Evaluation of Ringrot Symptom Expression in Selected Potato Clones

Summary of 1984 Results and Research Proposal for 1985

Gary D. Franc and Monty D. Harrison

Summary of 1984 results (see attached report for detailed information):

Twelve potato clones were inoculated with Corynebacterium sepedonicum and evaluated for ringrot symptom expression in the San Luis Valley, CO. Clones tested were A72685-2, AC77652-1, TC2-1, WNC230-14, WNC285-18, WNC521-12, WNC567-1, WNC672-2, Centennial Russet, Russet Burbank, Nooksack and Sangre.

All clones became infected (based on stem squeeze results), however, clones TC2-1 and WNC230-14 failed to develop foliar symptoms at any time during the growing season. Russet Burbank developed symptoms earlier in the growing season (17 July) than did any other clone. Clones A72685-2 and WNC567-1 developed foliar symptoms by 7 August while all other clones developed foliar symptoms after this date. Foliar symptom expression in the treatment plots was not as pronounced and did not progress as rapidly in 1984 as they did in previous years.

All clones developed ringrot symptoms in daughter tubers. The percentage of daughter tubers with symptoms ranged from 2.6% to 20.0%. Tuber symptoms in clones TC2-1 and WNC285-18 were considered weak because tubers had to be cut open before symptoms could be observed.

Research Proposal for 1985

Approximately six promising numbered clones will be evaluated for ringrot symptom expression in the San Luis Valley. Clonal reactions including foliar and tuber symptoms will be compared to those with known ringrot reactions including Russet Burbank and WNC-230-14.

Proposed Budget

Land Preparation and Plot Maintenance	$600.00
Labor	450.00
Travel	500.00
Supplies	100.00
Total	$1,650.00

The Effect of Ringrot Infection on Symptom Development in Potato Clones

Gary D. Franc and Monty D. Harrison

Abstract

Twelve potato clones were inoculated with Corynebacterium sepedonicum and evaluated for ringrot symptom expression in the San Luis Valley, CO. Clones tested were A72685-2, AC77652-1, TC2-1, WNC230-14, WNC285-18, WNC521-12, WNC567-1, WNC672-2, Centennial Russet, Russet Burbank, Nooksack and Sangre.

All clones became infected (based on stem squeeze results), however, clones TC2-1 and WNC230-14 failed to develop foliar symptoms at any time during the growing season. Russet Burbank developed symptoms earlier in the growing season (17 July) than did any other clone. Clones A72685-2 and WNC567-1 developed foliar symptoms by 7 August while all other clones developed foliar symptoms after this date. Foliar symptom expression in the treatment plots was not as pronounced and did not progress as rapidly in 1984 as they did in previous years.

All clones developed ringrot symptoms in daughter tubers. The percentage of daughter tubers with symptoms ranged from 2.6% to 20.0%. Tuber symptoms in clones TC2-1 and WNC285-18 were considered weak because tubers had to be cut open before symptoms could be observed.

Materials and Methods

Twelve potato clones were tested for ringrot (Corynebacterium sepedonicum) symptom expression in the San Luis Valley. Clones tested were

A72685-2, AC77652-1, TC2-1, WNC230-14, WNC285-18, WNC521-12, WNC567-1, WNC672-2, Centennial Russet, Nooksack, Russet Burbank and Sangre.

Tuber seedpieces were cut and immediately immersed in tap water (treatment A; uninoculated control) or tap water to which a macerate prepared from ringrot infected tubers had been added (treatment B). All treatment A tubers were planted before planting treatment B tubers to preclude cross-contamination. Treatment plots were planted on 17 May, 1985.

Treatment plots were visually inspected periodically throughout the growing season for the development of foliar ringrot symptoms. Typical symptoms were wilting, interveinal chlorosis and interveinal necrosis. Russet Burbank also developed a typical "early dwarfing" symptom. Plants were visually inspected on 17, 30 and 31 July and on 7, 21, and 27 August. On 21 August, several stems in each plot were pulled and a stem squeeze test was done (a preliminary diagnostic test done in the field).

Tubers were evaluated for symptom expression on 18 September. Approximately 10 daughter tubers for each replication (3 replications) were evaluated on this date and the percentage of tubers expressing symptoms was determined. Tubers were also rated on an arbitrary scale (0-3) for the intensity of symptom expression. A "0" rating indicated that tubers had to be cut open before symptoms could be observed; a rating of 1, 2 or 3 indicated that at least 1 tuber for 1, 2 or 3 replications, respectively, had tuber surface-cracking symptoms evident.

Results

Inoculation of seedpieces with ringrot did not reduce the final stand counts as determined on 21 August (Table 1). This is consistent with

observations made in previous years. Data for stem squeezes (not shown) showed that all inoculated clones were infected on this date.

The data for foliar symptom expression are summarized in Table 2. Russet Burbank developed foliar symptoms (early dwarfing) earlier than did any other cultivar tested (17 July). This is consistent with observations made in previous years and, therefore, Russet Burbank serves as a convenient reference to insure that ringrot inoculations were successful. Interveinal chlorosis symptoms (IVC) were not visible for Russet Burbank on 30 July but were visible on 31 July. All other clones appeared healthy on these dates.

On 7 August, IVC (ringrot) symptoms were evident for clone A72685-2 and wilting (W) due to ringrot infection (based on comparison with uninoculated controls) was visible for clone WNC567-1. Russet Burbank also developed wilting symptoms by this date. All other clones appeared healthy (clones WNC672-2, Centennial, Nooksack and Sangre were not evaluated on 7 August).

Clones A72685-2, AC77652-1, WNC521-12, WNC567-1, WNC672-2 and Russet Burbank had ringrot symptoms evident on 21 August while all other clones appeared healthy.

Clone AC77652-1 appeared healthy on 27 August even though IVC symptoms had been observed on 21 August. Clone WNC285-18 had more leaves with marginal necrosis visible for the inoculated plots on 27 August than for the uninoculated plots. Stem squeezes of plants with marginal necrosis indicated that infection had occurred in these plants while squeezes of inoculated stems, lacking marginal necrosis, appeared typical for healthy plants. Sangre, Nooksack and Centennial Russet developed ringrot symptoms by 27 August. Symptoms for these cultivars were subtle, however, and

consisted only of a general wilt for Nooksack and Sangre and leaf necrosis for Centennial. These symptoms were verified by the stem squeeze and also by comparison to the uninoculated control plants.

The data for daughter tuber symptom expression is shown in Table 3. All clones developed tuber symptoms. However, the percentage of daughter tubers with symptoms ranged from 2.6% to 20.0% and the intensity of tuber symptoms also varied greatly. The percentage of daughter tubers with symptoms for Centennial Russet, Russet Burbank, Sangre and Nooksack was 10.0%, 13.3%, 13.3% and 20.0%, respectively. It should be noted, however, that many tubers were extensively decayed in the Sangre plots and were not rated. If tuber evaluations had been done earlier many more tubers for Sangre may have been rated as ringrot positive before extensive decay occurred. All numbered clones had fewer than 10% of the daughter tubers with symptoms.

Clone TC2-1 and WNC285-18 had 3.8% and 3.3% of the daughter tubers with symptoms, respectively, and all tubers had to be cut before symptoms could be observed. Tuber symptoms for these clones were considered weak for this reason. All other clones had at least one daughter tuber with tuber surface-cracking symptoms evident.

Discussion

All clones became infected with ringrot after inoculation of tuber seedpieces. Infection diagnosis was based on stem squeeze tests done in the field as well as tuber symptom expression. Russet Burbank developed symptoms earlier in the growing season (17 July) followed by clones A72685-2 and WNC567-1 (7 August). Clones TC2-1 and WNC230-14 failed to develop

foliar ringrot symptoms during the growing season. Tuber symptom expression for TC2-1 and WNC285-18 was also considered very weak.

Symptom expression in the field in terms of foliar interveinal chlorosis followed by interveinal necrosis was almost nonexistent in the treatment plots in 1984. The onset of these symptoms was much slower in 1984 than in previous years and infected Russet Burbank stems were still growing on 27 August. During previous tests, infected Russet Burbank stems were usually completely dead by the end of August. The strain of C. sepedonicum used in this study may be different from those used during previous tests. It may be that the strain used in 1984 was not as virulent and infected plants persisted in the field.

Table 1. The effect of ringrot inoculation of cut seedpieces on stand counts - Center, Colorado, 1984.

Clone Tested	Average Stand Count[1]	
	Water Inoculated	Ringrot inoculated
1) A72685-2	7.0	6.0
2) AC77652-1	5.7	6.0
3) TC2-1	7.0	6.3
4) WNC230-14	5.0	7.0
5) WNC285-18	6.3	6.0
6) WNC521-12	7.0	7.0
7) WNC567-1	5.7	6.7
8) WNC672-2	7.0	7.0
9) Centennial Russet	6.7	6.7
10) Nooksack	5.7	7.0
11) Russet Burbank	7.0	7.0
12) Sangre	7.0	5.0
	$\bar{X}$ = 6.4	$\bar{X}$ = 6.5

[1] Seven tuber seedpieces were planted per treatment plot. Each datum entry represents the average of three replications.

Table 2. The effect of ringrot inoculation on foliar symptom expression in selected potato clones - Center, CO, 1984.

Clone Tested	Date plants were evaluated[1]				
	17 Jul	30-31 Jul	7 Aug	21 Aug	27 Aug
1) A72685-2	0[2]	0	+IVC	+IVC	+IVC[4]
2) AC77652-1	0	0	0	+IVC	0
3) TC2-1	0	0	0	0	0
4) WNC230-14	0	0	0	0	0
5) WNC285-18	0	0	0	0	+MN[4]
6) WNC521-12	0	0	0	+IVC, IVN	+IVC,W
7) WNC567-1	0	0	+W	+W	+W
8) WNC672-2	0	0	3	+IVC	+IVC
9) Centennial Russet	0	0	3	0	+LN
10) Nooksack	0	0	3	0	+W
11) Russet Burbank	+ED	+ED,IVC	+ED,IVC,W	+ED,IVC,W	+LN,W
12) Sangre	0	0	3	0	+W[4]

[1] ED = early dwarfing; IVC = interveinal chlorosis; IVN = Interveinal necrosis; W = wilting; MN = necrosis of leaf margins; LN = general leaf necrosis. All inoculated treatments were compared to uninoculated controls.

[2] 0 = inoculated clones appeared healthy; + = inoculated clones appeared ringrot infected.

[3] Clones were not evaluated.

[4] Symptoms were very subtle.

Table 3. The effect of ringrot inoculation on the incidence of daughter tuber symptom expression in the San Luis Valley, Center, CO, 18 September 1984.

Clone Tested	Percentage of tubers with visible ringrot symptoms[1]	Intensity of ringrot symptom expression (0-3)[2]
1) A72685-2	9.4	1
2) AC77652-1	7.9	3
3) TC2-1	3.8	0
4) WNC230-14	5.4	1
5) WNC285-18	3.3	0
6) WNC521-12	2.9	1
7) WNC567-1	3.1	2
8) WNC672-2	2.6	1
9) Centennial Russet	10.0	2
10) Nooksack	20.0	2
11) Russet Burbank	13.3	2
12) Sangre	13.3	2

[1] Approximately 10 tubers for each of three replications were evaluated. Each datum point represents the average of three replications.

[2] 0 = tuber symptoms were only visible after cutting open.
1 = at least one tuber in one replication had tuber surface-cracking symptoms evident.
2 = at least one tuber in two replications had tuber surface-cracking symptoms evident.
3 = at least one tuber in three replications had tuber surface-cracking symptoms evident.