

**A. Identification:**

1. **Crop Kind and Market Class:** Soft White Common Spring Wheat
2. **Selection No's:** S0900366, WA8162
3. **Proposed Name:** 'Seahawk'. Seahawk was chosen because Mike Pumphrey, a life-long Denver Broncos fan, lost a bet on Super Bowl XLVIII; nonetheless, this name should be timely and appreciated by Pacific Northwest residents and wheat growers. Like the 2013-2014 Seattle Seahawks championship football team, this cultivar has a great defense and a solid offense.
4. **Pedigree:** Whit/Alpowa-Yr5//Whit/Alpowa-Yr15

**B. General Situation**

1. **Release Justification:** WA8162 is a broadly-adapted soft white spring wheat with near-immunity to stripe rust based on a combination of seedling and adult plant resistance genes, Hessian fly resistance, superior test weight, aluminum tolerance, and very good-to-excellent yield potential in intermediate, high rainfall, and irrigated production areas of the Pacific Northwest. WA8162 represents a unique combination of yield protection traits that are not currently available in a soft white spring wheat variety. Near-immunity to stripe rust, Hessian fly resistance, aluminum tolerance, high test weight, and short height with good straw strength should be of particular interest to growers in the intermediate to high rainfall and irrigated regions, where each may limit profitability. In severe stripe rust epidemics of 2010 and 2011, WA8162 yields were ~12-35 bu/A higher than elite commercial varieties in replicated trials, even with fungicide application in 2011. In 2012 and 2013 stripe rust losses were minimal due to fungicide application and lower disease pressure; WA8162 yields in 2012-2013 were statistically equal to Louise and better than all other varieties in the >20" rainfall locations of Washington State.
2. **Use type:** Soft white common bread wheat.
3. **Description:** Semi-dwarf, soft white spring wheat with later maturity, common head type, white straw and white glumes.
4. **Intention:** WA8162 is targeted to replace Whit, Babe, Nick, and Alpowa, and to complement or partially replace Diva, JD, and Louise in >16" annual rainfall production areas due to its superior stripe rust resistance combined with Hessian fly resistance, improved test weight, shorter height, aluminum tolerance, and yield potential. WA8162 was tested in Oregon State University (OSU) and University of Idaho (UI) Variety Trials in 2013, and ranked 3<sup>rd</sup> of 40 (OSU) and 2<sup>nd</sup> of 15 (U of I) for yield across sites in each state. Broad adaptation, solid yield protection, and good agronomics should make this a preferred variety across the Pacific Northwest.

### C. General Agronomics:

1. **Agronomic performance:** WA8162 was evaluated in preliminary (2 site-years), and advanced (5 site-years) breeding nurseries from 2010-2011 (Table 1), and at 31 site-years in WSU variety testing trials from 2012-2013. In addition, WA8162 was entered in OSU (4 site-years) and UI (7 site-years) variety trials in 2013. Averaged over all rain-fed WSU Variety Testing trials in 2012-2013 (29 site-years), WA8162 (57 bu/A) yielded similarly to Diva (58 bu/A), less than Louise (59 bu/A), and significantly greater than Alpowa, Alturas, Babe, and Nick ( $\leq 55$  bu/A) (Table 5). WA8162 has significantly higher test weight compared to Alturas, Diva, Louise, Nick and Whit. In 2010 and 2011, stripe rust pressure substantially influenced yield potential, and WA8162 yields were significantly higher than all check varieties: Louise, Diva, Alturas, Alpowa, Nick and Whit (Table 1). Across three 2010-2011 trials with severe stripe rust pressure, WA8162 (86 bu/A) yielded significantly higher than the best check variety, Louise (62 bu/A). This data under severe stripe rust pressure demonstrates the importance of improving stripe rust resistance levels in soft white spring wheat varieties, and the potential increased profitability from growing WA8162. WA8162 performed better than all other commercially available WSU soft white spring wheat varieties in OSU and UI Variety Trials in 2013.

### 2. Other Agronomic Traits:

a. **Plant height:** WA8162 is, on average, two-three inches shorter than Louise and Diva, and equal to, or shorter than all other commercially-relevant comparison varieties (Table 5).

b. **Heading date:** The heading date of WA8162 is on average one day earlier than Alpowa, and one day later than Diva and Louise (Tables 5).

c. **Test weight:** Averaged across 2012-2013 WSU Variety Trial data, the test weight average of grain from WA8162 (60.6 lb/bu) was significantly higher than check varieties Alturas, Diva, Louise, Nick and Whit (Table 5).

d. **Grain protein content:** Grain protein content averages of WA8162 were similar to all check varieties (Table 5).

3. **Quality summary from the Western Wheat Quality Lab:** WA8162 has good end-use quality with properties similar to the high quality checks used for this analysis. WA8162 displays good grain characteristics. Milling quality is mixed in performing better than Alpowa, but less than Diva. Flour properties of WA8162 are that it forms relatively weak dough. The solvent retention profile for carbonate and sucrose is more desirable than Alpowa but less than Diva. Water solvent retention is good, similar to Diva. Baking performance is between Alpowa for lower performance and Diva for highest performance. With limited data, Japanese sponge cake quality appears promising. Overall WA8162 fits well with the high quality varieties available to plant in Washington.

### Compared to Alpowa, Diva, Louise and Whit (WWQL data):

- Test weight is greater than Louise and Whit; similar to Alpowa and Diva.

- Grain protein is less than Whit; similar to all other checks.
- SKCS kernel hardness is similar to Alpowa; greater than all other checks.
- Kernel weight is similar to Alpowa and Whit; less than Diva and Louise.
- Flour yield is greater than Alpowa; similar to Louise and Whit; less than Diva.
- Break flour yield is greater than Alpowa; similar to Louise and Whit; less than Diva.
- Flour Ash is similar to Alpowa; greater than all other checks.
- Milling performance is greater than Alpowa and Whit; less than Diva and Louise.
- Flour protein is similar to all checks.
- Flour swelling volume indicates 'normal' amylose content.
- Flour SDS is less (weaker) than Alpowa and Louise; similar to Diva and Whit.
- Carbonate solvent retention is less than Alpowa; similar to Louise and Whit; greater than Diva.
- Sucrose solvent retention is less than Alpowa; similar to Louise and Whit; greater than Diva.
- Water solvent retention is less than Alpowa; similar to Diva and Louise; greater than Whit.
- Lactic acid solvent retention is less than (weaker) than Alpowa, Diva and Louise; similar to Whit.
- Dough water absorption is greater than Louise; similar to all other checks.
- Cookie performance is greater than Alpowa; similar to Whit; less than Diva and Louise.
- Cake performance is similar to Alpowa and Louise (limited data).
- L-DOPA color reaction indicates WA8162 will produce dark fresh dough products..

**Overall, release of this variety is expected to:**

- increase the overall quality of the wheat crop in Washington
- have both neutral and positive effects
- *X exert no positive or negative 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):

**4. Resistance to diseases and insects:**

**a. Stripe Rust:**

WA8162 has both *Yr5* and *Yr15* based on pedigree and DNA markers for both genes. Both parents likely have *Yr39* and *Sr2/Yr30*, so WA8162 most likely has both of these adult plant resistance genes. We have observed moderate pseudo black chaff on WA8162 in some environments, which is a good phenotypic marker for *Sr2/Yr30*. This pyramid of seedling and adult plant resistance genes is expected to be durable and highly effective.



*From Xianming Chen:*

WA8162 was tested in the WSU Spring Wheat Variety Trial nursery in 2012 (1232\_SEDN) and 2013 (1332\_SEDN) in various locations of Washington. The line was also tested in 2013 (1334\_SMPN) and in 2011 as S0900366 at Whitlow Farm near Pullman and Mt. Vernon in 2011 (1134\_SMPN) in the WSU Spring Wheat Breeding Program nurseries. In all of the tests, WA 8162 was highly resistant with infection type (IT) 0-2 and severity 0-5. For comparison, the most grown soft white spring wheat variety Louise with a high level of high-temperature adult-plant (HTAP) resistance had IT 2-5 and severity 5-25% at adult-plant stage. The most grown hard red spring wheat variety Espresso with combination of a moderate level of HTAP resistance plus an effective all-stage resistance gene (*Yr15*) had IT 0-2 and severity 0-5%. A susceptible check wheat line, either AvS or Lemhi, had a highly susceptible reaction (IT 8) and 70-100% severity, indicating adequate rust levels for evaluation of wheat lines for stripe rust resistance.

WA 8162, together with other entries in the 2012 (1232\_SEDN) and 2013 (1332\_SEDN) WSU Variety Trial nurseries, was tested with five selected races of the stripe rust pathogen in the greenhouse at seedling stage and a low diurnal temperature cycle (4-20°C); and at adult-plant stage and a high diurnal temperature cycle (10-30°C). As expected, WA 8162 was highly resistance (IT 1-2) in all of the race tests, similar to Espresso.

All of the field and greenhouse data indicate that WA 8162 has all-stage resistance against all selected races which collectively cover all known virulences of the pathogen in the U.S. and include all predominant races and most virulent races in the recent years. Based on its pedigree, WA 8162 likely has all-stage resistance genes *Yr5* and/or *Yr15*; and HTAP resistance gene *Yr39* from Alpowa and *Yr30* from Whit (WA 8008). Because the line likely has a good combination of durable HTAP resistance genes and effective all-stage resistance genes, the overall resistance is high and should last long. The line should be released if it has relatively good yield potential and quality.

- 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 trials conducted at the University of Idaho, WA8162 is **resistant** to Hessian fly (HF) [*Mayetiola destructor* (Say)] biotypes E, F and GP. This is supported by the lack of symptoms in field testing locations infested by Hessian fly in 2011-2013.
  - e. **Russian wheat aphid:** No data available for assessment.
5. **Area of Adaptation:** WA8162 is broadly adapted to PNW wheat production areas. Based on WSU, OSU, and UI Variety Testing, WA8162 has good yield adaptation across SE Washington, N and S Idaho and N and E Oregon. WA8162 also has aluminum tolerance and performed as well as any soft white spring wheat variety in trials on soils with aluminum toxicity. WA8162 has performed particularly well in

areas receiving >20 inches annual precipitation, irrigated areas, and/or areas subject to moderate to severe stripe rust pressure.

6. **Weaknesses:** WA8162 does not have any striking weaknesses. Yield in low rainfall areas is average. However, there are fewer spring wheat acres in these areas, and Louise and Diva are good complements available to growers.
7. **FGIS Results:** Thirty of 30 samples submitted to FGIS 2012-2013 graded soft white wheat.
- D. **Other Comments:** Soft white spring wheat varieties with near-immunity to stripe rust are needed for PNW producers. The stripe rust resistance, Hessian fly resistance, plant height, test weight, aluminum tolerance and yield potential of WA8162 represent a unique package consistent with grower preference that will enhance variety options. All widely grown soft white spring wheat varieties have inadequate stripe rust resistance in years with high disease pressure. Seedling resistance to stripe rust based on a combination of *Yr5* and *Yr15*, combined with adult plant resistance (*Whit* and *Alpowa* both have *Yr39* and *Sr2/Yr30*), is likely durable. JD spring club wheat is the only commercially available soft white spring wheat with a similar stripe rust resistance level, but it is limited by Hessian fly susceptibility, height/straw strength, lower yield potential, and the club market class, compared to WA8162.
- E. **Seed Source, Status, and Availability:** Breeders Seed is being produced from 500 head-rows in Yuma, AZ this winter, and at least a five acre Foundation Seed increase is intended in 2014.