

# CSU Wheat Trial Results and Breeding Program Update

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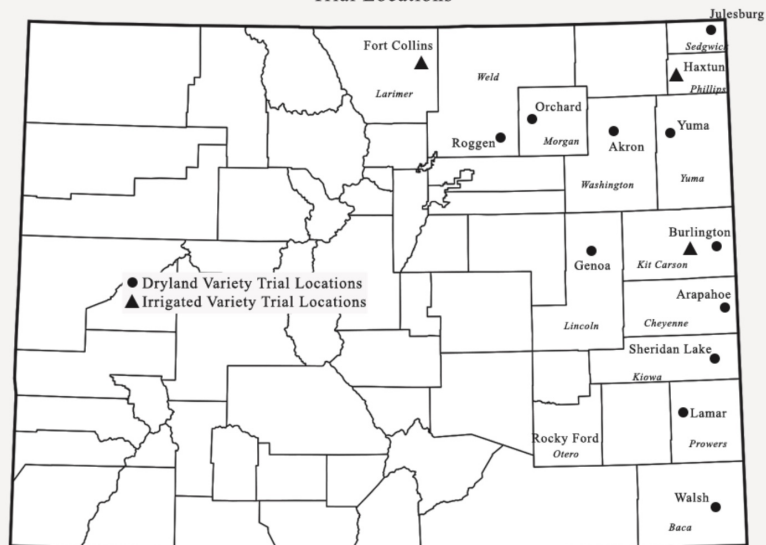


# Outline



- CSU Variety Trial Results
  - Dryland (UVPT) and Irrigated (IVPT) variety trials: 2017 multi-location summary, two-year and three year averages
  - Collaborative On-Farm Trial (COFT)
  - Variety selection strategies
- Wheat streak mosaic virus issues
  - Management approaches
  - Sources of resistance
  - Field resistance/susceptibility ratings from 2017
- CSU Wheat Breeding Program
  - New wheat variety releases (2017)
  - Potential future wheat variety releases (2018)

2017 UVPT (Dryland) and IVPT (Irrigated)  
Trial Locations



<http://csucrops.com>

Technical Report TR 17-4

# Agricultural Experiment Station

Colorado  
State  
University

College of Agricultural Sciences

Department of Soil & Crop Sciences

Extension

## Making Better Decisions



## 2017 Colorado Winter Wheat Variety Performance Trials

Crops  
Testing

<http://bit.ly/2w54m12>



# Summary of 2017 Dryland Winter Wheat Variety Performance Results

Variety <sup>b</sup>	2017 Individual Trial Yield <sup>a</sup>								2017 Multi-Location Average			
	Akron	Arapahoe	Burlington	Julesburg	Orchard	Roggen	Sheridan Lake	Yuma	Yield bu/ac	Yield % of avg	Test	
											Weight lb/bu	Height in
Langin	107.7	63.2	100.2	67.0	63.1	70.1	69.3	79.6	77.5	115%	60.0	31
Byrd	93.5	72.3	98.8	67.1	51.5	70.5	73.1	79.9	75.8	112%	60.1	34
Avery	88.6	69.0	91.8	65.4	56.3	71.4	75.8	70.6	73.6	109%	60.1	35
Antero	98.0	66.6	93.9	64.6	52.5	73.1	76.5	57.7	72.8	108%	59.6	34
Joe	107.1	55.0	91.7	62.6	47.1	66.9	70.0	78.2	72.3	107%	59.8	35
Snowmass	90.3	62.4	79.2	68.3	52.2	66.2	71.8	73.5	70.5	104%	59.7	35
Sunshine	99.8	54.6	95.8	59.6	53.8	64.1	62.0	57.1	68.4	101%	58.9	32
Oakley CL	96.0	55.6	80.9	61.2	42.4	65.0	72.8	70.4	68.0	101%	59.7	34
WB-Grainfield	100.4	54.8	90.5	59.7	46.7	62.0	66.7	62.4	67.9	101%	60.4	33
LCS Mint	88.5	55.2	86.5	59.7	43.6	66.6	71.0	67.6	67.3	100%	60.3	34
Tatanka	92.0	54.3	91.4	57.7	48.7	65.3	62.0	63.7	66.9	99%	59.1	31
SY Rugged	95.6	49.3	82.9	61.1	45.4	67.9	64.3	61.3	66.0	98%	58.8	30
Denali	82.7	49.8	88.5	55.9	43.6	65.1	67.1	68.3	65.1	96%	59.1	34
SY Wolf	92.1	54.3	82.2	53.4	41.3	68.6	66.2	60.9	64.9	96%	59.3	32
Hatcher	91.8	60.9	76.8	50.7	36.7	62.8	61.1	66.0	63.4	94%	58.9	32
Ruth	94.9	53.2	84.6	51.9	42.1	61.0	57.3	60.0	63.1	94%	60.2	33
Brawl CL Plus	85.9	53.6	85.7	56.1	42.7	61.3	59.4	60.3	63.1	93%	59.9	32
WB4462	87.4	47.0	86.0	58.4	46.9	64.2	60.4	54.4	63.1	93%	60.3	34
SY Monument	88.6	49.0	81.8	53.1	47.9	60.6	66.4	56.4	63.0	93%	58.4	31
Larry	90.3	48.8	89.3	56.6	40.1	58.3	64.7	54.6	62.8	93%	59.3	33
Winterhawk	81.1	46.2	83.0	57.6	45.7	65.2	60.8	55.6	61.9	92%	59.3	35
Cowboy	80.8	53.0	76.6	50.0	39.0	62.2	68.7	62.5	61.6	91%	57.3	33
TAM 114	84.4	53.4	78.2	54.5	43.3	56.4	57.9	61.6	61.2	91%	59.9	31
LCS Chrome	85.9	47.5	76.5	52.8	39.3	61.7	60.6	55.4	60.0	89%	59.2	32
Settler CL	80.6	53.2	81.8	43.5	42.0	62.9	60.9	49.1	59.3	88%	58.3	31
WB4721	85.2	44.2	83.2	48.8	43.4	59.1	60.2	45.7	58.7	87%	60.4	31
Loma	54.6	33.7	33.4	22.1	25.0	36.5	41.2	33.4	35.0	52%	55.7	31





**Summary of 2-Yr (2016 and 2017) Dryland  
Variety Performance Results**

Variety <sup>b</sup>	Brand/Source	Market Class <sup>c</sup>	2-Year Average <sup>a</sup>		Test Weight	Plant Height
			Yield bu/ac	Yield % trial average		
Langin	PlainsGold	HRW	81.5	112%	59.5	31
Antero	PlainsGold	<b>HWW</b>	79.5	110%	58.4	34
Avery	PlainsGold	HRW	78.0	108%	59.4	35
Byrd	PlainsGold	HRW	77.9	107%	59.7	34
CO12D2011	Colorado State University exp.	<b>HWW</b>	77.6	107%	60.7	34
Joe	Kansas Wheat Alliance	<b>HWW</b>	77.0	106%	59.2	35
Sunshine	PlainsGold	<b>HWW</b>	75.0	103%	57.7	33
WB-Grainfield	WestBred Monsanto	HRW	74.7	103%	59.9	34
LCS Mint	Limagrain	HRW	73.9	102%	59.9	34
Oakley CL	Kansas Wheat Alliance	HRW	73.4	101%	59.0	33
Hatcher	PlainsGold	HRW	73.0	101%	58.3	32
Snowmass	PlainsGold	<b>HWW</b>	73.0	101%	59.3	34
Denali	PlainsGold	HRW	72.2	100%	59.3	35
TAM 114	AGSECO	HRW	70.9	98%	60.2	32
Cowboy	Crop Res. Foundation of WY	HRW	70.7	97%	57.1	33
SY Monument	AgriPro Syngenta	HRW	70.5	97%	58.3	32
Winterhawk	WestBred Monsanto	HRW	70.1	97%	59.4	35
Ruth	Husker Genetics	HRW	70.0	96%	60.3	34
SY Wolf	AgriPro Syngenta	HRW	69.9	96%	57.7	32
Brawl CL Plus	PlainsGold	HRW	69.8	96%	58.9	33
WB4721	WestBred Monsanto	HRW	68.4	94%	60.4	32
Settler CL	Husker Genetics	HRW	68.1	94%	58.0	32
LCS Chrome	Limagrain	HRW	67.8	93%	59.2	32
CO14A065	Colorado State University exp.	HRW	66.2	91%	55.7	32
CO14A058	Colorado State University exp.	HRW	64.7	89%	55.8	33
<b>Average</b>			<b>72.6</b>		<b>58.8</b>	<b>33</b>



**Summary of 3-Yr (2015, 2016, and 2017)  
Dryland Variety Performance Results**

Variety <sup>b</sup>	Brand/Source	Market Class <sup>c</sup>	3-Year Average <sup>a</sup>			
			Yield bu/ac	Yield % trial average	Test Weight lb/bu	Plant Height in
Joe	Kansas Wheat Alliance	<b>HWW</b>	78.6	112%	59.6	34
Antero	PlainsGold	<b>HWW</b>	78.5	111%	58.4	34
Langin	PlainsGold	HRW	75.6	107%	59.3	31
Oakley CL	Kansas Wheat Alliance	HRW	73.0	104%	58.7	32
Avery	PlainsGold	HRW	72.2	102%	58.8	35
SY Monument	AgriPro Syngenta	HRW	71.8	102%	58.4	32
WB-Grainfield	WestBred Monsanto	HRW	71.8	102%	59.6	33
Byrd	PlainsGold	HRW	71.4	101%	59.2	34
LCS Mint	Limagrain	HRW	70.5	100%	59.2	34
Denali	PlainsGold	HRW	70.5	100%	59.1	35
Sunshine	PlainsGold	<b>HWW</b>	70.0	99%	57.5	32
TAM 114	AGSECO	HRW	69.9	99%	59.9	33
Ruth	Husker Genetics	HRW	69.7	99%	60.1	34
Winterhawk	WestBred Monsanto	HRW	68.1	97%	59.2	34
Snowmass	PlainsGold	<b>HWW</b>	68.0	96%	58.6	34
Hatcher	PlainsGold	HRW	67.5	96%	57.7	32
SY Wolf	AgriPro Syngenta	HRW	67.5	96%	57.4	32
Cowboy	Crop Res. Foundation of WY	HRW	66.8	95%	56.8	33
Settler CL	Husker Genetics	HRW	64.4	91%	57.4	32
Brawl CL Plus	PlainsGold	HRW	63.3	90%	58.7	33
<b>Average</b>			<b>70.5</b>		<b>58.7</b>	<b>33</b>



## Summary of 2017 Irrigated Variety Performance Results

Variety <sup>b</sup>	<u>2017 Individual Trial Yield<sup>a</sup></u>			<u>2017 Multi-Location Average</u>			
	Burlington	Fort	Haxtun	Yield	Yield	Test	
		Collins				Weight	Lodging
		bu/ac		bu/ac	% of avg	lb/bu	scale (1-9) <sup>c</sup>
SY Wolf	115.9	102.3	74.1	97.4	104%	57.0	3
WB4303	108.0	108.2	72.0	96.1	103%	55.3	2
Denali	106.8	105.0	74.6	95.5	102%	58.5	4
Byrd	110.1	96.2	78.8	95.1	102%	58.2	5
Langin	114.4	87.8	82.4	94.8	102%	57.9	5
KanMark	111.6	103.0	68.5	94.4	101%	58.0	3
Cowboy	109.4	103.7	67.8	93.6	100%	55.1	8
SY Sunrise	110.9	94.3	73.1	92.8	99%	58.9	5
Brawl CL Plus	113.3	83.5	75.4	90.7	97%	58.1	2
Avery	98.0	91.4	79.9	89.8	96%	57.0	8
Larry	110.4	96.0	60.7	89.0	95%	57.1	4
Sunshine	116.1	74.4	74.1	88.2	95%	56.2	5
Thunder CL	109.5	85.8	57.9	84.4	90%	57.6	1
WB-Grainfield	106.2	78.1	67.1	83.8	90%	58.8	4
Antero	92.7	77.8	79.8	83.4	89%	58.0	7
WB4458	99.4	88.0	61.4	83.0	89%	56.3	2





**Summary of 2-Yr (2016 and 2017) Irrigated  
Variety Performance Results**

Variety <sup>b</sup>	Brand/Source	Market Class <sup>c</sup>	2-Year Average <sup>a</sup>				
			Yield	Yield	Test Weight	Plant Height	Lodging
			bu/ac	% trial average	lb/bu	in	scale (1-9) <sup>d</sup>
Denali	PlainsGold	HRW	95.3	105%	58.4	40	4
SY Sunrise	AgriPro Syngenta	HRW	94.9	104%	59.3	35	3
CO12D2011	Colorado State University Exp.	<b>HWW</b>	93.9	103%	59.0	38	4
WB4303	WestBred Monsanto	HRW	93.6	103%	54.7	36	1
KanMark	Kansas Wheat Alliance	HRW	93.0	102%	57.1	33	2
SY Wolf	AgriPro Syngenta	HRW	92.9	102%	56.5	38	3
Langin	PlainsGold	HRW	92.6	102%	57.6	36	7
Brawl CL Plus	PlainsGold	HRW	92.5	102%	58.1	39	2
Byrd	PlainsGold	HRW	91.2	100%	57.8	37	6
Sunshine	PlainsGold	<b>HWW</b>	90.2	99%	54.7	36	5
WB4458	WestBred Monsanto	HRW	89.9	99%	57.1	37	2
Thunder CL	PlainsGold	<b>HWW</b>	89.1	98%	57.6	38	2
Avery	PlainsGold	HRW	87.0	96%	57.1	38	7
Cowboy	Crop Research Foundation of WY	HRW	86.3	95%	55.5	37	8
Antero	PlainsGold	<b>HWW</b>	82.8	91%	56.3	38	7
<b>Average</b>			<b>91.0</b>		<b>57.1</b>	<b>37</b>	<b>4</b>





**Colorado State University**  
EXTENSION

Summary of 3-Yr (2015, 2016, and 2017)

**Irrigated Variety Performance Results**

**Crops  
Testing**

www.csucrops.com

Variety <sup>b</sup>	Brand/Source	Market Class <sup>c</sup>	3-Year Average <sup>a</sup>				
			Yield	Yield	Test	Plant	Lodging
			bu/ac	% trial average	Weight lb/bu	Height in	
							scale (1-9) <sup>d</sup>
Denali	PlainsGold	HRW	92.5	108%	58.5	39	4
SY Sunrise	AgriPro Syngenta	HRW	91.2	106%	58.8	35	3
SY Wolf	AgriPro Syngenta	HRW	90.3	105%	56.3	37	3
Langin	PlainsGold	HRW	88.1	102%	57.5	36	6
KanMark	Kansas Wheat Alliance	HRW	86.4	101%	57.0	33	2
Byrd	PlainsGold	HRW	85.2	99%	57.4	37	6
Brawl CL Plus	PlainsGold	HRW	84.1	98%	57.7	37	2
Sunshine	PlainsGold	<b>HWW</b>	83.8	97%	55.0	35	5
Avery	PlainsGold	HRW	83.6	97%	56.9	38	7
Cowboy	Crop Research Foundation of WY	HRW	82.8	96%	55.7	36	8
Antero	PlainsGold	<b>HWW</b>	82.0	95%	56.3	38	7
Thunder CL	PlainsGold	<b>HWW</b>	81.2	95%	57.3	38	2
<b>Average</b>			<b>85.9</b>		<b>57.0</b>	<b>37</b>	<b>5</b>

## 2017 Collaborative On-Farm Test (COFT) Variety Performance Results

2017 Varieties (ranked left to right by highest yield)

County/Nearest Town	<u>Langin</u>			<u>Avery</u>			<u>Sunshine</u>			<u>Denali</u>			<u>COFT Average</u>		
	Yield <sup>a</sup>	Test Weight	Protein	Yield <sup>a</sup>	Test Weight	Protein	Yield <sup>a</sup>	Test Weight	Protein	Yield <sup>a</sup>	Test Weight	Protein	Yield <sup>a</sup>	Test Weight	Protein
	bu/ac	lb/bu	percent	bu/ac	lb/bu	percent	bu/ac	lb/bu	percent	bu/ac	lb/bu	percent	bu/ac	lb/bu	percent
Adams/Bennett N	62.2	60.6	9.2	56.0	59.8	8.9	51.5	58.2	10.0	51.2	59.9	9.7	55.2	59.6	9.5
Arapahoe/Deer Trail	17.0	59.9	10.6	14.6	55.8	10.9	17.7	57.8	10.7	17.2	57.6	10.9	16.6	57.8	10.8
Bent/Lamar	29.6	54.4	13.9	35.7	55.5	12.9	30.5	55.7	13.5	38.2	55.7	12.4	33.5	55.3	13.2
Cheyenne/Cheyenne Wells	89.9	60.8	10.2	86.4	61.7	9.5	74.0	61.0	12.2	78.6	60.1	10.8	82.3	60.9	10.7
Kiowa/Haswell	32.1	52.8	12.3	28.5	54.7	12.9	29.2	55.5	13.7	22.7	50.0	12.9	28.1	53.3	13.0
Kiowa/Towner	12.7	60.3	10.2	12.0	59.8	10.8	8.9	59.6	11.2	11.1	59.9	10.3	11.2	59.9	10.6
Kit Carson/Bethune	88.4	58.4	10.3	81.5	58.4	10.5	65.1	58.1	11.4	81.0	55.1	10.3	79.0	57.5	10.6
Kit Carson/Burlington N	92.7	57.7	12.5	87.7	55.4	10.8	65.0	52.9	15.8	43.3	50.6	15.0	72.2	54.2	13.5
Kit Carson/Stratton	102.1	55.8	10.8	88.2	54.5	10.8	89.5	55.9	10.3	90.5	54.5	11.0	92.6	55.2	10.7
Logan/Leroy	82.4	61.1	10.8	73.4	60.9	10.5	66.3	60.0	11.6	66.5	58.2	11.5	72.2	60.1	11.1
Morgan/Orchard	30.4	60.2	8.6	38.5	60.3	9.0	30.5	59.9	10.4	37.8	62.2	9.4	34.3	60.7	9.4
Phillips/Haxtun	84.4	57.6	9.4	82.4	57.5	9.8	82.1	58.2	9.9	78.9	58.9	10.5	82.0	58.1	9.9
Prowers/Granada	47.4	60.6	10.7	45.9	61.7	9.6	42.7	62.2	10.9	41.0	61.3	9.7	44.3	61.5	10.2
Prowers/Holly	44.4	58.9	12.2	37.8	55.9	12.0	40.9	59.6	12.7	34.1	56.6	12.5	39.3	57.8	12.3
Prowers/Lamar	67.4	62.0	10.6	61.5	62.3	10.4	57.6	61.1	11.8	60.5	60.9	11.0	61.8	61.6	10.9
Washington/Akron	81.2	60.7	9.9	70.3	60.9	10.9	80.2	61.2	11.0	69.6	60.1	9.8	75.3	60.7	10.4
Washington/Akron S	16.7	56.7	10.5	15.9	54.7	11.3	18.3	53.7	12.2	16.7	52.7	12.3	16.9	54.5	11.6
Washington/Anton	44.6	57.0	10.7	30.3	56.4	10.8	39.6	59.1	10.9	27.7	55.5	11.4	35.6	57.0	11.0
Washington/Central	60.0	60.0	10.7	54.3	58.8	10.2	56.2	57.6	10.3	48.5	57.2	11.5	54.8	58.4	10.7
Weld/Keenesburg	42.9	60.0	12.5	35.1	55.0	12.3	38.5	58.7	12.7	28.3	54.7	12.7	36.2	57.1	12.6
Weld/New Raymer	39.8	59.8	11.7	32.2	59.3	12.6	35.6	61.0	13.1	33.6	58.1	12.1	35.3	59.6	12.4
Weld/New Raymer SW	52.7	61.3	10.3	53.6	62.0	9.3	49.9	60.5	9.8	50.4	62.0	9.8	51.7	61.5	9.8
Weld/Roggen	68.7	64.2	8.7	77.9	62.9	8.6	69.5	64.9	9.4	68.1	63.5	9.4	71.1	63.9	9.0
Yuma/Yuma	75.8	60.3	8.2	58.4	61.3	8.1	58.5	62.1	8.8	61.3	62.1	8.2	63.5	61.5	8.3
<b>Average</b>	<b>56.9</b>	<b>59.2</b>	<b>10.6</b>	<b>52.4</b>	<b>58.6</b>	<b>10.6</b>	<b>49.9</b>	<b>58.9</b>	<b>11.4</b>	<b>48.2</b>	<b>57.8</b>	<b>11.0</b>	<b>51.9</b>	<b>58.6</b>	<b>10.9</b>

Yield Significance<sup>b</sup>

A

B

C

C

LSD ( $P < 0.30$ ) for yield = 1.8 bu/ac

LSD ( $P < 0.30$ ) for test weight = 0.4 lb/bu

<sup>a</sup>All yield and protein data are corrected to 12% moisture.

<sup>b</sup>Yield significance: varieties with different letters have yields that are significantly different from one another.



## Extension Agronomy

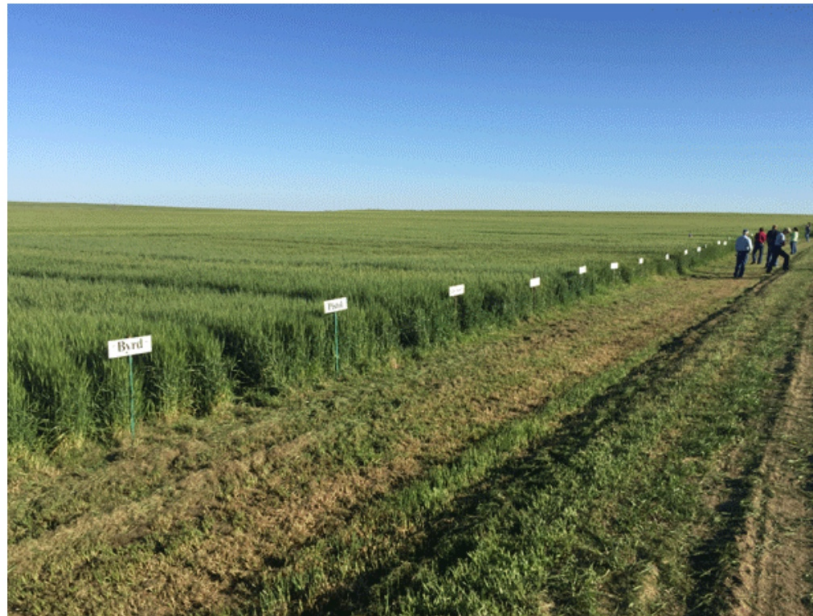
### eUpdate

Issue 646 August 11th, 2017

2. Controlling tall, thick... Next Article -->

### Factors to consider when selecting a wheat variety

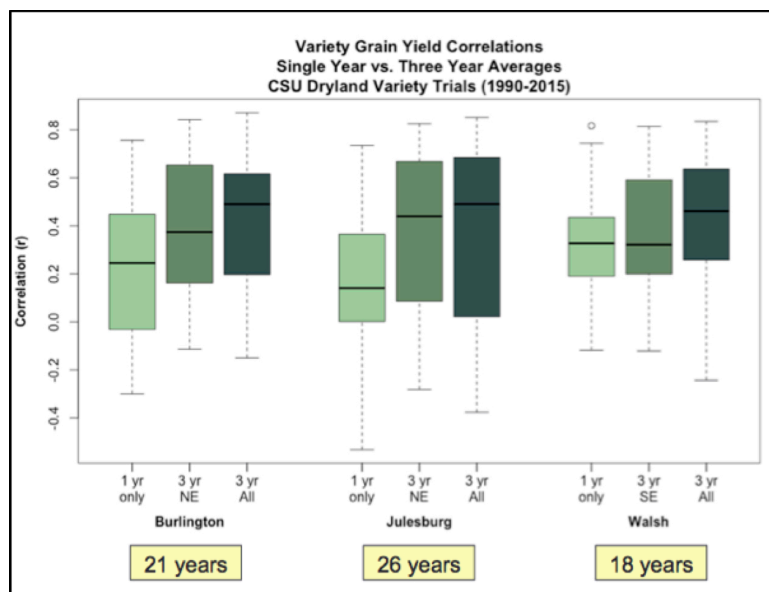
In recent years, wheat producers are faced with an increasing number of varieties from which to choose. One of the reasons behind having so many available varieties is that many public institutions and private companies are in the business of wheat breeding in the Plains: Colorado State University, Kansas State University, Oklahoma State University, Texas A&M University, University of Nebraska, AgriPro/Syngenta, Limagrain, and WestBred/Monsanto.



web - <http://ksu.ag/2uNZQz2>

# Variety Selection Strategies

- Select several varieties that are adapted to your region of the state.
  - In our case, this could be northeast and southeast Colorado, right?
  - I don't agree with this one bit!
  - We have clearly demonstrated that the best predictor of grain yield of a future trial is obtained by using data from all available trial locations and not data subsets by location, region, or year.



## Perspectives on Wheat Variety Trials and Wheat Variety Trial Data

2015 Making Better Decisions Report  
(2016 Field Days Edition)  
page 44

web - <http://bit.ly/2wepYbz>



# Variety Selection Strategies

- Narrow down the number of varieties in your list to a few solid candidates, considering:
  - Production system – dryland vs. irrigated (straw strength...)
  - Environmental stress tolerance – drought, heat, winterhardiness
  - Pest resistance – stripe rust, WSMV (wheat stem sawfly...)
  - Maturity – spread workload, reduce risk of spring freeze damage, reduce risk of heat stress at flowering or during grain filling
  - (Quality – not mentioned anywhere in the KSU document. Huh?)
- Resources – Colorado Wheat Variety Database
  - Available at [ramwheatdb.com](http://ramwheatdb.com), using smart-phone, tablet, or desktop
  - Variety characteristics: updated, searchable by name/characteristics
  - Multi-year summaries: multiple states/regions, 4-year summaries
  - Head-to-heads: multiple states/regions, sortable output, percent of trials where one variety is better, percent of trial wins for each variety, regression plot to compare variety responses

# Outline



- CSU Variety Trial Results
  - Dryland (UVPT) and Irrigated (IVPT) variety trials 2017, two-year and three year averages
  - Collaborative On-Farm Trial (COFT)
  - Variety selection strategies
- Wheat streak mosaic virus issues
  - Management approaches
  - Sources of resistance
  - Field resistance/susceptibility ratings from 2017
- CSU Wheat Breeding Program
  - New wheat variety releases (2017)
  - Potential future wheat variety releases (2018)

# Wheat Streak Mosaic

Department of Plant Pathology

MF3383

Wheat Disease

Wheat streak mosaic is one of the most economically devastating wheat diseases in Kansas and the Great Plains. The disease is most common in the western portion of the state, with sporadic outbreaks in central and eastern Kansas.

## Symptoms

Plants infected with the disease often have yellow leaves with contrasting green and yellow streaks

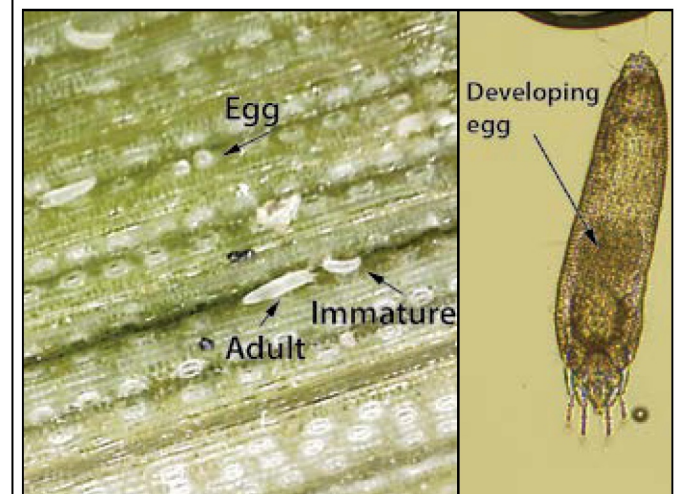
## Quick Facts

- Wheat streak mosaic causes a yellow discoloration of leaves. This discoloration is most intense near the leaf tip. Plants infected as seedlings are often stunted and have a reduced head size.
- Wheat streak mosaic can reduce yield by

Web  
[bit.ly/2wjkWDD](http://bit.ly/2wjkWDD)



*Figure 1. Wheat with symptoms of wheat streak mosaic. Infected plants often have bright yellow discoloration and are often smaller than healthy wheat. The diseased plants also may have a prostrate growth habit.*



*Figure 3. Wheat curl mites live in colonies on the upper surface of the leaf where the leaf's edges curl around them due to their feeding. Adult, immature, and egg stages magnified 220× (left). Close-up of a female wheat curl mite (smaller than 0.03 mm).*

# Wheat Curl Mite

- Primary role in virus transmission (*vector*)
  - Wheat streak mosaic virus (*WSMV*)
  - Wheat mosaic virus (*WMoV*, aka High Plains Virus)
  - Triticum mosaic virus (*TrMV*)
  - A single wheat curl mite can carry all three viruses at once and can simultaneously transmit them to the same wheat plant
  - A wheat plant carrying *WSMV* + others will typically show much more severe symptoms than a plant with *WSMV* alone
- Management – no available chemical options as with stripe rust!
  - Control volunteer to eliminate/reduce curl mite populations
  - Delayed planting to reduce curl mite infestation in wheat
  - Varietal tolerance or resistance



# Varietal Tolerance or Resistance

- Resistance to the wheat curl mite – “slim pickings”
  - Two common sources: chromosome 1A, chromosome 6D
  - TAM 112, TAM 204: both sources
  - Avery, Byrd, Langin: 6D source only
  - Resistance may not be 100% effective under very high curl mite pressure (as in western Kansas in 2017)
- Resistance to the viruses – “slimmer pickings”
  - Three available sources: *Wsm1*, *Wsm2*, *Wsm3*
  - *Wsm1* – effective against *WSMV+TrMV*: *Mace* (NE)
  - *Wsm2* – effective against *WSMV only*: *Oakley CL*, *Joe* (KWA)  
*Snowmass* (PG)
  - *Wsm3* – effective against *WSMV+TrmV*, not temp-sensitive

# Field Resistance and Susceptibility Ratings

## Data from Kirk Broders, CSU Plant Pathologist

### Description of Winter Wheat Varieties in Eastern Colorado Dryland and Irrigated Trials (2017)

Name, Class, and Pedigree	Origin	RWA*	HD	HT	SS	COL**	YR	LR	WSMV*	TW	MILL	BAKE	Comments
Antero Hard white winter KS01HW152-1/TAM 111	CSU 2012	S	5	7	8	5	2	7	5	5	4	6	CSU release (2012), marketed by PlainsGold. Medium height and maturity, good test weight, fair straw strength, good resistance to stripe rust. Moderate sprouting tolerance.
Avery Hard red winter TAM 112/Byrd	CSU 2015	S	6	7	7	5	6	7	3	4	4	3	CSU release (2015), marketed by PlainsGold. Doubled haploid-derived line, similar to Byrd with higher yield potential, larger kernels and slightly improved quality. Carries wheat curl mite resistance from TAM 112 parent. Moderately susceptible to stripe rust.
Brawl CL Plus Hard red winter Teal 11A/Above//CO99314	CSU 2011	S	2	6	3	9	5	5	7	4	4	3	CSU release (2011), marketed by PlainsGold. Two-gene Clearfield wheat. Excellent test weight, straw strength, milling and baking quality. Early maturity, medium height, long coleoptile. Intermediate reaction to both stripe rust and leaf rust.
Byrd Hard red winter TAM 112/CO970547-7	CSU 2011	S	4	6	7	6	7	7	2	4	3	2	CSU release (2011), marketed by PlainsGold. Excellent drought tolerance and quality. Average test weight and straw strength. Moderately susceptible to stripe rust. Carries wheat curl mite resistance from TAM 112 parent.

### More resistant or tolerant

- Avery (3)
- Byrd (2)
- Denali (3)
- Joe (3)
- Oakley CL (2)
- Snowmass (3)

### More susceptible

- Brawl CL Plus (7)
- SY Monument (8)
- Sunshine (8)
- WB-Grainfield (8)
- Thunder CL (9)

# Outline



- CSU Variety Trial Results
  - Dryland (UVPT) and Irrigated (IVPT) variety trials 2017, two-year and three year averages
  - Collaborative On-Farm Trial (COFT)
  - Variety selection strategies
- Wheat streak mosaic virus issues
  - Management approaches
  - Sources of resistance
  - Field resistance/susceptibility ratings from 2017
- CSU Wheat Breeding Program
  - New wheat variety releases (2017)
  - Potential future wheat variety releases (2018)

# CO12D2011 Hard White Winter Wheat

- Parentage – Denali/HV9W07-482W//Antero
  - HV9W07-482W: Westbred experimental (KS01HW163-4/KS01HW168-4)
  - Denali, Antero: CSU releases 2011, 2012
- Selection and testing history
  - Cross made in 2011, doubled haploid made 2012 (HPI-Manhattan KS)
  - Yuma AZ seed increase and line selection 2013
  - Advanced Yield Nursery 2014
  - CSU Elite Trial 2015-2017
  - UVPT, IVPT 2016-2017
  - Regional cooperative breeder trial (SRPN) 2017
- Seed increase, purification, release
  - Breeder seed purification (Yuma AZ 2016)
  - Foundation seed increase (Fort Collins 2017)
  - Release approved July 2017



Table 2. Grain yield (bu/acre) and test weight (lb/bushel) of CO12D2011 and other entries in the CSU Elite Trial from 2015-2017. Values are multiple-location averages of best linear unbiased predictors (BLUPs) from spatial analyses of individual-location trial data. Data are ranked by the three-year average grain yield over 28 dryland locations in Colorado. The average, maximum, and minimum values are from the entire set of entries tested.

Entry	2015 Yield	2016 Yield	2017 Yield	3 Year Avg Yield	3 Year Avg TestWt	3 Year Yield Northeast	3 Year Yield Southeast	3 Year Yield Irrigated
Langin	67.7	82.3	70.2	73.8	57.4	75.0	70.4	87.3
Byrd	65.7	79.8	69.8	72.2	58.0	73.1	69.4	85.1
Antero	68.7	80.6	65.2	71.7	58.0	72.7	68.8	90.1
CO12D2011	66.0	79.3	67.4	71.2	59.6	72.1	68.8	90.2
Avery	64.6	78.1	68.3	70.7	57.4	71.6	68.2	86.3
WB-Grainfield	62.5	81.7	63.8	69.8	57.9	70.6	67.5	91.6
Denali	66.6	78.5	60.5	68.7	57.4	69.9	65.0	88.4
Snowmass	63.8	76.1	64.8	68.5	57.3	68.9	67.3	85.2
Sunshine	61.2	78.2	63.2	68.0	57.5	69.5	63.3	83.4
Brawl CL Plus	56.9	76.0	58.3	64.2	57.6	64.4	63.8	83.0
Average	63.0	78.1	64.9	70.3	57.7	71.2	67.6	87.2
Max	75.3	82.4	74.4	75.4	59.6	76.6	71.7	91.6
Min	51.4	73.5	48.7	64.2	56.8	64.4	63.3	83.0
Locations	8	10	10	28	28	21	7	6

Table 5. Grain yield (bu/acre) and test weight (lb/bu) summary of CO12D2011 and other entries in the dryland Uniform Variety Performance Trial (UVPT) from 2016 to 2017. Data are ranked by the two-year yield average across 16 trial locations.

Entry	2016 Yield	2016 TestWt	2017 Yield	2017 TestWt	Two-Year Yield	Two-Year TestWt	Two-Year Yield Northeast	Two-Year Yield Southeast
Langin	85.4	59.0	78.3	60.4	81.8	59.7	80.8	83.5
Antero	86.2	57.2	74.1	59.9	80.2	58.6	78.5	82.9
Avery	82.4	58.6	74.5	60.3	78.4	59.4	77.1	80.6
CO12D2011	83.2	60.1	73.1	61.5	78.1	60.8	77.8	78.6
Joe	81.7	58.7	74.2	60.0	78.0	59.3	78.9	76.5
Byrd	80.0	59.3	75.9	60.2	77.9	59.7	76.8	79.8
Sunshine	81.6	56.4	69.3	59.3	75.4	57.9	77.8	71.6
WB-Grainfield	81.5	59.4	69.4	60.7	75.4	60.0	75.4	75.5
LCS Mint	80.5	59.4	69.3	60.5	74.9	60.0	74.2	76.2
Oakley CL	78.8	58.4	70.2	59.9	74.5	59.1	74.9	73.8
Snowmass	75.4	58.8	71.7	60.0	73.5	59.4	73.0	74.4
Denali	79.3	59.5	67.3	59.4	73.3	59.5	73.2	73.5
Hatcher	82.6	57.7	63.4	59.2	73.0	58.5	71.8	74.9
Cowboy	79.8	56.8	63.6	57.7	71.7	57.2	69.3	75.7
SY Monument	78.1	58.2	65.2	58.6	71.6	58.4	70.8	73.0
TAM 114	80.7	60.6	61.8	60.2	71.2	60.4	71.7	70.5
Winterhawk	78.4	59.6	63.7	59.5	71.1	59.5	71.8	69.8
SY Wolf	74.9	56.1	66.4	59.6	70.6	57.9	71.9	68.4
Ruth	76.8	60.3	63.6	60.3	70.2	60.3	71.7	67.8
Brawl CL Plus	76.5	58.0	63.9	60.2	70.2	59.1	70.1	70.3
WB4721	78.2	60.4	60.7	60.6	69.4	60.5	68.8	70.6
LCS Chrome	75.6	59.1	61.6	59.4	68.6	59.3	67.9	69.7
Settler CL	76.8	57.7	60.2	58.6	68.5	58.2	67.6	70.1
Average	79.7	58.7	67.9	59.8	73.8	59.2	73.6	74.2
Locations	8	8	8	8	16	16	10	6



Table 6. Grain yield (bu/acre), test weight (lb/bushel), and lodging score (1=erect to 9=flat) summary of CO12D2011 and other entries in the CSU Irrigated Variety Performance Trial (IVPT) in 2016 and 2017. Data are ranked by the average yield across all six trial locations.

Entry	2016			2017			Avg Yield	Avg TestWt	Avg Lodging
	Fort Collins	Haxtun	Rocky Ford	Fort Collins	Haxtun	Burlington			
Denali	86.0	61.6	58.1	105.0	74.6	106.8	95.3	58.4	3.7
SY Sunrise	91.1	61.3	59.9	94.3	73.1	110.9	94.8	59.3	1.6
CO12D2011	83.5	61.2	61.8	94.9	78.0	118.9	93.9	59.0	3.8
WB4303	90.0	56.3	53.7	108.2	72.0	108.0	93.6	54.7	1.2
KanMark	83.8	57.9	58.5	103.0	68.5	111.6	93.0	57.1	1.7
SY Wolf	80.6	57.8	55.8	102.3	74.1	115.9	92.9	56.5	2.2
Langin	75.0	60.6	58.2	87.8	82.4	114.4	92.6	57.6	5.7
Brawl CL Plus	88.3	60.2	59.6	83.5	75.4	113.3	92.5	58.1	2.1
Byrd	74.8	60.2	59.9	96.2	78.8	110.1	91.2	57.8	5.3
Sunshine	63.4	54.4	55.5	74.4	74.1	116.1	90.2	54.7	4.3
Thunder CL	100.2	57.9	58.0	85.8	57.9	109.5	89.1	57.6	1.5
Avery	64.1	61.0	59.1	91.4	79.9	98.0	87.0	57.1	6.9
Cowboy	61.9	59.8	55.0	103.7	67.8	109.4	86.3	55.5	6.8
Antero	62.7	58.7	56.9	77.8	79.8	92.7	82.8	56.3	6.2
Average	79.0	59.2	57.9	93.5	74.0	109.7	91.1	57.1	3.8
LSD (0.30)	6.3	5.9	7.4	5.1	4.2	8.0			

# CO12D2011 Hard White Winter Wheat



- Primary strengths
  - Higher dryland grain yield relative to both Snowmass and Sunshine and similar grain yield compared to Antero.
  - Higher irrigated grain yield relative to Sunshine and Thunder CL.
  - Milling and baking quality characteristics similar to Sunshine, with significantly lower polyphenol oxidase concentration.
  - Very high test weight, good pre-harvest sprouting tolerance, and good straw strength.
  - Good resistance to stripe rust, similar to Antero, and significantly better than Snowmass and Sunshine.
- Primary weaknesses
  - End-use quality, specifically water absorption and dough strength, is only to the level of Sunshine, but not Snowmass.



# CO14A065 Hard Red Winter Wheat (*CoAxiom*)

- Parentage – (AF28/Byrd)/(AF10/2\*Byrd) – about 66% Byrd
  - AF28: Hatcher derived line (A-genome *Axigen* trait)
  - AF10: Hatcher derived line (D-genome *Axigen* trait)
  - Byrd: CSU release 2011
- Selection and testing history
  - First crosses made fall 2010, last cross made spring 2012
  - Greenhouse increase fall 2012, greenhouse selection spring 2013
  - Yuma AZ seed increase and line selection 2014
  - Fort Collins herbicide tolerance trial 2015
  - CSU Elite Trial 2016-2017
  - UVPT 2016-2017
- Seed increase and purification
  - Breeder seed purification (Yuma AZ 2016)
  - Foundation seed increase (Fort Collins, Yuma AZ 2017)
  - Release approved July 2017

Table 4. Grain yield (bu/acre) and test weight (lb/bushel) of CO14A065 and other entries in the CSU Elite Trial from 2016-2017. Values are multiple-location averages of best linear unbiased predictors (BLUPs) from spatial analyses of individual-location trial data. Data are ranked by the two-year average grain yield over 20 dryland locations in Colorado. The average, maximum, and minimum values are from the entire set of entries tested.

Entry	2016 Yield	2017 Yield	2 Year Avg Yield	2 Year Avg TestWt	2 Year Yield Northeast	2 Year Yield Southeast	2 Year Yield Irrigated
Langin	82.3	70.2	76.2	57.5	77.5	73.2	88.9
Byrd	79.8	69.8	74.8	58.0	75.9	72.3	86.9
Avery	78.1	68.3	73.2	57.5	74.1	71.1	88.9
Joe	79.3	67.0	73.1	57.6	75.2	68.4	89.1
Antero	80.6	65.2	72.9	58.1	73.2	72.2	85.2
WB-Grainfield	81.7	63.8	72.7	57.9	73.6	70.6	90.6
Sunshine	78.2	63.2	70.7	57.7	72.5	66.5	86.2
Snowmass	76.1	64.8	70.4	57.4	70.9	69.3	85.1
Denali	78.5	60.5	69.5	57.6	70.2	67.9	90.6
TAM 114	77.7	58.5	68.1	58.0	68.9	66.3	87.2
Brawl CL Plus	76.0	58.3	67.2	58.0	67.5	66.5	86.9
CO14A065	73.7	59.1	66.4	55.2	66.7	65.8	88.2
Average	78.1	64.9	72.5	57.7	73.4	70.3	90.4
Max	82.4	74.4	78.4	59.9	78.8	78.5	97.4
Min	73.5	48.7	66.4	55.1	66.7	65.3	85.1
Locations	10	10	20	20	14	6	4

Table 7. Grain yield (bu/acre) and test weight (lb/bu) summary of CO14A065 and other entries in the dryland Uniform Variety Performance Trial (UVPT) from 2016 to 2017. Data are ranked by the two-year yield average across 16 trial locations.

Entry	2016 Yield	2016 TestWt	2017 Yield	2017 TestWt	Two-Year Yield	Two-Year TestWt	Two-Year Yield Northeast	Two-Year Yield Southeast
Langin	85.4	59.0	77.5	60.0	81.5	59.5	80.8	82.5
Antero	86.2	57.2	72.9	59.6	79.5	58.4	78.5	81.3
Avery	82.4	58.6	73.6	60.1	78.0	59.3	77.1	79.5
Byrd	80.0	59.3	75.8	60.1	77.9	59.7	76.8	79.7
Joe	81.7	58.7	72.3	59.8	77.0	59.2	78.9	74.0
Sunshine	81.6	56.4	68.4	58.9	75.0	57.7	77.8	70.3
WB-Grainfield	81.5	59.4	67.9	60.4	74.7	59.9	75.4	73.5
LCS Mint	80.5	59.4	67.3	60.3	73.9	59.9	74.2	73.6
Oakley CL	78.8	58.4	68.0	59.7	73.4	59.0	74.9	70.9
Hatcher	82.6	57.7	63.4	59.0	73.0	58.3	71.8	74.9
Snowmass	75.4	58.8	70.5	59.7	73.0	59.3	73.0	72.8
Denali	79.3	59.5	65.1	59.1	72.2	59.3	73.2	70.6
TAM 114	80.7	60.6	61.2	59.9	70.9	60.2	71.7	69.7
Cowboy	79.8	56.8	61.6	57.3	70.7	57.1	69.3	73.1
SY Monument	78.1	58.2	63.0	58.4	70.5	58.3	70.8	70.1
Winterhawk	78.4	59.6	61.9	59.3	70.2	59.4	71.8	67.4
Ruth	76.8	60.3	63.1	60.2	70.0	60.3	71.7	67.1
SY Wolf	74.9	56.1	64.9	59.3	69.9	57.7	71.9	66.4
Brawl CL Plus	76.5	58.0	63.1	59.9	69.8	58.9	70.1	69.4
WB4721	78.2	60.4	58.7	60.4	68.4	60.4	68.8	67.9
Settler CL	76.8	57.7	59.3	58.3	68.0	58.0	67.6	68.8
LCS Chrome	75.6	59.1	60.0	59.2	67.8	59.2	67.9	67.5
CO14A065	73.1	55.4	59.3	56.0	66.2	55.7	65.1	67.9
Average	78.9	58.3	65.8	59.2	72.3	58.8	72.6	71.9
Locations	8	8	8	8	16	16	10	6

# CO14A065 Hard Red Winter Wheat

- Primary strengths
  - A novel, non-GMO herbicide tolerance trait to provide more economic and effective control of both cheatgrass and feral rye in winter wheat:  
*Axigen* herbicide tolerance trait  
*CoAxium Wheat Production System*  
*Aggressor* herbicide (Albaugh LLC)
  - Statistically similar grain yield as the widely grown two-gene *Clearfield* wheat variety *Brawl CL Plus*.
  - Good quality characteristics, good straw strength.
- Primary weaknesses
  - Lower yield and test weight compared to most available hard red and hard white winter wheat varieties.
  - Lateness to heading, approximately 4 days later than Denali



# Potential Future Wheat Variety Releases

- Hard red
  - CO12D1770 - Denali/Antero//Byrd
  - CO13D1783 - CO08W218/Snowmass//Byrd
- Hard white
  - CO13D1299 - CO07W722-F5/Snowmass//Brawl CL Plus
  - CO13D1479 - CO07W722-F5/Antero//Snowmass
  - CO13D1383 - CO07W722-F5/Snowmass//CO07W722-F5
- Hard red *Clearfield*
  - CO13003C - CO06072/4\*Byrd (two-gene *Byrd*)
- Hard red *CoAxiom*
  - CO14A050 - AF28/Byrd//AF10/2\*Byrd
  - CO14A136 - AF10/2\*Byrd//AF26/Byrd
  - CO15A018 - AF28/Byrd//AF26/Byrd/AF28/Byrd//AF10 M3/2\*Byrd
  - CO14A070 - AF28/Byrd//AF10/2\*Byrd

# Acknowledgements



Colorado Wheat  
Administrative Committee



Colorado  
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Questions?