WSU WILKE RESEARCH AND EXTENSION FARM OPERATION, PRODUCTION, AND ECONOMIC PERFORMANCE FOR 2022

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 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 rainfall 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 accessed through the Wheat and 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 three-year rotation that includes summer fallow, winter wheat, and spring cereals. Farmers remain 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 fields; three fields are in a more traditional three-year crop rotation, and four fields are in an intensified four-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. It was divided into two fields in 2021 to increase diversity.

Soil compaction, soil pH, and wireworm population data are collected each spring from GPS-recorded locations within each field. Soil samples are also collected from these GPS locations prior to seeding, and fertilizer is applied according to soil sample results and WSU recommendations. Fertilizer rates are expresses as lb/acre in N-P-K-S format. For example, 16-20-0-13 is the application of 16 lb/acre nitrogen, 20 lb/acre phosphorus, 0 lb/acre potassium, and 13 lb/acre sulfur.

Operations

All crops in 2021–2022 were seeded with the farm's John Deere 750 direct-seed, low disturbance disk drill using a 7.5-inch row spacing. Deep-banded fertilizer applications were applied in between the rows on a 15-inch spacing. The farm was harvested with its new John Deere 9500 combine from August 8 through August 24.

Winter Wheat on Fallow (3-Year Field 7; 4-Year Field 4)

Field 7 and Field 4 were seeded to 'Piranha CL+' Clearfield soft white winter wheat (SWWW) on September 10, 2021, at 65 lb/acre (1,000,000 seeds per acre) into no-till fallow. Seed was treated with Highline Grain Growers (HLGG) Gold 0.56 Fall (3.0 oz/cwt Dividend Extreme, 0.16 oz/cwt Vibrance, 0.051 oz/cwt Rancona CTS, and 0.56 oz/cwt Cruiser 5FS). Prior to seeding, ammonium chloride was spoke-wheel injected into both fields at a rate of 4-0-0-0-10 Cl. Dry 16-20-0-13 fertilizer was applied at a rate of 53 lb/acre with the seed. Solution 32 (90%) and thio-sul (10%) was variably applied across three application zones to account for field variability and yield potential. Field 7 received an average of 85-0-0-7, and overall, 32% received greater than 89-0-0-8, 8% received less than 56-0-0-5, and 61% received a rate in between. Field 4 averaged 82-0-0-7, and overall, 43% received greater than 96-0-0-8, 9% received less than 66-0-0-6, and 48% received a rate in between.

Field 7 postemergence weed control was applied using 15 gpa of carrier that included Osprey Xtra applied at 4.5 oz/acre, Huskie applied at 15 oz/acre, Linkage water condition agent at 2.0 qt/100 gallons, AMS at 1 lb/acre, and molasses at 32 oz/acre on May 1, 2022. At harvest, this field was mostly weed free, but a few downy brome plants were observed on the outside edge of the field.

In the fall, Field 4 postemergence weed control was applied using 10 gpa of carrier that included PowerFlex HL applied at 2 oz/acre, nonionic surfactant (NIS) at 1.0 qt/100, and Solution 32 at 1 qt/acre on November 2, 2021. In the spring, postemergence weed control was applied using 15 gpa of carrier that included Osprey Xtra applied at 4.5 oz/acre, Huskie applied at 15 oz/acre, Linkage water condition agent at 2.0 qt/100 gallons, AMS at 1 lb/acre, and molasses (fertilizer) at 32 oz/acre on May 1, 2022. At harvest, this field was mostly broadleaf weed free, but downy brome was observed throughout the field and poverty (a.k.a. sterile) brome was documented within the field.

Continuous Winter Wheat (4-Year Field 3;Continuous Northwest)

Field 3 was seeded to ‘Sockeye CL+’ Clearfield SWWW on October 18, 2021, at 80 lb/acre (940,000 seeds per acre) in a spring canola field that was sprayed out on July 12, 2021, because of severe frost damage. Seed was treated with Lumivia CPL 0.5 oz/cwt. Dry 18-30-0-5 fertilizer was applied at a rate of 48 lb/acre with the seed. Liquid Solution 32 (76%), thio-sul (8%), and ammonium chloride (16%) fertilizer was applied at a rate of 14-0-0-1, plus 1 lb/acre Cl. The bulk of the fertilizer (82-12-0.25-9) was applied in the spring for the failed canola crop. On May 12, 2022, an application of 3.2 oz/acre Envita and 32 oz/acre of molasses was applied. Post-plant preemergence weed control was applied on October 19, 2021, using 10 gpa of carrier that included Anthem Flex applied at 3.0 oz/acre. Postemergence weed control was applied using 10 gpa of carrier that included 12.4 oz/acre Salvo, 32 oz/acre molasses, and 1 qt/100 gallons Full Load Complete on May 1, 2022. At harvest, this field had a population of broadleaf weeds. A postharvest WEED-IT application was completed on September 14, 2022, and included 5.8 oz/acre Paraquat Concentrate (44 oz/acre broadcast rate) and 1.16 oz/acre nonionic surfactant (1 qt/100 gallons broadcast rate).

Field Northwest was seeded to ‘Hulk’ SWWW on October 12, 2021, at 72 lb/acre (850,000 seeds/acre) into low yielding spring canola stubble. Seed was treated with Highline Grain Growers (HLGG) Gold 0.56 Fall (3.0 oz/cwt Dividend Extreme, 0.16 oz/cwt Vibrance, 0.051 oz/cwt Rancona CTS, and 0.56 oz/cwt Cruiser 5FS). Dry 18-30-0-5 was applied at a rate of 48 lb/acre with the seed. Solution 32 (90%) and thio-sul (10%) was variably applied across three application zones to account for field variability and yield potential. Field Northwest received an average of 41-0-0-4, and overall, 13% received greater than 46-0-0-4, 19% received less than 40-0-0-3, and 68% received a rate in between. Post-planting preemergence weed control was applied on October 19, 2021, using 10 gpa of carrier that included Anthem Flex applied at 3.0 oz/acre. Postemergence weed control was applied using 10 gpa of carrier that included 12.4 oz/acre Salvo, 32 oz/acre molasses, and 1 qt/100 gallons Full Load Complete on May 1, 2022. At harvest, this field had a low population of feral rye, Canada thistle, wild oat, and horseweed (a.k.a. marestail). A postharvest WEED-IT application was completed on September 14, 2022, and included 2.9 oz/acre Paraquat Concentrate (44 oz/acre broadcast rate) and 0.58 oz/acre nonionic surfactant (1 qt/100 gallons broadcast rate).

In the fall, Field 4 postemergence weed control was applied using 10 gpa of carrier that included PowerFlex HL applied at 2 oz/acre, nonionic surfactant (NIS) at 1.0 qt/100, and Solution 32 at 1 qt/acre on November 2, 2021. In the spring, postemergence weed control was applied using 15 gpa of carrier that included Osprey Xtra applied at 4.5 oz/acre, Huskie applied at 15 oz/acre, Linkage water condition agent at 2.0 qt/100, AMS at 1 lb/acre, and molasses at 32 oz/acre on May 1, 2022. At harvest, this field was mostly broadleaf weed free, but downy brome was observed throughout the field and poverty brome was documented within the field.

Spring Wheat (3-Year Field 2)

Field 2 was seeded to 'Net CL+' Dark Northern Spring Wheat (DNS) on April 13, 2022, at 64 lb/acre (900,000 seeds per acre) into winter wheat residue. Seed was treated with HLGG Gold 0.69 (3.0 oz/cwt Dividend Extreme, 0.16 oz/cwt Vibrance, 0.255 oz/cwt Mertect 340F, and 0.69 oz/cwt Cruiser 5FS). Dry 19-21-0.6-9 with 0.05 B, 0.27 Zn, and 0.54 Mg was applied at a 44 lb/acre rate with the seed. Solution 32 and thio-sul (10:1 ratio) was variably applied across three application zones to account for field variability and yield potential with an average application of 32-0-0-3. Overall, 20% received greater than 40-0-0-3, 14% received less than 23-0-0-2, and 66% received a rate in between. On March 31, 2022, a preplant burndown herbicide was applied including 32 oz/acre RT3 and 1 qt/100 gallons Full Load Complete at 10 gpa. Postemergence weed control was applied on June 7, 2022, in a carrier volume of 10 gpa. This application included Brox-M at 16 oz/acre, Axial Star at 16.4 oz/acre, Slant EC at 4 oz/acre, Downrigger at 1 qt/100 gallons, and molasses at 32 oz/acre. At harvest, this field had a low population of broadleaf weeds throughout the canopy. A postharvest WEED-IT application was completed on September 19, 2022, and included 5.8 oz/acre Paraquat Concentrate (44 oz/ac broadcast rate) and 1.16 oz/acre nonionic surfactant (1 qt/100 gallons broadcast rate).

Spring Canola (4-Year Field 1; Continuous Northeast)

'NCC101S' spring canola was seeded in Field 3 on April 18, 2022, at 5.7 lb/acre (498,000 seeds per acre) into winter wheat residue. Dry 19-21-0.6-9 with 0.05 B, 0.27 Zn, and 0.54 Mg was applied at a 44 lb/acre rate with the seed. Solution 32 and thio-sul (10:1 ratio) was variably applied across three application zones to account for field variability and yield potential. The average rate applied was 24-0-0-2. Overall, 31% received greater than 25-0-0-2, 9% received less than 21-0-0-2, and 59% received a rate in between. On March 31, 2022, a preplant burndown herbicide was applied including 32 oz/acre RT3 and 1 qt/100 gallons Full Load Complete at 10 gpa. Postemergence weed control was applied on June 7, 2022, in a carrier volume of 10 gpa. This application included 6 oz/acre Volunteer, 1% v/v crop oil, 32 oz/acre molasses, and 1 gallon/acre Rally fertilizer. The Rally in this application contained an additional 1 lb/acre of nitrogen. At harvest, this field had an infestation of broadleaf weeds, including pigweed, common lambsquarters, and prickly lettuce.

'L343PC' Liberty Link spring canola was seeded in Northeast on April 19, 2022, at 5.9 lb/acre (457,000 seeds per acre) into spring wheat residue. Dry 19-21-0.6-9 with 0.05 B, 0.27 Zn, and 0.54 Mg was applied at a 44 lb/acre rate with the seed. Solution 32 and thio-sul (10:1 ratio) was variably applied across three application zones to account for field variability and yield potential. The average rate applied was 26-0-0-2. Overall, 18% received greater than 33-0-0-3, 25% received less than 21-0-0-2,

and 56% received a rate in between. On March 31, 2022, a preplant burndown herbicide was applied including 32 oz/acre RT3 and 1 qt/100 gallons Full Load Complete at 10 gpa. Postemergence weed control was applied across the whole field on May 25, 2022, in a carrier volume of 10 gpa. This application included 6 oz/acre Volunteer, 1% v/v crop oil, and 32 oz/acre molasses. On June 7, 2022, a second postemergence herbicide application was applied in a carrier volume of 20 gpa. This application included 25 oz/acre Liberty 280 SL and 7 gal/acre 9-0-0-10 fertilizer. At harvest, this field was weed free.

No-till Fallow (3-Year Field 5; 4-Year Field 6)

Both fields of no-till fallow (NTF) were treated the same and were maintained for weeds. Both fields were relatively weed free after four herbicide applications. The first herbicide application was 3 oz/acre Valor SX at a carrier volume of 10 gpa and was applied on November 4, 2021. The second application was on April 27, 2022, using a carrier volume of 10 gpa and included 24 oz/acre Gly Star 5 Extra, 1 qt/100 gallons Full Load Complete, and 32 oz/acre molasses. The third application was on June 7, 2022, at a carrier volume of 10 gpa and included 32 oz/acre Gly Star Plus, 1 qt/100 gallons Full Load Complete, and 32 oz/acre molasses. The fourth, fifth, and sixth applications were applied with a WEED-IT Precision Sprayer. On July 19, 2022, an average of 3.54 oz/acre RT3 and 1.6 oz/acre Full Load Complete was applied on Field 6, and 3.13 oz/acre RT3 and 1.4 oz/acre Full Load Complete was applied on Field 5. On August 5, 2022, an average of 12.6 oz/acre RT3 and 1.3 oz/acre Valkyrie was applied on Field 6, and 14.0 oz/acre RT3 and 1.4 oz/acre Valkyrie was applied on Field 5. On September 14, 2022, an average of 2.43 oz/acre of Paraquat Concentrate and 0.8 oz/acre NIS was applied on Field 6, and 3.1 oz/acre Paraquat Concentrate and 1.0 oz/acre NIS was applied on Field 5. Common lambsquarters, wild oat, and redroot pigweed were the three most common weeds present, and Russian thistle, prickly lettuce, and horseweed were very limited.

Soil Compaction

Soil compaction data were collected with a Spectrum Soil Compaction meter. Data were collected within each field in the spring of the year prior to seeding to determine changes in compaction over time. Compaction levels are monitored within each field and within a given crop rotation, which assists in potential management decisions in the future. Field 5 had the least amount of compaction with an average of 170 psi/18 inches, and Field 1 had the greatest average soil compaction with 226 psi/18 inches (Figure 1). For Fields 2, 6, and Northeast, compaction averaged 211, 212, and 183 psi/18 inches, respectively. Maximum compaction levels were typically observed at the six-inch depth.

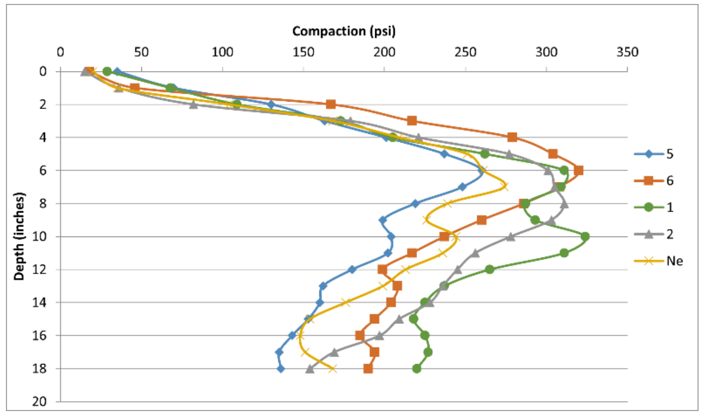

Figure 1. Soil compaction data were collected in the spring of the year from five fields at the WSU Wilke Research and Extension Farm in 2022.

Wireworm Populations

Wireworm population data were collected within each field 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 wireworm populations. Across the farm, wireworm populations are very low. Field 5, Field 6, and Field Northeast had the least number of wireworms with no wireworms trapped. Field 1 averaged 0.4 wireworms/trap and Field 2 averaged 0.8 wireworms/trap.

Soil Samples

Soil samples were collected prior to seeding winter wheat, spring wheat, and spring canola from three production zones in each field. Data were used to help determine yield potential and nutrient requirements for the crops within these zones. Soil sample data presented in Tables 1–5 are an average of the three production zones in each field. No-till fallow fields are soil sampled from the same five GPS-marked locations at the same time as those fields being spring-cropped (Table 6 and Table 7). Continuous winter wheat in Field 3 and Northwest were not sampled prior to seeding, as soil samples from the previous crop were used along with nutrient removal. 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.

Table 1. Winter wheat, 3-year, Field 7.

Soil pH	5.5			Phosphorus	16 mg/kg
Organic Matter	1.9% (39 lb/acre N credit for OM)			Ammonium N	2 lb/acre
	Soil Depth (in)				
	0–12	12–24	24–36	36–48	Total
Nitrate-N (lb/acre)	43	18	14	19	94
Sulfate-S (mg/kg)	10	5	4	--	19
Soil Water (in)	1.6	1.7	1.3	1.6	6.2
Sum of Tested N: 136 lb/acre N					

Table 2. Winter wheat, 4-year, Field 4.

Soil pH	5.3			Phosphorus	18 mg/kg
Organic Matter	2.4% (49 lb/acre N credit for OM)			Ammonium N	3 lb/acre
	Soil Depth (in)				
	0–12	12–24	24–36	36–48	Total
Nitrate-N (lb/acre)	56	22	19	19	116
Sulfate-S (mg/kg)	9	3	4	--	16
Soil Water (in)	1.6	1.5	1.6	1.6	6.2
Sum of Tested N: 168 lb/acre N					

Table 3. DNS wheat, 3-year, Field 2.

Soil pH	5.8			Phosphorus	12 mg/kg
Organic Matter	2.3% (47 lb/acre N credit for OM)			Ammonium N	5 lb/acre
	Soil Depth (in)				
	0–12	12–24	24–36	36–48	Total
Nitrate-N (lb/acre)	17	22	27	11	78
Sulfate-S (mg/kg)	7	4	3	--	14
Soil Water (in)	2.7	2.4	1.4	1.0	7.5
Sum of Tested N: 130 lb/acre N					

Table 4. Spring canola, 4-year, Field 1.

Soil pH	5.8			Phosphorus	14 mg/kg
Organic Matter	3.0% (59 lb/acre N credit for OM)			Ammonium N	12 lb/acre
	Soil Depth (in)				
	0–12	12–24	24–36	36–48	Total
Nitrate-N (lb/acre)	13	19	34	19	84
Sulfate-S (mg/kg)	8	23	4	--	34
Soil Water (in)	3.0	2.6	1.7	1.1	8.4
Sum of Tested N: 153 lb/acre N					

Table 5. Spring canola, continuous, Northeast.

Soil pH	6.0			Phosphorus	11 mg/kg
Organic Matter	2.1% (43 lb/acre N credit for OM)			Ammonium N	7 lb/acre
	Soil Depth (in)				
	0–12	12–24	24–36	36–48	Total
Nitrate-N (lb/acre)	17	27	13	11	68
Sulfate-S (mg/kg)	8	5	8	--	22
Soil Water (in)	2.6	2.3	1.5	1.2	7.7
Sum of Tested N: 118 lb/acre N					

Table 6. No-till fallow, 3-year, Field 5.

Soil pH	5.7			Phosphorus	18 mg/kg
Organic Matter	2.3% (46 lb/acre N credit for OM)			Ammonium N	7 lb/acre
	Soil Depth (in)				
	0–12	13–24	25–36	37–48	Total
Nitrate-N (lb/acre)	25	33	32	17	107
Sulfate-S (mg/kg)	9	8	6	--	23
Soil Water (in)	2.9	2.2	1.9	1.8	8.7
Sum of Tested N: 160 lb/acre N					

Table 7. No-till fallow, 4-year, Field 6.

Soil pH	6.0			Phosphorus	13 mg/kg
Organic Matter	2.9% (58 lb/acre N credit for OM)			Ammonium N	11 lb/acre
	Soil Depth (in)				
	0–12	12–24	24–36	36–48	Total
Nitrate-N (lb/acre)	19	31	19	9	78
Sulfate-S (mg/kg)	10	9	8	--	26
Soil Water (in)	2.8	2.2	1.7	1.1	7.7
Sum of Tested N: 147 lb/acre N					

Soil pH and KCl Extractable Aluminum (Al)

Soil pH and KCl extractable Al is rapidly becoming of great interest to farmers and field consultants. Soil pH and exchangeable Al soil samples are collected prior to seeding in fields planted to spring crop and no-till fallow. Soil samples are collected from the same five GPS locations where soil compaction and wireworm data are collected. Samples are collected at a depth of 0–3, 3–6, and 6–12 inches. Aluminum toxicity traditionally begins to occur when soil pH levels are less than 5.0 and KCl extractable Al measurements are greater than 25 ppm. At a depth of 0–3 inches, soil pH levels are above 5.0, and KCl Al ranged from 2.7 to 8.6 ppm (Table 8). At a depth of 3–6 inches, soil pH levels ranged from 5.0 to 5.6, and KCl Al ranged from 1.6 ppm in Field 2 to 28.1 ppm in Field 5. At a depth of 6–12 inches, pH ranged from 6.2 to 6.5, and KCl Al ranged from 1.4 to 2.7 ppm.

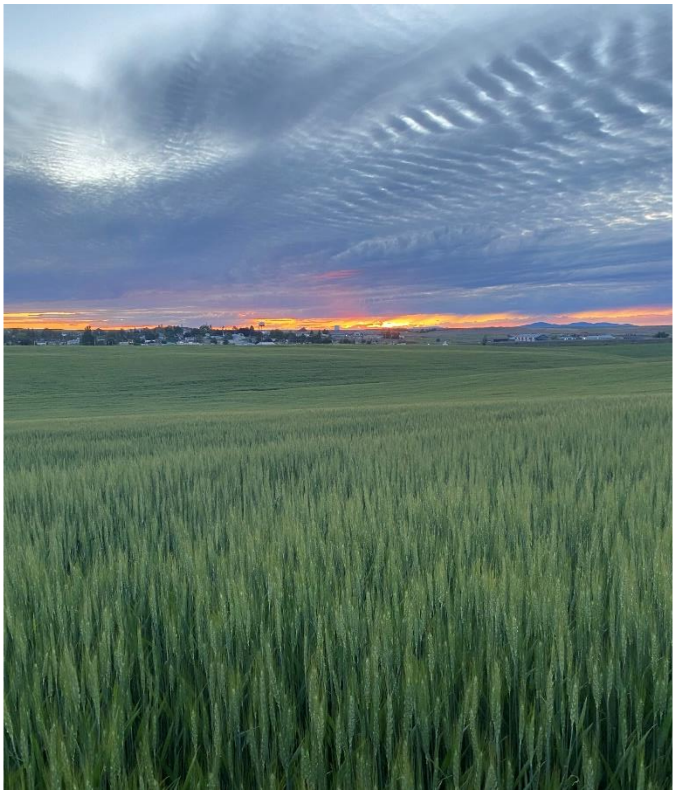

Table 8. Soil pH and KCl extractable aluminum in five fields at the WSU Wilke Research and Extension Farm in the spring of 2022.

	Field 1 (canola)	Field 2 (DNS)	Field 5 (NTF)	Field 6 (NTF)	Northeast (canola)
0–3 inches					
pH	5.1	5.3	5.3	5.3	5.5
KCl Al (ppm)	4.2	3.5	8.6	8.4	2.7
3–6 inches					
pH	5.0	5.4	5.2	5.2	5.6
KCl Al (ppm)	21.8	1.6	28.1	25.1	3.9
6–12 inches					
pH	6.2	6.4	6.3	6.4	6.2
KCl Al (ppm)	1.4	2.4	2.5	2.7	1.8

Production and Economic Performance

Nitrogen uptake efficiency (NUE) was at or above 50 percent for SWWW in Field 4 and Field 7 seeded on fallow, and Field 3 and Northwest on continuous cropping (Table 9). For fields at or above 50 percent, 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. Field 2 was seeded to DNS wheat, and NUE averaged only 41 percent, which implies the crop was overfertilized or fertilizer timing could be adjusted and above-average fertilizer should be available for next year's production. Soft white wheat traditionally requires 2.7 lb N/bu, and SWWW on fallow averaged 2.5 lb N/bu while continuous SWWW averaged 2.1 lb N/bu. DNS traditionally requires 3.6 lb N/bu and it had 4.3 lb N/bu available.

Table 9. 2022 nitrogen use efficiency.

	Field 2 (DNS wheat)	Field 3 (SWWW)	Field 4 (SWWW)	Field 7 (SWWW)	Northwest (SWWW)
Soil Test Nitrogen*	126	184	122	88	110
Applied Nitrogen	40	23	100	103	50
Total Nitrogen	166	207	222	191	160
Grain Yield	38.8	67.9	90.4	77.5	51.7
Grain Protein	13.6%	10.1%	8.6%	9.8%	12.4%
lb N/bu	4.3	3.1	2.5	2.5	3.1
Nitrogen Uptake Efficiency	**41%**	**50%**	**53%**	**60%**	**60%**

* Soil test nitrogen is calculated by inputting soil test results into 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 postharvest selling. All grain is marketed by November 15. The average marketing window for winter wheat is about 13 months, and 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. In 2022, before harvest, an estimated 25% of the SWWW crop was forward contracted and no canola or DNS wheat was forward contracted. Market grades for each crop are provided as these also impact the final market price.

Average input costs per year at the WSU Wilke Farm were up 30.7% over the three-year average (2019–21). However, economic returns over input costs were up 94.5%—the highest in the last ten years. This is mostly the result of higher-than-average crop yields across the board, strong market prices, and aggressive crop rotations. Tables 10–15 summarize the rotation, production, and economic performance of the three-year rotation, four-year rotation, and continuous cropping system at the Wilke Farm in 2022.

The three-year crop rotation returns above input costs averaged $219/acre, 75% greater than the three-year average. The four-year crop rotation returns above input costs averaged $293/acre, 119% greater than the previous three-year average. The continuous cropping system returns above input costs averaged $215/acre, 45% greater than the previous three-year average. The WSU Wilke Farm is enrolled in the farm program and purchases crop insurance each year. Revenue associated with the farm program is not included, but revenue and costs associated with crop insurance are included in the field summaries to maintain consistency over the years.

Table 10. Three-year cropping rotation sequence at the Wilke Farm from 2018 to 2023.

Year	Field 2	Field 5	Field 7
2018	Winter Wheat (66.7 bu/acre)	DNS Wheat (34.3 bu/acre)	No-till Fallow
2019	Spring Wheat (49.6 bu/acre)	No-till Fallow	Winter Wheat (68.1 bu/acre)
2020	No-till Fallow	Winter Wheat/Canola (76 bu/acre; 2,080 lb/acre)	Spring Wheat (55.5 bu/acre)
2021	Winter Wheat (55.5 bu/acre)	Spring Wheat (24.3 bu/acre)	No-till Fallow
2022	**DNS Wheat (38.8 bu/acre)**	**No-till Fallow**	**Winter Wheat (77.5 bu/acre)**
2023	NTF	Winter Wheat/Canola	Spring cereal

Table 11. Three-year crop rotation production at the Wilke Farm, 2022.

	Field 2	Field 5	Field 7
Cropping Specifics			
Acreage	27.5	26.6	32.2
Crop	‘Net CL+’ DNS wheat	No-till Fallow	‘Piranha CL+’ SWWW
Crop Production			
Yield	38.8 bu/acre	--	77.5 bu/acre
Mkt Grade	#1 DNS, 60.4, 13.6% protein, 1.6% dockage	--	#2 SWH, 59.7, 0.3% dockage
Gross Economic Return*			
Mkt Price	$8.71/bu	--	$8.39/bu
Crop Sales	$337.98/acre	--	$650.22/acre
Insurance	$0.00/acre	--	$0.00/acre
Gross Return	$337.98/acre	--	$650.22/acre
Input Costs			
Seed	$25.46/acre	--	$22.91/acre
Fertilizer	$61.37/acre	--	$94.87/acre
Herbicides	$45.78/acre	$57.02/acre	$32.39/acre
Insurance	$23.98/acre	--	$23.98/acre

	Field 2	Field 5	Field 7
Total	$156.59/acre	$57.02/acre	$174.15/acre
Summary			
Return over Costs	$181.39/acre	-$57.02/acre	$476.08/acre
3-Year Rotation Return over Input Costs†		**$219/acre**	

* Revenue and costs include crop insurance.
† Costs do not include fixed costs associated with the farm.

Table 12. Four-year cropping rotation sequence at the Wilke Farm from 2018 to 2023.

Year	Field 1	Field 3	Field 4	Field 6
2018	Spring Canola (1,020 lb/acre)	DNS Wheat (50.3 bu/acre)	Winter Wheat (77.5 bu/acre)	No-till Fallow
2019	Spring Wheat (57.1 bu/acre)	No-till Fallow	Spring Canola (1,278 lb/acre)	Winter Wheat (71.9 bu/acre)
2020	No-till Fallow	Winter Wheat (99.2 bu/acre)	Winter Barley (1.82 ton/acre)	Spring Canola (1,755 lb/acre)
2021	Winter Wheat (60.2 bu/acre)	Spring Canola (not harvested, frost)	No-till Fallow	Spring Wheat (21.4 bu/acre)
2022	**Spring Canola (1,290 lb/acre)**	**Winter Wheat (67.9 bu/acre)**	**Winter Wheat (90.4 bu/acre)**	**No-till Fallow**
2023	Winter Wheat	No-till Fallow	Broadleaf	Winter Wheat

Table 13. Four-year crop rotation production at the Wilke Farm, 2022.

	Field 1	Field 3	Field 4	Field 6
Cropping Specifics				
Acreage	18.1	27.5	25.7	29.5
Crop	'NC101S' Spring Canola	'Sockeye CL+' SWWW	'Piranha CL+' SWWW	No-till Fallow
Crop Production				
Yield	1,290 lb/acre	67.9 bu/acre	90.4 bu/acre	--
Mkt Grade	#1 non-GMO canola, 8.8% dockage	#2 SWH, 59.1, 0.3% dockage	#1 SWH, 60.7, 0.2% dockage	--
Gross Economic Return*				
Mkt Price	$0.305/lb	$8.36/bu	$8.44/bu	--
Crop Sales	$393.45/acre	$567.64/acre	$762.98/acre	--
Insurance	$0.00/acre	$0.00/acre	$0.00/acre	--
Total Return	$393.45/acre	$567.64/acre	$762.98/acre	--
Input Costs				
Seed	$64.50/acre	$28.25/acre	$22.91/acre	--
Fertilizer	$51.49/acre	$48.66/acre	$93.06/acre	--
Herbicides	$24.78/acre	$22.12/acre	$45.53/acre	$54.05/acre
Insurance	$30.82/acre	$23.98/acre	$23.98/acre	--
Total	$171.59/acre	$123.01/acre	$185.48/acre	$54.05/acre
Summary				
Return over Costs	$221.86/acre	$444.63/acre	$577.50/acre	-$54.05/acre
4-Year Rotation Return over Input Costs†			**$293/acre**	

* Revenue and costs include crop insurance.
† Costs do not include fixed costs associated with the farm.

Table 14. Continuous crop rotation sequence at the Wilke Farm from 2018 to 2023.

Year	Field Northwest	Field Northeast
2018	Winter Wheat (52.3 bu/acre)	Winter Wheat (52.3 bu/acre)
2019	Spring Wheat (44.1 bu/acre)	Spring Wheat (44.1 bu/acre)
2020	Spring Wheat (49.6 bu/acre)	Spring Wheat (49.6 bu/acre)
2021	Spring Canola (705 lb/acre)	Spring Wheat (20.3 bu/acre)
2022	**Winter Wheat (51.7 bu/acre)**	**Spring Canola (1,336 lb/acre)**
2023	Spring Cereal	Winter Wheat

Table 15. Continuous crop rotation production at the Wilke Farm, 2022.

	Field Northwest	Field Northeast
Cropping Specifics		
Acreage	32.6	34.4
Crop	'Hulk' Winter Wheat	'Invigor L343PC' Spring Canola
Crop Production		
Yield	51.7 bu/acre	1,336 lb/acre
Mkt Grade	#2 SWH, 58.2, 0.4% dockage	#1 GMO canola, 2.7% dockage
Gross Economic Return*		
Mkt Price	$8.39/lb	$0.26/lb
Crop Sales	$433.76/acre	$341.36/acre
Insurance	$0.00/acre	$0.00/acre
Total Return	$433.76/acre	$341.36/acre
Input Costs		
Seed	$25.86/acre	$81.01/acre
Fertilizer	$54.78/acre	$53.37/acre
Herbicides	$20.89/acre	$49.84/acre
Insurance	$23.98/acre	$30.82/acre
Total	$125.51/acre	$215.04/acre
Summary		
Return over Costs	$308.25/acre	$126.32/acre
Continuous Rotation Return over Input Costs†	**$215/acre**	

* Revenue and costs include crop insurance, unlike previous years' publications.

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

Summary

Weather in the first half of the 2022 crop year played a major role in the overall agronomic and economic production. The 2022 (Table 16) and 2021 (Table 17) growing seasons started drier than average through the first seven months, with precipitation 21.3% less than the ten-year average. The spring (April–May) was colder than average with only a total of 739 growing degree days (GDD), 32% less than the 13-year average. June was very favorable for wheat and canola production, with cooler than average temperatures (7% less GDD than the 13-year average) and 2.10 inches of precipitation, compared to the ten-year average of 0.92 inches.

A summary of WSU Wilke Research and Extension Farm economic returns over input costs using three-year averages is shown in Figure 2. Over the last three years (2020 to 2022), the three-year rotation, four-year rotation, and continuous cropping rotation have averaged returns above input costs of $151, $189, and $179 per acre, respectively. Over the last six years, the continuous rotation and four-year rotation have averaged returns above input costs of $149 and $145 per acre, respectively, and are not significantly different. The three-year rotation has averaged $127/acre return above costs during this period and is significantly less than both the continuous rotation and the four-year rotation.

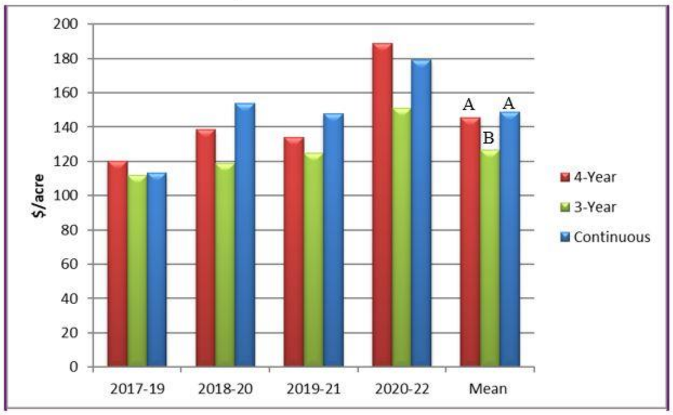

Figure 2. Three-year average economic return over input costs of three-year, four-year, and continuous cropping systems at the WSU Wilke Research and Extension Farm. Costs do not include fixed costs associated with the farm. Means within columns assigned different case letters are significantly different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

WSU Wilke Research Summary

Research and outreach are a large component of the farm. In 2022, there were 18.15 acres of Farm Service Agency (FSA) certified research plots in the fall and an additional 4.00 acres certified in the spring. These are mostly small research plots established and harvested with plot equipment. Large-scale research plots are not certified as research, because they are harvested with the commercial combine and grain is taken to the warehouse.

Small Plots

- University of Idaho. “Spring Canola Variety Plots.” This project helps companies bring the best canola genetics to market and helps farmers with selecting the best genetics. The trial was not harvested because of severe frost damage.
- Arron Carter, WSU. “Soft White Wheat Breeding Plots.” These are the advanced generation selections for the intermediate rainfall zone.
- Isaac Madsen, WSU. “Peola Feasibility.” This project is evaluating the feasibility of intercropping winter canola and winter pea together to enhance overall production and potentially increase profitability.
- Michael Neff, WSU. “Stand Establishment and Winter Survival in Canola.” This project evaluated over 100 winter canola cultivars under earlier-than-average seeding dates.
- Aaron Esser, WSU. “Winter Canola Stand Establishment Study.” This project is evaluating the feasibility of in row and seed-applied, water-absorbent material to improve stand establishment and yield.
- Aaron Esser, WSU. “Enhanced Wireworm Control in Spring Wheat.” This project is evaluating the feasibility of Teraxxa seed-applied insecticide over time in comparison with other insecticides for wireworm control.
- Aaron Esser, WSU. “Spring Cereal Seed Treatment Studies.” These studies look at biological and fungicidal seed-applied products to reduce disease and improve yield.
- Aaron Esser, WSU. “Mycorrhiza Application in Spring Wheat.” This study is examining commercially available mycorrhiza products applied to spring wheat following both winter wheat and winter canola.
- Ian Burke, WSU. “Herbicide Evaluation.” This project is examining many different compounds for weed control in predominate wheat production systems.
- Drew Lyon, WSU. “Downy Brome Control in Winter Wheat Using Preemergence and Postemergence Herbicides.”
- Michael Pumphrey, WSU. “Liming and Aluminum Tolerant Varieties of Wheat Interaction.”

Large Plots

- Aaron Esser, WSU. “Benefits of Spring Fungicide and Pi-Dust Application in Winter Wheat Production.”
- Isaac Madsen, WSU. “Spring Canola Variety Plots.” This project evaluated six spring canola varieties and is designed to help farmers select the best genetics for their situation.
- Ian Burke, WSU. “Compost Application and Winter Pea Production Feasibility in the Intermediate Cropping System.” This study was initiated in the fall of 2016.
- Aaron Esser, WSU. “Calcium Carbonate Application to Improve Soil pH and Improve Profitability.” This study was initiated in the fall of 2016.
- Aaron Esser, WSU. “Value of Incorporating Spring Canola and Chickpea into Cereal Grain Cropping Systems.” This study was initiated in the spring of 2014.
- Aaron Esser, WSU. “Chloride Application in Winter Wheat.” This project is examining the feasibility of ammonium chloride application in winter wheat production for improved yield.
- Aaron Esser, WSU. “Evaluating Envita and Utrisha N Nitrogen Inhibitors in Wheat Production.”
- Aaron Esser, WSU. “Cover Crop Feasibility as a Replacement for Summer Fallow Systems.”

Weather Data

Table 16 and Table 17 provide weather data for Davenport, Washington, in 2022 and 2021, respectively.

Table 16. Weather data for Davenport, Washington, in 2022 (crop year summary: Sept. 1, 2021, to Aug. 31, 2022).

	Temperature (°F)			Degree	Rain	Rain
Month	High	Low	Mean	Days*	Fall (in.)	Days
9	72.3	44.9	58.7	798	0.92	7
10	58.6	35.3	45.9	436	0.71	8
11	43.7	30.6	37.1	185	1.98	17
12	29.8	19.1	25.0	34	0.38	7
1	28.9	20.5	25.8	2	1.23	8
2	35.2	20.5	27.6	34	0.89	8
3	49.3	31.4	39.8	270	0.88	7
4	50.2	29.0	39.7	232	1.09	11
5	59.3	37.4	48.5	507	1.46	13
6	69.4	47.7	59.2	797	2.10	13
7	86.5	55.4	72.2	1,207	0.45	5
8	88.9	57.7	73.9	1,280	0.12	3
Total				**5,782**	**12.21**	**107**

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

Table 17. Weather data for Davenport, Washington, in 2021 (crop year summary: Sept. 1, 2020, to Aug. 31, 2021).

	Temperature (°F)			Degree	Rain	Rain
Month	High	Low	Mean	Days*	Fall (in.)	Days
9	76.3	47.5	61.7	897	0.58	4
10	57.0	34.6	45.2	473	0.91	6
11	41.4	28.0	34.1	111	1.22	14
12	33.5	23.9	28.8	25	1.39	12
1	35.9	26.4	31.1	48	2.41	16
2	34.0	21.2	27.4	47	0.21	6
3	50.9	27.9	38.9	231	0.08	2
4	59.4	32.2	47.0	414	0.39	3
5	67.7	39.0	55.2	662	0.03	2
6	82.2	53.2	69.1	1072	0.49	3
7	90.2	57.8	76.0	1,302	0.02	1
8	81.7	53.8	68.6	1,108	0.00	0
Total				**6,390**	**7.73**	**69**

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

AGWEATHERNET STATION located at the Wilke Research and Extension Farm.

You can access Wilke weather data at [AgWeatherNet | Washington State University (wsu.edu)](). AgWeatherNet link on the widget takes you to a map of weather stations throughout the state.

For additional information, please contact Aaron Esser, aarons@wsu.edu, (509) 660-0566.

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