Release of 'UI Platinum' Hard White Spring Wheat

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ABSTRACT

'UI Platinum' (Reg. No. CV------, PI) HWS wheat (*Triticum aestivum* L.) was developed by the Idaho Agricultural Experiment Station using a modified bulk selection breeding procedure. UI Platinum was derived from the cross 'Blanca Grande' x 'Jerome' and tested under experimental numbers A01178S, IDO694, and IDO694C. Blanca Grande (PI 631481) is a hard white spring wheat cultivar that was released by Resource Seeds, Inc in 2002 and patented in 2003. Jerome (PI 632712, Souza et al., 2005) is a hard red spring wheat cultivar that was released in 2004. The initial cross of UI Platinum was made in a greenhouse in Aberdeen, ID in January 2001. Grain yield, end-use quality, and resistance to stripe rust (*Puccinia striiformis* Westend f. sp. *tritici*) of UI Platinum are better or equivalent to the three widely grown hard white spring cultivars 'SnowCrest', 'WB Idamax', and 'WB Paloma'. UI Platinum is also early and short, which is desirable in the areas with potato – wheat rotation. UI Platinum is going to be released for its improved grain yield and desirable bread and whole grain end-use quality in irrigated and high rainfall production areas using intensive management practices. The University of Idaho Agricultural Experiment Station will maintain Breeder and Foundation seed of UI Platinum. U.S. Plant Variety Protection with Title V will be sought for UI Platinum. A research fee will be assessed on all Registered and Certified seed sales. All seed requests should be sent to the inventor/breeder during the period of protection by the Plant Variety Protection Certificate. Seed of this release is deposited in the National Plant Germplasm System where it will be available after the expiration of the Plant Variety Protection for research purposes, including development

and commercialization of new cultivars. It is requested that appropriate recognition be made if this germplasm contributes to the development of new germplasm or cultivars.

INTRODUCTION

Hard white wheat (*Triticum aestivum* L.) is a preferred market class for whole grain end-use products that showed an increasing demand in domestic and international markets. The objective of this study was to develop a hard white spring (HWS) wheat cultivar with high grain yield, desirable end-use quality, and resistance to stripe rust, with short plant height that can be produced under irrigated and high rainfall production areas in Southeastern Idaho and other regions of the Pacific Northwest (PNW). 'UI Platinum' (Reg. No. CV------, PI) HWS wheat was developed by the Idaho Agricultural Experiment Station using a modified bulk selection breeding procedure. UI Platinum was derived from the cross 'Blanca Grande' x 'Jerome' and tested under experimental numbers A01178S, IDO694, and IDO694C. Blanca Grande (PI 631481) is a hard white spring wheat cultivar that was released by Resource Seeds, Inc in 2002 and patented in 2003. Jerome (PI 632712, Souza et al., 2005) is a hard red spring wheat cultivar that was released in 2004. The initial cross of UI Platinum was made in a greenhouse in Aberdeen, ID in January 2001. Grain yield, end-use quality, and resistance to stripe rust (*Puccinia striiformis* Westend f. sp. *tritici*) of UI Platinum are better or equivalent to the three widely grown hard white spring cultivars 'SnowCrest', 'WB Idamax', and 'WB Paloma'. UI Platinum is also early and short, which is desirable in the areas with potato – wheat rotation. UI Platinum is going to be released for its improved grain yield and desirable bread and whole grain end-use quality in irrigated and high rainfall production areas using intensive management practices.

METHODS

UI Platinum was developed using a modified bulk-breeding method. The initial cross of UI Platinum was made in a greenhouse in Aberdeen, ID and the F_1 (A01178S) was planted in a field headrow in spring 2001. The headrow was bulk harvested and used as F_2 seeds. The F_2 to F_4 generations were advanced using the bulk method (without intentional selection) in 4.5 m^2 plots from 2002 to 2004 in the field at Aberdeen. In summer 2004, 100 individual heads were selected

and individually threshed and planted as single row plots in 2005. Out of the 100 headrows, eight $F_{4:5}$ headrows were selected for short stature and uniformity. Grains from the six headrows were tested for SDS-Sedimentation (SDS-SED) and two of them had larger SDS-SED were selected and planted in an unreplicated yield trial (4.5 m^2 plots) in 2006. Based on agronomic performance one line A01178S-1 was selected and named as IDO694 in 2007. IDO694 was tested in replicated elite yield trials in Aberdeen, Tetonia, and Kimberly, Idaho from 2008 to 2009.

IDO694C was a sister line almost identical to IDO694 except for resistance to stripe rust re-selected in 2009. IDO694C was then tested in the University of Idaho Spring Wheat Elite Trials (UISWEYTs) from 2010 to 2014, in the Western Regional Hard Spring Wheat Nurseries (WTHSWNs), Idaho State Spring Wheat Variety Yield Trials (IDSWVYTs), Washington and Oregon State Variety Trials, and industry test plots from 2012 to 2014. The name of UI Platinum was given to IDO694C because of its consistent grain yield and end-use quality in diverse environments.

Seed purification of UI Platinum was done by a two-year purification system, headrow and headrow-derived plot. In summer 2011, 400 single heads were selected from a seed-increase plot and planted in 400 breeder seed headrows in Tetonia in spring 2012. Uniform headrows were harvested and tested for protein and test weight. The selected headrows were individually planted into plots and replicated 2 times in Aberdeen in spring 2013. The headrow and plot trials in both years were planted with isolation to prevent any outcrossing and maintain purity. In the second year plot trial, a small sample (one tea spoon) of each entry that planted in the plots was simultaneously screened for resistance to stripe rust in the USDA-ARS Stripe Rust Nursery in Pullman, WA. The breeder seed (450 LB) of UI Platinum came from a composite seed from 96 plots that had similar plant height and heading dates, similar level of stripe rust resistance, protein content, and test weight. Four hundred pounds of the breeder seed were planted for foundation seed production in an irrigated field in Aberdeen, ID, in spring 2014.

Data from the UISWEYTs, WRHSWNs, IDSWVYTs, and other trials described above were analyzed separately using SAS v. 9.2 (SAS institute, Cary, NC). Homogeneity of variance testing was performed for grain yield across all location-years (environments) using Levene's test (Levene, 1960). A combined analysis of variance for grain yield, grain volume weight, days to

heading, and plant height was performed among the homogeneous trials. Across-year analyses used a fixed model with location-years and genotypes as fixed factors. The LSD test ($\alpha = 0.05$) was used to determine the significance of mean differences among genotypes for the traits evaluated.

CHARACTERISTICS

General Description

UI Platinum's juvenile plant growth is erect. At boot stage, UI Platinum's plants are blue-green and have recurved flag leaves. Coleoptiles are white and the anthers are yellow. Stem internodes are hollow, and peduncles are erect. UI Platinum has awned, white chaffed, mid-dense, tapering heads. UI Platinum's kernels are amber, hard, and ovate, with rounded to angular cheeks, a shallow crease, and the brush length is short similar to the parent, Blanca Grande. Kernel weight of UI Platinum was 43 mg in breeder seed produced in 2013.

Agronomic Performance

Yield and agronomic performance in the UISWEYT under irrigation in Southeast Idaho

UI Platinum and three widely grown hard white spring wheat cultivars SnowCrest, WB Paloma, and WB Idamax were evaluated in the UISWEYTs under irrigation in Southeast Idaho over 2012 and 2013. Agronomic performance of the four cultivars was summarized in Table 1. Yield of UI Platinum (107.7 Bu/A) was higher than that of SnowCrest (98.5 Bu/A), similar to that of Paloma (107.0 Bu/A), and lower than that of Idamax (112.1 Bu/A). UI Platinum (165.4 d) was one to two days earlier than Paloma (166.8 d) and Idamax (166.9 d), but similar to SnowCrest (165.5 d). Test weight of the UI Platinum (60.9 Lb/Bu) was higher than that of SnowCrest (59.5 Lb/Bu) and Idamax 59.7 Lb/Bu), but similar to that of Paloma (61.0 Lb/Bu). UI Platinum (31.3 In) has similar plant height to SnowCrest (30.8 In), but one inch shorter than Paloma (32.2 In) and Idamax (32.5 In).

Table 1. Yield and agronomic performance of UI Platinum compared to the three hard white spring check cultivars in the UISWEYTs under irrigation in Southeast Idaho over 2012 and 2013.

Cultivar	Yield Bu/A	Test Weight Lb/Bu	Days to Heading d.	Plant Height In.
	2012			
UI Platinum	113.9	61.9	164.2	31.5
SnowCrest	104.0	60.7	164.1	30.7
WB-Idamax	120.3	61.0	165.9	31.8
WB-Paloma	114.4	61.8	166.6	32.3
No. of Location	3	3	3	3
	2013			
UI Platinum	101.5	59.8	166.6	31.1
SnowCrest	92.9	58.4	166.9	31.0
WB-Idamax	104.0	58.4	168.0	33.1
WB-Paloma	99.7	60.3	167.0	32.1
No. of Location	3	3	3	3
	Two years			
UI Platinum	107.7	60.9	165.4	31.3
SnowCrest	98.5	59.5	165.5	30.8
WB-Idamax	112.1	59.7	166.9	32.5
WB-Paloma	107.0	61.0	166.8	32.2
No. of Location	6	6	6	6

End-use quality in irrigated environments in Southeast Idaho

Diverse grain samples of UI Platinum and the three high quality hard white spring wheat cultivars SnowCrest, WB Paloma, WB Idamax, and one new HWS cultivar were tested for end-use quality in Idaho Wheat Quality lab. Based on the overall performance in the six environments of two years (Table 2), UI Platinum has similar flour protein content to the four cultivars, but higher flour yield than SnowCrest and greater water absorption than WB Paloma and Dayn. Bread volume of UI Platinum was larger than that of Idamax and Dayn but similar to that of SnowCrest and Paloma although its mix peak time was shorter than those of SnowCrest and Idamax. The four cultivars (UI Platinum, Idamax, Paloma, and SnowCrest) were also tested for whole grain end-use quality in an industry quality lab. The overall quality scores of UI

Platinum (89) were similar to Idamax (88) and Paloma (88), but better than SnowCrest (85) (data not shown).

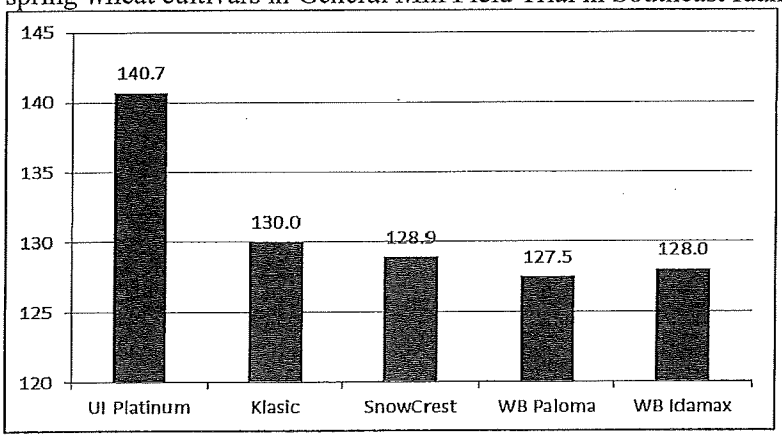
Table 2. Mean end-use quality data of UI Platinum compared to the four check cultivars grown in four irrigated environments over two years

Cultivar	Protein (%)	Flour Yield (%)	Mix Peak Time (Min.)	Water Absorption (%)	Bake Volume (cc)
UI Platinum	12.7	64.2	3.6	63	1138
SnowCrest	13.2	61.3	4.7	63	1163
Idamax	13.0	64.9	4.8	63	1071
Paloma	12.7	64.2	4.2	62	1117
Dayn	12.5	65.1	3.0	62	1054

Yield performance in the General Mill Field Trial

Grain yield of UI Platinum was the top one in the General Mill Field Trial (GMFT) in Blackfoot, Southeast Idaho. Grain yield (140.7 Bu/A) of UI Platinum was significantly higher than those of the four widely grown hard white spring (HWS) wheat cultivars Klasic (130 Bu/A), SnowCrest (128.9 Bu/A), WB Paloma (127.5 Bu/A), and WB Idamax (128.0 Bu/A) under intensive irrigation management (Figure 1).

Figure 1. Grain yield (Bu/A) of UI Platinum compared to the four widely grown hard white spring wheat cultivars in General Mill Field Trial in Southeast Idaho in 2013.



Yield performance in the WRHSWNs

In the WRHSWNs, yield of UI Platinum (81.9 Bu/A) was similar to that of 'UI Winchester' (80 Bu/A, PI 642362, Chen et al., 2010) but 7% higher than the hard white spring check 'Clear White' (76.4 Bu/A, PI635044, Chicaiza et al., 2005) in 15 environments over 2012 and 2013 (Figure 2). Furthermore, yield of UI Platinum was the highest (147 Bu/A) in the fall planted trial in Davis, CA in 2013, about 25.6% higher than that of two checks used in the trial (Figure 3).

Figure 2. UI Platinum yield performance compared to the two check cultivars in the Western Regional Hard Spring Wheat Trials in 2012 and 2013 (15 environments).

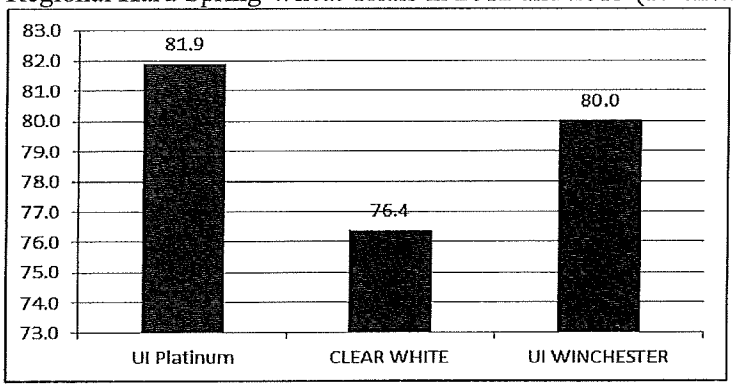
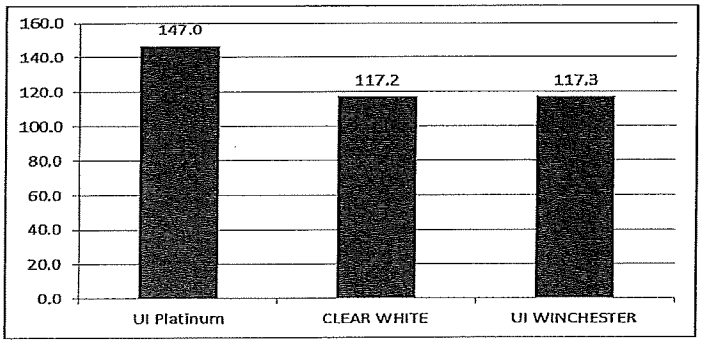


Figure 3. UI Platinum yield performance compared to the two check cultivars in fall planted spring wheat trial in Davis, CA, in 2013.



Agronomic performance in the State Variety trials

In the State Variety Trials in OR and WA, yield of UI Platinum was 12 Bu/A higher than that of 'Dayn' (PI666941, PVP201300130) in the four trials in Oregon over 2012 and 2013, while 6.6 Bu/A lower than that of Dayn in the fourteen trials in Washington in 2013 (Figure 4). UI Platinum was 10 to 15 cm shorter, and 6-7 days earlier than Dayn in different environments in

both states. UI Platinum had similar test weight to Dayn (60.8 vs. 60.4 Lb/Bu) in WA, while better test weight in OR (61.6 vs. 59.4 Lb/Bu). The two cultivars have similar protein content 14.1 vs. 13.7 in WA and 15.1 vs. 15.5% in OR.

UI Platinum had similar yield performance, heading date, and height to the three check cultivars in eight irrigated trials (UISWVYTs) in Southeast Idaho over 2012 and 2013 (Figure 5).

Figure 4. UI Platinum yield performance (Bu/A) compared to the hard white spring check cultivar Dayn in 18 State Variety Trials in OR and WA over 2012 and 2013.

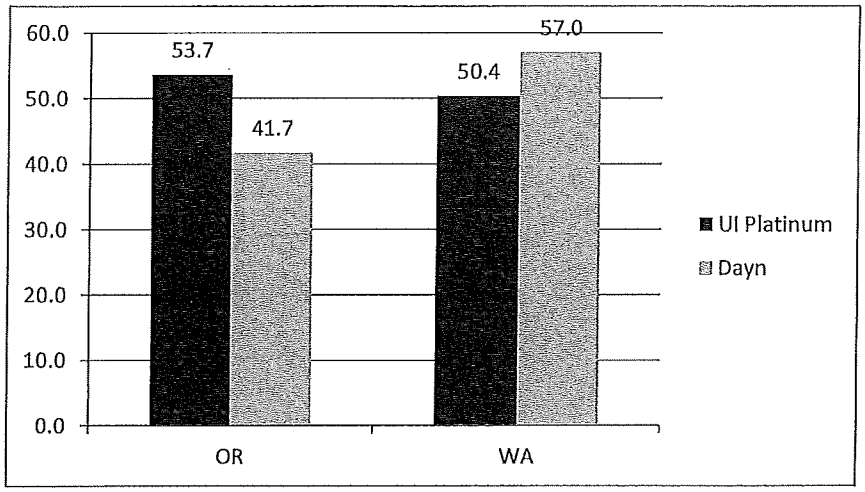
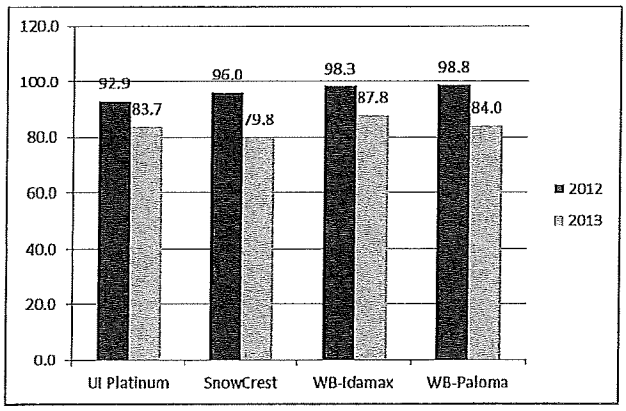


Figure 5. UI Platinum yield performance (Bu/A) compared to the three hard white spring check cultivars in eight irrigated variety trials (UISWVYTs) in Southeast Idaho over 2012 and 2013.



Disease Resistance

Resistance to stripe rust

UI Platinum has similar level of stripe rust resistance to WB Idamax, but better resistance than SnowCrest and WB Paloma. The average infection type and severity over 2012 and 2013 were 3 and 5% in soft dough stage for Platinum and Idamax, while 5 and 30% for SnowCrest and Paloma, respectively.

AVAILABILITY

UI Platinum has been genetically uniform and stable over three generations of seed increase. UI Platinum contains tall plant variants at a frequency less than 20 per 10,000 plants, dark chaff variants at a frequency less than 5 per 10,000 plants, red kernel seed at a frequency less than 5 per four pounds seed. The University of Idaho Agricultural Experiment Station will maintain Breeder and Foundation seed of UI Platinum. U.S. Plant Variety Protection with Title V will be sought for UI Platinum. A research fee will be assessed on all Registered and Certified seed sales. All seed requests should be sent to the inventor/breeder during the period of protection by the Plant Variety Protection Certificate. Seed of this release is deposited in the National Plant Germplasm System where it will be available after the expiration of the Plant Variety Protection for research purposes, including development and commercialization of new cultivars. Small quantities of seed for research purposes may be obtained from the corresponding author for at least 5 yr from the date of this publication. It is requested that appropriate recognition be made if this germplasm contributes to the development of new germplasm or cultivars.

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