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Coordinated Agricultural Projects (CAP)



Variety and germplasm released by the WheatCAP

PVP source <https://www.ars-grin.gov/cgi-bin/npgs/pvp/pvplist.pl>

2017 Variety releases

1. ‘UI Sparrow (IDO1108DH) soft white winter wheat (PVP 201700189, application submitted 2017-03-30). This cultivar was developed using double haploid system and has high grain yield in most areas in ID and WA. The high grain yield was contributed by more productive spikes and spikelet numbers. This cultivar also has a combination of resistance genes that provides protection to stripe rust, snow mold, and dwarf bunt. UI Sparrow has very good winter hardiness and low grain cadmium content.
2. “Melba”, Common wheat released by Washington State University. PVP 201700203. Application Submitted 2017-02-05.
3. “Ryan”, Common wheat released by Washington State University. PVP 201700204. Experimental synonym WA 8214. Application submitted 2017-02-05.
4. ‘Tekoa’, Common wheat released by Washington State University. PVP 201700124. Experimental synonym WA 8189. Application submitted 2017-03-09.
5. ‘NS Presser CLP’. Common wheat released by Montana State University. PVP 201700053, application submitted 2017-01-11. This is a Clearfield variety with two genes for resistance to imidazolinone herbicides. Initial selection of herbicide resistance was accomplished using molecular markers. The variety has been licensed to a private company for commercialization
6. ‘Stardust’ (PVP 201700107) is a hard white cultivar developed by the OAES with a sufficient level of pre-harvest sprouting tolerance and resistance to the wheat soilborne mosaic/wheat spindle streak-mosaic complex appropriate to the central corridor of the southern Plains.
7. ‘AGS2055’ (AR11LE24, PVP No. 201600401) is a common wheat variety released by the Board of Trustees of the University of Arkansas/ University of Georgia Research Foundation, Inc. from the University of Arkansas.
8. ‘Tatanka’ are hard red winter wheat varieties released by Kansas State University Research Foundation in 2017. PVP 201700131, application submitted 2017-03-20.
9. ‘Jasper’ Soft white winter wheat released by Washington State University. PVP 20160029, application submitted 2016-11-28.
10. ‘Sequoia’ is a hard red winter wheat released by Washington State University. PVP 201600315, application submitted 2016-07-27.

11. 'Smith's Gold' (PVP201800136) is a hard red winter wheat cultivar developed by the Oklahoma Agricultural Experimental Station and designated as a potential replacement for 'Gallagher' with improved stripe rust resistance and baking quality. PVP pending.
12. 'Spirit Rider' (PVP201800137) is a hard red winter wheat cultivar developed by the Oklahoma Agricultural Experimental Station with elevated total dietary fiber in the grain and was selected with the aid of DNA marker assays for *Lr34* and *Rht8*. It was also found to carry the *Wx-B1b* allele, and it apparently has gene(s) conferring strong acid-soil tolerance different from *ALMT1*. PVP pending.
13. 'Lonerider' (PVP201800135) is a hard red winter wheat cultivar developed by the Oklahoma Agricultural Experimental Station with unusually broad adaptation to the southern and central Plains. Critical to its release was using marker assays to select for the absence of 1RS and presence of *Glu-D1d* in a genetic background prone to weaker gluten. PVP pending.
14. 'Lang-MN' (PVP201800165) is a hard red spring variety released by the MN wheat-breeding program in 2017. Lang-MN has competitive grain yields, high grain protein. Lang-MN has good resistance to Fusarium head blight, leaf rust, stripe rust, and bacterial leaf streak.
15. 'Thompson' (PVP 201800429) is a HRS wheat released by SDSU that has an excellent combination of high yield and disease resistance. Thompson has medium height and medium maturity with average protein content, test weight and grain quality. It is moderately resistant to leaf rust, stem rust and FHB.

Pending PVP

16. 'Tiburon HP' is a Dessert Durum variety developed in collaboration between the UCD and Arizona Grain. Tiburon HP is a backcross derivative of Tiburon with the introgression of the high grain protein content gene and the *Yr36* stripe rust resistance gene.
17. 'Bob Dole', is a winter wheat varieties released by Kansas State University Research Foundation in 2017 pending PVP.
18. 'AG Icon' are hard red winter wheat varieties released by Kansas State University Research Foundation in 2017 pending PVP.

Public release

19. 'Earl' hard white winter wheat released by Washington State University. Published in the Journal of Plant Registration. 'Jasper' Soft white winter wheat released by Washington State University. Public release Washington State University.

2017 Germplasm releases

1. Two lines derived from the D genome NAM population fixed from *Pm58*. Developed by E. L. Olson at Michigan State University.
2. 'Yecora Rojo 515' is a backcross derivative of Yecora Rojo combining *Puccinia striiformis* resistance genes *Yr5* and *Yr15*. It was developed by the University of California Wheat Breeding program.

2017 Mapping Populations

1. Eric Olson from Michigan State University developed a D genome nested association mapping population (DNAM). This is a BC₂F₄ population derived from direct hybridization of seven *Ae. tauschii* accessions with a common hexaploid wheat line, KS05HW14. The population is comprised of 420 RILs with a family structure of lines derived from a common *Ae. tauschii* accession. Subpopulations are derived from individual BC₁F₁ plants
2. Dr. Jianli Chen from the University of Idaho developed a DH population UI Platinum x LCS Star (UIP-Star) and genotyped it with the 90K SNP platform under support of Idaho Wheat Commission. The population has been planted in three environments in S ID and assessed for SPS and PTN in two environments this summer.
3. Dr. Daolin Fu from the University of Idaho generated an EMS population of UI Platinum, the parental line contributing the SNS 5AL QTL in the CAP project. More than 4,000 M₂ have been harvested.
4. Dr. Dubcovsky from UC Davis developed a TILLING population of 1,535 lines from the tetraploid wheat Kronos. All lines were sequenced by Exome Capture and four million mutations are available in database publicly available on line.
5. Dr. Sunish Sehgal developed an EMS Tilling population from the variety Overland (recurrent parent of winter wheat NAM population). 20,000 seeds were mutagenized and M₂ seeds was harvested from nearly 1,050 M₁'s in summer 2017.

2017 Cloned wheat genes

Sr13. From *T. turgidum* ssp. *dicoccoides*. Confers resistance to the wheat stem rust UG99-race group.

Sr21. From *T. monococcum*. Confers resistance to the wheat stem rust UG99-race group.

2018 Variety releases

With PVP

1. UC-Lassik-RS is a hard red spring variety with five *sbeII* mutations that result in a 42-53% increase in amylose and 880-905% increase in resistant starch. UC-Lassik-RS performs well agronomically in Sacramento, San Joaquin and Imperial valleys of California and has good breadmaking quality characteristics. PVP application 201800070 (11/22/2017).
2. UC-Patwin-RS is a hard white spring variety with five *sbeII* mutations that result in a 69-77% increase in amylose and 1034-1102% increase in resistant starch. UC-Patwin-RS has excellent breadmaking quality characteristics and high yield potential in the San Joaquin and Imperial valleys of California. PVP application 201800058 (11/22/2017).
3. UC-Desert King-RS is a Desert Durum® variety with four *sbeII* mutations and a 41-58% increase in amylose and 900% increase in resistant starch. UC-Desert King-RS showed a 55% reduction in cadmium content in the grain and excellent pasta quality. PVP application 201800069 (11/22/2017).

Pending PVP

4. Desert Gold (PVP 201900010) is a Desert Durum® variety with reduced cadmium (*Cdu1* gene), increase yellow pigment (two QTL for semolina yellow pigment) and color stability

- (*lpxB1.1* mutation) and increased gluten strengths. It showed very high grain yield in the San Joaquin and Imperial Valleys and excellent pasta quality. PVP submission pending.
5. Central Red (PVP 201900011) is a hard red spring wheat variety with one of the highest yields in the Sacramento and San Joaquin valleys and excellent breadmaking quality. It was selected with molecular markers for s resistance gene *Yr15* effective against stripe rust, strong gluten allele *Glu-D1d*, and the 2NS/2AS translocation from *Aegilops ventricosa*. PVP submission pending.
 6. ‘Showdown’ (OK12716, PVP 201900170) hard red winter wheat, developed by the Oklahoma Agricultural Experimental Station, will be targeted for statewide adoption with improved yield potential, stripe rust resistance, Hessian fly resistance, and test weight over the recently released HRW cultivar, Bentley.
 7. ‘Green Hammer’ (OK13209, PVP 201900171) hard red winter wheat, developed by the Oklahoma Agricultural Experimental Station, has a more limited target region, specifically southwest, central, and north central Oklahoma, with elevated grain protein content, superior test weight, and exceptional protection against leaf rust and stripe rust. Yield responses to fungicide treatments in OSU variety trials have routinely been neutral.
 8. ‘Baker’s Ann’ (OK13621, PVP 201900172) hard red winter wheat, developed by the Oklahoma Agricultural Experimental Station, will be intended solely for contracted production and direct shipment to end-users with a need for elevated dough strength in the HRW class.
 9. ‘Skydance’ (OK13625, PVP 201900173) hard red winter wheat, developed by the Oklahoma Agricultural Experimental Station, will be targeted to those environments which may transiently lack for soil-available nitrogen, combined with broad and effective foliar disease resistance and exceptional milling and baking quality. An apparently higher nitrogen-use efficiency level was discovered from research at Tipton, OK originating from a previous CAP project emphasizing this trait in collaboration with UN-L.
 10. ‘KS Venada’ (PVP 201900192) is a hard white winter wheat cultivar developed by the Kansas State University. It has competitive yield in central Kansas and good disease package with improved straw strength and pre-harvest sprouting tolerance.
 11. ‘Purl’ is a soft white winter wheat variety targeted to the high rainfall production zones of Washington and Northern Idaho. This line has very high test-weight and has the second highest yield average over three years. Purl combines excellent abiotic and biotic stress resistance, being resistant to stripe rust, eyespot foot rot, cereal cyst nematodes, low pH soils, and cold temperatures. The line has good end-use quality for domestic and export markets. PVP still pending, checked 2019 08.
 12. ‘Breck’ (CO12D2011, PVP 201800521), a hard white winter wheat, released fall 2017. Markers for *Glu-B1a1* (HMWG Bx7oe+8), *Glu-D1d* (HMWG 5+10), PHS3AS, *Lr24/Sr24*, and *Lr37/Yr17* confirmed by USDA genotyping lab in Manhattan KS.
 13. ‘Incline AX’ (CO14A065, PVP 201800522), hard red CoAXium winter wheat, released fall 2017. The first wheat variety released compatible with the CoAXium wheat production system. Markers for *Lr46* and *Glu-D1a* (HMWG 2+12) confirmed by USDA genotyping lab in Manhattan KS.
 14. ‘Whitetail’ is a new soft white winter wheat variety release through Michigan Crop Improvement Association. **No PVP found in 2019**

Pending PVP in 2017 report that received PVP in 2018

1. ‘Smith’s Gold’ (PVP201800136, 1/24/2018) is a hard red winter wheat cultivar developed by the Oklahoma Agricultural Experimental Station and designated as a potential replacement for ‘Gallagher’ with improved stripe rust resistance and baking quality.
2. ‘Spirit Rider’ (PVP201800137, 1/24/2018) is a hard red winter wheat cultivar developed by the Oklahoma Agricultural Experimental Station with elevated total dietary fiber in the grain and was selected with the aid of DNA marker assays for *Lr34* and *Rht8*. It was also found to carry the *Wx-B1b* allele, and it apparently has gene(s) conferring strong acid-soil tolerance different from *ALMT1*.
3. ‘Lonerider’ (PVP201800135, 1/24/2018) is a hard red winter wheat cultivar developed by the Oklahoma Agricultural Experimental Station with unusually broad adaptation to the southern and central Plains. Critical to its release was using marker assays to select for the absence of IRS and presence of *Glu-D1d* in a genetic background prone to weaker gluten.
4. ‘Lang-MN’ (PVP201800165, 3/8/2018) is a hard red spring variety released by the MN wheat-breeding program in 2017. Lang-MN has competitive grain yields, high grain protein. Lang-MN has good resistance to Fusarium head blight, leaf rust, stripe rust, and bacterial leaf streak.
5. ‘Thompson’ (PVP 201800429, 8/22/2018) is a HRS wheat released by SDSU that has an excellent combination of high yield and disease resistance. Thompson has medium height and medium maturity with average protein content, test weight and grain quality. It is moderately resistant to leaf rust, stem rust and FHB.

2018 Germplasm releases

1. Induced mutant ***RHT-B1E529K*** (PI 687144) confers reduced height by partially suppressing the semi-dwarf phenotype of *Rht-B1b*. This mutation is also associated with length increases in coleoptiles, seedling shoots, and stem internodes relative to the *Rht-B1b* allele
2. “KS05HW14” is a hard white winter experimental line developed by the Kansas State University. It has good crossability with *Aegilops tauschii*, a very important genetic resource that could contribute various traits of agronomic importance for wheat.
3. Six winter wheat germplasm from CSU: Snowmass 2.0, Canvas, Whistler, Monarch, Byrd CL Plus and Crescent AX.

2018 Populations releases

1. The spring wheat TCAP NAM population consisting of 2400 RIL was deposited in the NSGC.
2. South Dakota State University. RIL population 1- SD52/SD1001, 92 F₅ RILs, Genotyped - 1,200 GBS SNPs, Trait- Bacterial Leaf Streak resistance.
3. South Dakota State University. RIL population 2 - Lyman/Emerson, 92 F₅ RILs for FHB resistance, will be genotyped soon.
4. A doubled haploid population (140 DH lines) from the cross between UC-Lassik-RS c UC-Patwin-RS, two lines that share loss-of-function mutations in five of the *sbeII* genes. Developed by the University of California, Davis was genotyped with the 90K Illumina. Assay in the ND genotyping laboratory. The objective is to identify loci that help ameliorate yield penalties in line with increased levels of amylose and resistant starch.

5. CO960293-2/TAM 111 mapping population with 217 RILs developed by Drs. Shuyu Liu and Jackie Rudd from Texas A&M. A QTL for yield on chromosome 2B and a QTL for TKW have been already identified.

2019 new commercial wheat varieties (24)

1. **‘Dagmar’** (PVP application pending from Montana State University) is a solid-stemmed hard red spring wheat intended for acreage infested with the wheat stem sawfly. Dagmar has shown excellent dryland yield potential and high gluten strength. PVP 201900306, and it was submitted on 3/9/2020
2. **‘Amarillo’** (PVP application pending from UC Davis) is a hard white spring with high levels of yellow pigment in the flour. The expected market for this variety is the artisan baker market and consumers interested in the nutritional value of food.
3. **‘UI Bronze Jade’** (PI 691501, PVP Pending 2020) hard white winter wheat (*Triticum aestivum* L.) was developed and released by the Idaho Agricultural Experimental Station in 2019. Compared to ‘UI Silver’, UI Bronze Jade had significantly higher grain yield, shorter plant height, better resistance to stripe rust, and comparable bread-baking quality. UI Bronze Jade is adapted to irrigated and dryland production environments in southeastern Idaho and in rainfed environments in northern Idaho. The high grain yield was contributed by more productive spikes and spikelet numbers.
4. **‘Winner’** (SD14115-5) is a hard red winter wheat cultivar developed by the South Dakota Agricultural Experimental Station with unusually broad adaptation to the eastern half of the Northern Great Plains. ‘Winner’ has medium height and medium maturity with higher yield potential, good baking quality, and moderate resistance to stem rust. (recommended for release in fall 2019)
5. **‘Draper’** (SD14113-3) is a hard red winter wheat cultivar developed by the South Dakota Agricultural Experimental Station with a limited target region, specifically western South Dakota. ‘Draper’ has improved yield potential with average test weight, grain protein, and good milling and baking quality. It is resistant to soilborne mosaic virus. (recommended for release in fall 2019)
6. **‘SD13062-2’** hard red winter wheat germplasm with moderate resistance to FHB (it has a comparable level of resistance to cv. Everest). In addition, SD13062-2 has good yield potential with above-average grain protein content and test weight.
7. **‘TAM 115’** hard red winter wheat cultivar from Texas A&M AgriLife Research. It is adapted to High Plains with resistance to greenbug and wheat curl mite and superior end-use quality. PVP pending.
8. **‘TAM 205’** hard red winter wheat cultivar from Texas A&M AgriLife Research. It is adapted to Rolling Plains with resistance genes *Wsm2* and *Fhb1*. PVP pending.
9. **‘Guardian’** (CO13D0787), a hard red winter wheat, released in 2019 by Colorado State University. Has combined resistance for wheat curl mite (CMC-T112-6D) and wheat streak mosaic virus (*Wsm2*).
10. **‘Fortify SF’** (CO15SFD107), a hard red winter wheat, released in 2019 by Colorado State University. Has the semi-solid-stemmed trait for partial resistance to wheat stem sawfly.

11. **‘KS Dallas’** is a hard red winter wheat variety developed by Kansas State University. It has high yield potential and excellent wheat streak mosaic virus resistance. It carries Bx7OE allele, which confers strong mixing tolerance. PVP application pending.
12. **‘KS Western Star’** is a hard red winter wheat variety developed by Kansas State University. It has good yield potential and drought tolerance. It carries cmc4 allele, which confers wheat curl mite resistance. PVP application pending.
13. **‘KS Silverado’** is a hard white winter wheat variety developed by Kansas State University. It has good yield potential and broad adaptation. It has pre-harvest sprouting tolerance and good disease resistance package. PVP application pending.
14. **‘AM Cartwright’** is a hard red winter wheat variety developed by Kansas State University. It has competitive yields, excellent disease resistance package, and good baking quality. PVP application pending.
15. **‘AR01040-4-1’** (PVP application pending) is a common wheat variety released by the Board of Trustees of the University of Arkansas from the University of Arkansas.
16. **‘Net CI+’** is a hard red spring wheat variety released by WSU with two-gene resistance to Imazamox. It is broadly adapted with Hessian fly resistance, adult plant resistance to stripe rust, very good yield, test weight, and grain protein concentration. Approved for release in 2019. PVP will be submitted winter 2020.
17. **‘Stingray CL+’** is a soft white winter wheat cultivar released by WSU with two-gene resistance to Imazamox. It also carries the *Pchl* gene and *Yr17* gene for disease resistance. Stingray CL+ has the *Rht-B1b* dwarfing allele and carries the *Ax1+Ax2** alleles as *GluA1* and the *Dx2+Dy12* alleles at *GluD1*. It is broadly adapted across the Pacific Northwest and has very good end-use quality. Submitted to PVP and pending.
18. **‘Scorpio’** is a hard red winter wheat released by WSU for its excellent tolerance to low pH soils. This line has very good strip rust resistance, and carries the resistance gene *Yr17* among other unknown sources. Scorpio carries the *Rht-B1b* allele for dwarfing and the *Dx5+Dy10* alleles at *GluD1*. Scorpio does exceptionally well in no-till production systems. PVP will be submitted fall 2019.
19. **‘Devote’** is a soft white winter wheat released by WSU for production in <12” rainfall zones of Washington. This line has excellent disease resistance, as it carries the *Pchl* gene, *Yr17* gene, *Lr68* gene, and a stripe rust resistance gene from the cultivar Eltan. It is also tolerant to snow mold and *Fusarium* crown rot and has very good cold tolerance and end-use quality attributes. PVP will be submitted fall 2019.
20. **‘MN-Washburn’** (PVP to be submitted) is a hard red spring variety released by the UMN wheat breeding program in 2019 that has competitive grain yield and good lodging resistance. MN-Washburn is resistant to prevalent races of leaf and stripe rust and is moderately resistant to *Fusarium* head blight and bacterial leaf streak.
21. **‘MI14R1140’** is a soft red winter wheat released by the Michigan Crop Improvement Association.

22. **‘MI14W1039’** is a soft white winter wheat released by the Michigan Crop Improvement Association.
23. **‘Battle AX’** (CO15A018), a hard red winter wheat released in 2019 by Colorado State University. Marketed by MonTech in Montana.
24. **‘AP18 AX’** (CO14A136), a hard red winter wheat released in 2019 by Colorado State University. Marketed by Agripro-Syngenta.

2019 PVP that were Pending in 2018

1. **‘UC-Desert Gold’** (PVP 201900010 from UC Davis) is a Desert Durum® variety with reduced cadmium (*Cdu1* gene), increase yellow pigment (two QTL for semolina yellow pigment) and color stability (*lpxB1.1* mutation) and increased gluten strengths. It showed very high grain yield in the San Joaquin and Imperial Valleys and excellent pasta quality.
2. **‘UC-Central Red’** (PVP 201900011 from UC Davis) is a hard red spring wheat variety with one of the highest yields in the Sacramento and San Joaquin valleys and excellent breadmaking quality. It was selected with molecular markers for s resistance gene *Yr15* effective against stripe rust, strong gluten allele *Glu-D1d*, and the 2NS/2AS translocation from *Aegilops ventricosa*.
3. **‘Skydance’** (OK13625, PVP 201900173) is a hard red winter wheat, developed by the Oklahoma Agricultural Experimental Station. It has high nitrogen use efficiency and broad and effective foliar disease resistance.
4. **‘Showdown’** (OK12716, PVP 201900170) is hard red winter wheat developed by the Oklahoma Agricultural Experimental Station with improved yield potential, stripe rust resistance, Hessian fly resistance, and superior test weight.
5. **‘Green Hammer’** (OK13209, PVP 201900171) is a hard red winter wheat developed by the Oklahoma Agricultural Experimental Station that has elevated grain protein content, superior test weight, and exceptional protection against leaf rust and stripe rust.
6. **‘Baker’s Ann’** (OK13621, PVP 201900172) hard red winter wheat, developed by the Oklahoma Agricultural Experimental Station for contracted production and direct shipment to end-users with a need for elevated dough strength in the HRW class.
7. **‘KS Venada’** (PVP 201900192) is a hard white winter wheat cultivar developed by Kansas State University. It has competitive yield in central Kansas and good disease package with improved straw strength and pre-harvest sprouting tolerance.
8. **‘Breck’** (CO12D2011, PVP 201800521) is a hard white winter wheat released by the Colorado Wheat Research Foundation carrying *Glu-B1a1* (HMWG Bx7oe+8), *Glu-D1d* (HMWG 5+10), PHS3AS, *Lr24/Sr24*, and *Lr37/Yr17* genes.
9. **‘Incline AX’** (CO14A065, PVP 201800522) is a hard red winter wheat released by the Colorado Wheat Research Foundation compatible with the CoAXium wheat production system carrying *Lr46* and *Glu-D1a* (HMWG 2+12).

2019 Germplasm

- Three hard white winter wheat germplasms with adult plant resistance to stem rust, KS14U6380R5, KS16U6380R10 and KS16U6380R11 were developed by the USDA-ARS group in Kansas.

2019 Mapping Populations

- University of Idaho deposited two doubled haploid mapping populations (UI Platinum x SY Capstone and UI Platinum x LCS Star) that are being used in cloning of yield component projects.
- Texas A&M University developed 3 mapping population: a) A set of 222 F₆ RILs from the cross of TAM 204/Iba. The population was genotypes and yield components have were collected from five environments in Texas. b) A set of 180 F₆ RILs from TAM 112/Duster that were genotypes and tested in six environments in Texas and Oklahoma mainly for drought tolerance. c) A set of 178 F₆ RILS from TAM 111/TX05A001822 that were tested in five environments. QTL analyses are under way. Bread-making quality was analyzed in three environments.

2020 New Commercial Wheat Varieties

1. **‘Yecora Rojo 515’** (PVP pending) is a hard white spring variety released by the UC Davis wheat-breeding program. It is derived from the popular variety Yecora Rojo by introgression of the stripe rust resistance genes *Yr5* and *Yr15* using marker assisted selection.
2. **‘UI Cookie’** (PVP 202000298, filed July 14, 2020) is a soft white spring wheat (*Triticum aestivum* L.) developed and released by the Idaho Agricultural Experiment Station in 2020. UI Cookie has high grain yield, excellent end-use quality, and tolerance to fusarium head blight. It shows also improved resistance to stripe rust and stem rust compared to the widely grown soft white spring wheat cultivar ‘UI Stone’ (PI 660550). More productive tiller numbers contributed the high grain yield.
3. **‘Erie’** (PVP pending) is a soft red winter wheat jointly released by Ohio State University and Cornell University. Erie has very good resistance to Fusarium Head Blight (FHB, caused by the fungus *Fusarium graminearum*), Powdery Mildew, leaf rust, Stagonospora Leaf Blotch, and Stagonospora Glume Blotch.
4. **‘NY99056-161’** is a soft white winter developed by Cornell University. (PVP pending) is a soft white winter wheat variety released by the Cornell small grains breeding program. NY99056-161 has excellent yield and the highest level of resistance to Fusarium Head Blight of any variety grown in NY and is rated as moderately resistant. It is also resistant to Wheat Spindle Streak Mosaic Virus and moderately resistant to powdery mildew.
5. **‘Byrd CL Plus’**, a hard red winter wheat variety released by Colorado State University, with two-gene Clearfield technology, high drought stress tolerance and excellent straw strength. PVP 201900407.

6. **‘Canvas’**, a hard red winter wheat variety released by Colorado State University with excellent stripe and stem rust resistance, good test weight and high end-use quality PVP 201900408.
7. **‘Crescent AX’**, a hard red winter wheat variety released by Colorado State University compatible with the CoAXium wheat production system. Crescent AX has medium-early maturity, very good test weight, wheat curl mite resistance, and good end-use quality. PVP 201900409.
8. **‘Monarch’**, a hard white winter wheat variety released by Colorado State University in 2018 with excellent straw strength and excellent irrigated yield potential. Monarch has very good stripe rust resistance and quality and very low polyphenol oxidase (PPO) activity. PVP 201900410.
9. **‘Snowmass 2.0’**, a hard white winter wheat variety released by Colorado State University in 2018, with high yield potential and protein content under dryland and irrigated environments. PVP 201900411.
10. **‘Whistler’**, a hard red winter wheat variety released by Colorado State University with late late-maturity and taller stature. Whistler has excellent resistance to powdery mildew, stripe and stem rust populations in the central plains, while maintaining solid resistance to WSMV and SBMV. PVP 201900412.
11. **‘CO14A055-258’** (AF28/Byrd/3/AF10/2*Byrd), a new high-yielding CoAXium wheat that was approved for release in summer 2020. Variety name pending, PVP not yet submitted.
12. **‘OK Corral’** (PVP 202000252 PI 693783) is released as a beardless (awnless) high-quality HRW variety developed by the Oklahoma Agricultural Experimental Station that can be used for all purposes of wheat production, i.e., from silage/hay, or graze-out or dual-purpose, or grain production only. The variety has the potentially unique source of Hessian fly resistance.
13. **‘MN-Torgy’** is a hard red spring wheat variety developed by the University of Minnesota wheat breeding program and released in 2020. MN-Torgy has a balance of high grain yield and grain protein content and is moderately resistant to important diseases including Fusarium head blight and bacterial leaf streak.
14. **‘SD Andes’** (9/2020) is hard red winter wheat cultivar developed by the South Dakota Agricultural Experimental Station adapted to the eastern half of South Dakota. It has excellent straw strength and winter hardiness with medium height and late maturity. ‘SD Andes’ had good yielding potential with average protein and test weight and acceptable end-use quality. It is moderate resistant-resistant (MR-R) to stripe rust.
15. **‘AR06146E-1-4’** (PVP application pending) is a common wheat variety released by the Board of Trustees of the University of Arkansas from the University of Arkansas in 2020.
16. **‘KS Hatchett’** (PVP pending) is a hard red winter wheat cultivar developed by Kansas State University for central Kansas. It has excellent yield potential and good test weight. It has durable resistance to leaf rust.
17. **‘KS Hamilton’** (PVP pending) is a hard red winter wheat cultivar developed by Kansas State University for western Kansas. It has very competitive yield potential. It has good resistances to wheat streak-mosaic virus, stem rust, soilborne mosaic virus, and Hessian fly.

18. **'Hedge CL+'** (PVP pending) is a spring club wheat variety released in 2020 by WSU with two-gene resistance to Imazamox. It is broadly adapted with excellent resistance to stripe rust, very good yield, excellent test weight, and excellent soft white club wheat quality.
19. **'MI160898'** (PVP pending) is a new soft red winter wheat variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential and excellent milling and baking quality. DON mycotoxin levels and visual FHB index are very low in MI16R0898 conferred by the *Fhb1* gene. MI16R0898 is has excellent resistance to Stagonospora Leaf Blotch due in part to the absence of the ToxA receptor *Tsn1*. Soilborne Mosaic Virus resistance in MI16R0898 is conferred by the *Sbm1* gene. .
20. **'MI14W0190'** (PVP pending) is a new soft white winter wheat variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential and excellent milling and baking quality. Fusarium head blight resistance in MI14W0190 is due in part to the *Fhb1* resistance gene. MI14W0190 also has excellent resistance to Stripe Rust.
21. **'MI16W0133'** (PVP pending) is a new soft white winter wheat variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential (top 10% of commercial wheat varieties) and excellent milling and baking quality. MI16W0133 has excellent resistance to Stagonospora Leaf Blotch due to the absence of the ToxA receptor *Tsn1*. The *Sbm1* gene confers resistance to Soil-borne Mosaic Virus.
22. **'MI16W0528'** is a new soft white winter wheat variety developed by Michigan State University Wheat Breeding and Genetics. This variety is ideal for production in Michigan with high yield potential and excellent milling and baking quality. In 2019, grain yield for MI16W0528 ranked #1 out of 39 entries in the Uniform Eastern Soft White Winter Wheat Nursery tested in Richville, MI and New Haven, IN. MI16W0528 is moderately resistant to FHB and is resistant to Soil-borne Mosaic Virus due to *Sbm1*.

2020 PVP that were Pending in 2019

1. **'MN-Washburn'** (PVP 202000190, submitted February 28, 2020) is a hard red spring variety released by the UMN wheat-breeding program that has competitive grain yield and good lodging resistance. MN-Washburn is resistant to prevalent races of leaf and stripe rust and is moderately resistant to Fusarium head blight and bacterial leaf streak.
2. **'UC-Amarillo'** (PVP 202000013, submitted October 23, 2019) is a hard white spring variety released by the UC Davis wheat breeding program, which has a unique yellow flower, obtained by the introgression of a functional *PSY1* gene by marker assisted selection.
3. **'Dagmar'** (PVP 201900306, submitted 3/9/2020, Montana State University) is a solid-stemmed hard red spring wheat intended for acreage infested with the wheat stem sawfly. Dagmar has shown excellent dryland yield potential and high gluten strength.
4. **'Winner'** (PVP 202000357, submitted 08/11/2020) is a hard red winter wheat cultivar developed by the South Dakota Agricultural Experimental Station with unusually broad adaptation to the eastern half of the Northern Great Plains. 'Winner' has medium height and medium maturity with higher yield potential, good baking quality, and moderate resistance to stem rust.

5. **‘Draper’** (PVP 202000356, submitted 08/11/2020) is a hard red winter wheat cultivar developed by the South Dakota Agricultural Experimental Station with a limited target region, specifically western South Dakota. ‘Draper’ has improved yield potential with average test weight, grain protein, and good milling and baking quality. It is resistant to soilborne mosaic virus.
6. **‘FourOsix’** (PVP 201900053, submitted 12/19/2018). FourOsix is a hard red winter wheat released by Montana State University.
7. **‘Ray’** (PVP 201900058, submitted 01/07/2019). Ray is a hard red forage winter wheat released by Montana State University.
8. **‘MTF1435’** (PVP 201900073, submitted 01/09/2019). MTF1435 is a hard red forage winter wheat released by Montana State University.
9. **‘Bobcat’** (PVP 202000177, submitted 02/03/2020). Bobcat is a hard red winter wheat released by Montana State University.
10. **‘Flathead’** (PVP 202000202, submitted 03/09/2020) hard red winter wheat released by Montana State University.
11. **‘StandClear CLP’** (PVP 202000183, submitted 02/07/2020). StandClear CLP is a hard red winter wheat released by Montana State University.
12. **‘Battle AX’** (PVP 201900406, submitted 9/9/19, CO15A018), a hard red winter wheat released by Colorado State University and marketed by MonTech in Montana.
13. **‘AP18 AX’** (PVP 2020000351, submitted 5/28/20, CO14A136), a hard red winter wheat released by Colorado State University and marketed by Agripro-Syngenta.
14. **‘Stingray CL+’** (PVP 201900290, submitted 8/13/19) is a soft white winter wheat cultivar released by WSU with two-gene resistance to Imazamox. It also carries the *Pch1* gene and *Yr17* gene for disease resistance. Stingray CL+ has the *Rht-B1b* dwarfing allele and carries the *Ax1+Ax2** alleles as *GluA1* and the *Dx2+Dy12* alleles at *GluD1*. It is broadly adapted across the Pacific Northwest and has very good end-use quality.
15. **‘Scorpio’** (PVP 202000261, submitted 5/4/20) is a hard red winter wheat released by WSU for its excellent tolerance to low pH soils. This line has very good strip rust resistance, and carries the resistance gene *Yr17* among other unknown sources. Scorpio carries the *Rht-B1b* allele for dwarfing and the *Dx5+Dy10* alleles at *Glu-D1*. Scorpio does exceptionally well in no-till production systems.
16. **‘Devote’** (PVP 202000262, submitted 5/4/20) is a soft white winter wheat released by WSU for production in <12” rainfall zones of Washington. This line has excellent disease resistance, as it carries resistance genes *Pch1*, *Yr17*, and *Lr68*. It is also tolerant to snow mold and Fusarium crown rot and has very good cold tolerance and end-use quality.
17. **‘Purl’** (PVP 201900302, submitted 7/29/19) is a soft white winter wheat variety targeted to the high rainfall production zones of Washington and Northern Idaho. This line has very high test-weight and has the second highest yield average over three years. Purl combines excellent abiotic and biotic stress resistance, being resistant to stripe rust, eyespot foot rot, cereal cyst nematodes, low pH soils, and cold temperatures. The line has good end-use quality for domestic and export markets.

2020 Germplasm

Sr60 introgression. PI 689563. The *Sr60*-resistant haplotype found in *T. monococcum* is not present in polyploid wheat. We introgressed Sr60 into hexaploid wheat using marker assisted selection and developed a diagnostic molecular marker to accelerate its deployment and pyramiding with other resistance genes.

***Glu-B1x* mutant:** PI 692251, ***Glu-B1y* mutant:** PI 692253 and ***Glu-B1x Glu-B1y* double mutant:** PI 692252. Individual loss-of-function mutants of *Glu-B1x* ($\Delta Bx6$) and *Glu-B1y* ($\Delta By8$) were associated with significant reductions in gluten strength compared to the wildtype, with stronger effects in the ΔBxy double mutant.

2020 Populations

1. Two previously reported DHL mapping populations (UI Platinum x SY Capstone and UI Platinum x LCS Star) generated under support of WheatCAP were deposited in NSGC in the spring of 2020.
2. University of Idaho developed two EMS populations, one from UI Brundage and another from UI Platinum. The two EMS populations will be used in the functional analysis for the identified QTLs.
3. A spring wheat NAM population, consisting of 852 RILs from 10 stem rust resistant sources, all crossed with susceptible line LMPG-6, were deposited in the NSGC and published in the *Journal of Plant Registrations*. The 10 stem rust resistance sources, all with adult plant resistance, consist of 9 Kenyan cultivars and one Minnesota cultivar
4. Wheat D-Genome Nested Association Mapping (NAM) population registered in 2020 and published in the *Journal of Plant Registrations* by Eric Olson (Michigan State University).