2004 PROGRESS REPORT
STATE HORTICULTURAL ASSOCIATION OF PENNSYLVANIA, INC.

Evaluation of Materials to Reduce Over-wintering Apple Scab

Personnel: James W. Travis and Noemi O. Halbrendt, Penn State University, Fruit Research and Extension Center, P.O. Box 330, 290 University Drive, Biglerville, PA 17307

Duration: Year 1 of 3 year project.

Justification:

Apple scab, caused by the fungus *Venturia inaequalis* is a serious disease of apple affecting commercial production in Pennsylvania. The major consequence of the disease is a reduction in quality of the infected fruit and the increased need for synthetic fungicide application in orchards. Without proper management, losses of 70% or more in marketable fruit are likely.

The apple scab fungus overwinters on dead apple leaves on the ground. Wet weather in the spring and summer of 2004 resulted in high carry-over inoculum potential for apple scab in 2005. In early spring the fungus spreads from dead leaves on the orchard floor into the tree by the release of ascospores during rain events that result in infection periods. The release of ascospores coincides with bud break and normally continues for up to 5 weeks after petal fall. Under favorable conditions of temperature and moisture, the ascospores germinate and penetrate the leaf or fruit. The fungal body (mycelium) quickly colonizes the sub-cuticular layer, where it produces abundant numbers of spores to spread the disease. The production of spores continues until the cuticle ruptures and characteristic scab lesions appear. In autumn, at leaf fall, the scab fungus survives inside the infected leaves on the ground, which completes the life cycle.

At present, a preventive program of multiple applications of conventional synthetic fungicides applied to the tree canopy control apple scab in most seasons. These sprays are a significant cost to growers. For a scab control program to be effective, leaves and fruit must be treated immediately before or after rain events during the period from bud break to mid June. If apple scab is not prevented during 'primary' infection periods, secondary infection cycles occur that continue throughout the season until harvest as was experienced throughout much of Pennsylvania in 2003 and 2004. If primary infections can be reduced or prevented through the reduction in scab spores being released from over-wintering leaves on the ground, growers will have a better opportunity to control scab and may be able to reduce fungicide applications and cost. Besides the cost, the repeated application of a fungicide also raises the potential of fungicide resistance. An apple scab control method that provides an alternative approach would be of great interest and benefit to apple growers since it would have the potential of producing a quality apple, at perhaps a lesser cost and less risk of fungicide resistance. This project proposes to continue to evaluate materials that will reduce over-wintering apple scab in fallen leaves in the orchard by promoting early leaf degradation and / or scab fungal mortality.

Microbial Extracts
Microbial extract brewed aerobically with a microbial food source that enhances populations of beneficial microorganisms. Extracts from mushroom substrate was shown to inhibit germination of spores of *V. inaequalis* in an *in vitro* assay and seedling trees in growth chambers (Yohalem *et. al*, 1994). Microbial extracts have a wide range of mechanisms that include inhibition of spore germination, antagonism, and competition with disease organisms that potentially contribute to disease suppression (Cronin *et. al*., 1996).

Dolomitic Lime
Dolomitic lime (50% Ca Oxide, 40 % Mg Oxide, 4% other lime) applied to the orchard floor after leaf drop has been shown to reduce spring spore counts by 50 to 90% (Spotts, et. al., 1997, OSU Extension Service - www.goodfruit.com/link).

Urea

Autumn or early spring urea applications have been shown to lower over-wintered apple scab levels in the orchard by increasing leaf degradation and by creating an alkaline condition that suppresses the number of scab spores produced. Urea softens leaf tissue which promotes degradation by microorganisms and thus may promote the buildup of organisms antagonistic to apple scab in orchards (www.agf.gov.bc.ca/cropprot/tfipm/applescb., Burchill, 1968).

Research Objectives:

This project evaluated alternative and traditional materials for apple scab management in Pennsylvania. Data collected from this project will give management options to apple growers to manage apple scab in fallen leaves. Fall ground application of several materials is expected to reduce the over-wintering apple scab and subsequently reduce the number of applications of conventional fungicides required in the early season.

Materials and Method:

1. Laboratory Experiment

a. Conducted a bioassayed to determine the viability of frozen block of fungal antagonist *Microsphaeropsis ochracea* (P30A) obtained from Ron Hampton of Agro Engage, Canada.

b. Evaluated the microbial activities of different kinds of compost that was used to brew and extract fungal antagonistic biomass prior to orchard application.

2. Orchard Evaluation (November - December 2004)

The orchard trial was conducted in the Penn State Fruit Research and Extension Center research orchards to evaluate the efficacy of several available alternatives including biocontrol agents and microbial extracts that inhibit conidial germination of *V. inaequalis.* Treatments were established on a five-cultivar apple block in a randomized complete block design with 4 replications. Spray treatments were applied on the ground in the fall with a boom sprayer at 50 psi and 50 gal/A.

3. Scab Assessment to be accomplished this spring of 2005 (April - June)

Impact on spring ascospores production will be determined by microscopically examining the number of mature ascospores surviving in the leaf litter in each treatment plot. At least twenty five apple leaves per treatment replicate were collected after leaf fall in 2004 and prepared for over-wintering in vinyl coated mesh bags. These samples were placed out under the apple trees and treated last fall of 2004. The number of ascospores will be counted in spring of 2005. Data will be analyzed for significant treatment differences by analysis of variance.

Results:

The orchard fall ground application to overwintering scab infected leaves was conducted at the Pennsylvania State University, Fruit Research and Extension Center orchards, Biglerville, PA on a mature five-cultivar ('Rome Beauty', 'Golden Delicious', 'Stayman', 'Cortland', and 'Red Delicious') orchard of dwarf/Malling 26 rootstocks spaced at 35 x 10 x 8 ft. Trees were arranged in a randomized complete block design with 4 replications. Sprays were applied with a boom sprayer at 50 psi, which delivered 50 gal/A. Treatment applications were made when 70-90 % leaves have fallen (3 Dec). Treatment programs included 1) Microbial extracts/Compost tea, 2) Urea 5% (v/v), 3) Dolomitic lime 3000 lbs/A, 4) Compost 5 T/A, and 5) Water control. Fallen leaves were collected and placed between vinyl coated mesh bags and placed under the trees prior to treatment application. Several observations on ascospores production will be conducted this spring (April-May 2005) by microscopically examining the number of mature ascospores surviving in the leaf litter in each treatment plot. Data will be analyzed for significant treatment differences by analysis of variance.

The apple scab antagonist *Microsphaeropsis ochracea* reported by other workers (Bernier et. al, 1996; Benyagoub et.al., 1997; Carisse et. al., 2000) to reduce air-borne ascospores in the spring by 70-80 % was not included in the fall trial because it did not demonstrate suppression of apple scab in the 2004 spring orchard trials.

There is a need to continue this project to evaluate the effectiveness of alternative materials on fallen apple leaves over several growing season.

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