Cooperative Extension
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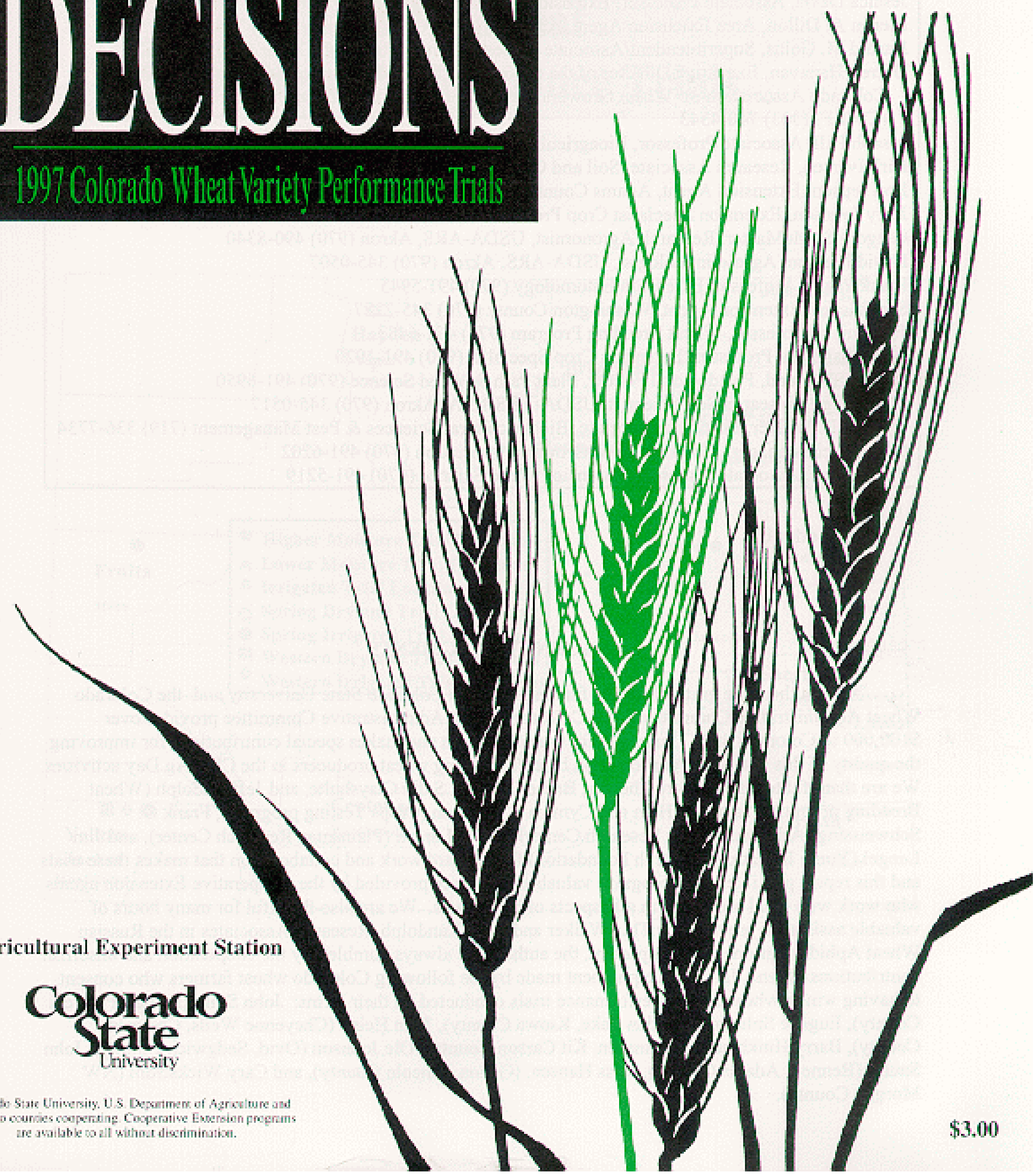
MAKING BETTER DECISIONS

1997 Colorado Wheat Variety Performance Trials



Agricultural Experiment Station

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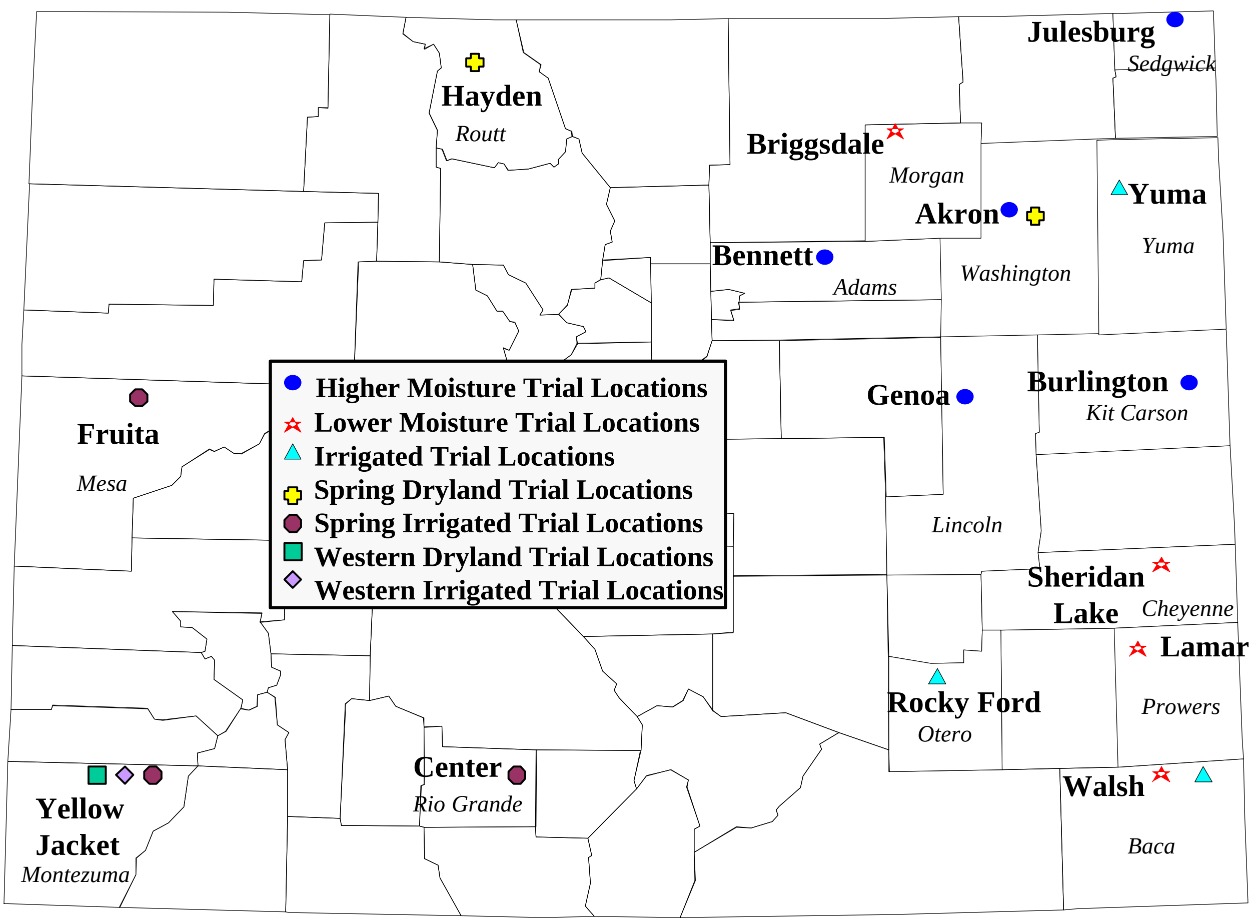
1997 Wheat
Variety Performance Trials



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1997 COLORADO WINTER WHEAT VARIETY PERFORMANCE TRIALS

Introduction

Making Better Decisions is a publication of Colorado State University. CSU and its collaborators, are committed to providing the best information, in an appealing form, and in the most timely manner to Colorado wheat producers. Better use of performance trial results by Colorado wheat producers can lead to better variety selection and earlier adoption of higher yielding varieties. An estimated 3.1 million acres of winter wheat were planted in Colorado in the fall of 1997. The value of the 1997/98 crop should exceed $300 million. Experience indicates that increases in yields of 10 to 20% can result from wise selection of varieties. Consequently, the winter wheat variety decision in Colorado is worth $30 to $60 million annually!

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

1) Variety trial results are reported via e-mail to county Cooperative Extension offices
2) Variety trial results are put up on DTN (Data Transmission Network)
3) Variety trial results are available on the Soil and Crop Sciences Extension Internet page (http:/**/www.colostate.edu/Depts/SoilCrop/extens.html**)
4) Variety trial results are faxed, or e-mailed, to anyone requesting trial results.
5) Results are published in CWAC's *Wheat Grower*
6) Results are published in *The Colorado Farmer Stockman*
7) Results are published in *From the Ground Up*, a Soil and Crop Science Extension publication.

Trial Conditions and Methods - 1996/97

Moist planting conditions in the fall of 1996 led to good plant stands. Fall and spring drought with little snowfall and relatively mild winter temperatures characterized much of eastern Colorado. For the second year in a row, serious mite infestations (brown mite, Banks grass mite, and wheat curl mite) were observed in central eastern and south eastern Colorado in the fall and spring. Wheat streak mosaic, vectored by the wheat curl mite, was widespread in the same areas where mites were a problem. Warm, and dry conditions also favored the wide spread infestation of Russian wheat aphids in the early spring, the worst since 1989. Late spring rain provided relief from nearly eight months of drought and saved the 1997 crop for most of eastern Colorado.

Colorado winter wheat variety trials are conducted by soil moisture group, with different varieties in each group except for some varieties that are common to all three groups. In 1997, **lower moisture** variety trials were harvested at Briggsdale, Sheridan Lake, Lamar, and Walsh. Above average yields were obtained by comparison to previous years. Test weights at Lamar and Sheridan Lake were low, averaging 50 lb/bu, while test weights at Walsh and Briggsdale averaged 57 lb/bu. Successful **higher moisture** trials were conducted at Akron, Bennett, Burlington, Genoa, and Ovid. The Burlington trial was severely affected by drought, infested with wheat streak mosaic virus, and attacked by Russian wheat aphids. Low yields at Burlington made higher moisture average yields below average and even below the average yields observed in the lower moisture group. We had two excellent **irrigated** wheat variety trials at Yuma and Rocky Ford with average yields of 92 bu/ac, including several plot yields in excess of 120 bu/ac at Yuma.

A randomized complete block field design with four replicates was used in all trials. Four 12 inch-spaced rows, 44 feet long, were harvested from each plot. All varieties were seeded at 600,000 seeds/acre. Grain yields were adjusted to 12% moisture. The least significant difference (LSD) value, alpha=0.30, is reported for yields. Carmer[1] (1976) found that producers' risk of economic loss was minimized by using LSD alpha values of 0.20 to 0.40 when selecting hybrids based on crop performance trials.

Trials include public, private, and experimental varieties. Testing **Colorado numbered lines** is very important for identification of varieties with wide adaptability to our highly variable growing conditions. Each year, more than a million new genetic combinations are created by the wheat breeding team in Fort Collins. After heavy screening, the most promising of these lines are

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

tested in the Colorado variety trials throughout eastern Colorado. In 1997, 24 numbered lines were in their first year of testing, eight lines were in their second year, and two lines were in their third year of testing. The following summary tables do not include performance results of Colorado experimental lines except for the -R# lines. The -R#'s are experimental lines derived by backcrossing resistance to Russian wheat aphid into the named variety. The Colorado experimental lines performed very well by comparison to the named varieties and hold much promise for even higher yielding varieties in the future.

Table 1. 1997 Variety Performance Trial Information.

Locations	Entries #	Date of Planting 1996	Date of Harvest 1997	Soil Texture	Previous Crop	Fertilization (lb/A) Nitrogen, N	Phosphorus P_2O_5	Type of Irrigation
Higher Moisture								
Akron	44	Oct 3	July 14	Silt Loam	Fallow	120	40	None
Bennett	44	Sept 16	July 8	Sandy Clay	Fallow	30	0	None
Burlington	44	Sept 9	July 7	Silt Loam	Fallow	120	40	None
Genoa	44	Sept 13	July 14	Sandy Clay	Fallow	55	20	None
Julesburg	44	Oct 2	July 16	Silt Loam	Fallow	120	40	None
Lower Moisture								
Briggsdale	40	Sept 16	July 11	Sandy Clay	Fallow	40	12-15	None
Lamar	40	Sept 12	June 30	Silt Loam	Fallow	35	0	None
Sheridan Lake	40	Sept 12	July 7	Silt Loam	Fallow	40	27	None
Walsh	40	Sept 17	July 1	Sandy Clay Loam	Fallow	100	40	None
Irrigated								
Rocky Ford	26	Sept 25	July 2	Silty Clay Loam	Fallow	0	50	Furrow
Yuma	26	Sept 23	July 15	Sandy Loam		150	50	Sprinkler

Descriptions of Winter Wheat Varieties in Trials:

2137 A 1995 Kansas release of Pioneer material. Semidwarf, early, high test weight and yield.

Akron A 1994 Colorado release from the cross TAM 107/Hail. Semidwarf with lax heads.

Alliance Developed by Nebraska and USDA-ARS. Similar to Redland in test weight and protein. Above normal tolerance to crown rot and root rot.

Arapahoe A 1988 Nebraska release. Similar to Brule, but with higher test weight and one day earlier maturity.

Arlin A 1992 Kansas released to the American White Wheat Producers Association. Hard white and semidwarf with marginal winter hardiness. Milling and dough mixing properties similar to Newton and very sprout susceptible.

Baca A 1973 Colorado release selected from Scout. Similar to Scout but has a yield advantage in drought stress conditions.

Buckskin An older, tall Nebraska variety with adaptation to the north central area of Colorado.

Coronado A 1994 Agripro release; semidwarf, early, acid soil tolerance.

Custer A 1994 Oklahoma State release. Medium early and moderately resistant to leaf rust. Excellent yield potential, but questionable quality.

G1594(EXP) An experimental hard white from Cargill/Goertzen.

G1720(EXP) An experimental hard white from Cargill/Goertzen.

G1878 An experimental hard red from Cargill/Goertzen.

G12017(EXP) An experimental hard white from Cargill/Goertzen.

Halt A 1994 Colorado release resistant to the Russian wheat aphid from the crosses Sumner/CO820026, F1//PI372129, F1/3/TAM 107.

Jagger A 1994 release selected from a cross of a sister-line of Karl by Stephens, a high yielding soft white wheat. Bronze chaffed semidwarf with good straw strength. Lower test weights and protein than Karl. Tends to green up early in spring and has marginal winter hardiness.

Karl 92 A 1992 Kansas semidwarf release. Reselection from 'Karl', similar in most traits, but improved leaf rust resistance, earlier maturity, and higher yielding than Karl.

Lamar A 1988 Colorado release derived from a cross of Vona with an experimental line to improve test weight. Drought resistant.

Lamar-R31 A Russian wheat aphid-resistant derivative of Lamar.

Laredo A 1992 Agripro release of intermediate height with strong straw, early maturity, and excellent leaf rust resistance.

Longhorn A 1991 Agripro release derived from NS2630-1/Thunderbird. An awnless wheat with vigorous spring growth.

Niobrara A 1994 Nebraska release. Tall, late variety.

Ogallala A 1993 Agripro release. Semidwarf.

Platte A 1994 Agripro release semidwarf hard white wheat.

Pronghorn A 1996 Nebraska release tested as NE88584. Tall, medium maturity, weak straw.

Prowers A Russian wheat aphid-resistant derivative of Lamar tested as Lamar-R32.

Q566 A 1994 hybrid wheat release from Hybritech, Inc.

QAP7501 New winter wheat hybrid from Agripro.

QAP7510 New winter wheat hybrid from Agripro.

QAP7601 New winter wheat hybrid from Agripro.

Rowdy A 1995 Agripro release tested as W91-091.

Sandy A 1980 Colorado release. Excellent stand establishment and tolerance to root rot.

Scout 66 A selection from Scout released by Nebraska in 1967. Resistant to shattering, but sometimes difficult to thresh.

Snow White A hard white from Cargill.

TAM 107 A 1984 Texas release with reddish brown chaff. Backcross-derived line from TAM 105. Similar to TAM 105, but resistant to stem rust, good winter hardiness, excellent heat tolerance, good emergence ability, good straw strength, and resistance to greenbug biotype C. Tolerant to some mite vectors, thus reducing Wheat Streak Mosaic Virus infection.

TAM 107-R3 A Russian wheat aphid-resistant derivative of TAM 107.

TAM 107-R7 A Russian wheat aphid-resistant derivative of TAM 107.

TAM 110 A 1996 Texas release tested as TXGH12588-105. Essentially TAM 107 with resistance to biotype E of greenbug.

Vista A 1992 Nebraska release. Heading time similar to Arapahoe.

Wichita A 1944 Kansas release (long-term check variety).

Windstar A 1997 Nebraska release. Tall semidwarf, medium to late maturity.

Yuma A 1991 Colorado release derived from the cross NS14/NS25/2*Vona.

Yuma-R18 A Russian wheat aphid-resistant derivative of Yuma.

Yumar A Russian wheat aphid-resistant derivative of Yuma tested as Yuma-R21.

Table 2. Winter Wheat High Moisture Performance Summary for 1997.

	Location**					Averages				
	Akron	Bennett	Burlington	Genoa	Julesburg	1997				3-Yr
Variety*	Yield	Yield	Yield	Yield	Yield	Yield	Test Wt	% Yield of TAM 107	4-Loc. Yield***	1995-97
	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	lb/bu		bu/ac	bu/ac
TAM 107-R3	43.9	52.3	38.0	53.8	45.5	46.7	56.3	108	48.9	-----
Q566	51.8	53.4	9.8	48.7	57.2	44.2	54.2	102	52.8	53.5 [1]
TAM 110	44.0	45.6	26.2	54.8	47.5	43.6	56.3	101	48.0	-----
TAM 107	43.9	52.8	23.8	50.4	44.9	43.2	55.6	100	48.0	50.3 [6]
TAM 107-R7	43.5	52.9	28.3	46.9	41.0	42.5	55.9	98	46.1	-----
Yumar	46.4	48.1	22.4	45.7	48.5	42.2	56.5	98	47.2	-----
Halt	47.5	51.1	30.8	36.9	41.7	41.6	56.9	96	44.3	48.8
Sandy	52.0	49.3	10.3	48.1	46.1	41.2	56.2	95	48.9	46.4
Akron	51.3	41.6	13.5	41.8	53.9	40.4	55.2	94	47.2	50.9 [4]
Alliance	47.8	52.1	14.4	38.3	46.5	39.8	56.9	92	46.2	51.0 [3]
Vista	46.2	45.7	12.6	48.4	46.0	39.8	55.1	92	46.6	50.0
Scout 66	41.7	48.7	12.1	46.1	46.6	39.0	56.8	90	45.8	42.8
Arlin	41.6	52.3	13.1	46.3	40.9	38.9	57.2	90	45.3	47.1
Prowers	42.4	41.6	12.3	45.4	48.0	37.9	56.2	88	44.3	-----
Yuma	46.8	44.1	10.6	35.9	49.9	37.4	55.8	87	44.2	50.3 [5]
Lamar	42.5	45.0	7.1	45.8	46.7	37.4	55.5	87	45.0	47.9
Agripro Longhorn	48.4	43.4	12.3	36.2	46.8	37.4	55.4	87	43.7	46.7
G12017 (EXP)	41.6	44.5	13.5	40.2	46.7	37.3	54.9	86	43.2	-----
Jagger	44.2	41.4	11.9	40.5	47.7	37.2	55.3	86	43.5	52.7 [2]
QAP7510	43.8	42.8	15.6	35.1	47.6	37.0	56.2	86	42.3	-----
Lamar-R31	42.2	41.5	14.6	40.8	45.5	36.9	56.3	85	42.5	-----
Arapahoe	43.5	38.5	8.6	39.3	40.1	34.0	53.9	79	40.3	46.1
Snow White	41.7	46.5	9.1	35.4	36.5	33.8	55.9	78	40.0	-----
YUMA-R18	38.5	41.2	14.2	32.3	40.1	33.3	54.5	77	38.0	-----
Agripro Ogallala	36.8	44.1	13.7	30.2	37.8	32.5	56.8	75	37.2	46.5
Agripro Laredo	38.3	42.2	7.2	31.6	42.7	32.4	56.2	75	38.7	44.0
G1594 (EXP)	39.9	38.2	5.4	30.1	42.3	31.2	54.6	72	37.6	-----
G1720 (EXP)	34.7	44.1	2.3	31.0	39.3	30.3	53.4	70	37.3	-----
G1878	35.5	33.4	4.5	33.3	42.6	29.9	55.8	69	36.2	-----
Wichita	34.9	28.3	18.3	29.3	37.6	29.7	56.8	69	32.6	36.9
Karl 92	35.2	34.9	9.1	28.1	38.2	29.1	56.0	67	34.1	41.9
Means, Yield	43.0	44.6	14.4	40.2	44.6	37.3		86	43.5	-----
CV%, Yield	13.5	15.6	24.0	9.1	8.1					
$LSD_{(.3)}$, Yield	4.3	5.3	2.6	2.8	2.7					
Test Weight Average	58.9	57.2	48.1	55.6	59.0		55.8			

*Varieties ranked by the average yield over five locations in 1997.

**Bennett and Genoa grain yields are adjusted to 12% moisture content.

***Average yield over locations without the Burlington location which was severely affected by drought, mites, wheat streak mosaic virus, and Russian wheat aphids.

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

Table 3. Winter Wheat Lower Moisture Performance Summary for 1997.

	Location**								Averages			
	Briggsdale		Lamar		Sheridan Lake		Walsh		1997			3-Yr
Variety*	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	% Yield of TAM 107	1995/96/97
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu		bu/ac
TAM 107-R3	60.0	56.0	39.6	52.2	64.0	50.9	52.6	57.7	54.0	54.2	112	-----
TAM 110	61.4	55.4	39.6	50.6	60.8	51.5	51.7	57.5	53.4	53.7	111	-----
Niobrara	59.7	56.2	34.6	50.5	58.6	50.2	48.1	56.1	50.2	53.2	104	-----
Alliance	55.8	57.9	34.4	52.3	58.0	52.8	50.6	56.9	49.7	55.0	103	49.7 [1]
Vista	56.1	56.9	34.8	50.9	57.9	50.4	46.4	56.2	48.8	53.6	101	48.0 [2]
Akron	58.5	57.3	31.7	49.8	55.0	50.5	49.0	56.3	48.6	53.5	101	47.8 [3]
Halt	55.5	57.2	35.5	52.1	50.5	49.9	52.2	58.4	48.4	54.4	101	46.1
Yumar	57.7	56.1	34.9	51.8	52.1	49.9	48.8	58.4	48.4	54.1	101	-----
TAM 107	60.2	55.5	32.2	50.6	58.9	50.5	41.4	56.7	48.1	53.3	100	44.4
TAM 107-R7	54.7	55.7	32.9	50.2	52.3	49.7	49.1	57.0	47.2	53.1	98	-----
Sandy	59.0	57.6	32.0	52.4	45.6	51.0	51.9	58.4	47.1	54.8	98	46.8 [5]
Buckskin	59.7	57.6	28.0	51.8	46.7	51.5	50.8	58.4	46.3	54.8	96	45.2
Lamar-R31	57.4	57.6	30.0	51.7	45.6	51.9	51.6	59.3	46.1	55.1	96	-----
Yuma-R18	57.2	56.7	28.2	49.8	44.0	47.8	54.6	56.7	46.0	52.8	96	-----
Yuma	60.3	57.6	29.4	49.5	50.4	48.5	43.5	56.7	45.9	53.1	95	47.6 [4]
Baca	54.4	58.8	27.9	52.2	48.4	54.3	50.7	58.8	45.4	56.0	94	43.3
Prowers	56.2	57.9	29.0	50.8	44.8	52.4	49.2	59.9	44.8	55.2	93	-----
Lamar	57.1	57.9	25.0	51.3	45.1	51.3	48.9	58.8	44.0	54.8	92	46.5 [6]
Pronghorn	52.0	58.2	29.9	53.1	52.1	52.1	39.9	57.3	43.5	55.2	90	-----
Windstar	55.6	56.3	22.7	51.2	47.6	48.4	46.4	55.2	43.1	52.8	90	-----
Jagger	53.2	57.4	28.0	48.8	49.7	48.4	34.7	56.1	41.4	52.7	86	43.6
Agripro Longhorn	48.2	55.6	26.8	50.1	45.3	49.7	44.2	57.5	41.1	53.2	85	-----
Arlin	56.5	57.4	26.0	51.4	40.4	51.3	38.7	57.3	40.4	54.4	84	40.8
Wichita	45.4	57.2	26.2	52.2	38.0	52.8	34.9	58.5	36.1	55.2	75	35.1
Means	56.3	57.0	30.8	51.1	50.5	50.7	47.1	57.5	46.2	54.1	96	-----
CV%	8.3		12.5		7.0		14.0					
LSD $_{(.3)}$	3.5		3.0		2.6		5.0					

*Varieties ranked by the average yield over four locations in 1997.

**Briggsdale, Lamar, and Sheridan Lake grain yields are adjusted to 12% moisture content.

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

Table 4. Winter Wheat Irrigated Performance Summary for 1997.

	Location**				Averages			
	Rocky Ford		Yuma		1997			3-Yr
Variety*	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	% Yield of TAM 107	1995/96/97
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu		bu/ac
QAP7601	90.6	55.9	110.0	56.0	100.3	55.9	108	-----
Custer	88.0	55.4	109.8	56.9	98.9	56.2	106	81.2 [1]
2137	94.9	56.4	102.2	54.3	98.6	55.4	106	-----
TAM 107-R3	96.5	54.4	100.4	54.0	98.5	54.2	106	-----
QAP7501	87.8	56.4	107.1	55.7	97.5	56.0	105	-----
QAP7510	87.4	56.2	106.3	55.7	96.9	56.0	104	-----
Agripro Laredo	78.4	55.9	112.5	56.1	95.5	56.0	102	75.8 [3]
Agripro Rowdy	90.0	58.4	98.1	55.3	94.0	56.8	101	74.2 [6]
TAM 107	86.6	54.6	99.9	53.7	93.2	54.1	100	76.8 [2]
Yuma-R18	92.7	54.3	92.6	53.7	92.7	54.0	99	-----
Yuma	92.5	54.8	88.0	53.9	90.3	54.3	97	75.8 [4]
Agripro Ogallala	79.3	58.3	100.0	56.9	89.7	57.6	96	75.3 [5]
Jagger	79.8	55.5	98.3	54.4	89.1	54.9	96	-----
TAM 107-R7	80.9	54.6	96.8	53.9	88.9	54.3	95	-----
TAM 110	87.5	55.5	89.6	53.3	88.5	54.4	95	-----
Yumar	92.2	55.2	83.6	54.6	87.9	54.9	94	-----
Agripro Coronado	77.4	53.7	91.0	54.6	84.2	54.1	90	-----
Akron	86.7	55.2	78.7	54.7	82.7	55.0	89	72.5
Karl 92	71.8	57.7	91.6	55.7	81.7	56.7	88	72.4
Halt	76.0	55.9	85.7	53.2	80.8	54.6	87	71.7
Means	85.8	55.7	97.1	54.8	91.5	55.3		
CV%	7.2		6.4					
$LSD_{(.3)}$	4.6		4.5					

*Varieties ranked by the average yield over two locations in 1997.
**Grain yields are adjusted to 12% moisture content.
[1......6] Variety rank based on 3-yr average yields.

Parentage of some Colorado wheat varieties

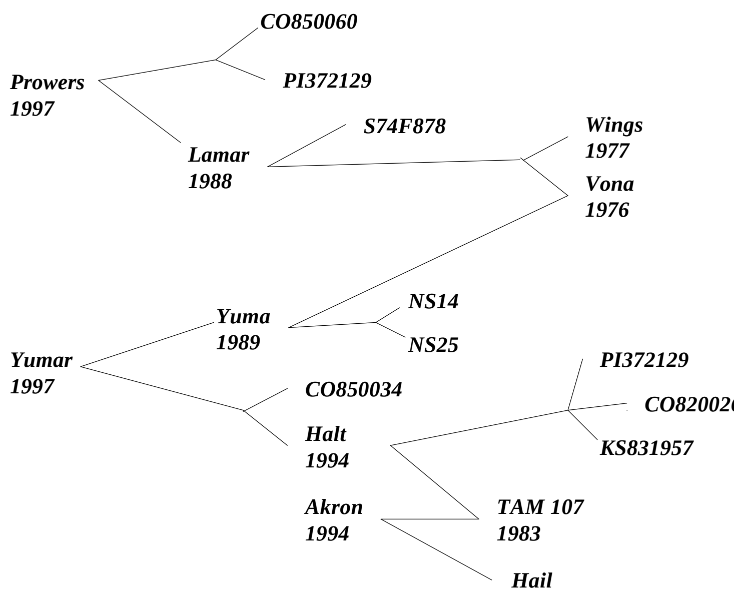


Table 5. Winter Wheat Variety Average Agronomic, Pest, and Quality Traits.

Variety	Percent of Acreage	Relative[1]					Resistance or Tolerance to[1]					Relative Quality[3]		
	1998[2]	Height (in)	Maturity	Straw Strgth	Winter Hardy	Coleop length (mm)	RWA	Leaf Rust	Stem Rust	Hess. Fly	Wheat Streak Mosaic	Milling	Mixing	Baking
Akron	11.9	32	3	2	3	80	9	1	3	5	3	2	3	2
Alliance	0.7	32	3	2	2	75	9	1	1	5	3	2	2	2
Arapahoe	2.1	39	4	4	2	75	9	1	1	5	8	2	2	2
Baca	1.9	47	2	6	3	120	9	5	5	-	7	2	0	3
Buckskin	1.0	47	4	5	3	120	9	-	5	-	-	-	-	-
Fairview	1.3	40	4	5	3	-	9	-	-	-	-	2	3	3
Halt	3.7	30	2	2	3	75	1	8	1	-	3	2	3	2
Hawk	1.2	29	3	4	3	75	9	7	5	8	6	2	0	3
Jagger	-	32	3	2	8	75	9	1	1	-	-	2	2	2
Lamar	9.4	41	4	4	2	110	9	7	2	8	6	2	3	2
Laredo	-	30	3	3	3	80	9	1	2	8	-	2	2	6
Longhorn	1.0	35	3	3	3	110	9	-	-	8	-	2	3	6
Ogallala	-	31	3	3	3	-	9	2	2	8	3	2	-	-
Prowers	-	41	4	4	2	110	1	7	2	8	6	2	3	2
QT 542	-	41	4	4	1	110	9	7	6	-	-	-	-	-
Rawhide	-	32	3	4	3	80	9	7	2	-	7	2	2	3
Sandy	-	43	5	5	2	120	9	3	-	8	-	2	0	4
Scout(s)	1.7	47	2	6	3	120	9	5	5	7	7	2	0	3
TAM 107	43.3	31	2	3	3	80	9	9	1	8	2	2	4	6
TAM 200	0.9	27	3	1	8	75	9	1	1	8	2	8	3	6
Thunderbird	-	39	3	4	5	110	9	2	1	8	5	-	-	-
Tomahawk	1.8	30	3	2	3	75	9	3	1	8	7	2	2	2
Turkey	-	59	8	9	1	120	9	8	8	9	7	2	3	2
Vista	1.3	31	3	4	3	70	9	5	3	5	6	2	0	3
Vona	-	29	3	3	6	70	9	7	3	5	8	4	2	2
Wichita	-	51	1	8	5	120	9	5	8	8	-	2	8	6
Yuma	5.5	30	3	2	5	70	9	5	1	-	7	4	2	2
Yumar	-	32	3	3	5	70	1	5	1	-	7	4	2	2

[1]Rated on a scale of 0 to 9; 0 is best and 9 poorest except for maturity (where 0 is earliest and 9 latest). A dash indicates insufficient data.
[2]Includes most varieties grown on at least 0.5% of acreage for 1998 harvest, based on Colorado Crop & Livestock Reporting Service survey.
[3]Rated on a scale of 0 to 9; 0 is best and 9 poorest. A zero rating means long mixing time. Varieties with a 0 rating are particularly good for blending with mellow or weak wheats. Mixing time and baking quality will vary with the environmental conditions under which the varieties are grown.

COFT 1997
Collaborative On-Farm Tests of Winter Wheat Varieties

Objective

Compare on-farm performance of RWA-resistant "Halt" to RWA-susceptible "TAM 107"

Trial Conditions

- Grower plants and harvests with own equipment
- Long (1/4 mile), narrow (wider than header) strips
- Varieties planted side-by-side
- Grower receives 100# seed each variety
- 18 tests in 9 counties (below) where RWA is common

1996-97 Production Constraints

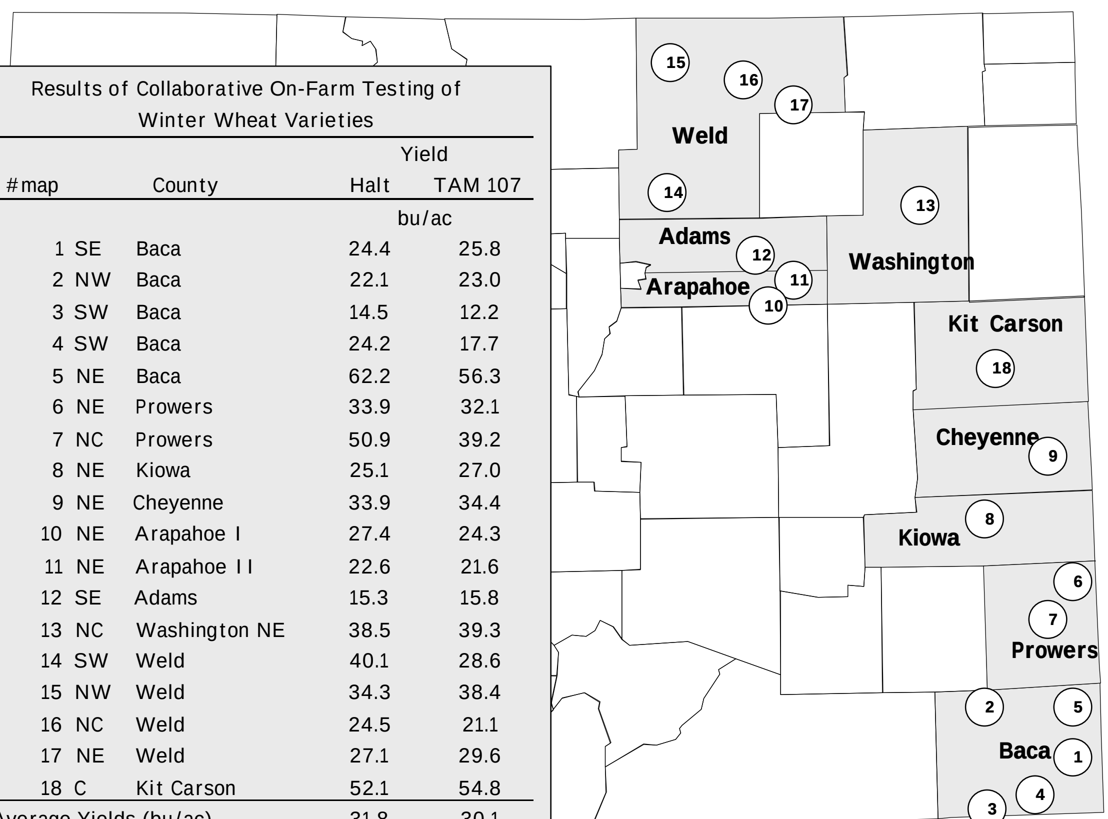
- Fall and spring drought
- Widespread wheat mites
- Wheat Streak Mosaic Virus
- Russian wheat aphid

Cooperative Extension Agents Make It Work

- Recruit volunteer cooperators.
- Distribute seed and guidelines.
- Visit tests fall, spring, summer.
- Responsible for harvest.
- See list of agents on next page.

Results

- Halt = TAM 107 when no RWA
- Halt > TAM 107 with RWA present



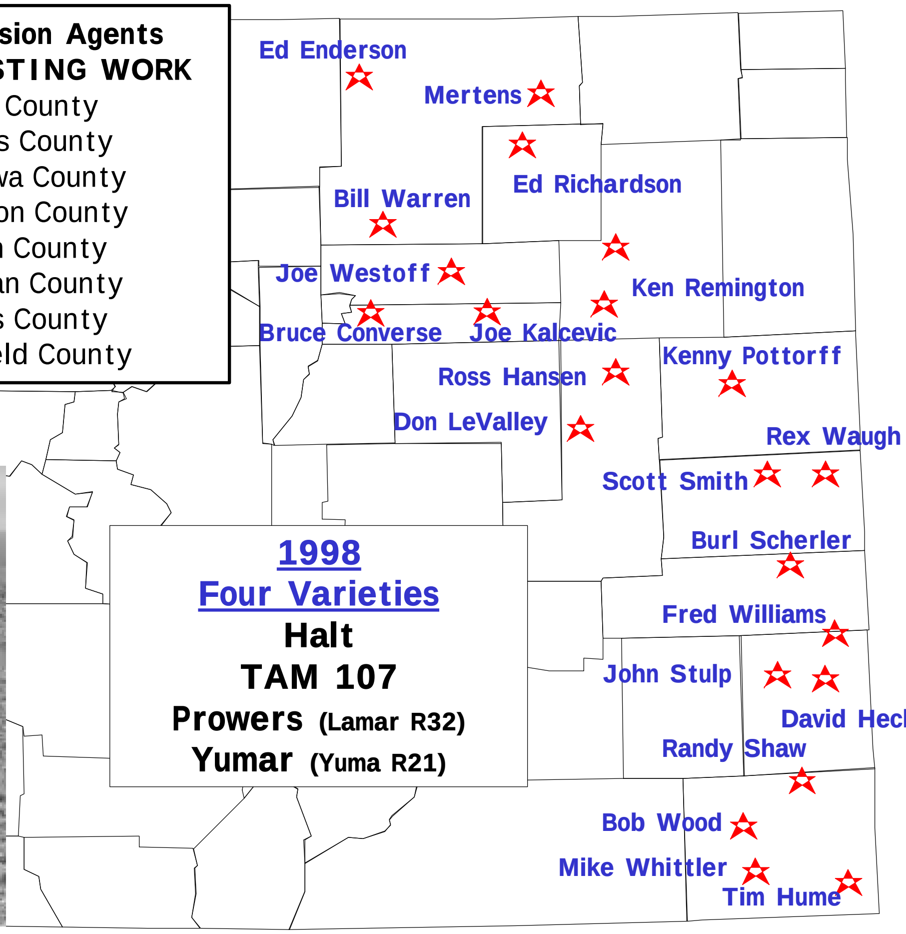
Results of Collaborative On-Farm Testing of Winter Wheat Varieties

#map	County	Yield Halt	TAM 107
		bu/ac	
1 SE	Baca	24.4	25.8
2 NW	Baca	22.1	23.0
3 SW	Baca	14.5	12.2
4 SW	Baca	24.2	17.7
5 NE	Baca	62.2	56.3
6 NE	Prowers	33.9	32.1
7 NC	Prowers	50.9	39.2
8 NE	Kiowa	25.1	27.0
9 NE	Cheyenne	33.9	34.4
10 NE	Arapahoe I	27.4	24.3
11 NE	Arapahoe II	22.6	21.6
12 SE	Adams	15.3	15.8
13 NC	Washington NE	38.5	39.3
14 SW	Weld	40.1	28.6
15 NW	Weld	34.3	38.4
16 NC	Weld	24.5	21.1
17 NE	Weld	27.1	29.6
18 C	Kit Carson	52.1	54.8
Average Yields (bu/ac)		31.8	30.1
Average Test Wt (lb/bu)		59.3	58.3

1997-1998 Collaborative On-Farm Tests

The Colorado Wheat Producers who, for the good of the whole wheat community, donate the use of their land, labor, and machinery to make on-farm testing possible.

The Cooperative Extension Agents
MAKING ON-FARM TESTING WORK
Tim Macklin - Baca County
Dick Scott - Prowers County
George Ellicott - Kiowa County
Ron Meyer - Kit Carson County
Kurt Jones - Lincoln County
Bruce Bosley - Morgan County
Ron Jepson - Adams County
Jerry Alldredge - Weld County

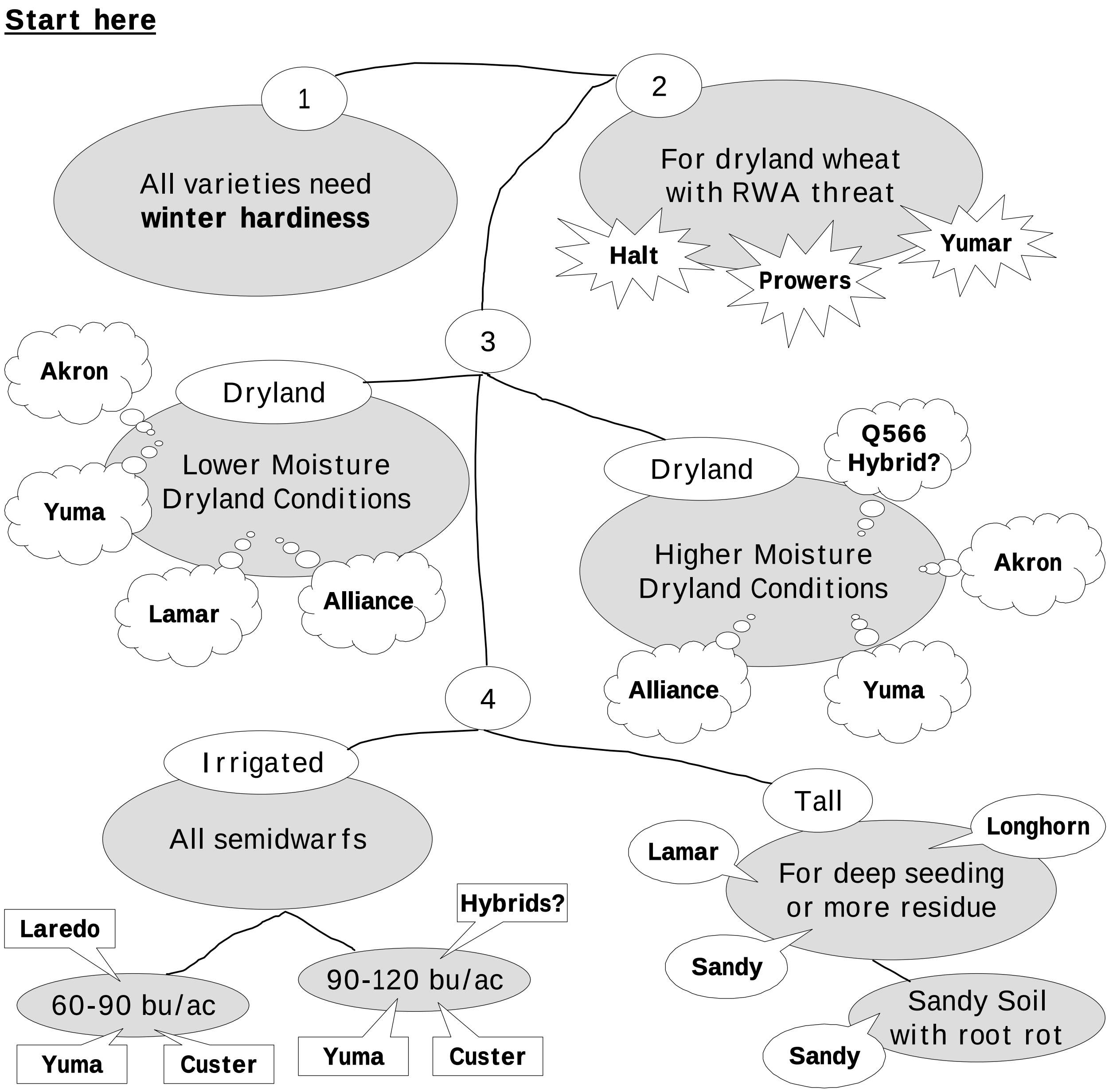


1998
Four Varieties
Halt
TAM 107
Prowers (Lamar R32)
Yumar (Yuma R21)

Kurt Jones

Decision Tree for Winter Wheat Variety Selection in Colorado

Jim Quick and Jerry Johnson

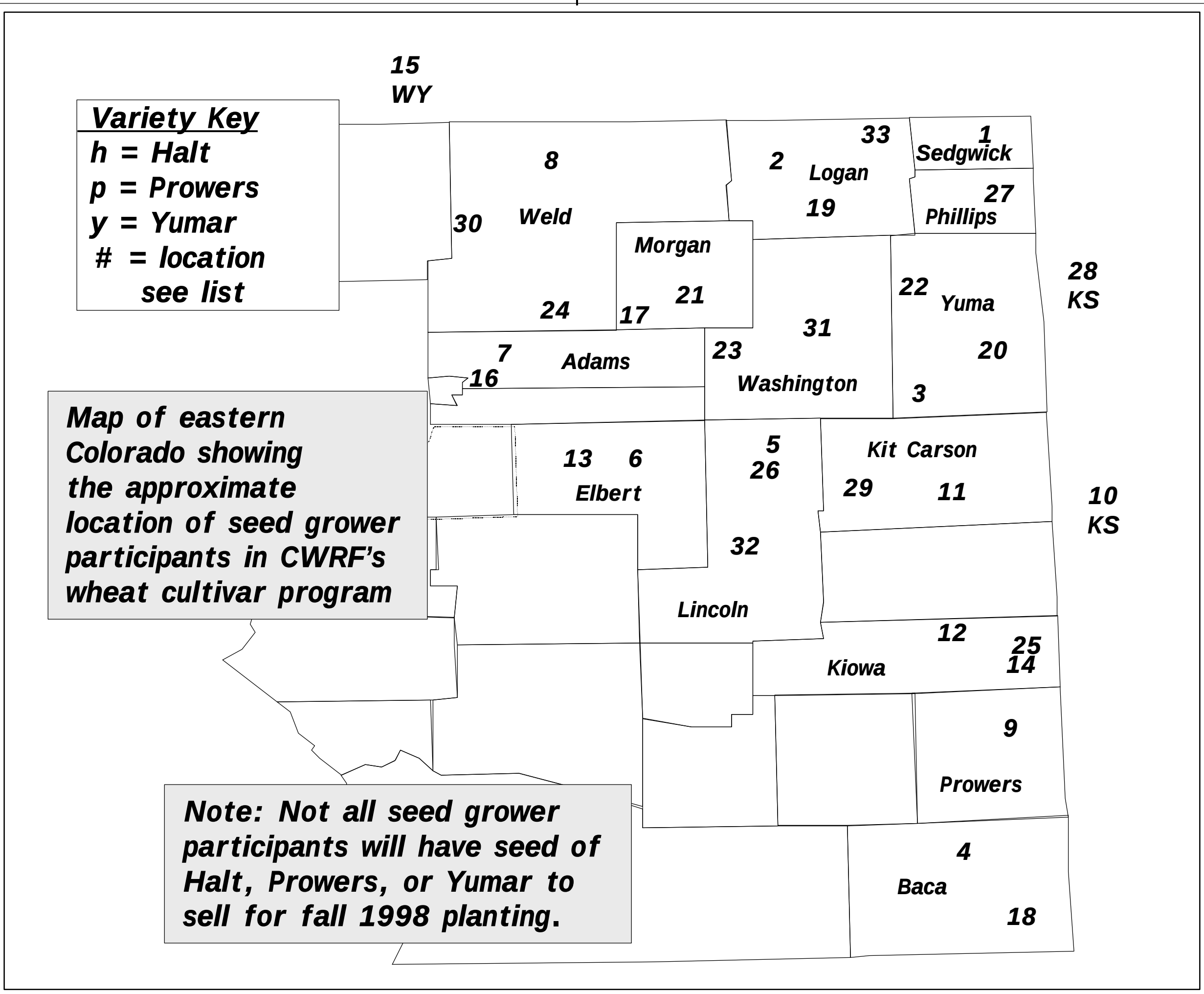


The best choice of a winter wheat variety in Colorado depends upon production conditions that vary across locations and years. Performance trial results are informative but cannot capture all the variation that needs to be taken into account in selecting the best variety for so many different production conditions. The decision tree is our way of trying to combine many years of empirical knowledge of wheat variety performance with the quantitative performance of varieties compared in experimental conditions. Varieties listed in the decision tree are not recommendations of the authors nor CSU, but rather varieties that the authors think growers should consider for the production conditions specified in the tree. Production conditions taken into account when formulating the decision tree include: stand establishment under dry conditions; winter hardiness; maturity; potential for spring frost damage; resistant to Russian wheat aphids; and yield performance across locations. Production risks can be significantly reduced by planting more than one variety and it should be remembered that avoiding poor variety decisions may be as important as choosing the winner among winners.

Seed grower participants in Colorado Wheat Research Foundation's wheat cultivar program for three wheat varieties resistant to Russian wheat aphid
(as of 6/1/98)

Darrell Hanavan, Jerry Johnson, Jim Quick, and Gil Waibel

Map #	Participant	City	Phone	Key	Map #	Participant	City	Phone	Key
1	Gayle Anderson	Sedgwick	9704635735	h	18	Plainsman Agri-Search Foundation	Walsh	7193245643	py
2	L. V. Propst Corp.	Merino	9705220090	hpy	19	Smith Farms	Fleming	9702653991	py
3	Edsel & Dennis Collette	Kirk	9703624302	hy	20	Elmar Pinckard	Idalia	9703547231	py
4	Ron Drosselmeyer	Two Buttes	7193265969	hp	21	Harry Thompson	Snyder	9708423168	h
5	Dry Creek Seed Company	Genoa	7197632367	hpy	22	Andrews Brothers Seed Cleaning	Yuma	9708480709	h
6	Kochis Farms	Matheson	7197752596	hp	23	Wagers Seed	Woodrow	9708422022	h
7	Curtis Lewton	Bennett	3036444327	h	24	Cooksey Farms	Roggen	3038495214	h
8	Don Mais	Stoneham	9707352281	hpy	25	Robert Weber	Sher Lake	7197293533	p
9	Douglas Melcher	Holly	7195376214	h	26	Roger Bruch	Genoa	7197632294	y
10	Paramount Seed	Quinter (KS)	9137542151	h	27	Gary Rafert	Amherst	9708542607	p
11	Pottorff Seed Farms	Stratton	7193485546	hy	28	Bunjes Quality Seed (KS)	St. Francis	7853222717	p
12	Scherler Farms	Sheridan Lake	7197293367	hp	29	CSF Farms	Seibert	9706642281	y
13	Ed Scherrer	Matheson	7195412885	hpy	30	Allen Letterly	Eaton	9704540989	y
14	Splitter Farms	Sheridan Lake	7197293567	hpy	31	Perry Bros. Seed, Inc.	Otis	9702463401	y
15	Lance Theobald	Pine Bluffs (WY)	3072453431	h	32	Michael Dean Parker	Karval	7194465260	y
16	Trupp's Certified Seed	Bennett	3036443416	hpy	33	Terry Ring	Crook	9702535009	py
17	Midcap Farms	Wiggins	9704325566	p					



Map of eastern Colorado showing the approximate location of seed grower participants in CWRF's wheat cultivar program

Note: Not all seed grower participants will have seed of Halt, Prowers, or Yumar to sell for fall 1998 planting.

CSU Research on Weed Management in Winter Wheat

Phil Westra

KOCHIA RESEARCH
(Kirk Howatt, Ph.D. student)

- Evaluation of over 400 kochia accessions shows >50% are resistant to SU and triazine herbicides
- Screening new herbicides for kochia control
- Genetics of kochia population

PHIL WESTRA
(Project Leader)

- Large research program
  - New wheat herbicides
  - Kochia research
  - GIS & GPS in weed science
  - Herbicide resistant varieties
- Education
  - Ph.D. students
  - M.S. students
  - International students
- Extension
  - Agent training
  - State and local meetings
  - State and national organizations

NEW WHEAT HERBICIDES FOR 1999
(Tim D'Amato Research Associate, Samuel Vissotto, MS student, Clark Oman, Ph.D. student)

- ***Maverick*** for downy brome control
- ***Paramount*** for field bindweed control in fallow
- ***Starane*** for broadleaf control like 2,4-D and Banvel

GIS AND GPS APPLICATIONS TO WEED SCIENCE
(Dawn Wyse-Pester Ph.D. student)

- Mapping goatgrass distribution in eastern Colorado wheat fields
- Could lead to variable weed management within fields
- Could lead to reduction in cultural and chemical inputs needed to control goatgrass

HERBICIDE-RESISTANT WHEAT CULTIVAR DEVELOPMENT
(Todd Pester Ph.D. student)

- Collaboration with Jim Quick to develop cultivars resistant to American Cyanamid's imazamox grass herbicide

NATIONAL JOINTED GOATGRASS EXTENSION COORDINATOR FROM CSU'S WEED SCIENCE PROJECT
(Mack Thompson Ph.D. student)

- Will develop integrated management strategies, BMPs. To reduce impact of jointed goatgrass on wheat production

Common Fall Pests in Colorado Winter Wheat

Frank Peairs

Banks grass mites commonly move into the margins of newly planted wheat fields from adjacent corn. This can result in the loss of several rows of plants, particularly if warm dry weather persists after wheat emergence. Banks grass mite produces heavy webbing to protect colonies that are usually found on the undersides of leaves. Damaged leaves first become yellow, then brown and necrotic. Heavy populations can kill small plants and reduce kernel size in larger plants. Overwintering mites are bright orange. With the onset of winter conditions the mites move to the crowns of wheat plants where they feed until spring. Small, pearly-white eggs then are laid that mature into pale to bright green male and female adults. Banks grass mite can be controlled by applying a miticide, such as dimethoate, to affected areas of the field.

Brown wheat mites spend the summer in the soil as a white egg resistant to hot, dry conditions. In the fall, as cooler, wetter conditions return, eggs develop and hatch. Damaged leaves will be finely mottled and may have chlorotic tips. Heavily infested crops have a droughty appearance, or a yellowish to bronzed discoloration. Brown wheat mite is similar in size to Banks grass mite, but is dark brown and has much longer front legs. On warm, calm days brown wheat mites may be found on leaves, otherwise they can be found under soil or surface debris. Female brown wheat mites mature after feeding on wheat for about two weeks and then lay round, red eggs which give rise to further fall (one or two) and spring (two or three) generations. Both red and white eggs are placed on soil particles adjacent to wheat plants. Brown wheat mite generally does not require treatment in the fall, but fields where fall activity are observed should be watched closely next spring.

Wheat curl mites, the vector of Wheat Streak Mosaic virus and High Plains virus, is carried by winds to newly emerged winter wheat as summer hosts, such as corn and perennial grasses, start to dry down. These are wormlike mites that are visible only with aid of a hand lens (at least 10X) or a microscope. They are found on leaves, often in the spaces between veins. Infested leaves will have tightly rolled edges, while infested plants often display the stunting and chlorotic speckles or streaks typical of wheat streak mosaic. Problems are most common where volunteer wheat is abundant at planting and where wheat emerges before adjacent corn dries down. Destruction of volunteer wheat and the maintenance of a two-week volunteer-free period prior to planting winter wheat in the fall is the most effective management practice for this mite and the disease that it vectors. Varietal resistance, such as that found in 'TAM 107', is available. There is some evidence for the existence of wheat curl mite biotypes that are unaffected by this source of resistance.

Minimizing Fall Pest Problems

- ! Control volunteer wheat and barley. Try to have a three-week volunteer-free period prior to emergence of fall seedings. Adjust planting dates to plant as late as possible within the time period known to produce a good crop in your area.
- ! Use adequate fertilization.
- ! Plant certified, treated seed.
- ! Select a variety that is well adapted to local growing conditions.
- ! Apply an insecticide treatment, if there is economic justification. See the 1997 Colorado Pesticide Guide -- Field Crops for insecticides and miticides registered for these uses. BE SURE TO READ, UNDERSTAND AND FOLLOW ALL LABEL INSTRUCTIONS.

Management of Russian Wheat Aphid Through Grazing

C.B. Walker and F.B. Peairs

Many producers in the Southern Great Plains use wheat as both a forage and cash grain crop to increase farm income. Winter wheat is a valuable source of high-quality forage and can be grazed until the jointing stage of growth with little effect on yields .

Grazing has been reported to reduce greenbug damage in winter wheat. Research conducted over several years in eastern Colorado has shown that grazing winter wheat can also cause a short-term but significant reduction in early season Russian wheat aphid infestations. This reduction in infestation levels can be great enough that aphids in grazed plots do not reach economic threshold levels and insecticide applications can be postponed (Table 1.). Research has also shown that moderate grazing in either fall (November/December) or spring (February/March) is most effective in reducing infestations. However, severe grazing over both fall and spring, while reducing Russian wheat aphid infestations, can significantly affect grain yields. Grazing studies over a two-year period have also shown that the Russian wheat aphid resistance found in 'Halt' is not reduced by grazing. The impact of grazing on Russian wheat aphid-resistant varieties will be investigated further as more varieties are released.

Table 1. Percentage of Russian wheat aphid infested tillers after grazing. Data represents average of three cultivars, Lamar, Colorado 1996-1997.

Treatment	% Tillers infested with RWA	
	March	May
Ungrazed	1.0	13.0
Fall Grazed	1.0	4.8
Spring Grazed	0.4	6.3
Fall & Spring Grazed	0.2	8.6

Grazing could become a major component of an Integrated Pest Management (IPM) program where forage is needed. Producers that graze wheat can benefit from gains to cattle and delay the build-up of Russian wheat aphids early in the season. In addition, this practice can delay the onset or minimize the number of insecticide applications needed to control Russian wheat aphid.

There are no predictable effects of grazing on yield components, and varieties may vary in the impact of grazing on grain yield and test weight. The stage of wheat development is critical in determining when cattle should be removed from the field. Cattle should be removed prior to jointing and additional nitrogen should be top-dressed in the spring to compensate for the nitrogen removed by grazing.

Virus Diseases of Wheat in Colorado

Linnea Skoglund and Joe Hill

Wheat Streak Mosaic - Wheat Streak Mosaic Virus (WSMV) is by far the most important and prevalent virus of wheat in Colorado. Distribution of WSMV is closely related to the dispersal of its mite vector, wheat curl mite. Infected plants are stunted with mottled and green-yellow-streaked leaves. Streaks are parallel and discontinuous. Margins of fields are often the first, and at times the only, areas affected.

Barley Yellow Dwarf - Barley Yellow Dwarf is common and widespread in Colorado. Symptoms caused by Barley Yellow Dwarf Virus (BYDV) are extremely variable and often overlooked or associated with nutritional or nonparasitic disorders. Field diagnosis is sometimes associated with the presence of aphid vectors and the occurrence of yellowed stunted plants singly or in small groups among normal plants. Diseased plants have less flexible leaves and underdeveloped root systems.

High Plains Disease - A new virus disease of wheat was found in 1994. The causal agent has been identified as the High Plains Virus (HPV). Symptoms resemble severe wheat streak mosaic symptoms. Initially light green spots develop on the youngest leaves. The spots enlarge, coalesce and become necrotic. Plants are stunted with bright mosaic streaking. A major difference between wheat streak mosaic and high plains disease is that wheat plants infected with HPV die. HPV is spread by the wheat curl mite and can be seedborne (rare).

Wheat Soilborne Mosaic - Symptoms caused by Wheat Soilborne Mosaic Virus (WSBMV) vary from mild-green to prominent-yellow leaf mosaics. Moderate to severe stunting can develop with certain strains and some can cause rosetting. Wheat fields may be uniformly diseased but more often show patterns associated with the distribution of the fungal vector, which often develops in low-lying wet areas. Symptoms are most distinct in early spring growth and frequently disappear as the season progresses. As new leaves unfold they appear mottled and develop parallel dashes and streaks. Leaf sheaths also are distinctly mottled.

The Situation in 1998

Very little disease has been reported in the 1997/98 wheat crop. There are some fields in Washington and Yuma counties that have mild infections of BYDV. There is no treatment for virus in wheat. The best control is avoidance. Late planting of winter wheat (after Sept. 15) will help avoid the mites and aphids that vector most of these viruses. Control of volunteers is essential to remove that green bridge for the vectors as well as a source of inoculum. Varieties resistant to the virus or to the vector exist, but may not be well adapted to our areas.

WHEAT CROPPING SYSTEMS AND SOIL MANAGEMENT

Optimum Wheat Stubble Height to Reduce Erosion and Evaporation

D.C. Nielsen, R.M. Aiken, and G.S. McMaster

(Adapted from Conservation Tillage Fact Sheet #4-97)

How high should I set my cutter bar when I harvest my wheat? The answer to that question may depend upon your objective. If you want to be sure to harvest every head possible, you could run the sickle on the ground. But if your objective has something to do with good residue management and the protection residue offers the soil from wind erosion while reducing evaporation from the soil surface, then a higher cutting height may be better for you.

A rule of thumb followed by many Great Plains wheat growers is to cut wheat at 2/3 of the plant height (20 in. cutting height on 30 in. tall wheat). This rule fits observations of the distributions of head heights seen in the field, where a cutting height of 2/3 of the plant height would harvest 99% of the heads. But does this height of stubble provide adequate protection to the soil surface against wind erosion and reduce evaporation so that precipitation storage during the fallow period is maximized?

Erosion Protection

Increasing stem height and stem density (number of stems per square foot) reduces the wind speed near the soil surface. Erosivity (0 = no erosion, 1 = erosion rate from bare soil surface) decreases as winds are slowed by taller stubble or higher stem density (Fig. 1). Stem density is the number of stems in a foot of row times the row spacing (in feet). For example, 80 stems in a foot of row with a row spacing of 9 inches (0.75 ft.) equals a stem density of 60 stems/ft^2. Stem densities vary widely from year to year, depending on tillering and seeding rate, but generally range from 20 to 70 stems/ft^2. A low cutting height of 4 in. provides little

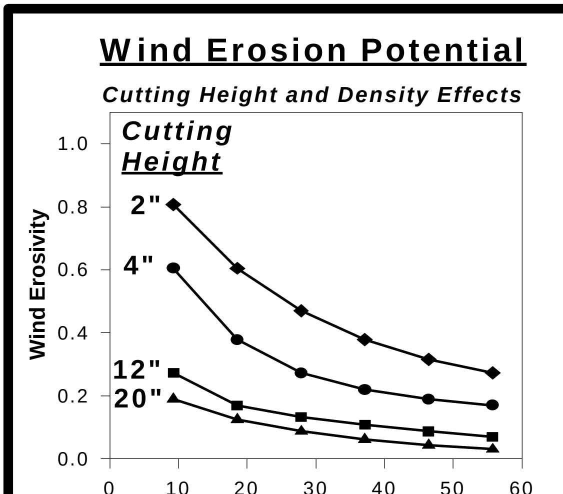


Fig. 1

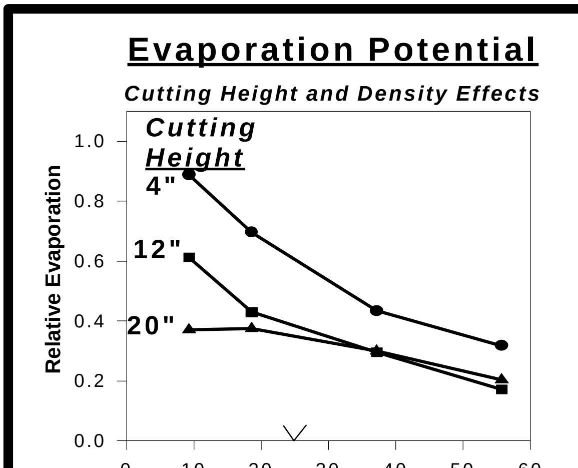


Fig. 2

protection when stubble is sparse (9 stems/ft^2). Higher cutting heights of 12 in. or 20 in. increase soil protection (reduce erosivity). Little additional protection against erosion is gained for stems taller than 12 in. when stem density is greater than 25 stems/ft^2.

Reducing Evaporation

As standing wheat stubble slows the wind near the soil surface and shades the soil surface, evaporation rate declines (Fig. 2). The relative evaporation rate (0 = no evaporation, 1 = evaporation from a wet, bare soil surface) declines as stem height and stem density increase. A low cutting height of 4 in. provides little protection against evaporation for sparse stands. Increasing the stubble height of dense stands (greater than 25 stems/ft^2) from 12 in. to 20 in. does little to reduce evaporation further.

Optimum Wheat Cutting Height

How do the three objectives of choosing a cutting height to minimize harvest losses, erosivity, and relative evaporation fit together? Figure 3 shows lines depicting the stem height and densities where 80% of the maximum benefits for soil and water conservation occur. For example, with a stem density of 37 stems/ft^2, a cutting height of only 6 in. is needed to obtain 80% of the maximum erosion protection, compared with a 12 in. cutting height needed to obtain 80% of the maximum evaporation protection. Cutting wheat to a height that minimizes evaporation will automatically minimize erosivity. For both erosion protection and evaporation reduction, stem density and height can substitute for each other (i.e., a tall, low density stand can provide the same protection as a short, high density stand.)

A stripper header for a combine does not cut wheat stems at harvest. Closely spaced fingers on a fast-moving reel remove the heads from the stems, leaving the stems as tall as possible. For a stem density less than 25 stems/ft^2, it is not possible to obtain 80% of the maximum water conservation benefits, regardless of how tall the stems are. Therefore, leaving the stubble as tall as possible through the use of a stripper header would reduce the evaporation potential as much as possible.

Figure 3 shows the typical maximum height that both traditional height and semidwarf wheat varieties can be cut and still minimize yield loss caused by missed heads. Cutting wheat in this range of heights (15 to 22 in.) would achieve the goals of minimizing harvest losses, erosivity, and relative evaporation. Stubble height in this range is very effective in trapping snow and increasing overwinter soil water contents, although stubble taller than 18 in. may be more likely to be flattened under some winter storm conditions. The additional soil water stored through snow catch and reduced evaporation from tall stubble has a value of about 7.5 bu/a of wheat for every inch of additional water stored in the soil profile.

Standing residues are 5 to 7 times more effective than flat residues in controlling wind erosion. Therefore, producers should keep implement, truck, and livestock traffic to a minimum, concentrating necessary traffic in areas with lowest soil erodibility. Careful management of wheat cutting height can reduce erosion and evaporation while optimizing yield.

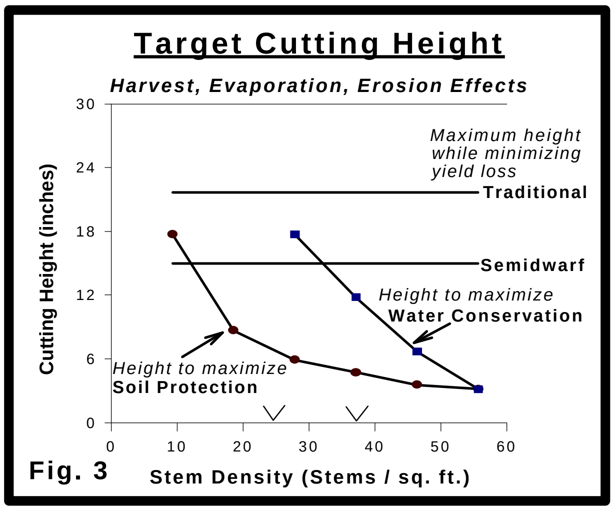


Fig. 3

Diagnosing the Cause of Poor Wheat Growth on Knolls

Jessica Davis, Merle Vigil, Kirk Iversen, Bruce Bosley, Ron Jepson, and Stan Pilcher

In the Spring of 1997, we sampled nine wheat fields in eastern Colorado where parts of the field were not looking very good. These poor growth areas had stunted plants; sometimes they were pale green or yellowish green in color, and in some of the cases, they were purple on the stem and lower leaves. We soil sampled the field area that looked the poorest, an adjacent area that looked good, and an area in between these two extremes to try to determine what was causing the poor growth and to determine what some possible solutions might be.

The areas with poor growth had significantly higher soil pH than the areas with good, healthy plants (Table 1). The poor growth areas also had significantly lower levels of extractable phosphorus (P), potassium (K), zinc (Zn), and manganese (Mn) in the soil. On the other hand, soil nitrate (NO_3-N) and boron (B) levels were higher in the soils where the plants weren't doing well. This is probably because the plants were not vigorous enough to take up as much of these nutrients.

We also sampled the wheat plants to see if they had insufficient nutrient levels in the poor growth areas (Table 2). The wheat in the poor growth areas had significantly higher levels of calcium (Ca), magnesium (Mg), zinc (Zn), and copper (Cu) than the wheat in the healthy looking areas. This is probably due to a "concentration effect"; since the plants were smaller, some nutrients became more concentrated.

So what caused the poor growth? This depends on the specific situation. In some cases, maybe it was lack of moisture due to shallow soils with low organic matter content. In some cases, the symptoms looked like phosphorus deficiency (purpling), and in others the symptoms looked like zinc deficiency (yellowing).

The best approach is to soil sample the poor growth area of the field separate from the rest of the field to see if you need more phosphorus or zinc fertilizer in that area of the field. If manure is available, it can provide both phosphorus and zinc and also help build up soil organic matter and soil water holding capacity.

Table 1. Average soil properties (0-6 inches) in the poor wheat growth areas, good areas, and moderate areas from 9 fields in eastern Colorado.

Soil Property	Good Area	Moderate Area	Poor Area
pH	7.4 B*	7.7 A	7.7 A
Organic Matter (%)	1.4	1.4	1.3
NO_3-N (ppm)	9.9 B	16.1 AB	21.2 A
P (ppm)	6.4 A	3.4 B	2.6 B
K (ppm)	528 A	425 B	401 B
Ca (meq/L)	3.8	4.8	7.3
Mg (meq/L)	1.2	1.3	2.1
Zn (ppm)	0.8 A	0.5 AB	0.4 B
Fe (ppm)	8.1	4.9	4.2
Mn (ppm)	4.3 A	4.0 AB	3.2 B
Cu (ppm)	2.8	2.8	2.7
B (mg/L)	0.07 B	0.09 AB	0.12 A
Cl (ppm)	7.3	6.2	8.3
SO_4-S (ppm)	2.4	2.9	41.0

*Different letters denote significant differences between areas at the 0.05 probability level.

Table 2. Average plant nutrient content in wheat in poor growth areas, good areas, and moderate areas in 9 fields in eastern Colorado.

Plant Nutrient	Good Area	Moderate Area	Poor Area
N (%)	3.75	3.76	3.93
P (%)	0.23	0.21	0.22
K (%)	3.15	3.10	3.11
Ca (%)	0.41 B*	0.47 AB	0.52 A
Mg (%)	0.16 B	0.17 B	0.20 A
Zn (ppm)	12.1 B	15.7 AB	18.5 A
Fe (ppm)	173	255	239
Mn (ppm)	77	90	102
Cu (ppm)	6.2 C	7.4 B	8.4 A
B (ppm)	11	15	9
Cl (%)	0.57	0.60	0.63
S (%)	0.44	0.41	0.48

*Different letters denote significant differences between areas at the 0.05 probability level.

Making Better Marketing Decisions in 1998

Darrell Hanavan

Just two years ago, U.S. and world wheat stocks were the tightest in history and resulted in record high average wheat prices. Now less than two years later, U.S. ending stocks are projected to exceed the historic 10-year average and climb to the highest level since May 31, 1991. As a result, wheat prices are at their lowest level in 5 years, falling over 25 percent this past marketing year.

On the positive side, plantings of U.S. all-wheat for harvest in 1998 are projected to be down 6 percent from last year and the lowest planted acreage since the 1988 wheat crop. The big keys to the price of wheat this current marketing year will be the number of acres actually harvested and the yield. So, watch the weather closely.

Understanding historical market trends can help Colorado wheat producers make better marketing decisions. Only 32% of the state's winter wheat production is marketed during of the months of December to February when the highest prices have been be obtained for the lowest storage and interest costs. Forty-nine percent of Colorado's winter wheat production is sold prior to December when market prices have been the lowest. On the average, there has been a 66 cents per bushel advantage in market prices by selling after December instead of selling in July. The estimated cost of storage and interest is five to six cents per bushel per month. Producers who are unwilling or unable to take advantage of this historic rise in prices after November might consider options or futures contracts to manage financial risk.

The movement in the price of wheat the past two marketing years has contradicted long term trends. July was the month with the highest average price in the 1996-97 marketing year; and August was the month with the highest average price in the 1997-98 marketing year. Wheat producers should still observe long term price trends when making decisions to sell wheat early in the marketing season as they may miss out on upward price movement that historically occurs after November.

Colorado Average Wheat Prices
1987-97
(July-June)

Marketing Year	July Average $/Bu.	Highest Monthly Average $/Bu.	$/Bushel Gain
1987-88	2.18	3.11	+0.93
1988-89	3.25	4.08	+0.83
1989-90	3.73	3.81	+0.08
1990-91	2.69	2.69	0.00
1991-92	2.47	3.88	+1.41
1992-93	3.06	3.36	+0.30
1993-94	2.70	3.58	+0.88
1994-95	3.02	3.71	+0.69
1995-96	4.20	5.67	+1.47
1996-97	4.78	4.78	0.00
10-Year Average	**$3.21**	**$3.87**	**$0.66**

Marketing Hard White Wheat

Rob Bruns

Hard white wheat ***Value*** will drive the acceptance and commercialization of this exciting new crop. Interestingly, the perceived value of hard whites among the wheat research community and grower groups is probably greater than actual market value. As the wheat community moves forward with hard white wheat development, it is time to "GET REAL" about the market value of hard white wheat.

What is the real value of Hard Whites?

- Is there **milling** value? As long as the ash standard is used by the baking industry, the only additional value is related to a 1% - 2% increase in flour yield. This would equate to a $.03 to $.07 per bushel value.
- Is there value in export **preference**? There are a number of key markets that prefer white wheat, but those same customers are price sensitive. Supplying these markets will not be profitable unless the preference is great enough to command a higher price than currently paid for Australians hard white wheat.
- Is there value in improved **taste**? Improved flavor has been demonstrated in controlled studies, but to date, no one has been able to successfully market taste to the baking industry or to the consumers.
- Is there value in **special utilization**? There are currently several groups that utilize hard white wheat and generate enough additional income to cover the costs of production, segregation, storage and distribution. These would include American White Wheat Producers Association, ConAgra Flour Milling, Cargill Flour Milling, and Pro Mar in Idaho. All of these programs have hard white varieties with special end-use traits, in addition to the white seed coat.

To be successful, hard white wheat has to create enough extra value to overcome the added costs. Some examples of inherent added cost could be: technology costs, grain production costs, transportation & storage costs, special handling costs, market development costs, and non-grade disposition costs.

Based upon my experience, the following formula is necessary for successful hard white wheat market development:

Objective: ***"create enough value to overcome development costs"***

Strategies:

- Develop multiple special utilization projects to create industry awareness and minimum scales.
- Blend in mini-commodity programs on the coattail of the special utilization projects.
- Once the industry is familiar with hard white wheat, the true commodity value will level out naturally.

Are there white wheat value-added opportunities for the Colorado grower?

AgriPro and ConAgra have an identity preserved special utilization wheat programs in Colorado. They are in the third year of a hard white wheat program that supplies special quality hard white wheat to the ConAgra Denver mill. This program targets high value special quality traits and high yielding AgriPro varieties Platte and Solomon. The basic elements of this program include:

- ***Up-front premium targets at planting.***
- ***On-farm yield performance better than or equal to the red varieties.***
- ***Identity preserved growing from certified seed.***
- ***Grower friendly pricing, storage and delivery to multiple local delivery points established by ConAgra.***

If you are interested in finding more about this program, contact an Agripro dealer or Rob Bruns**.**

Eastern Colorado Extension Wheat Educators

Location	Extension Contact	Phone	E-Mail Address
Adams County	Ron Jepson	303-637-8117	adams@coop.ext.colostate.edu
Baca County	Tim Macklin	719-523-6971	baca@coop.ext.colostate.edu
Cheyenne County	Office Director	719-767-5716	cheyenne@coop.ext.colostate.edu
Crowley County	Ron Ackerman	719-267-4741	crowley@coop.ext.colostate.edu
Kiowa County	George Ellicott	719-438-5321	kiowa@coop.ext.colostate.edu
Kit Carson County	Ron Meyer	719-346-5571	rmeyer@coop.ext.colostate.edu
Lincoln County	Kurt Jones	719 743-2542	lincoln@coop.ext.colostate.edu
Logan County	Randy Buhler	970-522-3200	logan@coop.ext.colostate.edu
Morgan County	Bruce Bosley	970-867-2493	morgan@coop.ext.colostate.edu
Prowers County	Dick Scott	719-336-2985	prowers@coop.ext.colostate.edu
Sedgwick County	Gary Lancaster	970-474-3479	sedgwick@coop.ext.colostate.edu
Washington County	Stan Pilcher	970-345-2287	washingt@coop.ext.colostate.edu
Weld County	Jerry Alldredge	970-356-4000 Ext. 4465	weld@coop.ext.colostate.edu

Descriptions of Spring Varieties in Trials:

Variety Name	Class	Origin
2375	Hard Red	North Dakota
AC Teal	Hard Red	Canada
Blanca	Soft White	Colorado
Butte 86	Hard Red	North Dakota
Bz987-331	Hard Red	Western Plant Breeders
Bz992-322c	Hard Red	Western Plant Breeders
CA896	Hard Red	California
Centennial	Soft White	Idaho
Cortez	Durum	Western Plant Breeders
Forge	Hard Red	South Dakota
Grandin	Hard Red	North Dakota
Hamer	Hard Red	Agripro Biosciences, Inc.
ID377S	Hard White	Idaho
ID462	Hard Red	Idaho
ID469	Hard Red	Idaho
ID474	Soft White	Idaho
ID476	Hard Red	Idaho
ID488	Soft White	Idaho
Klasic	Hard White	California
Lloyd	Durum	North Dakota
MT RWA 116	Hard Red	Montana
N93-0119	Hard Red	Agripro Biosciences, Inc.
N93-0136	Hard Red	Agripro Biosciences, Inc.
N93-0211	Hard Red	Agripro Biosciences, Inc.
Nora	Hard Red	Agripro Biosciences, Inc.
Norlander	Hard Red	Agripro Biosciences, Inc.

Variety Name	Class	Origin
NX94-0217	Hard Red	Hybritech
NX96-5406	Hard Red	Hybritech
NX96-5411	Hard Red	Hybritech
OR492092	Hard White	Oregon
Oslo	Hard Red	Agripro Biosciences, Inc.
Owens	Soft White	Idaho
Oxen	Hard Red	Agripro Biosciences, Inc.
PH 891-74	Durum	Western Plant Breeders
PH 894-402	Durum	Western Plant Breeders
PH 992-313	Durum	Western Plant Breeders
Pomerelle	Soft White	Idaho
Russ	Hard Red	South Dakota
SDM 50031	Hard Red	Sunstar Seeds
SDM 50032	Hard Red	Sunstar Seeds
Sharp	Hard Red	Sunstar Seeds
Spillman	Hard Red	Washington
Sylvan	Hard Red	Colorado
Trenton	Hard Red	North Dakota
UT3007	Hard Red	Utah
WB 881	Durum	Western Plant Breeders
Whitebird	Soft White	Idaho
Yecora Rojo	Hard Red	California

Table 6. Dryland Spring Wheat Performance Trial at Akron in 1996 and 1997.

	1996		1997		Average	
Variety	Yield	Test wt	Yield	Test wt	Yield	Test wt
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu
ID488*	36.1	59.7	20.8	53.9	28.5	56.8
Oxen	28.4	59.9	25.4	50.4	26.9	55.2
ID377S*	31.9	60.4	21.0	52.6	26.5	56.5
Russ	29.7	59.7	23.1	57.5	26.4	58.6
Grandin	34.9	60.0	17.8	50.6	26.4	55.3
Nora	26.8	60.5	25.4	55.0	26.1	57.8
Butte 86	29.2	60.6	22.8	51.9	26.0	56.3
N93-0119	33.4	59.9	18.3	50.5	25.9	55.2
2375	29.1	59.9	22.4	53.8	25.8	56.9
Trenton	29.9	60.8	20.7	51.7	25.3	56.3
Sharp	25.6	61.5	24.0	56.1	24.8	58.8
N93-0136	29.7	61.4	19.4	51.5	24.6	56.5
MT RWA 116	30.1	59.1	19.1	51.9	24.6	51.9
AC Teal	27.7	58.8	19.6	52.2	23.7	55.5
Forge	22.8	61.0	24.3	53.6	23.6	57.3
Norlander	27.5	60.0	19.6	53.1	23.6	56.6
N93-0211	27.6	60.0	18.4	52.5	23.0	56.3
Hamer	26.3	60.5	19.7	51.5	23.0	56.0
Oslo	24.7	57.9	18.3	50.9	21.5	54.4
Means	**27.5**		**20.7**			
CV %	12.4		13.4			
$LSD_{(0.05)}$	4.8		3.9			

*White grain

Previous Crop: Proso; Planting Date: 3/6/97; Harvest Date: 7/20/97; Seeding Rate: 60 lb/acre; Soil Type: Weld Silt Loam; Fertilizer: 50 lb N/acre

Table 7. Dryland Spring Wheat Performance Trial at Hayden in 1997.

Variety	Yield	Test wt	Plant height
	bu/ac	lb/bu	inches
ID488	25.4	55.7	21.8
Blanca	24.1	52.9	23.8
Butte 86	22.7	57.5	24.5
2375	21.7	60.3	23.5
ID377S	20.8	58.0	23.5
Grandin	17.3	56.9	24.8
Means	**22.0**	**59.9**	**23.6**
CV %	13.6		
$LSD_{(0.05)}$	4.0		

Previous Crop: Winter wheat; Planting Date: 5/16/97; Seeding Rate: 60 lb/acre; Harvest Date: 9/2/97; Soil Type: Clay Loam; Fertilizer: None

Note: Plot yields reduced by wild oat competition.

Table 8. Irrigated Spring Wheat Performance Trial at Fruita in 1997.

Variety	Yield	Test wt	Plant height	Day to heading
	bu/ac	lb/bu	inches	*
ID377S	70.4	56.9	27.5	62.3
Blanca	70.0	56.2	28.0	65.8
Klasic	67.1	52.6	16.8	58.3
Sylvan	62.0	56.0	28.2	66.0
2375	61.3	56.2	23.5	59.2
Lloyd	53.9	55.5	24.8	66.0
Means	**64.2**	**55.6**	**24.8**	**62.9**
CV %	6.5			
$LSD_{(0.05)}$	9.9			

*Days to heading after planting

Previous Crop: Corn; Planting Date: 4/1/97; Seeding Rate: 120 lb/acre; Harvest Date: 8/19/97; Soil Type: Youngston Loam; Irrigation: Furrow, 6 applications; Fertilizer: 120 lb N/acre

Table 9. Irrigated Durum Spring Wheat Performance Trial at San Luis Valley in 1997.

Variety	Yield	Test wt	Plant lodging	Heading date	Grain protein	Grain hardness
	bu/ac	lb/bu	%	*	%	**
Cortez	132.7	56.3	0.0	31.0	12.2	98
PH 891-74	125.3	56.7	3.8	31.0	13.4	101
WB 881	104.9	54.6	16.3	37.0	12.9	101
Lloyd	103.4	53.4	5.0	40.5	12.2	87
PH 894-402	66.3	50.7	31.3	36.8	13.1	87
Means	**106.5**	**54.3**	**19.3**	**35.3**	**12.8**	**94.6**
CV %	12.1					
$LSD_{(0.05)}$	17.3					

*Date of 50 % heading; days after June 1.
**Grain hardness: > 40 = hard wheat; < 40 = soft wheat.

Previous Crop: Potatoes; Planting Date: 4/22/97; Harvest Data: 9/25/97; Seeding Rate: 140 lb/acre; Soil Type: Sandy loam; Irrigation: center pivot; Fertilizer: 24 lb/acre nitrogen; 100 lb/acre phosphate

Note: The durum varieties were part of the irrigated hard red spring wheat variety trial. Lodging was excessive for one variety even though only 24 lb/acre N was applied. All these varieties produced a fairly low bushel weight; probably the result of bacterial black chaff.

The yield of Cortez and experimental PH891-74 were exceptional. Both are early maturing varieties, fairly short height, and good bushel weights.

Table 10. Irrigated Hard Red Spring Wheat Performance Trial at San Luis Valley in 1997.

Variety	Yield	Test wt	Plant lodging	Heading date	Grain protein	Grain hardness
	bu/ac	lb/bu	%	*	%	**
Klasic***	121.6	54.7	10.0	29.5	12.4	50
SDM 50032	118.6	56.6	1.3	39.0	12.8	68
Nora	113.2	58.6	12.5	38.5	13.8	75
Yecora	112.4	56.6	0.0	30.0	12.7	57
SDM 50031	110.8	55.9	12.5	34.8	12.3	62
NX96-5411	109.4	55.1	6.3	39.5	12.0	74
Oslo	108.8	52.3	0.0	36.5	13.2	38
NX94-0217	108.0	56.5	6.3	37.8	13.7	57
Bz987-331	105.2	55.4	53.8	36.8	13.1	48
ID469	95.6	53.5	0.0	35.3	11.7	9
Bz992-322c	94.8	50.9	22.5	37.8	14.3	61
PH 992-313	92.4	53.3	61.3	39.0	13.7	60
NX96-5406	91.7	55.2	45.0	38.8	13.5	61
ID377S***	91.5	55.8	85.0	39.0	13.8	62
N93-0136	91.5	53.6	56.3	41.3	12.4	63
ID476	88.6	53.1	21.3	37.5	14.0	61
ID462	76.6	53.8	82.5	39.5	14.0	65
Blanca***	75.7	53.6	70.0	43.3	12.5	5
Means	**100.4**	**54.7**	**30.4**	**37.4**	**13.1**	**54**
CV %	12.1					
LSD $_{(0.05)}$	17.3					

*Date of 50 % heading; days after June 1.
**Grain hardness: > 40 = hard wheat;   < 40 = soft wheat.
***White grain

Previous Crop: Potatoes; Planting Date: 4/22/97; Harvest Date: 9/25/97; Seeding Rate: 120 lb/acre; Soil Type: Sandy loam; Irrigation: center pivot; Fertilizer: 24 lb/acre nitrogen; 100 lb/acre phosphate

Note: Varieties producing less than 100 bu/acre had low bushel weight or excess lodging or both. Bacterial black chaff reduced bushel weight. Lodging was excessive for some varieties and also reduced yield and bushel weight, even though only 24 lb/acre N was applied.

Table 11. Irrigated Soft White Spring Wheat Performance Trial at San Luis Valley in 1997.

Variety	Yield	Test wt	Plant height	Plant lodging	Heading date	Grain protein
	bu/ac	lb/bu	inches	%	*	%
Centennial	101.1	53.8	43.4	55.8	34.0	12.9
ID174	100.1	54.7	45.2	69.2	36.8	12.7
ID488	84.0	52.5	43.2	86.7	34.0	12.4
Whitebird	80.9	54.5	45.4	76.7	39.0	12.2
Owens	72.4	51.8	45.6	90.8	39.0	12.9
Blanca	60.5	51.1	46.6	81.7	40.2	13.4
Means	**83.2**	**53.1**	**44.9**	**76.8**	**37.2**	**12.8**
CV %	18.1					
LSD $_{(0.05)}$	17.9					

*Date of 50 % heading; days after June 1.

Previous Crop: Potatoes; Planting Date: 4/14/97; Harvest Date: 9/29/97; Seeding Rate: 100 lb/acre; Soil Type: Sandy loam; Irrigation: center pivot; Fertilizer: 24 lb/acre nitrogen; 100 lb/acre phosphate

Note: This trial had six replications. The yields in this trial were relatively low. Lodging was excessive for all varieties even though only 24 lb/acre N was applied. Bushel weights were low for all varieties; probably the result of bacterial black chaff and/or lodging. Low protein (<12%) is desirable in soft wheats; however, low yields helped produce excessive proteins in this trial this year.

Table 12. Irrigated Hard Red Spring Wheat Performance Trial at Yellow Jacket in 1997.

Variety	Yield	Test wt	Heading date	Grain protein	Grain hardness
	bu/ac	lb/bu	*	%	**
Blanca***	113.3	55.3	7/3	10.2	9
ID377S***	111.1	58.0	6/30	11.1	60
Pomerelle	111.0	56.0	7/ 3	9.9	14
Sylvan	102.0	58.5	7/5	8.4	63
ID474	101.7	56.0	7/3	10.1	8
Spillman	98.6	55.3	7/3	10.2	68
CA896	97.3	55.8	6/30	11.6	49
ID462	96.8	57.3	6/30	12.8	68
Oslo	88.2	54.8	6/30	12.2	40
UT3007	86.5	56.8	6/30	14.4	94
ID469	82.9	55.3	6/27	10.6	23
MT RWA 116	81.2	55.3	6/30	12.4	71
Lloyd***	73.7	52.3	7/5	14.1	97
OR492092	68.3	55.3	7/3	11.3	69
Means	**93.7**	**55.8**			
CV %	6.3				
LSD $_{(0.05)}$	8.6				

*50% of the plants headed
**Grain hardness: > 40 = hard wheat; < 40 = soft wheat.
***White grain.

Previous crop: Dry beans (fall chisel plowed); Planted: 4/30/97; Harvested: 9/24/97; Seeding Rate: 90 lb/acre; Emergence: 5/10/97; Soil Type: Wittco Silty Clay Loam; Irrigation: 13.5 in. gross (5 sprinkler applications); Rainfall: 6.2 in. (5/1 - 8/31); Fertilizer: 140 lb/acre nitrogen; 40 lb/acre phosphate (urea and 11-52-0) was broadcast on 4/18/97; Herbicide: Harmony Extra @ 1/2 oz /acre + 2,4-D @ 8 oz /acre on 5/29/97; Insecticide: None

Note: The 1997 growing season was wetter than normal. A hail storm Sept. 21 caused some grain shattering with OR492092 receiving the most damage. It was estimated that the grain loss did not exceed five percent for any variety. Russian wheat aphid damage was minor. UT3007 was the only variety to lodge (100% at harvest). The test weights were determined from grain samples taken directly from the plot combine and were not recleaned.

Descriptions of Winter Varieties in Western Trials:

Variety Name	Class	Origin
Fairview	Hard Red	Colorado
Garland	Hard Red	Utah
Halt	Hard Red	Colorado
ID355	Hard White	Idaho
ID465	Hard Red	Idaho
ID477	Hard Red	Idaho
ID479	Hard Red	Idaho
ID497	Hard Red	Idaho
ID498	Hard Red	Idaho
Jeff	Hard Red	Idaho
Manning	Hard Red	Utah
OR880017	Hard White	Oregon
OR889128	Hard White	Oregon
Presto	Triticale	Colorado
Promontory	Hard Red	Idaho
Quantum 555	Hard Red	Hybritech
Stephens	Soft White	Oregon
TAM 107	Hard Red	Texas
UT150	Hard Red	Utah
UT182064	Hard Red	Utah
UT199847	Hard Red	Utah
UT201971	Hard Red	Utah
UT742149	Hard Red	Utah
UT94158	Hard White	Utah
UT944151	Hard Red	Utah
UT944157	Hard White	Utah
WA7814	Hard Red	Washington
WA7815	Hard Red	Washington
Wanser	Hard Red	Washington

Table 13. Dryland Hard Red Winter Wheat Performance Trial at Yellow Jacket in 1996/97.

Variety	Yield*	Test wt	Plant height	Heading date	Grain protein	Grain hardness
	bu/ac	lb/bu	inches	**	%	***
Halt	37.2	53.5	22	6/16	12.8	40
ID498	34.2	55.0	26	6/16	12.8	63
UT201971	32.1	58.0	29	6/23	13.8	73
ID479	30.9	54.5	26	6/16	12.5	67
UT182064	30.6	50.0	27	6/23	13.7	62
Manning	30.0	53.0	26	6/16	12.7	83
Fairview	29.5	54.5	26	6/09	13.3	67
Presto	29.4	52.5	31	6/09	12.1	37
UT199847	29.2	57.0	30	6/23	14.3	68
OR889128	29.0	55.0	25	6/09	12.7	64
UT944151	28.1	52.5	27	6/23	14.4	54
UT150	27.3	51.0	27	6/23	14.6	92
Promontory	27.3	54.5	24	6/16	13.2	67
Jeff	27.2	56.0	32	6/16	13.3	76
WA7815	26.8	55.0	30	6/23	14.6	79
UT944157	26.7	55.0	25	6/16	14.1	70
ID465	26.1	51.5	26	6/23	14.5	86
Garland	25.8	47.0	17	6/23	14.9	69
OR880017	25.7	56.0	24	6/23	13.6	74
UT742149	25.7	49.5	25	6/23	12.8	75
ID477	25.5	55.0	27	6/23	13.8	78
ID355	25.3	57.5	27	6/23	14.1	79
Wanser	25.1	54.0	27	6/16	13.2	69
WA7814	24.4	56.0	28	6/16	14.7	73
ID497	23.1	56.5	30	6/16	14.6	72
UT944158	22.6	51.5	24	6/23	13.7	58
Mean	**27.9**					
CV %	9					

*Bushel yield based on 60 lb/bu and not adjusted for moisture
**Heading date: 50% of the plants headed
***Grain hardness: > 40 = hard wheat; < 40 = soft wheat

Previous crop: Dry beans; Planted: 10/15/96; Harvested: 9/10/97; Seeding rate: 40 lb/acre; Soil type: Wittco silty clay; loam; Precipitation: 11.4 inches (10/15/96 - 7/31/97)
Fertilizer: 50 lb N/acre (NH4NO3) broadcast on 5/6/97; Herbicide: Harmony Extra 1/2 oz/acre + 2,4-D amine 4 oz/acre on 5/14/97; Insecticide: None

Note: The 1996-97 growing season had abundant winter moisture with good spring rains. All entries including the Russian wheat aphid (RWA) resistant variety Halt displayed RWA symptoms by 6/9. The wheat was not sprayed for RWA. The results indicate that Halt performed well in fare of RWA pressure. Dwarf bunt was noted at harvest in Halt, Wanser, and WA7814.

Table 14. Irrigated Winter Wheat Performance Trial at Yellow Jacket in 1996/97.

	Yield*	Test wt	Plant height	Heading date	Grain protein	Grain hardness
Variety	bu/ac	lb/bu	inches	**	%	***
Quantum 555	95.9	59.5	32	6/16	9.7	74
Stephens	92.8	57.5	32	6/16	10.8	16
Garland	90.2	57.0	24	6/23	11.4	65
Tam 107	89.0	60.5	28	6/09	10.2	94
Halt	86.3	58.5	28	6/09	9.5	68
Fairview	83.6	60.5	37	6/16	9.7	103
Mean	**89.6**					
CV %	11					
$LSD_{(0.05)}$	NS					

*Bushel yield based on 60 lb/bu and not adjusted for moisture
**Heading date: 50% of the plants headed
***Grain hardness: > 40 = hard wheat; < 40 = soft wheat

Previous crop: Fallow; Planted: 10/17/96; Harvested: 9/5/97; Seeding rate: 80 lb/acre; Soil type: Wittco silty clay loam; Precipitation: 11.4 inches (10/17/96 - 7/31/97); Irrigation: 15.5 in gross (6 sprinkler applications); Fertilizer: 80 lb N/acre (NH4NO3) broadcast on 5/7/97; Herbicide: Harmony Extra 1/2 oz/acre + 2,4-D amine 4 oz/acre on 5/14/97; Insecticide: None

Note: All varieties including the Russian wheat aphid (RWA) resistant variety Halt displayed RWA symptoms by 6/9. The RWA infestation level prior to heading was not believed high enough to make an insecticide treatment economical.

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