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Evaluation of Advanced Clones for Reaction to Bacterial Ring Rot Infection

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Summary:

Thirteen numbered clones and four cultivars were evaluated in the field in the San Luis Valley for their reaction to inoculation with bacterial ring rot. The timing of the symptom development, the type of expression, both in the foliage and in tubers, and the number of plants out of each clone or cultivar exhibiting symptoms was measured.

All of the clones and cultivars were susceptible to infection by bacterial ring rot. Symptoms appeared between 51 days after planting (DAP) in the case of Russet Burbank to 72 DAP for WNC230-14. All of the clones had recognizable symptoms by 58 DAP, but varied in the number of plants expressing these symptoms. The clones with the lowest number of plants expressing symptoms were AC83044-1 and CO79018-11 with 9.5% and 4.8%. From 14.3% in the case of CO79018-11 to 100% in the case of many other clones. The only clone of any concern regarding foliage symptoms was CO79018-1 (14.3%). CO83027-2 showed 50% or more of the plants positive 87 DAP as compared with the other clones ranging between 51 DAP to 72 DAP. In addition, the total number of plants expressing symptoms with this clone was slightly lower than the others at 76.2%. This clone should be evaluated further. Symptom type was quite consistent between clones and all showed a wide range of symptom characteristics. Tubers from all clones showed symptoms by mid-September, with five clones, AC75430-1, AC83044-1, AC83172-1, CO79018-11 and CO81038-6, exhibiting 30% or less symptomatic tubers.

Materials & Methods: Tubers of the clones and cultivars to be tested were obtained from the SLV Research Center Cultivar Development Program in April, 1990. Bacterial ring rot inoculum was prepared using a mixture of ground up infected tubers and cultured bacteria washed from the plates. This slurry was placed into three 5 gallon buckets. In addition, distilled water was placed in three other 5 gallon buckets for use with the controls. The plot was pre-irrigated and appropriate rows opened up 48 hours prior to planting. Forty two tubers of each clone were selected in the 4-6 oz. range. These tubers were cut in half at the field. Each clone had twenty one of the seedpieces used as controls. These were placed in the bucket containing the water while the other twenty one were reserved for use with the inoculum. Seedpieces were left in the water for 5 minutes and then placed in the plot. All controls were treated and laid out in the plot prior to any work with the ring rot inoculum. Upon completion of the controls, the remaining twenty one seedpieces from each clone were used for inoculation. These were placed in the bucket with the ring rot slurry for 5 minutes and then placed in the plot. All potatoes were handplanted and mechanically covered. The potatoes were planted on May 21, 1990 in a randomized complete block plot design. Three replications or blocks were used with seven seedpieces each for the

control and inoculated treatment per replication. Control and infected seedpieces from the same clone were planted in the same row within the block with a three foot space between the two sets of seven seedpieces. This aided in comparison evaluations of the plants during the growing season. A spacing of 12" was used between seedpieces within a given replication. A three foot blank space was left between blocks and one blank row was left between each planted row to separate treatments, minimize potential cross contamination and create conditions for easy viewing of plant symptoms.

The plot was irrigated by overhead sprinkler and weeds were controlled with a pre-emergence herbicide application of Turbo and a fall fumigation of Busan. Early blight and insects were controlled throughout the season with timed fungicide and insecticide applications as necessary.

Plant emergence was recorded and plants were examined for foliar symptoms of bacterial ring rot at weekly intervals beginning on July 10 (51 DAP) until August 24 (96 DAP), at which time plant maturity and other factors would not allow further reading. Date of first symptom expression, number of plants in each plot showing symptoms on each reading date and the types of symptoms showing. Also, at harvest, 10 tubers randomly selected from each replication (30 total for each clone) were examined to determine what symptoms might be present.

Results: Data from the field symptom information table shows that all of the clones demonstrated symptoms by July 17 or 58 DAP. The earliest symptom development was seen in Russet Burbank with symptoms of early dwarfing and rosetting by July 10, 51 DAP. Clones were variable in terms of the number of replications and plants showing symptoms at this time. Three clones, CO79018-11, AC83044-1 and CO83027-2 had only 4.8%, 9.5% and 14.3% of the plants showing symptoms at this time which compared well with Centennial at 4.8% and Sangre at 19.0%. However, by the end of July at 71 DAP all clones except the CO79018-11 and AC83027-2 had 50% or more of the plants showing positive symptoms. On the last reading, CO79018-11 ended up with only 14.3% of the plants expressing symptoms. AC83027-2 had 50% or more of the plants showing symptoms by 8/15 at 96 DAP and ended up with 76.2% of the plants showing symptoms at the time of the last reading. This compared quite well with Centennial which had 66.7% of the plants demonstrating symptoms 96 DAP and Russet Burbank which had 76.2% of the plants exhibiting symptoms. Again this year, WNC230-14 was among the latest clones to express symptoms and had the second lowest percent of plants with symptoms at the time of the last reading, 55.0%. The symptom range and type was excellent for all clones.

Data from the tuber symptom evaluation showed that all of the clones will exhibit tuber symptoms. However, five of the clones demonstrated 30% or less tubers with symptoms. Two clones are of real concern here, CO79018-11 and CO81038-6. However, given that the CO81038-6 displayed excellent foliar symptoms, both early in the season and in terms of the number of plants expressing symptoms, this does not seem to be a problem. CO79018-11 on the other hand, should be considered as a very poor expressor of bacterial ring rot symptoms, both in the foliage and in the tubers.

Discussion: At this point in time only two clones are of concern regarding symptom expression to bacterial ring rot, CO79018-11 and CO83027-2. It is recommended that the CO79018-11 be dropped from consideration for grower release because of the very poor ability to express bacterial ring rot or if released, be sold only with the use of the bacterial ring rot affidavit for poor symptom expression under SLV conditions. CO83027-2, while similar to the Centennial in expression, should be evaluated further next year. The clones A80559-2, AC83044-1, AC83044-2, AC83064-1, AC83064-6, AC83068-1, AC83172-1, AC83306-1 and CO83027-2 have completed the first year of evaluation. The clones AC75430-1 and CO82142-2 have completed two years of evaluation. The clones CO79018-11 and CO81038-6 have completed three years of evaluation, but both have been discarded from the Cultivar Development Program. For 1991 the eleven clones with either one or two years of evaluation will be tested further and up to an additional thirteen clones may be added.

Screening of two methods of inoculation: Two additional methods of inoculation were compared with the method currently used in the clonal evaluation. Because of difficulty in obtaining a good inoculum source, neither of the methods was as effective as the tuber dip. However, both methods will be tried again in 1991. In addition, the use of freeze dried cultures of Clavibacter michiganense pv. sepedonicum (Cms) will be incorporated.

Eye poke: Two oz. seedpieces were allowed to sprout. All but one or two major sprouts near the apical end were detached. Bacterial ring rot, Cms, inoculum was prepared by growing the bacteria on selective media, washing it off of the plates, suspending it, centrifuging it to clean it up and concentrating it to approximately 1×10^8 cfu/ml. A 0.01 ml inoculation was made at the base of each of the sprouts remaining and a sterile toothpick was used to puncture the seedpiece at the base of the eye, through the inoculum droplet and into the eye's base. This introduced the inoculum into the region of the seedpiece most likely to allow the infection process at the earliest possible date. Each poked area was sealed with vaseline. Tubers were planted in the same way as the tuber dip used in the clonal evaluation. Five cultivars (CR, RB, Sangre, WNC230-14 and Ute Russet) with four treatments (Control, eye poke, cork bore and tuber dip) by four replications were laid out in a randomized complete block experimental design. All plot treatment and irrigation was the same as the clonal evaluation described earlier.

Cork bore: Two oz. seedpieces were used. A #2 Cork bore was utilized to punch out a portion of the seedpiece just below the apical end where active sprouts were visible. This cylinder of tissue was removed and 0.05 ml of a suspension containing approximately 1×10^6 cfu/ml of Cms was introduced into the hole. The cylinder was replaced and the edges sealed with vaseline. These were planted in the same manner as the other treatments.

BACTERIAL RINGROT STUDY 1990: FRANC/DAVIDSON
FIELD SYMPTOM INFORMATION

CLONE # AND NAME	DATE FIRST SYMPTOMS APPEARED	# OF REPS POSITIVE	# OF PLANTS POSITIVE	% PLANTS POSITIVE	DATE 50% OR MORE PLANTS POSITIVE	% PLANTS POSITIVE 100 DAP	SUMMARY OF SYMPTOMS OVER SEASON
1 A80559-2	7/17	3	6	28.5%	7/30	85.7%	W,IVC,IVN,MN
2 AC75430-1	7/17	3	9	42.9%	7/30	100.0%	ED,W,IVC,IVN,MN
3 AC83044-1	7/17	1	2	9.5%	7/30	100.0%	ED,W,IVC,IVN,MN
4 AC83044-2	7/17	3	7	33.3%	7/30	100.0%	ED,W,IVC,IVN,MN
5 AC83064-1	7/17	3	7	33.3%	7/30	100.0%	ED,W,IVC,IVN,MN
6 AC83064-6	7/17	3	9	42.9%	7/30	90.5%	ED,W,IVC,IVN,MN
7 AC83068-1	7/17	3	7	36.8%	7/30	100.0%	ED,W,IVC,IVN,MN
8 AC83172-1	7/17	2	9	42.9%	7/30	95.2%	ED,W,IVC,IVN,MN
9 AC83306-1	7/17	3	7	33.3%	7/30	100.0%	W,IVC,IVN,MN
10 CO79018-11	7/17	1	1	4.8%	----	14.3%	ED,IVC,IVN,MN
11 CO81038-6	7/17	3	16	76.2%	7/17	100.0%	ED,W,IVC,IVN,MN
12 CO82142-4	7/17	3	6	28.6%	7/30	100.0%	ED,W,IVC,IVN,MN
13 CO83027-2	7/17	2	3	14.3%	8/15	76.2%	ED,W,IVC,IVN,MN
14 CENTENNIAL	7/17	1	1	4.8%	8/15	66.7%	W,IVC,MN
15 RUS. BURBANK	7/10	2	5	23.8%	7/17	76.2%	ED,R,W,IVC,IVN,MN
16 SANGRE	7/17	3	4	19.0%	7/30	100.0%	W,IVC,IVN,MN
17 WNC230-14	7/30	2	6	30.0%	8/15	55.0%	W,IVC,IVN,MN

Key to symptoms: ED-early dwarf, R-rosette, IVC-interveinal chlorosis, IVN-interveinal necrosis, MN-marginal necrosis
Planting date on 5/21/90. Last reading taken on 8/24/90 (approximately 100 DAP).

BACTERIAL RINGROT STUDY 1990: FRANC/DAVIDSON
TUBER SYMPTOM DATA EVALUATED ON 9-12-90

CLONE#	CLONE NAME	TUBERS WITH EXTERNAL SYMPTOMS	TUBERS WITH INTERNAL SYMPTOMS	TUBERS SHOWING SYMPTOMS	TUBERS SHOWING NO SYMPTOMS
1	A80559-2	16.7%	46.7%	63.3%	36.7%
2	AC75430-1	0.0%	26.7%	26.7%	73.3%
3	AC83044-1	0.0%	30.0%	30.0%	70.0%
4	AC83044-2	3.3%	33.3%	36.7%	63.3%
5	AC83064-1	26.7%	33.3%	60.0%	40.0%
6	AC83064-6	13.3%	46.7%	60.0%	40.0%
7	AC83068-1	13.3%	40.0%	53.3%	46.7%
8	AC83172-1	16.7%	13.3%	30.0%	70.0%
9	AC83306-1	10.0%	36.7%	46.7%	53.3%
10	CO79018-11	0.0%	6.7%	6.7%	93.3%
11	CO81038-6	0.0%	10.0%	10.0%	90.0%
12	CO82142-4	13.3%	26.7%	40.0%	60.0%
13	CO83027-2	33.3%	20.0%	53.3%	46.7%
14	CENTENNIAL	13.3%	23.3%	36.7%	63.3%
15	R. BURBANK	30.0%	16.7%	46.7%	53.3%
16	SANGRE	13.3%	26.7%	40.0%	60.0%
17	WNC230-14	6.7%	10.0%	16.7%	83.3%

30 Tubers were randomly picked and assayed per clone.