UMassAmherst

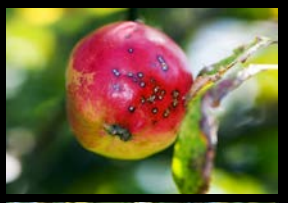
No Bad Apples!

Dealing with Apple Pests in the Home Garden

Plant, Soil & Insect Sciences

Basic questions

- Why do I want these apples?
- Ultimate use determines "damage tolerance"
- Sales vs. personal
- "Kissed by nature"



Tackling Management of Apple Diseases

- The rationale and reality of pest management
- Know your adversaries – a rogues gallery of diseases of apples
- The toolbox – methods of pest management in general
- Applying tools to management

Ultimate use of apples matters

- Cider doesn't require blemish-free apples
- "Cyder is their common drink" Lord Gordon on the New England colonists
- Pies, apple butter, sauce

Historic perspective

- Within last 120 yrs., farmers began to use chemicals to treat fungal plant diseases
- Solutions of sulfur, or copper, lime and oil (Bordeaux mix)
- Developed for grapes, but useful against apple scab
- Could produce more fresh, high quality fruit

Historic perspective

- 1900 – growers averaged 2 or 3 fungicide applications per year
- Decreased damage from 50 to 100% to more like 25 to 50%
- 1940's – averaged 18 sprays and still suffered over 10% crop damage

Controlling nature

- 1950's and 60's emphasis was on "clean fruit"
- "Sterilize" the orchard
- Americans came to expect unblemished fruit

Fungicide dependence

- Fungicides allowed growers to produce relatively disease susceptible varieties
- Market expected & paid most for unblemished fruit
- To market fruit, commercial growers must control diseases

Before fungicides

- Orchards from cider pomace
- John Chapman
- Seedlings common, but good varieties grafted
- Roxbury Russett, Westfield Seek No Further, Rhode Island Greening, Sheepnose, Winter Banana, Esopus Spitzenberg…

Transition period

- Over 14,000 varieties of apples in the 1800's
- By 1915, 24 varieties – 80% of U.S. apples
- By 1964, 10 varieties – 80% of crop
- By 1990, 7 varieties – 80% and two varieties, Delicious and Golden Delicious >50%

Back to basic questions

- Why do I want these apples?
- Ultimate use determines "damage tolerance"
- Sales vs. personal
- Kissed by nature

Basic questions

- Do I want to use organic methods? Why?
- Take care of my land and the environment
- To have food that doesn't have residues of standard pesticides
- Work with nature, rather than trying to subdue it

We always have options

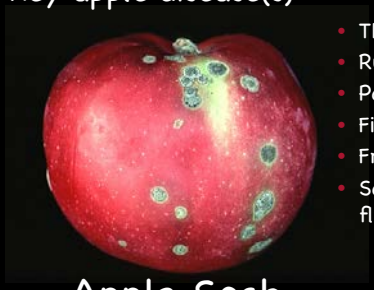
- Do nothing - most domesticated apple cultivars won't last long
- Spray a lot with standard chemicals - older commercial approach
- Spray less with standard chemicals integrated with other controls - IPM approach
- Spray with organic chemicals integrated with other controls - organic approach

Low

Amount of work

High

Key apple disease(s)



- The rest …
- Rusts
- Powdery mildew
- Fire blight
- Fruit rots
- Sooty blotch/ flyspeck

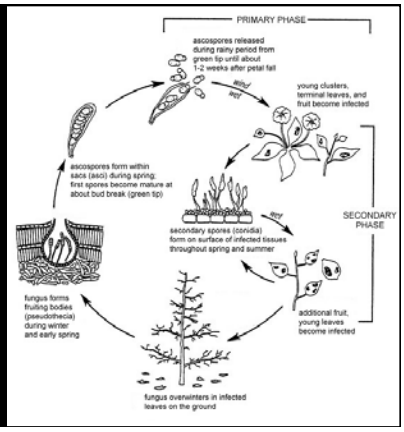
Apple Scab

Understand pathogen biology: know when risk is high

DISEASES	MAR	APR	MAY	JUN	JUL	AUG
Apple Scab		P		S		
Powdery Mildew		P		S		
Fire Blight			P	S		
Fly Speck, Sooty Blotch				P	S	

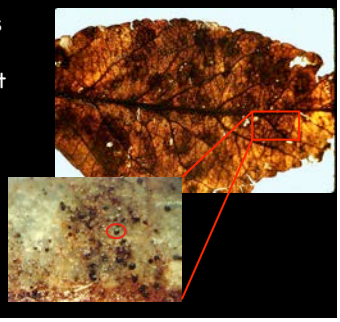
- P = primary infection - the first infections
- S = secondary infection - the later infections during the year

Disease cycle: apple scab



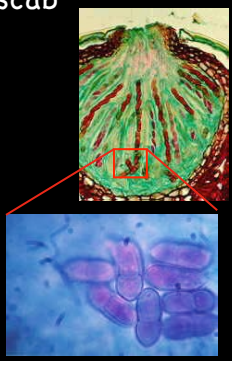
Disease cycle: apple scab

- In spring, scab fungus produces spores
- Apple trees just producing new leaves



Disease cycle: apple scab

- Spores produced in fruiting bodies
- Released with rain
- Float into the air
- Contact new leaves

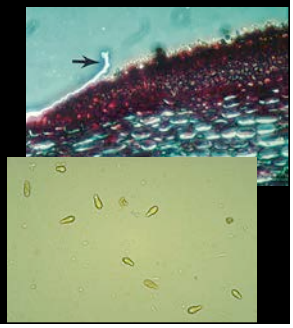


Disease cycle: apple scab

- Spores infect young leaves
- Hyphae grow
- Fungus produces different kind of spores
- Conidia

Disease cycle: apple scab

- Conidia are asexual
- Released in rain
- Cause more infections
- Secondary cycle
- Repeats



Disease cycle: apple scab

- Lesions darken
- Leaves may die
- Fruit infected

Disease cycle: apple scab

- Wet season causes defoliation
- Leaves on ground with fungus

Disease cycle: apple scab

- For fruiting apples, fruit destroyed

Types of IPM tools

Chemical

Resistant cultivars

Cultural controls

Biological controls

Forecast models

Types of IPM tools

Resistant cultivars

The easiest way to control scab

- Many scab resistant cultivars
- Topaz
- Liberty
- Redfree
- Goldrush
- Prima
- Jonafree
- Enterprise
- Williams Pride
- Dayton

Potential problem

Topaz with scab from new apple scab race

Resistance to diseases

- Need to either plant, or graft to establish trees
- Varieties are different from familiar cultivars
- Not resistant to all diseases
- Not resistant to insects

Liberty

Disease resistance

- None resistant to summer diseases
- Some are resistant to mildew, rust and/or fire blight
- Don't forget rootstocks – resistance to fire blight important

Finding resistance

- Domestic apple, *Malus x domestica*, probably originated in Khazakstan
- *M. domestica* is a natural hybrid of several Malus species that probably crossed in this melting pot

Apples want to be eaten

Apple forests have significant genetic diversity. Animals, such as bears, eat fruit and seeds are spread.

Prospecting for resistance

Examining apples on wild trees, later collected, sorted and labeled for seed removal.

Types of IPM tools

Cultural controls

Scab initial inoculum

- Scab epidemics start on the orchard floor
- Most scab spores don't travel more than 100 ft.
- Remove wild or unsprayed trees near orchard border

Getting rid of initial inoculum

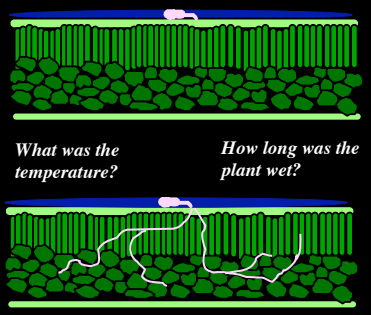
- Remove fallen infected leaves in fall or very early spring
- Rake
- Mower to chop into small pieces
- Nitrogen or compost application in spring

Types of IPM tools

- Chemical
- Resistant cultivars
- Cultural controls
- Biological controls
- Forecast models

Biology of scab infection

- Mills Periods
- Wetting periods
- Developed to tell when an infection had happened



Infection times change as the temperature changes

It rains for 48 hours:

Mills Periods

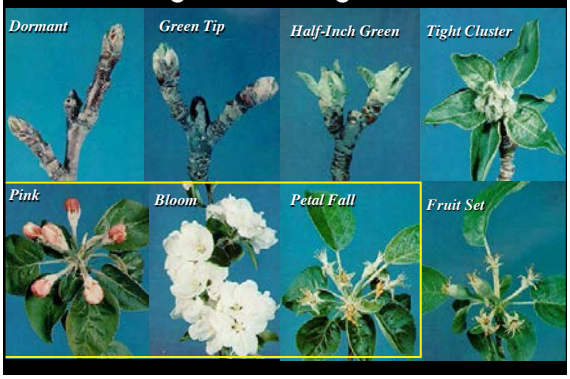
Temp.	Hrs. Wet
34	70
44	25
54	13
64	9
74	9

If the average temperature is 44, is there an infection?

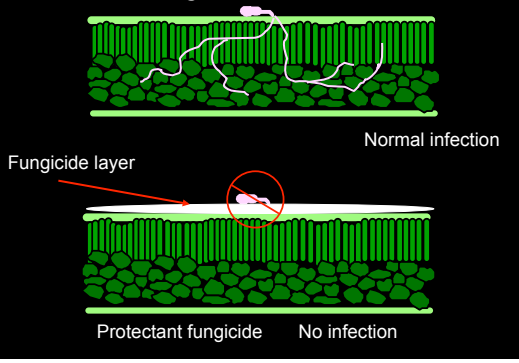
If the average temperature is 34, is there an infection?

If the average temperature is 64, is there an infection?

Growth stages and fungicides



What do fungicides do?



Keep it organic, keep it simple

- Sulfur
- An effective, protectant, fungicide
- Short activity span
- Liquid forms easier to use than powder/dry formulations
- Must be applied before a scab infection period

Alternative organic – green tip

- Copper – can damage fruit
- Broad spectrum biocide
- Bordeaux Mixture
  - copper plus hydrated lime and oil
- Target - powdery mildew, black rot

Fungicides

- Lime sulfur
- Used if sulfur didn't go on before rain
- Apply within 48 hrs. of start of rain
- Liquid form - smelly
- If used frequently can damage trees

Fungicides

- Captan
- Very effective against apple scab, rots, summer blemishes
- Bonide: captan 50W
- Dragon: captan
- Ortho Home Orchard Spray: captan plus insecticide
- Protects

Fungicides

- Mancozeb
- Moderately effective against apple scab; good against rust
- Bonide: mancozeb
- Dragon: mancozeb
- Protects

Experimental organic fungicides

- Potassium bicarbonate
- Kaligreen
- Also Armicarb, but it hasn't gotten OMRI approval
- Phosphorous acid a.k.a. phosphite
- Phosphorous acid is not phosphoric acid
- AgriFos, Phostrol

Experimental

- Hydrogen peroxide
- A strong oxidizer, disinfectant
- Can do the same on plant surfaces
- Does not last long
- No protection
- Oxidate

Fungicide rates*

	1 Gallon	10 Gallon	100 Gallon
Copper Sulfate	1 Tbsp.	1.6 oz.	1 lb.
Lime Sulfur	.65 fl.oz.	6.4 fl.oz.	½ Gallon
Sprayable Sulfur	3.4 oz.	1.2 lb.	5 lb
Captan (50W)	2 Tbsp	3.2 oz.	2 lb

*The label is the law! Always read and follow it.

Fungicides can control more than one disease

Tree Fruit/Disease	*Bordeaux mixture*	*Captan*	*Chlorothalonil*[4]	*Liquid copper*	*Ferbam*[3]	*Lime sulfur*	*Mancozeb*[4]	*Sulfur*[3]	*Neem oil*[6]
Apple and Pear									
Fire blight	X			X					
Powdery mildew						X		X	X
Rust					X		X	X	X
Scab	X not pear	X not pear			X	X	X	X	X

Cedar apple rust

- Has two hosts
- Apple and juniper (Eastern red cedar)

Cedar apple rust

Powdery mildew

- Initial inoculum in buds
- Multiple infections per year

Management of mildew

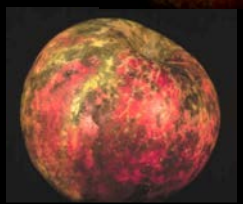
- Use least susceptible or resistant cultivars
- For ex., don't plant Ginger Gold if mildew is an issue!
- Remove obviously infected shoots ASAP.
- Spray with sulfur or bicarbonates
- Pink, petal fall, first cover

Mildew and rusts infections coincide with scab

- Scab sprays with sulfur will generally slow or control powdery mildew
- Sulfur won't control rust
- No good organic fungicide for rust control

Summer blemishes sooty blotch and flyspeck

- Just a blemish on the surface of fruit
- Keep trees well pruned for good air circulation



Clean it off

- Can soak in a 5 to 10% bleach solution for ~ 5 min.
- Rinse, and rub off with a cloth

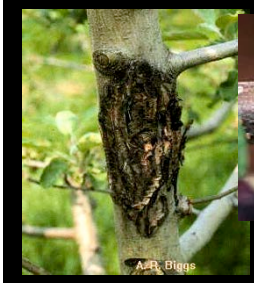
Rots may be a problem

- Usually black rot
- Most critical period is at petal fall and fruit set
- Remove old, dead wood
- Remove mummies

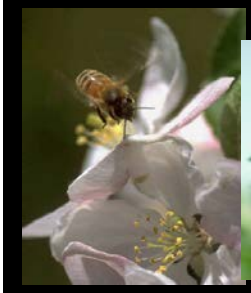
Fire blight

- Attacks a number of plants in the rose family
- Pear and apple

Fire blight symptoms: overwintering canker



Fire blight infects blossoms



Fire blight

Fire blight spreads in tree

- Canker spread.
- Throughout the summer, bacteria can continue to spread into the main trunks and tissue of trees
- Rootstocks

Fire blight difficult to manage

- Prune out any cankers in winter
- If it hits, prune out branches well in front of visible infection – go to next branch junction
- Commercial growers use streptomycin
- Resistant cultivars