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Evaluation of Advanced Clones for Ringrot Expression

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Summary: Thirteen numbered clones and three named cultivars were evaluated for their susceptibility to potato ringrot and the type and timing of symptom expression. All clones and cultivars were susceptible to ringrot infection as evidenced by symptom expression and the presence of ringrot bacteria in the vascular bundles of the stems. Minimum time required for recognizable visible symptoms to appear ranged from 66 to 100 days from planting. Percentage of inoculated plants which showed recognizable symptoms by mid August ranged from 0 to 100%. Some clones showed detectable symptoms in as few as 15-19% of the inoculated plants as late as August 26.

Tubers from all clones and cultivars showed typical ringrot symptoms at harvest time in mid September.

Methods and Materials: Thirteen advanced clones from the Colorado breeding program and three standard cultivars (Table 1) were tested for ringrot susceptibility and symptom expression in field tests in the San Luis Valley. Tubers from each clone and cultivar were cut into seedpieces approximately 1.5 to 2.0 oz. Half of the cut seedpieces were inoculated with Corynebacterium sepedonicum by dipping them into a slurry prepared by macerating infected tubers from the 1986 crop in water with a food blender. The other half of the seedpieces were not inoculated and served as uninfected controls. The seedpieces (both inoculated and uninoculated) wer planted in randomized replicated plots in the San Luis Valley on May 18, 1987. Seven inoculated and seven uninoculated seedpieces were planted in each of three replications.

Plots were furrow irrigated and weeds were controlled during the growing season using conventional methods.

Plants were examined regularly during the growing season (total of seven times) and emergence, date of first symptom expression, number of plants slowing symptoms and the types of symptoms present were recorded.

At maturity tubers from infected plants were dug and examined to determine if ringrot symptoms were present and the types of symptoms expressed.

Results Data (Table 1) show that inoculation had little effect on plant emergence. Stands ranged from a low of 81.0% in Centennial Russet to 100% for Russet Burbank, Sangre and several clones. Earliest symptoms appeared 66 days after planting in Russet Burbank, Sangre, and Clones AC80369-1, AC77101-1, AC77652-1, AC80545-1, CO8011-5, and BR7093-24. Clones BC0038-1, TC582-1 and AC77513-1 showed first symptoms 78 days after planting and the remainder of the clones plus Centennial Russet did not exhibit symptoms until 88-100 days after planting.

The percentage of inoculated plants which showed recognizable symptoms by mid-August (approx. 90 days after planting) ranged from a low of 9.5% in WC230-14 and AC77652-1 to 100% in AC80545-1.

Sangre, AC80369-1, AC77101-1, AC80545-1, CO8011-5, and BR7093-24 developed recognizable symptoms in 75-100% of the inoculated plants by August 14. Russet Burbank, TC582-1, Centennial Russet, and AC77226-13 had symptoms in 25-74% of the plants by mid-August. The remainder of the test clones showed symptoms in less than 25% of the inoculated plants. In clones AC77652-1 and WC230-14 only 9.5% of the plants showed ringrot symptoms and clone AC77226-10 did not show definite readable symptoms in any plants on August 14. Several clones had readable symptoms in less than 25% of the inoculated plants as late as August 26. These included WC230-14, AC77226-10, AC77652-1, AC79100-1, and AC77513-1.

Symptoms in most clones and cultivars were typical of the range of symptoms normally shown by infected plants. The one exception to this was clone AC79100-1 which showed only wilt symptoms. No typical interveinal chlorosis and necrosis ever appeared in this clone.

Stems of all clones and cultivars regardless of whether or not symptoms were present were invaded by the ringrot organism as evidenced by the presence of typical bacterial exudate from the vascular bundles when the bases of the stems were squeezed.

Ringrot-infected tubers showing typical symptoms including surface cracking, vascular discoloration and bacterial exudate from vascular bundles were found in all clones and cultivars (Table 2).

Discussion: Although all clones tested were susceptible to ringrot infection, several of them expressed symptoms late (88 - 100 days after planting), expressed symptoms in an unusually small percentage of infected plants or produced symptoms which would be difficult to read as ringrot during field inspections. Among this group of clones are: AC77226-10 (100 days, 9.5%); AC79100-1 (88 days, 14-19%, wilt symptoms only), AC77226-13 (88 days, 28-43%), and AC77652-1 (66 days, 9.5 - 19%). These clones may prove difficult to manage in a certification program due to their late expression, the low incidence of disease expression and sometimes limited range of symptoms. These clones closely resemble WC230-14 in terms of ringrot expression. On the other hand, there are several clones including AC80369-1, AC77101-1, AC80545-1, CO8011-5, and BR7093-24 which show typical symptoms early in the season (66 days) and a high percentage of inoculated plants (76-100%) show symptoms. This group is much like Sangre and would be desirable in a certification program since infection would likely be easily detected if inoculum were present.

An intermediate group including BC0038-1 and TC582-1 and AC77513-1 shows symptoms earlier than the problem group (about 78 days) and symptoms are expressed by a higher percentage of infected plants. These clones may present detection problems under some circumstances and this fact should be carefully considered prior to release.

Table 1. Response of 16 clones and cultivars to inoculation with Corynebacterium sepedonicum - San Luis Valley, 1987.

Clone/Cultivar	Average emergence (%)	Days to earliest symptom expression	% plants with ringrot symptoms 6/23	6/30	7/13	7/23	8/4	8/14	8/26	Symptoms observed[4]
Russet Burbank	100.0	66	0	0	0	14.3	28.6	33.3	57.1	W, ED, IVC, IVN, MN, Sq
WC 230-14	90.5	88[1]	0	0	0	0	4.8?[3]	9.5	14.3	W, ED, IVC, Sq
Centennial Russet	81.0	88[1]	0	0	0	0	4.8	33.3	33.3	W, IVC, MN, Sq
Sangre	100.0	66	0	0	0	4.8	38.1	85.7	85.7	W, IVC, IVN, MN, Sq
AC77226-10	95.2	100[2]	0	0	0	0	0	19.0?	9.5 + 14.3	W, IVC, Sq
AC80369-1	95.2	66	0	0	0	9.5	66.6	85.7	85.7	W, ED, IVC, IVN, MN, Sq
AC77101-1	95.2	66	0	0	0	4.8	76.2	95.2	95.2	ED, IVC, W, IVN, MN, Sq
AC77652-1	90.5	66	0	0	0	4.8	0	9.5+ 9.5?	19.0	ED, TW, IVC, Sq
AC79100-1	100.0	88	0	0	0	0	0	14.3	19.0	W, Sq
AC77226-13	95.2	88[1]	0	0	0	0	9.5?	28.6	42.9	TW, W, IVC, Sq, MN
AC77513-1	100.0	78	0	0	0	0	9.5	23.8	23.8	TW, ED, W, IVC, MN, Sq
AC80545-1	100.0	66	0	0	0	4.8	23.8	100.0	100.0	W, IVC, IVN, MN, Sq
CO8011-5	90.5	66	0	0	0	9.5	52.4	76.2	76.2	W, ED, IVC, MN, Sq
BR7093-24	100.0	66	0	0	0	19.0	57.1	81.0	85.7	W, ED, IVC, MN, Sq
BC0038-1	100.0	78	0	0	0	0	4.8	14.3	42.9	W, ED, Sq
TC582-1	100.0	78	0	0	0	0	4.8	38.1+ 14.3?	57.1	IVC, MN, Sq

[1]Some plants with questionable symptoms by 78 days
[2]Some plants with questionable symptoms by 88 days
[3]? = plants with marginal symptoms which would not be readily detected during normal field inspections.
[4]W = wilt, TW = terminal wilt, IVC = interveinal chlorosis, IVN = interveinal necrosis, MN = marginal necrosis, ED = early dwarf, Sq = bacterial exudate from stem.

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Table 2. Tuber symptoms resulting from inoculation 16 clones and cultivars with Corynebacterium sepedonicum - SLV, 1987

Clone/cultivar	Tuber symptoms[1]
Russet Burbank	SC, VD, VS
WC 230-14	SC, VD, VS
Centennial Russet	SC, VD, VS
Sangre	SC, VD, VS
AC77226-10	SC, VD, VS
AC80369-1	SC, VD, VS
AC77101-1	SC, VD, VS
AC77652-1	SC, VD, VS
AC79100-1	SC, VD, VS
AC77226-13	SC, VD, VS
AC77513-1	SC, VD, VS
AC80545-1	SC, VD, VS
CO8011-5	SC, VD, VS
BR7093-24	SC, VD, VS
BC0038-1	SC, VD, VS
TC582-1	SC, VD, VS

[1]SC = surface cracking, VD = vascular discoloration, VS = vascular exudate when squeezed