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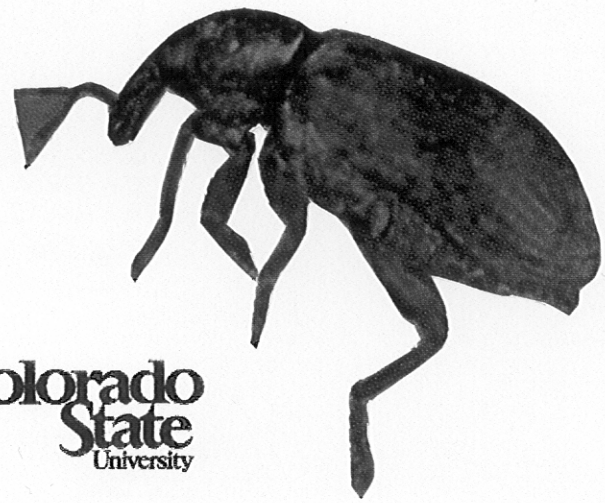
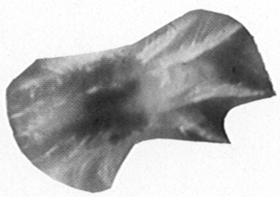
Agricultural Experiment Station
Cooperative Extension
Arkansas Valley Research Center
October 2003

2002 RESEARCH REPORTS





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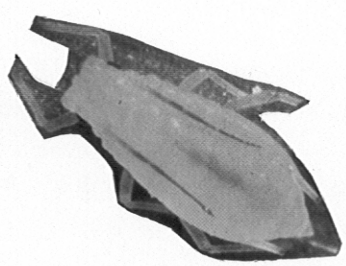

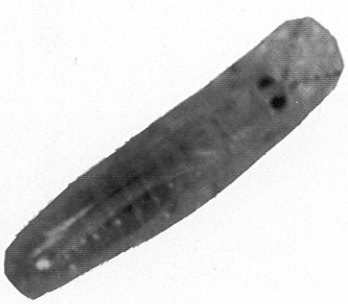

ARKANSAS VALLEY RESEARCH CENTER

Established in 1888

Rocky Ford, Colorado

COLORADO AGRICULTURAL EXPERIMENT STATION

Vol. CXV

THE ENTOMOLOGISTS

John L. Hoerner
ca. 1937-1960

Gordon T. Mickle
1946-1961

Wm. M. Hantsbarger
1961-1983

Frank C. Schweissing
1961-2003

Whitney S. Cranshaw
1983-

Colorado State University Photographic Archives

Cover Story

The first annual report of this Research Center[1] in 1888 by Superintendent Frank Watrous was a planning outline for research to be carried out in 1889. One of the last comments he made in the report was "an especially thorough observation of insect pests relative to their extermination" should be made. In the annual reports of the twelve subsequent years, through 1900, there were 45 references to insect pests and problems they caused at the Research Center. Many of them are still familiar insect pests today.

Early work on insect pests, through the mid-1930's, in this area was mostly in the form of identification services and communication to the Superintendent on how to deal with a particular problem from entomologists based at Fort Collins.

It is likely the first entomologist to carry out research, on site, at this Research Center was **John L. Hoerner**, who was a native of Las Animas and very familiar with the area. He began his career with Colorado State College in about 1937 and through the years carried out several research projects in the Arkansas Valley. This included work with onion thrips, squash bugs and cutworms. His last project here dealt with the tomato fruitworm after it had caused devastating losses to growers and the canning companies during the 1950's. He developed an effective method of detecting eggs of this pest in the field, determined economic injury levels, and evaluated insecticides for use against this pest.

Gordon T. Mickle, State Extension Entomologist, was instrumental in initiating field plot research to deal with severe mite infestations on corn in the Arkansas Valley. He tested a number of acaricides for control of this pest, but more importantly was the first in Colorado to use a systemic acaricide, as a corn seed treatment. This method provided excellent mite control. He carried out on-farm demonstration plots to educate growers as to it's effectiveness.

The State Extension Entomologist, **William M. Hantsbarger** continued to develop effective educational programs for growers in our area on the management of mites on corn, thrips on onions, weevil in alfalfa and later greenbug on sorghum, using results of research carried out at this Research Center.

Frank C. Schweissing was employed as the entomologist at this Research Center in 1961. The Colorado Growers and Shippers Assn.(Arkansas Valley Onion Growers) and the Canning Companies were instrumental in obtaining this position. The initial work was with onion thrips, various tomato insects and an insect survey through the Valley. Research quickly expanded to the alfalfa weevil and spotted alfalfa aphid on alfalfa, Banks grass mite on corn and later the greenbug on sorghum and the southwestern corn borer on corn although other insect pests were dealt with on a more limited basis. Studies have, over the years, included evaluation of new insecticides and acaricides, insect migration patterns, cultural practices to reduce insect damage, host plant resistance and tolerance and the integration of these methods to manage insect pest problems. He was particularly involved with obtaining registrations for new acaricides which were effective against the Banks grass mite. The mite was the major arthropod pest of corn in the Arkansas Valley, but it was only a minor pest when considering the total corn production in the United States. New registrations for mites were not a high priority in industry and extra effort was necessary to obtain these relatively few registrations.

Vegetable crop insects are the specialty of **Whitney S. Cranshaw** and he has carried out extensive studies at this Research Center on the onion thrips including insecticide evaluation, varietal tolerance, cross resistance between insecticides to thrips within chemical groups and the effect of fungicides on insecticide performance. He has also carried out research on various other vegetable insects including the striped cucumber beetle, psyllid and squash bug.

It is interesting to note that, within the last 60 years, several insect pests have migrated from other areas into the Arkansas Valley or their biological habits changed. The alfalfa weevil was a foreign introduction that has been on the Western Slope of Colorado since the early 1900's but was not detected here until 1956. The spotted alfalfa aphid was a foreign introduction to the U.S. in the 1950's and quickly moved into the Arkansas Valley. The greenbug, also a foreign introduction, for many years infested winter small grains during the cooler parts of the season. However, in 1968, a new biotype was found infesting sorghum in the heat of the summer. The Russian wheat aphid is a foreign introduction found in our area in the 1980's. The southwestern corn borer was thought not to winter in Colorado, north of a line running through Baca County, but on two occasions, in the early 1970's and late 1990's, after a series of mild winters, became a pest of corn throughout the Valley. The onion thrips and Banks grass mite are the two major arthropod pests that seem to have a long history in the Arkansas Valley.

[1]This Research Center was started as the Bent Agricultural Experiment Station in 1888. Bent County divided into several smaller entities and in 1889 the Center was renamed the Arkansas Valley Agricultural Experiment Station subsequently called the Rocky Ford Substation, Arkansas Valley Branch Station and finally, to date, the Arkansas Valley Research Center.

Cover Photograph Credits

Department of Bioagricultural Science & Pest Management
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J. C. Owens
F. C. Schweissing

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Rocky Ford, Colorado

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ROCKY FORD, COLORADO

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	2005	Bill Elder, 13500 Hwy. 50, Las Animas, CO 81054
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	2004	Dean Rusher, 7995 Co. Ln. 10, Olney Sps., CO 81062
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Huerfano		
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	2004 Chairman	*Paul E. Philpott, Box 3, Hoehne, CO 81046
	2005	
Otero	2003	Hans Hansen, 36606 Road JJ, La Junta, CO 81050
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	2005	Robert Gerler, 25320 Road BB, La Junta, CO 81050
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	2004	Dan Genova, 33200 South Rd, Pueblo, CO 81006
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*Research Committee Member

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		Lorenz Sutherland, 318 Lacy, La Junta, CO 81050

2002 Climatic Conditions
Arkansas Valley Research Center
Colorado State University
Rocky Ford, Colorado
Frank C. Schweissing, Superintendent

Dry! Hot! The annual precipitation of 3.52" was the lowest recorded in the 114 year history of this Center. The Rocky Ford Ditch, which supplies irrigation water to this Center, was completely without water, at times, during July and August. The supply of irrigation water from all canals in the Arkansas Valley was below normal and inadequate for crop production. While many farmers were unable to plant, limited their planting, or were unable to finish their crops, we were able to protect the research plots and get adequate production, except for the onion plots which were substantially below normal. Fall harvest was carried out without interruption.

The frost free period of 153 days between May 13 and October 13 was 5 days shorter than average. Based on a nominal growing season of May 1 to September 30, there were 3165 corn growing degree days which is above normal (2852DD).

2002 Frost Dates		2002	Average Frost Dates*		Average*
Last Spring Frost	First Fall Frost	Frost Free Period (days)	Last Spring Frost	First Fall Frost	Frost Free Period (days)
May 13 - 32°F	Oct. 13 - 27°F	153	May 1	October 6	158

Month	Temperature(F°)			Precipitation		Snowfall	10 Year Precip.	
	High	Low	Avg.	2002 inches	Normal* inches	Total inches		Inches
Jan.	72	-5	33.1	0.31	0.27	6.0	1993	11.35
Feb	76	-7	36.4	0.14	0.29	1.0	1994	11.42
March	81	4	41.5	0.09	0.68	2.0	1995	11.64
April	91	26	57.6	0.14	1.31	1.0	1996	13.38
May	104	31	64.3	0.08	1.83		1997	18.58
June	103	49	77.7	0.66	1.39		1998	14.62
July	104	56	80.0	0.06	1.98		1999	19.96
Aug.	103	49	76.9	0.49	1.56		2000	9.60
Sept.	98	37	67.3	0.64	0.90		2001	11.99
Oct.	89	23	50.3	0.36	0.78	0.5	2002	3.52
Nov.	79	8	41.0	0.08	0.46	0.0		
Dec.	68	-5	32.9	0.47	0.32	4.3	Average	12.71
			Total	**3.52**	**11.77**	**13.8**		

*Average - 102 years

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This research is partially supported by the
Arkansas Valley Onion Growers Ass'n.

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Compiled by Frank C. Schweissing

NOTICE

This publication is a compilation of reports dealing with research carried out at the Arkansas Valley Research Center. Trade names have been used to simplify reporting, but mention of a product does not constitute a recommendation nor an endorsement by Colorado State University or the Colorado Agricultural Experiment Station. In particular, pesticides mentioned in various reports may not be registered for public use. Pesticides are to be used only in accordance with the manufacturers' label.

2002 ALFALFA VARIETY PERFORMANCE TRIAL REPORT

Location: Arkansas Valley Research Center
Rocky Ford, Colorado

Stand Established: 1997

Investigator: Frank C. Schweissing, Superintendent

This is a report of the results of an irrigated alfalfa variety trial, planted August 29, 1997, after 5 years of production. There are 25 commercial and 3 public varieties included in this test.

The trial was set up in a randomized complete block, with four replications (1 plot = 75 sq. ft.). The trial was managed to reduce factors which limit production. The plot area was fertilized with 150 lbs. of P_2O_5 per acre prior to planting and again on November 30, 1998. Sencor 75 DF .50 lbs. + Gromoxone .31 lbs. ai/acre were applied on February 16, 1999, February 22,2000 and at .75 lbs. + .47 lbs. ai/acre respectively on March 9, 2001 and March 12, 2002. Furadan 4F at .75 lbs. ai/acre was applied on April 21, 1999, at 1.0 lb. ai/acre on April 25, 2000, at .5 lbs. ai/acre on May 13, 2001 and Warrior T at .025 lbs. ai/acre was applied on May 13, 2002 for alfalfa weevil control.

Harvest dates in 2002 were May 30, July 3, August 8, October 1. Rainfall from April through September was 2.1 inches compared to a long term average of 9 inches. Growing degree days were above normal. The trial was irrigated prior to the 1st, 2nd and 3rd cuttings, but irrigation water was unavailable for the 4th cutting. This was an extremely dry year for this area, however, the average yield, in this the 5th year of the trial, of 5.29 tons, compared favorably to 4.43 tons in 2001, 5.84 tons in 2000, 6.35 tons in 1999 and 5.36 tons in 1998. Significant differences in yields were observed for all cuttings and total yield.

Yields are reported in oven-dry weights. If you want to determine yields with a particular percent moisture, divide dry yield by 1.00 minus the percent moisture you usually sell your hay. Example: (Yield/1.00-.10)=yield with 10% moisture or 5.29/.90=5.88 tons.

Decisions as to variety selection in addition to being based on highest yields should include consideration of those varieties which are doing better after 5 years of harvest.

Table 1.-Forage yields of 28 alfalfa varieties at the Arkansas Valley Research Center, Rocky Ford, Colorado in 1998-2002.

Variety	Brand/Source	1st Cut 5/30	2nd Cut 7/3	3rd Cut 8/8	4th Cut 10/1	2002 Total	2001 Total	2000 Total	1999 Total	1998 Total	5 Yr. Total
		Tons dry matter/acre[1]									
WL334RK	W-L Research	1.94	1.45	1.52	1.36	6.27	4.81	6.65	7.03	5.86	30.62
Reno	NK Seeds	1.82	1.43	1.44	1.22	5.91	4.95	6.43	6.59	5.57	29.45
Leaf Master	Union Seed Co.	1.87	1.50	1.33	1.14	5.84	4.98	6.44	6.73	5.24	29.23
Millennia	Union Seed Co.	1.89	1.44	1.35	1.15	5.83	4.84	6.36	6.64	5.48	29.15
DK143	DeKalb Genetics Corp.	1.80	1.42	1.38	1.14	5.74	4.65	6.34	6.52	5.67	28.92
Focus	Seed Solutions	1.87	1.47	1.39	1.14	5.87	4.84	6.36	6.48	5.35	28.90
Lahontan	USDA-NV	1.93	1.46	1.47	1.40	6.26	4.96	6.08	6.06	5.13	28.49
ZX 9352*	ABI Alfalfa	1.72	1.35	1.46	1.34	5.87	4.67	5.81	6.55	5.46	28.36
TMF Multi-plierII	Mycogen Seeds	1.74	1.34	1.31	1.17	5.56	4.44	6.00	6.40	5.44	27.84
Big Horn	Cargill Hybrid Seeds	1.77	1.35	1.32	1.08	5.52	4.47	5.94	6.48	5.41	27.82
WL 325 HQ	W-L Research	1.88	1.39	1.35	1.06	5.68	4.64	6.12	6.01	5.25	27.70
Archer	America's Alfalfas	1.65	1.27	1.39	1.25	5.56	4.69	5.87	6.29	5.24	27.65
5454	Pioneer Hi-Bred Int'l	1.50	1.21	1.33	1.21	5.25	4.60	5.86	6.49	5.43	27.63
DK142	DeKalb Genetics Corp.	1.62	1.29	1.29	1.17	5.37	4.48	5.95	6.47	5.34	27.61
Cimarron 3i	Great Plains Research	1.60	1.05	1.16	1.02	4.83	4.25	6.24	6.62	5.54	27.48
Evergreen	Seed Solutions	1.58	1.47	1.54	1.36	5.95	4.58	5.74	6.11	5.07	27.45
ZC 9651*	ABI Alfalfa	1.62	1.25	1.30	1.22	5.39	4.40	5.66	6.39	5.56	27.40
Depend + EV	Agripro Seeds Inc.	1.56	1.14	1.22	1.06	4.98	4.38	5.74	6.63	5.60	27.33
WL 324	W-L Research	1.72	1.20	1.20	1.05	5.17	4.28	5.54	6.52	5.74	27.25
Innovator + Z	America's Alfalfas	1.53	1.21	1.33	1.03	5.10	4.46	5.68	6.27	5.43	26.94
631	Garst Seed Co.	1.47	1.06	1.25	1.06	4.84	4.21	5.69	6.60	5.38	26.72
DK127	DeKalb Genetics Corp.	1.59	1.24	1.29	0.98	5.10	4.13	5.74	6.29	5.24	26.50
630	Garst Seed Co.	1.42	1.20	1.19	0.96	4.77	4.20	5.64	6.19	5.34	26.14
Affinity + Z	America's Alfalfas	1.43	1.12	1.17	0.99	4.71	4.02	5.44	6.44	5.44	26.05
Haygrazer	Great Plain Research	1.58	1.03	1.14	0.98	4.73	4.31	5.46	6.24	5.29	26.03
ZC 9650*	ABI Alfalfa	1.42	1.12	1.18	0.99	4.71	4.14	5.46	6.01	5.30	25.62
Ranger	USDA-NE	1.15	0.84	1.06	0.92	3.97	3.71	4.83	5.25	4.71	22.47
Vernal	USDA-WI	0.96	0.75	0.92	0.73	3.36	3.01	4.49	5.39	4.51	20.76
Column Mean		1.63	1.25	1.30	1.11	5.29	4.43	5.84	6.35	5.36	27.27
LSD (0.05)		0.25	0.16	0.17	0.16	0.68	0.46	0.48	0.42	0.31	1.66
CV(%)		11.08	9.29	9.06	10.21	9.17	7.44	5.90	4.72	4.12	4.33

[1] Yields calculated on oven-dry basis. *Indicates experimental entry.

Planted August 29, 1997 at 10.2 lbs. seed/acre

2002 Alfalfa Variety Performance Trial Report

Location: Arkansas Valley Research Center
Rocky Ford, Colorado 81067

Stand Established: 2000

Investigator: Frank C. Schweissing, Superintendent

This is a report of the results of an irrigated alfalfa variety trial, planted September 1, 2000, after two years of production. There are 22 commercial and 2 public varieties included in this test.

The trial was set up as a randomized complete block, with four replications (1 plot = 75 sq. ft.). The trial is managed to reduce factors which limit production. The plot area was fertilized with 100 lbs. of P_2O_5 + 21 lbs. of N per acre prior to planting. Sencor DF .75 lbs. + Gramoxone Extra .47 lbs. ai/acre was applied March 12, 2002 to control winter annual weeds. Warrior T .025 lbs. ai/acre was applied May 13, 2002 to control the alfalfa weevil.

Harvest dates in 2002 were May 29, July 2, August 7 and October 1. Rainfall from April through September was 2.1 inches compared to a long term average of 9 inches. The trial was irrigated prior to the 1st, 2nd and 3rd cuttings but not the 4th cutting due to the lack of irrigation water. This was an extremely dry year but the average trial yield of 7.26 tons/acre was substantially better than the first years production of 4.95 tons.

Yields are reported in oven-dry weights. If you want to determine yields with a particular percent moisture, divide dry yield by 1.00 minus the percent moisture you usually sell your hay. Example: (Yield/1.00-.10) = yield with 10% moisture or 7.26/.90 = 8.07 tons per acre.

Decision as to value of a particular variety for production in our area needs to be based on several year's results. We have had situations where a variety would do very well for 2-3 years and then production would rapidly drop off in succeeding years.

Table 1.-Forage yields of 24 alfalfa varieties in the irrigated trial at the Arkansas Valley Research Center, Rocky Ford, Colorado. 2001-02.

Variety	Brand/Source	1st Cut 5/29	2nd Cut 7/2	3rd Cut 8/7	4th Cut 10/1	2002 Total	2001 Total	2-yr. Total
		Tons dry matter/acre[1]						
Arapaho	Dairyland Research	2.85	1.88	2.01	1.54	8.28	5.52	13.80
Arrowhead	Dairyland Research	2.56	1.86	1.73	1.48	7.63	5.15	12.78
ZX 9450A*	ABI Alfalfa, Inc.	2.41	2.03	1.73	1.32	7.49	5.20	12.69
FG 6M71*	Forage Genetics Int'l.	2.30	1.89	1.87	1.42	7.48	5.10	12.58
Emperor	America's Alfalfas	2.58	1.79	1.71	1.34	7.42	5.09	12.51
Dagger + EV	AgriPro	2.53	1.72	1.81	1.37	7.43	5.03	12.46
Ranger	USDA-NE	2.46	1.80	1.81	1.56	7.63	4.83	12.46
ZG 9650A*	ABI Alfalfa, Inc.	2.38	1.83	1.79	1.36	7.36	5.07	12.43
Lahontan	USDA-NV	2.47	1.78	1.87	1.42	7.54	4.87	12.41
Target Plus	Producers Hybrids	2.43	1.69	1.74	1.37	7.23	5.17	12.40
Abilene + Z	America's Alfalfas	2.27	1.84	1.72	1.42	7.25	5.06	12.31
53V08	Pioneer Hi-Bred Int'l.	2.49	1.75	1.74	1.31	7.29	5.02	12.31
Magnum V-Wet	Dairyland Research	2.43	1.69	1.84	1.44	7.40	4.90	12.30
Winter Crown	Dairyland Research	2.46	1.65	1.78	1.30	7.19	5.06	12.25
54Q53	Pioneer Hi-Bred Int'l.	2.36	1.71	1.70	1.36	7.13	4.91	12.04
ZX 9853*	ABI Alfalfa, Inc.	2.47	1.70	1.72	1.33	7.22	4.71	11.93
Geneva	Norvartis	2.33	1.75	1.71	1.36	7.15	4.78	11.93
FG 5M84*	Forage Genetics Int'l.	2.19	1.76	1.75	1.30	7.00	4.90	11.90
ZC 9941A*	ABI Alfalfa, Inc.	2.46	1.53	1.69	1.40	7.08	4.77	11.85
4200	Seed Solutions	2.18	1.75	1.76	1.36	7.05	4.79	11.84
Samurai	America's Alfalfas	2.36	1.60	1.72	1.24	6.92	4.74	11.66
Baralfa 42IG	Barenbrug U.S.A.	2.45	1.61	1.64	1.24	6.94	4.70	11.64
FG 3R139	Forage Genetics Int'l.	2.18	1.67	1.70	1.29	6.84	4.67	11.51
A30-06	ABI Alfalfa, Inc.	2.15	1.45	1.52	1.22	6.34	4.70	11.04
Column Mean		2.41	1.74	1.75	1.36	7.26	4.95	12.21
LSD (0.05)		0.29	0.21	0.20	0.15	0.76	0.33	1.04
CV (%)		8.66	8.53	8.04	7.86	7.39	4.71	6.05

[1]Yields calculated on oven-dry basis. *Indicates experimental entry

Planted: September 1, 2000

Report to the Potash and Phosphate Institute
Jessica Davis, Merlin Dillon, and Frank Schweissing
Colorado State University
February 21, 2003

We continued our study on potash application to alfalfa in three locations in 2002: Rocky Ford in the Arkansas River Basin, Center in the San Luis Valley, and Eaton in the Northeast.

Rocky Ford

The plots at Rocky Ford were placed in a field of Ranger in its second year (planted 9/1/00). Treatments were made on January 10. There were four replicates in a randomized complete block design. In addition to the treatments, 100 lbs P_2O_5/acre and 10 lbs N/acre were applied as 11-52-00 on 10/30/99. We harvested a 5 ft wide by 12 ft long swath from each plot (10 ft by 15 ft) on May 29, July 2, and August 7 of 2002. The fourth cutting at Rocky Ford was abandoned due to a water shortage, lack of irrigation, and the appearance of a severe dry area in part of the plot. This not only affected the fourth cutting, but may also have affected the results of the first three cuttings, even though no visual symptoms were present at those times.

Alfalfa Yields at Rocky Ford, Colorado, 2002.

K_20 Application Rate (lbs/acre)	First Cutting (tons/acre)	Second Cutting (tons/acre)	Third Cutting (tons/acre)	Total (tons/acre)
0	11.5	7.0	7.1	25.6
40	10.8	7.0	7.6	25.3
80	10.8	7.0	7.6	25.4
180	10.6	7.1	7.1	24.8

Analysis of variance was performed, and no significant difference was found at Rocky Ford at $p<0.05$.

Center

Fertilizer treatments were applied by hand on April 2, just before the alfalfa began to green up. The field was irrigated April 1, and rocks (cobbles) were rolled April 4. The season was exceptionally warm and dry, and harvests were earlier than normal. Harvest dates were June 13, July 17, and September 3.

There were four replicates in a randomized complete block design. Plot size was 7 ft wide and 12 ft long. About 60 lbs of wet matter was harvested from each plot at each cutting. Three samples were taken, weighed, and oven dried to determine dry matter percentage.

Alfalfa Yields at Center, Colorado, 2002.

K Application Rate (lbs/acre)	First Cutting (tons/acre)	Second Cutting (tons/acre)	Third Cutting (tons/acre)	Total (tons/acre)
0	2.0	1.9	2.8	6.7
40	2.1	1.9	2.8	6.8
40 as Sul-Po-Mag	2.0	1.8	2.9	6.8
80	2.1	1.9	2.8	6.8
180	2.2	2.0	2.9	7.1

The Sul-Po-Mag treatment supplied an additional 18 lbs S/acre and 40 lbs Mg/acre.

Analysis of variance was performed, and no significant difference was found at Center at $p<0.05$.

Eaton

We included the Sul-Po-Mag treatment at Eaton as well as at Center. Treatments were applied on February 7, 2002. There were four replicates in a randomized complete block design. Plot size was 5 ft wide and 12 ft long.

Unfortunately, the Eaton trial was laid out in a farmer's field, and the irrigation quantity and uniformity were very poor. Therefore, although we were working with the producer to improve his irrigation techniques, we felt that the variability was so great that it would mask any potential treatment effects, and we decided not to harvest the plots individually.

2002 Pinto Bean Trials
Arkansas Valley Research Center

This is the tthirteenth year a variety trial has been carried out at this Center in recent times. The overall trial yield average was very good considering the short water supply and high daily temperatures of this season. This years trial average was 3407 lbs./acre compared to 3020 lbs./acre in 2001, 3664 lbs./acre in 2000, 2749 lbs./acre in 1999, 2134 lbs./acre in 1998, 2461 lbs./acre in 1997, 3419 lbs./acre in 1996, 1599 lbs./acre in 1995, 3129 lbs./acre in 1994, 3760 lbs./acre in 1993, 2541 lbs./acre in 1992, 2361 lbs./acre in 1991 and 2848 lbs./acre in 1990.

Precipitation for the year was 3.52", which is the lowest recorded amount in the 114 year history of the Center. Irrigation water was not available at times in July and most of August.

Test Plot Information

Purpose - To evaluate the inherent genetic ability of selected pinto bean varieties to yield under irrigated conditions of the Arkansas Valley.

Data -
1. Yields
2. Test Weight
3. Seeds/ lb.

Plot - 32' X 10'(4 rows)

Design - Randomized complete blocks (3 replications)

Varieties - 20 entries

Fertilizer - 75 lbs. P_2O_5 + 10 lbs. N/acre as 11-52-0 - 11/7/01
64 lbs N/Acre as NH_3 - chiseled in - 12/3/01

Herbicide - Eptam 3 lbs. + Treflan .75 lbs. AI/Acre - incorporated 6/17/02
Basagran .75 lbs. AI/Acre - 7/1/02

Insecticide - none Fungicide - none

Plant - June 11, 2002

Irrigate - 6/12, 7/7, 7/24, 8/3, 8/31. The last 2 irrigations were very short - less than 8 hrs.

Harvest - Cut - 9/18; Lift-9/24; Thresh - 9/24 - 3 rows, 32' long Self propelled plot combine.

Jerry J. Johnson
James P. Hain
Frank C. Schweissing

Pinto Bean Performance Trial at Rocky Ford[1] in 2002.

Variety	Yield	Moisture	Test Weight	Seed/lb
	lb/ac	%	lb/bu	No.
Bill Z	4260	12.2	59.2	1081
Montrose	4071	13.1	61.3	1087
CO83783	3778	13.3	59.8	1011
USPT 72	3751	11.4	59.5	1094
CO75965	3695	13.4	58.9	1133
Poncho	3647	12.5	60.0	1025
CO96753	3642	16.8	58.1	981
Rally	3566	13.6	60.1	1017
CO96731	3525	13.8	59.6	1037
CO83777	3478	13.7	60.1	999
Grand Mesa	3412	11.4	59.2	1230
GTS-900	3401	13.9	59.8	1040
CO83778	3385	12.5	59.0	1012
CO96737	3330	13.8	59.8	1015
CO96775	3330	12.1	59.1	1065
USPT-73	3260	13.1	58.4	1006
CO75563	3185	11.4	58.3	1094
CO84975	3138	11.8	60.4	1196
Buckskin	3004	11.6	58.9	1133
CO75495	2983	11.5	59.9	1059
CO75619	2886	11.4	59.4	1186
USPT 74	2235	12.2	58.8	1162
Average	**3407**	**12.7**	**59.4**	**1076**
$LSD_{(0.30)}$	274			

[1]Trial conducted on the Arkansas Valley Research Center; seeded 6/11 and harvested 9/24.

Pinto Bean Varietal Descriptions

Bill Z	A medium maturity (95 d) variety release by Colorado State University in 1985. It has a vine growth habit with resistance to bean common mosaic virus and moderate tolerance to bacterial brown spot. It is a productive variety, however it is susceptible to white mold and rust.
Buckskin	A variety from released by Syngenta Seeds, Inc. (RNK101). It is a vine Type III growth habit with resistance to bean common mosaic virus, susceptible to white mold and rust, with medium maturity (95 d).
CO	Experimental lines from Colorado State University.
Grand Mesa	A medium maturity (94 d) from Colorado State University (CO 75511) released in 2001, with resistance to rust, bean common mosaic virus and semi-upright architecture. It has field tolerance to white mold.
GTS-900	A full season (99 to 102 d) variety from Gentec Seed Co. with resistance to rust and upright architecture. It has some field tolerance to white mold.
Montrose	A medium maturity (95 d) released from Colorado State University in 1999 (CO 51715) with resistance to rust, bean common mosaic and has high yield potential and excellent seed quality. It has prostrate vine type growth habit and is highly susceptible to white mold.
Poncho	A medium maturity (96 d) from Rogers/Syngenta Seed, Inc. with resistance to bean common mosaic and has high yield potential and excellent seed quality. It has semi upright type growth habit and is susceptible rust.
Rally	A full season (98 to 102) variety from Gentec Seed Co. with resistance to rust and upright architecture. It has some field tolerance to white mold.
USPT-72	An experimental line from USDA-ARS, Prosser, WA, with resistance to rust, bean common mosaic and has high yield potential.
USPT-73	An experimental line from USDA-ARS, Prosser, WA, with resistance to rust, bean common mosaic and has high yield potential.
USPT-74	An experimental line from USDA-ARS, Prosser, WA, with resistance to rust, bean common mosaic and has high yield potential.

2002 Corn Grain and Silage Variety Trial
Arkansas Valley Research Center

The average grain yield in this trial was 184 bushels per acre compared to 2001-206 bu., 2000-233 bu., 1999-206 bu., 1998-200 bu., 1997-206 bu., 1996-219 bu., 1995-197 bu., 1994-230 bu., 1993-178 bu., 1991-209 bu. and 1990-183 bu. The average silage yield was 31 tons per acre compared to 2001-34T., 2000-39T., 1999-33T., 1998-40T., 1997-32T., 1996-36T., 1995-35T., 1994-33T., 1993-27T., 1992-41T., 1991-37T., and 1990-31T. The average silking date for the grain trial was 4 days earlier and for the forage trial 6 days earlier than in 2001. Grain yields were adjusted to 15.5% moisture and 56 pound bushels while silage yields were adjusted to 70% moisture. This allows direct comparison between varieties, but actual harvest moistures and silking dates indicate maturity and should be considered when choosing a variety. This was a water short year.

Test Plot Information

Purpose - To evaluate the inherent genetic ability of selected corn varieties to yield grain and silage under irrigated conditions in the Arkansas Valley.

Data - 1. Grain yields
2. Forage yields
3. Growth factors

Plots - Grain - 32' X 10' (4rows) Harvest 2 rows
Silage - 32' X 5' (2 rows)

Design - Randomized complete blocks (3 replications)

Varieties - Grain-25 entries Silage-21 entries ISO-8 entries

Fertilizer - 50 lbs. P_2O_5 + 11 lbs. N/Acre - 11/7/01
175 lbs. N as urea - 12/5/01

Herbicide - Bladex 90 DF 1.0 lbs. AI/Acre - 4/15/02
Dual Magnum 1.14 lbs. AI/Acre - 4/23/02
2,4D .25 lbs. + Clarity .25 lbs. AI/Acre - 6/17/02

Insecticide - Capture .08 lbs. AI/Acre - 7/26/02

Soil - Silty, clay loam, 1-1.5% o.m., pH ca. 7.8

Plant - April 25, 2002

Irrigate - 4/26, 5/20, 6/21, 7/2, 7/17, 7/24, 8/3, 8/31 - The last 3 irrigations were shorter than 8 hrs.

Harvest - Silage - September 13, 2002 - Forage harvester
Grain - October 10, 2002 - Self-propelled two row plot combine

Jerry J. Johnson
James P. Hain
Frank C. Schweissing

Irrigated corn performance at Rocky Ford[1] in 2002.

Hybrid	Yield	Moisture	Test Weight	Plant Height	Density	Silking[2]	Lodging
	lb/ac	%	lb/bu	in	plants/ac	date	%
NK Brand N68-K7 (BT) (LL)	225	12.9	54.7	84	28768	195	0.3
Producers Hybrids 7290 (BT)	210	13.2	54.9	85	27951	195	0.6
HYTEST HT7806	200	15.4	59.3	84	27875	196	0.0
Kaystar X-2201	200	15.1	57.0	85	26746	195	1.0
Garst 8348	199	13.5	60.1	84	28135	195	3.4
DEKALB DKC60-19 (RR/YG)	197	13.8	59.4	75	27663	188	0.0
Garst 8371	193	15.2	58.6	83	27413	192	3.7
Pioneer brand 33P67 (BT)	192	13.6	61.5	84	29403	194	0.0
Garst 8301	191	14.3	56.9	87	26789	194	1.7
NK Brand N72-J5	191	14.9	58.9	84	29494	191	0.9
ASGROW RX897RR	191	14.4	58.4	94	29639	202	1.9
Garst 8383 Y61 (BT)	190	14.5	59.7	85	28677	194	0.6
Producers Hybrids 7284 (BT)	188	12.7	59.2	83	27225	194	0.0
Grand Valley SX1300 (BT)	179	13.5	60.1	82	25562	190	0.4
Grand Valley SX1395	179	14.0	58.2	83	26136	196	3.1
DEKALB DKC64-01YG	178	14.4	60.6	81	27758	194	3.4
ASGROW RX730RR/YG	176	13.4	58.8	83	27497	193	0.0
Triumph 1416	174	13.5	52.5	83	28133	192	1.0
Garst 8255 (RR)	172	17.5	58.4	94	27372	200	1.4
NK Brand N67-T4 (BT) (LL)	171	13.3	59.2	79	28469	191	0.7
Triumph 1120 (BT) (RR)	168	12.0	58.1	87	28762	194	0.0
Pioneer brand 32W86	163	13.4	61.6	93	26206	195	5.7
Grand Valley SX1600	161	15.7	58.4	91	27951	197	6.1
Kaystar KX-915	161	16.2	58.2	90	26408	201	0.0
Pioneer brand 31N27	149	15.8	58.3	87	27407	197	6.7
Average	**184**	**14.3**	**58.4**	**85**	**27738**	**195**	**1.7**
$LSD_{(0.30)}$	18						

[1]Trial conducted on the Arkansas Valley Research Center; seeded 5/8 and harvested 10/10. No appreciable ear drop.
[2]Julian date.

Irrigated ISO corn performance at Rocky Ford[1] in 2002.

Hybrid	Yield	Moisture	Test Weight	Plant Height	Density	Silking[2]	Lodging
	lb/ac	%	lb/bu	in	plants/ac	date	%
ASGROW RX730IMI	212	17.3	56.6	82	27860	197	4.9
DEKALB DKC58-24 (RR/YG)	210	12.4	60.0	83	26953	197	0.0
DEKALB DK647	202	18.3	55.7	86	25694	200	3.5
ASGROW RX730YG	202	16.8	57.8	79	25047	198	0.0
DEKALB DKC57-40/RR	200	12.5	60.5	81	26953	197	6.5
DEKALB DK647BTY	200	17.0	57.3	91	23656	199	1.2
DEKALB DK551BTY	190	13.2	58.5	81	26318	199	0.0
DEKALB DK551	175	12.9	58.8	83	25016	198	9.2
Average	**199**	**15.0**	**58.2**	**83**	**25937**	**198**	**3.2**
$LSD_{(0.30)}$	11						

[1]Trial conducted on the Arkansas Valley Research Center; seeded 5/8 and harvested 10/10.
[2]Julian date.

Corn silage performance at Rocky Ford[1] in 2002.

Hybrid	Yield	Moisture	Density	Plant Height	Silking[2]
	t/ac	%	plants/ac	in	date
Garst 8285 (RR)	40.1	49.9	29222	97	201
ASGROW RX897 (RR)	35.8	52.5	29585	93	200
Mycogen 288IMI	34.6	53.6	28539	98	198
HYTEST HT7815	34.6	56.4	27264	96	201
Grand Valley SX1606	34.4	54.6	27770	103	194
Mycogen 8681FQ	33.5	56.9	28768	100	200
Grand Valley GVX0126	32.2	58.0	25773	100	201
Garst 8315 (IT)	31.7	52.4	26045	95	200
AgriPro HY 9646	31.4	52.2	28133	96	198
DEKALB DK743	31.3	56.8	26953	100	200
Grand Valley SX1602	30.8	53.5	26681	95	201
Pioneer brand 31B13 (BT)	30.7	55.4	27407	93	196
MBS 3811 x Lfy 497L	30.2	49.2	26874	105	200
HYTEST HT7820	30.1	55.2	26590	98	201
Pioneer brand 33R77	29.8	49.9	25410	99	195
US Seeds US C1132ND	29.8	54.1	29948	95	196
Pioneer brand 31G98	29.7	55.2	27770	94	197
DEKALB DKC65-00 (RR)	29.4	53.3	28859	89	195
FR 1064 x Lfy 419 L	27.5	51.2	27588	102	196
Lfy 860L x FR 9661	25.9	42.6	28042	102	190
US Seeds US C1119ND	23.1	51.2	26396	92	192
Average	**31.3**	**53.1**	**27601**	**97**	**198**
$LSD_{(0.30)}$	3.1				

[1]Trial conducted on the Arkansas Valley Research Center; seeded 4/26 and harvested 9/13.
[2]Julian date.

Nitrogen Fertilization of Irrigated Corn Following Alfalfa and Watermelon at AVRC

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SUMMARY

This study evaluated the effects of N fertilizer rate and N source (urea and Polyon®[3]) on corn yields for 3 years following 5 years of alfalfa and one year of watermelon production. Corn grain yields were not increased by N fertilization in 2000, but were increased by increasing residual soil N levels in 2001, and by N fertilization in 2002. Nitrogen source did not significantly effect corn yields in 2000 and 2001, but Polyon® had slightly higher yields than urea in 2002. When averaged over 3 years, corn grain yields were near maximum with the application of 75 lb N/a per year. Silage yields generally increased with increasing N rate each of the years. Soil residual NO_3-N levels were increased with increasing N fertilizer rate in 2000. Residual soil N levels declined following the 2001 corn crop. In 2002, irrigation water was limited and became unavailable due to drought conditions the first week of August. Therefore, the 2002 corn crop suffered from drought stress and reduced yields. Thus total N uptake was lower than in the previous two corn crops. The 3 year average N fertilizer use efficiency was 64% at the lowest fertilizer N rate and less than 40% at the higher N rates. Thus, N fertilizer application to corn in Arkansas River Valley produced in rotation with vegetable crops and alfalfa may need to be reduced to prevent NO_3-N contamination of groundwater in this area. Based on this study, it appears that a minimal amount (50 to 75 lb N/a) of N fertilizer may be needed to maintain high grain and silage corn yields in the Valley in rotation with vegetable crops and alfalfa. Fertilizer N appears to be moving out of the root zone with downward movement of irrigation water. Residual soil NO_3-N levels declined with each additional corn crop in the check (no N added) treatment.

PROBLEM

High nitrate-N (NO_3-N) levels have been reported in groundwater in the Arkansas River Valley in Colorado, which is a major producer of melons, onions, and other vegetable crops grown in rotation with alfalfa, corn, sorghum, winter wheat, and soybeans. Relatively high rates of N fertilizer are used to optimize crop yields and quality, generally without regard to soil testing. Vegetable crops generally have shallow rooting depths and require frequent irrigation to maintain

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[3]Trade names and company names are included for the benefit of the reader and do not imply any endorsement or preferential treatment of the product by the authors or the USDA, Agricultural Research Service.

market quality. High residual soil NO_3-N levels, high N fertilization rates to shallow-rooted crops, shallow water tables, and excess water application to control soil salinity all contribute to a high NO_3-N leaching potential.

Application of slow-release fertilizers to crops in the Arkansas Valley could potentially increase nitrogen use efficiency (NUE) and reduce nitrate-N leaching potential. Nitrogen management research is needed to develop improved NUE and N management practices for furrow irrigated crops in this area. Improved N management practices for crops in the Arkansas River Valley should optimize crop yields while minimizing N fertilizer impacts on ground water quality.

Objectives of this research were to determine N fertilizer needs for optimizing furrow-irrigated corn yields in a high residual soil N environment in Arkansas River Valley, evaluate the effects of a slow-release N fertilizer on N fertilizer use efficiency by corn, and evaluate the influence of N management on residual soil NO_3-N and potential for groundwater contamination.

A N fertilizer rate and source study was initiated under conventional till, furrow irrigated corn on a calcareous Rocky Ford silty clay loam soil at the Arkansas Valley Research Center (AVRC) in 2000. The plot area had previously been in alfalfa for 5 years, before being plowed up on 20 October 98. Two applications of 150 lb P_2O_5/a as 11-52-0 added 64 lb N/a during the five years of alfalfa production. Watermelon was produced on the plot area in 1999 with 21 lb N/a added with the phosphate fertilizer. Six broadcast N rates were established (0, 50, 100, 150, 200, and 250 lb N/a) in 2000, however, the N rates were reduced (0, 25, 50, 75, 100, and 125 lb N/a) in 2002 because of a large amount of residual soil N following the 2000 N application. No N fertilizer was applied in 2001. Two N sources, urea and Polyon® (a slow-release urea fertilizer), were applied at each N rate. The N fertilizer was broadcast and incorporated with a harrow before corn planting. In the fall of 2000, 2001, and 2002, 11 lb N/a was applied with the phosphate fertilizer just prior to plowing.

Corn (Pioneer 33A14 hybrid) was planted on April 27, 2000 at a seeding rate of about 28,400 seeds per acre. The 2001 corn (DeKalb 642RR hybrid) crop was planted on April 24 at a seeding rate of about 40,000 seeds per acre. The 2002 corn (Garst 8559 Bt/RR) was planted on April 23rd at a seeding rate of about 39,000 seeds/acre.

Soil NO_3-N levels in the 0-6 ft profile have been monitored since the spring of 1999. The N fertilizer rates were not reapplied in 2001 because of high levels of residual soil NO_3-N following fertilization of the 2000 corn crop.

In 2002, the plot area was irrigated 10 times with approximately 26 inches of total water applied. The last irrigation occurred on August 2nd, shortly after pollination was completed. Due to limited availability of irrigation water, normal full length irrigations were not possible in 2002. The N level in the irrigation water was monitored by AVRC throughout each growing season. The irrigation water contained an average of 2.5 ppm NO_3-N in 2000, 2.8 ppm NO_3-N in 2001, and 2.4 ppm NO_3-N in 2002. The N contribution from the irrigation water to the plot area would have amounted to about 6 lb N/a in 1999 while irrigating the watermelon, about 15 lb N/a in 2000, about 14 lb N/a in 2001, and about 14 lb N/a in 2002 while irrigating the corn crops. Assuming a 50% irrigation efficiency, about 7 to 8 lbs of N may have entered the soil each year. Growing season precipitation was 2.1 inches from April through September.

RESULTS

In April 1999, the soil NO_3-N in the profile was concentrated in the 0-2 ft soil depth, with low levels of NO_3-N at deeper depths (Table 1). The total amount of NO_3-N in the 6-ft profile was 114 lb N/a. Following the watermelon crop, soil NO_3-N levels in November 1999 had decreased in the top 2 ft but increased in the deeper soil depths. The total amount of NO_3-N in the 6-ft profile was 157 lb N/a in November of 1999. In April 2000, soil NO_3-N levels in upper part of the soil profile had increased, with a total level of 181 lb N/a in the 6-ft profile. Thus soil NO_3-N levels just prior to N fertilization and corn planting was relatively high, despite the fact that little N fertilizer had been applied during the previous 6 years. In 2001, soil NO_3-N levels had declined following the second corn crop. After corn harvest in 2002, soil NO_3-N levels had increased slightly compared with levels after harvest in 2001. The check plot (no N fertilizer applied) has had sufficient residual soil N to produce 568 bu of corn in 3 years. The mineralization of available N from the soil organic matter in this soil appears to be quite high, as evidenced from the corn yields obtained from the check plots and removal of 313 lb N/a in the grain in 3 years.

The total watermelon oven dry biomass produced (tops + melons) in 1999 was 12,094 lb/a with the tops contributing 4,098 lb/a of this total. The amount of N in the watermelon tops and unharvested melons, with a C/N ratio of about 12, potentially contributed up to 184 lb N/a to the 2000 corn crop (Halvorson et al., 2001). This might explain the unexpected high level of soil N (181 lb N/a) at corn planting in 2000 (Table 1).

Table 1. Average soil NO_3-N levels in the non-fertilized check plots before and after the 1999 watermelon crop and the 2000, 2001, and 2002 corn crops.

Soil Depth	1999 Watermelon		2000 Corn		2001 Corn		2002 Corn	
	Apr. 1	Nov. 8	Apr. 10	Oct. 25	Mar. 20	Nov. 5	Apr. 1	Sep. 24
feet	Soil NO_3-N, lb/a							
0-1	82	41	79	42	72	20	47	25
1-2	13	23	33	22	15	6	16	17
2-3	6	26	24	32	14	5	5	13
3-4	4	25	18	20	11	6	4	9
4-5	5	24	15	17	7	8	2	9
5-6	4	17	11	7	6	6	2	14
Total	114	157	181	140	125	52	76	87

Residual soil NO_3-N levels after corn harvest for each N rate in 2001 and 2002 are reported in Table 2. Residual soil NO_3-N levels were approaching more normal levels after harvest of the 2001 corn crop which was not fertilized. Residual NO_3-N levels in the 6 ft soil profile on 24 September 2002 still increased with increasing rates of N fertilization. The increase in residual soil

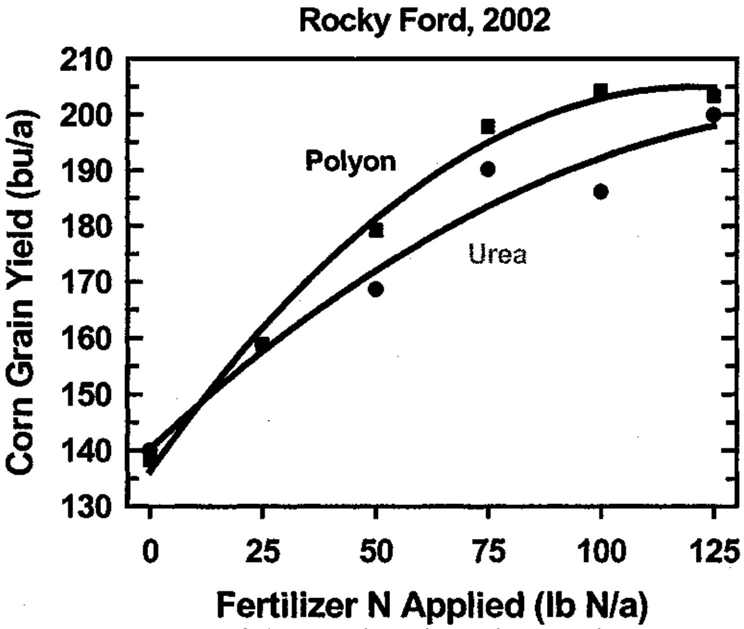

Figure 1. Corn yield as a function of N rate in 2002.

NO_3-N levels in 2002 over those following the 2001 crop were probably due to the reduced N use by the 2002 corn crop due to drought and water stress. Yields, grain and biomass, were reduced from the previous two years due to the drought in 2002.

Corn grain yields increased significantly with increasing rate of N fertilization in 2002 (Figure 1). The Polyon® treatments had a significantly greater average yield (180 bu/a) than the urea treatments (174 bu/a) in 2002 when a response to N fertilization was obtained. The overall average grain yields were 254 bu/a in 2000, 198 bu/a in 2001 (Halvorson et al., 2001, 2002b, 2002c), and 177 bu/a in 2002 when averaged over all N rates and N sources. The lower yields in 2001 than in 2000 were partially caused by insect damage to the corn ear during ear development (Figure 2). The low yields in 2002 were the result of water stress due to lack of irrigation water during grain fill.

Table 2. Soil NO_3-N levels with soil depth on 5 November 2001 and 24 September 2002 for each N rate treatments.

Soil Depth	2000 Fertilizer N Rate (lb N/a)						2002 Fertilizer N Rate (lb N/a)					
	0	50	100	150	200	250	0	25	50	75	100	125
	N1	N2	N3	N4	N5	N6	N1	N2	N3	N4	N5	N6
	5 November 2001						24 September 2002					
ft	Soil NO_3-N, lb N/a											
0-1	20	22	20	18	21	45	25	29	40	43	51	42
1-2	6	7	8	7	13	20	17	9	14	19	16	16
2-3	5	6	9	10	20	40	13	12	11	18	16	18
3-4	6	6	5	14	16	14	9	9	18	15	21	20
4-5	8	6	5	14	20	16	9	10	10	18	14	20
5-6	6	9	7	12	17	14	14	9	15	29	16	19
Total	52	55	54	76	107	149	87	78	99	142	134	135

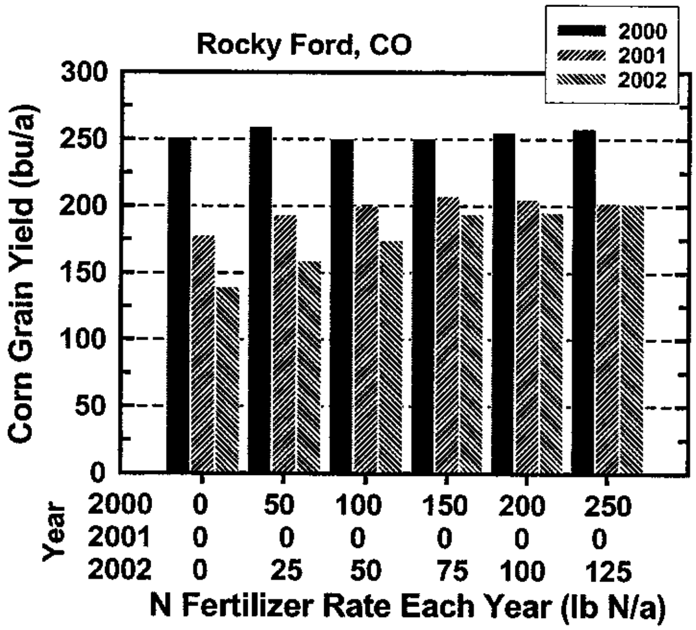

Figure 2. Corn grain yield each crop year as a function of N applied.

Corn silage yields (70% moisture) in 2000 increased significantly with increasing N rate up to 150 lb N/a then declined with increasing N rate (Figure 3). The 2001 silage yields did not increase significantly with increasing residual soil NO_3-N levels. The 2002 silage yields increased significantly with increasing N rate, but did not vary with N source.

Crop N fertilizer use efficiency (NFUE) based on total biomass N uptake in 2000 decreased with increasing N rate with NFUE of 41, 21, 15, 2, and 7% for the 50, 100, 150, 200, and 250 lb N/a treatments, respectively. The two year NFUE's based on total biomass N uptake for the combined 2000 and 2001 crops were 71, 39, 34, 25, and 25 % for these same respective N treatments. The three year NFUE was 64, 41, 42, 32, and 38 % for the N2, N3, N4, N5, and N6 fertilizer N treatments, respectively. Based on total N removal by grain in 3 years, the NFUE was 42, 24, 25, 25, and 23 % for the N2, N3, N4, N5, and N6 fertilizer N treatments respectively.

Based on the corn N uptake data, an average of 0.7 lb N/bu was removed in the corn grain in 2000, 0.68 lb N/bu in 2001, and 0.63 lb N/bu in 2002. Nitrogen removal in the grain increased with increasing N rate when averaged over 3 years. An average total N requirement of 1.09 lb N/bu was required to produce the 2000 corn crop, 1.19 lb N/bu in 2001, and 0.87 lb N/bu in 2002 with a 3 year average of 1.05 lb N/bu with no influence of N rate or N source on the amount of N required to produce a bushel of corn. These total N requirement values from AVRC are in agreement with total N needs of irrigated corn of 1.1 to 1.2 lb N/bu reported in the literature and used by the fertilizer industry to estimate N fertilizer needs.

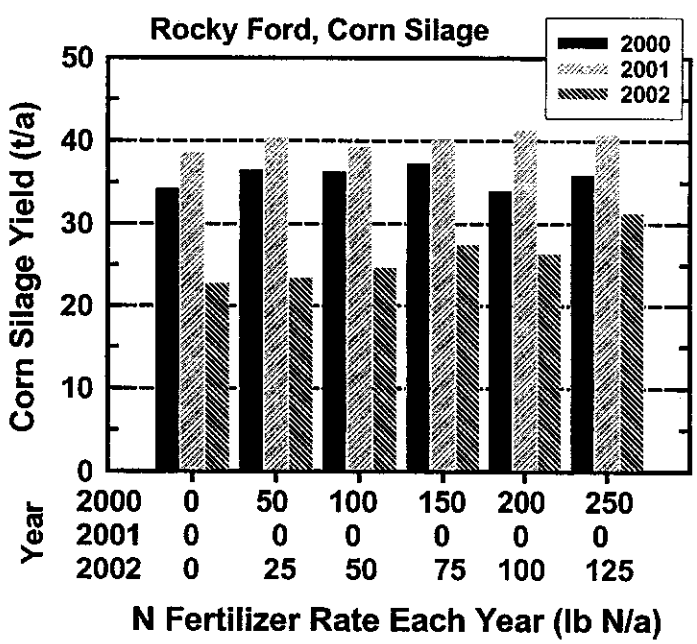

Figure 3. Corn silage yield each year as a function of N applied.

Although the irrigation water contributed some N to the cropping system, it does not appear to be a major contributor to the high levels of NO_3-N found in the soils at AVRC. Soil N mineralization potential needs to be assessed on this soil to evaluate the contribution of soil organic matter to the supply of available N to the crop.

A plot of the 3 year average (annual) corn grain yield as a function of

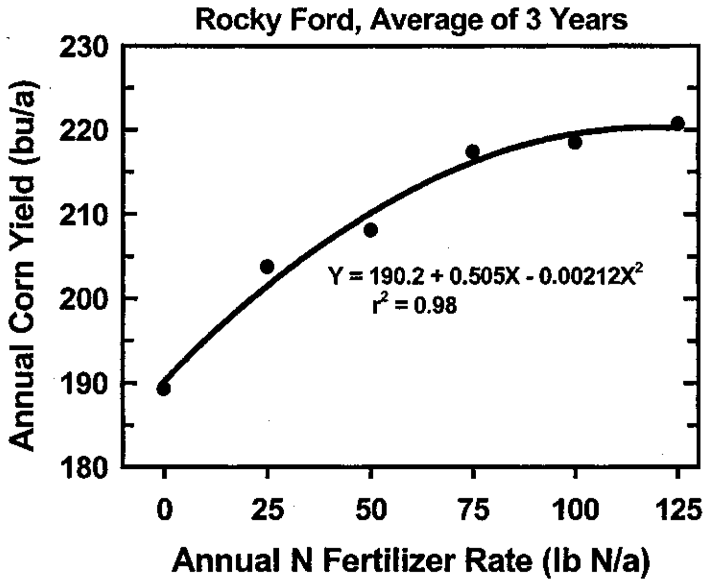

Figure 4. Three year average corn yield as a function of average N applied.

the average (annual) N fertilizer application rate for the 3 years shows a curvilinear increase in grain yield with increasing rate of N fertilizer application. Grain yields start to level off above an annual rate of 75 lb N/a. This would indicate that N fertilizer rates applied to corn could potentially be reduced in the Arkansas Valley while maintaining high yield potential when rotating with vegetable crops and alfalfa, which would reduce nitrate leaching potential.

This corn N study will be continued on the same plots in 2003. Nitrogen fertilizer will be applied at rates similar to those used in 2002. Nitrogen fertilization effects on residual soil NO_3-N levels will continue to be monitored. Based on the soil NO_3-N data in Table 2, the addition of N fertilizer increased the level of soil NO_3-N throughout the 6 ft profile. Assuming an effective rooting depth of 3 to 4 ft, some of the fertilizer N was leached beyond the corn root zone in this study. This observation is supported by an adjacent ^{15}N fertilizer study with onion and corn by Halvorson et al. (2002a), who found fertilizer N leached to a 6-ft depth the year of application to an onion crop and was still present after harvest of the following corn crop with no additional fertilizer N applied.

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The authors wish to thank Patti Norris, Brad Floyd, Catherine Cannon, Kevin Tanabe, and Marvin Wallace for their field assistance and analytical support in processing the soil and plant samples and collecting the data reported herein.

Evaluation of Corn Borer Resistant (Bt) Hybrids to the Southwestern Corn Borer - 2002 Arkansas Valley Research Center

Twenty one corn hybrids, including 19 Bt and 2 non-Bt hybrids, were evaluated for resistance to the southwestern corn borer (SWCB), *Diatraea grandiosella* Dyar. The yield of one non-Bt variety was the lowest in the trial, however the yield of the other non-Bt variety, 2725, was not significantly different from the top yielding Bt variety (Table 1). Infestations of the SWCB were very low and yields were influenced more by agronomic characteristics than insect resistance. The corn earworm (CEW), *Helicoverpa zia* Boddie was not a factor in this test.

The infestation (SWCB) rate for the non-Bt variety Mycogen 2725 was 4%, below the 2001 rate of 23%, the 2000 rate of 77% and the 1999 rate of 8% as measured by broken/lodged plants. The low infestation rate in 2002 could be due to a combination of factors caused by the drouth resulting in substantially reduced corn acreage and the increasing percentage of acreage planted to Bt corn varieties. The overwintering (2001-2002) survival rate of SWCB larvae in the non-Bt varieties was 44% of the infested stalks which comprised 60% of the total number of stalks checked. Twenty six percent of the total number of stalks checked had live SWCB larvae in the spring of 2002.

Test Plot Information

Date - 1. Yields - grain
2. Broken/lodged stalks

Plot - 32' X 10' (4 rows) Harvest - 2 rows

Design - Randomized complete blocks (4 replications)

Varieties - 21 entries

Fertilizer - 75 lbs. P_2O_5 + 16 lbs. N/Acre as 11-52-00 - 11/7/01
217 lbs. N/A as NH_3 - 12/3/01

Herbicide - Bladex 4L 1 lb. AI/Acre - 4/19/02
Dual Magnum 1.14 lbs. + Gramoxone .31 lbs. AI/Acre - 5/7/02
Clarity .25 lbs. + 2,4D .25 lbs. AI/Acre - 6/19/02

Acaricide - Comite 1.69 lbs. AI/Acre - 7/8/02

Soil - Silty, clay loam, 1-1.5% o.m., pH ca. 7.8

Plant - May 8, 2002

Irrigate - 5/8, 5/29, 6/28, 7/15, 8/1 - last irrigation less than 8 hours.

Harvest - October 10, 2002 - self-propelled two row plot combine

Frank C. Schweissing

Table 1.-Grain yields of corn borer resistant (Bt) and non-resistant corn hybrids. Arkansas Valley Research Center, C.S.U., Rocky Ford, Colorado. 2002.

Hybrid[1]	Brand	Grain Yield[2] BU/Acre	Moisture %	Test Wt.	Plant Ht. "	Silking[3] Julian	%[4] B/L
H-9235 Bt/RR	Golden Harvest	190.54	18.1	58.8	79.5	201	0
RX799 Bt	Asgrow	180.41	20.8	59.4	87.0	201	<1
H-9226 Bt/RR	Golden Harvest	178.75	16.3	57.7	78.3	200	2
1866 Bt	Triumph	175.04	24.4	58.2	93.5	204	1
DKC 53-34	DeKalb	174.93	12.7	59.4	80.0	199	1
2725*	Mycogen	173.53	16.8	57.3	77.5	200	4
8363	Garst	171.30	21.2	59.1	85.3	201	0
33B51	Pioneer	170.34	18.7	58.6	77.5	200	1
9476	AgriPro	169.78	14.4	58.2	83.0	201	0
8484	Garst	168.52	20.4	57.4	84.3	200	0
34R07	Pioneer	166.12	16.2	59.8	84.3	199	0
HC 7700 Bt	Fontanelle	165.54	23.9	59.5	73.3	200	0
7821 Bt	Mycogen	165.31	19.2	58.8	85.8	200	0
6920 Bt	Mycogen	164.21	19.7	58.3	83.5	201	1
9570	AgriPro	164.09	18.7	58.6	82.0	199	<1
HC 7735 Bt/RR	Fontanelle	162.16	16.1	56.6	80.0	201	0
DKC57-72	DeKalb	156.50	16.3	60.4	75.8	199	0
5737 Bt	4 Star	156.49	14.2	58.2	78.0	200	<1
1120 Bt/RR	Triumph	156.19	15.6	58.9	79.8	201	0
32P76	Pioneer	144.03	26.3	57.6	80.5	203	1
DK580RR*	DeKalb	141.06	14.5	59.9	78.0	200	3
Column Mean		166.42					
LSD(0.10)		17.42					
CV%		8.86					

1 - Plant May 8, 2002 *not Bt

2 - Yield adjusted 15.5% moisture and 56 lb. bushels. Test wt.= lbs./bushel at harvest.

3 - Number of days from January 1.

4 - Percent of all stalks broken or lodged for each treatment.
Harvest - October 10, 2002

Chemical Control of the Southwestern Corn Borer - 2002
Arkansas Valley Research Center
Rocky Ford, Colorado
Frank C. Schweissing

This was a hot dry production year with substantially above average growing degree days (3165), well below average annual rainfall (3.52") and a lack of irrigation water particularly in August. However, we were able to maintain good production in the trial by reserving as much water as possible for the plots combined with a low southwestern corn borer (SWCB) infestation level.

The infestation level of this pest was the lowest since this trial was initiated two years ago, possibly due to reduced corn production in the area and drouth. Insecticide control of the SWCB can be an important alternative to Bt varieties in the management of this pest.

Methods and Materials - Supporting information relating to the test plots is given on page 2.

The two row plots were separated by four rows of corn which served as a buffer between plots to reduce the effect of chemical drift and maintain pest population pressure on the various treatments.

The insecticides were applied August 1 and a second time on August 15 on half of each plot. Silwet L-77 at 10 oz./acre was added to each treatment. The insecticides were applied with a compressed air sprayer, mounted on a Hahn Hi-Boy sprayer at 38 p.s.i. at the rate of 25 g.p.a.

Broken or lodged plants for each plot were counted on October 4, 2002. Corn was harvested for grain on October 10, 2002.

Results and Discussion - There are two points of interest in this trial. There was no significant difference in yield between one and two applications for any of the treatments and the Asana treatment provided as good or better yields than any other treatment for either one or two applications.

The trials of the past two years resulted in Warrior, Capture and Furadan providing substantially better yields than Asana, Pounce and Lorsban with one application and there was no significant difference between one and two applications of the first three mentioned treatments. If two applications were made Asana and Pounce could provide control comparable to Warrior, Capture and Furadan. This trial would indicate that Asana could provide control that compared to the first three under much reduced infestation levels.

If it becomes necessary to use an insecticide to manage the SWCB at moderate to high infestation levels Warrior, Capture and Furadan should be the insecticides of choice. In addition, with proper timing one application of these insecticides can do the job.

Test Plot Information - 2002
Arkansas Valley Research Center

Purpose - To evaluate the effectiveness of selected insecticides for the control of the southwestern corn borer *Diatraea grandiosella* Dyar, in corn.

Data - 1. Broken stalks, lodging
2. Grain Yields

Plots - Treated 87.12' long X 2 rows (5') wide = 435.6 sq. Ft. = 100^{th} acre

Design - Split plot, randomized block (4 replications)

Variety - Mycogen 6888

Fertilizer - 75 lbs. P_2O_5 + 16 lbs. N/A - disc, 217 lbs. N/A as NH_3, chisel - preplant

Herbicide - Bladex 4L 1 lbs. AI/Acre - 4/19
Dual Magnum 1.14 lbs. + Gramoxone .31 lbs. AI/Acre - 5/7
Clarity .25 lbs. + 2, 4-D .25 lbs. AI/Acre - 6/19
Clarity .25 lbs. AI/Acre - 6/27

Acaricide - Comite 1.69 lbs. AI/Acre - 7/8

Soil - Silty, clay loam, 1-1.5% o.m., pH ca. 7.8

Plant - May 8, 2002 Half Silk - July 17, 2002

Irrigate - 5/8, 5/29, 6/28, 7/15, 8/1

Treated - August 1 and 15 - Hahn Hi-Boy, compressed air sprayer - 38 p.s.i. - 25 g.p.a. - TW12 cone nozzle

Harvest - October 10, 2002 - self-propelled two row combine

Frank C. Schweissing

Table 1.-Chemical control of the southwestern corn borer in corn. Arkansas Valley Research Center, C.S.U., Rocky Ford, Colorado. 2002.

Treatment[1]		AI[2]	1 Application[1]				Sig.[5]	2 Applications[1]				
			Yield[3]	Moist	Test Wt.	B/L[4]		Yield[3]	Rank[6]	Moist	Test Wt.	B/L[4]
			bu/A	%	lbs/bu.	%		bu/A		%	lbs/bu	%
Asana XL	.66EC	.05	199.23	14.9	56.6	<1	N.S.	197.92	2	15.3	56.5	1.3
Capture	2EC	.08	194.50	15.4	56.5	<1	N.S.	190.46	4	15.5	56.8	<1
Warrior	1CS	.03	193.40	15.6	56.3	0	N.S.	199.14	1	15.6	56.4	<1
Furadan	4F	1.00	185.43	15.8	56.6	<1	N.S.	190.08	5	15.2	56.6	<1
Pounce	3.2EC	.20	185.34	15.4	56.3	1.7	N.S.	194.45	3	15.8	56.7	<1
Lorsban	4E	1.00	181.21	14.9	56.9	4.1	N.S.	182.87	6	15.1	56.4	2.4
Untreated			177.39	15.3	55.0	7.9	N.S.	173.43	7	15.5	56.8	7.0
Column Mean			188.07					189.76				
LSD(0.10)			9.20					11.77				
CV(%)			3.99					5.06				

1 - Treated - 1X - August 1, 2002; 2X - August 1 & 15, 2002

2 - Active insecticide per acre.

3 - Average yield per acre, 4 replications per treatment, 15.5% moisture, 56 lb. bushel.

4 - Percent of all plants broken or lodged for each treatment. Four replications per treatment.

5 - N.S. - not significant difference between the 1 and 2 applications - t test (0.10)

6 - Rank by yield for treatments with two applications.

POST EMERGENCE WEED CONTROL IN CORN
Colorado State University - Weed Science

Project Code: CORN1302

Location - ARKANSAS VALLEY RESEARCH CENTER

Crop: CORN
Plot Width: 10 FT

Variety: DK 580RR
Plot Length: 30 FT

Planting Date: 5/6/02
Reps 3

Application Date	5/30/02
Time of Day	11 AM
Application Method	Broadcast
Application Timing	Post
Air Temp (F)	85
Soil Temp (F)	63
Relative Humidity	35
Wind Velocity	3

Equipment-

Sprayer Type	Speed mph	Nozzle Type	Nozzle Size	Nozzle Ht.	Nozzle Spacing	Boom Width	GPA	PSI
Backpack CO2	3	FLAT FAN	1102LP	12 In.	20 In.	10 Ft.	22	24

All entries except Option alone provided fairly good control of all three weed species. Combination of Callisto + Atrazine, Roundup Ultra + Harness and Touchdown + Dual II Mag provided the best control.

AMARE - Redroot Pigweed
KCHSC - Kochia
ECHCG - Barnyard grass

Tim Damato
Phil Westra
Frank Schweissing

Colorado State University

POST EMERGENT BROAD SPECTRUM WEED CONTROL

Trial ID: CORN1302 Investigator: CSU WEED SCIENCE
Location: ROCKY FORD, CO Study Dir.: Dr. Phil Westra

Weed Code					AMARE	KCHSC	ECHCG
Rating Date					Jul-01-02	Jul-01-02	Jul-01-02
Trt-Eval Interval					31 DA-A	31 DA-A	31 DA-A
Trt Treatment	Form	Fm		Rate			
No. Name	Amt	Ds	Rate	Unit			
1 CHECK					0.0 c	0.0 d	0.0 e
2 OPTION	70	DF	1.5	OZ/A	60.0 b	18.3 c	50.0 d
COC		L	1	% V/V			
UAN		L	2	% V/V			
3 DISTINCT	70	DF	6	OZ/A	100.0 a	86.7 ab	66.7 c
NIS		L	0.25	% V/V			
UAN		L	2	% V/V			
4 DISTINCT	70	DF	6	OZ/A	100.0 a	90.0 ab	73.3 c
OPTION	70	DF	1.5	OZ/A			
NIS		L	0.25	% V/V			
UAN		L	2	% V/V			
5 CALLISTO	4	L	3	OZ/A	100.0 a	80.0 ab	83.3 b
ATRAZINE	90	DF	0.25	LB A/A			
COC		L	1	% V/V			
UAN		L	2	% V/V			
6 CALLISTO	4	L	3	OZ/A	100.0 a	86.7 ab	96.7 a
ATRAZINE	90	DF	0.25	LB A/A			
DUAL II MAG	7.6	L	1	PT/A			
COC		L	1	% V/V			
UAN		L	2	% V/V			
7 CALLISTO	4	L	3	OZ/A	100.0 a	73.3 b	86.7 ab
OPTION	70	DF	1.5	OZ/A			
COC		L	1	% V/V			
UAN		L	2	% V/V			
8 OPTION	70	DF	1.5	OZ/A	98.3 a	96.7 a	86.7 ab
STARANE	1.5	L	10.6	OZ/A			
COC		L	1	% V/V			
UAN		L	2	% V/V			
9 ROUNDUP ULTRA MAX	5	L	24	OZ/A	100.0 a	81.7 ab	98.3 a
10 ROUNDUP ULTRA MAX	5	L	24	OZ/A	100.0 a	91.7 ab	100.0 a
HARNESS	7	L	1.1	PT/A			
11 TOUCHDOWN IQ	3	L	40	OZ/A	100.0 a	90.0 ab	100.0 a
12 TOUCHDOWN IQ	3	L	40	OZ/A	100.0 a	96.7 a	100.0 a
DUAL II MAG	7.6	L	1	PT/A			
LSD (P=.05)					4.52	13.74	9.77
Standard Deviation					2.67	8.11	5.77
CV					3.03	10.92	7.35
Bartlett's X2					2.002	4.689	5.869
P(Bartlett's X2)					0.157	0.861	0.438

Colorado State University

Weed Code	AMARE	KCHSC	ECHCG
Rating Date	Jul-01-02	Jul-01-02	Jul-01-02
Trt-Eval Interval	31 DA-A	31 DA-A	31 DA-A
Replicate F	0.681	1.023	2.025
Replicate Prob(F)	0.5163	0.3760	0.1559
Treatment F	379.637	44.904	77.121
Treatment Prob(F)	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Winter Wheat Variety Trial - 2001-2002
Arkansas Valley Research Center

Thirty cultivars, including eight experimental lines, from the Colorado State University Wheat Breeding Project were entered in this years trial. The average yield of 88.0 bushels per acre is somewhat higher than the previous year (2000). The 2001 trial was hailed out. The range in yield was 61.4 bu. To 101.3 bu. Per acre. The extremely dry weather from the fall of 2001 through 2002 had less effect on the wheat than other crops due to an adequate irrigation water supply throughout the trial.

Test Plot Information

Data - 1. Grain yields
2. Growth factors

Plots - 30' X 5' (4 rows), Harvest 5' X 24'

Design - Randomized complete block (3 replications)

Variety - 30 cultivars, including 8 experimental lines

Fertilizer - 71.5 lbs. NO_3-N in soil test
50 lbs. P_2O_5 - 11/7/00
61 lbs. N as urea in irrigation water - 4/22/02

Herbicide - Bronate 1 lb. AI/Acre - 3/13/02

Insecticide - DiSyston 8E .75 lbs. AI/Acre - 4/22/02

Plant - September 24, 2001 1,000,000 seeds/acre

Irrigate - 9/25, 10/9, 4/8, 4/22, 5/8, 5/26 6-8 hrs./run

Harvest - June 26, 2002 - small plot combine

Jerry J. Johnson
James P. Hain
Frank C. Schweissing

Winter wheat irrigated uniform variety performance trial at Rocky Ford in 2002[1]

Variety	Yield	% of Trial Average	Test Weight	Grain Moisture	Plant Height	Lodging
	bu/ac	%	lb/bu	%	inches	0-9
Above	101.3	115	59.1	9.9	37	2
Prairie Red	99.7	113	57.9	9.3	36	3
Wesley	96.6	110	59.7	10.0	35	1
Avalanche	96.2	109	61.3	10.7	38	3
CO980376	95.3	108	58.4	11.8	36	5
CO980607	95.2	108	58.9	12.0	36	4
Jagalene	95.1	108	59.7	10.9	37	2
Trego	94.8	108	59.7	11.0	36	6
Nuplains	93.2	106	59.7	10.6	36	2
Platte	92.9	106	59.5	10.1	34	1
Ok101	92.9	106	57.8	7.1	35	2
Yuma	92.1	105	57.2	10.0	36	2
CO99508	92.1	105	55.4	10.0	37	4
CO980829	91.9	104	57.2	11.1	36	2
TAM 111	91.4	104	58.9	11.0	38	2
CO980630	91.0	103	59.5	10.6	35	5
Lakin	90.4	103	59.2	12.3	38	3
CO980719	88.5	101	57.3	12.0	36	7
CO99534	88.1	100	57.6	9.9	37	4
NW97S278	85.0	97	58.5	11.0	36	2
2137	85.0	97	57.8	10.5	36	1
Dumas	83.6	95	61.2	10.8	36	1
Yumar	83.3	95	56.6	10.2	37	2
CO970547	81.8	93	59.9	10.9	37	5
TAM 107	80.7	92	59.1	10.2	37	3
Akron	80.6	92	57.1	9.7	37	6
Jagger	79.1	90	58.5	9.7	36	3
CDC Falcon	73.5	84	57.2	9.9	35	1
Enhancer	68.2	78	58.2	11.5	37	7
Venango	61.4	70	59.3	14.7	36	2
Average	**88.0**		**58.6**	**10.7**	**36**	**3**
CV%	9.7					
$LSD_{(0.30)}$	7.3					

[1]Trial conducted on the Arkansas Valley Research Center; seeded 9/24/01and harvested 6/26/02.

Description of winter wheat varieties.

NAME AND PEDIGREE	ORIGIN	RWA	HD	HT	SS	COL	WH	LR	WSMV	TW	PC	MILL	BAKE	COMMENTS
2137 W2440/W9488A//2163	KSU-1995	S	6	5	2	4	3	7	4	5	4	5	5	Release by KSU from Pioneer winter wheat program. Semidwarf, medium-early maturity. Good winterhardiness, good straw strength, good barley yellow dwarf virus tolerance, very susceptible to stem rust and stripe rust. Marginal tillering capacity and row cover characteristics in Colorado. Good performance record in irrigated CSU Variety Trials.
Above Tam 110*4/FS2	CSU-TX 2001	S	2	2	4	7	4	9	5	6	6	4	7	Clearfield* winter wheat developed cooperatively by CSU and Texas A&M-Amarillo. White chaff, early maturing, semidwarf. Good performance record in CSU Variety Trials in 2000 and 2001.
Akron TAM 107/Hail	CSU-1994	S	5	5	4	5	3	8	9	5	6	8	5	Semidwarf, medium-early maturity, vigorous fall and spring growth characteristics, closes canopy early in spring and competes well with weeds. Lax spike may contribute to enhanced hail tolerance. Excellent yield performance record in Colorado.
Alliance Arkan/Colt//Chisholm sib	NEB-1993	S	3	5	5	4	2	8	9	6	4	7	6	Medium-early maturing semidwarrf, short coleoptile, above average tolerance to root rot and crown rot. Excellent yield performance record in Colorado.
AP502 CL TXGH12588-26*4/FS2	Agripro-2001	S	1	1	4	6	3	9	5	8	6	6	7	Clearfield* winter wheat marketed through Agripro Wheat seed associates. Red chaff, early maturing, semidwarf.
Avalanche KS87H325/Rio Blanco	CSU-2001	S	5	5	4	6	4	4	5	2	5	2	3	Hard white winter wheat (HWW) released by CSU from KSU-Hays wheat breeding program material. Sister selection to Trego. Two days earlier than Trego in Colorado Variety Trials. High test weight, good stand establishment and fall growth, good milling and bread baking quality, not suited for Asian noodles. Excellent yield performance record in Colorado.
CDC Falcon Norstar*2/Vona//Abilene	CAN-SASK-2000	S	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA	Developed by University of Saskatchewan winter wheat breeding program, marketed in the US by Western Plant Breeders. First entered in Colorado Irrigated Variety Trials in 2002.
Cutter Jagger/WI89-189-14	Agripro-2001	S	2	5	NA	NA	3	3	5	2	2	4	5	Developed and marketed by Agripro. Good test weight, good fall growth characteristics. Good performance record in regional breeder trials in Colorado in 2000 and 2001, first entered in Colorado Variety Trials in 2002.
Dumas WI90-425//N84-0758//WI81-297-3	Agripro-2000	S	3	4	4	NA	4	3	8	3	6	1	5	Developed and marketed by Agripro, targeted for irrigated production in the western Great Plains. Good test weight. Good performance record in regional breeder trials in Colorado in 2000, first entered in Colorado Variety Trials in 2002.
Enhancer 1992 Nebraska Bulk Selection	Goertzen-1998	S	5	5	8	5	5	7	6	7	2	8	6	Developed and marketed by Cargill-Goertzen. Medium height and medium maturity. Poor straw strength (just slightly better than Scout 66) and very low test weight. Very good fall growth characteristics, good stripe rust resistance. Excellent yield performance record in Colorado Dryland Variety Trials.
Golden Spike Arbon/Hansel/4/Hansel/3/CI1 4106/Columbia/2/McCall	Utah St.-1999	S	9	7	6	6	NA	NA	NA	8	1	NA	NA	Hard white winter wheat (HWW) developed by Utah State University and marketed by General Mills. Bronze-chaffed, very late maturity, very good noodle quality characteristics, resistant to dwarf bunt and common bunt. Good resistance to stripe rust largely responsible for good performance in Colorado Variety Trials in 2001.

*Russian Wheat Aphid resistance (RWA), heading date (HD), plant height (HT), straw strength (SS), Coleoptile length (COL), winterhardiness (WH), leaf rust resistance (LR), wheat streak mosaic virus tolerance (WSMV), test weight (TW), Protein Content (PC), milling quality (MILL), and baking quality (BAKE).
* Rating scale: 0 - very good, very early, or very short to 9 - very poor, very late, or very tall.

NAME AND PEDIGREE	ORIGIN	RWA	HD	HT	SS	COL	WH	LR	WSMV	TW	PC	MILL	BAKE	COMMENTS
Halt Sumner/CO820026,F1//PI372129, F1/3/TAM 107	CSU-1994	R	2	1	3	4	4	9	7	6	5	4	1	Developed from a complex cross with 50% TAM 107 parentage. RWA resistant, semidwarf, early maturity, below average test weight, very good milling and baking quality characteristics. Dryland yield record similar to TAM 107 with advantages over TAM 107 seen at higher yield levels. Excellent expression of RWA resistance.
Intrada Rio Blanco/TAM 200	OK-2000	S	5	2	5	4	NA	5	7	4	3	1	2	Hard white winter wheat (HWW) identified by Oklahoma State from material from KSU-Hays breeding program. Medium maturity, semidwarf, good fall growth characteristics, very good milling and baking quality. Marginal performance in 2001 Colorado Dryland Variety Trials.
Jagalene Abilene/Jagger	Agripro-2001	S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Developed and marketed by Agripro. First entered in Colorado Variety Trials in 2002.
Jagger KS82W418/Stephens	KSU-1994	S	1	4	6	4	8	8	4	5	2	6	3	Developed from cross between a Karl sister selection and a soft white wheat from Oregon. Bronze-chaffed, early maturing semidwarf, good tolerance to WSMV. Below average straw strength and test weight. Breaks dormancy very early, marginal winterhardiness. High grain protein content and good baking quality characteristics.
Kalvesta Oelson/Hamra//Australia 215/3/Karl92	Goertzen-1999	S	3	2	3	4	2	9	8	4	1	2	3	Developed and marketed from Cargill-Goertzen. Originated from a cross with 50% Karl 92 parentage. Medium-early, semidwarf. Good milling and baking quality characteristics.
Lakin Arlin/KS89H130	KSU-2000	S	5	5	4	4	4	9	5	5	4	4	3	Hard white winter wheat (HWW) developed by KSU-Hays, wheat breeding program. Medium height, medium maturity. Suitable for both domestic (bread) and export (Asian noodles) uses. Good yield performance in 2000 Colorado Dryland Variety Trials, stripe rust susceptibility negatively affected yields in 2001.
NuFrontier Undisclosed	General Mills-2000	S	7	6	5	5	4	7	8	4	5	4	5	Hard white winter wheat (HWW), privately developed in the Great Plains and marketed exclusively by General Mills. Medium-late maturing, tall semidwarf. Entered in Colorado Trials in 2001.
NuHorizon Undisclosed	General Mills-2000	S	6	1	3	8	4	4	4	1	4	5	7	Hard white winter wheat (HWW), privately developed in the Great Plains and marketed exclusively by General Mills. Medium maturing semidwarf, excellent test weight. Good stripe rust resistance in 2001 Colorado Variety Trials.
Nuplains Abilene/KS831862	NEB-1999	S	8	3	4	3	2	6	8	3	1	1	3	Hard white winter wheat (HWW). Medium-late maturity, semidwarf, excellent straw strength, good test weight. High protein, very good milling and baking quality characteristics, inconsistent noodle quality evaluations. First entered in Colorado Trials in 2000.
Ok101 OK87W663/Mesa//2180	OK-2001	S	2	5	4	NA	6	5	7	4	7	2	4	Hard red winter wheat from Oklahoma State. Good fall forage production and excellent recovery after grazing. Large kernel size, good milling and baking quality. Targeted for production in north central Oklahoma and irrigated production in the High Plains. First entered in CSU Variety Trials in 2002.
Prairie Red CO850034/PI372129//5*TAM 107	CSU-1998	R	1	2	4	6	4	9	5	5	6	4	6	Developed via "backcross transfer" of RWA resistance directly into TAM 107. Bronze-chaffed, semidwarf, early maturity. Very similar to TAM 107 except for its RWA resistance. Poor end-use quality reputation.

*Russian Wheat Aphid resistance (RWA), heading date (HD), plant height (HT), straw strength (SS), Coleoptile length (COL), winterhardiness (WH), leaf rust resistance (LR), wheat streak mosaic virus tolerance (WSMV), test weight (TW), Protein Content (PC), milling quality (MILL), and baking quality (BAKE).

* Rating scale: 0 - very good, very early, or very short to 9 - very poor, very late, or very tall.

NAME AND PEDIGREE	ORIGIN	RWA	HD	HT	SS	COL	WH	LR	WSMV	TW	PC	MILL	BAKE	COMMENTS
Prowers CO850060/PI372129//5* Lamar	CSU-1997	MR	7	8	7	8	2	6	7	1	2	4	2	Developed from the backcross transfer of RWA resistance into Lamar. Moderately resistant to RWA, tall, medium-late maturity, very good milling and baking quality characteristics. Similar to Lamar, except moderately resistant to RWA.
Prowers 99 CO850060/PI372129//5* Lamar	CSU-1999	R	7	8	7	8	2	6	7	1	2	4	2	Developed from reselection within Prowers for improved RWA resistance. Tall, long coleoptile, medium-late maturity, high test weight and very good milling and baking quality characteristics. Very similar to Lamar and Prowers, except for improved RWA resistance.
Stanton PI220350/KS87H57//TAM-200/KS87H66/3/KS87H325	KSU-2000	R	5	6	5	5	4	2	5	4	4	1	4	RWA-resistant (different resistance gene from CSU varieties), medium-tall, medium maturity. Good performance record in CSU Dryland Variety Trials in 2000 and 2001.
TAM 107 TAM 105*4/Amigo	TX-1984	S	1	2	4	6	4	9	5	5	6	5	7	Developed via "backcross transfer" of Greenbug resistance directly into TAM 105. Bronze-chaffed, early maturing semidwarf, medium long coleoptile, good heat and drought tolerance, poor end-use quality reputation. Very susceptible to leaf rust.
TAM 110 (Tam105*4/Amigo)*5// Largo	TX-1995	S	2	2	4	3	4	9	5	7	7	5	7	Developed via "backcross transfer" of an additional Greenbug resistance gene directly into TAM 107. Very similar to TAM 107. Low test weight, marginal end-use quality reputation.
Thunderbolt Abilene/KS90WGRC10	Agripro-1999	S	5	5	3	5	4	1	5	1	3	1	2	Developed and marketed by Agripro. Originated from cross between Abilene and a leaf rust resistant version of TAM 107. Bronze chaffed, medium height and maturity, good straw strength. High test weight, good milling and baking quality, good leaf disease resistance. Targeted for dryland production in the west-central Great Plains.
Trego KS87H325/Rio Blanco	KSU-1999	S	6	4	4	3	4	2	5	1	7	2	5	Hard white winter wheat (HWW) developed by KSU-Hays breeding program. Medium-late maturity, semidwarf, high test weight. Excellent dryland performance record in Colorado Variety Trials.
Venango Random Mating Population	Goertzen-2000	S	6	3	3	3	4	5	5	3	4	NA	NA	Developed and marketed by Cargill-Goertzen. Medium-late maturing, semidwarf, very good straw strength, good test weights. Very good yield performance under irrigated conditions in CSU Variety Trials. Observed to shatter quite severely in 1999 (Lamar, CO dryland testing site).
Wesley KS831936-3//Colt/Cody	NEB-1998	S	4	0	2	4	3	7	7	8	1	4	2	Medium-early, short, excellent straw strength. Good winterhardiness and baking quality characteristics. May be best adapted for irrigated production systems.
Wichita Early Blackhull/Tenmarq	KSU-1944	S	4	9	8	8	5	NA	8	2	3	4	7	Tall, early, very long coleoptile, very poor straw strength, strong tendency to shatter prior to harvest. (Long-term check variety)
Yuma NS14/NS25/2/2*Vona	CSU-1991	S	5	3	3	3	4	8	6	5	7	7	3	Developed from a complex cross with 75% Vona parentage. Medium maturity, semidwarf, very good straw strength, short coleoptile, good baking quality characteristics. Good dryland and irrigated yield performance in CSU Variety Trials.
Yumar Yuma/PI372129//CO850034 /3/4*Yuma	CSU-1997	R	5	4	3	3	4	8	6	4	6	5	3	Developed via "backcross transfer" of RWA resistance directly into Yuma. Medium-maturing semidwarf. Very good straw strength, slighly better than Yuma despite taller stature. Good baking quality characteristics. Good irrigated performance in CSU Variety Trials.

*Russian Wheat Aphid resistance (RWA), heading date (HD), plant height (HT), straw strength (SS), Coleoptile length (COL), winterhardiness (WH), leaf rust resistance (LR), wheat streak mosaic virus tolerance (WSMV), test weight (TW), Protein Content (PC), milling quality (MILL), and baking quality (BAKE).

* Rating scale: 0 - very good, very early, or very short to 9 - very poor, very late, or very tall.

Irrigated Forage Sorghum Hybrid Performance Test at Rocky Ford, 2002.

INVESTIGATOR: Frank C. Schweissing, Superintendent, Arkansas Valley Research Center, Rocky Ford, Colorado.

PURPOSE: To identify high yielding hybrids under irrigated conditions.

PLOT: Two rows with 30" spacing, 32' long. SEEDING DENSITY: 96,800 Seed/A. PLANTED: June 13. HARVESTED: September 12.

EMERGENCE DATE: ca. 10-15days after planting[1]. SOIL TEMP: 69^0 F.

IRRIGATION[2]: Four furrow irrigations: June 15, July 10, July 29, August 31, total applied 12 acre-in/A.

PEST CONTROL: Preemmergence Herbicide: bifenox 2 lbs. AI/A. Postemergence Herbicide: Clarity .25 lbs. AI/A. Insecticide: none.

Summary: Growing Season Precipitation and Temperature/1
Arkansas Valley Research Center, Rocky Ford, Otero County.

Month	Rainfall	GDD/2	>90F	>100F	DAP/3
	in.		———	no. of days	———
June	0.04	433	16	6	17
July	0.06	801	29	13	48
August	0.49	733	27	4	79
September	0.43	254	9	0	91
Total	1.02	2221	81	23	91

/1 Growing season from June 13 (planting) to September 12 (harvest).
/2 GDD: Growing Degree Days for sorghum.
/3 DAP: Days After Planting.

CULTURAL PRACTICES: Previous crop: corn. Field Preparation: plow, disc, roller pack, float. Cultivation: 1X.

SOIL: silty-clay loam, 1-1.5% O.M., pH-ca. 7.8. FERTILIZER: 75 lbs. P_2O_5 and 196 lbs. N/Acre.

COMMENTS: Excessively dry and hot. Late planting in dry soil. Forage yields below average.

[1]Emergence very uneven due to inability of water to sub out in dry powdery soil.

[2]No irrigation water in August until very last day. The last two irrigation runs were very short (2-3 hrs.) and rainfall from April through September was 2.1" compared to a long term average of 9".

Table 1.-Irrigated Forage Sorghum Hybrid Performance Test at Rocky Ford, 2002[1]

Brand	Hybrid	Forage Type[2]	Days to 50% Bloom	Plant Ht.	Stage At Harvest[3]	Stem Sugar	Dry Matter	Forage Yield[4]	Yield % of Test Avg.
			(No.)	(Ins.)		(%)	(%)	(T/A)	(%)
NK BRAND	SS 405	FS	88	109	MM	7	23	27.54	121
NK BRAND	Sordan 79	SS	71	112	ED	8	24	27.52	121
NK BRAND	X 922	SS	----	106	Veg	6	19	25.39	111
NK BRAND	1900	FS	----	100	Veg	6	18	23.32	102
NK BRAND	NK 300	FS	83	77	ED	9	22	23.02	101
NK BRAND	HiKane II	FS	71	98	ED	11	23	21.75	95
NK BRAND	Trudan 8	SS	65	98	ED	9	29	21.75	95
(Check)	NB 305F	FS	83	101	SD	10	21	20.83	91
MYCOGEN	2715	corn	64	68	ED	9	24	19.60	86
NK BRAND	X921	SS	----	92	Veg	6	18	17.49	77
Average			81	96		8	22	22.82	
LSD (0.20)								4.01	
CV%								18.89	

1 - Planted June 13, 2002; Harvest September 12, 2002

2 - Forage Type: FS, Forage Sorghum; SS, sorghum sudan

3 - Seed Maturation. Veg, vegetative; PM, premilk; EM early milk; MM, midmilk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough

4 - Forage yield adjusted to 70% moisture based on oven-dried samples.

Chemical Control of Greenbugs on Sorghum - 2002
Arkansas Valley Research Center
Colorado State University
Rocky Ford, Colorado

Weather for the season could be defined as hot and dry. Precipitation from April through September was 2.1 inches compared to a long term average of 9 inches. Accumulated growing degree days (50° - 86°F) from May 1 to September 20 was 3165, higher than any one of the previous 20 growing seasons and substantially above the 21 year average of 2852. Irrigation water was in short supply in July and was not available in August.

Greenbug populations were generally low in the plots but did allow for differential counts between treatments. Two years ago biotype identification (2000), by Gerald Wilde, Kansas State University, showed biotype I to be about 80% of the sample and biotype K 20%. Insecticide resistance, in that year, varied from 11 to 18 % in the samples. We can't be sure what biotype changes have occurred, but due to very little insecticide use, because of low greenbug populations, the past two years insecticide resistance probably remained the same or is lower.

Methods and Materials - Supporting information relating to the test plots is given on page 3.

Four row plots, 36' long were planted with various treated and untreated seed (Pioneer 8500) and each treatment was replicated four times. Four foot alleys were cut between blocks effectively reducing the plots to 32' in length.

The various insecticide seed treatments (Table 1) were applied by Syngenta on May 22, 2002 and Counter CR was banded over the row at planting. Concep III (herbicide protection) and Apron, Allegiance, Captan, Maxim (disease protection) were all applied by Syngenta, as indicated in Table 1, on May 22, 2002.

Greenbug counts were taken from two whole plants per plot at each counting date August 13, 20 and 27. This amounts to 8 plants per treatment from 4 replications per date in each test.

Results and Discussion-This trial was carried out under the adverse conditions described previously and greenbug populations were relatively low when compared to previous trials. Leaf damage was limited and grain loss to birds was high so grain harvest was not carried out. The different treatments probably would not have resulted in yield differences with the untreated plots.

However, it appears, that after two months Gaucho provides as good or better control of greenbugs than the other insecticide seed treatments and Counter CR.

Frank C. Schweissing

Test Plot Information - 2002
Arkansas Valley Research Center

Purpose - To evaluate the effectiveness of various seed treatment insecticides for the control of greenbugs, *Schizaphis graminum* (Rondani), on sorghum. The greenbugs were likely to be biotype I with very little insecticide resistance.

Data - 1. Aphid populations

Plots - Treated - 43.56' X 4 rows (5') wide = 435.6 sq. ft. = 100th acre.

Design - Randomized block, 4 replications

Variety - Pioneer 8500

Fertilizer - 75 lbs. P_2O_5 + 16 lbs. N AI/Acre as 11-50-00; 11-7-01
196 lbs. N as NH_3 chisel and roll; 12-3-01

Herbicide - Clarity .25 lbs. AI/Acre - 7/1 & 7/9

Soil - Silty-clay loam, 1-1.5% o.m., pH-ca. 7.8.

Plant - June 13, 2002 79,805 seeds/acre ca. 5.5 lbs./acre

Irrigate - 6/15, 7/10, 7/30, 8/31

Treated - Seed - 5-22-02 Syngenta
Counter - 6-13-02 over row at planting

Harvest - none

Table 1.-Sorghum seed treatment trial to control greenbugs. Aphid counts. Arkansas Valley Research Center, C.S.U., Rocky Ford, Colorado. 2002.

Treatment[1]		AI[2]	Greenbug Counts[3]		
			8/13	8/20	8/27
Concep III	8EC	40.0	365.00	607.50	571.25
Maxim	4FS	2.5			
Apron XL	3LS	7.5			
Concep III	8EC	40.0	20.00	41.50	79.00
Captan 400	FS	90.0			
Allegiance-FL	FS	4.0			
Gaucho 480	FS	250.0			
Concep III	8EC	40.0	106.75	166.25	147.50
Maxim	4FS	2.5			
Apron XL	3LS	7.5			
Cruiser	5FS	200.0			
Concep III	8EC	40.0	85.25	331.75	212.50
Maxim	4FS	2.5			
Apron XL	3LS	7.5			
A9765	FS	50.0			
Concep III	8EC	40.0	62.50	146.25	177.50
Maxim	4FS	2.5			
Apron XL	3LS	7.5			
A9765	FS	100.0			
Concep III	8EC	40.0	190.00	472.50	365.75
Maxim	4FS	2.5			
Apron XL	3LS	7.5			
Counter CR	20G	6.0			

1 - Seed treated-May 22,2002; Planted Pioneer 8500-June 13, 2002 Counter CR banded over row at planting.

2 - GA/100 Kg seed except Counter CR 6 oz./1000' row.

3 - Average number of aphids counted on 2 plants per plot, 4 replications per treatment.

Soybean Variety Trial - 2002
Arkansas Valley Research Center

This is the fourth soybean trial at this Center in recent years. Trials were initiated in 1999 due to a renewed interest in oil crops. Precipitation for the year (3.52") was the lowest in the recorded history (114 years) of the Center. Irrigation water was limited but except for August when the R.F. Ditch was out, we were able to irrigate the plots. Trial yields averaged 75.9 bushels per acre for the trial compared to 68.8 bu. per acre in 2001, 66.0 bu. per acre in 2000 and 53.7 bu. per acre in 1999. Yields ranged from 62.8 to 88.6 bu. per acre.

Test Plot Information

Purpose - To evaluate the inherent genetic ability of selected soybean varieties to yield under irrigated conditions in the Arkansas Valley.

Data - 1. Yields
2. Growth factors

Plots - 32' X 10' (4 rows) Harvest-2 rows

Design - Randomized complete blocks (3 replications)

Variety - 15 entries

Fertilizer - 75 lbs. P_2O_5/A + 16 lbs. N/acre as 11-52-0 - 11/7/01
Equivalent of 15 oz. of soybean innoculant/300 lbs. of seed

Herbicide - Basagran 1.0 lb. + Blazer .25 lbs. + Poast .28 lbs. AI/Acre - 6/17
Basagran .75 lbs. AI/Acre - 7/11

Insecticide - none

Soil - Silty, clay loam, 1-1.5 o.m., pH - ca. 7.8

Plant - May 16, 2002

Irrigate - 5/16, 5/28, 7/7, 7/29, 9/1
Harvest - October 7, 2002 Self-propelled two row plot combine

Jerry Johnson
Jim Hain
Frank Schweissing

Soybean performance at Rocky Ford[1] in 2002.

Variety	Yield	Moisture	Test Weight	Plant Height	Leaf Dropping[2]
	bu/ac	%	lb/bu	in	date
DG 3399 + RR	88.6	8.5	54.4	39	272
Syngenta S39-Q4	87.7	10.8	53.5	39	276
Garst 3135 (RR)	83.5	8.4	55.6	32	262
Triumph TR3752RR	80.8	8.8	55.6	41	271
Pioneer brand 93B85	79.8	8.6	55.1	36	267
DG 3390 N RR	78.4	8.7	54.9	38	272
US Seeds US S4002 (RR)	77.2	8.7	55.2	36	273
Pioneer brand 93B68	75.5	8.5	56.6	33	264
Pioneer brand 93B72	74.5	9.1	55.0	37	266
US Seeds US S3902 (RR)	74.3	9.9	55.1	39	273
AG3701 + Myconate +	72.2	8.6	56.3	34	268
DG 3388 RR	69.3	8.6	55.3	41	271
Garst 355 (RR)	68.5	8.4	56.6	35	263
AG3701 + Myconate -	65.6	8.7	56.3	38	269
Garst 3083 (RR)	62.8	8.7	55.4	30	260
Average	75.9	8.9	55.4	37	269
$LSD_{(0.30)}$	5.1				

[1]Trial conducted on the Arkansas Valley Research Center; seeded 5/16 and harvested 10/7.
[2]Julian date.
*Myconate® is a trademark product of VAMTech, L.L.C., commercially available for enhancing mycorrhizal colonization.

WEED CONTROL IN SOYBEANS
Colorado State University - Weed Science

Project Code: SOYB-01

Location - ARKANSAS VALLEY RESEARCH CENTER

Crop: SOYBEAN
Plot Width: 10 FT

Variety: AG 3701RR
Plot Length: 30 FT

Planting Date: 5/16/02
Reps 3

Application Date	5/30/02
Time of Day	12 Noon
Application Method	Broadcast
Application Timing	Post
Air Temp (F)	85
Soil Temp (F)	63
Relative Humidity	35
Wind Velocity	3

Equipment-

Sprayer Type	Speed mph	Nozzle Type	Nozzle Size	Nozzle Ht.	Nozzle Spacing	Boom Width	GPA	PSI
Backpack CO2	3	FLAT FAN	1102LP	12 In.	20 In.	10 Ft.	22	24

Roundup and Touchdown + combinations provided excellent control of the weed species in this test. Other entries were effective against some but not all species.

AMARE - Redroot Pigweed
KCHSC - Kochia
V Mallow - Venice Mallow
ECHCG - Barnyard grass

Tim Damato
Phil Westra
Frank Schweissing

Colorado State University

WEED CONTROL IN SOYBEANS

Trial ID: SOYB-01 Investigator: CSU WEED SCIENCE
Location: ROCKY FORD, CO Study Dir.: Dr. Phil Westra

Weed Code					AMARE	KCHSC	VMALLOW	ECHCG
Rating Date					Jul-01-02	Jul-01-02	Jul-01-02	Jul-01-02
Trt-Eval Interval					31 DA-A	31 DA-A	31 DA-A	31 DA-A
Trt No.	Treatment Name	Form Amt	Fm Ds	Rate / Rate Unit				
1	CHECK				0.0 d	0.0 e	0.0 d	0.0 d
2	ROUNDUP ULTRA MAX	5	L	27 OZ/A	100.0 a	100.0 a	100.0 a	100.0 a
3	ROUNDUP ULTRA MAX	5	L	27 OZ/A	100.0 a	100.0 a	100.0 a	100.0 a
	OUTLOOK	6	L	12 OZ/A				
4	TOUCHDOWN	3	L	32 OZ/A	100.0 a	100.0 a	100.0 a	100.0 a
5	TOUCHDOWN	3	L	32 OZ/A	100.0 a	100.0 a	100.0 a	100.0 a
	DUAL II MAG		L	1 PT/A				
6	RAPTOR	1	L	4 OZ/A	93.3 a	73.3 d	56.7 c	100.0 a
	NIS		L	0.5 % V/V				
	UAN		L	1.25 % V/V				
7	RAPTOR	1	L	4 OZ/A	95.0 a	78.3 c	60.0 c	100.0 a
	OUTLOOK	6	L	12 OZ/A				
	NIS		L	0.5 % V/V				
	UAN		L	1.25 % V/V				
8	BASAGRAN	4	L	1 PT/A	78.3 b	90.0 b	93.3 a	86.7 ab
	PURSUIT	2	L	4 OZ/A				
	NIS		L	0.5 % V/V				
	UAN		L	1.25 % V/V				
9	FLEXSTAR	1.88	L	0.75 PT/A	50.0 c	90.0 b	78.3 b	73.3 c
	FUSION	2.66	L	0.5 PT/A				
	NIS		L	0.5 % V/V				
	UAN		L	1.25 % V/V				
10	BLAZER	2	L	1 PT/A	95.0 a	100.0 a	75.0 b	76.7 bc
	RAPTOR	1	L	4 OZ/A				
	NIS		L	0.5 % V/V				
	UAN		L	1.25 % V/V				
LSD (P=.05)					6.02	2.28	9.72	10.49
Standard Deviation					3.51	1.33	5.67	6.12
CV					4.32	1.59	7.43	7.31
Bartlett's X2					2.589	0.0	4.155	3.688
P(Bartlett's X2)					0.108	1.00	0.385	0.158
Replicate F					0.474	0.474	0.337	0.356
Replicate Prob(F)					0.6302	0.6302	0.7182	0.7050
Treatment F					257.602	1619.421	93.533	78.109
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Onion Variety Trial

Mike Bartolo
Frank Schweissing
Arkansas Valley Research Center
Colorado State University

PRODUCTION INFORMATION

***Plots** - planted 20' long X 2 rows (3.3') wide. 16" X 24" - 2.5" spacing. Harvest 16' of row. Each plot was replicated four times in the trial.*

***Planted** - March 14th , 2002*

***Fertilizer** - 75 lbs. P_2O_5/A and 16 lbs N/A as 11-52-0 - preplant. ~ 100 lbs. N/A residual.*

***Insect Control** - Lannate (0.9 lbs AI/A) +Warrior (0.03 lbs AI/A) on July 3rd*

***Weed Control** - Prowl 3.3E (0.825 AI/A) + Roundup Ultra (0.75 lbs AI/A) on April 4th*
-Goal 2 (0.25 lbs. AI/A) on Mat 10th
-Goal 2 (0.18 lbs. AI/A) + Dual II (0.95 lbs AI/A) on June 19th (All ground applications)
-Hand weeded 3 times

***Disease Control** - None Applied*

***Irrigation** - 13 times (approximately 2" each irrigation)*

Note: The last irrigation was applied on August 11th due to a lack of water.

***Harvest** - September 12th*

***Grade** - November 19th - 20th*

Comments

The 2002 season was one of the hottest and driest ever recorded in the Rocky Ford area. The drought had a severe impact on the trials. A complete lack of irrigation water during mid-bulbing resulted in drastically reduced bulb sizes and yields. One positive aspect of the dry conditions was the absence of diseases. Accordingly, the trial did not require any fungicide/bacteriacide applications. The vast majority of culls were sprouts and the occurrence of bulb rots were negligible.

In general, the longer season varieties like Ranchero, X-202 (Tequilla), and Sweet Perfection performed well under the stressful conditions. Cometa continued to look like a promising white variety.

Please contact Mike Bartolo or Frank Schweissing at the Arkansas Valley Research Center (719-254-6312) for additional information.

ONION VARIETY TRIAL

Arkansas Valley Research Center

Colorado State University, Rocky Ford, Colorado, 2002

Variety	*Source*	*Maturity (% tops down) 9-12*	*Colossals ≥ 4" %*	*Jumbos 3"-4" %*	*Medium 2¼"-3" %*	**C J M CWT/A**	*Pre-Pack 1¾"-2¼" %*	**Total Market. CWT/A**	*Culls %*	*Total Weight CWT/A*
Ranchero	Sunseeds	90	0	15.2	81.2	**443.9**	2.0	**453.7**	1.6	461.0
Sweet Perfection	Crookham	80	0	24.8	69.0	**426.7**	3.0	**439.4**	3.1	452.4
X-202	Waldow	70	0	20.9	73.3	**403.0**	3.7	**416.9**	2.0	426.3
X-201	Waldow	70	0	22.1	73.6	**408.7**	1.7	**415.7**	2.6	427.1
XPH01N03	Crookham	60	0	18.7	68.9	**384.2**	8.0	**410.8**	4.4	426.3
Tequilla	D. Palmer	70	0	11.3	81.4	**394.4**	3.5	**407.1**	3.8	421.0
Torero	Sunseeds	50	0	12.6	82.8	**395.3**	2.7	**405.9**	1.8	414.0
XPH97H33	Crookham	90	0	29.0	67.3	**389.9**	2.3	**399.7**	1.4	405.5
Santa Fe	Seminis	90	0	15.3	74.4	**367.5**	8.4	**399.3**	1.8	406.7
Genesis	Crookham	50	0	16.7	74.9	**395.3**	0.5	**397.7**	7.9	429.6
Cannonball	Seminis	90	0	21.1	74.5	**382.2**	3.6	**396.5**	0.7	399.2
Vaquero	Sunseeds	70	0	18.2	73.9	**364.2**	7.7	**394.0**	0.1	394.4
SR7004	Sunseeds	90	0	8.6	87.0	**367.5**	4.0	**383.0**	0.3	384.2
Raptor	Seedworks	90	0	10.5	82.7	**361.4**	3.1	**372.4**	3.6	386.3
XPH97H24	Cookham	70	0	11.9	76.7	**352.4**	3.7	**367.5**	7.7	397.7
Colorado 6	Burrell	70	0	19.8	69.0	**351.6**	4.7	**365.4**	6.4	379.7
Cometa (W)	Sunseeds	70	0	6.4	85.7	**342.2**	6.4	**365.0**	1.4	370.3
Super Chief	Seminis	80	0	8.9	84.1	**338.9**	6.7	**363.0**	0.4	364.6
Mesquite	D. Palmer	70	0	12.0	76.3	**330.7**	8.1	**357.3**	3.6	364.6

Variety	*Source*	*Maturity (% tops down) 9-12*	*Colossals ≥ 4" %*	*Jumbos 3"-4" %*	*Medium 2¼"-3" %*	***C J M CWT/A***	*Pre-Pack 1¾"-2¼" %*	***Total Market. CWT/A***	*Culls %*	*Total Weight CWT/A*
SWO 6001	Seedworks	90	0	14.7	74.7	**324.2**	7.9	**353.6**	2.6	361.0
Kingfisher	Seminis	90	1.8	14.6	79.8	**339.7**	2.4	**348.7**	1.3	353.2
SDX 2002	Seedex	90	0	10.2	80.8	**323.0**	8.0	**345.8**	1.0	349.5
T-433	Takii	80	0	18.6	76.1	**328.3**	4.3	**341.8**	1.0	345.4
T-439	Takii	100	0	7.8	87.0	**317.3**	4.6	**332.4**	0.5	334.0
XPH97H27	Crookham	70	0	26.4	60.4	**322.6**	2.2	**329.9**	10.9	369.5
Tioga	Seminis	90	0	0.8	93.7	**312.4**	5.1	**329.5**	0.4	330.7
DPSX 1172	D. Palmer	80	0	8.2	78.0	**303.8**	6.9	**327.1**	6.7	350.7
SX7600	Sunseeds	70	0	5.5	86.0	**306.2**	6.0	**325.0**	2.4	332.8
DPSX 1171	D. Palmer	100	0	4.0	83.8	**289.5**	9.6	**320.5**	2.6	328.7
Granero	Sunseeds	100	0	9.8	84.7	**289.5**	4.8	**304.2**	0.7	305.4
Legend	Bejo	80	0	0.9	79.2	**243.3**	19.5	**300.1**	0.4	301.3
Delgado	Bejo	90	0	4.3	88.7	**266.6**	4.9	**278.9**	2.1	282.1
Gladstone (W)	Bejo	90	0	8.6	76.6	**242.1**	10.1	**270.3**	4.7	283.8
SR7003	Sunseeds	90	0	9.3	80.9	**252.7**	8.3	**267.8**	1.5	271.1
Varsity	Seedworks	90	0	2.3	85.4	**232.3**	11.4	**264.2**	0.9	266.6
Tamara	Bejo	100	0	1.9	82.0	**213.9**	15.7	**256.0**	0.4	256.8
Eagle	Takii	90	0	4.5	86.2	**231.5**	7.4	**251.9**	1.8	256.8
W10	Seedex	80	0	6.3	55.8	**198.4**	35.8	**248.7**	2.0	253.6
Redwing (R)	Bejo	40	0	2.1	82.5	**209.9**	10.9	**235.6**	4.5	245.8
Daytona	Bejo	80	0	3.5	82.8	**211.5**	11.0	**234.8**	2.7	241.7
T-441	Takii	90	0	1.4	77.7	**152.3**	17.2	**183.3**	3.6	188.6
DPSX 3015(R)	D. Palmer	100	0	2.0	71.0	**108.2**	26.6	**146.1**	0.3	146.6
lsd (0.05) =						**104.8**		**98.8**		

Interactions between Salinity and Onion Production Practices in the Arkansas Valley, Colorado

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In the Arkansas Valley of Colorado, onions are often grown in areas with saline soils and low quality irrigation water. Variety and irrigation experiments were conducted in 2000 and 2001 to evaluate the response of onions to soil salinity. The first experiment investigated three rates of magnesium sulfate applied to five onion varieties. The second experiment compared the impact of furrow and drip irrigation on onion yield and salt distribution in the soil profile. In both years, *Colorado 6* and *Vision* varieties had the highest total marketable weight. In 2001, the magnesium sulfate application rates were doubled to increase the probability of achieving a yield reduction. In both years, however, salinity level had no significant ($p \leq 0.05$) effect on the yield or grade of individual varieties. In the irrigation experiments, drip irrigation gave rise to higher electrical conductivity (EC_e) in the furrow and lower EC_e in the middle of the double-row bed. Furrow irrigation gave rise to a salt distribution pattern inverse of the drip irrigation results. As drip irrigation in the Arkansas Valley becomes more widely adopted, the location of the drip tape in relation to the seed row will need to be optimized to better manage water use and salt distribution in the soil profile.

Materials and Methods

<u>Variety Trial</u>

This field trial was conducted in two years on a Rocky Ford silty clay loam at Colorado State University's Arkansas Valley Research Center. Five onion cultivars were sown from seed on March 7, 2000 and March 8, 2001. These onion cultivars include: Blanco Duro (Sunseeds, white), Colorado 6 (Burrell Seeds, yellow), Daytona (Bejo Seeds, yellow), Redwing (Bejo Seeds, red), and Vision (Seminis Seeds, yellow).

The experiment was a randomized split block design with four replications and three treatments as main plots and five onion varieties as sub-plots. In 2000, the main treatments included a single application of either 0 kg ha^{-1}, 4710 kg ha^{-1}, or 9420 kg ha^{-1} of agricultural grade magnesium sulfate applied prior to planting on March 6, 2000. In 2001, the same rates were applied twice, March 7 and June 20, 2001. Two applications were made in 2001 to increase the potential for a significant plant response compared to the previous year. The single application in 2000 and the first application in 2001 were broadcast over the plots and incorporated with a rotary hoe. The second application in 2001 was incorporated with a cultivator.

The onion seeds were planted in a double row bed with 112 cm between irrigation furrows, 46 cm between seed rows, and an in-row spacing of 7 cm. Each plot (1.1 by 7.6 m) contained two seed rows. Pests were controlled using established methods (Schwartz and Bartolo, 1995). The crops were irrigated 13 times each season with approximately 2×10^5 liter (two acre-in/acre) of water per irrigation event.

In each year, soil samples were taken prior to planting at a depth of 0 to 30 cm from the furrow, seed row, and middle of the bed. Additional samples were taken were taken at 0 to 10 cm, 10 to 20 cm, 20 to 30 cm, and 30 to 60 cm at two times in the middle of the season and one time after harvest. Soil samples were taken to the laboratory for analysis. The saturated soil paste electrical conductivity (EC_e) was evaluated using a Hach CO 150 electrical conductivity meter and conductivity cup (Rhoades et al., 1989).

The onion plots were harvested on September 19, 2000 and September 20, 2001. Onions from each plot were weighed and graded into individual market classes.

Irrigation Trial

These studies were carried out in field trials at the Arkansas Valley Research Center, Rocky Ford, Colorado, on a Rocky Ford silty clay loam. In both years, seeds of X-202 (Waldow Seeds), a long-day, Sweet Spanish type, were sown in early March on a double row bed (46 cm between rows) with a 112 cm space between irrigation furrows. Each plot (27 m X 3.3 m) contained a total of six rows of onions. The two outer rows served as a border. Water for furrow irrigation was delivered by gated pipe. Water for drip irrigation was delivered by drip tubing (T-Tape, TSX-508-30-340) buried 5 cm deep in the middle of the bed and 23 cm from the seed row. There was112 cm between each drip line. Other production practices were carried out according to established recommendations (Schwartz and Bartolo, 1995).

The experiment was a randomized block design with four replications. The furrow irrigation plots received approximately 8.6 X 10^6 liters (7.0 acre-ft/acre) of water during the 2000 season and 8.4 X 10^6 liters (6.8 acre-ft/acre) of water during the 2001 season. The drip irrigation plots received approximately 1.55 X 10^6 liters (1.26 acre-ft/acre) of water during the 2000 season and approximately 1.63 X 10^6 liters (1.32 acre-ft/acre) of water during the 2001 season. These amounts reflect the total water applied and include runoff and deep percolation losses. The EC of the irrigation water averaged approximately 1.0 dS m^{-1} for both years.

In each year, soil samples were taken prior to planting to a depth of 0 to 30 cm from the furrow, seed row, and middle of the bed. Additional samples were taken at 0 to 15 cm and 15 to 30 cm two times in the middle of the season and one time after harvest. Soil samples were taken to the laboratory for analysis. The saturated soil paste electrical conductivity (EC_e) was evaluated using a Hach CO 150 electrical conductivity meter and conductivity cup (Rhoades et al., 1989).

The onion plots were harvested on September 19, 2000 and September 20, 2001. Onions from each plot were weighed and graded into individual market classes.

Results and Discussion

Variety Trial

Although there was a slight trend for the higher salinity treatments to depress yields in most varieties, there was not a significant ($p \leq 0.05$) variety by salt treatment interaction in either 2000 (Figure 1) or 2001 (Figure 2). As might be expected, there were significant yield differences between varieties. These differences were generally consistent with yield trials conducted in previous years.

There were significant salinity distribution differences in the soil between salt treatments throughout the field season. The interactions between salt treatments and salinity distribution within four depth increments were significantly different for the April, June, and September 2000 sampling dates. The interactions between salt treatment and location, salt treatment and sample depth, and sample depth by treatments were significant for the May, July, and October 2001 sampling dates. A typical salinity pattern for the onion seed row is illustrated in Figure 3. Overall, the salts exhibited a specific pattern of distribution. Salt concentration was similar to what others found (Bernsten and Fireman, 1957), that is, highest in the middle of the bed and lowest in the irrigation furrow.

The onion varieties were exposed to salinity conditions well above those reported to cause yield reductions (Maas and Hoffman, 1977). Adequately irrigated onions may be able to overcome some of the effects of high soil salinity by growing into regions of the soil less affected by salt accumulation (data not shown). In addition, the complement of individual ions may contribute to varied responses to salinity stress. In the Arkansas Valley, most salts contain Ca and Mg as opposed to the Na salts examined in the literature.

Irrigation Trial

In both years, there was not a significant difference in onion yield between the drip and furrow-irrigated treatments (Table 1). The drip irrigation treatment had significantly higher EC_e in the middle of the bed as compared to furrow irrigation. There were significant differences in EC_e in the seed rows within the drip and furrow-irrigated plots. (Tables 2-6). The irrigation treatments as a whole resulted in significantly different salt distribution patterns. Despite this and the fact that the drip irrigation treatment received approximately 6.9 X 10^6 liters (5.6 acre-ft/acre) less water than the furrow irrigation treatment, onion yields were not significantly different. We suspect that onion yields may be increased if the distance between the drip line and seed row decreased. Correct placement of the drip line (distance from the seed row) could increase yields and water use efficiency while mitigating harmful salt accumulation. We will continue to test the optimum drip line configuration for onion production under saline conditions.

References

Bernstein, L. and M. Fireman. 1957. Laboratory studies on salt distribution in furrow-irrigated soil with special reference to the pre-emergence period. Soil Sci. 83:249-263.

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Figure 1. *Mean total market weight (colossal, jumbo, medium, and prepack) for five onion varieties over all treatments in the 2000 variety-salinity field trial. Yield differences within individual varieties were not significant ($p \leq 0.05$). Yield differences between varieties were significant,* LSD=3.84 *($p \leq 0.05$).*

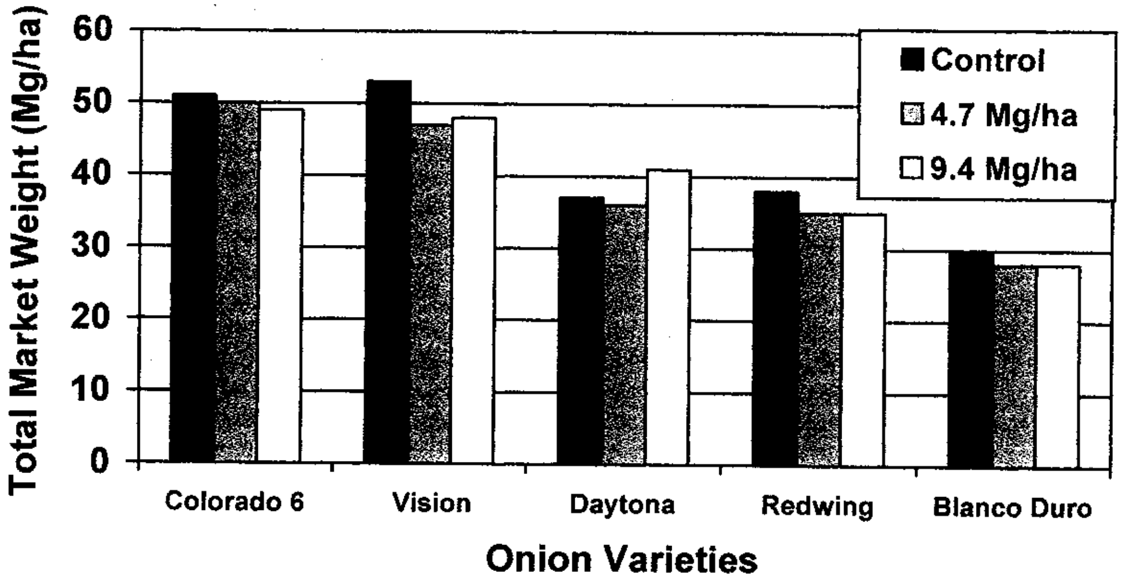


Figure 2. *Mean total market weight (colossal, jumbo, medium, and prepack) for five onion varieties over all treatments in the 2001 variety-salinity field trial. Yield differences within individual varieties were not significant ($p \leq 0.05$). Yield differences between varieties were significant,* LSD=5.12 *($p \leq 0.05$).*

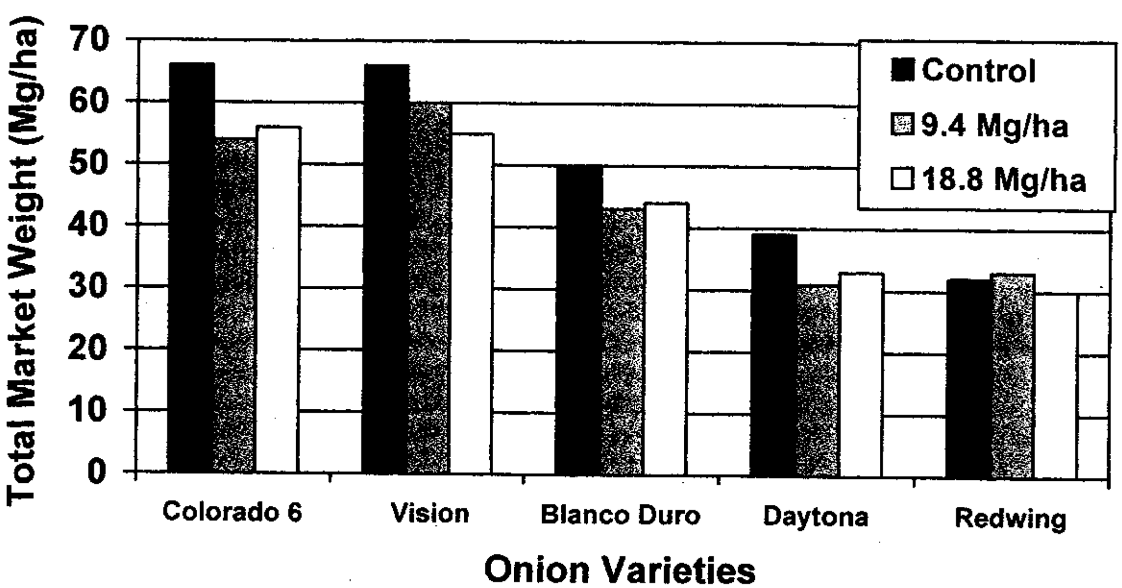


Figure 3. Mean EC_e for soil samples collected from the onion seed row location at 0 to 10, 10 to 20, and 20 to 30 cm depths in October 2001. Means were not significantly different at the 10 to 20 and 20 to 30 cm depths ($p \leq 0.05$). The LSD = 0.514 for the 0 to 10 cm depth ($p \leq 0.05$).

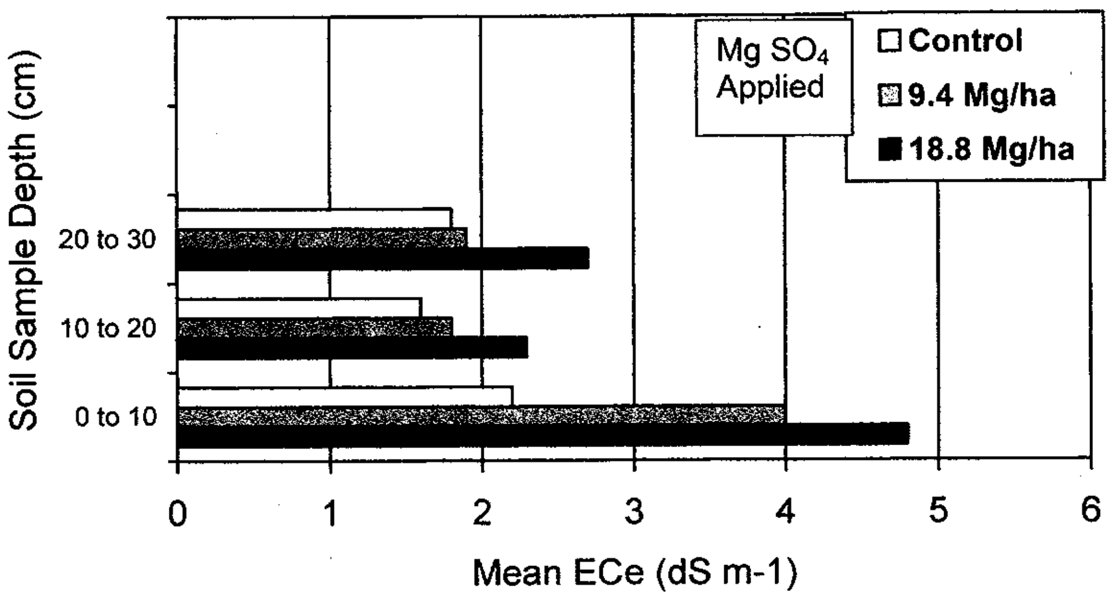


Table 1. Mean onion total marketable yield (Mg ha^{-1}) in 2000 and 2001 for drip and furrow-irrigated onions. Means with a common letter are not significantly different within rows ($p \leq 0.05$) by least significant differences.

Year	Drip	Furrow	LSD
2000	43.3 a	46.7 a	6.7
2001	51.8 a	49.6 a	5.8

Table 2. Mean June 2000 EC_e (dS m^{-1}) comparing drip and furrow irrigation. Samples were collected in the middle of the bed, seed row, and irrigation furrow at 0 to 15 and 15 to 30 cm. Means with a common letter are not significantly different within rows ($p \leq 0.05$) by least significant differences.

Sample Location	Sample Depth (cm)					
	0 to 15			15 to 30		
	Drip	Furrow	LSD	Drip	Furrow	LSD
middle	1.66 b	3.31 a	1.43	1.05 b	2.14 a	0.89
seed row	2.29 a	2.02 a	0.77	1.44 a	1.45 a	0.66
furrow	2.45 a	1.33 b	0.97	1.63 a	1.01 b	0.29

Table 3. Mean September 2000 EC_e (dS m^{-1}) comparing drip and furrow irrigation. Samples were collected in the middle of the bed, seed row, and irrigation furrow at 0 to 15 and 15 to 30 cm. Means with a common letter are not significantly different within rows ($p < 0.05$) by least significant differences.

Sample Location	Sample Depth (cm)					
	0 to 15			15 to 30		
	Drip	Furrow	LSD	Drip	Furrow	LSD
middle	1.62 b	4.43 a	2.39	1.18 a	1.72 a	1.10
seed row	2.08 a	2.06 a	1.21	1.65 a	1.23 a	0.44
furrow	2.23 a	1.30 a	1.08	1.51 a	1.21 a	0.54

Table 4. Mean May 2001 EC_e (dS m^{-1}) comparing drip and furrow irrigation. Samples were collected in the middle of the bed, seed row, and irrigation furrow at 0 to 15 and 15 to 30 cm. Means with a common letter are not significantly different within rows ($p < 0.05$) by least significant differences.

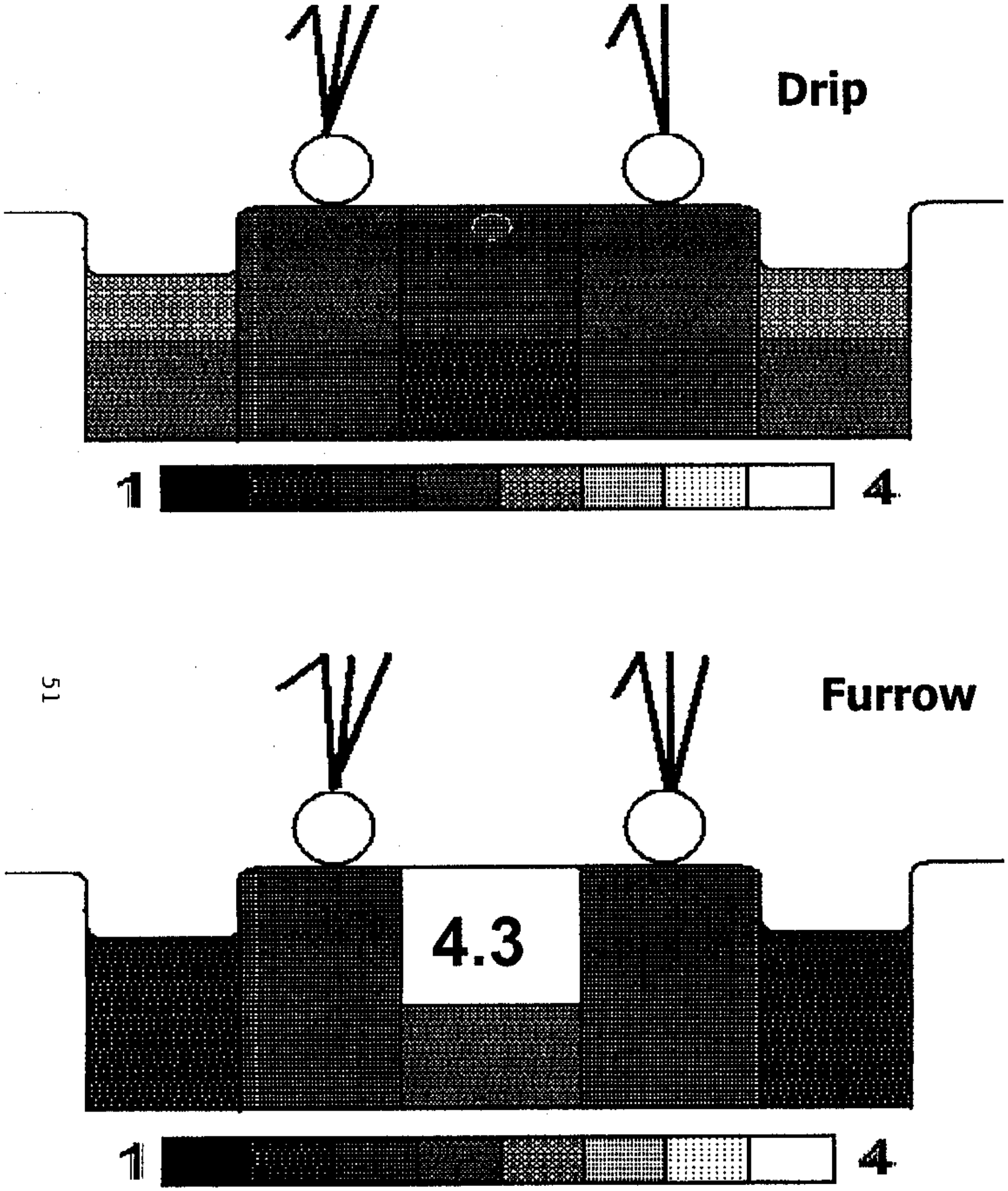
Sample Location	Sample Depth (cm)					
	0 to 15			15 to 30		
	Drip	Furrow	LSD	Drip	Furrow	LSD
middle	1.35 b	1.79 a	0.25	1.11 b	1.61 a	0.40
seed row	1.32 a	1.11 a	0.37	1.48 a	1.10 a	0.67
furrow	1.74 a	1.44 a	0.73	1.40 a	1.19 a	0.40

Table 5. Mean July 2001 EC_e (dS m^{-1}) comparing drip and furrow irrigation. Samples were collected in the middle of the bed, seed row, and irrigation furrow at 0 to 15 and 15 to 30 cm. Means with a common letter are not significantly different within rows ($p < 0.05$) by least significant differences.

Sample Depth (cm)						
Sample Location	0 to 15			15 to 30		
	Drip	Furrow	LSD	Drip	Furrow	LSD
middle	1.10 b	2.03 a	0.30	1.01 a	1.57 a	0.62
seed row	2.33 a	1.19 a	1.42	1.43 a	1.12 a	0.40
furrow	1.35 a	0.97 b	0.34	1.36 a	0.85 b	0.37

Table 6. Mean October 2001 EC_e (dS m^{-1}) comparing drip and furrow irrigation. Samples were collected in the middle of the bed, seed row, and irrigation furrow at 0 to 15 and 15 to 30 cm. Means with a common letter are not significantly different within rows ($p < 0.05$) by least significant differences.

Sample Depth (cm)						
Sample Location	0 to 15			15 to 30		
	Drip	Furrow	LSD	Drip	Furrow	LSD
middle	1.58 b	4.33 a	1.71	1.50 b	2.22 a	0.41
seed row	2.50 a	1.73 b	0.71	1.71 a	1.61 a	0.21
furrow	2.64 a	1.48 b	0.47	2.03 a	1.35 b	0.67



Salt distribution patterns measured in ECe (dS/m) for drip and furrow-irrigated onions. Samples were taken after harvest (October).

2002 Onion – Bactericide Screening Study **October 28, 2002**

Dr. Howard F. Schwartz and David H. Gent, Dept. of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523-1177

Objective: The objective of this study was to evaluate the effectiveness of various fungicides and bactericides in controlling the primary bacterial diseases in Colorado, including Xanthomonas Leaf Blight (*Xanthomonas campestris*), Sour Skin (*Burkholderia cepacia)*, Slippery Skin *(B. gladioli* pv. *alliicola*), Bacterial Soft Rot (*Erwinia carotovora* subsp. *carotovora*), and Pantoea blight/Soft Rot (*Pantoea ananitas*).

Experimental Design: Direct seeded onion plots were established at ARDEC in Fort Collins with the yellow onion variety 'Vantage'. All treatments were applied in 25 gallons of water per acre with a CO_2 backpack at 32 psi pressure, using Teejet 8002 flat-fan nozzles (2 per bed of 2 onion lines). Plots were 2 rows 30" wide by 25 feet in length with an untreated spreader row separating each treatment. The experiment was a randomized complete block design with 4 replicates.

This study was replicated at the Arkansas Valley Research Center in Rocky Ford with the yellow variety 'X202'. Plots at this site were 40" wide by 25 feet in length, separated by a single untreated spreader row. All treatments were applied in 25 gallons per acre water at 32 psi with 8002 flat-fan nozzles (3 per bed of 2 onion lines). The experiment was a randomized complete block design with 4 replicates.

Both fields were furrow irrigated and grown according to local recommendations.

Rocky Ford and ARDEC Protocol:

Treatments:	Product/Acre (unless otherwise stated):
1. Untreated Control	
2. Dithane DF + Kocide 2000	3.36 lb/A + 1.5 lb/A
3. Cuprofix MZ DF	7.25 lb/A
4. NuCop 50 DF + Dithane DF + Latron	2 lb/A + 3.36lb/A + 0.5% (v/v)
5. NuCop 3L + Dithane DF + Latron	2.67 pt/A + 3.36lb/A + 0.5%(v/v)

Treatment Application Dates:

ARDEC	Rocky Ford
(1) 29 July	(1) 1 July
(2) 5 August	(2) 8 July
(3) 12 August	(3) 16 July
(4) 19 August	(4) 23 July
(5) 25 August	(5) 30 July
(6) 1 September	(6) 6 August
(7) 9 September	(7) 14 August
(8) 18 September	(8) 20 August
(9) 23 September	(9) 27 August

Plot Inoculations: 10^8cfu/ml *Xanthomonas campestris*

ARDEC	Rocky Ford
(1) 24 August	(1) 13 August
(2) 29 August	(2) 26 August

Disease Notes and Evaluations:

9/2/02 Rocky Ford, First disease evaluation. Percent foliage infected or killed from bacterial disease complex and/or phytotoxicity

9/17/01 Rocky Ford, 20 bulbs from each plot were collected and stored at 70°F for curing and later storage rot evaluation.

Results: Yields were not measured at Rocky Ford or ARDEC because disease pressure was not intense enough to separate the effects of bactericide treatments. Severe drought conditions unfavorable to disease development dominated most of the season at ARDEC and Rocky Ford and allowed little secondary spread of *Xanthomonas*. No treatment resulted in any visible phytotoxicity or growth effects.

ACKNOWLEDGEMENTS: We gratefully acknowledge the assistance of Mike Bartolo and Frank Schweissing at Rocky Ford and ARDEC staff. Partial financial assistance from the CSU Agr. Experiment Station, Arkansas Valley Growers and Shippers Association, Colorado Onion Association, Cerexagri and MicroFlo Company, LLC is also acknowledged and appreciated.

2002 Onion – Bactericide Spray Timing Study **October 29, 2002**

Dr. Howard F. Schwartz and David H. Gent, Dept. of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523-1177

Objective: The objective of this study was to evaluate the effectiveness of new fungicides and bactericides in controlling the primary bacterial diseases in Colorado, including Xanthomonas Leaf Blight (*Xanthomonas campestris*), Sour Skin (*Burkholderia cepacia)*, Slippery Skin *(B. gladioli* pv. *alliicola*), Bacterial Soft Rot (*Erwinia carotovora* subsp. *carotovora*), and Pantoea blight/Soft Rot (*Pantoea ananitas*).

Experimental Design: This study was conducted at the Arkansas Valley Research Center in Rocky Ford with the yellow variety 'X202'. Plots at this site were 40" wide by 60 feet in length, separated by a single untreated spreader row. All treatments were applied in 25 gallons per acre water at 32 psi with 8002 flat-fan nozzles (2 per bed of 2 onion lines). The experiment was a randomized split-block design with 4 replicates. The main plot received 1.5 lb/A Kocide 2000 and the subplots, each 15 feet in length, received 0.5, 1.0, or 2.0 lb/A Maneb 75 DF. Sprays programs were initiated on a weekly staggered scheduled that began 4 weeks pre-bulbing to 2 weeks post-bulbing. The field was furrow irrigated and grown according to local recommendations.

Spray Protocol:

Treatments	**Treatment Application Dates**									
	6/24	**7/1**	**7/8**	**7/16**	**7/23**	**7/30**	**8/6**	**8/14**	**8/20**	**Total Sprays**
1. Untreated Control (Maneb only)*					x	x	x	x	x	5
2. 4 weeks pre-bulb	x	x	x	x	x	x	x	x	x	9
3. 3 weeks pre-bulb		x	x	x	x	x	x	x	x	8
4. 2 weeks pre-bulb			x	x	x	x	x	x	x	7
5. 1 week pre-bulb				x	x	x	x	x	x	6
6. Bulbing					x	x	x	x	x	5
7. 1 week post-bulb						x	x	x	x	4
8. 2 week post-bulb							x	x	x	3

*Treatments 2 to 8 included Kocide 2000 at 1.5 lb/A

Results: No natural epidemics of bacterial leaf blights developed in 2002. Therefore, no inferences can be made about either the timing of sprays or the effect of maneb rate on Kocide 2000 enhancement of bacterial disease suppression. This study will be repeated in 2003.

ACKNOWLEDGEMENTS: We gratefully acknowledge the assistance of Mike Bartolo and Frank Schweissing at Rocky Ford and ARDEC staff. Partial financial assistance from the CSU Agr. Experiment Station, Arkansas Valley Growers and Shippers Association, and the Colorado Onion Association is also acknowledged and appreciated.

2002 Onion – New and Biological Bactericide Study **October 29, 2002**

Dr. Howard F. Schwartz and David H. Gent, Dept. of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523-1177

Objective: The objective of this study was to evaluate the effectiveness of new fungicides and bactericides in controlling the primary bacterial diseases in Colorado, including Xanthomonas Leaf Blight (*Xanthomonas campestris*), Sour Skin (*Burkholderia cepacia)*, Slippery Skin *(B. gladioli* pv. *alliicola*), Bacterial Soft Rot (*Erwinia carotovora* subsp. *carotovora*), and Pantoea blight/Soft Rot (*Pantoea ananitas*).

Experimental Design: Direct seeded onion plots were established at ARDEC in Fort Collins with the yellow onion variety 'Vantage'. All treatments were applied in 25 gallons of water per acre with a CO_2 backpack at 32 psi pressure, using Teejet 8002 flat-fan nozzles (2 per bed of 2 onion lines). Plots were 2 rows 30" wide by 30 feet in length with an untreated spreader row separating each treatment.The experiment was a randomized split-block design with 4 replicates. ManKocide at 2 lb/A was applied to the sub-plot beginning two weeks prebulbing.

This study was replicated at the Arkansas Valley Research Center in Rocky Ford with the yellow variety 'X202'. Plots at this site were 40" wide by 30 feet in length, separated by a single untreated spreader row. All treatments were applied in 25 gallons per acre water at 32 psi with 8002 flat-fan nozzles (3 per bed of 2 onion lines). The experiment was a randomized split-block design with 4 replicates. ManKocide at 2 lb/A was applied to the sub-plot beginning two weeks prebulbing.

Both fields were furrow irrigated and grown according to local recommendations. All treatments were applied according to label recommendations.

Rocky Ford and ARDEC Protocol:

	Application Dates:		
Main Plot Treatments:	**Rocky Ford**	**ARDEC**	**Rate:**
1. Untreated Control	(--)	(--)	(--)
2. Kocide 2000	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	1.5 lb/A
3. $ZnSO_4$	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	1.0 lb/A
4. FeCl ($6H_20$)	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	22.9 g/A
5. Messenger	5/4, 5/17, 6/1, 6/15, 6/24, 7/8, 7/16, 7/23, 8/6, 8/20, 8/27	6/29, 7/15, 7/29, 8/12, 8/25, 9/9, 9/23	6 oz/A
6. Actigard	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	0.75 oz/A
7. Milsana	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	6/24, 7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	1 pt/A
8. Plant Growth Promoting Rhizobacter	5/4, 6/24	5/4, 7/29	ARDEC: seed treatment and prebulb foliar spray at 1% Rocky Ford: seedling and prebulb foliar sprays at 1% (v/v)

9. *Pantoea agglomerans* C9-1	7/1, 7/8, 7/16	8/5, 8/25	10^8 cfu/ml
10. Effersan	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	200 ppm
Split Plot Treatments:			
11. ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	2.0 lb/A
12. Kocide 2000 + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	1.5 lb/A + 2.0 lb/A
13. $ZnSO_4$ + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	1.0 lb/A + 2.0 lb/A
14. FeCl ($6H_20$) + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	22.9 g/A + 2.0 lb/A
15. Messenger + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	6 oz/A + 2.0 lb/A
16. Actigard + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	0.75 oz/A + 2.0 lb/A
17. Milsana + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	1 pt/A + 2.0 lb/A
18. Plant Growth Promoting Rhizobacter + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	1% v/v + 2.0 lb/A
19. *Pantoea agglomerans* C9-1 + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	10^8 cfu/ml + 2.0 lb/A
20. Effersan + ManKocide	7/1, 7/8, 7/16, 7/23, 7/30, 8/6, 8/14, 8/20, 8/27	7/8, 7/29, 8/5, 8/12, 8/19, 8/25, 9/1, 9/9, 9/18, 9/23	200 ppm + 2.0 lb/A

Spreader Row Inoculations: 10^8/ml bacterial cell suspension of X*anthomonas campestris*

Rocky Ford	ARDEC
(1) 8/13/02	(1) 8/24/02
(2) 8/26/02	(2) 8/29/02
	(3) 9/07/02

Disease Notes and Evaluations:

9/02/02 Rocky Ford, First disease evaluation. % foliage infected or killed from bacterial disease complex and/or phytotoxicity

9/17/02 Rocky Ford, harvest, 2 lines x 10' were topped, sorted according to market class, weighed as lbs/plot, and converted to cwt/A. 20 bulbs from each plot were collected and stored at 70°C for curing and later storage rot evaluation.

10/28/02 ARDEC, harvest, 2 lines x 10' were topped, sorted according to market class, weighed as lbs/plot, and converted to cwt/A. 20 bulbs from several plots were collected and stored at 70°C for curing and later storage rot evaluation.

Results: The final season disease severity at Rocky Ford is reported in Table 1. No treatment significantly improved disease suppression compared to the untreated control, but disease pressure was not intense enough due to severe drought to accurately determine efficacy under more typical growing conditions.

Yields were not measured at Rocky Ford or ARDEC for all treatments because disease pressure was not intense enough to separate the effects of bactericide treatments. A few key treatments were harvested at both locations to determine if growth regulating or injurious effects had any impact on yield (Table 2).

Table 1. Rocky Ford Final Season Disease Severity:

Treatments:	**Final Season Disease Severity**
1. Untreated Control	5.8% ab
2. Kocide 2000	7.8% ab
3. $ZnSO_4$	6.8% ab
4. FeCl ($6H_20$)	9.5% a
5. Messenger	7.0% ab
6. Actigard	2.8% b
7. Milsana	7.8% b
8. PGPR	4.0% ab
9. *P. agglomerans* C9-1	4.0% ab
10. Effersan	7.8% ab
Split Plot Treatments:	
11. ManKocide	2.8% b
12. Kocide 2000 + ManKocide	7.2% ab
13. $ZnSO_4$ + ManKocide	4.4% ab
14. FeCl ($6H_20$) + ManKocide	6.5% ab
15. Messenger + ManKocide	6.3% ab
16. Actigard + ManKocide	2.4% b
17. Milsana + ManKocide	5.3% ab
18. PGPR + ManKocide	5.5% ab
19. *P. agglomerans* C9-1 + ManKocide	3.3% b
20. Effersan + ManKocide	3.8% ab
C.V.%:	*88.3*
Treatment F Value:	*2.15*
Treatment P Value:	*0.011*
$LSD_{.05}$:	*5.99*

Table 2. Rocky Ford Onion Bacterial Complex: Yield Measurements

	Yield (CWT/A)[1]				
	Rocky Ford			**ARDEC**	
Treatment	**Jumbo**	**Medium**	**Total[2]**	**Medium**	**Total[2]**
1. Untreated Control	73.8a	232.6a	378.3a (--)	137.2a	283.6a (--)
2. Kocide 2000	58.2a	203.9a	356.1ab(-5.9)	82.3ab	256.1ab (-9.7%)
5. Messenger	49.7a	235.9a	344.0ab(-9.1)	121.5ab	273.1ab(-3.7%)
6. Actigard	50.3a	185.6a	298.0b(-21.2)	98.0ab	206.5b(-27.2%)
7. Milsana	66.0a	188.2a	338.5ab(-10.5)	120.2ab	273.1ab(-3.7%)
8. PGPR	61.4a	237.8a	365.9ab(-3.3)	69.3b	270.5ab(-4.6%)
C.V.%:	*15.5*	*11.4*	*8.1*	*45.0*	*20.2*
Treatment F Value:	*0.40*	*1.00*	*0.70*	*0.91*	*0.72*
Treatment P Value:	*0.90*	*0.47*	*0.69*	*0.53*	*0.68*
$LSD_{.05}$:	*2.83*	*4.12*	*5.59*	*4.53*	*5.25*

[1] Treatments followed by the same letter are not significantly different at α=0.1.

[2] % yield increase over untreated control

Discussion: Conditions unfavorable to disease development dominated most of the season at Rocky Ford and ARDEC and suppressed Xanthomonas leaf blight development in the plots. Less than 1.6 inches of rain fell from 1 May to 30 September at Rocky Ford and less than 6 inches at ARDEC during the same period. Average daily high temperatures varied from 81.9 to 94.9°F at Rocky Ford and 69.6 to 90.1°F at ARDEC from May through September.

ACKNOWLEDGEMENTS: We gratefully acknowledge the assistance of Mike Bartolo and Frank Schweissing at Rocky Ford and ARDEC staff. Partial financial assistance from the CSU Agr. Experiment Station, Arkansas Valley Growers and Shippers Association, and the Colorado Onion Association is also acknowledged and appreciated.

2002 Onion – Fungicide Screening Study **10/28/02**

Dr. Howard F. Schwartz, David H. Gent and Kris Otto, Dept. of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523-1177

Objective: The objective of this study was to evaluate the effectiveness of various fungicides in managing the primary foliar and storage fungal pathogens of onion in Colorado, including Downy Mildew (*Peronospora destructor*), Botrytis Blast/Neck Rot (*Botrytis alli*), Purple Blotch (*Alternaria porri*), Blue Mold (*Penicillium* species) and Black Mold (*Aspergillus niger*).

Experimental Design: Direct seeded onion plots were established at ARDEC in Fort Collins with the yellow onion variety 'Vantage'. All treatments were applied in 25 gallons of water per acre with a CO_2 backpack at 32 psi pressure, using Teejet 8002 flat-fan nozzles (2 per bed of 2 onion lines). Plots were one row 30" wide by 25 feet in length with an untreated spreader row separating each treatment. The experiment was a randomized complete block design with 4 replicates.

Several treatments in this study were duplicated at the Arkansas Valley Research Center in Rocky Ford with the yellow variety 'X202'. Plots at this site were 40" wide by 25 feet in length, separated by a single untreated spreader row. All treatments were applied in 25 gallons per acre water at 32 psi with 8002 flat-fan nozzles (3 per bed of 2 onion lines). The experiment was a randomized complete block design with 4 replicates. Both fields were furrow irrigated and grown according to local recommendations.

Rocky Ford Protocol:

Treatments:	Product/Acre (unless otherwise stated):
1. Untreated Control	--
2. NuCop 50 DF + Dithane DF + Latron	2 lb/A + 3.36 lb/A + 0.5% (v/v)
3a. Switch sprays 1,2,4 & 6	26.25 g a.i./A
3b. NuCop 50 DF + Dithane DF + Latron	2 lb/A + 3.36 lb/A + 0.5% (v/v)
4a. Quadris sprays 1,2,4 & 6	6 oz/A
4b. NuCop 50 DF + Dithane DF + Latron	2.0 lb/A + 3.36lb/A + 0.5% (v/v)

ARDEC Protocol:

Treatments:	Product/Acre (unless otherwise stated):
1. Untreated Control	--
2. NuCop 50 DF + Dithane DF + Latron	2 lb/A + 3.36 lb/A + 0.25% (v/v)
3a. Switch sprays 1,2,4 & 6	26.25 g a.i./A
3b. NuCop 50 DF + Dithane DF + Latron	2 lb/A + 3.36 lb/A + 0.5% (v/v)
4a. Quadris sprays 1,2,4 & 6	6 oz/A
4b. NuCop 50 DF + Dithane DF + Latron	2.0 lb/A + 3.36lb/A + 0.5% (v/v)
5. DPX-KQ667 + Silwet L77	33 oz a.i./A + 12oz/A
6. DPX-KP481 + Manzate + Silwet L77	6 oz a.i./A + 30 oz a.i. + 12oz/A
7. DPX-JE874 + Kocide 2000 + Silwet L77	3 oz a.i./A + 1.5lb/A + 12 oz/A
8. Curzate + Manzate + Silwet L77	3 oz a.i./A + 30 oz/A + 12 oz/A
9. DPX-JE874 + BravoWeatherStik + Silwet L77	3 oz a.i./A + 18 oz a.i./A 12 oz/A
10. Manzate + Silwet L77	36 oz a.i./A + 12 oz/A
11a. Cabrio 500EG	12 oz/A
11b. Bravo Ultrex + Silwet L77	1.8 lb/A + 12 oz/A
12a. Pristine 516	1.18 lb/A
12b. Bravo Ultrex + Silwet L77	1.8 lb/A + 12 oz/A
13a. Cabrio 500EG	12 oz/A
13b. Bravo Ultrex + Silwet L77	1.8 lb/A + 12 oz/A
13c. Pristine 516	1.18 lb/A
14. Untreated Control B	--

Treatment Application Dates:		Plot Inoculations: 10^8/ml suspension of *Botrytis alli and Alternaria porri*	
Rocky Ford	ARDEC	Rocky Ford	ARDEC
(1) 8/06/02	(1) 8/12/02	(1) 8/13/02	(1) 8/30/02
(2) 8/14/02	(2) 8/19/02	(2) 9/10/02	
(3) 8/20/02	(3) 8/25/02		
(4) 8/27/02	(4) 9/01/02		
	(5) 9/09/02		
	(6) 9/19/02		

Disease Notes and Evaluations:

9/17/02 Rocky Ford, 20 bulbs from each plot were collected and stored at 70°C for curing and later storage rot evaluation.

Results: Disease pressure was very light at Rocky Ford and ARDEC. Only trace amounts of Botrytis (less than 1% disease severity and incidence) were visible after inoculation, presumably because warm, dry conditions dominated throughout the entire season. Yields were not measured at Rocky Ford or ARDEC because disease pressure was not intense enough to separate the effects of fungicide treatments.

Treatments that included Silwet L77 had visible phytotoxicity in the form of leaf scalding and tip death after 2 applications, but the phytotoxicity was generally limited to 3 to 5% of the foliage. This is consistent with previous work we have conducted with high rates of organosilicone surfactants on onion.

Storage rot incidence was evaluated on 12-10-02, and there were no significant differences between treatments (average of 1 – 2 %)..

ACKNOWLEDGEMENTS: We gratefully acknowledge the assistance of Mike Bartolo and Frank Schweissing at Rocky Ford and ARDEC staff. Partial financial assistance from the CSU Agr. Experiment Station, Arkansas Valley Growers and Shippers Association, Colorado Onion Association, MicroFlo, Dupont Crop Protection, and Syngenta Crop Protection and BASF is also acknowledged and appreciated.

PRE and Layby Weed Control in Onions with Outlook

Colorado State University – Weed Science

Project Code: ONIO022 **Location:** Rocky Ford, CO **Cooperator:** COA, BASF, Mike Bartolo

Site Description

Crop: Onions **Variety:** 202 Waldow **Planting Date:** March 14, 2002
Plot Width: 6.7 feet **Plot Width:** 30 feet **Replications:** 3

Irrigation Type: Furrow

Soil Description

Texture	%OM	%Sand	%Silt	%Clay	pH	CEC
Silty Clay Loam	1.5				7.8	

Application Information

Application Date	A	B	C	D	E
Time of Day	4-4-02	4-10-02	4-15-02	4-29-02	5-10-02
Application Method	Broadcast	Broadcast	Broadcast	Broadcast	Broadcast
Application Timing	Pre	Loop	Flag	1 Leaf	2 Leaf
Air Temp (F)	54	58	80	50	51
Soil Temp (F)	50	52	54	52	N/A
Relative Humidity (%)	15	50	20	40	29
Wind Velocity (mph)	2.5	1.0	2.0	1.0	2.8

Application Equipment

Sprayer Type	Speed (mph)	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	PSI
Backpack	3	Flat Fan	11002	20"	20"	6.7'	20	30

Summary Comments

The purpose of this study was to compare Outlook, Prowl and Dacthal for PRE weed control and Outlook for LAYBY weed control following PRE applications of Prowl + Roundup. Outlook was applied PRE, loop, flag, 1 leaf and 2 leaf at 1x and 2x rates. Weed control and onion injury evaluations were made before the 2 leaf application so they reflect only the effects of Prowl + Roundup PRE treatment for treatments 13 and 14. Outlook has excellent onion safety when applied at the 2 leaf stage based on previous experiments.

Onion injury was minimal for all treatment except the lowest PRE Outlook treatments. There is no good reason why that treatment caused injury while the 2x rate did not. Based on injury ratings it appears that Outlook is safe for applications to onions at much earlier stages than those evaluated in the IR-4 residue studies conducted in 2001. Outlook PRE provided slightly better kochia control than Dacthal, but Prowl PRE was consistently the best treatment. Pigweed control was good to excellent for all treatments, while venice mallow was not controlled with any treatment.

PRE and Layby Weed Control in Onions with Outlook

Colorado State University

Trial ID: ONI0022 Study Dir.: COA
Location: Rocky Ford, CO Investigator: Dr. Scott Nissen, Jim Sebastian

Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Grow Stg	Appl Code	ONION Phyto % 5-9-02	Kochia Control % 5-9-02	Pigweed Control % 5-9-02	VMall Control % 5-9-02
1	Untreated Check							4.0	0.0	0.0	0.0
2	Handweed							2.7	100.0	100.0	100.0
3	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	18.3	85.0	85.0	0.0
3	Outlook	6	SL	0.64	LB A/A	PRE	A				
4	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	6.3	86.7	87.3	0.0
4	Outlook	6	SL	1.28	LB A/A	PRE	A				
5	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	3.0	90.0	88.3	0.0
5	Prowl	3.3	EC	1.2	LB A/A	PRE	A				
6	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	4.7	76.7	81.7	0.0
6	Dacthal	75	WP	10	LB A/A	PRE	A				
7	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	3.7	95.0	94.3	0.0
7	Prowl	3.3	EC	1.2	LB A/A	PRE	A				
7	Outlook	6	SL	0.64	LB A/A	LOOP	B				
8	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	3.3	95.0	96.7	0.0
8	Prowl	3.3	EC	1.2	LB A/A	PRE	A				
8	Outlook	6	SL	1.28	LB A/A	LOOP	B				
9	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	4.3	94.0	94.0	0.0
9	Prowl	3.3	EC	1.2	LB A/A	PRE	A				
9	Outlook	6	SL	0.64	LB A/A	FLAG	C				
10	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	4.0	93.3	95.0	0.0
10	Prowl	3.3	EC	1.2	LB A/A	PRE	A				
10	Outlook	6	SL	1.28	LB A/A	FLAG	C				
11	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	3.3	91.7	91.7	0.0
11	Prowl	3.3	EC	1.2	LB A/A	PRE	A				
11	Outlook	6	SL	0.64	LB A/A	1 LEAF	D				
12	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	6.0	94.0	94.0	0.0
12	Prowl	3.3	EC	1.2	LB A/A	PRE	A				
12	Outlook	6	SL	1.28	LB A/A	1 LEAF	D				
13	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	5.0	94.7	92.3	0.0
13	Prowl	3.3	EC	1.2	LB A/A	PRE	A				
13	Outlook	6	SL	0.64	LB A/A	2 LEAF	E				

PRE and Layby Weed Control in Onions with Outlook

Colorado State University

Trial ID: ONI0022 | Study Dir.: COA
Location: Rocky Ford, CO | Investigator: Dr. Scott Nissen, Jim Sebastian

Weed Code								Kochia	Pigweed	VMall
Crop Code							ONION			
Rating Data Type							Phyto	Control	Control	Control
Rating Unit							%	%	%	%
Rating Date							-----------5-9-02-----------			
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Grow Stg	Appl Code			
14	Prowl	3.3	EC	1.2	LB A/A	PRE	A			
14	Outlook	6	SL	1.28	LB A/A	2 LEAF	E			
14	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A	7.0	95.0	95.7	0.0
LSD (P=.01)								15.08	7.27	8.82	0.00
Standard Deviation								6.65	3.20	3.89	0.00
CV								122.97	3.76	4.55	0.0

PRE Weed Control in Onions: Part I

Colorado State University – Weed Science

Project Code: ONIO042 **Location:** Rocky Ford, CO **Cooperator:** COA, BASF, Mike Bartolo

Site Description

Crop: Onions **Variety:** 202 Waldow **Planting Date:** March 14, 2002
Plot Width: 6.7 feet **Plot Width:** 30 feet **Replications:** 3

Irrigation Type: Furrow

Soil Description

Texture	%OM	%Sand	%Silt	%Clay	pH	CEC
Silty Clay Loam	1.5				7.8	

Application Information

	A
Application Date	4-4-02
Time of Day	12:30 AM
Application Method	Broadcast
Application Timing	PRE
Air Temp (F)	56
Soil Temp (F)	50
Relative Humidity (%)	16
Wind Velocity (mph)	5.2

Application Equipment

Sprayer Type	Speed (mph)	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	PSI
Backpack	3	Flat Fan	11002	20"	20"	6.7'	20	30

Summary Comments

The purpose of this study was to evaluate crop safety and efficacy of standard and future PRE herbicides for onions. The best way to evaluate the risk associated with these treatments is to evaluate performance under a wide range of environmental conditions. Each field season protocols similar to this one are established at a number of locations across Colorado.

Prowl provided the most consistent weed control and at rates equivalent to 7.3 pints of product onion injury was not significantly different from the untreated control. Dacthal and Nortron provided similar pigweed and kochia control, while weed control with Outlook was poor. Venice mallow was not controlled with any herbicide evaluated.

PRE Weed Control in Onions: Part I

Colorado State University

Trial ID: ONI0042 Study Dir.: Dr. Scott Nissen
Location: Rocky Ford, CO Investigator: Dr. Scott Nissen, Jim Sebastian

Weed Code									Kochia	Pigweed	V-Mallow
Crop Code								ONION			
Rating Data Type								Phyto	Control	Control	Control
Rating Unit								%	%	%	%
Rating Date								5-9-02			
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Grow Stg	Appl Code				
1	Nontreated					PRE	A	3.7	0.0	0.0	0.0
2	Hand Weeded					PRE	A	4.0	100.0	100.0	100.0
3	Prowl	3.3	EC	1.2	LB A/A	PRE	A	4.7	95.0	90.0	0.0
3	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A				
4	Prowl	3.3	EC	1.5	LB A/A	PRE	A	5.7	96.7	93.3	0.0
4	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A				
5	Prowl	3.3	EC	3.0	LB A/A	PRE	A	5.0	96.7	93.0	0.0
5	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A				
6	Outlook	6	SL	0.64	LB A/A	PRE	A	4.7	59.0	56.7	0.0
6	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A				
7	Dacthal	75	WP	8	LB A/A	PRE	A	5.3	80.0	70.0	0.0
7	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A				
8	Dacthal	75	WP	10	LB A/A	PRE	A	7.0	76.7	75.0	0.0
8	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A				
9	Nortron	4	SC	0.5	LB A/A	PRE	A	4.0	78.3	78.3	0.0
9	Roundup Ultra	3	SL	0.75	LB A/A	PRE	A				
10	Nortron	4	SC	1.0	LB A/A	PRE	A	6.7	85.0	78.3	0.0
10	Roundup Ultra	3	SC	0.75	LB A/A	PRE	A				
LSD (P=.01)								3.11	39.35	39.87	0.00
Standard Deviation								1.32	16.75	16.97	0.00
CV								26.12	21.83	23.09	0.0

Callisto Evaluations for Weed Control in Onions

Colorado State University – Weed Science

Project Code: ONIO062 **Location:** Rocky Ford, CO **Cooperator: COA,** Mike Bartolo

Site Description

Crop: Onions **Variety:** **Planting Date: 4-11-02**
Plot Width: 6.7 feet **Plot Width:** 30 feet **Replications:** 3

Irrigation Type: Furrow

Soil Description

Texture	%OM	%Sand	%Silt	%Clay	pH	CEC
Silty Clay Loam	1.5				7.8	

Application Information

	A	B
Application Date	5-10-02	6-21-02
Time of Day	7:00 AM	10:00 AM
Application Method	Broadcast	Broadcast
Application Timing	Post-2 Leaf	6 Leaf
Air Temp (F)	51	96
Soil Temp (F)	-	75
Relative Humidity (%)	29	16
Wind Velocity (mph)	2.9 Average	2 to 4

Application Equipment

Sprayer Type	Speed (mph)	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	PSI
Backpack	3	Flat Fan	11002	20"	20"	6.7'	20	30

Summary Comments

Callisto is a new PRE and POST applied herbicide being developed by Syngenta for weed control in corn. The purpose of this study was to evaluate Callisto as a potential POST product for weed control onions. Callisto controls a wide range of broadleaf weeds and some grasses. In corn, combinations of Atrazine + Callisto have provided excellent weed control. Since Atrazine is photosystem II inhibitor, this study evaluated Callisto alone and in combination with Buctril, another photosystem II inhibitor.

In this study, Callisto appeared to have some crop safety; however, from other locations and greenhouse research root absorption following rainfall can cause severe onion injury. The most interesting thing about this location was that combinations of Callisto + Buctril seemed to be less injurious. Callisto did seem to improve venice mallow control. The fact that Rocky Ford received very little precipitation during the growing season is one reason the onions survived.

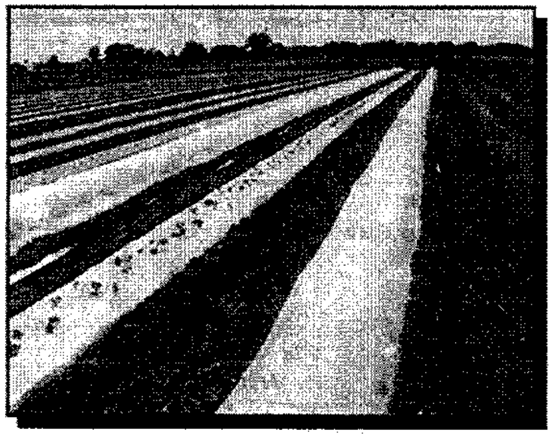
Callisto Evaluations for Weed Control in Onions

Colorado State University

Trial ID: ONI0062 | Study Dir.: COA, Mike Bartolo
Location: Rocky Ford, CO | Investigator: Dr. Scott Nissen, Jim Sebastian

Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Grow Stg	Appl Code					
	Crop Code							ONION	Pigweed	V-mall	ONION	ONION
	Rating Data Type							Injury	Control	Control	Injury	Injury
	Rating Unit							%	%	%	%	%
	Rating Date							------	5-30-02	-----	6-21-02	7-16-02
1	Untreated Check						A	3.3	0.0	0.0	34.7	3.7
2	Callisto	4	EC	1	FL OZ/A	2 Leaf	A	6.3	65.0	70.0	39.0	8.7
2	COC	100	L	1	% V/V	2 Leaf	A					
2	Callisto (Optional)	4	EC	1	FL OZ/A	6 Leaf	B					
2	COC (Optional)	100	L	1	% V/V	6 Leaf	B					
3	Callisto	4	EC	2	FL OZ/A	2 Leaf	A	5.3	70.0	73.3	38.3	12.7
3	COC	100	L	1	% V/V	2 Leaf	A					
3	Callisto (Optional)	4	EC	2	FL OZ/A	6 Leaf	B					
3	COC (Optional)	100	L	1	% V/V	6 Leaf	B					
4	Callisto	4	EC	3	FL OZ/A	2 Leaf	A	6.0	76.7	76.7	8.3	18.3
4	COC	100	L	1	% V/V	2 Leaf	A					
4	Callisto (Optional)	4	EC	3	FL OZ/A	6 Leaf	B					
4	COC (Optional)	100	L	1	% V/V	6 Leaf	B					
5	Callisto	4	EC	1	FL OZ/A	2 Leaf	A	6.0	87.3	87.3	7.3	11.7
5	Buctril	2	EC	10	FL OZ/A	2 Leaf	A					
5	Callisto (Optional)	4	EC	1	FL OZ/A	6 Leaf	B					
5	Buctril (Optional)	2	EC	10	FL OZ/A	6 Leaf	B					
6	Callisto	4	EC	2	FL OZ/A	2 Leaf	A	5.7	95.7	94.0	36.0	12.7
6	Buctril	2	EC	10	FL OZ/A	2 Leaf	A					
6	Callisto (Optional)	4	EC	2	FL OZ/A	6 Leaf	B					
6	Buctril (Optional)	2	EC	10	FL OZ/A	6 Leaf	B					
7	Buctril	2	EC	10	FL OZ/A	2 Leaf	A	4.7	85.0	88.3	38.0	5.0
7	Buctril (Optional)	2	EC	10	FL OZ/A	6 Leaf	B					
8	Buctril	2	EC	10	FL OZ/A	2 Leaf	A	5.7	81.7	85.0	41.7	6.7
8	Goal	2	EC	8	FL OZ/A	2 Leaf	A					
8	Buctril (Optional)	2	EC	10	FL OZ/A	6 Leaf	B					
8	Goal	2	EC	8	FL OZ/A	6 Leaf	B					
	LSD (P=.01)							4	12	7	112	8
	Standard Deviation							2	5	2	46	3
	CV							30	7	4	151	33

Early Cantaloupe Trial



Mike Bartolo
Arkansas Valley Research Center
Colorado State University

Cantaloupe are one of the mainstays of the Arkansas Valley produce industry. The price for cantaloupe grown for road-side stands and other direct markets is consistently greater early in the season. Therefore, growers may benefit by expanding the traditional marketing period.

As seen in previous studies, early hybrid varieties used in conjunction with plasticulture techniques can help expand the production period and improve yields for early market melons. This study was an expansion of those trials to determine how early cantaloupes can be produced in the Arkansas Valley using additional combinations of plastic mulches, row covers and hybrid varieties.

The 2002 season was extremely hot and dry. These conditions proved to be ideal for melon production. Yields and quality were some of the best recorded at the Arkansas Valley Research Center (AVRC).

Overall, a combination of clear plastic mulch, clear plastic row covers, fabric covers, and a transplanted early variety provided the earliest harvest with the first fruit being picked on June 28.

Methods

This study was conducted at the AVRC in Rocky Ford. Beds, 45 inches wide and 60 inches between centers, were shaped in early April. Drip lines were placed 1-2 inches from the center of the bed at a depth of 3 inches The test area was then sprayed with a combination of Prefar (Gowan Chemical) and Alanap (Uniroyal Chemical) for weed control. The beds were covered with clear embossed plastic mulch (Mechanical Transplanter) on April 19 using a one-bed mulch layer.

A fresh-market variety, "Earligold" (Hollar Seeds), and two western shipping types, "Nitro" and "Gold Rush" (Harris Moran) were used in these trials. Cantaloupe seeds or four-week-old transplants were set through holes in the plastic mulch in a single row down the center of the bed at an in-row spacing of 18 inches. Each plot was one bed wide (5 feet) and 18 feet long and was replicated three times.

The following twelve production methods were evaluated:

1. *Earligold transplanted April 22 into clear mulch and covered with a spun-bound polyester fabric plus a perforated row cover.*

Yield and earliness of Earligold (Hollar Seeds), Gold Rush, and Nitro (Harris Moran) cantaloupe grown with different plasticulture combinations.

Variety and Seeding or Transplanting Date	Row Cover	First Harvest	Aveage Fruit Size (lbs)	Market. Fruit per acre	Market. Yield (lbs/acre)
Earligold Transplanted April 22	perforated plus fabric	June 28	2.89	12,422	36,526
Gold Rush Transplanted April 22	perforated plus fabric	July 5	2.79	14,520	40,866
Nitro Transplanted April 22	perforated plus fabric	July 4	4.11	11,616	47,835
Earligold Seeded April 19	perforated plus fabric	July 8	3.23	15,488	50,223
Earligold Transplanted April 23	perforated	July 1	2.97	11,454	34,122
Gold Rush Transplanted April 23	perforated	July 5	3.07	14,036	42,608
Nitro Transplanted April 23	perforated	July 4	4.32	10,002	43,237
Earligold Seeded April 19	perforated	July 8	3.12	14,197	44,141
Earligold Transplanted May 6	none	July 8	3.53	15,649	55,837
Gold Rush Transplanted May 6	none	July 16	2.92	17,585	51,901
Nitro Transplanted May 6	none	July 11	4.43	12,906	57,241
Earligold Seeded April 19	none	July 13	3.30	15,488	51,062
LSD (0.05)=			0.52	3,630	13,155

2. Gold Rush transplanted April 22 into clear mulch and covered with a spun-bound polyester fabric plus a perforated row cover.
3. Nitro transplanted April 22 into clear mulch and covered with a spun-bound polyester fabric plus a perforated row cover
4. Earligold seeded April 19 into clear mulch and covered with a spun-bound polyester fabric plus a perforated row cover
5. Earligold transplanted April 23 into clear mulch and covered with perforated plastic
6. Gold Rush transplanted April 23 into clear mulch and covered with perforated plastic
7. Nitro transplanted April 23 into clear mulch and covered with a perforated row cover
8. Earligold seeded April 19 into clear mulch and covered with perforated plastic .
9. Earligold transplanted into clear mulch May 6
10. Gold Rush transplanted into clear mulch May 6
11. Nitro transplanted into clear mulch May 6
12. Earligold seeded into clear mulch April 19

Plastic row covers were suspended by wire hoops spaced 3-4 feet apart. The plastic row covers were made of clear perforated polyethylene (Mechanical Transplanter). The fabric rows covers were made of spun-bound polyester (Kimberly Clark) and were placed directly over the transplanted melons for the earliest treatments (April 22). The fabric row covers were removed on May 11 (by pulling them out one end of the plastic tunnel). Large slits were cut into the tops of the plastic row covers for ventilation in early May and the plastic row covers were completely removed off the transplanted and seeded treatments in late May to early June depending on the treatment. Generally, row covers were removed from a treatment when the first fruiting flowers were discovered.

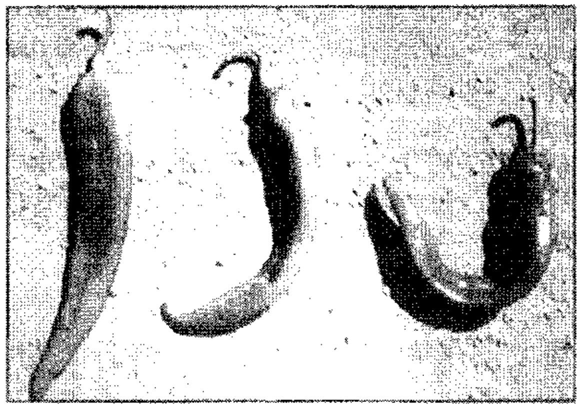
Beside the application of herbicides, weeds were controlled via cultivation and hand weeding. No other pest control measures were used. The crop was irrigated as needed via drip lines.

Cantaloupe were harvested at full slip every 1-2 days. Marketable melons were weighed and counted at each harvest. Melons were considered marketable if they weighed over 2 lbs. and were free of any physical defects.

Temperature (°F)in April and May 2002 during establishment period of early cantaloupe.

Date-April	High	Low	Date-May	High	Low
19	80	34	1	85	50
20	54	38	2	69	38
21	69	27	3	78	37
22	78	29	4	77	39
23	86	32	5	89	39
24	85	40	6	87	46
25	70	36	7	85	44
26	82	34	8	79	38
27	76	44	9	71	35
28	82	34	10	86	45
29	81	33	11	84	55
30	88	42	12	61	47

Hybrid Chile Establishment



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Colorado State University

In the Arkansas Valley, direct-seeded peppers are often subjected to storm damage, soil crusting, and severe weed competition. Transplanting peppers is one way to overcome problems with establishing the stand of peppers. Having a good quality pepper transplant is important if earliness and yield are to be maximized. Further, with the introduction of expensive hybrid chile varieties, it is even more critical that transplants are grown and handled properly.

This study was conducted to determine how different methods of crop establishment affect the yield and fruit characteristics of a hybrid anaheim-type chile ("Navojoa" - Seminis). Direct-seeding and transplanting different sized peppers at different in-row spacings were compared .

Under furrow-irrigated conditions, both direct-seeded peppers produced higher yields than any transplanted treatment. Direct-seeded peppers were also higher in quality than transplanted peppers. Direct-seeded peppers produced fruit that were straighter and bigger (length and width) than the fruit from transplanted peppers. Also, transplanted pepper plants were consistently shorter than the direct-seeded plants and as a result, the fruit had a tendency to touch the ground.

In terms of earliness, the fruit from large transplants (75 cells per tray) matured about 7-10 days earlier than those from smaller sized transplants and about 20 days earlier than those from direct-seeded peppers.

Transplants grown in flats containing 75, 200, and 288 plants per tray all produced peppers with comparable yields and quality.

In terms of in-row spacing, yields and fruit quality were not significantly different between the 6, 9, and 12 -inch spacings. Regardless of in-row spacing, the pods on all transplanted peppers were consistently shorter and more curved than the pods on direct-seeded peppers.

Methods

This study was conducted at the Arkansas Valley Research Center in Rocky Ford. For the conventionally grown (furrow) peppers, beds, 30 inches between centers, were shaped in early April. Peppers were direct-seeded on

April 24 with a Stanhey vacuum planter and later thinned to an in-row spacing of 9 inches. Transplants were set out by hand on May 16. All transplants were set into the ground to the depth of their first true leaves. Experimental plots consisted of four rows 12.5 feet long. Plots were randomized within each of five blocks.

Weeds were controlled by a pre-emergence application of Roundup (glyphosate), mechanical cultivation and hoeing. No other pest controls were needed.

Irrigation was by furrows with every-other row being used.

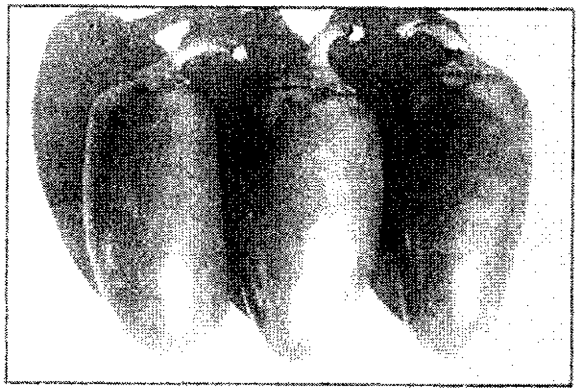
The trial was harvested beginning August 28. All marketable sized fruit were weighed and recorded. A 25 pepper sub-sample was taken from each plot to determine average fruit weight, fruit length, and degree of fruit curvature

Marketable yield and fruit characteristics of the hybrid anaheim-type pepper Navojoa (Seminis) grown with conventional furrow irrigation.

Treatment	In-Row Spacing	Fruit Width (cm)	Fruit Length (cm)	% of curved fruit			Average Pod Weight oz.	Market Yield (lbs/acre)
				strght	slight[1]	severe[2]		
Direct-Seed	9	3.7	21.1	42	53	5	2.1	30,631
200 cell	6	3.5	19.6	15	71	14	1.9	24,846
200 cell	9	3.6	19.1	22	64	14	1.9	22,058
200 cell	12	3.3	18.7	21	64	15	1.8	22,233
75 cell	12	3.4	18.9	16	71	13	1.6	26,519
288 cell	12	3.6	19.2	19	67	14	1.7	21,954
lsd (0.05) =		0.3	0.9	12	12	9	0.2	5,508

1. Slight curvature: "Banana shaped"
2. Severe curvature: Greater than banana shaped but less than "C" shaped (Anything more curved was considered a cull)

Jalapeno Establishment Trial



Mike Bartolo
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Some of the new jalapeno varieties are extremely productive, have a large size, and are resistant to several diseases. Unfortunately, being hybrids, these varieties are expensive. Therefore, growers must use seed sparingly to minimize costs. Precision planting and transplanting are common ways to reduce seed use. Of the two methods, transplanting has the added benefits of ensuring a good stand and allowing more weed control options. Even so, proper handling and placement of pepper transplants is important if yields are to be maximized. Further, when using transplants, it important to consider how transplanted peppers respond to harvesting. In many places, mechanical harvesting is becoming the only economical way to pick jalapeno peppers used for processing. Therefore, it is important to note if transplanting methods alter plant size, shape, and lodging characteristics.

This study, therefore, was conducted to determine how different methods of crop establishment affect the yield, and fruit and plant characteristics of a hybrid jalapeno. Direct-seeding and transplanting at different in-row spacings were compared.

In the 2002 trial, direct-seeded peppers had slightly higher yields and fruit size than transplanted peppers. Transplants set at a 6, 9, and 12 inch in-row spacing produced similar yields and fruit sizes. All transplants, regardless of in-row spacing, produced peppers plants of approximately the same height yet, significantly shorter than the direct-seeded peppers. In addition, the fruit were set closer to the ground in transplanted peppers compared to direct-seeded peppers. Unfortunately, shorter plants and fruit close to the ground make the transplanted peppers less amenable to mechanical harvest. Overall, there was no noticeable lodging in any treatment.

Methods

This study was conducted at the Arkansas Valley Research Center in Rocky Ford. Beds, 30 inches between centers, were shaped in early April. The jalapeno pepper, "Grande", (Seminis) was direct-seeded on April 24 with a Earthway hand planter and later thinned *to an in-row spacing of 9 inches. Transplants were grown in the greenhouse for six weeks in 200 cell flats. The transplants were set out by hand on May 16 and were placed into the ground to the depth of their first true leaves. Experimental plots consisted of three rows 12.5 feet long. Plots were randomized within each of seven blocks.*

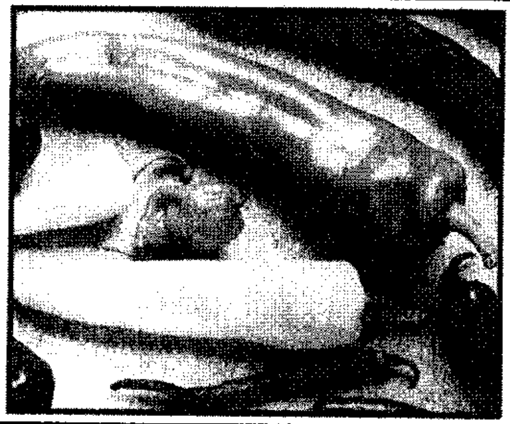
Weeds were controlled by a pre-emergence (seed) and pre-transplant application of Roundup (glyphosate), mechanical cultivation, and hoeing. No other pest controls were needed. Irrigation was by gravity-flow furrows with every-other furrow being used.

The trial was harvested twice September 3 and September 19 . All marketable sized fruit were weighed and recorded. A 25 pepper sub-sample was taken from each plot to determine average fruit weight.

Marketable yield and fruit and plant size of the hybrid jalapeno pepper Grande (Seminis).

Treatment	In-Row Spacing	Ave Fruit Weight (oz)	Plant Height (in)	Marketable Yield (lbs/acre)
Direct-Seeded	9	0.99	20.7	20,386
Transplant	6	0.88	15.2	18,190
Transplant	9	0.89	13.7	18,748
Transplant	12	0.89	14.0	17,981
lsd (0.05) =		0.11	2.0	2,640

Pepper Stand Reduction Trial



Mike Bartolo
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Colorado State University

A number of environmental conditions can affect the stand of peppers. Early season soil crusting, wind storms, pests, and diseases may all reduce pepper populations. It is not clear how the yield and market quality of peppers are impacted by changes in plant population.

This study was conducted to determine the yield and quality of a long green chile pepper subjected to different levels of stand reduction at different stages of plant development.

In 2002, the growing season was extremely hot and dry. A shortage of irrigation water in August was detrimental to all pepper treatments. Despite these stressful environmental conditions, pepper yields were good and there were significant differences between treatments.

In general, stand reduction at a later stage of plant development was more detrimental to yield than stand reduction at an early stage. Stand reduction up to 50% of the control still had fairly good yields. On the other hand, a 75% stand reduction severely reduced yields regardless of when the reduction occurred.

In terms of pepper pod quality, there was not a significant difference between treatments for pod length and pod weight. Pod width was generally greater in the 50% and 75% stand reduction treatments.

Methods

The long green chile variety "NuMex Joe E. Parker" (Burrell Seeds) was used in this study. Peppers were direct-seeded into 30 inch rows on April 22nd with a Stanhay vacuum planter. Seeds were placed every 1.2 inches to ensure an adequate stand. Irrigation was by gravity-flow furrows and other production practices were standard for the area.

All treatments were thinned to a uniform in-row spacing of 6 inches on June 17th. Each plot was 4 rows wide (10 ft) and 13 ft long and was replicated four times in the trial. On July 5th, the "Early" stand treatments were thinned to remove either 25% , 50%, or 75% of the peppers. The same process occurred for the "Late" treatments on August 7th . Standard production practices continued for the remainder of the season. Harvest was initiated on September 18th and was completed on October 3rd . All marketable pods were *picked and weighed. The weight of a 25 pod sub-sample was recorded to determine average pod weight. In addition, the length and width of five randomly selected pods from each plot were recorded.*

This project was generously supported by the National Crop Insurance Services.

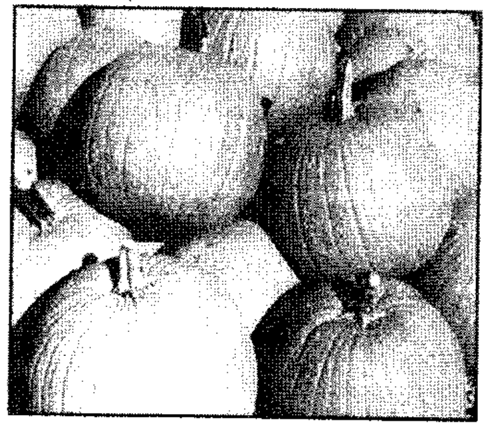
Pepper development at the times of stand reduction

Stage of Development	Date	Plant Height (in)	Developing Pods	Leaf number or leaf area
EARLY	July 5	8-10	0	19-25 leaves per plant
LATE	August 7	20-25	6-8	2100-2500 cm^2

Marketable yield and pod quality of chile peppers (var. NuMex Joe E. Parker) subjected to different levels of stand reduction at two stages of development.

Treatment	Average Pod Width (cm)	Average Pod Length (cm)	Average Pod Weight (oz)	Marketable Yield (lbs/acre)
Control - Early	4.55	19.15	2.43	29,687
25% Reduction - Early	4.50	19.20	2.46	25,130
50% Reduction - Early	4.52	19.35	2.40	28,380
75% Reduction - Early	4.77	19.40	2.48	22,852
Control - Late	4.32	19.35	2.32	30,893
25% Reduction - Late	4.42	19.00	2.51	28,079
50% Reduction - Late	4.70	19.05	2.51	26,537
75% Reduction - Late	4.47	19.30	2.51	16,485
lsd (0.05)	0.24	ns	ns	3,696

Pumpkin Variety Trial



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Arkansas Valley Research Center
Colorado State University

Pumpkins are an increasingly important vegetable crop in Colorado. Most pumpkins are shipped to retail outlets or direct-marketed through road-side stands or other types of on-farm sales. Almost all of the pumpkins grown in the state are for the decorative/Halloween market.

Pumpkins are considered a fairly low input vegetable crop. Accordingly, open-pollinated varieties like "Howden" are sown on most of the acreage. New hybrid varieties, however, may help improve overall production and offer growers alternative strategies to combat powdery mildew.

Despite the severe lack of adequate irrigation water in 2002, several pumpkin varieties performed extremely well in the trial. Most notably, "Magic Lantern" (Harris Moran) had good yields and outstanding fruit quality. Further, "Magic Lantern" had good powdery mildew tolerance.

Methods

This study was conducted at the Arkansas Valley Research Center (AVRC) in Rocky Ford. Beds, 60 inches between centers, were shaped in early May. Irrigation was by gravity flow furrows spaced 60 inches apart as well. The test area was pre-irrigated in late May and then cultivated to help with weed control.

Nine pumpkin varieties were sown on June 12 with an Earthway hand planter. Each plot was four beds wide (20 feet) and 20 feet long and was replicated four times.

At the 2-3 leaf stage, the pumpkins were thinned down to 25 plants per plot for an in-row spacing of approximately 3 feet.

A single application of "Asana" was made to control squash bugs. No other pesticides were used for the remainder of the season.

The plots were fully irrigated three times and with one final and very brief irrigation in early August.

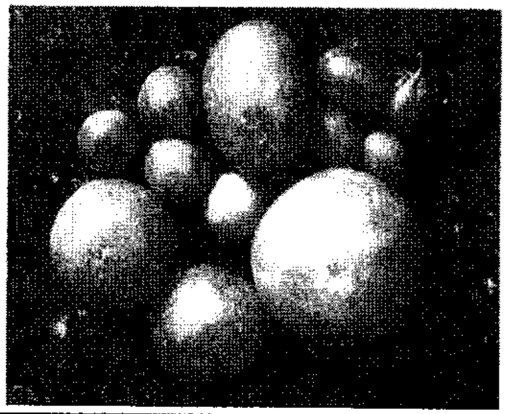
The pumpkins were harvested on October 2. All pumpkins that were less than 25% green, firm, and free of any physical defects were considered marketable. Total fruit weight and numbers were recorded.

Please contact the AVRC at (719)254-6312 with any questions concerning the results.

Marketable yield, average fruit weight, and fruit number of pumpkins grown in a replicated trial at the Arkansas Valley Research Center, Rocky Ford.

Variety	Source	Fruit Number per acre	Average Fruit Weight (lbs)	Marketable Yield (lbs/acre)
Magic Lantern	Harris Moran	5,281	8.53	45,095
Sorcerer	Chesmore	5,172	8.24	42,860
Aspen	Hollar	3,947	8.60	33,595
Merlin	Harris Moran	4,356	7.59	33,456
Frosty	Hollar	4,383	7.29	32,569
Autumn King	Burrell	2,559	11.69	31,120
Howden's Howden	Chesmore	2,286	9.30	21,548
Phantom	Seminis	2,232	8.66	20,955
Howden	Burrell	1,667	9.57	16,664
LSD (0.05) =		991	1.50	11,019

Tomato Spacing Trial



Mike Bartolo
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Colorado State University

A number of hybrid tomato varieties have proven to be very productive in the Arkansas Valley. Locally, some tomatoes are still direct-seeded. However, the high cost of hybrid seed makes direct-seeding increasingly cost-prohibitive and transplanting more economical. Accordingly, it is important to know what are the optimum production conditions for transplanted hybrid tomatoes. This study, therefore, was conducted to determine how different plant populations affect the yield, earliness and fruit characteristics of a hybrid tomato grown under intensive production conditions.

Methods

The tomato variety "Sunbrite" (Seminis) was transplanted through black plastic mulch on May 14. Mulched beds were on 60 inch centers and had a covered surface of 32 inch. Tomatoes were placed in a single row down the center of the bed at either a 9 or an 18 in-row spacing. These spacings corresponded to 11616 and 5808 plants per acre. The crop was irrigated via drip lines placed 3 inches below the soil surface and down the center of the bed. The tomatoes were pruned but were not staked. Each plot was 15 feet long and one bed (5 feet) wide and was replicated four times. The plots were harvested eight times, beginning on August 6 and ending September 2[4]. Tomatoes were considered marketable if they were at least 5 oz. and free of any physical defects (cracks, rots).

Results and Discussion

The season, in general, was extremely hot and dry and there was a significant infection by curly top virus. Despite the environmental conditions, the tomatoes grew fairly well.

Overall, marketable yields were not significantly different between the 9 and 18 inch in-row spacings. The 18-inch in-row spacings gave rise to slightly larger tomatoes, although the differences were not significant ($P \geq 0.05$). Earliness was approximately the same in both treatments.

Average fruit size and marketable yield of "Sunbrite" hybrid tomato grown at either a 9 or 18 inch in-row spacing. Tomatoes were grown with black plastic mulch and drip irrigation.

Treatment	***Average Fruit Weight (oz)***	***Marketable Yield per Acre (lbs)***
9 inch In-Row Spacing	*6.92*	*66,066*
18 inch In-Row Spacing	*7.39*	*63,539*
lsd (0.05)=	ns	ns

Foliar Boron Application to Field Grown Tomatoes

By Henry G. Taber[1], Michael Bartolo[2], and Vince Lawson[1]
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In 2002, a collaborative research project was conducted between Iowa State University and Colorado State University. The goal was to investigate the relationship between soil K and B levels and tomato plant absorption of B. This field study, therefore, was initiated to examine K soil rates coupled with foliar B application at two locations: low residual K (Muscatine, IA) and high residual K (Rocky Ford, CO). For the purpose of this paper, only the Rocky Ford results are reported.

General Methods:

Tomato transplants, cv. Mt. Spring, were set May 15, 2002, with black plastic mulch and a single line source trickle irrigation system. Row width was 5 feet and in-row plant spacing was 15 inches with 18 plants per treatment plot.

The center 10 plants were used for harvest while the 3 plants on the outside were used for leaf and flower analysis. The plants were pruned to the first flower cluster and staked according to the Florida stake and weave training system. Normal weed control and pest management practices of the area were followed.

The experimental design was a split plot, factorial, randomized complete block with 4 replications. The main factor was pre-plant K rates (0, 200, and 400 lbs K_20/acre). The sub plot was B foliar application: none, 0.25 B lbs/acre at initial flowering , and a second quarter-pound application approximately 4 weeks later.

Soil, flower, and leaf samples were taken throughout the growing season for elemental analysis. Ripe fruit was harvested beginning August 7 and harvested once per week for 7 weeks. After the last harvest, all green fruit were harvested to indicate total fruit set among the treatments. Fruit were sorted into marketable and unmarketable (or cull), and number and weight determined in each category. Cull fruit were those too small, defects greater than 5%, and rots.

The soil type at Rocky Ford consisted of alluvial Rocky Ford silty clay loam (fine-silty, mixed, calcareous, mesic Ustic Torriorthents). Rocky Ford soil levels of K and B were very high. The soil extraction procedure used was Mehlich No. 3 and a B level of $\leq$ 0.5 ppm indicates a probable response to B application. Soil samples taken after final harvest (late October) reflected spring pre-plant application of potash (Table 1A).

Water used for irrigation was analyzed for mineral content throughout the growing season. The Rocky Ford site water was from the Arkansas River until August when extremely dry conditions resulted in switching to a well that was of lesser quality. Mineral content is presented in Table 2. Considerable quantities of Ca, Mg, and S were deposited in the active rootzone by the irrigation water

Results:

There was a significant interaction of K rate B application (P=.06) for <u>total</u> yield (Table 3). The reduction in yield by foliar B application occurred only at the no K rate (from 1729 to 1400 cwt/acre). Further, adding K to these high K residual soils reduced total fruit produced, but only at the no foliar B application. These same effects were also evident with marketable yield. There was no treatment effect on culls, which represented 6.4% of the total yield. Clearly, the yield data indicates that application of either K or B reduced total and marketable yield compared with no treatment. There were no significant treatment effects at any harvest date.

Marketable fruit size significantly changed with harvest date, from a low of 5.2 oz. (first harvest of Aug 7) to a high of 7.4 oz. in mid-August. Average fruit size was 6.3 oz. for the 7 week harvest period and was not affected by treatment.

On the high residual soils of the Arkansas River Valley, the soil K treatment had no effect on leaf petiole K concentration. Further, leaf K concentration did not decline during the growing season. Correlation of petiole sap K concentration to leaf K concentration was poor at both locations when measured on an individual plot basis, i.e. $r = .21$ to .49. However, when average values were used the correlation was very high, $r = .91$ to .99.

The Rocky Ford site maintained a uniform leaf K% without K rate influencing either leaf K or Mg concentration . The plant analysis research data indicates that when first flower cluster is at anthesis, and 2nd flower cluster is developing, the most recently mature leaf K%, dry wt. basis, should be $\geq$ 4.5% and petiole sap K level $\geq$ 6000 ppm (Calif. Data).

The foliar B application in June did not elevate leaf B concentration, as measured by the July sample date (Table 5). However, after two 0.25 lbs B/acre applications the leaf B was significantly elevated (9% at the August sample date). The leaf B concentration almost doubled by the harvest period and the flower B concn was 2X that of leaf. Boron is considered to be immobile in tomato plant, but perhaps with levels in excess of vegetative demand considerable B can be shunted to reproductive tissue.

The relationship of leaf and flower elemental concentration for other nutrients is presented in Table 6. Trends that occurred were that flowers had significantly less Ca and Mn, but more P and Zn, compared to leaf. At the high K residual Rocky Ford site, flower K concentration was significantly greater than leaf. All other leaf elements measured: P, Ca, Mg, Mn, Mo, Cu, and Zn were in the sufficiency range, or above.

Conclusions

The Mehlich No. 3 soil test for K is a good predictor of the need for additional K. At the very high residual K site (Rocky Ford, CO), no additional K was needed and K application significantly reduced yield. Leaf petiole K sap can be a useful tool to evaluate the need for K sidedressing.

The June foliar B application of 0.25 lbs B/acre was not detected in the July leaf or flower sample. However, a second application in July elevated August leaf B concn by 9 % . At the Rocky Ford site, leaf B levels were high, approaching the toxicity level of 100 ppm.

Boron is known to play a major function in flowering, and flower analysis may be a better predictor of plant B need than leaf analysis. However, we were not able to create differential leaf/flower B levels to fully test this idea. Interestingly, with ample plant B the tomato will accumulate B in flower much like P.

Future Work

- Verify the occurrence of the high flower B concentration.
- Evaluate Mehlich No. 3 soil B level as a predictor of tomato response to added soil and/or foliar B.

Table 1. Preplant sample of the treatment area taken in early May, 2002. Values are means of 4 replications. Interpretation from ISU guidelines, Pm 1688 (revised, Nov. 2002). Soil elements by Mehlich No. 3 extraction. The soil pH by 1:2 (soil:water) method.

Element	Rocky Ford	Interpretation
pH	7.14	Sl. alkaline
P, ppm	51 ± 7	High
K, ppm	314 ± 11	v. high
Ca, ppm	6990 ± 133	--
Mg, ppm	637 ± 23	High
B, ppm	2.74 ± .11	High
Zn, ppm	6.93 ± .71	High

Table 1A. After harvest soil analysis of K treatments Rocky Ford, CO, 2002.

	Soil concn, ppm, dry wt. basis	
K rate, lbs K_2O/ac	B	K
	Rocky Ford	
0	2.21	273
200	2.16	302
400	2.24	325
Sign., P > F	n.s.	L *

Table 2. Irrigation water analysis Rocky Ford, CO, during the 2002 growing season. Values are in ppm. The detection limit of the ICAP instrument was 0.01 ppm.

Date	B	K	Ca	Mg	Na	S	pH	Ec, mS
	Rocky Ford site							
May	.14	4.60	133	50.1	95	146	8.21	1.21
June	.11	4.41	112	40.4	74	116	8.07	1.24
July	.15	4.80	120	50.1	96	147	8.12	1.24
Aug-Sept*	.29	1.13	503	94.2	142	383	7.77	2.66

* Switched from Arkansas River to a well because of extremely dry growing season. P, Cu, Fe, and Mo concentrations were < .01 ppm for both locations and all sample dates.

Table 3. Effect of preplant K rate and foliar B application on total season tomato yield, harvest from Aug. 7 to Sept. 23, 2002, Rocky Ford, CO. Values are cwt/acre and the S.E. $_{.05}$ = 140 cwt/acre.

K_2O rate, lbs/a	B application, lbs/acre: 0	0.25 lb at flower	0.25 lb 4 wks later
	cwt/acre		
0	1729	1420	1403
200	1442	1426	1254
400	1400	1500	1422

Table 4. Effect of soil K rate on the most recently matured leaf petiole sap K concentration at selected sampling dates, 2002.

Sample Date	Preplant soil K_2O rate, lbs/acre: 0	200	400
	Rocky Ford site, K ppm petiole sap		
June 14	4167	4367	4133
July 12	4150	4433	4267
August 5	4133	4400	4050

Table 5. Foliar B application effect on tomato leaf and flower B concentration at Rocky Ford, CO.

B rate, lbs/a [1]	Leaf B, ppm Rocky Ford	Flower B, ppm Rocky Ford
	June sample	
none	48	128
	July sample	
none	48	101
0.25	48	110
	August sample	
none	77	Na
0.25	82	Na
0.50	85	Na

1) Leaf sample taken before foliar B application. Solubor supplied at 0.25 lbs B/acre on the June and July application dates

Table 6. Relationship of the elemental concentration in leaf versus flower cluster of Mt. Spring tomato for selected nutrients.

Element	June sample data Leaf	Flowers	July sample date Leaf	Flowers
	Rocky Ford, CO, high soil K site			
K, %	2.77	4.09	3.22	3.32
P, %	0.21	0.80	0.43	0.95
Ca, %	3.65	2.61	2.77	1.65
Cu, ppm	34	33	33	30
Mn, ppm	79	64	60	42
Mo, ppm	1.57	1.74	1.38	1.97
Zn, ppm	37	15	36	60

Watermelon Establishment Trial

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Intensive production practices can improve the yield and earliness of watermelons grown in the Arkansas Valley. Improved hybrid varieties are another tool growers can use to increase production. Since hybrid seed is expensive, it is important that growers know the best plant population and establishment method to optimize yield and fruit size. This study, therefore, was conducted to compare different establishment methods and in-row spacings for the watermelon variety "Stars and Stripes". Melons were transplanted or seeded into black plastic mulch to determine effects on yield, fruit size, and earliness.

In 2002, the hot and dry conditions gave rise to excellent yields and quality. Overall, watermelons were very productive when grown with intensive production methods. In terms of earliness, transplanted melons matured only a couple days before seeded melons.

Overall, there was not a significant difference in yield between any of the treatments. Generally, an in-row spacing of 3 or 4 feet gave the best yield of larger (> 15 lb) melons. Direct-seeding and transplanting produced comparable yields for each respective in-row spacing.

Methods

This trial was conducted at the Arkansas Valley Research Center, on a Rocky Ford silty clay loam. Beds, 60 inches between centers, were shaped in early April and drip lines were placed 1-2 inches from the center of the bed at a depth of 2-3 inches. The beds were then covered with black embossed plastic mulch (Mechanical Transplanter) on April 23rd.

The hybrid watermelon variety "Stars and Stripes" (Seminis Seeds), an elongated Allsweet type, was seeded through holes in the center of the plastic mulch on May 7th. Two to three seeds were set in each hill and later thinned down to one plant. Four-week old transplants were set out on May 17th. The transplants were grown in the greenhouse in 72-cell flats. Similarly, plants were placed in single rows down the center of the bed. Both seeds and transplants were placed at in-rows spacings of 2, 3, or 4 feet. Each plot was one bed wide (5 feet) and 24 feet long and was replicated four times.

The melons were irrigated by the drip lines as needed using canal (Rocky Ford Ditch) water. Besides hand-weeding between the mulched beds, the plots required no other pest control.

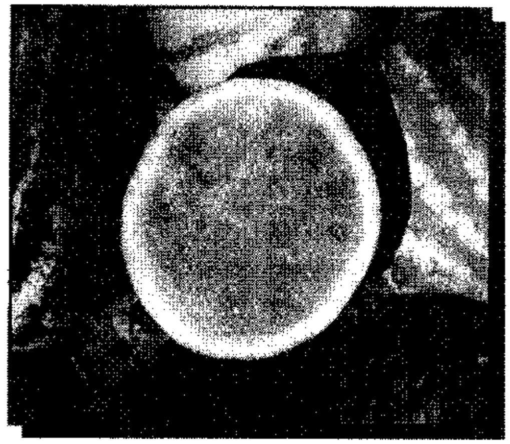
Each plot was harvested over a 5-7 day period. The maturity date represents the mid-point of the harvest period. Only fully ripe melons were selected. Each marketable melon was individually weighed.

Watermelons were considered marketable if they weighed over 8 lbs and were free of any physical defects

Yield, average fruit weight, and earliness of seeded and transplanted hybrid watermelon ("Stars and Stripes"- Seminis Seeds) grown using black plastic mulch and drip irrigation.

Method	In-Row Spacing (ft)	Maturity Date	Total Weight - melons > 8 lbs lbs/acre	Average Total Weight lbs	Market Weight - melons > 15 lbs lbs/acre	Average Market Weight lbs
Transplant	2	7-30	85,105	16.92	60,911	20.04
	3	7-30	96,694	17.42	72,418	19.75
	4	7-31	81,366	18.71	68,715	20.46
Direct-Seed	2	8-1	80,586	15.65	54,087	18.21
	3	8-3	106,649	16.05	70,621	19.27
	4	8-1	88,971	16.36	62,245	18.82
LSD (0.05) =			ns	ns	ns	ns

Seedless Watermelon Trial



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Seedless watermelons are increasingly in demand by consumers throughout the country and represent a valuable new crop for Colorado growers. Like seeded melons, seedless watermelon grow exceptionally well in the Arkansas Valley. Unlike seeded watermelons, however, seedless watermelons require special production practices to optimize yield and quality. Specifically, seedless watermelons are best grown with plastic mulch and drip irrigation. With the use of expensive production practices, variety selection becomes critical.

This study was conducted to evaluate the horticultural characteristics of 22 seedless watermelon varieties. All varieties were grown with plastic mulch and drip irrigation.

Methods

This trial was conducted at the Arkansas Valley Research Center, on a Rocky Ford silty clay loam. Beds, 60 inches between centers, were shaped in early April and drip lines were placed 1-2 inches from the center of the bed at a depth of 2-3 inches. The beds were then covered with black embossed plastic mulch (Mechanical Transplanter) on April 23.

The watermelon varieties were sown in the greenhouse in 72-cell flats on April 9. At the 2-3 true leaf stage, the melons were transplanted in the field on May 17. Plants were placed in single rows down the center of the bed at an in-row spacings of 3 feet. Each plot was one bed wide (5 feet) and 24 feet long and was replicated three times.

"Stars and Stripes" (Seminis Seeds), an elongated Allsweet type, was used as the pollinator. The pollinator was randomly distributed throughout the plot area at a ratio of 1:2.5. Every seedless watermelon plot was bordered on at least one side by a pollinator plot.

The melons were irrigated by the drip lines as needed using canal (Rocky Ford Ditch) water. Besides hand-weeding between the mulched beds, the plots required no other pest control.

Each plot was harvested over a 5-7 day period. The maturity date represents the mid-point of the harvest period. Only fully ripe melons were selected. Each marketable melon was individually weighed. Watermelons were considered marketable if they weighed over 6 lbs and were free of any physical defects

Marketable yield, average fruit weight, and fruit number of seedless watermelon grown in a replicated trial at the Arkansas Valley Research Center, Rocky Ford, CO.

Variety	Source	Maturity Date	% of Total > 10 lbs	Total Average Fruit Weight (lbs)	Total Marketable Yield (lbs/acre)
WT- 0014	D. Palmer	8-1	92.9	15.9	87,979
Trillion	Abbott & Cobb	7-30	70.4	11.7	82,461
Sweet Eat N'	D. Palmer	7-30	92.2	13.7	79,569
Butterball	D. Palmer	7-28	68.1	11.1	79,327
Freedom	Sunseeds	7-30	96.8	14.9	71,607
5244	Abbott & Cobb	7-28	66.7	11.9	70,240
Revolution	Sunseeds	7-28	89.8	14.2	69,260
Chilly Willy	D. Palmer	7-29	77.9	12.8	66,779
Constitution	Sunseeds	7-30	81.1	11.5	66,719
7167	Abbott & Cobb	7-27	89.8	12.7	64,287
CS 4812	Colorado Seeds	7-31	78.4	11.8	64,021
CS 4930	Colorado Seeds	7-29	91.2	13.7	61,685
CS 4830	Colorado Seeds	7-29	72.9	11.3	61,153
5544	Abbott & Cobb	7-29	72.2	12.3	60,814
Boston	Sunseeds	7-28	60.6	10.2	59,435
SXW 0017	Sunseeds	7-28	32.6	8.9	58,539
Afternoon Delight	D. Palmer	7-28	84.1	12.5	57,450
CS 4810	Colorado Seeds	7-27	81.1	12.4	57,426
Premiere	Colorado Seeds	7-29	86.1	12.1	57,015
SXW 0016	Sunseeds	7-29	63.1	10.9	50,904
HSR 3005	Hollar	8-1	74.8	12.1	50,856
CS 48215	Colorado Seeds	7-26	71.7	10.6	48,799
LSD (0.05) =					20,425

Zinnia Stand Loss Trial

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Stand loss in crops can occur due to a variety of environmental stresses. In terms of yield, different plants have different capacities to compensate for reduced populations. This study was conducted to determine the yield response of zinnia (Zinnia elegans Jacq.), grown for seed, to stand loss incurred at different stages of plant development. The effect of removing 25%, 50%, and 75% of the zinnia stand at the pre-bloom, early, mid, and late-bloom stages was examined.

In 2002, the growing season was extremely hot and dry. A shortage of irrigation water in August was stressful to all zinnia treatments. Despite these dry environmental conditions, zinnia yields were good and there were significant differences between treatments. In general, yield losses increased as the amount of stand loss increased.

This project was generously supported by the National Crop Insurance Services.

Introduction

The plains of eastern Colorado are often exposed to extreme environmental conditions including low and high temperatures and severe storms that contain hail (Doesken, 1994). Zinnias grown for flower seed production in the Arkansas Valley of Colorado are subjected to a variety of weather-related stresses. To date, there have been no studies describing how zinnias respond to stand losses.

Our objective was to determine how different levels of stand reduction during zinnia development affect seed yield. This information is needed to document the effects of stand loss on zinnia and gain insights into possible production options after stand has occurred.

Materials and Methods

This study was conducted in field trials at the Arkansas Valley Research Center, Rocky Ford, Colorado, on a Rocky Ford silty clay loam [Ustic Torriorthents, fine silty, mixed, (calcareous, mesic)]. Seeds of "Will Rogers" red-flowered zinnia (Burrell Seed Co.) were sown on 24 May 2002. Plots, 15 ft long X 4 rows (10 ft) wide, were used. The plot area was over-seeded and thinned to a uniform stand (6 inch in-row spacing) in all plots soon after emergence. There were approximately 120 plants per plot.

Weeds were controlled by cultivation and hand weeding. No other pest controls *were used. The crop was irrigated as needed via gravity-flow furrows spaced 30 inches apart. The experiment was a randomized complete block with four replications.*

On 3 July, prior to the blooming of the first flowers, the stand reduction treatments were initiated. Zinnia plants were removed by hand. Either 25%, 50%, or 75% of the plants were removed from plots. Equal numbers of plants were removed from each row within the plot. Stand reduction was repeated on other plots every two weeks corresponding to the early, mid, and late-bloom stages (Table 1). The plots were harvested on 21 October 2002. All flower heads were hand-picked and placed in a paper bag. The harvested material was air-dried in a greenhouse and then weighed (Table 2).

Mature seeds were separated from the remaining flowers structures (cones, petals, immature seeds) by breaking up the heads by hand and running the mixture through an air-blowing seed cleaner. This process was repeated three times until the zinnia seed was free of debris. The mature seed was then weighed (Table 2)

Analysis of variance was performed on seed yield. The means were separated using Duncan's multiple range test.

Literature Cited

Doesken, N.J. 1994. Hail, hail, hail - The summertime hazard of eastern Colorado. Colo. Climate 17(7):84.

***Table 1**. Stages of zinnia (cv. "Will Rogers") development at different stand reduction dates in 2002.*

Stage	***Date***	***Description***
Pre-Bloom	*July 3*	*Plant height 25-28 cm.* *Leaf area is 450-550 cm^2.* *Plant has 1 unopened buds.*
Early Bloom	*July 17*	*Plant height 45-50 cm.* *Leaf area is 1900-2200 cm^2.* *Plant has 3-4 unopened buds and one open flower.*
Mid-Bloom	*July 31*	*Plant height 68-75 cm.* *Leaf area is 4000-5000 cm^2.* *Plant has 4-6 unopened buds and 3-4 open flowers.*
Late Bloom	*August 14*	*Plant height 79-90 cm.* *Leaf area is 5000-5500 cm^2.* *Plant has 4-7 unopened buds and 6-8 open flowers. Some of the older flower heads are drying out.*

***Table 2**. Effect of stand reduction on zinnia flower and seed weight in 2002. Stand reduction occurred at four different intervals during development.*

Stand of Development	***Stand Reduction %***	***Total Flower Weight lbs/acre***	***Seed Weight lbs/acre***
Control	***0***	***882.8 a***	***353.1 a***
Pre-bloom	***25***	***782.8 abc***	***313.1 abc***
	50	***629.2 bcd***	***251.7 bcd***
	75	***459.5 d***	***183.8 d***
Early Bloom	***25***	***643.5 abcd***	***257.4 abcd***
	50	***681.7 adcd***	***272.7 abcd***
	75	***607.1 cd***	***242.8 cd***
Mid-Bloom	***25***	***854.8 ab***	***341.9 ab***
	50	***745.7 abc***	***298.2 abc***
	75	***558.2 cd***	***223.2 cd***
Late Bloom	***25***	***881.8 a***	***352.7 a***
	50	***753.2 abc***	***301.3 abc***
	75	***616.6 bcd***	***246.6 bcd***
Lsd 0.05 =		212.3	84.93

2003 Research Plots
Arkansas Valley Research Center
Colorado State University
Rocky Ford, Colorado

Field Crops

ALFALFA *- 24.5 acres*
Variety Trials -24 entries, 3rd year; 32 entries, planted - new trial
Alfalfa Weevil - Varietal Resistance - 32entries - 7th year
Fertility - Potassium - 4 treatments

BEANS *(Pinto)*
Variety Trial - 18 entries

CORN *- 23.3 acres*
Variety Trial - 36 grain entries, 14 forage entries
SW Corn Borer Pheromone Traps - Arkansas Valley - 5

FERTILITY *- N fertility Response - Long Term 6 rates, 2 types*

SMALL GRAINS

Winter Wheat	*Harvest*	*Plant*
Variety Trial	*30 entries*	*30 entries*

SORGHUM *- 4.8 acres*
Variety Trial - 14 forage entries

SOYBEANS *- 11.1 acres*
Variety Trial - 6 entries

ALTERNATIVE CROPS
Birdsfoot Trefoil - 2 varieties

Vegetable Crops

ONIONS *- 5.9 acres*

Variety Trial - 42 entries
Disease Management -
Disease Variety screening trial - 40 entries
Bacteriocide Screening - 9 treatments
Bacteriophage Trial - 2 treatments
Biocontrol Treatments - 13 entries
Fungicide Treatments - 14 treatments
Insect Management - entries
Weed Management -
Timing and Crop Safety Herbicide Trial - 12 entries
New herbicide - 7 treatments

CANTALOUPE

Plastic Mulch Study-Fresh Market - 3 varieties, 12 treatments
Foliar Fertilizer - 2 treatments

PEPPERS

Variety Demonstration - 20 seeded entries
Plastic Mulch Demonstration - drip irrigation, black plastic, 50 varieties
Hybrid Anaheim Plant Establishment - 1 variety, 14 treatments
Chili Stand Reduction Trial - 8 treatments
Soil Crusting Trial - 4 treatments
Residue Testing for I-4 program - 1 chemical

TOMATOES *- Drip Irrigation and Plastic*

Staked and Mulch Variety Demonstration - 10 entries
Early Tomato Production - 3 varieties, 3 row cover

WATERMELONS

Seedless Establishment Trial on Colored Mulches- 6 treatments
Foliar Fertilization Trial - 3 treatments

OTHER

Sweet corn, cucumber, squash, eggplant, edamame, peanuts, sunflowers, potatoes

A new drip irrigation system installed on 6.5 acres.