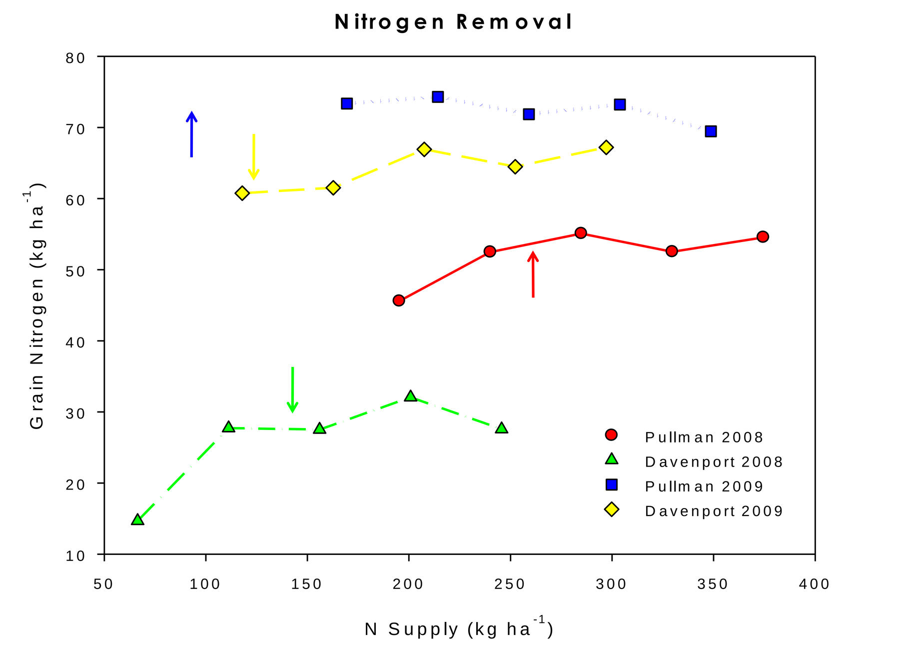
Canola grain (and oil) yield responded to applied N in 2008 but not in 2009. The C factor (initial slope) in the Mitscherlich model was not significantly different between site years. The A factor (theoretical maximum yield) was greatest for Pullman 2009.

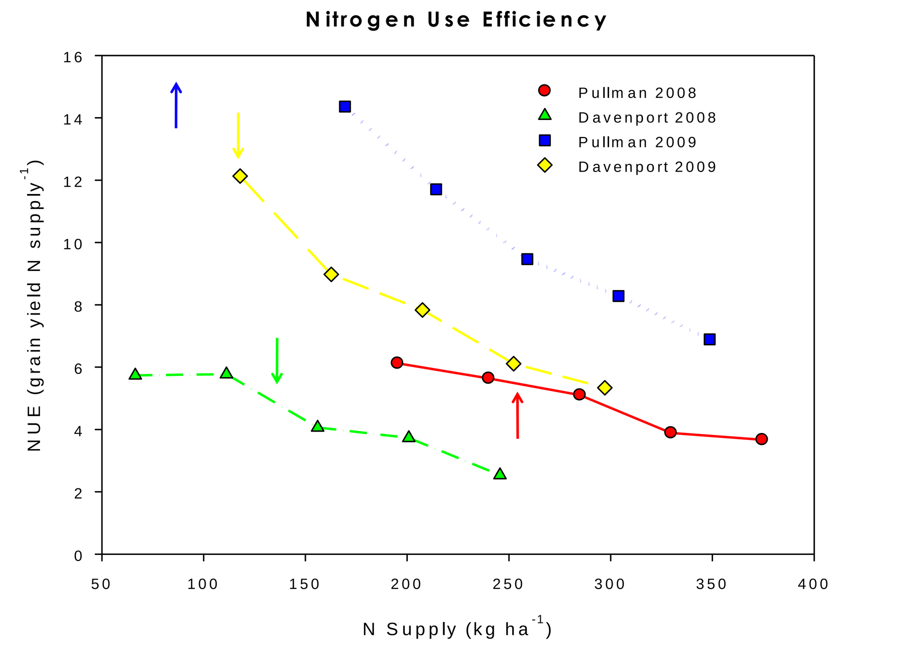
Eastern Washington Precipitation Gradient





Study sites fell within the Cascade mountain range rain shadow. A synergistic effect was observed as both N supply and available water are increased.





Grain N was not increased significantly with increase N supply. NUE was greater with greater available water. Arrows indicate N supply where 90% of maximum yield was reached

Conclusions

•Canola efficiently uses high levels of soil residual N, decreasing responses to N fertilizer.

•Higher yield potential wasn't correlated with higher N requirement thereby raising questions whether an approach of yield based N requirement calculation is appropriate.

•There was no excess consumption of nitrogen beyond what was needed for maximum yield.

•Although efficiency factor C did not differ, nitrogen use efficiency was increased with increased water.

•A nitrogen x sulfur interaction was present but there was no practical significance to the effect.

Acknowledgements

Thanks to the Washington State Biofuels Feedstock Cropping Systems Program, WSU Agricultural Research Center, and National Science Foundation for funding this research.