COVER CROPS IN FIELD-GROWN NURSERIES: IMPACTS ON TREE GROWTH, PEST, AND BENEFICIAL ARTHROPODS

A Thesis

Submitted to

The School of Graduate and Professional Studies

Department of Agricultural and Environmental Science

Tennessee State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

Axel Gonzalez

June 2021

Keywords: *Chrysobothris femorata*, *Trifolium incarnatum* L, triticale (× *Triticosecale* W.), red maple *Acer rubrum*

COPYRIGHT

COVER CROPS IN FIELD-GROWN NURSERIES: IMPACTS ON TREE GROWTH, PEST, AND BENEFICIAL ARTHROPODS

June 2021

Axel Gonzalez

To the Graduate School:

We are submitting a thesis by Axel Gonzalez titled "Cover Crops in Field-Grown Nurseries: Impacts on Tree Growth, Pest, and Beneficial Arthropods". We recommend that it be accepted in partial fulfillment of the requirements for the degree, Master of Science in Agricultural Sciences with concentration in Plant Science.

Karla Addesso, Ph.D.

Chairperson

Anthony Witcher, Ph.D.

Committee Member

Jason B. Oliver, Ph.D.

Committee Member

Jianwei Li, Ph.D.

Committee Member

Lisa Alexander, Ph.D.

Committee Member

Accepted for the Graduate School:

Robbie Melton, Ph.D.

Dean of the Graduate School

DEDICATION

This thesis is dedicated to my family and friends, especially to my beloved wife Susan and my daughter Maya, for always be there to me in the good and bad times.

ACKNOWLEDGEMENT

My most genuine gratitude and respect go to my research advisor Dr. Karla Addesso for her amazing guidance and patience throughout the planning and execution of this thesis. Thank you for providing such a great mentoring and encouraging me to give the best of myself and to look at my work in different ways. Your support was essential to my success.

I would like to thank Dr. Jason Oliver, Dr. Anthony Witcher, Dr. Jianwei Li and Dr. Lisa Alexander for serving on my committee. I offer my sincere appreciation for the time and help. Your comments were crucial to accomplish this thesis.

Special thanks for the unconditional support of Ms. Paul O'Neal, research assistant in Insect Ecology lab at TSUNRC. Thank you for all the hard work and extra time spent on this project and your invaluable friendship.

Thanks to Ms. Nadeer Youssef for the advice and training. Your experience on insect identification was a great contribution to this work.

Thanks to my lab members Victoria, Faith, and Megan. And finally, thanks to my graduate student friends Ravi, Milan, Krishna, Isha, Vivek, for being there and help me in good part of this journey.

COVER CROPS IN FIELD-GROWN NURSERIES: IMPACTS ON TREE GROWTH, PEST, AND BENEFICIAL ARTHROPODS

ABSTRACT

AXEL GONZALEZ. Cover Crops in Field-Grown Nurseries: Impacts on Tree Growth, Pest, and Beneficial Arthropods (Under the direction of DR. KARLA ADDESSO).

The purpose of this thesis was to evaluate the performance of cover cropping in ornamental nursery production systems. The first experiment evaluated the growth of red maple trees at two different transplant timings into a crimson clover, Fall Transplant and Spring Transplant. The trees in the Spring Transplanted treatment grew more compared to the Fall Transplanted treatment.

In the second experiment, the establishment of two winter cover crops, crimson clover and triticale, was evaluated using Broadcast or Drill planting methods. The triticale established better with Drill method while crimson clover established equally well when Drilled or Broadcast. No significant differences were observed in soil microbial biomass carbon and nitrogen, or arthropod community composition indices between the treatments.

The third experiment consisted of the final two years of a four-year study on red maple trees grown with or without cover crop during the first two years post-transplant. The initial two-year study established the success of the cover crop in protecting trees against flatheaded borer damage, but with negative impact on tree growth. The total number of damaged trees during years 3 and 4 confirms that trees are more susceptible

during first two years after transplant. A total of 24 attacks on Herbicided trees, 2 attacks on Herbicide + insecticide trees, 6 attacks on Cover Crop trees and 0 attacks on Cover Crop + Insecticide trees were recorded. Trees in Herbicide rows remained one season ahead in growth compared to the trees under Cover Crop rows.

A fourth experiment was conducted as a follow-up to the original cover crop study. Four treatments were evaluated: Cover Crop, Early Kill Cover Crop, Herbicide and Mulch Mat. The Early Kill treatment was evaluated to minimize competition between the cover crop and trees while still providing protection against borers. Unfortunately, the Early Kill treatment did not prevent borer attacks. Over the two-year evaluation period, the Early Kill treatment had more attacks than the Herbicide treatment (16 vs. 11 attacks). The Cover Crop and Mulch Mat treatments had 6 attacked trees each.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES