

CROP INFECTIOUS DISEASES

Dogs are an orange's best friend*Proc. Natl Acad. Sci. USA* **117**, 3492–3501 (2020)

Citrus huanglongbing (HLB) is an infectious disease that results in billion-dollar losses for commercial citrus fruit growers worldwide. The bacteria *Candidatus Liberibacter asiaticus* (CLAs) is spread by the insect vector Asian citrus psyllid feeding on citrus fruits and infecting the tree. Visual tree assessment is unreliable, as the typical leaf discolouration can be mistaken for conditions like zinc deficiency and is only visible months after infection. Molecular detection, such as quantitative polymerase chain reaction (qPCR) and immunoassays, is the most reliable technique, but this requires the daunting and expensive task of routinely testing hundreds to thousands of trees twice a year. These approaches do not allow for practical early detection, which is the most effective way to control the spread of CLAs.

In the pursuit of an improved citrus tree management strategy, Gottwald and colleagues turned to an old friend — the detection dog — to develop a practical method of early CLAs detection. They trained ten dogs to identify CLAs-infected samples of Valencia orange or Ruby Red grapefruit on rough lemon rootstock. Once reliable in controlled settings, they were trained to detect infected trees in the field. The dogs successfully identified subclinical infections with an overall 99% reliability

within 1–2 seconds per tree over the course of testing ~10,000 trees. They could detect trees 2 weeks after CLAs infection, with an 87% detection rate at 3 months and >97% at 7 months post-infection. Compared to qPCR, which had a <20% detection rate at 32 months post-infection, the dogs were faster, less costly and more reliable at detecting early-stage CLAs infections.

Gottwald and colleagues predict using detection dogs would cost US\$7.50 per tree with immediate results, compared to qPCR, which costs US\$37.50 per tree and requires a two-week wait to receive the test results. Over a ten-year period, they modelled operating profits of a farm using dogs for early CLAs detection, estimating around US\$10,000 per acre higher operating profit than using qPCR or visual detection. Detection dogs will be useful for citrus farmers across the world, and especially important in low-income economies where molecular testing is not widely available. Additionally, early CLAs detection will reduce the need for pesticide treatments, which will contribute to more sustainable citrus fruit farming.

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