A model for the spread of HLB attributed to D. citri

Jo Ann Lee¹, Susan E. Halbert², James Keesling¹, and Burton H. Singer³

¹Department of Mathematics, University of Florida, Gainesville, Florida; ²Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville, Florida; and ³Emerging Pathogens Institute, University of Florida, Gainesville, Florida

INTRODUCTION

Abstract
A model of the transmission of HLB between the psyllids and trees in a citrus grove is developed to attempt to understand the spread of HLB in Florida. We simulate the spread of HLB in a single grove and focus on the impact of the following factors: long distance migration and local movement of the psyllid vector, vertical and feeding transmission of Las among psyllids, and the difference between the latent period (time between initial infection and the point at which psyllids can acquire the pathogen) and incubation period (time between initial infection and the point at which symptoms appear) of HLB in the trees.

We are particularly concerned with whether the vertical and feeding transmission could be a factor for the rapid rate at which Florida saw the disease spread in its early stages. We also show that if the difference between the latent and incubation period of the disease in the tree is large, then the removal of trees in a grove may not be a reasonable management strategy. One should then consider tradeoffs among combinations of interventions that involve nutrient management of trees, psyllid control, and removal of trees.

Special Questions
A. Why can you find positive psyllid nymphs when you cannot find positive plants?
B. With the difference in the latent period and incubation period, can you get ahead of the disease curve by roguing?
C. How did greening spread so quickly in Florida?

RESULTS

MODEL

接受了假设

- 坚果果在系统性感染的植物中。
- 最有效的传播途径是通过传介媒介
- 病原体在系统性受感染的植物中传播。

- 传播途径包括垂直传播和吸汁传播。
- 垂直传播和吸汁传播

- 设计
- 随机出现的感染性成虫是由于传播途径的延迟。
- 近距离感染在两种方式中：在模型 I 中这是唯一的，而在模型 II 中则会出现。

- 使用的标准模型与直接感染的成虫在一个果园中表现为一个水源设施，促进介质传播的多样性。

- 结果

 közül

- 第一个模型比较了标准模型（蓝线）。
- 第二个模型使用了标准模型来比较状态的传播在一个果园中的终点。

DISCUSSION

Consequences
A. The dual pathway for adult/nymph-to-nymph transmission allows infected psyllids to develop on healthy trees. We hypothesize the bacterial release at feeding sites is enough to cause transmission among the psyllid population and not necessarily to the tree.
B. The rate of spread of the disease with the dual pathway transmissions does not depend on the latent period of the disease in the tree. The latent period is the period of time between initial infection of a tree and the time when another psyllid can acquire the pathogens from the same tree.
C. Using the standard model with less infected psyllids in a grove, Figure 2 shows that the removal of symptomatic trees is not effective since there would be a large number of infected adults and infectious trees (e) remaining.
D. The rapid increase in the number of infected psyllids within a single grove allows for a growing population and not necessarily to the tree.