

PEST AND DISEASE MANAGEMENT IN CARROTS

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Common Diseases of Carrot

- ▣ **Cavity Spot**
- ▣ **Alternaria Leaf Blight**
- ▣ **Xanthomonas Leaf Blight**
- ▣ **Cercospora Leaf Blight**
- ▣ **Soft Rot**
- ▣ **Powdery Mildew**
- ▣ **Southern Blight *Sclerotium rolfsii***
- ▣ **White Mold *Sclerotinia sclerotiorum*, *S. minor***
- ▣ **Root Knot Nematode**

Common Insects of Carrots

▣ Aphids

- Willow Carrot Aphid .> Carrot Motley Dwarf
- Crown Root Aphid

Leafhopper

BLVTA > similar to aster yellows

Damage by feeding on foliage

Saltmarsh Caterpillars

Flea Beetles

Do not have Carrot Rust Fly or Carrot Weevil in California

Cavity Spot (*Pythium violae* & *P. sulcatum*)



Cavity Spot



Over reliance on
menfenoxam can lead to
enhanced
biodegradation.

Rotation of crops and
chemistries is important
for long term
management of cavity
spot.

Mefenoxam –Ridomil
Fenamidone- Reason
Cyazofamid-Ranman
Fluopicolide-Presidio

Foliar Diseases of Carrots

▣ Fungal Diseases

- ▣ Alternaria Leaf Blight (ALB) *Alternaria dauci*
- ▣ Cercospora Leaf Blight (CLB) *Cercospora carotae*

▣ Bacterial Disease

- ▣ Bacterial Leaf Blight *Xanthomonas campestris pv. carotae*

Alternaria Leaf Blight

Alternaria dauci

- ▣ Infection begins on older leaves first.
- ▣ Initially, the lesions are water-soaked, brown-green. The lesions become black, dry, sometimes with a yellow halo.
- ▣ The lesions enlarge and will be combined.
- ▣ On the petioles there will be tan lesions with a black border.

Disease Development

▣ Infected Seed.

- *A. dauci* can be seed borne. ALB infection must be minimized in seed production fields.
- Seed treatments of hot water dip and iprodione reduces seed contamination.

▣ In-season Prevention.

- Avoid planting new fields near old carrot fields.
- Remove volunteer carrots.
- Make sure all carrot residue is soil incorporated and broken down.

Alternaria Leaf Blight

Alteraria dauci



Loss of 40% of canopy can prevent machine harvesting of carrots



Infected volunteer carrots



Spore movement from old field to young field.



Movement of spores from carrot debris to nearby fields.



Movement of spores from carrot debris to nearby fields.



Carrot debris on irrigation lines



ALB Control Summary

- ▣ Use clean seed, especially if you plant carrots in new area.
 - Remove volunteer carrot plants.
 - Clean equipment between fields.
- ▣ Avoid planting new fields of carrots alongside older carrot fields.
- ▣ Make sure old carrot debris is soil incorporated and is fully decomposed.
- ▣ Apply fungicides.

Cercospora Leaf Blight



Control of Cercospora

- ▣ Use clean seed.
- ▣ Make sure the crop debris from old carrot crop is completely decomposed.
- ▣ Apply fungicides
 - The same materials used for Alternaria leaf blight.

Bacterial Leaf Blight

Xanthomonas campestris pv. *carotae*

- ❑ **Difficult to distinguish from ALB.**
- ❑ **Lesions begin at margins of leaf blades.**
- ❑ **Initially, the lesions are water-soaked, brown green. The lesions become brown, sometimes with a yellow halo.**
- ❑ **Petiole lesions are brown, sometimes with bacterial ooze.**
- ❑ **Plants that have bolted (formed flower stalks) will often have bacterial ooze from cracks on stalks.**

Alternaria or Xanthomonas?

Xanthomonas campestris pv *carota*

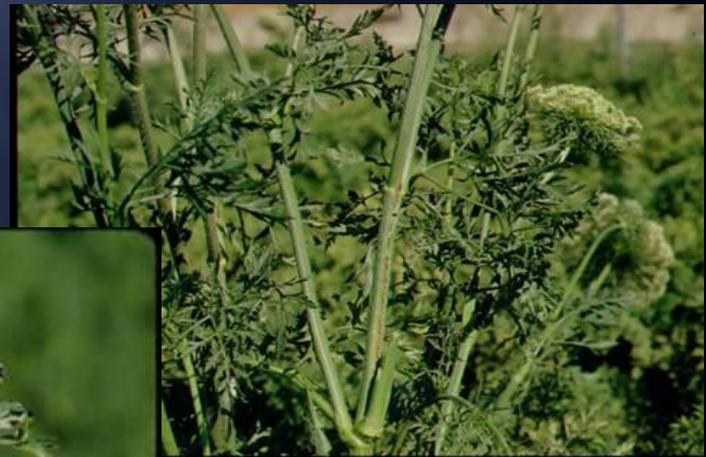
Alternaria dauci



Bacterial Leaf Blight



Bacterial Leaf Blight





Methods of Control

- **Use clean seed. Hot water dip of seed can reduce incidence of BLB**
- **Once again make all carrot debris left over from harvest is completely decomposed.**
- **Use bactericides such as copper.**

Soft Rot (*Erwinia carotovora*)





Soft Rot on Finished Product



Soft Rot



Infection occurs in the field, however the problem may appear in the field, in the shed, or after the carrots are processed.

Soft rot promoted by warm weather, saturated soils, and mature carrots

Prevention: avoid over watering carrots during periods of high temperatures, especially if carrots are at or near maturity.

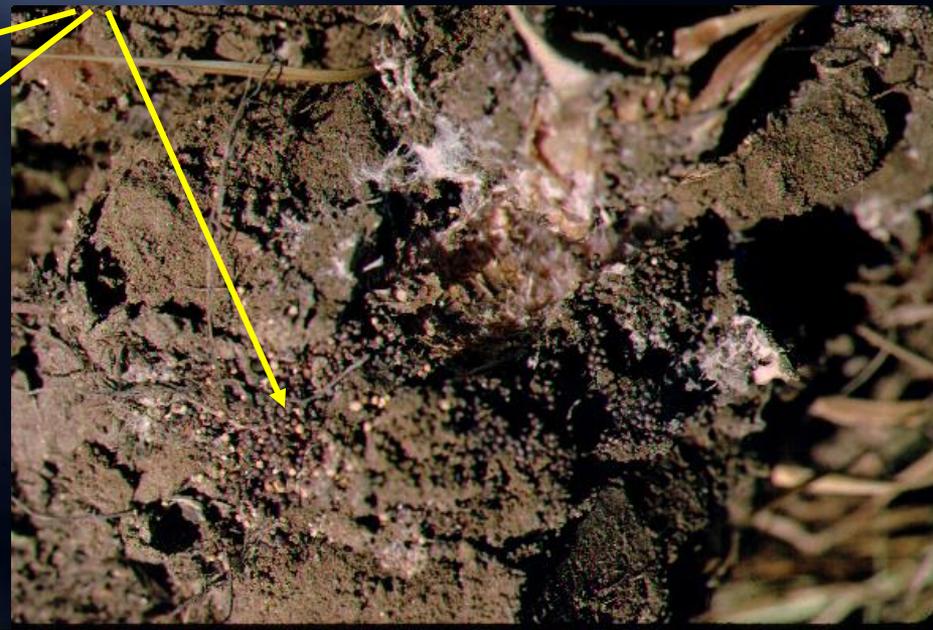
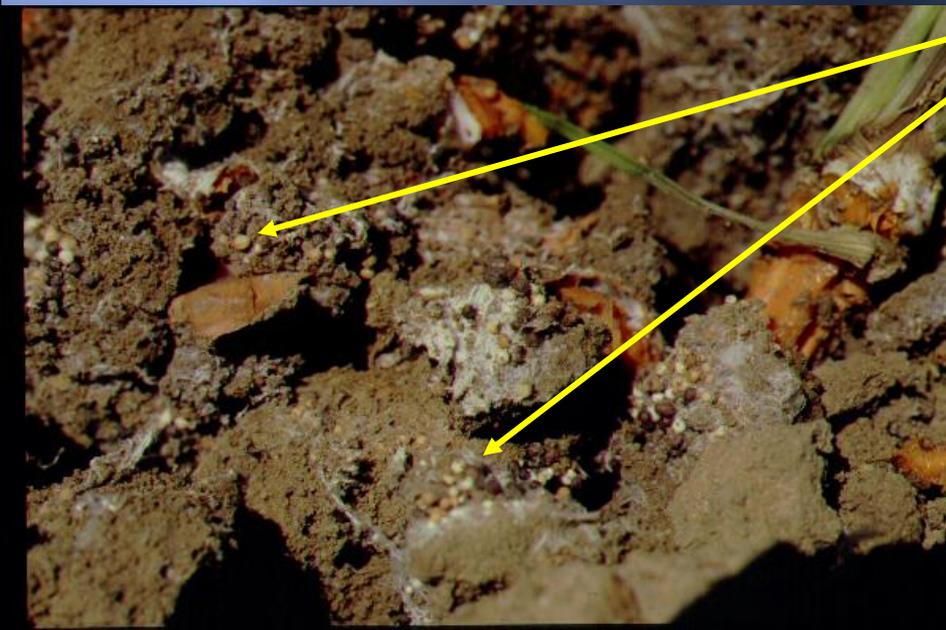
Southern Blight vs Cottony Soft Rot (White Mold)

- **Southern Blight-Sclerotium rolfsii**
 - Occurs in periods of high temperatures. High temperatures of 80° to 99°F favor the disease
 - Soil borne sclerotia.
- **Cottony soft rot (white mold) -Sclerotinia sclerotiorum and S. minor**
 - Most active when soil temperatures are 55° to 77°F. Moist soils are necessary for fungal activity
 - S. sclerotiorum is only soil borne. Infection occurs by soil borne sclerotia.
 - S. minor is soil borne or air borne, Sclerotia can either infect plants directly by sclerotia or produce aerial spores.

Southern Blight (*Sclerotium rolfsii*)



Numerous small tan-brown sclerotia



Cottony Soft Rot (*Sclerotinia sclerotiorum*)



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Management of Southern Blight

- ▣ **Rotation to nonhosts such as corn or small grains for at least 2 years reduces numbers of sclerotia.**
- ▣ **Deep Plowing**
- ▣ **Burying plant refuse helps destroy sclerotia**
- ▣ **Fungicides**

Management of White Mold

- ▣ **Deep plowing**
 - **but not eliminate it completely because spores may be blown in from other fields.**
- ▣ **A 3-year rotation to cereals, corn, or cotton will help reduce sclerotial populations in the soil.**
- ▣ **Trimming the sides of the foliage after the canopy closes may increase ventilation between rows and allow leaves to dry.**
- ▣ **Avoid planting into fields with a history of cottony soft rot.**

Black Root Rot (Black Crown)

Alternaria radicina



Black Root Rot



Management of Black Root Rot

- ▣ **Initially is a seed borne disease.**
 - **Use certified clean seed**
- ▣ **Once introduced to a field it is then a soil borne pathogen.**
 - **Deep plowing**
 - **Fungicides**

Root Dieback (Forking & Stubbing)



Often caused by *Pythium ultimum* or *P. irregulare*.

Occurs soon after planting

Example of forking and stubbing by nematodes



Example of forking and stubbing by *Rhizoctonia*



Phytoplasmas- *Aster Yellows and BLTVA*

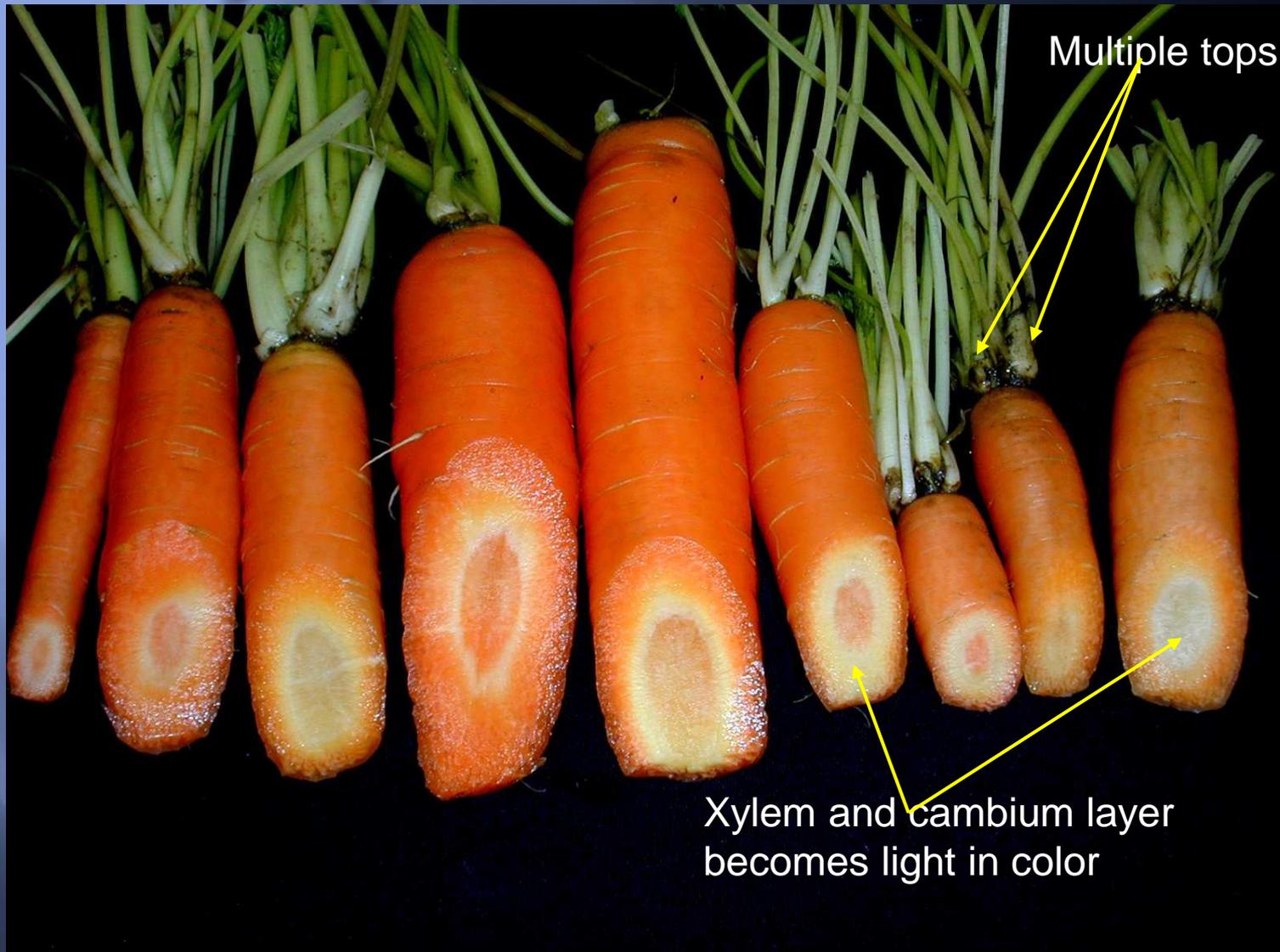


Green flower heads

**Thin woody roots
with many root hairs**



Phytoplasmas-Aster Yellows



Phytoplasmas

- ▣ Aster yellows not common on carrots in California
- ▣ Beet Leafhopper-transmitted Virescence Agent Yellows more common in California (BLTVA)
- ▣ Both transmitted by leafhoppers. More common in fields near foothills.
- ▣ Treatment generally not required in California. Eliminating weeds around field or treating weeds around field may be of some benefit.

Powdery Mildew



A fungal disease caused by *Erysiphe polygoni*.

The plants become more likely to develop powdery mildew as they get older.

Some varieties more susceptible than others.

Treatment: Sulfur works well as well as many other fungicides.

Powdery Mildew



Crown Rot (*Rhizoctonia solani*)



Area of field that got too hot and dry.
Run hands through canopy and tops will fall off.



Soil gets hot and dry, injures root at soil line.
Rhizoctonia often follows.



Carrot Motley Dwarf



Motley dwarf is caused by 2 viruses, *Carrot Red Leaf* and *Carrot Mottle Virus*.

Only transmitted by the Carrot Willow Aphid.

Necessary to have all 3 to have Carrot Motley Dwarf.

Treatment: Avoid planting new fields near older fields.

Nematodes

- Several species of RKN: *Meloidogyne hapla*, *M. incognita*, and *M. javanica* main species in California carrot fields.
- Galls on feeder roots, rough tap root, forked or stubby roots.
- Resistant carrot varieties being developed.
- Crop Rotations-difficult because of wide host range.
- Planting dates-some species less active in cool soil.
- Soil fumigants-soil sampling to determine nematode levels.

Root Knot Nematode





Flea Beetle

Palestriped and Potato Flea Beetles







Cavity Spot



Cavity Spot



Flea Beetle



Cavity Spot



Crown Aphids



Carrot Rust Fly



Carrot Weevil



Carrot weevil life cycle
[Picture by S. Mahr]



Carrots damaged by carrot weevils
[Picture by S. Mahr]

Thank You !

