

WSU WILKE RESEARCH AND EXTENSION FARM

OPERATION, PRODUCTION, AND ECONOMIC
PERFORMANCE FOR 2018



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 this facility. This annual technical bulletin is written primarily for farmers and crop consultants in the intermediate cropping zone (12 to 17 inches of annual precipitation). It also provides documentation of the operations and production on the Wilke Farm to assist University faculty with small plot research experiments. Previous technical bulletins can be found on the [WSU Small Grains website](#).

The Wilke Farm remains in a direct-seed cropping system using no-till fallow, winter wheat, spring cereals, and broadleaf crops. Broadleaf crops are used in place of 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 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 now in diversified continuous crop production after many years in continuous cereal grain only production.

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 and fertilizer is applied according to soil sample results and WSU recommendations.

Operations

Winter wheat into fallow was seeded with Mondovi Corner Farm's JD 1895 direct-seed, low disturbance disk drill on 7.5-inch spacing. Continuous winter wheat seeding into spring canola stubble on the north side was seeded with Dewald Farm's Bougault direct-seed, low disturbance disk drill on 7.5-inch spacing. The spring crops were seeded by WSU using a JD 750 direct-seed, low disturbance disk drill on 7.5-inch spacing. The farm was harvested with the farm's John Deere 6622 combine from August 8 through August 24.



Winter Wheat (3-year Field 2; 4-year Field 4)

Field 2 and Field 4 were seeded to 'Jasper' soft white winter wheat on September 1, 2017 at 70 lb/acre (800,000 seeds/acre) into no-till fallow. Seed was treated with CruiserMaxx Vibrance Cereals + 0.5 fl oz imidacloprid/cwt. Dry 15-19-0-11 with 0.05 B and 0.25 Zn was applied at a rate of 50 lb/acre with the seed. Solution 32 was applied below the seed at 88 lb N/acre. An additional 4 lb N/acre was applied with herbicides. Postemergence weed control included Affinity Broadspec applied at 0.6 oz/acre, Rhonox MCPA Ester at 16 oz/acre, Solution 32 at 1.2 gal/acre, Interlock at 4 oz/acre and 1.0 qt/100 gallons M-90 on April 26, 2018.

Spring Wheat (3-year Field 5; 4-year Field 3)

Field 5 was seeded to 'Alum' Dark Northern Spring (DNS) wheat on April 23 at 76 lb/acre (930,000 seeds/acre). It was treated with CruiserMaxx Cereals with 1.33 oz Cruiser and 2.0 oz/cwt Zn, and was seeded into winter wheat residue. Dry 15-19-0-11 with 0.05 B and 0.25 Zn was applied at a rate of 53 lb/acre with the seed. The drill was not capable of banding deep fertilizer, so it was applied on May 19 with a spoke-wheel applicator. Solution 32 and ThioSul was variably applied across three application zones to account for field variability and yield potential, and averaged 91-0-0-6. Overall, 28% received greater than 98-0-0-7, 12% received less than 74-0-0-5, and the remaining 60% received something in between. One day prior to seeding, 32.0 oz/acre RT3, 4 oz/acre Interlock, 1.5 qt/100 gallons Alliance, and 1.0 qt/100 gallons Activate Plus were applied. Postemergence weed control was applied on May 31. This application included 15 oz/acre Huskie and 12 oz/acre Rhonox MCPA Ester.

Field 3 was seeded to 'Alum' DNS wheat on April 20 at 76 lb/acre (930,000 seeds/acre). It was treated with CruiserMaxx Cereals with 1.33 oz Cruiser and 2.0 oz/cwt Zn, and was seeded into chickpea residue. Dry 15-19-0-11 with 0.05 B and 0.25 Zn was applied at a rate of 53 lb/acre with the seed. The drill was not capable of banding deep fertilizer, so it was applied on May 18 with a spoke-wheel applicator. Solution 32 and ThioSul was variably applied across three application zones to account for field variability and yield potential and averaged 89-0-0-6. Overall, 42% received greater than 98-0-0-7, 18% received less than 74-0-0-5, and the remaining 40% received something in between. Four days after seeding, 32.0 oz/acre RT3, 4 oz/acre Interlock, 1.5 qt/100 gallons Alliance, and 1.0 qt/100 gallons Activate Plus were applied. Postemergence weed control was applied on May 31. This application included 15 oz/acre Huskie and 12 oz/acre Rhonox MCPA Ester.

Spring Canola (4-year Field 1)

Prior to seeding, a dry run with the drill was completed to help minimize hair pinning of previous winter wheat residue. 'DG 200CL' spring canola was seeded on April 26 at 2.5 lb/acre (180,160 seeds/acre). Dry 15-19-0-11 with 0.05 B and 0.25 Zn was applied at a rate of 53 lb/acre with the seed. The spring canola was reseeded without dry fertilizer on April 30 at 2.5 lb/acre to reach the targeted seed rate of 360,320 seeds per acre. The drill was not capable of banding deep fertilizer, so it was applied on May 21 with a spoke-wheel applicator. Solution 32 and ThioSul was variably applied across three application zones to account for field variability and yield potential and averaged 66-0-0-5. Overall, 28% received greater than 70-0-0-5, 26% received less than 57-0-0-4, and the remaining 45% received something in between. Four days prior to the first seeding, 32.0 oz/acre RT3, 4 oz/acre Interlock, 1.5 qt/100 gallons Alliance, and 1.0 qt/100 gallons Activate Plus were applied. Postemergence weed control was applied on May 30. This application included 6 oz/acre Intensity, 4 oz/acre Interlock, 12 oz/acre Max-In Boron, and 4 qt/100 gallons mentholated seed oil.



No-till Fallow

(3-year Field 7; 4-year Field 6)

Both fields of no-till fallow were treated the same and were maintained relatively weed free with four herbicide applications. The first herbicide application was applied on April 25 at 32.0 oz/acre RT3, 1.5 qt/100 gallons Alliance, and 1.0 qt/100 gallons Activate Plus. The second application was on June 6 and was 32.0 oz/acre RT3 and 1.0 qt/100 gallons Liberate. The third application was on July 18 at 32.0 oz/acre RT3 and 13.5 lb/100 gallons AMS Max. The fourth and final application was custom applied at 47 oz/acre Gramoxone, 3.4 oz/acre Interlock, 8.6 oz/acre Aduro, and 75 oz/acre Solution 32 on September 7.

Winter Wheat (North)

‘Jasper’ and ‘Puma’ winter wheat were seeded into spring canola residue on October 5 at 70 lb/acre (755,000 seeds/acre). Liquid starter fertilizer at 1.0 gal/acre 8-18-6 PowerUp and 1.0 gal/acre 10-34 fertilizer were applied at a rate of 2-6-0-1 plus 0.02 Zn with the seed. Aqua and ThioSul were applied deep at 57-0-0-9. Postemergence weed control included 4.75 oz/acre Osprey, 0.6 oz/acre Affinity Broadspec, 16 oz/acre Rhonox MCPA Ester, 1.0 gal/acre Solution 32, and 1.0 qt/100 gallons M-90 on April 26, 2018.

Soil Compaction

Soil compaction data are collected with a Spectrum Soil Compaction meter. Data are collected within each plot in the spring of the year prior to seeding, and compaction levels are monitored over time within a given crop rotation, which assists in potential management decisions. Plot 5 was deep ripped in the

fall of 2014 with a low disturbance Case IH Ecolo-til 2500 to monitor changes over time. Plot 5 had the least amount of compaction with an average of 102 psi/18 inches, and Plot 6 had the greatest average with 200 psi/18 inches (Figure 1). For Plots 3, 1, and 7, compaction averaged 147, 154, and 164 psi/18 inches, respectively. Maximum compaction levels were typically observed at the six-inch depth.

Wireworm Populations

Wireworm population data are collected within each plot in the spring of the year, prior to seeding, using the modified solar bait trap method. This is done to monitor populations over time and better match seed-applied insecticide with wireworm populations. Plots 3 and 5 had the least number of wireworms, averaging 0.8/trap. Plot 7 had the greatest population, averaging 5.4/trap. Plot 1 and Plot 6 averaged 1.0/trap and 3.2/trap, respectively.

Soil Samples

Winter wheat soil samples are collected prior to seeding in the fall from five GPS-marked locations (Tables 1, 2, and 3). Fields seeded to spring crop are sampled according to three production zones and are used to help determine yield potential and nutrient requirements for the crops within these zones. Spring soil samples in Tables 4, 5, and 6 are an average of the three production zones. No-till fallow fields are soil sampled from the same five GPS-marked locations at the same time as those fields being spring cropped (Tables 7 and 8). Soil samples are also used as a historical reference for changing soil conditions over time. Soil pH, organic matter, phosphorus, and ammonium nitrogen are collected only from the top 12 inches of soil.

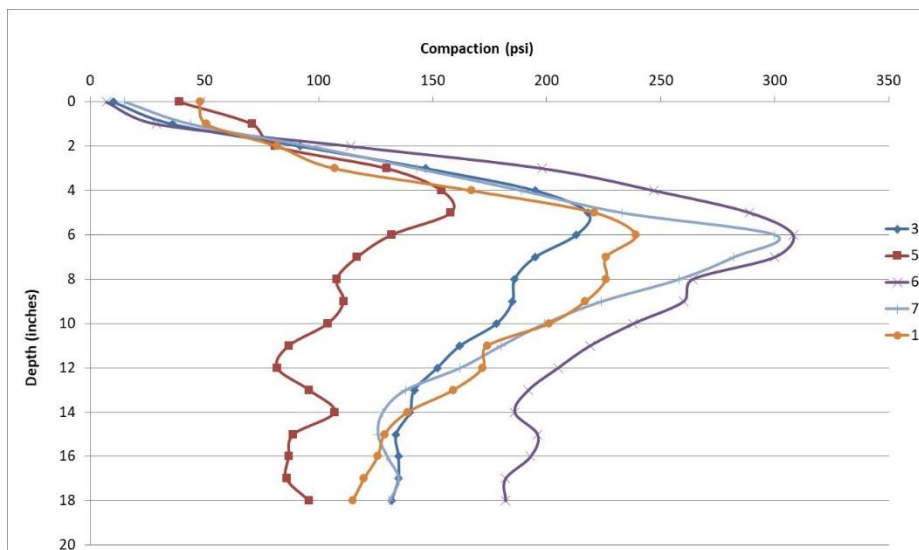


Figure 1. Soil compaction data collected in the spring of the year from the plots at the WSU Wilke Research and Extension Farm in 2018.



Table 1. Winter wheat 3-year Field 2.

Soil pH	5.7					Phosphorus	16 mg/kg
Organic Matter	2.9% (57 lb/acre N)					Ammonium N	10 lb/acre
		<u>Soil Depth (in)</u>					
		<u>0-12</u>	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>		<u>Total</u>
Nitrate-N (lb/acre)		77	29	22	36		164
Sulfate-S (mg/kg)		8	5	8	--		22
Moisture (in)		2.4	2.2	2.3	2.5		9.4
Sum of Tested N: 231 lb/acre N							

Table 2. Winter wheat 4-year Field 4.

Soil pH	6.0					Phosphorus	13 mg/kg
Organic Matter	2.6% (51 lb/acre N)					Ammonium N	10 lb/acre
		<u>Soil Depth (in)</u>					
		<u>0-12</u>	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>		<u>Total</u>
Nitrate-N (lb/acre)		56	24	18	41		139
Sulfate-S (mg/kg)		8	6	7	--		21
Moisture (in)		2.0	2.1	2.0	2.1		8.2
Sum of Tested N: 200 lb/acre N							

Table 3. Winter wheat field North.

Soil pH	5.7					Phosphorus	20 mg/kg
Organic Matter	2.5% (51 lb/acre N)					Ammonium N	10 lb/acre
		<u>Soil Depth (in)</u>					
		<u>0-12</u>	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>		<u>Total</u>
Nitrate-N (lb/acre)		22	5	2	7		36
Sulfate-S (mg/kg)		9	5	5	--		20
Moisture (in)		0.8	0.8	1.2	1.1		3.9
Sum of Tested N: 97 lb/acre N							

Table 4. DNS wheat 3-year Field 5.

Soil pH	6.2			Phosphorus	12 mg/kg
Organic Matter	2.2% (44 lb/acre N)			Ammonium N	5 lb/acre
	<u>Soil Depth (in)</u>				
	<u>0-12</u>	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>Total</u>
Nitrate-N (lb/acre)	8	7	8	4	26
Sulfate-S (mg/kg)	6	6	7	--	20
Moisture (in)	3.5	3.1	3.0	1.7	11.4
Sum of Tested N: 76 lb/acre N					

Table 5. DNS wheat 4-year Field 3.

Soil pH	6.3			Phosphorus	15 mg/kg
Organic Matter	2.5% (50 lb/acre N)			Ammonium N	5 lb/acre
	<u>Soil Depth (in)</u>				
	<u>0-12</u>	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>Total</u>
Nitrate-N (lb/acre)	12	12	11	11	46
Sulfate-S (mg/kg)	8	7	7	--	21
Moisture (in)	3.2	2.9	2.5	2.2	10.8
Sum of Tested N: 101 lb/acre N					

Table 6. Spring canola 4-year Field 1.

Soil pH	6.3			Phosphorus	11.6 mg/kg
Organic Matter	2.4% (47 lb/acre N)			Ammonium N	4 lb/acre
	<u>Soil Depth (in)</u>				
	<u>0-12</u>	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>Total</u>
Nitrate-N (lb/acre)	11	11	10	9	42
Sulfate-S (mg/kg)	7	6	9.4	--	22
Moisture (in)	3.4	2.7	2.4	2.0	10.4
Sum of Tested N: 93 lb/acre N					

Table 7. No-till fallow 3-year Field 7.

Soil pH	6.2			Phosphorus	14 mg/kg
Organic Matter	2.3% (45 lb/acre N)			Ammonium N	21 lb/acre
	<u>Soil Depth (in)</u>				
	<u>0-12</u>	<u>13-24</u>	<u>25-36</u>	<u>37-48</u>	<u>Total</u>
Nitrate-N (lb/acre)	12	11	13	6	42
Sulfate-S (mg/kg)	7	8	8	--	22
Moisture (in)	3.2	2.8	2.3	2.2	10.4
Sum of Tested N: 108 lb/acre N					

Table 8. No-till fallow 4-year Field 6.

Soil pH	6.0			Phosphorus	15 mg/kg
Organic Matter	2.6% (52 lb/acre N)			Ammonium N	21 lb/acre
	Soil Depth (in)				
	<u>0–12</u>	<u>12–24</u>	<u>24–36</u>	<u>36–48</u>	<u>Total</u>
Nitrate-N (lb/acre)	17	21	20	9	67
Sulfate-S (mg/kg)	6	7	9	--	22
Moisture (in)	3.2	2.8	2.0	1.9	9.9
Sum of Tested N: 140 lb/acre N					

Production and Economic Performance

Nitrogen uptake efficiency was above 50 percent for continuous winter wheat and below 50 percent across both winter wheat on

fallow fields and for DNS wheat (Table 9). For continuous winter wheat, this implies the nitrogen fertilizer program was adequate and an average amount of nitrogen should be available in the soil for next year’s production. Fields below 50 percent efficiency imply the crop was over fertilized or fertilizer timing could be adjusted, and above average fertilizer should be available for next year’s production.

Table 9. 2018 Nitrogen use efficiency.

	Field 2 (SWWW)	Field 3 (DNS Wheat)	Field 4 (SWWW)	Field 5 (DNS Wheat)	North (SWWW)
Soil Test Nitrogen [†]	203	74	173	24	90
Applied Nitrogen	100	95	100	99	63
Total Nitrogen	303	169	273	133	153
Grain Yield	67	50	77	34	52
Grain Protein	10.1%	12.4%	9.8	12.1%	10.1%
lb N/bu	4.5	3.4	3.6	3.6	2.9
Nitrogen Use Efficiency	33.5%	48%	41.5%	43.8%	52%

[†]Soil test nitrogen is calculated using soil test results in combination with the [WSU Dryland Wheat Nitrogen Fertilizer Calculator](#).

The WSU Wilke Farm grain marketing plan, which begins once the crop has emerged, uses forward contracts and post-harvest selling. All grain is marketed by November 15. The average marketing window for winter wheat is about 13 months—7 months for spring crops. Forward contract values do not exceed the crop revenue insurance coverage value. The potential for a forward contract is evaluated monthly and is based on a targeted rate of return on investment based on estimated expenses. Market grades for each crop are provided as these also impact final market price.

Average input costs per year at the WSU Wilke Farm was down 20.2% over the last 3-year average and were the lowest since 2010. This is mostly because of lower seed, fertilizer, and herbicide costs per acre across most crops and no fungicide expense. Economic returns over input costs were up 107.6% over the previous 3-year average and were \$90/acre more than 2017. This is reflective of higher grain prices, reduced costs, and improved performance of the 4-year and continuous crop

rotations. Tables 10–15 summarize the rotation, production, and economic performance of the 3-year rotation, 4-year rotation, and continuous cropping system at the Wilke Farm in 2018.

The 3-year crop rotation returns above input costs averaged \$92/acre, 4.7% less than the 3-year average. The winter wheat yield was compromised by feral rye and multiple wicking applications. Spring wheat yield was compromised by reduced stand because of hair pinning that resulted from using a low disturbance disk drill in heavily mowed winter wheat residue. The 4-year crop rotation returns above input costs averaged \$144/acre, 48.7% more than the previous 3-year average. The continuous cropping system returns above input costs averaged \$186/acre, 382% greater than the previous 3-year average. The WSU Wilke Farm is enrolled in the farm program and purchases crop insurance each year. Revenue or costs associated with both the farm program and crop insurance are not included in the plot summaries to maintain consistency over years and results are based on crop production only.

Table 10. 3-year cropping rotation sequence at the Wilke Farm from 2014 to 2019.

Year	Plot 2	Plot 5	Plot 7
2014	No-till Fallow	Winter Wheat (51.7 bu/acre)	HWSW (19.8 bu/acre)
2015	Winter Wheat (51.5 bu/acre)	DNS Wheat (24.5 bu/acre)	No-till Fallow
2016	DNS Wheat (49.0 bu/ac)	No-till Fallow	Winter Wheat (84.2 bu/acre)
2017	No-till Fallow	Winter Wheat (93.6 bu/acre)	DNS Wheat (32.8 bu/acre)
2018	Winter Wheat (66.7 bu/acre)	DNS Wheat (34.3 bu/acre)	No-till Fallow
2019	Spring Cereal	No-till Fallow	Winter Wheat

Table 11. 3-year crop rotation production at the Wilke Farm, 2018.

	Plot 2	Plot 5	Plot 7
Cropping Specifics			
Acreage	23.50	26.6	30.9
Crop	'Jasper' SWWW	'Alum' DNS wheat	No-till Fallow
Crop Production			
Yield	66.7 bu/acre	34.3 bu/acre	--
Mkt Grade	#1 SWH 61.5 0.4% 315 FN	#1 DNS 61.2 0.60% 12.1% 305 FN	--
Gross Economic Return[†]			
Mkt Price	\$5.37/bu	\$5.40/bu	--
Gross Return	\$357.63/acre	\$184.99/acre	--
Input Costs			
Seed	\$17.67/acre	\$24.45/acre	--
Fertilizer	\$48.47/acre	\$58.66/acre	--
Herbicides	\$15.28/acre	\$21.96/acre	\$36.66/acre
Fungicide	--	--	--
Total	\$81.42/acre	\$105.07/acre	\$36.66/acre
Summary			
Return over Costs	\$276.21/acre	79.92/acre	-\$36.66/acre
3-Year Rotation Return over Input Costs[‡]		\$92.40/acre	

[†]Revenue does not include crop insurance revenue.

[‡]Costs do not include fixed costs associated with the farm.

Table 12. 4-year cropping rotation sequence at the Wilke Farm from 2014 to 2019.

Year	Plot 1	Plot 3	Plot 4	Plot 6
2014	Spring Canola (701 lb/acre)	SWSW (23 bu/acre)	Winter Wheat (55.9 bu/acre)	No-till Fallow
2015	DNS Wheat (23.0 bu/acre)	No-till Fallow	Spring Canola (479 lb/acre)	Winter Wheat (50.1 bu/acre)
2016	No-till Fallow	Winter Wheat (94.5 bu/acre)	DNS Wheat (48.9 lb/acre)	Oriental Mustard (1,325 lb/acre)
2017	Winter Wheat (90.8 bu/acre)	Chickpea (1,066 lb/acre)	No-till Fallow	DNS Wheat (32.1 bu/acre)
2018	Spring Canola (1020 lb/acre)	DNS Wheat (50.3 bu/acre)	Winter Wheat (77.5 bu/acre)	No-till Fallow
2019	Spring Cereal	No-till Fallow	Broadleaf	Winter Wheat

Table 13. 4-year crop rotation production at the Wilke Farm, 2018.

	Plot 1	Plot 3	Plot 4	Plot 6
Cropping Specifics				
Acreage	21.7	27.5	26.2	26.9
Crop	'DG 200 CL+' Spring Canola	'Alum' DNS wheat	'Jasper' Winter Wheat	No-till Fallow
Crop Production				
Yield	1,022 lb/acre	50.3 bu/acre	77.5 bu/acre	--
Mkt Grade	#1 Canola GMO 1.80%	#1 DNS 62.3 1.10% 12.4% 353 FN	#1 SWH 60.7 0.1% 393 FN	--
Gross Economic Return[†]				
Mkt Price	\$0.162/lb	\$5.97/bu	\$5.42/bu	--
Gross Return	\$165.23/acre	\$300.48/acre	\$419.87/acre	--
Input Costs				
Seed	\$32.00/acre	24.45/acre	\$17.67/acre	--
Fertilizer	\$49.27/acre	\$57.60/acre	\$48.47/acre	--
Herbicides	\$16.20/acre	\$22.16/acre	\$15.28/acre	\$36.66/acre
Fungicide	--	--	--	--
Total	\$97.47/acre	\$104.21/acre	\$81.42/acre	\$36.66/acre
Summary				
Return over Costs	\$67.76/acre	\$196.27/acre	\$338.45/acre	-\$36.66/acre
4-Year Rotation Return over Input Costs[‡]			\$144.17/acre	

[†]Revenue does not include crop insurance revenue.

[‡]Costs do not include fixed costs associated with the farm.

Table 14. Continuous crop rotation sequence at the Wilke Farm from 2014 to 2019.

Year	North Side
2014	DNS Wheat (21.0 bu/acre)
2015	HR Winter Wheat (24.4 bu/acre)
2016	Spring Barley (1.68 ton/acre)
2017	Spring Canola (1,055 lb/acre)
2018	Winter Wheat (52 bu/acre)
2019	Spring cereal

Table 15. Continuous crop rotation production at the Wilke Farm, 2018.

North Side	
Cropping Specifics	
Acreage	62.4
Crop	'Jasper'/'Puma' Winter Wheat
Crop Production	
Yield	52.3 bu/acre
Mkt Grade	#2 SWW 59.4 0.30%
Gross Economic Return[†]	
Mkt Price	\$5.104/bu
Gross Return	\$267.05/acre
Input Costs	
Seed	\$17.62/acre
Fertilizer	\$34.01/acre
Herbicides	\$29.79/acre
Fungicide	--
Total	\$81.41/acre
Summary	
Continuous Rotation Return over Input Costs[‡]	\$185.64/acre

[†]Revenue does include any crop insurance revenue.

[‡]Costs do not include fixed costs associated with the farm.

Summary

Weather played a major role in the overall agronomic and economic production in 2018, with early favorable wet conditions increasing yield potentials that were subsequently limited by hot, dry summer conditions. Overall, 2018 (Table 17) and 2017 (Table 18) growing season totals were very similar. However, in 2018 the fall was drier with only 3.82 inches of precipitation compared to 6.37 inches in 2017. The winter of 2018 was warmer with 117 cumulative growing degree days (GDD) compared to 14 GDD in 2017. The spring of 2018 was a little warmer and much drier with 1428 GDD and 4.68 inches of

precipitation compared to 1303 GDD and only 6.75 inches in 2017. The summer of 2018 was very similar to the summer of 2017 with 3,139 GDD and 0.18 inches of precipitation compared to 3,272 GDD and 0.38 inches of precipitation in 2017.

A summary of WSU Wilke Research and Extension Farm economic returns over input costs using 3-year averages is shown in Figure 2. Over the last three years (2016 to 2018), the 3-year rotation, 4-year rotation, and continuous cropping rotation have averaged returns above input costs of \$116, \$135, and \$100/acre, respectively. Over the last six years, the 3-year rotation and 4-year rotation have averaged returns above input costs of \$104 and \$102/acre, respectively. These are both

Chickpea Operations and Production at WSU Wilke

‘Billy Bean’ chickpeas were seeded on 19.8 acres of miscellaneous ground at the WSU Wilke Farm on April 30. They were seeded at 135 lb/acre, and dry 15-19-0-11 with 0.05 B and 0.25 Zn fertilizer applied at a rate of 53 lb/acre with the seed. Three days prior to seeding, 32.0 oz/acre RT3, 4 oz/acre Dimetric metribuzin, 2 oz/acre Sharpen, and 1.0 gal/100 gallons crop oil concentrate were applied. Postemergence weed control was applied on May 30. This application included 6 oz/acre Intensity, 4 oz/acre Interlock, 12 oz/acre Max-In Boron, and 4 qt/100 gallons MSO. Priaxor fungicide was applied at 4 oz/acre on June 20. Preharvest burn down herbicide was applied on August 15 and included Paraquat applied at 21 oz/acre with 16 oz/100 gallons Activate Plus. Table 16 summarizes production and costs associated with the chickpea crop.

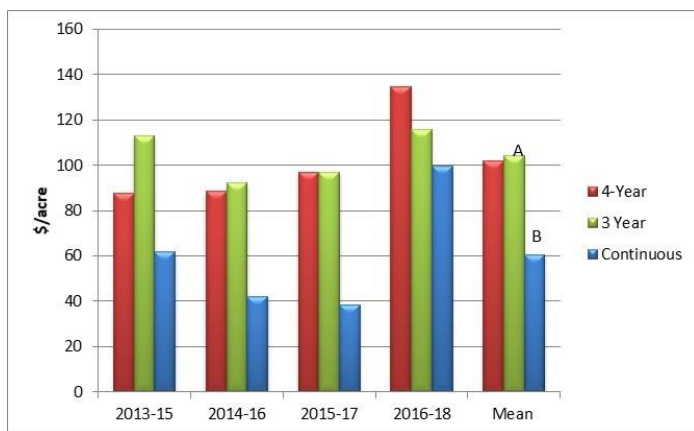


Figure 2. Three-year average economic return over input costs of 3-year, 4-year, and continuous cropping systems at the WSU Wilke Research and Extension Farm. Costs do not include fixed costs associated with the farm. Means within columns assigned different case letters are significantly different ($P < 0.10$).

significantly greater than the \$61/acre return above cost of the continuous cropping system.

Table 16. Chickpea production at the Wilke Farm, 2018.

		Misc.
Cropping Specifics		
Acreage		19.8
Crop		‘Billy Bean’ Chickpea
Crop Production		
Yield		1,096 lb/acre
Mkt Grade		#1 Small Chickpea 4.60% 1.0% smalls
Gross Economic Return[†]		
Mkt Price		\$0.267/lb
Gross Return		\$292.85/acre
Input Costs		
Seed		\$69.40/acre
Fertilizer/Insecticide		\$15.75/acre
Herbicides		\$38.73/acre
Fungicide		\$13.76/acre
Total		\$137.64/acre
Summary		
Chickpea Return over Input Costs[‡]		\$155.21/acre

[†]Revenue does include any crop insurance or farm program revenue.

[‡]Costs do not include fixed costs associated with the farm.

Weather Data

The following tables provide weather data for Davenport, WA in 2018 and 2017, respectively.

Table 17. Weather data for Davenport, WA in 2018 (Crop Year Summary: 09/01/2017 to 08/31/2018).

Month	Temperature			Degree Days*	Rain Fall	Rain Days
	High	Low	Mean			
9	73.0	46.4	59.8	830	0.44	3
10	55.5	33.3	43.8	385	1.17	7
11	41.7	29.6	35.4	143	2.21	19
12	28.9	20.3	24.6	8	1.34	8
1	35.6	27.6	31.3	41	2.14	17
2	36.9	20.0	28.3	68	0.78	7
3	46.5	28.4	37.0	186	1.70	9
4	55.1	34.5	44.9	384	2.20	12
5	72.5	46.9	60.2	858	0.78	7
6	73.4	45.9	60.8	830	0.14	4
7	86.5	54.6	72.0	1195	0.00	0
8	82.9	52.9	68.7	1114	0.04	2
Total				6042	12.94	95

*Degree days calculated using 32°F as the base temperature.

Table 18. Weather data for Davenport, WA in 2017 (Crop Year Summary: 09/01/2016 to 08/31/2017).

Month	Temperature			Degree Days*	Rain Fall	Rain Days
	High	Low	Mean			
9	70.7	42.9	56.8	744	0.25	4
10	54.3	38.7	46.1	450	4.70	21
11	49.1	34.3	41.0	297	1.42	16
12	27.0	13.6	21.1	2	0.37	5
1	23.5	12.6	18.4	4	1.17	8
2	32.0	19.2	26.2	8	2.15	12
3	45.6	31.1	38.2	210	3.33	19
4	54.9	34.3	44.3	377	1.84	10
5	66.9	43.3	55.6	716	1.58	10
6	74.8	46.6	62.0	862	0.38	4
7	86.9	54.1	72.2	1193	0.00	0
8	87.4	55.1	72.0	1217	0.00	0
Total				6080	17.19	109

*Growing degree days calculated using 32°F as the base temperature.

Special Thanks



AGWEATHERNET STATION located at the Wilke Research and Extension Farm.

You can access Wilke weather data at the [AgWeatherNet link on the widget](#) that takes you to a map of weather stations throughout the state.

[Wilke Farm website](#)

[Lincoln-Adams Extension website](#)

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