

CSU WHEAT BREEDING PROGRAM UPDATE

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New Cultivars, Experimental Lines

- New Cultivar Release – ‘Langin’ (CO11D446)
 - Background
 - General characteristics
 - Yield trial data
 - Quality data
- Foundation Seed increases 2017
- Breeder Seed increases 2017
- CWRF Royalty Expenditures – FY 2016-17



Langin Hard Red Winter Wheat

- Parentage – CO050270/Byrd
 - CO050270: CSU experimental line (Hatcher/NW97S295)
 - Byrd: CSU release (2011)
- Selection and testing history
 - Cross made in 2009, double haploid made 2010
 - Preliminary yield trial 2012
 - CSU Elite Trial 2013-2016
 - Regional cooperative breeder trial (SRPN) 2014-2015
 - UVPT, IVPT 2014-2016 (tested as CO11D446)
- Seed increase and purification
 - Headrow purification (Yuma AZ 2014)
 - Breeder seed increase (Fort Collins 2015)
 - Foundation seed increase (Yuma AZ 2016)



Table 1. Best linear unbiased predictors (BLUPs) for grain yield (bu/acre) and test weight (lb/bu) for CO11D446 and other entries in an unreplicated yield trial at Fort Collins in 2012. CO11D446 and check entries (Byrd, Avery, Hatcher, Bill Brown) are highlighted in **bold**. BLUPs were derived via spatial analysis using multiple replications of a repeated check (Byrd) throughout the nursery.

Entry	Pedigree	Yield	Test Weight
Byrd	TAM 112/CO970547-7	75.1	60.5
CO11D182	TAM 112/Byrd	73.8	61.9
Avery	TAM 112/Byrd	72.6	60.9
CO11D203	TAM 112/Byrd	70.4	59.9
CO11D446	CO050270/Byrd	70.3	60.6
CO11D149	Ripper/Byrd	69.8	58.5
CO11D450	CO050270/Byrd	69.6	59.5
CO11D458	CO050270/Byrd	69.2	61.0
CO11D307	CO050173/CO050322	69.2	60.6
CO11D416	CO050270/Byrd	68.8	60.6
CO11D195	TAM 112/Byrd	68.8	61.4
CO11D187	TAM 112/Byrd	67.7	60.8
CO11D280	CO050173/CO050322	67.2	61.9
CO11D013	Bill Brown/Byrd	67.0	61.7
CO11D054	Bill Brown/Byrd	67.0	61.6
CO11D301	CO050173/CO050322	66.2	61.7
CO11D015	Bill Brown/Byrd	66.1	58.1
CO11D409	CO050270/Hatcher	66.0	60.4
CO11D055	Bill Brown/Byrd	65.5	61.7
CO11D302	CO050173/CO050322	65.3	60.4
CO11D345	CO050173/CO050322	65.3	61.5
CO11D346	CO050173/CO050322	65.2	61.5
Hatcher	Yuma/PI 372129//TAM-200/3/4*Yuma/4/KS91H184/Vista	65.1	60.7
CO11D217	CO050173/CO050322	65.0	61.4
CO11D152	Ripper/Byrd	65.0	58.7

Table 2. Grain yield (bu/acre) and test weight (lb/bushel) summary of CO11D446 and other entries in the CSU Elite Trial from 2013-2016. Data are ranked by the three-year average (2014-2016) over 28 dryland locations in Colorado. Values are best-linear unbiased predictors (BLUPs) from spatial analyses of yield trial data.

					Multi-Year Averages								
					2 Yr	3 Yr	3 Yr	3 YR NE	3 YR SE	3 YR Irrig	3 YR	4 Yr	4 Yr
Entry	2013	2014	2015	2016	Yield	Yield	TestWt	CO	CO	CO-NE	Western KS	Yield	TestWt
Antero	33.6	67.0	68.7	80.6	75.3	72.4	58.8	76.4	60.3	93.3	67.3	64.6	58.8
CO11D446	33.3	65.7	67.7	82.3	75.8	72.2	57.7	75.8	61.4	90.2	68.1	64.4	57.7
Byrd	33.3	65.5	65.7	79.8	73.6	70.7	58.5	74.0	60.7	86.0	54.8	63.2	58.4
Denali	34.1	65.7	66.6	78.5	73.2	70.5	58.9	74.5	58.6	91.0	59.1	63.2	59.0
Avery	34.2	67.5	64.6	78.1	72.1	70.5	58.0	73.6	61.0	88.1	52.3	63.2	58.1
WB-Grainfield		62.1	62.5	81.7	73.1	69.2	58.5	72.4	59.7	92.4	66.8		
LCS Mint	34.8	63.5	59.0	78.6	69.9	67.6	59.0	70.3	59.5	94.2	55.9	61.0	59.1
Hatcher	32.7	64.1	57.0	79.5	69.5	67.6	57.9	70.2	59.8	82.7	59.3	60.6	57.9
Sunshine	33.3	62.0	61.2	78.2	70.6	67.6	58.2	71.4	56.0	84.4	58.7	60.7	58.1
Snowmass	31.4	60.7	63.8	76.1	70.6	67.1	58.3	70.0	58.3	87.4	50.6	59.9	58.1
Brawl CL Plus	33.9	61.2	56.9	76.0	67.5	65.3	58.7	67.9	57.4	82.8	58.9	59.0	58.8
Average	33.5	64.1	63.1	79.0	71.9	69.1	58.4	72.4	59.3	88.4	59.2	62.0	58.4
Locations	7	10	8	10	18	28	28	21	7	6	6	35	35



Table 6. Grain yield (bu/acre) and test weight (lb/bu) summary of CO11D446 and other entries in the dryland Uniform Variety Performance Trial (UVPT) from 2014 to 2016. Data are ranked by the two-year yield average across 17 trial locations.

Entry				<u>Two Year Averages</u>			Test Weight	Three Year Avg
	2014 Yield	2015 Yield	2016 Yield	All Yield	Northeast Yield	Southeast Yield		
Joe		81.3	81.7	81.5	86.6	72.2	59.5	
Antero	62.3	76.7	86.2	81.2	84.0	76.0	57.8	74.6
SY Monument	56.7	74.1	78.1	76.0	81.5	65.8	58.5	69.3
Oakley CL	58.0	72.2	78.8	75.3	79.2	68.0	58.0	69.3
CO11D446	58.9	65.2	85.4	74.7	73.1	77.6	59.0	69.2
TAM 114		68.1	80.7	74.0	78.3	66.2	59.9	
WB-Grainfield	54.7	66.6	81.5	73.6	75.9	69.3	59.2	67.0
Denali	59.2	67.4	79.3	73.0	77.1	65.4	59.1	68.2
Ruth		69.3	76.8	72.8	77.9	63.6	60.1	
LCS Mint	55.4	64.5	80.5	72.1	73.4	69.7	58.6	66.3
Avery	64.1	61.9	82.4	71.5	71.3	71.9	58.0	69.0
Winterhawk	55.5	64.6	78.4	71.1	74.8	64.3	59.1	65.7
Sunshine	56.4	61.2	81.6	70.8	73.5	66.0	56.7	65.8
Hatcher	57.2	57.8	82.6	69.4	69.2	69.8	57.0	65.2
Cowboy	60.2	59.9	79.8	69.3	71.3	65.5	56.5	66.1
Byrd	60.4	59.7	80.0	69.3	68.1	71.4	58.7	66.2
SY Wolf		63.2	74.9	68.7	72.9	61.0	56.4	
KanMark	53.3	61.3	76.5	68.5	70.8	64.1	58.5	63.2
TAM 204		61.4	74.5	67.6	67.9	66.9	55.1	
Settler CL	58.7	57.9	76.8	66.8	68.5	63.7	56.8	64.0
Snowmass	56.4	59.0	75.4	66.8	67.9	64.7	58.0	63.2
Brawl CL Plus	55.4	51.7	76.5	63.4	63.3	63.4	58.1	60.6
MTS1024		51.9	70.5	60.6	64.7	53.1	54.5	
Ripper	56.5	44.8	76.0	59.5	58.0	62.2	55.7	58.5
Akron	54.8	48.3	71.7	59.3	57.8	62.1	56.0	57.7
Prairie Red	54.5	45.8	69.0	56.7	56.2	57.6	56.7	55.9
Average	57.4	62.1	78.3	69.7	71.7	66.2	57.7	65.3
Locations	9	9	8	17	11	6	17	26



Table 7. Grain yield (bu/acre) and test weight (lb/bushel) summary of **CO11D446** and other entries in the CSU Irrigated Variety Performance Trial (IVPT) from 2014 to 2016. Data are ranked by the average yield across the Haxtun location. No data were available from the Rocky Fort Trial in 2014 or 2015.

Entry	Fort Collins (2014-16)		Haxtun (2014-16)		Rocky Ford (2016)	
	Yield	Test Weight	Yield	Test Weight	Yield	Test Weight
WB-Cedar	83.1	56.5	102.3	59.8	101.3	59.2
CO11D446	85.0	56.9	98.1	59.6	98.8	58.2
SY Wolf	93.8	58.3	97.1	55.5	85.7	55.8
Sunshine	72.4	55.8	96.0	56.1	111.0	55.5
Denali	101.1	59.8	95.7	59.5	101.8	58.1
Antero	91.1	56.8	93.0	57.3	98.5	56.9
KanMark	88.0	57.7	91.7	57.9	95.0	58.5
Oakley CL	84.9	57.3	89.8	55.6	88.9	59.0
Brawl CL Plus	83.5	58.3	89.4	58.3	97.1	59.6
Byrd	88.0	57.5	89.1	58.6	95.4	59.9
Avery	91.6	57.7	83.8	58.2	105.1	59.1
Yuma	77.1	56.0	83.4	57.4	90.2	58.5
Thunder CL	91.9	59.3	82.8	56.2	91.4	58.0
Cowboy	90.3	58.5	82.6	56.9	99.6	55.0
Hatcher	83.6	56.6	80.8	57.5	86.0	57.2
Average	87.0	57.5	90.4	57.6	96.4	57.9
Years	3	3	3	3	1	1

Figure 1. Entry-site mean yield regression of CO11D446 and Byrd from 61 replicated dryland trials (UVPT and CSU Elite) in eastern Colorado (2013-2016).

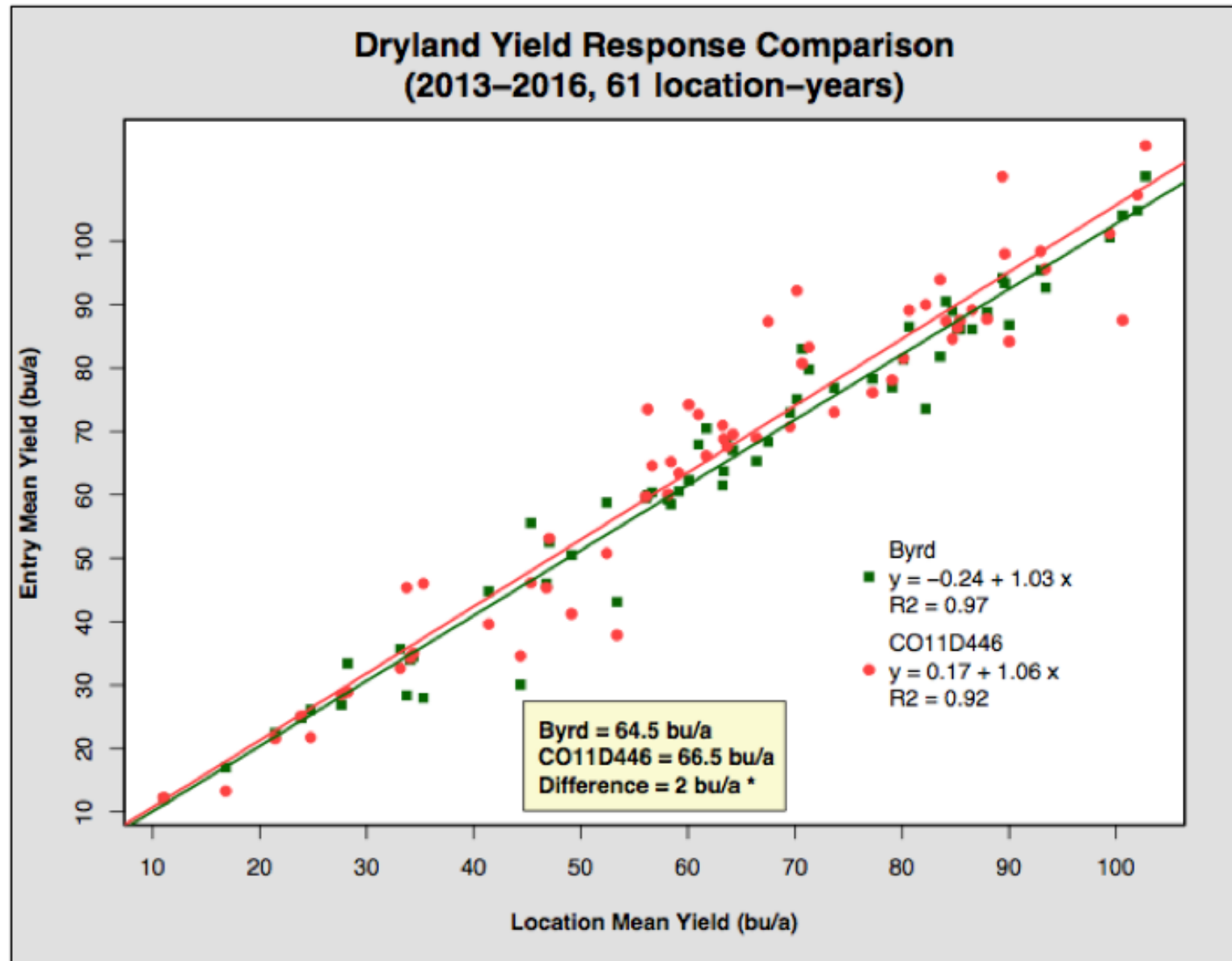


Table 8. Milling and bread baking characteristics of **CO11D446**, Byrd, Avery, and Denali across multiple individual-location quality evaluations between 2013 and 2015.

Trait (unit of measurement)	Samples	CO11D446	Byrd	Avery	Denali
SKCS kernel weight (mg) †	23	28.7	27.8 ns	28.9 ns	30.4 *
SKCS kernel diameter (mm)	23	2.52	2.53 ns	2.59 *	2.60 *
SKCS kernel hardness (score)	23	59.3	60.5 ns	60.4 ns	58.6 ns
Test weight (lb/bu)	24	57.4	57.5 ns	57.3 ns	59.1 *
NIR wheat ash (%)	31	1.43	1.47 ns	1.42 ns	1.49 *
Total flour extraction (%)	24	72.3	73.6 *	72.0 ns	71.4 *
Break flour extraction (%)	24	48.6	51.6 *	49.0 ns	49.4 *
Wheat protein content (%)	41	12.0	12.3 *	12.4 *	12.1 ns
Mixograph mixing time (min)	26	6.1	5.3 *	5.0 *	3.2 *
Mixograph tolerance (score) ‡	26	4.9	4.6 *	4.2 *	2.5 *
Bake mix time (min)	24	6.0	5.2 *	4.9 *	3.1 *
Bake absorption (%)	24	62.7	63.1 ns	62.0 ns	61.0 *
Loaf volume (cc)	24	1026	1063 *	1005 ns	815 *
Crumb grain (score) ‡	24	3.7	3.8 ns	3.8 ns	2.5 *
Milling Rating		Good	Good	Very Good	Good
Baking Rating		Good	Good	Good	Acceptable

† Single kernel characterization system (SKCS).

‡ Mixograph tolerance and crumb grain scores: 0=very poor, 6=very good.

* Value significantly different from CO11D446 based on a paired t-test at the 5% probability level; ns=not significant.

Langin Hard Red Winter Wheat

Key Advantages

- Higher dryland grain yield relative to Byrd.
- Equivalent drought stress tolerance and greater yield responsiveness at higher yield levels compared to Byrd.
- Excellent winterhardiness and good test weight.
- Stripe rust resistance (average score=2.5), similar to Antero (2.6), better than Hatcher (4.9), Avery (6.1), Byrd (6.3), Denali (7.3), Ripper (8.1), Akron (8.5).
- Resistance to prevalent biotypes of the wheat curl mite, the vector of wheat streak mosaic and other viruses. Byrd and Avery are also resistant.
- Resistance to the wheat soilborne mosaic virus-wheat spindle streak mosaic virus complex.
- Good milling and baking quality characteristics.



Langin Hard Red Winter Wheat

Key Disadvantages

- Early maturity (similar to Ripper) may lead to increased risk of spring freezes. Avoid planting this one too early.
- Susceptibility to both leaf and stem rust, similar to both Byrd and Avery.
- Marginal straw strength – slightly lower than Byrd (2016 avg scores – 6.0 vs. 7.5).
- Plant height – about 1” shorter than Hatcher.
- All sorts of things that will appear if and when it gets on significant acreage.





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HOT TOPICS



CSU Names New Wheat Variety After Ed Langin

Russ Baldwin | Sep 26, 2016 | Comments 0



Edward Langin

New Colorado State University Wheat Variety named in honor of former Southeast Colorado Agronomist and Champion of Agricultural Research, Edward "Ed" Langin.

By Kelly Roesch, SEA Extension Agronomist

Colorado State University wheat breeder Dr. Scott Haley and his team develop wheat varieties with two main objectives in mind: 1) yield and yield stability, which includes stress tolerance, agronomics and disease and insect resistance; and 2) end-use quality, or more specifically, milling, dough mixing and bread baking. Since 1973, the CSU wheat breeding program has released 39 new wheat varieties with the 2016 release of PlainsGold® Langin being the 39th.

- Edward J. Langin
(Jan 4 1924 - July 7 2006)
- CSU extension and AES agronomist
- Hired in April 1967 as Assistant Agronomist at SE Colorado Branch Experiment Station at Springfield.
- Helped to establish the Plainsman Agri-Search Foundation (1974).
- All around good guy.



New Cultivars, Experimental Lines

- New cultivar releases – ‘Langin’ (CO11D446)
 - Background
 - General characteristics
 - Yield trial data
 - Quality data
- Foundation seed increases 2017
- Breeder seed increases 2017
- CWRF royalty expenditures – FY 2016-17



Breeding Pipeline – Foundation Seed 2017

- Two QPE herbicide tolerant lines
 - CO14A058, CO14A065 – (AF28/Byrd)//(AF10/2*Byrd)
 - Yield statistically similar to Brawl CL Plus in 2016
 - Good quality, stripe rust reaction similar to Byrd
 - Two large Foundation Seed increases in 2017 (Fort Collins, Yuma AZ)
- “Snowmass-type” hard white
 - CO12D2011 – Denali/HV9W07-482W//Antero
 - Doubled haploid from first year of Ardent partnership
 - Yield similar to Antero, high test weight
 - Good stripe rust resistance, straw strength, pre-harvest sprouting tolerance, lower polyphenol oxidase (PPO)



Breeding Pipeline – Breeder Seed 2017

- Thirteen (13) QPE herbicide tolerant hard reds
 - All performed better than CO14A058/065 in 2016
 - Seed purification being done in Yuma AZ 2016-17
- Nine (9) "Snowmass-type" hard white lines
 - Key crossing parents – Snowmass, CO07W722-F5
 - Eight (8) are DH lines from 2nd year Ardent partnership
 - Good yield, test weight, stripe rust resistance, straw strength, pre-harvest sprouting tolerance
 - All have dough strength properties like Snowmass, a couple have higher water absorption like Snowmass
- Six (6) non-Clearfield, non-QPE hard red lines
- One (1) two-gene Clearfield 'Byrd'



CWRF Royalty Expenditures – FY 2016-17

Item	Amount
Doubled haploid lab (salaries, benefits, supplies)	\$120,000
Research associate I - field and lab support	\$44,000
Graduate student support (1 student, stipend+tuition)	\$17,500
2017 Yuma Arizona seed increases (QPE, HWW)	\$40,000
DNA marker lab supplies	\$15,000
Barcode adapters for 384-plex GBS	\$9,000
Plot combine maintenance/service	\$8,000
Planting envelope/harvest bag/stake printer	\$14,000
Total	\$267,500



Acknowledgements – Funding



Colorado Wheat
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Questions?