

Tree Fruit Diseases

Influence of Nitrogen and Phosphorus Applied as Broadcast, Foliar, Planting Hole Treatment, and Fertigation on Incidence of Crown and Root Rot of Apple Trees

Raj Utkhede and Emmerson Smith

Agriculture and Agri-Food Canada Research Station, Summerland, B.C., Canada

Keywords: crown rot, root rot, *Phytophthora cactorum*, apple

Phytophthora cactorum crown and root rot (PCRR) is one of the most serious soilborne diseases of apple trees (*Malus domestica*) in the Okanagan Valley of British Columbia. Controversy exists over the relationship between nitrogen fertilizers applied to soil and the severity of plant diseases. Information is lacking on the effect of nitrogen form and application methods (as a soil, foliar treatment, or through drip irrigation systems) on the incidence and severity of PCRR.

The field test was conducted in a sandy loam soil at the Agriculture Canada Summerland Research Station. The soil (pH 6.2) in the field trial area contained 32 mg kg⁻¹ N, 73 mg kg⁻¹ P, 213 mg kg⁻¹ K, 232 mg kg⁻¹ Mg, 1211 mg kg⁻¹ Ca, 30 mg kg⁻¹ Na, and 2.8% organic matter. One-year-old Macspur on MM.106 rootstocks were planted on 15 April 1985 with spacings of 3.5 m between rows and 1 m between trees. Six treatments were arranged in a randomized complete block design with 4 replications. Each plot consisted of 8 trees. The treatments were: 1) ammonium nitrate (34-0-0-NPK) broadcast in spring (April) at 240 g tree⁻¹ year⁻¹ (233 kg ha⁻¹ N year⁻¹); 2) ammonium nitrate broadcast in spring and early autumn (September) at 120 g tree⁻¹ year⁻¹ (233 kg ha⁻¹ N year⁻¹); 3) ammonium nitrate applied in the irrigation water at 7.5 g tree⁻¹ wk⁻¹ (73 kg ha⁻¹ N year⁻¹) for 10 wk year⁻¹; 4) urea (46-0-0 NPK) applied to runoff as a foliar spray in spring and early autumn each year at 1.00 kg 100 L⁻¹ of water (28 kg N ha⁻¹ yr⁻¹); 5) monoammonium phosphate (11-55-0 NPK) applied as a planting hole treatment at 1 g L⁻¹ of soil (31 kg N ha⁻¹) at planting, and 6) unfertilized control. Soil around each tree was infested with *P. cactorum* annually in mid-June. The trees were irrigated with microjets for 4 h immediately after soil infestation with *P. cactorum*. During the growing season the test plot was irrigated with 50 liters of water delivered for 4 h at 2-day intervals. Weeds, insects, and foliar diseases were controlled by standard orchard practices. The presence or absence of *P. cactorum* in the bark or roots of symptomatic trees was confirmed every year. A disease rating (1=healthy—no infection at all; 2=initial—less than one-fourth of the bark/roots at the crown region infected; 3=intermediate—about one-fourth to one-half of the bark/roots infected; 4=terminal—more than half the bark/roots infected; 5=dead—tree trunk is completely girdled, all roots are infected, and the tree is dead) was assigned to each tree in late September of years 1987-1993.

This eight-year study has shown that ammonium nitrate applied as a single dose in spring at 240 g tree⁻¹ year⁻¹, as a split dose at 120 g tree⁻¹ each in spring and early autumn, and in irrigation water (fertigation) at 7.5 g tree⁻¹ wk⁻¹ for 10 wk year⁻¹ significantly increased phytophthora crown and root rot of Macspur on MM.106 rootstock. There was no significant difference in *P. cactorum* infection between the unfertilized control and treatments with urea

Proceedings of the 69th Annual Western Orchard Pest & Disease Management Conference

applied as a foliar spray at 1.0 kg 100 L⁻¹ of water in spring and early autumn and monoammonium phosphate applied as a planting hole treatment at 1 g l⁻¹ of soil at planting time.