



# California Certified Strawberry Nurseries: *pathogens of regulatory significance for the Santa Maria area*



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Santa Barbara Ag Commissioner's Office**



# **Strawberry Registration & Certification Program**

**– Counties are local helpers**

Applicant must perform pre-plant MeBR fumigation and start with qualified plants from first year propagation from registered or foundation stock



Applicant must keep varieties separate  
and rogue any off-types



Applicant tags plants



and keeps track  
of all paperwork



Applicant must perform extensive pest management to keep plants “commercially clean”



Requirement for certified nursery field to be at least 1 mile from commercial production is now waved, grower can produce fruit and nursery plants *in the same field*





## **Strawberry Registration & Certification Program**

Applicant must pay fees of \$150  
*and*

\$60/acre if we do the sampling  
*or*

\$50/acre if grower provides labor for sampling

# Steps in the process:

## 1. Site Approval



Maps



Varieties

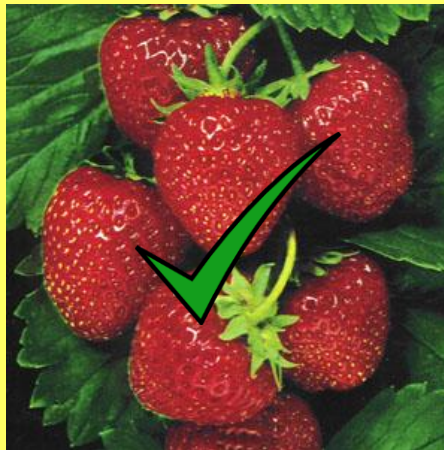


Fumigation records

# Steps in the process:

2. Two Growing Season Inspections
3. One Inspection at Harvest

Blocks must be *free-from*  
Off types, Diseases, Insect problems  
and Genetic disorders





**No visual symptoms of  
3 common diseases:**

***Colletotrichum* spp.**

***Phytophthora* spp.**

***Xanthomonas* spp.**

***Suspects confirmed by  
the State Pathology Lab***



# Anthracnose

Pathogen: *Colletotrichum acutatum*



- Stem lesions or characteristic crown symptoms usually precede the collapse of affected plants
- Anthracnose lesions on a runner

# Anthracnose

Pathogen: *Colletotrichum acutatum*



- Anthracnose crown infection causes strawberry plants to wilt and die

# Anthracnose

Pathogen: *Colletotrichum acutatum*



- Like Phytophthora crown rot, the internal crown tissue is discolored, but with anthracnose the discolored tissue is cinnamon to red in color



# Anthracnose

Pathogen: *Colletotrichum acutatum*



- Fruit decay is common
- Small, sunken, oval-to-round brown spots (on green fruit) or black spots (red fruit) develop and may expand to cover most or all of the fruit surface



# Anthracnose

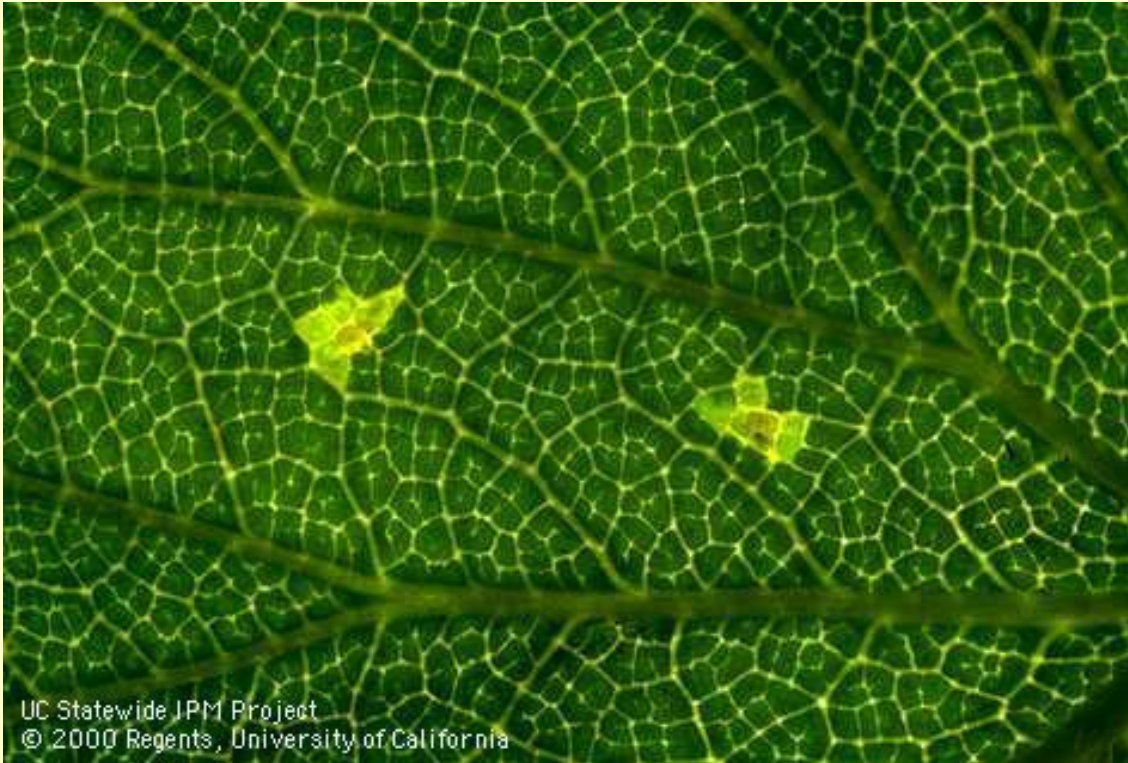
Pathogen: *Colletotrichum acutatum*



- Soil fumigation destroys most residual inoculum but fields can be re-infected
- Fungicide dips can be used on transplants before planting in production fields.
- Foliar fungicides are available for use on plants when the disease is present and conditions are ideal for foliar and fruit disease development.
- Running water treatments can be used to wash soil from transplants.
- Follow good cultural procedures to prevent disease inoculum from entering the field – keep weeds out

# Angular Leaf Spot

Pathogen: *Xanthomonas fragariae*



- Small watersoaked spots, translucent when viewed against the light
- Delimited by veins

# Angular Leaf Spot

Pathogen: *Xanthomonas fragariae*



- Angular leaf spot lesions develop on the upper leaves as the disease progresses

# Angular Leaf Spot

Pathogen: *Xanthomonas fragariae*



- Angular leaf spot generally has a minor impact on fruit yields.
- It is a concern at strawberry nurseries, which may be subject to quarantine regulations for angular leaf spot on nursery stock.

- Chemical controls are typically ineffective
- Copper-containing compounds are registered but have caused phytotoxicity with repeated applications.



# Phytophthora Crown Rot

Pathogens: *Phytophthora cactorum*, *P. citricola*,  
*P. parasitica*, and *P. megasperma*



- Symptoms include plant stunting and small leaves.
- Plant collapse may occur rapidly or slowly.
- Brown discoloration can be seen in the crown vascular tissue or throughout the crown tissue.

# Phytophthora Root Rot

Pathogens: *Phytophthora cactorum*, *P. citricola*,  
*P. parasitica*, and *P. megasperma*



- The same *Phytophthora* species also attack roots, causing a brown to black root rot
- Symptoms are not diagnostic

- Phytophthora* is soil-borne.
- Infections can occur during cool to moderate temperatures, which are typical throughout coastal fruit-production cycles.

# Phytophthora Root Rot

Pathogens: *Phytophthora cactorum*, *P. citricola*,  
*P. parasitica*, and *P. megasperma*



- When the soil becomes saturated with water, the pathogen can produce and release zoospores, which swim through water-filled pores to infect plant tissue.
- *Phytophthora* species also produce resilient spores (chlamydospores, oospores) that enable them to survive in soil for long periods without a host or under adverse conditions.

# Red Stele

Pathogen: *Phytophthora fragariae*  
var. *fragariae*



- Symptoms of red stele include severe stunting occasionally followed by death of plants.
- Affected plants become stunted as older leaves die and are replaced by smaller, younger leaves with short petioles.

“B”-rated – extra concern to the nursery industry



# Red Stele

Pathogen: *Phytophthora fragariae*  
var. *fragariae*



- Young lateral roots are often completely rotted.
- New crown roots die from their tips back, producing a symptom called "rat tail"
- Splitting affected roots reveals the red stele symptom

# Viral Diseases

- Mottle
- Leafroll
- Veinbanding
- Witchesbroom
- Crinkle
- Latent "C"
- Pallidosis
- Feather leaf
- Necrotic shock
- Mild yellow edge
- Tomato Ringspot
- Pseudo mild yellow edge

•Indexed at the  
Foundation  
Stock stage

•Keep Certified  
nursery stock  
clean through  
vector control

# Nematode sampling:

## Free-from foliar and soil-borne parasitic nematodes

*Collect samples on a 40 foot x 40 foot grid interval  
throughout the planting*

Also No Mollusks Allowed



# Foliar nematode:

## *Aphelenchoides fragariae*

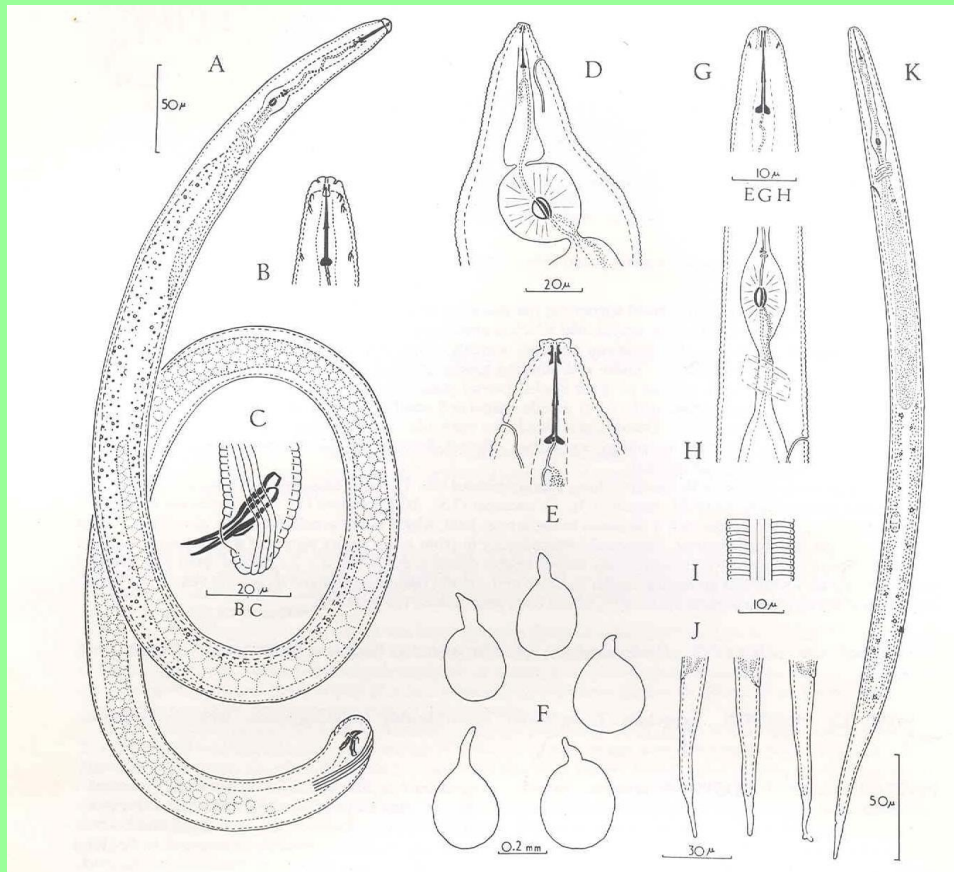


- Symptoms of foliar nematode include stunted growth, reddened leaves, small curled or crinkled leaves (crimp), deformed buds and flowers, and a reduction in flowering and fruiting.



# Strawberry Nematodes:

## Soil-borne endo- and ecto- parasites



Root Lesion

*(Pratylenchus penetrans)*

Stem

*(Ditylenchus dipsaci)*

Dagger

*(Xiphinema americanum)*

Needle

*(Longidorus elongatus)*

Root knot

*(Meloidogyne incognita,*  
*M. javanica, M. hapla)*

# Strawberry Nematodes:

## Soil-borne endo- and ecto- parasites



- When using certified nursery stock, plant pathogenic nematodes are rarely found to be causing significant damage in production areas

- Controlled with pre-plant fumigation



Questions???

