Citrus Canker : some Facts Speculations and Myths About This Highly Dramatized Bacterial Disease

By JACK O. WHITESIDE

Nursery persons, growers and others involved in the production, handling and marketing of citrus are all being affected and inconvenienced to varying degrees by the regulatory measures presently being applied in Florida to eradicate the canker disease caused by the bacterium, *Xanthomonas campestris* pv. *citri*.

From my analysis of the situation, the measures that are currently being applied against this disease can only be justified if the potential long-term economic losses from canker are likely to be significantly greater than the costs of a disruptive and possibly unsuccessful eradication campaign.

In a previous article (8), I concluded that even if it were not eradicated, canker would probably not be a major problem in Florida because of certain climatic limitations. Nevertheless, I did not rule out the possibility that it might require some additional spray treatments for acceptable control. In fact, I intentionally put the worst complexion I felt justified on what might happen if the pathogen did survive here. After studying the situation in Argentina in more detail, I believe that my original estimates of the number of spray treatments that might be needed specifically for canker control were too high.

In Corrientes Province, Argentina, where canker has been present for at least 20 years (3), there are only a few citrus groves, mostly comprised of young grapefruit trees, where canker is of some concern. In many of the groves that were afflicted in earlier years, the disease has become less troublesome or has even disappeared as the trees grew older. This is attributed partly to the more effective and timely utilization of copper spray treatments and partly to the groves becoming less prone to attack as they become more mature. Furthermore, the planting of windbreaks has helped considerably to reduce disease severity (3). Nevertheless, as will be explained later in this article, this does not necessarily mean that windbreaks would be required in Florida if the disease survived here.

In Entre Rios Province, Argentina, where canker was first recorded in 1976 (3), the disease has turned out to be even less troublesome than in Corrientes.

Persons visiting Argentina to observe canker could unknowingly form a false impression of the overall importance of canker in that country. By specifying an interest in canker, they are generally shown the most severely affected groves. In most instances, these are young grapefruit groves that have received little or no properly timed spray treatments and that are in locations exposed to strong winds.

Judgments as to how serious canker is in Argentina could also be influenced by the way canker behaved in some groves in the late 1970s. For three consecutive years, rainfall was well above normal and canker did cause significant fruit losses in some groves, particularly on grapefruit (3). With the return of more normal rainfall (about 50 inches annually), the disease has since become much less important (3).

Selected viewing of canker-affected groves in Argentina may cause a visitor to form an erroneous impression as to how severe canker would be in Florida if it survived here. In reality, even if canker behaved in Florida much as it does in Argentina, we would have little to worry about. At most, only one or two extra spray treatments might be needed and perhaps only on grapefruit grown for the fresh market. No spray treatment specifically for canker control should be necessary on processing fruit.

Table 1. Number of citrus trees found infected with canker in Florida citrus nurseries and groves from 1910, when the disease entered Florida, to 1933, when the State was declared canker free.

Period	Nurseries	Groves
Before May 1, 1915	320,406	5,650
May 1, 1915 to April 30, 1916	21,364	5,597
May 1 to December 31, 1916	451	2,089
1917	44	372
1918	4	15
1919	1	4
1920	0	540
1921	0	0
1922	6	873
1923	0	11
1924	0	0
1925	0	5
1926	0	2
1927	0	85
1928	0	0
1929	0	0
1930	0	0
1931	0	0
1932	0	0
1933	0	0

The critical period of fruit susceptibility to canker is during the first 3 months after petal fall (5), just as for melanose. In Florida, melanose can normally be reliably controlled by two postbloom copper spray treatments. Control failures can, however, occur in some years if only one treatment is applied, particularly if it is applied at the wrong time. If two postbloom copper treatments had to be applied to control canker, there would be some additional benefit in terms of melanose control, which in itself would improve packouts. It would

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be unfair, therefore to debit the whole cost of an additional post bloom copper treatment of canker control.

As far as the foliage is concerned there might be some justification for the spring growth flush to protect it from canker. Injury to this flush would probably be to minor in itself to justify such treatment, but where there is a history of canker. it might be needed to prevent. a build up of inoculum to infect the fruit. Based on what happens in Argentina it seems hardly likely that the summer growth flushes would be numerous enough to justify any spray treatments specifically for canker control after June. In an earlier article (8), I predicted that canker would be less severe in Florida than in Argentina, because the average rainfall in Florida during the time of emergence of the spring growth flush and post bloom (particularly during the first 1-2 months after petal fall) is less than it is the corresponding period in Argentina. I also explained that. canker

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should be less serious in Florida because, when it rains here, the winds are not as strong or sustained as they can be in Argentina. The ingress of canker bacteria into the host substrate is facilitated when rain hits the leaf or fruit surface with the additional force induced by high winds (4). Yet, despite the seemingly more favorable conditions for infection in Argentina, canker has not turned out to be a very serious disease even in that country.

Prior to the Argentine experience, the only large canker-affected citrus-producing countries we could refer to were in Asia. However, extrapolation as to the potential severity of the disease in Florida, based on information available from such countries as Japan, China, Taiwan and India was considered inadmissible by Florida authorities, because highly susceptible varieties are not commonly grown there. Now we have the experience of Argentina to help us make a more meaningful evaluation. The climatic conditions in the northeastern citrus-producing provinces of Argentina probably come closer to those in Florida than do those of any other major canker-infected citrus-producing country. Furthermore, most of the varieties grown in Argentina are the same as those grown in Florida.

It appears to me that the great fears expressed about canker in Florida over the years (2, 6, 7) were largely unnecessary. How much damage did canker cause to citrus trees and fruit in Florida before it was declared eliminated in 1933? Apparently, not very much. What seems to have caused so much alarm were published projections to the effect that if the canker pathogen were allowed to survive, it would have finally caused death of trees or soon rendered them worthless (7). However, I have been unable to find any authenticated reports from those days of canker actually causing serious tree damage — not even in nurseries -- despite the fact that canker was present in Florida for 5 years before any sanitary or eradication procedures were enforced.

Was canker really eliminated back in those days because of the eradication procedures applied? I believe the answer to this question is no. The procedures that were applied must have eradicated it in nurseries, but in groves it was probably a different matter. When the disease appeared in a nursery, the whole nursery or a major portion of it was burned to prevent survival. The action taken in groves was less drastic. In groves, it was only mandatory to burn those trees that showed canker lesions. While some growers did voluntarily remove apparently healthy neighboring trees to improve the chances of eradication many did not. The disease apparently disappeared even in those groves where no additional barrier to spread was provided. There must have been many instances where cankier pustules were missed by the inspectors. The human eye would never be able to detect the last vestiges of canker infection. Canker pustules, particularly the smaller ones are not very conspicuous and it would only take one surviving pustule to perpetuate the disease. Pockets of canker may still have existed in some groves even after the pathogen was supposedly eradicated. Perhaps the disease has survived in some locations even to this day. Small amounts of leaf or fruit spotting caused by canker could be missed by even the most ardent observer.

Before the Plant Act was enacted in April, 1915, there was unrestricted planting out of trees from canker-infected nurseries. The canker inspection reports published by the Florida State Plant Board (1) showed that before the restrictions were imposed, a total of 338,512 trees (later to be defined as exposed trees) were moved from infected nurseries and planted in 21 Florida counties. By November 30, 1916, 178,113 of the exposed trees had been burned. I was unable to ascertain the fate of the remaining 160,399 exposed trees. From thereon, the records (1) I examined did not differentiate between the numbers of exposed trees that might have subsequently shown canker and other trees that showed symptoms. Nevertheless, this has little bearing on the present discussion, because after November 30, 1916, the numbers of trees from all sources found infected with canker in groves was very low (Table 1).

It would seem from the records (1) that once the disease was eliminated from the nurseries, the number of trees found with canker symptoms in groves dropped dramatically. While there were some upsurges, notably in 1920, 1922 and 1927, these were due to a few isolated occurrences. In 1920, the 540 trees with canker (Table 1) were on three adjacent properties at Boynton Beach. In 1922, the only trees observed with canker were at the then isolated community of Davie in Broward County, where 873 trees on 15 different properties were infected. The 85 trees recorded for 1927 were in a single grove at Fort Lauderdale.

The numbers of canker-infected trees found in Florida groves during the outbreaks of the teens and twenties were remarkably low, considering the number of exposed trees that had been planted out from infected nurseries from 1910 to 1915, before the Plant Act was enacted. What were the possible reasons for this? Perhaps the tree to tree movement of the disease in groves was slow or perhaps the grove conditions were generally unfavorable for infection or disease perpetuation. If the latter idea is true, the symptoms would have soon disappeared because of the eventual dropping of the leaves that had canker and because of the bark formation, which would have

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eventually obscured any pustules on the twigs. The sudden reduction in numbers of canker cases found in the groves after 1915-1916 would seem to indicate a poor infection or survival capability of the pathogen, except perhaps in a few grove locations, such as those detected in 1920, 1922 and 1927.

If canker is not a potentially serious disease for Florida citrus groves, is there any real need to eliminate it from nurseries? The answer to this question might have to be yes; however, not because the disease is likely to be devastating in nurseries and groves, but because of lingering doubts and emotional fears that may be difficult to dispel after nearly three quarters of a century of repetitive alarm. In any event, it is always prudent to plant out only those threes that are disease-free. While this is not practically feasible with such diseases as scab, Alternaria brown spot or greasy spot, it might be possible to keep nursery trees free from canker through appropriate inspection, hygiene, sanitation and quarantine measures.

It seems strange that it has taken so long for the long-held concept of canker being a devastating disease, and of it having been previously eradicated in Florida by tree burning, to be questioned. It is mainly because of the Argentine experiences that I decided to challenge some of the earlier Florida reports about canker and to scrutinize the Plant Boards records (1) in greater detail.

I believe we should no longer accept without question some of the earlier Florida reports about canker. Unsupported and inflated statements about how injurious canker would be to citrus groves if the pathogen were not eradicated could continue to cause unnecessary disruption to the Florida citrus industry. They could also give some of those citrus-growing areas of the world that do not have canker a false impression of what to expect if canker were ever introduced there and even cause unnecessary concern to those areas that are obviously too dry for the disease to even exist.

I believe that if canker did persist in Florida, it would have little or no overall impact on fruit yields or even on production costs. The main problem caused by the disease might be with the marketing of fresh fruit in some consuming areas outside Florida because of current regulations concerning the disease. Ironically, it was in Florida, beginning back in the teens, that the devastating disease image of canker was created. This undeserved reputation evolved from statements made by some government personnel back in history to the effect that if the canker bacteria were not eradicated they might kill trees. The fear of canker was further increased by a belief back in those days that there would be no way of preventing or controlling canker except to burn infected trees. We even hear such views expressed today by some authorities.

The message has gone out from Florida to the whole world that canker is, or potentially is, a disease that could be highly detrimental to a citrus industry. In response, the U.S.A. and some other countries decided to ban the importation of citrus fruits from all those producing areas with canker. If it had not been for the overstatements about canker in the first place, the consequent trading restrictions would probably not have become so drastic. Surely, it is about time that we recognize canker for what it really is: just another leaf- and fruit-spotting disease and one that has been proven in other countries to be controllable in groves without having to destroy any citrus trees. CVM

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