Managing (and Avoiding!) Blueberry Diseases

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The Fruit Doctor™ Consultant
- Highbush blueberry is native to N. America (NJ): descendant of the “swamp blueberry”
- Habitat: sandy hummocks above bogs
  - Acidic, well-drained low-fertility soils
  - Shallow water table
- Root adaptations
  - Many fine feeder roots without root hairs
  - Mycorrhizae: “fungus roots”

What Do Blueberries Want?

- Sandy or silt loam soils
  - High organic matter (4–7%)
  - Low nitrogen
  - Acidic (pH 4.3–5.0)
  - Well-drained

- Water
  - Steady supply (1–2 in/wk)
  - No “wet feet”
Choosing A Site

- **Topography**
  - Good drainage
  - Avoid “frost pockets”

- **Soils**
  - Lighter soils preferred; heavier soils (>10% clay) usable with raised beds and amendment
  - Avoid:
    - Saline soils
    - Soils with high calcium content and natural pH>6.0 (e.g., limestone soils)

- **Know the cropping history of the site**
Preparing The Site

- Start in the spring 1 or 2 years before planting

- Test soil for:
  - pH
  - Organic matter (%)
  - Nutrient profile (N, P, K, Ca, Mg, and minors)
  - Pathogenic nematodes

- If land has been tilled repeatedly, disk or harrow to break up any plow pan
Preparing The Site

- Plant cover crops to:
  - Increase organic matter in soil
  - Reduce or eliminate any residual herbicides
  - Reduce pathogenic nematodes to protect roots and avoid transmission of viruses
  - Control perennial weeds

- Amend the soil with sulfur to reduce pH
  - Target pH is 4.5–5.0
  - Start 6 months to 1 year before planting blueberries
Cover Crops

- “Green manure” to increase organic matter and control weeds
  - Buckwheat (grows well in acidic soils)
  - Sorghum/sudangrass, sudangrass, Japanese millet

- Rapeseed (canola) to reduce pathogenic nematodes
  - 1 or 2 crops after “green manure”
  - Requires sulfur to produce chemicals toxic to nematodes
Plant sorghum, sudangrass, buckwheat or millet in mid-May

Plant rapeseed (canola), ‘Dwarf Essex’ variety, in August. Plant a second crop the following spring.
Applying Sulfur

- Use pelletized or granular sulfur, not powdered
- Incorporate with other nutrients and green manure into the upper 6-12 inches of the entire field—not just the planting rows!
- Retest after 6 months and make another application as needed to reach the target pH
- Don’t go below a pH of 4.0
  - Aluminum and manganese become toxic at low pH
  - Some nutrients become unavailable
Planting

- Create raised beds
  - 8 to 10 inches high
  - 4 ft wide
- Install drip or sprinkler irrigation
- Mulch plantings
  - 4- to 6-inch layer
  - Peat moss, pine bark chips, composted sawdust
Maintenance

- Test soil every 2 years and adjust pH with sulfur
- Add mulch to maintain a 4-6 inch layer
- Analyze leaf tissue to determine nutrient status
- Add nitrogen annually in the form of ammonium sulfate in soils with a natural pH > 5
- Prune when dormant to remove all dead wood, the oldest canes (about 1 of every 6 canes), twiggy growth, and suckers below knee level
Fruit Rots

- Major fungal fruit rots
  - Anthracnose or ripe rot \((Colletotrichum acutatum)\)
  - Botrytis blight or gray mold \((Botrytis cinerea)\)
  - Mummy berry \((Monilinia vaccinii-corymbosi)\)

- Minor fungal fruit rots
  - Alternaria
  - Phomopsis
Blossom blight
Leaf infection

Fruit rot

Botrytis (gray mold)

Primary Phase
Secondary Phase

Mummyberry

Anthracnose fruit rot
Blueberry Anthracnose (Ripe Rot)

• A fruit rot, caused by the fungus *Colletotrichum acutatum*
• Spores infect green fruit in the field
• Rot symptoms develop on ripe fruit

• Most losses occur after harvest, on fresh fruit in storage
• Sticky, orange masses of spores appear on infected berries and spread by contact
Blueberry Anthracnose

*Colletotrichum acutatum*
In spring, overwintering infections sporulate. Peak sporulation occurs during bloom. Spores (conidia) are spread by rain and splashing water. Spores may infect and blight blossoms. Berries are susceptible from fruit set to ripening. Infections remain latent on green fruit. Ripe berries sporulate, creating inoculum for new overwintering infections. The fungus overwinters in living buds and blighted wood.

Disease Cycle of Blueberry Anthracnose
Anthracnose Control

- No completely resistant cultivars
  - Berkeley, Coville, and Bluecrop are very susceptible
  - Elliott, Legacy, and Brigitta Blue are somewhat resistant. Duke has shown good field resistance

- Use good canopy management: prune for light penetration and air circulation, quick drying

- Remove all fruit after harvest. Overripe, sporulating fruit will infect developing buds for next year

- Use fungicides to protect developing fruit
Mummy Berry Disease Cycle

- **Apothecium**: Formed within the soil, releasing ascospores.
- **Bud clusters**: Formed with leaf wetness.
- **Infected berries**: Turn pink and fall to the ground at harvest.
- **Infected flowers**: Develop into berries filled with mummy berry fungus.
- **Conidia**: Form on blighted tissue during wet periods.
- **High relative humidity**: Stimulates conidia formation.
- **Wind**: Moves the fungus to new locations.

**Conditions for Growth**
- **Moist soil**: >10 degrees C (50 degrees F)
Primary infection creates “pseudoflower” on leaf that attracts bees, who pick up conidia (spores).

Fruit are infected through ovules. Fungus replaces plant tissue in “mummies.”

Bees carry spores to stigmas of flowers when collecting pollen.
Mummy Berry Control

- Sanitation is key!
  - Before “mummy cups” appear (ca. March 10), remove mummies from under bushes by raking, sweeping, and hoeing into row middles. Bury mummies by disking or cultivating under 1–2 inches of soil, or under a 1-2 inch layer of mulch
  - In very small plantings, rake up and burn mummies
  - An application of 50% urea at time of cultivation will hasten decomposition of mummies and kill any open cups

- In heavily infested fields, fungicides may be needed
For control of Alternaria, anthracnose, **mummy berry**, leaf spot and blotch, Phomopsis twig blight and fruit rot, powdery mildew, and rusts at 2 oz/A

- Group 3 (sterol inhibitor): no more than 4 applications per season
- Use of a wetting agent (e.g. Latron B-1956, Latron CS-7) is recommended on the Indar label
- PHI: **30 days**

**Section 3 Supplemental Label on Blueberry**

Label must be in user’s possession!
Botrytis (Gray Mold)

- Occurs sporadically, often during a prolonged period of cool, wet weather at bloom
  - “Weak” pathogen; opportunist on dead/senescent tissue
  - Overwinters in dead twigs and decomposed plant material in the soil

- Causes a blossom blight, dieback of green twigs, and a postharvest fruit rot

- Fruit are infected early in development but show no symptoms until they are in storage
Botrytis overwinters in sclerotia on dead twigs. Spores infect susceptible blossom tissue, blossoms infect leaves.

Spores may infect other dead tissue.

Inoculum from all of these sources infects fruit.
Botrytis Control

- Use good canopy management: prune for light penetration and air circulation to promote quick drying
- Avoid excessive nitrogen application
- Use fungicides from mid-bloom to petal fall if conditions or history favor Botrytis
  - Prolonged period of wet, cool weather at bloom
  - Blossom injury due to frost
  - Cultivars have tight clusters (Weymouth, Rancocas, and Blueray) or many unpollinated flowers
Blueberry Disease Management

**Fungicide and spray timing**
- Indar, Pristine, Or Switch
- Abound, Cabrio, Pristine, Captain or Ziram (Elevate, Captevate, or Switch)
- Abound, Cabrio, Pristine, Allette, or phosphonates

**Diseases**
- Monilinia, Botrytis, Phomopsis, Anthracnose, Alternaria
- Monilinia and Phomopsis
- Alternaria

**Crop Phenology**
- Vegetative bud break and leaf elongation
- Flowering period
- Harvest
Stem and Foliage Diseases

- Fungal diseases
  - Phomopsis twig blight and canker (*Phomopsis vacinii*)
  - Botryosphaeria stem blight (*Botryosphaeria dothidea*)
  - Botryosphaeria stem canker (*Botryosphaeria corticis*)
Phomopsis Twig Blight

- Blighting of year-old woody shoots bearing flower buds
  - Kills shoots
  - Reduces fruit yield
- Conidia (spores) enter through flowers or leaf margins
- Common in mid-Atlantic
Phomopsis Canker

More rarely, *Phomopsis* will cause a canker on one-, two-, or three-year old shoots. Cankers start as brownish areas that become grayish and sunken as they progress down the stem.
Managing Phomopsis Diseases

- Avoid mechanical damage and stress
  - Keep plants well-watered during hot, dry weather to avoid heat stress
  - Avoid injuring wood when pruning and cultivating
  - Do not fertilize late in the summer to avoid cold injury
- Prune weak canes, twiggy growth, and all dead wood during dormancy
- Apply dormant lime sulfur sprays in late fall and/or early spring
  - Weymouth, Earliblue, and Berkeley are the most susceptible varieties
Botryosphaeria Stem Blight

- Leaves turn yellow or red and dry up on one or a few branches
- Brownish discoloration on one side of stem
- Infection enters wood through wounds
- Becoming more common in mid-Atlantic
Botryosphaeria Stem Canker

- Different pathogen than stem blight
- Attacks current-year (green) shoots
- Small reddish or brownish lesions swell and crack over time, leaving deep fissures
- Stem appears to be “bubbling”
Managing Botryosphaeria Diseases

- No chemical control for either disease
- Buy disease-free nursery stock
- Avoid pruning or mechanical damage when plant is active
- For stem blight, prune diseased stems 6–8 inches below any sign of disease or discoloration, and destroy them
- For stem canker, remove diseased plants and destroy them
Phytophthora Root Rot

- Caused by *Phytophthora cinnamomi*
- Associated with poor drainage and waterlogged soils. At temperatures above 68° F, infection can occur in 2 to 5 hours
- Early symptoms
  - Yellowing or reddening of leaves, and lack of new growth
  - Small roots turn brown or black; brown, discolored streaks may extend into the crown and affected stems
Phytophthora Root Rot
Managing Phytophthora

- Avoid wet soils by careful site selection and improvement of drainage before planting
  - Amendments to improve soil texture
  - Raised beds
- Do not over-irrigate
- If a field is flooded and may remain wet for several days, apply Aliette or a phosphonate fungicide (e.g., Phostrol or ProPhyt)
Viruses and Phytoplasmas

Blueberry scorch, caused by a virus transmitted by aphids (not yet found in MD)

Blueberry stunt (plant on right), caused by a phytoplasma transmitted by leafhoppers
Viruses and Phytoplasmas

Blueberry shoestring, a viral disease transmitted by aphids. Other symptoms include purplish berries and reddened corollas on blossom clusters.
Managing Viruses and Phytoplasmas

- There are no chemical controls for diseases caused by viruses and phytoplasmas
- Prevention is the best strategy
  - Reduce nematode populations before planting
  - Buy certified, virus- and phytoplasma-free plants
  - Control insects that transmit these organisms (aphids, leafhoppers, planthoppers)
Managing Viruses and Phytoplasmas

- Have symptomatic plants tested for infection (Agdia, MDA)
- Remove and destroy infected plants promptly