San Joaquin Valley Guide for ACP/HLB Management in Organic Citrus

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1. Introduction

Organic and/or in-transition-to-become organic citrus makes up approximately 5% of the total citrus production in the San Joaquin Valley of California. Organic citrus is increasingly desired by consumers. Before the arrival of Asian citrus psyllid (ACP), the main barriers to organic production were management of soft scales and weeds. Organic growers relied upon natural enemies and applications of organic insecticides for insect and mite pest control and managed weeds with mowing, discing and/or cover crops. However, ACP transmits a deadly bacterium *Candidatus* liberibacter asiaticus (CLas) that causes huanglongbing. Thus, the situation has changed from managing pests to prevent crop damage to managing a disease known to be lethal to citrus. Research has shown that natural enemies are delayed in their control of psyllids and therefore cannot be solely relied upon for control of disease spread. Organic insecticides, in both laboratory and field trials, are very effective if they make direct contact with pests, but have an extremely short residual life and have little effect if they do not contact insects. The following best management practices for organic growers are intended to maximize control of ACP and minimize spread of HLB by providing a minimum standard for organic citrus production. Always check with your certifier before implementing a new technique.

2. ACP Monitoring and Thresholds

*One of the **key components to ACP Management** is to utilize sampling methods to monitor for the presence and seasonal densities of psyllids. In early stages of infestation,* ***ACP are aggregated on field edges.***

Tap Sampling is used to estimate the number of adults on a citrus tree. For tap sampling, you need a stick or mallet to tap the branches and a clipboard (preferably white) that the ACP will fall on. The branches chosen for tap sampling should be about mid height of the entire tree. the branch gently two to three times over the clipboard and then count the adult ACP fallen on the clipboard. Spraying the clipboard with slightly soapy water helps to keep them on the clipboard to count them. In California conditions, tap sampling reveals small numbers of psyllids, unless the population density is very high.

Visual Survey is used to count the eggs and nymphal stages of ACP. For the visual survey, it is important to know the structure of the plant and feeding behavior of Asian Citrus Psyllid. Adult ACP can feed on any leaf material, including soft, flush leaves and the hardened, waxy mature leaves and green stems. However, most adults and other stages of the pest are found on the new leaf growth of the tree (flush). ACP lay their eggs only on the youngest newly emerging leaf flush (Fig. 1a). and nymphs can only feed on soft expanding leaf flush and soft green stems. Once the flush hardens off, then only adults can feed on it.

Fig 1. (A) Newly emerged flush suitable for ACP oviposition, (B) Newly emerged flush and developmental stage flush, perfect for laying eggs and nymph feeding, (C) Developmental stage flush for ACP feeding in all stages, (D) Close to maturing flush suitable for adult ACP and late stage ACP nymph feeding

The only tool needed for counting ACP eggs and nymphs is a *hand lens*. ACP eggs are shiny, orange and teardrop shaped. Nymphs have five stages and require 15 - 47 days to mature depending on the season and temperature. The stages of the nymphs can be distinguished by their size and shape. Earlier stages will be small and found mostly on leaves (Fig. 1B). Stages 3-5 are easier to identify because the wing buds and the red eyes are more visible, they produce obvious white waxy tubules, and they tend to congregate on stems, especially at the nodes where leaves attach (Fig. 1C). One of the signs of ACP presence is honeydew and sooty mold on the leaves. Ants actively tend and protect the nymphs to consume the honeydew.

Thresholds for ACP Control. San Joaquin Valley growers are currently utilizing an eradicative approach. Thus, any psyllid finds are rapidly treated with insecticides. In this region, local eradication is achievable because the environment is not very conducive to egg laying by the psyllid (extremes of winter cold and summer heat harden foliage). In other areas of the state, where the psyllid is well-established and reoccurs because of a milder climate and more continuous flush availability (coastal and inland southern California), psyllid populations are being managed not eradicated. The action threshold for management is 0.5 psyllid nymphs/flush or 2 flushes infested/10 flushes sampled. ***Note: Any ACP presence, even if kept below the suggested threshold, still poses a risk for HLB transmission.***

3. ACP Management

a. Cultural and Mechanical Methods of Suppression

i. Cultural Management

Pruning and nitrogen both stimulate citrus trees to produce leaf flush that is susceptible to egg laying by the psyllid. Therefore, these practices should be timed so that they produce flush during periods of the year when ACP are least active (spring and early summer) and minimized.

ii. Barriers

1. Mesh Tree Covers

Mesh tree covers are primarily used to protect new plantings and smaller sized trees. The covers prevent access to the trees by psyllids. However, there can be secondary pest outbreaks inside of the tree covers that must be managed and the covers need to be replaced as the tree grows. Mesh tree covers should be placed on trees keeping in mind to leave no gaps or holes for ACP to penetrate the covering.

2. Living Windbreaks

Significant reductions in psyllids have been observed along citrus borders that have windbreaks. The challenges with utilizing living windbreaks are the time to establishment and their water usage. Living wind breaks should be planted close to the border but allowing enough space for equipment to access the ends of the rows. Ideally, windbreaks would be placed around the entire field, but if the grove is near residential areas, sides facing residential areas should be prioritized.

3. Mesh Fencing and Containment

Screen mesh fence barrier should be at least 12 feet high and 30-40 feet from the border of the grove to allow for equipment to turn at the ends of rows. If the operator

decides to attach an apparatus to capture psyllids, such as a yellow sticky tape, it should be placed at a height of 6 feet on the fence, because that is the typical flight height of the psyllid. It is essential that the fence is made of a permeable material so air can move through with ease but small enough to prevent psyllids from penetrating. The fencing can be optimally placed on the sides where psyllids regularly penetrate the grove. *Mesh Screening Recommendation:* 50 mesh anti-insect netting or mesh used to prevent thrips, OptiNet 40 (hole size 0.40 x 0.79 mm) or OptiNet 50 (hole size 0.25 x 0.79 mm) that protect against whiteflies, aphid and psyllids are a commonly used brand. The OptiNet 40 would allow more airflow, but also be less protective in letting psyllids pass through.

CUPS - Citrus Under Protective Structure is similar to the mesh fencing but fully encloses the sides and top of the grove. CUPS prevents entry to the grove completely, however, the construction costs for this type of structure are high.

iii. Repellants

1. Repellent Sprays

Visual repellents: Particle films such as kaolin clay or diatomaceous earth can be applied to the canopy of citrus trees to help repel psyllids and reduce egg-laying. Under most conditions, there is the added benefit of enhanced growth in particular with kaolin because its light color reflects additional light into the interior of the canopy. However, with enhanced growth, trees can be quick to grow out of the treatment leaving untreated, exposed flush which is very attractive to psyllids. These materials are not rain fast and in Florida, must be reapplied every two weeks. In California, they are used for sunburn protection in the desert areas but at this time, the rate of flush outgrowing in CA is unknown. Issues include difficulties in adhering the materials to new leaves, especially lemons and the problem of secondary outbreaks of pests such as California red scale, because particle films prevent natural enemies from reaching their prey.

Chemical repellents: Repellent chemicals are sprayed onto trees acting to reduce psyllid feeding and/or egg-laying. Repellent sprays may have synergistic effects with organic insecticides but this is yet to be investigated. At this time, the level of repellency of tested chemicals, when applied to field trees, has not supported their registration.

Reflective Mulch

Reflective mulch disrupts the psyllid's ability to find the citrus plant while in flight. This technique has been shown to reduce psyllid pressure in young citrus trees under Florida conditions. An added benefit is mulch reflects additional light up to the canopy and can accelerate growth rates. This technique is most effective when combined with other tools such as insecticides or other tools that could provide extra protection from psyllids. Check with the certifier because some mulches are not biodegradable and so not allowed because they become incorporated in the soil as they age.

3. Attract and Kill Devices

Development of an attract and kill trap has been approached from multiple angles and is currently still in development. The trap must be more attractive to the ACP than the citrus tree and kill ACP through exposure to a low-dose of insecticide. ACP are primarily attracted to color (yellow and lime green—with more specific colors noted in Allan et al. (2020) and secondarily attracted to scent. At the moment, a conventional insecticide incorporated in a trap is not acceptable for organic citrus unless the traps are hung outside the orchard.

b. Chemical Methods of Control

i. Registered and Tested Organic Insecticides

Table 1 shows the currently recommended insecticides for ACP control in California citrus. These products are recommended because they have shown the greatest efficacy against psyllids in field trials. A large number of organic insecticides have been screened in the laboratory, greenhouse and field for efficacy against ACP (Bethke et al. 2014, 2017; Qureshi and Stansly 2014, 2016a, 2016b, 2017, 2019a, 2019b; Tofansazi and Grafton-Cardwell 2016, Tofansazi et al. 2016, 2017, 2018). In addition, Beth Grafton-Cardwell directed scouts to monitor grower applications of organic insecticides in various orchards around the state. The results of these studies of organic products are shown in Appendix Table 2. In general, many of the organic compounds are toxic to psyllid adults and/or nymphs in the laboratory, greenhouse or semi-field studies, but many fail in whole field trials. Most work well on psyllids if an adjuvant such as oil or Oroboost is added and direct contact with the insect is made. However, residual toxicity is less than 14 days for most of these compounds. Orchard studies have shown that ACP populations must be very low for single applications of these insecticides to be effective, even with the addition of oil. Research is needed to determine if there are additional products that could be recommended to manage psyllids. Studies of multiple applications, adjuvants and mixtures are needed to improve residuality.

Table 1: Currently recommended organic insecticides for ACP control in California citrus. See the UC IPM Guidelines for Citrus https://www2.ipm.ucanr.edu/agriculture/citrus/asian-citrus-psyllid/

Formulation	Insecticide	Rate/acre	Adjuvant	Comments
Entrust SC Naturalyte	Spinosad	10 fl oz	0.25-1% 415 or 440 oil	pH 6-9 Oil (1%) + NufilmP (16 oz)
Pyganic EC 5.0II	Pyrethrins	15.61 fl oz	0.25-1% 415 or 440 oil	pH 5.5-7 Treat at night (UV sensitive) Oil (.5%) + NufilmP (16 oz) Do not use during bloom
Oil*	415, 435, 440	0.25-0.5%		

**Higher rates of oil can be used with caution due to potential phytoxicity to the trees. Ensure trees are well-irrigated during hot weather.*

ii. Factors to consider that influence efficacy and residuality of insecticides

Coverage, Mixing and Dilution

Ground applications (outside coverage, 100-250 gpa) have been shown to be more effective than aerial applications (10-50 gpa). Studies are needed to compare ultra low volume and low volume ground applications compared to aerial applications with regard to efficacy and length of control.

Remember to mix compounds in the correct order for maximum efficacy.

1. Add wettable powders and water dispersible granules
2. Agitate tank mix
3. Add buffers, water conditioners, or anti-foam
4. Add liquid flowables, suspensions, and liquid/dry fertilizers

5. Add emulsifiable concentrates
6. Add Surfactants/Adjuvants

Mixtures and Rotations
While mixtures of insecticide active ingredients are generally not recommended for citrus pest management, there are indications that organic control of ACP is an exception to that rule. Grower experience indicates that not just adjuvants, but mixing two active ingredients can increase the efficacy and/or the residual effect.

Night Applications
Some organic insecticides are UV sensitive. Thus, applying insecticides at night avoids this problem and extends the life of the insecticide. Additionally, psyllids are less likely to fly at night and more likely to be contacted with the insecticide treatment.

Frequency of Application
Because of the short residual nature of organic insecticides, it has been recommended that two applications of organic insecticides be applied, about 7-10 days apart when an ACP treatment is necessary.

pH
Improper pH can significantly reduce the efficacy of an insecticide. Some organic insecticides are very sensitive. See Table 1 for pH ranges.

Adjuvants
It is clear that adjuvants are critical for improving the efficacy and residual life of organic insecticides. Oils are most commonly used, but other adjuvants (in particular NuFilm P) need further study to determine their best use (concentrations and combinations with each insecticide). Adjuvants should be added to the tank after the pesticide has been mixed with water.

iii. Tactics for managing psyllids with chemical controls

Whenever possible, treat the perimeter first to avoid chasing the psyllids out of the orchard.

1. Eradicative Treatments
In areas such as the San Joaquin Valley, where psyllid densities are extremely low, the approach is to locally eradicate them whenever they are found. This involves applying insecticides in the infested and neighboring orchards and residences in a timely and uniform manner. Organic insecticides are approved for use in this situation, but two applications 10-14 days apart are needed. Follow up monitoring must be conducted to demonstrate the insecticides are effective and if more psyllids are found, more treatments are needed.

2. Areawide Treatments
In areas of southern California where the psyllid is well-established, areawide treatments are applied. Area wide treatments are a regional coordinated effort with the goal of having a spray applied to a region within a specific window of time; this helps to control the insect broadly within the region. For organic growers, this includes a winter and 1-2 fall treatments of two organic insecticides applied 10-14 days apart (a total of 4-6 applications).

3. Young Orchards and Replants

Young orchards and replanted trees are very attractive to psyllids because of the quantity and frequency of new flush available for egg laying. Additional monitoring is needed and extra treatments may be needed.

4. Full Coverage Versus Perimeter-Only Treatments

When psyllid populations are very low, they prefer to infest trees along the perimeter of the orchard. For areawide programs, perimeter treatments could be applied as a protectant in regions where psyllids are scarce and as an early or additional treatment in regions where psyllids are common. Perimeter only treatments should not be used for eradicative treatments. This tactic does not work for heavy populations of psyllids, as they infest the entire orchard. This tactic also does not work for young orchards because the psyllids don't perceive an edge when the trees are less than 6 feet high.

c. Biological Control

It is very difficult to utilize biological control agents alone to prevent spread of HLB because it only takes a few psyllids to spread the disease. It is difficult for natural enemies to continuously reduce psyllids as low as insecticide treatments. In the San Joaquin valley, where local eradication is possible, it is important to utilize insecticides. Research and field demonstrations are needed to improve the utilization of biological control in regions of southern California where ACP is being managed.

i. Predators

Lacewings, spiders, ladybugs, syrphid flies and other generalist predators play a significant role in reducing psyllid populations. In California, Kistner et al. (2016, 2017) have demonstrated in residential citrus that the syrphid flies provide the bulk of psyllid control. However, generalists tend to arrive as psyllid populations are building. The difficulty is how to rear and release or attract syrphids and other generalists in sufficient numbers to keep psyllid populations low enough throughout the season to prevent disease transmission.

ii. Parasites

Tamarixia radiata has been imported, released and demonstrated to be an effective parasitoid of ACP. It impacts ACP in two ways. First, it lays its eggs in late stage nymphs and secondly, it host feeds on nymphs and kills them. The observation of natural populations in S. California citrus orchards, is *Tamarixia* appears in the fall (Sep-Dec) in orchards with fairly high populations of psyllids (>5/leaf). Thus, on their own they do not arrive early enough in the season or control psyllids sufficiently to keep them below the action threshold. *Tamarixia* is expensive to rear and so only limited quantities are available for releases (100s/site). In SJV, *T. radiata* has been released by the CPDPC program in and around residential areas when ACP has been found, but they are not relied upon for eradication, rather insecticides are the first line of defense. Insecticides, including organic insecticides such as Entrust, Pyganic and oil, are toxic to *Tamarixia* (Tofangsazi et al. 2018), thus parasite releases and insecticide treatments are not compatible when applied at the same time.

iii. Ant Control

Ant control is critical to allow natural enemies to reduce ACP populations. Ants actively

protect psyllids from predators and parasites, as the honeydew from ACP is a food resource. This is a much greater problem in southern California where Argentine ant is the most common species compared to the San Joaquin Valley where the native gray ant is most common. Boric acid is the only product available for organic citrus. It has been utilized in liquid in bait stations, but these need to be refilled at frequent intervals to prevent evaporation from altering the concentration of the toxicant and causing ants to avoid it. Sticky barriers can be applied to the trunk, however, they can not touch the tree bark directly and they are difficult to maintain because the adhesive material can affect the bark and it is not OMRI approved. Research is ongoing with hydrogels, an encapsulated liquid, that could be more easily applied. Ant control is improved by pruning trees to reduce access points, and growing cover crops or applying mulch that interferes with trail following.

4. HLB Management

a. Surveys for HLB

The CDFA survey crews are sampling psyllids and suspect leaf tissue all around the state of California and submitting samples for testing in regulatory labs. If the grower is located in the San Joaquin Valley and finds psyllids or suspects disease symptoms, leaf samples can be submitted to CCTEA (information below) and they should be report the finding to CDFA or the county Ag Commissioner.

In southern California, where psyllids are endemic, growers can submit samples to the following labs if they would like additional information. However, if the grove is located in an HLB Quarantine zone all collecting needs to be done by regulatory authorities.

As ACP are aggregated on the edges of groves, *the best practice for sampling leaves for HLB testing is to collect leaves from trees on the edges of groves.*

i. PCR testing of grower submitted samples by laboratories:

The Citrus Pest Detection Program (formerly the Central California Tristeza Eradication Agency) can receive samples of psyllids or plant material from growers, except not from HLB Quarantine zones. Please note: There is an official protocol for sample preparation before submission to this lab, so we recommend you contact the CCTEA prior to collection. Samples incorrectly prepared may be rejected from the lab upon submission. The Agency can also test for citrus stubborn, which can cause leaf symptoms similar to HLB.

https://www.cctea.org
559-686-4973
22847 Road 140
Tulare, CA 93274

ii. EDTs- Early Detection Techniques

Many EDTs studied and several are in some stage of development (such as detection of proteins produced by the bacteria or the tree and volatile changes in sick trees) but none are USDA-approved regulatory tools to confirm the presence of CLas. Canines are currently being used to determine if trees have been exposed to the CLas bacterium,

the causal agent of HLB. Exposure could mean the bacterium is present but not causing disease to the trees. No PCR positive results have been found in commercial citrus following a canine alert to date, however, growers in some regions are removing trees in response to the alerts in an effort to prevent disease establishment. In the San Joaquin Valley, the best prevention of HLB establishment is detection of psyllids, testing the psyllids for CLas, and insecticidal eradication of the psyllids.

iii. Infected Tree Removal

PCR+ trees or nymphs: California is currently under an HLB-eradication program If HLB is detected, treatment with conventional insecticides for trees infested with infected nymphs and removal of PCR-positive infected trees is mandatory. Please see the Voluntary Grower Response Plan for HLB for additional information: **www.citrusinsider.org/psyllid-and-disease-control/voluntary-grower-response-plan-for-huanglongbing**

iv. Tree Nutrition

Maintaining tree health, especially root health is critical for withstanding ACP and HLB. Many nutritional products were tested in Florida. While they can improve tree health, none are a cure for the disease. Talk to a qualified individual before choosing nutrients or supplements.

v. Resistant/Tolerant Varieties

There are no truly CLas-resistant citrus varieties with edible fruit at the moment. There are indications of some varieties that have some level of tolerance, but more research needs to be done to develop a truly resistant variety.

vi. Bactericides

Antimicrobial substances that act directly on the bacterium (CLas) have been developed and some are registered for use. However, there are no organically-approved formulations.

5. Integrative Management/Stacking Techniques

The current understanding of ACP and HLB management is that there is no silver bullet or single technique/tactic for management. In response to this, researchers are at the threshold of investigating the "stacking" of techniques to see if effects of any one technique can be enhanced. One of the most important concerns to Florida growers is repopulating orchards with natural enemies and preventing entry of new pests. Currently, entomologists in Florida are working on understanding how hedgerows using native plants can be combined with other management techniques to sustain natural enemy populations. This technique will not be sustainable in some areas of California due to the need for water. However, other stacking ideas have also been proposed. For example, how artificial fencing around a grove in addition to hedgerows may help suppress ACP populations and sustain natural enemy communities. It has also been proposed to look at artificial fencing in combination with kaolin treatments. Kaolin can keep ACP populations low. However, depending on tree age, trees can grow out of the kaolin treatments very quickly and the fencing, for example, may assist in continuing to keep populations low by preventing further invasion. To minimize the risk of HLB transmission and maintain ACP populations at low levels over the long term in California organic orchards, stacking the techniques mentioned in this document is a good starting point (ex: screen fencing + kaolin border spray).

6. Conclusion

A diversity of approaches is still under investigation for organic citrus. This includes but is not limited to investigation of new active ingredients, stacking techniques, and conservation biological control. Organic citrus currently has few tools available for use and it is a central goal of researchers to provide additional tools or refinement of existing tools. This document will be updated as the SJV situation changes and as new tools and techniques arise.

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Appendix

Table 2. Organic chemicals that have been tested in University laboratory (Lab), greenhouse (GH) and field (Field) trials and show efficacy against psyllids or utilized by PCAs for other citrus pests and have potential for use against ACP.

Product	AI	Omri certified/ label for citrus	Guideline recommending use - test type[a]	ACP on label	Efficacy against pests noted by growers and potential for ACP	Notes to improve efficacy for ACP (100-250 gpa)
Pyganic (botanical)	pyrethrins	Yes	UC IPM - GH, Lab, Orchard	Yes	Suppression: Katydid, thrips, GWSS Control: aphids, citricola scale crawlers, leafhoppers, ACP	pH 5.5-7 Treat at night (UV sensitive) Oil (.5%) + NufilmP (16 oz) Max rate Pyganic 5 EC for GWSS (15.61 fl oz) Do not use during bloom
Entrust SC Naturalyte	spinosad	Yes	UC IPM - GH, Lab, Orchard	Yes	Suppression: katydid Control: thrips, ACP	pH 6-9 Oil (1%) + NufilmP (16 oz) Max label 10 oz More effective as mixture with Aza-direct
Grandevo (bacteria)	*Chromobacterium subtsugae*	Yes	GH	Yes	Suppression: thrips, does not work on its own unless 1-2 lbs as a 'prespray' followed by Veratran	pH 6-8 Oil (.5-1%) 415-440 in 100-250 gpa
Venerate XC or CG (bacteria)	*Burkholderia* strain A396	Yes	GH	Yes	Little activity against thrips and mites	
PFR-97 (fungus)	*Isaria fumosorosea* strain 97	Yes	GH	No	Control: thrips, mites	pH neutral 6.5-7.5 Treat at night
Met 52 EC (fungus)	*Metarhizium anisopliae*	No/Citrus not on label	GH	No	?	
Mycotrol ESO (fungus)	*Beauveria bassiana* GHA	Yes	GH	Yes	?	
BioCeres (fungus)	*Beauveria bassiana* ANT-03		None	No	?	
Requiem EC (botanical)	*Chenopodium ambrosioides*	No Omri		Yes	Low activity against mites	
Aza-Direct, others (botanical)	azadirachtin	Yes	GH	Some	Suppression: thrips Control: Tank mix with Entrust or Pyganic for thrips, citricola crawlers Aza-Direct is the most effective formulation	pH 5.5-7 Oil (.5-1%) in 100-250 gpa Night treatments (reduced activity of insects and drying time)
Azera (botanical)	Azadirachtin + pyrethrins	Yes	GH	Yes	Little activity This formulation has low rates of pyrethrins and azadirachtin	
Cinnerate	Cinnamon oil	Not tested		No	Control: Citrus red mite	

Product	AI	Omri certified /label for citrus	Guideline recommending use	ACP on label	Efficacy against pests noted by growers and potential for ACP	Notes to improve efficacy for ACP (100-250 gpa)
Ecotec Plus	Rosemary, geraniol, pepperment oil	Not tested		No	Control: peelminer	
Pest Out	Cottonseed oil, clove oil, garlic oil	Yes	GH	No	?	
Ecotrol EC	Rosemary and peppermint oil	Yes		No	?	
Trilogy (botanical)	Neem oil	Yes		No	Very expensive	
Various 415 and 440 oils: IAP Spray Oil and othersl	Mineral oil	Yes	UC IPM U. Florida - GH, Orchard	No	IAP 415 most common label that allows spring use 440 is gaining use in organics	March (1.5%-2%) Later in season (1%) in 100-250 gpa High rates must treat at night Avoid May-June fruit sensitivity
Oroboost	Adjuvant, spreader, surfactant	Yes	GH	No	Problems with phytotoxicity	
Sil-Matrix	Potassium silicate	Yes	GH	No	?	
Nufilm P, Sustain	Adjuvant, spreader	Yes		No	Sustain is being used more 8-16 oz/acre	Oil breaks the Sustain apart, so keep the oil below 1%
M-pede	Potassium salts of fatty acids	Yes		No	Problems with phytotoxicity (High label rate on a hot day with oil will mark fruit)	
Surround	Kaolin clay	Yes	GH, Orchard	No	Sunburn protection Control: 50 lb surround plus 10 lb lime for grasshoppers, leafhoppers on the outside row	Interruption of natural enemies Delay applying nutritionals Agitation is critical Pesticide treatments may flake it off No more than 350 gpa with 50 lb Add Nufilm P or oil to help with sticking
Celite 610, others (must have label for citrus)	Diatomaceous earth	Expired certification/ Citrus not on label	GH	No	Control: 100 lb for cottony cushion scale and red scale, 20 lb for thrips	Photosynthesis inhibition Interruption of Aphytis Agitation is critical

[a]*test type: Greenhouse, laboratory, orchard*

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