Session 10: Epidemiology
10.1 Relationship between insecticide sprays and huanglongbing progress in a citrus orchard in São Paulo, Brazil

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Citrus huanglongbing (HLB), also known as greening or yellow shoot disease, is one of the most serious citrus diseases in the world. The Asian citrus psyllid (Diaphorina citri) is considered a serious pest of citrus in the world due to its ability to transmit the HLB agent. Management of HLB is difficult and requires an integrated approach including the use of healthy nursery trees, frequent surveys and eradication of symptomatic trees, and the use of insecticides to control HLB throughout the control of its vector. The purpose of this work was to relate the number of insecticide sprays with HLB incidence, in the conditions of a commercial orchard in Brazil. A total of 716,476 citrus plants (Citrus sinensis), from five to ten years old, distributed in 357 blocks were subjected to a different number of insecticide sprays (3 to 12) during three growing seasons (2004/2005, 2005/2006, and 2006/2007) in a farm located in São Paulo State, Brazil. Eradication of symptomatic trees was carried out in the whole area 4 to 8 times per growing season. Incidences of HLB in all blocks ranged from 0.0 to 8.35 % of symptomatic trees. The relationship between the number of eradicated plants and the number of insecticide sprays was investigated. Temporal data analysis was done by non-linear regression between disease incidence (y) and time (x) to all blocks, which were grouped according to its management. The Gompertz model was fitted to the data and its rate parameter (b), final incidence and number of sprays were divided, in ascending order, in three classes. The grouped blocks, belonging to the different parameter classes, were located on the map of the farm. There was no negative relationship between the number of sprays and HLB incidence (eradicated plants) considering each one of the three growing seasons (Figure 1). No relationship was also observed between the average number (Figure 2A) or the total number (Figure 2B) of insecticide sprays per block and the eradicated plants in the last season (to minimize the influence of a long latent period). These results suggest that, in the conditions of the farm, the low incidence of HLB was due more to eradication of symptomatic trees than to insecticide sprays. On the maps, the grouped blocks with the highest rates of disease progress were close to another farm, which had no management of the disease. The grouped blocks with the lowest final incidences were located in the center of the farm (Figure 3). Probably, the trees of that farm without disease management served as source of inoculum. Internal insecticide sprays were not efficient to avoid HLB-bacteria transmission by infectious psyllids from such external source.
Figure 1. Average number (symbols) and standard error (bars) of eradicated plants per block related to the number of insecticide sprays, during the years 2004/2005 (A), 2005/2006 (B) and 2006/2007(C), from blocks with plants from five to ten years old.

Figure 2. Average number (symbols) of eradicated plants per block, during the year 2006/2007, related to the number of insecticide sprays (average per block), during the years 2004/2005, 2005/2006 and 2006/2007, classified by the initial HLB incidence (2004/2005) (A). Average number (symbols) and standard error (bars) of eradicated plants per block, during the year 2006/2007, related to the total number of insecticide sprays, during the years 2004/2005, 2005/2006 and 2006/2007 (B).
Figure 3. Maps of the farm. Classes of rate disease progress (A), final incidence (B) and total number of insecticide sprays (C). The different colors represent the highest (red), intermediate (orange) and lowest (green) values of each variable.