WSU WILKE RESEARCH AND EXTENSION FARM OPERATION, PRODUCTION, AND ECONOMIC PERFORMANCE FOR 2014

Washington State Oilseed Cropping Systems Series

WSU PEER REVIEWED

TB04

By
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WSU Wilke Research and Extension Farm Operation, Production, and Economic Performance for 2014

Current Situation

The WSU Wilke Research and Extension Farm is a 320-acre facility located on the eastern edge of Davenport, WA, and is split (north and south) by State Highway 2. Washington State University maintains and operates the facility. The focus of this annual technical bulletin is on farmers in the intermediate cropping zone (12 to 17 inches of annual precipitation) and the field-men who assist them. It is also designed for documenting operations and production on the Wilke Farm for University faculty to assist with small plot research experiments.

The Wilke Farm remains in a direct seed cropping system utilizing no-till fallow, winter wheat, and spring cereals. Broadleaf crops remain a viable option and are substituted with spring and winter cereals when weed pressures and market prices create opportunities for profitable production. The predominant cropping system practiced by farmers in this region is a 3-year rotation, which includes summer fallow, winter wheat, and spring cereals. Farmers are interested in intensifying rotations to reduce fallow years and increase crop diversity to improve long-term agronomic benefits and economic stability.

The south side of the farm is divided into seven plots; three plots are in a more traditional 3-year crop rotation, and four plots are in an intensified 4-year crop rotation. The north side of the farm remains in an intensified rotation that forgoes summer fallow, and is in a continuous cereal grain production. In 2010 through 2013, cereal rye (feral rye) infestations caused cropping decisions to be altered on the Wilke Farm, especially in the no-till fallow winter wheat portion of the rotations (these changes are noted in ***red italic*** in the data tables). In the fall of 2013, the no-till fallow winter wheat portion of the rotation was seeded as planned according to the rotation without alterations due to feral rye.

Soil compaction and wireworm population data are collected each spring from GPS recorded locations within each plot. Soil samples are also collected from these GPS locations prior to seeding each plot, and fertilizer is applied according to soil samples results and WSU recommendations.

Operation

Winter wheat was seeded by Crop Production Service's Case IH direct-seed hoe drill with Anderson openers on 12-inch spacing. The spring crops were seeded with Kevin Klein's SeedMaster direct-seed hoe drill on 12-inch spacing (Figure 1). The farm was harvested with our John Deere 6622 combine on August 11 through 25, 2014 (Figure 2).

Figure 1. Seeding the Wilke Farm with a SeedMaster direct seed drill in 2014.

Winter Wheat *(3-year Plot 5; 4-year Plot 4)*

Plot 4 and Plot 5 were seeded to 'Crescent' soft white winter club wheat on September 10, 2013, at 70 lb/ac into no-till fallow. Seed was treated with 0.33oz/cwt CruiserMaxx Cereals plus Vibrance. Anhydrous ammonium was applied below the seed at 90 lb N/ac. Liquid ammonium Thio-Sul, 12-0-0-26, ammonium polyphosphate, 10-34-0-0, and Power Up, 6-18-6-1 were applied at a rate of 6-9-1-7 with the seed. Post-emergence herbicide/fungicide application was applied on April 30, 2013. This application included 3.5 oz/ac PowerFlex, 24.6 oz/ac Bison Advance, 4.0 oz/ac Bumper 41.8 EC, 10.0 oz/ac Topsin, and 1.0 lb/ac spray grade fertilizer.

Spring Wheat *(3-year Plot 7; 4-year Plot 3; Continuous North)*

Plot 3 was seeded to 'Diva' soft white spring wheat into canola residue on April 29, at 75 lb/ac. It was treated with 0.33 oz/cwt CruiserMaxx Cereals plus 1.0/cwt Nipsit Inside. Anhydrous ammonium was applied below the seed at 43 lb N/ac, and liquid ammonium thiosulfate, 11-37 and NACHURS was applied at a rate of 7-12-1-9 with the seed. Liquid boron was also applied with the seed at 10.5 oz/ac. Prior to seeding on April 25, 32.0 oz/ac RT3 (glyphosate), 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate were applied. Post-emergence weed control was applied on June 5. This application included 16.4 oz/ac Axial XL and 17.0 oz/ac Orion.

On April 29, Plot 7 was seeded to 'Dayn' hard white spring wheat into winter wheat residue at 75 lb/ac.

It was treated with 0.33 oz/cwt CruiserMaxx Cereals plus 1.0/cwt imidacloprid. Anhydrous ammonium was applied below the seed at 67 lb N/ac, and liquid ammonium thiosulfate, 11-37 and NACHURS was applied at a rate of 7-12-1-9 with the seed. Liquid boron was also applied with the seed at 10.5 oz/ac. On April 10, 32.0 oz/ac Credit Extreme (glyphosate), 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate was applied. Prior to seeding, 16.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate were applied. Post-emergence weed control was applied on June 5, and included 16.4 oz/ac Axial XL and 17.0 oz/ac Orion.

Also on April 29, North was seeded to ‘Glee’ dark northern spring wheat into barley residue at 70 lb/ac. It was treated with 0.33 oz/cwt CruiserMaxx Cereals plus 1.17/cwt imidacloprid. Anhydrous ammonium was applied below the seed at 70 lb N/ac, and liquid ammonium thiosulfate, 11-37 and NACHURS was applied at a rate of 7-12-1-9 with the seed. Liquid boron was also applied with the seed at 10.5 oz/ac. Prior to seeding on April 25, 32.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate were applied. Post-emergence weed control was applied on June 5, and included 16.4 oz/ac Axial XL and 17.0 oz/ac Orion.

Spring Canola *(4-year Plot 1)*

‘L120’Liberty Link spring canola was seeded and fertilized in one pass on April 30, into spring wheat residue at 5 lb/ac. Anhydrous ammonium was applied below the seed at 43 lb N/ac, and liquid ammonium thiosulfate, 11-37 and NACHURS was applied at a rate of 7-12-1-9 with the seed. Liquid boron was also applied with the seed at 10.5 oz/ac. Prior to seeding on April 25, 32.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate was applied. Post-emergence weed control included 22.0 oz/ac Liberty®, 5.0 oz/ac Assure II, and 0.8 gal/ac 9-0-0-10 fertilizer on June 6, for both broadleaf and grassy weed control. Warrior insecticide was aerial applied on July 7, at 3.84 oz/ac for aphid control. On August 4, 16.0 oz/ac Spodnam was applied by airplane to help reduce pod shatter.

No-till Fallow *(3-year Plot 2; 4-year Plot 6)*

No-till fallow was maintained relatively weed free with four herbicide applications. In Plot 2, the first application on April 25 was 32.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate. The second application on June 5 was 32 oz/ac RT3, and 15 lb/100 gal AMS Maxx. The third application on August 18 was 40.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate was applied. The fourth and final application of 48 oz/ac Gramoxone® SL and 1 qt/100 gal NIS was applied on September 5.

Figure 2. Harvesting the Wilke Farm with our John Deere 6622 combine in 2014.

In Plot 6 the first application on May 21 was 32.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate. The second application on July 18 was 32 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate. The third application on August 12 was 40.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate. The fourth and final application of 48 oz/ac Gramoxone® SL and 1 qt/100 gal NIS was applied on September 9.

Soil Compaction

Soil compaction data are collected at five GPS recorded data points with a Spectrum Soil Compaction meter. Data is collected within each plot in the spring of the year prior to seeding, and monitors compaction levels over time within a given crop rotation, which assists in potential management decisions. Plot 3 had the least amount of compaction with an average of 238 psi/18 inches, and Plot 7 had the greatest average with 286 psi/18 inches (Figure 3). Plots 6, 2, 4, 1, North and 5 compaction averaged 252, 257, 257, 260, 267, and 275 psi/18 inches respectively.

Wireworm Populations

Wireworm population data are collected at five GPS recorded data points (the same points are used for all data collection) within each plot in the spring of the year prior to seeding using the modified solar bait trap method (Esser 2012). This is done to monitor populations over time, and better match seed applied insecticide with populations. Plot 4 had the least amount of wireworms, averaging 0.0/trap, and Plot 6 had the greatest population, averaging 2.2/trap. North and Plots 7, 1, 3, 5, and 2 averaged 0.4, 0.6, 1.2, 1.2, 1.3, and 1.8/trap respectively.

Soil Samples

All soil samples were collected prior to seeding. Soil samples are used to help determine yield potential and nutrient requirements for the crops each year. They are also used for a historical reference of changing soil conditions over time. Soil pH, organic matter, phosphorus, and ammonium nitrogen is collected from the top 12 inches of soil only.

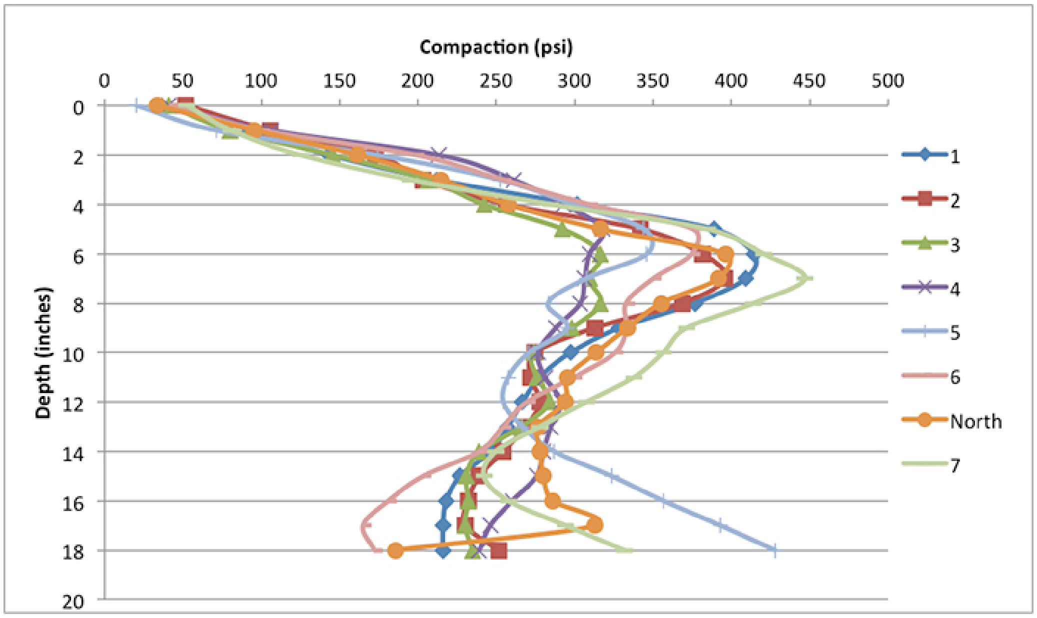

Figure 3. Soil compaction data collected in the spring of 2014 from the plots at the WSU Wilke Research and Extension Farm.

Table 1. Winter Wheat, 3-year Plot 5

Soil pH	5.7			**Phosphorus**	13 ppm
Organic Matter	2.0% (40 lb/ac N)			**Ammonium N**	5 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	78	16	31	40	165
Sulfate-S (mg/kg)	12	4	30	—	46
Moisture (inches)	1.7	1.6	1.6	1.7	6.6
Sum of Tested N: 210 lb/ac N					

Table 2. Winter Wheat, 4-year Plot 4

Soil pH	5.8			**Phosphorus**	12 ppm
Organic Matter	2.7% (54 lb/ac N)			**Ammonium N**	4 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	43	13	15	26	97
Sulfate-S (mg/kg)	12	4	10	—	26
Moisture (inches)	1.7	1.9	1.8	1.7	7.0
Sum of Tested N: 155 lb/ac N					

Table 3. Spring Wheat, 3-year Plot 7

Soil pH	6.3			**Phosphorus**	14 ppm
Organic Matter	2.0% (40 lb/ac N)			**Ammonium N**	8 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	8	6	2	4	20
Sulfate-S (mg/kg)	10	10	8	—	28
Moisture (inches)	2.3	1.5	0.9	1.0	5.8
Sum of Tested N: 68 lb/ac N					

Table 4. Spring Wheat, 4-year Plot 3

Soil pH	5.9			**Phosphorus**	17 mg/kg
Organic Matter	1.6% (32 lb/ac N)			**Ammonium N**	6 lb/ac
	Soil Depth (inches)				
	0-12	**12-24**	**24-36**	**36-48**	**Total**
Nitrate-N (lb/ac)	13	11	2	4	30
Sulfate-S (mg/kg)	9	3	2	—	14
Moisture (inches)	2.0	1.3	0.8	1.1	5.3
Sum of Tested N: 68 lb/ac N					

Table 5. Spring Wheat, Continuous North

Soil pH	5.8			**Phosphorus**	17 ppm
Organic Matter	2.4% (48 lb/ac N)			**Ammonium N**	12 lb/ac
	Soil Depth (inches)				
	0-12	**13-24**	**25-36**	**37-48**	**Total**
Nitrate-N (lb/ac)	15	11	2	3	31
Sulfate-S (mg/kg)	16	8	8	-	32
Moisture (inches)	2.0	1.5	1.1	1.3	5.8
Sum of Tested N: 91 lb/ac N					

Table 6. Spring Canola, 4-year Plot 1

Soil pH	5.8			**Phosphorus**	14 ppm
Organic Matter	2.6% (52 lb/ac N)			**Ammonium N**	6 lb/ac
	Soil Depth (inches)				
	0-12	**13-24**	**25-36**	**37-48**	**Total**
Nitrate-N (lb/ac)	22	10	7	12	51
Sulfate-S (mg/kg)	12	8	138	—	158
Moisture (inches)	2.1	1.4	0.9	1.2	5.7
Sum of Tested N: 109 lb/ac N					

Table 7. No-till Fallow, 3-year Plot 2

Soil pH	6.1			**Phosphorus**	17 ppm
Organic Matter	3.2% (64 lb/ac N)			**Ammonium N**	7 lb/ac
	Soil Depth (inches)				
	0-12	**13-24**	**25-36**	**37-48**	**Total**
Nitrate-N (lb/ac)	22	13	2	3	40
Sulfate-S (mg/kg)	16	8	10	—	34
Moisture (inches)	2.3	1.6	1.0	1.3	6.2
Sum of Tested N: 111 lb/ac N					

Table 8. No-till Fallow, 4-year Plot 6

Soil pH	6.3			**Phosphorus**	12 ppm
Organic Matter	2.4% (48 lb/ac N)			**Ammonium N**	5 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	25	20	1	14	60
Sulfate-S (mg/kg)	10	8	10	—	28
Moisture (inches)	2.1	1.5	0.8	1.0	5.5
Sum of Tested N: 113 lb/ac N					

Production and Economic Performance

Nitrogen uptake efficiency across the farm was well below 50 percent across all crops. This implies the farm was greatly over fertilized across all crops for harvested yields and grain protein, and a large amount of nitrogen should be available in the soil for next year's production.

Despite average input costs at the Wilke Farm being down 4.3 percent over the last 3-year average, economic returns over input costs were much less than the previous 3-year average.

The following tables summarize the rotation, production, and economic performance of the 3-year rotation, 4-year rotation, and the continuous cropping system at the Wilke Farm in 2014. The 3-year crop rotation returns above input costs averaged $88/ac which is 60 percent less than the 3-year average. The 4-year crop rotation returns above input costs averaged $64/ac which is 75 percent less than the previous 3-year average. The continuous cropping system returns above input costs averaged $45/ac, also 75 percent less than the previous 3-year average. Crop insurance was purchased on the farm and was collected for spring wheat and canola production, but this revenue is not included in the plot summaries to maintain consistency over years, and results based specifically on crop production only.

Table 10. 2014 Nitrogen Uptake Efficiency

	Plot 3	Plot 4	Plot 5	Plot 7	North
Soil Test Nitrogen	68	155	210	68	91
Applied Nitrogen	50	96	96	74	77
Total Nitrogen	118	251	306	142	168
Grain Yield	23.0	55.9	51.6	19.8	21
Grain Protein	13.0%	11.6%	12.4%	16.6%	16.4%
Lb N/bu	5.1	4.5	5.9	7.2	8.0
Nitrogen Uptake Efficiency	**38%**	**39%**	**32%**	**29%**	**27%**

Table 11. 3-year Cropping Rotation Sequence at the Wilke Farm from 2010-2015.

Year	Plot 2	Plot 5	Plot 7
2010	DNS Wheat (53.4 bu/ac)	No-till Fallow	*SWSW* (57.6 bu/ac)
2011	*Spring Barley (1.97ton/ac)*	Winter Wheat (87.4 bu/ac)	DNS Wheat (43.8 bu/ac)
2012	*HWSW* (46.4 bu/ac)	DNS Wheat (45.7 bu/ac)	No-till Fallow
2013	DNS Wheat (60.9 bu/ac)	No-till Fallow	Winter Wheat (85.5 bu/ac)
2014	**No-till Fallow**	**Winter Wheat (51.7 bu/ac)**	**HWSW (19.8 bu/ac)**
2015	Winter Wheat	Spring Cereal	No-till Fallow

Red italicized crops are those that have been altered for cereal rye management.

Table 12. 3-year Crop Rotation Production at the Wilke Farm, 2014.

	Plot 2	Plot 5	Plot 7
Cropping Specifics			
Acreage	19.7	24.1	34.1
Crop	No-till Fallow	'Crescent' SWWW club	*'Dayn'* HWSW
Crop Production			
Yield	—	51.6 bu/ac	19.8 bu/ac
Mkt Grade	—	#1 WHC 58.0 tw, 0.7% dockage, 12.4% protein	#4 HWW 55.8 tw 0.9% dockage , 16.6% protein
Gross Economic Return†			
Mkt Price	—	$8.14/bu	$7.14/bu
Gross Return	—	$420.02/ac	$141.37/ac
Input Costs			
Seed	—	$22.98/ac	$24.37/ac
Fertilizer	—	$71.49/ac	$58.55/ac
Herbicides	$45.56/ac	$28.58/ac	$38.09/ac
Fungicide	—	$6.25/ac	—
Total	$45.56/ac	$124.57/ac	$121.03/ac
Summary			
Return over Costs	-$45.56/ac	$294.45/ac	$19.34/ac
3-Year Rotation Return over input Costs‡		**$88.05/ac**	

†Revenue does not include crop insurance revenue.
‡Costs do not include fixed costs associated with the farm.

Table 13. 4-year Cropping Rotation Sequence at the Wilke Farm from 2010-2015.

Year	Plot 1	Plot 3	Plot 4	Plot 6
2010	DNS Wheat (55.7 bu/ac)	DNS Wheat (42.5 bu/ac)	*Spring Wheat* (60.8 bu/ac)	No-till Fallow
2011	DNS Wheat (51.2 bu/ac)	*Spring Barley* (1.76 ton/ac)	DNS Wheat (47.0 bu/ac)	Winter Wheat (84.4 bu/ac)
2012	*Spring Canola* (1,542 lb/ac)	*HWSW* (53.1 bu/ac)	Spring Barley (1.45 ton/ac)	DNS Wheat (38.4 bu/ac)
2013	*SWSW* (65.7 bu/ac)	Spring Canola (1,748 lb/ac)	No-till Fallow	DNS Wheat (50.4 lb/ac)
2014	**Spring Canola (701 lb/ac)**	**SWSW (23 bu/ac)**	**Winter Wheat (55.9 bu/ac)**	**No-till Fallow**
2015	Spring Cereal	No-till Fallow	Spring Canola	Winter Wheat

Red italicized crops are those that have been altered for cereal rye management.

Table 14. 4-year Crop Rotation Production at the Wilke Farm, 2014.

	Plot 1	Plot 3	Plot 4	Plot 6
Cropping Specifics				
Acreage	28.2	27.5	26.1	29.4
Crop	*'L120 Liberty Link'* Canola	*'Diva'* SWSW	*'Crescent'* SWWW (club)	No-till Fallow
Crop Production				
Yield	701 lb/ac	23.0 bu/ac	55.9 bu/ac	—
Mkt Grade	#1 Canola 0.8% dockage	#3 SWW 57.8 tw, 1.8% dockage, 13.0% protein	#1 SWC 58.1 tw, 0.6% dockage, 11.60% protein	—
Gross Economic Return†				
Mkt Price	$0.1647/lb	$6.33/bu	$8.23/bu	—
Gross Return	$115.54/ac	$145.59/ac	$460.06	—
Input Costs				
Seed	$58.75/ac	$20.62/ac	$18.26/ac	—
Fertilizer	$45.95/ac	$45.95/ac	$71.49/ac	—
Herbicides	$29.81/ac	$33.88/ac	$28.58/ac	$44.67/ac
Fungicide	—	—	$6.25/ac	—
Insecticide	$11.93/ac	—	—	—
Pod Sealant	$24.20/ac	—	—	—
Total	$170.63/ac	$100.44/ac	$124.57/ac	$44.67/ac
Summary				
Return over Costs	-$55.09/ac	$45.15/ac	$335.49/ac	-$44.67/ac
4-Year Rotation Return over input Costs‡		**$64/ac**		

†Revenue does not include crop insurance revenue.
‡Costs do not include fixed costs associated with the farm.

Table 15. Continuous Crop Rotation Sequence at the Wilke Farm from 2010-2015.

Year	North Side
2010	Spring Barley (1.42 ton/ac)
2011	Spring Wheat (50.0 bu/ac)
2012	*Spring Wheat* (41.7 bu/ac)
2013	Spring Barley (1.73 ton/ac)
2014	**DNS Wheat (21.0 bu/ac)**
2015	HR Winter Wheat

Red italicized crops are those that have been altered for cereal rye management.

Table 16. Continuous Crop Rotation Production at the Wilke Farm, 2014.

	North Side
Cropping Specifics	
Acreage	49.1
Crop	'Diva' DNS Wheat
Crop Production	
Yield	21.0 bu/ac
Mkt Grade	#2 DNS 57.7 tw 1.0% dockage, 16.4% protein
Gross Economic Return†	
Mkt Price	$7.68/bu
Gross Return	$161.32/ac
Input Costs	
Seed	$22.65ac
Fertilizer	$60.15/ac
Herbicides	$33.88/ac
Fungicide	—
Total	$116.67/ac
Summary	
Continuous Rotation Return over input Costs‡	**$44.65/ac**

†Revenue does not include crop insurance revenue.
‡Costs do not include fixed costs associated with the farm.

Summary

A summary of WSU Wilke Research and Extension Farm economic returns over input costs using 3-year averages is shown in Figure 4.

Over the last three years (2012 to 2014), the 3-year rotation, 4-year rotation, and continuous cropping have averaged returns above input costs of $157, $176, and $137/ac respectively. Over the last five years, the 3-year rotation, 4-year rotation, and continuous cropping have averaged returns above input costs of $195, $229, and $164/ac respectively.

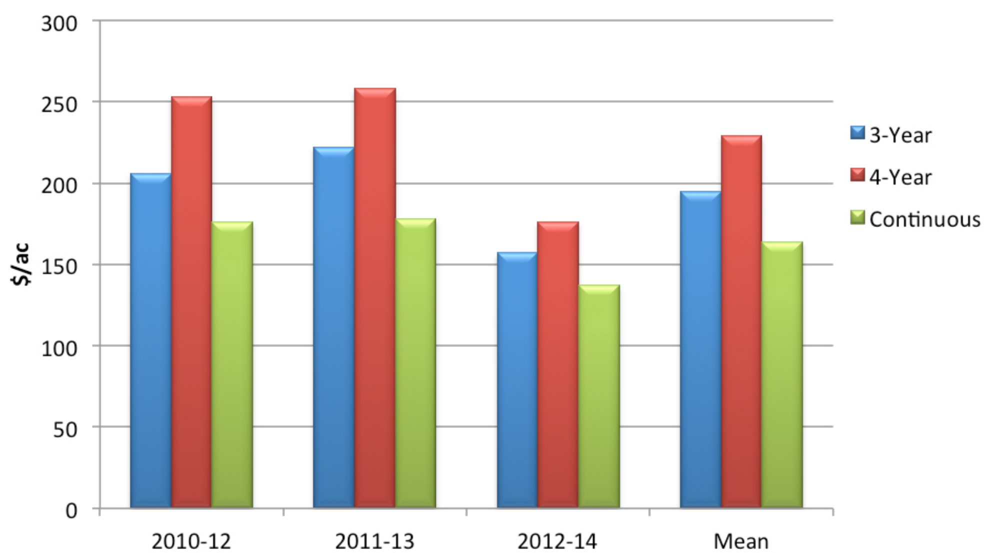

Figure 4. Three year average economic return over input costs of a 3-year, 4-year and continuous cropping system at the WSU Wilke Research and Extension Farm. Costs do not include fixed costs associated with the farm.

Special Thanks

General support

General support

Kevin Klein Custom seeding spring

Crop Production Services

Custom seeding winter wheat


Rocky Top Ranch for use of grain truck at harvest

Weather Data

Table 17. Davenport

2014 Crop Year Summary (09/01/2013 to 08/31/2014)

	Temperature					
Month	High	Low	Mean	Degree Days	Rain Fall	Rain Days
9	72.9	49.3	60.7	349	1.46	12
10	57.2	33.2	43.9	6	.14	3
11	40.8	26.7	33.1	0	1.27	8
12	29.7	17.1	23.2	0	.54	8
1	32.6	24.6	28.6	0	.44	5
2	31.4	19.3	25.2	0	1.42	9
3	48.4	29.4	38.2	0	1.95	13
4	57.7	33.2	45.9	8	1.15	7
5	69.2	42.4	56.5	186	.78	5
6	72.7	46.7	60.7	298	1.24	4
7	88.9	57.3	74.1	716	.02	1
8	84.3	55.5	70.3	617	.5	.5
Total				**2180**	**10.91**	**80**

2013 Crop Year Summary (09/01/2012 to 08/31/2013)

	Temperature					
Month	High	Low	Mean	Degree Days	Rain Fall	Rain Days
9	86.0	37.8	61.6	640	0	0
10	75.7	26.7	46.4	234	1.31	14
11	60.8	16.8	37.0	56	2.79	15
12	48.4	12.8	25.4	5	1.50	13
1	38.1	3.4	22.7	0	.70	8
2	41.2	14.7	29.9	0	.30	9
3	67.7	19.9	39.0	65	.58	5
4	72.2	22.9	44.4	145	.74	8
5	84.3	23.3	55.1	433	.72	8
6	87.2	36.2	60.2	576	1.90	10
7	95.3	46.7	72.0	945	0	0
8	92.5	46.0	70.0	917	.56	6
Total				**4016**	**11.10**	**96**

AGWEATHERNET STATION located at the Wilke Research and Extension Farm.

You can access Wilke weather data at http://wilkefarm.wsu.edu/. AgWeatherNet link on the widget takes you to a map of weather stations throughout the state.

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