water.

Another interesting data set from 2011 show that WW extracted 2.3 inches more water than WC by time of harvest. These soil water differences were highly significant statistically and apparent in all six replicates. Our previous experience had indicated that WC extracts more soil water than WW, but that was obviously not the case in 2011.

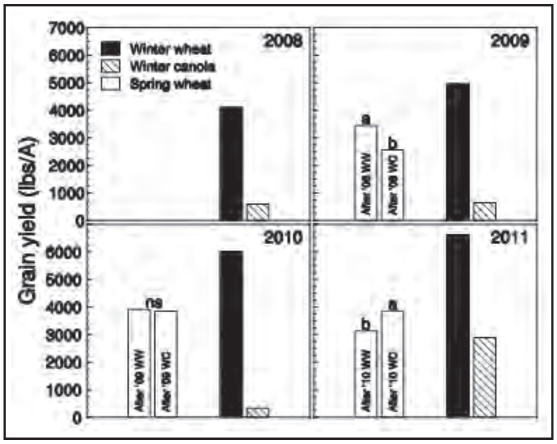

Fig. 1. Grain yield of winter wheat (solid bars) versus winter canola (striped bars) in 2008, 2009, 2010, and 2011. Both crops were planted into no-till fallow on the Hal Johnson farm. Subsequent grain yield of spring wheat (solid white bars) grown after either winter wheat or winter canola is shown for 2009, 2010, and 2011.

Fig. 2. WSU research technician in winter canola plot on the Hal Johnson farm NE of Davenport, WA

Camelina Cropping Systems Experiment at Lind

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A camelina cropping systems experiment was established at the WSU Dryland Research Station at Lind in the 2008 crop year. This experiment will be conducted for nine years to evaluate the traditional 2-year winter wheat-summer fallow (WW-SF) rotation with a 3-year winter wheat-camelina-summer fallow (WW-C-SF) rotation. Experimental design is a randomized complete block with four replications. Each phase of both rotations appears each year in 30 ft x 250 ft plots (total = 20 plots). More than 90% of dry cropland acres in the less than 12-inch annual precipitation zone are in WW-SF. The logical fit for camelina in this dry region is in a 3-year WW-C-SF rotation.

The experiment is located on a south-facing slope. Soils on south-facing slopes are exposed to intense sunlight and drying, thus maintaining adequate seed-zone water content for deep-furrow planting of winter wheat can be a problem in dry years. Crop-year (Sept. 1 – Aug. 31) precipitation was 6.85, 8.46, 11.58, and 11.70 inches in 2008, 2009, 2010, and 2011, respectively. Due to inadequate seed-zone water in late August of 2007 and 2008, we were unable to establish WW with deep-furrow planting into carryover moisture and instead planted WW in late October after the onset of fall rains. For this reason, combined with low crop-year precipitation, WW grain yields were low in 2008 and 2009 (Fig. 1).

For the 2008, 2009, and 2010 crop years, camelina was planted in mid October. However, we learned from the camelina planting date and method experiment (also at the Lind Station, see related article in this booklet) that the best camelina seed yield potential appears to be from a late February-early March planting. A later planting date allows for application of glyphosate herbicide just before planting to control tumble mustard, tansy mustard, and flixweed; these broadleaf weeds establish during the fall and winter. For these reasons, we changed the planting date on or about March 1 beginning in 2011 (Fig. 2).

Grain yields in both the WW-SF and WW-C-SF rotations are shown in Fig. 1. Average seed yield of camelina ranged from less than

100 lbs/acre in 2008 under extreme drought to 690 lbs/acre in 2011. Winter wheat grain yield in the WW-SF rotation has, to date, been generally slightly (but not significantly) higher than in the WW-C-SF rotation (Fig. 1). We believe the reason for this is because soil water in the 6-ft profile has been depleted more after camelina than after WW (data not shown). We believe that broadleaf weeds, mainly Russian thistle, are responsible for this large soil water extraction in camelina. Russian thistle becomes established in April and there are currently no in-crop broadleaf herbicides that can be applied to camelina. However, before planting the 2012 crop, we applied Sonalan® soil-residual herbicide before planting camelina on half of the plot area to determine its effectiveness for control of Russian thistle.

Growers need to be mindful that camelina produces relatively little residue. With heavy tillage, soil erosion may be a problem during or after camelina production. To reduce the potential for soil erosion, we recommend that (i) camelina be planted directly into standing and undisturbed WW stubble, and (ii) non-inversion conservation tillage (i.e., apply glyphosate, undercut for primary spring tillage, and rodweed only as needed to control weeds) be conducted during the 13-month-long fallow period after camelina seed harvest. Funding for this research is provided by the WSU Biofuels Project.

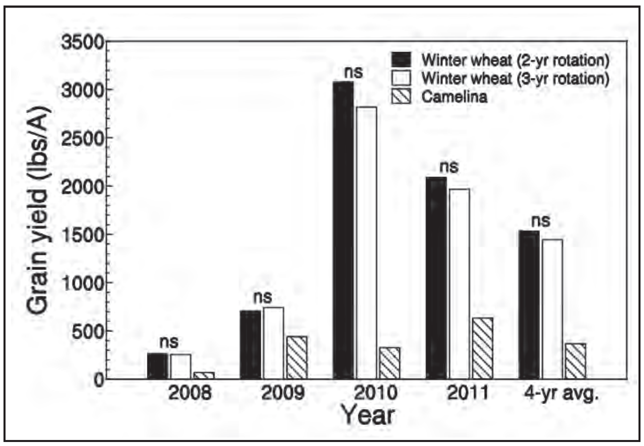

Fig. 1. Grain yield of winter wheat grown either in a two-year winter wheat-summer fallow rotation or a three-year winter wheat-camelina-summer fallow rotation as well as camelina seed yield during the first four years of a long-term camelina

Fig. 2. Camelina plant stands in the cropping systems experiment at Lind. Camelina seed is direct drilled in early March into standing and undisturbed winter wheat stubble with a Kile no-till drill equipped with paired-row hoe-type openers. Fertilizer is delivered below the seed with the drill.

Rotational Influence of Biofuel and Other Crops on Winter Wheat

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In this study, eight spring crops (spring wheat, spring barley, dry pea, lentil, camelina, yellow mustard, oriental mustard, and canola) are planted in year1 followed by winter wheat (year2) grown across all year1 spring crops. The winter wheat planted within each of the previous spring crop areas is divided into sub-plots and fertilizer rates of 32, 64, 96, 128, 160 lb N/acre are applied with a split application of 70% in the fall and 30% in the spring. The spring crops are managed with uniform fertilizer applications to all crops except the pea and lentil that did not receive fertilizer.

Results from four spring crop years are in Table 1 and preliminary conclusions are:

- Spring crop productivity is variable, but barley and camelina are the most consistent
- Camelina out-yielded the other Brassica crops
- Market prices will be a large determining factor in spring crop choice
- Winter wheat yield following spring crops is highest after pea or lentil followed closely by the Brassicas and superior to following wheat or barley
- Economic return for spring crops should include their influence on the following crop
- When reliable results show wheat performance after spring crops, growers can also assign rotational benefits to biofuel