Potato Progress

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Volunteer Potato Update for the Columbia Basin 2002

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Introduction:

We (Seymour & Boydston) have conducted laboratory and field experiments since 1994 to establish the freezing behavior of potato tubers. Laboratory studies showed that tubers are killed by brief exposures in the range of 27.5°F to 28.5°F, but that no injury occurs at 30.2°F regardless of the time of exposure. Field trials confirmed laboratory data and evaluated winterkill of potato tubers under field conditions. This knowledge has enabled us to forecast the potential for volunteer potatoes early in the crop year based on field soil temperature data and on limited field sampling.

All of us are currently cooperating to monitor soil temperatures at three sites representing the range of climatic conditions in the Columbia Basin. Data loggers were installed at the ARS facility at Paterson, WSU Othello, and the Paul Morris farm near Quincy during the last week of November 2001. Soil temperatures are recorded hourly at 2", 4", 6", and 8" depths, and air temperature is recorded at 5 feet and at the soil surface. The instrumentation was calibrated in the laboratory prior to installation to ensure that differences in temperature readings between sites reflect weather conditions and not variability between sensors. Tubers on the soil surface at all three sites were exposed to critical temperatures before instrumentation was installed and were likely not viable by late November, but temperatures were not low enough to freeze buried tubers at any of the sites.

Results:

Soil temperatures at Paterson so far this winter have been insufficiently cold to freeze tubers at the shallowest depth monitored. Minimum soil temperatures to date have been 32.3°F, 33.3°F, 33.9°F, and 34.9°F at 2", 4", 6", and 8" deep, respectively, substantially higher than the temperatures required to kill tubers. Temperature at the soil surface reached 19°F on December 28, so tubers on the surface have been exposed to lethal temperatures and are not viable. Based on Thornton and Newberry's data on number of tuber leavings by depth, we estimate tuber mortality at Paterson to be about 27% so far this winter.

The surface temperature at WSU Othello reached about 15°F on December 29 and minimum soil temperatures to date have been 27.4°F, 31.2°F, 32.4°F, and 33°F at 2", 4", 6", and 8" deep, respectively. All tubers on the soil surface and most tubers at 2" deep have frozen, and frozen tubers were recovered from about 3" deep on January 9. Although soil temperatures have not been cold enough to freeze tubers below 4", many tubers between 2" and 4" are likely not viable. As a result, we estimate current tuber mortality at Othello to be between 42% and 50%.

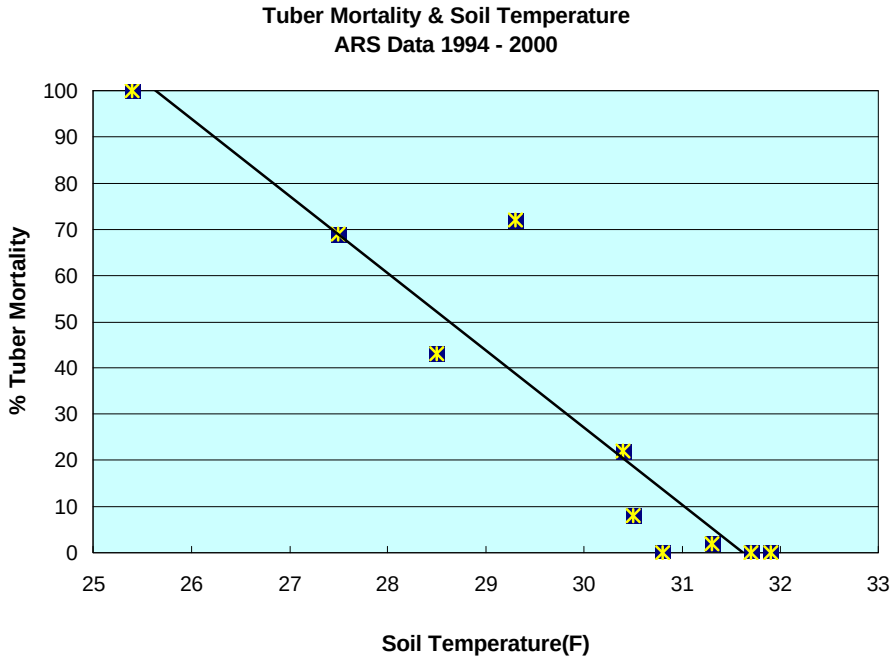
Despite surface temperature minimums of about 15°F near Quincy on December 19, soil temperatures at 2” deep have been substantially higher than at Othello. The soil temperature minimum at 2” deep was 30.2°F, and soil temperatures have remained above freezing at the other three depths monitored. Snow cover insulated the soil when the lowest air temperatures occurred, and as a result only about 22% of tubers at 2" deep were killed. Tubers below 2” deep have survived, and we estimate tuber mortality at Quincy to be about 32% to date.

Discussion:

We will be collecting soil temperature data from all locations monthly, and in February and March we will sample potato fields near the instrumentation to verify our estimates of tuber mortality. Very cold conditions have occurred in the Columbia Basin as late as the last week of February, so about six weeks remain this winter during which tubers may be exposed to critical temperatures. **For further updates, see the Research portion of the WSPC website, www.potatoes.com.**

Minimum Soil Temperature by Depth to January 9, 2002

Depth	Paterson	Othello	Quincy
0”	19.2	14.7	15.1
2”	32.3	27.4	30.2
4”	33.3	31.2	32.8
6”	33.9	32.4	33.3
8”	34.8	32.9	33.7



Breeding for Resistance to Columbia Root-knot Nematode and Corky Ringspot Disease

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Columbia Root-knot nematode penetrates tubers and causes brown spots in the flesh and ugly bumps in the skin. The tobacco rattle virus is transmitted to potato tubers by stubby root nematodes and results in the black sectors known as corky ringspot disease. Soil fumigation with Telone and/or Vapam is the most common treatment for these problems. The combined fumigation may cost up to $350 per acre. In research funded by the Washington State Potato Commission we aim to breed varieties resistant to these two problems.

We have found resistance to root-knot nematodes in several wild species, two endemic to Mexico and one from the southwestern United States. We incorporated the resistance from one of these into advanced breeding lines. Resistance to corky ringspot was found in advanced breeding clones derived from crosses with old European potato varieties. Resistance to corky ringspot is not unusual in European varieties. Until now resistance to root-knot was non-existent in potato varieties.

After obtaining single resistance to each of these problems we have been making crosses to combine them. Every year we conduct numerous distinct components of the project to incorporate these resistances into the promising materials of the Tri-State Variety Development Program. We make crosses of resistant materials among themselves and with superior numbered lines and varieties. We plant out seedling tubers and select single-hills. We plant out twelve-hill plots (which were last year's single hill selections) and select the best of these. Using tubers from last year's selected twelve-hills we plant replicated trials in infested growers' fields and fields at the IAREC-WSU experiment station. Each fall we slice and peel thousands of tubers to obtain resistance scores of numbered breeding clones. After identifying resistant clones with superior agronomic performance and good fry color we virus index tubers of these to select a clean seed supply so that we may multiply the clones and submit them to the Tri-State Program. The USDA/ARS Aberdeen Program, the University of Idaho potato breeding programs as well as the Oregon State University Breeding Program are complementing the work at USDA/ARS, Prosser with the goal of incorporating combined resistance into future varieties.

In the year 2000 growing season we were able to identify promising materials with resistance to corky ringspot tested at growers' fields in Washington and Oregon. Results are shown in figure 1A. We also plant the Tri-State and Western Regional Trials in these infested fields to provide resistance information to the Tri-State Program. Fortuitously, we have information that the late blight resistant clone A90586-11 and the excellent dual purpose clone A9014-2 appear to have significant resistance to corky ringspot disease (Fig 1B.) In a root-knot infested field we were able to narrow our attention down to a number of root-knot resistant breeding clones, Figure 1C.

At the present time the breeding population devoted to this subproject is about 10,000 seedlings per year. We are attempting to increase the size of the population to increase our chances to select variety quality resistant clones in the future.

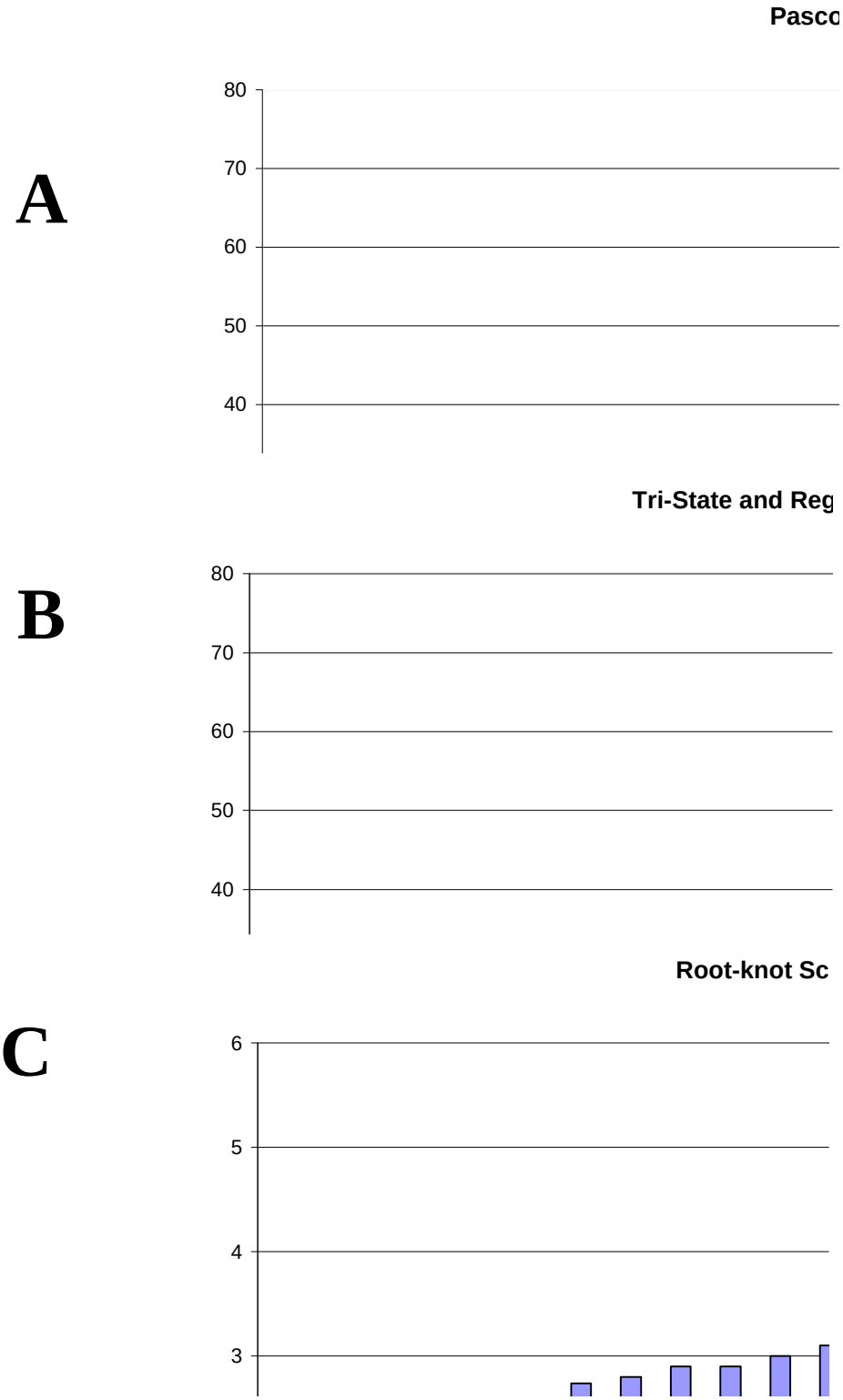

Figure 1. Field screening results in the year 2000 for advanced clones resistant to corky ringspot disease and Columbia root-knot nematode.