derived from advanced biofuels. The Pacific Northwest is expected to contribute 5% of this need for advanced biofuels. Although a considerable effort is now underway to ascertain the potential of growing oilseeds for advanced biofuels, little is known concerning the environmental impact of growing oilseed crops in rotations in this region. Of interest is the impact of growing oilseeds on wind erosion and PM10 (particles ≤10µm in diameter) emissions, which are acute environmental concerns in the drier areas of the Columbia Plateau.

In September 2011, we examined the potential for wind erosion and PM^{10} emissions at the end of the fallow phase of a winter wheat-fallow versus a winter wheat-camelina-fallow rotation at Lind, WA and a winter wheat-fallow versus a winter wheat-safflower-fallow rotation at Ritzville, WA. An undercutter implement was used for primary spring tillage and then a rodweeder was used to control weeds for the duration of the fallow phase of the rotations at both sites. A portable wind tunnel (Fig. 1) was used to assess total horizontal sediment flux and PM^{10}concentrations after sowing but prior to wheat emergence. Total sediment flux was measured using an isokenetic wedge-shaped sampler while PM^{10}concentrations were measured using Dusttrak aerosol monitors. Our results indicate a 15% increase in sediment flux in the camelina rotation at Lind and an 80% increase in sediment flux in the safflower rotation at Ritzville compared with the winter wheat-fallow rotation. Most apparent was lower residue cover following the oilseed crops, which likely contributed to the higher sediment flux from fallow after the oilseed versus winter wheat crop. Our results suggest that, even with conservation tillage best management practices, wind erosion may be accentuated by growing oilseeds in tillage-based fallow systems in the Columbia Plateau.

Fig. 1. A portable wind tunnel was used to measure soil sediment flux and PM^{10} emissions, shown here at the Ron Jirava farm near Ritzville.

Biofuels Research in Western Washington

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Biofuel crop production research in western Washington has included canola, camelina, rapeseed, mustard, and flaxseed, with different experiments focused on seeding rate and date, and on nitrogen (N) fertilizer timing, rate, and source. The experiments were done at WSU Mt. Vernon and WSU Puyallup from 2008-2011.

Canola was the most successful biofuel crop grown in the western Washington experiments. We identified mid August to early September as the fall planting window, with later plantings likely to yield poorly or fail. Fall planted canola yielded 3000-5000 lbs/acre. Spring planted canola (late April planting) averaged 2000-4000 lbs/acre. Organically-managed canola competed well against weeds when planted within the fall window, and our research indicated that it could be a viable rotation crop in western Washington. The organic canola oil would have much greater value as a food crop than a biofuel crop. Volunteer canola plants showed the potential to become problem weeds in subsequent crops under organic management, and would need to be managed carefully.

Additional experiments with canola focused on biosolids as a nutrient source, and showed similar production using two very different biosolids sources (heat-dried biosolids with 6% N and lagooned/dewatered biosolids with 2% N) each applied at two rates. Spring planted canola competed well against weeds in these experiments. Rapeseed yields were similar to canola and may also be a viable biofuels crop.

Camelina was much less successful than canola, with variable yields in the experiments (often less than 1500 lb/acre) and one crop failure. Neither winter nor spring plantings were productive, and we did not identify a successful camelina production strategy for western WA. Flax also performed poorly; yields in 2008 ranged from 1100-1600 lbs/acre, but only from 300-500 lbs/acre in 2009. Getting flax to harvest maturity is a major concern with this species, as seed pods in both years were quite wet at harvest.

Mustard also had variable and generally low yields, ranging from about 800-2800 lbs/acre. Mustard was an excellent competitor against weeds, and may have more of a role as a niche cover crop than a biofuels crop.

In summary, canola appears to be the most viable biofuels crop in western Washington, but still faces serious obstacles, including lack of local processing capacity, and exclusion zones where canola cannot be grown because of risk of contamination of brassica seed crops. Although not a biofuel use, organic production of canola could yield organic canola oil for food and organic canola meal for dairies, beef cattle, and poultry that is limited in supply and could command a high price.

Canola and Camelina Diseases

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In 2011 our project focused on identifying potential canola (primarily *Rhizoctonia*) and camelina (downy mildew) diseases in WA, and screening for resistance to those pathogens.

Canola: Previous with resistance to Rhizoctonia diseases has been done with *R. solani* AG 2-1, and little is known about the virulence of two other groups common in the PNW: AG-10 and *Ceratobasidium* spp. We screened 20 canola cultivars to test for resistance/tolerance to soils inoculated with the diseases. None of the cultivars exhibited resistance to AG 2-1; all were killed in the experiment. One *B. napus* hybrid (Visby) showed high level of tolerance to damping-off from *R. solani* AG 8, AG 10 and the binucleate *Rhizoctonia*, while two genotypes (Amanda and Baldur) exhibited high level of tolerance to *R. solani* AG 10.

Camelina: Downy mildew of camelina was observed in fields in 2010 and 2011, with an incidence of less than 5%, but it may be impacting yield. We planted seed infested with downy mildew, and found that infected plants resulted from infested seed, indicating that the disease is seed transmitted. The pathogen was confirmed as *Hyaloperonospora camelinae*. Growers should use certified or tested seed, and seed treatment with mefanoxam may control the disease.

We will continue to monitor and investigate canola and camelina diseases in 2012. We will verify the identity of pathogen on camelina and relation to *H. parasitica* (downy mildew of Brassicas) with DNA work, and confirm if isolates from camelina are cross-pathogenic to canola.

Fig. 1. Flowering stem of camelina infected with downy mildew (*Hyaloperonospora camelinae*).

Winter Canola Rotation Benefit Experiment

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A winter canola rotation benefit study was initiated in August 2007 at the Hal Johnson farm located east of Davenport, WA. Average annual precipitation at the site is 18 inches. The traditional 3-year winter wheat (WW)-spring wheat (SW)-no-till fallow (NTF) rotation is compared to a 3-year winter canola (WC)-SW-NTF rotation. All crops are produced using direct seeding. Experimental design is a randomized complete block with six replications (total area per site is 0.9 acres). Fertilizer rate is based on soil test. All crops are planted and fertilized with a no-till hoe-opener drill and grain yield is determined using a plot combine. In addition to grain yield, soil volumetric water content is measured in all plots just after harvest in August, in mid March, and again after grain harvest.

Excellent stands of WC were once again achieved from mid August 2010 planting into no-till summer fallow. The WC plants survived the winter in good shape and produced a revised seed yield of 2910 lbs/acre in 2011 (Fig. 1 and Fig. 2). This is, by far, the best WC seed yield obtained during the first four years of the experiment. Winter wheat planted into no-till fallow produced 115 bu/acre in 2011; the highest WW yield so far obtained (Fig. 1).

One very interesting phenomena in 2011 was that SW after WC produced a significantly higher 67 bu/acre compared to 60 bu/acre after WW (Fig. 1) despite the fact that there were no differences in soil water content after harvest of WC and WW in August 2010. These data show that WC provided a significant rotation benefit to spring wheat compared to WW that was not related to