yields averaged 3100 lbs ac^{-1} among years in all treatments (Table 1). Safflower oilseed yields were significantly higher under the 100 than 145 lb N acre^{-1} fertilizer rate in 2008. Safflower oilseed yields were not significantly different between the full and 70% ET treatments, indicating a potential 5 to 7 inch water savings using a deficit irrigation strategy depending on year. Deficit irrigation (70% of ET) had a positive effect on WUE with an average increase of 23 lb seed yield acre^{-1} inch^{-1} of water applied. Oil contents of the seed were 1.5 – 2.2% higher under deficit irrigation than under full irrigation following the higher yields and greater water use efficiencies.

Table 1. Yield of safflower and water use at the USDA-ARS Field Station near Paterson, Benton County, WA.

		Full Irrigation				Deficit Irrigation			
N rate (lb/acre)		100		145		100		145	
Yield	Yr	lb/acre	lb/ac/inch Water	lb/acre	lb/ac/inch Water	lb/acre	lb/ac/inch Water	lb/acre	lb/ac/inch Water
Cw99 OL	08'	3103	107	3084	106	3250	135	3026	126
	09'	2547	88	2419	84	2819	118	2212	93
	10'	3040	103	2877	98	2934	129	3105	137
	11'	3197	118	3839	141	3170	161	2860	145
	Average	2972	104	3055	107	3043	136	2801	125
S345	08'	3370	116	3017	104	3557	148	3326	139
	09'	2326	81	2982	103	2793	117	2383	100
	10'	3028	103	3068	104	2871	127	3361	148
	11'	2826	104	3292	121	2595	132	2398	122
	Average	2888	101	3090	108	2954	131	2867	127
S 334	08'	----	----	----	----	----	----	----	----
	09'	----	----	----	----	----	----	----	----
	10'	2936	100	2390	81	2978	131	2822	124
	11'	1547	57	2121	80	1207	61	1444	73
	Average	2242	31	2256	81	2093	39	2133	99

Wind Erosion Potential from Oilseed Cropping Systems

B.S. SHARRATT, USDA-ARS AND W.F. SCHILLINGER, DEPT. OF CROP AND SOIL SCIENCES, WSU

The United States Energy Independence and Security Act of 2007 mandates the use of 36 billion gallons of biofuel by 2022 with 21 billion gallons being derived from advanced biofuel feedstocks. To meet this goal, the United States Department of Agriculture developed a strategy entitled "A USDA regional roadmap to meeting the biofuels goals of the Renewable Fuels Standard by 2022" in which it is anticipated that 4.6% of the advanced biofuels would be produced in the northwestern United States. Although progress ish being made in growing oilseeds for advanced biofuels, little is known concerning the impact of growing oilseed crops on environmental resources.

Fig. 1. Wind erosion assessed using a wind tunnel after sowing winter wheat at Lind, WA in August 2011.

We examined the impact of growing oilseeds in a winter wheat-summer fallow rotation on wind erosion and PM10 (particles ≤10μm in diameter) emissions in eastern Washington state where atmospheric PM10 is an acute environmental concern. Wind erosion and PM10 emissions were measured at the end of the fallow phase of a winter wheat-summer fallow versus a winter wheat-camelina-summer fallow rotation or a winter wheat-safflower-summer fallow rotation in 2011 and 2012. In addition, camelina and safflower were direct seeded into standing stubble of the preceding winter wheat crop. The undercutter implement, a conservation tillage tool, was used for primary tillage during fallow in all rotations. A portable wind tunnel was used to assess horizontal sediment and PM10 flux after sowing wheat (Fig. 1).

Our results indicate that total sediment and PM10 flux were as much as 200% higher from the wheat-oilseed-fallow rotation compared with the wheat-fallow rotation (Table 1). The higher sediment and PM10 flux from the oilseed rotation was likely due to lower biomass of crop residue following the oilseed versus wheat crop.

Table 1. Horizontal sediment flux measured after sowing wheat into a winter wheat-summer fallow and winter wheat-camelina-summer fallow rotation at Lind, Washington and a winter wheat-summer fallow and winter wheat-safflower-summer fallow rotation at Ritzville, Washington.

Location	Year	Sediment flux (g m^{-1} min^{-1})	
		Wheat	Oilseed
Lind	2011	68	201
	2012	310	696
Ritzville	2011	344	674
	2012	232	634

Wind erosion and PM10 emissions may be accentuated by growing oilseeds in the low precipitation drylands of the Pacific Northwest. Therefore, the practice of conservation tillage and no-tillage for residue retention will be paramount to controlling wind erosion and PM10 emissions from oilseed cropping systems in the region.

Safflower Cropping Systems Experiment in the Low-Precipitation Zone

WILLIAM SCHILLINGER[1], RON JIRAVA[2], JOHN JACOBSEN[1], AND STEVE SCHOFSTOLL[1]
[1]DEPT. OF CROP AND SOIL SCIENCES, WSU, LIND; [2]COLLABORATING GROWER, RITZVILLE

Acronyms used: SAF, Safflower; SW, Spring wheat; TF, Tilled fallow; WW, Winter wheat

The objective of this study is to evaluate safflower production potential when grown in a 3-year winter wheat-safflower-tilled summer fallow (WW-SAF-TF) rotation compared to several cereal-only rotations. The WW-SAF-TF rotation is incorporated in long-term dryland cropping systems experiment on the Ron Jirava farm located west of Ritzville, WA. Annual precipitation at the site over the past 15 years has averaged 10.6 inches.

We compare the WW-SAF-TF rotation with another 3-year rotation, winter wheat-spring wheat-tilled fallow (WW-SW-TF) and the traditional 2-year rotation of winter wheat-tilled fallow (WW-TF). Each phase of all rotations is present each year and there are four replicates. Size of individual plots is 500 ft x 30 ft. Soil water is measured in all plots after grain harvest, in early April, and from fallow in early September. Treflan, a soil-residual herbicide, is applied in March to be rain incorporated into plots that will be sown to safflower. Safflower is direct seeded (Fig. 1) at a rate of 40 lbs/acre + fertilized into standing and undisturbed winter wheat stubble in April. Grain yield is determined with a commercial-sized combine and a weigh wagon.

Fig. 1. Safflower is direct-seeded into standing and undisturbed winter wheat stubble. These safflower plants were still in the juvenile stage of growth in mid-May 2012, but grew rapidly thereafter.

Grain yield of safflower averaged 880 lbs/acre in 2012. For comparison, grain yield of spring wheat and spring barley (also planted recrop, i.e., no fallow) at the site averaged 30 bushels/acre and 1960 lbs/acre, respectively. Safflower was planted on April 9, 2012. Air and soil temperatures were cold throughout the month of April and safflower seedlings were still emerging well into the month of May. In the 2013 crop year, we chose to wait until late April to plant safflower. This allowed an additional glyphosate herbicide application just before planting and likely promoted more rapid and uniform emergence. Soil water dynamics, weeds, and effects of safflower on subsequent winter wheat grain yield are measured. Winter wheat grain yield in 2012 in the WW-SAF-TF, WW-SW-TF, and WW-TF rotations was 62, 79, and 75 bushels/acre, respectively.