

Fe²⁺ Ions Solution Alleviates the Symptoms of Citrus Greening Disease in Plants

Aichi Steel Corporation (President: Takahiro Fujioka), Hiroshima University (President: Mitsuo Ochi) Emeritus Professor Yoshikuni Masaoka, and a research group from the Hiroshima University Graduate School of Biosphere Science have discovered and shown that spraying of an Fe²⁺ ions solution¹ is highly effective in alleviating the symptoms of citrus greening disease² (CG).

These results were published on June 4, 2020 as a journal article in the *International Journal of Molecular Sciences*, a journal specializing in life sciences, (Published by MDPI: Head Office - Basel, Switzerland).³

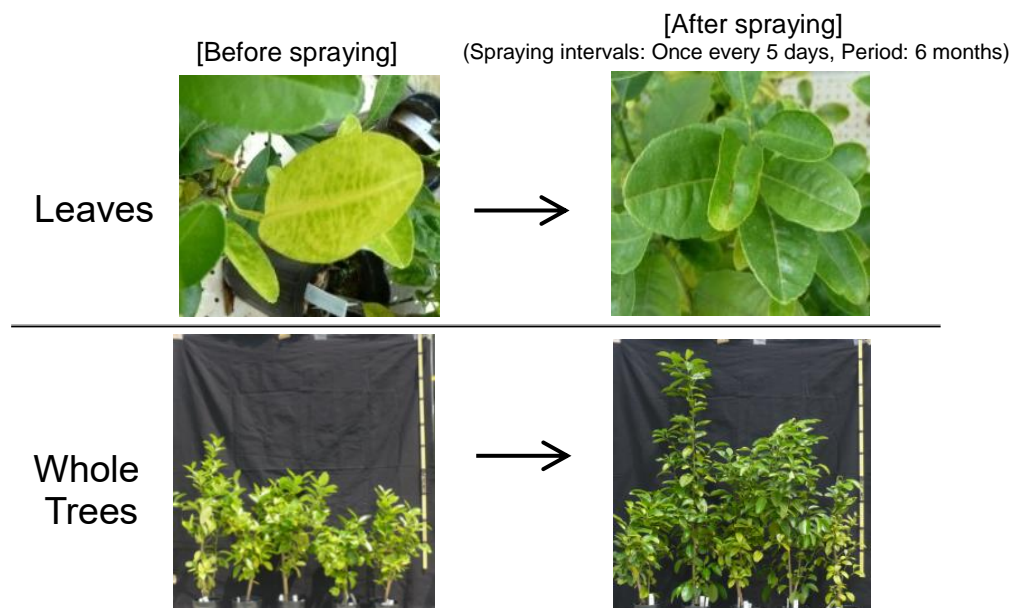
CG is a disease that greatly decreases the yield of citrus trees and has severe impacts throughout tropical and subtropical zones. It has become a serious problem as there is no fundamental treatment other than felling the infected trees.

Professor Masaoka and the Hiroshima University research group found that the symptoms of CG in infected trees are similar to those of iron deficiency. They sprayed infected citrus trees (rough lemon, etc.) in a greenhouse with an Fe²⁺ ions solution developed by Aichi Steel, which is easily absorbed by the plants, and the results showed alleviation of the symptoms of the disease. Measurement of the Fe²⁺ ions in the solution was carried out by Toyota Central R&D Labs, Inc.

The research group assumed that iron nutrients are not evenly distributed in plants infected with CG, and this causes the iron deficiency. It is believed that, although it is difficult for the plants to absorb regular iron (Fe³⁺), if there are Fe²⁺ ions the iron nutrients are absorbed, even by infected plants, and the symptoms of iron deficiency are alleviated.

Going forward, these effects will be verified by field tests in places where CG is prevalent, such as America and Southeast Asia, and it is hoped that this will contribute to the stable supply of citrus.

[Comparison of before and after spraying with the Fe²⁺ ions solution (trial in a closed system greenhouse)]



*1 Manufactured iron solution with Fe²⁺ ions for easy absorption of iron by plants.

The regular form of ferrous ions in the atmosphere is Fe³⁺ but the nutrients are incorporated into plants through conversion by the plants into Fe²⁺ ions.

*2 A disease caused by bacteria that infects citrus plants, leading to yellow leaves and poor growth of the trees overall. It also reduces the growth of fruits and causes die back and plant death.

*3 Name of article: "[Fe²⁺ Ions Alleviate the Symptom of Citrus Greening Disease](#)"

Source: *International Journal of Molecular Sciences* (Published by MDPI: Head Office – Basel, Switzerland)