Sound Horticulture
360-739-9095
www.SoundHorticulture.com
Science, Nature & Service

Strawberries

Overview:
Strawberries are grown throughout the temperate Northern Hemisphere from coastal fields in Florida to glasshouses in Finland. No matter where they are grown, they are a favorite crop for aphids, spider mites, thrips and humans, to name a few. Biological control of insect pests of strawberries has been very successful in recent years primarily due to the use of fresh, aggressive beneficial insects, capable of acting in a preventative role and generalist mites, capable of feeding on multiple prey and pollen.

Outdoor Crops:
Over wintering pest mites and pests such as the Strawberry Root Weevil are controlled and eliminated by applying Stratiolaelaps (formerly known as Hypoaspis miles) at a rate of 20 liters per acre (about 10 mites per square foot). This rate should be increased in areas that have a history of severe spider mite infestation or Root Weevils. Stratiolaelaps (H.miles) can be applied at any time although it is best applied when the field is first planted out. They will over winter and provide continuous control for many years.

Spider mite control is achieved by introducing Amblyseius fallacis in the early spring, after the last frost day, at a rate of 10,000 per acre. If a second introduction is needed, it is most effective in the late season, after picking has stopped. The fallacis will over winter and return in increasing numbers each year until the crop is pulled out of the ground, so second year introductions are not common. The weakness of all generalist mite predators is that they cannot tolerate webbing. If the weather turns hot and dry, the potential for runaway spider mite infestations increases rapidly. Major, hot season spider mite problems must be controlled immediately by using Phytoseiulus persimilis. It is critical to entirely contain the outbreak site, so care must be made to make sure that the site is treated in a large enough radius. P.persimilis is a tropical mite and will only feed on pest mites, so it will not persist after the pest mites have been eliminated or after a significant frost. They will only over winter in the mild, coastal climates. A.fallacis and P.persimilis work extremely well together, often balancing in a 1 to 1 ratio. A.fallacis is also very resistant to organophosphate insecticides and miticides, so it will persist even in an aggressively sprayed crop.
Whitefly is not a common pest for outdoor strawberries, but it has the potential to be a major pest in some situations. Inundation of flying pests cannot be prevented and economically, cannot be dealt with by using beneficial insects and mites alone. Field releases of the predatory beetle, Delphastus catalinae have been very successful. Delphastus will stay in a crop as long as whitefly is present. The larvae and the adults are all aggressive predators, preferring eggs, but capable of feeding on all life stages, including adult whitefly. Being aware of nearby vegetation that may be a host of whitefly may help in anticipating waves of attack, and could be an excellent point of biological control.

Aphids like strawberries, and have been documented as carriers of virus. This is no reason to resort to a spray program however, as spray programs do not ensure eradication and will only make elimination harder to accomplish by killing and repelling native beneficials. Preventative releases of Aphidoletes aphidimyza have been successful in Strawberries in British Columbia, Florida, and Ontario. Releases of Aphidoletes directly onto the hot spots will achieve control within 2 weeks. Preventative releases of 2,000 to 3,000 per acre per week, will find any aphid cluster as small as an individual, provided that dispersion after release is not affected negatively. Aphidoletes are excellent flyers and have a very highly tuned ability to find an aphid

by the scent of its' honeydew. Releases should be made at dusk, after the thermal winds have died down or before the evening thermal winds have started, depending on your local conditions. Aphidoletes will cycle within the crop and over winter in any climate. Effectiveness drops rapidly in the fall as the larvae are triggered into diapause after the fall equinox.

Thrips will come and go as they please in an outdoor Strawberry crop. The presence of Stratiolaelaps (Hypoaspis) will feed directly on the pupating thrip by swarming it. The presence of A.fallacis in the crop will help control the 1st and 2nd instar of the thrip to some extent, provided that they are not overwhelmed by spider mites. In the case of severe infestations, A.cucumeris can be broadcast over the crop or placed beside the rows at a rate of up to 25 per foot of crop. Native Orius and other predatory bugs or insects such as lacewings will all help as volunteers, provided chemicals have been minimized or eliminated.
By the second year of production, Root Weevil and Spider Mite problems should be minimalised or eliminated due to the persistence of the Stratiolaelaps (Hypoaspis) and the fallacis. The occurrence of Aphids should also be reduced due to the establishment and cycling of the Aphidoletes.

Indoor Production:
As in all greenhouse production systems, cleanup is critical. Pest problems from previous years will not disappear on their own. If the house had a Spider Mite problem in the previous year, you can count on them returning.

After a thorough cleaning using soaps or detergents throughout the entire structure, make sure all weeds are removed. Before introducing the Strawberry plants, apply Hypoaspis miles to the interface between the floor and the posts and walls, as this is where the Spider Mites are hibernating. About 15 to 25 ml at each post and a similar concentration along the walls will help control the return of the Mites.
A few days before the plants arrive, place any clean plant (even a house plant) in the greenhouse to see if any Whitefly have survived. If any Whitefly are attracted to the plant, use a "Dustbuster" vacuum to remove the pest, on at least a daily basis. Freeze the vacuum overnight before dumping the dead Whitefly.
When the plants are set out, apply Stratiolaelaps (Hypoaspis) to the blocks or bags as evenly as possible, at a rate of at least 10 mites per running foot. Within 10 days, follow this application with a nematode application. The nematodes will help control any Fungus Gnats that may be getting started and they will feed the Stratiolaelaps (Hypoaspis), allowing them to disperse and reproduce.

At the same time, during the setting out stage, monitoring/trapping/banker plants should be started, in the case of the beans for Spider Mite control, or set out, in the case of Eggplant for Whitefly control. The beans should be planted at the base of every support pole. They will show Spider Mite damage very quickly and hold the emerging Spider Mites back from the crop. The infested bean plants can then be carefully removed and replaced, or even better, converted to banking plants by adding P.persimilis to them. The Eggplant will attract Whitefly away from the Strawberries. Two Eggplants per acre are all that are needed to prevent a minor infestation. The Eggplants should be inoculated with Encarsia formosa and Delphastus as soon as they are set out. Do not wait for Whitefly to show on the cards or in the crop, as that will be too late.
As soon as the first flower appears on the Strawberry plants, apply fallacis at a rate of 5 per plant. The fallacis will establish on the plant with pollen and will control any Spider Mites that move onto plants. The fallacis will also help control Whitefly, by eating their eggs, and any Thrip that may develop, by eating the early instar larvae.

Aphid prevention is accomplished by releasing 0.2 to 0.5 Aphidoletes per square meter, per week. The essential elements are; weekly releases, separate "hot spot" treatments, and a "neutral" release point. We have found that fresh, non-stored Aphidoletes will effectively prevent any Aphids from establishing in the crop if they are released away from known "hot spots" and are forced to disperse. The best time for release is at the end of the day. If the circulating fans cannot be turned off on the night of release, care must be taken to ensure that they are released

“downstream” of the fans, and not allowed to be sucked up into the intake side of the fan.

We do not recommend Aphidius banking systems as they are too expensive and become hyperparasite generators very early in the season, undermining whatever was accomplished up until then. Additionally, banker plants create a “false positive” for the Aphidoletes preventative system. If the pest Aphid is the Green Peach Aphid, or the Potato Aphid, direct releases of specialized Aphidius species will work well. Aphidoletes will work well on all species of Aphids but will only control fast species such as Melon Aphid using the preventative technique, described above.

As the weather warms up, the potential for Spider Mite outbreaks becomes great. Spider Mites that have evaded the prevention of the fallacis should be treated with P.persimilis. You can use the persimilis that is banking on the bean plants or purchase more. We only recommend purchasing persimilis on bean leaves as they will typically respond about 10 days to 2 weeks faster than the same number applied in a granular carrier. With Spider Mites, like most pests, any delays in reaction by hours results in delays in control by days, or even weeks.

Persistent Whitefly problems should be dealt with by applying Encarsia at 2 per square meter on a weekly basis. You should only use fresh *Encarsia*, as dispersal, egg laying, and decision making abilities are drastically reduced by storage. At Applied we have produced a product called *Encarsia Max*, which is a non-stored Encarsia, guaranteed to be no more than 48 hours from harvest when you receive it. Max is available in limited supply, so regular Encarsia can be used at twice the above rate. Applied’s regular Encarsia is guaranteed to be no more than 7 days from harvest, and is not stored below 10 degrees Celsius. Consider adding more Eggplants into the house if the existing Eggplants are overwhelmed. High numbers of Whitefly adults can be stripped out of the house by vacuuming the Eggplants daily. During the winter months, adult Whitefly can live for over 3 months, so removing them whenever possible is a very good and effective decision.

©Applied Bionomics