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.

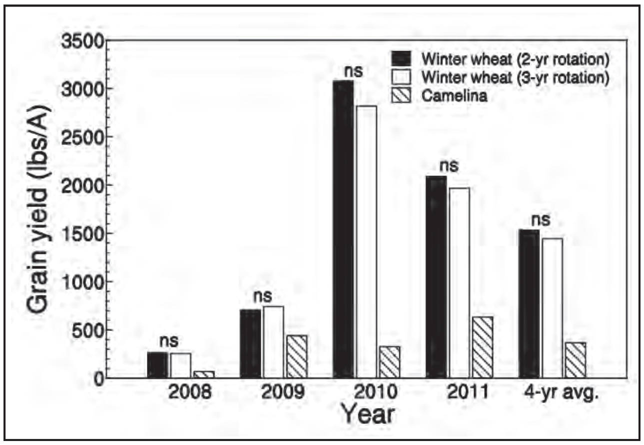

Fig. 1. Grain yield of winter wheat grown either in a two-year winter wheat-summer fallow rotation or a three-year winter wheat-camelina-summer fallow rotation as well as camelina seed yield during the first four years of a long-term camelina

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

crops due to increased productivity of winter wheat and reduced N fertilizer input costs. This information boosts growers' decision-making ability to grow biofuel or any spring crop prior to winter wheat.

2010 Rotation Study Spring Crops planted to winter wheat for 2011 at Spillman Farm, Pullman, WA

Table 1. Spring Crop Seed Yields, 2008 Moscow, 2009, 2010, and 2011 Pullman

Spring Crop	2008	2009	2010	2011	2008-11 avg.	Avg. % Variation
	---------------------- lbs/acre --------------------					
Spring Wheat	3750	3915	1700	2770	3035	26.4
Spring Barley	4625	5485	3520	4145	4445	13.8
Dry Pea	1830	245	840	2565	1370	61.4
Lentil	1075	740	480	1850	1035	56.8
Camelina	1895	2585	1715	1530	1930	17.0
Yellow Mustard	1390	1635	695	1415	1285	23.1
Oriental Mustard	915	2290	700	1750	1415	42.9
Canola	700	1610	670	1395	1095	37.3
Average	2025	2315	1290	2175	1950	34.8
LSD (0.05)	515	765	750	455		

Increasing Seed Size and Seedling Emergence in the Brassicas Arabidopsis and Camelina

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In low rainfall, dryland-cropping areas of Eastern Washington stand establishment can have a major impact on yields of camelina and canola. One approach to facilitate stand establishment is to develop varieties with larger seeds and longer hypocotyls as seedlings while maintaining normal stature as adults. Unfortunately, few mechanisms have been identified that uncouple adult stature from seedling height. The Neff lab has identified a group of plant-specific genes that, when mutated in a particular way, increase seed size and seedling height without adversely affecting adult stature. These genes encode AHL (AT-Hook Containing, Nuclear Localized) proteins. In the Brassica *Arabidopsis thaliana,* we have identified a unique mutation (*sob3-6*) in one of these genes, *SOB3/AHL29*, that expresses a protein with a disrupted DNA-binding domain and a normal protein/protein interaction domain. In *Arabidopsis*, this mutation confers normal adult plants that produce larger seeds and seedlings with hypocotyl stems that are up to twice as long as the wild type. We have shown that a similar DNA-binding mutation (*esc-11*) in another *AHL* family member in *Arabidopsis*, *ESC/AHL27*, confers similar phenotypes as *sob3-6*. We have also shown that expressing this *Arabidopsis* mutation in the Brassica *Camelina sativa* leads to taller seedlings with no negative impact on adult size. By analyzing seed weight, we have shown that these taller seedlings are, in part, caused by an increase in seed size (Figure 1). However, the increase in height using the *Arabidopsis* mutant allele in camelina is only 30% and not the 100% realized by using the *Arabidopsis* mutant