

I. Deciduous Orchard Diseases
Chemical and biological control
1. Crown gall; Apple

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Crown gall, caused by Agrobacterium tumefaciens is of economic concern to apple nurseries in British Columbia and worldwide. The biological agent Agrobacterium radiobacter strain 84 has a temporary registration to control crown gall in fruit trees in Canada. Our earlier 3-year study showed that crown gall of apple trees is not controlled by Agrobacterium radiobacter strain 84. This paper reports the study of chemical and biological control of apple trees in the Kootenay valley of British Columbia.

In 1988, 1989 and 1990, field trials were conducted on the same plot at Creston in British Columbia. The site for conducting these tests had a history of severe incidence of crown gall in previous years. Antonovka seedlings were grown in sterilized (121°C, 20 min) soil mixture (peat moss, perlite, soil and sand mixture, 1:1:1:1, respectively) for 3 months before transplanting in the field in the spring of each year. Bacteria grown on agar plate(s) of biocontrol agents and chemical treatments were added to 4L of water for field treatments. Seedlings were dipped into bacterial suspension or chemical treatment solution before transplanting. Sewage sludge was applied as a soil broadcast treatment. Each year, 3-month-old seedlings were planted 30 cm apart and in rows 2 m apart in replicated plots. Spacing between replications was 1 m. Transplants were planted in randomized complete block design.

For the 1988 field trial, six treatments were replicated four times, 13 seedlings per replicate plot. Seven treatments were replicated 4 times, 13 seedlings per plot were planted for the 1989 field trial. For the 1990 trial, nine treatments were replicated 5 times, 15 seedlings per plot. Disease incidence, percent dead trees, and shoot growth were assessed in the fall of each year.

Agrobacterium radiobacter strain 84 did not control crown gall on Antonovka apple seedlings when applied as a root dip in 1988, 1989 or 1990. Copper oxychloride treatment applied at 5 g a.i./L was effective in reducing the crown gall infection but was phytotoxic to young seedlings. Copper oxychloride treatment applied at 2.5 g a.i. and 5 g a.i./L and sewage sludge applied at 260 g per tree as broadcast were effective in reducing the crown gall infection but these treatments were phytotoxic to young seedlings in 1989. Copper oxychloride at lower concentrations (0.3, 0.6 and 0.9 g a.i./L) and sewage sludge at 130 g per tree as broadcast did not control crown gall in the 1990 field trial. The strain AB8 of Bacillus subtilis applied as root dip treatment significantly reduced the crown gall on Antonovka seedlings and was not phytotoxic to young seedlings.