ANNUAL PROJECT REPORT FOR 1989

Submitted to:
SLV Research Center Committee
Area II Potato Administrative Committee

TITLE: Colorado State Cooperative Extension Potato Research

PROJECT LEADER: Gary D. Franc, Ph.D., Area Extension Agent (Potatoes)

PROJECT JUSTIFICATION: This project addresses work done primarily in the area of plant pathology. Disease causing micro-organisms such as bacteria, fungi and viruses continue to cause loss of tuber yield and quality in the San Luis Valley. Other work on tuber quality as well as production practices was also done at the request of the Committee. Experimental approaches and objectives for this project were selected so duplication of other research does not occur.

PROJECT STATUS: This is the third reporting year for this project. No funding was received for this project in 1989. Funding was received for cooperative work done on Potato Virus S with Rob Davidson.

During the first year, a project was proposed to determine factors associated with shatter-bruise in the SLV. The results for this study are reported here. The data of this and other research will be reported locally in newsletters throughout the harvest season.

SIGNIFICANT ACCOMPLISHMENTS FOR 1989: FACTORS INFLUENCING SHATTERBRUISE IN THE SAN LUIS VALLEY. Tuber samples (40 tubers each) were collected from 50 Centennial Russet fields and rated for the amount of shatterbruise present. Although the relative influence of various factors on shatterbruise incidence will vary from year to year, data from this study clearly indicated the importance of handling tubers properly during harvest and storage.

The most important factors found for increasing shatterbruise incidence were the number of times tubers were dropped when harvested and moved from the field to storage and the maximum drop height ($P<0.05$). As the number of drops or the maximum drop height increased, the incidence of total shatterbruise increased significantly ($P<0.05$). The most important factors growers need to control to reduce shatterbruise is to decrease the number of times tubers are dropped from one conveyor or chain to the next and, when these drops are necessary, to minimize the height tubers fall.

OBJECTIVES FOR 1990:

1. To determine if fungicide resistant strains of *Alternaria solani* are being selected in Colorado through the repeated use of Bravo fungicides.

BACKGROUND INFORMATION: It was reported that Bravo fungicides failed to control early blight in some potato fields near Wiggins, Colorado. This report came from a potato grower who, since at least 1980, exclusively used Bravo for early blight control. Constant use of a single fungicide for disease control is known to select for resistant populations of some types of fungi. However, this type of resistance has not been reported for early blight. I propose to determine, in controlled laboratory studies, if early blight strains from the Wiggins/Fort Morgan area of Colorado are resistant to Bravo by comparing them with strains recovered from the San Luis Valley.

This work is especially important since we anticipate permanent loss of EBDC fungicides. Because of the loss of EBDC's, more growers will use Bravo fungicides in the SLV. Additionally, the lighter skinned chipping cultivars, which will be grown here if a processing plant is built, are traditionally more susceptible to early blight infection. Therefore, early blight control will become more critical in the Valley's future for several reasons. If this work shows that resistance is possible and anticipated for the SLV, it may be delayed or prevented by alternating fungicide use patterns, changing labels, etc.

2. To determine if the ringrot bacterium can be transmitted through true potato seed.

BACKGROUND INFORMATION: Relatively little is known about how the ringrot bacterium, *Corynebacterium sepedonicum*, persists in 'healthy' potato seed stocks and causes new infections. However, a recent development has been the discovery that the ringrot bacterium can be recovered from sugar-beet seed. The ringrot bacterium is also known to be present in true seed recovered from the fruit harvested from infected tomato plants.

Because of the close similarities in the physiology of potato and tomato plants, it is also possible that true seed recovered from potato 'seed balls' could also carry the bacterium. Determining the presence or absence of the ringrot bacterium in true potato seed would be a significant contribution to understanding the nature of the disease. The planting and handling of true potato seed is a necessary part of all potato breeding programs and true potato seed is even being developed for use by home gardeners and third world countries. If ringrot is to be eradicated, sources of the pathogen must be identified and management strategies developed.

True potato seed will be harvested from inoculated plants grown in the field. This seed will be assayed to determine if the ringrot bacterium can be recovered. Standard materials and methods will be used to complete the study.

FUNDING REQUEST:

1989 Allocation: **NONE**

1990 Budget Request:

Objective 1:	**$4,800.00**
Objective 2:	**$2,000.00**
Total:	**$6,800.00**

FACTORS INFLUENCING SHATTERBRUISE IN THE SAN LUIS VALLEY

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Abstract

Tuber samples were collected from 50 Centennial Russet fields and rated for the amount of shatterbruise present. Although the relative influence of various factors on shatterbruise incidence will vary from year to year, data from this study clearly indicated the importance of handling tubers properly during harvest and storage. The most important factors found for increasing shatterbruise were the number of times tubers were dropped when handled from the field to storage and the maximum drop height ($P<0.05$). As the number of drops or the maximum drop height increased, the incidence of total shatterbruise increased significantly ($P<0.05$). The most important factors growers will need to control to decrease shatterbruise is to reduce the number of times tubers are dropped from one conveyor or chain to the next and, when these drops are necessary, minimize the height tubers fall.

Materials & Methods

Tuber samples were collected from 50 Centennial Russet fields during the 1987 harvest season. Tubers were collected from the harvester or from storage and rated for the amount of shatterbruise present. Ratings were done by dipping tubers in catechol to stain bruised areas and peeling. The number of individual shatterbruise sites and the severity of each injured site was determined. Ratings used were; 1) slight (discolored area removed with one pass of the peeler), 2) medium (discolored area removed with two passes of the peeler) and 3) severe (discolored area removed with three passes of the peeler). The percentage of tuber surface area skinned was also estimated using the Horsfall-Barratt scale (0-11). Forty tubers (4 replications of 10 tubers each) were rated for each field.

The data for the incidence of shatterbruise is shown in the Table (2-pages). The influence of various factors on shatterbruise incidence was determined using *MSTAT* (subprogram: *CORR*). Factors analyzed were total fertility during the growing season (total N, P & K), total seasonal water, soil pH, soil moisture content at harvest, 'cloddiness' or rockiness of soil at harvest, soil and pulp temperature at harvest, the number of times tubers were dropped during harvest until the point they were assayed, the maximum drop height, use of sand versus air harvester, days from vine-kill to harvest, specific gravity and several other factors. Data also were analyzed using multiple regression through the CSU Statistical Laboratory, and showed similar results to the data presented here from the MSTAT analysis.

Results

Data analysis showed that specific gravity, cloddiness, total N, P, and K had little measurable effect on the shatterbruise incidence. Total water, the percentage of soil moisture at harvest, soil and pulp temperatures and the number of days from vine-kill until harvest had moderate effects on the shatterbruise incidence ($P>0.05$). The most important factors for increasing shatterbruise were the number of drops from the field to storage and the maximum drop height ($P<0.05$). As the number of drops or the maximum drop height increased, the incidence of total shatterbruise increased significantly ($P<0.05$).

DISCUSSION

Previous research has shown that the incidence of shatterbruise is greatly influenced by temperature and tuber turgidity. The fact that temperature did not appear to be important in the study reported here is because most tubers were at acceptable temperatures during harvest. As tuber temperature decreases, shatterbruise incidence is known to increase. Shatterbruise and blackspot (two different types of bruising injury) are known to increase dramatically when tuber temperatures are 45 F or lower.

The relative importance of the various factors will vary from year to year. Data reported for this study clearly indicated the importance of handling tubers properly during harvest and storage. The most important factor growers need to control to decrease shatterbruise is to reduce the number of times tubers are dropped from one conveyor or chain to the next and, when drops are necessary, minimize the height tubers fall.

This work was done in cooperation with Agro Engineering, and would not have been possible without their assistance.

FINAL SHATTERBRUISE DATA SET GD FRANC 2-3-88

AIR CHECK & SHATTER BRUISE DATA 1987 SEASON
G.D. FRANC EXTENSION POTATO SPECIALIST/AGRO-ENGINEERING
COMBINED.WKS FILE

GROWER	LOCATION	CLODINESS AT HARVEST	SOIL TYPE	DEGREE OF ROCKS	WATER SOURCE	WATER QUALITY	N APPLIED BY SYSTEM	GROUND WATER LEVEL	SEASON TOTAL WATER	LAST IRRIG.	PLANTING DATE	HARVEST DATE	% MOISTURE AT VINE KILL	% MOISTURE AT HARVEST	TOTAL N	TOTAL P	TOTAL K	LAST N	PREPLANT N	FIRST N INJECTION	RESIDUAL SOIL N	RESIDUAL SOIL P	RESIDUAL SOLUABLE SALTS	SOIL pH	FIELD TEMP.	SOIL TEMP	PULP TEMP.	# DROPS WINDROW PILE	MAX. DROP HEIGHT
1 ADKINS-CORZINE	HOOPER	NONE	SL	NONE	GWD	20	34	9	20.25	9/9	5/10	10/1	30	35	150	I	I	7/25	100	5/15	19	130	0.4	8	76	64	64	10	15
2 AYARS 4	SARGENT	SLIGHT	SL	SM GRAV	GWD	60	80	7.5	16	8/28	5/8	9/21	12	22	159	180	130	NONE	65	NONE	29	81	0.45	7.7	68	70	71	16	20
3 COLBERT 1	EAST	NONE	SL	NONE	GWD	20	32	8	19.2	8/28	5/7	9/15	25	7	171	180	0	7/21	100	6/29	12	77	0.93	7.8	63	58	58	11	17
4 COLBERT 5	EAST	NONE	SL	NONE	GWD	20	34	8	20.3	9/3	5/22	9/28	25	27	160	180	0	7/25	100	7/6	10	52	1.14	7.9	61	53	53	11	17
5 DAVIS	CENTER	NONE	GSL	GRAVELLY	GWD	30	38	9	15	8/15	5/2	9/23	20	30	190	120	35	7/15	140	6/26	149	98	1.34	7.9	77	64	60	21	60
6 DUTTON	BONEN	LG CLODS	GCL	COBBLES	SURF	0	0	5	14.8	8/21	5/20	9/29	50	55	160	50	40	5/23	140	7/16	24	78	0.5	7.1	72	67	86	14	18
7 ELLIOT 6N	NEST	SOME	SL	GRAVELLY	GWD	24	39	17	19.6	8/30	5/10	9/22	30	32	170	200	50	7/13	120	6/24	50	138	0.45	7.4	73	60	62	16	16
8 ELLIOT 7N	NEST	SOME	SL	GRAVELLY	GWD	24	41	18	20.4	9/4	5/15	9/1	10	15	180	160	50	7/16	135	6/29	250	137	0.83	6.7	70	69	65	16	16
9 FAUCETTE 2	TERRACE	LG CLODS	SL	COBBLES	SURF	0	0	15	23.8	8/29	5/11	9/29	50	37	178	160	0	7/19	75	7/2	14	43	0.22	6.7	55	50	49	12	24
10 FELMLEE 7	HOOPER	NONE	LS	NONE	GWD	45	83	15	22	9/6	5/15	9/24	30	33	162	182	30	8/7	70	7/3	14	53	0.58	8.3	70	67	67	19	16
11 FORD 2	CENTER	NONE	LS	GRAVELLY	GWD	33	43	9	15.6	8/26	5/5	9/16	20	25	150	167	101	7/11	82	6/23	31	123	0.63	7.4	72	61	63	6	22
12 GALLAGHER	CARMEL	MANY	SCL	SM GRAV	DRAIN	0	0	4	13.3	9/1	5/11	9/24	10	50	155	120	0	7/22	100	7/21	158	115	1.7	7.8	53	52	49	7	20
13 HAGEDORN	S.RIVER	NONE	LS	NONE	GWD+SURF	0	0	6	20	8/22	5/1	9/15	30	5	170	220	0	7/14	110	7/10	17	62	0.37	7.2	61	49	51	2	14
14 HARRISON	NEST	MANY	GLS	V. GRAV	GWD	24	50	11	25	8/25	5/7	9/21	20	25	I	I	I	7/20	I	6/25	31	157	0.83	7.2	58	52	52	16	18
15 HEERSINK 1	NV	SOME	SL	V. GRAV	GWD	35	60	5	20.6	9/4	5/8	9/22	50	45	184	180	60	7/17	130	7/20	65	146	0.52	6.6	74	66	70	19	18
16 HEERSINK 2	NV	NONE	SL	GRAVELLY	GWD	35	64	4	21.8	9/4	5/12	9/28	50	40	184	180	60	7/18	140	7/20	58	85	0.49	7.9	51	43	50	19	18
17 HOLLAND DAV	SARGENT	SLIGHT	SL	SM GRAV	GWD	88	125	6	17	8/23	5/8	9/11	0	10	196	125	35	7/5	100	7/25	14	106	0.94	7.7	68	60	60	14	14
18 HOLLAND NB	EAST	NONE	LS	NONE	GWD	77	131	9	20.4	9/2	5/9	9/22	50	40	170	180	0	7/27	110	7/10	34	54	0.38	8.1	76	68	60	17	15
19 HOLLAND NEW	HOOPER	NONE	LS	NONE	GWD	21	35	8	20	9/1	5/15	9/17	40	40	180	200	0	7/27	110	7/10	17	95	0.48	8.1	69	62	55	17	15
20 JOSE HUNT3	HOOPER	SLIGHT	SL	NONE	GWD	20	35	12	20.75	9/4	5/20	9/23	30	25	150	238	60	7/10	130	7/20	26	78	0.42	8.2	55	55	52	12	12
21 KELLY N	CARMEL	SOME	SCL	NONE	SURF	0	0	5	19	8/29	5/8	9/23	30	35	170	170	0	7/20	110	6/20	22	92	0.58	7.6	44	55	50	8	14
22 MCDONALD H	SARGENT	SOME	GSL	GRAVELLY	GWD	57	97	10	20.5	8/23	5/10	9/7	30	25	145	230	50	7/22	90	6/26	14	150	0.47	7.1	53	63	67	14	18
23 MESSICK 1	SARGENT	SOME	SL	GRAVELLY	GWD	55	86	6	18.8	9/9	5/20	9/28	30	40	143	181	100	8/12	107	6/23	42	143	0.65	6.8	62	51	55	17	18
24 MESSICK 6	EAST	NONE	SL	NONE	GWD	45	75	10	19.9	9/3	5/10	9/24	60	37	181	177	100	8/5	107	6/27	127	108	1.42	7.7	78	56	72	17	18
25 MILLER	EAST	NONE	LS	NONE	GWD	65	119	9	21.9	9/4	5/5	9/23	45	40	200	200	40	8/5	100	6/27	17	78	0.81	7.6	62	50	55	14	20
26 MITCHELL H	NV	NONE	GSL	SM GRAV	GWD	35	53	6	18.3	8/29	4/28	9/22	15	30	180	180	0	I	140	I	118	90	0.52	7.6	50	54	50	18	18
27 MITCHELL 5	NV	SOME	GSL	SM GRAV	GWD	35	51	6	17.5	9/1	5/3	9/28	15	25	180	180	0	I	140	I	106	103	0.52	7.9	75	62	57	18	18
28 MIX SH	SARGENT	SOME	GSL	GRAVELLY	GWD	60	105	9	21	8/23	5/7	9/16	20	12	148	100	0	7/24	90	7/3	24	97	0.39	7.8	77	64	64	16	18
29 MONIER 3	HOOPER	SLIGHT	SL	NONE	GWD	10	18	11	21.9	9/6	5/12	9/28	32	32	160	238	58	7/9	130	6/23	7	43	0.5	8.3	65	59	60	12	12
30 MONTER H	NEST	SOME	GLS	V. GRAV	GWD	24	44	16	22	9/7	5/21	9/29	17	30	I	I	I	I	I	I	19	70	0.28	7.9	64	50	52	13	24
31 MONTER 10N	NEST	SOME	GLS	COBBLES	GWD	24	50	16	25	9/5	5/13	9/16	15	22	I	I	I	I	I	I	98	25	0.48	7.5	77	62	67	13	24
32 MYERS 2	CENTER	NONE	LS	NONE	GWD	45	68	7	18	9/2	5/6	9/21	40	32	205	130	40	7/22	125	7/14	43	114	0.29	8.1	71	66	70	15	18
33 MYERS 7LOF	CENTER	NONE	LS	NONE	GWD	40	52	5.5	15.7	8/22	5/1	9/15	45	30	150	160	0	7/19	100	6/20	38	130	0.76	7.3	39	45	45	15	16
34 MYERS SG	SARGENT	SOME	SL	GRAVELLY	GWD	45	66	6.5	17.5	8/22	5/10	9/17	10	17	189	177	71	7/17	122	6/30	72	91	0.58	7.9	65	70	70	10	15
35 NISSEN E	EAST	NONE	LS	NONE	GWD	5	9	12	21.55	9/10	5/22	9/24	5	20	180	188	52	7/26	100	7/19	12	30	0.26	7.9	78	61	71	17	16
36 PAULSON MTL.	NV	LG CLODS	SL	COBBLES	GWD	15	26	8	20.6	9/3	5/10	9/15	5	25	185	180	70	8/2	100	7/1	26	105	0.32	7.7	55	52	52	10	18
37 PEPPER CRS10	HOOPER	NONE	SL	SM GRAV	GWD	21	37	9	21.15	9/9	5/20	10/1	40	35	225	220	230	0	180	7/18	139	51	0.63	8	72	66	62	13	20
38 PETERSON 5N	SARGENT	SOME	SL	GRAVELLY	GWD	35	57	6	19.5	9/4	5/14	9/23	0	30	160	170	50	7/9	110	7/7	60	92	0.6	7.9	47	50	48	17	18
39 PETERSON 7N	SARGENT	MANY	GSL	GRAVELLY	GWD	60	100	7	20	9/6	5/10	9/28	10	40	160	170	50	7/15	100	7/3	31	109	0.41	8	67	58	57	12	18
40 PRICE TP6	CENTER	SOME	GSL	COBBLES	GWD	60	94	9	18.75	9/8	5/14	10/1	40	37	180	165	30	NONE	180	NONE	65	82	0.44	7.8	72	70	63	15	18
41 ROCKEY 4	CENTER	SOME	GSL	V. GRAV	GWD	28	58	7	25	I	I	9/29	I	35	I	170	30	I	80	I	41	120	0.42	8.1	I	I	I	I	17
42 SANDERSON	NV	LG CLODS	GSL	GRAVELLY	GWD	35	58	6	20	9/7	5/8	9/19	20	37	180	180	100	7/20	120	6/25	46	172	0.6	7.7	64	53	53	15	24
43 SAUER 3	EAST	NONE	LS	NONE	GWD	21	33	12	18.7	9/2	5/11	9/23	20	50	180	115	0	7/18	115	6/27	10	46	0.63	8	60	50	54	12	12
44 SCIDMORE 1	EAST	NONE	SL	NONE	GWD	20	35	9.5	20.9	9/2	5/3	9/24	0	40	175	180	30	7/15	150	7/15	38	78	0.93	7.5	79	71	64	16	16
45 SCIDMORE 4	EAST	NONE	SL	NONE	GWD	20	35	7	20.7	8/29	5/3	9/15	20	5	200	180	30	NONE	200	NONE	10	90	0.6	7.7	63	58	58	16	16
46 SCOTT LS5	SARGENT	SOME	GSL	COBBLES	GWD	57	92	7	19.3	8/29	5/7	9/19	35	45	178	158	53	7/31	73	7/2	43	99	0.56	7.7	78	58	78	18	18
47 SEESE HN	CARMEL	SOME	SCL	GRAVELLY	SURF	0	0	6	19	8/30	5/11	9/25	20	30	146	160	50	7/17	116	7/9	58	99	1.41	7.7	67	58	64	12	15
48 SHRIVER H	S.RIVER	NONE	LS	NONE	GWD	21	41	6	23.6	9/2	5/5	9/23	20	30	155	180	0	7/20	80	7/20	24	76	0.28	8	62	55	55	10	24
49 WOLFE	EAST	SLIGHT	LS	SM GRAV	GWD	I	ERR	I	I	I	I	I	I	I	I	I	I	I	I	I	108	126	0.51	7.9	70	61	67	14	15
50 WOLFE-PRENT	EAST	NONE	LS	NONE	GWD	I	ERR	I	I	I	I	I	I	25	I	I	I	I	I	I	89	101	0.59	7.8	74	62	64	14	15

HARVESTOR DIRECT DIG OPERATION:

BRUISE GRADE: AVG # PER REP (R#) TEN TUBERS PER REP. SKINNING IS BB SCALE (0=0% SA)

MODEL	OR WINDROWED	4,6 OR 8 ROW	VINE KILL TYPE	# DAYS VINE KILL TO HARVEST	VINE BEATING	SPECIFIC GRAVITY RESULTS	R1 BBSKIN	R1 SLI	R1 MED	R1 SEV	R1 TOT	R2 BBSKIN	R2 SLI	R2 MED	R2 SEV	R2 TOT	R3 BBSKIN	R3 SLI	R3 MED	R3 SEV	R3 TOT	R4 BBSKIN	R4 SLI	R4 MED	R4 SEV	R4 TOT	COMMENTS
LOCK SAND	W6	8	FROST	18	NO	1.0755@15.5	0.80	2.30	0.80	0.50	3.60	1.00	3.40	1.20	0.70	5.30	1.10	3.00	1.40	1.00	5.40	0.80	3.10	1.00	0.20	4.30	SMALL YIELD
LOGAN SAND	W6	6	SULF ACID	21	YES	1.0756@16.5	2.00	3.20	1.30	1.20	5.70	1.60	3.40	1.70	1.10	6.20	1.20	2.50	1.10	1.20	4.80	1.30	2.60	1.50	0.60	4.70	VERY LARGE POTATOES
CURL SAND	W4	4	SULF ACID	16	YES		1.00	2.40	1.50	0.30	4.20	1.10	2.20	0.40	0.10	2.70	1.50	2.00	1.00	0.30	3.30	0.90	0.60	0.30	0.10	1.00	SEED
CURL SAND	W4	4	DIQUAT	16	YES	1.0765@14.5	1.20	1.20	0.30	0.40	1.90	1.80	0.80	0.40	0.20	1.40	2.10	0.80	0.00	0.20	1.00	1.80	0.70	0.70	0.60	2.00	SMALL YIELD
LOCK AIR	W6	8	DIQUAT	31	YES	1.0712@16	1.50	6.80	2.00	3.80	12.60	1.40	4.70	2.50	4.50	11.70	1.60	3.40	3.00	3.30	9.70	1.00	3.40	1.70	2.50	7.60	LOTS OF PEAS AND WEEDS IN HILLS, FULL SORTING DONE BEFORE PILING
LOCK AIR	W2	4	NONE	20	YES	1.085@14.5	3.60	2.10	0.70	1.30	4.10	3.80	0.70	0.80	1.30	2.80	3.00	1.10	0.50	0.80	2.40	2.70	1.00	0.50	1.50	3.00	WATER SLUICING OPERATION TO CLEAN DIRT AND ROCKS, LARGE CLODS AND ROCKS
LOCK AIR	W2	4	NATURAL	20	NO	1.0795@16	1.00	2.30	1.00	0.30	3.60	1.00	2.90	1.90	0.70	5.50	1.00	3.90	1.20	0.20	5.30	0.90	2.10	1.10	0.40	3.60	
LOCK AIR	W2	4	NATURAL	27	NO	1.0805@15.5	0.60	1.60	0.20	0.20	2.00	0.90	2.80	0.80	0.10	3.70	0.60	2.20	0.40	0.10	2.70	0.70	1.40	0.40	0.20	2.00	
HOFFMAN	DD2	2	DIQUAT	27	YES	1.08@14.5	1.20	1.70	0.40	0.70	2.80	1.40	2.00	1.20	0.50	3.70	1.00	1.40	1.00	0.50	2.90	1.10	1.40	0.40	1.00	2.80	BIG ROCKS, COMMERCIALS MOVED TO STORAGE BY SEMI-TRAILER
GRIMME	W4	6	NATURAL	15	NO	1.08@16	2.00	3.80	1.20	0.20	5.20	2.00	2.50	1.30	0.70	4.50	1.80	2.50	1.90	0.80	5.20	1.50	3.40	1.90	0.50	5.80	SORTING RUNNING VERY FULL
CURL SAND	W2	6	DIQUAT	20	YES	1.086@16.5	1.30	2.00	1.20	0.90	4.10	1.20	2.10	1.30	0.50	3.90	1.00	4.10	2.10	1.40	7.60	1.60	2.80	1.70	1.50	6.00	
LOCK AIR	W2	4	DIQUAT	21	NO	1.078@16	2.30	1.00	0.40	0.00	1.40	2.20	1.90	0.10	0.70	2.70	2.40	1.30	0.40	0.80	2.50	0.70	1.40	0.60	0.30	2.30	
VARNER	W2	6	DIQUAT	20	YES		1.10	1.20	0.40	0.90	2.50	0.70	0.70	1.00	1.10	2.80	0.80	0.40	0.80	0.90	2.10	0.50	0.50	0.10	0.50	1.10	SAMPLE OFF OF TRUCK
LENCO	W2	6	DIQUAT	21	NO	1.0722@16.5	1.20	2.60	1.70	0.40	4.70	1.00	2.30	1.50	0.60	4.40	1.20	2.50	1.10	0.50	4.10	1.10	2.70	0.40	0.20	3.30	
LOCK AIR	W4	6	DIQUAT	14	NO	1.079@16	1.30	2.10	0.40	0.50	3.00	1.10	2.90	2.00	1.00	5.90	1.50	3.10	1.90	0.50	5.50	1.20	3.30	1.50	0.60	5.40	
LOCK AIR	W4	6	NONE	14	NO	1.0782@14.5	1.00	3.10	2.80	1.10	7.00	0.80	3.50	1.90	0.30	5.70	0.80	3.40	2.00	1.10	6.50	0.90	2.00	1.50	1.70	5.20	WITH ONE TRUCK UNLOADING PILING NOT VERY FULL, ROLL AT SORTER
LOGAN SAND	W4	6	BHN JCKPT	18	NO		1.90	1.00	0.90	1.10	3.00	0.60	1.70	1.20	1.20	4.10	1.30	1.10	1.50	0.80	3.40	0.90	0.70	1.40	1.40	3.50	HARVESTER ONE ROUND BEHIND WINDROWER
LOGAN SAND	W4	6	BHN JCKPT	20	NO	1.0765@16	0.70	4.30	1.90	0.90	7.10	0.60	2.40	1.20	0.40	4.00	1.20	2.50	1.10	0.90	4.50	0.90	2.40	0.70	0.20	3.30	
LOGAN SAND	W4	6	SULF ACID	20	NO	1.0810@16.5	1.00	4.50	1.50	1.00	7.00	1.10	5.80	2.00	0.50	8.30	0.90	4.80	1.00	0.30	6.10	1.40	3.50	0.60	0.70	4.80	
LOCK AIR	W4	6	NONE	12	NO	1.0735@16	2.00	2.80	0.90	0.70	4.40	1.90	3.40	1.20	0.40	5.00	2.20	2.70	0.90	0.80	4.40	1.90	2.10	1.00	0.40	3.50	
HOFFMAN	W1	3	DIQUAT	21	YES	1.0825@16	0.90	0.80	0.40	0.30	1.50	0.80	1.30	0.80	0.30	2.40	0.80	0.80	0.20	0.30	1.30	0.70	1.00	1.00	0.40	2.40	VINES MOWED WHEN VERY DEAD
LOCK AIR	W4	6	DIQUAT	19	NO	1.0782@16.5	1.00	9.00	0.30	0.90	10.20	1.00	6.10	1.00	0.60	7.70	1.00	4.30	0.10	0.40	4.80	1.10	7.40	1.20	1.40	10.00	SEED POTATOES, WENT THROUGH SIZER
LOCK AIR	W4	6	NATURAL	13	NO	1.0767@14.5	1.10	3.90	1.20	0.10	5.20	0.60	3.10	0.40	0.40	3.90	0.80	3.40	0.60	0.30	4.30	1.00	2.10	0.50	0.40	3.00	
GRIMME	W4	6	DIQUAT	14	NO	1.077@16	1.30	1.90	1.60	0.80	4.30	1.40	1.70	0.80	0.50	3.00	1.00	1.60	0.40	0.50	2.50	0.70	0.80	0.70	0.10	1.60	
LOCK AIR	W2	4	DIQUAT	14	YES	1.070@16	0.70	2.10	1.00	0.30	3.40	1.00	2.50	0.40	0.20	3.10	1.10	1.40	0.50	0.00	1.90	0.90	1.90	0.30	0.40	2.60	
LOGAN SAND	W4	6	MOWING	20	YES	1.0815@16	1.00	4.20	1.20	0.80	6.20	1.10	3.10	1.80	0.60	5.50	1.20	2.50	1.50	0.20	4.20	1.00	2.50	0.70	0.50	3.70	
LOGAN SAND	W4	6	MOWING	20	YES	1.079@14.5	1.00	3.70	2.10	0.80	6.60	1.10	3.10	2.20	1.60	6.90	1.40	5.00	1.90	1.20	8.10	1.10	3.40	2.00	1.40	6.80	
LOCK AIR	W2	4	DIQUAT	19	YES	1.0869@16.5	0.80	3.40	0.00	0.50	3.90	1.00	4.40	0.70	0.40	5.50	0.80	2.10	0.40	0.40	2.90	0.80	2.40	0.70	0.00	3.10	
LOGAN	W4	6	NATURAL	17	NO	1.0785@14.5	0.70	1.40	0.40	0.60	2.40	0.40	1.30	0.30	0.10	1.70	0.80	1.00	0.20	0.20	1.40	0.50	1.00	0.20	0.10	1.30	
HOFFMAN	W4	6	DIQUAT	21	YES	1.0845@14.5	1.50	1.90	0.80	0.40	3.10	1.60	2.90	1.40	1.00	5.30	1.30	2.20	1.70	0.30	4.20	1.40	2.40	1.30	0.80	4.50	
HOFFMAN	W4	6	DIQUAT	32	YES	1.0835@16.5	0.80	1.70	0.70	1.10	3.50	0.90	2.80	0.80	0.50	4.10	1.30	2.70	0.80	0.60	4.10	1.00	1.20	0.40	0.50	2.10	
PARMA	W6	6	DIQUAT	14	YES	1.0775@16.5	1.30	5.50	2.50	1.20	9.20	1.20	4.70	2.80	1.60	9.10	2.10	6.30	3.60	1.40	11.30	1.20	4.60	2.70	1.40	8.70	
PARMA	W6	6	DIQUAT	21	YES		1.30	2.90	1.20	0.90	5.00	1.00	2.60	1.40	1.10	5.10	1.00	2.40	1.60	0.30	4.30	1.50	2.40	1.50	0.80	4.70	
CURL	W4	6	DIQUAT	22	YES	1.0815@16.5	1.30	1.50	1.00	0.60	3.10	1.30	1.70	0.90	0.20	2.80	1.00	2.40	1.20	0.20	3.80	1.40	1.90	1.10	0.40	3.40	
LOGAN SAND	W4	6	FROST	14	NO	1.0775@16	2.70	1.00	0.30	0.10	1.40	1.40	1.60	0.20	0.00	1.80	1.80	0.60	0.20	0.00	0.80	1.20	1.50	0.80	0.30	2.60	
LENCO	W2	4	DIQUAT	14	YES	1.0836@16.5	1.80	1.90	1.00	0.80	3.70	2.00	1.50	1.80	0.80	4.10	2.70	1.20	1.10	0.50	2.80	1.90	2.10	1.20	0.60	3.90	
LOCK AIR	W2	4	FROST	21	NO	1.0755@15.5	1.30	2.20	0.60	0.20	3.00	1.20	3.50	0.70	0.00	4.20	1.00	2.90	0.80	0.20	3.90	1.10	2.00	1.20	0.30	3.50	
LOGAN VERT	W4	6	DIQUAT	21	NO	1.0713@16	1.40	1.40	0.70	0.20	2.30	1.40	1.50	0.70	0.30	2.50	1.40	1.80	0.40	0.50	2.70	1.10	2.00	0.90	0.20	3.10	
LOGAN	W4	6	NATURAL	18	NO	1.0763@14.5	1.00	2.30	1.40	0.50	4.20	1.30	3.50	1.70	0.20	5.40	1.10	3.50	1.20	0.90	5.60	0.90	3.30	3.20	0.70	7.20	
LOGAN	W2	4	FROST	21	NO	1.078@15.5	1.00	3.60	1.40	0.60	5.60	1.10	2.60	0.90	0.20	3.70	1.10	4.20	1.20	0.80	6.20	1.00	2.50	1.00	0.30	3.80	
I	W2	4	NATURAL	I	YES	1.083@14.5	0.90	1.80	1.20	0.70	3.70	1.00	2.50	1.80	1.50	5.80	0.80	1.40	1.40	1.50	4.30	0.80	1.00	0.70	0.30	2.00	
LOCK AIR	W2	4	DIQUAT	23	NO	1.0782@17	1.50	3.60	1.40	1.10	6.10	1.50	3.70	1.50	0.70	5.90	1.20	3.20	0.70	0.90	4.80	1.40	3.30	0.00	0.50	3.80	TRUCK HAS LOTS OF DIRT AND ROCK
DAHLMAN	W4	6	DIQUAT	18	NO	1.075@16	1.10	4.00	1.70	0.80	6.50	1.00	3.20	1.80	0.40	5.40	1.20	3.00	1.60	0.60	5.20	1.10	4.00	2.40	0.70	7.10	
LOGAN	W4	6	NATURAL	22	NO	1.074@16	1.10	2.00	0.80	0.60	3.40	1.40	2.50	1.40	0.40	4.30	1.20	2.00	1.40	0.30	3.70	1.30	3.70	1.50	0.50	5.70	
LOGAN	W4	6	DIQUAT	14	NO		0.70	1.50	0.70	0.40	2.60	0.90	1.60	0.70	0.20	2.50	0.90	0.40	0.50	0.40	1.30	0.60	0.50	0.50	0.10	1.10	WINDROWER AHEAD BY 1.25 ROUNDS
HOFFMAN	W2	4	DIQUAT	20	NO	1.078@17	1.40	3.20	1.10	0.50	4.80	1.20	5.60	1.30	1.00	7.90	1.00	5.30	1.30	1.10	7.70	1.00	5.50	1.20	0.90	7.60	SOME POTATOES LEFT IN WINDROW FOR 2 ROUNDS BEHIND HARVESTER
LOCK AIR	W2	4	FROST	14	NO	1.0825@14.5	1.30	3.40	1.70	0.60	5.70	1.20	2.90	1.80	1.20	5.90	1.40	2.20	1.40	1.10	4.70	1.10	1.90	1.70	0.80	4.40	
PARMA	W6	6	NATURAL	Q4	NO	1.075@16	1.00	1.90	0.60	0.30	2.80	0.20	1.60	0.60	0.50	2.70	0.60	1.60	0.50	0.20	2.30	0.20	1.70	0.60	0.20	2.50	
LOCK SAND	W6	6	I	I	NO	1.0782@16	1.20	2.80	1.80	1.20	5.80	1.30	2.50	1.40	0.20	4.10	1.10	3.60	2.20	0.50	6.30	0.80	2.80	1.10	0.20	4.10	
LOCK SAND	W6	6	I	I	NO	1.0745@15.5	1.30	2.30	0.50	0.30	3.10	1.20	3.00	0.70	0.20	3.90	1.50	2.20	0.30	0.30	2.80	1.00	2.70	0.50	0.50	3.70	

1989 VINE DESICCATION TRIALS FOR THREE POTATO CULTIVARS IN COLORADO

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ABSTRACT

Ten foliar treatments were tested for their ability to desiccate Centennial Russet, Russet Nugget and Sangre potato vines in the San Luis Valley, Colorado. Data for treatment effects showed that most treatments had significantly more foliage desiccated when compared to the non-treated check throughout the data collection period (P=0.05). Some treatments and rates used in the study were experimental. Vine desiccants should only be used according to label directions.

<u>DIQUAT:</u> Generally, data showed more foliar desiccation occurred with the Diquat 3 pt single application, followed by the Diquat 2 pt single application with the Diquat 2 pt split application resulting in the least amount of desiccation. These trends were often significant (P=0.05). As the season progressed and natural desiccation occurred, treatments effects became less noticeable.

Treatments receiving Paraquat or the Diquat 3 pt single application rate consistently resulted in the greatest amount of desiccated foliage throughout the study (P=0.05). Paraquat was significantly better than the Diquat 3 pt rate only for Sangre data collected August 16 (P=0.05). Paraquat was significantly better than the Diquat 2 pt single application for Sangre data collected August 16 as well as for data collected August 18 (P=0.05).

On August 28 and September 1, significantly more dead stems were found in the Diquat treated plots than in non-treated plots (P=0.05). This difference was no longer measured on September 8. Data for the estimated percentage of stems dead showed that on or after August 28, Diquat treatments had an equal effect on stem death (P=0.05). Paraquat significantly increased the estimated percentage of stems dead when compared to the non-treated check. Paraquat was significantly better than Diquat treatments only for data collected September 1 (P=0.05).

<u>DES-I-CATE:</u> Plots treated with Des-i-cate plus crop oil concentrate (treatment 5) or a half-rate Des-i-cate treatment plus 1 pt Diquat (treatment 6) always had significantly more foliage desiccated than the non-treated check (P=0.05). Treatment 6 generally resulted in more desiccation than treatment 5 and these differences were occasionally significant (P=0.05). Des-i-cate treatments 5 and 6 were never better than the Diquat 2 pt split application and were occasionally significantly worse (P=0.05).

The percentage of stems dead for treatment 6 was significantly greater than the non-treated check on August 28 and September 1 but not September 8 (P=0.05). Treatment 6 was not significantly different from the Diquat treatments (P=0.05).

Data also showed treatment 5 effects were intermediate and the stem death measured was statistically equal to both treatment 6 and the non-treated check (P=0.05).

<u>THIO-SUL:</u> The effects of Thio-sul treatments 9 and 10 were detected within 24 hr after application for Centennial and Russet Nugget but not Sangre (P=0.05). These treatments also showed no effect on Sangre by August 16 (P=0.05). Treatments 9 and 10 were statistically equal throughout the data collection period (P=0.05). Thio-sul treatment 8 was significantly better than the two Thio-sul treatments applied 5 days earlier during a light rain (P=0.05). Since treatment 8 was applied in sunny weather, this data also showed that effects of Thio-sul are greatly reduced by rain.

Treatments 9 and 10 had no effect on stem death when compared to the non-treated check (P=0.05). However, treatment 8 significantly increased the estimated percentage of stems dead when compared to the non-treated check or when compared with treatments 9 and 10 (P=0.05).

<u>CULTIVAR EFFECTS:</u> Data for cultivar effects showed the amount of foliage and stem death measured in plots was correlated with cultivar maturity. Sangre, the earliest maturing cultivar, typically had the greatest amount of tissue desiccated followed by Centennial and finally by Russet Nugget. Data showed treatment rates sufficient for desiccation on Sangre may not be adequate for desiccation of later maturing cultivars.

<u>TUBER EFFECTS:</u> For all treatments, there was no significant effect on the amount of stem-end discoloration (SED) observed (P=0.05). However, data also showed the amount of SED differed significantly for the cultivars tested (P=0.05). Centennial and Russet Nugget had the same amount of natural SED present while the SED observed for Sangre was significantly less (P=0.05).

MATERIALS AND METHODS

Field plots were located at the San Luis Valley Research Center near Center, Colorado. The soil type is a gravelly sandy loam and plots were irrigated throughout the growing season using overhead irrigation. Normal cultural practices were followed throughout the study.

Cultivars used in the study were Centennial Russet, Russet Nugget and Sangre. Centennial is a medium to late maturing dark russet grown for the fresh market and is the most common cultivar in the San Luis Valley. Sangre is an early to medium maturing red-skinned white-fleshed cultivar and is also grown for the fresh market. Russet Nugget is a late maturing cultivar with vigorous vine growth and high tuber solids. The characteristics of the Russet Nugget tuber make it suitable for processing as well as the fresh market. A frequent grower complaint with the Russet Nugget is that the 1 pt/A rate of Diquat is inadequate for desiccation. Therefore, most growers use sulfuric acid (ca. 22 gpa) for desiccation prior to harvest.

Vine desiccation treatments were applied on August 9, 1989. Because this is considerably earlier than normal vine kill time in the SLV, this study was a rigorous test of desiccation efficacy for the various chemical treatments. Russet Nuggets were still flowering at the time treatments were applied and the Centennial and Sangre were starting to become senescent.

A portable (back-pack) sprayer was used to apply treatments to plots 25 ft long X 4 rows wide (row spacing was 34 in). All treatments, except treatments 8, 9 and 10, were delivered in a total volume of 40 gal/A at 15 psi boom pressure. Thio-sul treatments 8, 9 and 10 were delivered in total volumes of 25, 25 and 33 gpa, respectively. These applications were made by increasing ground-speed. A sulfuric acid treatment was planned for the study as well. However, equipment failure prevented this treatment from being included. The treatment plot area planned for the sulfuric acid treatment was instead used for treatment 8.

Treatments 2 through 7 were applied from 10 AM until noon and treatments 9 and 10 were applied from 1 to 2 PM. Weather in the morning was cloudy and cool. However, a light drizzle occurred during the afternoon applications. Because it was not known what effect light rain had on the Thio-sul treatments, treatment 8 (25 gpa undiluted Thio-sul) was applied to previously non-treated foliage on August 14 (5 days later than treatment 9). Sunny conditions prevailed when this application was made. Treatments used and their application rates are listed in Table 1.

TREATMENT DESIGNATIONS USED IN DATA TABLES:	TREATMENTS APPLIED TO FOLIAGE ON A PER ACRE BASIS:	TOTAL VOL APPLIED (gpa)
1. NON-TREATED	NO TREATMENT APPLIED	0
2. DQT 1 pt/A + REPEAT 5 DL	DIQUAT (1 pt) + .25% X-77. REPEAT 5DL	40 (each)
3. DQT 2 pt/A	DIQUAT (2 pt) + .25% X-77 v/v	40
4. DQT 3 pt/A	DIQUAT (3 pt) + .25% X-77 v/v	40
5. DSCATE + OIL	DES-I-CATE (1.04 lb)/CROP OIL (1 qt)	40
6. DSCATE + DQT	DES-I-CATE (0.52 lb)/1 pt DIQUAT/.75 qt	40
7. PARAQUAT	PARAQUAT (.5 LB) + .25% X-77 v/v	40
8. THSL 25 gpa (sunny)	TREATMENT 9, APPLIED 5 DL. (SUNNY)	25
9. THSL 25 gpa (drizzle)	THIO-SUL + 1 pt X-77 (DRIZZLE)	25
10. THSL + WATER (drizzle)	25 THIO-SUL:8 WATER (v:v) + 1 pt X-77	33

All treatments were applied at 15 psi (boom) using 8006 tips. Center, CO 1989.

Table 1. Foliar vine desiccation treatments used in 1989.

All data were collected from the center two rows of the field plots. Ratings for foliar desiccation (estimated percentage of foliage dead) were taken on August 10, 16, 18, 28 and September 1. Three visual readings per treatment plot, using the Horsfall-Barratt scale (0-11), were made on each date and averaged to give one value per plot for statistical analysis. On August 28, September 1 and September 8, the percentage of stems dead was estimated using the Horsfall-Barratt scale by taking one visual reading per plot. On September 13, 10 tubers from each treatment plot were harvested by hand and rated for stem-end discoloration (SED) using a scale of 1-3 (lightest to darkest).

A 2 level factorial, randomized complete block of 10 treatments, three replications and three cultivars was used for the experimental design. All data were analyzed using *MSTAT-C* (subprograms: *MISVALEST* and *FACTOR*, experimental model number 8) and means were separated using Duncan's Multiple Range Test at alpha=0.05 (subprogram: *RANGE*). All data collected using the Horsfall-Barratt scale were analyzed directly and converted to percentages for presentation in this report. *Because of rounding error and the fact that data were converted* *to percentage after mean separation, treatment averages (cultivars combined) and cultivar averages (treatments combined) cannot be calculated directly from the tables.*

RESULTS

The treatment designations used in the tables are explained more completely in Table 1. Data for the estimated percentage of foliage and stems necrotic is shown in Tables 2-6 and 7-9, respectively. The stem-end discoloration (SED) data is shown in Table 10. The data presentation format in the tables is in a standardized format. All data are presented in three groups; 1. treatment averages for individual cultivars are in the middle three columns, 2. overall treatment means (averaged over cultivars) are in the right column and 3. cultivar means (averaged over treatment) are shown in the bottom row. When statistical analysis showed different cultivars responded differently to treatment (i.e., for Tables 2 and 3 the cultivar X treatment interaction was significant at $P=0.05$), treatment mean separation was done for cultivars individually (middle columns). If the interaction was not significant (all other tables), the overall mean separation was done for cultivar (bottom row, treatments combined) and treatment (right column, cultivars combined).

Treatment Effects on Foliage

DIQUAT: Data show that effects of Diquat treatments 2-4 could be detected within 24 hr and had significantly more dead foliage present than the non-treated check (Table 2) ($P=0.05$). Furthermore, these Diquat treatments always had significantly more foliage desiccated when compared to the non-treated check throughout the data collection period ($P=0.05$). After 24 hr, the 2 and 3 pt. rate killed significantly more foliage than the 1 pt rate for the three cultivars tested ($P=0.05$).

The second pint of Diquat was applied to treatment 2 (making a 2 pt total, split application) on August 14. By August 16 (Table 3), the three Diquat treatments were statistically equivalent for Russet Nugget and Sangre treated foliage, but not for Centennial ($P=0.05$). On August 16, Centennial still showed significantly more dead foliage from the Diquat 2 pt single application and the Diquat 3 pt single application when compared to the Diquat 2 pt split application ($P=0.05$). The Diquat 3 pt application was also significantly better than the Diquat 2 pt single application ($P=0.05$).

Interpretation of the data for the remaining tables is simplified because cultivar X treatment interactions were not significant ($P=0.05$). Data collected August 18 showed significantly more desiccation occurred with the Diquat 3 pt single application, followed by the Diquat 2 pt single application with the Diquat 2 pt split application resulting in the least amount of desiccation ($P=0.05$). As the season progressed, data collected on August 28 and September 1 showed that all Diquat treatments 2-4 were equal ($P=0.05$).

DES-I-CATE: Plots treated with Des-i-cate plus crop oil concentrate (treatment 5) or a half-rate Des-i-cate treatment plus 1 pt Diquat (treatment 6) always had significantly more foliage desiccated than the non-treated check ($P=0.05$). Treatment 6 generally resulted in more desiccation than treatment 5. These differences were significant within 24 hr of application (August 10) for Russet Nugget and Sangre and were also significant on August 16 for Russet Nugget ($P=0.05$). At all other times, the treatments were statistically equal ($P=0.05$).

Des-i-cate treatments 5 and 6 were never significantly better than the Diquat 2 pt split application (treatment 2) and were occasionally worse (P=0.05).

PARAQUAT: Paraquat (treatment 7) and the Diquat 3 pt single application (treatment 4) consistently resulted in the greatest amount desiccated foliage throughout the study (Tables 2-6) (P=0.05). Paraquat was significantly better than Diquat 3 pt only for Sangre data collected August 16 (Table 3) (P=0.05). Paraquat was also significantly better than the Diquat 2 pt single application (treatment 3) for Sangre data collected on August 16 as well as for data collected on August 18 (Table 4) (P=0.05).

THIO-SUL: Data collected August 10 (Table 2) showed that effects of Thio-sul treatments 9 and 10 were detected within 24 hr after application for Centennial and Russet Nugget but not Sangre (P=0.05). These treatments also showed no effect on Sangre by August 16 (P=0.05). Treatments 9 and 10 were statistically equal throughout the data collection period (P=0.05).

Plots for treatment 8 were identical to the non-treated check at the time data was collected for Table 2 because the application was not made until August 14 (2 days prior to collecting data for Table 3). However, after application (Tables 3-6) treatment 8 was significantly better than the two Thio-sul treatments applied 5 days earlier (P=0.05). Since treatment 8 was applied in sunny weather and treatment 9 was applied during light rain, the data also showed the effect of Thio-sul is reduced by rain.

Treatment Effects on Stems

DIQUAT: On August 28 and September 1, significantly more dead stems were found in the Diquat treated plots (treatments 2-4) than in the non-treated check (P=0.05). This difference was no longer measured on September 8. Data for the estimated percentage of stems dead showed that on or after August 28 (Tables 7-9), Diquat treatments 2-4 had an equal effect on stem death (P=0.05).

DES-I-CATE: The percentage of stems dead for treatment 6 was significantly greater than the non-treated check on August 28 (Table 7) and September 1 (Table 8) but not September 8 (Table 9) (P=0.05). Treatment 6 was not significantly different from the Diquat treatments (P=0.05). Data also showed treatment 5 was intermediate and the stem death measured was statistically equal to both treatment 6 and the non-treated check (P=0.05).

PARAQUAT: Paraquat significantly increased the estimated percentage of stems dead when compared to the non-treated check. Paraquat was significantly better than Diquat treatments 2-4 only for data collected September 1 (Table 9) (P=0.05).

THIO-SUL: Treatments 9 and 10 had no effect on stem death when compared to the non-treated check (Tables 7-9) (P=0.05). However, treatment 8 significantly increased the estimated percentage of stems dead when compared to the non-treated check or with treatments 9 and 10 (P=0.05).

Cultivar Effects

The cultivar effects are shown in the bottom row of the Tables 4-11. When all treatments are averaged, the data show that the amount of foliage and stem death measured in the plots was correlated with the expected maturity of the cultivars. Sangre, the earliest maturing cultivar, typically had the greatest amount of foliage and stems dead followed by Centennial and finally by Russet Nugget. The data indicate that treatment rates sufficient for desiccation on Sangre may not be adequate for desiccation of later maturing cultivars.

Treatment Effects on Tubers

For all treatments, there were no significant effects on the amount of stem-end discoloration (SED) observed (Table 10) (P=0.05). However, the data showed that the amount of SED varied significantly with cultivar (P=0.05). Centennial and Russet Nugget had the same amount of SED present and the SED observed for Sangre was significantly less (P=0.05).

DISCUSSION

Paraquat was included in this study as a desiccation standard and is not labelled for vine desiccation because of potential storage problems with harvested tubers.

Data collected during this study showed Thio-sul (25 gpa) applied when sunny (treatment 8) was equivalent to the Diquat 2 pt split application (treatment 2). The data also showed that treatment with Thio-sul should <u>not</u> be done if any precipitation is anticipated. Because treatments 9 and 10 were being applied when light rain started, it cannot be determined how soon after application rain effects will not be noticed.

Des-i-cate plus crop oil concentrate was generally weaker than the split application of Diquat. Co-application of Des-i-cate plus Diquat increased the amount of desiccation measured. However, the split application of Diquat was occasionally significantly better than this treatment (P=0.05).

Higher rates of Diquat had greater activity than lower rates, resulting in more potato foliage death. Diquat applied at 2 and 3 pt/A single application rates (treatments 3 and 4) resulted in significantly more early vine death when compared to the 2 pt split application (treatment 2). This effect was still measurable at a minimum of 9 days after treatments were applied (Table 4). The split application treatment (treatment 2) never resulted in better desiccation than treatments 3 and 4 (P=0.05).

Rapid early vine death is a desirable treatment effect, especially in the San Luis Valley where the growing and harvesting season is so short (ca. 90 d) when compared to most other potato production areas in the United States. If the higher rates of Diquat were to result in more complete and dependable vine death, as this study showed, it would give growers in the San Luis Valley more flexibility in their farming operation. Currently, repeated application of Diquat is sometimes needed for adequate vine kill. Minimizing the need for multiple applications also decreases costs associated with vine kill as well as the risk of pesticide drift onto sensitive crops commonly grown in close association with potatoes in the San Luis Valley.

The authors wish to thank Tim D'Amato, Corbett Henderson and Christopher Still for technical assistance.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	3.0 C	0.8 E	3.5 D	2.0
2. DQT 1 pt/A + REPEAT 5 DL	15.0 B	18.5 B	22.0 B	18.5
3. DQT 2 pt/A	23.5 A	31.0 A	35.0 A	29.5
4. DQT 3 pt/A	26.5 A	35.0 A	40.5 A	33.0
5. DSCATE + OIL	12.0 B	3.5 D	10.5 C	8.0
6. DSCATE + DQT	12.0 B	9.0 C	18.5 B	12.0
7. PARAQUAT	28.0 A	26.5 A	42.0 A	33.0
8. THSL 25 gpa (sunny)	4.0 C	0.8 E	4.0 D	3.0
9. THSL 25 gpa (drizzle)	11.5 B	4.0 D	5.5 D	6.5
10. THSL + WATER (drizzle)	10.5 B	2.5 D	6.0 D	6.0
CULTIVAR AVERAGE	12.0	8.5	14.0	P=0.05

Table 2. The effect of different chemical treatments on the estimated percentage of foliage desiccated, August 10, 1989.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	3.0 E	1.8 E	11.5 E	4.5
2. DQT 1 pt/A + REPEAT 5 DL	33.0 C	38.5 AB	52.0 BCD	40.5
3. DQT 2 pt/A	56.0 B	46.0 AB	63.0 B	56.0
4. DQT 3 pt/A	75.0 A	54.0 A	59.5 BC	63.0
5. DSCATE + OIL	29.5 C	19.5 C	38.5 D	28.0
6. DSCATE + DQT	33.0 C	35.0 B	46.0 CD	38.5
7. PARAQUAT	65.0 AB	42.0 AB	84.0 A	65.0
8. THSL 25 gpa (sunny)	37.0 C	35.0 B	40.5 D	37.0
9. THSL 25 gpa (drizzle)	10.5 D	8.0 D	18.5 E	11.5
10. THSL + WATER (drizzle)	11.5 D	10.0 D	16.0 E	12.0
CULTIVAR AVERAGE	29.5	23.5	42.0	P=0.05

Table 3. The effect of different chemical treatments on the estimated percentage of foliage desiccated, August 16, 1989.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	7.0	3.0	15.0	9.0 E
2. DQT 1 pt/A + REPEAT 5 DL	52.0	38.5	54.0	48.0 C
3. DQT 2 pt/A	63.0	46.0	70.5	59.5 B
4. DQT 3 pt/A	86.0	61.5	76.5	75.0 A
5. DSCATE + OIL	44.0	18.5	58.0	38.5 C
6. DSCATE + DQT	46.0	38.5	58.0	48.0 BC
7. PARAQUAT	79.0	52.0	91.5	78.0 A
8. THSL 25 gpa (sunny)	52.0	35.0	52.0	46.0 C
9. THSL 25 gpa (drizzle)	16.0	10.5	23.5	16.0 D
10. THSL + WATER (drizzle)	15.0	10.0	19.5	14.0 D
CULTIVAR AVERAGE	44.0 b	26.5 c	52.0 a	P=0.05

Table 4. The effect of different chemical treatments on the estimated percentage of foliage desiccated, August 18, 1989.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	58.0	12.0	70.5	42.0 E
2. DQT 1 pt/A + REPEAT 5 DL	98.6	65.0	98.0	93.5 A
3. DQT 2 pt/A	98.0	65.0	98.0	93.0 A
4. DQT 3 pt/A	99.6	79.0	99.2	96.0 A
5. DSCATE + OIL	94.5	40.5	88.5	81.5 BC
6. DSCATE + DQT	93.5	61.5	89.5	85.0 B
7. PARAQUAT	99.4	72.0	100.0	96.0 A
8. THSL 25 gpa (sunny)	98.4	72.0	99.2	94.5 A
9. THSL 25 gpa (drizzle)	65.0	18.5	88.5	59.5 DE
10. THSL + WATER (drizzle)	92.0	23.5	84.0	72.0 CD
CULTIVAR AVERAGE	94.5 a	50.0 b	94.5 a	P=0.05

Table 5. The effect of different chemical treatments on the estimated percentage of foliage desiccated, August 28, 1989.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	73.5	21.0	88.0	63.0 F
2. DQT 1 pt/A + REPEAT 5 DL	99.8	58.0	98.0	93.5 ABCD
3. DQT 2 pt/A	99.6	78.0	97.5	95.5 ABC
4. DQT 3 pt/A	100.0	90.0	98.4	97.0 A
5. DSCATE + OIL	97.5	46.0	96.5	90.0 CD
6. DSCATE + DQT	97.0	63.0	96.5	91.5 BCD
7. PARAQUAT	100.0	75.0	100.0	96.5 AB
8. THSL 25 gpa (sunny)	98.0	79.0	100.0	96.0 ABC
9. THSL 25 gpa (drizzle)	87.0	25.0	96.0	78.0 EF
10. THSL + WATER (drizzle)	98.6	37.0	91.0	87.0 DE
CULTIVAR AVERAGE	97.0 a	59.5 b	97.0 a	P=0.05

Table 6. The effect of different chemical treatments on the estimated percentage of foliage desiccated, September 1, 1989.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	10.0	1.4	35.0	10.0 D
2. DQT 1 pt/A + REPEAT 5 DL	72.0	10.0	88.0	56.0 AB
3. DQT 2 pt/A	72.0	17.0	63.0	48.0 ABC
4. DQT 3 pt/A	80.5	54.0	37.0	58.0 AB
5. DSCATE + OIL	35.0	10.0	22.0	21.0 BCD
6. DSCATE + DQT	46.0	19.5	76.5	46.0 ABC
7. PARAQUAT	85.0	54.0	94.0	81.5 A
8. THSL 25 gpa (sunny)	40.5	35.0	92.5	61.5 A
9. THSL 25 gpa (drizzle)	12.0	4.5	40.5	14.0 CD
10. THSL + WATER (drizzle)	10.0	4.5	54.0	15.0 CD
CULTIVAR AVERAGE	44.0 b	14.0 c	65.0 a	P=0.05

Table 7. The effect of different chemical treatments on the estimated percentage of stems desiccated, August 28, 1989.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	35.0	7.5	59.5	28.0 D
2. DQT 1 pt/A + REPEAT 5 DL	95.5	15.0	90.0	76.5 B
3. DQT 2 pt/A	90.0	21.0	95.5	79.0 B
4. DQT 3 pt/A	94.0	65.0	63.0	79.0 B
5. DSCATE + OIL	54.0	15.0	44.0	35.0 CD
6. DSCATE + DQT	76.5	28.0	85.0	65.0 BC
7. PARAQUAT	97.0	76.5	98.6	94.0 A
8. THSL 25 gpa (sunny)	59.5	59.5	98.6	81.5 AB
9. THSL 25 gpa (drizzle)	23.5	10.0	65.0	28.0 D
10. THSL + WATER (drizzle)	35.0	12.0	72.0	37.0 CD
CULTIVAR AVERAGE	73.5 a	26.5 b	84.0 a	P=0.05

Table 8. The effect of different chemical treatments on the estimated percentage of stems desiccated, September 1, 1989.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	72.0	19.5	97.0	72.0 B
2. DQT 1 pt/A + REPEAT 5 DL	98.6	28.0	97.0	88.5 AB
3. DQT 2 pt/A	97.0	28.0	97.0	87.0 AB
4. DQT 3 pt/A	100.0	65.0	83.0	90.0 AB
5. DSCATE + OIL	94.0	54.0	83.0	81.5 B
6. DSCATE + DQT	92.5	40.5	95.5	85.0 AB
7. PARAQUAT	100.0	85.0	99.4	97.0 A
8. THSL 25 gpa (sunny)	90.0	80.5	100.0	93.5 AB
9. THSL 25 gpa (drizzle)	76.5	19.5	98.0	75.0 B
10. THSL + WATER (drizzle)	76.5	40.5	98.6	81.5 B
CULTIVAR AVERAGE	93.5 a	46.0 b	96.0 a	P=0.05

Table 9. The effect of different chemical treatments on the estimated percentage of stems desiccated, September 9, 1989.

TREATMENT APPLIED	CULTIVAR TREATED: CENTENNIAL	R. NUGGET	SANGRE	TREATMENT AVERAGE
1. NON-TREATED	9.7	10.7	9.7	10.0 A
2. DQT 1 pt/A + REPEAT 5 DL	12.7	9.8	8.3	10.3 A
3. DQT 2 pt/A	10.7	10.1	7.0	9.3 A
4. DQT 3 pt/A	10.0	15.0	7.0	10.7 A
5. DSCATE + OIL	10.3	10.3	7.5	9.4 A
6. DSCATE + DQT	10.3	14.7	7.7	10.9 A
7. PARAQUAT	9.7	11.3	8.7	9.9 A
8. THSL 25 gpa (sunny)	10.0	14.3	9.3	11.2 A
9. THSL 25 gpa (drizzle)	9.3	10.7	7.3	9.1 A
10. THSL + WATER (drizzle)	10.7	8.3	7.7	8.9 A
CULTIVAR AVERAGE	10.3 a	11.5 a	8.0 b	P=0.05

Table 10. The effect of different chemical treatments on internal tuber stem-end discoloration at harvest.

FINAL REPORT

Fungicide Trials for Control of Potato Early Blight in Colorado

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Summary

Fourteen fungicide treatments were compared to a non-treated water check for control of foliar early blight, *Alternaria solani, on potatoes* in Colorado.

The data showed that there were no detectable treatment effects on plant vigor or height except for Busan WB treated plots (P=0.05). By August 15, application of low and medium rates of Busan WB significantly reduced plant height (stem length) when compared to the water check. However, the Busan WB treatment effect on height was not correlated with rate (P=0.05). Also, there was a significant linear trend (P=0.05) that as Nusan EC rates increased, plant stems became shorter. Therefore, Busan WB and/or Nusan EC may affect plant growth and additional testing should be done.

Generally, all treatments, except Busan WB and Nusan EC, were grouped closely and provided the greatest amount of disease control. Where differences could be measured, treatments 8-15 always had significantly lower disease ratings than the check plot. The only significant differences among means occurred early, when ratings showed the high rate of Bravo 720 provided significantly better control than treatments with Bravo/Sulfur, Maneb + Zinc or Rovral + Triton (P=0.05). In this study, Rovral + Triton applied at a 21 day interval compared favorably to the other treatments applied at a 7 day interval.

Busan WB showed a concentration or rate effect on disease control. The trend showed that disease control at the highest application rate was usually best. However, differences for high rate versus low rate was significant only for data collected at the end of the growing season (P=0.05). The high rate consistently showed significantly less disease than the non-treated check (P=0.05). The high rate of Nusan EC also had significantly lower disease than the check, but only later in the growing season (P=0.05). The data showed that Busan WB and Nusan EC have activity against *Alternaria solani* and suggest higher rates and/or different formulations may provide additional control.

There were no significant treatment effects on yield of US #1 less than 10 ounces, US #1 greater than 10 ounces, US #2, B Size, culls, marketable yield (US #1 + US #2), and total yield (P=0.05). The low disease pressure observed in the research plots in 1989 may explain the lack of yield response.

Materials & Methods

Fungicide trial research plots were established within a certified seed field located at the SLV Research Center. The potato cultivar used for the study was Sangre selection #14. Sangre is a red-skinned white-fleshed cultivar and selection #14 is later maturing and higher yielding than the original Sangre selection. Normal fertilization and cultivation practices were followed during the growing season and the research plots were watered using furrow irrigation. The soil type was a gravelly sandy loam. Plots were planted May 9 and harvested on September 21, 1989. On August 29, vines were desiccated with Diquat to aid in harvest. The center two rows of each plot was harvested and the tubers were graded using standard practices. Total yield and grade (cwt/acre) were calculated for presentation in Table 3.

The statistical design used for the study was a randomized complete block design of 15 treatments and 3 replications. Each treatment plot was 4 rows (34 inch between rows) X 25 ft long with 5 ft buffers between treatment plots. Treatments were applied with the aid of a backpack sprayer in a total volume of 40 gal of spray per acre. The boom pressure was 20 psi during applications.

All treatments were applied at a 7 day interval (total of 6 applications), except treatment 15 (Rovral + Triton) which was applied at a 21 day interval (total of 2 applications). Treatment application times were between 8-11 AM on July 11, 18, 25, August 1, 8, and 15. Treatment 15 was applied on July 11 and August 1. The sprayer boom was rinsed by spraying 1 liter clean water between treatments having different active ingredients. In the case of treatments where only the rate changed, treatment order was from most dilute to most concentrated without rinsing between treatments. Treatment 1 was the non-treated check and consisted of only water applied to the foliage.

Vigor ratings were recorded on July 28 and stem heights were measured on July 28, August 8 and August 15. Early blight disease severity was estimated on August 8 and August 15 using the Horsfall-Barratt (HB) scale (0-11). The HB data was used to estimate the percent leaflets infected by early blight. Disease severity was also determined on August 18 and 29 by counting the number of early blight lesions per leaflet for each treatment plot. Nine randomly selected leaves, three leaves from each the top, middle and bottom third of the plant canopy, were counted for each treatment plot.

Data were analyzed using the two-way AOV program in *MSTAT*. For treatments whose means differed significantly (P=0.05), mean separation was done using Duncan's Multiple Range Test (DMRT) at P=0.05.

Results & Discussion

Treatment Effects on Plant Growth: The effect of foliar fungicide treatments on Sangre potato plant vigor and height is shown in Table 1. The data show that there were no detectable treatment effects on vigor or height except for Busan WB height measurements made on August 15 (P=0.05).

By August 15, the low and medium rates of Busan WB significantly reduced plant height (stem length) when compared to the water check (treatment #1). Furthermore, the medium rate of Busan WB significantly reduced plant height when compared to plots receiving Busan WB at either high or low rates. Therefore, the Busan WB treatment effect on height was not correlated with rate (illustrated in Figure 1). Also, there was a significant linear trend (Figure 1) that as Nusan EC rates increased, plant stems became shorter (P=0.05). Since the Busan WB and Nusan EC have not been extensively tested on potatoes, the data presented in Table 1 and illustrated in Figure 1 suggest Busan WB and/or Nusan EC affect plant growth and additional testing should be done.

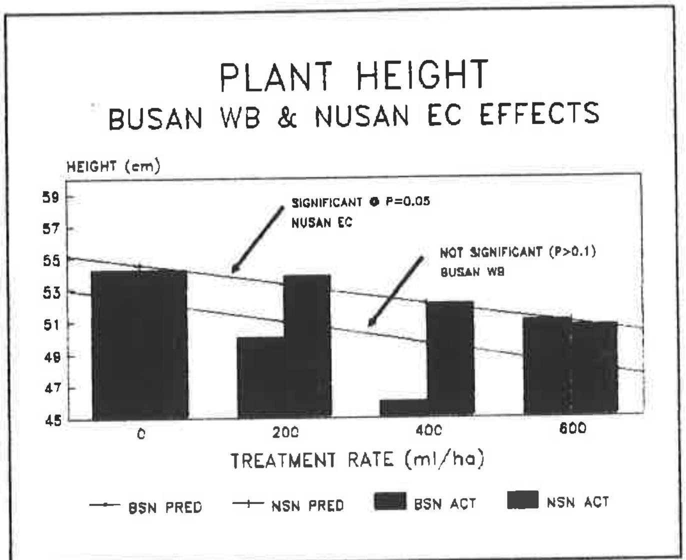

Figure 1: The effect of Busan WB and Nusan EC rate on potato plant growth. Actual data values are shown by the bars and linear trends are shown by the lines.

<ins>Treatment Effects on Disease Control:</ins> The effect of fungicide treatments on foliar early blight disease severity is shown in Table 2 and illustrated in the two figures. Generally, all treatments, except Busan WB and Nusan EC (Buckman's products; treatments 2-7 in Figure 3), were grouped closely and provided the greatest amount of disease control. Where differences could be measured, treatments 8-15 always had significantly lower disease ratings than the check plot.

The only significant differences among means for treatments 8-15 (these treatments are called 'marketed' products in Figure 2) occurred early in the growing season. On August 8, the high rate of Bravo 720 (treatment 9) provided significantly better control than treatments with Bravo/Sulfur, Maneb + Zinc or Rovral + Triton (P=0.05). Later in the growing season, these differences were no longer significant (P=0.05).

In this study, Rovral + Triton applied at a 21 day interval compared favorably to other treatments applied at a 7 day interval. Rovral + Triton provided statistically equivalent disease control when compared to treatments 8-14 except for the high rate of Bravo 720 early in the growing season (P=0.05).

The Busan WB showed a concentration or rate effect. The trend showed that disease control at the highest rate was usually best. However, the differences for high rate versus low rate was significant only for data collected at the end of the growing season (P=0.05). The high rate consistently showed significantly less disease than the non-treated check (P=0.05). The data showed that Busan WB has activity against *Alternaria solani* and that higher rates and/or different formulations should be tested for additional control.

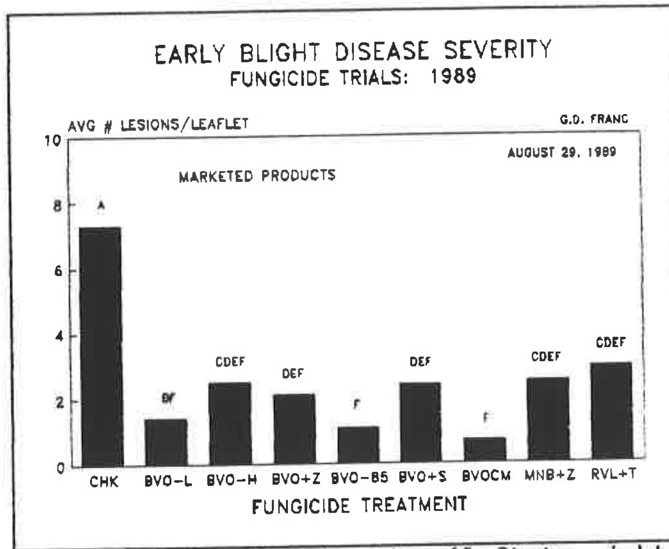

Figure 2. Treatment order (left to right) is: 1, 8 through 15. See Table 2 for treatment numbers.

The high rate of Nusan EC had significantly lower disease than the check, but only later in the growing season (P=0.05). The low and medium rates of Busan WB and Nusan EC had the same amount of disease as the check throughout the study (P=0.05). The data show that Nusan EC, like Busan WB, also has activity against *A. solani*. However, its activity versus rate is not as consistent as in the case of Busan WB. The data suggest that different rates and/or formulations should be tried to determine if additional disease control is possible.

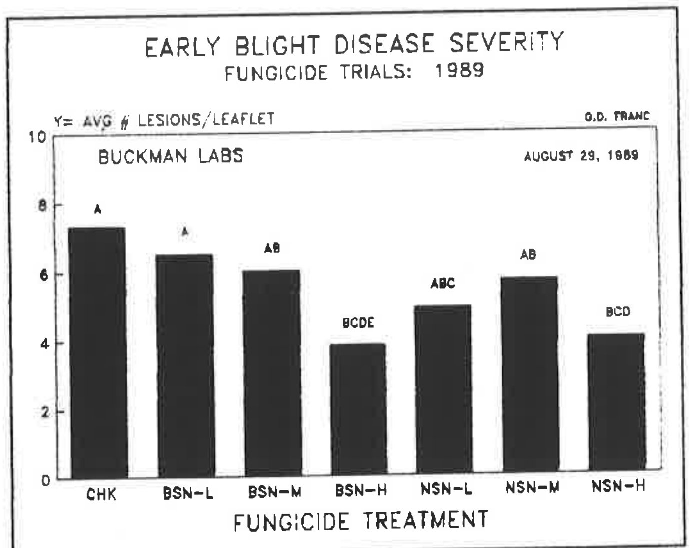

Figure 3. Treatment order (left to right) is: 1, 2 through 7. See Table 2 for treatment numbers.

<u>Treatment Effects on Yield:</u> The effect of foliar fungicide treatments on Sangre grade and yield is shown in Table 3. There were no significant treatment effects on yield of US #1 less than 10 ounces, US #1 greater than 10 ounces, US #2, B Size, culls, marketable yield (US #1 + US #2), and total yield (P=0.05). The low disease pressure noted in the plots in 1989 may account for the lack of treatment effect on yield. The plots were under furrow irrigation and would have had greater disease pressure if they were maintained under overhead irrigation.

Table 1. The effect of foliar fungicide treatments on Sangre potato plant vigor and height. G.D. Franc, Ph.D.; Center, CO 1989.

TREATMENT NUMBER	RATE/ACRE /HECTARE[1]	TREATMENT INTERVAL	VIGOR[2] JULY 28	HEIGHT RATINGS; (cm)[3] JULY 28	AUGUST 8	AUGUST 15
1 CHECK	WATER ONLY	7 DAYS	5 A[4]	45.0 A	50.9 A	54.2 AB
2 BUSAN WB (LOW)	200 ml/hectare	7 DAYS	4 A	48.6 A	51.9 A	50.0 C
3 BUSAN WB (MED)	400 ml/hectare	7 DAYS	5 A	42.6 A	49.3 A	46.0 D
4 BUSAN WB (HIGH)	600 ml/hectare	7 DAYS	5 A	47.2 A	51.8 A	51.0 ABC
5 NUSAN EC (LOW)	200 ml/hectare	7 DAYS	5 A	50.9 A	52.4 A	53.8 ABC
6 NUSAN EC (MED)	400 ml/hectare	7 DAYS	5 A	49.1 A	50.8 A	52.1 ABC
7 NUSAN EC (HIGH)	600 ml/hectare	7 DAYS	5 A	49.1 A	52.8 A	50.7 BC
8 BRAVO 720 (LOW)	1.0 pt	7 DAYS	5 A	50.2 A	50.9 A	52.3 ABC
9 BRAVO 720 (HIGH)	1.5 pt	7 DAYS	6 A	45.9 A	53.2 A	55.0 A
10 BRAVO + ZINC	1.0 pt + 0.2 lbs ai	7 DAYS	5 A	49.9 A	52.6 A	53.0 ABC
11 BRAVO 85	0.9 lbs	7 DAYS	7 A	48.6 A	52.5 A	52.2 ABC
12 BRAVO + SULFUR	4.25 pt	7 DAYS	6 A	50.6 A	55.4 A	53.6 ABC
13 BRAVO CM	4.0 lbs	7 DAYS	6 A	48.4 A	52.5 A	52.2 ABC
14 MANEB + ZINC	1.5 qt	7 DAYS	4 A	47.9 A	52.5 A	53.6 ABC
15 ROVRAL + TRITON	0.75 lb ai + 1 pt	21 DAYS	6 A	47.5 A	52.2 A	51.9 ABC

1 Treatments were applied to replicated plots (3 replications) in a total volume of 40 gallons/acre.

2 For each replication, vigor was rated relative to the check (treatment #1) on a scale of 1 to 10 (1=worst, 10=best). The check plot was assigned a rating of 5.

3 Height (cm) was measured from the soil line to the growing point of 5 randomly selected stems per treatment plot.

4 Treatment means with different letters differ significantly (P=0.05). Duncan's Multiple Range Test was used for mean separation.

Table 2. The effect of fungicide treatments on early blight disease severity on Sangre potato foliage. Gary D. Franc, Ph.D.; Center, CO 1989.

TREATMENT NUMBER	RATE/ACRE /HECTARE[1]	TREATMENT INTERVAL	ESTIMATED % LEAFLETS INFECTED		AVERAGE # LESIONS/LEAFLET	
			AUGUST 8[2]	AUGUST 15[2]	AUGUST 18[3]	AUGUST 29[3]
1 CHECK	WATER ONLY	7 DAYS	4.4 A[4]	12.0 A	1.3 A	7.3 A
2 BUSAN WB (LOW)	200 ml/hectare	7 DAYS	3.0 ABC	9.7 AB	1.4 A	6.5 A
3 BUSAN WB (MED)	400 ml/hectare	7 DAYS	3.0 ABCD	9.3 AB	1.1 A	6.0 AB
4 BUSAN WB (HIGH)	600 ml/hectare	7 DAYS	2.7 BCD	7.5 BC	1.2 A	3.8 BCDE
5 NUSAN EC (LOW)	200 ml/hectare	7 DAYS	3.0 ABCD	8.4 ABC	1.8 A	4.9 ABC
6 NUSAN EC (MED)	400 ml/hectare	7 DAYS	3.4 AB	8.6 AB	1.2 A	5.7 AB
7 NUSAN EC (HIGH)	600 ml/hectare	7 DAYS	3.1 AB	7.5 BC	0.9 A	4.0 BCD
8 BRAVO 720 (LOW)	1.0 pt	7 DAYS	1.2 EF	3.6 D	0.9 A	1.4 EF
9 BRAVO 720 (HIGH)	1.5 pt	7 DAYS	0.4 F	3.1 D	0.9 A	2.5 CDEF
10 BRAVO + ZINC	1.0 pt + 0.2 lbs ai	7 DAYS	0.8 EF	3.1 D	0.3 A	2.1 DEF
11 BRAVO 85	0.9 lbs	7 DAYS	1.2 EF	4.1 D	0.6 A	1.1 F
12 BRAVO + SULFUR	4.25 pt	7 DAYS	1.5 DE	4.0 D	0.3 A	2.4 DEF
13 BRAVO CM	4.0 lbs	7 DAYS	0.8 EF	3.5 D	0.2 A	0.7 F
14 MANEB + ZINC	1.5 qt	7 DAYS	1.5 DE	3.5 D	0.3 A	2.5 CDEF
15 ROVRAL + TRITON	0.75 lb ai + 1 pt	21 DAYS	1.6 CDE	5.5 CD	0.7 A	2.9 CDEF

[1] Treatments were applied to replicated plots (3 replications) in a total volume of 151.4 liters/acre (40 gal/acre).

[2] Determined by estimating the percent leaflets infected for the top, middle and bottom third of the plant canopy. Three estimates were done for each treatment plot using the Horsfall-Barratt scale (0-11).

[3] Determined by counting the number of early blight lesions/leaflet for 9 leaves selected randomly from each treatment plot. Three leaves from each the top, middle and bottom third of the canopy were counted.

[4] Treatment means with different letters differ significantly (P=0.05). Duncan's multiple range test was used for mean separation.

Table 3. The effect of foliar fungicide treatments for early blight control on Sangre grade and yield. Yields are reported in cwt/acre. G.D. Franc, Ph.D.; Center, CO.

TREATMENT NUMBER	RATE/ACRE /HECTARE[1]	TREATMENT INTERVAL	:US #1 :>10 OZ	US #1 <10 OZ	:US #2 :	B SIZE	:CULLS :	MARKETS US1 + US2	TOTAL
1 CHECK	WATER ONLY	7 DAYS	59.96 A[2]	176.81 A	13.33 A	93.89 A	28.49 A	250.10 A	372.48 A
2 BUSAN WB (LOW)	200 ml/hectare	7 DAYS	64.88 A	165.74 A	14.66 A	102.91 A	29.01 A	245.28 A	377.20 A
3 BUSAN WB (MED)	400 ml/hectare	7 DAYS	50.94 A	174.35 A	10.86 A	116.75 A	22.65 A	236.16 A	375.56 A
4 BUSAN WB (HIGH)	600 ml/hectare	7 DAYS	55.25 A	161.95 A	19.37 A	108.75 A	27.78 A	236.57 A	373.10 A
5 NUSAN EC (LOW)	200 ml/hectare	7 DAYS	96.25 A	172.92 A	15.78 A	75.65 A	20.09 A	284.95 A	380.69 A
6 NUSAN EC (MED)	400 ml/hectare	7 DAYS	52.79 A	179.99 A	11.58 A	105.57 A	35.67 A	244.36 A	385.61 A
7 NUSAN EC (HIGH)	600 ml/hectare	7 DAYS	60.68 A	172.71 A	17.01 A	98.30 A	24.70 A	250.41 A	373.41 A
8 BRAVO 720 (LOW)	1.0 pt	7 DAYS	79.23 A	181.22 A	15.38 A	93.89 A	26.45 A	275.83 A	396.16 A
9 BRAVO 720 (HIGH)	1.5 pt	7 DAYS	54.22 A	191.47 A	17.12 A	101.88 A	38.34 A	262.81 A	403.03 A
10 BRAVO + ZINC	1.0 pt + 0.2 lbs ai	7 DAYS	69.60 A	172.10 A	30.24 A	97.89 A	29.11 A	271.93 A	398.93 A
11 BRAVO 85	0.9 lbs	7 DAYS	91.23 A	190.14 A	25.63 A	95.84 A	15.48 A	306.99 A	418.30 A
12 BRAVO + SULFUR	4.25 pt	7 DAYS	85.79 A	197.52 A	27.47 A	98.09 A	10.97 A	310.78 A	419.84 A
13 BRAVO CM	4.0 lbs	7 DAYS	64.27 A	171.48 A	21.83 A	116.13 A	16.71 A	257.58 A	390.42 A
14 MANEB + ZINC	1.5 qt	7 DAYS	65.60 A	189.32 A	17.94 A	94.92 A	26.03 A	272.85 A	393.81 A
15 ROVRAL + TRITON	0.75 lb ai + 1 pt	21 DAYS	77.90 A	203.26 A	14.25 A	102.60 A	20.40 A	295.41 A	418.41 A

[1] Treatments were applied to replicated plots (3 replications) in a total volume of 40 gallons/acre.

[2] For each treatment plot, the center two rows, each 25 ft long, were harvested and graded. Treatment means with different letters differ significantly (P=0.05). Duncan's Multiple Range Test was used for mean separation.

Potato Virus S Weed Survey Result for 1989

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Materials and Methods

Weed surveys were done in 1989 in 6 potato fields. The potato cultivar and production type (seed versus commercial) are listed in the table. Foliage collected during the survey was placed in individually labelled zip-lock bags and immediately refrigerated. The foliage was assayed for PVS using standard ELISA procedures with AGDIA test kits.

Results

Data in Table 1 show that, based on ELISA tests, weeds appeared to be hosts for PVS in local potato fields. Presence of PVS in weeds was not dependent on whether the fields tested were for seed or commercial production. The percentage of potatoes sampled which were PVS infected ranged from 11.1% for Centennial (field 1) to 90.0% for White Rose (field 6). Results for the two commercial fields ranged from 40% to 100% for Sangre and Norkotah, respectively.

Objectives for 1990

Preliminary indications are that weed hosts may be a source of PVS which could infect healthy potatoes under the right conditions. We plan to repeat the weed survey, ELISA test for presence of PVS and followup with inoculations to micropropagated PVS-free potato plants. We hope to obtain some idea of the effectiveness of weeds as a PVS source for potato infection. In addition, we plan to obtain aphid colonies and screen SLV biotypes for their ability to spread PVS from infected potato plants and weed leaves to healthy potatoes.

Table 1. Potato Virus S survey results for 6 potato fields, Center CO 1989 (Franc & Davidson).

POTATO CULTIVAR	NUMBER and WEED HOST ASSAYED	NUMBER: PVS +:	PERCENT PVS +
1 CENTENNIAL-seed	18 POTATO	2	11.1%
	6 KOCHIA	1	16.7%
	6 LQUARTER	0	0.0%
	6 NIGHTSHADE	0	0.0%
	64 PIGWEED	6	9.4%
1 WEED TOTALS	82	7	8.5%
2 SANGRE-commercial	10 POTATO	4	40.0%
	3 KOCHIA	1	33.3%
	37 LQUARTER	3	8.1%
	10 NIGHTSHADE	1	10.0%
	4 PURSLANE	1	25.0%
	36 PIGWEED	6	16.7%
2 WEED TOTALS	90	12	13.3%
3 NORKOTAH-commercial	1 POTATO	1	100.0%
	2 KOCHIA	0	0.0%
	2 LQUARTER	0	0.0%
	4 PIGWEED	1	25.0%
3 WEED TOTALS	8	1	12.5%
4 R. NUGGET-seed	10 POTATO	5	50.0%
	20 LQUARTER	1	5.0%
	12 NIGHTSHADE	0	0.0%
	1 PURSLANE	0	0.0%
	50 PIGWEED	6	12.0%
4 WEED TOTALS	83	7	8.4%
5 CENTENNIAL-seed	13 POTATO	7	53.8%
	2 KOCHIA	0	0.0%
	20 LQUARTER	1	5.0%
	3 NIGHTSHADE	0	0.0%
	54 PIGWEED	1	1.9%
5 WEED TOTALS	79	2	2.5%
6 WHITE ROSE-seed	10 POTATO	9	90.0%
	2 KOCHIA	0	0.0%
	14 LQUARTER	1	7.1%
	12 NIGHTSHADE	0	0.0%
	60 PIGWEED	0	0.0%
6 WEED TOTALS	88	1	1.1%