How much yield is needed to offset the cost of injecting trees with oxytetracycline?

By Ariel Singerman

Citrus growers in Florida are now allowed to inject their trees with oxytetracycline (OTC) to try to control *Candidatus* Liberibacter asiaticus and/or suppress citrus greening. The use of OTC is expected to improve the trees' health and, in turn, increase yield. In this article, cost estimates are used to address the question of what yield response is needed to make the treatment economically viable.

OTC can be applied only once a year to bearing trees and cannot be applied for more than two consecutive years. Table 1 (page13) provides estimates of the annual materials, injection, labor and total cost of injecting trees with OTC on a per-tree and per-acre basis for different trunk sizes when using a compound concentration of 5,500 parts per million (ppm). Such concentration is the one suggested for bearing trees in poor health condition.

COST CONSIDERATIONS

The cost of the compound is $106 per pound based on the average of quotes obtained for the least expensive of the two OTC products available at the time of the study. The cost of the injector and the cost of labor are based on the information provided on the website of one of the compound manufacturers. The manufacturer estimates that the cost of an injector is $18, and it can be used between 100 and 200 times, so this study uses the average (150).

Assuming a tree density of 150 trees per acre,

Photo by Ute Albrecht, UF/IFAS

Table 1. Estimates of annual materials, injection, labor and total cost of injecting trees with oxytetracycline on a per tree and per acre basis by trunk diameter

1	2	3	4	5	6	7	8	9	10
Trunk Diameter	Compound Volume	Compound Cost	Injector Cost	Labor Cost	Total Cost	Compound Cost	Injector Cost	Labor Cost	Total Cost
(Inches)	(Milliliters)	($/Tree)				($/Acre[1])			
2.125 - 3	25	0.03	0.12	1.20	1.35	4.79	18	180	202.79
3 - 4.25	50	0.06	0.12	1.20	1.38	9.58	18	180	207.58
4.25 - 6	100	0.13	0.12	1.20	1.45	19.16	18	180	217.16
more than 6	150	0.19	0.12	1.20	1.51	28.75	18	180	226.75

[1]Assuming a tree density of 150 trees per acre

the corresponding cost per tree is $0.12 (=$18/150 trees). The manufacturer also estimates that the cost of labor and equipment ranges from $0.90 to $1.50 per tree, so this study uses the average of that range, which is $1.20 per tree. Columns 3 through 6 in Table 1 show the cost estimates of the compound, injector, labor and total cost on a per tree basis for different tree trunk sizes. Columns 7 through 10 show the cost estimates for the same categories but on a per acre basis (assuming a tree density of 150 trees per acre).

For trees that are in good condition and have a full canopy, the compound concentration doubles to 11,000 ppm. The estimates for the total cost by trunk diameter are shown in Table 1, but the reader needs to look one size up in diameter because as shown in column 2 of Table 1, the compound volume doubles as the diameter size increases to the next category. Thus, for example, the cost for treating a healthy tree with a trunk diameter of 2.125 to 3 inches would be $1.38 per tree, which would translate into $207.58 per acre (assuming 150 trees per acre). The only value missing in Table 1 is that for trees that are more than 6 inches in diameter. For such trees, the cost per tree would be $1.70, which would translate into $255.49 per acre.

According to the Florida Department of Citrus (FDOC) final field box report for 2022–23, the average delivered-in price for processed Valencia oranges was $3.29 per pound

Table 2. Valencia yield response per acre needed to offset the annual cost of injecting trees with oxytetracycline by trunk diameter

1	2	3	4	5	6
Trunk Diameter (Inches)	Valencia Yield Response Needed to Offset Annual Treatment Cost (Boxes/Acre)	Percent Increase Relative to Florida's 2022–23 Average Valencia Yield (51 Boxes/Acre)	Percent Increase Relative to 100 Boxes/ Acre	Percent Increase Relative to 150 Boxes/Acre	Percent Increase Relative to 200 Boxes/Acre
2.125 - 3	16.7	32.8%	16.7%	11.1%	8.4%
3 - 4.25	17.1	33.6%	17.1%	11.4%	8.6%
4.25 - 6	17.9	35.1%	17.9%	11.9%	9.0%
more than 6	18.7	36.7%	18.7%	12.5%	9.3%

solids, and yield was 5.09 pound solids per box, resulting in a delivered-in price per box of $16.71. The cost of picking and hauling Valencia oranges in 2022–23 is estimated at $4.46 per box, while the FDOC assessment was $0.12 per box. It can then be estimated that the average on-tree price for processed Valencia oranges during 2022–23 was $12.13 per box.

YIELD AMOUNTS

Dividing the total cost per acre estimates in column 10 of Table 1 by the on-tree price gives estimates of the yield response per acre growers need to obtain to offset the annual cost of injecting trees with oxytetracycline. Table 2 shows such estimates by tree trunk sizes; the additional number of boxes needed ranges from 16.7 to 18.7 per acre. Column 3 of Table 2 also shows that such an increase in yield would represent a 33% to 37% increase relative to the statewide (average) yield for Valencia oranges in 2022–23 (which is 51 boxes per acre). One of the manufacturers stated that "it is not uncommon to see a 30% to 35% yield benefit in year one."

If a grower has a yield of 51 boxes per acre, and the manufacturer's stated benefit is achieved, Table 2 shows that the additional yield would only allow the grower to offset the cost of the treatment. Regarding year two, the same manufacturer stated that the yield benefit can be as high as 60%. If such an outcome is realized — and, importantly, prices stay at a similarly high level next season — about half of that benefit would be needed to pay

for the treatment in the second season, and only the remainder would translate into profit.

However, in Table 2 (page 14), columns 4, 5 and 6 show the percent increase that the number of boxes in column 2 would represent when a grower has a yield of 100, 150 and 200 boxes per acre, respectively. At such yield, and if the expected yield response stated by the manufacturer is realized, the treatment may be profitable in both the first and second year.

If the grower's yield is higher than the state average, the treatment may be profitable in both the first and second year.

CONCLUSION

Cost estimates are used to address the question of what yield response would be needed for injecting trees with oxytetracycline to be an economically viable treatment for growers to adopt. It was found that if the grower's yield is equal to the statewide (average) yield for Valencia oranges, the expected additional yield would only allow the grower to offset the cost of the treatment in the first year but may result in a profit in the second year. If the grower's yield is higher than the state average, the treatment may be profitable in both the first and second year. Importantly, however, this analysis does not consider the potential long-term negative impact that injecting trees may have.

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Bayer Project Update

By Rick Dantzler, CRDF chief operating officer

The Citrus Research and Development Foundation's (CRDF) project with Bayer Crop Science Division (Bayer) is nearing its end. While we didn't hit the homerun we had hoped for, we did hit a solid double off the outfield wall. Here's a summary of the project to date.

In 2017, CRDF, PepsiCo and Coca-Cola partnered to fund a project with Bayer that had three objectives: 1) to develop a high throughput screening cascade to evaluate antibacterial microbes and synthetic compounds for efficacy against HLB, 2) to find a curative antibacterial microbe and 3) to develop a plant host defense solution using a synthetic chemical. To set this approach up for success, Bayer established collaborations with the University of California Davis, Southern Gardens Citrus, Texas A&M University and the University of Florida to evaluate advanced leads selected from *in vitro* assays in *in planta* test systems. The Bayer team included scientists from California, France and Germany.

At the end of the three-year project, the high throughput screening cascade has been established, 2,500 antibacterial microbes have been screened against pathogens, and 150,000 synthetic chemicals have been tested for inducing plant natural defenses (plant defense inducers, or PDIs). Of those showing sufficient levels of efficacy, 6,560 were tested in citrus. From these, top candidates were placed in four Florida field trials.

With an annual cash burn rate of more than CRDF could sustain, the California Citrus Research Board joined with CRDF, PepsiCo and Coca-Cola to fund the project long enough to apply for a U.S. Department of Agriculture National Institute of Food and Agriculture (NIFA) grant. The proposal was accepted for funding by NIFA, providing three more years of funding.

During this three-year period, promising antibacterial microbial candidates were narrowed, and synthetic PDIs were optimized, leading to synthesis of 6,000 PDI analogs. Top performers of both approaches were placed in field trials. Other scientists were also given access to the high throughput screening cascade that had been developed.

This three-year period expired several weeks ago. No cost extensions were granted to allow scientists to finish their work, including field trials. CRDF is evaluating outcomes to determine next steps. Here's where we are:

Despite testing 23 antibacterial microbial strains in greenhouse HLB-positive trees, none were determined to be efficacious enough against Liberibacter *and* have suitable toxicology profiles to believe they could receive registration approval from federal regulatory agencies. However, two synthetic PDIs show enough promise in greenhouse conditions to warrant further work. In one ongoing field trial, one of these analogs — especially when sprayed as a follow-up to an oxytetracycline (OTC) injection — showed a good level of protection against HLB. Tree performance was better than in those receiving only OTC. If a decision is made to pursue further work on this PDI, the next step would likely be another year of field trials.

CRDF's Research Management Committee will soon review all project results to make a recommendation to the board about whether to proceed, and if so, what next steps it would recommend.

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