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Insect and Disease ID and Management for Home Vegetable Gardeners

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- **Insect and Disease Pests**

Because of time constraints, we'll stick with the common ones as examples, and then touch on ecology and host preferences, because this gives some insight on potential management strategies.

Where applicable, we'll discuss relative efficacies of available pesticides and how best to use them. Also, we'll discuss non-chemical strategies to mitigate pest problems.

- **Other Stuff**

Inevitably there will be pest issues not covered in the presentation, so I hope to leave time for specific questions.

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Flea Beetles

The biggies (1): Striped and crucifer flea beetles – brassica crops.

Co-evolved with these crops, using glucosinolate compounds as attractants (brassicas). Not all are equally attractive! Generally, the “hotter”, the more attractive. Cruciferous weeds (wild mustard, pennycress, etc.) are also hosts.

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Considerations for flea beetle management:

Crucifer flea beetles tend to be numerous where hosts (wild and cultivated) are common. **DUH!** But this means 1) you should identify and try to eliminate wild hosts, 2) move host crops around a lot, and with distance, and 3) eliminate host residue immediately upon finishing with the crop.

Trap cropping with attractive hosts (*B. juncea* vars.) has been found to have some positive effects when used in proximity to less attractive hosts like broccoli. Downside – this also builds up flea beetle population!

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Eggplant, Tobacco and Potato Flea Beetles

Another group of specialist herbivores. These utilize alkaloids found in solanaceous crops. Eggplant is a favored host; tomatoes less so. Nightshade weeds like **horsenettle** are highly favored.

Many of the same principles of cultural management apply. Weed management and rotation are critical. Trap cropping likely less effective with these pests. Remember – eggplant is tough! Control is essential when plants are young, but they can tolerate significant numbers of beetles once mature and bearing fruit.

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Some insecticide information:

Pyrethrin – Broad Spectrum

Keep sodium channels in nerve cells open, causing uncontrolled nerve activity. Fair to good control on many common insect pests, BUT be cautions when aphids are a potential problem. Can flare aphid and mite populations due to lack of efficacy and elimination of some beneficials. Toxic to bees and wasps, but very short lived. Some formulations approved for organic use.
Pyganic, Pyrotec, others.

Spinosyn – Limited Spectrum

Enhances activity of neurotransmitter, acetylcholine, resulting in hyperexcitation. Excellent control of caterpillars and SOME beetles. Not reliable for sucking insects. Fairly toxic to bees and wasps so avoid direct contact. Maintains other beneficials, so less likely to flare apids. Homeowner formulation is not for certified organics.
Capt. Jack's Dead Bug Brew - Bonide

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Insecticide info cont'd:

Bacillus thuringiencis (*B.t.*) products – Limited Spectrum

Mid-gut membrane disruptors. Good control of caterpillars (some B.t. strain variability) especially against smaller larvae. Maintains beneficials so not likely to cause secondary pest outbreak. Compatible with organic systems.
Dipel, Thuricide, others

Neem oil products – Limited Spectrum

Feeding disruptor and growth regulator. Highly variable with fair efficacy against some beetles (not flea beetle) and caterpillars. Not good on aphids and leafhoppers. Maintains beneficials. Compatible with organic systems.
Neem Oil, Triple Action Neem Oil, others

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Insecticide info cont'd:

Insecticidal soaps (potassium salts of fatty acids) – Limited spectrum

These alkaline materials disrupt cell membranes in soft-bodied insects, causing leakage. Doesn't work well on hard shelled things like beetles and some true bugs. Only works when wet. No residual. Compatible with organic systems.
Safer's, others

Neonicotinoid (imidacloprid) – Limited spectrum

Like nicotine, this binds to insect central nervous system sites that accept acetylcholine, blocking neurotransmission. Some insects susceptible (many beetles, aphids, bees), others not at all (caterpillars). Mammals, birds, reptiles not affected. Systemic when applied to roots. Long pre-harvest period.
Bayer Fruit, Citrus and Vegetable Insect Control

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Striped Cucumber Beetle

Significant pest of all cucurbits, due to direct feeding injury and disease transmission. Look-alike western corn rootworm beetle can feed heavily on blossoms but causes little significant damage. Look for “untidy” stripes and protruding abdomen. Larvae are soil-dwelling.

THIS

NOT THIS

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Considerations for cucumber beetle management

Another specialist, so it will be found in association with cucurbit crops. Rotate, separate, cultivate, destroy host residue to limit carry-over pop.

Highly attracted to cotyledon leaves and immature foliage. Don't wait to scout! Transplanting avoids cotyledon stage (some practical issues here).

Vectors bacterial wilt (not to watermelons), so control at 0-4 true leaf stage is CRITICAL. Exclusion may be necessary. Insecticidal control is weak (except neonicotinoid). Varietal resistance to wilt exists in some modern cucumber varieties.

Feeding after vine-run is less important. Difficult to acquire wilt at this stage due to high plant mass. Only treat if overrun by beetles. Exclusion now also excludes bees!

Will feed on rinds of maturing fruit, so late-stage control becomes important again. Scout as fruit enlarge. Treat if beetles present and causing injury. Determine your customers' (THAT'S YOU!) threshold for cosmetic injury.

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Cuke beetle management

Do everything you can to inhibit population build-up. This means spatial separation between host crops and seasonal rotation. Remove finished host material promptly and till in all potential residue.

Limit exposure to young plants – barriers, transplants, sprays

Use wilt resistant varieties where available. **Dasher II, Marketmore 76/80, Monarch, Salad Bush, Supersett, Trailblazer. Pickle – Calypso, Regal, Score**

Insecticides/repellants only moderately useful unless you are able to use systemic insecticide (neonicotinoid) at planting or a more toxic alternative (pyrethrin) on foliage.

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Aphids – *GPA, Potato, Melon, Cabbage*

The degree to which these pests are problematic varies by species, crop, crop maturity, environmental factors and human intervention.

Melon aphids (L), and cabbage aphids (R).

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A lot can be said of aphids. Here are a few general points to consider:

Negatives

- Can build to high populations rapidly.
- Can be a contaminant/quality issue.
- OMRI approved (and many other) insecticides are pretty useless and may make the situation worse.

Positives

- Are attacked by a host of indigenous predators and parasites.
- Environment can be altered to favor natural enemies.
- Can be tolerated on some crops at certain times.

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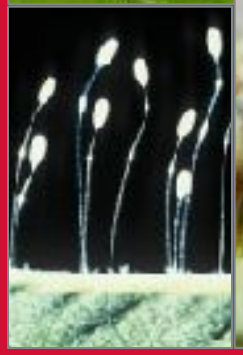
Dominant predators observed and quantified in recent study of European corn borer egg predation in NJ as affected by companion plantings. Aphid populations adversely affected by presence of companion plantings.



Umbelliferae – Dill, coriander, yarrow, etc.
Asteracae – Certain types – Coreposis, cosmos, etc.

Bickerton, Hamilton. 2012. J. Econ. Ent.

Pyrethroids also kill most beneficial insects.
"When you kill off the natural enemies, you inherit their work"

UC Davis lists pyrethrins as "highly toxic" to bees, although when used alone, residual toxicity is <2 hrs. Avoid direct contact! Adjust timing!

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Mites!

Two-spotted spider mite (TSSM). Multiple crop hosts. Loves heat and leaf surfaces with trichomes….tomatoes, eggplants, watermelon especially but nothing is totally immune.

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TSSM - Generally worse in high tunnels due to absence of rain.

- **Consider the release of predatory mites like *Neoseiulus fallacis* or *N. californicus* immediately upon discovery of TSSM.**

- **These work very well on peppers, and are good for suppression on tomatoes BUT once temperatures routinely exceed 85°F in the tunnels, predatory mites do not fare well.**

- **In the field, scout often. Spot treat vigorously with insecticidal soaps or even hard sprays of water. Keep it up until they seem to have abated locally.**

- **Be aware that crops next to favored hosts are at risk….eggplant, watermelon are such favored hosts.**

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Brassica pests:

Relatively easy to deal with if regular scouting is done. Of all, ICW is probably the most damaging, as it is common and prefers young tissue.

Spinosyn will control all of these, but *B.t.* formulations are also good if used regularly so that small larvae are targeted. There are predators and parasites, but these rarely provide acceptable control. Hand picking can help. **Destroy residue** – this is critical and needs to be a community effort.

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Beet and Spinach leafminers

Primarily early season pests, these miners overwinter as pupae in soil. Flies emerge in April and May, laying eggs on leaves.

Damage to chard in late May can be extensive.

Exclusion of flies with row cover can be effective, but it needs to be done early and cover should be kept off foliage to minimize leaf wetness (disease).

Spinosyn is quite effective, but should be targeted to fly activity.

Deep tillage at season's end may help.

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Cabbage maggot

Several generations, but the April/May flight is the most damaging. Favored by cool, moist conditions and likes soils high in organic material.

Eggs laid where soil meets the base of the stem.

Exclusion may also be effective, as will delaying planting until after June 1st. Be sure to rotate and employ deep tillage at season's end.

For information on flight activity, see NEWA:
http://newa.cornell.edu/
Click on weather station nearest you and then select cabbage maggot!!

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Squash vine borer

Moth is active during the day, and can lay eggs from mid-June through mid-August. Summer squash, acorn squash and pumpkins are most often affected. Row covers can be effective but must be removed when blossoms appear to permit pollination.

Spinosyn or pyrethrin sprays directed at the base of the plant while adults are appearing in pheromone baited bucket traps can be effective.

Remove all host debris when crop is finished. Cultivate with enough depth prevent adult emergence from soil in the spring.

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Allium leaf miner

The new pest in town! ALM adults are active in late March through April and again in September-October.

Characteristic feeding/egg scars on leaves indicate infestation. Maggots tunnel toward bulb and pupate. The injury they cause often leads to a rot in the bulb or neck.

Row covers are effective at preventing egg laying during periods of adult activity. Chives appear to be the first crop to get hit in the spring. Injury to scallions, onions and leeks can be severe.

Removal of all host debris prior to end of season can help prevent overwintering.

Any specific bug questions before a few final thoughts on insects and management?

Spined soldier bug nymph with squash bug. Ends badly for squash bug.

Specimen Label

Dow AgroSciences

Entrust®

Naturalyte® Insect Control

®Trademark of Dow AgroSciences LLC

A Naturalyte® insect control product formulated for control of lepidopterous larvae (worms or caterpillars), leafminers, thrips, and red imported fire ants.

Group	5	INSECTICIDE

Active Ingredient:

spinosad (a mixture of spinosyn A and spinosyn D)	80%
Other Ingredients	20%
Total	100%

Contains 80% active ingredient on a weight basis.

EPA Reg. No. 62719-282

OMRI Listed

Listed by the Organic Materials Review Institute (OMRI) for use in organic production.

Keep Out of Reach of Children

CAUTION

Mixers/loaders must wear:

- An approved dust/mist filtering respirator (NSHA/NIOSH approval number prefix TC-21C), or NIOSH approved respirator with any N, R, P or HE filter.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

First Aid

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.

Environmental Hazards

This product is toxic to bees exposed to treatment for 3 hours following treatment. Do not apply this pesticide to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period. This product is toxic to aquatic invertebrates. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Apply this product only as specified on the label.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Read all Directions for Use carefully before applying.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your state or tribe, consult the agency responsible for pesticide regulation.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the

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What to do about bees?

Products accepted in organic systems are not systemic, so toxicity to bees must come from direct exposure. This can be avoided by adjusting the timing of applications. Evenings, after bees have left the field, are generally best.

NJ beekeepers need to be notified. See: NJAC 7:30-9.11 for exact requirements.

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Some points to return to (over and over)!

- **Encourage (create) plant diversity near the crops.** Plants in the Umbelliferae and Asteraceae families offer nectar and pollen to beneficials. This will help, especially with aphids. Avoid allowing Brassica or Solanaceous plants (intentional or not) to grow near related crops.

- **Scout regularly and often!** Try to do it the same way each time, and keep notes. This will help you spot trends and make decisions. Keep track of beneficials too.

- **Avoid any insecticide unless you really need it.** Apply based on scouting results and actual risk to crop. Choose product based on 1) Efficacy and 2) Potential negative impact on beneficials.

- **Cleanliness counts!** Practice crop rotation (time and distance matter). Dispose of crop residue quickly and completely. Identify potential alternate hosts for pests and eliminate them as much as possible.

Can't forget the *syrphids*! These are effective aphid predators that can be recruited through the use of companion plants.

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Bacterial leaf spot of cucurbits

Water-soaked lesions on leaf surface where moisture lingers. Spots become necrotic and often fall out. No spores……it's not a fungus.

Can cause lesions on fruit, which lead to premature rotting.

Zucchini have been hit hard in recent years. Seedborne and on debris.

Cleanliness
Rotation
Copper

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Powdery Mildew

Common. You'll get it! You can live with some. Not the same organism you see on phlox or lilacs.

Feeds on live cells, so it tends to damage/kill tissue slowly.

Infects mature foliage, especially when tissue is under stress….. Fruit production is stressful!!

Plant sequentially to have new crop waiting. Apply protectant fungicides at first sign of lesions.

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A few fungicides available to the home gardener, and their uses.

Phosphite fungicides (potassium salts of phosphorous acid) – Monterrey Agri-Fos, others?

Disrupt metabolic pathways and inhibit formation of some necessary enzymes in oomycetes (Downy mildews, Pythium root rot). Systemic

Chlorothalonil (organochlorine fungicide) – Chlorothalonil 720, Daconil 2787, others

Disrupts enzyme reactions. Broad spectrum protectant. Not systemic.

Copper (copper octanoate) – Monterrey Liqui Copper, others

Denatures some fungal and bacterial enzymes. Not systemic. Approved for organic settings.

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This is the bad one……

Downy Mildew

Yellow spots, becoming necrotic on top.

Dark sporulation along veins beneath.

This fungal pathogen kills very quickly, absorbing nutrient from dying tissue.

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The cucurbit downy mildew pathogen has at least 6 races, all of which infect cucumber. Beyond that, the races vary in their pathogenicity, with relatively few capable of infecting watermelon and pumpkin/winter squash.

CDM does not overwinter here, but does so where live hosts are present year round (Gulf Coast) as it requires a living host to reproduce. Spores arrive with low pressure systems and require specific conditions to infect.

CDM Forecast!! http://cdm.ipmpipe.org/ VERY USEFUL!

Utilize available varietal resistance. Protectant/phosphite fungicides are useful but not a foolproof solution.

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Expected foliar diseases of tomato, ie. early blight and septoria leaf spot.

Utilize varietal resistance, if the tomato is acceptable for your uses.

Promote drying conditions. Use protectant fungicides.

Remove debris, promote complete decomposition of residue.

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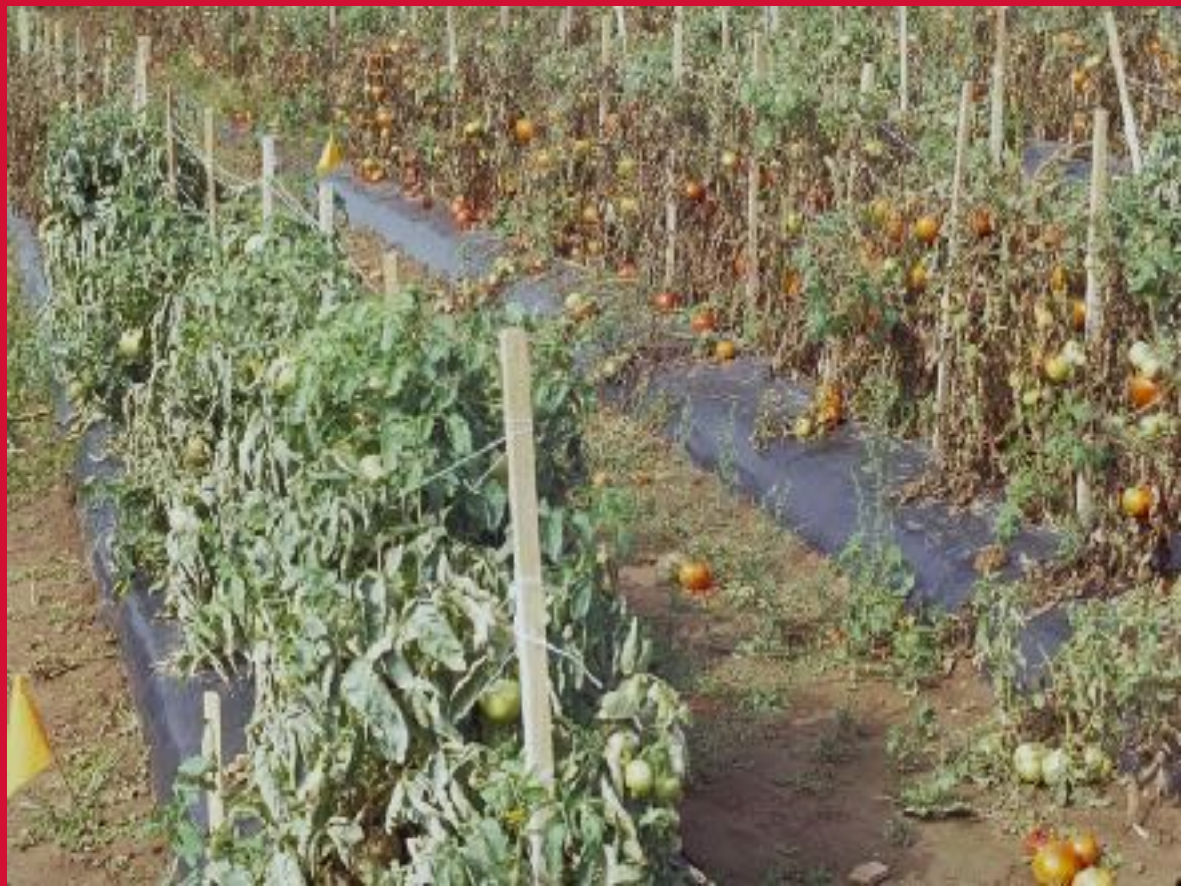
Early Blight

- **Tolerant varieties**
  - **'Mountain Merit', 'Defiant', 'Iron Lady', 'Mountain Magic', 'Plum Regal', Juliet', 'Jasper'**
- **Crop rotation**
- **Good air circulation**
- **Sanitation**

Organic fungicides
- **Copper**

Synthetic fungicides
- **Chlorothalonil**
- **Mancozeb**



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Blossom-end Rot

Not a disease, but a calcium deficiency.

Calcitic lime may help, but soils are rarely deficient.

Dry conditions, heavy fruit load and uneven watering are prime drivers of this disorder.

Elongated types (plums) are most at risk.

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Crucifer downy mildew

Typically a fall disease of broccoli and collard greens.

Big problem on collards, as leaf is edible portion.

Varietal resistance is not reliable.

Rotation and debris removal are a must!!!

Phosphite fungicides.

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Basil Downy Mildew

Worst on sweet basil.

Yellow "sectors" visible on upper leaf surface.
Dark sporulation on lower surface.

Look for resistance in newer varieties hitting the market.
'Eleanora', 3 new Rutgers varieties. **'Obsession', 'Devotion' and 'Thunderstruck'. * only available in commercial lots this year.**

Plant in full sun. Allow for good air flow. Phosphite fungicides are good.

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Cercospora leaf spot

Typically a late summer disease, affecting beet, chard and spinach foliage.

Promote drying conditions. Leaf wetness is required for infection.

Rotate, remove all debris at end of season. Turn over soil….deeper is better.

Protectant fungicides offer some relief.

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Rules of Thumb for Disease Management

ROTATE – This is good on several levels, but may be difficult in small-scale situations like community gardens.

REMOVE – Debris removal (old vines and other debris that is not easily decomposed) will help reduce inoculum load locally.

RUTHLESS (you!) – If the crop is "over the hill" or losing productivity due to disease…..eliminate it and move on. This counts for some insect pests too.

HYGIENE - Start with clean seed/plants. DO NOT toss foreign vegetable matter into the plot.

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Questions?