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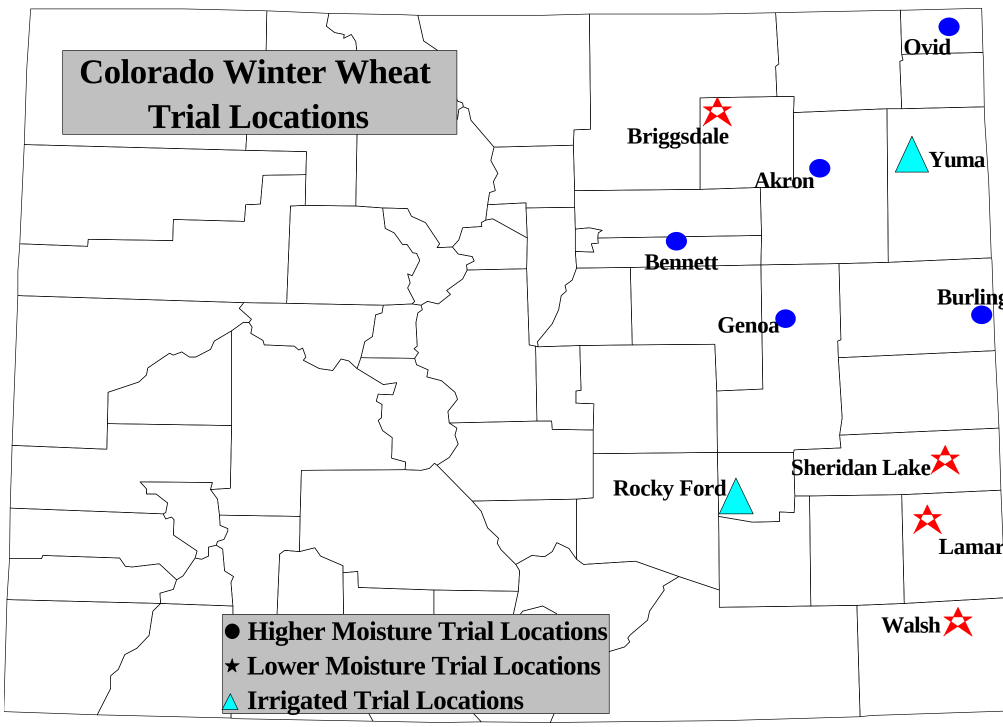

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1996 COLORADO WINTER WHEAT VARIETY PERFORMANCE TRIALS

Introduction

The theme of this report, *Making Better Decisions*, is founded on the conviction that more and better information and better use of performance trial results by Colorado wheat producers can lead to better variety selection. An estimated 3.1 million acres of winter wheat were planted in Colorado in the fall of 1996 that should produce a crop with a conservative value of $333 million! Experience indicates that increases in yield up to 20% or more can result from wise selection of varieties. The variety decision may be worth as much as $60 million to Colorado wheat producers annually.

Colorado State University, with all its collaborators, are committed to providing the best information, in an appealing form, and in the most timely manner. Immediately after harvest, and prior to fall planting, we provide rapid and widespread access to current trial results in different media forms:

1) Variety trial results are reported via e-mail to county Cooperative Extension offices; and
2) Variety trial results are put up on DTN (Data Transmission Network); and
3) Variety trial results are available on the Soil and Crop Sciences Extension Internet page (http://www.colostate.edu/Depts/SoilCrop/extens.html); and
4) Variety trial results are faxed, or e-mailed, to anyone requesting trial results.

A hard copy report like this one is distributed during June at the Colorado Wheat Field Days. With contributions from Colorado State University specialists in crop production, breeding, entomology, pathology, irrigation, fertility, marketing, and weed science, this report is intended to serve as a wheat production resource, as well as the traditional summary of winter wheat variety performance in eastern Colorado.

Variety Performance Trials

In 1995, dry fall planting conditions in Colorado led to delayed planting and small wheat plants going into winter. In early 1996, plant stands were reduced, sometimes dramatically, by multiple warming trends at early spring green-up followed by freezing temperatures. Much of the wheat crop in southeastern Colorado was lost to drought, including lower moisture trials at Lamar, Sheridan Lake and Walsh before late spring rains arrived in abundance.

Winter wheat variety trials in Colorado are conducted by moisture group, as **three subsets of locations** with different varieties in each subset except for some varieties that are common to all three subsets. In 1996, the only **lower moisture** (LM) variety trial harvested was at Briggsdale. Successful **higher moisture** (HM) trials were conducted at Akron, Bennett, Burlington, Genoa, and Ovid. Two successful **irrigated** (I) winter wheat variety trials were conducted at Rocky Ford and Yuma. A randomized complete block field design with four replicates was used in all trials. Wheat plots were planted and harvested by Colorado State University research personnel with Colorado State University equipment. Grain yields are adjusted to 12% moisture content. Harvest area was approximately 200 sq.ft., consisting of four 12 inch-spaced rows and 50 feet in length. All varieties were seeded at 500,000 seeds/acre for the dryland trials and 600,000 seeds/acre for the irrigated trials. The least significant difference (LSD) value, alpha=0.30, is reported for yield. Carmer (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, over 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 tested in the Colorado variety trials throughout eastern Colorado. In 1996, 27 numbered lines were in their first year of testing, seven lines in their second year, and one line in it's fifth year of testing.

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

Table 1. 1996 Variety Performance Trial Information.

Locations	Entries #	Date of Planting 1995	Date of Harvest 1996	Soil Texture	Previous Crop	Fertilization (lbs/A) Nitrogen, N	Phosphorus, P_2O_5	Type of Irrigation
Higher Moisture								
Akron	38	Sept 24	July 18	Silt Loam	Fallow	60	30	None
Bennett	38	Sept 13	July 12	Sandy Clay	Fallow	30	0	None
Burlington	38	Sept 14	July 16	Silt Loam	Fallow	60	30	None
Genoa	38	Sept 13	July 22					None
Ovid	38	Sept 18	July 22	Silt Loam	Fallow	60	30	None
Lower Moisture								
Briggsdale	36	Sept 10	July 17	Sandy Clay	Fallow	0	0	None
Irrigated								
Rocky Ford	22	Sept 20	July 11	Silty Clay Loam	Fallow	0	0	Furrow
Yuma	22	Sept 16	July 28	Sandy Loam	Potato	150	60	Sprinkler

Descriptions of Varieties in Trials

Akron — A 1994 Colorado release from the cross TAM 107/Hail. It is a semidwarf with lax heads.

Alliance — It was developed by Nebraska and the USDA-ARS from the cross Arkan/Colt//Chisholm sib. Alliance is similar to Redland in test weight and protein. It has shown above normal tolerance to crown rot and root rot.

Arapahoe — A 1988 Nebraska release. It is similar to Brule, but with higher test weight and one day earlier maturity.

Arlin — A 1992 Kansas release to the American White Wheat Producers Association. It is a hard white winter wheat and is a semidwarf with marginal winter hardiness. It is moderately resistant to Soil Borne Mosaic Virus. Arlin has milling and dough mixing properties similar to Newton and is 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.

Custer — A 1994 Oklahoma State release from the cross Chisholm/TAM 105//Romanian line. Medium early and susceptible to Soil Borne Mosaic Virus. It is moderately resistant to leaf rust. It has excellent yield potential, but very questionable quality.

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 that was developed from a cross of a sister-line of Karl by Stephens, a high yielding soft white wheat. It is resistant to Soil Borne Mosaic Virus, spindle streak, tan spot, and speckled leaf blotch. It is moderately resistant to glume blotch, bacterial streak, cephalosporium stripe and wheat streak. It is susceptible to powdery mildew, Hessian fly, greenbugs and Russian wheat aphid. It is a bronze chaffed semidwarf, and 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. It is a reselection from 'Karl', similar in most traits, but improved leaf rust resistance, earlier maturity, and higher yielding than Karl.

KS84HW196 — A 1986 Kansas release hard white winter wheat. It is similar to Newton in most traits.

Lamar	A 1988 Colorado release derived from a cross of Vona with an experimental line to improve test weight. Drought resistant.
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.
Ogallala	A 1993 Agripro release.
Platte	A 1994 Agripro release semidwarf hard white winter wheat.
Quantum 566	A 1994 hybrid wheat release from Hybritech, Inc.
Quantum AP7501	New winter wheat hybrid from Agripro.
Quantum AP7510	New winter wheat hybrid from Agripro.
Quantum AP7601	New winter wheat hybrid from Agripro.
Rio Blanco	A 1989 Agripro hard white winter wheat released by Agripro. Semidwarf height with moderate resistance to sprouting and slightly better winter hardiness than Arlin.
Rowdy	A 1995 Agripro release tested as W91-091.
Soloman	A 1994 Agripro release semidwarf hard white winter wheat.
Sandy	A 1980 Colorado release from crosses between a Mexican semidwarf, Trapper and Centurk. Sandy has excellent stand establishment ability and tolerance to root rot.
Scout 66	A selection from Scout released by Nebraska in 1967. It is resistant to shattering, but some difficulty in threshing.
TAM 107	A 1984 Texas release that has reddish brown chaff. It is a backcross-derived line from TAM 105. It is similar to TAM 105, but has resistance to stem rust, good winter hardiness, excellent heat tolerance, good emergence ability, good straw strength, and resistance to biotype C greenbug. It has tolerance to some mite vectors, thus reducing Wheat Streak Mosaic Virus infection.
Vista	A 1992 Nebraska release derived primarily from Brule and Centurk. Heading time similar to Arapahoe.
Wichita	A 1944 Kansas release (long-term check variety).
Yuma	A 1991 Colorado release derived from the cross NS14/NS25/2*Vona.

Table 2. Winter Wheat Higher Moisture Performance Summary for 1996.

	Location										Averages				
	Akron		Bennett		Burlington		Genoa		Ovid		1996			2-Yr	3-Yr
Variety*	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	% Yield of TAM 107	1995/96	1994/95/96
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu		bu/ac	bu/ac
AKRON	87.7	59.0	53.6	58.5	39.7	53.7	34.6	50.7	60.7	54.6	55.3	55.3	103	56.2 [3]**	49.0
QUANTUM 566	85.7	57.6	54.7	57.0	41.6	53.5	34.8	50.4	59.6	53.6	55.3	54.4	103	57.7 [2]	51.1
LAMAR	82.9	59.8	55.9	59.6	34.8	55.2	40.4	49.3	58.8	57.6	54.6	56.3	102	53.3	45.9
TAM 107	82.5	57.6	54.2	56.8	43.3	55.8	26.7	46.7	61.6	54.6	53.6	54.3	100	53.1	46.6
ALLIANCE	86.1	57.0	55.3	57.1	43.2	54.5	30.6	49.5	50.5	52.0	53.1	54.0	99	55.9 [4]	-----
YUMA-R21	84.6	59.0	53.4	57.6	39.0	55.1	32.2	51.6	49.2	54.7	51.7	55.6	96	-----	-----
YUMA	84.3	57.6	61.0	57.5	33.9	52.8	31.1	47.2	47.8	54.2	51.6	53.9	96	55.8 [5]	49.2
JAGGER	90.3	57.0	52.8	55.9	36.7	54.9	22.3	47.3	55.3	55.6	51.5	54.1	96	59.7 [1]	-----
SANDY	84.0	59.6	53.7	60.1	38.2	54.3	31.2	48.2	49.9	54.7	51.4	55.4	96	48.5	43.1
TAM 107-R3	77.4	57.4	48.6	56.7	42.6	55.5	24.7	50.9	56.1	55.5	49.9	55.2	93	-----	-----
HALT	83.3	56.6	45.4	56.6	37.5	53.2	20.0	49.1	58.9	54.8	49.0	54.1	91	51.9	45.5
AGRI. PLATTE	82.2	60.3	50.8	57.9	40.9	57.4	34.5	50.8	36.2	55.5	48.9	56.4	91	-----	-----
SCOUT 66	72.0	58.4	50.3	58.4	38.2	55.8	32.1	49.7	52.1	55.3	48.9	55.5	91	44.8	40.3
TAM 107-R6	78.9	57.4	47.7	56.5	43.0	55.3	23.6	47.7	50.8	54.4	48.8	54.3	91	-----	-----
ARLIN	84.0	57.6	49.1	56.7	32.1	54.5	24.0	49.3	50.0	57.0	47.8	55.0	89	51.4	44.1
TAM 107-R7	75.8	56.9	47.9	56.7	42.8	55.2	27.1	48.5	39.7	53.6	46.7	54.2	87	-----	-----
VISTA	80.1	56.4	53.2	56.9	41.6	54.8	22.6	47.3	35.7	52.4	46.6	53.6	87	54.1	47.9
TAM 107-R2	74.3	57.8	50.7	57.1	37.6	54.6	27.9	49.2	37.6	52.3	45.6	54.2	85	-----	-----
AGRI. LONGHORN	74.9	58.5	46.2	56.3	31.8	53.3	28.3	48.1	46.4	56.0	45.5	54.4	85	51.4	45.1
AGRI. SOLOMON	82.4	58.2	51.7	59.8	22.0	50.3	22.9	35.5	47.4	55.3	45.3	51.9	84	-----	-----
AGRI. LAREDO	80.5	57.1	46.0	56.6	31.8	54.0	23.8	50.9	42.5	54.5	44.9	54.6	84	50.6	45.2
YUMA-R17	76.7	58.1	57.6	57.2	29.7	52.1	28.8	48.4	30.6	50.8	44.7	53.3	83	-----	-----
KARL 92	76.9	57.6	44.1	56.6	34.6	55.3	20.7	50.4	42.7	55.6	43.8	55.1	82	47.6	43.0
AGRI. OGALLALA	78.7	59.2	44.6	59.1	31.0	56.2	23.8	51.9	41.0	56.0	43.8	56.5	82	53.4	46.1
YUMA-R18	80.2	58.8	53.4	56.8	28.4	52.5	27.9	50.4	27.2	50.4	43.4	53.8	81	-----	-----
WICHITA	72.3	58.2	46.5	57.3	34.2	56.4	26.5	49.2	37.1	56.3	43.3	55.5	81	40.3	36.6
CUSTER	76.7	59.3	46.2	58.8	32.8	54.9	20.8	50.2	39.8	54.2	43.3	55.5	81	50.8	-----
AGRI. RIO BLANCO	75.6	58.5	46.0	58.9	34.8	54.8	23.4	49.7	33.7	53.6	42.7	55.1	80	46.0	40.7
ARAPAHOE	76.8	56.8	45.4	57.3	37.8	54.1	24.1	46.9	28.9	50.4	42.6	53.1	79	51.7	45.6
TAM 200-R9	76.6	60.7	50.1	59.7	29.3	56.6	24.2	49.3	32.5	53.8	42.5	56.0	79	-----	-----
YUMA-R12	77.4	56.9	51.3	56.3	33.1	53.9	17.7	44.3	28.8	51.9	41.7	52.7	78	-----	-----
Means	80.1	58.1	50.6	57.6	36.1	54.5	26.9	48.7	44.8	54.2	47.7	54.6			
CV%	7.3		11.5		12.3		21.2		12.5						
$LSD_{(.3)}$	4.3		4.1		3.3		4.9		5.0						

*Varieties ranked by the average yield over five locations in 1996.
**Rank of top five varieties in two-year average yields.

Table 3. Winter Wheat Lower Moisture Performance Summary for 1996.

	Location		
	Briggsdale		
Variety*	Yield	Test Wt	% Yield of TAM 107
	bu/ac	lb/bu	
YUMA	77.6	55.1	127
ALLIANCE	76.4	56.4	125
LAMAR-R31	72.4	58.2	119
LAMAR	72.3	57.9	119
VISTA	70.9	55.3	116
LAMAR-R32	70.7	58.6	116
JAGGER	70.1	54.5	115
HALT	70.1	55.2	115
AKRON	69.9	57.6	115
SANDY	69.6	58.7	114
ARLIN	69.6	54.3	114
LAMAR-R33	68.6	59.4	113
LAMAR-R35	67.4	58.9	110
BUCKSKIN	65.7	57.9	108
YUMA-R17	65.7	55.0	108
BACA	65.6	57.2	108
YUMA-R21	65.1	56.7	107
TAM 107-R3	62.9	55.4	103
TAM 107-R7	62.0	55.5	102
TAM 107-R2	61.6	55.6	101
YUMA-R12	61.5	54.2	101
TAM 107	61.0	55.0	100
YUMA-R18	59.4	54.3	97
TAM 107-R6	58.9	55.4	97
KARL 92	57.6	55.3	95
HW84196	57.5	56.6	94
WICHITA	48.4	54.6	79
Means	65.9	56.2	
CV%	10.6		
$LSD_{(.3)}$	5.2		

*Varieties ranked by the yield for 1996.

Table 4. Winter Wheat Irrigated Performance Summary for 1996.

	Location				Averages				
	Rocky Ford		Yuma		1996			2-Yr	3-Yr
Variety*	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	% Yield of TAM 107	1995/96	1994/95/96
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu		bu/ac	bu/ac
QUANTUM AP 7510	71.5	54.6	96.9	57.3	84.2	55.9	101	82.5 [1]**	-----
TAM 107	78.9	50.0	87.5	57.3	83.2	53.7	100	68.6 [5]	63.7
AKRON	77.1	52.0	87.7	56.2	82.4	54.1	99	67.3	65.1
QUANTUM AP 7501	69.8	52.3	92.1	57.3	81.0	54.8	97	78.0 [2]	-----
CUSTER	66.1	53.5	95.6	58.8	80.8	56.2	97	72.4 [4]	-----
YUMA	67.7	50.5	91.3	55.8	79.5	53.2	96	68.6	64.8
KARL 92	64.8	51.1	93.5	59.0	79.2	55.0	95	67.7	65.0
AGRIPRO PLATTE	74.3	53.0	83.9	57.3	79.1	55.1	95	-----	-----
QUANTUM AP 7601	70.3	53.0	87.3	57.5	78.8	55.3	95	74.2 [3]	-----
JAGGER	68.5	51.0	87.4	56.3	77.9	53.6	94	-----	-----
VISTA	71.1	53.1	83.7	56.6	77.4	54.8	93	64.5	62.7
AGRIPRO LAREDO	63.2	52.3	90.7	57.1	77.0	54.7	93	66.1	62.4
HALT	64.9	51.7	88.7	56.7	76.8	54.2	92	67.1	-----
AGRIPRO OGALLALA	66.8	53.5	86.4	59.0	76.6	56.3	92	68.2	65.1
TAM 200-R10	72.3	52.7	74.5	57.5	73.4	55.1	88	-----	-----
AGRIPRO ROWDY	54.4	53.8	82.7	57.4	68.5	55.6	82	64.4	-----
AGRIPRO SOLOMON	41.6	44.8	74.1	56.1	57.8	50.4	69	-----	-----
Means	67.3	51.9	87.3	57.2	77.3	54.6			
CV%	12.6		9.6						
LSD $_{(.3)}$	6.4		6.1						

*Varieties ranked by the average yield over two locations in 1996.
**Rank of top five varieties in two-year average yields.

Table 5. Comparison of Winter Wheat Varieties for Agronomic, Pest, and Quality Traits.[1]

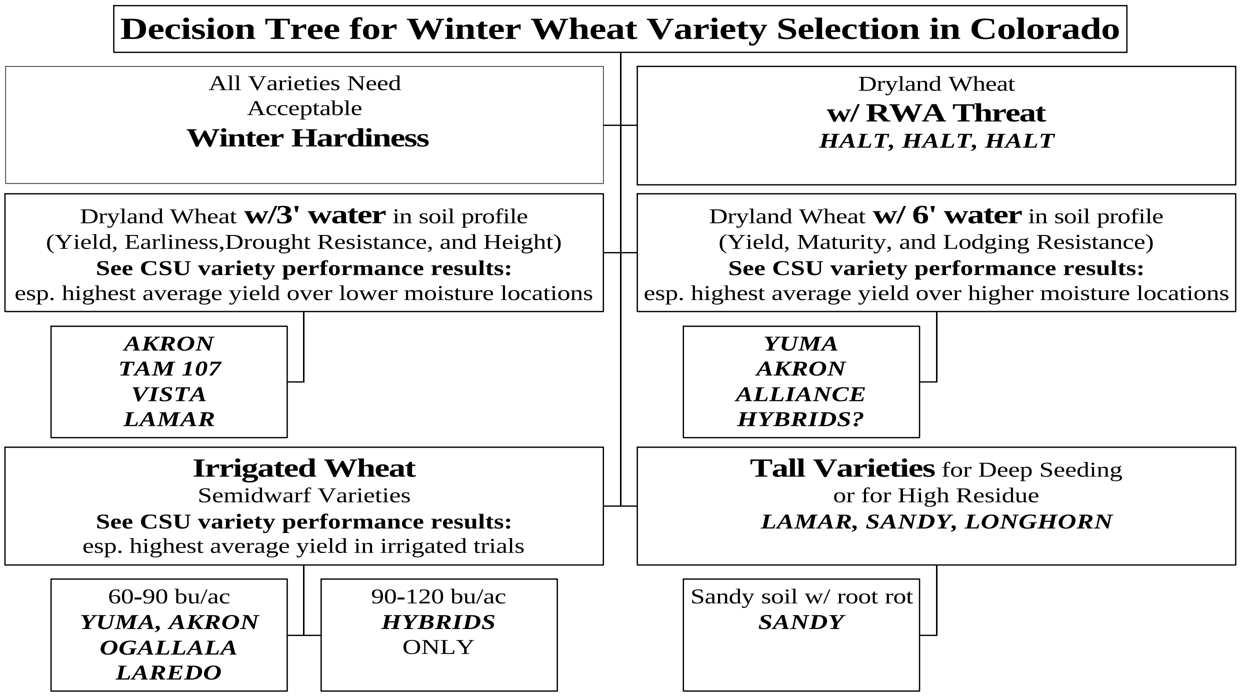
Variety	Percent of Acreage	Relative					Resistance or Tolerance to					Relative Quality		
	1996[2]	Height (in)	Maturity	Straw Strght	Winter Hardy	Coleop length (mm)	RWA	Leaf Rust	Stem Rust	Hess. Fly	Wheat Streak Mosaic	Milling	Mixing[3]	Baking
Akron	3.1	32	3	2	3	75	9	1	3	-	3	2	3	2
Arapahoe	1.0	39	4	4	2	75	9	1	1	5	8	2	2	2
Baca	1.7	47	2	6	3	120	9	5	5	-	7	2	0	3
Buckskin	-	47	4	5	3	120	9	-	5	-	-	-	-	-
Fairview	1.0	40	4	5	3	-	9	-	-	-	-	2	3	3
Halt	0.8	30	2	2	3	75	1	8	1	-	3	2	3	2
Hawk	1.1	29	3	4	3	75	9	7	5	8	6	2	0	3
Ike	1.2	35	3	4	3	75	9	2	2	2	6	3	3	3
Jagger	-	32	3	2	8	75	9	1	1	-	-	2	2	2
Lamar	8.0	41	4	4	2	110	9	7	2	8	6	2	3	2
Laredo	1.4	30	3	3	3	80	9	1	2	8	-	2	2	6
Longhorn	2.3	35	3	3	3	110	9	-	-	8	-	2	3	6
Ogallala	-	31	3	3	3	-	9	2	2	8	3	2	-	-
QT 542	-	41	4	4	1	110	9	7	6	-	-	-	-	-
QT 549	-	30	4	3	1	75	9	5	3	-	-	-	-	-
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)	2.1	47	2	6	3	120	9	5	5	7	7	2	0	3
TAM 107	55.1	31	2	3	3	80	9	9	1	8	2	2	4	6
TAM 200	1.6	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	2.2	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	0.8	31	3	4	3	70	9	5	3	5	6	2	0	3
Vona	1.0	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	6.0	30	3	2	5	70	9	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 1997 harvest, based on Colorado Crop & Livestock Reporting Service survey.

[3]A zero rating means long mixing time. Varieties with a 0 rating are particularly good for blending with mellow or weak wheats. Mixing time will vary with the environmental conditions under which the varieties are grown.

MAKING BETTER VARIETY DECISIONS



CSU Winter Wheat Variety Suggestions

Jim Quick and Jerry Johnson

The best choice of a winter wheat variety in Colorado depends upon production risk factors that vary in importance and differ across locations and even by years. Stand establishment under dry conditions can differ among varieties. All varieties need acceptable winter hardiness. The potential benefits of early maturity, i.e., heat and drought, must be weighed against the potential for spring frost damage. Resistant varieties should be strongly considered for areas prone to damaged by Russian wheat aphid infestations. Varieties that were high-yielding across locations in CSU wheat variety performance trials should be considered for their yielding ability. Production risks can be significantly reduced by planting more than one variety. The chart above provides a conceptual framework for avoiding poor variety decisions, and suggests varieties that we think Colorado wheat producers should consider for different agroclimatic conditions.

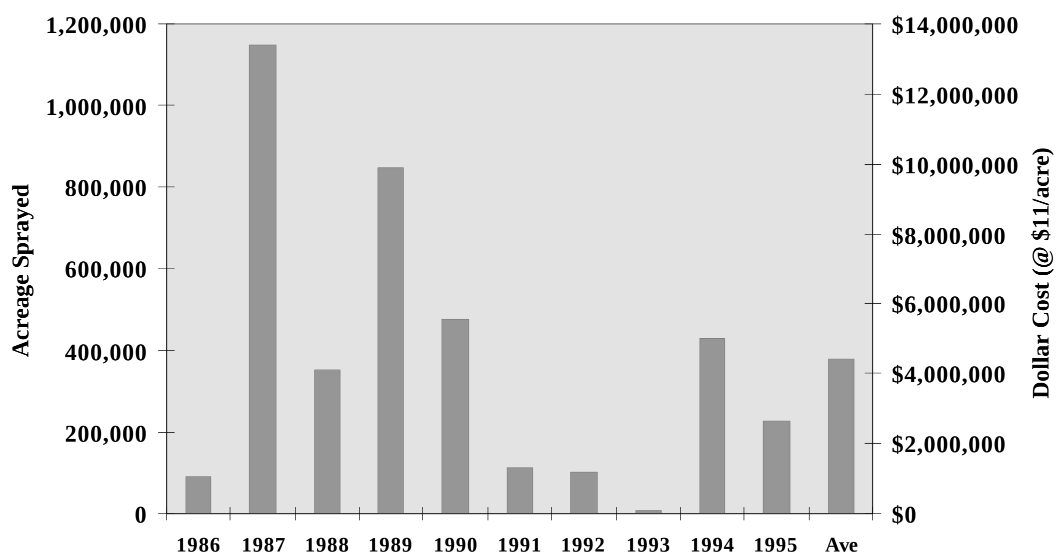
For example, a hypothetical, conservation-sensitive, wheat producer in eastern Arapahoe county in the fall of 1996 (lower moisture, rolling and erodible terrain of light textured soils, and 5 years of 10 has risk of serious RWA infestation) might have debated among planting Halt, or a higher yielding semidwarf variety, or a tall variety. Since there was almost no data from lower moisture trials due to drought in 1996, the grower might consider planting TAM 107. However, CSU trial data shows that Halt is expected to be equal yielding to TAM 107 and since, there is a 50% chance of having to spray for RWA, Halt would be a better choice than TAM 107. Soil moisture in the fall of 1996 was quite good, even in lower moisture areas, so the grower might not be so tempted to grow a tall variety with better chances of obtaining good stands (longer coleoptile) and fall cover to reduce erosion. Nevertheless, a tall variety might be considered. The expected economic cost associated with a 50% probability of having to spray for RWA is 0.5 x $12/acre or $6 per acre. If wheat is expected to sell at the long term average July price of $2.94/bushel, then the grower might plant a tall variety that out yields Halt by 3 or 4 bu/ac. Lamar is the only variety that could, under certain conditions, out yield Halt by that amount and provide the benefits of a tall variety. However, Lamar is later maturing so the grower would have to balance the risk of late season drought against the potential benefits of a tall variety. In the end the grower might justifiably decide to plant the most erodible portions of his farm to Lamar and the remainder to Halt.

Where Do We Stand With 'Halt'?

Jerry Johnson, Jim Quick, Frank Peairs, Gretchen Hopley,
Gary Hein[1], Mike Brewer[2], and Jim Krall[3]

Since identification in Texas for the first time in 1986, the Russian wheat aphid (RWA), a native to Southern Russia, has been exceedingly costly to U.S. cereal producers. By 1990, the Russian wheat aphid had been found in 17 western states as well as three western Canadian provinces. In Colorado, over the past ten years more than 4,000,000 acres have been sprayed at a cost exceeding $45 million to our wheat growers (Figure 1). Spraying four million acres of wheat has also added large amounts of pesticide, at additional unknown cost, to our fragile agricultural systems. The Russian wheat aphid has also nearly eliminated spring barley from eastern Colorado where it once thrived on nearly 100,000 acres.

Figure 1. Colorado Wheat Acreage Sprayed for Russian Wheat Aphid 1986-95 and Estimated Dollar Cost



Colorado State University wheat breeder, Jim Quick, rapidly procured resistance to the Russian wheat aphid and in collaboration with CSU Entomologist, Frank Peairs, has bred wheats for resistance under Colorado conditions. Using accelerated breeding techniques, this CSU team was able to release the first hard red winter wheat variety resistant to Russian wheat aphid in 1994---- only seven years after the first cross had been made! Halt is a white chaff, early-maturing variety (within a day of TAM 107), with good straw strength, and good milling and baking qualities. While Halt was being developed, TAM 107 became the dominant wheat variety in Colorado. Figure 2 below shows the growth and dominance of TAM 107 acreage in Colorado from 1988 to 1997.

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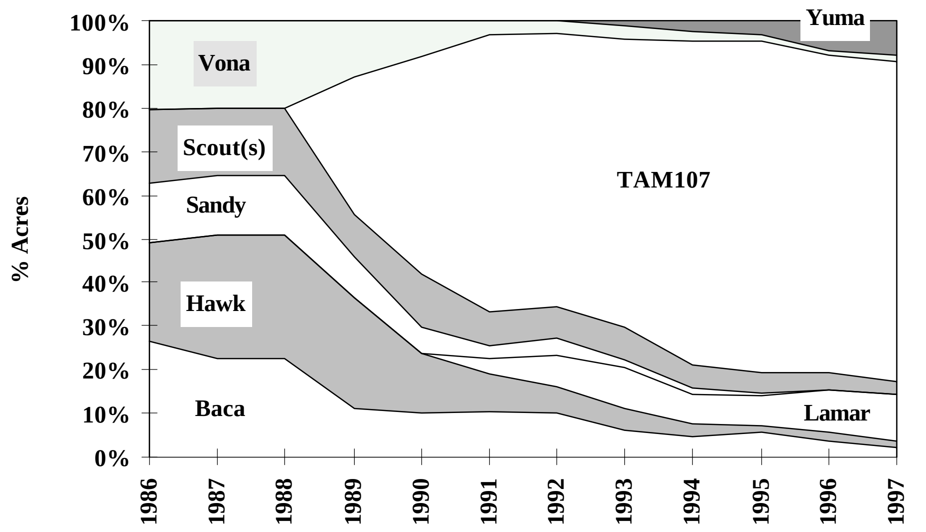
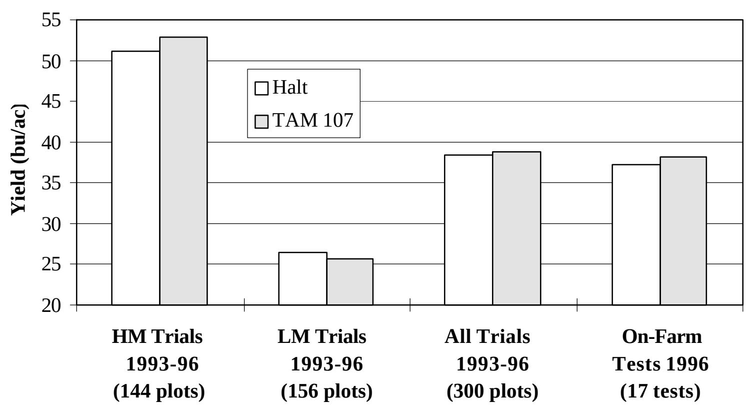
Figure 2. Wheat Varieties Planted in Colorado, 1986-97



Halt Performance in Colorado

Since 1993, Halt and TAM 107 have been tested in 300 plots within replicated trials across eastern Colorado in multi-location variety and seeding rate trials. Yield performance for the two varieties is shown in Figure 3. Results are grouped according to the general moisture conditions that prevail in eastern Colorado (HM = higher moisture locations which are mostly north of I-70 and LM = low moisture locations which are mostly south of I-70).

Figure 3. Yield Performance of Halt and TAM 107 in Colorado, 1993-96



In the fall of 1995, 28 collaborative on-farm tests (COFT) of Halt and TAM 107 were planted by eastern Colorado wheat producers in Baca, Prowers, Kiowa, Adams, Arapahoe, Washington, and Weld counties. The varieties were planted by grower-collaborators (volunteers) in the lower moisture, more RWA susceptible, counties side-by-side in long, narrow strips in the growers' fields and using their equipment.

Dry fall planting conditions in the fall of 1995 led to delayed planting and small wheat plants going into winter. These same conditions resulted in reduced Russian wheat aphid populations. Plant stands were reduced, sometimes dramatically, by multiple warming trends at early spring green-up followed by freezing temperatures. Much of the wheat crop in SE Colorado was lost, including all but three COFT trials, before late spring rains arrived in abundance. Yields in Table 1. have been corrected to 12% grain moisture.

Table 1. Halt and TAM 107 Performance in 1996, Collaborative On-Farm Tests.

County Location	Halt	TAM 107
	bu/ac	bu/ac
Northwest Weld	23.8	28.7
Northcentral Weld	33.1	37.2
Central Washington I.	51.9	46.1
Central Washington II.	56.9	51.5
Southeast Weld I.	29.2	28.1
Southeast Weld II.	24.9	24.7
West Adams	42.3	42.2
East Adams	45.1	40.5
Southwest Washington I.	40.0	38.1
Southwest Washington II.	72.7	72.8
Southeast Adams	50.0	48.3
Northeast Arapahoe	33.9	35.4
Southeast Arapahoe I.	52.0	53.6
Southeast Arapahoe II.	44.4	48.0
Northeast Prowers	6.0	14.2
Northcentral Prowers I.	10.5	13.2
Northcentral Prowers II.	17.3	26.8
Average Yields	37.3	38.2

The performance of Halt was very similar to TAM 107 in these on-farm tests as it was in CSU's replicated small-plot trials from 1993-96 (Figure 3). There was no RWA pressure at any location in 1996. In terms of yield, the choice of Halt appears to be a 'win/win' situation compared to TAM 107. If there is an RWA infestation, Halt will provide protection, if there is no RWA problem growers can expect to obtain equal yields with Halt as with TAM 107. The test weight for Halt averages 0.6 to 0.9 lb/bu lower than TAM 107 when grown under similar conditions in Colorado. Both Halt and TAM 107 are susceptible to less rust but Halt has much better mixing and baking quality.

In the fall of 1996, 16 new on-farm tests of Halt and TAM 107 were planted by collaborating growers in Baca, Prowers, Kiowa, Cheyenne, Adams, Weld, and Morgan counties. Collaboration has been the key to success of the on-farm tests: 20 volunteer wheat growers, 7 county extension agents, CSU crops testing, wheat breeding, extension entomology programs, CWAC, USDA/ARS (weigh wagon), seed grower donations (Kenneth Pottorff [2200 lb Halt seed] and Douglas Melcher [2200 lb TAM 107 seed]), and many more. The results of the new test should prove extremely interesting as serious damage from RWA mounts. The newly developed RWA-resistant lines of TAM 107, Yuma, and Lamar are planned for introduction in the on-farm tests to be planted in the fall of 1998.

Halt Performance in Nebraska and Wyoming

University of Nebraska entomologists, Gary Hein and John Thomas, maintained artificially infested plots of TAM 107 and Arapahoe from 1994-1996 at Scottsbluff to measure the yield loss due to RWA on susceptible varieties. On the average, 60-80% of tillers were infested by mid-May and this level of infestation resulted in yield losses of 29-46% when compared to non-infested plots of the same varieties.

Halt and five other commonly grown varieties were included in 17 replicated small-plot trials in the Nebraska Panhandle from 1993 through 1996. There were no significant infestations of RWA during the four years. On the average over the 68 plots, Halt (46.0 bu/ac) was higher yielding than TAM 107 (44.8 bu/ac), Buckskin (44.4 bu/ac), Arapahoe (44.3 bu/ac), Centura (44.1 bu/ac), and Pronghorn (43.7 bu/ac). Halt had same average test weight as TAM 107 in these trials.

Nebraska entomologists also conducted on-farm tests of Halt , TAM 107 and Centura in collaboration with four volunteer Nebraska Panhandle growers in 1996. Over the four locations and without any RWA pressure, Halt's average yield was 33.2 bu/ac, Centura's was 32.9 bu/ac, and TAM 107's was 27 bu/ac. On-farm testing is continuing in Nebraska in 1997.

University of Wyoming Entomologist, Mike Brewer, collaboratively conducted three on-farm tests in SE Wyoming in 1996. Halt's average yield was 33.7 bu/ac, TAM 107's 31.2 bu/ac, and Buckskin's 30.6 bu/ac. Halt has been compared to Buckskin in replicated University of Wyoming wheat variety trials in 1994 through 1996. Over eleven trials in three years (42 plots of each variety), Halt yielded 49.8 bu/ac and Buckskin yielded 49.4 bu/ac.

Halt - A Protected Variety

Halt Certified Wheat is protected under the Plant Variety Protection Act and can only be sold as Certified seed. Only existing Certified seed growers, listed below, may produce and sell Halt seed. Any seed producer may apply for certification through the Colorado Seed Growers Association (970-491-6202). Buyers of Certified seed pay royalties, one cent per pound of Certified seed purchased, to the Colorado Wheat Research Foundation (CWRF), who officially owns the variety. CWRF returns most of the royalty fees to Colorado State University's wheat variety improvement program- wheat breeding, wheat quality, molecular genetics, plant protection, and variety testing.

Halt Certified Wheat Seed Producers

Gayle Anderson, Sedgwick, Co	970-463-5735
Edsel and Dennis Collette, Kirk, CO	970-463-4302
Ron Drosselmeyer, Two Buttes, CO	719-326-5969
Hansen Farms, Genoa, CO	719-763-2483
Kenneth Pottorff Seed, CO	719-348-5213
Kochis farms, Matheson, CO	719-775-2596
Curtis Lewton, Bennett, CO	303-644-4327
Don Mais, Stoneham, CO	970-735-2281
Douglas Melcher, Holly, CO	719-537-6214
Propst Ranch, Merino, CO	970-522-3178
Scherler Farms, Sheridan Lake, CO	719-729-3367
Ed Scherler, Matheson, CO	719-541-2885
Eugene Splitter, Sheridan Lake, CO	719-729-3567
Trupp's Certified Seed, Bennett, CO	303-644-3416
Lance Theobold, Pine Bluffs, WY	307-245-3431

WHEAT PEST MANAGEMENT

Insect Pests of Colorado Wheat

Frank Peairs

Several springtime pests attack wheat in eastern Colorado, including aphids (mostly Russian wheat aphid), cutworms (army cutworm and pale western cutworm), and mites (mostly brown wheat mite, Banks grass mite on rare occasions). In normal-to-drier years it is possible to be confronted simultaneously with two or more of these problems. With one exception, the only management tactic available when these pests start to build up in the spring is a well-timed insecticide application based on scouting and established action thresholds. If the crop has not yet jointed, grazing is an option in some parts of the state that will delay, but not eliminate, the need to treat aphid and mite problems. Grazing has reduced cutworm population densities by about 2/3 in our studies and therefore could control low to moderate infestations.

Colorado Wheat Pests and Their Damage

Army Cutworm: Pale-to-dark gray caterpillars feeding on above and below-ground foliage early in spring. May also show a preference for broad-leaf weeds. Heavy feeding damage makes crop look as if it had been grazed.

Banks Grass Mite: Leaves silvery then brown at tips and edges. Webbing present. Associated with dry growing conditions. Fall infestations are common along field margins near maturing corn. Damaging infestations are rare in springtime. Similar in appearance to brown wheat mite but lacking prominent front legs.

Brown Wheat Mite: Leaves brown at tip, generally with a silvery and then a scorched appearance. Small (pencil point) brown mites with relatively long front legs. Smaller, round eggs in soil are bright red in color if population is active. White eggs indicate that the population is moving into its inactive summer phase. Outbreaks are closely associated with prolonged dry weather conditions.

Pale western cutworm: Plants cut just above crown below soil line in early spring. Damage first appears as wilting and dying plants. Large areas of damage can appear as drought injury, and entire fields may be destroyed. Most common in dry years and in dry parts of fields. White, unmarked caterpillars with distinct brown head. "Face" with two slanted darker brown bars.

Russian Wheat Aphid: Leaves rolled and containing small green insects. Leaves with white streaking and, at cooler temperatures, pinkish-purplish discoloration. Plants may be stunted or prostrate. Emerged heads may be bleached or have awns trapped in tightly-rolled flag leaf. Heavily damaged plants may occur in circular patches.

Scouting and Action Thresholds

Scout for **cutworms** by walking a diagonal or zigzag pattern across the field, stopping at least 10 times and checking for cutworms along one foot of drill row. Check for cutworms in the soil at the base of the plants and halfway to the adjacent rows on either side. Consider treating for pale western cutworm if an average of 2-3 are found per row foot. Consider treating for army cutworm when there are two or more cutworms per square foot if the crop is moisture stressed or thin. If the crop is healthy, consider treating when there are four or more cutworms per square foot.

To determine the infestation level for **Russian wheat aphid**, walk a diagonal or zigzag pattern across the field, stop 10 times and collect 10 tillers **at random** at each stop. Examine the tillers and count the number that contains RWA. This number is the percent infested tillers and can be compared to the economic threshold calculated with the following formula **for susceptible varieties**:

ET = <u>CC X 200</u> EY x MV

where:

ET = Percent infested tillers above which an insecticide application will be cost effective.
CC = Control cost per acre (insecticide plus application)
EY = Expected yield per acre
MV = Market value per bushel

After flowering substitute 500 for 200 in the numerator of the formula. If the calculated ET is lower than the percent infested tillers observed, a treatment should be cost effective. There probably is no benefit from insecticide applications made after the crop has reached the soft dough stage.

To determine the infestation level of **brown wheat mite**, walk a diagonal or zigzag pattern across the field, stop at least 10 times and count the mites on the plants in one foot of row. Consider treating if counts average at least 200 mites per row-foot in the early spring. It is best to count on calm, sunny afternoons. Also, if white eggs are present and red eggs are mostly hatched, the population is in natural decline and treatment is not economically justified.

Selecting an Insecticide

The best insecticide choice depends on which of these pests are present. There are no research results available on controlling pest combinations, so following guidelines are based on experience with single pest situations. **Our general experience with tank mixing these insecticides with wheat herbicides is that you are more likely to experience crop injury as (1) crop stress increases and as (2) the number of chemicals mixed together increases.**

PEST OR PEST COMBINATION	GOOD INSECTICIDE CHOICES
ARMY CUTWORM	WARRIOR 1E
BROWN WHEAT MITE	DIMETHOATE (various formulations)
RUSSIAN WHEAT APHID	LORSBAN 4E-SG, DI-SYSTON 8E
ARMY CUTWORM + BROWN WHEAT MITE	WARRIOR 1E + DIMETHOATE
ARMY CUTWORM + RUSSIAN WHEAT APHID	WARRIOR 1E + LORSBAN 4E-SG
BROWN WHEAT MITE + RUSSIAN WHEAT APHID	LORSBAN 4E-SG

BE SURE TO READ, UNDERSTAND, AND FOLLOW ALL LABEL INSTRUCTIONS.

Kochia Management Issues in Winter Wheat

Phil Westra and Tim D'Amato[4]

Kochia is one of the most widespread and competitive weeds in winter wheat fields of the Central Great Plains region. Kochia, a spring annual, typically emerges between mid-March and mid-April in Colorado wheat fields depending on soil temperature and moisture. Kochia not only competes with wheat to reduce yields but can remain green at harvest time and cause serious wheat harvesting problems.

Management of kochia infestations in wheat can be costly and difficult. Sulfonylurea (SU) herbicides (Glean, Ally, Amber, and others) were effective in controlling kochia when first introduced for use on wheat in the early 1980's. Unfortunately, continuous use of SU herbicides has resulted in the appearance of resistant kochia biotypes. SU herbicides continued to be used in tankmixes with 2,4-D and/or Banvel, but tankmixes with 2,4-D did not provide effective kochia control and resistant kochia biotypes continued to appear in Colorado wheatfields. A 3-year statewide survey of kochia infestations in Colorado, conducted by the CSU Weed Science program from 1991-1993, revealed a high percentage (50% or greater) of kochia was resistant to SU herbicides. In addition, less than 20% of kochia plants were 100% susceptible to SU herbicides.

Banvel has been an effective kochia herbicide, and at rates of 3 or 4 ounces product/acre provides 2-4 weeks residual weed control in the cool, early spring conditions. However, Banvel use under certain conditions has been associated with crop damage, particularly when used on TAM 107. Studies were conducted by CSU Weed Science from 1994-1996 investigating potential for herbicide injury from Banvel, 2,4-D, and Ally (individually and in combinations) on TAM 107, TAM 200, Lamar, Yuma, and Scout 66. Herbicide applications were made early in the spring, at dormancy break, mid-spring when the wheat was fully tillered, and late season when the wheat was jointed. Plots treated with Banvel and Banvel tankmixes would sometimes show visual injury symptoms following the late season application or the earlier timings if followed by frost. Visual injury symptoms appeared on all varieties but did not significantly reduce yields. Data trends, however, suggested that TAM 107 and Scout 66 were more sensitive to Banvel applications than the other wheat varieties, and that application timing can be critical. Our current recommendation for use of Banvel is to apply it as early as possible and to limit the rate of Banvel on TAM 107 to 3 ounces product/acre.

The Karnal Bunt Situation- Spring 1997

Linnea Skoglund and William Brown

Karnal bunt created a great stir in 1996. U.S. wheat exports were halted in March 1996 and the entire wheat industry was mobilized to address the problem. A national Karnal bunt survey was conducted on the entire 1996 U.S. wheat crop to assure foreign importers that important wheat-producing areas of the U.S. are free of Karnal bunt. Exports have resumed from most areas of the country, though a revised quarantine remains in effect for areas of Arizona, California, New Mexico and Texas.

Restrictions were imposed in Alabama, Florida, Georgia, and Tennessee after the national survey uncovered Karnal bunt-like spores in the 1996 wheat crop. It was later learned that the spores came from smutted ryegrass seed that had contaminated the wheat. Ryegrass smut spores do not infect wheat. No bunted wheat was ever found and restrictions were lifted in March 1997.

The 1996 survey went exceptionally well in Colorado due to excellent cooperation among growers, elevator operators, CSU, and state and federal entities. Over 500 wheat samples were carefully inspected at CSU and all found negative for Karnal bunt. The survey will be continued in 1997.

Can we expect Karnal bunt to spread throughout wheat-producing areas and become established? The question continues to rage in the scientific community. *Tilletia indica* teliospores, the survival structure of Karnal bunt found in the soil and on seed, can survive Colorado's climatic conditions. However, the actual infective units, secondary sporidia produced on leaves, require cool temperatures and high humidity at the time of wheat heading and flowering to survive and reproduce. These conditions are not likely to occur, especially in our eastern plains. It remains to been seen whether or not Karnal bunt is here to stay.

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[4]Research Associate, Extension Weed Science

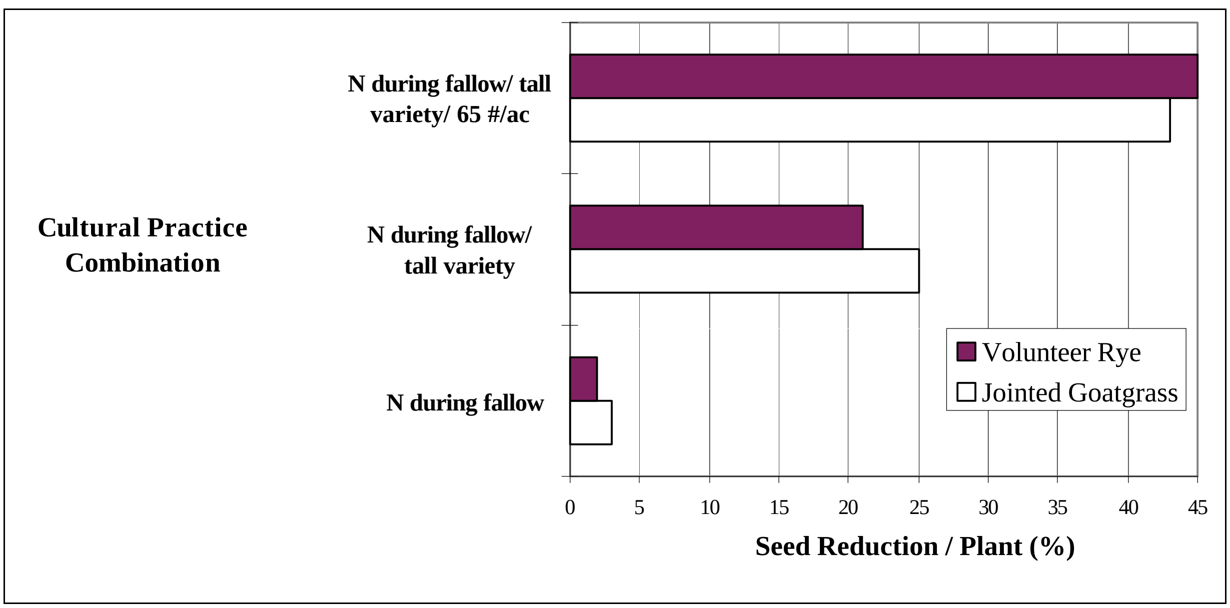
Minimizing Winter Annual Grass Seed Production in the Wheat/Fallow Rotation

Randy Anderson

Jointed goatgrass and volunteer rye are troublesome weeds for producers using a wheat-fallow rotation. Producers must seek to reduce the number of weed seeds in the soil in order to reduce future weed populations because no current herbicides are available that control these weeds in wheat. Combinations of cultural practices can increase the competitiveness of wheat and reduce the growth of jointed goatgrass and volunteer rye. Less weed growth results in lower weed seed production and ultimately, fewer seeds in the soil. Various combinations of these cultural practices were tested at Akron:

Timing of N application: (50 lbs N/ac)	A) during fallow (5 months before planting) B) at planting
Seeding rate:	A) high, 65 lbs seed/ac B) medium, 40 lbs seed/ac
Cultivar:	A) tall, Lamar B) semidwarf, TAM 107

The figure below shows that by combining these cultural practices, N applied during fallow with Lamar planted at 65 lbs/ac, seed number per weed can be reduced by 40 to 45% for both jointed goatgrass and volunteer rye. Using only one or two of the practices is less effective.



WHEAT CROPPING SYSTEMS AND SOIL MANAGEMENT

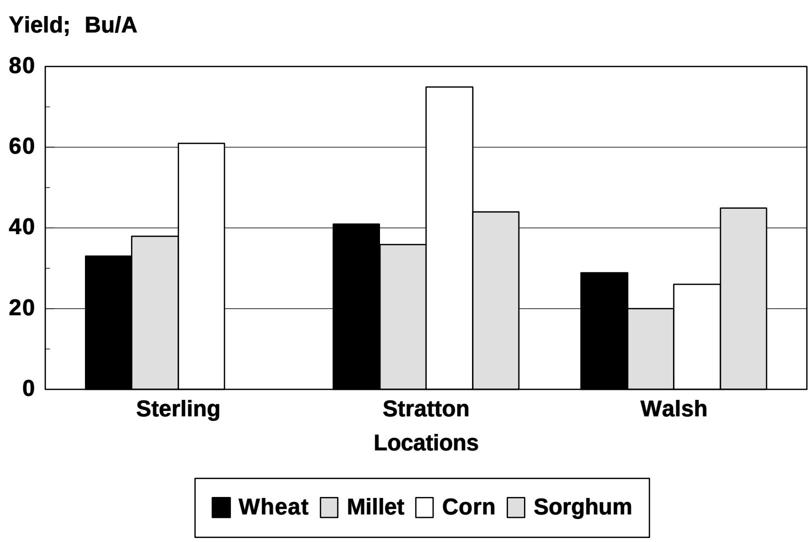
Improving Dryland Cropping Systems for Eastern Colorado

Gary Peterson and Dwayne Westfall

One of the objectives of the Colorado Dryland Agroecosystem Project, established in the fall of 1985, is to determine the conditions under which fewer or shorter summer fallow periods can increase grain yields and income. All results from this project, including grain yields, stover yields, crop residue amounts, soil water measurements, and crop nutrient content are reported annually in technical bulletins. This summary updates our findings for the last 11 years.

The wheat-corn (sorghum)-fallow (3-year) and wheat-corn-millet-fallow or wheat-sorghum-sorghum-fallow (4-year) rotations have increased average annualized grain production by 72- 90% compared to wheat-fallow. Economic analyzes show that the 3-year rotation increases net annual income 25-40% in northeastern Colorado. However, in southeastern Colorado the three year wheat-sorghum-fallow rotation, using stubble mulch tillage in the fallow prior to wheat planting, netted about the same amount of return as reduced till wheat-fallow. No-till management allows more water storage than conventional tillage, but it cost more to control weeds with herbicides than by tillage. Summer crops (corn, grain sorghum, and annual forages) inserted into the rotation leads to more conserved water in the soil profile which is converted to additional production and results in more profit than wheat-fallow system.

The figure below provides a summary of 11 years' average yield history for wheat, corn, sorghum, and proso millet at our three study locations, including results from all years, even those where yield losses occurred due to hail, early and late freezes, insect pests, severe drought, etc.



Getting Started on Variable Rate Fertilizer Technology for Dryland Winter Wheat

Rodrigo Ortega[5], Dwayne Westfall and Gary Peterson

The use of variable rate fertilizer technology (VRT) is receiving considerable attention due to potential economic and environmental benefits, especially minimization of adverse environmental impacts caused by excessive rates of fertilizers and agricultural chemicals. To determine the variability of soil properties in typical dryland cropping systems that are associated with the potential application of VRT to dryland situations, we initiated studies around Sterling and Stratton.

Within the field at Sterling, phosphorus concentrations varied from 1 to 31 ppm, $CaCO_3$ varied from 0-2 %C, and pH from 5.7 to 8.5. Organic matter varied from 1.19 to 2.03 % while inorganic N (NO_3-N + NH_4-N) varied from 12 to 32 ppm across the landscape. At places where there were low P levels, there were high levels of $CaCO_3$ and high pH, but low organic matter. Similar variations in soil properties were found at the Stratton location.

Wheat yield varied from 14 to 97 bu/A at Sterling, and from 17 to 90 bu/A in the Stratton field. The variation of yield within the field was correlated to pH, lime content, inorganic N, soil test P, organic matter, and soil water content in the spring. These results demonstrate that many factors affected yield and that successful use of VRT will depend on more than soil test parameters. We feel that VRT can become an economically viable crop management strategy for dryland systems but we have to develop a "smart sampling" procedure to minimize initial sampling costs and better understand factors that affect yields other than soil test parameters.

Winter Wheat Response to Biosolids (Sewage Sludge) Additions

Ken Barbarick

A primary method for recycling biosolids (sewage sludge) is application to agricultural and range land. Biosolids contain essential plant nutrients such as nitrogen, phosphorus, and zinc, all of which are deficient in many eastern Colorado soils. We established four sites on two farms in Adams County (farmers: Marvin and Kevin Helzer plus Jim and Robby Hazlett) in 1982 to compare Littleton and Englewood biosolids with nitrogen fertilizer effects on grain yield, protein content, elemental content, and soil properties. We grew 'Vona' the first eight years and 'TAM107' the next three years. Biosolids rates ranged from 0 to 12 dry tons/acre and nitrogen fertilizer rates ranged from 0 to 120 pounds/acre.

Our average responses showed that neither biosolids nor nitrogen fertilizer significantly affected grain yields. We did observe a trend of higher yields with biosolids when our sites received above-average precipitation. Biosolids consistently produced higher protein concentrations with most levels above 12%. Projected income averaged $155/acre for biosolids and $135/acre for nitrogen fertilizer. The higher income for biosolids results primarily because most wastewater treatment plants would supply the material without cost to the farmer. This study showed that continuous application of 3 dry tons biosolids/acre would supply adequate nitrogen without causing large accumulations of nitrate in the soil.

We initiated a new study on John Sauter's farm in 1993 to more accurately determine the nitrogen value of the biosolids. To date, we estimate that the each dry ton of biosolids would supply 25 pounds of slow-release nitrogen. Also, the nitrogen carryover for the next crop following application appears to be about 7 pounds of nitrogen per ton of biosolids.

Judicious application of biosolids can supply slow-release nitrogen while recycling the plant nutrients in the waste material. Farmers who recycle biosolids on their land, in essence, are improving the environment while helping the cities handle their waste products.

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[5]Graduate Student, Soil and Crop Sciences

Banding Phosphorus for Better Results
Jessica Davis

Banding phosphorus fertilizer is known to be more efficient than broadcasting. Higher efficiency of banded phosphorus results from less soil-fertilizer contact compared to broadcast application. Improved P-use efficiency means that wheat growers can obtain the same yields with lower P fertilizer rates. However, traditional below-the-seed banding can be more difficult than broadcast application. Surface banding of P can be done with a slight modification of hoe drills. With this technique, fertilizer is dribbled over the seed row after row closure and behind the disks. Wind and water move soil (with P fertilizer) into the furrow and crown roots develop around the band. The table below compares the effects of no P fertilizer with broadcast application, traditional banding below the seed, and surface banding of P fertilizer on yield and P uptake. In this particular study, no yield advantage was observed for broadcast fertilization over the control. Both band application methods resulted in significantly higher yields than the no-P control.

Phosphorus Placement	Yield (bu/A)	P Uptake (lb P_2O_5/A)
no P fertilizer	55.5	25.8
broadcast	55.5	25.8
banded below the seed	60.0	28.0
surface banded	61.0	28.9

Colorado data from Westfall and Follett, SIA no. 557.

Two other P fertilizer application methods that combine application or seeding operations are seed row application and dual application of N and P fertilizer. Seed row application (directly with the seed) has the primary advantage of combining two operations into one. Phosphorus uptake efficiency is increased with seed row application, and P application rates can be reduced. Caution should be taken to make sure that seed and fertilizer remain well mixed during seeding. Dual application of N and P also has the advantage of combining operations by placing N and P in the same injection zone. The presence of N in the combination increases P uptake as well as yields. Usually, anhydrous ammonia is combined with 10-34-0 to achieve this response.

Using Crop Diversity in Alternative Crop Water Extraction

David Nielsen

Inserting a spring-planted crop into a wheat-fallow production system allows producers to take advantage of different rooting and soil water extraction patterns. Crop species show diversity in both the rooting depth and amount of soil water extracted from a given depth.

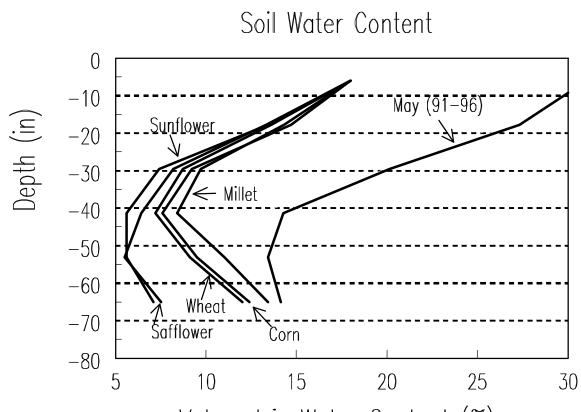


Fig. 1

The average (1991-1996) soil water profile in May following wheat and prior to planting corn is shown in Fig. 1. The difference in water content lines defines the average amount of water available for extraction by the plant during the growing season. Sunflower and safflower are similar, extracting water in the lower depths down to a volumetric water content below 8%. Wheat and corn are similar to one another in soil water extraction with depth. Millet left the highest volumetric water content at the lower soil depths at the end of its growing season. All five of these crops tend to dry the soil down similarly in the top three feet of the profile. Other measures of soil water extraction over time indicate that millet typically extracts water mainly from the top 3 to 4 feet, wheat and corn from the top 4 to 5 feet, and sunflowers and safflower from the top 6 feet.

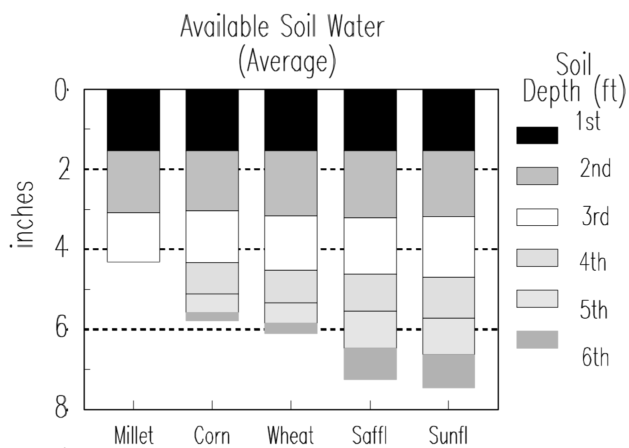


Fig. 2

Water extraction (Fig. 2) is not greatly different among species in the top two feet of the profile. The main differences in profile water extraction occur in the lower half of the profile with no water extraction at this depth by millet, about 1.5 inches extracted by corn and wheat, and about 2.7 inches extracted by safflower and sunflower. These differences are probably due to the difference in rooting depth and density associated with tap root systems (sunflower, safflower) compared with fibrous root systems (corn, wheat, millet). Understanding the differences among species allows producers to make better water and nutrient management decisions. When wet springtime conditions occur, soil water percolates to lower layers of the soil, taking nitrogen with it. This water and nitrogen can be recovered by deeper rooting species. However, if soil samples indicate that water is not available deep in the profile, shallow rooted species (e.g., millet) may be the best choice.

WHEAT MARKETING, RESEARCH, AND EXTENSION

Making Better Marketing Decisions in 1997

Darrell Hanavan

World wheat stocks are still tight by historic standards. Production will again be the key factor affecting the price of wheat in the 1997-98 marketing year. If U.S. and world wheat production is average or below average, then wheat prices could become extremely volatile in the coming year.

Colorado Average Wheat Prices from 1986-96

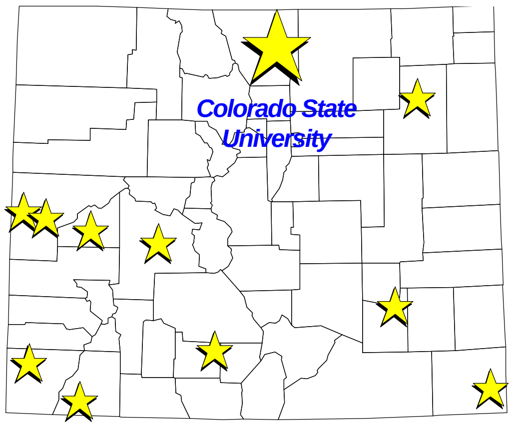
Market Year (July-June)	Average July Price $/bu	Highest Month Ave. Price $/bu (month of year price occurred)	Gain $/bu
1986-87	2.09	2.54 (May)	+.45
1987-88	2.18	3.11 (June)	+.93
1988-89	3.25	4.08 (April)	+.83
1989-90	3.73	3.81 (December)	+.08
1990-91	2.69	2.69 (July)	0.00
1991-92	2.47	3.80 (February)	+1.41
1992-93	3.06	3.36 (January)	+.30
1993-94	2.70	3.58 (January)	+.88
1994-95	3.02	3.71 (January)	+.69
1995-96	4.20	5.67 (April)	+1.47
10-Year	2.94	3.64 Jan-Feb	+.70

Understanding historical market trends can help Colorado wheat producers make better marketing decisions. Only 24% of the state's production is marketed during the months of December to February when the highest prices can be obtained for the lowest storage and interest costs. Forty-two percent of Colorado's winter wheat production is sold prior to December when market prices are lowest. On the average, there has been a 70 cent 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 of prices after November might consider options or futures contracts to manage financial risk.

July was the month of highest prices last year (this happens about once every ten years). High July prices in one year have never repeated themselves the following year. Wheat producers should be cautious about selling new crop wheat in July as they may miss out on upward trends that usually occur after November.

Colorado Agricultural Experiment Station (CAES)
Agricultural Research Pays!
Lee Sommers

The return on investment for publically funded agricultural research is 35% per year according to a national study by the USDA Economic Research Service. The source of agricultural research funds has shifted from predominately public funds in the 1950's to over 50% private sector investment presently.



The Colorado Agricultural Experiment Station (CAES) is a unit within Colorado State University. The CAES is not a single location but rather an integrated, state-wide agricultural research system. Research programs are conducted at the main campus in Fort Collins, at off-campus research centers located throughout Colorado and with individual cooperators. The CAES supports research activities in 19 on-campus departments. Site specific studies are conducted at 10 off-campus research centers.

The goal of the CAES programs is to meet the agricultural research needs of Colorado citizens. CAES research programs emphasize basic and applied research as illustrated by the Russian wheat aphid example. This pest entered Colorado in the mid-1980's causing multimillion dollar losses to wheat and barley growers. With special funding from the Colorado legislature and significant financial assistance from the wheat industry, the CAES immediately funded research on the biology and control of the aphid as well as breeding for resistance. As a result of strong collaboration between entomologists and breeders, the resistant wheat variety, 'Halt', was developed and released in only seven years, about five years faster than it normally takes to release a new cultivar. Besides protecting our wheat crop from the ravages of this pest, adoption of this new aphid-resistant wheat variety would result in immediate and significant environmental benefits because no insecticides would be needed to control the aphid.

Feel free to contact us at the Agricultural Experiment Station, Colorado State University, Fort Collins, CO 80523-3001 (970-491-5372) or at one of the research center locations below.

Research Center	**Location**	**Contact**	**Phone**
Eastern Colorado	Akron, CO	David Schutz	970-345-6402
ARS-USDA	Akron, CO	Randy Anderson	970-345-2259
Plainsman	Walsh, CO	Kevin Larson	719-324-5643
Arkansas Valley	Rocky Ford, CO	Frank Schweissing	719-254-6312
San Luis Valley	Center, CO	David Holm	719-754-3594
San Juan Basin	Hesperus, CO	David Schafer	970-385-4574
Southwest Colorado	Yellow Jacket, CO	Abdel Berrada	970-562-4255
Mountain Meadow	Gunnison, CO	Joe Brummer	970-641-2515
Rogers Mesa	Hotchkiss, CO	Alvan Gaus	970-872-3387
Orchard Mesa	Grand Junction, CO	Harold Larsen	970-434-3264
Fruita	Fruita, CO	Harold Golus	970-858-3629

Colorado State University Cooperative Extension

Extension Activities and Wheat Production

Ron Jepson[6]

Colorado State University Cooperative Extension agents continue to bring unbiased, reasearch-based information to Colorado wheat producers. Extension agents provide education on a variety of wheat topics through seminars, one-on-one field contacts, newsletters, radio, newspapers and satellite information systems. In addition, they monitor crop progress and pests.

Extension agents work with producers to establish wheat variety research plots and field days, wheat variety strip plots (such as the TAM 107 and Halt side-by-side strip plots), and Russian wheat aphid biological control research sites. Extension agents also have been researching the effects of spring grazing on wheat yield and soil compaction.

Extension agents are available to provide education on wheat marketing, dryland cropping systems and alternative dryland crops. Many agents are Certified Crop Advisors and are available for on-site crop inspections, teaching wheat producers the science and art of troubleshooting nutrient and pest situations. Agents interact with CSU faculty specialists in some of these situations and in providing educational programs.

Extension agents have represented Colorado State University in the state for over 75 years. Agents and farmers continue to work toward efficient and productive wheat farming and dryland cropping systems.

Eastern Colorado Extension Wheat Educators

Location	Extension Contact	Phone	E-Mail Address
Adams County	Ron Jepson	303-637-8117	adams@coop.ext.colostate.edu
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Kiowa County	George Ellicott	719-438-5321	kiowa@coop.ext.colostate.edu
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Additional Copies

Additional copies of this report may be ordered from Crops Testing, Cynthia Johnson at C-4 Plant Science Building, Fort Collins, CO 80523; Telephone (970) 491-1914; FAX number (970) 491-2758; or e-mail cjohnson@ceres.agsci.colostate.edu for $3/copy. Colorado Cooperative Extension agents may obtain up to 10 copies of this report by calling Cynthia Johnson or by sending an e-mail message.

[6]Adams County Cooperative Extension, Brighton

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Extension Information

1996 Colorado Corn Hybrid Performance Trials
1996 Colorado Sunflower Hybrid Performance Trials
1996 Northeastern Colorado Pinto Bean Variety Performance Trials
Collaborative On-Farm Test (COFT) Results for 1996
1996 CSU Winter Wheat Variety Performance Trial Results
and much more..,