Canola versus Wheat Rotation Effects on Subsequent Wheat Yield

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Canola is considered the most promising, domestically-produced oilseed crop for diversifying wheat-based cropping systems in the Inland Pacific Northwest. Canola serves as a break or non-host crop for many important soilborne pathogens of wheat and helps farmers control weeds. The vast majority of studies in the literature report that canola has a positive effective on subsequent wheat yield.

We conducted a 6-year field experiment near Davenport, WA to measure the effects of winter canola (WC) versus winter wheat (WW) on the subsequent production of spring wheat (SW). Averaged over the years, there were no differences between WC and WW in soil water use or overwinter water recharge into the soil following these crops (Fig. 1). Subsequent SW had excellent plant stands, was weed free, was adequately fertilized, and had no foliar or root diseases. Root lesion nematode populations were miniscule and insignificant. Average SW seed yield following WC was 49 bu/ac versus 58 bu/ac following WW (Table 1); a 17% reduction (p<0.0001). Visual differences in SW plant height and head density between treatments were also apparent (Fig. 2). Spring wheat grain yield differences could not be attributed to the variables measured.

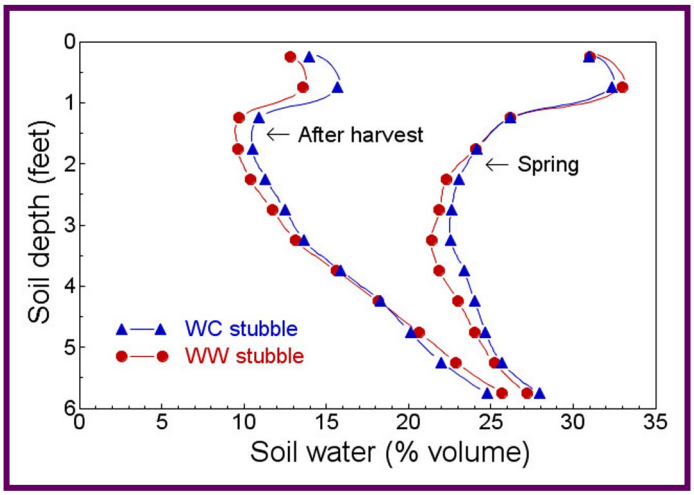

Figure 1. Spatial distribution of volumetric soil water in the 0-to 180-cm soil profile after harvest of WC and WW in August and overwinter soil water recharge following these two crops measured in late April. Data are averaged over five years.

Table 1. Seed yield of winter canola (WC) and winter wheat (WW) and the subsequent seed yield of spring wheat (SW) following either WC or WW.

Seed yield (kg ha^{-1})						
Crop Year	WC	WW	Crop Year	SW after WC	SW after WW	p-value for SW
2008	674	4593	2009	2875 b[a]	3858 a	0.0002
2009	721	5561	2010	4314	4381	0.3656
2011[b]	3235	7424	2012	2762 b	3806 a	0.0013
2012	4256	7226	2013	5167	5666	0.0593
2013	4129	7072	2014	1219 b	1948 a	0.0004
5-yr avg	2603	6375[c]	5-yr avg.	3267 b	3932 a	< 0.0001

[a] Within-year spring wheat grain yield means followed by a different letter are significantly different at p<0.05.
[b] Winter canola was killed by cold during the 2010 crop year; therefore, no WC or WW harvest in 2010 nor SW crop in 2011.
[c] Analysis of variance was not conducted for seed yield differences between WW and WC.

We believe whatever factor(s) responsible for reduction in SW yield following WC is/are short lived as evidenced by no differences in yield of second-year SW when back-to-back SW (i.e., WC-SW-SW and WW-SW-SW) was grown in two years. Similarly, in the dry (<12-inch annual precipitation) region of the PNW where a 2-year WW-SF rotation is commonly practiced, there have been no reports of WW yield decline in a 4-year WC-SF-WW-SF rotation compared to 2-year WW-SF.

Figure 2. Spring wheat after WW versus after WC at time of harvest in August 2014 near Davenport, WA. Note the pronounced visual differences in plant height and head density between treatments.

In May of every year of our study, replicated soil cores in the WC, WW, and SW phases of the experiment were collected and archived in 2-inch increments to a depth of 6 inches. As part of his doctoral soils research at WSU, Jeremy Hansen conducted comprehensive laboratory analysis of these cores each year to determine any soil microbial differences. Specifically, Dr. Hansen used phospholipid fatty acid analysis of the soil to determine treatment differences in biomarker groups of fungi, mycorrhizae, Gram-negative, and Gram-positive bacteria which may help explain our field-study results (see Hansen et al. article on page 36).

Making Connections and Making a Difference: WSU-WOCS Extension & Outreach

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The primary function of the Extension and outreach side of the Washington State Oilseed Cropping Systems (WOCS) project is to be the conduit between the researchers on the team and all stakeholders in the canola industry. At the same time, input from growers, crop consultants, seed suppliers, processors, agencies, and other university personnel is a key component in shaping what questions the WOCS field and greenhouse studies are designed to answer. Communication is our top priority as we share results from research and demonstration trials. This includes phone calls, emails, radio and newspaper interviews, news releases, presentations, field tours, workshops, website (www.css.wsu.edu/oilseeds), Facebook page (WSU Oilseeds), serving as a WSU liaison to the WA Oilseed Commission, WSU Dryland Crops Team member, and the formation of a Pacific Northwest Canola Association (see abstract on pg. 46). Our field tours and winter workshops once again set attendance records in 2017-18.

Group listening to a presentation at one of the three workshops given in January 2018.

We strive to involve a broad spectrum of stakeholders and presentation methods in all our events, and that has proven to be a valuable method to increase attendance. A record 317 individuals attended our 2018 Oilseed Workshops at Hartline, Richland, and Colfax, with 170 attending for the first time (Fig. 1). We also met our goal of more than half of attendees being producers at each location. Our invited speakers from the Canola Council of Canada and Kansas State University added their perspectives and knowledge about canola production and were very well received. More details