Short Note 6.3

Comparison of Department Website Justification Statements

Soon after the 1900-ft program was implemented in residential areas of Broward and Miami-Dade counties, the Department added a webpage entitled, "Summary of the Justification for Removing Canker-Exposed Trees within 1900 Feet of Infected Trees." It would be used by public information officers, in explaining the ability of the 1900-ft rule to capture a high percentage of the subsequently infected trees.

Many versions of this statement would appear in the media, quoting Department officials. The interesting part of this, was the justification statement changed during the program. The statement was authored by Drs. Wayne Dixon, Timothy Schubert and Xiaoan Sun. Only Dr. Sun had been a co-author of the two articles (January 2001 and April 2002) on the field study.

The first important change to the statements concerns the removal of infected trees in the Broward sites after they were found with citrus canker. The first justification statement, prior to the publication of the April 2002 article stated that none of these trees were cut down. This was later changed to read that all of the infected trees were promptly removed. In Site B1, there were 450 infected citrus trees and in Site B2, there were 229 infected citrus trees, for a total of 679 infected trees. The trees would be removed in the 12 to 18 months of the study. It is uncertain exactly when inspections began in the Broward sites.

Mr. Gaskalla stated at the Public Hearings in November 2001 that Dr. Sun was responsible for the identification of the oldest lesion on each infected tree. So, it seemed very odd that Dr. Sun, with his knowledge of the field study, could make inspections, and not know the trees were being cut down. He would have to arrive and make his inspections prior to the removal of these trees. It was later stated that Dr. Sun was actively making inspections of lesion ages during the first eight months of the study.

The statement of how effective is the 1900-ft rule depends on which justification statement is used. The first justification statement indicated that the rule would eliminate all subsequent infected trees 19 out of 20 times, while a later statement changed this to 17 out of 20 times. These ratios correspond to 95% and 85% levels, respectively.

Initially, the Department had a simple statement that the rule would capture, on the average, 95% of the subsequently infected trees. Then, they made another statement that the rule would also be successful in eliminating all subsequent infected trees 95% of the time. Both of these statements can be found in legal briefs filed in by the Department. Then there is this new statement which appears in the justification statement, which states that there is a <u>minimum</u> 17 out of 20 chance (85%) of complete eradication using the 1900-ft rule. So, this would cover the 19 out of 20 chance (95%) statement. It should be added that none of these statements can be found in either of the two published articles.[1,2] on the field study.

Summary of the Justification for Removing Canker-Exposed Trees within 1900 Feet of Infected Trees.

[1] An epidemiological study is designed to track disease spread so that intelligent regulatory or other disease management options can be targeted to best advantage. Epidemiological studies conducted in both commercial and residential citrus in Florida and South America over the last 10 years have strongly reinforced the concept that removal of citrus exposed to citrus canker inoculum from infected trees is an essential component of any successful eradication program.

[2] Inoculum of the canker pathogen is dispersed in two ways: via wind-blown rain, and by human activity that involves the transport of infected or contaminated plants, tools, clothing, etc. The removal of exposed plants is crucial for eradication because the best detection methods currently available for disease detection are always well behind the actual expression of the disease on host plants. Delays in detection are caused by slow expression of detectable disease symptoms after infection and the constraints on visual survey methods.

[3] The most recent epidemiological study used mixed age and varieties of residential citrus, and was conducted in North Dade and South Broward Counties during 1998-99. A description of this study is being prepared for publication.

[4] Four study sites were selected based on their relative isolation from each other, the recent appearance of only a few infected trees in each area, and the absence of the disease in the surrounding citrus. At the beginning, all citrus (ca. 19,000) in the vicinity were identified and their location plotted using satellite-based global positioning technology. The disease status of each tree in the study area was then determined on a 30-day basis by a field plant pathologist. The trees infected at the outset were identified as focal trees, and presumed to be the direct or indirect source of inoculum for all subsequent disease development in the area. The data taken on each visit consisted of a determination of whether canker lesions were present or absent, host variety and age/size, lesion age, an estimate of disease severity based on percent of canopy exhibiting lesions, and location of the lesions within the canopy. Data was collected every 30 days at each of the study sites to monitor disease progress over time through the area. All trees remained in place throughout the course of the study.

[5] The main conclusion that can be drawn from the composite data is that subsequent infections resulting from inoculum dispersal from focal trees lie within approximately 1200 feet 90% of the time, within 1900 feet 95% of the time, and within 2700 feet 99% of the time. In other words, in order to eliminate the next generation of canker infections (ones that are already established and not yet detected), the project will be successful nineteen times out of twenty if all citrus trees within 1900 feet of the infected tree(s) are removed. The program selected the 95% success level as striking a balance between taking too few and too many trees and still reaching the goal of eradication.

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Changes to FDACS Justification Statement (see Comparison Statement)

It should be remembered that the FDACS Justification Statement was the only source of information for residents when the bulk of the residential cutting took place in year 2000 - 2002. Further, the average resident would not be able to understand most of the April 2002 article, as it contained advanced spatial statistical analyses.

1. First and second paragraphs remain the same. Third paragraph was updated to reflect the fact that two peer-reviewed articles were published.

2. Fourth paragraph was changed from 4 sites to 5 sites. Interesting the wording is still the sites were relatively isolated from each other, although sites B1 and B2 were adjacent to each other as a result of a subdivision of Site 4. No mention of the subdivision of Site 4.

3. Fourth paragraph, fourth sentence was changed from "... were presumed to be the direct or indirect source of inoculum" to "... were presumed to be the source of inoculum." So, instead of explaining what an indirect source of inoculum might be, the word was eliminated.

4. Fourth paragraph third and sixth sentence, was changed from "... every 30 days" to "... was determined on a regular basis" in regards to inspection frequency. Change eliminate any information on how often inspections were done. Dr. Sun was supposedly responsible for inspections. How could he not know how frequently inspections were conducted? It is noted that 30-days is repeated twice.

5. Fourth paragraph, last sentence was changed from, "All trees remained in place throughout the study" to "All trees remained in place throughout the course of the study for the three sites in northern Dade County and all identified infected trees were removed as soon as possible after identification from the two sites in southern Broward." This change makes the summary consistent with the April 2002 article. [2]

6. Fifth paragraph, first sentence, "... 1900 feet" is changed to "... 1950 feet."

7. Fifth paragraph, first sentence, added in parenthesis, "... (as with all biological phenomena, absolute precision in predictions is not possible)."

8. Fifth paragraph, second sentence, "... 19 out of 20 times" changed to "...a minimum of 17 out of 20 times." This is an 85% chance. Making the 1900-ft policy effective a minimum 85% of the time would covers the prior statements that it is 95% successful. It is pretty weird to have a minimum success probability. There is no similar statement in the published articles.

9. Fifth paragraph, second sentence, the phase"... 95% success level" changed to "... 1900 feet". Also, added at the end of this sentence, ... if removed within a reasonable time frame."

10. After fifth paragraph, second sentence, a sentence is added, "A composite analysis of the data from all five study sites is the basis for that determination." The sentence is interesting, because the prior justification statement states the 1900-ft rule is based on data from four sites. The "determination" is likely a reference to the idea that 1900-ft would "strike the proper balance" between removing too many or too few trees.

11. Additional paragraph added, "The application of the 1900' exposure radius rule has resulted in successful eradication of citrus canker in a number of both residential and commercial plantings in Central and South Florida."

The comparison justification statement as provided on the next page was likely produced in year 2006, as it is entitled "Citrus Health Response Plan." An Adobe pdf file of this justification statement will be posted on the website, and hopefully easier to read in this form.

Other justification statements will be posted on the website.

Comparison Justification Statement (~ posted in 2006)

Citrus Health RESPONSE PROGRAM

Working together to produce healthy citrus

Summary of the Justification for Removing Canker-Exposed Trees within 1900 Feet of Infected Trees

An epidemiological study is designed to track disease spread so that intelligent regulatory or other disease management options can be targeted to best advantage. Epidemiological studies conducted in both commercial and residential citrus in Florida and South America over the last 10 years have strongly reinforced the concept that removal of citrus exposed to citrus canker inoculum from infected trees is an essential component of any successful eradication program.

Inoculum of the canker pathogen is dispersed in two ways: via wind-blown rain, and by human activity that involves the transport of infected or contaminated plants, tools, clothing, etc. The removal of exposed plants is crucial for eradication because the best methods currently available for disease detection are always well behind the actual expression of the disease on host plants. Delays in detection are caused by slow expression of detectable disease symptoms after infection and the constraints on visual survey methods.

The most recent epidemiological study of citrus canker used mixed age and varieties of residential citrus, and was conducted in North Dade and South Broward counties during 1998-99. To date, two peer-reviewed journal articles have been published in the journal *Phytopathology* (see citations below).

The study was done in an area where canker was only recently established, where the citrus leafminer was present (a new factor in the epidemiological equation for the Western Hemisphere), and where many thousands of trees in five separate sites could be monitored to provide the data for the study. This scenario was made possible only because of the unfortunate continued spread of the disease into new areas in spite of various protocols that had been utilized previously in the program. Previous methods included hatracking exposed trees; removing all exposed trees within 125 feet; removing of all infected trees and only infected trees as soon as possible after discovery.

The five study sites were selected based on their relative isolation from each other, the recent appearance of only a few infected trees in each area, and the absence of the disease in the surrounding citrus. At the beginning, all citrus trees in the vicinity (approximately 19,000 in all) were identified and their location plotted using satellite-based global positioning technology. The disease status of each tree in the study area was then determined on a regular basis by a field plant pathologist. The trees infected at the outset were identified as focal trees, and presumed to be the source of inoculum for subsequent disease development in the area. That new population of infected trees was then considered the source of inoculum for the next generation of infections, etc. The data taken on each visit consisted of a determination of whether canker lesions were present or absent, host variety and age/size, lesion age, an estimate of disease severity based on percent of canopy exhibiting lesions, and location of the lesions within the canopy. Data was collected on a regular basis and then "parsed" into 30-day intervals at each of the study sites as a means of monitoring disease progress over time through the area. All trees remained in place throughout the course of the study for the three sites in northern Dade County, and all identified infected trees were removed as soon as possible after identification from the two sites in southern Broward County.

The main conclusion that can be drawn from the composite data is that subsequent infections resulting from inoculum dispersal from focal trees lie within approximately 1200 feet 90% of the time, within 1950 feet 95% of the time, and within 2700 feet 99% of the time (as with all biological phenomena, absolute precision in predictions such as this are not possible). In other words, in order to eliminate the next generation of canker infections (ones that are already established and not yet detected), the project will be successful a minimum of seventeen times out of twenty if all citrus trees within 1900 feet of the infected tree(s) are removed within a reasonable time frame (30-60 days) after discovery. A composite analysis of the data from all five study sites is the basis for that determination. The program selected the 1900-foot exposure radius as striking a balance between removing too few and too many trees and still reaching the goal of eradication.

The application of the 1900' exposure radius rule has resulted in successful eradication of citrus canker in a number of both residential and commercial citrus plantings in Central and South Florida.

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Citations:

Gottwald, T. R., G. Hughes, J. H. Graham, X. Sun, and T. Riley. 2001. The citrus canker epidemic in Florida: The scientific basis of regulatory eradication policy for an invasive species. *Phytopathology* 91: 30-34.

Gottwald, T. R., X. Sun, T. Riley, J. H. Graham, F. Ferrandino, and E. J. Taylor. 2002. Geo-referenced spatiotemporal analysis of the urban citrus canker epidemic in Florida. *Phytopathology* 92: 361-377.

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References:

1. Gottwald, T. R., Hughes, G., Graham, J. H, Sun, X., Riley, T., 2001, The Scientific Basis of Regulatory Eradication Policy for an Invasive Species, Phytopathology, 91:30-34.
2. Gottwald, T.R., X. Sun, Riley, T. Graham, J. H., Ferrandino, F. and Taylor, E., 2002, Geo-Referenced Spatiotemporal Analysis of the Urban Citrus Canker Epidemic in Florida, Phytopathology, Vol 92, No. 4.