Prevention and Control Measures to Contain the Advance of Huanglongbing (HLB) or Citrus Greening in the State of Paraná, Brazil

Technical Note No. 06/2023 Curitiba, July 28, 2023

Citrus production in the North and Northwest regions of the sate of Paraná, Brazil, is **at serious risk due to the increase in the occurrence of Huanglongbing disease (HLB) or citrus greening**. The Agricultural Defense Agency of Paraná - Adapar, the Institute of Rural Development of Paraná - IDR-Paraná and the State Secretariat of Agriculture and Supply - SEAB issue this Technical Note with the purpose of alerting and guiding the entire society of Paraná and, in particular, all the segments of the citrus production chain in the State on the severity of HLB, the obligation to comply with current phytosanitary legislation and on the strict adoption of technical measures to combat this disease.

Socioeconomic importance of the citrus production

The area occupied by citriculture in the state of Paraná is approximately 29,000 ha, including 20,500 ha of oranges, 7,000 ha of tangerines and 1,500 ha of Tahiti lime. The yearly GPV (Gross Production Value) of citriculture accounts for 826.8 million Reais (Approximately 168.7 million US$) with a production of 842.4 thousand tons of fruits (SEAB/Deral, 2022/preliminary data). Two areas stand out in the production of citrus fruits in the State, the North and Northwest regions in the production of oranges, and the Vale do Ribeira, Metropolitan Region of Curitiba, in the production of tangerines.

The orange produced in the North and Northwest regions is destined mainly for the production of concentrated juice (FCOJ) and ready-to-drink juice (NFC) in four larger industrial units. However, more than a dozen companies are also present, focusing on fruits for the *in natura* market. An entire production chain is already established in these regions, with the generation of jobs and income, having a majort economic impact in several municipalities, such as Paranavaí, Alto Paraná, Guairaça, Terra Rica, Atalaia, São João do Caiuá, Nova Esperança, Cruzeiro do Oeste , Altonia, Uraí and Nova América da Colina.

The disease

HLB is the main quarantine pest that affects citrus worldwide, due to its severity, rapid dissemination, and control difficulties. In Brazil, the bacterium "*Candidatus* Liberibacter asiaticus" (*C*Las) is the main causal agent of HLB. *C*Las affects plants of almost all citrus species and is transmitted by the Asian citrus psyllid *Diaphorina citri*

Kuwayama. HLB is present in citrus producing regions of more than 50 countries in Africa, Asia, Oceania, and the Americas, causing large economic losses. The first report in Brazil was in 2004, in the region of Araraquara, in the state of São Paulo. In 2007, the disease was detected for the first time in Paraná, in Altonia, in the Northwest region of the State. Currently, there are reports of HLB in all municipalities in the Northwest and North of Paraná, where there are commercial cultivation of citrus. On the other hand, the orchards of the Vale do Ribeira region are still free of this disease.

Millions of citrus plants with HLB symptoms have already been eliminated from orchards in the states of São Paulo, Minas Gerais and Paraná. However, the occurrence of the disease continues to increase in these states, and the incidence of diseased plants in São Paulo increased from 16.9% in 2016 to 24.4% in 2022. In Paraná, there is no updated official data on the incidence of the disease, but the rates are also worrying and are growing.

The initial identification of citrus plants with HLB can be done by observing the symptoms of the disease on leaves and fruits, but confirmation must be done by polymerase chain reaction test, PCR. HLB usually appears first in one or a few branches, but as the disease progresses there is an increase in symptomatic branches, and generalized chlorosis of the entire plant canopy may occur. The fruits, on the other hand, become smaller, asymmetrical, greener, and may have aborted seeds, reduced sugars, and high acidity.

HLB seriously affects the production of citrus plants, mainly due to premature fruit drop, which results in reduced production. Furthermore, the disease can lead to the premature death of the citrus plant, reducing the useful life of the orchards. Practically all commercial citrus species and cultivars are susceptible to HLB, regardless of the rootstock used. Grapefruit, sweet oranges, and tangerines are very susceptible to the disease, while limes, lemons, and sour oranges are less susceptible.

There is still no curative treatment for HLB. Thus, control must be preventive, preventing citrus plants from being infected. For this, regular inspections must be carried out in the orchards to identify and eliminate diseased plants, and as well as frequent applications of insecticides to control the insect vector, the Asian citrus psyllid *Diaphorina citri*. The preventive management of the disease also includes the use of windbreaks, the planting of healthy seedlings and planting density.

Insect vector control

The increase in the occurrence of HLB is probably related to the recent increase in the vector insect population due to failures in its control. These failures in the control of the Asian citrus psyllid can also contribute to the development of insect populations resistant to the main insecticides available on the market. To ensure an effective and safe approach to psyllid control, it is essential to follow some essential practices. First, it is essential to carefully plan the use of insecticides with different mechanisms of action. The diversification of the insecticides used, changing the chemical groups, helps to avoid the development of resistance, maintaining the effectiveness of these insecticides. Furthermore, when selecting insecticides, it is essential to adjust adjuvants that are in

perfect synergy with the chosen products. This procedure optimizes the action of the insecticides and maximizes control of psyllids, reducing the risk of unwanted interference.

Mixtures of insecticides with fungicides, and/or with foliar fertilizers and plant stimulants in the same tank should be avoided. Certain chemicals can have adverse reactions when combined, compromising the performance of the insecticide and even reducing its effectiveness in controlling the psyllid.

An efficient alternative to obtain a more lasting control of the insect vector of the HLB bacterium is the combination and intercalation of chemical products with biological products. This procedure provides an increase in the spectrum of action and can increase the overall effectiveness of management. However, it is essential to look for adequate compatibility with the use of fungicides, so that there is no negative interference in the action of entomopathogenic fungi, which are important biological control agents.

Ensuring the preservation of these beneficial agents contributes to the balance of the ecosystem and to maintain the natural control of the psyllid. In the same way, it is important to maintain programs for the release of natural enemies of the psyllid, such as *Tamarixia radiata*, which aim to reduce the reproduction of the vector insect in home orchards and ornamental plants, where chemical control is not normally carried out.

Elimination of symptomatic plants

The elimination of symptomatic citrus plants is essential to revert the current trend of increasing in the incidence of HLB in the orchards. The main measures to be observed are the following: a) the producer or the Technical Manager (RT) must carry out regular inspections in the orchards to identify and eliminate the plants with HLB symptoms. Inspections should start from the second year of implantation of the orchard. It is recommended to carry out at least four inspections on all citrus plants during the year. According to the MAPA (Ministry of Agriculture Livestock and Supply) Instruction nº 317/21, the elimination of symptomatic plants is mandatory for orchards up to the eighth year after planting, and optional for the others, as long as efficient control of the insect vector is carried out. The grower must eliminate, at his own expense, host plants with HLB symptoms, by pulling out or cutting close to the ground, with appropriate management to avoid sprouting; b) in all properties where there are host plants, the grower must monitor and control the insect vector of the HLB bacterium. This monitoring and control must be carried out in accordance with the technical recommendations established by scientific research and proven through auditable records; c) the grower must carry out the planting with healthy and quality nursery trees. Acquisition of nursery trees for trade and planting must observe the instruction of Adapar nº 359/19. The nursery trees must be produced in nurseries registered at RENASEM (National Registry of Seeds and Seedlings) and also registered at Adapar, with identification of the nursery and the nursery trees, presentation of plant protection documentation and invoice, in addition to authorization for the acquisition of citrus nursery trees, issued by Adapar; d) nursery trees should never be purchased from

street vendors. Commerce through street sales is prohibited in Paraná. This ban aims to prevent the introduction and spread of pests in the productive areas of the State, as well as to guarantee the quality and suitability of the nursery trees, contributing to the increase in productivity and competitiveness of the commercial citriculture in Paraná.

In order to comply with MAPA instruction no. 317/2021, Adapar carries out inspections on rural properties and villages with a view to correct the non-conformities and irregularities found, as well as to determine the eradication of all HLB host plants, in accordance with current plant protection legislation. Failure to comply with the notifications will result in the application of precautionary measures and the initiation of administrative processing against the offenders. The indictment installed will be forwarded to the Public Prosecutor's Office for application of civil sanctions, due to the fact that the offender is contributing to the spread of pests and diseases in citrus producing regions, of major economic importance.

Final considerations

HLB is undoubtedly a disease that has the potential to turn citriculture unfeasible, both in Paraná and throughout Brazil, with a major impact on the economy of the producing regions. In this sense, citrus growers need to be aware of the need to eliminate citrus plants with HLB and to carry out effective control of the insect vector. In turn, society in general also has an important role to play by not buying or planting citrus nursery trees purchased from street vendors, as well as by eliminating diseased plants in domestic orchards, both in urban areas and on rural properties. This goes for citrus plants (oranges, tangerines and lemons), and also for murraya plants, which are hosts for the bacterium of this disease and its vector insect, the psyllid.

Following these guidelines and recommended practices, Paraná will be able to maintain this important economic activity that is citriculture. In addition, it will be able to guarantee favorable conditions for its expansion, generating more jobs, income and supply of citrus fruits and their derivatives, a product of major nutritional value for the society.

Technical Team

Pedro Antonio Martins Auler/IDR-Paraná
Rui Pereira Leite Júnior/IDR-Paraná
Renato Rezende Young Blood/ADAPAR
Humberto Godoy Androcioli/IDR-Paraná
Rodolfo Bianco/IDR-Paraná
Paulo Jorge Pazim Marques/ADAPAR
Clandio Medeiros da Silva/IDR-Paraná
Eduardo Augustinho dos Santos/IDR-Paraná
Paulo Fernando de Souza Andrade/SEAB/Deral