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Commentary

Chemical Measures to Control Citrus Canker by *Xac*

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DESCRIPTION

Several species and varieties of citruses are subjected to different biotic and abiotic factors. Among the different animate diseases fungi, bacteria, algae, viruses and phytoplasma are important. The bacterial disease, citrus canker (*Xanthomonas axonopodis* (formerly *campestris*) *pv. citri*) is one of the most serious threats having international importance. Citrus canker is mainly a leaf-spotting and rind-blemishing disease; however, when conditions favour disease development, defoliation, shoot die back, and fruit drop occur. All aboveground citrus tissues are susceptible to *Xac* infection under field conditions. *Xanthomonas axonopodis pv. citri* (*Xac*) probably originated in Southeast Asia or India and presently occurs in over 30 countries including the United States (Florida) and Australia (northern region). The disease causes extensively damage to citrus and severity of canker infection varies with the species and varieties of citrus and the prevailing climatic conditions.

Different chemicals have been sprayed in different areas over quite long period of time. Among the antibiotics and fungicides treated against *Xanthomonas citri*, thiram (a fungicide made up of thiuram disulfide and the oxidized dimer of dimethyldithiocarbamate) was the most effective in checking the disease upto 500 ppm or higher concentration. Thiram was as effective as streptomycin sulphate, streptocyclin and agrimycin. Thiram activity was reduced when treated in combination with any of these antibiotics. Tests showed that thiram persisted on Eureka lemon 15 days after spraying. The results indicated that thiram may be useful in controlling citrus canker. *Xanthomonas campestris pv. citri* does not survive for long periods in the soil, in association with non-host plants or in plant debries. Copper based bactericides and wind break trees could significantly reduce the development of the disease. Foliar spray of 100 ppm streptocyclin+0.1% Copper oxychloride on *Xanthomonas axonopodis pv. citri* infection of 6 years old Kagzi lime was done in Maharashtra, India. Sprays were applied at the intervals of 7, 15 and 21 days and the most cost effective chemical control was achieved by spraying at intervals of 7 or 15 days.

The effects of windbreaks and copper based bactericide applications alone and in combination, incidence of citrus canker and its spread was observed. Copper based bactericide did reduce disease incidence and spread but not as effective as windbreaks. Skaggs Bonanza navel orange tree, which were treated by spraying different concentrations of compounds including 56% cuprous oxide, agro- streptomycin, 77% copper hydroxide and 50% Shajunwang (fungicide), results showed that the best treatment was 50% Shajunwang which achieved up to 94.5% control. Testing of copper hydroxide, carbendazim, sulfuric acid, streptomycin and bordeaux mixture for control of *Xanthomonas citri* (*Xac*) (*X. axonopodis pv. citri*) on citrus trees, the result showed that copper hydroxide gave the best disease control at 800 times concentration.

Copper-based products are routinely used as a standard control measure for citrus canker. Copper treatment induces the viable but non-culturable state in *Xac* but does not prevent the development of symptoms in susceptible plants. Short-term exposures to different concentrations of copper solutions were assayed by them to determine which treatment resulted in *Xac* non-culturability. Treatment of 106 ml^{-1} *Xac* cells for 10 min in a 135 micro M $CuSO_4$ solution (equivalent to three times the free soluble copper concentration applied in one field treatment) resulted in nonculturability. However, 16% of cells were viable based on 5-cyano-2,3-ditolyl tetrazolium chloride staining and 1% were capable of producing canker lesions after infiltrating grapefruit plants. Thyme essential oil and some chemical compounds are effective in controlling of citrus canker in Iran. The efficacy of copper application to summer and autumn leaf flushes against citrus canker (caused by *Xanthomonas axonopodis pv. citri*) in lemon is also found effective in controlling citrus canker.

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