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INSIDE THIS ISSUE

Colorado State University Cooperative Extension

Putting Knowledge to Work

FROM THE GROUND UP

Agronomy News

2004 Colorado Winter Wheat Variety Performance Trial Results

Performance trial results help Colorado wheat producers make better variety decisions.

Colorado State University, with the support and cooperation of the Colorado wheat industry, conducts annual dryland (UVPT) and irrigated (IVPT) variety performance trials to obtain unbiased and reliable information for Colorado wheat producers to make better wheat variety decisions. Good variety decisions can return millions of dollars to Colorado wheat producers.

Dryland planting conditions in fall of 2003 were generally poor due to dry soil conditions. These conditions led to extremely narrow planting windows at most locations to plant and obtain good stands. Inadequate fall and winter precipitation was followed by a dry spring (with the exception of some timely rains in AUGUST) and moderate drought stress conditions at many locations. The spring drought was aggravated by very short sub-soil moisture conditions. Uneven and incomplete fall emergence was observed at Lamar, Cheyenne Wells, Genoa, and

Performance trial results help Colorado wheat producers maker better variety decisions.

Orchard and led to these trials being abandoned (Genoa and Orchard) or yield data that were too variable to be useful for variety comparisons (Lamar and Cheyenne Wells). The trial at Walsh was lost to severe hail damage on the eve of harvest and the trial at Burlington was lost to spring drought and a severe spring freeze at flowering in mid-May. Rains beginning during the third week in June and continuing into early July provided very moderate temperatures during grain filling as well as leading to serious weed pressure in trials and production fields alike. The rain made it difficult to get into fields for harvest and led to reports of sprouting in both hard white and hard red varieties.

Russian wheat aphid pressure was high again this year, especially in east-central and southeastern Colorado. The new Russian wheat aphid biotype, denoted as "biotype B," overcomes the resistance in all RWA-resistant varieties released to date. This new biotype was found throughout eastern Colorado in 2004 in conjunction with the original RWA biotype (denoted as "biotype A"). Recent findings suggesting that additional biotypes may be present in Colorado and other areas of the Great Plains could present formidable challenges to our entomology and wheat breeding programs. Wheat steak mosaic virus and high plains disease were not problematic in 2004 while barley yellow dwarf virus, due to high greenbug infestation levels, was observed at the IVPT at Rocky Ford. Both leaf rust and stripe rust were identified in late-maturing wheat (due to poor stands) at some locations but infestations were generally very light and too late in the grain filling period to cause significant damage.

The following summary tables of results are designed to disseminate the essential information as quickly as possible to as many people as possible through the wheat industry, popular press, and DTN.

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FROM THE GROUND UP
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Colorado winter wheat Uniform Variety Performance Trial summary for 2004.

	Location										2004 Averages				
	Akron		Bennett		Julesburg		Sheridan		Yuma						
Variety[1]	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	% of Average	Grain Moisture	Test Wt	Plant Ht
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	%	%	lb/bu	in
Jagalene	69.6	60.2	51.4	56.6	53.7	59.7	50.4	57.4	45.3	56.3	54.1	114	11.2	58.0	25
Above	61.1	59.1	57.6	54.7	49.9	57.4	43.4	55.8	45.0	56.2	51.4	108	11.1	56.6	23
Harry	66.9	57.4	52.3	55.6	46.7	54.6	49.0	51.9	41.3	51.8	51.2	108	9.9	54.3	25
Goodstreak	68.2	59.8	54.5	57.0	50.7	59.4	42.6	58.1	39.1	56.1	51.0	108	11.2	58.1	29
Avalanche	57.9	60.2	56.0	57.8	44.0	58.9	50.7	58.0	44.5	56.2	50.6	107	11.3	58.2	25
Stanton	57.8	59.6	57.2	58.3	51.3	58.3	41.6	57.6	44.1	55.7	50.4	106	11.5	57.9	24
TAM 111	64.9	59.7	52.4	58.4	46.1	56.9	46.9	57.6	40.9	55.9	50.2	106	11.3	57.7	26
W99-194	61.5	57.8	55.5	56.5	47.2	57.2	42.6	57.7	39.1	55.5	49.2	104	11.4	57.0	26
Wahoo	59.2	57.4	53.9	57.5	47.1	56.9	47.4	55.3	37.7	54.7	49.1	103	11.1	56.4	25
Lakin	67.1	59.2	54.0	58.3	47.9	57.3	41.4	57.8	34.9	57.1	49.0	103	11.6	57.9	24
Yumar	66.5	59.6	57.6	56.1	48.3	58.5	40.0	56.6	31.0	55.1	48.7	103	11.1	57.2	25
AP502 CL	55.3	57.2	52.4	55.4	50.0	56.7	46.0	55.9	39.4	54.8	48.6	103	10.7	56.0	24
Yuma	66.8	58.3	54.6	54.9	50.4	57.1	38.6	57.1	31.6	54.7	48.4	102	10.9	56.4	24
Ankor	54.2	59.0	56.3	58.7	43.9	57.0	48.2	56.5	38.8	56.1	48.3	102	11.2	57.5	23
NuHills	56.4	61.2	50.4	54.6	46.4	58.2	44.0	56.3	43.2	54.6	48.1	101	11.1	57.0	24
Prairie Red	55.5	59.7	53.5	57.4	45.0	57.6	43.5	56.1	42.6	54.8	48.0	101	11.2	57.1	22
Trego	60.7	61.7	54.1	59.7	37.5	59.8	48.8	58.9	37.3	56.3	47.7	101	11.8	59.3	23
NuFrontier	68.1	60.2	51.3	57.5	40.3	57.2	39.1	57.1	37.9	55.4	47.3	100	11.3	57.5	25
Jagger	52.5	59.1	48.0	56.8	56.1	56.6	38.5	56.1	41.5	54.1	47.3	100	10.6	56.6	23
Akron	52.1	59.1	55.0	56.7	43.6	57.4	40.5	56.6	42.4	55.8	46.7	99	11.2	57.1	23
Alliance	64.0	57.7	55.8	54.9	49.1	56.6	35.9	57.1	26.9	55.0	46.4	98	11.1	56.3	24
T81	51.3	60.0	50.8	56.2	46.5	58.2	43.7	57.5	35.2	55.3	45.5	96	11.6	57.5	23
Overley	42.9	60.1	50.6	56.2	54.4	57.6	41.1	55.6	36.7	55.9	45.1	95	10.9	57.1	25
Millenium	62.6	59.2	47.8	59.3	49.8	57.8	32.9	55.1	32.4	55.7	45.1	95	11.4	57.4	28
NuHorizon	51.2	60.3	49.8	58.6	39.2	57.6	44.0	57.6	34.3	56.0	43.7	92	11.3	58.0	22
Thunderbolt	55.7	61.1	48.0	58.0	46.7	58.1	34.2	59.5	30.3	57.2	43.0	91	11.5	58.8	25
Prowers 99	54.4	60.0	49.7	59.6	44.2	57.5	26.8	57.3	35.8	55.0	42.2	89	11.8	57.9	27
Halt	50.3	58.7	52.2	57.2	49.3	56.2	32.4	57.3	25.6	54.4	41.9	88	10.9	56.8	22
Arrowsmith	43.4	58.9	42.3	58.8	49.7	59.4	36.0	56.2	35.2	56.2	41.3	87	11.9	57.9	27
Antelope	47.4	58.9	51.6	57.2	45.2	57.6	32.2	55.6	28.5	53.9	41.0	87	11.1	56.6	24
Average	**58.2**	**59.3**	**52.6**	**57.2**	**47.3**	**57.7**	**41.4**	**56.8**	**37.3**	**55.4**	**47.4**	**100**	**11.2**	**57.3**	**24**
CV %	10.0		7.3		10.8		13.2		13.7						
$LSD_{(0.30)}$	5.0		3.3		4.5		4.5		4.3						

[1]Varieties in table ranked by the average yield over four locations in 2004.

continued on page 4

Colorado winter wheat 3-Yr and 2-Yr Uniform Variety Performance Trial summary.

	Averages						
Variety[1]	3-Yr	2-	2004	2003	2002	3-Yr	2-Yr
	----------Yield (bu/ac)----------					----Twt (lb/bu)----	
Above	48.4	52.2 [(1)]	51.4	52.8	34.5	58.2	57.9
TAM 111	48.0	51.6 [(2)]	50.2	52.6	35.0	59.1	59.1
Trego	47.0	50.5 [(5)]	47.7	52.9	34.3	60.2	60.2
Jagalene	46.9	50.0	54.1	46.6	35.7	59.4	59.2
Ankor	46.7	50.2	48.3	51.8	33.7	58.2	58.3
Avalanche	46.5	50.5 [(4)]	50.6	50.4	31.6	59.7	59.5
Yuma	46.4	50.9 [(3)]	48.4	53.0	30.0	58.2	58.0
Stanton	46.2	49.8	50.4	49.4	32.6	59.1	59.0
Prairie Red	46.1	49.2	48.0	50.2	34.6	58.2	58.1
Yumar	45.6	49.6	48.7	50.3	30.8	58.6	58.6
AP502 CL	45.3	48.8	48.6	48.9	32.7	57.7	57.6
Lakin	45.3	48.4	49.0	47.8	33.9	58.8	58.6
Alliance	45.2	48.6	46.4	50.5	32.5	58.2	58.0
Akron	45.1	48.3	46.7	49.6	33.2	58.2	58.2
Jagger	43.4	46.6	47.3	46.0	31.7	58.2	58.0
Halt	42.4	44.5	41.9	46.7	34.7	58.0	57.8
Prowers 99	41.3	43.9	42.2	45.4	31.8	59.4	59.4
Thunderbolt	38.9	41.1	43.0	39.6	30.8	59.7	59.7

[1]Varieties in table ranked based on 3-Yr average yields.
[1--5]Varieties rank based on 2-Yr average yields.

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Colorado winter wheat Irrigated Variety Performance Trial summary for 2004.

	Location				2004 Averages				
	Haxtun		Rocky Ford						
Variety[1]	Yield	Test Weight	Yield	Test Weight	Yield	% of Average	Grain Moisture	Test Weight	Plant Height
	bu/ac	lb/bu	bu/ac	lb/bu	bu/ac	%	%	lb/bu	inches
Yuma	133.5	57.5	95.8	55.9	114.6	112	11.9	56.7	34
Ankor	120.6	59.4	97.3	53.9	108.9	106	11.6	56.6	38
Prairie Red	109.1	56.9	106.0	55.2	107.6	105	11.1	56.1	34
Ok102	112.3	59.3	99.9	57.7	106.1	103	12.3	58.5	35
NuHills	103.8	58.4	102.1	55.5	102.9	100	11.6	56.9	34
Overley	119.7	58.3	85.6	56.8	102.7	100	11.7	57.5	39
NuFrontier	111.7	56.2	92.2	57.4	101.9	99	11.9	56.8	38
Dumas	113.8	58.2	88.2	58.0	101.0	98	11.7	58.1	35
Jagalene	119.9	59.0	81.5	57.0	100.7	98	12.2	58.0	37
Antelope	121.5	57.0	79.6	54.8	100.6	98	11.2	55.9	36
Nuplains	110.6	58.6	89.1	57.0	99.9	97	12.5	57.8	37
NuHorizon	121.6	60.3	77.4	56.4	99.5	97	12.4	58.3	35
Wesley	113.8	58.9	83.3	54.2	98.6	96	11.2	56.5	33
Platte	107.8	61.0	77.2	53.2	92.5	90	12.0	57.1	33
Average	**115.7**	**58.5**	**89.7**	**55.9**	**102.7**	**100**	**11.8**	**57.2**	**36**
CV %	6.1		8.9						
$LSD_{(0.30)}$	6.1		6.8						

[1]Varieties in table ranked by the average yield over two locations in 2004.

Colorado winter wheat 3-Yr and 2-Yr Irrigated Variety Performance Trial summary.

	Averages						
Variety[1]	3-Yr	2-Yr	2004	2003	2002	3-Yr	2-Yr
	----------Yield (bu/ac)----------					---------Twt- (lb/bu)---------	
Yuma	105.1	110.1	114.6	107.1	92.6	57.8	57.9
Jagalene	104.5	109.4	100.7	115.1	92.5	59.0	58.7
Prairie Red	104.4	108.1	107.6	108.5	94.9	57.1	56.6
Wesley	100.1	103.7	98.6	107.1	91.0	58.2	57.8
Antelope	97.0	101.1	100.6	101.5	86.9	58.0	57.6
Ankor	96.9	100.1	108.9	94.3	88.8	56.7	57.0
Platte	96.2	96.3	92.5	98.8	95.8	57.8	56.8
Dumas	95.9	100.6	101.0	100.3	84.3	59.1	58.3
Nuplains	88.8	88.5	99.9	81.0	89.5	58.5	57.9

[1]Varieties in table ranked based on 3-Yr and 2-Yr average yields.

2004 Collaborative On-Farm Tests (COFT)

Introduction

Over half of Colorado's 2004 wheat acreage was planted to winter wheat varieties that have been tested in the COFT program which is in its' seventh year of testing. With on-farm testing, wheat producers get to evaluate new varieties on their own farms before seed of the new varieties is available on the market to all farmers. On-farm testing directly involves agents and producers in the variety development process, thereby speeding adoption of superior, new varieties.

Colorado State University Cooperative Extension agents have a large responsibility for the success of this program - recruiting volunteer growers, delivering seed, planning test layout and operations, helping with planting, keeping records, coordinating visits, communicating with growers and campus coordinators, coordination of weighing plot and measuring yields and collecting grain samples for quality analyses. COFT would not be possible without the collaboration of so many dedicated wheat producers throughout eastern Colorado.

In the fall of 2003, twenty-three eastern Colorado wheat producers planted collaborative on-farm tests (COFT) in Baca, Prowers, Kiowa, Cheyenne, Lincoln, Kit Carson, Phillips, Sedgwick, Logan, Morgan, Adams, and Weld counties. Working alongside local Extension agents, each producer/collaborator received 100 pounds seed of each variety and planted the five varieties in side-by-side strips. The objective was to compare performance and adaptability of newly-released varieties. Comparisons of interest were:

- Compare high yielding KSU hard white wheat, **Trego**, with CSU sister line selection, **Avalanche**.
- Ascertain relative performance and adaptability of high yielding CLEARFIELD* wheat variety, **Above**.
- Ascertain relative performance and adaptability of high yielding RWA resistant hard red winter wheat variety, **Ankor**.
- Ascertain relative performance and adaptability of high yielding AgriPro hard red winter wheat variety, **Jagalene**.

Results

Only seventeen of the twenty-three tests planted in the fall of 2003 were harvested this summer due to the widespread and prolonged effects of drought during last fall and winter. The effective window for planting to achieve satisfactory plant stands last fall was just too small for many eastern Colorado growers. It is estimated by our state agricultural statistics services that approximately 23% of planted wheat acreage in the state was abandoned and our rate of COFT failure was 26% (17/23). In general, low overall yields (27.5 bu/ac) can be attributed to poor stand establishment in the fall followed by droughty winter and spring conditions further causing reduced stands, reduced tillering, small plants, and abnormally early maturity. Disease and insect pests were generally not problematic this year but late rains (and hail) beginning in mid-June and continuing through harvest did little to improve yields but led to rapid weed development and grain sprouting in the head. This was the only year in the last 10 years that sprouting has been an issue in Colorado. Sprouting seemed to result from the coincidence of early wheat maturity (10 days to 2 weeks earlier than normal) and unusual mid- and late-June and early July (pre-monsoon) rains. With the wet harvest weather and shorter-than-normal wheat, producers had a hard time getting combines into their fields and getting the wheat to dry down before the next rain shower arrived and the weeds grew even taller. We really need to work with our biotechnologists to see if we might be able to transfer some of those genes from Russian thistle to wheat or corn.

However, even with a lower-than-target COFT success rate, only 74% when we can generally expect an 80% success rate or better, and below average yields, we were still able to make some meaningful variety comparisons, especially in northeastern Colorado (see 2004 COFT Results Table).

Avalanche vs Trego: The White Wheat Variety Comparison. There was no significant difference between these two in the SE/FR and Overall groups. Avalanche was significantly higher yielding than all varieties in the NE group where Trego was significantly higher yielding than Avalanche in 2003. Our conclusion is that there is no predictable superiority

continued on 7

2004 Collaborative On-Farm Tests (COFT) (continued)

in yield for one of these varieties over the other. Perhaps the most important difference is in maturity with Trego heading, on the average, 1-3 days later than Avalanche. This becomes important for producers seeking to reduce their overall risk to drought, freeze, and hail damage by planting varieties of different maturities. Avalanche would be considered a medium maturing variety like Ankor while Trego would be considered a medium-late maturing variety. Since, for all intents and purposes they are equal yielding under dryland conditions, choosing one or the other would depend on whether the producer already has a medium maturing variety or a medium late maturing variety and then he/she would select the maturity group that is missing and reduce the overall risk.

Adaptability of high yielding *CLEARFIELD** wheat variety, **Above**. Something to remember when looking at the performance of varieties in the COFT trials is that these five varieties are among the top all-time top yielding varieties in the state. Unfortunately, there is not a low yielding variety in the group so the fact that no significant performance differences were found among them is not unexpected. For Above, it means that there is no yield penalty to be paid for incorporation of the *CLEARFIELD** trait and, of course it is our most powerful tool to combat the deleterious effects of winter annual grasses like jointed goatgrass, downy brome, and volunteer rye. Above has shown consistently high yields the last few years in Colorado and would even be a good choice for high yields in areas that have lower risk of grassy weed infestation - and remember, there is no requirement to spray Above with Beyond herbicide in the event that weeds are not a problem. Above is early-maturing and could fill the early-maturing variety niche for producers seeking to reduce overall risk by planting varieties of different maturities. However, Above seed must be purchased annually and cannot be saved for use on the farm or sale to neighbors.

Adaptability of high yielding RWA resistant hard red winter wheat variety, **Ankor**. Stand up! Isn't Ankor a beautiful variety? Ankor has held it's own through thick and thin environmental conditions and, when compared to Akron, has showed a 2-3 bu/a yield advantage in CSU trials as well as trials in Kansas and Nebraska. Lack of significant differences among COFT varieties this year means that Ankor will yield along with top performers under droughty, low yield conditions and was significantly higher yielding than some varieties last year under average yield conditions. It is important that Ankor is medium maturing and should be considered by all Colorado producers in this medium role with an early and a later-maturing mix of varieties. As producers are not able to determine which biotype of RWA will infest their fields, the RWA resistance bred into Ankor will continue to be a useful management tool for RWA infestation in the near future.

Adaptability of high yielding AgriPro hard red winter wheat variety, **Jagalene**. This the first year that Jagalene has been in the COFT program and appears to have done better relative to other varieties in the NE group where it topped three tests in Logan and Morgan counties. Again, Jagalene yielded along with the best yielding varieties in Colorado and would fill the early maturity category for producers trying to spread their risk by planting varieties of different maturities.

Note: We are not planning to conduct the COFT program in 2004/2005 but will start it again in the fall of 2005 with exciting new releases from CSU and from private companies, if available. Thanks to all our cooperators who have so selflessly given time, land, and equipment to make this a success and to our agents above who have just been great collaborators!

Colorado Collaborative On-Farm Test (COFT) results in 2004.

	Variety (Yields in bu/ac @13 % moisture)					
COFT Location*	**Above**	**Ankor**	**Jagalene**	**Avalanche**	**Trego**	**Avg**
	----------Southeast and Front Range Locations----------					
Prowers NC	36.1	35.2	42.0	35.7	38.5	37.5
Baca EC	34.0	27.5	30.2	30.2	25.7	29.5
Baca NC	3.4	2.9	3.2	3.5	3.4	3.3
Kiowa NE	15.8	16.5	14.1	14.7	15.3	15.3
Morgan SW	35.1	33.8	34.8	36.4	35.6	35.2
Weld NC	25.6	28.6	35.1	26.0	25.5	28.2
Adams SE	20.0	24.6	20.4	18.9	18.8	20.5
SE and FR Average	**24.3**	**24.2**	**25.7**	**23.6**	**23.3**	**24.2**
**$LSD_{(0.30)}$	a	a	a	a	a	3.6
	----------Northeast Locations----------					
Kit Carson SW	39.4	38.9	36.8	49.0	40.7	41.0
Yuma NW	21.2	20.6	25.2	22.7	28.2	23.6
Yuma SE	5.8	16.0	3.6	19.4	1.1	9.2
Lincoln NC	18.3	17.4	20.5	22.3	22.8	20.2
Sedgwick SE	27.4	27.1	28.3	26.1	34.1	28.6
Sedgwick SC	27.7	26.5	27.5	26.7	25.9	26.9
Logan NE	28.8	27.6	30.0	31.4	31.4	29.8
Logan SC	28.0	28.1	29.0	25.8	22.3	26.6
Logan EC	47.2	45.4	51.8	46.9	50.1	48.3
Morgan NE	41.9	43.2	45.0	42.7	42.3	43.0
NE Average	**28.6**	**29.2**	**29.8**	**31.6**	**29.9**	**29.8**
$LSD_{(0.30)}$	b	b	ab	a	ab	1.7
Overall Average	**26.8**	**27.1**	**28.1**	**28.3**	**27.2**	**27.5**
$LSD_{(0.30)}$	a	a	a	a	a	2.0

*NC = North Central; EC = East Central; SC = South Central; NE = Northeastern; NW = Northwestern; SE = Southeastern; SW = Southwestern.

**Varieties with different letters indicate statistically different mean yields using a Least Significant Difference test with alpha = 0.30.

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

Name	Title	Office Location
Bruce Bosley	Platte River agronomist	Sterling
Tim Macklin	SE Area agronomist	Lamar
Alan Helm	Golden Plains specialist	Holyoke
Dwight Rus	Lincoln County agent	Hugo
Ron Meyer	Golden Plains agronomist	Burlington
Tim Burton	Cheyenne County agent	Cheyenne Wells
Bruce Fickenscher	Kiowa County agent	Eads
Gary Lancaster	Sedgwick County agent	Julesburg

A Decision Guide for Winter Wheat Variety Selection - Risk Reduction through Variety Maturity Ratings

We are taking a different approach to variety recommendation in light of the last three years of variety trials. It was a shock to us this year that data from only 5 of 11 dryland trials could be used to characterize variety performance. Together with test plot failures the last two years, we have only obtained useful data from 14 of 31 dryland trials since 2002! This lack of data directly affects our wheat improvement program in two ways. First, our efforts to make reliable variety recommendations based on trial performance are severely hampered. Secondly, breeding program decisions on which experimental lines to advance or discard are based on relatively few observations which raises the risk of throwing out a line that, if tested properly, may have proven to be the next wonder variety for Colorado.

In preparing this guide we were forced to look at three year averages (2002-2004). This average included only one year that was near what we would call normal (2003) - even though in this year we were only able to use 60% of the trials planted. This strategy has proven quite useful in the past, in Colorado and elsewhere, as opposed to using the most recent year of trial data to predict future trial performance. The most salient observation when looking at variety response across the three years is the amount of year to year variability, as evidenced by one variety being near the top one year and mediocre to abysmal the next.

What follows breaks from our traditional Decision Tree approach to variety recommendation and is our humble attempt to try to make some sense of the data. We in Colorado, like our public and private counterparts in adjacent states, have recommended for many years that producers should plant two to three different dryland varieties each year as a means to reduce risk. Our extension of this proven approach is that producers should also consider selecting varieties from different maturity groups, in so far as possible, following consideration of yield, quality, disease and insect resistance traits, and other agronomic features. The rationale for this approach is that farmers abandoned production fields and we lost trials in the past three years most often due to drought, spring freeze, and hail damage. We reason that the severity of these conditions is at least partially related to maturity and that maturity is a management factor over which we have at least a small degree of control. Given the fact that our trials indicate that one cannot reliably predict which variety among the top nine varieties (shaded in the table below) will be the top performing variety in a future, unknown year, it is apparent that maturity may be a useful indicator for variety selection with the hopes of reducing overall risk.

Application of this approach is not without its pitfalls. First, it can be seen from the trial data below that relative few varieties are available within the later-maturing group. Both Prowers 99 and Thunderbolt have performed consistently near the bottom of our trials and it would be difficult to recommend these as complements to varieties from the early or medium-maturing groups. Recently, several later maturing varieties have been included in our trials and some of these, particularly Goodstreak from Nebraska (which performed very well in 2004), may prove to fit this group with additional testing. Another potential difficulty with this approach is the fact that in most years later maturing varieties may suffer from stress during grain filling, though these conditions have not figured prominently in Colorado the last two years. We acknowledge the effect that planting date has on crop development and realize that producers may already stagger planting dates as a means to stagger

continued on 10

3-Year Variety Performance Summary with Maturity Class.

Variety[1]	Maturity	3-Yr Avg
		Yield (bu/ac)
Above	Early	48.4
TAM 111	Medium	48.0
Trego	Medium-late	47.0
Jagalene	Medium	46.9
Ankor	Medium	46.7
Avalanche	Medium	46.5
Yuma	Medium	46.4
Stanton	Medium-early	46.2
Prairie Red	Early	46.1
Yumar	Medium-early	45.6
AP502 CL	Early	45.3
Lakin	Medium-early	45.3
Alliance	Medium-early	45.2
Akron	Medium	45.1
Jagger	Early	43.4
Halt	Early	42.4
Prowers 99	Late	41.3
Thunderbolt	Late	38.9

[1]Varieties in table ranked based on 3-Yr average yields.

crop maturity to facilitate harvest. This notwithstanding, we strongly feel that consideration of maturity along with other common variety selection factors may serve as a promising risk reduction tool.

Irrigated Variety Selection

Unlike the dryland trials, we were fortunate to have two high yielding irrigated trials this year at Rocky Ford and Haxtun. At Haxtun, the CSU variety Yuma amazingly yielded 133 bu/ac in each of the three reps. The real decision for irrigated wheat in eastern Colorado seems to be whether to be whether to contract plant the AgriPro/ConAgra white wheat variety, Platte, for which producers receive bonuses or to plant a higher yielding variety like Yuma (9 bu/ac higher yielding than Platte on a three year trial average). It should be noted that Platte sometimes has performed better in producers irrigated fields than in our trials - even when the trial was in Platte field. Platte is susceptible to stripe rust and its yields were significantly reduced in years when stripe rust was present but new fungicides offer good protection. Growers in the northeast seem to have been pleased with the Platte IP program but for those irrigated producers who are not in the right geographical area, or not able to get new contracts, Yuma offers potential high yields. Jagalene and Wesley have also been top irrigated-performers throughout the region.

Two and three year average dryland and irrigated variety performance results can be viewed at the

CSU Crops Testing site
http://www.csucrops.com

or

CSU Wheat Breeding Program site
http://wheat.colostate.edu/vpt.html.

Jerry Johnson and Scott Haley
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‘Hatcher’ and ‘Bond CL’ New Wheat Cultivar Releases from CSU

In early August, 2004, the Colorado State University (CSU) Agricultural Experiment Station approved the release of two new winter wheat varieties from the CSU Wheat Breeding and Genetics Program. These new varieties are the most recent additions to the group of wheat varieties developed by CSU and marketed by the Colorado Wheat Research Foundation.

‘Hatcher’ is a high-yielding hard red winter wheat with good milling and baking properties and resistance to the original strain of RWA. Hatcher is positioned primarily as a replacement for other CSU-bred varieties with RWA resistance, particularly ‘Prairie Red’ and ‘Yumar’. In three years of statewide testing in the dryland Colorado Uniform Variety Performance Trial (UVPT), Hatcher yielded slightly less than ‘Above’ but greater than all other varieties in the trials (see table). ‘Hatcher’ was named in honor of the late E.L. “Shug” Hatcher, a former Colorado Wheat Industry leader who farmed near Lamar, CO.

‘Bond CL’ is a high-yielding hard red winter wheat that combines resistance to the original strain of RWA, excellent baking quality, and the Clearfield* herbicide tolerance gene. In three years of statewide testing in the dryland UVPT, ‘Bond CL’ was slightly lower yielding than ‘Above’ and ‘Hatcher’ but higher yielding than all other varieties in the trials. ‘Bond CL’ was named to highlight the “bonding” of the Clearfield* herbicide tolerance trait with RWA resistance and improved baking quality relative to ‘Above’. Detailed information on the new varieties may be found at http://wheat.colostate.edu.

Yield and test weight from UVPT by 3-year average (bolded).

Entry	2002	2003	2004	03-04 Avg	02-04 Avg	TestWt Avg
Above	34.5	52.8	51.4	52.2	**48.4**	58.2
Hatcher	**32.0**	**56.0**	**48.3**	**52.5**	**48.1**	**58.1**
Bond CL	**31.3**	**55.2**	**48.4**	**52.1**	**47.7**	**57.3**
Trego	34.3	52.9	47.7	50.5	**47.0**	60.2
Jagalene	35.7	46.6	54.1	50.0	**46.9**	59.4
Ankor	33.7	51.8	48.3	50.2	**46.7**	58.2
Avalanche	31.6	50.4	50.6	50.5	**46.5**	59.7
Yuma	30.0	53.0	48.4	50.9	**46.4**	58.2
Stanton	32.6	49.4	50.4	49.8	**46.2**	59.1
Prairie Red	34.6	50.2	48.0	49.2	**46.1**	58.2
Yumar	30.8	50.3	48.7	49.6	**45.6**	58.6
AP502 CL	32.7	48.9	48.6	48.8	**45.3**	57.7
Lakin	33.9	47.8	49.0	48.4	**45.3**	58.8
Alliance	32.5	50.5	46.4	48.6	**45.2**	58.2
Akron	33.2	49.6	46.7	48.3	**45.1**	58.2
Jagger	31.7	46.0	47.3	46.6	**43.4**	58.2
Thunderbolt	30.8	39.6	43.0	41.1	**38.9**	59.7
Average	**32.7**	**49.5**	**47.7**	**48.6**	**45.2**	**58.6**
Locations	**3**	**6**	**5**	**11**	**14**	**14**

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

‘Hatcher’ Hard Red Winter Wheat

- Bearded, white-chaffed, medium maturity, semidwarf
- Heading one day later than 'Yumar', plant height similar to 'Halt'
- Intermediate coleoptile length, good shattering tolerance, average straw strength
- Test weight similar to 'Yumar', superior to 'Prairie Red' and 'Ankor'
- Moderately susceptible to both leaf rust and stripe rust, resistant to "biotype A" RWA
- Excellent milling properties, good baking properties

‘Bond CL’ Clearfield* Wheat

- Bearded, white-chaffed, medium-early maturity, tall-semidwarf
- Heading two days later and plant height two inches taller than 'Above'
- Intermediate coleoptile length, good shattering tolerance, average straw strength
- Relatively low test weight, slightly lower than 'Halt'
- Moderately susceptible to both leaf rust and stripe rust
- Resistant to "biotype A" RWA and greenbug
- Acceptable milling properties, excellent baking properties

Managing New Russian Wheat Aphid Biotypes

Background

Wheat varieties resistant to Russian wheat aphid have been available in Colorado for about 10 years, starting with Halt. Since then, resistant versions of several popular Colorado HRW wheats have been released (the variety name in parentheses is the original, susceptible variety from which the resistant variety was developed through the backcross process), including Ankor (Akron), Prairie Red (TAM 107), Prowers 99 (Lamar) and Yumar (Yuma). The resistance in all of these varieties is conferred by the gene Dn4. The sixth resistant variety, Stanton, is a wheat variety from Kansas with a different source of resistance. Together, Russian wheat aphid resistant varieties accounted for approximately 25% of Colorado's wheat acres in the 2002 and 2003 crop years, with higher percentages in counties with more consistent infestations.

In the spring of 2003 we received a number of reports of unusual Russian wheat aphid damage in resistant varieties. We were soon able to confirm that this damage was caused by a new Russian wheat aphid biotype that is unaffected by the sources of resistance currently in use. We use the term "Biotype A" to refer to the original aphid for which the resistant varieties were developed and "Biotype B" to refer the new aphid population that is able to overcome the resistance in available resistant varieties.

Biotype Survey

As of July 15, 2004 we have collected 100 Russian wheat samples from Colorado and the southern Nebraska Panhandle. The majority are from wheat producing areas of eastern Colorado. Infested tillers were collected from each site. Twenty young aphids were placed in a pot containing one plant each of TAM 107 and Prairie Red, which was then held in a cage in the greenhouse until the TAM 107 plant was heavily damaged. Aphids that damaged only TAM 107 were considered to be Biotype A, while those that damaged both varieties were categorized as Biotype B (or a mixture of both biotypes). The results of the 91 usable samples are summarized in the map and table on page 13.

Roughly half (47%) of the samples we were able to classify were Biotype A, the original Russian wheat aphid. Biotype B was found throughout eastern Colorado. It was not found in the West Slope samples.

The range of Biotype B clearly has expanded since it was first observed in southeast Colorado last spring. However, it does not seem to have displaced Biotype A, and it is unknown whether this pattern will change over the next few years. Varieties resistant to Biotype A therefore remain an important Russian wheat aphid management tool.

How Many Biotypes?

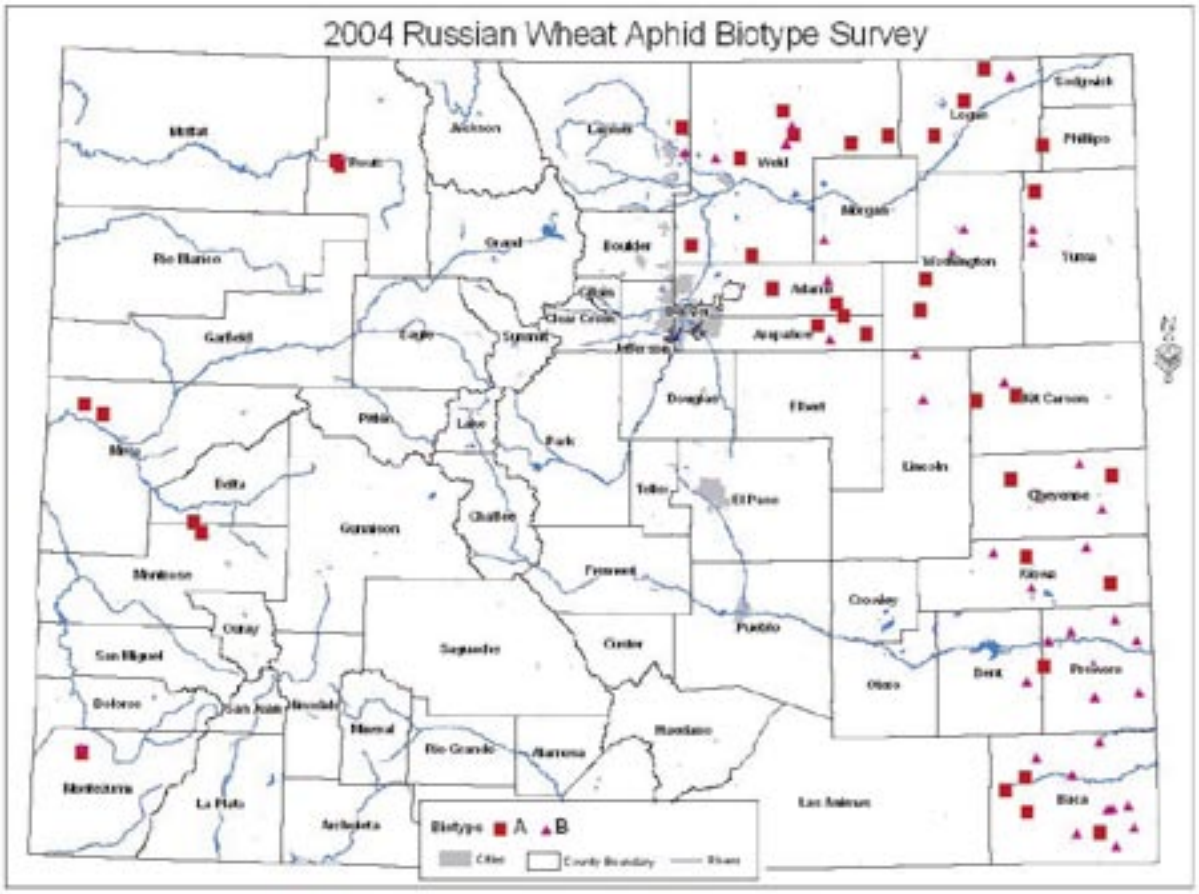
When we started our survey, only two biotypes were known. However, on June 4, 2004 a USDA researcher informed us that he had identified at least three additional biotypes – two from Texas and one from Wyoming. At that point we modified our survey methods to allow us to detect one or more of these new biotypes. To avoid confusion, we have presented our results to show the number and location of Biotype A and B samples. Realistically, Biotype B samples should be considered as "non-A". However, our opinion is that the Biotype B designation is accurate in most cases. Nonetheless, it does appear that we encountered at least two additional biotypes after we changed our methods – one from Baca County similar to the USDA Texas isolate and a previously unknown type from Montezuma County.

Developing New Resistant Varieties

A common question is how soon will varieties resistant to both Biotype A and the new biotype(s) be available? This depends on where we find new sources of resistance. If resistance is found in advanced breeding material with good quality and agronomic traits, then the development period would be relatively short. This is highly unlikely and, in fact, screening of over 350 elite breeding programs from Great Plains programs failed to identify any useful resistance. The more likely scenario will be that resistance will be found in an unadapted, undesirable wheat, as was the case with Dn4. If this is the case, the development period will be substantially longer, perhaps as long as 10 years. Effective resistance to Biotype B has been identified in a few breeding lines from CSU and the USDA-ARS in Stillwater, Oklahoma, and a collection of germplasm from the National Small Grains Collection

continued on 13

Managing New Russian Wheat Aphid Biotypes (continued)



County	Total Samples	Biotype		County	Total Samples	Biotype	
		A	B			A	B
Adams	3	2	1	Morgan	1	0	1
Arapahoe	4	3	1	Otero	2	1	1
Baca	13	5	8	Park	1	1	0
Bent	2	0	2	Phillips	1	1	0
Cheyenne	5	2	3	Prowers	10	1	9
Delta	4	4	0	Pueblo	1	0	1
Kiowa	5	2	3	Routt	2	2	0
Kit Carson	2	1	1	Washington	6	3	3
Lincoln	2	0	2	Weld	10	7	3
Larimer	2	1	1	Yuma	2	1	1
Logan	5	3	2	Nebraska(all)	6	2	4
Montezuma	2	2	0	TOTALS	91	43	48

continued on 14

Managing New Russian Wheat Aphid Biotypes (continued)

any, of these accessions found to be resistant to biotype B will be resistant to the new biotypes. We also have begun to screen for new sources of resistance. Most of the sources known to be resistant to Biotype A have proven to be susceptible to Biotype B. A promising exception is Dn7, which confers high resistance to both biotypes, but was transferred to wheat from rye and is generally associated with poor baking quality. Also some of the newly discovered biotypes are virulent to Dn7. In addition, we have evaluated more than 700 Biotype A resistant lines and have identified several promising new sources.

We also have started to screen an additional 12,000 lines from the National Small Grains Collection, which should be completed in the fall of 2005. Lines resistant to Biotype B will be rescreened with Biotype A and with a Dn7-virulent type to identify promising lines for use in the development of varieties with broad resistance to as many Russian wheat aphid biotypes as possible.

Management of the New Biotypes

The resistant varieties mentioned above are still the most economical and effective management option for Biotype A. However, currently available resistance is not effective against Biotype B or the other newly discovered types, so they must be managed with the methods developed before resistant varieties were available. These include biological control, cultural controls, and judicious insecticide treatments based on appropriate scouting and economic threshold information.

Biological controls consist of (1) native natural enemies, such as lady beetles, lacewings, and spiders, which feed on a variety of insects including aphids; (2) exotic natural enemies collected from the Russian wheat aphid's native range and imported specifically for its control; and (3) commercially available natural enemies, which can be purchased and released in large numbers to control Russian wheat aphid. Each of these approaches may provide some control benefit in certain situations, but overall, biological control has not been sufficiently effective against Russian wheat aphid.

Cultural controls are changes in crop production practices that result in a crop environment that is less favorable for the pest or more favorable for natural enemies. Several cultural controls are known to provide some control benefit for Russian wheat aphid. Delayed planting of winter wheat and early planting of spring grains can help reduce initial aphid infestations. Crop diversification by producing winter wheat in rotation with summer crops is thought to enhance biological control activity, as well as providing a number of other economic and pest management benefits. Finally, any practice that results in a healthier and more vigorous crop should help minimize Russian wheat aphid problems, which often are worse in stressed portions of the field.

The important considerations in chemical control of Russian wheat aphid are what product to use and when to use it. We have tested a number of insecticide treatments since Russian wheat aphid first appeared in Colorado. It is convenient to compare treatments based on their consistency in achieving very good control (better than 90% control at three weeks after treatment). These results, summarized in Table 1, indicate that one pint of Lorsban 4E has been our most consistent treatment. Other available treatments, which we have not tested as extensively, include Cruiser and Gaucho seed treatments, Di-Syston and Furadan soil treatments, and Mustang Max foliar treatment.

Table 1. Control of Russian wheat aphid with hand-applied insecticides in winter wheat, 1986-2003[1].

PRODUCT	LB (AI)/ ACRE	TESTS WITH > 90% CONTROL	TOTAL TESTS	% TESTS
LORSBAN 4E	0.50	23	39	59
DI-SYSTON 8E	0.75	16	41	39
LORSBAN 4E	0.25	7	21	33
DIMETHOATE 4E	0.375	7	33	21
DI-SYSTON 8E	0.50	2	10	20
PENNCAP M	.075	3	19	17
WARRIOR 1E	0.03	2	12	17

[1]Includes data from several states.

continued on 15

Managing New Russian Wheat Aphid Biotypes (continued)

The presence of other pests may have a bearing on the most appropriate treatment choice. For example, if cutworms are present in addition to Russian wheat aphid, a pyrethroid insecticide such as Mustang Max or Warrior would be a better choice than Lorsban 4E. The pyrethroids are highly effective against cutworms and moderately effective against Russian wheat aphid, while Lorsban is highly effective against the aphid but not effective against cutworms at the label rate.

See Table 2 for simple treatment guidelines for deciding whether a Russian wheat aphid treatment should be made. If one tiller shows damage, then the plant should be considered damaged. Aphids can be very difficult to find during cold weather, so base treatment decisions on damage alone under such conditions.

Table 2. Treatment guidelines for Russian wheat aphid by crop stage.

Crop Stage	Level at which aphids should be treated[1]
	FALL
Any growth stage	10-20% damaged plants
	SPRING
Regrowth to early boot	5-10% damaged and infested tillers
Early boot to flowering	10-20% damaged and infested tillers
After flowering	More than 20% damaged and infested tillers

[1]Based on a 100 plant or tiller sample.

An alternative threshold for the period from spring regrowth to heading, which takes into consideration control costs and expected crop value, is as follows:

$$\% \text{ Infested Tillers} = \frac{\text{Control Costs (\$/acre)} \times 200}{\text{Expected yield (bu/acre)} \times \text{Expected price (\$/bu)}}$$

For example, the % infested tillers above which treatment should be considered for $15 control costs, 34 bu/acre expected yield and $3.50 would be calculated as follows:

$$25\% \text{ Infested Tillers} = \frac{\$15.00 \times 200}{34 \times \$3.50}$$

Increases in crop value or reduced control costs result in less infestation required to justify treatment, while the reverse is true for decreased crop value or increased control costs. For example, if the price of wheat were lower it would take more aphid damage to justify an insecticide expenditure.

$$32\% \text{ Infested Tillers} = \frac{\$15.00 \times 200}{34 \times \$2.75}$$

If the percentage of infested tillers calculated in this manner is less than the percentage of infestation observed in a 100-tiller sample from the field being evaluated, then a treatment should be considered. After heading, use a factor of 500 rather than 200 in the numerator.

continued on 16

Further Information

The High Plains Integrated Pest Management Guide for Colorado, western Nebraska, Wyoming, and Montana provides on-line management information for Russian wheat aphid and the other pests and diseases of small grains, as well as most other crops grown in the region.

http://www.highplainsipm.org/

The Colorado State University fact sheet Aphids in Small Grains summarizes management information for Russian wheat aphid as well as other aphids that attack wheat and similar crops in Colorado.

http://www.ext.colostate.edu/pubs/insect/05568.pdf

Areawide Pest Management for Wheat: Management of Greenbug and Russian Wheat Aphid is a cooperative project between USDA-ARS and several states, including Colorado. This project is designed to improve the management of these key wheat pests through diversified cropping, resistant varieties, remote sensing, and other pest management tools. New pest management information is being developed through economic surveys, field research, and grower focus groups. Colorado research sites are located at Walsh, Lamar, and Briggsdale.

http://www.pswcrl.ars.usda.gov/AWPM2/index.htm

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"Science to Secure Food and the Environment"

2004 ASA-CSSA-SSSA International Annual Meetings with the Canadian Society of Soil Science Seattle, Washington - Oct 31 - Nov 4, 2004

The yearly meetings of American Society of Agronomy (ASA)-Crop Science Society of America (CSSA)-Soil Science Society of America (SSSA) bring together 4,000+ people from 40 countries representing academia, government and private industry, including a large contingent of undergraduate and graduate students.

http://www.asa-cssa-sssa.org/anmeet/

View Crop Water Use Reports at: www.coagmet.com

How much water did your crops use today? Check out www.coagmet.com to find daily crop water use (ET) reports. Because ET is affected by our ever- changing weather conditions, it can fluctuate daily. Weather conditions that impact crop ET are measured by a network of weather stations throughout Colorado. This weather data is used to calculate and produce ET reports for several common crops, including wheat.

New revisions to this website allow users to choose crops, weather stations, and planting/green-up dates to customize their reports. Users can bookmark their outputs and do not have to re-enter options each time they access the information. The website also provides a map to locate the nearest station(s) and instructions on how to use the information. We encourage you to check out this useful tool at www.coagmet.com and click on CoAgMet Crop Water Use Access.

CoAgMet is a service of Colorado State University and the USDA Ag. Research Service and NRCS.

Estimating Gene Flow in Wheat and Jointed Goatgrass: A Progress Report

In the era of genetically engineered (GE) crops, pollen-mediated gene flow is a concern for two reasons: (1) if the introduced genes spread to standard varieties of the crop, it may cause marketing problems for the conventional varieties, especially for export markets; and (2) if the genes are transferred to wild species, such as jointed goatgrass, negative environmental effects may result. Although GE wheat cultivars are not expected to be released in the near future, they will likely be introduced at some point. Therefore, to provide relevant information for regulatory agencies and growers, we have undertaken a three-year project to estimate gene flow in commercial-scale wheat fields, with funding from USDA's Biotechnology Risk Assessment Research Grants Program.

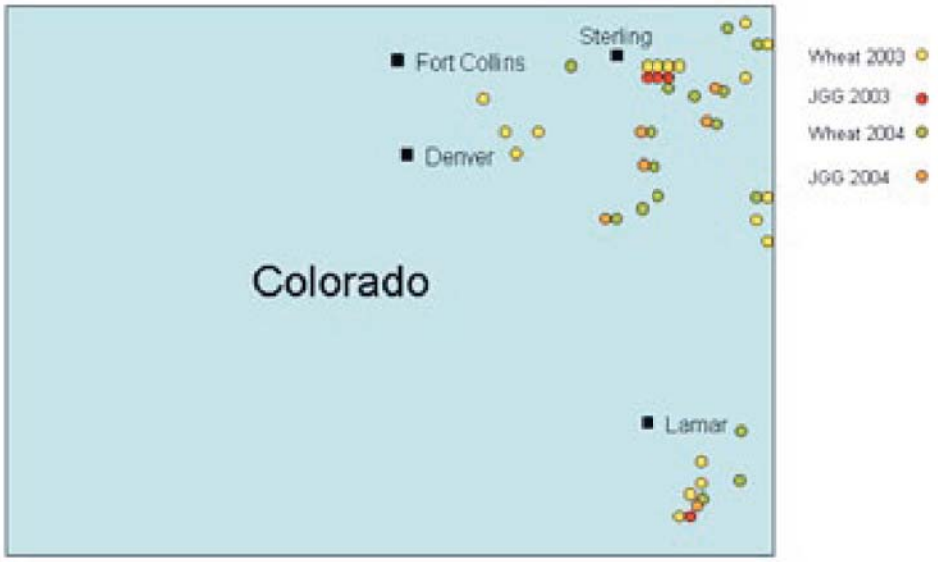

Figure 1: Locations of wheat and jointed goatgrass samples collected in 2003 and 2004.

Our project takes advantage of the Colorado release of 'Above', a Clearfield (imazamox herbicide tolerant) winter wheat variety. By sampling seeds of non-Clearfield varieties in fields adjacent to 'Above' fields and testing for their tolerance to Beyond (imazamox) herbicide, we can estimate the amount of cross-pollination that has taken place. The assumption is that herbicide tolerance in the standard varieties will be due almost entirely to genes obtained from the nearby source of 'Above' pollen.

We have now completed evaluation of 129 samples collected from 17 Eastern Colorado locations in 2003. Another 268 samples were collected from 20 locations during the 2004 harvest season (Fig. 1).

Herbicide tolerance of seeds collected in 2003 was evaluated in both greenhouse and field plantings; only the field data are presented here. Approximately 15,000 seeds per sample were planted at CSU's Agricultural Research, Development, and Education Center near Fort Collins in October, 2003. In early to mid-spring, 2004, the plots were sprayed twice with recommended rates of Beyond herbicide. Our objective was to kill plants that did not contain herbicide tolerance genes, but to allow survival of those plants that had received a single dose of the tolerance gene from 'Above' pollen. In early May, when control plants were in the boot stage, the numbers of survivors and dead plants were counted and the percentage of survivors calculated.

Preliminary results from a subset of locations and varieties are presented in Table 1. As expected, the highest rates of cross-pollination occurred at sampling positions closest to 'Above' and in varieties with heading dates similar to 'Above', such as 'Prairie Red' and 'Jagger.' Cross-pollination rates dropped off rapidly with distance, but we detected low levels of herbicide tolerance as far as 120 feet from 'Above.' The direction relative to 'Above' in which samples were collected had an important influence on degree of cross-pollination in some locations. Only a slight difference was seen between north and south directions at a location in Baca County, but a major difference occurred between directions at two sites in Kit Carson

continued on 18

County. These differences are most likely due to the direction of prevailing winds during the morning hours when most wheat pollen is shed. Although we assume that the herbicide tolerance observed in this study is due to cross-pollination, other explanations, such as seed impurities, cannot be completely ruled out. Please bear in mind that the data presented here represent a single season. We will evaluate samples for two more seasons before making more general conclusions about the level of gene flow in eastern Colorado wheat fields.

This project would not have been possible without the excellent cooperation we received from growers and extension agents during the past two seasons. We hope to continue those collaborations during the 2004-05 season.

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Table 1. Percent cross-pollination as determined by herbicide tolerance for a subset of locations and varieties sampled in 2003.

Sample location (county)	Variety	Direction from Above	Distance from Above, ft	Percent herbicide tolerance
Baca	Prairie Red	N	0.5	1.20
		N	40	0.15
		N	81	0.08
		N	120	0.00
		S	0.5	1.08
		S	40	0.06
		S	81	0.04
Kit Carson 1	Jagger	NE	0.75	2.58
		NE	20	0.94
		NE	40	0.29
		NE	120	0.32
		W	0.75	5.31
		W	20	3.34
		W	40	3.13
		W	120	0.50
Kit Carson 2	Ike	NE	0.75	0.26
		NE	20	0.11
		NE	40	0.17
		NE	120	0.11
		W	0.75	0.07
		W	20	0.09
		W	40	0.01
		W	120	0.03
Sedgwick	Akron	E	1	0.77
		E	20	0.02
		E	40	0.11
	Ankor	W	1	0.07
		W	20	0.01
		W	40	0.01
Weld	Yuma	N	3	0.08
		N	20	0.02
		N	40	0.01
		N	60	0.02
		N	90	0.01
		N	120	0.01

Wheat Information on the Web

Agricultural Research Service's Grain Marketing and Production Research Center (GMPRC)
http://www.usgmrl.ksu.edu/

Agriculture Network Information Center
http://www.agnic.org/

Agripro Wheat
http://www.agriprowheat.com/

Farmer Direct Foods
http://www.awwpa.com

BASF¹s Clearfield Website
http://www.clearfieldsystem.com/

CSU Wheat Breeding and Genetics Program
http://wheat.colostate.edu

Colorado Wheat Variety Performance Database
http://wheat.colostate.edu/vpt.html

Colorado Seed Programs
http://seeds.colostate.edu/

Crop Profile for Wheat (Winter) in Colorado
http://pestdata.ncsu.edu/cropprofiles/docs/cowheat-winter.html

Crop Variety Performance for Colorado Crops
http://www.csucrops.com

CSU Crop Production Factsheets
http://www.ext.colostate.edu/pubs/crops/pubcrop.html

CSU Dryland Ecosystems Project
http://www.colostate.edu/Depts/SoilCrop/dryland/dryland.htm

Hard Winter Wheat Regional Nursery Program
http://www.ianr.unl.edu/arslincoln/wheat/default.htm

IFAFS - Bringing Genomics to the Wheat Fields
http://maswheat.ucdavis.edu/

USDA-ARS Hard Winter Wheat Quality Lab
http://129.130.148.103/gqu/HWWQL/HWWQLHome.htm

Wheat Diseases and Pests Identification Guide
http://wheat.pw.usda.gov/ggpages/wpest.html