Short Note 6-2

The 1900-ft Policy and the Published Articles by Dr. Gottwald et al.

Introduction

At the November 14, 2001 Public Hearing, Barry Silver, an attorney who had participated in the Broward Case 2, pro bono, questioned Mr. Richard Gaskalla on the connection between the 1900-ft policy and the published articles on the field study. Copies of a manuscript of the April 2002 article was available at the meeting. According to the transcript of the meeting:

> MR. GASKALLA: There's a statement in there that indicates nineteen hundred and forty feet was the average. I'm not sure exactly what the statement is, but it alludes to the fact that nineteen hundred feet is a reasonable distance to use.

Mr. Gaskalla was wrong. There was no statement within the manuscript or the final article as published stating that the many “distances of spread” in the five tables resulted in an average of 1940-ft. Instead, since the 1900-ft rule had already been adopted, the April 2002 article simply stated that 1900-ft (579 m) was a “common distance” in the sets of results, as follows:

> Thus, 579 m is a distance that is neither the longest nor the shortest distance calculated but rather a compromise that represents a common distance of disease spread during a 30-day period.

Dr. Gottwald had in made a strong push for the 1900-ft rule at the November 16, 1999 meeting as follows:

> Tim [Dr. Gottwald] said he is going to make a plea and it is that going to 125-ft isn’t going to do it, nor will 800-ft. If you want too have an effect, you will have to take out much more out. Normal rain storm events can spread the disease 1900-ft.

One can consider this was a statement of belief, rather than fact. He did not state that his research showed inter-tree transport of bacteria up to 1900-ft. He was obviously walking a fine line.

In February 2000 when residential cutting was first implemented, there was no publically available research studies on the 1900-ft policy. However, public relations officers with FDACS stated that the policy was a result of epidemiology research conducted by the USDA. Dr. Gottwald was often mention as the scientist in charge of the research, and was in the process of preparing a report on the study.

In January 2001, a Letter to the Editor (LTE) was published in Phytopathology with calculated results from the study. [1] An LTE is not required to provide detailed specifics on a study. In April 2002, a more extensive article was published in Phytopathology on the research. [2] The first author of both of these articles is Dr. Gottwald. Both articles are posted on the website. The April 2002 article is quite technical in nature. The appendices of my book, provide a detailed bottoms-up examination of the field study, based on the April 2002 article, and other presentations by Dr. Gottwald.

April 2002 Article Statement

Since the April 2002 article [2] was the final presentation on the field study, this article is discussed first. The connection of field results to the chosen radius of 1900-ft is found on page 373 of the article as follows:

> If we consider the first four 30-day temporal periods over all of the study sites during which spread occurred, 3 of 12, 4 of 12, 7 of 12, and 7 of 12 of these 30-day periods had calculated distances of spread that required >579 m (1,900 ft) to circumscribe 90, 95, 99, and 100% of the newly infected trees, respectively. Thus, 579 m is a distance that is neither the longest nor the shortest distance calculated but rather a compromise that represents a common distance of disease spread during a 30-day period. It should be considered that spread of the disease over some of the larger distances measured could have been the result of movement of inoculum or infected plant materials by human or mechanical means. Thus, the distance estimates needed to circumscribe 95 or 99% of the newly infected trees, rather than 100%, would be a conservative estimate of maximum possible spread. Even so, it would appear from examination of results of the calculations presented that radii of ≥579 m would be necessary to define exposed trees for removal to contain spread in many cases.
>
> However, the data presented here does conclusively demonstrate that spread of ACC in urban Miami occurs over distances considerably greater than 38.1 m (125 ft), the distance previously used by the CCEP to define exposed trees. The application of the "125-ft rule" to define exposed trees for eradication was inadequate to contain the disease and curtail further spread and was likely one of the main contributing factors that resulted in the inability to suppress disease spread between 1996 and 2000 (27).

The main focus of the statement is that the 1900-ft is a "compromise" between the longest and shortest distance of spread based on the first four time periods. The authors chose only the first four time periods, because as more infected trees fill the study site, the distances between prior and newly infected trees tends to diminish.

Since the article considered the results of the first four periods in all 5 sites, there should be 20 values (5 x 4) for each of the four percentile level (90, 95, 99, 100%). The article does not specifically state these are percentile levels, but this can be inferred from the calculations. The first sentence of the discussion is discussing <u>ratios</u>, i.e. 4 out of 12. Apparently excluded from these ratios, are sites D2 and D3 because there are one or more zero distance values in the first four periods. As shown in Table 1, if these sites were not excluded, for the 95% level there would be 4 out of 20 values are greater than 579 m (1900-ft) and 4 out of 20 values are less than 38 m (125-ft):

Table 1: Frequency of distance values, first four time periods for 95% percentile level without excluding sites D2 and D3 with zero distance values

Site	Less than 38 m*	From 38 to 579 m*	Greater than 579 m
Site D1		1	3
Site D2		4	
Site D3	3	1	
Site B1		3	1
Site B2	1	3	
Total	4	12	4

* 38 m = 125-ft, 579 m = 1900-ft

The ratio results presented in the article are misleading, because all values in sites D2 and D3 were excluded. Further, since percentile values were used, the 90, 95, 99 and 100% values are the same for temporal periods with 10 or fewer infected trees. This explains why the distance value of 894 m is repeated four times corresponding to each percentile level.

The distance values corresponding to the articles ratios are provided below. Note there appears to be a slight error in the ratios calculated at the 99 and 100% levels. Only three sites, D1, B1 and B2, were included in these ratios.

<u>90% level</u>: (3 out of 12)

D1 1128 m, 769 m, B1: 894 m

<u>95% level:</u> (4 out of 12)

D1: 1159, 769, 599 m, B1: 894 m (4 out 12 counting duplicates)
Two new distances 1159 and 599 m

<u>99% level:</u> 6 out of 12

D1: 1159 m, 769 m, 599 m, B1: 3474 m, 875 m, 894 m
Three distances (tree pairs) used previously.
(Text on p. 373 states 7 out of 12, but it can not legitimately include the value in D2, because there would be more than 12 values)

100% level: (6 out of 12)

Same of 99% level, Text on p. 373 states 7 out of 12, but can not legitimately include the value in D2.

The authors' statement that the 579 m value (1900-ft) is within the range of values in the tables is a correct statement. However, there are problems with the authors' opinion that this represents a "compromise" in choosing an eradication policy as 38 m (125-ft) is also within the range of values. In fact of the 20 values , there are 3 zero values, suggesting that cutting only infected trees in these time periods would have eliminated the secondary spread of canker. There are equal number of values above 579 m (1900-ft) as there are below 38 m (125-ft).

January 2001 Article Statement

As stated in the Letter to the Editor:

> **Impacts of epidemiological research**. In December 1998, the Miami epidemiology study was reviewed by a group of scientists and regulatory officials. The consensus was (i) that the 125-ft (38 m) radius used to define exposure was inadequate to suppress the continued spread of canker, and (ii) that although disease spread was detected up to 58,850 ft (17,942 m), the majority of new canker infections occurred within approximately 1,900 ft (579 m) of known source trees. As a result, a new regulation, the "1,900-ft rule" was put into practice in late 1999, requiring the removal and destruction of diseased citrus trees and of all citrus trees within a 1,900-ft radius of a diseased tree (13,21). [1]

The 58,850 ft appears in Table 1, Site 4 in the fourth time period. The article does not make any specific recommendation on eradication policy. The 58,850 ft distance does not appear in the April 2002 article, nor would it fit within the site 4 (identified as sites B1 and B2, in April 2002).

The December 1998 meeting is discussed in my book. The article is vague on the specifics of this meeting— when it took place, what was discussed and who attended the meeting. It was not, according to Dr. Gottwald, a regular meeting of the Department or any other group.

Comparison to the FDACS Justification Statements

FDACS posted to their website, a short summary of the basis for the 1900-ft rule. The last paragraph is listed below.

> 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.

Drs. Dixon, Schubert and Sun are listed as authors of this summary. Dr. Sun is the only plant pathologist that was part of the field study.

It is noted that neither the April 2002 nor the January 2001 articles contain any similar statement. In fact, the words "success levels" and "composite data" are not found in either of these articles. The entire justification statement, as posted on the FDACS website in year 2000, is provided at the end of this note.

Concluding Remarks

The two articles on the field study do not provided any recommended distance for successful eradication. The articles do not demonstrate that 1900-ft in the necessary distance to eradicate citrus canker. They do not provide estimated success level, such as 95% or 99% level for the 1900-ft distance.

They provide the opinion that a 125-ft eradication radius should not be expected to capture all the subsequent occurrences of citrus canker within a residential setting. It is the authors' opinion that the 125-ft policy was inadequate to eliminate citrus canker. The two articles are supportive of the 1900-ft policy. The 2002 article states that 1900-ft is a "common distance of disease spread" as found in the tables of results.

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.

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 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.

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. 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 four 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.

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.

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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