Technical Report TR08-08 May 2008

Agricultural Experiment Station

Colorado State University

College of Agricultural Sciences

Department of Soil and Crop Sciences

Extension

MAKING BETTER DECISIONS

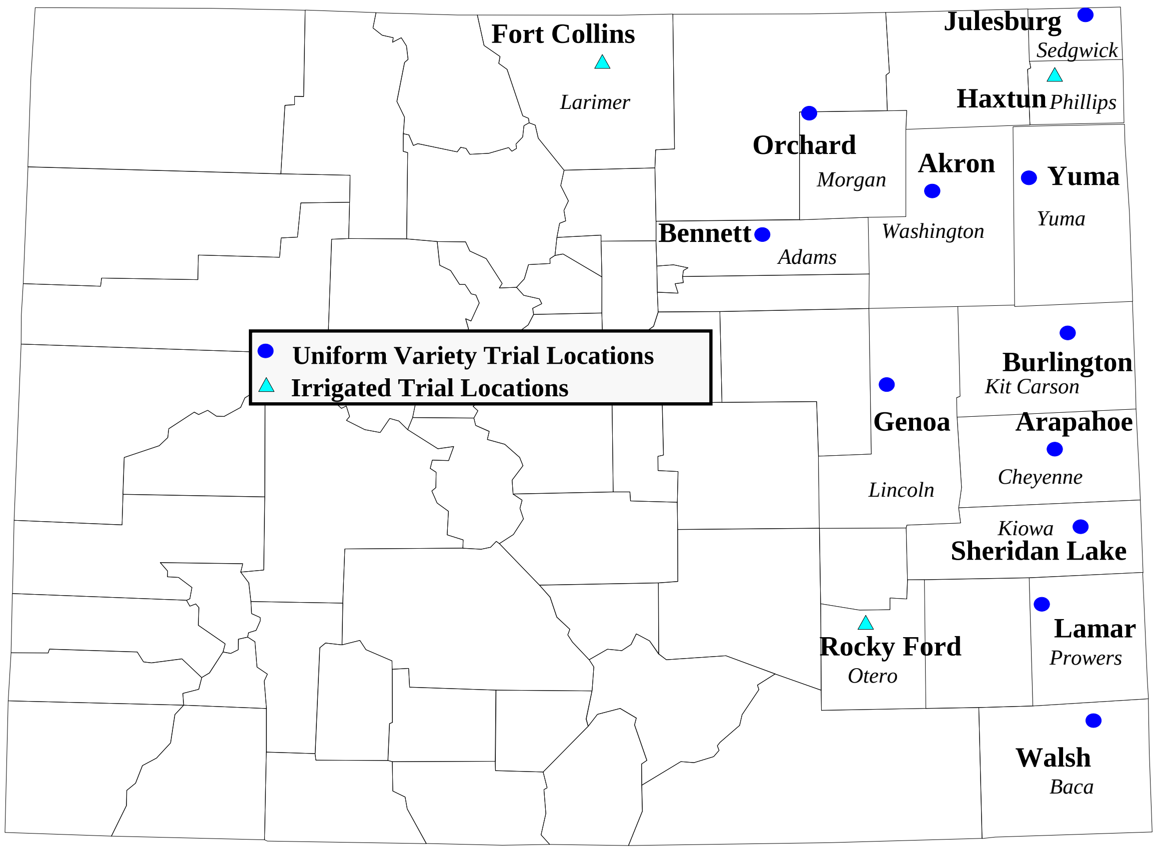
2007 Colorado Winter Wheat Variety Performance Trials

Acknowledgments

The authors are grateful for support received from Colorado State University and for the funding received from the Colorado Wheat Administrative Committee and the Colorado Wheat Research Foundation. The Colorado Wheat Administrative Committee provides substantial financial support to Colorado State University for wheat research. Crops Testing research associates Jim Hain and Alicia Davisson work hard to conduct variety trials and to produce this report. We are thankful to Kierra Jewell (CSU Extension), John Stromberger, Emily Heaton, Hayley Miller and Joshua Butler (Wheat Breeding Program), Chris Fryrear (Agricultural Research, Development and Education Center), Merle Vigil, Gene Uhler, Delbert Koch, and Paul Campbell, (Central Great Plains Research Center), and Jeff Rudolph, Thia Walker, Mike Koch, Terri Randolph and Scott Merrill (Russian Wheat Aphid Program), for their work and collaboration that make these trials and this report possible. The authors are thankful for 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 and Jeremy Stulp (Lamar, Prowers County), Burl Scherler (Brandon, Kiowa County), Dennis and Matt Campbell (Arapahoe, Cheyenne County), Randy Wilks (Burlington, Kit Carson County), David Deden (Julesburg, Sedgwick County), Greg Larson (Dailey, Phillips County), John Sauter (Bennett, Adams County), Ross Hansen (Genoa, Lincoln County), Cary Wickstrom (Orchard, Morgan County), and Bill and Steve Andrews (Yuma, Yuma County). We also acknowledge the participation of the Agricultural Research, Development and Education Center (ARDEC) – Fort Collins; Central Great Plains Research Station – Akron; Arkansas Valley Research Center – Rocky Ford; and the Plainsman Research Center – Walsh. We recognize valuable assistance provided by the Extension agents who work with eastern Colorado wheat producers in all aspects of the COFT program: Bruce Bosley, Platte River agronomist; Scott Brase, SE Area agronomist; and Alan Helm, Golden Plains agronomist. We are also very thankful for the efforts and sacrifices made by Colorado wheat producers who contributed time, land, and equipment to the success of the Collaborative On-Farm Testing program.

Funded by the Colorado Wheat Administrative Committee and Colorado State University

2007 and 2008 UVPT and IVPT Trial Locations



Wheat Planting Decision Meetings (2008)

Wednesday, August 13:

7:30 a.m.	Breakfast meeting at the Baca County Resource Center in Springfield
12:00 p.m.	Lunch meeting at the K&M Ranch House in Eads
6:30 p.m.	Dinner meeting at the Community Center in Burlington

Thursday, August 14:

7:30 a.m.	Breakfast meeting at the Dry Creek Seed Company Plant near Genoa
12:00 p.m.	Lunch meeting at the Central Great Plains Research Station at Akron
6:30 p.m.	Dinner meeting at Anderson Wheat Farms near Dailey

Friday, August 15:

7:30 a.m.	Breakfast meeting at the Pepper Pod in Hudson

Program:

Darrell Hanavan	Introduction (10 minutes)
Dr. Jerry Johnson	Variety Trial Results, COFT and Variety Decision Tree (30 minutes)
Dr. Scott Haley	CSU Wheat Breeding Program (30 minutes)
Brad Erker	Availability and Value of Certified Seed/PVPA (15 minutes)

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2007 EASTERN COLORADO WINTER WHEAT VARIETY PERFORMANCE TRIALS

Colorado State University provides unbiased and reliable information to Colorado wheat producers to help them make better wheat variety decisions. Colorado State University provides excellent research faculty and staff, a focused breeding program, graduate and undergraduate students, and dedicated agricultural extension specialists. However, wheat improvement in Colorado would not be possible without the support and cooperation of the entire Colorado wheat industry. On-going and strong support for a public breeding program is critical because variety development and testing is a long process, especially under the highly variable climatic conditions in Colorado.

Our wheat variety performance trials, and collaborative on-farm testing, represent the final stages of a wheat breeding program where promising experimental lines are tested under an increasingly broad range of environmental conditions. Variation in precipitation, as well as variable fall, winter, and spring temperature regimes, hail and spring freeze events, interact with disease and insect pests and variety maturity to affect wheat yields. As a consequence of large environmental variation, Colorado State University annually conducts a large number of performance trials, which serve to guide producer variety decisions and to assist our breeding program to more reliably select and advance the most promising lines toward release as new varieties.

Generally favorable planting and emergence conditions resulting from favorable summer precipitation led to good stands and heavy tillering wheat plants before winter. Among the eleven dryland trial locations, plant stands were variable in our Bennett and Genoa trials where emergence continued into the spring. Winter 2007 brought heavy snow to most of eastern Colorado after many years of insufficient winter precipitation. Insufficient snow catch occurred at Burlington where the dryland trial suffered from significant drought stress. Favorable fall, winter, and early spring temperatures, in combination with above average precipitation in most locations and well-developed plants, led to heavy tillering. Stripe rust and leaf rust appeared relatively early in the growing season and eventually reduced yields in some locations, especially in southeastern Colorado (Lamar, Sheridan Lake, Arapahoe) where it is rare to have such early and heavy rust infestations. Some trial locations did not receive enough late spring precipitation to sustain the lush growth created by favorable fall and winter conditions which led to reduced plant heights, fewer tillers reaching maturity, and lower trial yields.

2007 Trials

There were 40 different entries in the dryland performance trials (UVPT) and 32 entries in the irrigated performance trials (IVPT). All trials include a combination of public and private varieties and experimental lines from Colorado and surrounding states. Trials were planted in a randomized complete block design with four replicates in the dryland trials and three replicates in the irrigated trials. Plot size was approximately 160 ft^2 and all varieties were planted at 500,000 viable seeds per acre for dryland trials and 1.2 million viable seeds per acre for irrigated trials (viable seed is determined by a germination test prior to planting). Yields are corrected to13% moisture. All eleven dryland and three irrigated variety performance trials were harvested. Test weight information was obtained from cleaned grain samples from three replicates at Walsh, Burlington, Akron, Julesburg, and Fort Collins. For the remaining dryland and irrigated locations, test weight for each plot was estimated from single replicate, cleaned grain samples correlated to our Harvest Master combine test weight data.

In this report, individual trial summary performance tables are intended to provide all of the critical information necessary for producers to compare performance and select superior varieties. Complete performance results for all entries (including experimental lines) as well as additional variety information, including test weight, grain moisture, height, lodging information, and disease scores can be found on the following websites:

http://www.csucrops.com - CSU Crops Testing website for all Colorado crop performance results.

http://wheat.colostate.edu/vpt.html - Colorado Variety Performance Database (CSU Wheat Breeding Program).

http://www.coloradowheat.org - Colorado Wheat Administrative Committee, CAWG, and CWRF website.

COLORADO CONSERVATION TILLAGE ASSOCIATION The Colorado Conservation Tillage Association (CCTA) goal is to spread research and on-farm gained information regarding new techniques and the latest technology about products, equipment and research on no-till, minimum–till, conservation practices, energy conservation and water issues. The 21st Annual High Plains No-Till Conference, will be held February 3-4, 2009 at Island Grove Regional Park Events Center, Greeley, Colorado. For more information go to www.HighPlainsNoTill.com.

Summary of Dryland UVPT Results for 2007 by Trial Location.

Akron			Arapahoe			Bennett		
Variety	Yield	Test Weight	Variety	Yield	Test Weight	Variety	Yield	Test Weight
	bu/ac	lb/bu		bu/ac	lb/bu		bu/ac	lb/bu
TAM 112	70.1	61.9	Hatcher	60.7	62.4	Above	62.2	59.6
Endurance	69.2	62.3	TAM 111	55.0	61.4	Fuller	61.3	59.5
NuDakota	69.2	59.8	TAM 112	52.6	61.9	Hatcher	60.2	58.9
Danby	68.1	63.1	Bill Brown	51.3	62.4	Yuma	59.3	59.8
Bond CL	67.9	61.5	RonL	49.7	61.2	Overland	58.9	60.4
Infinity CL	67.6	61.1	NuDakota	49.5	60.6	TAM 111	58.3	59.2
Duster	67.5	62.2	Overland	49.5	61.3	RonL	57.5	61.0
NuFrontier	67.4	63.1	Fuller	49.4	60.6	Smoky Hill	57.3	60.2
Fuller	66.3	61.6	Smoky Hill	48.8	61.2	Ripper	57.3	60.4
TAM 111	65.5	61.3	Trego	48.2	61.0	NuDakota	57.1	58.6
Hawken	64.6	61.0	Duster	48.1	61.7	TAM 112	57.0	59.5
Akron	64.0	61.1	Infinity CL	47.4	60.8	Keota	56.9	59.9
Jagger	63.6	62.2	Hawken	46.9	60.8	Postrock	56.5	61.3
Smoky Hill	63.4	61.7	Ankor	46.8	61.2	Endurance	55.9	60.2
Keota	62.8	61.9	Yuma	46.8	61.5	OK Bullet	55.9	60.9
OK Bullet	62.5	62.1	Ripper	46.4	59.7	Avalanche	55.4	60.9
Bill Brown	62.0	62.6	Danby	46.0	62.9	Jagger	55.4	59.6
Above	61.8	60.7	Endurance	46.0	61.8	Alice	55.4	61.8
Alice	61.4	61.7	Bond CL	45.6	61.5	Prairie Red	54.7	59.4
Alliance	61.2	61.4	Postrock	44.7	62.0	Goodstreak	54.0	60.4
Yuma	60.3	62.6	Avalanche	44.7	62.7	Ankor	53.8	58.7
Hatcher	57.8	62.8	NuGrain	44.5	62.3	Alliance	53.5	57.8
Ankor	56.6	61.3	OK Bullet	44.4	60.6	Danby	53.3	60.4
Avalanche	56.3	62.5	Akron	44.2	60.7	Jagalene	53.2	60.8
Ripper	56.0	61.4	Goodstreak	44.2	61.7	Infinity CL	52.8	59.3
Postrock	55.5	62.3	Above	44.1	60.4	Akron	51.5	59.5
Overland	55.4	61.5	Alliance	43.6	60.8	Bond CL	49.9	58.5
Prairie Red	54.8	60.6	Prairie Red	43.5	60.2	Bill Brown	48.8	59.5
NuGrain	54.3	63.1	Jagger	43.5	60.6	NuGrain	48.1	61.0
Jagalene	53.3	63.0	Prowers 99	43.5	61.3	Trego	48.0	59.9
Goodstreak	52.9	62.4	Keota	42.6	61.9	Prowers 99	47.5	61.1
Trego	52.4	62.8	Alice	42.2	61.9	Hawken	47.3	59.6
Prowers 99	48.0	62.7	NuFrontier	40.5	61.6	Duster	45.8	60.2
RonL	42.8	62.8	Jagalene	39.4	62.1	NuFrontier	44.5	59.1
Average	60.7	61.9	**Average**	46.6	61.4	**Average**	54.2	59.9
$LSD_{(0.30)}$	7.5	0.3	$LSD_{(0.30)}$	3.5	0.5	$LSD_{(0.30)}$	4.5	0.9

	Akron	Arapahoe	Bennett
Cooperator:	Central Great Plains Res Stn	Dennis and Matt Campbell	John Sauter
Planting Date:	09/26/06	09/19/06	09/12/06
Harvest Date:	07/06/07	07/05/07	07/12/07

Burlington			Genoa			Julesburg		
Variety	Yield	Test Weight	Variety	Yield	Test Weight	Variety	Yield	Test Weight
	bu/ac	lb/bu		bu/ac	lb/bu		bu/ac	lb/bu
Bond CL	44.7	58.3	Hatcher	51.1	61.8	NuDakota	96.4	56.5
Ripper	43.1	57.9	Duster	42.8	61.2	Duster	87.0	58.1
Overland	43.1	57.4	TAM 111	42.6	61.8	Bond CL	85.6	56.0
Bill Brown	42.7	60.1	Hawken	42.4	60.8	Infinity CL	83.7	56.5
TAM 112	42.2	59.4	Infinity CL	41.7	60.9	Jagger	82.6	56.9
Duster	41.3	60.3	NuGrain	40.8	61.4	Hatcher	82.2	55.0
Endurance	40.9	59.8	Overland	40.0	61.1	Keota	81.0	56.9
Hatcher	40.9	60.8	Bond CL	39.7	60.3	Above	79.7	55.5
Prairie Red	39.6	59.5	RonL	38.8	61.4	Yuma	78.8	56.4
NuDakota	39.6	55.8	Trego	38.7	61.3	Jagalene	78.7	56.9
Hawken	39.4	58.4	Bill Brown	38.5	61.7	Alice	77.2	56.3
Jagger	38.6	58.7	Smoky Hill	38.2	61.1	Prairie Red	77.0	55.9
Keota	38.1	59.8	Alliance	37.8	60.3	Trego	76.8	58.3
NuGrain	38.0	61.5	Fuller	37.0	60.5	Fuller	76.2	57.4
Yuma	37.9	59.1	Yuma	36.8	60.3	Danby	75.9	59.6
NuFrontier	37.0	60.1	Ripper	36.2	59.5	Postrock	75.6	57.8
Alliance	36.1	59.2	Akron	35.9	61.0	Ripper	75.3	53.7
Alice	35.9	58.5	Danby	34.6	62.7	TAM 112	74.3	54.7
Jagalene	35.6	60.0	TAM 112	33.3	61.5	Alliance	73.4	55.6
Postrock	35.3	58.5	Endurance	33.0	60.7	Smoky Hill	73.2	57.9
Avalanche	34.6	60.4	Alice	32.8	59.9	NuFrontier	73.1	57.0
Akron	34.5	58.8	Above	32.6	59.4	TAM 111	72.5	54.8
OK Bullet	34.0	59.7	Ankor	32.5	60.5	Endurance	72.4	55.9
Smoky Hill	33.9	59.1	NuFrontier	32.3	61.1	Hawken	72.0	54.8
Infinity CL	33.7	57.9	Avalanche	32.0	61.0	Overland	71.4	54.9
Fuller	32.9	58.6	Prowers 99	31.5	61.0	OK Bullet	71.1	58.5
Prowers 99	32.0	58.8	Jagalene	30.0	60.7	NuGrain	67.3	58.1
Above	31.0	58.2	NuDakota	29.9	58.9	Bill Brown	67.2	55.6
Danby	29.9	61.3	Prairie Red	29.5	59.0	Akron	67.1	55.9
Ankor	29.8	57.7	Goodstreak	29.2	61.0	Prowers 99	64.2	58.3
Goodstreak	28.9	59.1	Jagger	27.1	59.6	RonL	63.7	56.6
Trego	27.5	61.2	Keota	26.7	60.6	Ankor	63.4	55.8
TAM 111	21.1	58.7	Postrock	23.8	60.4	Avalanche	59.0	54.5
RonL	14.6	61.0	OK Bullet	23.0	60.0	Goodstreak	45.7	56.1
Average	35.5	59.2	**Average**	35.1	60.7	**Average**	74.1	56.4
$LSD_{(0.30)}$	2.3	0.4	$LSD_{(0.30)}$	4.6	0.5	$LSD_{(0.30)}$	10.2	1.3

	Burlington	Genoa	Julesburg
Cooperator:	Randy Wilks	Ross Hansen	David Deden
Planting Date:	09/13/06	09/15/06	09/28/06
Harvest Date:	06/28/07	07/16/07	07/18/07

Lamar			Orchard			Sheridan Lake		
Variety	Yield	Test Weight	Variety	Yield	Test Weight	Variety	Yield	Test Weight
	bu/ac	lb/bu		bu/ac	lb/bu		bu/ac	lb/bu
Hawken	86.9	59.1	NuDakota	62.2	61.0	Ripper	75.6	59.5
Fuller	81.0	58.9	TAM 112	58.0	61.4	Hatcher	74.7	60.5
NuDakota	80.0	57.0	NuFrontier	56.9	62.3	Smoky Hill	74.4	61.0
TAM 111	77.4	59.2	Ripper	56.8	61.6	Akron	70.5	61.0
Hatcher	76.7	57.3	Keota	56.6	62.4	Bill Brown	70.5	61.6
Postrock	76.7	59.4	Bill Brown	56.0	62.9	Hawken	69.0	61.7
Smoky Hill	76.1	57.1	Hatcher	56.0	62.3	Fuller	68.4	61.0
Jagalene	74.7	58.9	Danby	54.5	63.3	Bond CL	68.1	61.0
Keota	74.3	59.8	Above	53.9	60.8	Ankor	67.8	60.7
OK Bullet	73.5	59.5	Smoky Hill	53.3	61.8	NuDakota	67.7	60.5
Alice	72.7	57.8	Fuller	52.9	62.2	TAM 112	67.1	61.9
Duster	72.1	58.1	Ankor	52.0	61.6	Alliance	66.5	60.1
Yuma	71.3	57.4	Yuma	51.8	62.1	Endurance	66.4	60.6
Jagger	68.8	56.5	Hawken	50.9	61.8	Overland	66.4	59.8
Danby	68.3	58.4	NuGrain	50.8	63.0	Avalanche	66.3	62.5
Infinity CL	67.4	57.4	Jagger	50.8	61.4	Danby	65.2	63.8
Overland	67.0	56.8	Bond CL	50.7	61.5	Duster	64.5	60.9
Bond CL	65.8	56.5	Prairie Red	50.1	61.0	Infinity CL	64.4	60.9
Bill Brown	65.5	56.6	Avalanche	49.7	62.9	Keota	64.3	61.6
NuGrain	64.9	58.3	Jagalene	49.7	62.0	TAM 111	64.2	62.4
Goodstreak	63.5	58.1	Endurance	49.6	62.5	Above	62.8	61.1
RonL	63.4	53.9	Goodstreak	48.3	61.6	Yuma	61.6	60.7
Endurance	62.3	56.7	Infinity CL	48.2	62.0	OK Bullet	61.5	62.5
NuFrontier	60.2	58.0	Trego	48.1	63.1	Jagalene	61.1	62.0
Above	58.5	53.0	Duster	47.7	62.1	Jagger	60.5	61.1
Prowers 99	58.1	57.9	Overland	47.5	61.9	Trego	60.4	62.8
Avalanche	57.4	56.3	Alliance	47.1	62.1	Prairie Red	59.5	60.1
Alliance	57.2	53.4	TAM 111	46.6	62.3	NuFrontier	58.8	61.4
Trego	56.1	54.7	OK Bullet	44.5	62.5	RonL	58.4	62.3
Akron	53.6	51.9	Postrock	43.7	60.7	Goodstreak	58.3	61.9
Prairie Red	49.9	51.8	Prowers 99	43.4	62.5	NuGrain	57.6	63.3
Ankor	48.5	52.6	Akron	41.9	61.3	Postrock	56.3	61.6
TAM 112	48.3	52.3	Alice	41.7	61.8	Alice	56.1	60.7
Ripper	48.2	51.5	RonL	34.5	60.6	Prowers 99	51.6	62.6
Average	66.1	56.5	**Average**	50.2	62.0	**Average**	64.3	61.4
$LSD_{(0.30)}$	3.3	0.9	$LSD_{(0.30)}$	3.9	0.6	$LSD_{(0.30)}$	4.3	0.3

	Lamar	Orchard	Sheridan Lake
Cooperator:	John and Jeremy Stulp	Cary Wickstrom	Burl Scherler
Planting Date:	09/19/06	09/18/06	09/20/06
Harvest Date:	07/05/07	07/03/07	07/04/07

Walsh			Yuma		
Variety	Yield	Test Weight	Variety	Yield	Test Weight
	bu/ac	lb/bu		bu/ac	lb/bu
Hawken	64.2	56.4	NuDakota	74.0	53.2
Postrock	63.9	57.7	Jagger	65.7	55.0
Alice	63.0	59.2	Keota	65.4	56.1
Jagger	62.6	56.9	Alice	65.4	56.3
Hatcher	61.5	57.5	NuGrain	63.9	56.5
Bill Brown	60.6	57.8	Overland	63.7	54.3
Endurance	59.8	56.1	Jagalene	63.7	55.6
TAM 111	59.4	56.1	TAM 111	62.4	55.0
TAM 112	59.1	57.1	Ankor	62.1	53.2
NuDakota	58.7	54.1	Infinity CL	61.5	53.8
Yuma	58.7	55.7	Postrock	59.6	55.2
NuGrain	58.4	58.8	Endurance	59.0	53.2
Keota	58.4	58.6	Akron	58.8	54.3
Above	58.1	56.3	Fuller	58.3	53.8
Ankor	57.4	56.0	TAM 112	56.1	54.1
Overland	56.7	56.6	Hawken	55.4	52.4
RonL	56.5	57.1	Trego	55.2	56.9
Trego	55.9	57.8	Above	54.5	53.9
Smoky Hill	55.6	55.4	Prairie Red	54.1	54.4
Danby	55.5	58.1	Danby	54.0	57.6
Ripper	55.2	54.6	OK Bullet	53.3	57.2
Prairie Red	55.2	55.7	Hatcher	53.2	54.0
Akron	54.8	56.7	Bond CL	52.5	53.0
Duster	54.4	56.8	Alliance	51.8	52.9
OK Bullet	54.2	56.6	Ripper	50.8	52.8
Infinity CL	54.2	55.4	Smoky Hill	50.7	54.2
Bond CL	54.2	54.4	Duster	50.3	54.8
Jagalene	53.5	58.0	Avalanche	49.7	54.8
Fuller	53.3	54.5	Goodstreak	49.5	57.3
Avalanche	53.2	58.4	Bill Brown	49.4	53.0
Alliance	51.4	54.9	NuFrontier	48.5	56.3
NuFrontier	50.0	56.5	RonL	46.4	54.4
Goodstreak	47.5	58.0	Yuma	45.5	52.1
Prowers 99	47.0	57.2	Prowers 99	45.1	55.2
Average	56.5	56.7	**Average**	56.2	54.6
$LSD_{(0.30)}$	3.1	0.7	$LSD_{(0.30)}$	7.2	0.9

	Walsh	Yuma
Cooperator:	Plainsman Research Center	Andrews Brothers
Planting Date:	09/20/07	09/16/06
Harvest Date:	07/02/07	07/11/07

Specific comments about individual dryland variety trial locations:

Akron – good fall emergence and growth, adequate (and non-uniform) fall subsoil moisture, excellent winter precipitation from late December snowfall, decent early spring precipitation, mild spring temperatures, drought stress symptoms appeared by early May, moderate rainfall in late May and mid-June relieved stress. No significant disease or insect problems noted.

Arapahoe – good fall stands and growth, excellent fall subsoil moisture, excellent winter precipitation from late December snowfall, minor snow mold observed after snow melt, moderate spring precipitation and temperature, stripe rust heavy by early June, leaf rust was then heavy on entries that kept the leaf from stripe rust. Drought stress symptoms evident by mid-June in some entries.

Bennett – very uneven fall emergence and growth, good fall precipitation and subsoil moisture, excellent winter precipitation from late December snowfall, moderate spring precipitation and temperature. Leaf and stripe rust both present at very low levels.

Burlington – excellent fall emergence and growth, minimal winter precipitation from late December snowfall, moderate spring precipitation but significant drought stress symptoms evident by early May, late May and June rains moderated severity of drought stress. No significant disease or insect problems noted.

Genoa – acceptable fall stands and good growth, excellent fall subsoil moisture, excellent winter precipitation from late December snowfall, moderate early spring precipitation and temperature. High populations of Bird cherry-oat aphids evident (and a few greenbugs), causing trapping of heads as they emerged from the boot. Drought stress evident by late May, moderated by late May and June precipitation. Damaging hail storm in early June caused about 30-40% damage. Leaf and stripe rust both present at very low levels.

Julesburg – good fall emergence and growth, adequate (and non-uniform) fall subsoil moisture, excellent winter precipitation from late December snowfall, moderate early spring precipitation and temperature, drought stress developed by mid-May due to lush growth and inadequate moisture availability, moderated by rainfall in late May and June (over 9" in mid-June). Stripe rust and leaf rust both present at significant levels by mid-June. Rains at maturity delayed harvest and lowered test weights.

Lamar – excellent fall emergence and growth, excellent fall precipitation and subsoil moisture, excellent winter precipitation from late December snowfall, good early spring precipitation and moderate temperature, heavy rainfall in mid-May contributed to heavy stripe rust infection (that moved to the heads on some entries) followed by heavy leaf rust infection on susceptible entries that kept the leaf from stripe rust. Minor hail damage in mid-May, minor lodging of very tall entries. Leaf rust scores only available on those entries that kept their leaf due to having stripe rust resistance.

Orchard – good fall emergence and growth, adequate (and non-uniform) fall subsoil moisture, excellent winter precipitation from late December snowfall, moderate early spring precipitation and temperature, early May rains moderated drought stress symptoms that had developed. Stripe rust found at very low levels.

Sheridan Lake – excellent fall emergence and growth, good fall precipitation and subsoil moisture, excellent winter precipitation from late December snowfall, good spring precipitation and moderate spring temperature. Moderate drought stress symptoms apparent on some entries by mid-May, extending toward early June with premature senescence of leaves of some entries. Stripe rust quite evident by mid-May, caused damage on susceptible entries. Leaf rust found but at very low levels.

Walsh – uneven fall emergence, good fall subsoil moisture, excellent winter precipitation from late December snowfall, good spring precipitation and moderate spring temperature. Evidence of minor snow mold infection after melting of the snow. Moderate drought stress symptoms apparent on some entries by mid-May. Stripe rust quite evident by mid-May, but remained at low levels throughout the season. Leaf rust found at very low levels.

Yuma – good fall emergence and growth, adequate fall subsoil moisture, excellent winter precipitation from late December snowfall, good spring precipitation and moderate spring temperature, extremely lush growth by mid-April. Hail event in mid-May caused significant head trapping. Significant drought stress symptoms evident by late May (though not very uniform throughout the trial) followed by good rains in late May and June. Leaf rust was found very low levels, stripe rust was not found at all.

Summary of 2007, 2-Yr, and 3-Yr Average Yield and Test Weight for Colorado Dryland Variety Trials.

2007 Average

Origin[3] Release Year	Variety[1]	Yield 2007	Test Weight 2007
		bu/ac	lb/bu
AP 2005	NuDakota	62.2	57.8
CSU 2004	Hatcher	61.3	59.4
AP 2006	Hawken	58.1	58.8
KSU 2006	Fuller	57.9	59.0
WB 2005	Keota	57.0	60.0
WB 2006	Smoky Hill	56.8	59.2
TX 2002	TAM 111	56.8	59.3
CSU 2004	Bond CL	56.8	58.4
NE 2004	Infinity CL	56.6	58.7
OK 2006	Duster	56.5	59.7
NE 2006	Overland	56.3	58.7
KSU 1994	Jagger	56.3	59.0
TX 2005	TAM 112	56.2	58.7
OK 2004	Endurance	55.9	59.1
CSU 2007	Bill Brown	55.7	58.6
CSU 1991	Yuma	55.4	58.9
KSU 2005	Danby	55.0	61.0
SD 2006	Alice	54.9	59.6
CSU 2006	Ripper	54.6	57.5
CSU-TX 2001	Above	54.5	58.1
AP 2001	Jagalene	53.9	60.0
AP 2005	Postrock	53.8	59.7
AP 2005	NuGrain	53.5	60.7
NE 1993	Alliance	52.7	58.0
OK 2006	OK Bullet	52.5	60.0

2-Yr Average[2]

Variety[1]	Yield 2006-07	Test Weight 2006-07
	bu/ac	lb/bu
NuDakota	45.0	57.1
Hatcher	44.0	59.0
Infinity CL	42.0	58.1
Keota	42.0	59.3
Endurance	41.5	58.8
Bill Brown	41.4	58.6
Bond CL	41.4	57.6
Ripper	41.2	57.2
Jagger	41.2	58.2
Yuma	40.8	58.1
TAM 111	40.6	59.0
Danby	40.1	60.5
Above	40.0	57.9
Alliance	39.5	57.9
Jagalene	39.2	59.6
Akron	39.1	58.2
Ankor	39.0	57.9
NuGrain	38.9	60.1
Trego	38.9	59.7
Postrock	38.6	58.9
Avalanche	38.5	59.3
Prairie Red	38.1	57.9
NuFrontier	37.9	59.1
Goodstreak	37.4	59.2
RonL	35.4	59.5

3-Yr Average[2]

Variety[1]	Yield 2005-07	Test Weight 2005-07
	bu/ac	lb/bu
Bill Brown	41.3	58.9
Hatcher	41.2	58.5
Bond CL	40.6	57.2
Ripper	40.4	57.1
Keota	39.2	58.3
Infinity CL	38.4	57.6
Jagger	38.4	57.6
Endurance	37.9	58.6
Above	37.7	58.0
Yuma	37.5	57.6
Jagalene	37.2	58.8
Alliance	37.1	57.7
Danby	37.0	59.6
TAM 111	36.8	58.5
NuGrain	36.8	59.5
Avalanche	36.7	59.0
Prairie Red	36.4	57.8
Ankor	35.9	57.6
NuFrontier	35.9	58.6
Akron	35.1	57.9
Goodstreak	35.0	58.9
Trego	34.7	59.2
Prowers 99	33.8	58.8
Average	37.4	58.3

CSU 1994	Akron	52.4	58.4
CSU 2002	Ankor	51.9	58.1
AP 2000	NuFrontier	51.7	59.7
CSU 1998	Prairie Red	51.6	58.0
KSU 1999	Trego	51.6	60.0
CSU 2001	Avalanche	50.8	59.7
KSU 2006	RonL	47.8	59.3
NE 2002	Goodstreak	47.5	59.8
CSU 1999	Prowers 99	46.5	59.9
	Average	54.5	59.1

Prowers 99	35.1	59.4
Average	39.9	58.7

[1]Varieties ranked according to average yield in 2007, according to average 2-yr yield, and according to average 3-yr yield.

[2]2-yr and 3-yr average yield and test weight are based on eleven 2007 trials, eleven 2006 trials, and ten 2005 trials.

[3]Variety origin code: CSU=Colorado State University; WB=WestBred, LLC; AP=AgriPro® COKER®; KSU=Kansas State University; TX=Texas A&M University; CSU-TX=Colorado State University/Texas A&M University release; NE=University of Nebraska; OK=Oklahoma State University; SD= South Dakota State University

Discussion of Dryland Wheat Variety Trial Results

Generally favorable planting and emergence conditions, resulting from favorable summer precipitation, led to good stands and tillering wheat plants before winter. Among the eleven dryland trial locations, plant stands were variable in our Bennett and Genoa trials where emergence continued into the spring. Winter 2007 brought heavy snow to most of eastern Colorado after many years of insufficient winter precipitation. Insufficient snow catch occurred at Burlington where the dryland trial suffered from significant drought stress.

Favorable fall, winter, and early spring temperatures, in combination with above average precipitation in most locations and well-developed plants, led to heavy tillering. Stripe rust and leaf rust appeared relatively early in the growing season and eventually reduced yields in some locations, especially in southeastern Colorado (Lamar, Sheridan Lake, Arapahoe) where it is rare to have such early and heavy rust infestations. Some trial locations did not receive enough late spring precipitation to sustain the lush growth created by favorable fall and winter conditions which led to reduced plant heights, fewer tillers reaching maturity, and lower trial yields.

Summary of Irrigated Variety Performance Trial Results for 2007 by Trial Location.

Dailey				Fort Collins			Rocky Ford		
Variety	Yield bu/ac	Test Weight lb/bu	WSMV (1-9)	Variety	Yield bu/ac	Test Weight lb/bu	Variety	Yield bu/ac	Test Weight lb/bu
TAM 112	105.1	60.3	3	Bill Brown	102.2	62.3	TAM 112	104.8	61.6
Yuma	91.7	57.6	3	Bond CL	100.5	61.0	NuDakota	101.3	59.3
Bond CL	89.1	58.2	4	NuDakota	97.3	59.0	Jagalene	101.2	60.7
TAM 111	88.5	56.4	7	Hawken	92.5	60.7	Bill Brown	101.1	60.8
NuDakota	85.6	54.7	7	Yuma	92.3	60.4	Aspen	100.2	59.9
Aspen	85.1	56.3	5	TAM 112	88.2	60.6	Yuma	98.2	58.9
NuGrain	85.1	59.0	5	Keota	87.0	61.5	Hatcher	97.6	60.8
Hatcher	83.9	58.2	6	Hatcher	86.8	61.2	TAM 111	97.1	61.7
Danby	83.7	59.4	4	NuGrain	85.6	62.3	Bond CL	96.6	59.8
Bill Brown	83.6	57.0	6	Postrock	83.6	60.9	Ankor	94.3	61.1
Keota	82.3	57.9	8	Jagalene	76.8	61.6	Hawken	91.8	61.1
Platte	82.1	58.6	7	Platte	75.9	62.1	Postrock	90.8	61.9
Prairie Red	79.7	57.0	3	TAM 111	75.7	61.0	Prairie Red	88.5	60.9
Jagalene	78.9	57.3	7	Ankor	70.2	60.4	NuGrain	87.8	62.2
Ankor	76.4	55.8	6	Danby	66.0	62.7	Keota	87.2	60.8
Postrock	76.1	56.8	4	Prairie Red	62.6	59.5	Danby	85.6	62.0
Hawken	73.5	57.3	7	Aspen	57.9	59.8	Platte	84.2	63.0
Average	84.2	57.5	5	**Average**	82.4	61.0	**Average**	94.6	61.0
$LSD_{(0.30)}$	4.8	0.7		$LSD_{(0.30)}$	7.1	0.3	$LSD_{(0.30)}$	7.6	1.0

	Dailey	Fort Collins	Rocky Ford
Cooperator:	Greg Larson	ARDEC	AVRS
Planting Date:	10/5/06	09/18/06	09/28/06
Harvest Date:	07/11/07	07/16/07	07/05/07
Influencing Disease:	WSMV	None significant	None significant

Specific comments about individual irrigated variety trial locations:

Dailey (Irrigated) – marginal fall stands and growth due to later planting, excellent winter precipitation from late December snowfalls. Severe symptoms from wheat streak mosaic virus evident by early June, stunting quite evident on very susceptible entries.

Fort Collins (Irrigated) – good fall stands and growth, excellent winter precipitation from late December snowfall, moderate early spring precipitation and temperature, first irrigation in early May relieved minor moisture stress that had developed. Leaf and stripe rust both present at very low levels.

Rocky Ford (Irrigated) – good fall emergence and growth. Stripe and leaf rust both present in the trial. Significant lodging of some entries. Good winter precipitation. Slight RWA infestation. High temperatures during grain filling may have limited yields.

Summary of 2007, 2-Yr, and 3-Yr Average Yield and Test Weight for the Irrigated Variety Performance Trial.

Variety Scores[5]			2007 Average[2]		
Origin[4] Release Year	Straw Strength[6] (1-9)	Stripe Rust[7] (1-9)	Variety[1]	Yield 2007 bu/ac	Test Weight 2007 lb/bu
TX 2005	7	9	TAM 112	99.4	60.8
CSU 2007	3	4	Bill Brown	95.6	60.0
CSU 2004	4	8	Bond CL	95.4	59.7
AP 2005	3	2	NuDakota	94.8	57.7
CSU 1991	3	6	Yuma	94.1	59.0
CSU 2004	4	4	Hatcher	89.4	60.1
TX 2002	3	2	TAM 111	87.1	59.7
AP 2005	4	8	NuGrain	86.2	61.1
AP 2006	2	2	Hawken	85.9	59.7
AP 2001	2	3	Jagalene	85.7	59.9
WB 2005	4	2	Keota	85.5	60.1
AP 2005	4	2	Postrock	83.5	59.9
WB 2006	1	4	Aspen	81.1	58.7
AP 1995	1	9	Platte	80.7	61.2
CSU 2002	3	8	Ankor	80.3	59.1
KSU 2005	5	4	Danby	78.5	61.4
CSU 1998	3	9	Prairie Red	77.0	59.2
			Average	87.1	59.8

2-Yr Average[3]		
Variety[1]	Yield 2006-07 bu/ac	Test Weight 2006-07 lb/bu
Bond CL	104.8	59.3
Yuma	98.1	59.3
NuDakota	97.7	58.4
TAM 111	95.3	59.2
Hatcher	94.9	59.6
Keota	94.0	59.5
NuGrain	91.0	60.3
Platte	89.6	60.4
Ankor	89.1	58.9
Jagalene	89.0	59.8
Danby	88.6	61.2
Bill Brown	87.9	59.6
Prairie Red	85.2	59.3
Postrock	84.2	59.5
Average	92.1	59.6

3-Yr Average[3]		
Variety[1]	Yield 2005-07 bu/ac	Test Weight 2005-07 lb/bu
Bond CL	101.0	59.2
Hatcher	92.9	59.7
Bill Brown	91.6	60.1
Yuma	91.5	59.1
TAM 111	91.3	59.3
NuGrain	91.1	60.5
Jagalene	87.3	60.1
Ankor	85.9	58.4
Platte	83.6	60.1
Prairie Red	78.1	58.2
Average	89.4	59.5

[1]Varieties ranked according to average yield in 2007, according to average 2-yr yield, and according to average 3-yr yield.

[2]All trials were planted at 1.2 million seeds/acre and fertilized and irrigated to obtain or exceed 100 bu/ac.

[3]2-yr and 3-yr average yield and test weight are based on three 2007 trials, one 2006 trial (Haxtun), and two 2005 trials (Rocky Ford and Fort Collins).

[4]Variety origin code: CSU=Colorado State University; WB=WestBred, LLC; AP=AgriPro® COKER®; KSU=Kansas State University; TX=Texas A&M University

[5]Average Stripe Rust and Straw Strength Scores are based on all available scores.

[6]Straw Strength score: 1=very good, 9=very poor

[7]Stripe Rust score: 1=very resistant, 9=very poor resistance

2007 Collaborative On-Farm Test (COFT) Performance Trial Results

Much of Colorado's 2007 wheat acreage was planted to winter wheat varieties that have been tested in the COFT program which is in its ninth year of testing. With on-farm testing, wheat producers can 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 new, superior varieties.

Colorado State University Cooperative Extension specialists 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 plots and measuring yields. Equally important, COFT would not be possible without the collaboration of so many dedicated wheat producers throughout eastern Colorado.

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

Name	Title	Office Location
Bruce Bosley	Platte River agronomist	Sterling
Scott Brase	SE Area agronomist	Lamar
Alan Helm	Golden Plains specialist	Holyoke
Ron Meyer	Golden Plains agronomist	Burlington

In the fall of 2006, nineteen eastern Colorado wheat producers (including the Plainsman Research Center at Walsh) planted 22 COFT trials in Baca, Prowers, Kiowa, Cheyenne, Kit Carson, Phillips, Logan, Adams, and Weld counties. Working with local Extension specialists, each collaborator received 100-150 pounds seed of each variety and planted the six varieties in side-by-side strips. The objective of the 2007 COFT was to compare performance and adaptability of newly-released varieties to varieties they might replace in Colorado for selection of the best performing hard red variety (Hatcher and Ripper), the best hard white variety (Avalanche and Danby), or the best Clearfield* wheat variety (Above and Bond CL).

Variety Performance in the 2007 Collaborative On-Farm Test

County/Town	HRW varieties: Hatcher	HRW varieties: Ripper	Clearfield Varieties: Bond CL	Clearfield Varieties: Above	HWW varieties: Danby	HWW varieties: Avalanche	Test Average	Comment
	Yield (bu/ac) at 13% moisture							
Adams/Byers	82.1	77.7	77.6	72.1	72.1	69.0	75.1	Deep snow cover, no-till, high fertility
Weld/Keenesburg	53.6	45.8	41.5	37.5	38.6	39.0	42.7	Variable weed infestations by variety
Weld/New Raymer	41.6	41.9	37.8	39.0	37.5	38.5	39.4	No-till, good fertility
Logan/Sterling W	57.4	53.4	59.2	49.2	55.4	51.3	54.3	No-till, good fertility, fair finishing moisture
Logan/Fleming	36.3	37.4	34.7	36.9	31.9	34.5	35.3	Low soil moisture mid May to mid June
Logan/Peetz	45.2	46.1	39.1	40.0	41.1	36.5	41.3	Good finishing moisture
Phillips/Paoli *6	51.2	51.3	52.9	58.2	50.6	52.4	52.8	Fertilized for high yield
Phillips/Haxtun *6	37.7	38.6	27.2	36.4	33.3	37.2	35.1	Wheat Steak Mosaic Virus
Phillips/Haxtun *3	33.5	32.3	29.6	41.2	31.3	32.7	33.4	Wheat Steak Mosaic Virus
Yuma/Yuma *6	30.1	38.7	29.7	33.9	31.5	29.0	32.2	Low fertility
Yuma/Yuma *3	27.4	26.8	35.1	37.9	27.2	31.7	31.0	Low fertility
Washington/Anton	22.1	17.7	14.9	11.5	17.6	9.5	15.6	Severe hail 5/14
Kit Carson/Bethune	36.1	31.5	30.9	33.6	31.2	31.2	32.4	Dry in fall 2006.
Kit Carson/Burlington	62.1	56.2	56.6	51.6	66.0	54.4	57.8	Excellent soil moisture fall 2006 and early 2007
Cheyenne/Arapahoe	60.7	69.8	60.7	58.4	54.6	43.7	58.0	Little moisture after snow, late rust
Kiowa/Haswell	27.8	22.4	21.9	17.4	15.1	13.2	19.6	Severe hail 5/29, broken & heads stems
Kiowa/Towner	49.3	40.7	50.9	48.0	49.0	45.1	47.2	Stripe & leaf rust largest factor
Prowers/Two Buttes	76.6	52.0	60.3	55.5	76.7	61.5	63.8	Great moisture, heavy stripe & leaf rust
Baca/Springfield	58.0	55.1	56.1	57.1	53.9	53.7	55.7	Little moisture after snow
Baca/Walsh I	53.4	42.7	51.5	49.5	51.5	43.1	48.6	Deep snow cover, little moisture after snow.
Baca/Walsh II	49.5	43.1	46.2	46.0	45.3	39.8	45.0	Deep snow cover, little moisture after snow.
Baca/Vilas	33.2	21.9	32.9	30.3	38.0	28.0	30.7	Spring drought, leaf and stripe rust
Average Yield	46.6	42.9	43.1	42.8	43.2	39.8	43.0	
$LSD_{(0.30)}$	1.6		1.2		1.2			
Significance	A	B	NS		A	B		

1. *6 - Trials planted specifically at 600,000 seeds/acre

2. *3 - Trials planted specifically at 300,000 seeds/acre

3. LSD and Significance are specific to the intended variety comparisons

Making Better Decisions Winter Wheat Variety Selection in Colorado for Fall 2007

Hard red wheat varieties to compare for planting in fall 2007:

	HRW varieties to consider			
	Hatcher	Ripper	Keota	Jagalene
UVPT 3yr Average Yield	41.2	40.4	39.2	37.2
UVPT 07 Average Yield	61.3	54.6	57.0	53.9
COFT 07 Average Yield	46.6	42.9		
Probability of 60+ Test Weight	31.9%	20.7%	49.2%	49.9%

Hatcher – highest yield over years, in 2007 UVPT, and in 2007 COFT trials. Test weight better than Ripper but lower than Keota and Jagalene in 2007. Better resistance to stripe rust than Ripper, similar to Jagalene and Keota.

Ripper – second highest yield over years albeit lower yielding than Hatcher and Keota in 2007 UVPT trials.

Keota – high yield over years and second to Hatcher in 2007. Similar test weight to Jagalene and better than Hatcher and Ripper in 2007. High protein content. Good stripe rust resistance.

Jagalene – the single most planted variety in Colorado this year. Jagalene has shown average yields over years and in 2007 was lower than Hatcher, Ripper, and Keota. Jagalene has the highest test weight among the four HRW varieties and good resistance to stripe rust. Has a tendency to shatter.

Hard white wheat varieties to compare:

	HWW varieties to consider	
	Danby	Avalanche
UVPT 3yr Average Yield	37.0	36.7
UVPT 07 Average Yield	55.0	50.8
COFT 07 Average Yield	43.2	39.8
Probability of 60+ Test Weight	44.5%	37.2%

Danby - had significantly higher yields in 2007 though average yields over years are similar. Test weight is better than Avalanche in 2007 and as good as the highest HRW varieties. Danby distinguishes itself due to good sprout tolerance and has considerably better stripe rust resistance than Avalanche.

Avalanche - yield has been stable over years albeit significantly lower than Danby in 2007. Test weight is average to good. Susceptible to stripe rust.

NuDakota - a new AgriPro hard white wheat (HWW) variety to keep your eye on. Excellent yield performance for two years but low test weight. Excellent resistance to both leaf and stripe rust. Better sprouting tolerance than many HWW, except Danby and Avalanche. We are waiting to see how it will perform in another year before making it a variety to consider for planting.

CLEARFIELD* wheat varieties to compare:

	CLEARFIELD varieties to consider		
	Bond CL	Infinity CL	Above
UVPT 3yr Average Yield	40.6	38.4	37.7
UVPT 07 Average Yield	56.8	56.6	54.5
COFT 07 Average Yield	43.1		42.8
Probability of 60+ Test Weight	18.3%	33.5%	24.7%

Bond CL – highest yielding Clearfield* variety over years including 2007 but low test weight, and is susceptible to stripe rust.

Infinity CL – good combination of high and stable yield, better test weight than the other two varieties and good stripe rust resistance.

Above – lower yielding than Bond CL and Infinity CL but better test weight than Bond CL. Susceptible to stripe rust but the earliest maturing CL variety.

Selecting your variety

Dryland wheat producers: **Our first suggestion is to plant more than one variety in order to spread your risk.** The suggested varieties below focus on yield as the primary criterion for variety selection. Additional information is provided (test weight, disease resistance, or different maturity), not because additional criteria are of equal importance as yield but rather because additional criteria can provide a basis for selecting a second or third variety that spreads your risk in a rational manner. Secondly, with the variability among trial locations in 2007, as well as variability among locations across years, **producers should consider multiple-year summary yield results** instead of single-location, or single-year results to make better variety decisions. All varieties are compared for performance over three years, including the two drought years in 2005 and 2006, so high average yield performance is also an indicator of yield stability. Test weight comparisons are made differently in this report than in other reports. Instead of reporting long term average test weight performance, we have computed the probability of obtaining or surpassing 60 lb/bu test weight. This provides a method of combining average test weight information for each variety together with the variability of test weight for each variety over trials into a comparison at a meaningful test weight benchmark (60 lb/bu). Probabilities were computed using test weight data of cleaned grain samples from a single replicate at each of the eleven UVPT trials in 2007 only. All varieties are susceptible to prevalent races of RWA and thus this does not figure into variety selection strategies.

Irrigated wheat producers: The most important variety selection criteria are yield, straw strength, and stripe rust resistance.

Bond CL – highest yielding irrigated variety over years. Low test weight is more manageable and less of a concern in irrigated conditions. It is susceptible to stripe rust but has reasonably good straw strength.

Hatcher – second highest irrigated wheat over years, good test weight under irrigated conditions, has good resistance to stripe rust. Straw strength of Hatcher is not as good as Bond CL and may be a concern under very high yielding conditions.

Description of winter wheat varieties in eastern trials.

ID/ Pedigree	Origin/ Type	RWA	HD	HT	SS	COL	WH	SR	LR	WSMV	TW	MILL	BAKE	Comments
Above TAM 110*4/FS2	CSU-TX 2001 Hard red winter	S	3	4	3	7	4	9	9	5	5	4	7	CSU/Texas A&M release (2001). Clearfield* winter wheat. Early maturing semidwarf, excellent dryland yield in CO. Leaf and stripe rust susceptible.
Akron TAM 107/Hail	CSU 1994 Hard red winter	S	5	5	4	5	3	8	9	9	5	7	6	CSU release (1994). Vigorous growth pattern, closes canopy early in spring and competes well with weeds. Best adapted under higher production dryland conditions. Leaf and stripe rust susceptible.
Alice Abilene/Karl	SD 2006 Hard white winter	S	4	3	--	5	2	--	8	--	4	5	5	South Dakota State release (2006). Earlier maturing than typical South Dakota materials, good winterhardiness. First tested in CSU trials in 2007.
Alliance Arkan/Colt//Chisholm sib	NE 1993 Hard red winter	S	5	4	4	4	2	6	8	9	5	6	7	Nebraska release (1993). Medium-early maturing semidwarf, short coleoptile, good tolerance to common dryland root rot.
Ankor Akron/Halt//4*Akron	CSU 2002 Hard red winter	R*	6	5	3	5	3	8	9	9	5	6	5	CSU release (2002). Backcross derivative of Akron with slightly higher grain yield under dryland conditions and improved straw strength. Leaf and stripe rust susceptible.
Aspen TAM 302/B1551W	Westbred 2006 Hard white winter	S	4	2	1	--	--	4	2	5	6	6	6	Westbred release (2006). Hard white winter wheat (HWW), good sprouting tolerance. First tested in CSU trials in 2007.
Avalanche KS87H325/Rio Blanco	CSU 2001 Hard white winter	S	5	5	4	5	4	8	8	5	2	2	5	CSU release (2001). Hard white winter wheat (HWW), sister selection to Trego. High test weight, excellent dryland yield in CO and Western KS. Leaf and stripe rust susceptible.
Bill Brown Yumar/Arlin	CSU 2007 Hard red winter	R*	4	4	3	2	5	4	2	6	2	4	3	CSU release (2007). Excellent dryland and irrigated yield record in CSU trials. High test weight, good leaf and stripe rust resistance. Good baking quality, short coleoptile.
Bond CL Yumar//TXGH12588-120*4/FS2	CSU 2004 Hard red winter	R*	5	5	4	5	4	8	5	8	7	7	3	CSU release (2004). Clearfield* winter wheat. Slightly later, slightly taller than Above. Excellent dryland yield in CO, very high irrigated yields, excellent baking quality, lower test weight. Leaf and stripe rust susceptible.
CO03W239 KS01-5539/CO99W165	CSU EXP Hard white winter	S	5	4	3	5	5	3	5	4	5	5	2	CSU experimental for possible release fall 2008. Hard white Clearfield* wheat. Excellent dryland yield in CO, excellent baking quality, average test weight, good stripe rust and moderate leaf rust resistance, moderate sprouting susceptibility.
Danby TREGO/JGR 8W	KSU 2005 Hard white winter	S	6	4	5	4	4	4	5	5	2	2	7	KSU-Hays release (2005). Hard white wheat (HWW), similar to Trego, with improved stripe rust resistance and preharvest sprouting tolerance.
Duster WO405D/HGF112//W 7469C/HCF012	OK 2006 Hard red winter	S	6	5	--	2	--	8	2	7	5	3	5	Oklahoma State release (2006). Good yield performance in western Plains breeder trials, first tested in CSU trials in 2007. Leaf rust resistant, stripe rust susceptible.
Endurance HBY756A/Siouxland//2180	OK 2004 Hard red winter	S	5	5	2	5	4	7	2	--	4	5	5	Oklahoma State release (2004). Dual-purpose (grain and grazing) wheat, excellent re-growth following grazing. Moderately susceptible to stripe rust, resistant to leaf rust.
Fuller Bulk selection	KSU 2006 Hard red winter	S	5	2	--	4	--	--	2	5	6	6	5	KSU-Manhattan release (2006). First tested in CSU trials in 2007. Average test weight, good leaf and stripe rust resistance.

Goodstreak SD3055/KS88H164//NE89646	NE 2002 Hard red winter	S	7	8	3	9	5	5	5	8	3	2	8	Nebraska release (2002). Tall, long coleoptile, medium-late maturing. Good test weight, marginal baking quality.
Hatcher Yuma/PI 372129//TAM-200/3/4*Yuma/4/KS91H184/Vista	CSU 2004 Hard red winter	R*	5	3	5	5	4	4	9	8	4	2	4	CSU release (2004). Medium maturing semidwarf. Good test weight, good stripe rust resistance, leaf rust susceptible. Excellent dryland and irrigated yield across the High Plains, good milling and baking quality.
Hawken Rowdy/W96-427	Agripro 2006 Hard red winter	S	3	4	2	5	--	2	4	7	3	5	6	Agripro release (2006). Targeted for northeast Colorado and further north, first tested in CSU trials in 2007. Good yields in 2007, average test weights. Good leaf and stripe rust resistance.
Infinity CL Windstar/3/NE94481//TXGH125888-120*4/FS2	NE 2004 Hard red winter	S	6	5	4	6	2	4	3	--	4	--	--	Nebraska release (2005). Clearfield* winter wheat. Test weight slightly lower than average, better baking quality than Above. Good dryland yield in 2006 and 2007 CSU trials.
Jagalene Abilene/Jagger	Agripro 2001 Hard red winter	S	5	4	2	4	3	3	9	4	3	2	5	Agripro release (2001). Good test weight, good stripe rust resistance. Good dryland and irrigated yield in CO, has been observed to shatter in CO and KS trials. Very leaf rust susceptible.
Jagger KS82W418/Stephens	KSU 1994 Hard red winter	S	2	5	5	5	8	2	9	4	5	5	3	KSU-Manhattan release (1994). Early maturing semidwarf, excellent baking quality, good WSMV tolerance and stripe rust resistance, very leaf rust susceptible.. Breaks dormancy very early in the spring.
Keota Custer/Jagger	Westbred 2005 Hard red winter	S	6	6	4	5	5	2	9	5	5	6	6	Westbred release (2005). First tested in CSU trials in 2005. Good stripe rust resistance, leaf rust susceptible. Good dryland yields in CSU trials. Slightly taller plant stature.
NuDakota Jagger/Romanian	Agripro 2005 Hard white winter	S	5	3	3	4	3	2	2	4	8	7	5	Agripro release (2005), first tested in CSU trials in 2006. Hard white wheat (HWW), good dryland yield record in CSU dryland trials but very low test weight. Good leaf and stripe rust resistance. Moderately-susceptible to pre-harvest sprouting.
NuFrontier Pioneer bulk selection (HBK0927)	Agripro 2000 Hard white winter	S	6	6	4	5	4	3	5	8	4	4	5	Agripro release (2000). Hard white wheat (HWW), medium-late maturing, tall. Good stripe rust resistance, best adapted to dryland conditions. Very poor pre-harvest sprouting tolerance.
NuGrain Platte/W92-456W	Agripro 2005 Hard white winter	S	6	5	4	5	4	8	9	5	3	--	--	Agripro release (2005), first tested in CSU trials in 2005 as GM10006. Hard white wheat (HWW), best adapted to irrigated conditions, though moderately susceptible to stripe rust and susceptible to leaf rust. Moderate sprout tolerance.
OK Bullet KS93U206//KS82W418/Stephens F3:9	OK 2006 Hard red winter	S	3	6	--	7	--	4	4	6	3	2	2	Oklahoma release (2006). First tested in CSU trials in 2007. Good milling and baking quality.
Overland Millennium 'S'/ND8974	NE 2006 Hard red winter	S	--	--	--	5	--	--	2	--	6	5	8	Nebraska release (2006) as "Husker Genetics Brand Overland", tested in NE trials as NE01643. Very good yields in Nebraska dryland trials, first tested in CSU trials in 2007. Moderate stripe rust resistance, good leaf rust resistance. Poor baking quality.
Platte N84-1104/Abilene	Agripro 1995 Hard white winter	S	6	2	1	3	5	9	9	7	3	3	1	Agripro release (1995). Hard white wheat (HWW), excellent test weight and milling and baking quality. Best adapted under irrigation, very susceptible to stripe rust and leaf rust.

														Poor sprout tolerance.
Postrock Ogallala/KSU94U261/ /Jagger	Agripro 2005 Hard red winter	S	4	4	3	5	5	2	2	4	3	3	4	Agripro release (2005), first tested in CSU trials in 2006. Good leaf and stripe rust resistance, good test weight. Average yields in 2006 and 2007 CO dryland variety trials.
Prairie Red CO850034/PI372129// 5*TAM 107	CSU 1998 Hard red winter	R*	3	3	3	6	4	9	9	5	5	4	7	CSU release (1998). Backcross derivative of TAM 107. Excellent stress tolerance, poor end-use quality reputation.
Prowers 99 CO850060/PI372129// 5*Lamar	CSU 1999 Hard red winter	R*	7	8	4	8	2	5	6	7	3	5	1	CSU release (1999), reselection from Prowers. Tall, long coleoptile, medium-late maturity, high test weight, excellent milling and baking quality characteristics.
Ripper CO940606/TAM107R- 2	CSU 2006 Hard red winter	R*	3	4	3	7	4	9	9	7	6	2	2	CSU release (2006). Excellent stress tolerance, high dryland yields in CO, excellent milling and baking quality. Leaf and stripe rust susceptible. Resistant to Ug-99 race of stem rust in Africa.
RonL Trego/CO960293	KSU 2006 Hard white winter	S	6	2	--	4	--	7	9	2	2	2	2	KSU-Hays release (2006). Hard white wheat (HWW), first tested in CSU trials in 2006. High test weight, excellent resistance to wheat streak mosaic virus. Very drought susceptible.
Smoky Hill 97 8/64 MASA	Westbred 2006 Hard red winter	S	6	2	--	4	--	2	2	8	5	--	--	Westbred release (2006). First tested in CSU trials in 2007. Good yield in 2007 CO dryland trials, average test weight. Good leaf and stripe rust resistance.
TAM 111 TAM- 107//TX78V3630/CTK 78/3/TX87V1233	TX 2002 Hard red winter	S	6	6	3	6	5	2	9	5	3	3	4	Texas A&M release (2002), marketed by Agripro. High test weight, good straw strength, good milling and baking quality characteristics. Leaf rust susceptible, good stripe rust resistance.
TAM 112 U1254-7-9-2- 1/TXGH10440	TX 2005 Hard red winter	S	4	5	7	7	--	9	9	2	5	6	6	Texas A&M release (2005), marketed by Watley Seed. Medium height, medium maturity. Good dryland performance in Western KS trials, first tested in CSU trials in 2007. Susceptible to leaf and stripe rust, very good WSMV tolerance.
Trego KS87H325/Rio Blanco	KSU 1999 Hard white winter	S	6	3	4	5	4	8	9	5	2	2	6	KSU release (1999). Hard white winter wheat (HWW), medium-late maturity, semidwarf, high test weight. Susceptible to both leaf and stripe rust.
Winterhawk 474S10-1/X87807- 26//HBK0736-3	Westbred 2007 Hard red winter	S	4	5	--	--	--	--	2	5	2	2	4	Westbred release (2007). First tested in CSU dryland trials in 2008. Good yield and test weight in western Plains in regional breeder trials. Good leaf rust resistance.
Yuma NS14/NS25//2*Vona	CSU 1991 Hard red winter	S	5	3	3	2	4	6	4	6	5	7	3	CSU release (1991). Medium maturity, semidwarf, short coleoptile, good baking quality characteristics. Good yields under dryland conditions and especially under irrigation.

Russian Wheat Aphid resistance (RWA), heading date (HD), plant height (HT), straw strength (SS), shatter (SH), coleoptiles length (COL), winterhardiness (WH), strip rust (SR), leaf rust resistance (LR), wheat streak mosaic virus tolerance (WSMV), test weight (TW), protein content (PC), milling quality (MILL), and baking quality (BAKE).

**Rating scale: 0 – very good, very early, or very short to 9 – very poor, very late, or very tall.

***RWA rating denotes resistance to the original biotype (biotype 1) of RWA. All available cultivars are susceptible to the new biotypes of RWA.

Protein Content

2007 Dryland Uniform Variety Performance Trial Protein Content Results					
Hayley Miller and John Stromberger, CSU Wheat Quality Lab					
Entry	**Akron**	**Burlington**	**Julesburg**	**Walsh**	**Average**
	%	**%**	**%**	**%**	**%**
Goodstreak	16.6	15.2	16.2	15.2	15.8
RonL	17.5	16.9	15.0	13.7	15.8
Overland	17.4	16.2	15.3	14.0	15.8
Trego	17.2	16.3	15.8	12.8	15.5
Fuller	15.2	16.0	14.7	16.1	15.5
Ripper	17.2	16.4	14.8	13.4	15.4
NuGrain	16.4	16.2	16.6	12.3	15.4
Jagger	15.1	17.2	15.9	11.9	15.0
Jagalene	17.1	16.7	12.4	13.5	14.9
Ankor	16.2	15.9	12.6	14.7	14.9
Danby	15.5	14.9	14.5	14.5	14.8
Postrock	17.1	15.4	12.8	13.9	14.8
Keota	15.4	15.6	15.5	12.5	14.8
Smoky Hill	16.0	17.0	12.0	14.0	14.7
Hawken	16.4	16.0	13.8	12.5	14.7
Duster	15.8	14.5	16.1	12.2	14.6
Prowers 99	16.1	15.6	13.6	12.5	14.4
NuFrontier	13.9	15.7	12.3	15.8	14.4
OK Bullet	16.2	14.8	11.5	14.0	14.1
Akron	15.0	15.6	13.8	12.1	14.1
Alliance	16.0	15.7	11.1	13.8	14.1
Bill Brown	14.1	13.5	16.1	12.1	14.0
NuDakota	15.4	15.7	12.0	12.7	13.9
Yuma	14.8	15.1	13.2	12.6	13.9
Bond CL	13.8	14.2	14.6	13.0	13.9
Prairie Red	14.7	14.9	13.0	12.9	13.9
Infinity CL	13.3	15.3	11.8	14.8	13.8
CO03W239	15.0	14.6	13.9	11.7	13.8
Alice	15.7	16.0	11.7	11.5	13.7
TAM 112	15.3	14.5	14.0	11.2	13.7
Endurance	13.7	14.5	15.1	11.5	13.7
TAM 111	13.9	17.2	11.3	11.8	13.6
Hatcher	15.7	12.6	12.9	12.9	13.5
Avalanche	14.0	16.0	11.9	11.6	13.4
Above	15.2	15.4	11.8	10.7	13.3
Average	**15.5**	**15.5**	**13.7**	**13.0**	**14.4**
All values are reported on a 12% moisture basis.					

2007 Irrigated Variety Performance Trial Protein Content Results	
Entry	**Fort Collins**
	%
TAM 111	16.3
Platte	16.2
TAM 112	16.0
Postrock	16.0
Aspen	15.9
NuGrain	15.8
Jagalene	15.7
Ankor	15.6
Prairie Red	15.3
Hawken	15.2
Danby	15.1
Hatcher	14.8
NuDakota	14.4
Keota	14.4
Yuma	13.6
Bond CL	13.6
CO03W239	13.4
Bill Brown	13.0
Average	**15.0**

Wheat Quality Results and Interpretation from the 2007 CSU Dryland Variety Trials

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Introduction

End-use quality maintenance and improvement is an important objective of all wheat breeding programs, but of special importance to Colorado due to the persistent stigma caused by the historic prevalence of TAM 107. Grain buying and end-use industries have become increasingly sophisticated in all markets and, while wheat producers are seldom rewarded for improved functional quality, technological advancements promise to increase the ability of the grain trade to identify and source good quality and discount poor quality.

Breeding for improved quality is very challenging. Quality is a function of variety interacting with climate and agronomic practices. Colorado climatic conditions are highly variable and unpredictable which complicates the evaluation process. Also, quality is measured by many traits and many genes are involved, further complicating breeding. Most experimental quality tests only approximate average quality needs of product manufacturers and don't match specific requirements of different wheat product types and processes. Finally, wheat quality testing must accommodate the reality of large sample numbers and small sample sizes typical of all wheat breeding programs. Despite these challenges, standard testing methodologies have been developed that are consistent, repeatable, and can be done in our laboratory on large numbers of small samples. They provide reliable assessments of functional quality characteristics for a broad array of potential product types and processes.

2007 Results

Grain samples were collected from four dryland variety trial locations (Akron, Burlington, Julesburg, and Walsh) and one irrigated location (Fort Collins). Preliminary dough mixing tests revealed that the Walsh and Fort Collins locations were unsuitable for analysis (dough was either too strong or too weak). Using standard testing protocols, quality tests were done in the CSU Wheat Quality Laboratory on samples from the three remaining locations. These tests, reported in Table 1 (for milling-related traits) and Table 2 (for baking-related traits), include the following:

<u>Milling-Related Traits</u>

- Wheat ash: obtained by prediction using whole-grain near-infrared reflectance spectroscopy (NIRs) with a Foss NIRSystems 6500. Wheat ash represents the remaining weight of a grain sample following incineration in a high-temperature oven. Millers prefer low wheat ash (values < 1.6%) as it tends to result in low-ash flour following milling.
- Single kernel characterization system (SKCS): the Perten SKCS 4100 provides data on kernel weight, diameter, and hardness of a grain sample. One hundred or more kernels are analyzed to provide an average and a measure of variability (standard deviation, STD) for each trait. Millers prefer a uniform sample with heavier (>30 grams/1000 kernels) kernels and larger kernel diameters (>2.40 mm) for improved milling performance. Hardness should be representative of the hard winter wheat class (60-80 hardness units).
- Flour yield: obtained using a modified Brabender Quadrumat Milling System. Flour yield represents the amount of flour obtained from milling a grain sample (approximately one pound). In general, millers prefer high flour extraction with low flour ash values. Due to variation among different milling systems, valid comparison of values from different mills and establishment of a single target value is not possible.

<u>Baking-Related Traits</u>

- Flour protein and ash: obtained by prediction using NIR analysis with a Foss NIRSystems 6500. In general, product manufacturers prefer hard wheat with higher flour protein and lower ash content. Higher flour protein content is associated with higher bake water absorption, which is highly desired by the industry because water is much cheaper than flour. Lower flour ash content is associated with brighter flour color and improved product color.

- Mixograph mixing time and tolerance: obtained using a National Manufacturing Computerized Mixograph. The Mixograph measures the resistance of a dough during mixing. Bakers generally prefer flours with moderate mixing time requirements (between 3 and 6 minutes) and good tolerance to breakdown of the dough with overmixing (subjective tolerance score ≥ 3).
- Pup loaf bake test: using a 100-gram straight-dough test, data on water absorption, mixing time, loaf volume, and crumb grain characteristics are obtained. In general, bakers prefer higher water absorption (> 62%), a moderate mixing time (between 3 and 5 minutes), high loaf volume (> 850 cubic centimeters), and a higher crumb grain score (score ≥ 3). The crumb grain score is a subjective assessment of the size, shape, and structure of the small holes in a slice of bread.

Composite Scores

The values reported for each trait in Table 1 (milling-related traits) and Table 2 (baking-related traits) represent the average across three locations. Because none of the traits can be used alone to represent overall milling or baking quality, a composite score was developed as a means to differentiate and characterize the entries. The development of a composite score also has the advantage of "smoothing" out differences in environmental conditions from year to year and utilizing all of the data generated on the samples. Composite scores were generated as follows:

1) Trait values were standardized such that individual values were converted to a score (1-10 scale) relative to the average of all entries tested. For example, an entry with a value close to the average of all entries was given a score of 5 while those with the lowest values and highest values were given scores of 1 and 10, respectively.

2) Weights were assigned to each trait as a function of their relative importance in milling or bread-baking. These weights were similar to those adopted by the USDA-ARS Hard Winter Wheat Quality Laboratory for development of composite scores for the Wheat Quality Council Testing Program. These weights were as follows:

Milling (weights total to 100%)	Baking (weights total to 100%)
Wheat ash – 16%	Flour protein – 10%
SKCS weight – 10%	Flour ash – 10%
Weight STD – 8%	Mixograph mix time – 5%
SKCS diameter – 10%	Mixograph tolerance – 5%
Diameter STD – 8%	Bake absorption – 15%
SKCS hardness– 10%	Bake mix time – 10%
Hardness STD – 8%	Bake loaf volume – 20%
Flour yield – 30%	Crumb grain – 25%

3) A composite score was generated using the standardized scores and the weights as follows:

Milling

[(wheat ash*1.6)+(SKCS weight*1.0)+(weight std*0.8)+(SKCS diameter*1)+(diameter STD*0.8)+(SKCS hardness*1.0)+(hardness STD*0.8)+(flour yield*3.0)]/10

Baking

[(flour protein*1.0)+(flour ash*1.0)+(mixograph mixtime*0.5)+(mixograph tolerance*0.5)+(bake absorption*1.5)+(bake mix time*1.0)+(bake loaf volume*2.0)+(crumb grain*2.5)]/10

Milling-related traits from entries in the 2007 Uniform Variety Performance Trial (UVPT). Values represent the average of evaluations from the Akron, Burlington, and Julesburg locations and are ranked in descending order of the composite score (see explanation in text).

		Single Kernel Characterization System							
Entry	Wheat Ash	Kernel weight	Weight STD	Kernel diameter	Diameter STD	Kernel hardness	Hardness STD	Flour Yield	Composite Score
	(%)	(grams/1000)		(mm)		(index)		(%)	
Postrock	1.47	30.0	6.4	2.70	0.43	53.8	17.2	65.1	6.2
TAM 111	1.55	29.5	8.8	2.57	0.49	62.7	15.6	67.2	6.0
CO03W239	1.49	25.9	7.3	2.40	0.39	70.1	17.7	66.6	6.0
Trego	1.55	31.2	7.3	2.70	0.39	68.3	16.4	62.5	5.8
Infinity CL	1.58	28.9	8.4	2.51	0.54	60.5	15.9	68.5	5.8
NuGrain	1.50	25.2	7.0	2.46	0.39	77.8	15.3	63.2	5.7
Avalanche	1.37	29.7	7.3	2.60	0.40	63.7	17.0	62.4	5.6
Prowers 99	1.62	29.4	8.3	2.58	0.49	69.2	13.7	64.1	5.6
Jagalene	1.49	28.0	7.6	2.56	0.44	67.8	16.6	62.9	5.4
Keota	1.62	32.3	8.4	2.76	0.47	66.1	16.8	63.0	5.3
OK Bullet	1.41	30.7	8.1	2.75	0.57	65.7	16.7	62.5	5.3
TAM 112	1.58	27.8	7.3	2.49	0.44	71.3	15.6	64.4	5.3
Jagger	1.57	27.3	7.1	2.52	0.40	60.7	17.1	65.2	5.3
Alice	1.42	27.3	7.2	2.46	0.43	72.6	16.3	62.5	5.3
Ripper	1.59	29.6	8.6	2.57	0.46	73.1	17.3	64.4	5.3
Yuma	1.61	27.5	7.5	2.49	0.44	67.7	15.4	64.5	5.2
NuFrontier	1.57	27.2	7.8	2.53	0.44	69.5	17.0	63.9	5.2
Bill Brown	1.61	26.6	9.1	2.52	0.57	75.5	16.7	65.6	5.2
Alliance	1.59	28.5	8.2	2.46	0.48	64.8	15.9	65.1	5.1
RonL	1.71	31.8	7.9	2.67	0.44	65.4	16.4	63.0	5.1
Duster	1.65	25.9	5.9	2.45	0.36	63.6	16.4	64.0	5.0
Prairie Red	1.59	27.8	7.9	2.53	0.55	61.0	15.3	64.9	5.0
Akron	1.63	26.5	6.5	2.44	0.36	67.1	15.5	63.0	4.9
Overland	1.78	27.0	6.8	2.41	0.38	65.8	15.4	63.9	4.9
Above	1.55	28.4	7.3	2.54	0.52	63.5	15.7	63.2	4.8
Ankor	1.68	28.7	7.7	2.57	0.46	69.6	15.7	63.0	4.8
Hawken	1.57	26.2	7.5	2.49	0.45	57.9	16.8	65.4	4.8
Fuller	1.63	27.2	7.0	2.56	0.47	61.4	16.4	64.0	4.8
Endurance	1.59	28.4	6.8	2.58	0.45	68.7	16.3	61.7	4.6
Danby	1.45	27.0	7.9	2.46	0.46	61.7	17.0	62.7	4.4
Hatcher	1.61	29.3	8.4	2.53	0.44	67.4	17.9	62.8	4.4
Smoky Hill	1.62	27.7	7.0	2.57	0.44	74.6	19.8	60.8	4.2
NuDakota	1.58	28.8	7.3	2.54	0.43	70.4	17.6	59.7	4.0
Bond CL	1.61	27.3	7.4	2.46	0.43	65.2	16.9	61.5	4.0
Goodstreak	1.72	28.1	8.8	2.55	0.44	70.2	16.5	61.7	3.8
Average	1.58	28.3	7.6	2.54	0.45	66.7	16.4	63.7	5.1
Minimum	1.37	25.2	5.9	2.40	0.36	53.8	13.7	59.7	3.8
Maximum	1.78	32.3	9.1	2.76	0.57	77.8	19.8	68.5	6.2

Baking-related traits from entries in the 2007 Uniform Variety Performance Trial (UVPT). Values represent the average of evaluations from the Akron, Burlington, and Julesburg locations and are ranked in descending order of the composite score (see explanation in text).

	Flour		Mixograph		Pup Loaf Bake				
Entry	Protein	Ash	Mixing Time	Tolerance Score	Water Absorption	Mixing Time	Loaf Volume	Crumb Grain	Composite Score
	(%)	(%)	(min)	(score)	(%)	(min)	(cc)	(score)	
NuGrain	15.5	0.49	2.4	2.0	68.9	2.9	1057	3.7	7.4
TAM 112	13.8	0.53	4.1	4.3	66.1	3.6	1018	4.3	6.6
Ripper	15.2	0.51	3.0	2.7	68.3	2.9	955	3.3	6.6
CO03W239	13.6	0.46	4.6	3.3	65.7	4.3	1005	4.7	6.5
Postrock	14.1	0.48	3.5	2.0	66.4	2.8	1005	3.7	6.4
RonL	14.9	0.47	3.0	1.3	67.9	2.6	932	3.3	6.4
Ankor	13.6	0.45	2.9	2.0	65.6	2.9	988	4.0	6.4
Yuma	13.6	0.44	3.6	4.7	65.7	3.2	855	3.3	6.3
Duster	13.9	0.53	3.5	4.0	66.3	3.3	947	4.0	6.3
Smoky Hill	13.8	0.47	4.2	2.7	65.9	4.0	1005	4.0	6.2
NuFrontier	13.3	0.47	3.2	1.7	65.2	3.0	1002	3.7	6.0
Akron	13.3	0.46	4.2	4.0	65.2	3.5	938	4.0	6.0
Fuller	13.7	0.48	4.3	4.0	65.8	3.7	962	3.7	5.9
Trego	15.0	0.46	2.6	1.0	68.1	2.3	917	3.0	5.9
Jagalene	14.2	0.50	3.1	1.3	66.7	2.8	968	3.7	5.9
Alliance	13.0	0.45	3.3	2.3	64.6	3.2	930	3.0	5.8
Prowers 99	14.2	0.49	4.6	4.3	66.6	4.4	952	4.0	5.6
Hatcher	12.7	0.47	4.0	4.3	64.2	3.5	873	4.3	5.6
OK Bullet	12.9	0.48	4.2	2.7	64.5	3.8	925	4.0	5.5
Bond CL	13.3	0.45	4.3	4.7	65.2	4.0	918	3.7	5.5
Prairie Red	13.2	0.47	3.3	3.3	65.0	2.9	978	2.7	5.4
Endurance	12.9	0.47	3.1	2.0	64.6	2.6	978	3.7	5.4
Alice	13.4	0.47	4.5	3.3	65.3	3.6	947	3.3	5.4
Hawken	14.4	0.50	5.3	4.7	67.0	5.1	980	3.3	5.4
Bill Brown	13.6	0.49	4.0	3.0	65.6	3.6	935	3.0	5.4
Avalanche	12.8	0.46	3.3	1.7	64.4	2.7	945	3.7	5.4
Keota	14.0	0.46	3.4	3.7	66.4	3.0	772	2.3	4.9
Jagger	14.6	0.51	2.8	1.0	67.4	2.4	882	2.7	4.9
Goodstreak	15.3	0.49	2.0	1.0	68.5	1.9	798	2.7	4.4
TAM 111	13.1	0.49	3.2	2.3	64.9	3.1	843	2.3	4.3
Infinity CL	12.2	0.46	5.8	5.0	63.3	5.3	930	3.7	4.3
Above	13.0	0.48	2.9	2.3	64.7	2.4	792	2.3	3.6
Overland	15.1	0.52	2.2	1.0	68.1	2.2	755	2.0	3.6
Danby	13.4	0.48	2.8	2.0	65.3	2.3	828	2.0	3.4
NuDakota	13.4	0.47	3.1	2.7	65.3	2.5	767	1.7	3.3
Average	13.8	0.48	3.5	2.8	66.0	3.2	922	3.3	5.5
Minimum	12.2	0.44	2.0	1.0	63.3	1.9	755	1.7	3.3
Maximum	15.5	0.53	5.8	5.0	68.9	5.3	1057	4.7	7.4

New Wheat Cultivar Released from Colorado State University

In early August 2007, the Colorado State University (CSU) Agricultural Experiment Station approved the release of a new winter wheat variety from the CSU Wheat Breeding and Genetics Program. This new variety is the most recent addition to the group of wheat varieties developed by CSU and marketed by the Colorado Wheat Research Foundation.

The new variety, named '**Bill Brown**', is a high-yielding, stress tolerant, hard red winter wheat with high test weight, good milling and baking quality, and excellent protection from both leaf and stripe rust. The name '**Bill Brown**' was chosen in honor of the memory of the former CSU Extension Plant Pathologist who devoted his career to the improvement and management of diseases of wheat and other grain crops.

In three years of statewide testing in the dryland Colorado Uniform Variety Performance Trial (UVPT), '**Bill Brown**' had grain yields similar to the high yielding wheat variety 'Hatcher' (see below). In three years of statewide testing in the Colorado Irrigated Variety Performance Trial (IVPT), '**Bill Brown**' was the highest yielding entry in the trials (see below). '**Bill Brown**' will be an excellent replacement for wheat cultivars targeted specifically for high yield, irrigated production conditions and an excellent complement to both 'Hatcher' and 'Ripper' for dryland production conditions.

Detailed information on '**Bill Brown**' and other recently released varieties may be found at the home page of the CSU Wheat Breeding and Genetics Program (*http://wheat.colostate.edu*).

Important Characteristics of 'Bill Brown'

- High dryland and irrigated grain yield, excellent stress tolerance
- High test weight, ½ lb/bu higher than 'Hatcher', 1 lb/bu higher than 'Prairie Red'
- Heading three days later than 'Prairie Red', one day earlier than 'Hatcher'
- Height three inches taller than 'Prairie Red', one inch taller than 'Hatcher', similar to 'Akron'
- Short coleoptile (similar to 'Yuma'), good shattering tolerance, good straw strength
- Excellent milling and baking properties
- Moderately resistant to stripe rust, resistant to leaf rust, resistant* to biotype 1 RWA, susceptible to biotype 2 RWA, moderately susceptible to wheat streak mosaic virus

2005-07 CSU Dryland Variety Trials (UVPT)

Entry	2005	2006	2007	Avg Yield	Avg TestWt
Hatcher	35.7	26.6	61.3	41.4	58.9
Bill Brown	**41.2**	**27.0**	**55.7**	**41.3**	**59.1**
Bond CL	38.9	26.0	56.8	40.6	57.5
Ripper	38.8	27.8	54.6	40.4	57.2
Jagger	32.7	26.1	56.3	38.5	58.3
Above	33.0	25.5	54.5	37.8	57.9
Yuma	30.7	26.2	55.4	37.6	58.2
Jagalene	33.0	24.5	53.9	37.3	59.5
Danby	30.8	25.2	55.0	37.2	60.6
Alliance	32.1	26.3	52.7	37.2	57.8
TAM 111	29.4	24.3	56.8	37.1	59.1
Avalanche	32.9	26.2	50.8	36.7	59.5
Prairie Red	33.0	24.6	51.6	36.5	57.8
Ankor	29.7	26.2	51.9	36.1	57.8
Prowers 99	31.2	23.6	46.5	33.9	59.3
Average	33.5	25.7	54.3	38.0	58.6
Locations	10	11	11	32	22

2005-07 CSU Irrigated Variety Trials (IVPT)

Entry	2005	2006	2007	Avg Yield	Avg TestWt
Bill Brown	**98.8**	**80.2**	**95.6**	**91.6**	**60.1**
Bond CL	89.8	79.5	95.4	88.2	58.5
TAM 111	87.2	84.8	87.1	86.4	59.9
Hatcher	89.7	71.0	89.4	83.4	59.7
NuGrain	88.0	72.2	86.2	82.1	60.6
Yuma	78.5	72.0	94.1	81.5	58.8
Jagalene	84.9	71.4	85.7	80.7	60.2
Ankor	81.8	74.7	80.3	78.9	58.5
Platte	68.7	80.7	80.7	76.7	60.1
Prairie Red	64.4	71.2	77.0	70.9	58.3
Average	83.2	75.8	87.2	82.0	59.5
Locations	3	3	3	9	

* RWA resistance denotes resistance to the original strain (biotype 1) of RWA. All available wheat varieties are susceptible to the new strains of RWA. "Resistance" means a wheat variety expected to suffer less loss to RWA biotype 1 than susceptible varieties under similar infestation and growing conditions. It does not mean no aphid infestation will occur. Losses associated with infestation will vary by variety and growing conditions.

Certified Seed Provides Timely Access and Assurance of Quality

Brad Erker, CSU Extension and Colorado Seed Growers Association

Colorado's seed certification system distributes new varieties to farmers quickly and efficiently
NOT INSPECTED = NOT CERTIFIED. All Certified wheat seed is field inspected and laboratory tested
Most varieties are protected with PVP and their seed cannot legally be sold unless they are Certified

Since 1929, the Colorado Seed Growers Association (CSGA) has provided seed quality assurance. CSGA includes 40-50 wheat seed growers who act as the link between wheat breeding programs and the wheat producers who plant over two million acres of wheat each year. As new varieties are released, only a tiny amount of seed is initially available. Through the production of the Foundation, Registered, and Certified classes of seed, and with careful inspection at each step, these new varieties are made available in sufficient quantities for farmers. CSGA promotes rapid adoption of new varieties as well as maintaining seed of popular older varieties.

All Certified seed is field inspected. Trained CSGA inspectors walk each field to look for varietal purity and problem weeds in the fields. CSGA's Standards are used by inspectors as the basis for a pass/fail recommendation on every field.

	Maximum permitted ratio of plants		
Factor	Foundation	Registered	Certified
Other varieties	1: 3,000	1: 2,000	1: 1,000
Inseparable other crops	1:10,000	1:10,000	1: 2,000
Rye in wheat, triticale, barley and oats	None	None	None
Noxious weeds seeds inseparable	None	None	None
Wild oats	None	None	1 plant/10A

Also available at www.seeds.colostate.edu.

All Certified wheat seed is laboratory tested. A two-pound seed sample is analyzed for germination and purity. Seeds are germinated in wet paper towels and the germination percentage must be listed on the tag. If a single prohibited noxious weed seed, jointed goatgrass seed, or feral rye seed is found, the seedlot is rejected and cannot be sold as seed.

All recent new wheat varieties are protected by the Plant Variety Protection Act (1994 PVPA) or by plant patent laws. Seed of PVPA protected varieties cannot be sold unless it goes through the certification process. Farmers can save seed to plant on their own farms but selling the seed, even to a neighbor, constitutes a violation of the PVPA and State Seed Law. Protection lasts 20 years on most varieties under the 1994 PVPA. *Clearfield** varieties, such as Above or Bond CL, are protected under PVP but also are subject to additional protection due to a patent that BASF Corporation holds on the gene conferring tolerance to Beyond herbicide. These varieties cannot be saved by farmers to plant on their own farm and violators are subject to severe fines.

Biosolids: A Valuable Fertilizer

Ken Barbarick, CSU Soil Scientist

After meeting stringent trace metal and pathogen regulations, biosolids from sewage-treatment facilities such as the Littleton/Englewood Wastewater Treatment Plant can serve as excellent organic sources of nitrogen and zinc. The organic nitrogen in the biosolids performs like a slow release fertilizer.

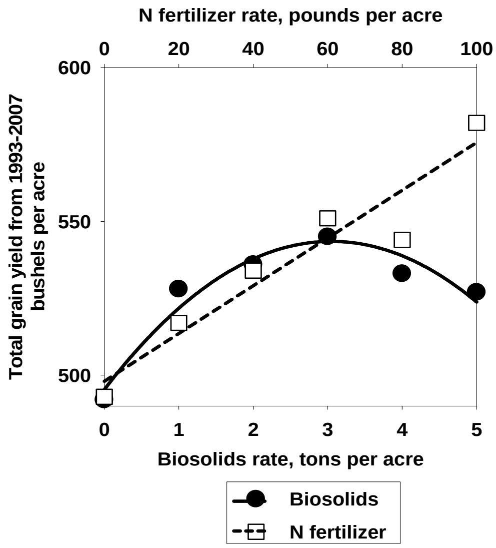
Two trials were established on the John Sauter farm, (Adams County) in a wheat-fallow rotation, one in the fall of 1993 and one in the fall of 1994. Nitrogen fertilizer applications (0, 20, 40, 60, 80, and 100 lb/N per acre) and biosolids applications (0, 1, 2, 3, 4, and 5 T/ac) were applied to each trial when the field was planted to wheat. The soil is Weld loam. Total wheat yields for each treatment (Figure 1) show that three dry tons biosolids per acre, applied every other year, from the Littleton/Englewood Wastewater Treatment Plant were comparable to 60 pounds of nitrogen fertilizer per acre, applied every other year, from 1993 through 2007. Identical N fertilizer and biosolids applications were made in 1994, 1996, 1998, 2000, 2002, 2004, and 2006; therefore, the cumulative amount is 7 times that shown.

We recommend about 2 dry tons biosolids per acre. Over the 15 years of our study, 1 dry ton of biosolids applied every other year to the wheat crop was found to be equivalent to 16 to 18 pounds of commercial nitrogen fertilizer applied every other year to wheat.

Biosolids and nitrogen fertilizer led to comparable levels of grain protein as shown for 2007 in Table 1. Many eastern Colorado soils are zinc deficient. Biosolids additions produced higher wheat-grain zinc concentrations (Table 1) indicating the biosolids are also a good zinc fertilizer. Also, soil samples from 2006 showed that seven applications 5 dry tons biosolids per acre treatment had increased the soil organic matter content in the top 8 inches from 1.1 to 1.4%.

Application of biosolids at agronomic rates (about 2 dry tons per acre) should provide an excellent source of nitrogen and zinc. After a land-application permit is issued by the Colorado Department of Public Health and Environment, arrangements can be made with municipalities to have biosolids applied to agricultural land and sometimes at no cost. Probably the greatest benefit of using biosolids is that the applied nitrogen and zinc will cost much less than comparable commercial fertilizers.

Figure 1: Cumulative yields from 1993 through 2007.



Effects of N fertilizer and biosolids rates on protein and zinc concentrations of dryland winter wheat grain at North Bennett, 2006-07.

N fertilizer pounds N per acre†	Protein %	Grain zinc ppm	Biosolids tons per acre†	Protein %	Grain zinc ppm
0	11.6	14	0	13.8	13
20	12.9	12	1	16.3	15
40	15.0	14	2	15.4	17
60	14.5	14	3	17.3	18
80	17.6	19	4	16.9	19
100	16.6	18	5	15.9	19

Rocky Mountain National Park: Connection to Fertilizer Management Decisions

Jessica Davis, Extension Soil Specialist

What does Rocky Mountain National Park (RMNP) have to do with fertilizer choices? Knowing just two facts illuminates the link between these two realms: 1) ammonia-nitrogen can travel more than 1000 miles from its source, and 2) N deposition in the park has been climbing steadily. Atmospheric N deposition ranges from 2 to 6 lb acre^{-1} yr^{-1} in the Rocky Mountains of Colorado and Wyoming and is estimated to be increasing by about 0.3 lb N acre^{-1} yr^{-1}. This may seem miniscule from an agricultural point of view, but due to the fragility of alpine ecosystems, small increases can have a big impact. The alpine areas are particularly sensitive to small increases in N deposition due to extensive areas of exposed bedrock, steep slopes, limited extent of soils and vegetation; short growing seasons, and rapid hydrologic flushing during snowmelt.

Increased N levels in RMNP can lead to measurable changes in ecosystem properties. Surface water NO_3-N levels have been increasing, especially in lakes with surrounding unvegetated terrain (rocky and talus slopes). Pine trees have demonstrated greater N:P ratios in their needles with increasing elevation, and trees on the east side of the Continental Divide have higher foliar % N, along with higher N mineralization potential. In general, there is more N in the soils, plants, and lakes on the east side of the park, and these changes can impact forest and grassland productivity; algae growth, acidification, and oxygen levels of freshwaters; and biodiversity.

In response to a high level of concern among citizens living near RMNP and the National Park Service, the Colorado Department of Public Health and Environment completed an inventory to identify the primary sources of ammonia in the state of Colorado; they found that fertilizer use contributes 20% of statewide ammonia emissions. The Colorado Air Quality Control Commission recently approved a Nitrogen Deposition Reduction Plan for the Park built on the voluntary use of Best Management Practices (BMPs) to reduce ammonia emissions from agriculture. In 5 years, an evaluation will be made to decide whether a voluntary approach to N deposition reduction is working.

With these developments in mind, it is important that farmers adopt BMPs to reduce ammonia volatilization from fertilizer immediately. Volatilization reduces fertilizer use efficiency and increases costs, so there are strong incentives in place to conserve ammonia in the soil for crop uptake. So what can farmers do? Some possible BMPs include:

- Soil sampling to determine N application rate and avoid over-fertilization
- Sub-surface banding or incorporation
- Using liquid urea solution instead of granular application
- Choosing controlled-release fertilizers to match N release with crop needs
- Consider applying urease inhibitors with urea
- Using BMPs will improve fertilizer efficiency, reduce costs, and decrease both the ecological impacts of N deposition in the Rockies and the political pressure associated with the park.

New Wheat Rust Looms – A serious threat to worldwide wheat production

Don Comis, USDA-ARS staff writer, provided the information for this article

Ug99 - it even sounds bad. That’s the name of a new race of wheat stem rust that USDA Agricultural Research Service scientists say is on the march worldwide. Discovered first in Uganda in 1999, Ug99 has spread across much of the wheat-growing areas of East Africa. It recently jumped the Red Sea, from East Africa to Yemen on the Arabian Peninsula, and was most recently been identified in Iran. Now it is perfectly positioned to move on to the wheat producing countries of Pakistan, India, and China.

U.S. plant scientists say that it’s only a matter of time before the spores will reach North America.

Ug99 poses a threat to wheat and barley not seen since the 1950s, when strains of stem rust reached epidemic proportions and destroyed 40% of the spring wheat crop in North America. Scientists are so worried about Ug99 that they say it is a pathogen that could stop Norman Borlaug’s Green Revolution in its tracks, leaving much of the world drastically short of food.

The Global Rust Initiative was formed in 2005 to fight the spread of Ug99. Recently, the Bill and Melinda Gates Foundation funded a large program through Cornell University to spearhead efforts aimed at combating Ug99. The U.S. has been involved from the start. Now Australia, Canada, India, Egypt, Ethiopia, Iran, Kenya, South Africa, Sudan, Turkey, Uganda and Yemen are joining the group.

So far, the Global Rust Initiative has focused on training plant pathologists around the world to monitor for rust, identifying new rust races and testing breeding lines from all parts of the world in Kenya to see if any are resistant to the new race. In the U.S., plant breeders hope that data from the Kenyan field-screening nursery will give them a head start on developing new resistant varieties.

Southern strategy

ARS and state wheat and barley breeders are pursuing a "Southern strategy" in the U.S. to keep Ug99 at bay, says Kay Simmons, ARS national program leader for plant genetics and grain crops. While they hope to develop resistant varieties for all of the U.S., they are focusing on varieties for Southern states - Texas, Louisiana and Georgia in particular - where stem rust will likely show up first and where it would be able to survive over a winter. High levels of Ug99 resistance deployed in the South may prevent Ug99 from taking hold and spreading to the rest of the country. As they did with soybean rust, U.S. plant pathologists also are setting up an early-warning system. They are planting susceptible and resistant wheat varieties at multiple locations around the country to monitor for the presence of Ug99 and other new rust strains.

Moving target

Not only is Ug99 tough (it has overcome nearly all known resistance genes), but it's able to change quickly, too. Yue Jin, a plant pathologist at the ARS Cereal Disease Laboratory in St. Paul, Minn., recently confirmed that several new variants of Ug99 have been identified in Kenya and other nearby countries. The new forms are even more virulent than Ug99, he says, as it has now defeated a gene known as "Sr24", a gene common to many US winter and spring wheats.

"We have to closely monitor for new forms of stem rust to make sure they cannot overcome the resistance genes we plan to introduce into wheat varieties," Jin says.

NEW RUST: Stem rust infects wheat. A new race out of Uganda is spreading and is said to pose a threat worldwide.

CSU Wheat Breeding – Approach and Strategy for Ug99 Preparedness

By Scott Haley, CSU Wheat Breeding

Without question, the appearance and spread of Ug99 is a significant concern for global wheat production and food security. Stem rust has a long and sordid history in the U.S. and other areas of the world of causing severe wheat yield reductions. While we have relied for many years on genetic resistance, coupled with focused barberry eradication (where the sexual stage of stem rust occurs to generate variability), the appearance of Ug99 has definitely changed the playing field for stem rust resistance breeding. At CSU, we have been quite active in making sure that we are ready in the event that Ug99 enters the U.S. and spreads to Colorado.

Through an effort coordinated by the USDA Agricultural Research Service (ARS), experimental lines and varieties from our program and other breeding programs have been evaluated in Kenya where Ug99 has become established. These data have shown that the vast majority of U.S. wheat germplasm is susceptible to Ug99 and the virulent races that have since evolved from Ug99. On the positive side, we have learned that our new variety 'Ripper' carries a gene from the old Oklahoma variety 'Triumph' that is effective against Ug99 and its new variants. We are currently working to identify molecular DNA markers linked with this gene (designated as "*SrTmp*") so that we can efficiently transfer this to other breeding materials in our program.

Testing by the USDA-ARS stem rust program at the Cereal Disease Laboratory in Minnesota has recently revealed that one of our most advanced lines, CO03W239 (a hard white *Clearfield** line), carries another gene that is quite effective against Ug99 and its variants. Interestingly, this gene (designated as "*Sr2*") is found not only in CO03W239 but also in several other advanced breeding lines in our program. Using molecular markers previously identified for *Sr2*, we are currently transferring this gene to other breeding materials in our program.

In addition to the *SrTmp* and *Sr2* genes, we are also working to transfer other resistance genes to our breeding materials. Using molecular markers, we have transferred a gene designated as "*Sr25*" to an 'Ankor' background. While we wouldn't expect that these materials would be yield-competitive with some of our other wheats (i.e., Hatcher, Ripper, Bill Brown), they will be useful in efforts to combine the *SrTmp*, *Sr2*, and *Sr25* genes into a common background to hopefully provide more durable resistance to Ug99 and its variants. We have also made crosses with several other resistance sources (provided by the USDA-ARS program in Manhattan KS) and are working with the USDA-ARS to identify and utilize molecular markers associated with these genes.

There are of course significant "wild cards" for us in the era of Ug99 resistance breeding. First, we do not know where or when Ug99 will arrive in the U.S. and then how fast it will spread to reach Colorado. Second, we don't know whether Ug99 itself or one or more of its virulent variants will arrive in the U.S. or Colorado. The recent spread of Ug99 to Iran is of particular concern because of the prevalence of barberry in that country which will favor further evolution of Ug99 and its variants. Finally, we don't yet know whether our dry and hot climate in Colorado will favor significant development of disease once Ug99 or its variants reaches Colorado. We are hopeful, however, that despite these unknowns, we will be ready in the event that that this new threat arrives in Colorado.

Information on Wheat Pest Problems

By Ned Tisserat, CSU Wheat Pathologist

I wanted to inform you of a resource that may be helpful in pest management decisions this coming year. There is a website called the High Plains IPM Guide at http://highplainsipm.org/Crops/ . If you go to this site there will be a list of crops. Click on small grains and it will take you to information concerning wheat pests. This guide contains information on insects, diseases and abiotic problems but currently not weed management. We are in the process of adding that component.

When you enter the small grain site, you will see that the various wheat insects and diseases are listed. So if you know what the problem is, just click on the pest and you should get a brief description and in some cases images and management options. For example, if you want to review fungicides available for stripe rust go to that site.

If you are unsure of exactly what pest problem you are dealing with, you can also try our new Wheat Symptoms Diagnostic Key located at the top of the small grains page. Just click the wheat symptoms key to start the program. As you enter the key there will be four windows. It takes a bit of time to get used to the layout. The window on the upper left has a series of questions concerning pest symptoms, time of development, etc. You can review and choose selections in this window in any order. As you click boxes to choose your selections, only problems (located in the upper right window) that match those symptoms will be retained. Pests not matching your choices are discarded in the lower right window. So by making a series of choices in the upper left window you should eventually narrow the list of potential causes of the problem that appear in the right window. The key also has lots of hyperlinks to fact sheets on ID and control of pests and is loaded with images of the pests. So it is a very good resource to use. Try it out and give me some feedback on what you think.

As always, if you have a problem and cannot figure out what is going on, we can assist you. We have a Plant Diagnostic Lab on campus and can help in diagnosis of insect, weed, and disease problems. Information on sample submission can be found at http://plantclinic.agsci.colostate.edu/.

Control Your Weeds and Stop Water Theft

Dr. Philip Westra, Weed Scientist, CSU

Weeds are a pest management problem every year. Some producers have their weed problems under good control while other wheat farmers watch weeds rob their wheat yield year after year. Developing a good weed management plan for our dryland wheat-based cropping system (including corn, sunflower, millet, and fallow) can pay big financial dividends with current high crop prices. Learn to identify and understand weed problems. Encourage your neighbors to control their weeds as well. No one wants fence rows filled with tumble weeds or jointed goat grass in fields along the highway and in waterways.

A conservative estimate of weed caused wheat yield loss is 5-10% annually- or 2 to 5 bu of lost wheat yield. Knowing your weeds, routine weed scouting and weed control can provide some of the best economic yield returns in wheat production.

Weeds are very opportunistic. They have been genetically programmed by natural selection to compete with crop species, survive, and reproduce, especially when favorable moisture or fertility conditions exist. When conditions are favorable for good wheat growth (~ 40 bu/acre yields), weeds will also grow well and will rob significant wheat yield from wheat producers. When fall, winter, and spring moisture is abundant, such as for the 2006-2007 wheat crop, weeds can appear to come from nowhere in staggering numbers. In drought conditions many weed seeds will not germinate and weed pressure may be low. Flixweed, feral rye, downy brome, jointed goatgrass, kochia, and Russian thistle respond very quickly to favorable growing conditions. Sometimes an ounce of prevention is worth more than a pound of cure.

Early emerging weeds cause the most damage. Weeds which germinate and grow before wheat emerges cause the most yield loss. Planting high quality certified wheat seed is one way to give your wheat crop an advantage against weeds. Regularly scout and identify the weed problems in early spring and consider using some of the many herbicide tools available for weed control.

Winter annual grass weeds. Downy brome, jointed goatgrass, and feral rye can be controlled or suppressed when sprayed with Beyond herbicide on *Clearfield** wheat varieties, Above or Bond CL. In non-*Clearfield** wheat, downy brome can be controlled or suppressed with Olympus, Maverick, or the new, PowerFlex™ herbicide. Be sure to use the recommended adjuvant systems with these herbicides and keep the spray gallonage at the high end of the recommended range. Control of winter annual grasses, and other weeds common in wheat, can be improved by a combination of the wheat herbicide programs above and weed control in summer crops in crop rotations.

Winter annual broadleaf weeds; flixweed, tansy mustard, and blue mustard are well controlled with Beyond, Olympus, or Powerflex when sprayed in the spring. Some growers use a mixture of Beyond + MCPA to broaden the spectrum of broadleaf weed control. Many growers use a mixture of Ally + 2,4-D to control these and early germinating summer annual broadleaf weeds. New blends of different sulfonylurea herbicides are being sold to provide greater recrop flexibility and better control of certain weeds. Starane is a good mix partner when kochia is a major problem, and ALS resistant kochia (resistant to sulfonylurea herbicides) is a known problem. Some growers use the premix, WideMatch®

herbicide if wild sunflower or Canada thistle needs to be controlled. (http://www.dowagro.com/usag/prod/086.htm).

New winter wheat herbicides: PowerFlex™ herbicide (http://www.dowagro.com/usag/prod/001.htm) will be available for use on downy brome and winter annual mustards in fall 2009. Huskie™ herbicide (http://www.bayercropscienceus.com/products_and_seeds/herbicides/huskie.html) is a safe, new herbicide from Bayer Crop Sciences which should provide excellent control of many winter annual and summer annual broadleaf weeds and eliminate crop rotation restrictions.

Herbicide prices. As producers move to formulations with less or no volatile organic solvents, costs of some herbicides may increase as these environmental issues may cause companies to move to more expensive granular dry herbicide formulations.

Useful wheat weed control guides:
*Guide to Weed Management in Nebraska 2008 - Research results and recommendations on weed management in Nebraska crop production. This 204-page circular (publication #941) can be found at (http://www.ianrpubs.unl.edu/epublic/pages).

*Use of herbicide tolerant crops as a component of an integrated weed management program - http://www.ianrpubs.unl.edu/epublic/live/g1484/build/g1484.pdf

When using Nebraska publications be sure to check on Colorado regulations to make sure that the product is registered for use in Colorado through their chemical dealer, cooperative extension, or the Colorado Department of Agriculture, Plant Sciences Division (Dr. Laura Quakenbush, Laura.Quakenbush@AG.STATE.CO.US, 303-239-4147).

The U.S. and World Wheat Market: Explanations and Forecasts

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At the risk of using a cliché, the wheat market is facing a near-perfect storm. There are 5 things occurring in wheat markets that are causing prices to increase well-beyond record levels. The reversal of anyone of these factors will result in lower prices, but it is unlikely the wheat market will see prices below $4.00 per bushel for the next 2 or 3 years.

The first factor was the impacted production in 2007. Parts of Texas, Oklahoma, Kansas and the prairie provinces of Canada experienced a severe spring freeze, hot and dry springs, and then wet summers. As a result, yields were impacted and US production was modest. Wheat acreage was also impacted because of acres allocated to corn. In 2008, acres are returning to other crops and ethanol production is not nearly as profitable as it was two years ago, but the $100 per barrel oil price remains even in the face of a weak economy. Thus, the demand for corn in the production of ethanol for blending and alternative fuel will persist.

The second factor was production relative to consumption. Stocks of wheat available throughout the world are at record lows. World stocks-to-use are at approximately 18%. The inventory has never been this low since the US entered the world wheat market in the mid-1970s. This is an event which is difficult to forecast because it has not happened before. Economic price forecasting models are well outside of sample ranges. That said, the actual average US farm price for the 2007/08 crop year matches some predictions closely. The average US farm price for 2007/08 is forecast to be $6.65/bu and a simple forecasting model predicts $6.50. The difficult question is what will price be over some lengthier forecast horizon?

The third factor is the relatively weak US dollar. Caution is always warranted when examining data on the value of the US dollar: the value relative to what? A simple measure is a direct comparison to currencies of countries with which the US trades. Such a measure communicates that the value of the US dollar has never been so weak. More sophisticated measures consider the volume of trade within the US economy as well as other currencies. These measures suggest that the US dollar is comparable to the value in the late-1990s. The bottom line is that the US dollar has weakened significantly since the early 2000s. And this is at the same time that world stocks of wheat are relatively small. It is not a surprise that foreign buyers have purchased wheat aggressively. These buyers will continue to purchase if world stocks remain tight after the next harvest and if the US dollar remains weak.

The fourth factor is that "short" markets overreact initially – or "short crops have long tails." A portion of the normal buyers in a market usually panic when news of a small crop starts to emerge. This is observed in drought years but the short crop may be caused simply by the strength of demand relative to supply. The buyers that need the crop the most, or that are most concerned about high prices, buy aggressively in part on fears of higher prices later and drive prices up. The concern or the panic increases the price. However, once the short crop is rationed to those that want it most then the prices tend to moderate. This is the long tail. Prices spike up early and then drift lower. This is likely what was observed in all wheat markets during January and February 2007. It is likely that wheat prices will weaken into the 2008 harvest. Prices will remain high but weak relative to the January and February period. Now that this factor has revealed itself, it will play no further role in impacting market prices. That is unless the crop in the field faces new weather pressures that emerge through the spring and summer of 2008.

The fifth factor is speculative dollars. The world is awash in wealth looking for somewhere to invest. Managers of this wealth were cautious about investing ever-more in world stock markets or world property markets. These managers were also worried about the prospects of inflation and the low nominal returns on interest paying assets such as bonds. Because of these concerns, a significant portion of this wealth has been used to buy commodity investments including oil and other energies, metals, and agricultural products. Corn and wheat producers are the beneficiary of this speculation. How large is it? For wheat, it is approximately $1/bu. The simple forecasting model mentioned earlier suggests the market is very close to a price implied by US supply and demand. But this simple model is routinely incorrect by 30-40% – it has this large of a forecast error. The best forecasting models have 10-15% errors – this is $0.40-0.50/bu with $4.00/bu wheat. Those models now forecast $5.70/bu for 2007/08 so this implies the average US farm price is close to $1/bu higher than is warranted by the underlying US and world supply and demand conditions. These differences are likely speculative demand. If the speculation disappears – which is unlikely without major changes in fiscal policy – then the wheat market will return to $5.50-6.00/bu range.

This fifth point leads to the question of what do these forecasting models say will be the impact on US wheat prices given probable changes in US production and world production? Likewise, how large of an impact can strengthening US dollar have on wheat prices? It will take a 7% increase in world stocks-to-use and at least two years to bring world stocks back to the 25% level that suggest wheat prices below $4.00/bu. 5% increases in world stocks-to-use occur, as in 1997/98 and 2000/01, but not frequently and not back to back. The US crop is forecast to bring US stocks back to average levels of 22-23% stocks-to-use. If this occurs then US prices will fall but exports will be excellent and prices will remain above the $6.00/bu level. This forecast includes the $1 speculative premium. Also, an excellent US crop will do little to pressure price down. However, dry weather persists this spring in the southern wheat belt. Any short crop news will repeat a price spike of January and February and average prices will be above $7.00/bu. A strengthening US dollar would have little impact on exports and price by itself. The US dollar is an expensive currency even when it is cheap. Foreign buyers purchase from the US when they have to and buy more strongly if the US dollar is inexpensive. This is a simplification but not an exaggeration. So, depending on weather and harvests, Colorado and US wheat producers will be in position to reap excellent prices over the next two-to-three years.

2007 Russian Wheat Aphid Biotype Survey Results for Colorado

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The Russian wheat aphid (RWA) is a serious pest of wheat and barley in the western United States. One of the most common management practices for reducing yield damage to winter wheat by RWA feeding is the use of resistant cultivars. Many RWA biotypes occur worldwide but until 2003, only one North American biotype (RWA Biotype 1) was known. Unfortunately, during the spring of 2003, a new biotype was observed in SE Colorado, which severely damaged the resistance bred into CSU varieties and Stanton from Kansas. Symptoms of RWA damage on the resistant cultivars included leaf rolling, white streaking and plant stunting. Experiments confirmed the presence of a new biotype virulent to the *Dn*4 gene, which is the gene that provides resistance to the original RWA biotype. The RWA biotype discovered in 2003 and virulent to our commercially available winter wheat cultivars has been designated as RWA Biotype 2. RWA surveys have been done over multiple years to determine the extent to which this biotype has spread throughout Colorado.

Russian wheat aphid samples were collected from 51 Colorado wheat fields in 2007. Three cultivars, referred to as differentials, were used to screen the samples: Yuma (susceptible to RWA Biotypes 1 and 2), Yumar (RWA Biotype 1 resistant version of Yuma, carrying the *Dn*4 gene), 2414-11 (STARS 02RWA2414-11, resistant to RWA Biotypes 1 and 2, carries the Dn7 resistance gene. This line is not yet commercially available). Symptoms caused by RWA feeding on these three differentials were used to determine the biotype. Russian wheat aphids were collected at sampling locations across the state based on the amount of winter wheat harvested in each county. Aphids from the sampled locations were placed on each of the differential plants. Russian wheat aphid damage symptoms were evaluated when the Yuma cultivar (the cultivar susceptible to all known North American biotypes) exhibited strong symptoms (e.g., leaf rolling, chlorosis or death). RWA Biotype 1 was defined by damage only to Yuma, and RWA Biotype 2 was defined by damage to both Yuma and Yumar. Potential new biotypes were determined based on damage to 2414-11.

Extensive snow cover across much of Colorado during the 2006-2007 winter appears to have resulted in a late and reduced population of RWA. Collection of samples frequently took intensive field scouting, and heavily infested fields were rarely encountered. As a result, only 50 samples were obtained in comparison to the more than 100 samples collected in each of the past surveys. Of the sampled locations in 2007, 4% tested as RWA Biotype 1 (2 of the sampled sites), and 96% of the locations tested as RWA Biotype 2.

Survey results indicate that RWA Biotype 2 continues to displace RWA Biotype 1. RWA Biotype 1 results were reduced from 18% of the 2005 survey sample results, to 7% of the 2006 sample results, and finally to 4% of the 2007 results. However, it is important to remember that collected samples may have populations of mixed biotypes and if Biotype 2 were present in the sample, then the sample will appear to be RWA Biotype 2. Therefore, a RWA Biotype 2 result from differentials is equivalent to stating that RWA Biotype 2 was collected at the location, but that we cannot rule out that RWA Biotype 1 also exists at that location.

Irrigated Winter Wheat Variety Performance Trial at Fruita, Colorado 2007

Calvin H. Pearson, Scott Haley

Introduction

Commercial production acreage of irrigated winter wheat in western Colorado has varied over the years. After years of limited production, producers in the area have again become interested in growing winter wheat. Furthermore, it has been several years since we have conducted a winter wheat variety performance trial in the Grand Valley (Pearson et al., 2000).

Various factors influence producers in deciding what crops to plant on their farm. The recent increases in the price of wheat have been an encouragement to growers to plant winter wheat. Other factors that may encourage producers to plant wheat are: 1) winter wheat often work wells into crop rotations in western Colorado, 2) growing winter wheat may spread out growing season workloads, and 3) growing winter wheat may free up irrigation water supplies that may be needed for other crops such as alfalfa and corn. Production technology is continually changing and this creates a need to evaluate winter wheat varieties, particularly those that have been recently developed in the intervening years and compare them to winter wheat varieties that were popular in past years.

Variety yield performance data can be used by various people- farmers when selecting varieties to plant on their farms, seedsmen in knowing which varieties to grow, companies to determine which varieties to market and in which locations varieties are best adapted and are best in end use applications, and university personnel in developing new wheat production technology and in educating people about the varieties researchers have tested.

During 2007 we evaluated 18 winter wheat varieties comparing those that have been recently developed to those that have been traditionally grown in Western Colorado.

Materials and Methods

Eighteen winter wheat varieties were evaluated at the Western Colorado Research Center at Fruita during 2007. The trial location was at N 38° 10.826’, W 108° 42.046’; and elevation 4583 feet. The experiment was a randomized, completed block with four replications. Prior to winter wheat, the field was a hybrid poplar plantation for six years.

Planting occurred on 3 Nov 2006 at 120 lbs seed/acre. Urea at 75 lbs N/acre was topdressed on 3 March 2007. Harmony Extra at 0.6 oz/A plus 10 oz/A of 2,4-D amine was applied by ground in 22 gal water/acre at 22 psi on 3 April 2007.

The experiment was furrow-irrigated using gated pipe. Winter wheat plots were harvested on 25 July 2007. Grain moistures and test weights were determined using a Dickey-John GAC 1200B seed analyzer. Protein concentration was determined by whole grain near infrared reflectance spectroscopy with a Foss NIRSystems 6500 (12% moisture basis).

Results and Discussion

Weed control was excellent during the growing season. Adequate irrigation water was available during the growing season and was not a limiting factor for crop production. Seven irrigations were applied to the winter wheat beginning with pre-plant irrigation in fall 2006 and ended with the last irrigation during mid-June 2007.

Grain moisture in the winter wheat variety performance trial at Fruita averaged 10.7% (Table 1). Grain moisture content ranged from a high of 11.3% for Darwin to a low of 9.9% for Juniper.

Grain yields of the winter wheat varieties averaged 122.7 bu/acre. Grain yields ranged from a high of 142.1 bu/acre for Bond CL to a low of 97.2 bu/acre for Hayden. Test weights averaged 60.1 lbs/bu. Test weights ranged from a high of 62.9 lbs/bu for Danby to a low of 57.6 lbs/bu for Lambert and Stephens.

Days to flowering averaged 136 days from 1 January 2007. Seven varieties began flowering at approximately 133 days while Simon and UI 99-22407 required 141 days to reach flowering.

Plant height averaged 39.3 inches. Plant height ranged from a high of 53.2 inches for Juniper to a low of 29.8 inches for Tubbs 06.

Some lodging occurred in the trial. The variety with the most lodging was Hayden (4.0). Despite Juniper being the tallest variety it did not lodge as much as Hayden. There was a small amount of lodging (less than 1.5) for other varieties.

Protein concentration averaged 9.4% and ranged from a high of 10.9% for Juniper to a low of 8.9% for Golden Spike. Five varieties (Darwin, Gary, Juniper, Akron, and Stephens) had protein concentrations at 10% or higher.

Agronomic characteristics of winter wheat varieties evaluated at Fruita, Colorado during 2007.

Variety	Market class	Grain moisture	Grain yield[2]		Test weight	Days to flower	Plant height	Lodging	Protein
		(%)	lbs/acre	bu/acre	lbs/bu	no.	in.	0.2-9.0	(%)
Bond CL	HRW	10.5	8526	142.1	62.0	133	38.9	1.3	9.8
Tubbs 06	SWW	10.6	8395	139.9	58.1	140	29.8	0.2	9.1
UI 99-22407	SWW	11.1	8297	138.3	58.5	141	39.2	0.2	9.6
Bill Brown	HRW	11.1	8255	137.6	61.2	133	33.9	0.9	9.6
Gary	HWW	10.6	7688	128.2	59.5	136	44.4	1.3	10.0
Simon	SWW	10.3	7600	126.7	58.9	141	38.1	0.2	9.8
Danby	HWW	11.1	7426	123.8	62.9	133	36.8	1.1	9.2
Golden Spike	HWW	10.2	7364	122.8	60.4	140	42.7	0.6	8.9
Fairview	HRW	10.0	7313	121.9	60.8	136	42.0	1.1	9.6
Hatcher	HRW	11.0	7292	121.5	60.8	133	37.1	0.5	9.6
Stephens	SWW	10.4	7269	121.1	57.6	137	36.1	0.4	10.1
Brundage	SWW	10.7	7197	120.0	60.2	133	33.2	0.2	5.0
Akron	HRW	10.8	7187	119.8	61.2	133	38.2	1.3	10.5
Darwin	HWW	11.3	7173	119.5	61.5	139	42.8	0.6	10.5
Alice	HWW	10.9	6969	116.1	60.0	133	33.1	0.2	9.9
Lambert	SWW	11.0	6560	109.3	57.6	137	38.5	0.2	9.1
Juniper	HRW	9.9	6162	102.7	59.7	139	53.2	1.4	10.9
Hayden	HRW	11.0	5833	97.2	60.4	139	48.5	4.0	9.1
Ave		10.7	7361	122.7	60.1	136	39.3	0.9	9.4
LSD (0.05)		0.4	1278	21.3	0.9	0.5	6.4	1.4	
CV (%)		2.8	12.2	12.2	1.1	0.3	11.6		

[1] HRW = hard red winter wheat; HWW = hard white winter wheat; SWW = soft white winter, CL = Clearfield* wheat

[2] Table is arranged by decreasing grain yield.

dwd

Small Grain Variety Performance Test at Hayden, Colorado 2007

Calvin H. Pearson, Scott Haley, and Jerry Johnson

Introduction

Each year small grain variety performance tests are conducted at Hayden, Colorado to identify varieties that are adapted for commercial production in northwest Colorado. Nineteen winter wheat varieties and breeding lines were evaluated during the 2007 growing season at the Mike Williams Farm near Hayden. Grain yields and protein content were calculated at 12% moisture content. The 2006-2007 growing season in the Craig/Hayden area was favorable for winter wheat production. The average maximum temperature for July 2007 at Hayden, Colorado was 89.9 degrees F. Precipitation at Hayden during the 2006-07 winter/spring growing season (September 2006 through July 2007, 11-month period) totaled 16.83 inches. Winter moisture in the Hayden area was good. During September 2006 through February 2007 a total of 11.2 inches of precipitation was received, and from March through July 2007 a total of 5.6 inches of precipitation was received at Hayden. There was no lodging in the winter wheat variety performance test in 2007.

Winter wheat variety performance test at Hayden, Colorado 2007.

Variety	Market class[1]	Grain moisture	Grain yield		Test weight	Plant height	Protein
		(%)	bu/acre	lbs/acre	lbs/bu	in.	(%)
TAM 111	HRW	9.5	59.6	3573	60.4	29.1	9.2
Ripper	HRW	9.1	59.0	3538	59.8	25.9	8.3
Ankor	HRW	9.3	58.6	3515	59.9	29.2	9.3
Hatcher	HRW	8.8	57.6	3458	59.3	26.1	8.7
IDO641	HWW	9.1	57.6	3456	59.2	27.6	9.3
Gary	HWW	9.0	57.0	3418	57.5	29.5	9.5
Avalanche	HWW	9.2	55.7	3340	61.3	27.5	9.5
Darwin	HWW	9.4	55.2	3312	61.4	31.1	10.5
Bond CL	HRW (CL)	9.2	55.2	3311	59.3	29.6	8.8
Above	HRW (CL)	9.0	52.0	3119	59.8	26.8	9.2
Juniper	HRW	8.6	51.9	3117	60.8	37.2	9.8
NuDakota	HWW	9.1	52.0	3116	58.6	25.4	9.7
UT9325-55	HRW	8.9	51.6	3100	58.7	30.7	10.4
Deloris	HWW	9.1	50.5	3033	59.3	30.8	9.7
Golden Spike	HWW	8.7	50.4	3024	57.9	30.1	9.2
UT9508-88	HRW	9.3	49.8	2990	59.6	29.4	9.8
Jagalene	HRW	9.1	48.7	2923	60.9	26.8	9.2
Danby	HWW	9.6	46.5	2790	62.9	26.3	9.7
Hayden	HRW	9.2	44.4	2662	60.8	32.0	10.8
Ave.		9.1	53.3	3200	59.9	29.0	9.5
LSD (0.05)		0.3	9.0	540	0.8	1.6	
CV (%)		2.1	11.9	11.9	0.9	4.0	

[1] HRW = hard red winter wheat; HWW = hard white winter wheat; CL = Clearfield* wheat.

Crops Testing

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