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1999 Colorado Winter Wheat Variety Performance Trial Results

Good year for testing yield potential.

INSIDE THIS ISSUE:

Colorado State University provides variety performance information to help Colorado wheat producers make better variety decisions. If performance trial information leads to earlier adoption of a superior variety by only one year, approximately $30 million will be earned for Colorado wheat producers.

Adequate soil moisture conditions in the fall and mild winter temperatures led to good plant stands, vigorous spring growth, and prolific tillering throughout most of eastern Colorado. Parts of Baca and Prowers counties were severely infested with Russian wheat aphids (RWA) while less severe, late, RWA infestations were present in

(Continued on page 2)

Yield results

(Continued from page 1)

other counties that commonly host the aphids. Heavy brown wheat mite infestations were observed in east central parts of eastern Colorado. Infection of leaf rust was found along the Kansas border

Winter wheat lower moisture performance summary for 1999.

	Location										Averages			
	Briggsdale		Cheyenne Wells		Lamar		Sheridan Lake		Walsh		1999			3-Yr
		Test		Test		Test		Test		Test		Test	% Yield of	
Variety*	Yield	Wt	Yield	Wt	Yield	Wt	Yield	Wt	Yield	Wt	Yield	Wt	TAM 107	1997/98/99
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu		bu/ac
Trego	48.0	56.9	54.1	57.6	74.5	58.2	69.2	57.8	74.7	60.5	64.1	58.2	112	------
Alliance	50.6	55.3	56.1	57.2	71.3	57.2	63.4	56.1	63.6	59.0	61.0	56.9	107	57.4 [1]
2137	51.8	55.0	46.0	56.8	70.0	57.2	72.1	57.8	61.4	59.0	60.3	57.2	105	------
XH 9806	51.4	55.7	44.9	58.1	70.2	57.7	63.5	57.8	66.1	59.2	59.2	57.7	104	------
Akron	48.8	56.0	54.1	56.8	69.2	57.5	63.1	57.2	59.3	58.1	58.9	57.1	103	54.9 [4]
Prairie Red	57.6	55.6	44.7	56.7	67.4	56.7	64.4	57.2	59.5	58.8	58.7	57.0	103	55.4 [3]
Yuma	46.7	53.8	48.0	56.0	66.0	56.8	63.8	57.0	68.1	57.7	58.5	56.3	102	54.2 [6]
Enhancer	48.0	53.7	48.0	56.3	67.6	58.3	64.2	56.0	63.3	54.9	58.2	55.9	102	------
T812	53.6	56.3	52.0	57.6	63.4	58.2	56.4	57.6	62.5	59.0	57.6	57.8	101	------
Yumar	42.6	55.1	49.0	56.2	65.2	57.4	63.6	56.3	66.8	59.8	57.4	57.0	100	52.2
TAM 107	52.7	55.0	46.4	56.3	63.1	57.2	61.5	56.0	62.1	59.0	57.2	56.7	100	54.8 [5]
G15011	48.6	55.7	49.7	56.4	64.2	57.8	57.3	57.1	65.6	58.9	57.1	57.2	100	------
Kalvesta	47.9	57.1	44.1	58.1	71.4	59.0	60.4	58.3	61.5	59.7	57.1	58.4	100	------
TAM 110	54.1	54.4	48.5	56.0	60.5	56.4	56.7	55.8	65.4	60.1	57.0	56.5	100	55.6 [2]
Windstar	49.3	54.5	42.8	56.4	67.3	56.5	63.7	56.4	58.5	56.2	56.3	56.0	98	52.2
Niobrara	50.3	55.2	39.5	55.4	61.2	55.1	61.6	56.4	62.2	58.5	55.0	56.1	96	52.9
Arlin	46.0	53.7	52.2	57.2	57.5	58.5	48.6	56.6	67.9	62.1	54.4	57.6	95	49.0
G12058	41.4	55.1	42.0	58.9	69.2	59.6	59.7	59.1	56.7	60.1	53.8	58.5	94	------
Halt	53.8	54.8	46.3	55.8	58.7	57.0	49.0	56.7	60.9	58.5	53.8	56.5	94	51.9
Prowers	43.8	56.5	42.0	58.7	63.4	59.8	59.0	58.7	54.9	59.3	52.6	58.6	92	50.3
Baca	51.5	57.6	37.9	58.3	55.2	58.3	49.7	57.7	56.8	60.1	50.2	58.4	88	49.0
Wichita	36.9	58.3	33.9	59.0	45.7	60.2	45.3	58.1	44.0	59.7	41.1	59.1	72	39.6
Average	**48.9**	**55.5**	**46.5**	**57.1**	**64.6**	**57.8**	**59.8**	**57.2**	**61.9**	**59.0**	**56.3**	**57.3**		
CV%	10.1		11.6		7.9		9.6		7.3					
$LSD_{(3)}$	4.2		4.5		4.3		4.8		3.9					

* Varieties ranked by the average yield over five locations in 1999.

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

(Continued on page 3)

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Yield results

(Continued from page 2)

south of I-70 to Baca County. Wheat streak mosaic and high plains disease, both vectored by the wheat curl mite, were found in all trials south of I-70. Symptoms of barley yellow dwarf disease, which is vectored by the Bird cherry-oat aphid, were also observed in SE Colorado trials. Wheat in east-central and northeastern Colorado suffered from a high temperature period in early June accompanied by strong drying winds that caused early senescence of flag leaves of many varieties in the Julesburg and

Winter wheat high moisture performance summary for 1999.

	Location										Averages			
	Akron		Bennett		Burlington		Genoa		Julesburg		1999			3-Yr
		Test		Test		Test		Test		Test		Test	% Yield of	
Variety*	Yield	Wt	Yield	Wt	Yield	Wt	Yield	Wt	Yield	Wt	Yield	Wt	TAM 107	1997/98/99
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu		bu/ac
XH 1888	81.5	59.1	92.5	57.3	59.3	58.8	86.9	56.1	67.4	60.2	77.5	58.3	118	------
Alliance	81.6	57.2	85.9	58.9	64.6	59.1	83.2	56.0	56.9	57.2	74.4	57.7	113	56.0 [2]
QAP 7406	74.3	59.3	79.8	57.5	59.2	58.3	87.0	56.2	65.9	59.7	73.2	58.2	112	------
XH 9806	77.6	59.1	82.4	59.1	59.3	57.6	88.1	57.3	56.8	59.1	72.9	58.4	111	------
Yumar	74.7	59.3	82.2	57.2	57.0	60.1	79.5	56.4	65.2	59.6	71.7	58.5	109	54.9 [4]
Jagger	71.9	58.5	78.3	57.6	52.6	57.3	84.5	56.3	69.8	60.1	71.4	58.0	109	54.3
Culver	69.6	56.8	83.0	57.9	53.9	56.5	90.0	56.8	60.5	57.3	71.4	57.1	109	------
Akron	75.9	58.1	85.9	57.9	56.4	58.3	81.3	56.9	56.8	59.5	71.3	58.2	109	56.1 [1]
Enhancer	76.2	57.3	75.2	58.4	53.0	57.4	88.1	56.9	62.0	57.7	70.9	57.5	108	53.9
Yuma	72.4	58.8	78.6	57.1	52.1	56.8	82.1	56.2	66.5	59.7	70.3	57.7	107	53.3
Prairie Red	73.7	57.9	79.7	57.1	55.2	57.3	80.2	56.2	58.0	58.9	69.4	57.5	106	55.1 [3]
G15048	73.8	58.8	76.7	60.3	59.5	60.0	80.5	58.7	54.4	59.0	69.0	59.4	105	------
Kalvesta	69.8	57.2	77.1	58.9	62.0	59.3	75.6	56.8	59.1	60.6	68.7	58.6	105	------
2137	66.6	57.8	82.5	57.9	51.7	59.0	78.4	56.0	63.0	59.2	68.4	58.0	104	------
Halt	64.3	57.3	84.2	58.4	53.2	56.9	80.3	55.6	59.9	56.5	68.4	56.9	104	54.4 [6]
G15011	67.0	58.1	78.1	59.0	54.6	58.1	81.2	57.5	60.1	60.3	68.2	58.6	104	------
T834	72.3	58.2	64.7	57.4	62.3	57.7	77.7	56.8	62.2	59.9	67.8	58.0	103	------
Trego	67.7	60.1	77.7	58.7	57.7	60.1	74.3	57.4	59.9	61.3	67.5	59.5	103	------
TAM 110	68.4	57.3	75.6	57.4	47.7	57.4	82.5	55.9	62.9	58.2	67.4	57.3	103	54.6 [5]
Wesley	73.2	57.7	63.9	57.9	60.1	54.3	72.5	55.7	62.9	58.0	66.5	56.7	101	------
G12058	69.1	58.9	71.1	59.7	55.8	58.9	77.5	58.5	58.5	60.2	66.4	59.3	101	------
TAM 107	74.9	58.1	66.9	56.4	53.8	58.7	72.9	56.0	59.3	58.9	65.6	57.6	100	54.0
Cossack	68.8	58.2	75.5	59.8	50.9	60.2	72.2	58.2	60.1	60.4	65.5	59.4	100	48.4
Thunderbolt	67.6	60.1	71.1	59.5	54.8	61.3	76.4	58.2	55.7	61.1	65.1	60.1	99	------
QAP 7510	63.0	58.7	75.2	59.5	55.1	59.0	74.5	57.3	54.8	60.5	64.5	59.0	98	51.1
Prowers	72.5	60.0	79.0	59.5	38.2	59.7	75.5	58.1	54.7	60.4	64.0	59.5	98	49.9
Arlin	72.0	59.3	65.3	57.5	44.3	60.1	73.6	56.6	61.0	61.1	63.2	58.9	96	50.1
Betty	66.0	56.6	72.9	56.8	53.2	60.6	67.9	56.8	52.7	59.7	62.5	58.1	95	------
Heyne	59.9	58.1	65.5	58.8	42.2	60.1	74.0	56.7	52.1	60.4	58.7	58.8	90	------
Wichita	56.3	59.1	54.5	59.3	37.5	57.0	56.0	57.0	42.1	61.3	49.3	58.7	75	38.9
Average	**70.8**	**58.4**	**76.0**	**58.3**	**53.9**	**58.5**	**78.5**	**56.8**	**59.4**	**59.5**	**67.7**	**58.3**		
CV%	9.5		8.8		18.1		6.6		6.2					
$LSD_{(.3)}$	5.8		5.7		8.4		4.4		3.1					

* Varieties ranked by the average yield over five locations in 1999.

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

(Continued on page 4)

Yield results

(Continued from page 3)

Burlington trials. The Briggsdale trial was heavily infested with common root rot. The Burlington trial was severely hailed and lodged.

Colorado winter wheat variety trials are conducted according to moisture group, with different varieties in each group, except for some varieties that are common to all three groups. In 1999, lower moisture variety trials were harvested at Briggsdale, Sheridan Lake, Lamar, Walsh, and Cheyenne Wells. Successful higher moisture trials were conducted at Burlington, Ovid, Bennett, Akron, and Genoa. Two irrigated winter wheat variety trials were conducted at Rocky Ford and Walsh. A randomized complete block field design with three replicates is used in all trials. Four or six, 12 inch-spaced rows, 46 feet long, are harvested from each plot. All dryland trials are seeded at 600,000 seeds/acre and the irrigated trials that are planted at 900,000 seeds/acre.

Yields at all trials were average to excellent in 1999. Summary performance results are provided below for each moisture group. These trials are extremely valuable to the CSU wheat-breeding program to screen new and promising lines that may become released varieties in the future. The HMVT

Winter wheat irrigated performance summary for 1999.

	Location						Average
	Rocky Ford				Walsh		3-Yr
		Test		Plant		Test	
Variety*	Yield	Wt	Lodging**	Height	Yield	Wt	1997/98/99
	bu/ac	lb/bu	0-9	inches	bu/ac	lb/bu	
T81	98.2	61.0	6	40	54.5	60.9	------
G15011	97.7	61.3	1	41	48.4	56.7	------
TAM 107	94.6	61.2	2	40	57.9	60.6	92.0 [6]
QAP 7406	93.2	58.6	2	42	54.0	59.8	------
2137	93.1	59.7	1	41	63.7	60.5	96.3 [2]
QAP 7510	93.0	60.0	0	38	50.6	58.9	96.6 [1]
Custer	92.5	60.3	4	40	78.9	59.8	93.5 [3]
Arlin	86.6	60.9	2	40	50.2	62.7	------
TAM 110	85.4	61.2	4	40	52.5	60.9	88.7
Jagger	85.4	58.5	9	39	61.5	59.7	86.9
Prairie Red	82.8	59.5	5	39	55.4	59.9	93.1 [4]
G12058	82.3	61.7	5	40	62.5	61.4	------
G15048	80.6	58.3	3	39	52.0	59.8	------
Yumar	80.3	58.4	3	40	56.4	59.3	90.7
Akron	79.6	58.0	2	40	57.2	61.3	85.7
Yuma	79.4	59.8	4	40	48.8	58.9	92.4 [5]
Kalvesta	78.6	60.6	5	40	56.0	62.5	------
Halt	77.4	58.2	2	38	59.8	58.3	85.0
XH1888	77.0	57.8	8	40	49.3	61.6	------
Enhancer	65.7	57.5	9	38	49.1	59.1	------
Cossack	65.4	60.1	2	41	50.5	59.5	------
Average	**84.2**	**59.6**	**4**	**40**	**55.7**	**60.1**	
CV%	9.7				19.8		
$LSD_{(.3)}$	7.0				9.4		

* Varieties ranked by the yield for Rocky Ford.

**0=erect 9=flat scale

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

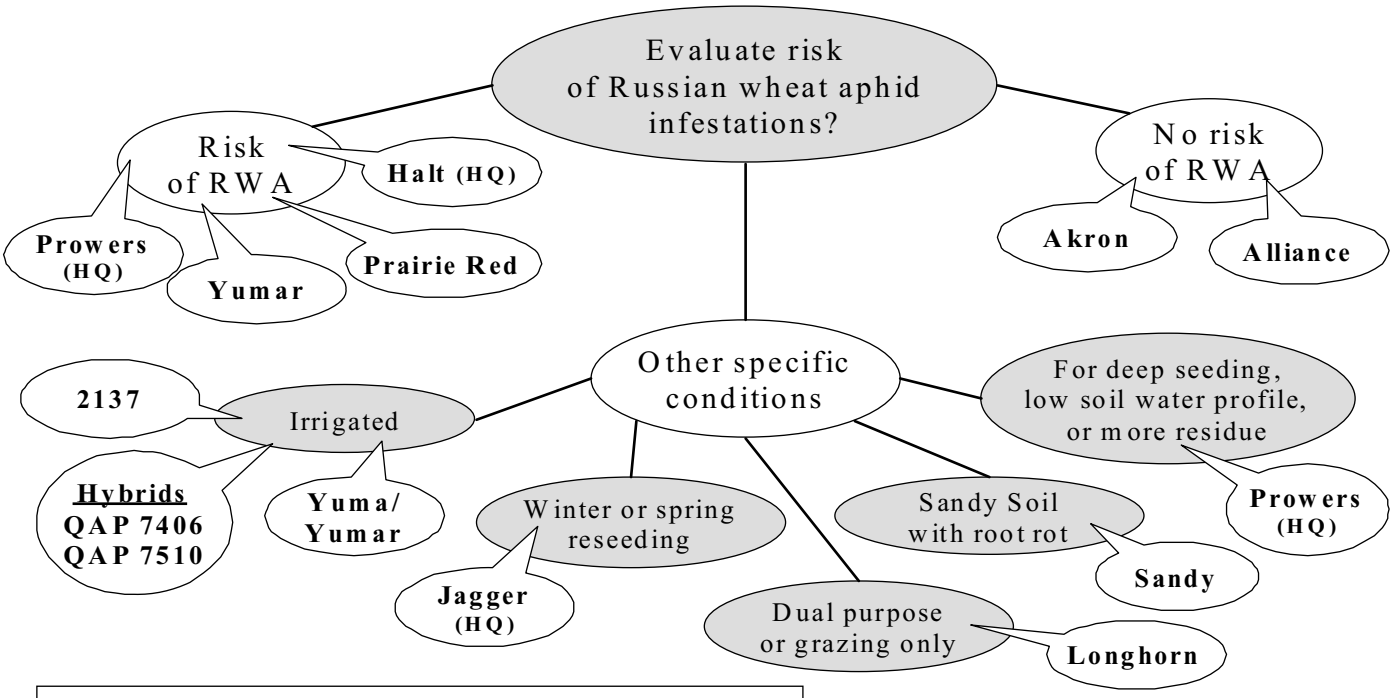
(Continued on page 5)

Yield results

(Continued from page 4)

Decision Tree for Winter Wheat Variety Selection in Colorado

Jerry Johnson and Scott Haley (July 1999)



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

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

included 14 advanced experimental lines (numbered CO lines), five of which ranked among the top ten entries for highest average yield over locations, with the best yielding 117% of TAM107. There were 24 experimental lines entered in the LMVT, including six of the ten top yielding entries in the trial, with the best yielding 110% of TAM 107.

Some exciting new varieties are expected to come from these performance results.

Variety planting suggestions, based on these trial results, are found in the revised "Decision Tree for Winter Wheat Variety Selection in Colorado." Results from the collaborative on-farm test program should be consulted before making a variety selection as Halt, Prowers, Yumar, and Prairie Red, four varieties resistant to the Russian wheat aphid, were compared to TAM 107 and Akron by 22 eastern Colorado wheat producers.

Jerry Johnson and Scott Haley
Crops Testing Specialist and Wheat Breeder

1999 Collaborative On-Farm Testing Results

Cooperation key to success.

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

The 1998-99 season was the fourth year of winter wheat variety on-farm testing. We have successfully evaluated the performance of six varieties under grower conditions across a large area. These exciting results are shown below but none of this would have been possible without excellent cooperation between growers and extension agents. Many collaborating growers have conducted tests each of the four years while most have had the test on their farms for three of the four years. Colorado State University Cooperative Extension agents have taken more and more responsibility for the success of the program – recruiting volunteer growers, delivering seed, planning field layout and operations, keeping records, coordinating visits, communicating with growers and campus coordinators, coordination of weighing plot yields. We are also thankful for the collaboration of the extension entomology team that monitored tests during the year. In addition to evaluation of new varieties under farm conditions, on-farm testing makes collaborating growers, some of them seed producers, and agents more involved in the variety development process, thereby reducing the number of years required for adoption of superior, new varieties.

The 1999 COFT results are broken into two groups according to geographic location within Colorado. (See chart on page 7.) Eight locations from the southeast Colorado group show Yumar to be the highest yielding variety with Akron, Halt, Prairie Red, and Prowers in a mid-yield group. TAM 107 was lowest yielding. Nine locations from the east-central Colorado group show Akron, Halt, and Prairie Red to be the highest yielding varieties with Prowers, TAM 107, and Yumar in a lower yielding group. Overall, Yumar, Akron, Halt, and Prairie Red were the top yielding varieties with Prowers and TAM 107 yielding less. The yield performance of Yumar was noteworthy, especially in southeast Colorado where climatic conditions were exceptionally favorable. Prowers performed well in the southeast as well. The newly released, RWA-resistant varieties performed consistently better than TAM 107 across the state. Of these varieties, Halt and Prowers are known to have better milling and baking quality characteristics than the others. Prowers had the highest average test weight across all locations.

Light to severe infestations of RWA were observed at most southeast Colorado locations and some east-central locations. Severe infestations of brown wheat mite were observed in several east-central locations. Hail severely reduced yields at one Kit Carson county location. Our sympathies go out to our Cheyenne county cooperator of long standing who lost his test to fire at the time of harvest.

Jerry Johnson
Crops Testing Specialist

1999 Colorado Collaborative On-Farm Test (COFT) Results

	VARIETY (Yield in bu/ac @ 13% moisture)						
County Location	**Akron**	**Halt**	**Prairie Red**	**Prowers**	**TAM 107**	**Yumar**	**Test Ave**
Baca EC	46.7	51.5	48.5	46.5	38.9	56.4	48.1
Baca SW	38.4	37.9	42.5	43.6	36.7	45.7	40.8
Baca WC	56.3	57.2	63.6	56.4	58.1	62.3	59.0
Baca SE	57.2	63.5	61.7	60.2	68.6	66.5	63.0
Prowers C	61.9	63.4	61.7	65.2	61.0	70.6	64.0
Prowers N	48.7	51.7	48.1	52.1	40.3	47.9	48.1
Prowers NC	47.5	45.8	49.5	52.1	38.8	43.9	46.3
Kiowa	69.7	65.1	66.4	61.5	66.4	70.3	66.6
SE Colorado Ave	**53.3**	**54.5**	**55.3**	**54.7**	**51.1**	**58.0**	**54.5**
Kit Carson W	77.6	74.4	81.4	67.7	78.9	79.8	76.6
Kit Carson NE	40.2	31.8	38.0	24.4	36.4	36.3	34.5
Kit Carson SE	83.5	96.0	87.4	66.9	81.7	82.0	82.9
Lincoln SC	39.9	43.7	38.9	32.0	29.0	37.1	36.7
Arapahoe SW	69.3	68.0	62.3	66.3	65.0	N/A	66.2
Arapahoe NC	28.7	32.0	34.5	38.8	31.8	38.2	34.0
Morgan	47.1	47.2	44.7	44.4	36.2	42.8	43.7
Weld SW	47.3	47.4	46.0	48.8	46.2	49.8	47.6
Weld NE	50.3	50.6	52.8	51.4	51.9	44.4	50.2
Central Ave	**53.8**	**54.6**	**54.0**	**49.0**	**50.8**	**51.3**	**52.5**
Variety Ave Yield	**53.5**	**54.5**	**54.6**	**51.7**	**50.9**	**54.6**	**53.3**
Variety Ave TWT	**59.8**	**59.5**	**60.1**	**61.2**	**59.8**	**60.3**	**60.1**

Note: Results for the second Lincoln County test will be published when available.

The Cooperative Extension Agents who make on-farm testing work:

Tim Macklin - Baca County; Dick Scott - Prowers County; Tim Burton - Cheyenne County; Ron Meyer - Kit Carson County; Kurt Jones - Lincoln County; Bruce Bosley - Morgan County
Ron Jepson - Adams County; Jerry Alldredge - Weld County; Leonard Pruett - SE Area Leader.

Wheat Fertilization Practices Surveyed

Low wheat prices and bad weather reduce fertilizer rates.

During the 1999 wheat field days, farmers were surveyed about their fertilization practices. Different scenarios were presented to the farmers to determine how wheat price, fertilizer price, and weather influence fertilizer decisions at planting and in the spring. Fifty-two farmers responded to the survey, representing 11 counties. The average wheat acreage was 1482 acres. Seventy-three percent of wheat farmers said that they soil test to help them make good fertilizer decisions.

Table 1. How much N fertilizer would you apply?

Time of Fertilization	Pre-planting or Planting	Spring
Farmers that Would Fertilize	97 %	39 %
Nitrogen Fertilizer Rate*	53 lbs N/acre	23 lbs N/acre

* based only on those farmers who would apply fertilizer at that time.

Nitrogen fertilizer rates were much lower in the spring than in the fall (Table 1). In addition, only about one-third of farmers would apply fertilizer in the spring, as opposed to nearly 100% in the fall.

Of those farmers questioned about a pre-plant scenario, about one-half said they would apply fertilizer pre-plant or at planting, about one-fourth said they would wait till spring, and about one-fourth said they would apply fertilizer at both times (Table 2a). When questioned about an early spring scenario, less than one-third would apply at that

Table 2a. When would you apply fertilizer (scenario posed pre-plant)?

Fertilizer Timing	Pre-planting or Planting
Neither Fall nor Spring	0 %
Fall Only	54 %
Spring Only	25 %
Both Fall and Spring	21 %

Table 2b. When would you apply fertilizer (scenario posed in early spring)?

Fertilizer Timing	Spring
No Spring Application	61 %
Early Spring	28 %
Late Spring	11 %
Both Early and Late Spring	0 %

(Continued on page 9)

Survey

(Continued from page 8)

time, and 11 % would wait till later to apply fertilizer (Table 2b). When farmers plan to apply fertilizer at planting or pre-plant, they choose anhydrous ammonia most often, with 11-52-0 as a distant second choice (Table 3). Spring fertilizer applications favored urea ammonium nitrate (UAN) and other unspecified types of fertilizer.

In the spring, most farmers would not apply any other fertilizer besides nitrogen (Table 4). But at pre-plant or planting time, nearly three-quarters of farmers would apply other fertilizer in addition to N. Phosphorus (P) would be applied most often at pre-plant or planting, but sulfur (S) would be applied more often than P in the spring.

Lastly, when wheat prices were high, N fertilizer application rates went up by 6 lbs N/acre. Weather also impacted N rates, but this effect was greatest in the spring. Pre-plant and planting applications were only reduced by 3 lbs N/acre due to bad weather. But spring applications were reduced by 15 lbs N/acre when weather conditions were limiting wheat yields.

Jessica Davis
Extension Soil Scientist

Table 3. What type of N fertilizer would you use?

Nitrogen Fertilizer Type	Pre-planting or Planting	Spring
anhydrous ammonia	61 %	8 %
11-52-0	19 %	8 %
urea ammonium nitrate	3 %	38 %
urea	6 %	0 %
ammonium nitrate	3 %	15 %
other	6 %	31 %

Table 4. Would you apply any other fertilizer besides N?

Response	Pre-planting or Planting	Spring
No	28 %	85 %
Yes--no specific type named	14 %	0 %
P	45 %	5 %
S	0 %	10 %
P and S	7 %	0 %
P and S and Zn	7 %	0 %

IMI-Wheat and White Wheat

New horizons for CSU's winter wheat breeding program.

The CSU Winter Wheat Breeding Program conducted yield trials of experimental breeding materials at four locations in Colorado (Walsh, Burlington, Akron, and Ovid). Although environmental conditions varied significantly among locations, breeding trial data were extremely informative. From a group of 150 experimental lines in advanced yield trials, approximately 25 will be retained and advanced for statewide testing (in the CSU Variety Performance Trial, VPT) in 1999-2000.

Among the materials advanced to the 2000 VPT are a group of five experimental lines that carry tolerance to imidazilonone herbicides ("IMI-Wheat"). Tolerance to such herbicides will allow selective control of several winter-annual grassy weeds (e.g., jointed goatgrass and downy brome – cheatgrass) which are problematic in Colorado. These lines are all in a background very similar to 'TAM 110' (which itself is genetically similar to 'TAM 107'), a cultivar that has showed good adaptation to Colorado conditions but is susceptible to the Russian wheat aphid (RWA). Through a partnership with American Cyanamid, and the technical assistance of the CSU weed science team we will work to combine this resistance with RWA resistance and improved end-use quality for deployment in Colorado.

Over the last 15 years, wheat breeding programs in the Great Plains have been devoting increased attention to development of hard white wheat (HWW) varieties. While several HWW varieties have been released over the years, the lack of varieties competitive (or even superior) to the best hard red winter (HRW) varieties has delayed conversion of significant Great Plains acreage from HRW to HWW. Recent or impending releases from neighboring states (e.g., 'Heyne' and 'Betty' in 1998 and 'Trego' and 'Nuplains' in 1999) promise to significantly change this situation. Of these varieties, Trego shows perhaps the greatest potential for adaptation under Colorado conditions, having performed especially well in the 1999 Lower Moisture Variety Trial. Two CSU experimental lines, one genetically similar to Trego, have performed as well or better than Trego in the Colorado trials and will be retained for further testing.

Winter wheat cultivar development is a long-term process, with a 10-12 year time frame between the time a cross is made and an improved variety is released. Each year 600-800 new cross combinations are made and over 1000 new experimental lines are developed by the CSU Winter Wheat Breeding Program. In addition to the excellent support of various cooperators at CSU and across the region, the solid and consistent financial support from the Colorado Wheat Administrative Committee and the Colorado Agricultural Experiment Station are vitally important to ensuring continued availability of improved wheat varieties for producers in Colorado.

Scott Haley
Wheat Breeder

Sulphur Fertilization of Dryland Wheat

Sulphur increased yield when soil pH was high and organic matter was low.

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

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

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

Jessica Davis
Extension Soil Scientist

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

Russian Wheat Aphid Resistant Wheats In Colorado

Different levels of resistance.

The first Russian wheat aphid resistant wheat, Halt, was released by the Colorado Agricultural Experiment Station in 1994. Halt has very good resistance to Russian wheat aphid that is based on a gene called Dn4. Halt does not require insecticide treatment for Russian wheat aphid and due to the effectiveness of Dn4 resistance in Halt, this gene was used to develop resistant versions of Lamar (Prowers), TAM 107 (Prairie Red), and Yuma (Yumar).

Our assumption has been that Dn4 resistance would be as effective in any wheat as it is in Halt. It appears that this is not entirely correct. Plants with typical Russian wheat aphid damage have been observed in all the resistant varieties, ranging from 6% in Halt to more than 40% in Prowers. All of these wheats are resistant to the Russian wheat aphid, but some are more resistant than others.

Value of resistance

This is a difficult question because the answer changes with the price of wheat, yield potential in a given field, cost of insecticide treatment, the level of the Russian wheat aphid infestation, and the presence of other pests such as pale western cutworm or brown wheat mite. The data in the table below were taken from severely infested small plots to show the value of the resistance that is currently available for Colorado wheat producers.

Precautions

- These data are from heavily infested small plots, so they repre-

VARIETY	% REDUCTION[1]	LOST VALUE[2]	WORTH SPRAYING?[3]	SAVINGS[4]
HALT[5]	5.0	$5.74	NO	$28.68
TAM 107	28.9	33.19	YES	---
PRAIRIE RED	10.7	12.29	NO	21.84
LAMAR	47.9	55.01	YES	---
PROWERS	26.7	30.66	YES	25.44
YUMA	47.7	54.78	YES	---
YUMAR	11.9	13.67	NO	42.96

[1]Compares the average yields of severely infested plots to average yields of plots completely protected by insecticides (without regard to cost).
[2]Value of the lost yield, using the Colorado 10 year average yield and price (33 bushels per acre and $3.48 per bushel).
[3]Is there sufficient yield loss to justify spraying, assuming a $12.00 per acre cost.
[4]Savings due to using a resistant variety, calculated by subtracting the lost value (column 3) of the resistant variety from the lost value of the susceptible version of the same variety.
[5]The % reduction for Halt is estimated from several experiments, because it wasn't directly included in the studies summarized here. The savings for Halt were calculated using TAM107 as the susceptible comparison.

RWA

(Continued from page 2)

sent the worst case. As infestations become lighter, the differences among varieties will become smaller.

♦ These comparisons are made with average economic conditions. Insecticide treatments are more easily justified when prices are high or when the cost for effective treatment is low.

♦ The comparisons in the table are between the resistant and susceptible versions of the same variety. When you make a variety choice for your operation, you should make comparisons among all resistant varieties and the varieties that have done well in your area over the past several years.

♦ While the lost value in Prairie Red and Yumar slightly exceeded the cost of an insecticide application, a breakeven return on chemical control does not justify it economically. This is because some yield loss can be expected even if an application is made. Some irreversible yield loss prior to treatment and some loss to infestation that occurred after the treatment effects wear off is expected. In other words, we are trying to compare the season-long benefit of varietal resistance to the temporary aphid relief (3-4 weeks) provided by an insecticide treatment.

♦ It would have been worthwhile to spray Prowers under the severe infestation conditions of this study. This probably would not be true with a light to moderate infestation. Even if you had not treated the Prowers it still would have been more profitable than unsprayed Lamar.

Conclusions

♦ Halt is our most resistant variety, based on % yield loss and % damaged plants observed in the field.

♦ A better way to define Russian wheat aphid resistance is by whether or not insecticide treatment can be justified economically for a given variety under heavy infestation. In this case and with currently available information, I would classify Halt, Prairie Red and Yumar as resistant and Prowers as moderately resistant.

♦ The resistance in Prowers has been improved to the level of Prairie Red and Yumar. This more resistant version will be proposed for release as a new variety.

Frank Peairs
Professor

meet. . .

On January 1, 1999, Dr. Scott D. Haley joined the faculty of the Soil and Crop Sciences Department, assuming leadership of the wheat breeding and genetics program previously directed by Dr. James S. Quick. Scott will direct all activities of the wheat breeding program including ongoing field and laboratory projects on Russian wheat aphid resistance, high temperature and drought stress tolerance, improved end-use quality (milling, baking, noodles), and improved agronomic adaptation and performance for production in Colorado and the west central Great Plains. He will also be active in teaching and advising activities within the department, conducting undergraduate and graduate level courses in plant breeding.

Scott comes to Colorado State from South Dakota State University from South Dakota State University where he had worked as a winter wheat breeder since 1993. He earned M.S. (1989) and Ph.D. (1992) degrees from Colorado State University and conducted post-doctoral research at Michigan State University (1992-1993). Scott and his wife Janice (also at CSU Alumnus) have two girls: Brenna, 7 and Devon, 5.

Weed Science Advances for Winter Wheat In Colorado

Herbicides and integrated management systems work.

New herbicides

Aim (FMC chemical Co.), labeled for use in winter wheat, is a contact, or burn-down type herbicide with no residual activity. It is labeled for control of kochia and other broad-leaf weeds.

Maverick (Monsanto Chemical Co.) is labeled for winter wheat as of Fall 1999 for control of annual brome species (downy brome, cheatgrass, Japanese brome), flixweed, pennycress, and suppression of blue mustard. Maverick provides most effective weed control when applied in the fall. The initial label will be for use in wheat/fallow rotations only.

Paramount (BASF Chemical Co.) Is labeled for use in fallow with rotation to wheat, pre-emergence to wheat, and in-crop sorghum for control of field bindweed, barnyardgrass, andfoxtail species. Paramount has excellent residual activity.

Starane (United Agri Products) is a post emergence herbicide for use in small grains for control of kochia. Starane has excellent crop safety in wheat, barley, and oats and, in a pre-mix with 2,4-D or MCPA, controls the spectrum of susceptible broadleaf weeds.

Integrated management systems

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

Jointed goatgrass BMPs

The National Jointed Goatgrass Research Program has funded the establishment of four large-scale, on-farm trials in the Great Plains for economic analysis and demonstra6tion of current practices compared to new integrated approaches. Called Best Management Practice sites (BMPs), practices to be studied include crop rotations, fertilizer placement, and winter wheat plating date. The crop rotations and cropping systems have been adapted to the environmental conditions and surrounding cultural practices of each area. Cooperators keep detailed records for economic analysis and researchers analyze seed cores and seedling counts to determine effects on the jointed goatgrass population. Although data from these sites is not yet available, field days will be held at several of the BMP sites this spring and summer.

Phil Westra, Tim D'Amato, Todd Pester, and Mack Thompson
Professor, Research Associate, graduate student, and graduate student

web sites

http://www.colostate.edu/Depts/SoilCrop/extension/CropVar/index.html
CSU's Crops Testing page of 1999 Wheat Variety Performance.

http://www.colostate.edu/Depts/CoopExt/PUBS/CROPS/pubcrop.html
CSU's Cooperative Extension publications relevant to crops and soils.

http://www.ksu.edu/kscpt/
Kansas State University's Crop Performance page with 1999 Variety Trial Results.

http:www.usask.ca/agriculture/plantsci//winter_wheat/contents.htm
Winter Wheat Production Manual from Canada (University of Saskatchewan).

http://www.hpj.com/wsdocs/whearts/kwf_intr.htm
Kansas Wheat Farm Adventures. Ever wonder what life is like on a farm? Join these farm families in their daily activities.

http://www.hpj.com/
High Plains Journal on the net.

http://www.nal.usda.gov/
The National Agricultural Library (NAL), part of the Agricultural Research Service of the U.S. Department of Agriculture, is one of four National Libraries in the United States.

http://www.uidaho.edu/aberdeen/cereals/index.html
University of Idaho, Aberdeen Extension Cereals Program: "The Cereals Information Source."

http://www.colostate.edu/Depts/CoopExt/GPA/
CSU's Golden Plains Area Cooperative Extension page full of information. Excellent.

gopher://greengenes.cit.cornell.edu or http://wheat/pw/usda/gov/
Database describes all commercial wheat cultivars in the U.S. and more.

http:/ianrwww.unl.edu/ianr/agronomy/varitest2.htm
University of Nebraska Wheat Variety Testing Homepage with 1999 results available.

http://www.ianr.unl.edu/pubs/FieldCrops/
University of Nebraska's famous Nebsheets for Crop Production. Excellent information.

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