ANNUAL PROJECT REPORT FOR 1988

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

TITLE: CSU Cooperative Extension Potato Research

PROJECT LEADER: Gary D. Franc, Ph.D., Area Extension Potato Specialist

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. The experimental approach and objectives for this project were selected so duplication of other research does not occur.

PROJECT STATUS: This is the second reporting year for this project.

During the first year, a project was proposed to determine factors associated with shatter-bruise in the SLV. The production practices of 50 SLV growers were studied and analyzed at the CSU Statistical Laboratory. It was not possible to show meaningful relationships of grower practices to the amount of tuber bruising measured for the data collected during the 1987 growing season. The data is being analyzed further to determine if more complex relationships exist and a report will be prepared when the final analysis is done.

A study was proposed in 1988 to identify the parameters needed for Erwinia replication in surface water. The materials needed to grow Erwinia were not available in 1988 (a world-wide shortage of pectate has occurred) so the study has not been completed. The study will be completed after the pectate becomes available.

SIGNIFICANT ACCOMPLISHMENTS FOR 1988: Soil Fumigation Study: Busan 1020 was applied by chemigation to field plots located in the San Luis Valley. There was no significant effect of treatment with Busan 1020 on *V. dahliae* soil populations or the percentage of plants infected with *V. dahliae* (P=0.05). There was also no effect of treatment on potato plant emergence, stand and vigor (P=0.05). However, ratings made on 26 August showed that Busan 1020 applied at 50 gpa significantly reduced the amount of necrotic foliage present when compared with the two lowest rates of 20 and 30 gpa and the non-treated check plots (P=0.05).

Results for weed populations versus rates of Busan 1020 applied to soil showed a significant treatment effect on the number of weeds present in the field (P=0.05). As the rate of Busan 1020 increased, weed populations decreased according to the equation: $Y=(-0.21)(X)+8.6$ where 'Y' is the weed population (m^{-2}) and 'X' is the rate of Busan 1020 in gpa. Rates of 40 and 50 gpa resulted in excellent weed control.

Data for potato plant heights showed that plants grown in treated plots were occasionally significantly taller than those growing in the check plots (P=0.05). There were no significant treatment effects on potato yield (P=0.05).

OBJECTIVES FOR 1989: 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.

PROPOSED RESEARCH FOR 1989. 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:

1988 Allocation: **$1,800.00**

1989 Budget Request: **$1,800.00**

Materials and Supplies	650.00
Plot Maintenance	150.00
Labor	800.00
Travel	50.00
Statistical Analysis	150.00
TOTAL	$1,800.00

FINAL REPORT TO BUCKMAN LABORATORIES

EFFECT OF SOIL FUMIGATION WITH BUSAN 1020 ON POTATO PRODUCTION IN THE SAN LUIS VALLEY, COLORADO

Dr. Gary D. Franc
CSU Area Extension Potato Specialist
SLV Research Center
0249 E.RD. 9 N.
Center, CO 81125

ABSTRACT

Busan 1020 was applied by chemigation to field plots located in south central Colorado. There was no significant effect of treatment with Busan 1020 on *V. dahliae* soil populations or the percentage of plants infected with *V. dahliae* (P=0.05). There was also no effect of treatment on potato plant emergence, stand and vigor (P=0.05). However, ratings made on 26 August showed that Busan 1020 applied at 50 gpa significantly reduced the amount of necrotic foliage present when compared with the two lowest rates of 20 and 30 gpa and the non-treated check plots (P=0.05).

Results for weed populations versus rates of Busan 1020 applied to soil showed a significant treatment effect on the number of weeds present in the field (P=0.05). As the rate of Busan 1020 increased, weed populations decreased according to the equation: $Y=(-0.21)(X)+8.6$ where 'Y' is the weed population (m^{-2}) and 'X' is the rate of Busan 1020 in gpa.

Data for potato plant heights showed that plants grown in treated plots were occasionally taller than those growing in the check plots (P=0.05). There were no significant treatment effects on potato yield (P=0.05).

EFFECT OF SOIL FUMIGATION BY FALL SOIL INJECTION OF BUSAN 1020 ON EARLY DYING IN POTATOES

Dr. Monty D. Harrison
CSU Department of Plant Pathology
Potato Virus Research Laboratory
Fort Collins, CO 80523

ABSTRACT

Busan 1020 was applied by injection to field plots located in north eastern Colorado. Data showed that there were no significant effects of treatment with Busan 1020 on *V. dahliae* soil populations or on stem infections by *V. dahliae* (P=0.05). Potato plant stands and weed populations were not significantly different among treatments on any of the dates data were collected (P=0.05). There was also no effect of treatment on plant color, maturity and yield except for the US #2 grade. Treatment with Busan 1020 at 50 gpa resulted in a significantly lower yield of this grade (P=0.05).

EFFECT OF SOIL FUMIGATION WITH BUSAN 1020 ON POTATO PRODUCTION IN THE SAN LUIS VALLEY, COLORADO

Dr. Gary D. Franc
CSU Area Extension Potato Specialist
SLV Research Center
0249 E.RD. 9 N.
Center, CO 81125

MATERIALS AND METHODS

The experiment was established in a commercial seed potato field ca. 4 miles north of Monte Vista, Colorado. This field consisted of a gravelly sandy loam soil and was planted with grain in 1987 and potatoes in 1986 and 1985. The entire field (ca. 125 acres) was being treated with Busan 1020 at the rate of 40 gpa by injection through the center pivot irrigation system.

Field plots for the experiment were established within the fumigated portion of the field. Sections of the field used for the experiment were fumigated during the evening of 25 September and early morning of 26 September 1987. Four rates (20, 30, 40, and 50 gpa) were tested by altering the injection rate of the chemical into the center pivot. Thus, the different rates were applied in wedge-shaped areas of the field because of movement of the center pivot.

Two non-treated check plots were established in each wedge by shielding the soil with a plastic sheet (ca. 25' X 50') prior to application of the chemical. Plastic sheets were removed within 24 hr of application to prevent solarization of soil within the check plots. The location of the wedges and check plots was determined by measuring so they could be re-located during the following growing season after planting.

During the growing season, treated field plots were established on each side of the non-treated check plots (i.e., outside of the area shielded with plastic sheeting) in the same rows as the check. Therefore, four treated field plots plus the two check plots were located within each wedge. All field plots used for data collection were 6 rows wide (34 in. centers) X 10 ft long. Because the cooperator planted the field at right angles to the direction that was originally planned, it became necessary to have six relatively short rows rather the two longer rows per field plot. The field was planted in early May with generation certified Centennial Russet seed potatoes.

To determine if the potential treatment effects were due to control of weeds, or if additional factors were involved (for example, disease control), one of the check plots within the wedge was randomly selected and weeds were repeatedly removed by hand during the growing season. This allowed a comparison to be made among fumigated plots and weed-free plots that had received no fumigant. The weed-free non-treated check plots were reported as treatment 2 in this report. The field diagram and approximate location of the experiment within the field is illustrated in Figure 1.

Verticillium assays. Soil populations of *Verticillium dahliae* were determined before and after fumigation. Soil samples (5 soil cores ca. 6-8 in deep per sample) were collected from within and near the check areas immediately prior to fumigation on 25 September, 1987. Six soil samples were collected from each wedge for a total of 24 samples. The soil probe was disinfested between each sample. Twenty-four additional samples were collected on 18 April, 1988. These samples were collected in the same manner except 4 samples per wedge were collected from treated areas and 2 samples per wedge were collected from the non-treated checks.

Soil samples were air dried and thoroughly mixed prior to assay. Samples were pulverized and passed through a 200 mesh screen and plated onto each of 5 petri plates (0.1 g/plate) containing ethanol agar. Cultures were incubated in the dark for 21 d at room temperature and the number of *Verticillium* colony forming units (cfu) determined by counting the characteristic colonies. The number of cfu/g air-dried soil was calculated for presentation in this report.

The effect of soil fumigation on stem infection was also determined. Six potato stems per plot were collected in early August and plated onto water agar. The percentage of stems invaded by *Verticillium* was calculated for each treatment.

Weed Counts. The number of weeds per square meter was determined ca. weekly (8 times) for each treatment during the growing season starting on 1 July and ending on 22 August. The total number of weeds was counted for 20 ft of row (2 rows X 10 ft) within each treatment plot. The same rows within the plot were counted for each date.

Potato Plant Stand, Vigor and Height. Stand counts were taken on 17 June, 23 June and 28 June. The total number of emerged plants in each plot (6 rows X 10 ft) was determined on each date.

Vigor ratings were taken ca. weekly (10 times) and started on 23 June and finished on 26 August. Vigor ratings were influenced by overall plant color, uniformity, width of the canopy and height. For each rating, treated field plots were compared to the closest (paired) non-treated check plot and assigned a value on a scale of 1 to 10. The check plot was arbitrarily assigned a median value of 5 and the two treated plots being compared to the check were each either assigned a value equal to the check (no noticeable vigor difference when compared to the check), a value greater than 5 (treated plots proportionately more vigorous than the check) or a value less than 5 (treated plots were proportionately less vigorous than the check).

Potato plant heights were measured 8 times during the growing season. Data were collected starting on 28 June and finishing on 22 August.

Potato Yields. Plots were harvested on 16 September using a single-row mechanical harvester. Three rows, each 10 ft long, were harvested from each plot. Potato tubers were bagged by hand and returned to Fort Collins where they were sized and graded on 22 September. Data were converted to cwt/A for presentation in this report.

Data Analysis. Data were analyzed using the *MSTAT* subprogram for a two-way analysis of variance for 6 treatments and 4 replications. The data for weed counts were averaged for the season and the significance of the linear trend was tested using linear regression analysis. Duncan's Multiple Range Test (DMRT) was used for mean separation at alpha=0.05.

RESULTS

The *V. dahliae* population in air dried field soil collected prior to fumigation was estimated at 0.98 cfu/g. There were no significant effects of Busan 1020 treatment on *V. dahliae* soil populations (P=0.05). After fumigation, populations measured in air dried field soil were 22.5, 37.0, 26.5, 19.0, and 29.5 cfu/g for plots treated with Busan 1020 at rates of 0, 20, 30, 40 and 50 gpa, respectively.

There were no significant differences observed at any time during the growing season among treatment means for emergence, stand and vigor (P=0.05). There were also no differences measured for the percentage of plants infected with *V. dahliae* (Figure 3). However, ratings made on 26 August for the estimated percentage of foliage necrotic (dead) showed that Busan 1020 applied at 50 gpa (treatment 6) significantly reduced the amount of necrotic foliage present when compared with the two lowest rates and the check plots (P=0.05).

Results for weed populations versus treatment are shown in Figure 2. The data showed there was a significant linear treatment effect on weed populations measured in the field plots (P=0.05). As the rate of Busan 1020 increased, weed populations decreased according to the equation: $Y=(-0.21)(X)+8.6$ where 'Y' is the weed population (m^{-2}) and 'X' is the rate of Busan 1020 in gpa.

Data for potato plant heights are shown in Table 1. The data showed that plants grown in treated plots were occasionally taller than those growing in the check plots. Plots for which plants were signicantly taller than those measured for both types of check plots (treatments 1 and 2) were treatment 6 (50 gpa) on 21 July and 22 August and treatments 3, 4 and 6 (20, 30 and 50 gpa, respectively) on 9 August (P=0.05). The difference between the weeded and non-weeded check plots never differed signicantly (P=0.05).

Data for yield measurements are shown in Table 2. There were no significant differences among treatment means for any of the grades measured (P=0.05).

DISCUSSION

Because of the way treatments were applied, there may have been variations in the data that were not corrected for statistically. The treatments were located in different areas of the field and within field variation could have modified the effects due to treatment. It is not known if this occurred. However, there is some indication that treatment 5 was placed within a less productive area of the field since plant heights and yields deviated noticeably from the trends observed for the other treatments. If it were possible to randomly place different treatments side by side in replicated plots, the effect of field plot location could be removed from effects due to treatment alone.

Field observations near the end of the growing season clearly showed that check plots in some of the wedges were less vigorous than the treated areas. The unmarked boundaries of the field area covered with plastic sheeting prior to fumigation were clearly visible within some of the wedges. A set of aerial infra-red and visible light photographs were taken to determine if these differences were visible throughout the treated wedge. Unfortunately, the photographs were misplaced by the agency contracted to provide the service. If they are found, they will be forwarded as an appendix to this report.

The seed potatoes used to plant the field were of excellent quality. The lack of more noticeable treatment effects may be related to the vigor of the plants grown from certified seed. Vigorous plants would be less likely to show the effects of infection by soil borne pathogens like *V. dahliae*. This is supported by the fact that when the grower was reducing the amount of irrigation water in an effort to prepare plants for harvest, qualitative differences became visible in the plots as plants became stressed. If the growing season was longer in the San Luis Valley, it is possible that treatment effects would become more pronounced. The San Luis Valley generally lacks economic numbers of the nematodes known to interact synergistically with *V. dahliae*. This may be another reason that other potato production areas showed a greater response to soil fumigation with Busan 1020.

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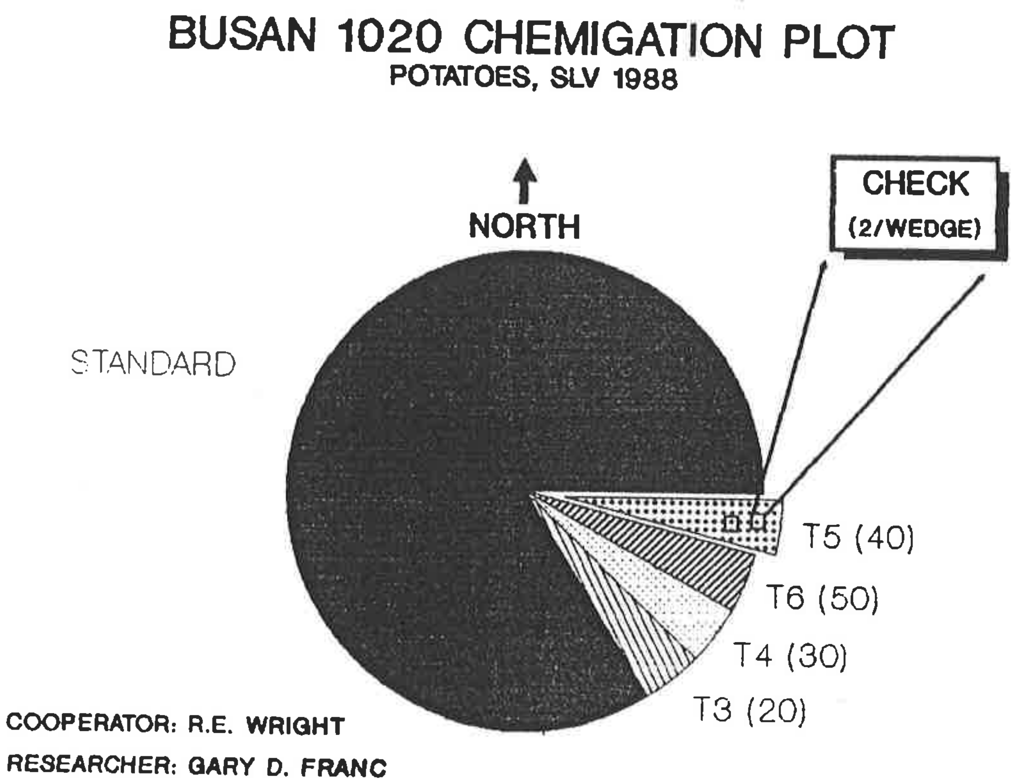

Figure 1. Experimental design used.

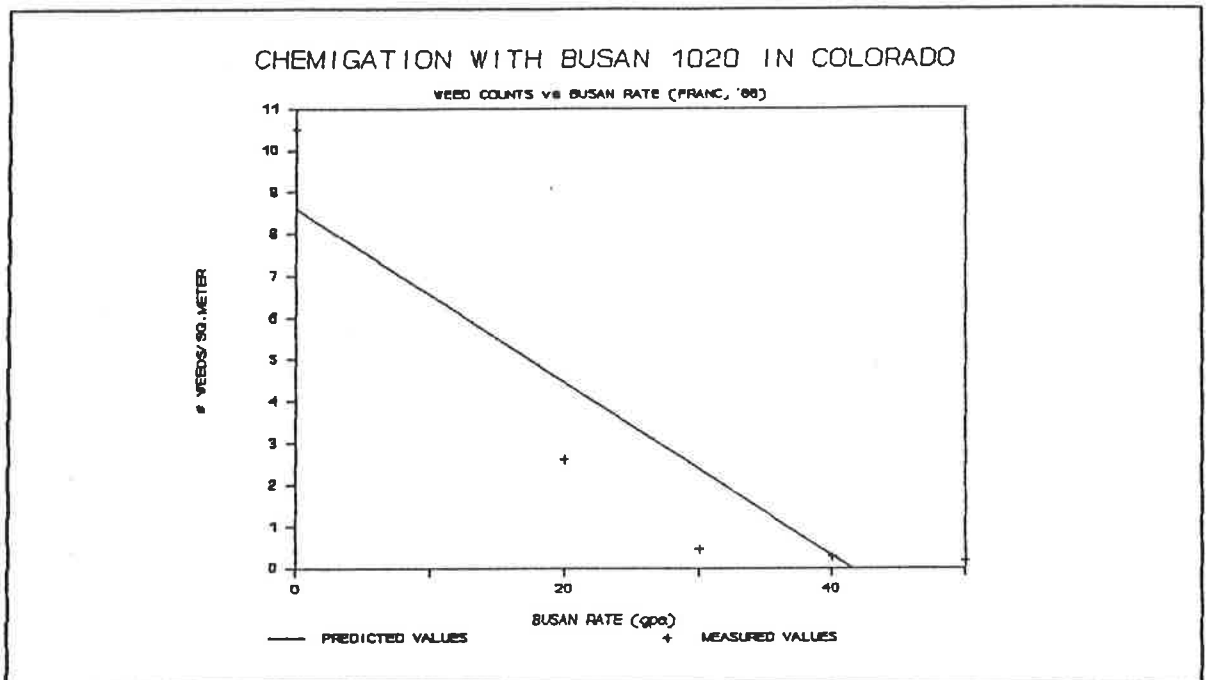

Figure 2. The relationship of Busan 1020 rates applied to soil and weed populations measured in field plots.

Table 1. Effect of chemigation with Busan 1020 on Centennial Russet potato plant height in the San Luis Valley, Center, CO (G. Franc, CSU 1988).

TREATMENT	POTATO PLANT HEIGHT (cm) ON:[1]							
(GPA)	6/28	7/5	7/13	7/21	7/28	8/3	8/9	8/22
1 (0)[2]	21.46 A[3]	34.19 B	48.18 A	51.55 BC	51.99 A	53.50 B	53.35 B	53.61 BC
2 (0)[2]	22.15 A	35.48 AB	47.28 A	51.86 BC	51.49 A	54.93 AB	52.31 B	52.79 C
3 (20)	23.41 A	38.98 A	47.33 A	51.51 BC	54.64 A	53.68 B	57.07 A	55.76 AB
4 (30)	23.73 A	38.38 A	48.56 A	53.66 AB	55.56 A	57.81 A	56.87 A	55.83 AB
5 (40)	23.34 A	33.24 B	46.45 A	50.06 C	53.07 A	52.42 B	53.08 B	52.29 C
6 (50)	22.07 A	35.52 AB	50.75 A	55.27 A	55.51 A	57.45 A	57.29 A	57.07 A

[1] Six plants were measured on each date. Each entry is the average of 4 replications.

[2] Treatment 1 is the non-treated check plot for which weeds were not removed. Treatment 2 is the non-treated check plot for which weeds were repeatedly removed throughout the growing season.

[3] Treatment means followed by different letters differ significantly (P=0.05). Duncan's Multiple Range Test (DMRT) was used for mean separation.

Table 2. The effect of fumigation with different rates of Busan 1020 on Centennial Russet potato yield and quality in the San Luis Valley (G. Franc, Center CO 1988).

Treatment (rate)	Total	Potato yields in cwt per acre: US #1 >10 oz	US #1 <10 oz	US #2	B's	Culls	Marketable[1] Yields
1 (0)	340.4	56.8	248.2	6.7	25.5	0.3	311.59
2 (0)	368.5	52.5	265.6	6.7	34.2	1.4	324.79
3 (20)	384.1	74.8	259.7	4.0	39.3	0.8	338.49
4 (30)	369.6	54.7	269.3	6.9	34.2	0.5	330.93
5 (40)	339.9	61.1	238.8	8.7	29.1	0.8	308.64
6 (50)	387.9	73.3	268.5	4.5	34.1	1.5	346.31

[1] Marketable yield includes all US #1 and US #2 grades. No significant differences occurred among treatment means.

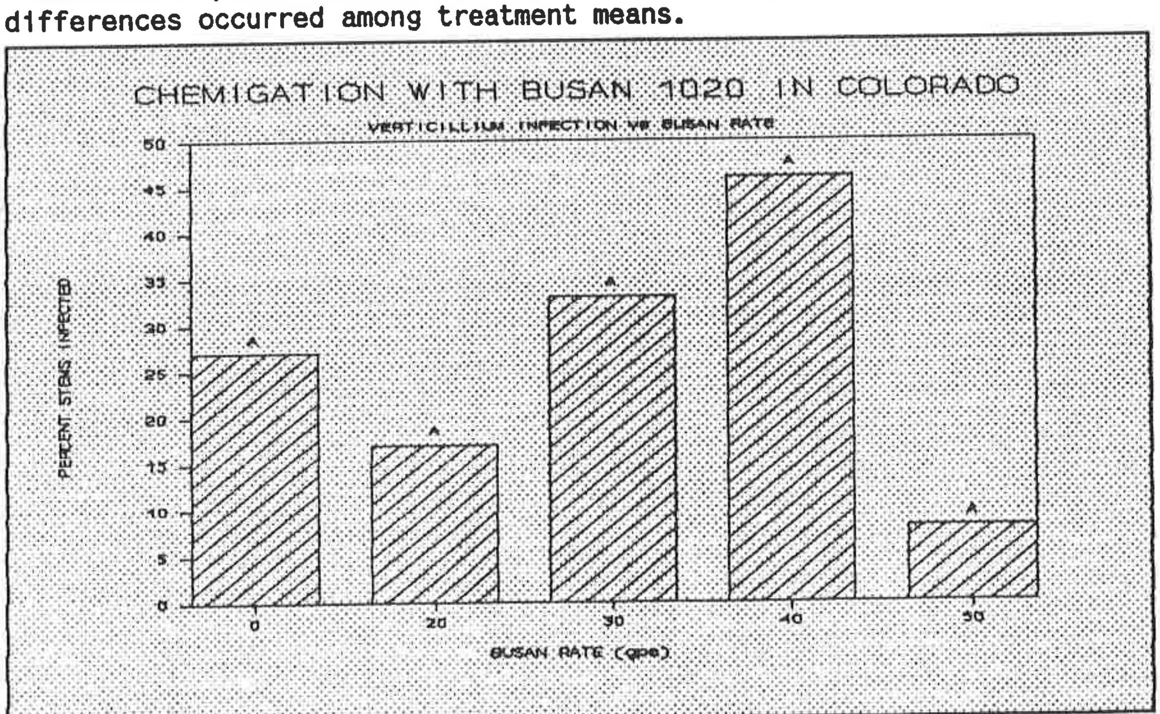

Figure 3. The effect of soil fumigation with Busan on stem infection by Verticillium.

Effect of soil fumigation by fall soil injection of Busan 1020 on early dying in potatoes

Dr. Monty D. Harrison

To determine the effect of soil injection of Busan 200 in the fall on reducing early dying in potatoes, a field experiment was carried out in the fall of 1987 and the spring and summer of 1988.

The effect of three rates of Busan 1020 on plant emergence, rate of maturity, soil populations of *Verticillium dahliae* and stem infection by the pathogen were evaluated using cv. Norgold Russet potatoes as the test crop.

Methods and Materials:

The experiment was established in a commercial field located approximately 5 miles west of Platteville, Colorado. The soil was sandy loam and the field had produced a crop of dry beans in 1987. Sixteen strips were established across the field and treatments were applied within the strips, each of which was 16 feet wide and extended the full length of the field (approximately 1100 ft.). Strips were permanently marked with colored flags to facilitate location of the fumigated areas after potatoes were planted. Unfumigated areas 16 feet wide were left between plots to separate treatments and avoid cross contamination.

Within each strip an area 50 feet long and 4 rows wide located 100 feet from the top of the field was marked and used as the area from which all samples were taken. This area within each strip was temporarily marked in the fall and permanently marked with colored flags after potatoes were planted in the spring. Just before fumigation, soil in each plot was sampled for assays of *Verticillium dahliae* populations by collecting 10 random soil cores approximately 2.5 cm diameter x 20 cm deep from each plot. Soil cores from each plot were bulked together, placed into plastic bags and returned to the laboratory for processing. The identical process was repeated in the spring (April) prior to planting to determine the effects of fumigation on *Verticillium* populations.

Plots were fumigated on November 6, 1987, by injecting Busan 1020 7-10 inches deep into the soil in each strip at the appropriate rate using gravity flow tractor drawn injection equipment. Approximately 0.4 inches of rain fell on the plots within a few hours after injection.

Potatoes, cv. Norgold Russet, were planted into the field by the cooperator on approximately April 15, 1988. Normal commercial practices for the area were used in the field. The field was irrigated by furrow irrigation.

Soil samples collected prior to fumigation as well as those collected in the spring prior to planting were assayed for populations of *Verticillium dahliae* by air drying the samples, thoroughly mixing the soil and pulverizing it with an electronic pulverizer to break up soil aggregates. The soil was then passed through a 200 mesh screen. Samples of the screened soil (0.1 gm) were plated on ethanol agar in each of five petri dishes with the aid of an Anderson air sampler. Cultures were incubated for approximately 21 days in the dark then *V. dahliae* colonies were counted with the aid of an illuminated magnifier. Counts were converted to colony forming units (cfu) per gram of soil. After potatoes emerged (May 27) stand counts were made in each plot to be certain that stand differences did not affect subsequent results.

At regular intervals during the growing season readings were made on relative plant color (i.e., greenness), plant maturity, the number of plants with typical verticillium wilt, proportion of plant stems invaded by *Verticillium*, and weed populations.

Relative greenness was measured by comparing treated plots with adjacent untreated areas.

Plant maturity (early dying severity) was estimated in each plot on four dates during the growing season using the Horsfall-Barratt rating scale to estimate the degree of maturity, including yellowing, wilting, and necrosis of foliage of plants in each plot. Five separate readings were made in each plot and all readings were averaged to provide a maturity index. The numbers of plants showing typical verticillium wilt symptoms in a standard length of row in each plot were counted four times during the season.

Ten random stems per plot were collected on July 15 and laboratory isolations were made to determine the proportion of stems invaded by *V. dahliae*. Stems were randomly collected from the plots, returned to the laboratory, and stored at approximately 5°C. Individual stems were prepared for isolation by stripping the leaves, washing in running water, soaking for about 3 minutes in 10% clorox solution and rinsing again with water. One cross section of tissue approximately 2-3 mm thick was cut from the base, the middle and the top of each stem and placed on the surface of water agar in petri dishes. The cultures were incubated at room temperature for 7-10 days and the tissues were examined microscopically for the presence of *Verticillium* growth. The presence of *Verticillium* in any section was considered evidence for infection of that stem by the fungus.

Weed counts were made three times during the growing season by carefully parting the potato foliage to expose the soil surface then counting the numbers of weed plants present in measured lengths of row.

At harvest, measured lengths of row in each plot were dug with a mechanical digger, the tubers hand picked and weighed. The tubers were returned to Fort Collins where they were sorted into standard U.S. grades and tubers in each grade weighed.

All data were analyzed by analysis of variance.

Results:

Results of the study are shown in Tables 1-4.

Data (Table 1) show that *V. dahliae* populations present in the soil were not reduced by fumigation with any of the three rates of Busan 1020. In fact, average populations in the soil in the spring were higher than those measured prior to fall fumigation in all cases except in the plots which received the 75 gal/A rate of the fumigant. Plant stands and weed populations were not significantly different among treatments on any of the dates on which data were collected.

Plant color and rate of maturity (Table 2) were not significantly affected by treatment nor were the percentage of infected stems, numbers of plants with typical verticillium wilt symptoms (Table 3), or tuber yield (Table 4) in all grades except US #2 potatoes. In the case of the US #2 grade, significantly less yield was measured in plots treated with 50 gal/A than any other treatment.

Discussion:

Data show that no differences could be measured between Busan 1020 treated plants and untreated plots in northeastern Colorado during the growing season following fall application of the fumigant by shank injection at rates of 30 to 75 gal/acre.

The Verticillium dahliae population in the soil in the field in which the study was done was very low. Populations were lower than the threshold numbers considered to be required to produce significant yield reductions in potatoes in the area where the study was made. This could explain why no significant differences could be measured among treatments in terms of stem infection and rate of plant maturity. However, the fact that no significant differences in weed populations could be measured among treatments and Verticillium populations were not reduced suggests that fall application of Busan 1020 by soil injection at the rates studied may not be effective for weed and disease control in northeastern Colorado. Since fall application of fumigants are necessary in this area of Colorado because of the early spring planting schedule necessary to meet marketing constraints, it is unlikely that the practice of spring fumigation will be adopted in this area of Colorado. If fall fumigation is ineffective as suggested by this study, it is unlikely that fumigation will be adopted as a part of potato production in this area of Colorado.

Table 1. Effect of fall soil fumigation with three rates of Busan 1020 on populations of _Verticillium_ _dahliae_ in soil potato stands and weed populations

Treatment	Rate/A	_Verticillium_ Propagules/Gram of Soil Fall 1987	Spring 1988	Number of Plants per 100 ft. of Row	Weed Populations Per Row 7/15	8/6	8/26
None	-	0.0	2.0	156.0A[1]	15.0A	9.5A	7.3A
Busan 1020	30 gal	1.5	2.5	163.0A	3.3A	8.5A	4.8A
Busan 1020	50 gal	3.0	3.5	148.8A	5.0A	9.8A	9.5A
Busan 1020	75 gal	1.5	0.5	161.5A	4.8A	3.5A	6.5A

[1]Means with a common letter do not differ significantly (P=0.05)

Table 2. Effect of fall soil fumigation with three rates of Busan 1020 on plant color, plant maturity

		Color Rating					Maturity Rating			
Treatment	Rate/A	7/1	7/8	7/22	7/29	8/6	7/15	7/22	7/29	8/6
None	-	5.9A[1]	6.9A	5.0A	6.1A	4.8A	1.6A	1.3A	3.6A	3.3A
Busan 1020	30 gal	6.0A	6.5A	5.5A	5.0A	5.1A	1.3A	1.3A	2.9A	3.5A
Busan 1020	50 gal	5.3A	6.3A	5.3A	5.5A	4.9A	1.3A	0.9A	2.4A	3.9A
Busan 1020	75 gal	5.3A	4.8A	5.8A	5.5A	5.3A	1.5A	1.8A	2.7A	3.8A

[1]Means with a common letter do not differ significantly (P=0.05)

Table 3. Effect of soil fumigation with three rates of Busan 1020 on the percentage of plant stems invaded by *Verticillium dahliae* and the number of plants showing typical symptoms of verticillium wilt

Treatment	Rate/A	% of Stems Invaded by *V. dahliae*	Number of plants with typical *Verticillium* wilt symptoms			
			7/8	7/22	7/29	8/6
None	-	35.0A[1]	1.75A	4.00A	6.25A	4.75A
Busan 1020	30 gal	32.5A	2.75A	1.50A	5.25A	6.25A
Busan 1020	50 gal	12.5A	2.50A	2.00A	6.75A	6.75A
Busan 1020	75 gal	30.0A	1.50A	1.50A	4.25A	4.75A

[1]Means with a common letter do not differ significantly (P=0.05)

Table 4. Effect of fall soil fumigation with three rates of Busan 1020 on potato tuber yield

Treatment	Rate/A	Tuber Yield cwt/A					
		Total	US #1 >10 oz	US #1 <10 oz	Total US #1	US #2	Marketable
None	-	454.9A[1]	111.4A	261.8A	373.3A	26.3AB	399.5A
Busan 1020	30 gal	439.7A	67.0A	249.2A	316.2A	52.3A	368.5A
Busan 1020	50 gal	425.9A	90.9A	249.7A	340.6A	12.5 B	353.1A
Busan 1020	75 gal	415.3A	99.6A	235.0A	334.6A	25.7AB	360.3A

[1]Means with a common letter do not differ significantly (P=0.05)