

Project Title: Impact of Alternative Crops on Winter Wheat and Spring Cereal Establishment, Growth, Yield, and Economics in Direct Seed Systems in the Intermediate Rainfall Area of Washington.

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Final Report

Objectives: The objectives of this project are to: a) evaluate the impact of alternative crops on establishment, growth, yield, and economics of winter wheat and spring cereals, and b) evaluate the impact of winter and spring cereals on establishment, growth, yield, and economics of spring seeded alternative crops in a continuous cropping system.

Key Words: alternative crops, crop rotations, chemical fallow

Statement of Problem: Lack of information about the effect of alternative crops on cereal grain production has limited the effectiveness of designing profitable crop rotations in the intermediate rainfall area of Washington.

Zone of interest: Intermediate rainfall zone

Abstract of Research Findings:

Studies were conducted in the intermediate cropping zone to evaluate the effect of broadleaf and cereal crops on establishment, growth and yield of winter wheat and spring cereals. The experimental design of the study is a split-block arrangement of a randomized complete block with alternative or previous crops as main-plots and winter wheat and spring cereals as sub-plots and crops being randomized within a block with four replications. Main plots were 36 by 36 feet and sub-plots are 12 by 36 feet. Previous crop treatments were seeded into cereal stubble fields that have been direct seeded for five to seven years with a double disk direct seed plot drill that seeds six feet and applies the complete fertilizer requirement at seeding time. Data collected during the study includes soil moisture, stand establishment, weed population, crop yield, grain quality, gross economic return and fertilizer, seed, and herbicide input costs. Chemical fallow had lower water use than each of the 5 previous crops. Safflower had the greatest water use at two of the four site years and had greater water use than barley and pea every year. Of the 5 previous crops, barley produced the greatest yield at 3 of the 4 site years and produced greater yield than all three broadleaf crops each of the 4 site years. Winter wheat, spring wheat, and spring barley yields are summarized and economic return over variable costs for the 2 year cropping sequence is being assembled and will be presented at a later date as will the weed population data.

Results and Interpretation:

Evaluation of impact of alternative crops on cereal yield. The focus of this project is to determine the impact of alternative crops on winter and spring wheat and barley. Results from the four year Wilke project concluded that cereal production in a rotation was generally the only crop that was profitable, therefore, maximizing cereal yield (especially winter wheat) in a rotation is desirable. Two year rotations were evaluated at the WSU Wilke Research and Extension Farm near

Davenport, WA in 2003-04, 2004-05, 2006-07 and at Mark Sheffel's farm near Wilbur, WA in 2006-07. The Wilke Farm is located in an area with historically 15 inches of precipitation per year. The site near Wilbur is located in an area with historically 12 inches of precipitation per year. Yellow mustard ('IdaGold'), spring pea ('Cruiser'), safflower ('Gila'), spring wheat ('Alpowa') and barley ('Baronesse') were seeded in the spring each year at all sites. Crops were fertilized at the time of seeding based on soil tests and projected crop yield. Chemical fallow was included as another alternative in a rotation as potential to increase winter wheat yield and reduce weed competition. Prior to seeding, the plot area was treated with glyphosate to control weeds and volunteer cereals. The experimental design of the study is a split-block arrangement of a randomized complete block with alternative crops as main-plots and winter wheat and spring cereals as sub-plots and crops being randomized within a block with four replications. Main plots were 36 by 36 feet and sub-plots are 12 by 36 feet. Replications are separated with alleyways to allow equipment operations between replications and alleys will be seeded to a spring cereal. Crops were seeded into cereal stubble in a field that have been direct seeded for five to seven years with a double disk direct seed plot drill that seeds six feet and has the capability to supply the complete fertilizer requirement at seeding time.

In crop weeds were treated using registered herbicides if any available. The chemical fallow plots were kept weed free applying glyphosate or glyphosate + 2,4-D when needed. Yield was determined by harvesting a 4.9 by 35 foot swath in a representative area of each plot using a small plot combine. Soil moisture in the profile to 5 feet were evaluated gravimetrically prior to planting and after crop harvest to determine crop use during the growing season. Winter wheat ('Eltan') was seeded on October 18, 2003, and on October 26, 2004 and ('Chukar') was seeded on September 14-15, 2006 at the Wilke Farm and Wilbur site. Spring wheat ('Alpowa') and barley (Baronesse) were seeded on May 3, 2004, and April 27, 2005. Spring wheat ('Louise') and barley were seeded on April 18-19, 2007 at the Wilke Farm and Wilbur site.

Total water use by previous crops is presented in Table 1. Overall chemical fallow, as anticipated, had lower water use than each of the 5 treatments in crop. Safflower had the greatest water use at two of the four site years and had greater water use than barley and pea every year. Table 5 summarizes previous crop yields with barley producing the greatest yield each 3 of the 4 site years and produced greater yield than all three broadleaf crops each site year. Table 3 summarizes the winter wheat, spring wheat, and spring barley yields following each of the previous crops. Economic return over variable costs for the 2 year cropping sequence is being assembled and will be presented at a later date as will the weed population data.

Table 1. Total water use to a depth of 5 feet of 5 crops and chemical fallow (previous crop) in a study carried out in 2003-2006.

Previous crop	Wilke 2003-04	Wilke 2004-05	Wilke 2006-07	Wilbur 2006-07
	----- inches moisture -----			
Safflower	7.0	10.3	10.9	7.9
Wheat	4.4	7.7	12.3	8.7
Yellow mustard	4.8	8.4	10.3	8.1
Barley	4.8	8.6	10.0	6.6
Pea	4.6	8.3	9.8	6.1
Chemical fallow	1.0	3.5	8.4	3.4
LSD _(0.05)	0.9	1.1	0.7	0.7

^aCrop water use is calculated by collecting soil moisture at beginning of season subtracting soil moisture at season end plus any precipitation recorded.

Table 2. Crop yield of 5 crops and chemical fallow (previous crop) in a study carried out in 2003-2006.

Previous crop	Wilke 2003-04	Wilke 2004-05	Wilke 2006-07	Wilbur 2006-07
	----- lb/ac -----			
Barley	1612	4178	2779	3358
Wheat	1070	1076	2492	2785
Pea	786	1301	1492	1379
Safflower	465	1437	720	1312
Yellow mustard	205	1355	803	873
Chemical fallow	-	-	-	-
LSD _(0.05)	271	728	835	312

Table 3. Winter wheat, spring wheat, or barley yield following broadleaf, cereal crops or chemical fallow at the WSU Wilke Research and Extension Farm near Davenport, WA in 2003-04, 2004-05 and 2006-07 and on Mark Sheffel's near Wilbur, WA in 2006-07.

Previous crop	Wilke 2003-04			Wilke 2004-05			Wilke 2006-07			Wilbur 2006-07		
	Winter wheat	Spring wheat	Spring Barley	Winter wheat	Spring wheat	Spring Barley	Winter wheat	Spring wheat	Spring Barley	Winter wheat	Spring wheat	Spring Barley
	----- lb/acre -----											
	----- (bu/ac) -----											
Yellow mustard	1482 (25)	1068 (18)	1924	2082 (35)	1888 (32)	1885	2194 (37)	1958 (33)	1728	1573 (26)	1273 (21)	720
Pea	2017 (34)	2825 (47)	1069	2191 (37)	1552 (26)	1810	2702 (45)	2021 (34)	1933	2540 (42)	1982 (33)	1363
Safflower	1494 (25)	1334 (22)	2739	2555 (43)	1484 (25)	1980	2386 (40)	1997 (33)	1594	1633 (27)	1358 (23)	866
Spring barley	1736 (29)	2190 (37)	2042	1885 (24)	1531 (26)	1520	2728 (45)	1908 (32)	2032	2000 (33)	1982 (33)	1074
Spring Wheat	3111 (52)	3155 (53)	2867	1344 (22)	1262 (21)	1708	2226 (37)	1404 (23)	1915	1972 (33)	1661 (28)	848
Chemical fallow	2645 (44)	2610 (44)	3105	3505 (58)	2222 (37)	3304	3117 (52)	2078 (35)	1647	2212 (37)	1891 (32)	1095
LSD _(0.05)	-----1660-----			----- 912 -----			----- 700 -----			----- 495 -----		
	----- (28)			----- (15)			----- (12)			----- (8)		

Interaction With Other Scientists Conducting Related Activities:

This project is complimentary to other cropping systems projects currently funded by STEEP. Chemical fallow plots are managed in relationship to Joe Yenish et.al STEEP funded project work examining herbicide efficacy in chemical fallow management. Additional interactions include Bill Schillinger, Rich Koenig, Don Wysocki, and Dennis Roe.

Publications and Presentations:

This project was shown and discussed at the 2003 and 2004 Wilke Field Day and was featured in 2006. It was also shown and discussed at the Northern Lincoln County Field Tour near Wilbur, WA in 1007. Specific aspects of the trial will be utilized in winter grower meetings as well.