No. 200300348

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Washington State University Research Foundation

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, [illegible] CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE [illegible] OR CONDITIONING IT [illegible] PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE, OR USING IT IN PRO[illegible]NG A HYBRID OR [illegible]NT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. (84 ST[illegible] AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

BARLEY

'Radiant'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this seventeenth day of September, in the year two thousand and four.

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER: Washington State University Research Foundation
2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME: 98NZ223
3. VARIETY NAME: Radiant
4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*: 1610 NE Eastgate Blvd. Pullman, WA 99163 USA
5. TELEPHONE *(include area code)*: (509) 335-5526
6. FAX *(include area code)*: (509) 335-7237

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PVPO NUMBER: 20030348
FILING DATE: September 24, 2003

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*: Corporation
8. IF INCORPORATED, GIVE STATE OF INCORPORATION: WA
9. DATE OF INCORPORATION: July 7, 1939

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*
Kenneth Spitzer
Washington State University Research Foundation
1610 NE Eastgate Blvd.
Pullman, WA 99163
USA

FEES RECEIVED
FILING AND EXAMINATION FEES: $ 3652.00 DATE 9/24/2003
CERTIFICATION FEE: $ 432.00 DATE 9/07/2004

11. TELEPHONE *(Include area code)*: (509) 335-4363
12. FAX *(Include area code)*: (509) 335-7237
13. E-MAIL: kspitzer@wsu.edu
14. CROP KIND *(Common Name)*: Barley
15. GENUS AND SPECIES NAME OF CROP: Hordeum vulgare
16. FAMILY NAME *(Botanical)*: Gramineae
17. IS THE VARIETY A FIRST GENERATION HYBRID? ☐ YES ☑ NO
18. DOES THE VARIETY CONTAIN ANY TRANSGENES? ***(OPTIONAL)*** ☐ YES ☐ NO
IF SO, PLEASE GIVE THE ASSIGNED USDA-APHIS REFERENCE NUMBER FOR THE APPROVED PETITION TO DEREGULATE THE GENETICALLY MODIFIED PLANT FOR COMMERICALIZATION. _____

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse)
- a. ☑ Exhibit A. Origin and Breeding History of the Variety
- b. ☑ Exhibit B. Statement of Distinctness
- c. ☑ Exhibit C. Objective Description of Variety
- d. ☑ Exhibit D. Additional Description of the Variety *(Optional)*
- e. ☑ Exhibit E. Statement of the Basis of the Owner's Ownership
- f. ☑ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
- g. ☑ Filing and Examination Fee ($3,652), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)*
☐ YES *(If "yes", answer items 21 and 22 below)* ☑ NO *(If "no", go to item 23)*

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES?
☐ YES ☐ NO
IF YES, WHICH CLASSES? ☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

22. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☐ YES ☐ NO
IF YES, SPECIFY THE NUMBER 1,2,3, etc. FOR EACH CLASS.
☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED
(If additional explanation is necessary, please use the space indicated on the reverse.)

23. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
☐ YES ☑ NO
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

24. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
☐ YES ☑ NO
IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

25. The owners declare that a viable sample of basic seed of the variety has been furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER		SIGNATURE OF OWNER	
Kenneth Spitzer			
NAME *(Please print or type)*		NAME *(Please print or type)*	
Kenneth Spitzer			
CAPACITY OR TITLE	DATE	CAPACITY OR TITLE	DATE
Interim Executive Director			

(See reverse for instructions and information collection burden statement)

INSTRUCTIONS

20030034 8

GENERAL: To be effectively filed with the Plant Variety Protection Office (PVPO), **ALL** of the following items must be **received** in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety at least 2,500 untreated seeds of each line necessary to **reproduce** the variety, or for tuber reproduced varieties verification that a viable *(in the sense that it will reproduce an entire plant)* tissue culture will be deposited and maintained in an approved public repository; (4) check drawn on a U.S. bank for $3,652 ($432 filing fee and $3,220 examination fee), payable to "Treasurer of the United States" *(See Section 97.6 of the Regulations and Rules of Practice.)* Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfiled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 401, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. **DO NOT** use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of $432 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

Plant Variety Protection Office
Telephone: (301) 504-5518
FAX: (301) 504-5291
Homepage: http://www.ams.usda.gov/science/pvpo/pvp.htm

To avoid conflict with other variety names in use, the applicant must check the appropriate recognized authority and provide evidence that name has been cleared by the appropriate recognized authority before the Certificate of Protection is issued. For example, for agricultural and vegetable crops, contact: Seed Branch, AMS, USDA, 10301 Baltimore Avenue, Suite 401 NAL Building, Beltsville, MD 20705. Telephone: (301) 504-5682 http://www.ams.usda.gov/lsg/seed.htm.

ITEM

19a. Give:
(1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified

19b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:

(1) identify these varieties and state all differences objectively;
(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.

19c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.

19d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, *etc.*

19e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.

20. If "Yes" is specified *(seed of this variety be sold by variety name only, as a class of certified seed)*, the applicant **MAY NOT** reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. *(See Regulations and Rules of Practice, Section 97.103).*

23. *See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.*

24. *See Section 55 of the Act for instructions on claiming the benefit of an earlier filing date.*

22. CONTINUED FROM FRONT *(Please provide a statement as to the limitation and sequence of generations that may be certified.)*

23. CONTINUED FROM FRONT *(Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)*

24. CONTINUED FROM FRONT *(Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)*

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. The fees for filing a change of address; owner's representative; ownership or assignment; or any modification of owner's name is specified in Section 97.175 of the regulations. *(See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.)*

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0055. The time required to complete this information collection is estimated to average 1.4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, sexual orientation, marital or family status, political beliefs, parental status, or protected genetic information. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

EXHIBIT A – ORIGIN AND BREEDING HISTORY

'RADIANT' (98NZ223)

1. Genealogy:
Radiant is a cross of proanthocyanidin-free *pant*29-667 (Harrington) × Baronesse. Harrington is a leading malting barley in the USA [Harvey, B.L. & Rossnagel, B.G. 1984. Harrington barley. Can.J. Plant Sci. 64:193-194]. Baronesse is a European feed barley developed from a complex cross by the company Nordsaat in Germany and released in USA in 1992 [PI629288]. It is the leading feed barley in the State of Washington.

2. Stages of selection and multiplication:
1994: Mutant *pant*29-667 was induced by sodium acid mutagenesis: Grains of Harrington were presoaked for 15 hrs in distilled water at 5^0C and treated with a solution of 10^{-3}M NaN_3 at pH3.0 for 2hrs. The NaN_3 solution was bubbled with O_2 during the treatment [von Wettstein, D., Jende Strid, B., Ahrenst-Larsen, B. & Erdal, K. 1980]. Proanthocyanidin-free barley prevents the formation of beer haze. MBAA Techn. Quarterly 17:16-23]. The grains were rinsed and planted in the field. M_2-grains were screened as follows with the Carlsberg Seed Fixation System: The grains were placed one hundred at a time in a matrix and subsequently pressed into a Cernit block in such a way that the embryo half of the grain is embedded in the Cernit block. One quarter of the projecting portion of the grains was ground away with a disc sander. The proanthocyanidins were stained red by placing the Cernit block face down in a freshly prepared 1% solution of vanillin in 6M HCl. The Cernit blocks were removed from the reagents after 5 min incubation at 50^0C, and washed in tap water. An intense red color had developed in the testa of grains containing proanthocyanidins, whereas the proanthocyanidin-free mutant grains remained uncolored. The embryo containing, protected half of the grain was removed from the Cernit block, germinated and the homozygous M_3 grain harvested in the green-house.

1995: The mutants were grown at the Spillman farm of WSU and *pant*29-667 selected as a highly viable mutant.

1996: In June *pant*29-667 was crossed with Baronesse and breeding with the **single seed descent** technology initiated. The F_1 grains were planted in September in the greenhouse and the F_2 grains harvested.

1997: In January the F_2 grains were planted in flats at a high density to develop only 1-2 tillers per plant and a single grain was harvested from each plant at maturity. The single F_3 grains were replanted in cones to yield mature heads by August. 709 F_3 plants homozygous for the *pant*29-667 gene were selected by subjecting the F_4 grain to the above described vanillin test. In September the F_4 grain of the 709 F_3 plants were planted as single rows by Southern Seed Technology at Leeston, New Zealand.

1998: The harvest from New Zealand was returned in February and the F_5 progeny planted in the spring in a singly replicated nursery at the Spillman Farm, Pullman and an irrigated singly replicated nursery at the WSU station Royal Slope.

1999: The 28 highest yielding lines at the two stations were selected for testing in replicated nurseries at Pullman and Royal Slope (F_6-generation). Among the 14 lines with the highest yield Radiant (98NZ223) and 98NZ015 turned out to be the most promising lines.

2000-2002: Radiant (98NZ223) was tested in the Washington State Uniform Nursery across 41 sites at 15 locations. It was analyzed in these trials for yield, plant height, maturity, lodging, field resistance to stripe rust, mildew, scald and net blotch. Malting quality was assessed in micromalting tests by the USDA-ARS Cereal Crops Research Unit at Madison WI.

2002: Radiant (98NZ223) was tested in the Western Regional Spring Barley Nursery at 14 locations.

2001: Approximately 1000 heads of the two lines were selected at random in 2001. They have been threshed, tested for absence of proanthocyanidin and have been planted and harvested in 2002 as head rows for breeder seed production. Breeder and Foundation seed stocks of Radiant are produced and maintained by the Washington State Crop Improvement Association (WSCIA) Foundation Seed Program. Seed production under certification will proceed from Breeder through Foundation, Registered, and Certified seed classes. Requests for seed can be made to the WSCIA Foundation Seed Program, Washington State University, Pullman, WA 99164-6420.

3. Evidence of uniformity and stability:
Radiant (98NZ223) has been stable and uniform with regard to plant morphology, absence of proanthocyanidins and other characteristics since 1997 (F_4). This represents six generations (1997-2002).

4. Variants during reproduction:
None

EXHIBIT B. Statement of Distinctness:

Radiant (Reg. no CV-311, PI 633971) is most similar to Baronesse but distinct from Baronesse and other compared varieties by the absence of proanthocyanidins (condensed tannins) in the testa (seed coat).

The average grain yield of Baronesse in the Washington State Extension Uniform Barley Nursery (WSEUBN) across 41 site-yr (15 locations from 2000 to 2002) was 4897 kg ha^{-1} (100%) and that of line Radiant 4852 kg ha^{1} (99%). 'Steptoe' yielded 4554 kg ha^{-1} (93%), Harrington 4505 kg ha^{-1} (92%) and 'Morex' 3428 kg ha^{-1} (70%). Depending on location, the yield of Radiant ranged from 2427 to 7302 kg ha^{-1} and that of Baronesse at the same locations from 2555 to 7542 kg ha^{-1}. In the same WSEUBN trials (41 site-yr), plant height of Radiant (71 - 81 cm) was similar to that of Baronesse (71 - 81 cm), and test weight of Radiant varied from 56.3 to 72.4 kg hl^{-1}, which again was similar to Baronesse (57.3 - 70.8 kg hl^{-1}). Under favorable weather conditions, kernel plumpness (on 2.4(19mm sieve) ranged from 80 to 98 %. Under high temperature (highs > 32 °C) conditions during grain filling plumpness declined in Radiant more severely than in Baronesse. Radiant typically headed at 178 to 185 and Baronesse at 176 to 180 Julian days based on WSEUBN observations

In the 2002 Western Regional Spring Barley Nursery, Radiant ranked third overall in yield among 37 cultivars tested at 15 locations with an average grain yield of 5394 kg ha^{-1}, compared to 5303 kg ha^{-1} for Baronesse and 4757 kg ha^{-1} for Harrington. For the overall means, Radiant was statistically equal to Baronesse and greater than Harrington. Lodging occurred at eight of the 15 test sites. Whereas, different lodging scores were employed across sites, Radiant had lodging equal to, greater than, and less than Baronesse at one, two and five sites, respectively. Radiant had lodging equal to and less than Harrington at six and two sites, respectively.

Field evaluations for disease resistance in trials in Washington at Pullman, Mt. Vernon, and/or Royal Slope have shown Radiant to have about the same level of moderate resistance to barley stripe rust (caused by Puccinia striiformis Westend. F. sp. hordei), powdery mildew (caused by Erysiphe graminis DC f. sp. hordei Ém. Marchal), net blotch (caused by Pyrenophora teres Drechs.) and scald [caused by Rhynchosporium secalis (Odem.) J.J. Davis] as Baronesse, but a superior level of resistance to these diseases compared to Morex. Radiant and Baronesse had no infected plants based on greenhouse screening of Hessian fly (Mayetiola destructor Say) Biotype GP at the USDA-ARS Entomology Laboratory at West Lafayette, IND.

EXHIBIT B – STATEMENT OF DISTINCTNESS

Radiant (NZ98223) [*pant*29-667(Harrington)×Baronesse] is similar to Baronesse in morphology, plant height, maturity and disease resistance but distinct from Harrington and Baronesse by the absence of proanthocyanidins (condensed tannins) in the testa (seed coat). Because of its unique and superior grain and malting quality it is targeted to supplant Baronesse and Harrington in the Washington barley production area.

A. Agronomic Characteristics.

Yield: The average yield of Radiant (98NZ223) in replicated trials of the Washington State Uniform Nursery across 41sites at 15 locations in the three years 2000 to 2002 amounted to 99% of Baronesse (Table 1). Steptoe, Harrington and Morex yielded 93%, 92% and 70% of Baronesse in the same trials (Table1).

Table 1: Radiant (98NZ223) in the State Uniform Nursery 2000-2002, Yield (LBS/A)
Numbers in [ ] have only been tested in 2years, numbers in ( ) are rankings among all lines.

	Anatone	Walla Walla [2]	Bickleton [2]	Ritzeville [2]	Mayview	Lamont	Almira [2]	Dayton
Baronesse	2281 (3)	3400 (4)	2385(10)	2946 (2)	3888 (3)	4225 (2)	3601 (5)	4515 (1)
Radiant	2167 (6)	3229 (12)	2663 (3)	2907 (4)	3878 (5)	4438 (1)	3540 (8)	4433 (3)
Farmington	1914(12)	3398 (5)	2286(11)	2688(11)	3909 (2)	3592 (7)	3509 (9)	4109 (8)
Bob	2270 (4)	3692 (2)	2705 (2)	3110 (1)	3720 (8)	4040 (3)	3473(10)	3997(10)
Harrington	2090(10)	3262 (8)	1927 (13)	2577(12)	3564(11)	3573 (8)	3245(14)	3781(12)
Steptoe	2372 (8)	3368 (6)	2494 (8)	2857 (5)	3744 (7)	2951(12)	3236(15)	4368 (4)
Morex	2092 (8)	3166(16)	2172 (12)	2367(13)	2585(13)	2725(13)	2815(18)	3548(13)

	St.John	Dusty	Fairfield	Farmington	Reardan	Pullman	Royal Slope	**41Site Mean**	**%**
Baronesse	4046 (5)	3975 (2)	6119 (1)	5566 (5)	5537 (2)	6288 (4)	6734 (7)	**4367**	**100**
Radiant	4195 (1)	3843 (4)	5875 (3)	5413 (8)	5377 (5)	6440 (2)	6520(11)	**4327**	**99**
Farmington	4087 (3)	3554 (9)	5397 (8)	6117 (1)	5278 (7)	6092 (8)	7506 (1)	**4226**	**97**
Bob	4129 (2)	3851 (3)	5666 (6)	5664 (4)	5439 (3)	5851(10)	6658 (9)	**4284**	**98**
Harrington	3870 (6)	3765 (5)	5270 (9)	5489 (6)	4986(10)	5911 (9)	6689 (8)	**4000**	**92**
Steptoe	3548(11)	3749 (6)	4700(12)	5327 (9)	5676 (1)	6128 (6)	6988 (6)	**4074**	**93**
Morex	3242(13)	2946(13)	4349(13)	4916(11)	4564(13)	5174(12)	4850(13)	**3434**	**79**

In the Western Regional Spring Barley Nursery 2002 (Table 2) Radiant (98NZ223) ranked overall 3 in yield among 37 tested cultivars at 14 tested locations with an average grain yield of 5394 kg/ha. Rank 1 with 5525 kg/ha was taken by PB1-95-2R-522 and rank 2 by Steptoe with 5483 kg/ha.

Table 2. Radiant (98NZ223) in the Western Regional Spring Barley Nursery 2002 Yield kg/ha and %relative to Baronesse and Harrington at 14 locations

	Tulelake CA	Aberdeen ID	Bonners Ferry ID	Moscow ID	Bozeman MT	Fargo ND	Minot ND
Steptoe	9709	5339	6031	5724	6005	5724	3209
Baronesse	6864	6049	4886	6063	5658	6063	4504
Harrington	5991	5622	3445	5746	4835	5746	4004
Radiant	6405	7082	3424	6085	6460	6085	4795
% of Baronesse	93	117	70	100	114	100	106
% of Harrington	107	126	99	106	134	106	120

	Williston ND	Klamath Falls OR	Logan UT	Pullman WA	Idaho Falls	Fairfield MT	Powell WY	Mean
Steptoe	3334	6596	1711	4659	7083	6361	5284	5483
Baronesse	3019	6428	2078	4428	6566	6511	5129	5303
Harrington	2661	5562	1326	4078	6228	5894	5454	4757
Radiant	2858	6859	2990	5308	6838	5089	5240	5394
% of Baronesse	95	107	144	120	104	78	102	104
% of Harrington	107	123	225	130	110	86	96	113

B. Genetic characteristics

The distinctness of Radiant (98NZ223) is demonstrated by the absence of proanthocyanidins in the seed coat due to the homozygous presence of the recessive gene *ant* 29-667, which blocks the biosynthesis of the catechin precursors of proanthocyanidins (Skadhauge *et al.*, 1997). The absence of proanthocyanidins is demonstrated by cutting off a piece of the endosperm from the grain with a razor blade or pliers and immersing the fragment into a 1% solution of vanillin in 6 molar HCl. (von Wettstein *et al.*, 1980; Aastrup, 1985). After 20 minutes proanthocyanidin containing grain fragments display an intense red color of the testa, while fragments from the proanthocyanidin-free cultivar Radiant remain colorless. Radiant has inherited the dominant *Deficiens* gene V^t from Baronesse, which reduces the formation of lateral spiklets to a small rudiment.

References:

Skadhauge, B., K.K.Thomsen & D. von Wettstein (1997) The role of the barlet testa layer and its flavonoid content in resistance to *Fusarium* infections. Hereditas 126: 147-160.

von Wettstein, D., B. Jende-Strid, B. Ahrenst-Larsen & K. Erdal (1980) Proanthocyanidin - free barley prevents the formation of beer haze. MBAA Technical Quarterly 17: 16-23.

Aastrup, S. (1985) A test for the prsence or absence of proanthocyanidins in barley and malt. Carlsberg Res. Commun. 50: 37-42.

C. Malting quality.

Proanthocyanidin-free barley is unique as it makes the technical processes for stabilization of beer against permanent and chill haze superfluous and thus assures good shelf-life of the beverage. The brewing industry has been highly interested in this novel type of barley for many years, but required that its yield is equal to the highest yielding varieties on the market. This has been achieved with Radiant by exploiting a gene mutant that blocks the last steps in the biosynthesis of proanthocyanidins in the seed coat of the grain and by demonstrating that such mutants need not be yield depressing. Indeed the yield of Radiant is high enough that it can compete with feed barley (e.g. Baronesse), a characteristic presently not achieved by other two-row malting barleys in the Pacific Northwest. Besides its advantage of producing chill haze stable beer, the malting quality properties of Radiant (98NZ223) are equal to those of Harrington, if grown under conditions assuring good malting quality [limited nitrogen supply giving low grain protein content] (Table3) . Removal of proanthocyandins from the grain prevents the formation of the gray color that makes barley porridge unattractive as baby food and in the use of barley as breakfast cereals. Proanthocyanidin-free barley has shown to have the same quality as proanthocyanidin containing barley for feed of beef cattle. Proanthocyanidin-free barley with high yield provides the farmer thus with several options in the market.

As examplified in Table 3 Radiant (98NZ223) can match Harrington in kernel weight, in a high malt extract of 82%, in holding a desired protein content of 10% and in consistently having a low β-glucan content.

Table 3. Malting quality of Radiant (98NZ223) from harvest at Royal Slope 2002

Line	Kernel weight mg	On 6/64" %	Malt extract %	Barley protein %	Wort protein %	S/T %	DP ASBC ^{0}	α-amy lase 20^0DU	β-glucan ppm	Quality Score
98NZ223	42.9	88.8	81.8	10.1	4.10	44.3	73	61.3	141	42
Harrington	45.1	95.0	82.0	11.3	6.26	56.6	89	74.0	404	32
Harrington Maltcheck	39.9	95.0	82.1	11.7	5.52	51.1	114	73.9	61	42
Morex	37.2	91.4	78.8	14.2	4.98	36.1	165	55.0	405	31
Morex Maltcheck	31.9	72.0	80.1	11.9	6.09	51.1	126	84.5	80	36

References:

von Wettstein, D., R.A. Nilan, B. Ahrenst-Larsen, K. Erdal, J. Ingversen, B. Jende-Strid, K. Nyegaard Kristiansen, J. Larsen, H. Outtrup & S.E. Ullrich (1985) Proanthocyanidin-free barley for brewing: Progress in breeding for high yield and research tool in polyphenol chemistry. MBAA Technical Quarterly 22, 41-52.

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digestion of barley grain by ruminal microorganisms. J. Sci. Food Agric. 79, 929-938.

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
BELTSVILLE, MARYLAND 70705
OBJECTIVE DESCRIPTION OF VARIETY
BARLEY (HORDEUM VULGARE)

EXHIBIT C
BARLEY

Name of applicant: **Washington State University Research Foundation**	FOR OFFICIAL USE ONLY PVPO NUMBER 200300348
1610 NE Eastgate Blvd., Pullman, WA 99163 USA	VARIETY NAME **RADIANT**

1. GROWTH HABIT:

[01] 1- SPRING 2- FACUTATIVE WINTER 3-WINTER

[03] EARLY GROWTH: 1-PROSTATE 2-PROSTRATE 3- ERECT

2. MATURITY (50% Flowering)

[02] HEADING 178-185 DAYS after January 1 1-EARLY 2-MIDSEASON 3-LATE

3. PLANT HEIGHT

[03] **71-81cm** 1-SEMIDWARF 2-SHORT 3- MEDIUM TALL 4-TALL

4.STEM:

[01] EXERTION (FL to spike at maturity) 1- 0-3cm ; 2- 3-10CM; 3- 10-15cm.

[02] ANTHOCYANIN 1-ABSENT 2-PRESENT

[05] NO. OF NODES

[03] COLLAR SHAPE 1- CLOSED; 2- V-SHAPED; 3-OPEN; 4- MODIFIED CLOSED OR OPEN

[01] SHAPE OF NECK 1- STRAIGHT; 2- SNAKY; 3- OTHER

5. LEAF:

[02] BASAL LEAF SHEATH (seedling) 1-GLABROUS; 2- PUBESCENT

[01] POSITION OF FLAG LEAF (at boot stage): 1-droopimg 2- upright

[02] WAXINESS: 1-ABSENT; 2-SLIGHTLY WAXY; 3- WAXY

[10] **MM.** WITH (First leaf below flag leaf)

[30] **CM.** LENGTH (First leaf below flag leaf

[02] Anthocyanin in leaf sheath: 1- ABSENT; 2-PRESENT

6. HEAD:

[01] TYPE: 1- TWO-ROWED; 2- SIX-ROWED

[01] DENSITY: 1-LAX; 2-ERECT (not dense); 3-ERECT(dense)

[01] SHAPE: 1-TAPERING; 2-STRAP; 3-CLAVATE; 4- OTHER

[02] WAXINESS: 1- Absent(Glossy); 2-Slightly Waxy; 3-Waxy

[01] Lateral Kernels Overlap: 1- NONE; 2- AT TIP; 3.-1/4-1/2 OF HEAD

[02] RACHIS (Hair on edge): 1- Lacking; 2- Few; 3- Covered

7. GLUME:

[03] LENGTH: 1- 1/3 OF LEMMA; 2- ½ OF LEMMA; 3- > ½ OF LEMMA

[02] HAIRS: 1 –NONE; 2- SHORT; 3- LONG

[04] HAIR COVERING: 1- NONE; 2- RESTRICTED TO MIDDLE; 3- CONFINED TO BAND; 4- COMPLETELY COVERED

[01] AWNS: 1- LESS THAN EQUAL TO LENGTH OF GLUMES; 2- EQUAL TO LENGTH OF GLUMES; > EQUAL TO LENGTH OF GLUMES

[03] AWN SURFACE: 1- SMOOTH; 2- SEMITHMOOTH; 3- ROUGH

8. LEMMA:

[05] AWN: 1-AWNLESS; 2- Awnless central rows, awnlets on lateral rows;
3- SHORT ON CENTRAL ROWS, awnlets on lateral rows;
4- SHORT (less than equal to length of spike);
5- LONG (longer than spike); 6- HOODED

[04] AWN SURFACE: 1-AWNLESS; 2-SMOOTH; 3-SEMITHMOOTH
4-ROUGH

[02] TEETH: 1- ABSENT; 2-FEW; 3- NUMEROUS

[01] HAIR: 1- ABSENT; 2-PRESENT

[01] SHAPE OF BASE: 1-DEPRESSION; 2- SLIGHT CREASE;
3- TRANSVERSE CREASE

[02] RACHILLA HAIRS: 1- SHORT; 2- LONG

9. STIGMA

[02] HAIRS: 1- FEW; 2- MANY

10. SEED

[02] TYPE: 1- NAKED; 2- COVERED

[01] Hair on ventral furrow: 1- ABSENT; 2- PRESENT

[04] LENGTH: 1- SHORT (8.mm); 2- SHORT TO MIDLONG (7.5-9.0mm);
3- MIDLONG (8.5-9.5mm); 4- MIDLONG TO LONG (9.0-10.5);
5- LONG (10.0 mm).

[03] WRINKLING OF HULL: 1- NAKED; 2- SLIGHTLY WRINKLED
3- SEMIWRINKLED; 4- WRINKLED

[01] ALEURONE COLOR: 1- COLORLESS (white or yellow) 2- BLUE

[00 PERCENT ABORTIVE

[38] GMS. PER 1000 SEEDS

11. DISEASE (0 – NOT TESTED, 1- SUSCEPTIBLE, 1.5 – PARTIALLY RESISTANT, 2- RESISTANT

[0] SEPTORIA	[1.5] NET BLOTCH	[1.5] SPOT BLOTCH	[1.5] POWDERY MILDEW
[2] LOOSE SMUT	[0] BACTERIAL BLIGHT	[0] COVERED SMUT	[0] FALSE LOOSE SMUT
[2] STEM RUST	[2] LEAF RUST	[0] SCAB	[1.5] SCALD
[0] AI	[0] BSMV	[0] BYDV	[1.5] STRIPE RUST

12. INSECT: (0- NOT TESTED; 1- SUSCEPTIBLE; 1.5- PARTIALLY RESISTANT; 2- RESISTANT

[0] GREEN BUG	[0] ENGLISH GRAIN APHID	[0] CHINCH BUG	[0] ARMY WORM
[0] GRASS HOPPERS	[0] CEREAL LEAF BEATLE	[0] OTHER	
[2] HESSIAN FLY RACE GP	[0] HESSIAN FLY RACE A	[0] HESSIAN FLY RACE B	[0] HESSIAN FLY RACE C
[0] HESSIAN FLY RACE D	[0] HESSIAN FLY RACE E	[0] HESSIAN FLY RACE F	[0] HESSIAN FLY RACE G

13. CHEMICAL (0 NOT TESTED; 1-SUSCEPTIBLE; 2- RESISTANT)

[0] DDT [0] OTHER

14. INDICATE WHICH VARIETY MOST CLOSELY RESEMBLES THAT SUBMITTED:

CHARACTER	NAME OF VARIETY	CHARACTER	NAME OF VARIETY
PLANT TILLERING	BARONESSE	SEED SIZE	BARONESSE
LEAVE SIZE	BARONESSE	COLEOPTILE ELONGATION	BARONESSE
LEAF COLOR	BARONESSE	SEEDLING PIGMENTATION	BARONESSE
LEAF CARRIAGE	BARONESSE		

EXHIBIT D –OPTIONAL SUPPORTING INFORMATION

Proanthocyanidin-free barley is a quality improved raw material for the malting and brewing industry because it insures an excellent haze stability of the beer [von Wettstein *et al.*,1980, 1985]. But proanthocyanidin-free barley is also excellent as feed barley, as shown by broiler chicken trials [von Wettstein *et al.* MBAA Techn. Quarterly *22*,41(1985)] and by researchers in Canada, where diets for finishing beef cattle normally comprise 80% or more dry-rolled barley grain [Wang *et al.*, 1999]. Line Radiant (98NZ223) was developed with a sodium azide induced mutation, blocking the last steps in the synthesis of proanthocyanidins. Proanthocyanidins, also known as condensed tannins, are polyphenolic compounds that bind strongly to proteins and carbohydrates. Proanthocyanidins are colorless but their name indicates that they are related to the red, blue or orange anthocyanin pigments in flowers. In barley proanthocyanidins are formed exclusively in the seed coat (testa) of the grain and they can be stained red with vanillin-HCl in the mature grain. This provides a practical test to distinguish proanthocyanidin-free barley from barley containing proanthocyanidins. Proanthocyanidins survive the malting process, are dissolved during the mashing procedure in the wort and land up in the beer produced by fermentation with yeast. There they precipitate proteins and carbohydrates especially under low temperature conditions. This is known to brewers as permanent and chill haze. Therefore any brewery that wishes to serve and sell brilliant clear beer with good shelve-life has to remove the proanthocyanidins by technical procedures prior to bottling or canning of the beer. Full scale brewing with proanthocyanidin-free barley produces beer without permanent or chill haze, thus making the technical stabilization procedures superfluous. Some brewers like to use mixtures of barley varieties. In that case it is to be observed that 50% proanthocyanidin-free barley in mixtures with proanthocyanidin containing barley provide the same chill-haze stability as achieved by presently used technical procedures [von Wettstein *et al.* MBAA Tchn.Quarterly *17*,16 (1980)]. Taste panel evaluations of beer made from pranthocyanidin-free barley and proanthocyanidin-containing barley have shown that proanthocyanidins do not contribute to beer flavor or taste (Erdal *et al.*, 1983). Porridge and pastes for breakfast cereals made from barley flour display an unattractive grey colour especially, when fortified with iron for health-care reasons. Barley grains of Radiant (98NZ223) was milled into flour and used for preparation of iron fortified porridge. Using color determination according to the Hunter scale in a BYK-Gardner Spectrograd Colorsystem Model No.96 the color was assessed. The L-value is a measure of light reflection (L=100 is pure white; L=0 is pure black). Normal perled barley showed a L-value of 50.95 ± 1.05 before and 45.61 ± 0.84 (P=0.0024) after fortification with iron. Radiant (98-NZ223) gave a value 47.33 ± 0.47 before and 46.40 (P=0.043) after fortification. [Theuer, 2001, 2002]. Thus no color change was taking place during porridge formation.

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Wang, Y, T.A.McAllister, J.X. Zhong, M.Y.Gruber, B.Skadhauge, B.Jende-Strid & K.-J. Cheng (1999) Effects of proanthocyanidins, dehulling and removal of pericarp on digestion of barley grain by ruminal microorganisms. J. Sci. Food Agric. 79, 929-938.

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Theuer, R.C. (2002) Effect of iron on the color of barley and other cereal porridges. J. Food Sci. 67, 1208-1211.

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No mistakes found.
D. Wettstein

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Registration of 'Radiant' Barley

'Radiant' (Reg. no. CV-311, PI 633971), a proanthocyanidin-free two-rowed spring feed and potential malting barley (*Hordeum vulgare* L.) released in 2003, was developed by the Washington State University (WSU) Agricultural Research Center cooperatively with the Idaho and Oregon Agricultural Experiment Stations and the USDA-ARS. Radiant is widely adapted to eastern Washington and the Pacific Northwest and is competitive agronomically with leading spring malt and feed barley cultivars. Proanthocyanidin-free barley is an improved raw material for the malting and brewing industry because it insures excellent haze stability of the beer, especially when hop extract is used (von Wettstein et al., 1980; 1985). Proanthocyanidin-free barley also is excellent as feed barley, as shown in comparisons with wild-type counterpart genotypes in broiler chicken trials (von Wettstein et al., 1985) and finishing beef cattle where rations are normally comprised of 80% or more of dry-rolled barley grain (Wang et al., 1999). Radiant is the first proanthocyanidin-free barley cultivar to be bred and released in North America.

Radiant is a selection from the cross ant29-667/'Baronesse'. The proanthocyanidin-free mutant ant29-667 was induced in the leading two-rowed malting barley 'Harrington' (Harvey and Rossnagel, 1984) with sodium azide and selected in 1994. M_2 grains were screened for absence of proanthocyanidins in the testa with the vanillin-HCl test using the nondestructive procedure of the Carlsberg Seed Fixation System (von Wettstein et al., 1980). Plants from the selected seeds were grown to maturity in the greenhouse. The M_3 plants were grown in the greenhouse and M_4 generation rows of selected mutants were sown at the Spillman Farm at Pullman, WA, in 1995. Mutant ant29-667 was identified as highly viable based on seed set and overall plant vigor. In June of 1996, ant29-667 was crossed with Baronesse, a high-yielding two-rowed barley. Baronesse is a feed-type barley developed from a complex cross by the company Nordsaat in Germany and has been grown in the USA since 1992.

Radiant (tested as experimental line 98NZ223) was bred using the single seed descent method. The F_1, F_2, and F_3 generations were grown in the greenhouse in Pullman, WA, from September 1996 to August 1997. More than 700 F_4 plants homozygous for the ant29-667 gene were selected with the vanillin-HCl test, and 30 grains of each were sent to New Zealand in September 1997 for propagation as single rows. Resulting F_5 grains were sown in the spring of 1998 in two single-replicate nurseries (1.5- by 3-m plot) at Pullman (dryland, ≈600 mm annual precipitation) and at Royal Slope (irrigated), WA. The line 98NZ223 was selected for high yield and tested in nurseries with three replicates (1.5- by 6.5-m plots) at Pullman and Royal Slope in 1999 and advanced to the Washington State Extension Uniform Barley Nursery (WSEUBN) in 2000. The average grain yield of Baronesse in the WSEUBN across 41 site-years (15 locations from 2000 to 2002) was 4897 kg ha^{-1} (100%), and that of line 98NZ223 was 4852 kg ha^{-1} (99%). 'Steptoe' (Muir and Nilan, 1973) yielded 4554 kg ha^{-1} (93%), Harrington 4505 kg ha^{-1} (92%), and 'Morex' (Rasmusson and Wilcoxson, 1979) 3428 kg ha^{-1} (70%). Depending on location, the yield of Radiant ranged from 2427 to 7302 kg ha^{-1} and that of Baronesse at the same locations from 2555 to 7542 kg ha^{-1}. In the same WSEUBN trials (41 site-years), plant height of Radiant (71–81 cm) was similar to that of Baronesse (71–81 cm), and test weight of Radiant varied from 56.3 to 72.4 kg hL^{-1}, which again was similar to Baronesse (57.3–70.8 kg hL^{-1}). Under favorable weather conditions, kernel plumpness on a 19-mm sieve ranged from 80 to 98%. Under high temperature conditions (highs >32°C) during grain filling, plumpness declined in Radiant more severely than in Baronesse. Radiant typically headed at 178 to 185 and Baronesse at 176 to 180 Julian days based on WSEUBN observations.

In the 2002 Western Regional Spring Barley Nursery, Radiant ranked third overall in yield among 37 cultivars tested at 15 locations with an average grain yield of 5394 kg ha^{-1}, compared with 5303 kg ha^{-1} for Baronesse and 4757 kg ha^{-1} for Harrington. For the overall means, Radiant was statistically equal to Baronesse and greater than Harrington. Lodging occurred at eight of the 15 test sites. Whereas, different lodging scores were employed across sites, Radiant had lodging equal to, greater than, and less than Baronesse at one, two, and five sites, respectively. Radiant had lodging equal to and less than Harrington at six and two sites, respectively.

Field evaluations for disease resistance in trials in Washington at Pullman, Mt. Vernon, and/or Royal Slope have shown Radiant to have about the same level of moderate resistance to barley stripe rust (caused by *Puccinia striiformis* Westend. F. sp. *hordei*), powdery mildew (caused by *Erysiphe graminis* DC f. sp. *hordei* Ém. Marchal), net blotch (caused by *Pyrenophora teres* Drechs.), and scald [caused by *Rhynchosporium secalis* (Odem.) J.J. Davis] as Baronesse, but a superior level of resistance to these diseases compared with Morex. Radiant and Baronesse had no infected plants based on greenhouse screening of Hessian fly (*Mayetiola destructor* Say) Biotype GP at the USDA-ARS Entomology Laboratory at West Lafayette, IN.

Porridge and pastes for breakfast cereals made from barley flour may change to a darker unattractive color with time, especially when fortified with iron for health reasons. Radiant has been used for preparation of porridge and compared with porridge made from normal proanthocyanidin containing barely. Whereas the porridge made with normal barley flour darkened after iron fortification, the porridge made with Radiant flour did not (Theuer, 2001, 2002).

On the basis of micromalting data from USDA-ARS Cereal Crops Research Unit at Madison, WI, from the years 1999 to 2002, malting quality parameters of Radiant matched those of Harrington. Under optimal malting barley growing conditions, Radiant, like Harrington, achieves a maximum malt extract of 82% and consistently has a low β-glucan content (141–363 mg kg^{-1}; Harrington 404–506 mg kg^{-1}). Radiant and Harrington carry the gene that controls a high amount of thermostable β-amylase, and thus, a relatively high amount of diastatic power. American Malting Barley Association pilot-scale malting tests began with grain from the 2003 crop.

Approximately 1200 spikes (with F9 seed) were selected at random in 2001 from the pure seed drills at Spillman Farm. They were threshed, tested for absence of proanthocyanidin, sown as head rows at the Royal Slope Station, rogued for uniformity (About 25 of the rows were eliminated), and harvested for Breeder seed in 2002. The Washington State Crop Improvement Association (WSCIA) Foundation Seed Program produced Foundation seed in 2003 at the Othello Station. Breeder and Foundation seed stocks of Radiant are maintained by WSCIA. Seed production under certification will proceed from Breeder through Foundation, Registered, and Certified seed classes. Requests for seed can be made to the WSCIA Foundation Seed Program, Washington State University, Pullman, WA 99164-6420. It is requested that appropriate recognition be given by citation, when Radiant contributes to

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research or the development of new breeding lines or cultivars. Application for U.S. Plant Variety Protection is in progress.

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

Application is required in order to determine if a plant variety protection certificate is to be issued *(7 U.S.C. 2421)*. The information is held confidential until the certificate is issued *(7 U.S.C. 2426)*.

1. NAME OF APPLICANT(S)	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER	3. VARIETY NAME
Washington State University Research Foundation	98NZ223	Radiant
4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*	5. TELEPHONE *(Include area code)*	6. FAX *(Include area code)*
1610 NE Eastgate Blvd. Pullman, WA 99163 USA	(509) 335-5526	(509) 335-7237
	7. PVPO NUMBER 20030348	

8. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. **If no, please explain.** ☑ YES ☐ NO

9. Is the applicant (individual or company) a U.S. national or a U.S. based company? **If no, give name of country.** ☑ YES ☐ NO

10. Is the applicant the original owner? ☑ YES ☐ NO **If no, please answer one of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?
☐ YES ☐ NO **If no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?
☐ YES ☐ NO **If no, give name of country**

11. Additional explanation on ownership *(Trace ownership from original breeder to current owner. Use the reverse for extra space if needed)*:

'Radiant' was developed by Diter von Wettstein, Barley Geneticist at Washington State University. Washington State University's ownership interests are assigned to the Washington State University Research Foundation.

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.
2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.
3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0055. The time required to complete this information collection is estimated to average 0.1 hour per response, including the time for reviewing the instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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