Spring Canola in Rotation at WSU Wilke Farm

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Spring canola has been incorporated into the 4-year direct seeded crop rotation at the WSU Wilke Research and Extension Farm near Davenport, WA to help control cereal rye infestations, diversify herbicide chemistry and improve profitability. Roundup Ready '*DKL 45-51*' canola was seeded in 2012 into Dark Northern Spring (DNS) residue and yield 1,542 lb/ac. In the 4-year crop rotation, canola had the second largest economic return over costs at $341/ac and was only $12/ac behind hard white spring wheat (HWSW) and $82 and $101/ac better than barley and DNS wheat. Winter wheat and fallow were not included in rotation because of cereal rye. A mixture of three Roundup Ready canola varieties was seeded in 2013 into HSWW residue and yield 1,748 lb/ac. In the 4-year crop rotation, canola had the second largest economic return over costs at $225/ac and was $86/ac less than soft white spring wheat (SWSW) and $51 better than DNS wheat. Consequently, the SWSW was following the 2012 canola crop. Fallow was included in rotation but winter wheat was not included in rotation because of cereal rye. Overall, given current market prices, yield potential and weed species, canola has been economically competitive with cereal grains in rotation.

Feral Rye *(Secale Cereale L.)* Control in Winter Canola *(Brassica Napus)* in the Pacific Northwest

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In the Pacific Northwest (PNW), where feral rye (*Secale cereale L.*) 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 (*Triticum aestivum*) 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 Oklahoma, clethodim, quizalofop, and glyphosate effectively controlled cereal rye in winter canola as measured by weed seed reduction compared to the nontreated check. In north central Washington, 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.

Oilseeds in Crop Rotation in the Intermediate Rainfall Zone

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The rotational study at the Beulah Wilke Research Farm near Davenport, WA was initiated in 2011 and is in its fourth cropping season. In total, six rotations are being evaluated for agronomics and economics. Three rotations are being evaluated in a three-year system. WW-SW-NTF represents a typical rotation for the area, while WW-SW-SC and WW-SW-SW allow researchers to evaluate the possibility of replacing fallow with a spring crop, and if there is a rotational benefit to using spring canola instead of spring wheat as the fallow-replacing crop. Three rotations are being evaluated in a four-year system. The conventional rotation is WW-SW-SW-NTF, which is compared to WW-SW-SW-CAM, where the oilseed crop camelina replaces fallow, and to WW-SC-SW-NTF, where fallow is included in the rotation, but a spring wheat crop is replaced by spring canola to calculate its rotational benefit.

Preliminary results from the 2013 harvest indicate that WW in the WW-SW-NTF rotation yielded higher (107 bu/ac) than in rotations where it had followed spring wheat (89 bu/ac), camelina (88 bu/ac), or spring canola (94 bu/ac). While there is a yield loss in the continuous cropping rotations, the economics of these rotations have yet to be analyzed, and will be in the coming year.

Characterization and Decomposition of Residue from Winter and Spring Canola Cultivars

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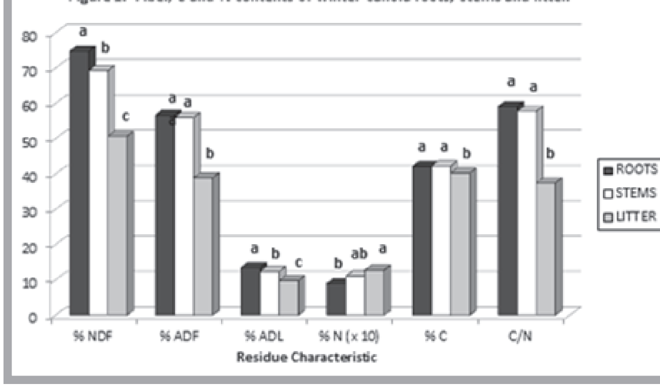
The residue characteristics and decomposition of spring and winter canola (*Brassica napus* L.) cultivars currently grown in the Pacific Northwest (PNW) was investigated. Above- and below-ground residue was collected post-harvest in 2011 and 2012 from Univ. of Idaho Canola Winter Variety Trials at Odessa, WA (irrigated site), Moscow and Genesee, ID, and Spring Variety Trials at Davenport and Colfax, WA and Moscow, ID. Residue was analyzed for fiber, carbon (C), and nitrogen (N) content, and decomposition in soil. Canola plant components varied in fiber and nutrient content with canola litter (leaves, small stems, pods) having lower neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), C, and C/N, and higher N than the roots and stems (Figure 1; $P<0.05$). Lower NDF, ADF, ADL and C/N along with higher N are indicators of rapid decomposition.

Figure 1. Fiber, C and N contents of winter canola roots, stems and litter.



Winter and spring canola stem, root and litter residue differed from one another in fiber and nutrient content, with winter canola having lower NDF, ADF, ADL, C, C/N, and higher N than spring canola. Because winter canola decomposes more rapidly than spring canola and may be used in crop rotations that include summer fallow, winter canola residue must be managed in order to avoid soil erosion, loss of soil organic matter, and degradation of soil quality. Canola stem residue decomposition in laboratory studies was highly correlated with C/N (Figure 2; $P<0.05$), and was also correlated with NDF and ADF. Buried residue, as in a conventionally tilled system, decomposed more rapidly than surface-placed residue. Residue characteristics varied with growing location, with residue from locations receiving higher precipitation having higher C/N. Residue from lower rainfall locations and winter canola cultivars shows potential to decompose more rapidly. We did not find clear differences in residue characteristics or decomposition among the seven winter and seven spring canola cultivars tested in the study. However, we have shown that decomposition occurs most rapidly when residue contains the least amounts of fiber components, highest N and lowest C/N. As marketing opportunities for oilseed crops produced in the PNW and worldwide increase, information on residue decomposition will be useful to growers who wish to incorporate canola into reduced tillage crop rotations to increase cropping diversity and prevent soil erosion. Additionally, canola residue may be managed for greatest economic success and soil quality benefits in conventional and conservation farming systems.

Figure 2. Correlation between canola residue decomposition and C/N.