WASHINGTON STATE UNIVERSITY EXTENSION

WSU WILKE RESEARCH AND EXTENSION FARM OPERATION, PRODUCTION, AND ECONOMIC PERFORMANCE FOR 2013

Washington State Oilseed Cropping Systems Series

By
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WSU PEER REVIEWED
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WSU Wilke Research and Extension Farm Operation, Production, and Economic Performance for 2013

Current Situation

The WSU Wilke Research and Extension Farm is a 320-acre facility located on the eastern edge of Davenport, Washington, and is split (north and south) by State Hwy 2. Washington State University maintains and operates this facility. This technical bulletin is an annual document designed for farmers and crop consultants in the intermediate cropping zone (12 to 17 inches of annual precipitation). It is also provides documentation of the operations and production on the Wilke Farm to assist university faculty 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 for 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 that includes summer fallow, winter wheat, and spring cereals. Farmers are interested in intensifying rotations to reduce fallow years and increasing crop diversity to improve long-term agronomic and economic stability.

The south side of the farm is divided into seven plots with three plots in a more traditional 3-year crop rotation, and four plots 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 (changes are noted in ***red italic type*** in the data tables) on the Wilke Farm, especially in the no-till fallow winter wheat portion of the rotations. In the fall of 2013, the no-till fallow winter wheat portion of the rotation was seeded as planned according to the rotation without alteration because of cereal 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 sample 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. The farm was harvested with the farm's John Deere 6622 combine on August 16 through 27.

Winter Wheat (3-year Plot 7; 4-year Plot 1)

'Xerpha' soft white winter wheat was seeded into Plot 7 on September 7, 2012 at 70 lb/ac into no-till fallow. It was treated with 0.33oz/cwt CruiserMaxx® Cereals plus Vibrance. Anhydrous ammonium was applied below the seed at 70 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 6-9-1-8 with the seed. Post-emergence weed control and fungicide application were applied on April 24, 2013. This application included 3.5 oz/ac PowerFlex®, 16.0 oz/ac Truslate™, 10.0 oz/ac Brox®-M, 4.0 oz/ac Tilt®, 10.0 oz/ac T-Methyl, and 1.25 lb/ac spray grade fertilizer. Post-harvest weed control was applied on October 4, and this application was 12.0 oz/ac Alecto 41S (glyphosate) and 1.0 qt/100 gal M-90.

Spring Wheat (3-year Plot 2; 4-year Plot 6)

'Diva' soft white spring wheat was seeded into Plot 1 instead of winter wheat for cereal rye management. It was seeded into spring canola residue on April 15, 2013, at 70 lb/ac. It was treated with 0.33oz/cwt CruiserMaxx® Cereals and 1.0 oz/cwt Nipsit Inside. Anhydrous ammonium was applied below the seed at 51 lb N/ac, and liquid ammonium thiosulfate, 11-37 and NACHURS® were applied at a rate of 7-12-1-9 with the seed.

Prior to seeding spring wheat on April 14, 32.0 oz/ac RT3™, 16 oz/ac 2,4-D, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate were applied. Post emergence weed control was applied on June 3. This application included 16.4 oz/ac Axial® XL, 17.0 oz/ac Orion™, 6.0 oz/ac Bison, and 4.0 oz/ac Tilt® fungicide for stripe rust control.

'Glee' Dark Northern Spring (DNS) wheat was seeded into winter wheat residue on April 16 at 70 lb/ac. It was treated with 0.66 oz/cwt CruiserMaxx Cereals. Anhydrous ammonium was applied below the seed at 91 lb N/ac. Both plots also had liquid ammonium thiosulfate, 11-37 and NACHURS applied at a rate of 9-15-1-9 with the seed.

Prior to seeding on April 14, 32.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate were applied. Post emergence weed control/fungicide was applied on June 3. This application included 16.4 oz/ac Axial XL, 17.0 oz/ac Orion, 6.0 oz/ac Bison, and 4.0 oz/ac Tilt for stripe rust control.

Spring Barley (Continuous; North)

'Lenetah' spring barley was seeded and fertilized in one pass on April 15 into spring wheat residue. The crop was seeded 70 lb/ac and it was treated with 1.33 oz/cwt CruiserMaxx Cereals plus 1.0 oz/cwt Nipsit Inside.

Higher rates of wireworm control were used despite low trapping pressure because of two specific areas in the field with observed wireworm damage the previous crop year. Anhydrous ammonium was applied below the seed at 71 lb N/ac, and liquid ammonium thiosulfate, 11-37 and NACHURS was applied at a rate of 9-12-1-9 with the seed.

Prior to seeding April 12, 32.0 oz/ac RT3, 1.5 qt/100 gal Alliance, and 1.0 qt/100 gal Activate was applied. Post-emergence weed control/fungicide was applied on June 1. This application included 16.4 oz/ac Axial XL, 17.0 oz/ac Orion, and 6.0 oz/ac Bison.

Spring Canola (4-year Plot 3)

A mixture of 3 varieties; 'DKL 45-51', 'DKL 55-55', and 'Hyclass 955' Roundup Ready spring canola varieties were seeded and fertilized in one pass on April 17, into spring wheat residue at 5 lb/ac. Anhydrous ammonium was applied below the seed at 51 lb N/ac, and liquid ammonium thiosulfate, 11-37 and NACHURS was applied at a rate of 9-15-1-9 with the seed.

Prior to seeding on April 14, 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 16.0 oz/ac Roundup PowerMax® and 15 lb/100 gal AMS Max on May 25, for both broadleaf and grassy weed control. Assure II at 8 oz/ac and 1 qt/100 gal NIS was applied on June 5, for additional grassy weed control. On August 4, 16.0 oz/ac Spodnam was applied by airplane to help reduce pod shatter.

No-till Fallow (3-year Plot 5; 4-year Plot 4)

No-till fallow was maintained relatively weed free with 4 herbicide applications in both plots 4 and 5. The first application on May 1 was 24.0 oz/ac RT3, 1.0 oz/ac Sharpen®, 8.3 lb/100 gal AMS, and 1.0 qt/100 gal NIS. The second application on July 18 was 32 oz/ac RT3, 1.0 oz/ac Sharpen, 4.0 qt/100 gal MSO, and 5.0 qt/100 gal UAN. The third application on June 12 was 32.0 oz/ac RT3 and 15 lb/100 gal AMS Max. The fourth and final application of 48 oz/ac Gromoxone® SL and 1 qt/100 gal NIS was applied on September 4.

Soil Compaction

Soil compaction data are collected from five GPS recorded data points within each plot in the spring of the year prior to seeding. This monitors compaction levels over-time, within a given crop rotation, and potential management decisions. Data were not collected in Plot 7 in 2013 because of an equipment malfunction. Plot 3 had the least amount of compaction, with an average of 192 psi/18 inches, and Plot 3 had the greatest compaction average with 239 psi/18 inches (Figure 1). North and Plots 1, 5, 2 and 4 compaction averaged 225, 227, 229, 231, 233 psi/18 inches, respectively.

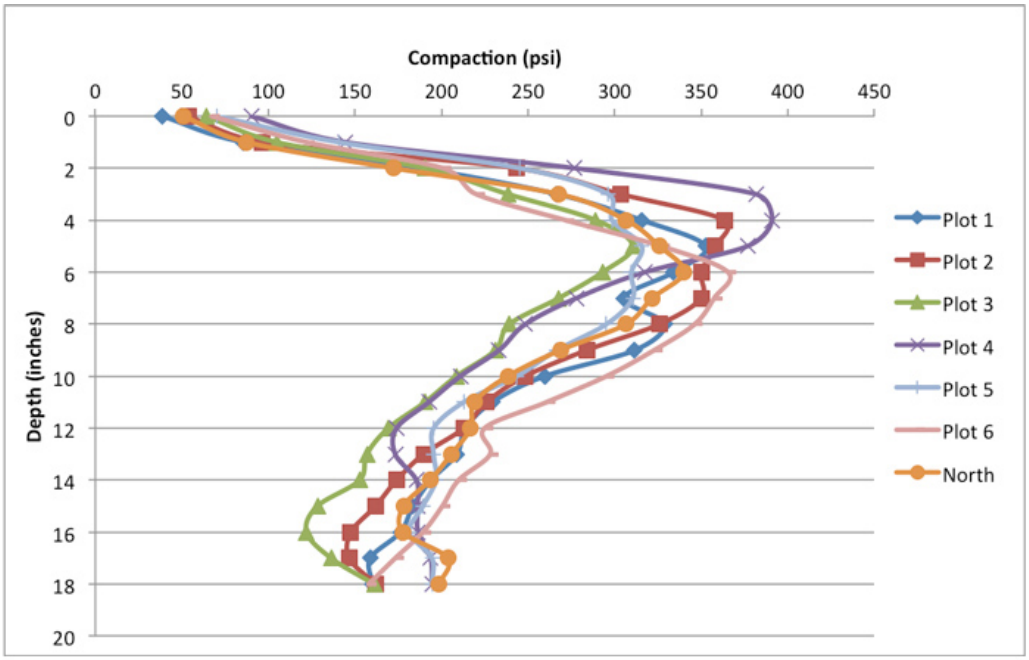

Figure 1. Soil compaction data collected in the spring of the year from the plots at the WSU Wilke Research and Extension Farm in 2013.

Wireworm Populations

Wireworm population data are collected from five GPS recorded data points 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. No data were collected from Plot 7, as it was already seeded to winter wheat. North had the least amount of wireworms, averaging 0.3/trap, and Plot 4 had the greatest population averaging 6.4/trap. Plots 1, 3, 2, 5, and 6 averaged 0.8, 1.3, 4.6, 5.7 and 5.8/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 for changing soil conditions over time.

Table 1. Winter Wheat, 3-year Plot 7

Soil pH	6.0			**Phosphorus**	22 mg/kg
Organic Matter	1.9% (38 lb/ac N)			**Ammonium N**	55 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	36	25	91	81	233
Sulfate-S (mg/kg)	33	11	66	—	110
Moisture (inches)	2.0	1.8	1.7	1.7	7.2
Sum of Tested N: 326 lb/ac N					

Table 2. Winter Wheat, 4-year Plot 1

Soil pH	6.4			**Phosphorus**	18 mg/kg
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)	11	9	11	14	45
Sulfate-S (mg/kg)	11	10	8	—	29
Moisture (inches)	3.1	2.8	2.4	2.0	10.3
Sum of Tested N: 103 lb/ac N					

Table 3. Spring Wheat, 3-year Plot 2

Soil pH	6.1			**Phosphorus**	16 mg/kg
Organic Matter	2.8% (56 lb/ac N)			**Ammonium N**	5 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	8	8	6	5	27
Sulfate-S (mg/kg)	6	7	26	—	39
Moisture (inches)	3.3	2.8	2.3	2.1	10.5
Sum of Tested N: 88 lb/ac N					

Table 4. Spring Wheat, 4-year Plot 6

Soil pH	6.1			**Phosphorus**	17 mg/kg
Organic Matter	2.9% (58 lb/ac N)			**Ammonium N**	5 lb/ac
	Soil Depth (inches)				
	1	2	3	4	Total
Nitrate-N (lb/ac)	10	9	9	7	35
Sulfate-S (mg/kg)	10	8	10	—	27
Moisture (inches)	3.4	2.9	2.2	1.7	10.2
Sum of Tested N: 98 lb/ac N					

Table 5. Spring Barley, continuous North

Soil pH	6.1			**Phosphorus**	15 mg/kg
Organic Matter	2.6% (52 lb/ac N)			**Ammonium N**	13 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	10	7	11	7	35
Sulfate-S (mg/kg)	13	5	19	—	37
Moisture (inches)	2.0	2.3	1.8	1.9	8.0
Sum of Tested N: 100 lb/ac N					

Table 6. Spring Canola, 4-year Plot 3

Soil pH	6.3			**Phosphorus**	12 mg/kg
Organic Matter	2.2% (44 lb/ac N)			**Ammonium N**	8 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	9	8	11	17	45
Sulfate-S (mg/kg)	11	8	12	—	31
Moisture (inches)	3.0	3.0	2.3	2.3	10.6
Sum of Tested N: 97 lb/ac N					

Table 7. No-till Fallow, 3-year Plot 5

Soil pH	6.3			**Phosphorus**	17 mg/kg
Organic Matter	1.8% (36 lb/ac N)			**Ammonium N**	9 lb/ac
	Soil Depth (inches)				
	0-12	13-24	25-36	37-48	Total
Nitrate-N (lb/ac)	7	6	13	17	43
Sulfate-S (mg/kg)	12	8	10	—	30
Moisture (inches)	2.9	2.3	2.2	2.0	9.4
Sum of Tested N: 88 lb/ac N					

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

Soil pH	6.2			**Phosphorus**	14 mg/kg
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)	9	10	13	12	44
Sulfate-S (mg/kg)	10	9	11	—	30
Moisture (inches)	3.3	3.2	2.3	1.7	10.5
Sum of Tested N: 97 lb/ac N					

Production and Economic Performance

3-Year Crop Rotation

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 2013. The 3-year crop rotation returns above input costs averaged $215/ac, the 4-year crop rotation returns above input costs averaged $168/ac, with the continuous cropping system returns above input costs averaged $139/ac.

Figure 2. Harvest 2013 was routinely interrupted by thunder storms at WSU Wilke Farm and throughout the region. This not only made harvest difficult, it had a negative impact on grain quality, causing sprouting and low falling numbers.

Table 9. 3-year Cropping Rotation Sequence at the Wilke Farm from 2009-14

Year	Plot 2	Plot 5	Plot 7
2009	Winter Wheat (71.7 bu/ac)	DNS Wheat (47.2 bu/ac)	No-till Fallow
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	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 (45.7 bu/ac)	Spring Cereal

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

Table 10. 3-year Crop Rotation Production at the Wilke Farm, 2013

	Plot 2	Plot 5	Plot 7
Cropping Specifics			
Acreage	25.6	18.0	33.1
Crop	*'Glee'* DNS Wheat	No-till Fallow	*'Xerpha'* SWWW
Crop Production			
Yield	60.9 bu/ac	—	85.5 bu/ac
Mkt Grade	#1 DNS 62.3 0.3% 12.0%	—	#2 SWW 60.0 0.4%, Spout 3.5% Falling Number 155
Gross Economic Return			
Mkt Price	$5.81/bu	—	$5.75/bu
Gross Return	$354.00/ac	—	492.00/ac
Input Costs			
Seed	$21.70/ac	—	$18.12/ac
Fertilizer	$84.78/ac	—	$79.87/ac
Herbicides	$35.66/ac	$43.89/ac	$26.30/ac
Fungicide	$2.84/ac	—	$7.50/ac
Total	$144.98ac	$43.89/ac	$131.79/ac
Summary			
Return over Costs	$209.02/ac	-$43.89/ac	$360.21/ac
3-Year Rotation Return over input Costs*		**$215/ac**	

*Costs do not include fixed costs associated with the farm

4-Year Crop Rotation

Table 11. 4-year Cropping Rotation Sequence at the Wilke Farm from 2009-14

Year	Plot 1	Plot 3	Plot 4	Plot 6
2009	Winter Wheat (61.9 bu/ac)	DNS Wheat (36.0 bu/ac)	No-till Fallow	DNS Wheat (24.4 bu/ac)
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	Spring Cereal	Winter Wheat	No-till Fallow

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

Figure 3. Harvesting barley in the continuous cereal grain rotation on the North side.

Table 12. 4-year Crop Rotation Production at the Wilke Farm, 2013

	Plot 1	Plot 3	Plot 4	Plot 6
Cropping Specifics				
Acreage	28.9	26.5	24.6	29.4
Crop	*'Diva'* SWSW	*'DKL51-45'* Canola	No-till Fallow	*'Glee'* DNS Wheat
Crop Production				
Yield	65.7 bu/ac	1,748 lb/ac	—	50.4 bu/ac
Mkt Grade	#1 SWW 62.6 0.4%	#1 Canola 0.8%	—	#1 DNS 62.4 0.3% 12.6%
Gross Economic Return				
Mkt Price	$6.58/bu	$0.2028/lb	—	$6.32/bu
Gross Return	$432.37/ac	$354.47/ac	—	$318.52/ac
Input Costs				
Seed	$22.29/ac	$52.00/ac	—	$21.70/ac
Fertilizer	$57.45/ac	$57.45/ac	—	$84.78/ac
Herbicides	$38.19/ac	$19.79/ac	$43.89/ac	$35.66/ac
Fungicide	$2.84/ac	—	—	$2.84/ac
Pod Sealant	—	$24.09/ac	—	—
Total	$120.77/ac	$153.32/ac	$43.89/ac	$144.98/ac
Summary				
Return over Costs	$311.60/ac	$201.15/ac	-$43.89/ac	$173.54/ac
4-Year Rotation Return over input Costs*		**$168/ac**		

*Costs do not include fixed costs associated with the farm

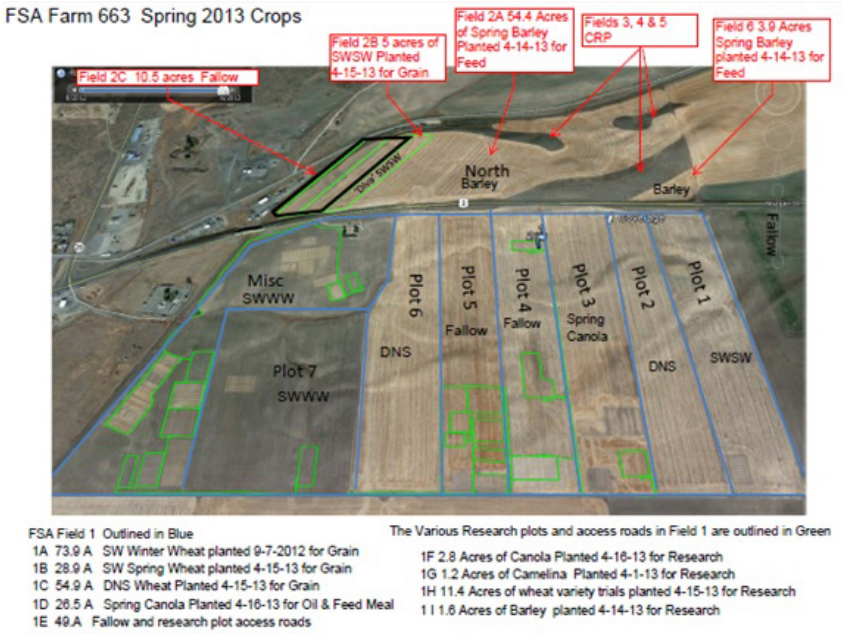

Figure 4. WSU Wilke Farm spring 2013 crop certification with the Farm Service Agency. Small research plots, outlined by the green lines, are important with nearly 30 acres certified.

Table 13. Continuous Crop Rotation Sequence at the Wilke Farm from 2009-14

Year	North Side
2009	Winter Wheat (28.9 bu/ac)
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	Spring Cereal

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

Table 14. Continuous Crop Rotation Production at the Wilke Farm, 2013

	North Side
Cropping Specifics	
Acreage	57.7
Crop	'Lenetah' Spring Barley
Crop Production	
Yield	1.73 ton/ac
Mkt Grade	#1 BRL 52.5 0.5%
Gross Economic Return	
Mkt Price	$156/ton
Gross Return	$269.88/ac
Input Costs	
Seed	$24.57/ac
Fertilizer	$70.94/ac
Herbicides	$35.65/ac
Fungicide	—
Total	$131.16/ac
Summary	
Continuous Rotation Return over input Costs*	**$139/ac**

*Costs do not include fixed costs associated with the farm

Summary

In summary, over the three years of 2011 to 2013, the 3-year rotation, 4-year rotation, and continuous cropping systems have averaged returns above input costs of $222, $258, and $178/ac respectively. Over the last 5 years, the 3-year rotation, 4-year rotation, and continuous cropping have averaged returns above input costs of $201, $228, and $154/ac respectively.

References

Esser, A.D. 2012. Wireworm Scouting: The Shovel Method and the Modified Wireworm Solar Bait Trap. *Washington State University Extension* Publication FS059E.

Figure 5. Roundup Ready spring canola in full bloom in Plot 3 at the WSU Wilke Farm. Weed control was very good for both broadleaf and grassy weeds.

Table 15. 2009-13 Return over Input Costs Summary

Year	3-Year	4-Year	Continuous	Mean
	$/ac			
2009-11	176	174	107	153
2010-12	206	253	176	212
2011-13	222	258	178	219
Mean	**201**	**228**	**154**	**195**

*Costs do not include fixed costs associated with the farm.

Special Thanks

Kevin Klein Custom Seeding

Mark Sheffels, use of grain truck at harvest

MONSANTO

Canola seed donation

Weather Data

Crop year weather data is to help provide context for 2013 yields and grain quality. Overall 2013 had 4% more growing degree days and 15% less precipitation than 2012.

Table 16. Davenport

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**

2012 Crop Year Summary (09/01/2011 to 08/31/2012)

	Temperature					
Month	High	Low	Mean	Degree Days	Rain Fall	Rain Days
9	86.0	37.8	62.9	677	.08	3
10	72.1	20.0	45.9	217	.34	7
11	53.4	13.5	32.9	8	1.07	7
12	47.5	10.7	26.4	4	1.02	9
1	47.7	4.1	27.5	0	.87	10
2	48.1	15.0	31.5	0	1.11	14
3	60.9	19.8	36.9	31	2.88	15
4	81.9	23.9	46.9	223	1.23	10
5	86.5	27.2	53.0	378	.74	3
6	82.0	33.6	57.5	514	2.96	13
7	92.9	36.8	69.9	901	.77	4
8	95.0	41.5	69.9	896	.01	1
Total				**3849**	**13.08**	**96**

AGWEATHERNET Station is 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.

Funding and support for the WOCS provided by:

Washington State Legislature, Washington State Department of Agriculture, Washington Department of Commerce, and the Washington State University Energy Program.

Funding and support for REACCH provided by:

Washington State Legislature, Washington State Department of Agriculture, Washington Department of Commerce, and the Washington State University Energy Program.

Cover image:

Crop Production Services seeding 'Crescent' winter club wheat at WSU Wilke Farm on Sept 10, 2013.

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Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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