

growing crop is to use imazamox resistant winter wheat varieties. However, research in the southern Great Plains has shown great variation in feral rye tolerance to imazamox. Therefore crop and chemical rotation are important strategies for the management of feral rye.

Results: In the PNW, where feral rye is considered a noxious weed in WA, very little research has been conducted on its biology, ecology, and management. Thus far, one study in 1977 evaluated paraquat and barban for control of feral rye in winter wheat and a second study in 1984 evaluated the effect of various herbicides on feral rye seed germination. Since then no research has been conducted with feral rye in PNW crops. With the introduction of winter canola into the winter wheat/fallow region an opportunity exists for growers to better manage feral rye in their production systems. In north central WA a study is being conducted to evaluate these three herbicides on a natural stand of feral rye in winter canola. In the 2010-2011 growing season feral rye seed production was decreased 79%, 99% and 100% by spring applications of clethodim, quizalofop, and glyphosate respectively. Winter canola treated with these three herbicides increased yield 31% to 33% compared to the nontreated canola yield. In the 2011-2012 growing season the most effective treatments were when quizalofop and glyphosate were split-applied in the fall and spring. These treatments decreased greatly feral rye plant population and seed population and increased substantially canola yield compared to the nontreated check.

Spring Canola Production at the WSU Wilke Research and Extension Farm

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The WSU Wilke Research and Extension Farm is a 320 acres facility located on the eastern edge of Davenport, WA. This farm is a direct seeded cropping system that utilizes no-till fallow, winter wheat, and spring cereals. Broadleaf crops also remain a viable option and are substituted when conditions warrant. Because of cereal rye infestations, 'DKL51-45' roundup ready spring canola was seeded into Plot 1 instead of no-till fallow. It was seeded and fertilized in one pass with a SeedMaster direct seed hoe drill on 12" spacing on May 2, 2012 at 2.6 lb/ac, and treated with Prosper FX. Anhydrous ammonium was applied below the seed at 51-0-0-0 and liquid ammonium thiosulfate, 11-37 and NACHURS was applied at a rate of 9-15-1-9 with the seed. Prior to seeding canola on April 21, 32.0 oz/ac RT3 herbicide, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate was applied. Roundup PowerMax® was applied on June 8 at 16 oz/ac with 15 lb/100 AMS Max®. On June 15, Assure II was applied at 8.0 oz/ac with 1 qt/100 non-ionic surfactant. On August 11, 16 oz/ac Spodnam was applied by airplane to help reduce pod shatter. Weed control in the spring canola was very good, and a heavy lady bug population helped eliminate the need for insecticide application in the crop. The crop was harvested with our John Deere 6622 combine on August 28. The canola yielded 1,542 lb/ac, was marked at \$0.29/lb and generated \$447.50 gross economic return. Total input costs that includes seed, fertilizer, herbicides and pod sealant totaled \$106.09/ac. Overall spring canola was the second most profitable crop on the farm in 2013 and returned \$82.46 and \$113.33/ac more than spring barley and spring wheat, respectively.

Winter Canola Rotation Benefit Experiment in the Intermediate Precipitation Zone

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Acronyms used: NTF, no-till summer fallow; SW, spring wheat; WC, winter canola; WW, winter wheat

The objective of this long-term experiment is to determine the benefits of winter canola (WC) grown in a 3-year WC-spring wheat (SW)-no-till fallow (NTF) rotation compared to the traditional winter wheat (WW)-SW-NTF rotation in the intermediate precipitation zone on water dynamics, grain yield of the subsequent SW crop, and soil microbial changes.

The study was initiated in August 2007 on deep, productive soils at the Hal Johnson farm west of Reardan, WA. Annual precipitation averages 18 inches. We are comparing a WC-SW-NFT rotation with the more traditional WW-SW-NTF system. All crops are direct seeded with a Kile hoe-opener drill. The experimental design is a randomized complete block with six replications. Individual plot size is 100 ft x 16 ft. Fertilizer application rate is based on soil test results. In addition to WC, WW, and SW grain yield (determined using a plot combine), we measure soil water content in all plots (i) just after harvest in August, (ii) in early April, and (iii) in NTF in August. Plant diseases and microbial attributes are assessed by Tim Paulitz and Ann Kennedy, respectively.

Excellent WC and WW grain yields were achieved in 2012. Winter canola averaged 3720 lbs/acre and WW 105 bushels/acre. On August 15, 2012 the price offered at Reardan for WC was 29 cents/pound and, for soft white WW, \$8.10/ bushel. Gross returns are, therefore, reported here as \$1079/acre for WC versus \$851/acre for WW.

Spring wheat grain yields in 2012 were significantly greater (57 versus 41 bu/acre) when the previous (i.e., 2011) crop was WW compared to WC (Fig. 1). What was the cause of these grain yield differences? There was 1.3 inches more soil water after the WC harvest compared to after WW harvest (Fig. 1). Similarly, at time of planting SW in April, the WC stubble had 1.4 inches greater soil water than WW stubble (Fig. 1). The difference in SW grain yields was likely due to soil water use by volunteer WC in SW. The late-spring broadleaf weed herbicide application in SW stunted, but did not completely kill the volunteer WC. Volunteer WC did not produce additional biomass, but plants stayed green throughout the growing season. In 2011, we had the opposite situation in regards to soil water with WC stubble having 1.1 inch less water in the 6-ft profile compared to WW stubble at time of SW planting. Yet, 2011 SW grain yield was significantly greater following WC compared to WW (64 versus 52 bushels/acre) (Fig. 1) with excellent weed control. There were no visual differences in SW foliar or root disease expression in either 2011 or 2012.

Averaged over five years, there are no significant differences in soil water use of WC compared to WW (Fig. 1). Similarly, there are no significant differences in soil water content in April on WC versus WW stubble (Fig. 1). The 4-year average SW grain yield following WC and WW is 53 and 58 bushels/acre, respectively (Fig. 1), which is not statistically different at the 5% probability level. In summary, our data (to date) indicate that, on average: (i) WC and WW use the same amount of soil water, (ii) over-winter soil water recharge is about the same on WC and WW stubble, and (iii) subsequent SW grain yield will be about the same following WC and WW.

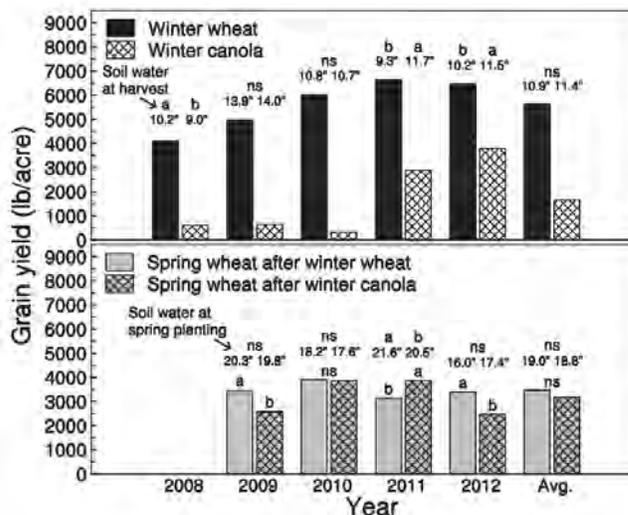


Fig. 1. Top: Winter wheat and winter canola grain yields from 2008 to 2012 and the 5-year average. Bottom: Spring wheat grain yields as affected by previous crop (either WW or WC) from 2009 to 2012 and the 4-year average. Numerical values above bars are total water content in the 6-foot soil profile. Within-year soil water values with different letters indicate significant differences at the 5% probability level. Letters above spring wheat grain yield bars indicate significant differences at the 5% probability level. ns = no significant differences.

Economic Returns to Canola Rotations in Eastern Washington

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Inclusion of canola into cropping systems may offer agronomic benefits to farms that translate into improved overall farm profitability over time. Research and grower experience suggests that canola can help improve weed and disease control, soil structure, moisture penetration, and nutrient availability, which may contribute to increases in wheat yields observed following canola in a rotation. Favorable current prices for canola and potential demand in regional food, feed, and biofuel markets may also make canola a profitable alternative crop in Washington.

We compare economic returns of cropping systems that incorporate canola with the returns to traditional cropping systems for three distinct growing regions in eastern Washington: 1) high-intermediate rainfall, 2) low rainfall, and 3) deep-well irrigated. We consider both conventional and reduced tillage systems in the low rainfall region. Returns are estimated using typical yields for each cropping region and costs of production and output prices for 2012. Sensitivity analysis was performed for yields and output prices.

All rotation systems considered resulted in positive returns, although the inclusion of canola raised input costs. In scenarios where average or low canola yields were considered, rotations with canola had positive returns but sometimes second to traditional cropping systems using average 2012 prices. However, when rotational impacts from canola were