at allocating that nitrogen to its seeds. Calculations for estimating the N requirement for canola based upon maximum theoretical yields have proven unsuccessful in our region. Recent research indicates that spring canola can root up to 5 ft, and efficiently scavenges high levels of residual soil N thereby minimizing responses to N fertilizer. Though rainfall gradient largely determines yield potential of canola in Pacific Northwest, yields at economically optimum N supply (EONS) are consistently lower than maximum theoretical yields and reached at a relatively lower total N supply (Fig. 1). The N requirement of canola at EONS can vary among years, but a single unit N requirement (UNR) of 11 kg N per kg seed was determined by considering multiple years and locations within a rainfall gradient.

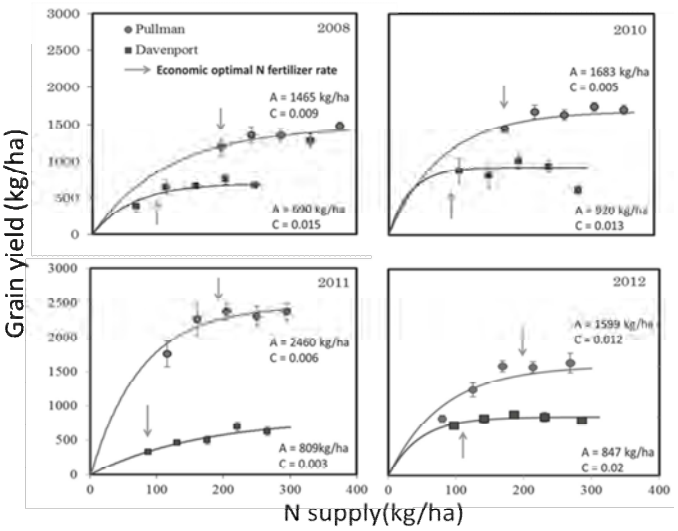

Fig. 1. Maximum yields (A) and efficiency factors (C) for spring canola at Pullman, WA, and Davenport, WA.

Assessing Crop Rotational Nitrogen Use Efficiency Using an N Balance Approach

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In annual cropping systems, N use efficiency is typically estimated on a single crop basis. However, this approach ignores the dynamic nature of N cycling within multi-year crop rotations featuring a diverse set of crops. We developed a component analysis of NUE of an entire cropping sequence of featuring canola (spring canola-spring pea-winter wheat). This approach provided insight into the propensity of cropping systems to retain and recycle N within a rotation by factoring in crop yields, grain and residue N, fertilizer N, N mineralization estimates, and changes in soil residual inorganic N within the intermediate and high rainfall zones of Eastern WA. The inclusion of peas led to positive N balances (N output exceeding N inputs) due biological N fixation (Fig. 1). Interestingly, N balances were also more positive for sequences that received higher rates of N fertilization during its spring canola cropping. This result suggests elevated N mineralization due to the return of canola residues with higher N concentrations, as well as contributions of fertilizer carry-over to the overall rotational NUE. By tracking changes in soil N supply between crops, the rotational NUE will help us evaluate and adopt alternative cropping systems with the propensity to retain and recycle N within a rotation.

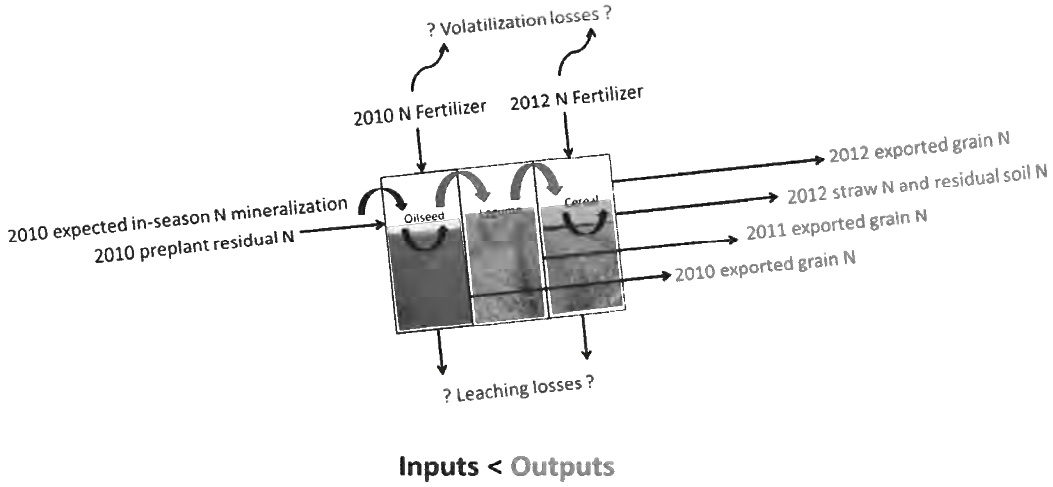

Fig 1. A positive N balance indicates N gains in the cropping system due to biological N fixation or enhanced N mineralization during the cropping sequence.