EVALUATION OF THE APPLE CULTIVAR KALEI® (RS103-130) FOR APPLE SCAB RESISTANCE IN WALDEN NY

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REPORT ON 2019 TRIAL FOR TESTING THREE APPLE CULTIVAR RESISTANCE TO APPLE SCAB FUNGUS *Venturia inaequalis*

Introduction

***Apple scab inoculum*:** *V. inaequalis* ascospores in leaf litter from natural infections established on untreated control trees in 2018 season, collected and imported to Walden NY plots from Highland NY.
***Cultivars*:** Kalei (RS103-130, Apple and Pear Australia Ltd.), third leaf. Ginger Gold, third leaf. Premier Honeycrisp, fourth leaf.
***Timeline and details of experiment set up*:**
14 March2019 – Visited and selected cultivar test plots for three cultivars in Walden NY.
28 March 2019 – Transplanted Ginger Gold trees next to Kalei and put up the isolation plastic barriers to prevent fungicide spray drift inflow into the eight-tree plots of the three cultivars (Fig-s 1 and 2). First primary inoculum of *V. inaequalis* in equal amounts per tree as leaf litter was introduced into the plots on the same day when barriers were installed.
4/22/2019 – Second inoculum of *V. inaequalis* in equal amounts as leaf litter per tree was introduced.
4/25/2019 – Third primary inoculum of *V. inaequalis* in equal amounts per tree as leaf litter was introduced into the plots.
6/4/2019 – Secondary scab inoculum i.e. conidia in the form of current-season infected spur and shoot leaves of McIntosh was introduced from an infected orchard in Clintondale NY. Branches with these leaves were placed in 1-gal water flasks to extend inoculum freshness and conidia release over extended time.
7/22/2019 – Apple scab disease incidence was rated on spur leaves and fruit.

Figure 1. Isolation of Kalei and of Ginger Gold plots for preventing fungicide spray drift inflow to the untreated trees of two tested apple cultivars for resistance to apple scab.

Figure 2. Premeir Honeycrisp plot on the left with isolation walls in proximity to Kalei and Ginger Gold plot (right) for preventing fungicide spray drift inflow for testing resistance to apple scab.

Materials and Methods

Each cultivar plot inside the isolation consisted of 7 (Ginger Gold) to 9 trees (Kalei, Premier Honeycrisp) We rated six trees of each cultivar. The percent scab infection incidence on spur leaves was calculated from the number of leaves with scab lesions versus the leaves without lesions on 20 randomly selected spur leaf clusters per tree. The percent scab incidence on fruit was calculated from the number of fruit with scab lesions versus the fruit without lesions on all fruit that each tree contained (ranged from 11 to 83 fruit per tree replicate for Kalei; 14 to 25 for Ginger Gold; 36 to 59 on Premier Honeycrsip). Disease incidences on leaves and fruit were subjected to Wilcoxon Rank Sum Test (α=0.05).

We monitored predicted (weather forecast) and actual apple scab infections (data collected in Walden NY from NEWA weather station: http://newa.cornell.edu/index.php?page=weather-station-page&WeatherStation=wal) using RIMpro model (RIMpro B.V., Zoelmond, Netherlands). To correctly calibrate RIMpro apple scab model, thus increasing the accuracy of predictions of apple scab infections and their severity on this location, we determined two biofixes: green tip date in Walden NY and the date of first ascospore release from last-years leaf litter placed in Highland NY. Green tip, which is when the earliest apple cultivar susceptible to scab reaches 50% of fruit buds at green tip, was reported on 3 April in Walden NY. We monitored apple scab ascospore release in Highland NY using vacuum spore trap tower (Fig. 3) and detected the first ascospore release on 28 March, but due to the higher detected abundance of caught ascospores we adjusted this date for Walden NY to an earlier date of 25 March.

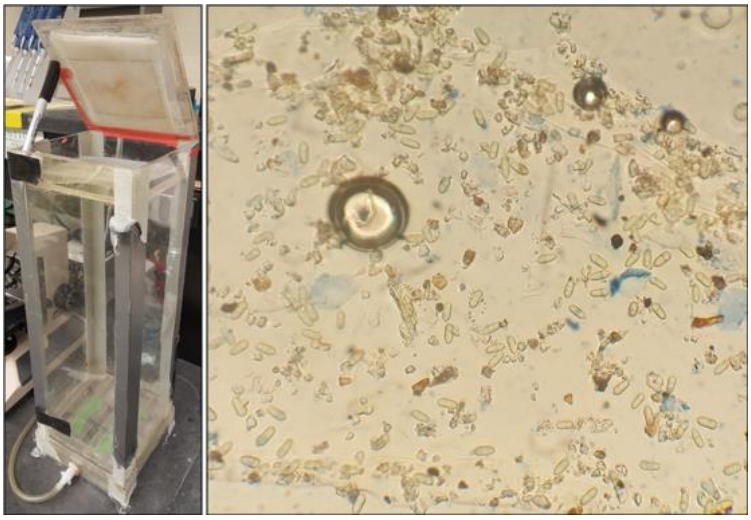

Figure 3. Vacuum tower for trapping apple scab ascospores on glass microscope slides (left). Observed and counted ascospores on a Vaseline coated microscopic glass slide (right). Each run of the scab spore trap tower contains three glass slides and total of six vacuum-concentrating spots examined for ascospore presence.

Additional information on determining the 2019 biofix date is available here: 3/28/2019: First Apple Scab Ascospores Detected in Vacuum Spore Trap in Leaf Litter from Highland NY – Farms in Lower Hudson Valley Set your Scab Biofix! by Acimovic Lab Posted on March 28, 2019. During this trial there were 10 major primary apple scab infection periods (ascospores) according to RIMpro (Fig. 4). Along with the introduced primary inoculum this demonstrates robust exposure of untreated trees of Kalei and the other two cultivars to abundant *V. inaequalis* inoculum. In addition, we exposed the trees to strong secondary inoculum (conidia).

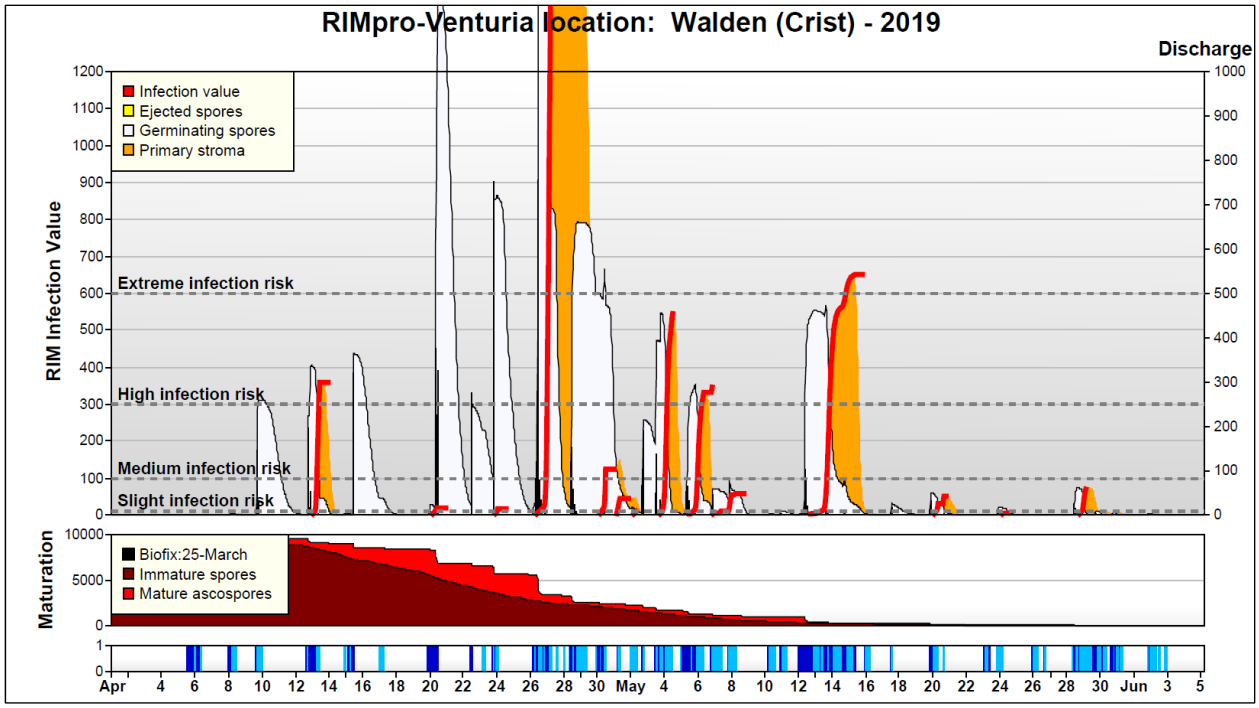

Figure 4. Actual (historical) RIMpro apple scab infection periods in 2019 for Walden NY. (A) White camel hump-like areas labelled "Germinating spores" designate cumulative number of *Venturia inaequalis*

ascospores that germinate over time and are read using the right-side vertical Y-axis scale that is labelled "Discharge". (B) Small black bars, right at the beginning of white humps, which are seen better by using the zoom-in tool on the RIMpro screen, show the number of spores ejected from leaf litter in the orchard during each one-hour interval. (C) The red curved line is the RIM infection value which, when divided by 100, is roughly the percentage of the total season's ascospores that are likely to cause infection in any given infection period. Read each curve's peak RIM infection value/s using the vertical Y-axis scale on the left-hand side of the graph labelled "RIM Infection Value". (D) Orange area called "Primary stroma" represents scab lesions that were initiated by infection from germinating spores and that are incubating in the leaf and which indicates the time during which kick-back fungicides can be applied. Incubating infections are worth noting because, if no fungicide was in place before the infection event began, some or all of the incubating infections can still be eliminated by using fungicides with post-infection activity. (E) The light red area in the middle "Maturation" graph is the proportion of mature ascospores that are ready for discharge with wetting events whereas the dark red area (E) shows the proportion of immature ascospores remaining in leaf litter. (F) The dark blue bars in the wetting graph with dates, at the bottom, are the actual rain periods. (G) The light blue bars next to dark blue bars are actual wetting periods when no rain is falling but trees continue to be wet after rain. Image used by permission of RIMpro B.V., Netherlands and Crist Bros Orchards Inc.

Results

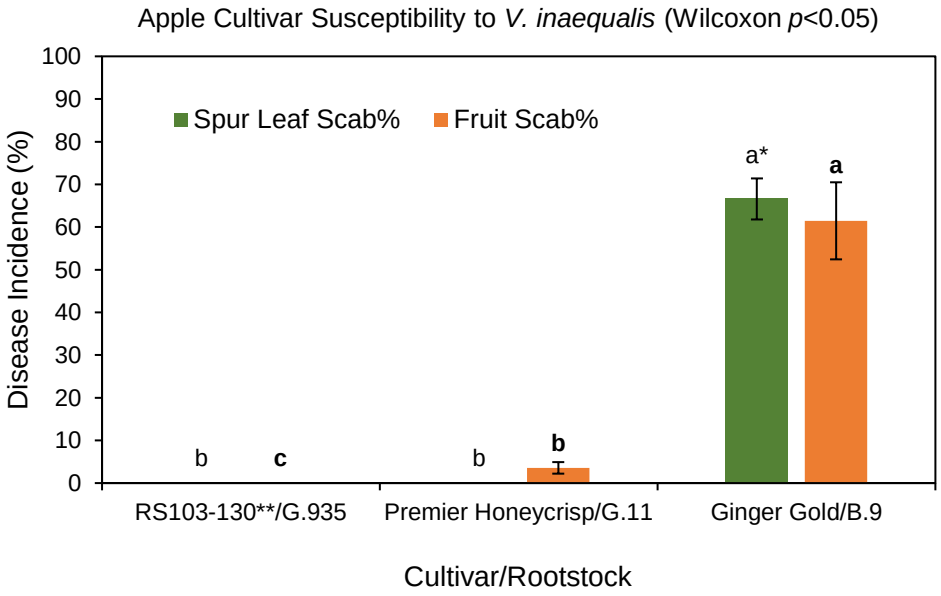

Figure 5. Apple scab incidence on apple spur leaves and fruit for Kalei, Premier Honeycrisp and Ginger Gold in 2019. *Incidence means followed by different type of letters within the same cultivar i.e. bar color are significantly different ($p < 0.05$). Error bars represent standard error of the mean (SEM). Each mean consists of 6 replicate trees. ** More info on Kalei (aka RS103-130) apple cultivar: https://patents.google.com/patent/USPP20028P3/en , http://www.fruticultura.agr.br/palestras_2019/pdf/Pal_6_Dr_Craig_Chester.pdf , https://www.treefruit.com.au/tree-fruit/2012/item/103-new-apple-opportunities-kalei-variety-azana-brand

On 22 July 2019, there were no apple scab symptoms detected on Kalei (Fig. 5). Premier Honeycrisp had very few "pin-point" scab infections on fruit that were not significantly different from zero infections detected on Kalei. It is unclear why there was not a single infection detected on examined leaves of Premier Honeycrisp, however, it is possible that organs differ slightly in their response to high levels of inoculum, especially on a newer Honeycrisp clone like this. However, on Ginger Gold apple scab infections on fruit and leaves were severe reaching incidence of 61 and 67%, respectively, indicating that infection pressure secured in the trial was severe and that the isolation protection walls around the test plots prevented inflow of fungicides into the test plots. One more year of testing Kalei is recommended to confirm this result and reaffirm validity of these results with two years of data, which are always necessary in field trials like this.

Report compiled by Dr. Srdjan G. Acimovic, plant pathologist at Cornell University's Hudson Valley Research Laboratory. Weather data for Walden NY during 2019 can be provided upon request. This report is available from November 2019 on this link: http://blogs.cornell.edu/acimoviclab/pesticide-efficacy-trials/

From: 7/22/2019 – 9/17/2019