

Management of Fresh Wheat Residue for Irrigated Winter Canola Production



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We concluded a 3-year irrigated winter canola (WC) field study in 2017 at the Jeff Schibel farm near Odessa, Washington. The two major objectives of this experiment were: (i) to understand the physiological mechanism(s) governing health when planted soon after the harvest of winter wheat (WW), and (ii) to learn how to effectively and profitably produce irrigated winter canola without burning or excessive tillage of wheat stubble. Our hypothesis was that fresh wheat stubble is not phytotoxic to WC and that WC can be successfully produced in a direct-seed system after wheat harvest as a viable alternative to field burning plus heavy tillage.

Five winter wheat stubble management treatments were established in August and September each year. The experiment was embedded in a circle of irrigated WC. Irrigated WW stubble in the plot area was burned in treatments 1 and 3 (below) in late August and irrigation water immediately applied to promote germination of volunteer wheat. Glyphosate was applied to the entire plot area (except for treatment 5, see below) at a rate of 24 oz/acre in early September. Land was prepared as required by protocols for each treatment (see list of treatments in next paragraph). Winter canola was planted in treatments 1 to 4 in early September using a no-till hoe drill with 12-inch row spacing and openers staggered on four ranks. In treatment 5, WC was broadcast into the WW crop before WW harvest in early August.

Treatments established at the Schibel site were: (1) stubble burned + disked, (2) stubble chopped + moldboard plowed, (3) stubble burned, then direct seeded (4) direct seeding into standing and undisturbed stubble, and (5) broadcast WC into WW before WW harvest. Experimental design was a randomized complete block with four replications of each treatment for a total of 20 plots. Application of irrigation water, which totaled about 15 inches for the crop year, was managed by Jeff Schibel.

Satisfactory stands of WC were established in all treatments each year (Fig. 1). The hypocotyl (i.e., the stem from ground level to the growing point at the first leaves) of WC elongated up to four inches and leaves extended above the 15-inch-tall WC by mid-October (Fig. 2, plant on right). In contrast, in the stubble burned treatment the hypocotyl was only one-inch long in mid-October (Fig. 2, plant on left).



Figure 1. WSU research technician John Jacobsen in a standing residue plot that was successfully direct seeded. The grain yield of this winter wheat field was 147 bu/acre and the stubble cut at a height of 15 inches.



Figure 2. Size of winter canola plants in mid-October. Plant on left was direct seeded after burning winter wheat stubble. The plant on the right was direct seeded into 15-inch tall wheat stubble.

In year 2, WC in both the direct seed into standing stubble and broadcast into standing WW before WW harvest was winterkilled. Winter canola plants in the other three treatments were hurt by the cold but many survived. In year 3, voles infested the two standing stubble treatments during the winter (when snow covered the ground for 75 days) and ate WC plants mostly down to ground level. Voles did not infest the other three treatments. Seed yields during the 3-year experiment are shown in Table 1.

Important take-home messages from this experiment are: (i) We found no evidence that fresh wheat stubble is toxic to WC as evidenced by no foliar or root diseases in any year, and; (ii) an Adams County farmer successfully produces irrigated WC direct seeded into freshly harvested WW stubble after mowing the stubble and, therefore, apparently avoiding extensive WC seedling hypocotyl elongation as experienced in our study.

Table 1. Winter canola seed yields in three years and the 3-year average yield with five wheat residue management treatments at the Jeff Schibel farm near Odessa, WA.

	Seed yield (lbs/acre)			
	Year 1	Year 2	Year 3	3-yr avg.
Stubble burned + disked	3092	2832	2776 ab	2900
Stubble burned + direct-seeded	3020	2678	2795 ab	2831
Stubble chopped + moldboard plowed	3246	1830	3158 a	2745
Direct seeded into undisturbed stubble	2988	**	2218 bc	
Broadcast into standing wheat	*	**	1939 c	
Statistical significance	ns ($p = 0.40$)	ns ($p = 0.06$)	$p < 0.001$	ns ($p = 0.52$)

* The broadcast into standing wheat before harvest treatment was not present in year 1.

** Canola killed by cold temperatures in 2014.

ns = No significant statistical differences at $p < 0.05$.

Soil Microbial Communities in a Long-Term Dryland Camelina Cropping Systems Experiment



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Camelina is a potential alternative and oilseed biofuel crop for wheat-based cropping systems of the Inland Pacific Northwest (PNW). We investigated the effect of this relatively new rotational crop on soil microbial communities. Camelina is a brassicaceous crop that contains glucosinolates which, upon cell rupture during the decay of residue, hydrolyze to produce isothiocyanates. Dimethyl-disulphide is a compound that is associated with the roots of camelina. Production of isothiocyanates and dimethyl-disulphide contribute to the "biofumigation effect" which can reduce the inoculum of soilborne pathogens. However, the non-selectivity of these compounds has potential to also impact beneficial soil microorganisms.

An 8-yr cropping systems experiment was initiated in 2009 at Lind, WA, to compare a 3-yr rotation of winter wheat (WW)-camelina (C)-summer fallow (SF) to the typical 2-yr WW-SF rotation. Microbial biomass and community composition were determined using phospholipid fatty acid analysis (PLFA). The abundance of fungi, mycorrhizae, Gram positive and negative bacteria, and total microbial biomass all declined over the 3-yr period in the WW-C-SF rotation. All microbial lipid biomarkers were significantly less in SF compared to WW (Fig. 1). The 2-yr WW-SF rotation demonstrated few differences in microbial lipid abundance and community structure between the rotation phases. Decline in microbial abundance and shift in community structure (Fig. 2) of the 3-yr WW-C-SF rotation was likely due to the combination of a