CITRUS ADVANCED TECHNOLOGY PROGRAM

QUARTERLY & FINAL REPORTS: Control of Citrus Greening, Canker & Emerging Diseases of Citrus

SELECT PERIOD September 2016

Quarterly Report ◉ Final

Proposal Title

An integrated approach for establishment of new citrus plantings faced with the HLB threat

Today's Date	Sponsoring Organization (drop-down)	Category (drop down)
09/25/2016	Citrus Research and Development Foundation	HLB epidemiology and mitigation of HLB by cultural pra

REPORT UPDATE (500 words-It is not necessary in this public report to disclose your institution's proprietary information or intellectual property.)

This is a three-year continuing project, terminated in Aug. 31, 2016. The overall objective was focused on determining the optimum combination of chemotherapy, thermotherapy, and nutrient therapy that can be registered for use in field citrus and control HLB. Based on our optimized nano delivery system and our screened effective antimicrobials from our previous funded projects (CRDF#584 and #617), a total of 14 antimicrobials were formulated in nano emulsions and applied on the HLB-affected potted plants in the greenhouse by foliar spray and bark-painting, including two agricultural antibiotics {Validoxyamine (VA) and Zhongshengmycin (ZS)}, seven antimicrobial compounds {Sulfadimethoxine Sodium (SDX), Silver Nitrate (SN), Silver Phosphite (SP), EBI-602, Actidione (ACT), p-Cymene (PCY) and Carvacrol (Carv)}, two antibiotics {(Oxytetracycline (OXY) and Streptomycin (Strep) }, combination of ACT and VA (Act+VA), and two positive controls {(Ampicillin (AMP) and Penicillin (Pen) }. The results indicated that the nanoemulsion formulation enhanced the therapeutic efficiency of the above antimicrobials against Las bacterium. We also screened two adjuvants and optimized one formulation to improve the effectiveness of Pen by foliar spray. More than 180 HLB-affected citrus trees were treated by combining thermotherapy, chemotherapy and nutrients. The thermotherapy was carried out by steam at 125~128 °F for 120 seconds or 180 seconds, respectively. The chemotherapy treatments included EBI-602, Silver nanoparticle and CARV, using Pen as the positive control. The Nutrient treatment was additional micronutrient nutrition beyond the normal fertilization. According to the Field Trial Tree Evaluation Methods developed by CRDF, we investigated tree canopy, tree health, fruit drop and fruit quality as well as Las bacterial titers by real-time PCR. The tree canopy decline index (DI) was compared between the treated and control plants. The two-year results showed that PEN was the more effective to control Las bacterium than EBI-602, silver nanoparticle or CARV. Thermotherapy and additional nutrition promoted citrus growth and vigor, especially in the severe HLB-affected trees, whereas Las bacterial titers returned to original levels after a short-term decrease by heat-treatment. The disease severity index (SDI) decreased by 6% after application with PEN, followed by EBI-602 (4%), CARV (3.5%) and silver nanoparticle (1.3%). The integrated practices (antimicrobial treatment coupled with heat treatment and nutrition fertilization) decreased the fruit drop by 10~20 %, increased the fruit and juice weight by 3~13 %, and decreased the ratio of brix to acid by 0.2~5.0 %. However, this project was terminated in Aug. 31, 2016. Thereby, we could not get the second year data of fruit drop, fruit quality and yield. In addition to keep on the field trials of our previous enhanced projects, more than three-year's results indicated that PEN was also the most effective antimicrobial in eliminating the Las bacterium by gravity bag infusion. Due to the larger molecular weight and less solubility in water, VA, SDX, PCY and CARV were not very effective when applied by gravity bag infusion. The outcomes of this project will have potentials to go forward to solve the immediate problems that Florida citrus faces. A total of three publications have been published in Crop Protection, PLoS ONE and Journal of Applied Microbiology.

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Organization IRREC-IFAS, University of Florida

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Form PR-12 Quarterly Reports **SUBMIT REPORT**

CITRUS RESEARCH AND DEVELOPMENT FOUNDATION, INC.