

# Technical Report

# TR93-8

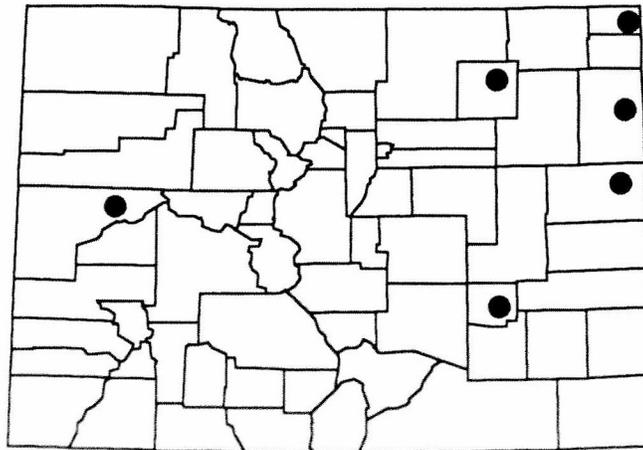
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December 1993

## Colorado Dry Bean Variety Performance Trials, 1993



● Irrigated Trial

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## **COLORADO DRY BEAN VARIETY PERFORMANCE TRIALS, 1993**

**John F. Shanahan, Howard F. Schwartz,  
Mark A. Brick, Frank C. Schweissing, Ron F. Meyer, Calvin H. Pearson,  
James P. Hain, Cynthia L. Johnson, and J. Barry Ogg<sup>1 2</sup>**

### **INTRODUCTION**

Extension and research personnel at Colorado State University annually evaluate commercial and public dry bean varieties at several locations in Colorado to determine varietal yield and adaptation to Colorado growing conditions. This information should enable producers and processors of dry bean to more efficiently manage production practices, providing consumers with a highly nutritious food product at an economical price. Funding for these experiments was provided by Colorado State University, the Colorado Dry Bean Administrative Committee and private industry.

If you have suggestions or comments regarding this information, please contact either your local Extension agent; John F. Shanahan, Extension Agronomist, Colorado State University (303) 491-6201; or Howard Schwartz, Extension Plant Pathologist, Colorado State University (303) 491-6987.

This program involved the following personnel (in alphabetical order):

1. Mark A. Brick, Plant Breeding, Agronomy
2. Tim D'Amato, Weed Science
3. James P. Hain, Research Associate, Agronomy
4. Cynthia L. Johnson, Research Associate, Agronomy
5. Ron Meyer, Cooperative Extension Agent, Agronomy
6. Barry Ogg, Research Associate, Agronomy
7. Calvin Pearson, Western Slope-Fruita, Agronomy
8. Stan Pilcher, Extension Entomology
8. Howard F. Schwartz, Extension Plant Pathology
10. Frank C. Schweissing, Arkansas Valley Research Center
11. John F. Shanahan, Extension Agronomy
12. Mark Van Gessel, Weed Science
13. Phil Westra, Extension Weed Science
14. Many local county agents, bean growers and dealers

### **ENTRY FORMS FOR 1994 TRIALS**

Entry forms for 1994 Test Plots may be obtained from the Department of Agronomy, Colorado State University, by contacting John F. Shanahan, Cooperative Extension Associate Professor, C-4 Plant Science Building, Fort Collins, CO 80523; Telephone (303) 491-6201 and FAX (303) 491-0564.

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<sup>1</sup>Associate Professor, Agronomy; Professor, Plant Pathology and Weed Science; Professor, Agronomy; Associate Professor, Arkansas Valley Research Center; Extension Agent, Kit Carson County; Associate Professor, Fruita Res. Center; Research Associates, Agronomy.

<sup>2</sup>The authors wish to express their appreciation to faculty for their advice and assistance. They also acknowledge the contribution of equipment, time, and land by several farmers on whose land most of the tests were conducted and seed from various bean dealers.

## PERFORMANCE TRIAL METHODOLOGY

### Location of Trials

In 1993, trials were conducted at Burlington, Delta, Julesburg, Rocky Ford, Wiggins, and Wray (see Colorado map on front cover). Important climatic and cultural factors for each site are shown in Table 1. All trials were surrounded by commercially grown beans to simulate grower conditions and to expose varieties to diseases, insects and other conditions. At Burlington, Julesburg, Wiggins and Wray, two separate market class studies were conducted: 1) pinto and 2) light red kidney, and at Burlington a third class was added 3) special (black, great northern, small white, and navy).

### Experimental Procedures

A randomized complete block field design with four replicates was used in all trials. Plots were planted and harvested by Colorado State University research personnel with CSU equipment. Plot area was approximately 400 ft.<sup>2</sup>, consisting of four 30 inch-spaced rows, and harvest area was approximately 200 ft.<sup>2</sup>. Irrigation methods at each site are shown in Table 1. Seed rate was approximately 87,120 seeds per acre.

**Table 1. Elevation and climatic conditions for 1993 dry bean trial sites.**

Trial Location	County	Elev. (FEET)	1993 GDD <sup>1</sup>	30-Year Average GDD	Irrigation Delivery
Burlington	Kit Carson	4170	2471	2728	Sprinkler
Delta	Delta	4930	2367	2671	Flood
Wiggins	Morgan	4320	2622	2632	Sprinkler
Julesburg	Sedgwick	3477	2591	2553	Flood
Rocky Ford	Otero	4170	2863	2906	Flood
Wray	Yuma	3560	2605	2771	Sprinkler
Average			2587	2710	

<sup>1</sup>Growing degree days calculated using temperature data from weather stations nearest to trials.

## PERFORMANCE TRIAL RESULTS

Grain yields are reported in pounds per acre adjusted to 14% moisture content. Other variables reported were grain moisture, grain test weight and seed number per pound, which is an indicator of seed quality. An analysis of variance and test of significance were computed on all performance categories where sufficient data were available. The LSD (Least Significant Difference) is also reported for each category where tests of significance indicated. When the difference between any two varieties is greater than the LSD value the probability is greater than 19:1 that the difference is real. The CV (coefficient of variation), the ratio of the standard deviation to the grand mean of the trial expressed as a percent. The CV is a relative term indicating the precision of the trial. Trials with a yield CV less than 10% are considered extremely precise while trials having a CV greater than 25% are less precise and the data from such trials should be considered

less reliable. Multiple year and location results, especially those having the greatest number of years, are generally best for predicting variety performance under future circumstances.

### **Weather Summary**

In general, the weather pattern affecting bean production in 1993 was the cooler than normal temperatures experienced throughout the state. For example, accumulated growing degree days were 10% below average at Burlington.

### **Disease Summary**

Because of the cooler and moister conditions, there was an increased incidence of rust and bacterial brown spot diseases, particularly in northeastern Colorado. Additionally, isolated outbreaks of white mold and fusarium wilt were also observed. The fusarium wilt disease was especially severe at the Wiggins trial. However, the disease was not consistently present throughout the entire plot area at Wiggins and produced variable variety responses, which is why the CV was high.

### **Description of Pinto Bean Varieties Tested in Colorado, 1993**

1. **ARAPAHO (80-1744)** - A pinto from Colorado State University released in 1993 with semi-upright growth habit. It has some field tolerance to white mold but is susceptible to rust.
2. **BILL Z (81-13197)** - A variety from Colorado State University with vine growth habit released in 1985 with resistance to some, but not all races of rust and moderate tolerance to bacterial brown spot. It is a productive variety when growing conditions are good. It is similar to Olathe with regard to white mold reactions and maturity.
3. **CHASE (89-5)** - A new vine variety from the University of Nebraska resistant to rust and white mold, and moderately resistant to bacterial brown spot.
4. **CAHONE** - A vine type variety developed by Colorado State University for dryland conditions in southwestern Colorado. It is grown under irrigation in New Mexico and in the Arkansas River Valley, but has very late maturity under irrigation.
5. **CO-07012-5** - An experimental line from Colorado State University.
6. **CO-59196** - An experimental line from Colorado State University.
7. **CO-62713** - An experimental line from Colorado State University.
8. **CO-74425** - An experimental line from Colorado State University, susceptible to rust and bacterial diseases.
9. **CO-97373** - An experimental line from Colorado State University.

10. **NW-410** - A vine variety released by the USDA. The variety has good yielding ability and tolerance to fusarium root rot, but is highly susceptible to rust and white mold.
11. **OLATHE** - A vine variety developed by Colorado State University and released in 1979. It has rust resistance against most, but not all prevalent races, and is susceptible to bacterial diseases and white mold. Seed size is comparable to UI-114, but seed shape is more rounded and may split more easily unless handled carefully.
12. **OTHELLO (GH 215)** - A semi-upright, pinto variety released by the USDA. The variety has very good yielding ability, tolerant to fusarium disease and soil compaction, can escape white mold under some conditions, but highly susceptible to rust and bacterial diseases.
13. **RNK-178** - An experimental line from Rogers NK Seed Co., with rust resistance and moderate resistance to some bacterial diseases.
14. **RNK-179** - An experimental line from Rogers NK Seed Co., susceptible to rust, but moderately resistant to some bacterial diseases.
15. **RNK-354** - An experimental line from Rogers NK Seed Co.
16. **RS-101** - An upright type pinto variety released by Ron Seacat, a western slope grower, susceptible to rust and bacterial diseases. The upright growth habit helps it escape white mold infection unless plant populations are too high.
17. **UI-114** - A variety released by the University of Idaho in 1967 with maturity of 95-100 days. It is susceptible to rust, fusarium, bacterial diseases and white mold.
18. **UI-126** - A variety released by the University of Idaho in 1983, with good yield potential and is similar to UI-114 for disease reaction.
19. **UI-129** - A variety released by the University of Idaho in 1983, with good yield potential and similar to UI-114 for its disease reaction.
20. **UI-196** - A variety released by the University of Idaho and the USDA in 1990, with high yield potential and similar to UI-114 for its disease reaction.

**Table 2. Results of pinto bean performance trial at Burlington in 1993.**

Steve Scott Farm					
SEEDING DATE--JUNE 8		HARVEST DATE--SEPT 15			
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
1139	CHASE	2316	63.6	13.8	1331
4	OLATHE	1945	55.7	13.4	1419
6	NW-410	1940	56.6	13.5	1433
258	UI-126	1878	60.7	14.5	1295
15	UI-129	1781	58.6	14.1	1324
520	RS-101	1764	59.5	13.3	1487
582	OTHELLO	1742	58.5	14.2	1339
46	BILL Z	1739	59.3	12.7	1428
1120	CO-74425	1735	57.8	13.9	1246
1125	ARAPAHO	1627	62.7	13.0	1303
2	UI-114	1611	55.2	14.0	1256
1098	CO-62713	1128	57.2	12.0	1310
GRAND COLUMN MEAN		1767	58.8	13.5	1348
COEF VAR		18	5.7	18.4	3
LSD (.05)		442	4.5	3.8	51

**Table 3. Results of pinto bean performance trial at Julesburg in 1993.**

Kent Gerk Farm					
SEEDING DATE--JUNE 9		HARVEST DATE--SEPT 10			
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
1139	CHASE	2399	59.7	15.0	1561
1135	RNK-178	2304	60.0	14.6	1453
46	BILL Z	2230	58.7	13.4	1664
6	NW-410	2132	58.3	12.8	1681
4	OLATHE	2029	57.8	13.8	1672
15	UI-129	2010	59.8	14.8	1487
2	UI-114	1998	59.2	13.9	1444
1112	RNK-179	1978	59.5	14.9	1594
582	OTHELLO	1964	60.9	13.4	1527
1120	CO-74425	1952	58.2	13.9	1297
258	UI-126	1831	59.3	14.5	1500
520	RS-101	1639	58.1	12.5	1755
1125	ARAPAHO	1573	57.9	14.8	1489
1098	CO-62713	1573	57.3	12.2	1493
GRAND COLUMN MEAN		1972	58.9	13.9	1544
COEF VAR		11	1.9	13.9	3
LSD (.05)		308	1.6	3.1	56

**Table 4. Results of pinto bean performance trial at Wiggins in 1993.**

Steve Bruntz Farm					
SEEDING DATE--JUNE 8		HARVEST DATE--SEPT 9			
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
258	UI-126	1944	54.0	12.4	1425
6	NW-410	1777	57.2	11.2	1562
582	OTHELLO	1713	52.1	11.4	1464
2	UI-114	1472	57.0	11.4	1498
46	BILL Z	1399	54.1	11.2	1685
1120	CO-74425	1298	57.6	11.2	1407
520	RS-101	1270	50.4	13.1	1640
4	OLATHE	1218	49.5	11.3	1659
1139	CHASE	1115	56.5	11.8	1718
15	UI-129	1044	53.3	12.1	1496
1125	ARAPAHO	887	0.0 *	11.8	1750
1098	CO-62713	815	0.0 *	12.3	1530
GRAND COLUMN MEAN		1329	54.2	11.8	1570
COEF VAR		26	8.7	10.2	5
LSD (.05)		478	5.2	1.9	111

\*No test weight data due to insufficient sample.

**Table 5. Results of pinto bean performance trial at Wray in 1993.**

Jim Hendrix-Val Farms					
SEEDING DATE--JUNE 8		HARVEST DATE--SEPT 9			
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
258	UI-126	2214	59.9	15.4	1339
46	BILL Z	2119	61.6	16.4	1628
582	OTHELLO	2069	61.0	15.9	1423
1120	CO-74425	2023	59.9	18.4	1349
1150	CO-07012-5	2022	60.5	14.6	1207
1098	CO-62713	1975	59.5	17.1	1457
15	UI-129	1944	59.7	15.4	1380
1139	CHASE	1893	61.0	14.9	1534
6	NW-410	1852	60.1	16.0	1533
1125	ARAPAHO	1849	58.9	14.5	1308
4	OLATHE	1844	57.3	16.6	1515
2	UI-114	1673	60.0	13.9	1462
520	RS-101	1462	59.1	14.7	1708
GRAND COLUMN MEAN		1918	59.9	15.7	1450
COEF VAR		14	2.8	17.2	2
LSD (.05)		387	NS	3.9	40

**Table 6. Average pinto bean performance over four eastern Colorado sites in 1993.**

VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEED /LB
258	UI-126	1967	58.5	14.2	1389
1139	CHASE	1931	60.2	13.9	1536
6	NW-410	1925	58.0	13.4	1552
46	BILL Z	1872	58.4	13.4	1601
582	OTHELLO	1872	58.1	13.7	1438
4	OLATHE	1759	55.1	13.8	1566
15	UI-129	1695	57.8	14.1	1422
2	UI-114	1688	57.8	13.3	1415
520	RS-101	1534	56.8	13.4	1647
1125	ARAPAHO	1484	44.9	13.5	1462
GRAND COLUMN MEAN		1773	56.6	13.7	1503
COEF VAR		16	5.1	7.2	3
LSD (.05)		208	2.0	0.7	35

**Table 7. Average pinto bean performance over eastern Colorado sites during 1991-93.**

VARIETY	1993	1992	1991	2 YR (93-92) AVG		3 YR (93-91) AVG	
	YIELD	YIELD	YIELD	YIELD	%TEST AVG	YIELD	%TEST AVG
BILL Z	1872	2407	2187	2139	106	2155	108
OTHELLO	1872	2301	2160	2087	104	2111	107
NW-410	1925	2143	2099	2034	101	2056	105
OLATHE	1759	2200	2167	1979	98	2042	102
UI-126	1967	2076	1962	2021	100	2002	102
UI-129	1695	2270	2014	1982	98	1993	100
UI-114	1688	2065	1995	1877	93	1916	97
RS-101	1534	2150	2080	1842	91	1921	97
CHASE	1931	2415	-----	2173	108	-----	----
AVERAGE	1805	2225	2083	2015		2025	

**Table 8. Results of pinto bean performance trial at Rocky Ford in 1993.**

Arkansas Valley Research Center						
SEEDING DATE--MAY 28			HARVEST DATE--SEPT 9			
VARIETY	YIELD* LB/A	% TEST WEIGHT	TEST WEIGHT	MOIST PCT	MATURITY**	RUST RATING
BILL Z	4564	118	61	10.7	M	S
UI-114	4398	114	61	10.7	E	S
RNK-354	4388	114	62	11.1	ML	S
UI-196	4330	112	62	11.2	ML	S
CHASE	4315	112	59	10.0	M	R
UI-129	4178	108	63	11.1	ME	S
UI-126	4178	108	62	10.8	ME	S
RNK-179	4154	108	60	10.7	-	S
NW-410	4115	107	62	12.8	M	S
CO-74425	4051	105	60	10.2	ML	S
CO-07012-5	4046	105	58	13.6	M	S
ARAPAHO	3990	103	60	11.6	ML	S
OLATHE	3843	99	60	11.1	M	S
CO-59196	3712	96	62	16.6	L	S
OTHELLO	3578	93	62	10.7	E	S
CAHONE	3390	88	61	14.0	VL	S
CO-62713	2696	70	58	9.9	E	R
CO-97373	1522	39	55	19.2	VL	R
GRAND COLUMN MEAN	3858					
COEF VAR	20					
LSD (.05)	571					

\*High yields due to favorable growing conditions and trace disease pressure late in the season.

\*\*E = early, ME = moderately early, ML = moderately late, L = late, VL = very late, R = resistant, and S = susceptible.

**Table 9. Results of pinto, black and pink bean performance trial at Delta in 1993.**

Shane Atchley Farm			
SEEDING DATE--JUNE 7		HARVEST DATE--OCT 1	
VARIETY NUMBER	VARIETY	YIELD LB/A	SEEDS /LB
1165	CO-59196	2340	1185
46	BILL Z	2261	1191
6	NW-410	2217	1316
1139	CHASE	1855	1256
258	UI-126	1700	1217
1120	CO-74425	1659	1158
4	OLATHE	1656	1260
36	CAHONE	1619	1307
1125	ARAPAHO	1581	1278
15	UI-129	1569	1280
582	OTHELLO	1560	1213
2	UI-114	1511	1250
1105	UI-906	1362	2784
1098	CO-62713	1094	1252
1169	UTAH PINK	1022	1072
GRAND COLUMN MEAN		1667	1335
COEF VAR		17	5
LSD (.05)		410	102

**Description of Light Red Kidney Bean Varieties Tested in Colorado, 1993**

1. **CO-97373** - A experimental line from Colorado State University, very late maturity.
2. **EARLY CALIFORNIA** - A light red kidney released by the University of California in 1990.
3. **FOXFIRE (RB-88702)** - An early maturity light red kidney variety from Rogers NK Seed Co., with bacterial blight and root rot tolerance.
4. **GTS-306** - An experimental line from Gen-Tec Seeds, Ltd., susceptible to bacterial diseases.
5. **SACRAMENTO LRK** - A light red kidney bush released by Sacramento Valley Milling in 1975.
6. **SVM 37-16** - An experimental light red kidney line from Sacramento Valley Milling.

Note: Kidney's usually escape white mold and have resistant to rust; however occasionally a few pustules are observed.

**Table 10. Results of light red kidney bean performance trial at Burlington in 1993.**

Steve Scott Farm					
SEEDING DATE--JUNE 8			HARVEST DATE--SEPT 15		
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
222	SACRAMENTO LRK	1463	62.3	13.8	827
1084	SVM 37-16	1455	60.8	16.4	814
1134	GTS-306	702	0.0 *	30.0	800
GRAND COLUMN MEAN		1207	41.0	20.0	814
COEF VAR		19	9.8	10.0	4
LSD (.05)		393	7.0	3.5	NS

\*No test weight data due to insufficient sample.

**Table 11. Results of light red kidney bean performance trial at Julesburg in 1993.**

Kent Gerk Farm					
SEEDING DATE--JUNE 9			HARVEST DATE--SEPT 10		
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
1091	FOXFIRE	1608	55.5	15.2	1114
222	SACRAMENTO LRK	1231	54.7	17.8	1018
1134	GTS-306	1043	57.7	13.3	1007
1084	SVM 37-16	431	0.0 *	20.0	988
GRAND COLUMN MEAN		1078	56.0	16.6	1032
COEF VAR		14	1.8	15.0	8
LSD (.05)		247	1.2	3.8	NS

\*No test weight data due to insufficient sample.

**Table 12. Results of light red kidney bean performance trial at Wiggins in 1993.**

Steve Bruntz Farm					
SEEDING DATE--JUNE 8			HARVEST DATE--SEPT 9		
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
1084	SVM 37-16	1427	54.7	15.8	923
222	SACRAMENTO LRK	1400	57.7	14.2	909
1134	GTS-306	1268	55.7	21.1	956
GRAND COLUMN MEAN		1365	56.0	17.0	929
COEF VAR		21	3.7	15.0	3
LSD (.05)		NS	NS	4.8	NS

**Table 13. Results of light red kidney bean performance trial at Wray in 1993.**

Jim Hendrix-Val Farms						
SEEDING DATE--JUNE 8			HARVEST DATE--SEPT 9			
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB	
1162	EARLY CALIFORNIA	1737	57.8	15.5	799	
222	SACRAMENTO LRK	1717	60.0	15.9	837	
1084	SVM 37-16	1626	59.8	14.4	795	
1134	GTS-306	1519	59.6	15.3	774	
GRAND COLUMN MEAN		1650	59.3	15.3	801	
COEF VAR		11	2.9	7.7	4	
LSD (.05)		NS	NS	NS	53	

**Table 14. Average light red kidney bean performance over four eastern Colorado sites in 1993.**

VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
222	SACRAMENTO LRK	1453	58.7	15.4	898
1084	SVM 37-16	1235	58.4	16.7	880
1134	GTS-306	1133	57.7	19.9	884
GRAND COLUMN MEAN		1274	58.3	17.3	887

**Description of Special Market Class Varieties Tested in Colorado, 1993**

1. **BERYL** - An upright, wide profile great northern variety from Rogers NK Seed Co., with tolerance to common bacterial blight.
2. **MARQUIS** - A great northern variety from Rogers NK Seed Co.
3. **PANTHER** - An upright black bean variety from Rogers NK Seed Co., with broad adaptability and good root rot tolerance.
4. **UI-125** - An upright, short vine small white bean variety from the University of Idaho with resistance to strains of bean rust, moderately tolerant to common blight and halo blight, and is less susceptible to white mold.
5. **UI-137** - An upright, short vine navy bean variety from the University of Idaho, susceptible to common blight, with moderate levels of white mold, and resistance to some rust strains.
6. **UI-906** - An upright, early-maturing black variety from the University of Idaho with avoidance to white mold, and resistance to rust and some bacterial diseases.

**Table 15. Results of special market class bean trial at Burlington in 1993.**

Steve Scott Farm					
SEEDING DATE--JUNE 8			HARVEST DATE--SEPT 15		
VARIETY NUMBER	VARIETY	YIELD LB/A	TEST WEIGHT	MOIST PCT	SEEDS /LB
1163	MARQUIS	2092	62.2	16.2	1535
594	BERYL	1954	63.0	15.5	1610
1168	UI-137	1681	64.4	15.8	2610
1119	PANTHER	1370	58.3	23.8	2374
1105	UI-906	1366	60.2	18.7	2624
1167	UI-125	1206	62.1	23.7	2681
GRAND COLUMN MEAN		1612	61.7	18.9	2239
COEF VAR		14	4.1	11.5	2
LSD (.05)		337	3.8	3.3	72

**Table 16. Dry bean disease reactions in 1993 - Dr. H. F. Schwartz.**

Variety	Fusarium Wilt	Rust	Bacterial Brown Spot
<b>Pinto Lines:</b>			
Othello	MR	S	S
Olathe	MS	S	S
Bill Z	MR	S	MR/MS
Arapaho	S	S	S
Chase	MS	R	MR/MS
UI 114	S	S	S
UI 126	S	S	S
UI 129	MS/S	S	S
RS 101	S	S	S
NW 410	MS/MR	S	S
CO 59196	R	S	S
CO 62713	MS	S	S
CO 70125	-	-	S
CO 74425	MR	S	MS/S
RNK 178	-	R	MS/MR
RNK-179	-	S	MR/MS
<b>Kidney Lines:</b>			
SAC LRK	R	R	S
GTS-306	R	R	S
SVM 37-16	R	R	S
Foxfire	-	R	S
Early California	-	R	S
CO 97373	R	R	R

Composite of evaluations from Burlington, Fort Collins, Julesburg, Wiggins, and Wray in 1992-93. S = susceptible, MS = moderately susceptible, MR = moderately resistant, R = resistant, and - = not evaluated at site where specific disease occurred.