▶ INSTRUCTIONS

(●) *Quarterly Report* ( ) *Annual Report* ( ) *Final*

Required: What is the "headline" for this report (e.g. a one-sentence "newspaper headline" describing what you accomplished)

Alternative antimicrobial agent for citrus protection

Proposal Title

Fixed-Quat: A novel alternative to Cu fungicide/bactericide for preventing citrus canker

Today's Date	Sponsoring Organization (drop-down)	Category (drop down)
4/15/15	Citrus Research and Development Foundation	Pathogen/Disease Detection

REPORT UPDATE (500 words; summarize your accomplishments)

In the past year, Fixed-Quat A nanogel material was developed successfully using EPA approved materials. This material demonstrated no phytotoxicity under controlled laboratory conditions while providing strong antimicrobial properties against Xanthomonas alfalfae and other laboratory model bacteria. Later, the material was delivered for 2014 citrus canker trial. This material was sprayed on "Ray Ruby" grapefruit with 3 week intervals at two rates (100 ppm and 200 ppm). Trees were sprayed throughout the "canker" season from March to October. Results from the trial exhibited high efficacy against canker. While untreated control trees exhibited a total canker infection of 63%, trees sprayed with 100 ppm of Fixed-Quat A nanogel exhibited only 24% infection and those trees sprayed with 200 ppm of Fixed-Quat exhibited an impressive efficacy (infection reduced to 15%). In the same trial, commercial products Kocide 3000 and Magna-Bon displayed 16% and 18% infection respectively at standard applications rates. In this reporting period, feedback from the 2014 canker trial was taken into consideration to generate a new and improved Fixed-Quat A-II nanogel from environmentally safe, EPA approved for "Food Use" and industrially-attractive raw materials. The new nanogel material was synthesized with a concentration as high as 12,000 ppm to allow for easy transport and to allow for easier storage in bulk quantities. The Fixed-Quat A-II nanogel's safety was tested by phytotoxicity studies carried out in a Panasonic Environmental Test Chamber (Model MLR- 352H) which allowed for controlled day/night cycling temperatures, light intensity and humidity to simulate summer weather conditions (biocide application season). Studies conducted on Vinca sp, an ornamental plant revealed no sign of plant injury even as high as 900 ppm of Quat. Antimicrobial studies of Fixed-Quat A-II nanogel was conducted against Xanthamonas alfalfae subsp. citrumelonis (Citrus Canker Surrogate). The MIC of new Fixed-Quat A-II nanogel was found to be 0.8 – 1.6 ppm. The morphology and particle size of Fixed-Quat A-II nanogel was examined using Scanning Electron Microscopy (SEM) and indicated that Fixed-Quat A-II nanogel existed as a large layered micron size composite material. This demonstrates the film forming capability of Fixed-Quat nanogel. The size and composition of Fixed-Quat A-II was additionally studied using UV-Vis Spectroscopy and Dynamic Light Scattering (DLS). DLS confirmed that Fixed-Quat A-II exists as a large multi-micron composite while UV-Vis suggested interactions between the composite components. A batch of Fixed-Quat A-II nanogel (~3.0 gallon; 10,000 ppm) was delivered for 2015 citrus canker field trial.

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Contract Number 759

Project Duration (years) 3 *Year of Project* 2

Total Funds (current year) $85,495.00

SUBMIT REPORT

CITRUS RESEARCH AND DEVELOPMENT FOUNDATION, INC.