

**Oregon Agricultural Experiment Station
Oregon State University
Corvallis, OR 97331**

**Proposal for release of ORLD113092
Soft White Winter Wheat**

ORLD113092 is a common soft white winter wheat (*Triticum aestivum* L.) co-developed by Oregon State University (OSU) and Limagrain Cereal Seeds LLC (LCS) that is being proposed for release based on its yield potential, disease resistance and adaptation to growing conditions in the wheat production areas of Oregon, Washington and Idaho. It is targeted as a replacement cultivar in regions where Tubbs, Tubbs 06, and Xerpha are/was grown prior to becoming susceptible to stripe rust (*Puccinia striiformis* Westend). The proposed name for ORLD113092 is 'Norwest Duet'. This name has been cleared through the USDA.

ORLD113092 is an awned semi-dwarf soft white winter wheat from the cross Xerpha/Skiles. 'Xerpha' is a soft white winter wheat cultivar developed by Washington State University from a cross between Eltan and Estica. Skiles pedigree is Dusty/ZGP-4072//Unknown. The initial cross of Xerpha to Skiles was made in 2008 by OSU and forty F₂ seed was then provided to LCS in fall, 2009 to produce dihaploid lines. Dihaploid lines were returned to OSU in January, 2011 and were planted at the OSU Hyslop research farm in February, 2011 as single rows. The dihaploid nursery was provided supplemental irrigation and was evaluated for stripe rust resistance in June, 2011. Lines showing stripe rust resistance were harvested and planted as single plots in a yield nursery at the Ruggs field nursery east of Pendleton, Oregon in fall, 2011. The dihaploid nursery was evaluated for disease resistance, straw strength, yield and test weight. Lines selected by both OSU and LCS breeders were advanced by entering them into multiple location advanced and elite nursery testing in Oregon, Washington, and Idaho by OSU and LCS in fall 2012. Lines in the advance and elite nurseries were evaluated for disease resistance, yield, agronomic performance, and end-use quality by both OSU and LCS. In August, 2013, OSU and LCS breeders met to select lines or potential release candidates to be advanced to the apex nursery for further evaluation. The apex nursery was planted in multiple locations in Oregon, and Washington, and Idaho by OSU and LCS. The lines in the apex nursery were evaluated for disease resistance, yield, agronomic performance, and end-use quality by both OSU and LCS. In August 2014, OSU and LCS breeders met to select lines for potential release. ORLD113092 was advanced to breeder and foundation seed production. In addition, ORLD113092 was entered into extension testing in Oregon, Washington and Idaho in fall, 2014. Based on the yield, agronomic performance, and disease resistance of ORLD113092 in these trials it was decided to release ORLD113092.

ORLD113092 is best adapted to the low and intermediate rainfall production regions in Oregon, Washington and Idaho. ORLD113092 is a winter wheat that requires vernalization to initiate flowering. Based on response in the field and molecular markers, ORLD113092 is photoperiod sensitive. Agronomically, ORLD113092 averages 1 to 1.5 days later than Tubbs 06 for heading date (Table 2). For plant height, ORLD113092 is about 1 inch taller than Tubbs 06 with similar straw strength (Table 2).

In Oregon, ORLD113092 was evaluated in the Apex Nursery (Table 1) in 2014 and in the Oregon Elite Extension Trial in 2015 (Table 2). In the Apex Nursery ORLD113092 was similar to Skiles for yield (99.4 bu/ac and 100.2 bu/ac respectively) and had a mean test weight (lbs/bu) of 57.8 which was higher than the test weight of all the check cultivars except for Skiles. In the Oregon Elite Extension Trial, ORLD113092 had an equal or higher yield than all of the controls except for LCS ArtDeco. In comparison to Skiles and Tubbs 06, ORLD113092 had a 10 bu/ac higher mean yield (95.3) than either Skiles or Tubbs 06 (81.9 and 84.9 respectively).

ORLD113092 had a mean test weight (58.0 lbs/bu) similar to the test weight for Skiles (58.5 lbs/bu) and SY Ovation (58.6 lbs/bu). ORLD113092 was also evaluated in 2014 and 2015 by Limagrain Cereal Seeds in their Washington nurseries (Table 3 and 4). In 2014, LCS grew the equivalent of the Apex Nursery as part of the collaborative breeding effort between OSU and LCS (Table 3) in Idaho, Oregon and Washington. ORLD113092 had a similar mean yield to SY Ovation and Bobtail in the 2014 nurseries with test weight averaging over 60 lbs/bu across locations. ORLD113092 was again evaluated by LCS in trials in the Pacific Northwest in 2015 (Table 4). ORLD113092 had the third highest mean yield behind SY Ovation and LCS ArtDeco and test weights similar to LCS ArtDeco and greater than Bobtail or Stephens. ORLD113092 was evaluated in the 2015 Washington State University Wheat Variety testing nurseries (Table 5) in the below 12 inch precipitation nurseries (three sites) and the 12 to 16 inch precipitation nurseries (four sites). In comparison to the check cultivars Stephens, SY Ovation and Xerpha, ORLD113092 had a higher mean yield across the two precipitation zones and a test weight similar to Xerpha. In 2015, ORLD113092 was grown by Northwest Grain Growers in two locations in Washington, one in a high rainfall site near Walla Walla, WA and the other a low rainfall / dryland site near Eureka, WA (Table 6). ORLD113092 was one of the three top yielding lines at both locations and had a mean test weight similar to Kaseberg when averaged over the two sites. In Idaho, ORLD113092 was evaluated in the 2015 Winter Wheat Extension trials in both northern (Table 7) and southeastern (Table 8) Idaho. In the northern Idaho trials, ORLD113092 performed well under the rainfed conditions in all four locations (Tammany, Genesee, Moscow and Tensed, Idaho) having the second highest mean yield coming in behind only the cultivar LCS ArtDeco (Table 7). ORLD113092 appears to be well adapted to the growing conditions in this region of Idaho. In the southeastern Idaho trials ORLD113092 did not perform as well which was not unexpected since all three locations (Aberdeen, Kimberly and Rupert) are irrigated nurseries and ORLD113092 is best adapted to rainfed production regions (Table 8).

End-use quality of ORLD113092 was tested by the USDA-ARS Western Wheat Quality Laboratory in collaboration with the OSU wheat breeding program in 2015 on seed harvested from the Apex nurseries in 2014 (Table 9 and 10). Comparing ORLD113092 to three cultivars of varying levels of quality (Tubbs 06 moderate/low, Kaseberg – high and Bobtail – high), ORLD113092 was intermediate in performance, better than Tubbs 06 for most quality parameters while falling below Kaseberg and Bobtail for kernel hardness, percent break flour, and cookie diameter. ORLD113092 had a lower percent flour ash than either Kaseberg or Bobtail but percent flour yield for ORLD113092 was equal to that of Kaseberg. In terms of baking quality, ORLD113092 was acceptable to good for sugar snap cookie diameter and had a good sponge cake volume. In terms of solvent retention capacity (SRC) scores (Table 10), ORLD113092 is most similar to Tubbs 06 but with a better score for SRC-lactic acid (higher) and SRC-sucrose (lower) than Tubbs 06. The SRC-sucrose score for ORLD113092 is similar to both Bobtail and Kaseberg. Overall, ORLD113092 has an intermediate/good level of end-use quality that is better than Tubbs 06, one of the cultivars that ORLD113092 is targeted to replace. ORLD2113092 will be evaluated by the PNW Wheat Quality Council in early 2016.

In evaluation for stripe rust (*Puccinia striiformis* Westend) resistance in Oregon in 2015, ORLD113092 showed resistance to the current stripe rust races present in the Pacific Northwest (Table 11). ORLD113092 showed a similar level of resistance as Skiles and Bobtail. Based on molecular marker data, ORLD113092 carries the *Yr15* resistance gene that was most likely contributed by Skiles. ORLD113092 appears susceptible to Fusarium crown rot (*Fusarium pseudograminearum*) (Table 12), is susceptible to Septoria leaf blotch (*Septoria tritici* Roberge in Dezmaz), moderately susceptible to Cephalosporium stripe (*Cephalosporium gramineum* Nis. & Ika.), moderately susceptible to barley yellow dwarf virus (BYDV), and moderately susceptible to sharp eyespot (*Rhizoctonia cerealis*) (Table 13). Based on molecular marker data, ORLD113092 does not carry either of the *Pch1* or *Pch2* genes that confer resistance to strawbreaker foot rot (*Oculimacula acuformis* and *O. yallundae*) and is susceptible to strawbreaker foot rot. ORLD113092 is also susceptible to soilborne wheat mosaic virus (sbWMV).

In the fall of 2014, bulk seed from a breeder seed increase produced by LCS was planted in Yuma, Arizona under contract with Tim Dunn Farms to produce breeder and foundation seed of ORLD113092. The field was evaluated for uniformity in spring, 2015 and the field was then bulk harvested. Breeder seed and a small allotment of Foundation seed will be available in fall, 2015. Breeder seed will be maintained by LCS and Washington State Crop Improvement Association (WSCIA). A Plant Variety Protection (PVP) application will be submitted for ORLD113092 without the title 5 option allowing the sale of Registered, Certified or common classes of seed, with royalties on the authorization of OSU and LCS through their respective seed supplier networks. Royalties for ORLD113092 will be split between OSU and LCS based on the terms of the licensing agreement for ORLD113092. Recommended royalty split for ORLD113092 is 50 / 50 with seed of ORLD113092 being available to both the OSU seed

suppliers and LCS seed associates. The cultivar will be co-marketed by OSU and LCS. Certification classes recognized for ORLD113092 will include Foundation, Registered and Certified. A maximum of 1/1000 (0.1%) tall plants (heads two or more head lengths above the crop canopy) will be allowed in all classes of ORLD113092. A maximum of 1/1000 (0.1%) awnless/awnletted plants will be allowed in all classes of ORLD113092. A maximum of 1/1000 bronze or brown chaffed plants will be allowed in all classes of ORLD113092. A maximum of 60 red seed / pound (approximately 60/10,000) in all classes of ORLD113092 will be allowed. Seed of ORLD113092 will be deposited in the USDA National Small Grains Collection in Aberdeen, Idaho. It is requested that the source of this material be acknowledged in future use by wheat breeding and genetics programs.

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