Request for Release of ARS-Crescent (ARS970163-4C)

Identification:

1. Crop kind and market class: Soft White Club Winter Wheat (*Triticum aestivum* ssp. *compactum*).
2. Selection no.: Cross number: 97X163; Pure Line designation: X970163-4C

3. Pedigree and experimental designation:
   The pedigree of ARS-CRESCENT is: Dusty//Madsen sib/Dusty///WA7665/Rulo.

   Additional pedigree details:
   The pedigree of Dusty (PI 486429) is: Brevor / CI15923 // Nugaines .
   (C.J. Peterson, R.E. Allan, G.L. Rubenthaler, K.J. Morrison, O.A. Vogel. 1987. Registration of Dusty winter wheat. Crop Sci 27:1315).

   The pedigree of CI15923 (WA4992) is: 391-56-D8 // PI 178383 /2* Burt.

   The pedigree of Madsen (PI 511673) is: VPM1/Moisson951//2*Hill 81 .
   (R.E. Allan, C.J. Peterson, G.L. Rubenthaler, R.F. Line, D.E. Roberts. 1989. Registration of Madsen wheat. Crop Sci 29:1575).

   The pedigree of WA7665, (PI 561029) is: Tyee//Cappelle Desprez/Tres

   The pedigree of Rulo (PI 578137), is: Tyee // Roazon / Tres.

   Note that the pedigree of Chukar (PI 628641) is also WA7665/Rulo.
   (K.A. Garland Campbell, R.E. Allan, J. Anderson, J.A. Pritchett, L.M. Little, C.F. Morris, R.F. Line, X. Chen, M.K. Walker-Simmons, B.P. Carter, J.W. Burns, S.S. Jones, and P.E. Reisenauer. 2005. Registration of Chukar wheat. Crop Sci 45:1657-1659).

General Situation:

1. Release Justification. Currently the WSU-released club wheat cultivar, Bruehl, occupies most of the club wheat acreage in the Pacific Northwest. Although this cultivar is popular because it emerges well from deep sowing, tillers well, survives the winter and possesses snow mold and stripe rust resistance, Bruehl does not have resistance to foot rot, and can have low test weight.

2. Use Type: Club wheat

3. Description and General Information: ARS-CRESCENT is an intermediate to tall, awned white kernel club wheat with yield potential as good as Bruehl, coleoptile length equal to Bruehl, maturity and winter tolerance equal to Eltan, resistance to stripe rust and strawbreaker foot rot, and good test weight and end use quality. Because of its height and maturity, it is recommended for the traditional club wheat cultivation areas in WA. It is intended to compete with Bruehl in the non-snow mold areas of WA.

4. Variety intended to replace: Bruehl, Chukar. ARS-CRESCENT will compete well with Bruehl in the traditional club wheat growing areas of Adams, Southern Lincoln, and western Whitman counties. Bruehl will still be the recommended variety in the snow

mold areas of the state in northern Douglas, Lincoln and Grant counties. Snow mold is a serious disease that affects an estimated 200,000 acres of wheat production in WA. ARS-CRESCENT is moderately resistant to another serious disease, strawbreaker foot rot, which affects up to 1.3 to 1.8 million acres of wheat production in WA. Recent changes in the prevalent races of stripe rust (which affects most of the PNW wheat acreage) have overcome the resistance of many PNW wheat varieties, but ARS-CRESCENT remained resistant to stripe rust during the 2010 and 2011 growing season and was further selected for high levels of resistance during breeder seed increase at Othello in 2011.

Summary of Performance evaluations: Performance data for ARS-CRESCENT was compiled from all testing environments in ID (1 per year), OR (4 per year), and WA(8 per year) and compared to widely grown club and soft winter wheat checks using paired T-Tests (Table 1). ARS-CRESCENT was entered into the WSU Cereal Variety Testing program, 2010 and 2011 soft winter wheat nursery (Table 2).

1. In ARS nurseries from 2006 to 2011, in environments receiving less than 15 inches of precipitation per year, ARS-CRESCENT had grain yields significantly better than the club wheat Cara and our recently released SWW cultivar ARS-Amber and equal to all other club and SWW checks (Table 1). In environments receiving more than 15 inches of precipitation per year, ARS-CRESCENT had yields significantly better than Cara, Eltan, Finch, ORCF102 and Xerpha; significantly worse than Bruehl, ARS-Amber, ARS-Selbu (our other recently released SWW cultivar), and Legion; but equal to other checks. In the 2010 and 2011 Cereal Variety Trials, grain yields of ARS-CRESCENT were equal to the best club and SWW cultivars in the <12 inches, and 16-20 annual precipitation region and among the best in other rainfall regions, except under irrigation (Table 2). See also S. Guy's summary of performance in the WSU Cereal Variety Trials near the end of this document.

2. Agronomic characteristics: ARS-CRESCENT has significantly better test weight in dry environments than club wheat cultivars Bruehl, Cara and Chukar; and better than the SWW wheat cultivars ARS-Amber, and Legion (Table 1). In the high rainfall region, ARS-CRESCENT has better test weight than Bruehl, Cara, Chukar, and ORCF102. In the WSU Cereal Variety Trials, ARS-Crescent had significantly better test weight than Bruehl in all but the <12 in. rainfall zone where it was equal to Bruehl (Table 2). ARS-CRESCENT is a full-season wheat, with heading dates similar to Bruehl in most environments. The height of ARS-CRESCENT is similar to Bruehl, Chukar, and Xerpha. ARS-CRESCENT has better tillering capacity than Cara and Chukar, similar to Bruehl (as observed by K. Campbell).

3. Quality: ARS-CRESCENT has typical excellent club wheat milling and baking characteristics. Cake volume is greater than other club wheat cultivars and ARS-CRESCENT is expected to increase the quality of the crop in WA. See notes from USDA-ARS Wheat Quality Laboratory at end of this document and Table 7. The grain protein concentration of ARS-CRESCENT has been lower than other check cultivars in the WSU cereal variety trials (Table 2).

4. Disease reactions: ARS-CRESCENT was selected for resistance to stripe rust during its breeding history. This resistance was maintained under the severe epidemics of 2010 and 2011. As indicated in the report by X. Chen at the end of this document and Tables 8 and 9, the original selection was segregating for seedling resistance. Under breeder seed increase at Othello in 2011, approximately 1/3 of head rows were removed based on early season susceptible reactions to stripe rust. Therefore we expect that the breeder seed of ARS-CRESCENT will have even better resistance to stripe rust than reported here. The adult plant stripe rust resistance of ARS-CRESCENT is very good (Tables 8,9).

   ARS-CRESCENT possesses the *Pch1* gene for resistance to strawbreaker foot rot and shows a moderately resistant reaction to foot rot in inoculated nurseries, (Table 3), not as good as Cara and Madsen but better than the susceptible cultivars Bruehl and Eltan.

5. Winter hardiness: ARS-CRESCENT has been evaluated in 2009, 2010 and 2011 for tolerance to freezing temperatures in artificial freezing trials at the WSU Plant Growth Center and is not significantly different than Eltan in those trials but is significantly better than Stephens, Madsen and other club wheat cultivars (data from 2011 are in Table 4; data from previous years is similar).

6. Adaptation: ARS-CRESCENT appears to be adapted to low rainfall environments in Washington and is especially useful in areas that suffer from foot rot and stripe rust.

7. Emergence: Coleoptile length evaluation has been performed by Jeron Chatelain in Pendleton OR (Table 5). The coleoptile length of ARS-CRESCENT is longer than Cara, Coda and Hiller and not different from Bruehl, and Eltan.

8. Other important traits: ARS CRESCENT has the *Rht-B1a* allele (*Rht-2*) for reduced height. In addition to the Madsen allele at *Pch1*, ARS-Crescent has the 'Capelle Desprez' allele at *Pch2* indicating that it might have that gene for strawbreaker foot rot resistance as well.

9. Weaknesses: The lack of good snow mold resistance will limit use of ARS-CRESCENT north of US Route 2 in WA.

10. FGIS rating: ARS-CRESCENT has been selected in the USDA-ARS breeding program for typical club wheat kernel characteristics. Grain from the 2011 crop was submitted to FGIS for grading. Most of the samples graded club, with others grading western white (Table 6).

11. Other comments: The USDA-ARS recommends that ARS-CRESCENT be released without PVP protection.

Seed source status and availability: ARS-Crescent was planted as head rows at Othello in 2011 and rogued heavily by WSCIA and the ARS breeding program to remove rows that were susceptible and moderately susceptible to stripe rust. A bulk planting of 7 acres was planted for Foundation Seed in Prosser in the fall of 201