

Short Note 8.3:

Chipper Experiments and Undisclosed Studies

Introduction

From 2000 to 2006, the Department implemented the 1900-ft policy within residential neighborhoods. Probably, the most conspicuous piece of equipment was the wood chipper, which would reduce the tree to mulch, generally in pieces of 1- 2” in size. The chipped wood is exhausted into trailers. It is likely that some coarse wood particles may be produced as trees are chipped.

Drs. Gottwald, USDA/ARS and Graham, UF/IFAS purportedly collaborated on a series of field experiments, to investigate whether the dust from chippers could disseminate the canker bacteria. These experiments were funded under USDA/ARS Project 981-29. Very few details of the experimental setup and results were made public by the investigators.

In review of the research, four documents were examined: (1) First Year’s Progress Report for Project 981-29, (2) June 2000 International Citrus Canker Research Workshop , (3) 2002 Plant Health Progress article, published online by Drs. Gottwald, Schubert and Graham and (4) Graham et al. article in 2004, as provided in the references.

In reading the brief summaries in these documents, one should consider how little information has been provided. Where specifically were the experiments conducted? One document states the potentially exposed trees were observed in a containment greenhouse parked in the Opa-Locka airport. But no article states where the experiments were done. More unanswered questions arise: When were the experiments done? How many infected trees went into the chipper? How many lesions were on the trees? What kind of citrus trees were these? What was the weight or volume of these trees? What percentage of this volume would end up in the chipper? And the most important question, how much of the bacteria in terms of weight percentage could be in either mulch generated by the chipper?

The actual discussion is all very sketchy. In the International Citrus Canker Research Workshop, June 20, 2000, Dr. Gottwald states that they placed grapefruit trees a short distance from the chipper. What distance? Further he states that a number of them developed lesions within a containment greenhouse. How many of them, and how many lesions? What tests did they do to determine these lesions were actually canker? After all, residential trees can have a wide variety of fungal diseases.

I was very skeptical about the experiment. It seemed nearly impossible for a wood chipper that produce mostly wood mulch to disseminate canker bacteria. My skepticism came from the published literature on citrus canker infection mechanisms. Further, it seems that before anyone would bring a containment greenhouse from Orlando, Florida to the Opa-Locka Airport, in Miami-Dade county, there would be some basic experiments done to establish that this mechanism of infection was possible. Could a lab technician simply take a few leaves infected with canker, pulverize it to dust, then sprinkle it over, say an orange, and expect to see lesions develop? I wouldn’t expect it as water is needed to allow for the entry of canker. If they poured water on the dust, I would expect most of the dust to simply wash off.

Certainly, if it was this easy to conduct a pathogenicity test, it would be very useful for the program! I would expect any dust that was able to be disseminate 20-ft from a tree would be extremely dried out. Wood chippers are not operated in the rain.

Further, the amount of plant material with canker infections would likely be on the order of less than 10 grams, compared to 20 to 100 kilogram for a small to medium sized tree. This is based on the fact that citrus canker is non-systemic.

But, why would investigators, who sincerely wanted to support the Department with all their efforts, state they had discovered through experiments that the chippers could possibly cause the dissemination of citrus canker at an international conference on citrus canker. As discussed in the section entitled, "Alternative Explanation", it is believed experiments were far different than described. It is suggested that the containment greenhouse was not brought to Miami to conduct experiments on just chippers. If this was the case, why not do the experiment at the USDA/ARS offices, which in year 1999 was in Orlando? Yes, they have chippers in Orlando. And they can safely bring infected branches from Miami to Orlando. It is suggested a series of undisclosed field experiments were conducted to help justify the 125-ft policy. Also, it is suggested the "chipper experiment" and "landfill sampling" were invented to cover the budgets for Project 981-29. A landfill exists to the north of Okeechobee airport, so this would justify the trips to Miami.

Official Versions of the Chipper/ Landfill Experiments

In the first year's progress report of USDA/ARS Project 981-29, likely written in late 1999, the authors state [2]:

A mobile containment greenhouse was moved from the Orlando USDA lab to the CCEP site at the Opalocka airport. This laboratory establishes a laboratory, greenhouse, and a base of operations for the numerous experiments we will conduct in the Miami area.... Bacterial aerosols were found to be generated by chipping machinery and the debris that escaped the chipping machinery was capable of initiating disease in trap plants. Trap lines of susceptible plant material were also established radiating from a known point source of disease spread of the bacteria resulting from meteorological events.

The Opa-Locka airport is located in Miami-Dade County. Open experiment with citrus canker might violate quarantine rules if the study was conducted in Broward County. However, it is believed these experiments were conducted in Miami-Dade County. The last sentence is very interesting. A known point source? Meteorological events? It is all very sketchy. In Gottwald's presentation in November 2000, he shows a map, which identifies a citrus canker eradication office just north of the Opa-Locka airport. [3]

Dr. Gottwald made a presentation at the 2000 International Citrus Canker Research Workshop, where he states:

What we were looking at was one of the eradication methodologies that's used which is the use of a chipper to chip up material after it has been taken out of yards in the Miami area and is blown into the back of the truck. Unfortunately as a chipper works

and material is being blown into the back of a truck, a large volume of air is also being blown, and this has to be displaced. When such displacement occurs some air passes out the sides of the truck or returns through the back of the truck.

So we placed aerosol samplers around to determine if we could find bacteria that were aerosolized out of the backs of those trucks. Indeed, we were able to detect that. That's what the little pluses mean over there. You can see the time limits that we were sampling, the severity rating of the various trees and some description of those trees, how old the leaves were, et cetera. And we were able to recover bacteria coming out of the back of those trucks.

That's one question, but the other question is: Is this of any epidemiological significance whatsoever? So what if a little dust of canker material comes out? So we placed some potted trees of grapefruit a short distance away from these trucks, and we allowed the material that was blowing out from the back of these trucks to deposit onto these grapefruit trees.

We then returned the plants to the containment lab in Miami and allowed them to sit for a while. About 30 days later we found symptoms of citrus canker developing on a number of these plants. So, yes, there is something coming out of the back of those trucks. Aerosols are being produced, particles are being produced that have the bacteria in them, and they indeed do or potentially do have epidemiological significance. [4]

The term aerosol is used typically to describe fine liquid droplets, but it is also applicable to fine solid particles. Aerosols are generally defined as having particle size diameters of less than 1 μm .

On August 2002, Dr. Gottwald, with co-authors Schubert and Graham, published online, Citrus Canker: The Pathogen and its Impact, (available online at the www.apsnet.org) , where they state:

In Miami, where diseased trees are chipped after removal from dooryards, the debris produced is laden with Xac detectable by air sampling in the vicinity (10 to 20 ft) of the machinery. Aerosol inoculum is also capable of causing infection of wetted foliage in the zone of bacterial dispersal. This finding led to procedural changes for when and where chipping can be safely conducted to minimize the risk of bacterial dissemination in the area of tree destruction. [3]

The inoculum is now “capable” of causing infection, and this is a step back from the prior conclusion that the trees became infected. Also, a new added detail, the foliage is now wetted. In year 2000, grapefruit seedling became infected presumably from dust created by the chippers. No published article since this one, had claimed to be able to capture citrus canker by air sampling of dust escaping from the back of trucks.

Graham discusses experiments with chippers and landfill debris in a published article in 2004 on page 11 [5] as follows:

In urban areas, under eradication, diseased and potentially exposed trees within 1900-ft are removed and destroyed. Trees are cut down by chainsaws, and the debris moved to the street where commercial wood chipping machinery reduces the trees to pieces generally > 10 cm in size. The 'chipped' debris is exhausted into a covered trailer, transported to a landfill, dumped, and covered with soil. Some fine particles escape the covered trailers during the chipping process and when the trailers are emptied at the landfill. Air sampling experiments have been conducted to test the escaping debris for viable *X. axonopodis* pv. *citri* bacteria. In a few cases, when some infected trees were chipped, a few cells were detected in the escaping debris. Similar studies at landfills detected viable cells in the particulate matter escaping downwind from trucks dumping chipped material (Gottwald et al, unpublished). The duration of survival of the bacteria in such debris has not been tested. However, the lack of susceptible citrus within 579 ft of any infected tree in an urban setting and within much greater distances of any landfill makes the significance of such bacteria-laden debris for further spread of the disease questionable. Certainly if infected trees were allowed to remain in an area the inoculum, they would produce and disperse within a very short time would vastly outnumber those few viable cells that escape during tree destruction and disposal.

Graham's summary states that "a few cells were detected in the escaping debris" while Gottwald's description is of chipper trucks surrounded by grapefruit seedlings. Graham refers to unpublished data from "Gottwald et al." as support of the landfill experiments.

As pointed out in Graham's article, the lack of citrus within 1900-ft of an infected tree, makes it highly unlikely the chipper dust could contact a host tree- so why would there be any need to conduct these experiments?

In 2002, the chipper experiments were described in Broward Court. Judge Fleet wrote in his opinion on May 24, 2002, that the dust from chippers could have contributed to the spread of citrus canker, despite the lack of proper documentation on the experiment and results.

Alternative Explanation: Chipper Experiments were the Cover Story

It is suspected that no experiments as described were ever done with chippers. If the investigators stated that the chippers did not create potentially harmful dust, those who believed that canker was a highly contagious disease might be suspicious. Claiming that there was possibly harmful dust, was satisfying to program critics. Moving a containment greenhouse from Orlando to the Opa-Locka airport in Miami-Dade is likely true. But the rest was invented.

It is possible the real intent of claiming a potential for chippers to disseminate citrus canker, even if very limited as in Graham's 2004 article, was to establish a link between citrus canker with an enormous family of airborne diseases. Airborne diseases, many of them fungal diseases, can survive in dry conditions, and as aerosols, travel miles by air currents.

It is suspected that the chipper experiment was just a cover story. Residents had raised concerns in year 2000 if the Department was spreading the disease with chippers or on the boots of inspectors. It was also

suggested that lawn maintenance crews could spread the disease. Residents mistakenly believed the canker disease could be airborne. So, the conclusion of canker spread via chippers was right in line with program opponents viewpoints and would not receive much scrutiny.

The Real Experiment

Some parts of the chipper story are likely true. It is likely that a portable containment greenhouse was parked in the vicinity of Opa-Locka airport based on the transcripts from the International Citrus Canker Research Workshop. The other details of the “real experiment” are speculative. It is possible that the real experiment consisted of spraying high pressure water through infected seedlings located at various distances, perhaps as far away as 125-ft. It is possible to be within the regulations of the program, the trees were infected with citrus bacterial spot (CBS). It is possible that the experiment consisted of spraying a solution containing CBS on the healthy trees located in proximity of the sprayer. After the spraying, the trees would be placed in the mobile containment greenhouse at in the vicinity of Oka-Locka Airport.

The location of these experiments is unknown. It is possible that the experiments occurred in a large empty field about two miles north of Opa-Locka airport. It is also possible these experiments took place during the summer of 1997 or 1998. The summer months would be optimum conditions for the infection process.

If the Varela case [1] had gone forward, it is believed the plan was to show this experiment as proof positive that citrus canker could be dispersed to a distance of at least 125-ft. Since the class action lawsuit did not go forward, the results were never disclosed.

References

1. Department of Agriculture and Consumer Services v. Varela, 732 So. 2d 1146 (Fla. 3d DCA 1999)
2. Gottwald, T.R and Graham, J. H., Research in Support of Eradication and Control of Asiatic Citrus Canker, Progress report 981-29. Copy available on supporting documents website.
3. Gottwald, T.R, 2000, Presentation to the Broward Court Case 00-18394 (08) CACE. (copies of viewgraphs provided on supporting documents website).
4. Gottwald, T.R., Graham, J.H., Schubert, T.S., 2002. Citrus Canker, The Pathogen and its Impact, Plant Health Progress, online article available at www.apsnet.org.
5. Graham, J., Gottwald, T., Cubero, J., Drouillard, Survival of *Xanthomonas campestris* pv. *citri* on Various Surfaces, 2000. International Citrus Canker Research Workshop, June 20-22, 2000. (no paper, only abstract and transcript of talk available, paper requested from authors, no reply received).
6. Graham, J.H., Gottwald, T.R., Cubero, J. and Achor, D. S., 2004. *Xanthomonas axonopodis* pv. *citri*: factors affecting successful eradication of citrus canker, Molecular Plant Pathology, 5(1), 1-15.