Cooperative Extension
Colorado State University

MAKING BETTER DECISIONS

1999 Colorado Wheat Variety Performance Trials

Agricultural Experiment Station

Colorado State University

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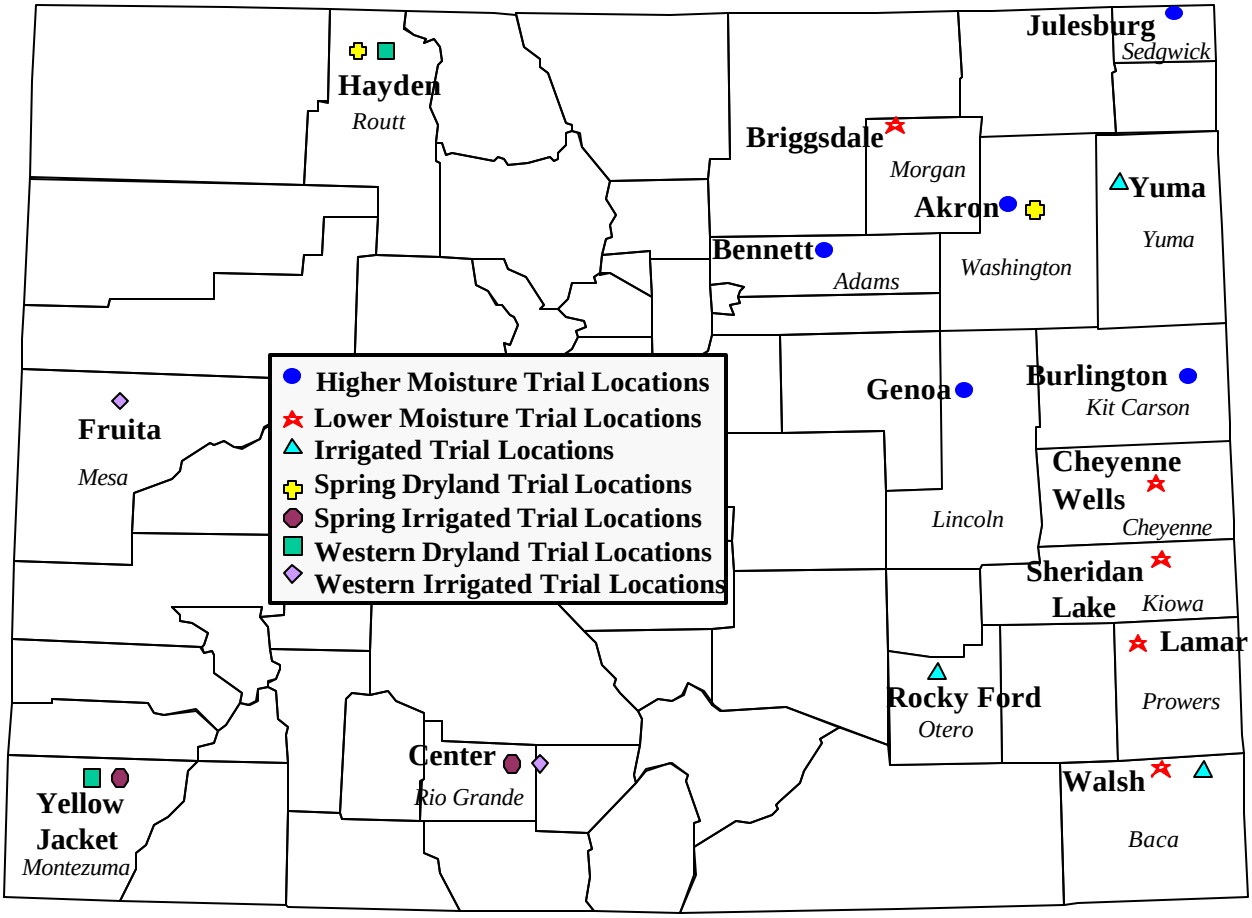
ACKNOWLEDGMENTS

The authors are grateful for the funding received from Colorado State University and the Colorado Wheat Administrative Committee. The Colorado Wheat Administrative Committee provides over $100,000 to Colorado State University for wheat research and makes special contributions for improving the quality of this report and participation by collaborating wheat producers in the CSU Ag Day activities. We are thankful to John Stromberger, Bruce Clifford, Sally Clayshulte, and Jeff Rudolph (Wheat Breeding program), James Hain and Cynthia Johnson (Crops Testing program), Frank Schweissing (Arkansas Valley Research Center), Kevin Larson (Plainsman Research Center), Merlin Dillon (San Luis Valley Research Center), Abdel Berrada (Southwestern Colorado Research Center), Calvin Pearson (Western Colorado Research Center), and Debbie Nicholes (Yuma Irrigation Research Foundation) for the hard work and collaboration that make these trials and this report possible. We recognize valuable assistance provided by the Cooperative Extension agents who work with local producers in all aspects of these trials. We are also thankful for many hours of valuable assistance provided by Thia Walker, Mike Koch and Terri Randolph, Research Associates in the Russian Wheat Aphid program. Most important, the authors are always humbled by the cooperation and unselfish contributions of land, labor and equipment made by the following Colorado wheat farmers who consent to having winter wheat variety performance trials conducted on their farms: John Stulp (Lamar, Prowers County), Eugene Splitter (Sheridan Lake, Kiowa County), Tom Heinz (Cheyenne Wells, Cheyenne County), Barry Hinkhouse (Burlington, Kit Carson County), Ole Johnson (Julesburg, Sedgwick County), John Sauter (Bennett, Adams County), Ross Hansen, (Genoa, Lincoln County), Cary Wickstrom (NW Morgan County), Dutch and Mike Williams (Hayden, Routt County).

1999 Wheat
Variety Performance Trials



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Technical Report TR 00-3

Agricultural Experiment Station	Department of Soil and Crop Sciences	Cooperative Extension	March 2000

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1999 COLORADO WINTER WHEAT VARIETY PERFORMANCE TRIALS

Introduction

Making Better Decisions is a publication of Colorado State University. We are committed to providing the best information, in an appealing form, and in the most timely manner to Colorado wheat producers. Reliable and unbiased performance trial results can lead to better variety selection and earlier adoption of higher yielding varieties.

Immediately after harvest, and prior to fall planting, CSU's Crops Testing program publishes current trial results in different media forms:

1) Results are published in CWAC's *Wheat Grower*
2) Variety trial results are put up on DTN (Data Transmission Network)
3) Variety trial results are available on the Crops Testing Internet page: **www.colostate.edu/Depts/SoilCrop/extension/CropVar/wheat1.html**
4) Results are published in *From the Ground Up*, a Soil and Crop Science Extension publication
5) Results are published in *The Colorado Farmer Stockman*
6) E-mail copies of results are sent to Cooperative Extension agents and producers who request them

Trial Conditions and Methods - 1998/99

Adequate soil moisture conditions in the fall and mild winter temperatures led to good plant stands, vigorous spring growth, and prolific tillering throughout most of eastern Colorado. Parts of Baca and Prowers counties were severely infested with Russian wheat aphids (RWA) while less severe, late, RWA infestations were present in other counties that commonly host the aphids. Heavy brown wheat mite infestations were observed in east central parts of eastern Colorado. Infection of leaf rust was found along the Kansas border south of I-70 to Baca County. Wheat streak mosaic virus and High Plains disease, both vectored by the wheat curl mite, were found in all trials south of I-70. Symptoms of barley yellow dwarf virus were also observed in trials south of I-70. Wheat in east-central and northeastern Colorado suffered from a high temperature period in early June accompanied by strong drying winds that caused early senescence of flag leaves of many varieties in the Julesburg and Burlington trials. The Briggsdale trial was heavily infested with common root rot. The Burlington trial was hailed and was severely lodged.

Colorado winter wheat variety trials are conducted according to moisture group, with different varieties in each group, except for some varieties that are common to all three groups. In 1999, lower moisture variety trials were harvested at Briggsdale, Sheridan Lake, Lamar, Walsh, and Cheyenne Wells. Successful higher moisture trials were conducted at Burlington, Julesburg, Bennett, Akron, and Genoa. Two irrigated winter wheat variety trials were conducted at Rocky Ford and Walsh.

Grain yields were adjusted to 13% moisture. The least significant difference (LSD) value, alpha=0.30, is reported for yields. Carmer[1] (1976) found that producers' risk of economic loss was minimized by using LSD alpha values of 0.20 to 0.40. A randomized complete block field design with three replicates is used in all trials. Four or six, 12 inch-spaced rows, 46 feet long, are harvested from each plot. All dryland trials are seeded at 600,000 seeds/acre and the irrigated trials that are planted at 900,000 seeds/acre.

Yields of all trials were average to excellent in 1999. Summary performance results are provided below for each moisture group. These trials are extremely valuable to the CSU wheat-breeding program to screen new and promising lines that may become released varieties in the future. The HMVT included 14 advanced experimental lines (numbered CO lines), five of which ranked among the top ten entries for highest average yield over locations, with the best yielding 117% of TAM107. There were 24 experimental lines entered in the LMVT, including six of the ten top yielding entries in the trial, with the best yielding 110% of TAM 107. Some exciting new varieties are expected to come from these performance results.

Variety planting suggestions, based on these trial results, are found in the revised **"Decision Tree for Winter Wheat Variety Selection in Colorado".** Results from the collaborative **on-farm test** program should be also consulted before making a variety selection since Halt, Prowers, Yumar, and Prairie Red, four varieties resistant to the Russian wheat aphid, were compared to TAM 107 and Akron by 18 eastern Colorado wheat producers in 1999.

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[1]Reference: Carmer, S.G. 1976. Optimal significance levels for application of the least significant difference in crop performance trials. Crop Sci. 16:95-99.

Description of winter wheat varieties.

NAME AND PEDIGREE	ORIGIN	RWA	HD	HT	SS	COL	WH	LR	WSMV	MILL	BAKE	COMMENTS
2137 W2440/W9488A//2163	KSU-1995	S	5	2	1	75	3	1	2	4	4	Semidwarf, medium-early maturity. Good winterhardiness, good leaf disease resistance, good straw strength. Public release from Pioneer winter wheat donation to Kansas State University.
Akron TAM 107/Hail	CSU-1994	S	4	6	5	80	3	1	3	6	5	Semidwarf, medium-early maturity, vigorous fall and spring growth characteristics, closes canopy early in spring. Lax spike may contribute to enhanced hail tolerance. Excellent yield performance record in Colorado.
Alliance Arkan/Colt//Chisholm sib	NEB-1993	S	4	6	6	75	2	1	3	6	6	Medium-early maturity, short coleoptile, above average tolerance to root rot and crown rot. Excellent yield performance record in Colorado.
Arlin HRW/HRS bulk selection	KSU-1992	S	0	0	2	NA	8	NA	NA	4	2	Hard white winter wheat, early maturing semidwarf. Very intolerant of high temperature and drought stress tolerances.
Baca Scout Selection	CSU-1973	S	1	8	7	120	3	5	7	3	3	Developed from a selection from Scout. Early maturing, tall, long coleoptile, historically stable performance under stress conditions in Colorado.
Betty KS82W418/Stephens	KSU-1998	S	8	4	0	NA	5	NA	NA	6	2	Hard white winter wheat (HWW), selected directly from Jagger for improved winterhardiness. Medium-late maturity, medium height. Poor tillering capacity and row cover capabilities in Colorado.
Cossack BCD1828/83	Goertzen-1998	S	7	7	7	NA	NA	NA	NA	1	1	A private entry from Cargill-Goertzen. Medium-tall, medium-late maturity with marginal straw strength. Very good fall growth characteristics and milling and baking quality characteristics.
Culver NE82419/Arapahoe	NEB-1998	S	6	5	5	NA	2	NA	NA	3	4	Developed from a cross with 50% Arapahoe parentage. Medium height, medium maturity, good winterhardiness.
Custer F-29-76/TAM-105//Chisholm	OK-1994	S	4	1	1	NA	5	NA	NA	4	7	Medium-maturity, short, with very good straw strength. Good performance record under irrigated conditions in Colorado. Unacceptable baking quality characteristics.
Enhancer 1992 Nebraska Bulk Selection	Goertzen-1998	S	4	6	8	NA	NA	NA	NA	6	6	A private entry from Cargill-Goertzen. Medium-tall, medium maturity with very poor straw strength (just slightly better than Scout 66). Very good fall growth characteristics.
Halt Sumner/CO820026,F1//PI372129, F1/3/TAM 107	CSU-1994	R	1	1	5	75	3	8	3	4	1	Developed from a complex cross with 50% TAM 107 parentage. Russian wheat aphid resistant, semidwarf, early maturity, very good baking quality characteristics.

* Heading date (HD), plant height (HT), straw strength (SS), winterhardiness (WH), leaf rust resistance (LR), wheat streak mosaic virus tolerance (WSMV), milling quality (MILL), and ba quality (BAKE) are rated on a 0-9 scale where 0 is best (earliest, shortest) and 9 is poorest (latest, tallest).
* Coleoptile length (COL) is reported in millimeters (mm), and Russian wheat aphid resistance (RWA) is rated on a scale of R=resistant, MR=moderately resistant, S=susceptible. NA = n available.

NAME AND PEDIGREE	ORIGIN	RWA	HD	HT	SS	COL	WH	LR	WSMV	MILL	BAKE	COMMENTS
Heyne KS82W422/SWM754308// KS831182/KS82W422	KSU-1998	S	5	3	0	NA	8	NA	NA	4	3	Hard white winter wheat (HWW). Medium maturity, semidwarf with excellent straw strength. Marginal winterhardiness, poor tillering capacity and row cover capabilities in Colorado.
Jagger KS82W418/Stephens	KSU-1994	S	0	4	7	75	8	5	2	6	1	Developed from cross between a Karl sister selection and a soft white wheat from Oregon. Bronze-chaffed, early maturing semidwarf, good tolerance to WSMV. Breaks dormancy very early, marginal winterhardiness. Very good baking quality characteristics.
Kalvesta Oelson/Hamra//Australia 215/3/Karl92	Goertzen-1999	S	3	3	2	NA	NA	NA	NA	3	3	A private entry from Cargill-Goertzen, developed from a cross with 50% Karl 92 parentage. Medium-early, semidwarf.
Longhorn NS2630-1/Thunderbird	Agripro-1991	S	3	6	3	110	3	NA	NA	3	6	Awnless (beardless) wheat, vigorous fall and spring growth, well-adapted for grazing situations. Marginal baking quality characteristics.
Niobrara TAM105*4/Amigo (TX80GH2679)//Brule Fsel #3	NEB-1994	S	4	6	4	75	3	5	NA	5	2	Developed from a cross with 50% parentage of a Brule sister selection. Medium-tall, medium-late, good winterhardiness and baking quality characteristics.
Nuplains Abilene/KS831862	NE-USDA-1999	S	7	4	1	NA	NA	NA	NA	1	2	Hard white winter wheat (HWWW). Medium-late maturity, semidwarf with excellent straw strength. Very good milling and baking quality characteristics. First entered in Colorado Trials in 2000.
Prairie Red CO850034/PI372129//5*TAM 107	CSU-1998	R	0	1	4	80	3	9	2	4	6	Developed via "backcross transfer" of RWA resistance into TAM 107. Bronze-chaffed, semidwarf, early maturity. Very similar to TAM 107. Marginal baking quality characteristics.
Prowers CO850060/PI372129//5*Lamar	CSU-1997	MR	7	7	7	110	2	7	6	4	2	Developed from the backcross transfer or Russian wheat aphid resistance into Lamar. Moderately resistant to Russian wheat aphid, tall, medium-late maturity, very good quality characteristics. Similar to Lamar, except moderately resistant to RWA.
Prowers 99 CO850060/PI372129//5*Lamar	CSU-1999	R	7	7	7	110	2	7	6	4	2	Developed from re selection within Prowers for improved RWA resistance. Tall, long coleoptile, medium-late maturity, very good quality characteristics. Very similar to Lamar and Prowers, except for its RWA resistance.
Sandy Complex Pedigree	CSU-1981	S	5	8	6	120	2	3	NA	3	4	Developed from a cross with 50% Centurk parentage. Tall, medium-late, good stand establishment characteristics and above average tolerance to root rot and crown rot.

* Heading date (HD), plant height (HT), straw strength (SS), winterhardiness (WH), leaf rust resistance (LR), wheat streak mosaic virus tolerance (WSMV), milling quality (MILL), and ba quality (BAKE) are rated on a 0-9 scale where 0 is best (earliest, shortest) and 9 is poorest (latest, tallest).
* Coleoptile length (COL) is reported in millimeters (mm), and Russian wheat aphid resistance (RWA) is rated on a scale of R=resistant, MR=moderately resistant, S=susceptible. NA = n available.

NAME AND PEDIGREE	ORIGIN	RWA	HD	HT	SS	COL	WH	LR	WSMV	MILL	BAKE	COMMENTS
TAM 107 TAM 105*4/Amigo	TX-1984	S	0	1	4	80	3	9	2	4	7	Developed via "backcross transfer" of Greenbug resistance directly into TAM 105. Bronze-chaffed, early semidwarf, medium long coleoptile, good heat and drought tolerance, poor end-use quality.
TAM 110 (TX71A562-6*4/Amigo)*4/Largo	TX-1995	S	0	2	5	80	3	9	2	5	7	Developed via "backcross transfer" of an additional Greenbug resistance gene directly into TAM 107. Very similar to TAM 107. Marginal end-use quality. Good yield performance record in Colorado.
Thunderbolt Abilene/KS90WGRC10	Agripro-1999	S	5	5	2	NA	NA	1	NA	1	2	Developed from cross between Abilene and a leaf rust resistant version of TAM 107. Bronze chaffed, early maturing semidwarf, good straw strength, good leaf disease resistance.
Trego KS87H325/Rio Blanco	KSU-1999	S	6	4	1	NA	4	3	NA	3	3	Hard white winter wheat (HWW) developed by KSU program in western Kansas (Hays). Medium maturity, semidwarf with excellent straw strength and good end-use quality characteristics.
Wesley KS831936-3//Colt/Cody	NEB-1998	S	3	0	1	NA	3	NA	NA	4	2	Medium-early, short, excellent straw strength. Good winterhardiness and baking quality characteristics. Because of excellent straw strength, may be best adapted for high-input, irrigated production systems.
Wichita Early Blackhull/Tenmarq	KSU-1944	S	1	9	8	120	5	5	NA	4	7	Tall, early, very long coleoptile, very poor straw strength, strong tendency to shatter prior to harvest. (Long-term check variety)
Windstar TX79A2729//Caldwell/Brule seln/3/Siouxland	NEB-1996	S	4	6	5	NA	2	NA	NA	6	5	Developed from a cross with 50% Siouxland parentage. Medium maturity, medium height.
Yuma NS14/NS25/2/2*Vona	CSU-1991	S	3	2	3	70	5	5	7	5	2	Developed from a complex cross with 75% Vona parentage. Medium-early maturity, semidwarf, good straw strength, short coleoptile, good baking quality characteristics.
Yumar Yuma/PI372129//CO850034/3/4 *Yuma	CSU-1997	R	5	6	1	70	5	5	7	5	2	Developed via "backcross transfer" of RWA resistance Yuma. Medium-maturing semidwarf. Good straw strength, slightly better than Yuma despite taller stature.

* Heading date (HD), plant height (HT), straw strength (SS), winterhardiness (WH), leaf rust resistance (LR), wheat streak mosaic virus tolerance (WSMV), milling quality (MILL), and ba quality (BAKE) are rated on a 0-9 scale where 0 is best (earliest, shortest) and 9 is poorest (latest, tallest).
* Coleoptile length (COL) is reported in millimeters (mm), and Russian wheat aphid resistance (RWA) is rated on a scale of R=resistant, MR=moderately resistant, S=susceptible. NA = n available.

Table 1. Winter wheat high moisture performance summary for 1999.

	Location										Averages		
	Akron		Bennett		Burlington		Genoa		Julesburg		1999		3-Yr
Variety[1]	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	1997/98/99
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac
Q 7588*	81.5	59.1	92.5	57.3	59.3	58.8	86.9	56.1	67.4	60.2	77.5	58.3	------
Alliance	81.6	57.2	85.9	58.9	64.6	59.1	83.2	56.0	56.9	57.2	74.4	57.7	56.0 [2]
QAP 7406*	74.3	59.3	79.8	57.5	59.2	58.3	87.0	56.2	65.9	59.7	73.2	58.2	------
XH 9806*	77.6	59.1	82.4	59.1	59.3	57.6	88.1	57.3	56.8	59.1	72.9	58.4	------
Yumar	74.7	59.3	82.2	57.2	57.0	60.1	79.5	56.4	65.2	59.6	71.7	58.5	54.9 [4]
Jagger	71.9	58.5	78.3	57.6	52.6	57.3	84.5	56.3	69.8	60.1	71.4	58.0	54.3
Culver	69.6	56.8	83.0	57.9	53.9	56.5	90.0	56.8	60.5	57.3	71.4	57.1	------
Akron	75.9	58.1	85.9	57.9	56.4	58.3	81.3	56.9	56.8	59.5	71.3	58.2	56.1 [1]
Enhancer	76.2	57.3	75.2	58.4	53.0	57.4	88.1	56.9	62.0	57.7	70.9	57.5	53.9
Yuma	72.4	58.8	78.6	57.1	52.1	56.8	82.1	56.2	66.5	59.7	70.3	57.7	53.3
Prairie Red	73.7	57.9	79.7	57.1	55.2	57.3	80.2	56.2	58.0	58.9	69.4	57.5	55.1 [3]
G15048	73.8	58.8	76.7	60.3	59.5	60.0	80.5	58.7	54.4	59.0	69.0	59.4	------
Kalvesta	69.8	57.2	77.1	58.9	62.0	59.3	75.6	56.8	59.1	60.6	68.7	58.6	------
2137	66.6	57.8	82.5	57.9	51.7	59.0	78.4	56.0	63.0	59.2	68.4	58.0	------
Halt	64.3	57.3	84.2	58.4	53.2	56.9	80.3	55.6	59.9	56.5	68.4	56.9	54.4 [6]
G15011	67.0	58.1	78.1	59.0	54.6	58.1	81.2	57.5	60.1	60.3	68.2	58.6	------
T834	72.3	58.2	64.7	57.4	62.3	57.7	77.7	56.8	62.2	59.9	67.8	58.0	------
Trego	67.7	60.1	77.7	58.7	57.7	60.1	74.3	57.4	59.9	61.3	67.5	59.5	------
TAM 110	68.4	57.3	75.6	57.4	47.7	57.4	82.5	55.9	62.9	58.2	67.4	57.3	54.6 [5]
Wesley	73.2	57.7	63.9	57.9	60.1	54.3	72.5	55.7	62.9	58.0	66.5	56.7	------
G12058	69.1	58.9	71.1	59.7	55.8	58.9	77.5	58.5	58.5	60.2	66.4	59.3	------
TAM 107	74.9	58.1	66.9	56.4	53.8	58.7	72.9	56.0	59.3	58.9	65.6	57.6	54.0
Cossack	68.8	58.2	75.5	59.8	50.9	60.2	72.2	58.2	60.1	60.4	65.5	59.4	48.4
Thunderbolt	67.6	60.1	71.1	59.5	54.8	61.3	76.4	58.2	55.7	61.1	65.1	60.1	------
QAP 7510*	63.0	58.7	75.2	59.5	55.1	59.0	74.5	57.3	54.8	60.5	64.5	59.0	51.1
Prowers	72.5	60.0	79.0	59.5	38.2	59.7	75.5	58.1	54.7	60.4	64.0	59.5	49.9
Arlin	72.0	59.3	65.3	57.5	44.3	60.1	73.6	56.6	61.0	61.1	63.2	58.9	50.1
Betty	66.0	56.6	72.9	56.8	53.2	60.6	67.9	56.8	52.7	59.7	62.5	58.1	------
Heyne	59.9	58.1	65.5	58.8	42.2	60.1	74.0	56.7	52.1	60.4	58.7	58.8	------
Wichita	56.3	59.1	54.5	59.3	37.5	57.0	56.0	57.0	42.1	61.3	49.3	58.7	38.9
Average	**70.8**	**58.4**	**76.0**	**58.3**	**53.9**	**58.5**	**78.5**	**56.8**	**59.4**	**59.5**	**67.7**	**58.3**	
CV%	9.5		8.8		18.1		6.6		6.2				
$LSD_{(.3)}$	5.8		5.7		8.4		4.4		3.1				

[1]Varieties ranked by the average yield over five locations in 1999.

[1.....6] Variety rank based on 3-Yr average yields.

*Denotes winter wheat hybrid entry.

Table 2. Winter wheat lower moisture performance summary for 1999.

	Location										Averages		
	Briggsdale		Cheyenne Wells		Lamar		Sheridan Lake		Walsh		1999		3-Yr
Variety[1]	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	1997/98/99
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac
Trego	48.0	56.9	54.1	57.6	74.5	58.2	69.2	57.8	74.7	60.5	64.1	58.2	------
Alliance	50.6	55.3	56.1	57.2	71.3	57.2	63.4	56.1	63.6	59.0	61.0	56.9	57.4 [1]
2137	51.8	55.0	46.0	56.8	70.0	57.2	72.1	57.8	61.4	59.0	60.3	57.2	------
Akron	48.8	56.0	54.1	56.8	69.2	57.5	63.1	57.2	59.3	58.1	58.9	57.1	54.9 [4]
Prairie Red	57.6	55.6	44.7	56.7	67.4	56.7	64.4	57.2	59.5	58.8	58.7	57.0	55.4 [3]
Yuma	46.7	53.8	48.0	56.0	66.0	56.8	63.8	57.0	68.1	57.7	58.5	56.3	54.2 [6]
Enhancer	48.0	53.7	48.0	56.3	67.6	58.3	64.2	56.0	63.3	54.9	58.2	55.9	------
T812	53.6	56.3	52.0	57.6	63.4	58.2	56.4	57.6	62.5	59.0	57.6	57.8	------
Yumar	42.6	55.1	49.0	56.2	65.2	57.4	63.6	56.3	66.8	59.8	57.4	57.0	52.2
TAM 107	52.7	55.0	46.4	56.3	63.1	57.2	61.5	56.0	62.1	59.0	57.2	56.7	54.8 [5]
G15011	48.6	55.7	49.7	56.4	64.2	57.8	57.3	57.1	65.6	58.9	57.1	57.2	------
Kalvesta	47.9	57.1	44.1	58.1	71.4	59.0	60.4	58.3	61.5	59.7	57.1	58.4	------
TAM 110	54.1	54.4	48.5	56.0	60.5	56.4	56.7	55.8	65.4	60.1	57.0	56.5	55.6 [2]
Windstar	49.3	54.5	42.8	56.4	67.3	56.5	63.7	56.4	58.5	56.2	56.3	56.0	52.2
Niobrara	50.3	55.2	39.5	55.4	61.2	55.1	61.6	56.4	62.2	58.5	55.0	56.1	52.9
Arlin	46.0	53.7	52.2	57.2	57.5	58.5	48.6	56.6	67.9	62.1	54.4	57.6	49.0
G12058	41.4	55.1	42.0	58.9	69.2	59.6	59.7	59.1	56.7	60.1	53.8	58.5	------
Halt	53.8	54.8	46.3	55.8	58.7	57.0	49.0	56.7	60.9	58.5	53.8	56.5	51.9
Prowers	43.8	56.5	42.0	58.7	63.4	59.8	59.0	58.7	54.9	59.3	52.6	58.6	50.3
Baca	51.5	57.6	37.9	58.3	55.2	58.3	49.7	57.7	56.8	60.1	50.2	58.4	49.0
Wichita	36.9	58.3	33.9	59.0	45.7	60.2	45.3	58.1	44.0	59.7	41.1	59.1	39.6
Average	**48.8**	**55.5**	**46.5**	**57.0**	**64.4**	**57.8**	**59.7**	**57.1**	**61.7**	**59.0**	**56.2**	**57.3**	
CV%	10.1		11.6		7.9		9.6		7.3				
$LSD_{(.3)}$	4.2		4.5		4.3		4.8		3.9				

[1]Varieties ranked by the average yield over five locations in 1999.

[1.....6] Variety rank based on 3-Yr average yields.

Table 3. Winter wheat irrigated performance summary for 1999.

	Location						Average
	Rocky Ford				Walsh		3-Yr
Variety[1]	Yield	Test Wt	Lodging[2]	Plant Height	Yield	Test Wt	1997/98/99
	bu/ac	lb/bu	0-9	inches	bu/ac	lb/bu	bu/ac
T81	98.2	61.0	6	40	54.5	60.9	------
G15011	97.7	61.3	1	41	48.4	56.7	------
TAM 107	94.6	61.2	2	40	57.9	60.6	92.0 [6]
QAP 7406	93.2	58.6	2	42	54.0	59.8	------
2137	93.1	59.7	1	41	63.7	60.5	96.3 [2]
QAP 7510	93.0	60.0	0	38	50.6	58.9	96.6 [1]
Custer	92.5	60.3	4	40	78.9	59.8	93.5 [3]
Arlin	86.6	60.9	2	40	50.2	62.7	------
TAM 110	85.4	61.2	4	40	52.5	60.9	88.7
Jagger	85.4	58.5	9	39	61.5	59.7	86.9
Prairie Red	82.8	59.5	5	39	55.4	59.9	93.1 [4]
G12058	82.3	61.7	5	40	62.5	61.4	------
G15048	80.6	58.3	3	39	52.0	59.8	------
Yumar	80.3	58.4	3	40	56.4	59.3	90.7
Akron	79.6	58.0	2	40	57.2	61.3	85.7
Yuma	79.4	59.8	4	40	48.8	58.9	92.4 [5]
Kalvesta	78.6	60.6	5	40	56.0	62.5	------
Halt	77.4	58.2	2	38	59.8	58.3	85.0
Q 7588	77.0	57.8	8	40	49.3	61.6	------
Enhancer	65.7	57.5	9	38	49.1	59.1	------
Cossack	65.4	60.1	2	41	50.5	59.5	------
Average	**84.2**	**59.6**	**3.7**	**39.8**	**55.7**	**60.1**	
CV%	9.7				19.8		
$LSD_{(.3)}$	7.0				9.4		

[1]Varieties ranked by the yield for Rocky Ford.

[2]Lodging scale: 0=completely erect, 9=completely flat.

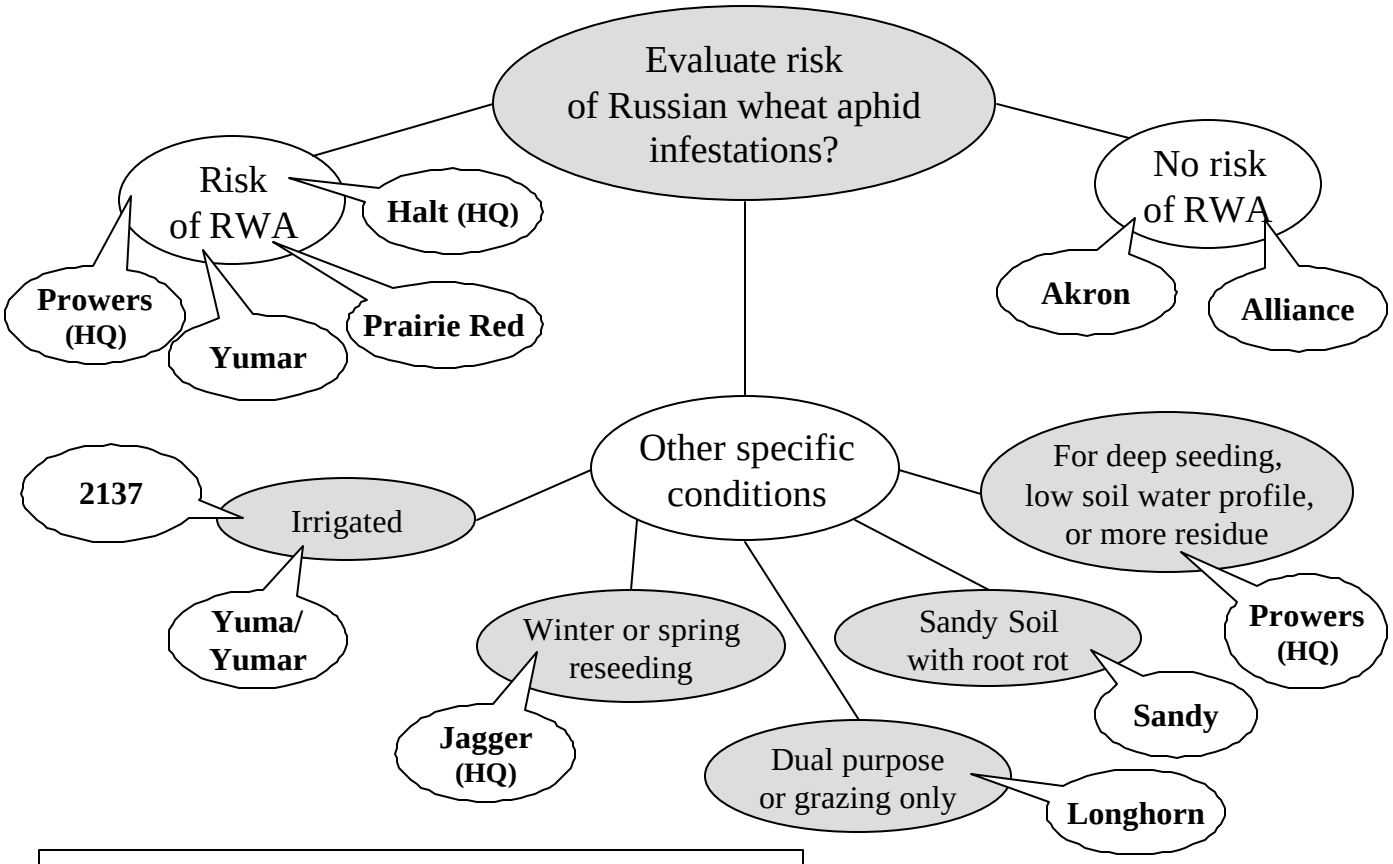
[1.....6] Variety rank based on 3-Yr average yields (not including Walsh).

Table 4. 1999 Trial Information.

		Date of	Date of		Fertilization (lb/A)		
Locations	Entries #	Planting 1998	Harvest 1999	Soil Texture	Nitrogen N	Phosphorus P_2O_5	Type of Irrigation
Higher Moisture							
Akron	45	9/23/98	7/12/99	Silty clay	70	0	None
Bennett	45	9/15/98	7/13/99	Sandy clay	40	37	None
Burlington	45	9/16/98	7/08/99	Silty clay	80	29	None
Genoa	45	9/15/98	7/22/99	Sandy clay	55	37	None
Julesburg	45	9/22/98	7/14/99	Clay	40	15	None
Lower Moisture							
Briggsdale	45	10/09/98	7/14/99	Sandy clay	25	37	None
Cheyenne Wells	45	9/16/98	7/08/99	Silt loam	30	37	None
Lamar	45	9/17/98	7/08/99	Silt loam	35	37	None
Sheridan Lake	45	9/16/98	7/07/99	Silt loam	5	37	None
Walsh	45	9/23/98	7/05/99	Sandy clay loam	45	0	None
Irrigated							
Rocky Ford	24	9/24/98	7/08/99	Silty clay loam	0	50	Furrow
Walsh	24	9/23/98	7/05/99	Sandy clay loam	90	0	Furrow

Decision Tree for Winter Wheat Variety Selection in Colorado

Jerry Johnson and Scott Haley



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

The best choice of a winter wheat variety in Colorado depends upon variable production conditions. The decision tree is an attempt to combine our empirical knowledge of wheat variety performance with the quantitative performance of varieties compared in CSU variety trials. Varieties listed in the decision tree are varieties that the authors think growers should consider for the production conditions specified in the tree. Note that even when aphids are not a problem, RWA-resistant varieties are expected to have equal yields of non-resistant varieties. The two hybrids in the decision tree have performed well in both irrigated and dryland trials but producers need to carefully consider potential yield advantages in the context of current market prices and production costs. Production risks may be reduced by planting more than one variety and it should be remembered that avoiding poor variety decisions may be as important as choosing the winner among winners.

1999 Collaborative On-Farm Testing Results

Jerry Johnson

In the fall of 1998, twenty-two eastern Colorado wheat producers planted collaborative on-farm tests (COFT) in Baca, Prowers, Kiowa, Cheyenne, Kit Carson, Arapahoe, Morgan, and Weld counties. The objective was to compare performance of the newly-released Russian wheat aphid (RWA)-resistant varieties – *Halt*, *Prowers*, *Yumar*, and *Prairie Red* – with the performance of the RWA-susceptible varieties *TAM 107* and *Akron*. Working alongside local Extension agents, each producer-collaborator received 100 pounds seed of each variety and planted the six varieties in side-by-side strips.

The 1998-99 season was the fourth year of winter wheat variety on-farm testing. Many collaborating producers have conducted tests each of the four years. Colorado State University Cooperative Extension agents have taken more and more responsibility for the success of this program – recruiting volunteer growers, delivering seed, planning field layout and operations, keeping records, coordinating visits, communicating with growers and campus coordinators, coordination of weighing plot yields. In addition to evaluation of new varieties under farm conditions, on-farm testing directly involves producers in the variety development process, thereby reducing the number of years required for adoption of superior, new varieties.

The 1999 COFT results are divided into two groups according to geographic location within Colorado. Eight locations from the southeast Colorado group showed *Yumar* to be the highest yielding variety with *Akron*, *Halt*, *Prairie Red*, and *Prowers* in a mid-yield group. *TAM 107* was lowest yielding. Nine locations from the east-central Colorado group showed *Akron*, *Halt*, and *Prairie Red* to be the highest yielding varieties with *Prowers*, *TAM 107*, and *Yumar* in a lower yielding group. Overall, *Yumar*, *Akron*, *Halt*, and *Prairie Red* were the top yielding varieties with *Prowers* and *TAM 107* yielding less. The yield performance of *Yumar* was noteworthy, especially in southeast Colorado where climatic conditions were exceptionally favorable. *Prowers* performed well in the southeast as well. The newly released, RWA-resistant varieties performed consistently better than *TAM 107* across the state.

Light to severe infestations of RWA were observed at most southeast Colorado locations and some east-central locations. Severe infestations of brown wheat mite were observed in several east-central locations. Hail reduced yields at the Kit Carson NE location.

This report is made available at no charge compliments of the Colorado Wheat Administrative Committee.

1999 Colorado Collaborative On-Farm Test (COFT) Results.

	Variety (Yield in bu/ac @ 13% moisture)						
County Location	**Akron**	**Halt**	**Prairie Red**	**Prowers**	**TAM 107**	**Yumar**	**Test Ave**
Baca EC	46.7	51.5	48.5	46.5	38.9	56.4	48.1
Baca SW	38.4	37.9	42.5	43.6	36.7	45.7	40.8
Baca WC	56.3	57.2	63.6	56.4	58.1	62.3	59.0
Baca SE	57.2	63.5	61.7	60.2	68.6	66.5	63.0
Prowers C	61.9	63.4	61.7	65.2	61.0	70.6	64.0
Prowers N	48.7	51.7	48.1	52.1	40.3	47.9	48.1
Prowers NC	47.5	45.8	49.5	52.1	38.8	43.9	46.3
Kiowa	69.7	65.1	66.4	61.5	66.4	70.3	66.6
SE Colorado Ave	**53.3**	**54.5**	**55.3**	**54.7**	**51.1**	**58.0**	**54.5**
Kit Carson W	77.6	74.4	81.4	67.7	78.9	79.8	76.6
Kit Carson NE	40.2	31.8	38.0	24.4	36.4	36.3	34.5
Kit Carson SE	83.5	96.0	87.4	66.9	81.7	82.0	82.9
Lincoln NC	76.0	95.2	74.7	54.0	84.7	93.3	79.7
Lincoln SC	39.9	43.7	38.9	32.0	29.0	37.1	36.7
Arapahoe SW	69.3	68.0	62.3	66.3	65.0	N/A	66.2
Arapahoe NC	28.7	32.0	34.5	38.8	31.8	38.2	34.0
Morgan	47.1	47.2	44.7	44.4	36.2	42.8	43.7
Weld SW	47.3	47.4	46.0	48.8	46.2	49.8	47.6
Weld NE	50.3	50.6	52.8	51.4	51.9	44.4	50.2
Central Ave	**56.0**	**58.6**	**56.1**	**49.5**	**54.2**	**56.0**	**55.2**
Variety Ave Yield	**54.8**	**56.8**	**55.7**	**51.8**	**52.8**	**56.9**	**54.8**
Variety Ave TWT	**58.0**	**58.5**	**58.2**	**58.3**	**58.4**	**59.1**	**58.4**
Protein Contents (%) 1998	**n/a**	**12.4**	**n/a**	**12.6**	**11.7**	**12.4**	**12.4**
Protein Contents (%) 1999	**10.4**	**10.9**	**10.4**	**10.9**	**10.7**	**10.3**	**10.6**

Halt and *Prowers* are known to have better milling and baking quality characteristics. *Prowers* had the highest test weight average across all locations. Grain samples from test locations were analyzed for protein content in 1998 and 1999. Results show that *Halt* and *Prowers* have higher protein content than the other varieties.

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

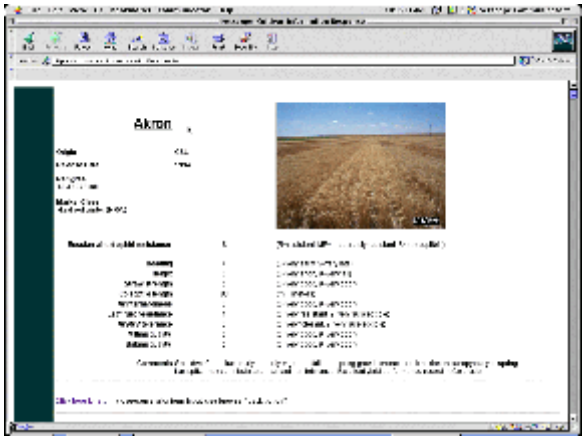
Location	Extension Contact	Phone	E-Mail Address
Adams County	Vacant	(303) 637-8117	adams@coop.ext.colostate.edu
Baca County	Tim Macklin	(719) 523-6971	baca@coop.ext.colostate.edu
Cheyenne County	Tim Burton	(719) 767-5716	cheyenne@coop.ext.colostate.edu
Kiowa County	George Ellicott	(719) 438-5321	kiowa@coop.ext.colostate.edu
Kit Carson County	Ron Meyer	(719) 346-5571	rmeyer@coop.ext.colostate.edu
Lincoln County	Vacant	(719) 743-2542	lincoln@coop.ext.colostate.edu
Logan County	Randy Buhler	(970) 522-3200 Ext. 5*	logan@coop.ext.colostate.edu
Morgan County	Bruce Bosley	(970) 867-2493	morgan@coop.ext.colostate.edu
Prowers County	Leonard Pruett	(719) 336-7734	prowers@coop.ext.colostate.edu
Prowers County	Richard Scott	(719) 336-7734	prowers@coop.ext.colostate.edu
Sedgwick County	Gary Lancaster	(970) 474-3479	sedgwick@coop.ext.colostate.edu
Washington County	Stan Pilcher	(970) 345-2287	washingt@coop.ext.colostate.edu
Weld County	Jerry Alldredge	(970) 356-4000 Ext. 4474	weld@coop.ext.colostate.edu

Colorado Winter Wheat Variety Performance Database

Scott Haley and Jerry Johnson

A relational database system accessible over the Internet/Web recently was developed to provide enhanced access to winter wheat variety and variety trial information from the CSU Variety Performance Trial program. The database system (found at "**http://triticum.agsci.colostate.edu/vpt.html**") will be updated annually with new variety information and variety trial data. The database currently consists of the following three components:

1) variety characteristics



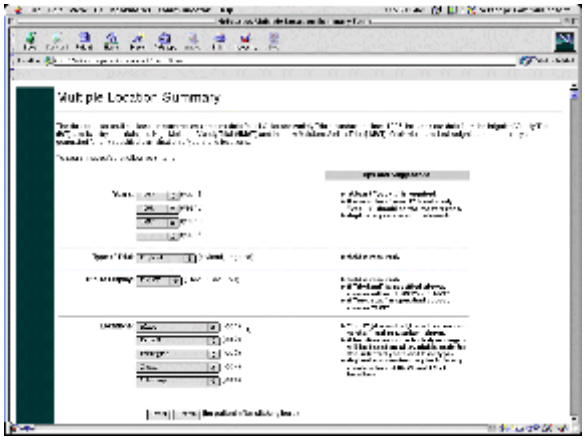
Information on winter wheat varieties grown in Colorado, and entered in CSU variety trials, includes:

- Origin, pedigree, and market class (e.g.., hard red or hard white winter).
- Disease and insect resistance, including Russian wheat aphid, wheat streak mosaic virus (WSMV), and leaf rust.
- Agronomic data, including plant height, maturity, straw strength, and winterhardiness.
- Milling and baking quality performance.
- Miscellaneous comments.

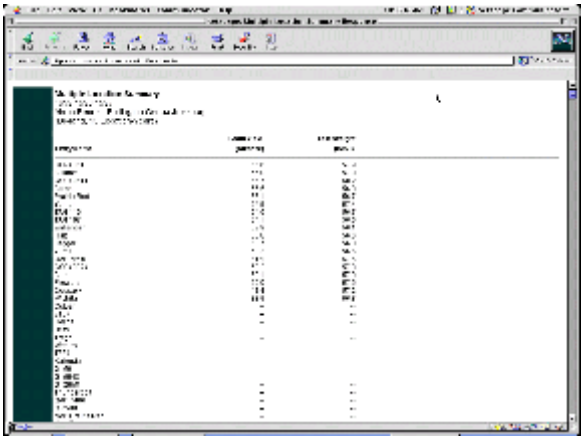
2) single location trial data

Grain yield and test weight data from individual trial locations may be displayed using simple form-based input. All dryland and irrigated trial data since 1990 are available.

3) multiple location summaries



Input Form



Summary Results

A simple input form (*above left*) is used to specify the years, trial type (dryland or irrigated), and locations to use in generating grain yield and test weight averages (*above right*). Any combination of years (up to four) or locations (up to five) may be specified. On the summary output, entries are displayed (sorted by average grain yield) along with the respective year and location information supplied by the user for generating the averages.

Maximum Economic Yield (MEY) of Irrigated Winter Wheat in Colorado

Jerry Johnson, Jessica Davis, and Mahdi Al-Kaisi

Introduction: Even though average Colorado yields of irrigated winter wheat have been low (55 bu/ac in 1996), yields of 120-150 bu/ac are possible with the right combination of variety plant population, fertilizer, irrigation regime, and pest control. The goal of the MEY study is to determine the major underlying causes of low irrigated wheat yields in Colorado and to test higher yielding alternatives that are economically feasible. Maximum yield agronomic field studies will be carried out for three years, starting in the fall of 1998, and the project will also include field surveys of high yielding irrigated wheat fields and on-farm tests of promising innovations. This study is a joint undertaking of Colorado State University's Agricultural Experiment Station, the Colorado Wheat Administrative Committee (CWAC), Farmland Industries, and Hybritech. CSU's Crops Testing program (Jerry Johnson), conducts the trial, surveys, and on-farm testing with the help of a graduate student (Ravi Sripata).

Results: The following tables provide 1999 yield results. The trial was conducted at the Irrigation Research Farm at Yuma following a wheat crop in 1998. Treatments included: two dates of planting (9/20/98 & 10/25/98), three hybrids and one public variety (Q 7888, Quantum® 7406, Quantum® AP7510, Yuma), eight fertilizer treatments (combinations of nitrogen, phosphorus, and micronutrients), and three plant populations (1.3 million, 900,000 and 500,000 seeds per acre). The planting dates were in separate blocks in the field that turned out to have quite different soil properties and yield potential. The first date of planting had shallower soil, less organic matter, and was sandier. Consequently the results for each date of planting are reported separately.

Discussion: Results indicate that it is possible to obtain high yields at a late date of planting. There were only slight benefits to increasing seeding rates due to sub-optimal fall emergence. Favorable tillering conditions during the winter and early spring of 1999 mostly compensated for lower plant stands. Good tillering also compensated for differences in seeding rates. There was a significant increase in yield due to nitrogen fertilizer but the response to phosphorus was not clear. There was no response to micronutrients, which also included potassium. Two of the hybrids, Q 7888 and Quantum 7406, clearly yielded higher than Yuma and the other hybrid, Quantum® AP7510. Unfortunately, the future availability of hybrid wheat seed is in question.

The 1999 MEY trial was a valuable learning experience. Complete yield results and analyses as well as trial conditions in 1998/99 and 1999/2000 can be found on our MEY web page at:
www.colostate.edu/Depts/SoilCrop/extension/CropVar/mey/mywebpage/default.html

Although we were not able to obtain 150 bu/ac as hoped, one plot yielded 141 bu/ac and one treatment combination (averaged over three replicates) yielded 127 bu/ac.

1999 MEY Yields for 1st and 2nd Dates of Planting (DOP).

Yields in bu/ac @ 13% moisture

Fertilizer Treatment				1st DOP	2nd DOP
F1	N low	P none	no micros	80	98
F2	N med	P none	no micros	91	105
F3	N med	P med	no micros	92	104
F4	N med	P high	no micros	96	109
F5	N high	P none	no micros	103	113
F6	N high	P med	no micros	102	112
F7	N high	P high	no micros	103	111
F8	N high	P high	with micros	102	108
Variety/Hybrid				**1st DOP**	**2nd DOP**
Q7406				100	113
Q7888				99	112
Yuma				95	102
AP7510				91	103
Planting Density (seeds/ac)				**1st DOP**	**2nd DOP**
1.3 million				96	110
900,000				96	110
500,000				96	102

Making Better Marketing Decisions in 2000

Darrell Hanavan

Four years ago, U.S. and worldwide wheat stocks were the lowest in history which resulted in record-high wheat prices. U.S. wheat stocks are now projected to exceed the 10-year average by 67 percent and to climb to the highest level since May 31, 1988. Consequently, wheat prices are at their lowest level in nine years and more than 23 percent below the 10-year average.

Projected planting of all U.S. wheat for harvest in 2000 is expected to be down approximately 3 percent, but are down more then 13 percent from the 10-year average and the lowest planted acreage since 1973. Actual acres harvested and yields will be the keys to the price of wheat in the 2000-2001 marketing year. Although U.S. wheat stocks are presently high, world wheat stocks are low. As world demand reduces U.S. wheat stocks in the coming year, prices should rise.

Understanding historical market trends can help Colorado wheat producers make better marketing decisions. Only 31 percent of the state's winter wheat production is marketed during the months of December to February when the highest price is typically received for the lowest carrying cost (storage plus interest). Forty-seven percent (47%) of Colorado's wheat production is sold prior to December when market prices have been the lowest. On average, there has been a 52-cent price advantage by selling after November instead of July. The estimated monthly carrying cost for storage and interest is five to six cents per bushel. Producers who are unable to take advantage of this historic rise in prices after November might consider options or futures contracts to manage financial risk.

Current wheat market fundamentals strongly suggest that prices will increase by substantially more than the 10-year average of 52 cents per bushel after November in the 2000-2001 marketing year. The price of wheat during the 1999-2000 marketing year has been erratic and uncharacteristic of long-term trends. Colorado wheat producers should strongly consider long-term price trends when making decisions to sell wheat early in the market season as they may miss out on upward price movement that historically occurs after November.

Colorado Average Wheat Prices, 1989-99 (July-June).

Marketing Year	July Average Price/Bu.	Highest Monthly Average Price/Bu.	Price/Bushel Gain	Month	12-Month Average
1989-90	3.73	3.81	+.08	December	3.59
1990-91	2.69	2.69	0.00	July	2.45
1991-92	2.47	3.88	+1.41	February	3.28
1992-93	3.06	3.36	+.30	January	3.12
1993-94	2.70	3.58	+.88	January	3.15
1994-95	3.02	3.71	+.69	January	3.53
1995-96	4.20	5.67	+1.47	April	4.92
1996-97	4.78	4.78	0.00	July	4.20
1997-98	3.20	3.33	+.13	August	3.16
1998-99	2.52	2.76	+.24	January	2.51
10-Year Average	**3.24**	**3.76**	**+.52**	**December-April**	**3.39**

Sulfur Fertilization of Dryland Winter Wheat

Jessica Davis

Sulfur increased yield when soil pH was high and OM was low.

In the 1980's, CSU researchers Hunter Follett and Dwayne Westfall studied sulfur fertilization of winter wheat at 15 locations throughout eastern Colorado. Fertilizer treatments were injected about four inches deep at 12-inch spacings as liquid ammonium thiosulfate about two weeks before planting. The nitrogen and phosphorus applications were uniform across the plots. Three of the fifteen locations had significant yield responses. However, the average soil sulfate levels in the responsive sites was less than the average level in the non-responsive sites.

Many wheat farmers apply sulfur with their pre-plant nitrogen and phosphorus applications. Often the stated purpose of the S is to reduce pH in the fertilizer band (thus increasing the availability of P, Zn, and Fe), not necessarily to supply S as a nutrient. A closer look at the Follett and Westfall dataset reveals that the yield response is related to the soil pH at the 15 study sites. One of the responsive sites had a low pH (6.6), but sulfur decreased yield significantly at this site. The other two responsive sites had yield increases due to S fertilization, and both had soil pH levels of 7.5 or greater.

Soil pH	Yield Response	Details
< 7.0	1/5 responsive sites	The responsive site had a negative yield response.
7.0-7.4	0/6 responsive sites	--
≥ 7.5	2/4 responsive sites	The responsive sites had soil OM ≤ 1.5 %, and the non-responsive sites had soil OM = 2.0 %.

However, there were two other sites with pH of 7.5 or greater which did not respond to S fertilization. Other research has shown that S fertilizer responses are more likely to occur in soils with low organic matter contents. This principle holds true in this case as well. The two sites with positive yield response of 3-4 bu/acre both had soil pH levels ≥ 7.5 and soil organic matter levels ≤ 1.5%. Therefore, S fertilization has the best chance of increasing yield when soil pH ≥ 7.5 and soil OM ≤ 1.5%. Be sure to consider the cost of the additional fertilizer when making your S fertilization decisions.

New Herbicides for Use in Wheat

Phil Westra and Tim D'Amato

Aim – (FMC Chemical Co.), is labeled for broadleaf weed control in wheat and barley. This product is a contact, or burn-down type herbicide with no residual activity. Coverage is critical and weed height should be four inches or less for effective results. Aim may be applied as a tank mix partner with other herbicides registered for use in wheat.

Maverick – (Monsanto Chemical Co.), is labeled for use in wheat in wheat/fallow rotations. Maverick is a selective herbicide for control of annual brome species (in the Great Plains region - downy brome, cheatgrass, Japanese brome), as well as control of flixweed and pennycress, and suppression of blue mustard. Maverick provides post and soil residual activity, and is most effective when applied in the fall.

Paramount – (BASF Chemical Co.), is labeled for use in fallow with rotation to wheat or grain sorghum, pre-emergence to wheat or grain sorghum, and in-crop grain sorghum. Paramount has excellent residual activity and is effective for management of field bindweed, as well as providing control of barnyardgrass and foxtail species. The Paramount label is expected to be expanded to in-crop wheat, and rotations that include millet and corn.

Starane – (United Agri Products), is a post emergence herbicide registered for use in small grains. Starane has excellent crop safety in wheat, barley, and oats and applied in a tank mix with 2,4-D or MCPA will provide control of a wide spectrum of susceptible broadleaf weeds.

Clearfield Wheat – "IMI Wheat" or wheat lines resistant to imidazolinone herbicides are being developed through partnership between American Cyanamid and several public and private programs in the Great Plains. Clearfield wheat is developed for resistance by way of induced mutation, not gene insertion, and is not classified as a GMO (genetically modified organism). Locally adapted Clearfield wheat seed should be available in the Central Great Plains Region by planting time in 2002. Imazamox will be the labeled herbicide for use in Clearfield wheat.

Imazamox provides selective control of winter annual grasses such as downy brome, jointed goatgrass, and feral rye. Screening trials are currently being conducted to assess the effectiveness of winter annual grass control of imazamox applied at various rates and timings.

Integrated Management Systems – A large scale experiment near Platner, CO, is evaluating the effects of cultural practices (variety, tillage, plant density, date of planting, and nitrogen application) on severity of jointed goatgrass infestation. No-tillage increased jointed goatgrass reproductive tillers over that of conventional-tillage or reduced-tillage. Increasing wheat planting rate from 40 to 60 lb/ac decreased jointed goatgrass growth characteristics. Delayed planting resulting in lower winter wheat production and higher jointed goatgrass production. The variety "Akron" yielded the highest while "TAM 107" produced the lowest jointed goatgrass infestation.

Implementation of Best Management Practices for Management of Jointed Goatgrass – The National Jointed Goatgrass Research Program has funded the establishment of four large scale, on-farm trials in the Great Plains for economic analysis and demonstration of current practices compared to new integrated approaches. Called Best Management Practice sites (BMPs), practices to be studied included crop rotations, fertilizer placement, and winter wheat planting date. The crop rotations and cropping systems have been adapted to environmental conditions and surrounding cultural practices of each area. Cooperators keep detailed records for economic analysis and researchers analyze soil core and seedling counts to determine effects on the jointed goatgrass populations. Although data from these sites are not yet available, field days will be held at several of the BMP sites this spring and summer.

High Plains 1999 Wheat Disease Update

Joe Hill and Bill Brown

In most years there are few problems with wheat diseases on the High Plains of Colorado. Climate is quite dry, and leaf diseases such as tan spot, powdery mildew, septoria, and rusts seldom cause significant damage. It should be noted that these diseases can be found but environmental conditions are generally not favorable for their development to damaging levels in most years.

An exception to the norm can be found where wheat is grown under irrigation. As agriculture systems evolve and more wheat (especially white wheat) is grown under pivot irrigation it will be necessary to carefully monitor the crop throughout the season for both an increase in leaf diseases and also root rot diseases like take-all and Cephalosporium.

There is grower concern about the impact of increasing acreage going to minimum tillage on wheat disease development. This is a valid concern when viewed from the perspective of recent events in the Red River Valley of North Dakota and Minnesota. The highly damaging attacks of Fusarium scab have caused significant losses. The problem developed because of several things coming together at the same time. Increased minimum tillage, a corn/small grain rotation with both crops hosting the Fursarium scab fungus and the increased frequency of rainfall during the wheat flowering period. It is unlikely such a situation would develop in Colorado even though we are seeing a significant increase in a dryland corn/wheat rotation. We have monitored the CSU Dryland Agroecosystems experiments for over 6 years and have yet to find any significant increased disease development in the wheat. The key to keeping disease incidence low is reducing stress on the wheat by increasing moisture retention and availability and the dry air.

A more significant problem may be developing with the virus situation. Both wheat streak mosaic (WSMV) and High Plains Disease (HPDV) viruses have the same wheat curl mite as a vector. The mites and the viruses survive in both wheat and corn. For many years we have managed WSMV (and presumably HPDV) with a system of volunteer elimination and delayed planting. The increase in dryland corn is providing the green bridge for both the viruses and the vector. The increased acreage of corn maturing later in the season may be, in fact, pushing the vector migration to the wheat later in the season. What may be the result is that the late planted wheat may be at its most susceptible stage just as the mites are leaving the corn. We have seen an increase in virus symptoms in wheat near dryland corn. It must be noted that this is a preliminary observation, not a validated research observation. But this highlights the need to pursue appropriate research to define what viruses, if any, are building up in dryland corn and then moving into wheat.

Preventing Insects in Farm-Stored Grain

Frank Peairs

Colorado has low to moderate risk for stored grain insect problems. Following a few simple guidelines can result in 2-3 years of pest-free storage. Growers may be planning on holding grain longer than usual in today's farm economy so careful attention to good grain storage practices is important.

There are three basic strategies for preventing stored grain insect problems:

1. Eliminating existing infestations.
2. Preventing the establishment of new infestations.
3. Discouraging the growth of infestations.

1. Eliminate existing infestations.

Thoroughly clean all debris and remaining grain from in and around the bins, including behind partitions, under floors, etc. Clean all transport and handling equipment. Even small amounts of infested grain can lead to problems. For example, 30 weevils held at ideal temperatures can become more than 10,000 weevils within five months.

Treat the bin with an approved bin treatment to kill any insects that survived the cleanup. Treat all interior surfaces, exterior surfaces around bin openings and a six foot band of soil around each bin. It may be necessary to fumigate inaccessible areas, such as under false floors.

Feed or destroy the first few bushels through handling equipment. This is sort of like rinsing the equipment out before use. Never store new grain on old grain, which is very likely to have some insects in it already.

2. Prevent the establishment of new infestations.

Treat grain going into long-term storage with an approved protectant. Monitor grain for insect activity and fumigate if problems are detected.

3. Discourage the growth of infestations.

Store clean, dry grain. Dockage greatly improves the survival of stored grain insects, especially the "bran bug" types. Adjust the combine to minimize damaged kernels. Consider screening the grain before storage. It is very difficult for insects to grow and reproduce on grain at 12% moisture or below.

Stored grain insect reproduction generally ceases below 60 F and all activity, including feeding, stops below 50 F. Cooling stored grain quickly and maintaining uniformly cool temperatures throughout the grain mass is a valuable deterrent to stored grain insect problems.

Seed Certification System

Gil Waibel

The Colorado Seed Growers Association (CSGA) is the seed certification agency in Colorado. There are wheat growers at many locations in the eastern half of Colorado. In order to produce certified seed, every grower must verify the seed source, have the field inspected, and pass a laboratory test that measure seed quality. The field inspection checks the varietal identity, measures for adequate isolation to prevent out-crossing, and searches for other crops, weeds, noxious weeds, diseases, and off-types in the field. Growers must take extra time when harvesting to thoroughly clean their bins, combines, augers, and trucks between varieties to prevent contamination. When the seed is conditioned, an approved seed conditioner must clean it. Once the seed is conditioned, it must be tested in the lab for germination, purity, and noxious weed seeds. The field and seed must meet certification standards before the seed lot can be "Certified."

There are four classes of seed in the certification system. The breeder produces Breeder's Seed. The foundation project at CSU produces the Foundation Seed from the Breeder's Seed. Growers can purchase Foundation Seed to produce Registered Seed. Registered Seed is used to produce Certified Seed, which is sold the farmers throughout the state. Every step of this seed increase is closely monitored to produce the highest quality seed possible.

Being a member of the Colorado Seed Growers Association enables anyone who wants to produce high quality seed to do so in a "third party" certification system. This gives the buyer of the seed a high level of assurance that the seed being planted is of the highest quality. New members are welcome. Please contact the CSGA office at 970-491-6202 or visit our web site at **www.colostate.edu/Depts/SoilCrop/extension/CSGA/default.html**.

Description of winter wheat varieties in western trials.

Variety Name	Class	Origin
2137	Hard Red	Kansas
Akron	Hard Red	Colorado
Blizzard	Hard Red	Idaho
Boundary	Soft White	Idaho
Brundage	Soft White	Idaho
Custer	Hard Red	Oklahoma
Fairview	Hard Red	Colorado
Garland	Hard Red	Utah
Golden Spike	Hard White	Utah
Halt	Hard Red	Colorado
Hayden	Hard Red	Colorado/Idaho
ID455	Hard Red	Idaho
ID479	Hard Red	Idaho
ID498	Hard Red	Idaho
ID501	Hard Red	Idaho
ID509	Hard Red	Idaho
ID510	Hard Red	Idaho
ID511	Hard Red	Idaho
ID513	Hard Red	Idaho
ID535	Hard Red	Idaho
ID537	Hard White	Idaho
ID539	Hard White	Idaho
Jeff	Hard Red	Idaho
Lambert	Soft White	Idaho
Madsen	Soft White	Washington
Malcolm	Soft White	Oregon
Manning	Hard Red	Utah
OR850513H	Soft White	Oregon
Platte	Hard White	Agripro Biosciences, Inc.
Prairie Red	Hard Red	Colorado
Presto	Triticale	Colorado
Promontory	Hard Red	Utah
Prowers	Hard Red	Colorado
Q 555	Hard Red	Hybritech
Q 7588	Hard Red	Hybritech
QAP 7406	Hard Red	Hybritech
QAP 7510	Hard Red	Hybritech
Stephens	Soft White	Oregon
Tomahawk	Hard Red	Agripro Biosciences, Inc.
UT199847	Hard Red	Utah
UT201971	Hard Red	Utah
UT203032	Hard Red	Utah
UT944151	Hard Red	Utah
Utah 100	Hard Red	Utah
Wesley	Hard Red	Nebraska
Yuma	Hard Red	Colorado

Table 5. Irrigated winter wheat variety performance trial at Center in 1998-99[1].

Variety	Yield	Grain Moist	Test Wt	Heading Date	Grain Protein
	bu/ac	%	lb/bu	(July)	%
QAP 7406	135.7	13.2	60.3	16	8.9
Q 7588	135.1	13.7	59.9	18	8.5
Yuma	134.7	12.3	58.5	16	8.3
Halt	129.2	11.8	58.9	16	9.3
Q 555	128.2	14.1	59.9	21	9.1
QAP 7510	117.8	12.0	60.3	16	9.5
Custer	116.6	12.7	61.3	17	10.3
Prairie Red	113.3	12.0	59.7	15	8.8
Platte	109.5	12.4	60.0	17	9.1
Tomahawk	102.8	12.0	58.3	15	9.3
Average	**122.3**	**12.6**	**59.7**	**16.5**	**9.1**
CV%	7.5				
$LSD_{(0.05)}$	13.3				

[1]Trial conducted on the Summit Farms, seeded 9/22/98 and harvested 8/16/99.

Site Information:
Previous crop: potatoes
Seeding rate: 100 lb/ac
Soil type: loamy sand
Irrigation: center pivot as needed

Note: The trial area was uniform and yields were good. The average yield was 122 bu/acre; the range was from 103-136 bu/acre. The bushel weights indicate good grain fill; bushel weights averaging 59.7 lb/bu. Grain moisture averaged 12.6%; later maturing varieties showing higher moisture. Grain protein was even lower than last year; averaging 9.1%. Grain hardness averaged 54.8.

Comments: The two highest yields in this trial were hybrid wheats. Recently, the company closed out their hybrid wheat program. These hybrids are no longer available. Yuma and Halt also produced excellent yields, 135 and 129 bu/acre, respectively. Tomahawk continues to produce low yields in these replicated field trials. Prairie Red and Halt are CSU varieties resistant to Russian Wheat Aphid.

Contact: Merlin Dillon, Area Extension Agent, Agronomy
San Luis Valley Research Center

Table 6. Irrigated winter wheat variety performance trial at Fruita in 1998-99[1].

Variety	Yield	Grain Moist	Test Wt	Plant Ht	Lodging[2]	Days to Heading[3]
	bu/ac	%	lb/bu	in	0.2-9.0	days
Malcolm	150.1	9.6	57.6	37	1	144
Brundage	145.6	10.4	60.2	36	1	142
ID501	144.4	9.6	62.3	33	2	138
OR850513H	143.9	10.0	61.2	33	0	139
2137	139.7	9.8	60.4	37	2	138
Stephens	138.8	10.0	56.8	36	4	143
Halt	136.1	9.5	59.4	36	5	138
Madsen	133.9	10.0	58.4	35	1	147
Garland	131.6	9.6	58.0	28	0	146
ID455	126.8	10.3	55.7	31	1	139
Golden Spike	108.4	10.0	58.3	41	6	146
ID509	102.2	10.2	57.8	37	6	143
ID510	98.5	9.7	59.0	39	6	142
Average	**130.8**	**9.9**	**58.8**	**35.0**	**2.8**	**142.0**
CV%	15.2					
$LSD_{(0.05)}$	28.4					

[1]Trial conducted on the Western Colorado Research Center; seeded 10/14/98 and harvested 7/24/99.
[2]Lodging: 0.2 = no lodging, 9 = total area lodged flat.
[3]From January 1.

Site Information:
Fertilizer: 18-46-0 disced in at 92 lb P_2O_5/ac and 36 lb N/ac on October 14, 1998. Top-dressed fertilizer application: ammonium nitrate at 100 lb N/ac on March 2, 1999
Herbicide: Applied Harmony Extra at 0.4 oz/ac and 0.25 lb/ac of 2,4-D on March 3, 1999
Irrigation: five irrigation applications
Previous crop: dry beans
Seeding rate: 120 lb/ac

Contact: Dr. Calvin Pearson, Professor
Western Colorado Research Center

Table 7. Dryland winter wheat variety performance trial at Hayden in 1998-99[1].

Variety	Yield	Grain Moist	Test Wt	Plant Ht	Lodging[2]
	bu/ac	%	lb/bu	in	0.2-9.0
UT944151	68.4	11.3	58.0	31	1
Golden Spike	67.1	11.5	56.5	30	1
Hayden	66.6	11.3	58.0	33	1
UT203032	64.6	11.5	58.7	35	1
Treated Hayden	64.1	11.4	57.6	31	1
Presto Triticale	62.9	11.4	55.1	38	2
UT199847	62.7	11.4	59.9	39	3
Brundage	62.1	11.9	54.3	25	1
ID479	61.4	11.2	58.0	32	2
ID498	61.4	11.6	57.4	30	1
ID539	60.6	11.4	57.5	30	2
Akron	59.5	11.5	59.5	29	2
ID535	59.5	11.6	57.8	30	2
UT201971	58.7	11.3	60.3	35	1
ID537	58.3	11.4	56.5	33	1
Lambert	57.6	11.7	55.0	28	1
Blizzard	57.3	11.4	56.8	33	1
Treated Prowers	56.8	11.1	58.7	34	2
Manning	56.4	11.7	57.4	28	1
Treated Akron	55.6	11.6	59.4	28	1
Utah 100	54.8	11.4	58.2	30	1
Fairview	54.4	11.4	58.9	30	1
Boundary	53.0	11.5	56.5	25	1
Promontory	52.8	11.5	58.8	29	1
ID513	52.7	11.4	57.8	26	1
Jeff	52.2	11.4	58.1	36	5
ID511	50.4	11.3	58.5	29	1
Prowers	49.4	11.3	58.2	34	3
Average	**58.6**	**11.4**	**57.8**	**31.1**	**1.5**
CV%	13.0				
$LSD_{(0.05)}$	10.8				

[1]Trial conducted on the Dutch and Mike Williams farm; seeded 10/9/98 and harvested 9/7/99.
[2]Lodging: 0.2 = no lodging, 9 = total area lodged flat.

Site Information:
Seeding rate: 56 lb/ac
Herbicide: Ally at 0.10 oz/ac and 2,4-D at 1/8 lb/ac were applied on May 10, 1999

Comments: Environmental conditions were very favorable for wheat production in the Hayden area in 1999.

Contact: Dr. Calvin Pearson, Professor
Western Colorado Research Center

Table 8. Dryland winter wheat variety performance trial at Yellow Jacket 1998-99[1].

Variety	Yield	Grain Moist	Test Wt	Plant Ht	Heading Date[2]
	bu/ac	%	lb/bu	in	date
Presto Triticale	51.4	13.4	52.9	33	6/02
UT201971	44.1	12.9	58.1	31	6/14
Manning	43.1	13.5	55.4	27	6/11
Lambert	42.8	13.2	53.4	28	6/11
Jeff	42.7	13.4	57.8	29	6/14
Fairview	42.7	13.0	57.4	30	6/11
ID498	42.2	13.2	55.0	28	6/14
ID539	41.6	13.4	55.0	27	6/11
UT199847	41.5	13.3	57.8	31	6/16
ID479	41.3	12.9	56.3	26	6/11
Prowers	40.5	12.8	57.7	30	6/11
ID537	39.9	13.4	51.8	32	6/11
ID513	39.9	13.0	54.9	26	6/16
UT944151	39.9	13.3	53.6	29	6/14
UT203032	39.8	12.9	54.5	29	6/11
ID535	39.8	13.3	54.2	27	6/16
Golden Spike	39.7	13.4	53.2	26	6/16
Brundage	39.5	13.6	54.2	25	6/11
Hayden	37.8	13.4	52.2	31	6/14
Promontory	37.1	12.8	57.0	25	6/11
Utah100	36.7	13.2	53.1	31	6/14
Blizzard	34.2	13.0	54.2	29	6/16
ID511	33.4	13.2	54.4	27	6/14
Boundary	31.8	13.0	53.0	24	6/16
Average	**40.1**	**13.2**	**54.9**	**28.2**	
CV%	7.5				
$LSD_{(0.05)}$	4.3				

[1]Trial conducted on the Southwestern Colorado Research Center; seeded 10/14/98 and harvested 8/31/99.
[2]50% of the plants headed.

Site Information:
Precipitation: 10/14/98 - 7/15/99 11.8 inches
Fertilizer: 50 lb N/ac as 34-0-0 on 5/11/99
Previous crop: fallow
Soil type: Wetherill silty clay loam

Comment: The 1998-99 growing season can be characterized as a wet fall, a dry winter, and above average precipitation in April, May and June. Consequently, yields were well above average. Russian wheat aphid damage was not evaluated in the trial but there was good RWA pressure during the spring on winter wheat in southwestern Colorado. Dwarf bunt was not observed in any of the entries. None of the entries lodged.

Contact: Dr. Abdel Berrada, Research Scientist
Southwestern Colorado Research Center

Spring Wheat Improvement

Jim Quick

The spring wheat breeding program began in 1996 with major agronomic objectives of Russian wheat aphid resistance, heat tolerance, and early maturity. A greenhouse-based Single Seed Descent program allows for rapid generation advance. In 1999, 600 F5 lines were evaluated in the field. We are developing cultivars having the following desirable agronomic traits: high yield and test weight with satisfactory kernel appearance; straw height and strength to maximize yield potential under desirable climatic conditions; early maturity and resistance to grain shattering; drought and heat tolerance; pest resistance, especially to leaf and stem rust, smuts, and Russian wheat aphid. New spring wheat cultivars for Colorado may be released as early as 2003.

New spring wheat cultivars must also have desirable milling and bread baking properties. For milling, we produce cultivars with high extraction of good straight-grade flour with acceptable ash, color, and sifting properties. The resulting bread flour has desirable levels of water absorption, dough development time, mixing tolerance, loaf volume, grain, texture, and crumb color.

Spring wheat could be planted in rotations which include a spring crop, either following winter wheat or following another spring crop such as corn, proso millet or sorghum. Acreage of rotations including spring crops has increased from about 20,000 to 200,000 acres (based on an increase in dryland corn acreage) during the past ten years.

Description of spring wheat varieties in trials.

Variety Name	Class	Origin
2375	Hard Red	North Dakota
AC Teal	Hard Red	Canada
B91 0228	Hard Red	Agripro Biosciences, Inc.
B92 0709	Hard Red	Agripro Biosciences, Inc.
Blanca	Soft White	Colorado
Butte 86	Hard Red	North Dakota
BZ692-108	Soft White	Western Plant Breeders
Centennial	Soft White	Idaho
Forge	Hard Red	South Dakota
Grandin	Hard Red	North Dakota
Hamer	Hard Red	Agripro Biosciences, Inc.
Hiline	Hard Red	Montana
ID377S	Hard White	Idaho
ID488	Soft White	Idaho
ID502	Hard Red	Idaho
ID505	Soft White	Idaho
ID506	Soft White	Idaho
ID524	Soft White	Idaho
Kauz	Hard White	CIMMYT
Kulm	Hard Red	North Dakota
MT RWA116	Hard Red	Montana
N93-0119	Hard Red	Agripro Biosciences, Inc.
N93-0136	Hard Red	Agripro Biosciences, Inc.
N93-0211	Hard Red	Agripro Biosciences, Inc.
N94-0105	Hard Red	Agripro Biosciences, Inc.
N94-0241	Hard Red	Agripro Biosciences, Inc.
N94-0287	Hard Red	Agripro Biosciences, Inc.
N94-0404	Hard Red	Agripro Biosciences, Inc.
N94-0440	Hard Red	Agripro Biosciences, Inc.
Nora	Hard Red	Agripro Biosciences, Inc.
Norlander	Hard Red	Agripro Biosciences, Inc.
Oslo	Hard Red	Agripro Biosciences, Inc.
Owens	Soft White	Idaho
Oxen	Hard Red	South Dakota
Russ	Hard Red	South Dakota
Sharp	Hard Red	South Dakota
Spillman	Hard Red	Washington
Sylvan	Hard Red	Colorado
Trenton	Hard Red	North Dakota
V5	Hard White	Israel
Whitebird	Soft White	Idaho
Zeke	Hard Red	Western Plant Breeders

Table 9. Irrigated soft white spring wheat variety performance trial at Center in 1999[1].

Variety	Yield	Test Wt	Heading Date	Plant Ht	Lodging	Grain Protein
	bu/ac	lb/bu	(June)	in	%	%
ID524	107.2	59.7	39	34	16.3	11.5
Centennial	107.1	59.6	36	38	15.0	12.4
ID505	104.1	59.2	40	38	26.3	12.2
Blanca	103.6	57.1	38	41	33.8	13.2
ID506	100.7	57.9	39	38	16.3	12.1
BZ692-108	96.9	58.6	38	38	36.3	11.8
Whitebird	95.6	59.1	40	39	43.8	11.9
Owens	87.1	57.6	40	40	47.5	12.5
Average	**101.1**	**58.6**	**38.7**	**38.4**	**29.4**	**12.2**
CV%	11.0					
$LSD_{(0.05)}$	16.3					

[1]Trial conducted on the San Luis Valley Research Center; seeded 4/16/99 and harvested 9/22/99.

Site Information:

Previous crop: potatoes
Seeding rate: 120 lb/ac
Soil type: sandy loam
Fertilizer: variable; precision applied
Weed control: bronate at 2 pt/ac
Irrigation: center pivot, as needed

Note: Spring wheat yields were fairly low this year; averaging only 101 bu/acre. The highest yield was 107 bu/acre. Snow fell immediately after an irrigation April 30 (1.5 inches moisture). This excess moisture leached much of our nitrogen. Another 20 # N/acre was applied. Nitrogen leaching also increased the variability of the trial.

Comments: Experimental lines ID524 and ID505 performed very well this year. The low yields of this trial make it hard to see the yield potential. ID524 is promising since it is short stature; lodging was about the same as Centennial. Maturity of ID524 is 3 days later which is not good. Centennial is still the best soft white spring variety for this area.

Contact: Merlin Dillon, Area Extension Agent, Agronomy
San Luis Valley Research Center

Table 10. Irrigated spring wheat variety performance trial at Yellow Jacket in 1999[1].

Variety	Yield	Grain Moist	Test Wt	Plant Ht	Heading Date[2]
	bu/ac	%	lb/bu	in	date
Blanca	100.5	10.9	54.8	36	7/2
Whitebird	92.9	10.3	57.9	34	7/2
Sylvan	92.1	10.2	56.8	38	7/4
BZ692-108	90.7	10.0	55.4	33	6/30
Zeke	87.5	10.2	54.2	32	6/28
ID377S	86.2	10.2	57.7	35	6/28
ID506	81.9	10.6	54.6	33	6/30
Spillman	80.1	10.0	54.1	33	7/2
ID502	79.1	10.0	56.4	33	6/30
MT RWA116	69.2	10.1	55.4	34	6/30
Average	**86.0**	**10.2**	**55.7**	**34**	
CV%	8.6				
$LSD_{(0.05)}$	10.7				

[1]Trial conducted on the Southwestern Colorado Research Center; seeded 4/19/99 and harvested 9/7/99.
[2]50% of the plants headed.

Site Information:
Fertilizer: 130 lb N/ac + 75 lb P_2
Insecticide: Lorsban 1 pt/ac on 6/30/99 for Russian wheat aphid
Irrigation: 8.5 inches (4 sprinkler irrigations)
Precipitation: 4/20/99 - 8/15/99 7.1 inches
Previous crop: Irrigated pinto bean
Soil type: Wetherill silty clay loam

Comment: Cooler temperatures and competition from volunteer pinto bean may have contributed to lower yields compared to previous years. Also, irrigation water applied was considerably less than prior years due to a wet July and August.

Contact: Dr. Abdel Berrada, Research Scientist
Southwestern Colorado Research Center

Table 11. Dryland spring wheat variety performance trial at Akron in 1999[1].

Variety	Yield	Test Wt	Plant Ht	Days to Heading
	bu/ac	lb/bu	cm	days
Oxen	32.1	53.3	46	89
2375	27.1	55.9	52	87
N94-0241	25.0	56.7	47	88
Hamer	24.6	56.7	43	91
Kauz	24.5	53.1	40	89
Oslo	23.1	53.9	32	88
N94-0105	22.7	52.4	52	94
Hiline	21.8	54.6	44	89
Forge	20.7	57.8	60	87
B91 0228	20.1	60.1	51	93
Russ	20.0	54.2	50	87
Nora	19.7	55.5	60	89
N93-0136	19.4	53.7	52	92
B92 0709	19.3	59.0	48	94
Butte 86	19.0	58.3	60	89
Norlander	18.9	58.0	53	88
V5	18.6	58.4	45	88
AC Teal	18.3	53.1	37	93
N94-0440	17.1	50.0	36	94
N94-0287	16.8	50.0	57	93
Kulm	16.7	58.7	53	91
N93-0119	15.6	50.9	39	93
N94-0404	15.5	56.9	53	96
ID488	15.5	55.2	55	92
MT RWA116	15.4	54.6	44	93
Sharp	14.7	58.2	47	87
N93-0211	13.7	55.2	47	92
ID377S	12.6	52.8	45	94
Grandin	11.8	50.9	57	92
Trenton	10.6	51.8	50	92
Average	**19.0**	**57.3**	**48.5**	**90.8**
CV%	11.3			
$LSD_{(0.05)}$	4.5			

[1]Trial conducted on the Central Great Plains Research Station; seeded 3/16/99 and harvested 7/19/99.

Site Information:
Seeding rate: 60 lb/ac

Note: Analyzed as a Randomized Complete Block Design with two replications (rep one excluded).

Contact: Dr. Jim Quick, Professor/Department Head
Department of Soil and Crop Sciences

Table 12. Dryland spring wheat variety performance trial at Hayden in 1999[1].

Variety	Yield	Grain Moist	Test Wt	Plant Ht	Lodging[2]
	bu/ac	%	lb/bu	in	0.2-9.0
2375	29.8	11.6	59.6	22	1
Grandin	29.3	11.5	60.6	25	1
Oxen	29.3	11.8	60.6	22	1
Sharp	29.1	11.3	61.4	25	1
Forge	28.2	11.2	61.9	24	2
Butte 86	26.0	11.4	61.0	26	2
Average	**28.6**	**11.3**	**60.8**	**23.9**	**1.4**
CV%	18.9				
$LSD_{(0.05)}$	NS				

[1]Trial conducted on the Dutch and Mike Williams farm; seeded 5/12/99 and harvested 9/16/99.
[2]Lodging: 0.2 = no lodging, 9 = total area lodged flat.

Site Information:
Seeding rate: 60 lb/ac

Note: The soil was sampled at planting to determine fertility. The results were pH 6.3, 0.4 mmhos/cm salts, 3.6% organic matter, 5.0 ppm nitrate-nitrogen, 15 ppm phosphorus, 390 ppm potassium, 2.1 ppm zinc, 44.8 ppm iron, 24.1 ppm manganese, and 3.4 ppm copper. Ally at 0.10 oz/acre was applied on May 25, 1999 for weed control.

Comments: Plant stands were somewhat sparse and irregular because of crusting that occurred during seedling emergence. Rainfall during the 1999 growing season was sporadic.

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www.colostate.edu/Depts/SoilCrop/extension/CropVar/index.html