Long-term Camelina Cropping Systems Experiment at Lind

W.F. SCHILLINGER, J.A. JACOBSEN, S.E. SCHOFSTOLL, B.S. SHARRATT, AND B.E. SAUER
DEPT. OF CROP AND SOIL SCIENCES, WSU; USDA-ARS

The objective of this study is to determine the long-term suitability of camelina in the typical winter wheat-summer fallow cropping zone of eastern Washington. This would allow farmers to plant crops in two out of three years (i.e., increase cropping intensity) instead of only once every other year as currently practiced.

We are currently in year five of a 9-year cropping systems experiment to evaluate camelina produced in a 3-year winter wheat-camelina-fallow rotation compared to the 2-year winter wheat-fallow rotation. Experimental design is a randomized complete block with four replicates. There are 20 plots, each 250 ft x 30 ft in size. Camelina is direct drilled + fertilized into standing wheat stubble during the first week of March. Winter wheat is planted into fallow in late August. Soil water content to a depth of six feet is measured in all 20 plots after camelina and winter wheat harvest in July and again in March, and from the eight fallow plots in late August just before planting winter wheat. Weed species in all camelina and wheat plots are identified, counted, and collected just before grain harvest and above ground dry biomass of each weed species is determined. Surface residue remaining after planting WW in both rotations is determined using the line-point method. The susceptibility of newly-planted winter wheat plots to wind erosion is determined by Brenton Sharratt using a wind tunnel.

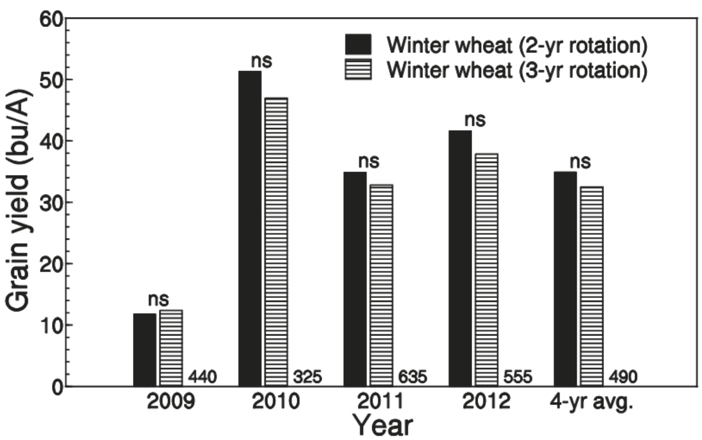

Fig. 1. Winter wheat grain yield grown in a 2-year winter wheat-fallow rotation versus a 3-year winter wheat-camelina-fallow rotation. Numerical values are camelina grain yield (lbs/acre) for each year and the 4-year average. ns = no significant differences. This long-term cropping systems experiment is conducted at the WSU Dryland Research Station near Lind.

Camelina grain yield in 2012 averaged 555 lbs/acre (Fig. 1 and Fig. 2). Crop year (Sept. 1 – Aug. 31) precipitation at the site was 11.09 inches (1.6 inches greater than normal for Lind). Why didn't camelina have a greater grain yield in a "wet" year? First, it was a cold spring. Secondly, only 0.24 inches of rain was received in May, a month during which camelina usually rapidly increases above-ground biomass. Our observation was that growth of camelina occurred at a slower rate in May 2012 compared to previous years. The 4-year (2009-2012) average camelina grain yield is 490 lbs/acre (Fig. 1) produced with an average 9.49 inches of crop-year precipitation.

The main weeds in camelina in 2012 were Russian thistle and tumble mustard, although the dry biomass produced by both of these weeds in 2012 was less than the 4-year average (data not shown). Over the four years, Russian thistle has produced slightly (but not significantly) more dry biomass in winter wheat than in camelina; the difference being Russian thistle plants tend to be few but large in wheat and small but more numerous in camelina. The benefits of camelina in the crop rotation to control downy brome was readily apparent in 2012 where we obtained complete control of this grass weed (data not shown) with the post-emergence application of Assure II herbicide. We have learned from previous research that the best overall planting date for camelina throughout the Pacific Northwest is late February-early March. This is also the best planting window for weed control as it allows glyphosate (or other non-soil-residual herbicide) to be applied before planting to control winter-emerging broadleaf weeds.

Fig. 2. WSU Research Technician, John Jacobsen, in the camelina cropping systems experiment at Lind in late May, 2012.

There were no statistically significant winter wheat grain yield differences in the 2-year versus 3-year rotations in 2012 or when averaged over the four years; however, the yield bar is generally slightly lower in the 3-year rotation (Fig. 1). This yield trend is likely due to soil water. Averaged over the four years, total water in fallow at the time of winter wheat planting in late August is 0.5 inches greater (P < 0.001) in the 2-year compared the 3-year rotation (Table 1). There are no differences in soil water content after the time of harvest of wheat and camelina nor are there differences in over-winter water gain on WW versus camelina stubble. The differences in water loss between the two fallow rotations occur during the summer (P < 0.005, Table 1). The average of 0.5 inches more water in the 2-year rotation would account for the 3-4 bushels/acre winter wheat grain yield increase in the 2-year rotation.

Why is greater water loss occurring during the summer in the 3-year rotation when both fallow systems are treated the same (i.e., plots are always undercut, rodweeded, and planted to winter wheat at the same time)? The answer could be that greater surface residue in the 2-year rotation provides better shading. Line-point residue measurements obtained after planting of winter wheat in 2012 showed 35% residue cover in the 2-year rotation versus 18% in the 3-year rotation (P < 0.02). These differences have been statistically significant every year and when averaged over the four years (P < 0.001, data not shown).

Table 1. Soil water content at the beginning (after harvest), early spring, and end of fallow (before planting) and associated gain or loss of water and precipitation storage efficiency (PSE = gain in soil water/precipitation) in the 6-ft soil profile in summer fallow in a 2-year winter wheat-summer fallow rotation versus a 3-year winter wheat-camelina-summer fallow rotation. The top portion of the table shows water content during the 2011-2012 fallow cycle and the bottom portion of the table shows water content for the 4-year average.

	Timing in fallow period					
	Beginning (late Aug.)	Spring (mid Mar.)	Over-winter gain	End (late Aug.)	Mar. to Aug. water	PSE† (%)
	Soil water content (inches)					
			A. 2011-2012			
Fallow treatment						
After winter wheat (2-yr rotation)	5.7	8.1	2.4	9.0	+ 0.9	30
After camelina (3-yr rotation)	5.8	8.6	2.8	9.1	+ 0.5	30
p-value	ns	ns	ns	Ns	ns	ns
			B. 4-year average			
Fallow treatment						
After winter wheat (2-yr rotaion)	6.1	9.3	3.2	8.9	- 0.4	29
After camelina (3-yr rotation)	5.8	9.3	3.6	8.4	-0.9	26
p-value	ns	ns	ns	0.001	0.005	ns

Camelina: What Will it Take to Make this Crop Attractive to Pacific Northwest Growers?

W.F. SCHILLINGER, DEPT. OF CROP AND SOIL SCIENCES, WSU, LIND

What will it take to make camelina production attractive to growers? During the past winter, I discussed this question with progressive farmers from Washington, Oregon, Idaho, Montana, and Colorado. The main factor is price. The price offered to PNW farmers for camelina seed in the past several years has ranged from $0.12 to 0.15 per pound. During this same time period, the price offered for canola seed has been $0.24 to 0.30 per pound (i.e., double). There are several oilseed crushing facilities in Washington and Oregon – all geared to “cold press” canola seed for oil extraction. The same crushing machinery can be used to cold press camelina seed, but crushers need certain minimum quantities of seed to keep their facilities in full-time operation.

All growers with whom I talked said they would sign contracts to produce camelina for $0.30 per pound. Included in this price was an agreement to deliver the camelina seed to a crushing facility within a 40 mile (one way) hauling distance from their farm. Two growers said they would consider producing camelina for a guaranteed $0.25 per pound. None of the growers interviewed would produce camelina for less than $0.25 per pound.