Fruit Pests

Saskatoon Berry
- Entomosporium Leaf & Berry Spot
- Saskatoon/Juniper Rust
- Cytospora canker
- Blackleaf / Witches’ Broom

General Diseases
- Fireblight
- Root rot

Strawberry
- Botrytis / Grey Mold
- Powdery Mildew
- Common Leaf Spot
- Leaf Scorch

Raspberry
- Cane Blight
- Spur Blight

Insects
- Strawberry
  - Lygus / Tarnished Plant Bug
  - 2-Spotted/Cyclamen Mites
  - Root weevil
- Raspberry
  - Raspberry Crown Borer
  - Raspberry Sawfly
- Future Concerns
  - SWD / BMSB

DISEASES

Saskatoon Berry
- Woolly Elm/Apple Aphid
- Saskatoon Bud Moth
- Saskatoon Sawfly
- Apple Curculio
- Lygus Bug

General Insects
- Aphids
- Mites

ENTOMOSPORIUM LEAF & BERRY SPOT
Entomosporium Leaf & Berry Spot

Entomosporium mespili

- Most serious disease of Saskatoon berry

Lesions on leaves - various degrees of infection

Symptoms / Damage

Fruit Symptoms
- Fruit have watery, greyish lesions
- Fruit may become discoloured, disfigured, shrivelled or cracked
- Fruit stalks may become infected

Conditions Favouring Disease Development

- High humidity / precipitation and warm temperatures
- Spores dispersed by precipitation
- Flourishes from early-May through mid-July
- Overwinters ... where?

Distinctive spores of Entomosporium
**Management Strategies**

- Ensure adequate air circulation
- Pruning
- Orchard orientation
- Careful consideration of plant stand density
- Apply water to the soil surface (not sprinkler applications)
- Control weeds
- Apply preventative fungicide sprays

**Preventative Sprays**

- **Timing**
  - Flowering stages = White Tip, Petal Drop, Green Fruit (varies with product)
  - Make 1st application after first rain event that occurs 1+ days after flowering (when petals open up)
  - Connected to spore dispersal

**Preventative Sprays**

- No product provides a cure, only PROTECTION / PREVENTION

**PRODUCT SELECTION**

- Chemistry/efficacy of products varies somewhat
- Pre-Harvest Interval (PHI)
  - Sets limits on application timing

**SASKATOON BERRY / JUNIPER RUST**

**Saskatoon Berry – Juniper Rust**

*Gymnosporangium nelsonii*

& other species

Firm, spiky outgrowths on leaves or fruit
Outgrowths on shoots, stems & leaves

Rusty outgrowths on fruit

Spores infect leaves & fruit

Telial horns

Spores re-infect Juniper

Conditions Favouring Disease Development
- Moist or rainy conditions
- Presence of diseased junipers

Management Strategies
- Avoid planting near native stands of Juniper
- If junipers are present within 1-2 km, remove infected galls (if possible)
- Chemical controls are available

STRAWBERRY DISEASES
**BOTRYTIS (GREY MOLD)**

**Botrytis (Gray Mould)**

*Botrytis cinerea*

- Attacks various plant parts

**Symptoms / Damage**

- Initially, rot is soft and light brown in colour
- Leaves, fruit, blossoms & blossom stalks covered with light gray growth
- Off-flavoured fruit
- May develop post-harvest

**Botrytis Fruit Rot – ripe and mature fruit affected**

**Symptoms / Damage**

- Botrytis infected leaf
- Botrytis infected fruit
- Botrytis infected cane
**Conditions Favouring Disease Development**

- Shade or dense foliage in the bed or row
- High humidity / Poor air circulation
- Extended periods of excessive moisture
- Cool spring & summer temperatures
- Lush, succulent growth or older tissues are more susceptible
- Factors that contribute to soft fruit
  - e.g. excessive N fertility during fruiting

**Management Strategies**

- Protective fungicide applications from bloom to harvest if conditions are cool, wet
  - Follow appropriate Pre-harvest Interval
- Ensure good straw mulch barrier between berries & soil (strawberries)
- Avoid bruising fruit
- Remove infected berries from the field

**Management Strategies**

- Remove decaying or diseased leaves, fruit & canes
- Remove spent canes
- Thin canopy to ensure adequate ventilation
- Ensure fruit is harvested regularly
- Avoid over-fertilization with Nitrogen

**DISEASES THAT AFFECT THE FOLIAGE**

- **POWDERY MILDEW**
  - Sphaerotheca macularis
  - Podosphaera clandestina
  - Affects all above ground plant parts
  - Can’t survive without host plant tissue

**Infected Raspberry Leaf**

**Infected Raspberry Leaf**
**Symptoms / Damage**

- Fine powdery white growth on leaf surfaces of lower leaves & suckers and on leaf undersides
- Leaves with purplish underside
- Leaves may be discoloured or stunted
- Infected leaves curl upwards (strawberry)

**Conditions Favouring Disease Development**

- Poor air flow due to dense shelterbelts or dense crop canopy
- Warm, dry days (inhibited by rainy, wet conditions)
  - 15 - 27°C
- Conditions of high humidity
- Develops in the spring and fall

**Management Strategies**

- Prune out infected shoots & remove infested crop debris, if incidence is low
- Ensure adequate air flow and ventilation within orchard and canopy
- Removal of any element that creates high humidity conditions
- Timely application of registered chemicals
- Avoid use of susceptible cultivars
**Common Leaf Spot**

- Most prevalent early in the season or in late summer
- Spread by rain, hands, tools or clothing when plants are wet

- Symptoms vary by cultivar
- Purplish spots on leaves
- Centres become grey or white with reddish to purplish borders
- May cause black seed

**Conditions Favouring Disease Development**

- Susceptible cultivars/varieties
- Succulent growth, due to excessive fertility
- Handling during wet weather

**Management Strategies**

- Use clean planting stock for new plantings
- Use less susceptible cultivars, if possible
- Remove infected plants
- Chemical fungicide sprays

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**Raspberry Diseases**
**Cane Blight**

*Leptosphaeria coniothyrium*

### Symptoms / Damage

- Laterals & leaves wilt
- Affected canes become brittle & snap off easily
- Producing canes may die between flowering & fruiting

### Management Strategies

- Choose a suitable planting site
- Use clean planting stock
- Ensure adequate canopy ventilation through pruning
- Remove & destroy diseased canes
- Avoid mechanical injury to canes
- Registered fungicides may be applied

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**Spur Blight**
**Spur Blight**

*Didymella applanta*

**Blighted Spurs**

- Fungus survives on infected canes
- Spores are spread by wind and water splash

**Symptoms / Damage**

- Brown or purplish discolouration at point of leaf attachment
- Discolouration will spread up & down

**Management Strategies**

- Prune out & destroy diseased canes after harvest
- Control weeds
- Use clean planting stock
- Thin canopy to improve canopy ventilation
- Ensure proper plant spacing
- Registered fungicides may be applied

**Symptoms / Damage**

- Leaves may become chlorotic
- Fruiting bodies may be apparent on the canes
- Buds may fail to break in the year following infection

**DISEASES THAT AFFECT THE ROOTS/CROWNS**
ROOT ROTTS

Root Rots

- May be caused by any one or combination of:
  - Pythium
  - Phytophthora
  - Rhizoctonia
  - Fusarium

Symptoms / Damage

- Plants may appear water or nutrient deficient
- Leaf size may be reduced
- Leaves and petioles may become wilted or discoloured
- Fruit may be stunted & will not size up

Wilting & Dieback from Root Rot

Symptoms / Damage

- Roots are dark brown to black
- Tissue discolouration may extend into the crown
- Root development is sparse or nil

Discoloured crown area & reduced root development

Management Strategies

- Ensure site location is suitable
- Use clean planting stock
- Rotate out of crop periodically, if disease develops
- Avoid over watering or waterlogged soils
- Remove infected plants

BONUS DISEASE
**FIRE BLIGHT**

**Erwinia amylovora**
- Very wide host range
- There is a strain specific to raspberries that will not infect apples, cherries, saskatoon berries, etc.

**Symptoms / Damage**
- Wilting of new shoots in characteristic “Shepherd’s Crook”
- Sudden wilting & browning of blossoms
- Foliage develops a scorched appearance
- Bacterial ooze may be seen in humid weather
- Young fruit may turn brown or black

**Management Strategies**
- Prune out infected canes and branches / shoots (25-45 cm below the lowest point of infection)
- Avoid succulent growth
- 2 biological products are registered for suppression of fireblight in Saskatoon berries, canebberries & non-bearing apples (nursery stock)

**INSECTS**
Woolly Elm Aphid

- Potential to cause substantial transplant damage/loss
- Most danger to plants that are less than 4 years old
- American Elm = alternate host
- Blue-black with white waxy material on back end

Symptoms / Damage

- Above ground
  - Lack of vigour in young plants
  - Early/prefmature fall colour change (late July/early August)
  - Partial leafing out, followed by early season plant death

- Below ground
  - White, woolly masses on plant roots
  - Presence and damage may not be noticed until after infestation (too late?)
1. Woolly Elm Aphid feeding on elm leaves

2. Swollen, spongy root

3. Life Cycle
1. September
2. Elm
3. Overwinter
4. Elm
5. Management Strategies
   - Orthene / Admire application (soil injection or drench) can be made for plants that are less than 4 years old (non-bearing plants) as well as for bearing plants
   - Apply mid-July to early August (better as early as possible)
   - Pre-harvest Interval varies (11 months / 14 day)
   - Avoid planting near American Elm stands

4. Saskatoon Bud Moth - adult
5. Saskatoon Bud Moth - larva

SASKATOON BUD MOTH

Saskatoon Bud Moth - adult

Photo by L. Harris
Symptoms / Damage

- Flower buds with tiny holes (oozing droplets may be present)
- Young leaves and flowers tied together with threads or webbing
- Yellowed flower buds may fall off when touched
- Loss of green, unripe fruit

Management Strategies

- Decis application (1st) when buds are at Green Tip stage
- Flower bud cluster is visible
- Buds are very small and tightly packed together
- Entire cluster appears green in colour

Saskatoon Sawfly

- *Hoplocampa montanicola* (+ 3 spp.)
- Plant-feeding, non-stinging wasp
- Yellow with brown markings

Symptoms / Damage

- Small holes at the top of small, green fruit
- Extensively damaged, hollow green fruit
- Green fruit may contain larvae

Life Cycle

- Adults appear in May (3-9 days prior to max flowering)
- Eggs laid in blossom nectaries (1/flower)
- Hatch 4 to 11 days after petal drop
- Larvae feed at top of fruit
- Younger fruit usually drop off plant
- Older fruit stay on plant (empty shell)
- Mature larvae drop out of fruit & overwinter in soil
- By end of June
Management Strategies

- Decis application (2nd) at early flowering (25-50% bloom)
- Decis application (3rd) after petal drop (observe PHI of 21 days)

Apple Curculio

*Anthonomus quadrigibbus*
- A type of weevil; reddish-brown
- Long, curved snout

Symptoms / Damage

- Green fruit and shoot tips with distinctive dark punctures
- Eggs are laid at base of fruit by stem
- Larvae in centre of ripe fruit

Life Cycle

- Adults emerge in spring at flowering
- Found at flowering & petal drop
- Feed on immature fruit & shoot tips
- Egg laying occurs about 1 month after peak flowering
- Eggs laid at base of fruit by stem (1 egg/fruit)
- Larvae eat seeds
- Larvae develop & pupate within fruit
- Fruit ripen & don’t drop
- Adults emerge by mid-July & enter leaf litter

Management Strategies

- Decis application (3rd) just after petal drop (observe 21 day PHI)
- Removal of affected green fruit can reduce populations (very time consuming)
- Effective weed management can help keep populations down
STRAWBERRY INSECTS

INSECTS THAT AFFECT FRUIT

TARNISHED PLANT BUG

Tarnished Plant Bug - adult

Tarnished Plant Bug, Lygus lineolaris
- A.K.A. Lygus Bug
- One of the most serious & widespread of strawberry pests
- Wide range of host plant species

Tarnished Plant Bug - nymph & adult on fruit

Tarnished Plant Bug - adult on flowers
**Symptoms / Damage**

- Yellow, aborting flower buds
- Droplets of brownish liquid may exude from newly pierced buds
- Fruit deformation

**Symptoms / Damage**

- Feeding by nymphs
  - Nubins or deformed fruit
  - Apical seediness
- Adult feeding
- CATFACING
- Feeding in Raspberries
  - Crumbly berry
  - Reduced plant vigour

NOTE: Catfacing can be caused by other factors, producing identical symptoms

**Monitoring**

- Scout the field perimeter in new fields or entire established fields
- Survey the field from pre-bloom until green fruit stage
- Tap plants or shake fruit clusters over a non-metallic pie plate
- Count the number of nymphs per 100 clusters
- Economic threshold = 1 nymph per inflorescence (strawberries)
Management Strategies

- Careful monitoring of TPB populations
- Remove weeds (especially leguminous species)
- Ensure alternate host crops are not planted too close to field / orchards (e.g. alfalfa)
- Timely application of registered chemicals
  - Saskatoons = Decis application (1st) can be effective

Root Weevils

- Various species
- Wide host range

Symptoms / Damage

- Leaves may be notched or ragged (feeding damage)
  - Indicates presence
- Stunting of plants
- Leaves may turn red & fruit can be small & seedy
- Wilting & plant death may occur in drought conditions

Monitoring

- Scout the field margins initially, as adults will walk in
- Monitor fields in July or August for leaf notching
- If notching is observed, return at night to find adults on the leaves with a flashlight
- Examine crowns of weak plants for injury
Management Strategies

- Do not maintain long rotations
- Ensure fields are isolated from wild plants, which harbour weevils
- Chemical controls can be effective

Insects That Affect Buds / Flowers

Bud / Clipper Weevils

Anthonomus signatus

Symptoms / Damage / Monitoring

- Obvious symptom = Clipped flower buds
- Monitor fields in May when flower buds begin to develop
- Sample 0.6 m of row in 5 locations in each field 2 times per week from pre-bloom onwards
- Economic threshold = 13-20 clipped buds per metre of row
Management Strategies

- Minimize the amount of trash in & around fields during mid to late summer
- Separate new plantings from infested plantings
- Tillage of old fields immediately after harvest will reduce clipper populations by harming pupal stage

CUTWORMS

Cutworms

- Strawberry Cutworm adult (Photo Courtesy MAFRI)
- Field-scale Cutworm Damage (Photo Courtesy MAFRI)
- Mature Cutworm larvae (Photo Courtesy MAFRI)
- Two-spotted Spider Mites (Photo Courtesy ARC)
- Spider Mite-damaged strawberry (Photo by R. Spencer)

OTHER INSECTS

Aphids

- Black mold growing on aphid honeydew
- Aphids - various

Mites

- Mite damaged leaves (Photo courtesy MAFRI)
- Two-spotted Spider Mites (Photo courtesy MAFRI)
**RASPBERRY INSECTS**

**INSECTS THAT AFFECT CROWNS OR STEMS**

**Raspberry Crown Borer**

*Pennisetia marginata*

- Adult moth resembling yellowjacket wasp
- Affects all cane fruit

**Raspberry Crown Borer - adult**

**Larvae in cane burrow**

**Raspberry Crown Borer - pupae**
**Symptoms / Damage**

- Larvae girdle new canes while feeding
- Symptoms may be confused with cane blight
- Foliage wilts & dies, with fruit remaining attached
- Damaged canes will break off when pulled (2nd year)
- Swellings may be apparent at the crown when dug

**Monitoring**

- Watch for damaged or wilting canes during summer, especially when surrounding plants appear healthy
- Dig out suspect crowns, looking for holes and sawdust

**Management Strategies**

- Prune out loose canes or canes with galls after harvest
- Remove & destroy wilting canes during summer
- Apply registered chemical treatments

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**Insects That Affect Foliage**

**Raspberry Sawfly**

- Larval stage feeds on leaves & other plant parts

**Monophadnoides geniculatus**

Raspberry Sawfly – adult

Raspberry Sawfly – damage
Raspberry Sawfly – adult

Raspberry Sawfly – larva

Raspberry Sawfly – egg

Symptoms / Damage

- Feeding on the leaves produces small holes
- Heavy infestations result in skeletonized leaves (veins intact)

Monitoring / Management

- Visually inspect leaves in June
- Determine the number of larvae present
- Determine whether skeletonization is occurring & if controls are required
- Chemical controls are available

OTHER DISEASES / INSECTS

- BLACKLEAF / WITCHES’ BROOM
- HAWTHORN LACE BUG
- MAPLE LEAFMINER – HEADS UP
- Spotted Wing Drosophila – HEADS UP
- APPLE MAGGOT – HEADS UP

WEEDS
Impact of Weeds

- Competition
  - Reduced crop survival / vigour (especially in establishment years)
  - Reduced yields
- Alternate hosts for disease & insect pests
- Negative customer perception
  - Sloppy appearance
  - Poorly managed operation

Weed Management Strategies

- Control weeds before planting (1-2 year)
- Manage weeds as best as you can in early establishment
- Plastic mulch (Saskatoons)
- Manage the between-row spaces
  - Mow
  - Grass or other crop
  - Bare soil

Weed Management Strategies

- For established plantings - Registered chemicals are effective & available
  - Chemical applications must be carefully timed to avoid damaging plants
- For Saskatoons - if planning orchard renovation - DON’T apply Casoron in fall prior

QUESTIONS???

PEST MANAGEMENT REGULATORY AGENCY (PMRA) E-LABEL SEARCH

http://pr-rp.hc-sc.gc.ca/is-re/index-eng.php

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