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Colorado State University

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Colorado State University
Knowledge to Go Places

FROM THE GROUND UP
Agronomy News

2002 Colorado Winter Wheat Variety Performance Trial Results

Performance trial results help Colorado wheat producers make better variety decisions.

Colorado State University conducts variety performance trials to obtain unbiased and reliable information for Colorado wheat producers to make better variety decisions. Good variety decisions can return millions of dollars to Colorado wheat producers.

Although precipitation in late summer and early fall 2001 was not abundant, trials were seeded timely and wheat stand establishment was excellent at all trial locations. The 2001/2002 winter temperatures were moderate but most trial locations suffered from lack of winter precipitation and snow cover. At each dryland trial location south of I-70, dry winter conditions combined with moderately cold temperatures caused significant winter injury and in some cases, total trial abandonment (e.g., Sheridan Lake, Cheyenne Wells).

Performance trial results help Colorado wheat producers make better variety decisions.

The winter drought carried through spring and early summer. Cold night temperatures in mid- and late-May led to widespread late spring freeze damage, especially in Northeast Colorado along Highway 14. As if conditions were not bad enough already, some areas were severely affected by hail, including the Genoa variety trial location. Continued widespread and severe drought conditions, combined with several periods of damaging high temperatures, led to earlier-than-normal harvest and extremely low yields. Though widespread throughout eastern Colorado, drought conditions were more prolonged and severe in southeastern Colorado.

In drought years like this, common dryland root rot often adversely affects yields-visible by sporadic 'white heads' in the field as was observed in many production fields and several trial locations. Insect pressure was low, but Russian wheat aphids could be found in some fields and may have caused slight yield reductions, especially along the Front Range. There was minimal yield loss to due wheat steak mosaic, high plains disease, or barley yellow dwarf virus. Stripe rust, which had been so severe in 2001, and leaf rust were present in relatively low levels in some irrigated fields after grain filling had commenced and probably had only small effects on yield.

Our dryland winter wheat variety trial (UVPT) is a single uniform variety performance trial comprised of 60 entries grown at 10 locations. Of the 60 entries in this trial, approximately half are named varieties and the other half are experimental lines. In addition to CSU varieties and experimental lines, the trial included public varieties from Nebraska, Oklahoma, Kansas, and Texas, and private varieties from Cargill-Goertzen and AgriPro. Due to winter injury, drought, spring freeze, and hail, only five of the ten trial locations were successfully harvested. Two of the five trials, Walsh and Lamar, were extremely low-yielding and highly variable preventing reliable differentiation among entries. Plot yields at Bennett, Akron, and Julesburg were low but reasonably high enough to be used for wheat variety selection purposes. Akron, the best dryland trial location all spring, experienced a damaging hail storm the night before harvest that reduced yields 15-25% in some entries. A randomized complete block field design with three replicates is used in all trials. Dryland trials were seeded at 600,000 seeds per acre and planted in 12 inch-spaced rows, except Julesburg that was seeded in 9 inch-spaced rows.

Irrigated variety trials were conducted at Rocky Ford, Haxtun, and Fort Collins. The irrigated trials are seeded 1.2 million seeds per acre. The Haxtun and Fort Collins trials were grown under sprinkler irrigation and the Rocky Ford trial was furrow-irrigated. Rocky Ford and Haxtun trials provided excellent results, but the Fort Collins trial suffered significantly from the spring freeze of May 9 and a damaging hail storm two weeks before harvest that reduced yields 30-70% in some entries.

The authors wish to make special note of two wheat improvement programs that will affect variety selection for the coming year:

FROM THE GROUND UP

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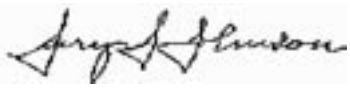

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Performance trial results help Colorado wheat producers make better variety decisions.

CLEARFIELD* wheat and Hard White Wheat (HWW) varieties.

CLEARFIELD* is a unique production system comprised of herbicide-tolerant wheat varieties, Beyond™ herbicide to manage problematic weed species, and a stewardship agreement with growers to ensure the use of best management practices for system sustainability. The first publicly-developed CLEARFIELD* winter wheat varieties to be released in the U.S., 'Above' (from Colorado State University and marketed by the Colorado Wheat Research Foundation) and 'AP502 CL' (marketed by AgriPro Seeds, Berthoud, CO) are tolerant to

Variety Above in NE Lincoln County

Beyond™ herbicide for use in the CLEARFIELD* wheat production system.

Above is an awned, white-chaffed, early maturing, semi dwarf hard red winter wheat. In 2000 and 2001 Colorado variety trials, Above yielded more than Akron, TAM 107, and TAM 110. Average test weight for Above in these trials was less than TAM 107, but more than TAM 110. Above matures 3.5 days earlier than Akron and about 1.5 days later than TAM 107. Above is short, similar to TAM 107, and has similarly good straw strength. Above is resistant to stem rust, susceptible to leaf rust, and moderately susceptible to both wheat streak mosaic virus and barley yellow dwarf virus. Above is resistant to greenbug, and susceptible to the Great Plains biotype of Hessian fly and Russian wheat aphid.

AP502 CL is an awned, red-chaffed, early maturing, semi dwarf hard red winter wheat. AP502 CL is very similar to Above in many respects, yet has shown lower average grain yield and test weight in Colorado variety trials. AgriPro Wheat intends to market AP502 CL in areas of the Great Plains where their distribution and marketing system is strongest.

More information on the CLEARFIELD* wheat production system can be obtained at the following websites:

CLEARFIELD Wheat Fact Sheet (http://wheat.colostate.edu/03116.html)

CLEARFIELD Wheat Fact Sheet (http://wheat.colostate.edu/03116.pdf)

BASF's CLEARFIELD website with their technical bulletin and the stewardship guide. (http://www.clearfieldsystem.com/html/default.asp)

White Wheat varieties

Development of hard white winter wheat (HWW) varieties has been a top breeding priority in the Great Plains for over 10 years. Enhanced preference for HWW over hard red winter wheat (HRW) in most export markets is the predominant factor driving the strong interest in increasing HWW acreage in the Great Plains.

In the 2002 US Farm Bill, a three-year market incentive program was established to foster development of US HWW production and markets. With the recent development of HWW varieties well adapted for production in Colorado, wheat producers now have an excellent opportunity to participate in a concerted, market-expansion effort. The most promising of these HWW varieties for production in Colorado include the following:

Trego is medium height, medium-late semi dwarf released by the Kansas State University program at Hays, KS, in 1999. Trego has shown both very high yield and test weight in CSU dryland trials and throughout the High Plains region. Trego has inadequate straw strength for irrigated production conditions. Trego is susceptible to Russian wheat aphid.

Avalanche is a medium height, medium maturing semi dwarf released by Colorado State University in 2001. Yields of Avalanche in CSU dryland variety trials have been slightly less than Trego (though equivalent to Akron) with similarly high test weight. Avalanche has performed better than average in experimental bread baking tests but, like Trego, is not suitable for Asian noodle production. Avalanche is susceptible to Russian wheat aphid.

Performance trial results help Colorado wheat producers make better variety decisions.

Lakin is an awned, white-chaffed, medium maturing, semi dwarf released by the KSU-Hays program in 2000. Grain yields of Lakin in CSU dryland variety trials have been slightly less than Trego and Avalanche, but its straw strength may allow successful irrigated production at moderately-high yield levels. Lakin possesses both good bread baking and good Asian noodle quality characteristics. Lakin is susceptible to Russian wheat aphid.

Platte is an awned, white-chaffed, medium maturing, semi dwarf released by AgriPro in 1995 and marketed under an exclusive contract arrangement with ConAgra Flour Milling. Platte has shown excellent straw strength as required for high-input, irrigated production conditions. Platte is very susceptible to stripe rust, a rare problem in Colorado except under very high moisture or irrigated conditions. Platte is susceptible to Russian wheat aphid.

More information concerning hard white wheat may be obtained at the following website: http: //www.awwpa.com (website for the American White Wheat Producers Association)

The authors encourage wheat producers to make use of the "Decision Tree for Winter Wheat Variety Selection in Colorado" because it reflects our synthesis of data and field observations over years and locations. Because this year provided so little information to aid variety selection, we think growers should rely on variety performance data acquired in more normal years. Unfortunately, some varieties were being tested for the first time in 2002 and there is just too little information to make sound recommendations. Producers are also encouraged to spread the variety decision risk by planting two or more varieties. The average performance over two or three years is a proven tool for yield performance evaluation but producers should be mindful of other variety characteristics, like maturity, height, disease and insect resistance, quality characteristics, and winter hardiness, that influence variety adaptation, performance, and marketing options.

Jerry Johnson and Scott Haley
Crops Testing and Wheat Breeder,
Colorado State University

Ed Schifferns COFT Plot on June 26, 2002.

Highest yielding COFT plot in 2002, averaging 41.8 bu/ac NE Lincoln County

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- Dry Bean Production
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- Precision Agriculture
- Salinity
- Nitrogen Fertilizer
- Phosphorus and Runoff

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Colorado Winter Wheat Dryland Uniform Variety Performance Trial Summary for 2002.

	Location								2002			
	Akron				Bennett		Julesburg		Average			
Variety[1]	Yield	Test Weight	Days to Heading[2]	Shatter[3]	Yield	Test Weight	Yield	Test Weight	Yield	% of Trial Average	Test Weight	Plant Height
	bu/ac	lb/bu	days	0-9	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	%	lb/bu	inches
Jagalene	38.6	61.3	146	7	34.5	61.4	34.0	58.6	35.7	111	60.4	23
TAM 111	37.8	59.1	147	4	32.6	62.1	34.5	56.4	35.0	109	59.2	24
Halt	38.3	58.4	142	6	30.9	60.9	34.9	56.3	34.7	108	58.5	22
Prairie Red	41.2	59.2	141	4	30.8	59.7	31.7	56.9	34.6	108	58.6	22
Above	44.1	59.7	142	3	23.9	61.2	35.6	56.9	34.5	108	59.3	22
Trego	40.2	61.2	148	5	31.1	62.1	31.6	58.1	34.3	107	60.5	21
Lakin	37.2	59.4	147	6	29.6	62.1	34.8	56.8	33.9	105	59.4	24
Akron	36.6	58.0	144	5	30.9	60.9	32.1	56.1	33.2	103	58.3	21
G970246	40.0	59.1	141	5	26.0	62.1	33.6	57.3	33.2	103	59.5	22
AP502 CL	36.4	57.1	141	3	28.4	60.2	33.4	56.6	32.7	102	58.0	22
Stanton	39.3	59.9	144	3	28.2	61.3	30.3	57.9	32.6	102	59.7	23
Alliance	35.5	58.5	145	5	29.8	62.3	32.3	55.7	32.5	101	58.8	21
Cutter	34.9	59.7	145	6	27.4	61.9	35.3	58.8	32.5	101	60.1	25
2137	34.0	58.3	146	4	30.4	61.9	32.1	54.7	32.2	100	58.3	22
TAM 110	39.4	59.1	142	3	24.6	60.7	32.8	57.4	32.2	100	59.1	23
G970466	34.5	58.5	146	6	27.1	62.4	33.6	55.9	31.8	99	58.9	22
Prowers 99	36.8	58.9	150	3	27.5	62.9	31.1	57.0	31.8	99	59.6	24
Jagger	38.1	60.0	141	5	25.3	60.4	31.7	56.7	31.7	99	59.0	25
Avalanche	38.7	60.2	146	5	24.0	64.0	32.0	57.4	31.6	98	60.5	23
Ok101	36.7	58.9	142	5	23.3	61.5	32.7	55.8	30.9	96	58.7	23
Yumar	34.7	57.8	146	4	25.1	61.1	32.6	56.9	30.8	96	58.6	21
Thunderbolt	35.0	60.0	147	7	23.8	62.3	33.5	57.2	30.8	96	59.8	22
G970447	31.3	57.7	144	5	28.7	61.3	31.8	54.9	30.6	95	58.0	20
Enhancer	32.5	57.7	145	6	26.2	62.0	32.3	55.1	30.3	94	58.3	24
Yuma	32.7	57.7	148	5	23.8	62.6	33.4	56.4	30.0	93	58.9	22
Venango	32.6	59.9	148	7	24.7	62.0	32.3	55.8	29.9	93	59.2	22
Dumas	33.4	59.6	146	4	22.4	62.3	33.6	56.9	29.8	93	59.6	22
G970209W	33.7	60.0	147	7	20.4	60.1	31.1	56.7	28.4	89	58.9	21
G970380A	27.5	57.9	141	5	25.9	60.7	30.5	56.2	28.0	87	58.3	22
Average	36.3	59.1	145	5	27.2	61.6	32.8	56.7	32.1		59.1	22
CV%	10.5				12.8		9.0					
$LSD_{(0.30)}$	3.3				3.0		2.5					

[1]Varieties in table ranked by the average yield over three locations in 2002.
[2]Julian date.
[3]Rating scale 0-9, with 0 = no shatter and 9 = severely shattered.

Colorado Winter Wheat Uniform Variety Performance Trial Summary for 2000-02.

	Averages							
	2000		2001		2002		3-Yr	
Variety[1]	Yield	Twt	Yield	Twt	Yield	Twt	Yield	Twt
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu
Trego	41.3	59.7	47.8	58.9	34.3	60.5	42.9	59.4
Stanton	38.6	58.0	46.3	56.8	32.6	59.7	40.9	57.8
Alliance	40.2	56.5	44.0	56.1	32.5	58.8	40.6	56.7
Enhancer	39.2	55.0	45.5	56.7	30.3	58.3	40.5	56.2
Akron	39.4	57.0	43.2	56.4	33.2	58.3	40.0	57.0
Jagger	36.3	55.8	46.7	57.0	31.7	59.0	39.9	56.8
Above	39.7	57.0	41.9	55.5	34.5	59.3	39.8	56.7
Avalanche	41.0	59.3	41.3	57.7	31.6	60.5	39.6	58.8
Yuma	39.0	56.8	43.1	56.0	30.0	58.9	39.3	56.8
Prairie Red	38.9	56.9	40.7	56.3	34.6	58.6	39.0	56.8
Halt	35.4	56.1	42.9	56.2	34.7	58.5	38.5	56.5
AP502 CL	38.8	56.3	39.5	55.2	32.7	58.0	38.2	56.0
Lakin	39.5	57.2	38.2	57.1	33.9	59.4	38.1	57.6
2137	40.3	56.1	37.8	55.7	32.2	58.3	38.0	56.3
TAM 110	39.6	56.7	37.9	55.1	32.2	59.1	37.7	56.4
Yumar	36.1	57.2	40.7	57.1	30.8	58.6	37.2	57.4
Venango	39.6	58.2	37.2	58.1	29.9	59.2	37.1	58.3
Prowers 99	32.9	58.1	41.4	58.8	31.8	59.6	36.3	58.6

[1]Varieties in table ranked based on 3-Yr average yields.

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From the Ground Up
Agronomy News

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Colorado Winter Wheat Uniform Variety Performance Trial Summary for 2001-02.

	Averages					
	2001		2002		2-Yr	
Variety[1]	Yield	Twt	Yield	Twt	Yield	Twt
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu
Trego	47.8	58.9	34.3	60.5	44.1	59.3
Stanton	46.3	56.8	32.6	59.7	42.6	57.6
Jagger	46.7	57.0	31.7	59.0	42.6	57.5
Enhancer	45.5	56.7	30.3	58.3	41.4	57.0
Alliance	44.0	56.1	32.5	58.8	40.8	56.8
Halt	42.9	56.2	34.7	58.5	40.6	56.8
Akron	43.2	56.4	33.2	58.3	40.4	57.0
Above	41.9	55.5	34.5	59.3	39.9	56.5
Yuma	43.1	56.0	30.0	58.9	39.5	56.8
Prairie Red	40.7	56.3	34.6	58.6	39.0	56.8
Prowers 99	41.4	58.8	31.8	59.6	38.8	58.9
Avalanche	41.3	57.7	31.6	60.5	38.6	58.4
Yumar	40.7	57.1	30.8	58.6	38.0	57.5
AP502 CL	39.5	55.2	32.7	58.0	37.7	55.8
Lakin	38.2	57.1	33.9	59.4	37.0	57.8
TAM 110	37.9	55.1	32.2	59.1	36.4	56.1
2137	37.8	55.7	32.2	58.3	36.3	56.4
Venango	37.2	58.1	29.9	59.2	35.2	58.4

[1]Varieties in table ranked based on 2-Yr average yields.

Eastern Colorado Cooperative Extension Wheat Educators and On-Farm Test Coordinators

Name	Title	Office Location
Bruce Bosley	Lower South Platte - Cropping Systems	Sterling
Tim Macklin	Southeast Area - Cropping Systems	Lamar
Ron Meyer	Golden Plains agronomist	Burlington
Bruce Fickenscher	Kiowa County agent	Eads
Thaddeus Gourd	Adams County agent	Brighton
Jerry Alldredge	Weld County-Soil & Crops	Greeley
Leonard Pruett	Southeast Area - Director	Lamar
Dwight Rus	Yuma County agent	Wray
Assefa Gebre-Amlak	Golden Plains -Crop Protection	Akron

Colorado Winter Wheat Irrigated Uniform Variety Performance Trial Summary for 2002.

	Location								2002			
	Haxtun				Rocky Ford				Average			
Variety[1]	Yield	Grain Moisture	Test Weight	Lodging[2]	Yield	Grain Moisture	Test Weight	Lodging	Yield	% of Trial Average	Test Weight	Plant Height
	bu/ac	%	lb/bu	1-9	bu/ac	%	lb/bu	1-9	bu/ac	%	lb/bu	inches
Platte	98.7	11.7	60.9	1	92.9	10.1	59.5	1	95.8	111	60.2	33
Prairie Red	90.1	11.0	58.7	1	99.7	9.3	57.9	3	94.9	110	58.3	34
Above	83.9	11.6	60.0	1	101.3	9.9	59.1	2	92.6	108	59.6	36
Yuma	93.1	11.1	58.3	1	92.1	10.0	57.2	2	92.6	108	57.8	35
Jagalene	89.8	11.7	60.0	1	95.1	10.9	59.7	2	92.4	107	59.8	36
Ok101	91.4	10.8	57.1	1	92.9	7.1	57.8	2	92.2	107	57.4	35
Avalanche	87.6	11.6	59.5	2	96.2	10.7	61.3	3	91.9	107	60.4	36
Lakin	92.9	11.9	60.4	1	90.4	12.3	59.2	3	91.6	106	59.8	37
Wesley	85.3	11.0	59.0	1	96.6	10.0	59.7	1	90.9	106	59.3	33
Nuplains	85.7	12.0	60.8	1	93.2	10.6	59.7	2	89.5	104	60.3	36
TAM 111	86.7	11.8	59.5	1	91.4	11.0	58.9	2	89.0	103	59.2	37
NW97S278	88.7	11.3	59.3	1	85.0	11.0	58.5	2	86.8	101	58.9	36
Trego	75.2	11.3	58.2	7	94.8	11.0	59.7	6	85.0	99	59.0	35
Yumar	85.7	12.1	59.6	1	83.3	10.2	56.6	2	84.5	98	58.1	36
Dumas	84.9	12.0	61.4	1	83.6	10.8	61.2	1	84.3	98	61.3	35
Jagger	85.2	11.0	58.2	1	79.1	9.7	58.5	3	82.2	95	58.3	35
2137	74.5	11.1	58.7	1	85.0	10.5	57.8	1	79.7	93	58.2	36
CDC Falcon	85.5	10.8	57.6	1	73.5	9.9	57.2	1	79.5	92	57.4	35
TAM 107	75.3	11.0	57.5	1	80.7	10.2	59.1	3	78.0	91	58.3	35
Akron	73.3	11.1	57.4	4	80.6	9.7	57.1	6	77.0	89	57.3	36
Venango	90.2	12.0	61.2	1	61.4	14.7	59.3	2	75.8	88	60.3	36
Enhancer	69.4	11.4	59.4	6	68.2	11.5	58.2	7	68.8	80	58.8	36
Average	85.1	11.4	59.2	2	87.1	10.5	58.8	3	86.1		59.0	35
CV%	12.5				10.2				11.4			
$LSD_{(0.30)}$	9.1				7.6				5.9			

[1]Varieties in table ranked by the average yield over two locations in 2002

[2]Rating scale 1-9, with 1 = no lodging and 9 = completely lodged.

Colorado Winter Wheat Irrigated Variety Performance Trial Summary for 2000-02.

	Averages							
	2000		2001		2002		3-Yr	
Variety[1]	Yield	Twt	Yield	Twt	Yield	Twt	Yield	Twt
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu
Wesley	96.2	54.4	108.2	61.9	90.9	59.3	98.5	58.6
Yuma	108.7	54.5	92.9	62.2	92.6	57.8	98.0	58.1
Jagger	105.3	54.6	101.2	62.9	82.2	58.3	96.2	58.6
Avalanche	102.9	56.8	90.3	62.2	91.9	60.4	95.0	59.8
Prairie Red	96.5	55.3	87.0	61.0	94.9	58.3	92.8	58.2
Venango	111.8	56.9	90.4	62.7	75.8	60.3	92.7	59.9
Enhancer	100.2	53.7	107.9	62.6	68.8	58.8	92.3	58.4
Trego	98.5	57.3	89.2	63.0	85.0	59.0	90.9	59.8
Yumar	97.2	52.2	89.0	61.0	84.5	58.1	90.3	57.1
TAM 107	110.6	55.0	80.5	60.6	78.0	58.3	89.7	58.0
Nuplains	98.1	56.1	80.3	62.0	89.5	60.3	89.3	59.4
2137	102.6	54.0	82.9	61.1	79.7	58.2	88.4	57.8
Akron	90.5	55.2	88.2	61.1	77.0	57.3	85.2	57.9

[1]Varieties in table ranked based on 3-Yr average yields.

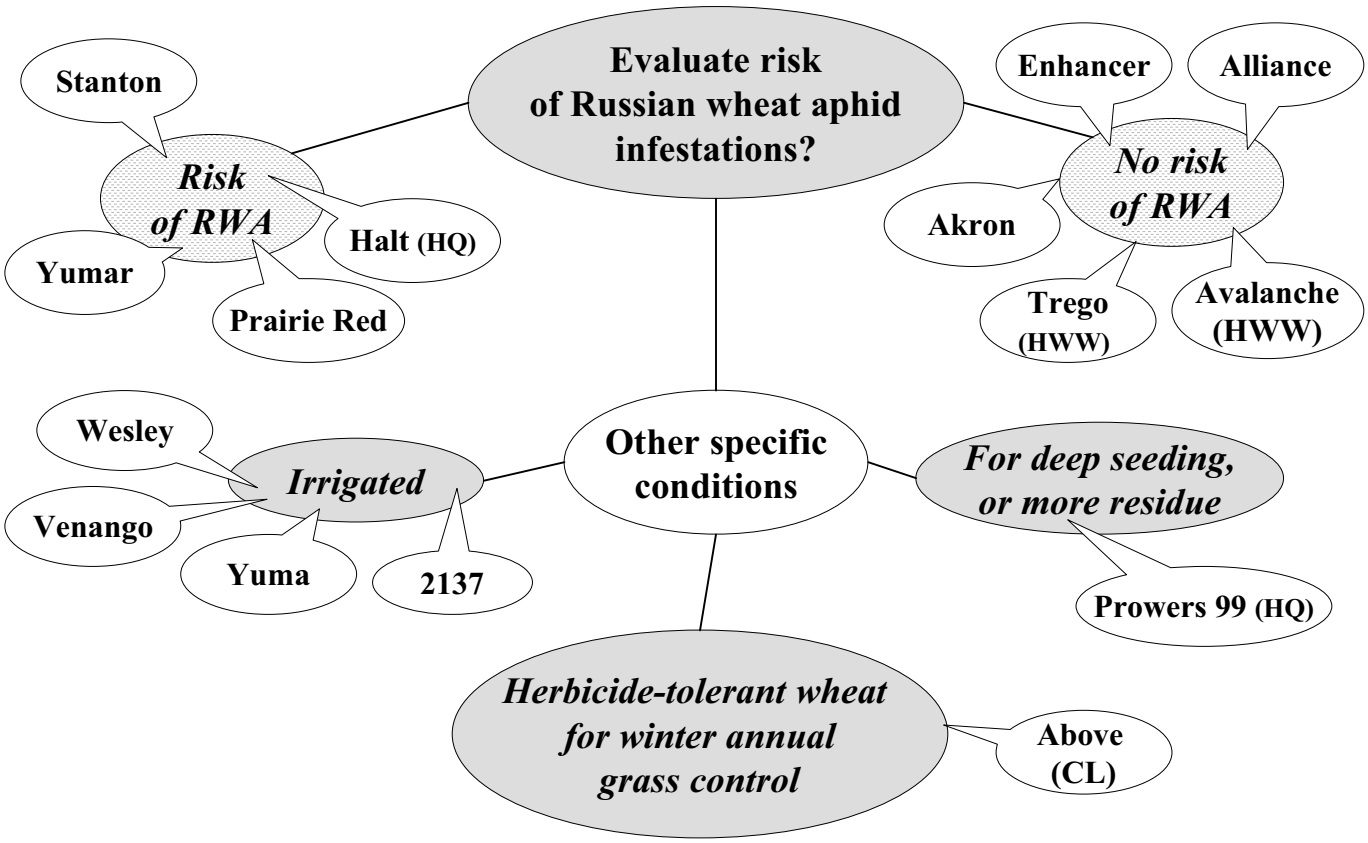
Colorado Winter Wheat Irrigated Variety Performance Trial Summary for 2001-02.

	Averages					
	2001		2002		2-Yr	
Variety[1]	Yield	Twt	Yield	Twt	Yield	Twt
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu
Wesley	108.2	61.9	90.9	59.3	99.6	60.6
NW97S278	109.8	63.5	86.8	58.9	98.3	61.2
Yuma	92.9	62.2	92.6	57.8	92.7	60.0
Above	91.2	60.4	92.6	59.6	91.9	60.0
Jagger	101.2	62.9	82.2	58.3	91.7	60.6
Avalanche	90.3	62.2	91.9	60.4	91.1	61.3
Prairie Red	87.0	61.0	94.9	58.3	91.0	59.7
Enhancer	107.9	62.6	68.8	58.8	88.4	60.7
Trego	89.2	63.0	85.0	59.0	87.1	61.0
Yumar	89.0	61.0	84.5	58.1	86.8	59.5
Lakin	80.4	60.3	91.6	59.8	86.0	60.0
Nuplains	80.3	62.0	89.5	60.3	84.9	61.1
Venango	90.4	62.7	75.8	60.3	83.1	61.5
Akron	88.2	61.1	77.0	57.3	82.6	59.2
2137	82.9	61.1	79.7	58.2	81.3	59.7
TAM 107	80.5	60.6	78.0	58.3	79.3	59.5

[1]Varieties in table ranked based on 2-Yr average yields.

Decision Tree for Winter Wheat Variety Selection in Colorado

Jerry Johnson and Scott Haley (July 2002)



(HQ) signifies high end-use (milling and baking) quality.

(HWW) signifies Hard White Winter wheat variety.

(CL) signifies herbicide-tolerant CLEARFIELD* wheat variety.

The best combination of winter wheat varieties in Colorado depends upon variable production conditions. Production risks may be reduced by planting two or more varieties. The decision tree suggests varieties for planting that have performed well in CSU variety trials over a period of two or more years. The 2002 dryland variety trial results failed to add valuable performance information, thus forcing us to base most decisions on previous years' results. It should be remembered that avoiding poor variety decisions may be as important as choosing the winner among winners.

The authors wish to make special note of two wheat improvement programs that will affect variety selection for the coming year: CLEARFIELD* wheat and Hard White Wheat (HWW) varieties. Refer to the introduction for more information concerning these programs.

2002 Colorado Collaborative On-Farm Test (COFT) Results

In the fall of 2001, twenty-eight eastern Colorado wheat producers planted collaborative on-farm tests (COFT) in Baca, Prowers, Kiowa, Lincoln, Kit Carson, Washington, Phillips, Arapahoe, Adams, Morgan, and Weld counties. The objective was to compare performance of the newly-released varieties, Avalanche (HWW) and Above (HRW CLEARFIELD), with the performance of the popular HRW variety, Akron, and the high-yielding HWW variety Trego. With the help of Federico Pardina, a graduate student in the wheat breeding program, we also hoped to use the COFT results to map eastern Colorado for yield and wheat quality characteristics. From two HRW wheat varieties and two HWW wheat varieties we hoped to deduce the optimum areas for adoption of hard white wheat in Colorado from the COFT results. We had originally planned to spray Beyond herbicide on the CLEARFIELD wheat variety, Above, in each test in order to demonstrate the efficacy of the CLEARFIELD package but that objective became operationally impossible and Above was grown under the same conditions as the other varieties.

Working alongside local Extension agents, each producer/collaborator received 100 pounds seed of each variety and planted the four varieties in side-by-side strips. The 2001-02 season was the fifth year of winter wheat variety on-farm testing and many collaborating producers have conducted tests each of the five years. Thanks to on-farm testing, wheat producers get to evaluate new varieties on their own farms before seed of the new varieties is available on the market to all farmers. On-farm testing directly involves agents and producers in the variety development process, thereby speeding adoption of superior, new varieties. Agents get experience with new varieties before the varieties are commonly available and share this experience with growers who are not COFT participants. The whole wheat community benefits from reliable and unbiased COFT results. Multiple COFT farm environments offer insights into variety performance to the wheat breeding program that might not be obtained from the small-plot trials. Farmers acquainted with COFT results tend to rely more on COFT results than on the traditional replicated small-plot results.

The 2002 COFT results are divided into three geographic groups- primarily for ease of understanding the results. Twenty-one test results are reported. The overall average performance of all four varieties was remarkably similar and there were no statistical differences among varieties. Conclusions should not be drawn from a single on-farm test. All tests suffered from winter, spring, and early summer drought. Some locations were severely affected by winter freezes and some tests barely survived the late May freeze. None of the varieties performed less well than any other variety under drought conditions so severe that they are reportedly only expected to occur once in 100 years. For example, some people feared that the variety Akron with its long head would not survive as well as other varieties in extreme drought conditions- which proved to be unfounded. The white wheat varieties, Avalanche and Trego, were not any more susceptible to loss by severe drought and freezing than their hard red cousins. No unexpected agronomic flaws were found in the new CLEARFIELD wheat variety, Above.

Colorado State University Cooperative Extension agents have a large responsibility for the success of this program -recruiting volunteer growers, delivering seed, planning test layout and operations, helping with planting, keeping records, coordinating visits, communicating with growers and campus coordinators, coordination of weighing plot and measuring yields and collecting grain samples for quality analyses. I am very thankful for the cooperation of so many dedicated and conscientious wheat producers throughout eastern Colorado. Even under the most stressful conditions, there was never an unkind or harsh word heard. This year, more than in the past, the successful harvest and conclusion of the COFT program was due to the long hours of hard work by our Cooperative Extension agents listed on page 7. This is truly a collaborative on-farm testing program.

Jerry Johnson
Extension Crops Testing

2002 Colorado Collaborative On-Farm Test (COFT) Results

	Variety (Yields in bu/ac @ 13% moisture)			
	Above	**Akron**	**Avalanche**	**Trego**
Test Location	**Yield**	**Yield**	**Yield**	**Yield**
NE Phillips	29.3	28.3	29.0	30.9
SE Phillips	29.2	22.7	24.4	23.6
SE Washington	36.1	37.4	36.9	37.4
NE Kit Carson	12.4	8.0	10.5	9.3
Central Kit Carson	20.3	19.6	14.2	14.6
SE Kit Carson	25.4	22.5	24.3	23.0
NE Lincoln	43.7	43.5	39.6	40.3
Golden Plains Ave	28.0	26.0	25.5	25.6
	Above	**Akron**	**Avalanche**	**Trego**
NW Weld	25.3	23.3	24.2	24.4
NW Morgan	28.2	32.4	27.9	32.5
SE Weld	35.2	32.6	32.8	33.9
South Weld	24.6	27.4	26.9	27.1
SW Morgan	28.3	28.9	28.5	26.6
SW Adams	24.1	24.8	18.2	25.0
South Adams	15.6	16.3	15.0	14.8
NE Arapahoe	27.1	27.6	27.4	28.4
Front Range Ave	26.1	26.7	25.1	26.6
	Above	**Akron**	**Avalanche**	**Trego**
NE Kiowa	8.5	11.6	8.7	9.0
East Kiowa	3.5	4.8	3.0	3.1
NE Prowers	6.2	3.4	11.4	11.2
NW Central Prowers	24.2	22.4	23.8	23.2
SW Baca	8.7	10.3	5.6	13.3
East Baca	11.8	15.8	10.9	15.2
SE Colorado Ave	10.5	11.4	10.6	12.5
	Above	**Akron**	**Avalanche**	**Trego**
Overall Ave	22.3	22.1	21.1	22.2

Site Specific Weed Management: Remote Sensing Detection and Site Specific Control

Jointed goatgrass is a nationwide problem estimated to cost producers over $145 million annually. In Colorado alone over 200,000 acres are infested with Jointed Goatgrass annually causing severe grain yield losses to farmers. Efficient management techniques are needed so that jointed goatgrass infestations can be controlled without causing any yield damage. One way of doing this is by mapping fields (using a handheld GPS) that are infested with jointed goatgrass and then doing site specific control of the infestations.

However, this process is time consuming, labor intensive, and costly. Alternatively, we can use remote sensing (i.e. aerial or satellite imagery) to identify field areas that are infested with jointed goatgrass and then treat specifically those areas with herbicide for control. The big question is: **Can we detect, identify, and map jointed goatgrass using remote sensing & then control it effectively??**

Dr. Phil Westra (CSU cooperative extension weed specialist) and his co-workers in past years have mapped jointed goatgrass infestation in several fields in Northeastern Colorado and have reported that these infestations are patchy in nature and tend to re-appear in the same spots in the following years. This gives us unique opportunity to site specifically control such weed infestations.

Likewise, the Clearfield wheat production system which incorporates Beyond (Imazamox) herbicide with Clearfield wheat allows for site-specific treatment of jointed goatgrass within a field.

Site specifically ~ meaning that we need to apply the herbicide Beyond (Imazamox), which is part of the Clearfield wheat system, only at locations of jointed goatgrass infestations and therefore be able to control jointed goatgrass within the entire field. Clearfield wheat has made site specific control of jointed goatgrass possible.

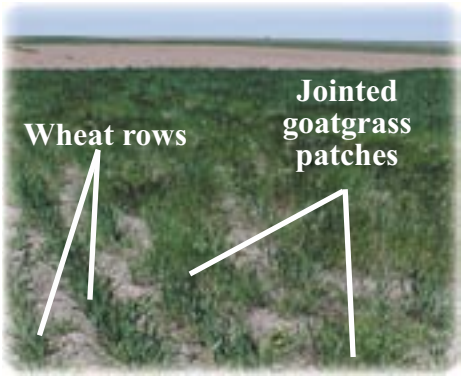


Figure 1.0. Jointed goatgrass patches mixed with wheat at study field 8, during 2001 - 2002 growing season.

The overall idea of this study is to "remotely" detect and map areas of wheat fields that are infested with jointed goatgrass and control them the very same year or to use prior information from previously mapped fields to treat jointed goatgrass in the following years. The specific objectives of this ongoing study, for the last three years were: (1) To determine if jointed goatgrass could be detected remotely in winter wheat fields at wheat maturity using digital color infrared aerial imagery. (2) To determine the minimum jointed goatgrass density that is accurately identified by using these techniques. (3) The third and final objective of this research was to control jointed goatgrass via site-specific application of Imazamox (Beyond herbicide) to test the herbicide efficacy in controlling weed infestation and impact on grain yield. Figure 1.0 above shows the patchy nature of jointed goatgrass infestations at study field 8 during 2001 - 2002 growing season.

Site Specific Weed Management: Remote Sensing Detection and Site Specific Control

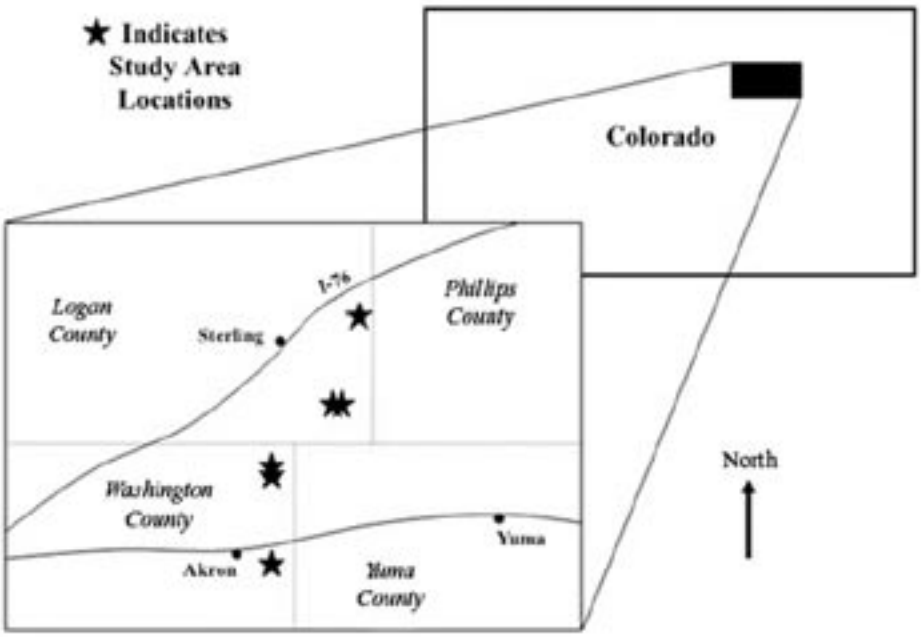


Figure 2.0 Location of fields in Colorado where this study was conducted over the last three years (1999-2002).

This ongoing study was conducted over three consecutive years (1999 - 2002 wheat growing seasons) at eight winter wheat fields located in Northeastern Colorado with historical infestations of jointed goatgrass (Figure 2.0). These fields were planted with both standard and Clearfield wheat. Data collected during the second and third years growing season include: digital color infrared imagery, weed locations using a global positioning (GPS) system, and several other field-crop parameters. This includes jointed goatgrass weed seed banks, wheat grain yield, as well as samples of height, density, and biomass for both wheat and jointed goatgrass.

The first year of research (1999 - 2000 growing season) gathered preliminary data regarding the spatial aggregation of jointed goatgrass using new technologies including global positioning systems (GPS). Results from the first year data indicated potential for mapping jointed goatgrass with remote sensing technology. Results from the second and third years of research indicate jointed goatgrass can be detected and mapped at accuracies ranging from 8% to 56% depending on the distribution of jointed goatgrass across the study field. These results indicate the optimum techniques for accurately (>80% accuracy) mapping jointed goatgrass within winter wheat are still to be investigated. However, results indicate jointed goatgrass detection accuracy was positively influenced by the density and the size of weed infestations. Accuracy results for assessing different densities of jointed goatgrass infestations is currently underway. From a farm management perspective, determining all types of weed infestations within a farm field is of practical value. Using the above remove sensing techniques, kochia, buckwheat, and several other "green" colored invasive weeds within our study fields were identified with accuracy range of 75% to 97%. Such detection accuracy makes remote sensing a very viable tool for site-specific weed management on farm fields.

Spatial statistical procedures were also utilized in an innovative approach to predict field variables with a high degree of accuracy. Table 1.0 below shows the highest accuracy achieved for predicting individual field variables. These field variable predictions are extremely useful in assessing and mapping wheat and jointed goatgrass patterns within a field.

Our site-specific control and management of jointed goatgrass study objective indicated that the efficacy of the herbicide when applied site-specifically versus uniform conventional application was same. Such a finding indicates that site-specific control of jointed goatgrass would save money to farmers on expensive herbicide and also be beneficial to the environment.

Table 1.0. Highest predictive accuracy for each field variable analyzed.

Predictive Accuracy	Wheat Height	Wheat Density	Wheat Biomass	Yield	Goatgrass Height	Goatgrass Density	Goatgrass Biomass
Highest Accuracy	97%	86%	96%	95%	66%	76%	82%

Site Specific Weed Management: Remote Sensing Detection and Site Specific Control

Figure 3. Visible distinction between Clearfield wheat (right) and standard wheat (left) with intermixed kochia infestations at Study Field 3 during the 2001 - 2002 growing season.

Figure 3 above shows the visible distinction between standard wheat (left) and Clearfield wheat (right) at a study field. Figure 4, shows the color infrared imagery for the same field with jointed goatgrass and kochia patches indicated.

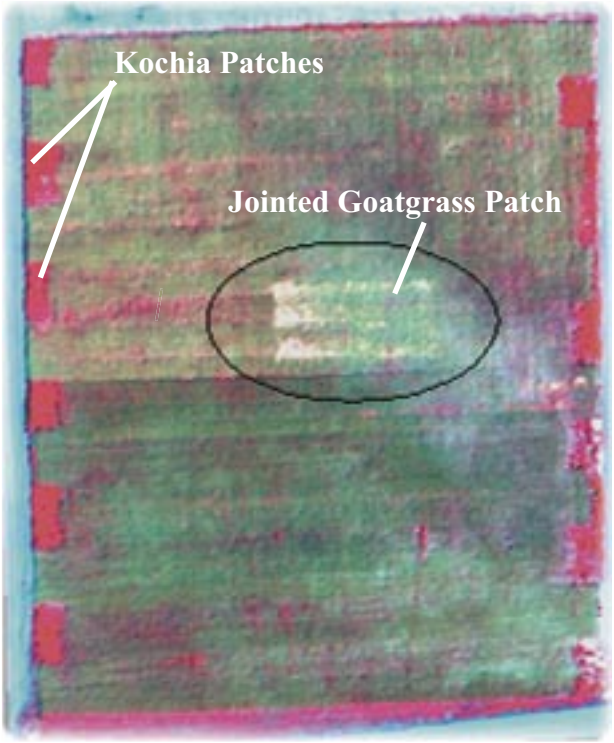


Figure 4. Color infrared imagery obtained overhead Study Field 3 during the 2001 - 2002 growing season with jointed goatgrass and kochia patches indicated.

These results indicate the first objective of detecting jointed goatgrass remotely in winter wheat fields at wheat maturity using digital color infrared aerial imagery needs further research before detection can be done with consistency and high accuracy levels. However, results indicate these techniques are very useful for identifying other "green" weeds within a winter wheat field such as kochia, buckwheat, and many others in an efficient manner.

The second objective of determining the minimum jointed goatgrass density that is accurately identified by using these techniques is currently underway. Results of this objective are expected to be consistent with those of the first objective.

Lastly, site-specific control of jointed goatgrass with applications of Imazamox (Beyond herbicide) were found to save money to farmers on expensive herbicide and also be beneficial to the environment.

Chris Woodward[1], *Raj Khosla*[2], *and Phil Westra*[3].

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[3]Weed Specialist, Department of Bio-Agricultural Sciences & Pest Management, CSU.

Colorado Wheat Variety Performance Database

Wheat Breeding and Genetics &
Crops Testing Programs

Soil and Crop Sciences Department
Colorado State University
Fort Collins, CO 80523

Website created and maintained by Scott Haley, CSU Wheat Breeder

To provide unbiased and reliable yield performance information to Colorado wheat growers, the Colorado State University Crops Testing Program annually conducts winter wheat variety trials at multiple locations throughout Colorado. A randomized complete block design with three replicates is used in all trials. Dryland trials are seeded in 50 foot plots at 600,000 seeds per acre whereas irrigated trials are seeded in 30 foot plots at 1.2 million seeds per acre.

The Colorado Wheat Variety Performance Database provides complete access to winter wheat cultivar information and performance data from these trials. The database may be used to find up-to-date information on wheat cultivars grown in Colorado, display grain yield and test weight data from individual trial locations, generate grain yield and test weight summaries across multiple trial locations and years, and generate head-to-head comparisons for two varieties of interest.

Wheat producers are encouraged to spread the variety decision risk by planting more than one variety. The average performance over two or three years is a proven tool for yield performance evaluation but producers should be mindful of other varietal characteristics, like maturity, height, disease and insect resistance, quality characteristics, and winter hardiness, that influence variety adaptation, performance, and marketing options.

Please select from one of the following:

- Historical variety trial data (1974-1989) (searchable) New
- CSU Wheat Variety Decision Tree (click PDF icon to download Acrobat Reader)
- Winter wheat variety information (searchable) Upd
- Single location data summaries (searchable)
- Multiple location data summaries (searchable)
- Variety head-to-head comparisons (searchable)

website address: http://triticum.agsci.colostate.edu/

Home Page | About The Program | New Wheat Varieties | Graduate Training | Information Resources | Wheat Field Days

Search by Wheat Variety Traits

The database for winter wheat variety information contains data for all public and private varieties included in the CSU variety performance trials in recent years. Experimental lines under development and older varieties that are no longer under production are not included in the database.

To search by variety name, click here.

For a PDF file containing information on all varieties in the database, click here. (click on PDF icon for Acrobat information)

To search by variety traits, specify the desired traits according to the scales described below. Avoid making your search too specific by limiting trait searches to a small number of important traits.

Rating Scale:

0=very good to 9=very poor except for the following:
Russian wheat aphid resistance - R=resistant, MR=moderately resistant, S=susceptible
Heading date - 0=very early, 9=very late
Plant height - 0=very short, 9=very tall
Coleoptile length - 0=very short, 9=very long

Russian Wheat Aphid Resistance		**Coleoptile length**	
Heading date		**Leaf rust resistance**	
Plant height		**Wheat streak mosaic virus tolerance**	
Straw strength		**Winterhardiness**	
Test weight		**Grain protein content**	
Relative milling quality		**Relative baking quality**	

Specify Output Type Form Output

Reset Search

Search for Historical Wheat Variety Trial Data

The database for historical wheat variety trial data contains data for all Colorado Variety Trials conducted between 1974 and 1989 (except 1976). Between 1974 and 1982, trials included a dryland trial (**VT**) and an irrigated trial (**IVPT**). Beginning in 1983, the dryland trials included a High Moisture Variety Trial (**HMVT**) and a Low Moisture Variety Trial (**LMVT**) in addition to the irrigated trial (**IVPT**). Grain yield and test weight summaries may be generated for individual locations within any year.

To search, first specify the desired year below. The list of locations available for selection will then include only those locations in the specific year chosen.

Year:

Location:

Search

Search for Multiple Location Summary

The database for multiple location summaries contains data for all Colorado Variety Trials conducted since 1998. Included are data from the Irrigated Variety Performance Trial (**IVPT**; 1998-2001) and and three dryland trials, the High Moisture Variety Trial (**HMVT**; from 1998-1999) and the Low Moisture Variety Trial (**LMVT**; from 1998-1999), and the Uniform Variety Performance Trial (**UVPT**; from 2000-present). Grain yield and test weight summaries may be generated for specified combinations of years and locations.

To search, specify the following criteria:

	Tips and Suggestions
Years: [2001] (year 1) [ ] (year 2) [ ] (year 3) [ ] (year 4)	• specify as many years as desired. • do not duplicate selections (e.g., do not select 1999 more than once).
Type of Trial: [ ] (dryland, irrigated)	• selection of either "dryland" or "irrigated" is required.
Locations: [ ] (loc 1) [ ] (loc 2) [ ] (loc 3) [ ] (loc 4) [ ] (loc 5) [ ] (loc 6) [ ] (loc 7) [ ] (loc 8)	• if locations are unselected, averages will be based on all available trials for the selected years and trial type. • do not duplicate selections (e.g., do not select Akron more than once).

Reset Search

Search for a Single Trial Location

The database for single location summaries contains data for all Colorado Variety Trials conducted since 1990. Included are data from the Irrigated Variety Performance Trial (**IVPT**; from 1990-present) and three dryland trials, the High Moisture Variety Trial (**HMVT**; from 1990-1999) and the Low Moisture Variety Trial (**LMVT**; from 1990-1999), and the Uniform Variety Performance Trial (**UVPT**; from 2000-present). Grain yield and test weight summaries may be generated for individual locations within any year.

To search, first specify the desired year below. The list of locations available for selection will then include only those locations in the specific year chosen.

Year: [ ]

Location: [ ]

Search

Wheat Information on the Web

Agriculture Network Information Center
http://www.agnic.org/

American White Wheat Producers Association
http://www.awwpa.com

BASF's Clearfield Website
http://www.clearfieldsystem.com/html/default.asp

Colorado Wheat Variety Performance Database
http://triticum.agsci.colostate.edu/vpt.html

Crop Variety Performance for Colorado Crops
http://www.colostate.edu/Depts/SoilCrop/extension/CropVar/index.html

CSU Crop Production Factsheets
http://www.ext.colostate.edu/pubs/crops/pubcrop.html

CSU Dryland Ecosystems Project
http://www.colostate.edu/Depts/SoilCrop/dryland/dryland.htm

Hard Winter Wheat Regional Nursery Program
http://www.ianr.unl.edu/arslincoln/wheat/default.htm

IFAFS - Bringing Genomics to the Wheat Fields
http://maswheat.ucdavis.edu/

USDA-ARS Hard Winter Wheat Quality Lab
http://gqu1.usgmrl.ksu.edu/gqu/

USDA-ARS Western Wheat Quality Lab
http://www.wsu.edu:8080/%7Ewwql/index.html

Wheat Diseases and Pests Identification Guide
http://wheat.pw.usda.gov/ggpages/wpest.html