

PROPOSAL FOR FINAL RELEASE FOR WA008039 (SWS)

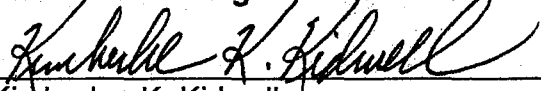
Date: February 26th, 2009

Plant Breeder: K.K. Kidwell

Breeding Team Members:

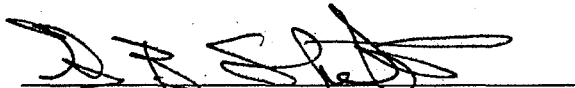
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Endorsement Signatures of the Team:



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Date




Gary B. Shelton

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Date



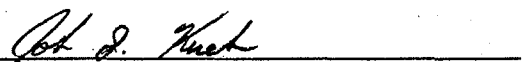
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Alpowa Replacement
VG-Stripe Rust Res
High Quality Ma
Alpowa

A. Identification:

1. **Crop Kind and Market Class:** Soft White Common Spring Wheat
2. **Selection No's:** S0400016, SW01003
3. **Proposed Name:** Babe
4. **Pedigree:** Alpowa/3/Centennial/Wawawai//Alpowa

B. General Situation

1. **Release Justification:** In the last three years, more than 184,000 acres of Alpowa have been grown in Washington State. Although Alpowa has moderate high-temperature, adult-plant resistance (HTAP) to stripe rust, this resistance level has proven to be inadequate under heavy inoculum pressure. Nick, another high yielding soft white spring wheat variety, has become highly susceptible to stripe rust in recent years. Currently, Louise and Wakanz are the only two soft white spring wheat varieties in commercial production in the Pacific Northwest that have adequate levels of HTAP resistance to stripe rust. Wakanz is a very late maturing variety that is primarily grown in the Dayton, WA area. Even though Louise is a high yielding variety with excellent end-use quality and broad adaptation, it is tall and tends to mature later than other varieties, which are undesirable characteristics for spring wheat grown in high rainfall areas. A high yielding replacement for Alpowa with improved emergence and higher levels of HTAP resistance to stripe rust is needed. WA008039 (referred to as WA8039 throughout the rest of this request) has outstanding grain yield potential across a broad range of production conditions, high test weight, excellent end-use quality and high levels of HTAP resistance. WA8039 does not appear to have the split coleoptile problem that often plagues Alpowa, and seedlings of WA8039 are upright compared to the prostrate growth habit of Alpowa seedlings.
2. **Use type:** Soft white common cookie, cake and pastry wheat.
3. **Description:** Semi-dwarf, soft white spring wheat with mid-season maturity, common head type, white straw and white glumes.
4. **Intention:** WA8039 is targeted to the intermediate (15-18 inch average annual precipitation) to high rainfall production zone as a replacement for Alpowa (moderate HTAP) and Nick (susceptible to stripe rust) based on its HTAP resistance to stripe rust. WA8039 also may supplant a portion of the Louise acreage in the high rainfall area because it is shorter in height than Louise.

C. General Agronomics:

1. **Agronomic performance:** WA8039 was evaluated in preliminary (2 site-years), state (5 site-years), and tri-state (6 site-years) breeding nurseries from 2005 through 2008 (Table 1), and also at seventeen and 15 variety testing locations in 2007 and 2008, respectively (Tables 2-4). Averaged over thirteen site-years of breeding trial data, WA8039 (76 bu/A) produced significantly more grain than Louise (70 bu/A) and Alturas (70 bu/A) (Table 1).

Based on 2007 and 2008 variety testing data, the grain yields of WA8039 were similar to those of Alpowa and Louise but significantly lower than those of Nick in the semi-arid region (Table 2), whereas WA8039, Alpowa, and Nick were similar and significantly less in grain yield than Louise in the intermediate rainfall zone (Table 3). In the high rainfall zone, grain yields of WA8039 (77 bu/A), Louise (77 bu/A) and Alpowa (75 bu/A) were similar, and produced significantly more grain than Nick (73 bu/A) (Table 4). Under irrigation, yield averages of WA8039 (116 bu/A), Alpowa (116 bu/A), and Nick (109 bu/A) were similar, and all three varieties produced significantly more grain than Louise (93 bu/A) (Table 4).

2. Other Agronomic Traits:

- a. **Plant height:** WA8039 was 1 to 6 inches shorter than Louise depending on location (Tables 1-4) and similar in height to Alturas (Table 1) and Alpowa across locations (Tables 2-4).
 - b. **Heading date:** Average heading dates of WA8039 were similar to those of Louise and Alpowa, and 2 to 4 days later than those of Nick (Tables 2-4).
 - c. **Test weight:** Test weight averages of grain from WA8039 were similar to or higher than those of grain from Alpowa and Nick, and were significantly higher than those of grain from Louise (Tables 2-4).
 - d. **Grain protein content:** Grain protein content averages of WA8039 were similar to those of Alpowa and Louise, and lower than those of Nick (Tables 2-4).
3. **Quality:** See Quality Assessment Report Provided by Morris et al (Pages 6-8).

Based on evaluation results from the 2008 PNW Quality Council, WA8039 was equal to or better than Louise, a high bar quality standard, for nearly every end-use quality parameter tested (data not shown but can be provided upon request). The ash content of WA8039 was significantly lower than that of Louise, whereas the gluten strength was similar to that of Louise, which was deemed by panel members as being a positive attribute. Panel members preferred the dough handling characteristics of WA8039 over those of Louise. The baking qualities of WA8039 and Louise were similar, and both outperformed Alturas and Cataldo, two other soft white spring wheat varieties included in the study.

4. Resistance to diseases and insects:

- a. **Stripe Rust:** WA8039 was tested on the Whitlow farm near Pullman and Mt. Vernon in breeding nurseries in 2005 (Table 5) and on the Spillman, Plant Path, and Whitlow farms near Pullman, Lind, Walla Walla, and Mt. Vernon in the variety trial nursery in 2007 and 2008 under natural infection of stripe rust (Tables 6-9). In these field nurseries, WA8039 was resistant (ITs 0-2) to moderately resistant (IT 5), similar to its parent, Alpowa, which has durable HTAP resistance. When tested in the greenhouse in 2007, WA8039 was susceptible (IT 7-8) to both PST-45 and PST-116 in the low-temperature (diurnal temperatures gradually changing from 4 to 20°C) seedling test, but resistant (IT 0-1) to these races in the high-temperature (diurnal temperatures gradually changing from 10 to 35°C) adult-plant test, similar to Alpowa

(Tables 10-11). When tested in the greenhouse in 2008, WA8039 had a intermediate reaction to races PST-17 and PST-37 and was susceptible (IT 7-8) to PST-45, PST-100, PST-116, and PST127 in the low-temperature (diurnal temperatures gradually changing from 4 to 20°C) seedling test, but resistant (IT 2-3) to PST-100, PST-116, and PST-127 in the high-temperature (diurnal temperatures gradually changing from 10 to 35°C) adult-plant test, higher than the HTAP resistance level (IT 3-5) in Alpowa (Tables 12). The results show that WA8039 has HTAP resistance.

b. Leaf Rust: No data available for assessment.

c. Powdery Mildew: No data available for assessment.

d. Hessian fly: Based on controlled environment insect screening evaluations conducted at the University of Idaho, 30% of the plants within the WA8039 population are resistant to Hessian fly (HF)[(*Mayetiola destructor* (Say))] biotypes E, F and GP indicating that this line is segregating for resistance. Individual resistant plants selected from a controlled environment screening conducted were used to create a bulk population of WA8039, which increased the level of HF resistance in the population to 65%. Seed of this bulk is under increase in New Zealand this winter, and the resulting population will be evaluated as WA8039HF in 2009 variety trials. If WA8039HF has similar or improved agronomic performance compared to the original WA8039 population, the WA8039HF seed lot will be used to replace the original WA8039 seed lot for future Breeder seed increases.

e. Russian wheat aphid: Based on parentage, this variety should be susceptible to the Russian wheat aphid (*Diuraphis noxia* (Mordvilko)).

5. Area of Adaptation: WA8039 is best adapted for production in the areas of eastern WA receiving more than 15 inches of average, annual precipitation (intermediate and high rainfall zones).

6. Weakness: The primary weakness of WA8039 is that it is segregating for resistance to the HF. A new bulk population with 65% resistance has been developed and will be tested in 2009 field trials to verify that it is similar in appearance and performance to the original. If results are favorable, this seed will be used to develop a new Breeder seed lot.

There also is merit to releasing varieties without HF resistance in that this trait is not needed in all spring wheat production zones. Regardless of the HF resistance status of this line, its agronomic benefits and stripe rust resistance merit release.

7. FGIS Results: All sixteen and fourteen samples submitted to FGIS in 2007 and 2008 respectively, were graded as SWS.

D. Other Comments: The limited number of soft white spring wheat varieties in commercial production with adequate levels of durable stripe rust resistance is a serious concern for regional wheat producers, and the release of WA8039 would

expand variety options with HTAP resistance for growers to choose from. The HTAP resistance source in WA8039 differs from that of Louise, which expands the genetic diversity of resistance genes deployed in the region to combat this disease. WA8039 has higher test weight and is shorter in height than Louise, and has superior stripe rust resistance compared to Alpowa and Nick making it well suited for production in the intermediate and high rainfall zones.

- E. Seed Source, Status, and Availability:** Approximately 1,736 pounds of Breeder seed were produced in 2008 and will be available as Foundation seed in 2009. 1000 heads will be snapped from the new Hessian fly resistant bulk population currently being grown in New Zealand. This new seed lot, with 65% resistance to Hessian fly, will be used to create new Breeder seed in 2009 to replace existing seed lots.

Assessment of the End-Use Quality of WA8039 Soft White Spring Wheat

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Line designation(s):	WA8039
Market class/type:	Soft White Spring
Requesting breeder:	
Release status request:	<input checked="" type="checkbox"/> Pre-Release <input type="checkbox"/> Full Release <input type="checkbox"/> Other
Years of quality testing:	5 (Table 13)
Check varieties:	Alpowa Alturas Louise
Maximum paired check comparisons:	19 13 22

INTRODUCTION

Following is an assessment of the quality of WA8039. Assessment of wheat quality involves data interpretation and therefore may vary accordingly. Data are from the Western Wheat Quality Lab and the Washington State University Wheat Quality Program. These data represent standard cultivar development and nursery testing procedures.

Nurseries and the corresponding nursery numbers are described in Table 13. Experimental genotypes are evaluated by comparison to check varieties grown in the same nursery (same location-year) to minimize environmental confounding. Check varieties and their occurrence in various nurseries are listed in Table 14. For statistical purposes a limited number of check varieties are used. These are generally selected on the basis of class, current production, occurrence in nurseries, and known quality attributes. Statistical analyses are conducted as essentially paired t-tests using balanced designs. N (the number of paired comparisons) varies according to the test conducted. Table 15 presents the analysis of variance by check variety for each quality parameter. LSDs assume an $\alpha = 0.05$. Table 16 lists the data used for analysis

<u>Trait abbreviation</u>	<u>Trait name</u>	<u>Units</u>	<u>Comments</u>
TWT	Test weight	lbs/bu	limits set for U.S. grades
WPROT	Wheat Protein	%	--
SKHRD	Single Kernel Hardness	unitless	--
SKWT	Single Kernel Weight	mg	--
SKWTSD	Single Kernel Weight sd	unitless	--
FYIELD	Flour Yield	%	--

BFYELD	Break Flour Yield	%	--
FASH	Flour Ash	%	lower values are preferred
MSCOR	Milling Score	unitless	--
FPROT	Flour Protein	%	--
FSV	Flour Swelling Volume		indicator of partial waxy
MABS	Mixograph Absorption	%	dough water absorption
CODI	Cookie Diameter	cm	--
CAVOL	Sponge Cake Volume	cc	--
LDOPA	L-DOPA	A ₄₇₅	polyphenol oxidase

INTERPRETIVE SUMMARY FOR WA8039
(as compared to Alpowa, Alturas and Louise)

Test weight is greater than Alturas and Louise; similar to Alpowa.

Grain protein is similar to all checks.

SKCS kernel hardness is similar to all checks.

Kernel weight is greater than Alturas; similar to Alpowa; less than Louise.

Flour yield is greater than Alpowa; similar to Louise; less than Alturas.

Break flour yield is similar to all checks.

Flour ash is less than Alturas; similar to Alpowa and Louise.

Milling Score is greater than Alpowa; similar to Alturas and Louise.

Flour protein is similar to all checks.

Flour Swelling Volume indicates normal starch.

Dough water absorption is similar to all checks.

Cookie diameter is greater than Alpowa; less than Alturas and Louise.

Sponge Cake Volume is greater than Alturas; similar to Louise (limited observations for both).

CONCLUSION

WA8039 has good grain and milling properties. End-use properties are essentially equivalent to established check varieties. Cookie performance is split between the two most widely grown checks Alpowa and Louise. No clear quality advantage is observed in WA8039. Release should be justified on non-quality considerations.

Overall, release of this variety is expected to:

- increase the overall quality of the wheat crop in Washington
- falls within the range of currently acceptable varieties and therefore should not have any particular effect on the overall quality of the wheat crop in Washington
- have both positive and negative effects on the overall quality of the wheat crop in Washington
- have both neutral and negative effects.
- decrease the overall quality of the wheat crop in Washington
- depend upon the variety that it will replace/supplant, meaning that its effect could be any one or a combination of the outcomes above
- require special handling, segregation, etc. for the following reason(s):

ACKNOWLEDGMENTS

The dedicated efforts of the following staff of the Western Wheat Quality Lab and Wheat Quality Program are gratefully acknowledged: Mary L. Baldrige, Tracy Harris, Gail Jacobson, Bozena Paszczynska, William J. Kelley; Pat K. Boyer, Eric Wegner, Shawna Vogl and Renee Engle (ret.). Special thanks to John Burns (ret.) and the WSU Cereal Variety Testing Program for providing many of the samples analyzed herein.

Table 1: Mean heading date (Julian), plant height (inches), grain protein content (%), test weight (lb/bu) and grain yield (bu/A) of WA8039 and check cultivars in field breeding trials from 2005-2008.

Location	Nursey Name	Precip. (in)		Heading Date				Plant Height				Grain Protein Content				Test Weight				Yield			
				WA8039	Louise	Alturas	LSD @.10	WA8039	Louise	Alturas	LSD @.10	WA8039	Louise	Alturas	LSD @.10	WA8039	Louise	Alturas	LSD @.10	WA8039	Louise	Alturas	LSD @.10
Lind	Tri-State	<15	2008	160	160	160	*	21	25	21	*	13.5	12.8	13.5	*	61.5	60.4	61.0	*	17	22	20	1.8
			2007	155	155	154	*	19	27	22	*	12.9	12.4	12.2	*	61.8	61.8	60.8	*	27	30	29	2.2
	State	2006	156	154	153	*	25	31	25	*	12.4	12.4	11.7	*	61.6	60.0	60.7	*	36	40	35	3.3	
Dusty	State	<15	2006	162	163	162	*	32	37	34	*	11.4	11.4	12.0	*	59.6	57.2	58.5	*	59	51	62	14.3
			Mean	158	158	157	2.2	24	30	26	2.5	12.6	12.3	12.4	0.9	61.1	59.9	60.3	1.2	35	36	37	3.6
Fairfield	State	>18	2006	180	178	179	*	36	38	29	*	10.3	10.7	9.3	*	61.3	59.1	59.8	*	70	69	58	8.1
Pullman	Tri-State	>18	2008	178	178	178	*	30	32	29	*	9.1	9.2	9.0	*	60.5	60.6	59.9	*	76	73	66	5.7
			2007	163	165	163	*	34	36	32	*	10.6	10.7	10.9	*	62.3	61.7	61.2	*	77	76	74	3.4
	State	2006	176	177	176	*	33	36	33	*	12.0	11.3	10.5	*	59.3	58.4	57.8	*	80	71	74	3.3	
	Preliminary	2005	175	175	175	*	34	35	31	*	13.0	13.0	13.0	*	58.6	57.0	58.3	*	63	56	51	5.7	
		Mean		174	175	174	2.4	33	35	31	2.9	11.0	11.0	10.5	0.7	60.4	59.4	59.4	1.2	73	69	65	2.3
Moses Lake	Tri-State	Irr	2008	156	158	157	*	31	39	35	*	11.9	12.0	11.3	*	62.5	61.0	60.8	*	123	95	105	16.8
			2007	155	153	153	*	39	37	37	*	9.6	10.2	9.9	*	62.3	60.9	60.5	*	134	114	119	13.6
	State	2006	158	156	157	*	39	41	39	*	12.3	12.5	11.3	*	62.5	61.5	61.5	*	119	106	116	12.9	
	Preliminary	2005	153	153	153	*	33	37	33	*	12.0	12.0	10.7	*	61.7	61.0	59.7	*	113	106	95	5.7	
		Mean		158	158	158	2.7	34	38	35	3.4	11.7	11.8	11.1	0.8	62.3	61.3	60.8	1.1	108	96	97	5.1
Grand Mean				164	164	163	1.3	31	35	31	1.7	11.6	11.6	11.2	0.5	61.2	60.1	60.0	0.7	76	70	70	2.2

Analysis Method: Analysis of Variance; na=not available.

* not available

Table 2: Mean heading date (Julian), plant height (inches), grain protein content (%), test weight (lb/bu) and grain yield (bu/A) of WA8039 and check cultivars in the 2007 and 2008 WSU Extension Uniform Cereal Variety Testing Spring Wheat Variety Performance Trials receiving less than 15 inches of average annual precipitation.

Location	Precip. (in)	Year	Heading Date					Plant Height					Grain Protein Content					Test Weight					Yield				
			WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10
Lind Fallow	<15	2008	160	160	160	156	1.1	21	21	24	20	1.7	13.6	13.5	13.3	14.0	0.3	61.9	61.5	60.5	60.6	1.1	16	18	18	20	2.1
		2007	155	154	154	151	0.9	22	22	25	20	1.2	12.9	12.7	12.3	13.6	0.3	61.1	60.6	60.9	60.3	0.5	26	27	31	28	3.2
		Mean	158	157	157	154	0.7	21	22	25	20	1.1	13.2	13.1	12.8	13.8	0.2	61.5	61.1	60.7	60.4	0.6	21	23	24	24	1.9
Ritzville Lamont		2007	156	157	155	154	1.3	21	20	23	19	2.6	12.3	13.1	12.1	12.8	0.9	57.9	56.6	56.5	58.3	1.2	20	19	23	22	4.1
		2008	176	178	175	173	1.5	26	25	28	24	1.5	11.8	11.4	11.2	12.5	0.5	58.6	58.7	58.4	58.3	0.7	28	27	25	27	4.6
		2007	167	168	166	164	1.4	31	30	34	30	1.6	10.6	10.2	10.6	11.0	0.6	60.4	60.7	58.9	60.0	1.1	49	44	50	46	5.6
Horse Heaven		2008	158	157	158	157	1.5	21	22	24	22	1.9	13.0	12.9	13.6	14.1	0.5	60.2	60.3	59.1	60.3	1.0	26	24	28	27	4.7
		2007	148	148	147	146	0.9	22	23	27	21	1.3	12.2	12.1	12.0	13.1	0.8	61.2	61.5	61.6	60.9	1.1	28	30	30	29	3.0
		Mean	153	153	153	151	0.9	21	23	26	22	1.1	12.6	12.5	12.8	13.6	0.4	60.7	60.9	60.4	60.6	0.6	27	27	29	28	2.7
Bickleton		2008	na	na	na	na	na	28	27	33	29	2.5	10.5	10.5	10.0	10.5	0.5	59.3	59.8	58.7	59.8	0.9	38	37	41	49	6.4
		2007	na	na	na	na	na	24	23	23	20	2.9	11.3	11.3	10.5	11.2	0.7	58.6	59.1	58.7	58.5	1.6	28	25	33	26	10.1
		Mean	na	na	na	na	na	26	25	28	25	1.9	10.9	10.9	10.3	10.9	0.4	59.0	59.4	58.7	59.2	0.6	33	31	37	38	5.8
Connell		2008	156	155	155	152	0.9	20	21	24	21	1.4	13.7	13.5	13.9	14.8	0.3	60.5	60.3	58.7	60.5	0.8	17	18	17	19	4.0
		2007	150	150	149	148	0.9	22	23	27	23	1.4	13.3	13.1	12.2	13.6	0.3	60.8	61.6	61.7	61.2	1.5	25	26	29	30	2.4
		Mean	153	153	152	150	0.6	21	23	27	22	1.0	13.5	13.3	13.0	14.2	0.2	60.7	61.0	60.2	60.9	0.8	21	22	32	24	2.3
Almira		2008	180	180	179	176	1.2	28	29	31	27	1.2	10.9	11.1	11.0	11.0	0.5	61.9	60.3	59.3	60.7	1.1	61	57	56	60	4.2
		2007	179	178	179	175	2.0	30	31	32	29	1.7	11.9	11.6	12.1	11.4	0.7	58.7	59.0	56.2	59.3	1.5	43	43	41	46	5.1
		Mean	179	179	179	175	1.2	29	30	31	28	1.0	11.4	11.3	11.5	11.2	0.4	60.3	59.7	57.7	60.0	0.9	52	50	48	53	3.3
Grand Mean																											
			162	162	161	159	0.4	24	25	27	24	0.5	12.1	12.1	11.9	12.6	0.1	60.1	60.0	59.2	59.9	0.3	31	30	32	33	1.3

Analysis Method: Analysis of Variance; na=not available.

Table 3: Mean heading date (Julian), plant height (inches), grain protein content (%), test weight (lb/bu) and grain yield (bu/A) of WA8039 and check cultivars in the 2007 and 2008 WSU Extension Uniform Cereal Variety Testing Spring Wheat Variety Performance Trials in areas receiving 15 to 18 inches of average annual precipitation.

Location	Precip. (in)	Year	Heading Date					Plant Height					Grain Protein Content					Test Weight					Yield				
			WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10
Walla Walla	15-18	2008	164	164	162	160	1.1	32	31	35	32	1.6	11.7	12.2	11.8	13.0	0.3	61.2	61.3	59.5	60.3	0.9	44	42	47	47	5.0
		2007	163	164	162	160	1.4	26	27	32	27	1.9	11.8	11.8	11.1	12.4	0.5	62.0	61.4	61.0	61.6	0.4	42	42	50	47	2.9
		Mean	163	164	162	160	0.9	29	29	33	30	1.2	11.8	12.0	11.5	12.7	0.3	61.6	61.3	60.2	61.0	0.6	42	42	48	47	2.9
Dayton		2008	176	177	177	174	1.0	30	30	34	29	1.2	11.5	11.6	12.0	12.1	0.3	57.0	57.1	56.7	57.4	0.3	54	57	61	59	3.5
		2007	174	173	175	172	1.9	31	31	33	29	1.8	11.0	10.9	10.9	11.8	0.6	58.9	59.5	58.9	59.8	0.9	68	71	72	66	6.7
		Mean	175	177	177	174	1.1	30	31	34	29	1.1	11.2	11.2	11.4	11.9	0.2	57.9	58.3	57.8	58.6	0.3	61	64	67	63	3.7
Endicott		2008	173	174	174	171	0.9	29	30	34	28	2.8	12.9	13.0	12.3	13.2	0.6	62.4	62.5	61.5	61.3	0.8	54	62	66	61	5.9
		2007	162	163	163	161	0.8	30	30	35	29	1.1	11.4	11.4	11.8	12.2	0.2	59.1	58.8	57.3	59.2	0.6	53	52	52	51	2.3
		Mean	168	169	168	166	0.6	29	30	34	28	1.5	12.1	12.2	12.1	12.7	0.3	60.7	60.6	59.4	60.2	0.5	53	57	59	56	3.1
St. John		2008	179	198	180	176	1.7	30	32	32	28	1.5	11.8	11.3	11.2	12.6	0.8	57.9	58.6	59.5	59.3	1.2	49	64	56	51	10.4
		2007	169	170	169	167	1.7	31	31	34	29	1.4	10.2	10.3	10.3	10.8	0.5	60.8	60.3	59.8	61.1	1.1	70	71	74	65	6.4
		Mean	174	175	175	171	1.2	30	31	33	29	1.0	11.0	10.8	10.7	11.7	0.5	59.4	59.5	59.6	60.2	0.8	59	67	65	58	6.0
Reardan		2008	na	na	na	na	na	26	26	61	26	1.8	10.5	10.9	10.0	11.1	0.7	61.6	61.8	61.7	61.2	0.7	37	41	42	36	4.1
		2007	178	179	179	177	1.7	31	31	34	28	1.1	12.6	13.5	13.6	14.1	0.4	59.0	59.0	58.1	58.0	0.8	49	40	32	37	6.3
		Mean	na	na	na	na	na	29	29	32	27	1.1	11.6	12.2	10.0	12.6	0.3	60.3	60.4	59.9	59.6	0.5	43	41	37	36	3.7
Mayview		2008	184	185	183	181	1.5	25	25	27	27	1.9	11.0	10.1	10.3	11.0	0.6	61.9	62.2	60.4	60.6	0.6	52	54	56	54	3.2
		2007	182	183	183	181	1.7	30	31	34	27	1.3	11.2	11.4	11.4	11.5	1.1	61.1	60.5	59.0	60.3	0.7	63	56	65	61	4.8
		Mean	183	184	183	181	1.1	28	28	30	27	1.2	11.1	10.8	10.9	11.2	0.4	61.5	61.3	60.4	60.6	0.5	58	55	60	58	2.8
Grand Mean																											
			173	174	173	171	0.4	29	30	33	28	0.5	11.5	11.5	11.4	12.1	0.1	60.2	60.2	59.4	60.0	0.2	53	54	56	53	1.6

Analysis Method: Analysis of Variance

Table 4: Mean heading date (Julian), plant height (inches), grain protein content (%), test weight (lb/bu) and grain yield (bu/A) of WA8039 and check cultivars in the 2007 and 2008 WSU Extension Uniform Cereal Variety Testing Spring Wheat Variety Performance Trials receiving more than 18 inches of average annual precipitation or with irrigation.

Location	Precip. (In)		Heading Date					Plant Height					Grain Protein Content					Test Weight					Yield				
			WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10	WA8039	Alpowa	Louise	Nick	LSD @.10
Pullman	>18	2008	178	179	178	174	0.7	31	30	33	29	1.3	10.8	11.3	10.7	10.9	0.8	59.3	59.4	59.5	59.6	1.0	70	71	69	68	3.7
		2007	168	169	169	164	1.4	35	35	38	34	1.3	11.3	11.5	11.7	12.2	0.9	61.7	60.8	60.6	61.2	1.1	93	85	91	80	7.8
		Mean	173	174	173	169	0.7	33	33	35	31	0.9	11.0	11.4	11.2	11.6	0.6	60.5	60.1	60.0	60.4	0.7	81	78	80	74	4.2
Fairfield		2007	179	180	178	178	1.4	30	31	34	28	1.8	9.1	9.2	8.8	9.0	0.5	61.0	61.1	60.7	60.8	0.6	62	59	64	57	4.8
Farmington		2008	185	186	184	181	0.9	28	24	33	31	2.5	10.7	10.9	10.8	11.0	0.5	59.6	59.9	58.6	60.3	1.0	61	59	60	63	5.8
		2007	176	180	177	175	1.4	37	38	40	36	2.2	10.9	11.6	11.4	12.1	0.6	60.0	59.8	59.0	59.0	0.7	99	100	101	95	10.4
		Mean	180	183	180	178	0.8	32	31	37	33	1.7	10.8	11.3	11.1	11.6	0.4	59.8	59.8	58.8	59.7	0.6	80	80	81	79	4.1
Grand Mean			177	179	177	174	0.5	32	32	35	31	0.8	10.6	10.9	10.7	11.0	0.3	60.3	60.2	59.7	60.2	0.4	77	75	77	73	2.5
Moses Lake	Irr	2008	158	158	156	155	2.2	32	32	35	30	2.7	13.2	13.0	14.0	13.2	1.1	59.5	59.6	56.5	61.2	2.4	106	104	72	92	23.1
		2007	155	157	154	152	1.3	37	40	38	35	2.7	9.8	10.5	10.5	10.7	0.6	60.9	60.7	60.1	60.8	1.3	126	129	114	126	7.8
		Mean	157	157	155	153	1.2	35	36	36	33	1.9	11.5	11.7	12.2	12.0	0.6	60.2	60.1	58.3	61.0	1.0	116	116	93	109	10.3
Overall Mean			168	169	168	166	0.2	28	28	31	27	0.3	11.6	11.7	11.5	12.1	0.1	60.2	60.1	59.3	60.0	0.2	52	52	52	51	1.1

Table 5: 2005 stripe rust infection type (IT) and severity (%) on WA8039 and check lines at Whitlow Farm and Mt. Vernon, WA when recorded at the indicated dates and stages of plant growth under natural infection.

ID	CLASS	Stripe Rust*					
		Whitlow		Mt. Vernon			
		7/1/05		5/25/05		6/29/05	
		Headed		Tillering		Flowering	
IT %		IT %		IT %			
LEMHI (S check)		8	100	8	30	8	100
Alpowa	SWS	2	10	0	0	2	20
Eden	SWC	8	50	0	0	2	10
Scarlet	HRS	8	70	8	20	8	60
WA8039	SWS	5	20	0	0	2	1

* Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in field data. Generally IT 0-3 are considered resistant, 4-6 intermediate, and 7-9 susceptible.

Table 6: 2007 stripe rust infection type (IT) and severity (%) on WA8039 and check lines at Spillman Farm, Plant Path Farm, Whitlow Farm, Mt. Vernon, Walla Walla, and Lind when recorded at the indicated dates and stages of plant growth under natural infection.

ID	CLASS	Stripe Rust*													
		Spillman	Plant Path	Whitlow	Mt. Vernon		Walla Walla	Lind							
		7/20/07	7/12/07	7/11/07	5/31/07	7/9/07	6/22/07	6/14/07							
		Milk	Flowering	Flowering	Tillering	Milk	Milk	Flowering							
IT %		IT %		IT %		IT %									
LEMHI (S check)		8	60	8	50	8	80	8	20	8	80	8	20	8	30
Alpowa	SWS	2	20	2	10	2	20	8	10	2-3	30	3	5	2	2
Eden	SWC	5	30	5	30	8	40	8	10	8	60	5	5	8	10
Scarlet	HRS	8	30	8	20	8	40	5	5	8	60	8	5	8	10
WA8039	SWS	2	20	0	0	2	2	2	5	5	30	0	0	0	0

* Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in field data. Generally IT 0-3 are considered resistant, 4-6 intermediate, and 7-9 susceptible.

Table 7: 2008 stripe rust infection type (IT) and severity (%) on WA8039 and check lines at Spillman Farm, Plant Path Farm, Whitlow Farm, Mt. Vernon, Walla Walla, and Lind when recorded at the indicated dates and stages of plant growth under natural infection.

ID	CLASS	Stripe Rust*						
		Spillman	Plant Path	Whitlow	Mt. Vernon		Walla Walla	Lind
		7/23/2008	7/22/2008	7/15/2008	6/4/2008	7/8/2008	7/1/2008	7/3/2008
		Dough	Milk	Early milk	Stem elong.	L. flowering	Milk	Milk
IT %	IT %	IT %	IT %	IT %	IT %	IT %		
Lemhi (S check)		8 70	8 100	8 90	8 50	9 100	8 5	0 0
Alpowa	SWS	3 20	2 30	2 20	8 20	2 10	1 5	0 0
Louise	SWS	2 5	2 5	2 1	8 5	2 10	3 20	0 0
WA8039	SWS	2 1	2 1	2 5	0 0	2 1	1 5	0 0

* Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in field data. Generally IT 0-3 are considered resistant, 4-6 intermediate, and 7-9 susceptible.

Table 8: 2008 stripe rust infection type (IT) and severity (%) on WA8039 and check lines at Spillman Farm, Plant Path Farm, Whitlow Farm, Mt. Vernon, Walla Walla, and Lind when recorded at the indicated dates and stages of plant growth under natural infection.

ID	CLASS	Stripe Rust*						
		Spillman	Plant Path	Whitlow	Mt. Vernon		Walla Walla	Lind
		7/23/2008	7/22/2008	7/17/2008	6/4/2008	7/7/2008	7/1/2008	7/3/2008
		S. dough	Milk	S. dough	Jointing	Flowering	Milk	Milk
IT %	IT %	IT %	IT %	IT %	IT %	IT %		
Lemhi (S check)		8 90	8 70	8 80	8 30	8 100	8 40	0 0
Alpowa	SWS	2 30	2 10	2 30	8 2	3 20	3 20	0 0
Louise	SWS	2 1	2 1	2 20	8 1	3 10	3 5	0 0
WA8039	SWS	2 1	2 5	2 20	8 1	3 5	3 10	0 0

* Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in field data. Generally IT 0-3 are considered resistant, 4-6 intermediate, and 7-9 susceptible.

Table 9: 2008 stripe rust infection type (IT) and severity (%) on WA8039 and check lines at Spillman Farm and Mt. Vernon when recorded at the indicated dates and stages of plant growth under natural infection.

ID	CLASS	Stripe Rust*		
		Pullman	Mt. Vernon	
		7/16/08	6/4/08	7/7/08
		Milk	Stem elong.	L. flowering
		IT %	IT %	IT %
Lemhi (S Check)		8 100	8 50	9 100
Treasure	SWS	8 10	1 5	5 40
Alturas	SWS	3 1	1 5	2 10
Louise	SWS	3 5	1 1	3 20
WA8039	SWS	3 5	1 1	2 10
Lemhi (S Check)		8 90	8 40	9 100

* Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in field data. Generally IT 0-3 are considered resistant, 4-6 intermediate, and 7-9 susceptible.

Table 10: Infection types on WA8039 and check lines produce by races of *Puccinia striiformis f. sp. tritici* in the seedling stage under controlled greenhouse conditions in 2007 (diurnal temperature changing from 4 to 20C).

		2007	
		PL 11/30/07	PL 12/12
		Inoc 12/12/07	Inoc 12/26
		Rd 12/31/07	Rd 1/14
ID	CLASS	PST-116	PST-45
Lemhi (S check)		8	8
Alpowa	SWS	8	7
Eden	SWC	8	2
Scarlet	HRS	8	8
WA8039	SWS	8	7

* Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in data. Generally IT 0-3 are considered resistant, 4-6 intermediate, and 7-9 susceptible.

Table 11: Infection types on WA8039 and check lines produce by races of *Puccinia striiformis f. sp. tritici* in the adult-plant stage under controlled greenhouse conditions in 2007 (diurnal temperature cycle gradually changing from 10 to 20C).

ID	Infection type and (number of adult-plants) tested under high-temperatures							
	PST-45		PST-100			PST-116		
	Rep 1	Rep 2	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
Lemhi (S check)	7 (3)	8 (3)	8 (3)	8 (3)	8 (3)	8 (3)	8 (3)	8 (3)
Alpowa	3 (3)	3 (1)	3 (2)	3-4 (2)	3-4 (3)	3 (3)	3 (3)	ND
WA8039	0 (4)	0 (5)	0 (2), 2 (1)	0 (3)	0 (3)	3 (2), 4 (1)	ND	ND

* Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in data. Generally IT 0-3 are considered resistant, 4-6 intermediate, and 7-9 susceptible. ** No data

Table 12: Infection types on WA8039 and check lines produce by races of *Puccinia striiformis f. sp. tritici* in the seedling stage (diurnal temperature changing from 4 to 20C) and in the adult-plant stage (diurnal temperature cycle gradually changing from 10 to 20C) under controlled greenhouse conditions in 2008.

ID		Seedling-LT (4-20C)						Adult-plant (10-35C)			
		Planting	1/16/08	1/24/08	12/12	1/1/08	11/30	2/20/08	12/27/07	12/27/07	12/27/07
		Inoc	1/28	2/4/08	12/26	1/14/08	12/11	3/3/08	2/8/08	2/6/08	2/5/08
		Reading	2/14/08	2/20/08	1/14	1/30	12/30	3/20/08	2/26/08	2/25/08	2/25/08
		Race	PST-17	PST-37	PST-45	PST-100	PST-116	PST-127	PST-100	PST-116	PST-127
Lemhi (S check)	1	8	8	8	8	8	8	8,8	8,8,8	8,8,8	
ALPOWA	2	8	8	7	7	8	8	3,5,5	3,5,5	5,5,5	
WA008039	8	5	5	7	8	8	8	2,2,2	2,2,2	2,2,3	

* Infection Type (IT) was recorded based on the 0-9 scale with ITs 8 and 9 combined as 8 (the most susceptible reaction) in data. Generally IT 0-3 are considered resistant, 4-6 intermediate, and 7-9 susceptible.

Table 13: Nursery Sources For WA8039 Data Set

Year	Nursery	Nursery Name	Location	Breeder Name
2004	47	SINGLE PLOT SOFT WHITE	PULLMAN	K.K. KIDWELL
2005	53	MOSES LAKE PREL SOFT WHITE #71	MOSES LAKE	K.K. KIDWELL
2006	64	STATE SWS	FAIRFIELD	K.K. KIDWELL
2006	65	STATE SWS	LIND	K.K. KIDWELL
2007	11	PNW WHEAT QUALITY COUNCIL	PULLMAN	C.F. MORRIS
2007	48	TRISTATE SOFT	PULLMAN	K.K. KIDWELL
2007	1013	G&E SOFT SPRING	DAYTON	C.F. MORRIS
2007	2013	G&E SOFT SPRING	ST JOHN	C.F. MORRIS
2007	3013	G&E SOFT SPRING	LAMONT	C.F. MORRIS
2007	4013	G&E SOFT SPRING	LIND	C.F. MORRIS
2007	5013	G&E SOFT SPRING	MOSES LAKE	C.F. MORRIS
2007	1042	G&E VARIETY RELEASE SWS	ALMIRA	K.K. KIDWELL
2007	2042	G&E VARIETY RELEASE SWS	BICKLETON	K.K. KIDWELL
2007	3042	G&E VARIETY RELEASE SWS	CONNELL	K.K. KIDWELL
2007	4042	G&E VARIETY RELEASE SWS	ENDICOTT	K.K. KIDWELL
2007	5042	G&E VARIETY RELEASE SWS	FAIRFIELD	K.K. KIDWELL
2007	6042	G&E VARIETY RELEASE SWS	FARMINGTON	K.K. KIDWELL
2007	7042	G&E VARIETY RELEASE SWS	HORSE HEAVEN	K.K. KIDWELL
2007	8042	G&E VARIETY RELEASE SWS	MAYVIEW	K.K. KIDWELL
2007	9042	G&E VARIETY RELEASE SWS	PULLMAN	K.K. KIDWELL
2008	8	WESTERN REGIONAL SOFT SPRING	COMPOSITE	C.F. MORRIS
2008	39	TRISTATE SOFT	PULLMAN	K.K. KIDWELL
2008	6013	G&E SOFT SPRING	BICKLETON	C.F. MORRIS
2008	7013	G&E SOFT SPRING	WALLA WALLA	C.F. MORRIS
2008	8013	G&E SOFT SPRING	REARDAN	C.F. MORRIS
2008	9013	G&E SOFT SPRING	HORSE HEAVEN	C.F. MORRIS
2008	10013	G&E SOFT SPRING	ALMIRA	C.F. MORRIS
2008	10042	WESTERN REG SOFT	PULLMAN	K.K. KIDWELL
2008	1056	G&E EXTRA SOFT SPRING	PULLMAN	K.K. KIDWELL
2008	2056	G&E EXTRA SOFT SPRING	ENDICOTT	K.K. KIDWELL
2008	3056	G&E EXTRA SOFT SPRING	FARMINGTON	K.K. KIDWELL

* Nurseries 13, 20042 and 20052006 were assigned new nursery numbers by location to give each location a unique nursery identification for statistical purposes.

Table 14. Data Pair by Nursery Number Detail

Variety	2005		2006		2007															
	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
ALPOWA	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
ALTURAS	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	1
LOUISE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ZAK	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WA8039	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Variety	2008										
	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
ALPOWA	1	0	1	1	1	1	1	1	0	0	0
ALTURAS	1	1	1	1	1	1	1	1	1	1	1
LOUISE	1	1	1	1	1	1	1	1	1	1	1
ZAK	0	0	0	0	0	0	0	0	0	0	0
WA8039	1	1	1	1	1	1	1	1	1	1	1

* 1 indicates data pair present in analysis
 * 0 indicates data pair not present in analysis

Table 15: Analysis of Variance Balanced Paired t Test Design

Variety	Test	p-Value	LSD	High Variety	Mean	Low Variety	Mean	Significance	Data Pairs
ALPOWA	TWT	0.48	0.59	WA8039	62.1	ALPOWA	61.9	NON	19
ALTURAS	TWT	0.01	0.61	WA8039	61.8	ALTURAS	61.0	SIGNIFICANT	13
LOUISE	TWT	0.00	0.61	WA8039	62.0	LOUISE	60.9	SIGNIFICANT	22
ALPOWA	WPROT	0.97	0.52	ALPOWA	11.4	WA8039	11.4	NON	19
ALTURAS	WPROT	0.57	0.64	WA8039	11.1	ALTURAS	10.9	NON	13
LOUISE	WPROT	0.48	0.54	WA8039	11.1	LOUISE	10.9	NON	22
ALPOWA	SKHRD	0.50	1.26	ALPOWA	23.3	WA8039	22.9	NON	18
ALTURAS	SKHRD	0.74	2.05	ALTURAS	21.9	WA8039	21.6	NON	12
LOUISE	SKHRD	0.25	1.97	WA8039	22.3	LOUISE	21.2	NON	21
ALPOWA	SKWT	0.15	1.4	WA8039	34.2	ALPOWA	33.2	NON	18
ALTURAS	SKWT	0.00	1.11	WA8039	33.3	ALTURAS	30.8	SIGNIFICANT	12
LOUISE	SKWT	0.00	1.29	LOUISE	37.6	WA8039	33.9	SIGNIFICANT	21
ALPOWA	SKWTSD	0.00	0.33	WA8039	8.3	ALPOWA	7.6	SIGNIFICANT	18
ALTURAS	SKWTSD	0.00	0.53	WA8039	8.3	ALTURAS	7.4	SIGNIFICANT	12
LOUISE	SKWTSD	0.00	0.43	LOUISE	9.8	WA8039	8.2	SIGNIFICANT	21
ALPOWA	FYELD	0.00	0.85	WA8039	69.6	ALPOWA	67.3	SIGNIFICANT	19
ALTURAS	FYELD	0.00	0.83	ALTURAS	70.2	WA8039	68.7	SIGNIFICANT	13
LOUISE	FYELD	0.50	0.82	LOUISE	69.7	WA8039	69.4	NON	22
ALPOWA	BKFYELD	0.11	0.88	WA8039	48.0	ALPOWA	47.3	NON	19
ALTURAS	BKFYELD	0.35	1.47	ALTURAS	49.2	WA8039	48.5	NON	13
LOUISE	BKFYELD	0.12	0.84	LOUISE	48.9	WA8039	48.3	NON	22
ALPOWA	FASH	0.24	0.02	WA8039	0.38	ALPOWA	0.37	NON	19
ALTURAS	FASH	0.01	0.02	ALTURAS	0.39	WA8039	0.37	SIGNIFICANT	13
LOUISE	FASH	0.09	0.01	WA8039	0.37	LOUISE	0.36	NON	22
ALPOWA	MSCOR	0.00	1.26	WA8039	85.4	ALPOWA	83.0	SIGNIFICANT	19
ALTURAS	MSCOR	0.56	1.73	ALTURAS	85.6	WA8039	85.1	NON	13
LOUISE	MSCOR	0.11	1.11	LOUISE	86.7	WA8039	85.8	NON	22
ALPOWA	FPROT	0.74	0.46	ALPOWA	9.80	WA8039	9.73	NON	19
ALTURAS	FPROT	0.61	0.51	ALTURAS	9.48	WA8039	9.36	NON	13
LOUISE	FPROT	0.44	0.49	WA8039	9.50	LOUISE	9.31	NON	22
ALPOWA	FSV	0.14	0.52	ALPOWA	20.9	WA8039	20.5	NON	18
ALTURAS	FSV	0.00	0.76	ALTURAS	21.2	WA8039	20.8	SIGNIFICANT	12
LOUISE	FSV	0.00	0.42	WA8039	20.5	LOUISE	19.2	SIGNIFICANT	21
ALPOWA	MABS	0.28	0.73	ALPOWA	55.9	WA8039	55.5	NON	18
ALTURAS	MABS	0.89	1.24	WA8039	55.7	ALTURAS	55.6	NON	9
LOUISE	MABS	0.92	0.85	LOUISE	55.6	WA8039	55.5	NON	18
ALPOWA	GODI	0.00	0.12	WA8039	9.28	ALPOWA	9.08	SIGNIFICANT	18
ALTURAS	GODI	0.02	0.11	ALTURAS	9.35	WA8039	9.21	SIGNIFICANT	12
LOUISE	GODI	0.00	0.09	LOUISE	9.53	WA8039	9.28	SIGNIFICANT	21
ALTURAS	CAVOL	0.01	31.77	WA8039	1327.5	ALTURAS	1175	SIGNIFICANT	2
LOUISE	CAVOL	0.35	413	WA8039	1327.5	LOUISE	1275	NON	2
ALPOWA	LDOPA	0.84	0.06	ALPOWA	1.17	WA8039	1.16	NON	18
ALTURAS	LDOPA	0.00	0.15	WA8039	1.16	ALTURAS	0.41	SIGNIFICANT	4
LOUISE	LDOPA	0.00	0.06	WA8039	1.16	LOUISE	1.05	SIGNIFICANT	18

Table 16: Data set for WA8039

Obs	YEAR	NURSCO	LABNUM	VAR	LOCATION	TWT	SKHRD	SKWT	SKWTSD	WPROT	FYELD	MSCOR	FASH	FPROT	FSV	RVA	MABS	CAVOL	CODI
1	2004	47	470009	WA8039	PULLMAN	63.1	13.8	38.3	8	9.5	66.6	86.8	0.3	8	22.2	.	.	.	9.66
2	2004	47	470014	ALTURAS	PULLMAN	62	17.5	34.4	7.3	9.2	68.5	87.3	0.33	8.2	24.6	.	.	.	9.66
3	2004	47	470016	LOUISE	PULLMAN	61.6	14.8	38	9.1	10.6	68.7	88.2	0.32	9.1	19.5	.	.	.	9.64
4	2005	53	530001	ALPOWA	MOSES LAKE	62.7	36.2	33.6	8.8	11.7	66.3	78.8	0.42	10.4	19.2	.	.	.	9.24
5	2005	53	530002	ALTURAS	MOSES LAKE	61.5	34.3	30.9	8.1	10.9	69.6	83	0.42	9.9	24	.	.	.	9.14
6	2005	53	530003	ZAK	MOSES LAKE	62.4	29.7	40.3	10.1	11.6	70.6	83.6	0.43	10.3	17.9	.	.	.	9.59
7	2005	53	530004	LOUISE	MOSES LAKE	62.3	27.6	41.6	10.2	11.9	71.2	85.7	0.41	10.7	17.6	.	.	.	9.65
8	2005	53	530008	WA8039	MOSES LAKE	63.6	35.7	37.6	9.5	11.5	69.5	82.9	0.42	10.3	20.1	.	.	.	9.36
9	2006	64	640001	ALTURAS	FAIRFIELD	61.2	39.4	29.4	5.6	9.2	70.4	86.6	0.38	7.9	21.6	.	.	1255	9.74
10	2006	64	640002	LOUISE	FAIRFIELD	60.5	30.1	35.8	9.1	9.1	70.1	85.5	0.39	7.8	16.4	.	.	1390	9.76
11	2006	64	640003	WA8039	FAIRFIELD	62.9	36.6	31.2	7.2	9	71	89.9	0.34	7.7	18.9	.	.	1390	9.65
12	2006	65	650001	ALTURAS	LIND	62.3	34.1	28.5	6.1	12.2	72.4	88.5	0.39	10.8	22.2	.	.	1165	9.27
13	2006	65	650002	LOUISE	LIND	61.3	30.7	36.3	9.1	13	71.3	87.1	0.39	11.4	17.3	.	.	1285	9.28
14	2006	65	650003	WA8039	LIND	63.1	34.8	29.8	7.8	12.6	70.7	86.3	0.39	11.1	18.9	.	.	1325	9.14
15	2007	11	110002	ALTURAS	ABERDEEN	60.8	20.1	31.2	6.4	11.5	.	.	0.45	9.5	23.6	183	57.3	1143	9.43
16	2007	11	110003	WA8039	PULLMAN	63.5	28.5	33.2	7.2	10.5	.	.	0.31	9.1	22	161	56	1320	9.34
17	2007	11	110004	LOUISE	PULLMAN	62.2	29.5	36.2	8.3	11.7	.	.	0.39	10.2	19	139	58	1308	9.56
18	2007	13	130065	ALPOWA	ST JOHN	58.2	27.44	25.5	6.24	11.4	63.8	78.8	0.37	9.4	20.1	.	55.1	.	9.11
19	2007	13	130066	ALTURAS	ST JOHN	61.1	21.07	29.4	7.04	10.1	70.1	86.8	0.37	7.8	24	.	52.8	.	9.8
20	2007	13	130067	LOUISE	ST JOHN	60.1	24.05	32.2	7.68	9.2	68.8	87.1	0.34	7.5	19.8	.	52.6	.	9.91
21	2007	13	130071	WA8039	ST JOHN	62.2	27.22	31	7.01	11	68.8	86.4	0.35	8.5	21	.	53.1	.	9.57
22	2007	48	480006	ALTURAS	PULLMAN	62.3	26.1	31.1	6.8	9.9	72.1	90.6	0.35	9	23.4	.	.	.	9.74
23	2007	48	480007	LOUISE	PULLMAN	62.3	30.2	36.1	9.1	9.9	70.8	90.9	0.32	8.2	19.2	.	.	.	9.8
24	2007	48	480009	WA8039	PULLMAN	63.3	26	34.2	7.5	10	71.7	92	0.32	8.8	20.7	.	.	.	9.56
25	2007	1013	130001	ALPOWA	DAYTON	60.5	14.63	31.1	7.13	11	68.9	84.6	0.38	9	22.5	.	56.6	.	9.39
26	2007	1013	130002	ALTURAS	DAYTON	61.1	13.25	30.7	6.76	10.5	73	87.3	0.42	8.9	24.6	.	55.7	.	9.69
27	2007	1013	130003	LOUISE	DAYTON	60.7	11.84	38.7	7.53	10.9	71.8	88.3	0.38	9	20.4	.	53.7	.	9.79
28	2007	1013	130007	WA8039	DAYTON	60.5	15.88	31.1	7.21	11.8	70.4	85.3	0.4	9.5	21.6	.	53.8	.	9.4
29	2007	1042	420002	WA8039	ALMIRA	61.1	25.9	30.9	8.5	10.3	69.4	83.4	0.41	9	21.6	.	56	.	9.34
30	2007	1042	420004	LOUISE	ALMIRA	60.4	23.4	37	8.7	9.8	70.9	87.2	0.38	8.6	20.4	.	53.8	.	9.91
31	2007	1042	420005	ALPOWA	ALMIRA	60.7	29.1	26.6	7.4	10.7	66.3	80.7	0.39	9.4	22.2	.	55.8	.	8.86
32	2007	2042	420009	WA8039	BICKLETON	62.3	15.1	37	7.5	12.2	70.7	85.7	0.4	10.6	21.9	.	57.3	.	9.25
33	2007	2042	420011	LOUISE	BICKLETON	62.2	19.9	40.5	8.7	9.8	71.1	86.8	0.39	8.1	20.1	.	54.6	.	9.86
34	2007	2042	420012	ALPOWA	BICKLETON	61.6	16.3	30.7	7	11.6	67.6	81.7	0.4	10.2	21.3	.	55.3	.	9.07
35	2007	3013	130017	ALPOWA	LAMONT	63.3	27.78	35.5	7.1	9.7	69.6	88.1	0.34	8.2	21.3	.	50.4	.	9.4
36	2007	3013	130018	ALTURAS	LAMONT	61.8	25.83	31.3	7.12	10.2	70.5	87.3	0.37	8.9	25.2	.	53.3	.	9.61
37	2007	3013	130019	LOUISE	LAMONT	59.9	27.11	34.7	9.99	10	68.3	84.5	0.37	8.6	17.6	.	52.8	.	9.41
38	2007	3013	130023	WA8039	LAMONT	61.1	30.72	32.5	9.12	10.3	68.9	85.9	0.36	8.9	19.8	.	53	.	9.46
39	2007	3042	420016	WA8039	CONNELL	62.8	22.3	39.8	8.3	14.5	69.6	84.9	0.39	12.5	18.2	.	59.3	.	9.08
40	2007	3042	420018	LOUISE	CONNELL	63.2	14.3	41.4	11.3	12.4	71.3	89.6	0.35	10.8	18.2	.	56.1	.	9.36
41	2007	3042	420019	ALPOWA	CONNELL	63.1	23.4	38.1	8.1	12.8	69.1	84.3	0.39	11.1	19.5	.	59.3	.	9.15
42	2007	4013	130033	ALPOWA	LIND	62.7	24.05	37.3	7.15	14.5	68.5	82.9	0.4	11.9	20.4	.	56.4	.	8.76

Table 16: Data set for WA8039

Obs	YEAR	NURSCO	LABNUM	VAR	LOCATION	TWT	SKHRD	SKWT	SKWTS	WPROT	FYELD	MSCOR	FASH	FPROT	FSV	RVA	MABS	CAVOL	CODI
43	2007	4013	130034	ALTURAS	LIND	62.4	27.98	33.3	7.3	12.3	73.5	88.6	0.41	10.9	24.6	.	55.9	.	9.24
44	2007	4013	130035	LOUISE	LIND	62.9	20.98	42.4	9.07	12.6	71	89.2	0.35	10.7	19.2	.	54.6	.	9.43
45	2007	4013	130039	WA8039	LIND	62.7	26.55	37.5	9.04	13.3	70.4	86.6	0.38	11.4	20.1	.	56	.	8.98
46	2007	4042	420023	WA8039	ENDICOTT	61.2	29.1	29.4	7.8	10.9	73.9	89.7	0.4	9.9	18.2	.	52.6	.	9.31
47	2007	4042	420025	LOUISE	ENDICOTT	58.2	23.4	31.7	7.7	11.2	68.1	85.5	0.35	9.7	16.7	.	55.5	.	9.71
48	2007	4042	420026	ALPOWA	ENDICOTT	59.7	26.3	29.3	6.9	11.3	66.5	84.8	0.33	9.8	18.9	.	53.4	.	9.15
49	2007	5013	130049	ALPOWA	MOSES LAKE	62	25.52	39.6	9.84	10.8	69.3	81.3	0.44	8.4	20.7	.	52.5	.	9.35
50	2007	5013	130050	ALTURAS	MOSES LAKE	61	27.26	37	8.6	11.1	69.6	81.1	0.45	9.1	22.5	.	53.5	.	9.76
51	2007	5013	130051	LOUISE	MOSES LAKE	62	21.46	45.5	12.4	11.2	70.8	85.2	0.41	9.1	17.9	.	53	.	9.66
52	2007	5013	130055	WA8039	MOSES LAKE	62	21.94	36.8	10.4	8.2	69.9	85.3	0.39	6.5	21	.	52.5	.	9.78
53	2007	5042	420030	WA8039	FAIRFIELD	62.3	13.8	37	7.2	8.1	69.4	87.2	0.35	6.6	21.9	.	51	.	9.82
54	2007	5042	420032	LOUISE	FAIRFIELD	62.3	13.1	42	8.8	8.4	71.1	88.7	0.36	7	21	.	52.7	.	9.94
55	2007	5042	420033	ALPOWA	FAIRFIELD	62.7	14.7	36.5	7.2	8.8	65.4	82.7	0.34	7.7	21.6	.	53.7	.	9.56
56	2007	6042	420037	WA8039	FARMINGTON	62.5	18.7	35.4	9.2	9.7	71.4	89.1	0.36	8.3	20.1	.	54.5	.	9.38
57	2007	6042	420039	LOUISE	FARMINGTON	59.6	24.6	34.8	8.8	11	69.7	86.3	0.37	9.6	18.2	.	56.6	.	9.74
58	2007	6042	420040	ALPOWA	FARMINGTON	62.4	20.5	34.4	7.9	10.2	70.3	87.1	0.37	8.5	20.4	.	55.5	.	9.51
59	2007	7042	420044	WA8039	HORSE HEAVEN	63.5	31.9	37.5	9.5	13.6	69	81	0.44	12	18.2	.	57.9	.	9.07
60	2007	7042	420046	LOUISE	HORSE HEAVEN	62.8	24.4	44	11	12	70.3	85.8	0.39	10.2	17.6	.	56.4	.	9.56
61	2007	7042	420047	ALPOWA	HORSE HEAVEN	63.3	27.9	38.8	8.9	11.9	67.3	81.3	0.4	10.6	18.9	.	57.1	.	9.38
62	2007	8042	420051	WA8039	MAYVIEW	61.9	25.1	30.2	6.7	10.9	69.7	88.9	0.33	9.6	21.3	.	55.4	.	9.54
63	2007	8042	420053	LOUISE	MAYVIEW	61	22.7	34.6	8.4	10.3	70.8	92.2	0.3	8.9	21.3	.	54.7	.	9.71
64	2007	8042	420054	ALPOWA	MAYVIEW	60.6	28.2	28.4	6.5	11.6	67.3	84.5	0.35	10.2	21.3	.	56.4	.	9.05
65	2007	9042	420058	WA8039	PULLMAN	63.6	27.8	35.3	7.9	10.5	70.8	90.9	0.32	8.8	21.3	.	54.4	.	9.65
66	2007	9042	420060	LOUISE	PULLMAN	62.4	29.4	38	9.3	11.6	70.8	89.6	0.34	9.5	18.9	.	55.1	.	9.68
67	2007	9042	420061	ALPOWA	PULLMAN	61.2	27.4	29	7.4	11.1	67.4	84.6	0.35	9.7	20.1	.	55.4	.	9.2