Vibrations against invasive whiteflies in citrus orchards

Problem
The orange spiny whitefly Aleurocanthus spiniferus is a pest of many crops, especially citrus. Mineral oils are sometimes used to control the orange spiny whitefly and need to be replaced with more sustainable solutions.

Solution
Orange spiny whiteflies communicate with each other through vibrations. Disruptive vibrations can interfere with their communication and reduce their populations. This method is especially effective when combined with other plant protection strategies.

Outcome
A mini-shaker controlled by a microchip vibrates the wires connected to the citrus plants. In combination with essential oils/plant extracts, the application of vibrations effectively reduces populations of orange spiny whitefly.

Practical recommendations
- Wires must touch the plants to transmit disruptive vibrations, which are better propagated through young and trimmed plants.
- Disruptive vibrations are effective if the distance between the mini-shakers does not exceed 50 meters. The poles carrying the mini-shakers are set at regular distances to ensure that the wire is under sufficient tension to guarantee an adequate vibration amplitude.
- The mini-shakers should be turned on at first signs of infestations, because whiteflies can mate without vibrational communication when population density is high, making mating disruption approaches ineffective.
- The simultaneous application of plant extracts/essential oils (e.g., Clitoria ternatea and orange essential oil) enhances the effects of the disruptive vibrations. It significantly affects the orange spiny whitefly, especially when population density is not yet high.
- The energy is supplied by solar panels connected to the mini-shaker by electric wires.
- The microchip of the mini-shaker can be programmed to transmit vibrations that target other pests which also rely on vibration signals.

Applicability box

<table>
<thead>
<tr>
<th>Input used</th>
<th>Geographical coverage</th>
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<tbody>
<tr>
<td>☐ Copper</td>
<td>Mediterranean basin and other citrus-</td>
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<tr>
<td>× Mineral oil</td>
<td>growing countries</td>
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<td>☐ Fertilisers</td>
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<td>☐ Anthelmintics</td>
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<td>☐ Antibiotics</td>
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<td>☐ Vitamins</td>
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<tr>
<th>Application time</th>
<th>Period of impact</th>
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<tr>
<td>During the cropping season</td>
<td>Actual crop</td>
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<th>Equipment</th>
<th>Best in</th>
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<tbody>
<tr>
<td>Poles, wires, mini-shaker, essential oils/plant extracts</td>
<td>Young citrus crops</td>
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Picture 1: The mini-shaker is connected to the pole, and wires are in contact with the plants (Photo: Sabina Avosani, CIHEAM-Bari).
Picture 2: Citrus plants are in direct contact with the wires that transmit the vibrations received from the pole and are powered by solar panels (Photo: Sabina Avosani, CIHEAM-Bari).
On-farm application

System approach

- Vibrations dissipate with distance. Therefore, it is important to install a sufficient number of mini-shakers and ensure signals are properly transmitted to the plants, for example, by tying stem and/or branches to the trellis wires.
- Vibrational signals used in synergy with essential oils/plant extracts can be considered a suitable strategy against orange spiny whitefly in organic citrus orchards. This method is free of chemicals and does not release harmful residues into the environment. Purchase and installation of vibratory devices should be seen as a farm investment for the long term, considering that periodical maintenance is required.

Further information

Further reading

Weblinks
Check the Farm Knowledge Platform for more practical recommendations.

About this practice abstract and RELACS

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RELACS: ‘Replacement of Contentious Inputs in Organic Farming Systems’ (RELACS) builds on results of previous research projects and takes far-advanced solutions forward. As a system approach to sustainable agriculture, organic farming aims to effectively manage ecological processes whilst lowering dependence on off-farm inputs. The RELACS partners will evaluate solutions to further reduce the use of external inputs and, if needed, develop and adopt cost-efficient and environmentally safe tools and technologies.

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