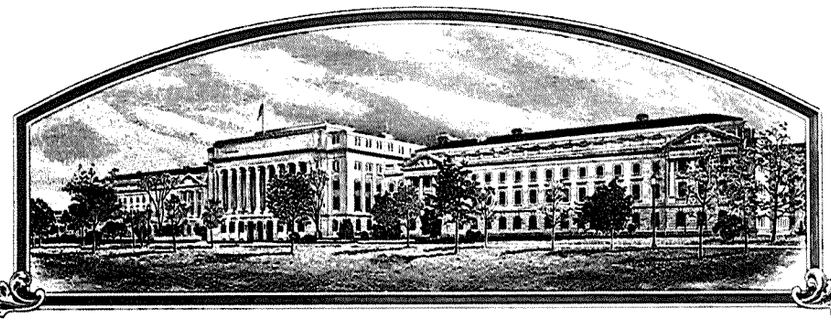

No. 202000423

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Washington State University and United States Government as Represented by the Secretary of Agriculture

Whereas, THERE HAS BEEN PRESENTED TO THE

Administrator of the Agricultural Marketing Service

An application requesting a certificate of protection for an alleged novel variety of sexually reproduced, asexually 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 germplasm material 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, or conditioning it for propagation, or stocking it for any of the above purposes, or using it in producing a hybrid or different variety there from, to the extent provided by the PLANT VARIETY PROTECTION ACT. In the United States seed of this variety (1) shall be sold by variety name only as a class of certified seed and (2) shall conform to the number of generations specified by the owner of the rights. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

WHEAT, CLUB

'Castella'

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 twenty eighth day of September, in the year* ***two thousand twenty-one.***

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Administrator
Agricultural Marketing Service

202000423

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 and U.S. Government as Represented by the Secretary of Agriculture

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME: ARS20060123-31C

3. VARIETY NAME: CASTELLA

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*: Office of Commercialization, Lighty 280/286, PO Box 641060, Pullman WA 99164-1060

5. TELEPHONE *(include area code)*: 509-335-5526

6. FAX *(include area code)*: 509-335-7237

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PVPO NUMBER: 202000423

FILING DATE: 9/4/2020

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*: Public University and US Government

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)*: Dr. Sita Pappu, AVP-Office of Commercialization Lighty 280/286, PO Box 641060, Pullman WA 99164-1060
Brian Nakanishi, USDA-ARS-OTT, 5601

11. TELEPHONE (Include area code): 509-335-5526

12. FAX (Include area code): 509-335-7237

FEES RECD

FILING AND EXAMINATION FEES: $ 5150.00
DATE 9/4/2020

CERTIFICATION FEE: $
DATE

13. E-MAIL: spappu@wsu.edu, brian.nakanishi@usda.gov

14. CROP KIND *(Common Name)*: Club wheat

15. GENUS AND SPECIES NAME OF CROP: Triticum aestivum ssp. compactum

16. FAMILY NAME *(Botanical)*: Poaceae

17. IS THE VARIETY A FIRST GENERATION HYBRID?
☐ YES ☒ NO

18. DOES THE VARIETY CONTAIN ANY BIOTECHNOLOGY EVENTS?
☐ YES ☒ NO

A biotechnology event is defined as a single insertion of a nucleic acid construct into a specific site in a plant's chromosome that is regulated under the U.S. Coordinated Framework for the Regulation of Biotechnology.

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD ONLY 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)*
☐ UNDECIDED

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions)
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. ☒ Filing and Examination Fee ($4,382),
✓ Make checks and money orders payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*
✓ *Credit Card Payments (See instructions on Page 2 of 11)*

MAH 11/20/2020

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 next page.)

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 next page.)*

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 next page.)*

25. The owners declare that a viable sample of basic seed will be furnished directly to an acceptable depository in support of the variety within three months of filing. Seed will be replenished upon request in accordance with such regulations as may be applicable. For a tuber propagated variety or vegetative propagated parent of the variety, a tissue culture or vegetative sample will be deposited in a public repository within three months of the date of the certificate fee request letter. These will be 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
Sita S. Pappu — Digitally signed by Sita Pappu Date: 2020.09.04 09:29:10 -07'00'	BRIAN NAKANISHI — Digitally signed by BRIAN NAKANISHI Date: 2020.09.03 23:03:48 -04'00'
NAME *(Please print or type)*: Sita S. Pappu	NAME *(Please print or type)*: Brian Nakanishi
CAPACITY OR TITLE: Assistant Vice President	DATE: September 4, 2020
CAPACITY OR TITLE: Acting Assistant Adminis	DATE: September 3, 2020

Continuation Page from ST – 470 (Application for Plant Variety Protection Certificate)

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.)*

Foundation seed First sale date: September 13, 2019

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).)*

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

EXHIBIT A – ORIGIN AND BREEDING HISTORY
** Use additional pages as needed.

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PVPO NUMBER

1. Name of Owner	2. Temporary Designation or Experimental Name	3. Variety Name
Washington State University and United States Government as Represented by the Secretary of Agriculture	ARS20060123-31C	CASTELLA

4. Describe the genealogy (back to and including public and commercial varieties, lines, or clones used) and the breeding method(s). **

The pedigree of Castella is NY89066-7131/B980696//Chukar. NY89-66-7131 is a breeding line from the soft white wheat breeding program located at Cornell University. B980696 is a breeding line from the Agripro (now Syngenta) soft red wheat breeding program with the pedigree L880421/Baranjka. Chukar is a club wheat with the pedigree WA7665I/Rulo from the USDA-ARS wheat breeding program in Pullman WA. All parents from other institutions were used under the Material Transfer Agreement for the Western Regional Nurseries, based on the Wheat Workers Code of Ethics which was in effect in 2006. Final cross was made in 2006. Cultivar was advanced through modified bulk and pedigree breeding.

5. Give the details of subsequent stages of selection and multiplication. **

Year	Detail of Stage	Selection Criteria
	Please see attached EXHIBIT A	

6. Is the variety uniform? X Yes _____No

How did you test for uniformity?

Castella has been observed to be stable and uniform with respect to plant morphology since 2012 as an F6 line. No variants were observed during this time frame, with the exception of those listed below, were observed in breeding program, Breeder and Foundation seed lots.

7. Is the variety stable? X Yes_____No

How did you test for stability? Over how many generations?

Castella has been observed to be stable and uniform with respect to plant morphology since 2012 as an F6 line. No variants were observed during this time frame. This represents six generations in which no variants were observed, with the exception of those listed below, were observed in breeding program, Breeder and Foundation seed lots.

8. Are genetic variants observed or expected during reproduction and multiplication? X Yes_____No

If yes, state how these variants may be identified, their type and frequency.

Under high fertility/high moisture conditions Castella SW Club Wheat may exhibit plants 3 to 6 inches taller than the main crop canopy at a frequency of not. greater than 0.01%. Under high fertility, these taller plants are frequently observed at very low percentages in semi-dwarf wheat genotypes. Also found within the crop may be awnless and awned common heads and awned club heads. The common head type and awned head types are caused by recessive alleles which persist at very low frequencies in wheat breeder seed. These head type variants may be up to 1/10,000 combined within the crop. Based on Foundation seed lots, Castella has been observed to have red seed variants, not greater than 4/10,000 or .04%.

Exhibit A appendix for Pritchett

1. Genealogy:

The pedigree of Castella is NY89066-7131/B980696//Chukar. NY89-66-7131 is a breeding line from the soft white wheat breeding program located at Cornell University. B980696 is a breeding line from the Agripro (now Syngenta) soft red wheat breeding program with the pedigree L880421/Baranjka. Chukar is a club wheat with the pedigree WA7665I/Rulo from the USDA-ARS wheat breeding program in Pullman WA. All parents from other institutions were used under the Material Transfer Agreement for the Western Regional Nurseries, based on the Wheat Workers Code of Ethics which was in effect in 2006.

2. Stages of selection and multiplication

2005 Initial F_1 cross made between NY89066-7131/B980696

2006 Final cross made with F_1 as female and Chukar as male

2007 F_1 population advanced as bulk without selection in WSU Plant Growth Facility

2008 F_2 population advanced as bulk at the WSU Plant Growth Facility.

2009 F_3 population selected for freezing tolerance in artificial freezing trials at WSU Plant Growth Facility. Harvested F_4 grain from surviving plants was selected for white seed.

2010 F_4 generation planted in single rows, 4 across and selected for resistance to stripe rust, for head type, height, and maturity. 60 heads were selected from these single row plots.

2011 The 60 F_5 head rows were planted at on WSU Research land at Pullman WA and selected for resistance to disease. The head row, 2006X123-0-31 was designated.

2012 Evaluated as F_6 breeding line in unreplicated nurseries with commercial checks on WSU research land at Pullman and on rented ground at the Oregon State University Columbia Basin Agricultural Research Center in Pendleton OR. Plot size was approximately 6.5 m^2. Breeding lines were selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

2013 Evaluated as F_7 breeding line in replicated preliminary nursery at six locations in Idaho, Oregon and Washington (tested as X20060123-0-31C); selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

2014 Evaluated as F_8 breeding line in replicated elite yield trials over multiple environments in Washington, Oregon and Idaho (tested as X20060123-0-31C). Selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

2015 Evaluated as F_9 breeding line in replicated elite yield trial over multiple environments in Washington, Oregon and Idaho (tested as ARS20060123-31C); Entered into Washington State Extension Cereal Variety Testing Soft Winter Wheat Nursery in all locations. Selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

2016 Evaluated as F_{10} breeding line in replicated elite yield trial over multiple environments in Washington, Oregon and Idaho (tested as ARS20060123-31C); Entered into Washington State Extension Cereal Variety Testing Soft Winter Wheat Nursery in all locations. Selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

2017 Evaluated as F_{11} breeding line in replicated elite yield trial over multiple environments in Washington, Oregon and Idaho (tested as ARS20060123-31C); Entered into Washington State Extension Cereal Variety Testing Soft Winter Wheat Nursery in all locations. Selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

Purification:

1500 heads were selected from a bulk increase of ARS20060123-31C at Pullman WA. Those head rows were planted on WSU Research land. Approximately 90% of the rows were retained based on phenotypic uniformity, harvested by hand and bulk threshed using a Vogel thresher for a good source of this purified seed. In addition, 1500 heads were harvested for breeder seed increase.

2018: Castella was approved for breeder seed increase with Washington State Crop Improvement Othello WA. Breeder seed was produced in 2018.

3. Evidence of uniformity and stability:

Castella has been observed to be uniform and stable with respect to plant morphology in multiple environments from 2012-2018. This represents 6 generations in which no variants, with the exception of those listed below, were observed in breeding program, Breeder and Foundation seed lots.

4. Variants observed:

Under high fertility/high moisture conditions Castella SW Club Wheat may

exhibit plants 3 to 6 inches taller than the main crop canopy at a frequency of not. greater than 0.01%. Under high fertility, these taller plants are frequently observed at very low percentages in semi-dwarf wheat genotypes. Also found within the crop may be awnless and awned common heads and awned club heads. The common head type and awned head types are caused by recessive alleles which persist at very low frequencies in wheat breeder seed. These head type variants may be up to 1/10,000 combined within the crop. Based on Foundation seed lots, Castella has been observed to have red seed variants, not greater than 4/10,000 or .04%.

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

EXHIBIT B – STATEMENT OF DISTINCTNESS

***** Use additional tables to present clear differences for additional comparison varieties. Use additional pages to present supporting evidence.***

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PVPO NUMBER

1. Name of Owner	2. Temporary Designation or Experimental Name	3. Variety Name
Washington State University and United States Government as Represented by the Secretary of Agriculture	ARS20060123-31C	CASTELLA

Based on overall morphology, Castella (*Applicant's new variety*) is most similar to Pritchett (*Most similar comparison variety(ies)*).

Castella (*Applicant's new variety*) most clearly differs from Pritchett (*Most similar comparison variety(ies)*) in the following traits:

Name the specific trait. Then list the value of that trait for each variety in the comparison. Submit appropriate supporting evidence (see the Guidelines for Presenting Evidence in Support of Variety Distinctness in the instructions below).

Eg. Leaf Pubescence ***Eg. Leaf Color*** ***Eg. Plant Height***	***heavy pubescence*** ***Dark Green (5GY 3/4)*** ***200 cm +/- 10 cm (N=25)***	***glabrous*** ***Light Green (2.5GY 8/10)*** ***250 cm +/- 15 cm (N=25)***	***photograph attached*** ***Munsell Color Chart*** ***statistics attached***
1. Qualitative traits:	**Applicant's New Variety** Castella	**1st Comparison Variety** Pritchett	**Location of Evidence Within the Application**
Head type, Presence of awns	Club Head Type No awns	Club Head Type Awns present	
2. Color traits:			
3. Quantitative traits:			
4. Other:			
Dwarfing, Glu-D1, Lr37/Yr17/Sr39, and SBMV1 genes			See Attached

Exhibit B. Statement of Distinctiveness for Castella Club Wheat

Genotype data

Table 1. Results from genotyping Castella vs. comparison wheat cultivars for major genes using KASP markers[1]

Entry	PCH1	Rht-B1	Rht-D1	Glu-D1	Lr37/Yr-17/Sr38	SBMV1
Pritchett	Resistant	Dwarfing	Wild type	2, 12 and others	Susceptible	Resistant
Castella	Resistant	Wild type	Dwarfing	5,10	Susceptible	Susceptible
Otto	Resistant	Dwarfing	Wild type	5,10	Resistant	Susceptible

1 Pritchett was assayed with Kompetitive Allele Specific PCR (KASP) markers (LGC Genomics, Beverly MA) developed based on analysis of specific genes including *Glu-D1-1-GluD1-2*; *Lr37-Yr17-Sr38*, *Pch1*, *Rht-B1*, and *Rht-D1, and SBMV1* (Chapman et al., 2008*;* Ellis et al., 2002*;* Helguera et al., 2003; Liu et al., 2008; McIntosh et al., 2014; Shubing et al., 2020). For additional details see Marker Assisted Selection in Wheat (https://maswheat.ucdavis.edu. verified 1 Sept 2020).

Table 2. Fluorescent label and amount of fluorescence of PCR products from KASP assays for Pritchett and checks

Marker	Allele	Florescence	Label	Phenotype	Reference
Pch-1	X allele	465-510nm	FAM	resistant	Chapman et al., 2008
	Y allele	533-580nm	VIC	susceptible	
Rht-B1	X allele	465-510nm	FAM	wild type	Ellis et al., 2002
	Y allele	533-580nm	VIC	dwarfing	
Rht-D1	X allele	465-510nm	FAM	wild type	Ellis et al., 2002
	Y allele	533-580nm	HEX	dwarfing	
Glu-D1	X allele	465-510nm	FAM	2+12 or others	Liu et al., 2008
	Y allele	533-580nm	VIC	5+10	
Lr37/Yr-17/Sr38	X allele	465-510nm	FAM	susceptible	Helguera et al., 2003
	Y allele	533-580nm	HEX	resistant	

Quantitative Data

Table 3. Agronomic comparisons of Pritchett vs. Club wheat cultivars in the Washington State Cereal Variety Testing Soft Winter Wheat Nursery 2014, 2015.

	All Zones. Total 25 site-years in Eastern WA[6]				
Entry	**Yield**	**Test Wt[1]**	**Prot[2]**	**Ht[3]**	**HD[4]**
	kg ha^{-1}	kg hl^{-1}	g kg^{-1}	cm	d. fr. Jan 1
Pritchett	4730	74.6	116	84	148
ARS-Crescent	4739	74.4	114	83	149
Bruehl	4404	73.2	118	87	149
Cara	4336	72.6	120	79	148
Coda	4497	76.7	121	85	148
LSD (.10)[5]	78	0.2	1	1	0.3

1 Test Wt. = Test weight

2 Prot, protein concentration

3 Ht, plant height

4 HD, heading date.

5 LSD = Least significant difference calculated at prob type 1 error =.10 from mixed models analysis over locations after checking to make sure that assumptions of homogeneity of variance were satisfied. In the analysis, entry name and location were fixed and blocks and incomplete blocks were random.

6 Location details at www.smallgrains.wsu.edu/variety/archives

Table 4. Marker profiles for club wheat cultivars Part 1

Name	Pch1		Rht-B1		Rht-D1	
	Allele call	Phenotype	Allele call	Phenotype	Allele call	Phenotype
Pritchett	Allele X	Resistant	Allele Y		Allele X	Wild type
ARS Crescent	Allele X	Resistant	Allele X	Wild type	Allele Y	Dwarfing
Bruehl	Allele Y	Susceptible	Allele Y	Dwarfing	Allele X	Wild type

Table 4. Marker profiles for club wheat cultivars Part 2

Name	Glu-D1		Lr37/Yr17/Sr38	
	Allele call	Phenotype	Allele call	Phenotype
Pritchett	Allele X	2+12 or others	Allele X	Susceptible
ARS Crescent	Allele X	2+12 or others	Allele X	Susceptible
Bruehl	Allele Y	5+10	Allele X	Susceptible

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

Exhibit C

OBJECTIVE DESCRIPTION OF VARIETY
Wheat (*Triticum* spp.)

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
Washington State University and United States Government as Represented by the Secretary of Agriculture	ARS20060123-31C	Castella

ADDRESS *(Street and No. or RD No., City, State, Zip Code and Country)*	FOR OFFICIAL USE ONLY
WSU, Lighty 280/286, PO Box 641060, Pullman, WA 99164-1060 and USDA-ARS-OTT, 5601 Sunnyside Ave., Rm 3-1156, Beltsville, MD	PVPO NUMBER

PLEASE READ ALL INSTRUCTIONS CAREFULLY:

Place the appropriate number that describes the varietal character of this variety in the boxes below. Place a zero in the first box (e.g., 0 9 9 or 0 9) when number is either 99 or less or 9 or less respectively. Data for quantitative plant characters should be based on a minimum of 100 plants. Comparative data should be determined from varieties entered in the same trial. Royal Horticultural Society or any recognized color standard may be used to determine plant colors; designate system used: _____. Please answer all questions for your variety; lack of response may delay progress of your application.

1. KIND: 3

1 = Common
2 = Durum
3 = Club
4 = Other (Specify) _____

1a. COMMON WHEAT MARKET CLASSES:

____ HRW (Hard Red Winter)
____ HRS (Hard Red Spring)
____ HW (Hard White)
____ SRW (Soft Red Winter)
✓ SW (Soft White)

2. VERNALIZATION: 2

1 = Spring
2 = Winter
3 = Other (Specify) _____

3. COLEOPTILE ANTHOCYANIN: 1

1 = Absent 2 = Present

4. JUVENILE PLANT GROWTH: 2

1 = Prostrate 2 = Semi-Erect 3 = Erect

5. PLANT COLOR: (boot stage) 2

1 = Yellow-Green
2 = Green
3 = Blue-Green

6. FLAG LEAF: (boot stage)

2 1 = Erect 2 = Recurved
_____ 1 = Not Twisted 2 = Twisted
_____ 1 = Wax Absent 2 = Wax Present

7. EAR EMERGENCE:

161 Number of Days (Average)
2 Number of Days Earlier Than * Otto
Same As * Pritchett
1 Number of Days Later Than * Purl

**Relative to a PVPO-Approved Commercial Variety Grown in the Same Trial*

8. ANTHER COLOR: 1 1 = Yellow 2 = Purple

9. PLANT HEIGHT: (from soil to top of head, excluding awns)

100 cm (Average)

15 cm Taller Than Purl *

Same As Otto *

5 cm Shorter Than Norwest Duet *

10. STEM:

A. ANTHOCYANIN 1 1 = Absent 2 = Present

B. WAXY BLOOM 2 1 = Absent 2 = Present

C. HAIRINESS (last internode of rachis) 1 1 = Absent 2 = Present

D. INTERNODE 1 1 = Hollow 2 = Semi-Solid 3 = Solid

3 Number of Nodes

E. PEDUNCLE 1 1 = Erect 2 = Recurved 3 = Semi-Erect

8 cm Length

F. AURICLE

1 Anthocyanin: 1 = Absent 2 = Present

2 Hair: 1 = Absent 2 = Present

11. HEAD: (At Maturity)

A. DENSITY 3

1 = Lax
2 = Middense (Laxidense)
3 = Dense

B. SHAPE 3

1 = Tapering
2 = Strap
3 = Clavate
4 = Other (Specify) _____

C. CURVATURE 2

1 = Erect
2 = Inclined
3 = Recurved

D. AWNEDNESS 1

1 = Awnless
2 = Apically Awnletted
3 = Awnletted
4 = Awned

12. GLUMES: (At Maturity)

A. COLOR 1

1 = White
2 = Tan
3 = Other (Specify) _____

B. SHOULDER 2

1 = Wanting 2 = Oblique
3 = Rounded 4 = Square
5 = Elevated 6 = Apiculate
7 = Other (Specify) _____

C. SHOULDER WIDTH 2

1 = Narrow
2 = Medium
3 = Wide

D. BEAK 2

1 = Obtuse
2 = Acute
3 = Acuminate

E. BEAK WIDTH 1

1 = Narrow
2 = Medium
3 = Wide

F. GLUME LENGTH 2

1 = Short (ca. 7 mm)
2 = Medium (ca. 8 mm)
3 = Long (ca. 9 mm)

G. WIDTH 2

1 = Narrow (ca. 3 mm)
2 = Medium (ca. 3.5 mm)
3 = Wide (ca. 4 mm)

H. PUBESCENCE 1

1 = Not Present
2 = Present

13. SEED:

A. SHAPE 3 1 = Ovate 2 = Oval 3 = Elliptical

B. CHEEK 1 1 = Rounded 2 = Angular

C. BRUSH

2 1 = Short
2 = Medium
3 = Long

2 1 = Not Collared
2 = Collared

D. CREASE

2 1 = Width 60% or less of Kernel
2 = Width 80% or less of Kernel
3 = Width Nearly as Wide as Kernel

2 1 = Depth 20% or less of Kernel
2 = Depth 35% or less of Kernel
3 = Depth 50% or less of Kernel

E. COLOR 1 1 = White 2 = Amber 3 = Red
4 = Other (Specify) _____

F. TEXTURE 2 1 = Hard 2 = Soft 3 = Other (Specify) _____

G. PHENOL REACTION (See Instructions) 4

1 = Ivory
2 = Fawn
3 = Light Brown
4 = Dark Brown
5 = Black

Text

H. SEED WEIGHT

38 g/1000 Seed (whole number only)

I. GERM SIZE 2

1 = Small
2 = Midsize
3 = Large

14. DISEASE: PLEASE INDICATE THE SPECIFIC RACE OR STRAIN TESTED (0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant)

0	Stem Rust (*Puccinia graminis* f. sp. *tritici*)	Race:
0	Leaf Rust (*Puccinia recondita* f. sp. *tritici*)	Race:
1	Stripe Rust (*Puccinia striiformis*)	Race: Pstv37
0	Loose Smut (*Ustilago tritici*)	Race:
0	Powdery Mildew (*Erysiphe graminis* f. sp. *tritici*)	Race:
0	Common Bunt (*Tilletia tritici* or T. *laevis*)	Race:
0	Dwarf Bunt (*Tilletia controversa*)	Race:
0	Karnal Bunt (*Tilletia indica*)	Race:
0	Flag Smut (*Urocystis agropyri*)	Race:
0	Tan Spot (*Pyrenophora tritici-repentis*)	Race:
0	Halo Spot (*Selenophoma donacis*)	Race:
0	Septoria spp.	Race:
0	*Septoria nodorum* (Glume Blotch)	Race:
0	*Septoria avenae* (Speckled Leaf Disease)	Race:
0	*Septoria tritici* (Speckled Leaf Blotch)	Race:
0	Scab (*Fusarium* spp.)	Race:
1	"Snow Molds"	Race: na
0	Kernel Smudge ("Black Point")	Race:
0	Common Root Rot (*Fusarium*, *Cochliobolus* and *Bipolaris* spp.)	Race:
00	Barley Yellow Dwarf Virus (BYDV)	Race:
0	Rhizoctonia Root Rot (*Rhizoctonia solani*)	Race:
0	Soilborne Mosaic Virus (SBMV)	Race:
0	Black Chaff (*Xanthomonas campestris* pv. *translucens*).	Race:

14. **DISEASE**: (continued) (0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant)

0 Wheat Yellow (Spindle Streak) Mosaic Virus Race: _____

0 Bacterial Leaf Blight (*Pseudomonas syringae* pv. *syringae*) Race: _____

0 Wheat Streak Mosaic Virus (WSMV) Race: _____

_____ Other (Specify) _____ Race: _____

_____ Other (Specify) _____ Race: _____

_____ Other (Specify) _____ Race: _____

_____ Other (Specify) _____ Race: _____

15. HOMOZYGOUS FOR SPECIFIC DISEASE RESISTANCE GENE

0 Stem rust _____

0 Leaf rust _____

0 Other _____

16. INSECT: PLEASE SPECIFY BIOTYPE (Where Needed) (0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant)

0 Stem Sawfly (*Cephus* spp.) (Specify) 0

0 Cereal Leaf Beetle (*Oulema melanopa*) (Specify) 0

0 Russian Aphid 1 (*Diuraphis noxia*) 0

0 Russian Aphid 2 (*Diuraphis noxia*) 0

0 Greenbug (*Schizaphis graminum*) (General) 0

0 Greenbug (*Schizaphis graminum*) Biotype A 0

0 Greenbug (*Schizaphis graminum*) Biotype B 0

0 Greenbug (*Schizaphis graminum*) Biotype C 0

0 Greenbug (*Schizaphis graminum*) Biotype E 0

0 Greenbug (*Schizaphis graminum*) Other (Specify) 0

0 Aphids (Specify) 0

0 Other (Specify) 0

0 Hessian Fly (*Mayetiola destructor*) Biotype A 0

0 Hessian Fly (*Mayetiola destructor*) Biotype B 0

0 Hessian Fly (*Mayetiola destructor*) Biotype C 0

0 Hessian Fly (*Mayetiola destructor*) Biotype D 0

0 Hessian Fly (*Mayetiola destructor*) Biotype E 0

0 Hessian Fly (*Mayetiola destructor*) Biotype F 0

0 Hessian Fly (*Mayetiola destructor*) Biotype G 0

1 Hessian Fly (*Mayetiola destructor*) Biotype GP 0 Pacific Northwest Biotype

0 Hessian Fly (*Mayetiola destructor*) Biotype H 0

16. **INSECT**: (continued) (0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant)

0 ____ Hessian Fly (*Mayetiola destructor*) Biotype I 0 _____

0 ____ Hessian Fly (*Mayetiola destructor*) Biotype J 0 _____

0 ____ Hessian Fly (*Mayetiola destructor*) Biotype L 0 _____

0 ____ Hessian Fly (*Mayetiola destructor*) Biotype M 0 _____

0 ____ Hessian Fly (*Mayetiola destructor*) Biotype N 0 _____

0 ____ Hessian Fly (*Mayetiola destructor)* Biotype O 0 _____

0 ____ Hessian Fly (*Mayetiola destructor*) (Specify) 0 _____

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17. HIGH MOLECULAR WEIGHT GLUTENIN SUBUNIT PROFILE (Check those that apply):

Glu-A1	**Glu-B1**	**Glu-D1**
____ 1	____ 6+8	____ 2+11
____ 2*	____ 7+8	____ 2+12
____ null	____ 7+9	____ 3+12
____ 1*	____ 13+16	✓ 5+10
	____ 13+19	____ null
	____ 17+18	

---

18. **TRANSLOCATIONS** (1=Present 2=Absent 3=Heterogeneous 4= Not Tested):

2 1BL/1RS 2 1A/1R 2 2NS/2AS 2 4DL/4AgS

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19. **IMIDAZOLINONE HERBICIDE TOLERANCE** (1=Present 2=Absent 3=Not Tested):

2 Als-1 2 Als-2 2 Als-3

20. END USE QUALITY:

Grain Protein _____

Flour Protein _____

SDS _____

Farniograph _____

Other _____

---

21. ADDITIONAL INFORMATION ON ANY ITEM ABOVE OR GENERAL COMMENTS:

WHEAT DESCRIPTOR ILLUSTRATIONS

Section Numbers Correspond to the Numbers of the Sections on the Form

4. EARLY PLANT GROWTH HABIT:

1 Prostrate | 2 Intermediate | 3 Erect

10. (D.) STEM INTERNODE X-SECTION:

1 Hollow | 2 Semi-solid | 3 Solid

11. (B.) SPIKE SHAPE:

1 Tapering | 2 Oblong | 3 Clavate | 4 Elliptical

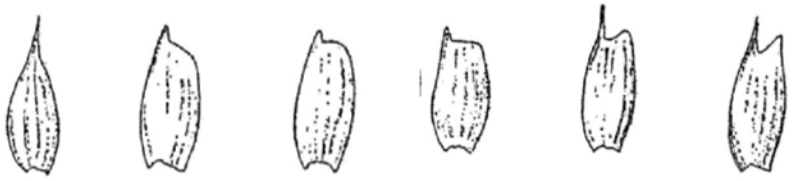
11. (D.) AWNEDNESS:

1 Awnless | 2 Apically Awnleted | 3 Awnleted | 4 Awned

12. (D.) BEAK SHAPE:

1 Obtuse | 2 Acute | 3 Acuminate

12. (C.) SHOULDER SHAPE:



1 Wanting | 2 Oblique | 3 Rounded | 4 Square | 5 Elevated | 6 Apiculate

13. (A.) SEED SHAPE:

1 Ovate | 2 Oval | 3 Elliptical

13. (B.) CHEEK SHAPE:

1 Rounded | 2 Angular

13. (C.) BRUSH SIZE

1 Small | 2 Midsized | 3 Large | 4 Collared

13. (C.) BRUSH HAIR LENGTH:

1 Short | 2 Medium | 3 Long

13. (I.) GERM (EMBRYO) SIZE:

1 Small | 2 Midsized | 3 Large

13. (D.) SEED CREASE WIDTH:

1 Narrow | 2 Mid-wide | 3 Wide

13. (D.)SEED CREASE DEPTH:

1 Shallow | 2 Mid-Deep | 3 Deep

References:

(a) L.W. Briggle and L.P. Reitz. 1963. Classification of Triticum Species and Wheat Varieties Grown in the United States. Technical Bulletin 1278. United States Department of Agriculture.

(b) W.E. Walls. 1965. A Standardized Phenol Method for Testing Wheat Seeds for Varietal Purity. Contribution No. 28 to the handbook of seed testing prepared by the Association of Official Seed Analysts.

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

EXHIBIT E - STATEMENT OF THE BASIS OF OWNERSHIP

FOR OFFICIAL USE ONLY
PVPO NUMBER

1. Name of Owner	2. Temporary Designation or Experimental Name	3. Variety Name
Washington State University and United States Government as Represented by the Secretary of Agriculture	ARS20060123-31C	CASTELLA

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

5. Is the applicant a U.S. national or a U.S. based entity? **If no, give name of country.** ☑ **YES** ☐ **NO**

6. 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**

7. .Additional explanation on ownership *(Trace ownership from original breeder to current owner).*

Castella variety was developed by Geneticists/Breeders at Washington State University (WSU) and United States Department of Agriculture. WSU breeders have assigned and transferred the ownership of the variety to Washington State University.
STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH
This invention was made with government support under grant no. 2016-68004-24770 awarded by United States Department of Agriculture through the National Institute of Food & Agriculture. The government has certain rights in the invention.

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.