Vegetable Disease Control
for the Organic Farmer/Gardener

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Foreword
A widespread misconception!

OMRI (Organic Materials Review Institute) does NOT determine which products are allowed for use in organic production. Only the NOP (National Organics Program) makes that determination, and a certifying agency can further refine the list.

OMRI is a private, non-profit organization that reviews products only for companies that request the review and pay the review fee.

NOP is a USDA agency charged with establishing the standards to be used in certified organic production.

Your organic certifying agency reserves the right to disallow products allowed by NOP. Submit to your certifying agency the list of products you plan to use, and get their approval prior to use.
What is a disease?
How does it differ from other plant problems?

- **Disease** - caused by a pathogen, such as a fungus, bacterium, virus, or nematode.
- **Disorder** - caused by cultural or environmental factors, a.k.a. “abiotic problems.”
- **Pest damage** - caused by insects or other animals that feed on or otherwise damage plants.
THE DISEASE TRIANGLE

Pathogen

Disease

Host

Environment

All 3 have to be present & favorable for disease to occur
Disease Control for the Organic Producer

• Plan ahead
• Must be integrated
  – with general production practices
• Must have an ecological basis
  – Manage soil
    • Encourage diversity of beneficial microorganisms
  – Crop diversity
Disease Control for the Organic Producer

- **Good crop husbandry**
- **Site selection**
  - Good water drainage
  - Good air drainage
  - No history of problems
- **Exclusion**
  - Seed treatments
  - Certified seed
  - Disease-free transplants
    - Avoid chain-store plants
  - Infested soil on tractor equipment

- **Protection materials**
  - Copper
  - Sulfur
  - Biologicals
  - Bicarbonates
  - Bacteriophages
  - Oils (mineral, essential)

- **Cultural practices**
Good crop husbandry

Happy plants resist disease better

Plants more susceptible to disease if:
• improper pH
• crowded
• weed competition
• seeded in cool soil
• inadequate fertilization
• excessive fertilization
  (poor drying conditions)

Cercospora leaf spot
Site selection for disease control
Good water drainage

Surface drainage prevents standing water

*Phytophthora capsici* on pepper

Good internal drainage very important

Fusarium crown of pumpkin on Dickson silt loam soil
Wet rot (whisker rot, Choanephora)

Controllable with site selection & planting density. Avoid tree-lined fields.
Field disease history

Keep records

Some soil-borne pathogens are in all soils and are unavoidable

Pythium

Rhizoctonia

Fusarium
Field disease history

Keep records

Some pathogens are limited in occurrence and clean fields should be available.

*Phytophthora capsici*

Southern blight

Fusarium wilt
Exclusion
Keeping the pathogen out

- Seed disinfestation
- Certified seed
- Disease-free transplants
  - Avoid chain-store plants
- Cleaning infested soil from tractor equipment
- Sanitizing transplant production tools
Seed treatment

- Seed disinfestation -- Hot water
- Seed protection -- Kodiak, T-22, Actinovate

<table>
<thead>
<tr>
<th>Crop</th>
<th>Temp (F)</th>
<th>Minutes</th>
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<tbody>
<tr>
<td>Brussels sprouts, cabbage, eggplant, spinach, tomato</td>
<td>122</td>
<td>25</td>
</tr>
<tr>
<td>Broccoli, cauliflower, cucumber, carrot, collard, kale, kohlrabi, rutabaga, turnip</td>
<td>122</td>
<td>20</td>
</tr>
<tr>
<td>Mustard, cress, radish</td>
<td>122</td>
<td>15</td>
</tr>
<tr>
<td>Pepper</td>
<td>125</td>
<td>30</td>
</tr>
<tr>
<td>Lettuce, celery</td>
<td>118</td>
<td>30</td>
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</table>

Diseases recently obtained from chain store garden centers:

- Pythium root rot of several vegetables
- Bacterial spot of tomato
- Late blight of tomato
- Bacterial spot of pepper
Clean equipment between fields

After working infested field, before working non-infested field

Clean tractor tires, plows, other implements if a difficult-to-control disease is present in some, but not all, fields.

E.g., Phytophthora blight, fusarium wilt, bacterial diseases
Prevent pathogen introduction into transplant production system

- Clean and disinfect any re-used trays, pots, tools, or surfaces, using 10% bleach (NOP approved) or a hydrogen peroxide (NOP and OMRI approved) product.
- Do not allow soil particles to contact potting mix.
  - Do not store or mix potting media on ground
  - Wash hands before working
  - Especially if you smoke! (viruses)
Protection materials I

- **Copper** - Good control of bacterial diseases; fair to moderate control of some fungal diseases. Note: There are some restrictions on how copper is used, but most copper products are NOP approved.

- **Sulfur** - Excellent control of powdery mildews; good control of peach scab; slight rust control.

- **Biologicals (biocontrols)** - Can provide fair control, but high pathogen population overwhelms them. Mostly for soil-borne diseases.
Bacterial spot of tomato

Not sprayed

Copper sprayed
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cont'd
Cucurbit powdery mildew

No Fungicide

Sulfur
Bean rust control
Resistant varieties and sulfur sprays
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cont'd
Biologicals

• Serenade
• Actinovate
• Companion
• RootShield, PlantShield, T-22
• SoilGard
• Kodiak
• Contans
A word about float beds:

Don’t use them.
If you do use them, mix your biofungicide with the soil before seeding.
Pythium root rot

Actinovate treated

Untreated
Protection materials II

• Bicarbonates
• Bacteriophages
• Oils
  – Mineral oils
  – Essential oils
Bicarbonates

Slight control of powdery mildews and a few other fungal diseases.

- sodium bicarbonate (baking soda)
- potassium bicarbonate
  - Armicarb
  - Kaligreen
Bacteriophages
AgriPhage™ by Omnilytics

Viruses that attack bacteria. Specific for bacterial spot and speck of tomato and bacterial spot of pepper.
Mineral Oils
Petroleum oils; OMRI listed

Moderate control of powdery mildews and some control of viruses vectored by aphids.

- JMS Stylet Oil
- Purespray Oil
Essential Oils

Plant extracts

Only slight disease control activity has been demonstrated.

• Neem, thyme, rosemary, clove, sesame, etc.

• Examples include Trilogy, Proud 3, Sporatec, Regalia (Reynutria)
Miscellaneous

• streptomycin sulfate, e.g., AgriStrep
• fish oil, e.g., Organocide
• humic acid, e.g., Humega
How to apply foliar disease-control products

boom air blast

backpack mist blower
Pumpkin powdery mildew control
2009 trial

Percent defoliation at harvest:

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Boom</th>
<th>Mist blower</th>
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</thead>
<tbody>
<tr>
<td>unsprayed check</td>
<td>66 ab</td>
<td>64 b</td>
</tr>
<tr>
<td>bicarbonate</td>
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<td>48 c</td>
<td>17 d</td>
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<tr>
<td>sulfur</td>
<td>42 c</td>
<td>10 d</td>
</tr>
</tbody>
</table>

Values followed by same letter do not significantly differ.
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- Cultural practices