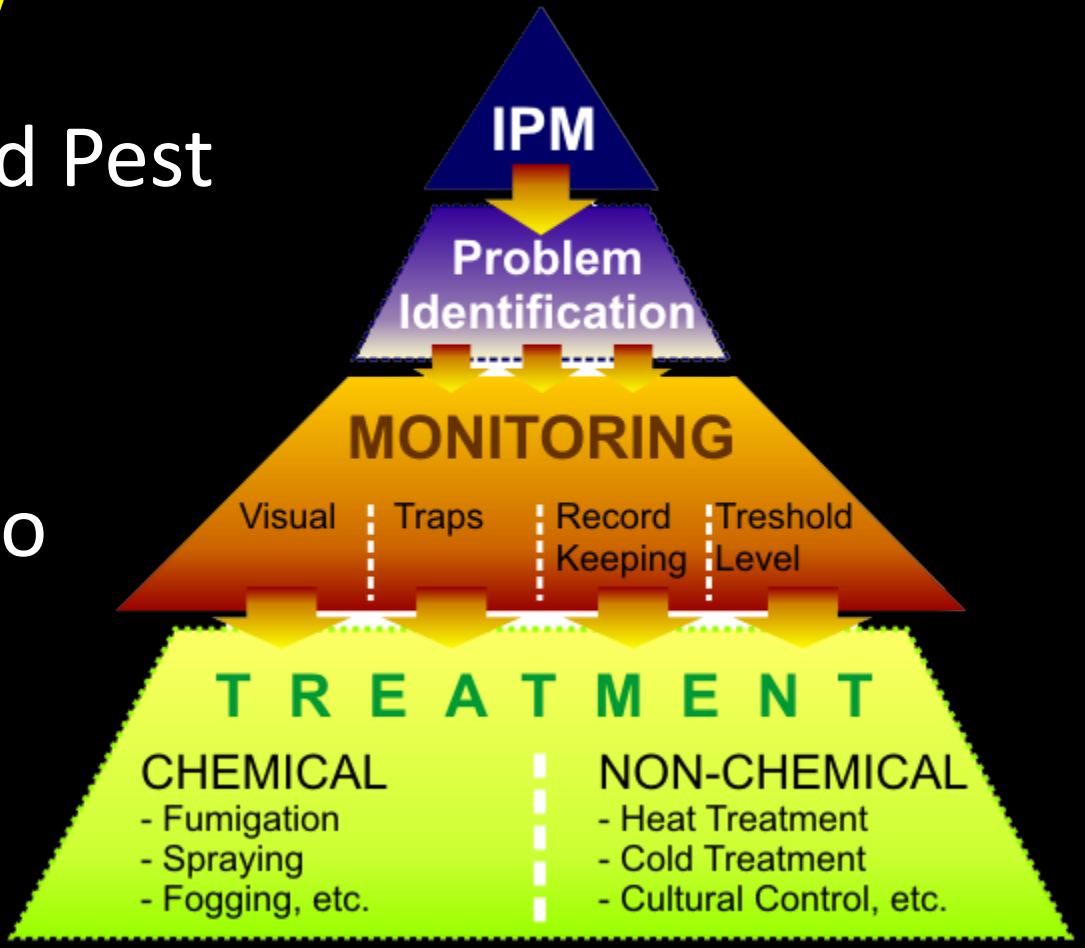
Extension Gardener
Class 9:

Integrated Pest Management

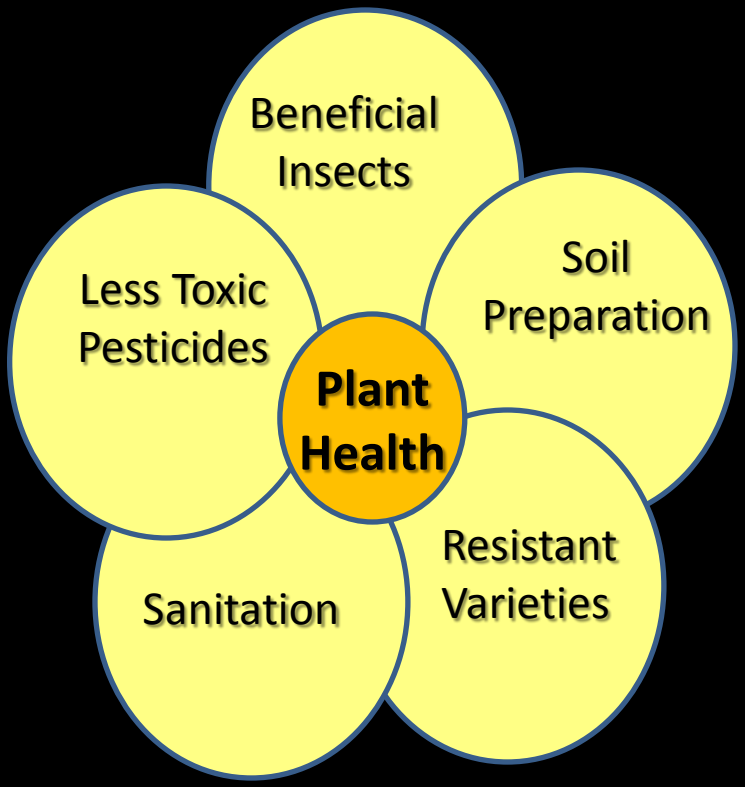
Focus for Today:

- What is Integrated Pest Management?
- IPM Practices
- Using pesticides to manage:
  - Diseases
  - Insects
  - Weeds
- IPM for ticks and deer



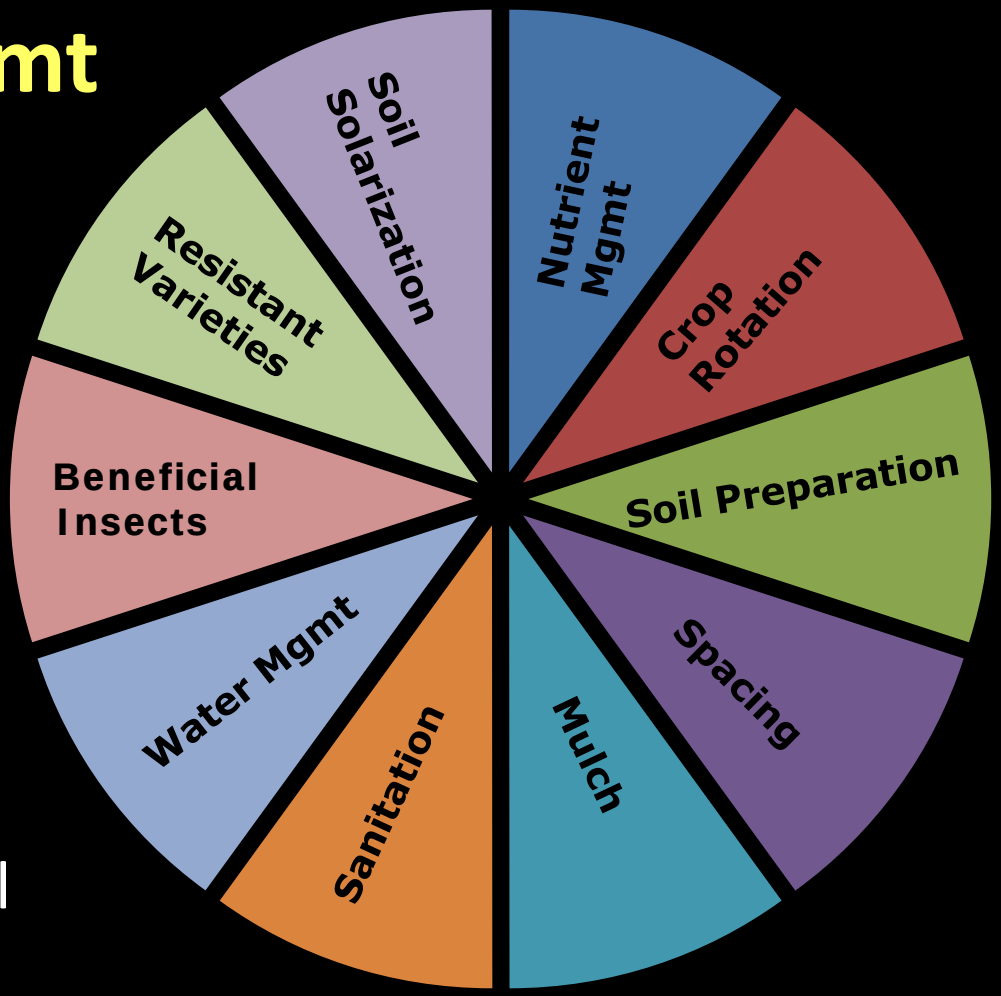
What is Integrated Pest Management (IPM)?

- **A comprehensive program** that includes both **preventative** and **control** strategies
- **Seeks balance, not eradication**
- **Goal =** minimize adverse effects on **environment** **AND** **protect plant health**



Focuses on:

- **Plant Health Mgmt**
  - Build healthy soils!
  - Sanitation
  - Plant selection
  - Reduce stress
- **Encouraging Beneficials**
- **Treatment**
  - Use less toxic/natural pesticides first



Step 1: Correct Diagnosis of the Problem!

- **Remember: 75% of plant problems are abiotic** (non living!)
- Most are in the **root system – soil** problems or **water** management issues
- **Plants that die within a few moths** of planting usually over or under watered
- **Living/Biotic Problems** include **insects and diseases**

Common Insect Pests

Two Main Groups

Chewing Insects

Beetles, Caterpillars, Grasshoppers (slugs/snails)

Holes in leaves, webbing and frass may be present

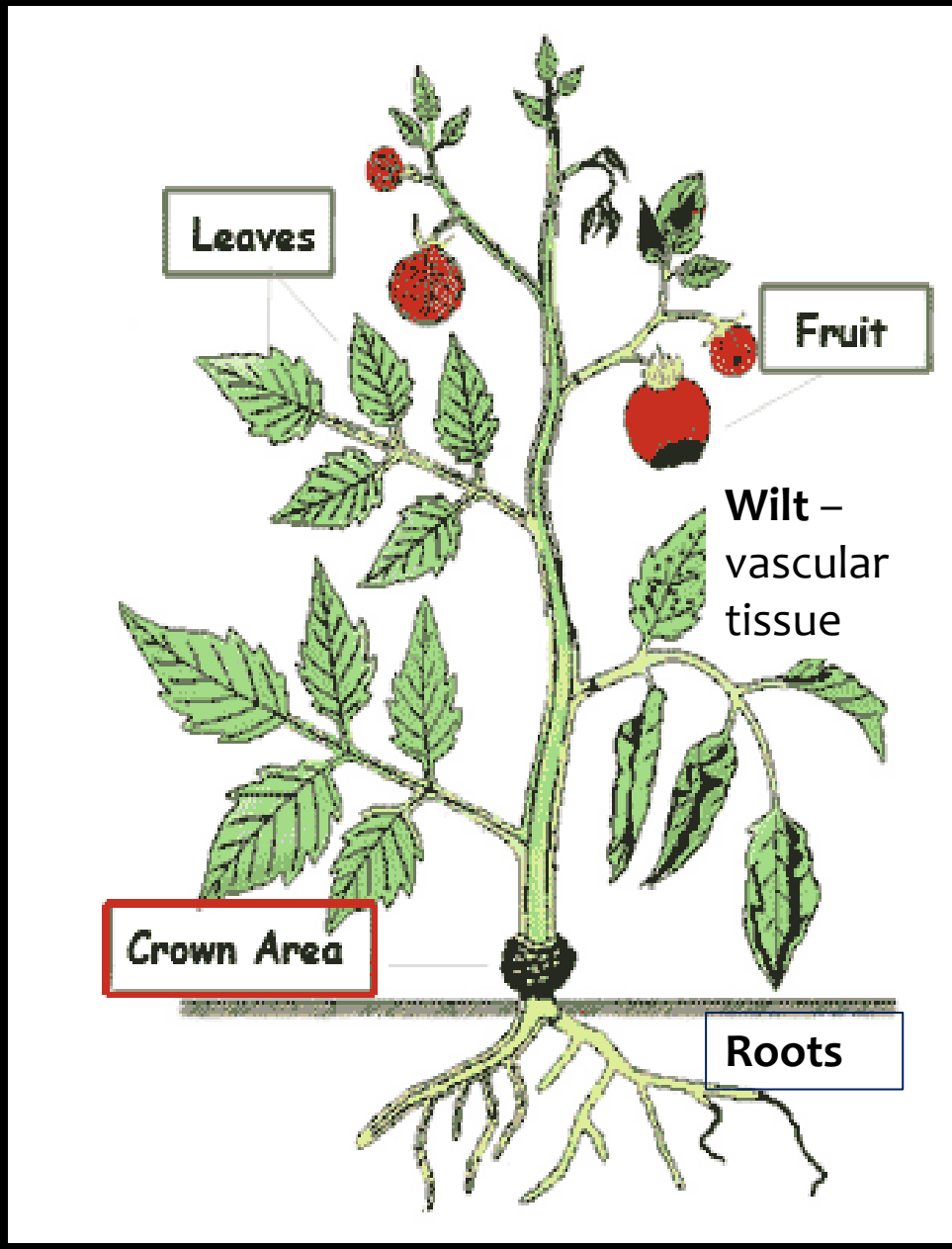
Piercing Sucking Insects

Aphids, Mealybug, Scale, Whitefly, Thrips, True Bugs

Distortion, Discoloration including Black Sooty Mold, Dieback – check back of leaf!

Plant Diseases

- **Can affect:**
  - **Leaves** – mildew, leaf spot, blight
  - **Flowers and Fruits** – fruit rots
  - **Stems and Limbs** - canker
    - **Vascular Tissue** - wilt
  - **Roots and Crown** – root rot, nematodes
- **Only <u>leaf diseases</u> are realistically treatable**



Non Treatable Problems

- Canker
- Root Rot
- Wilt
- Virus
- Nematodes
- Borers

Wilt diseases clog the vascular tissue of plants and cannot be treated

Step 2: Deciding If You Need To Do Anything

- Problem must be **correctly identified** before deciding what to do!
- Pest problems much easier to control if caught early - **Monitor Regularly!**
- **Be on the lookout for symptoms of problems**

Do You Need To Do Anything?

Is the insect/disease still active?

Is the problem serious?

- Is it likely to **persist** over a large portion of the growing season?
- Does it **threaten long term health** of the plant?
- NOTE: Young, recently planted plants are more sensitive to pest damage

Lecanium Scale can be a serious pest of trees. Stressed trees are more severely affected.

Do You Need To Do Anything?

- **Is the problem likely to reoccur?**
  - Would it better to replace the plant?
- **Is the plant valuable?**
- **Can anything be done?** When is the right time?

Azalea leaf gall is completely harmless – also by the time the galls form it is too late to treat.

Tolerance Levels

- **Will depend on type of plant** – edible versus ornamental
  - Typically less tolerant of damage on edible plants
- **Value of plant** - $1 annual versus $100 tree
- **Location of plant** – front yard versus backyard

Which would you treat?

Step 3: Determine a Course of Action

Short term:

May be able to treat with pesticide (synthetic or organic)

- **If infection active/ongoing**

Long term:

Prevention and IPM

Success of both depends on correct identification of the problem!

Caterpillars on broccoli – treat with an insecticide now, cover plants with row cover to prevent further infestation

Long Term:
Prevent Stress

Stress

- Reduces photosynthesis
- Reduces growth and defense
- Attracts pests

Stressors:

- Too dry or too wet,
- High or low soil pH,
- Nutrients too low or too high,
- Planted too deep
- Planted wrong season
- Compact soil

Drought stressed plants 'glow' and 'scream' to insects

Prevent Stress!

- **Improve Soil**: Alleviate compaction, add organic matter, correct pH and nutrient issues based on soil test results (class 2)
- **Choose right plant for the climate and site conditions**
  - Class 6 – ornamentals
  - Class 5 – fruits and berries
  - Class 4 – vegetables
  - Class 3 - lawns

Till compost, lime and nutrients into the soil before planting

Prevent Stress!

- Plant at the right time
- Plant disease resistant varieties
  - Classes 4, 5, 6
- Mulch
- Prune correctly
  - Class 7

Mulch conserves moisture, slowly enriches the soil and keeps mowers away from tree trunks

Prevent Stress: **Watering**

- **Water during drought**
  - Apply water slowly so it is able to soak deep into the soil
- **To reduce leaf diseases, avoid wetting leaves**
  - Most fungal leaf diseases require 4 hrs + of continual leaf wetness to infect
- **Don't overwater –** this encourages root rot!

Drip irrigation delivers water directly to the soil

Water fan sprinklers spray water in the air, wetting foliage

Prevent Stress:
Proper Spacing

- **Plan for mature size**
- Allows air flow between plants to **promote drying** & prevent disease
- **Allow adequate space to minimize:**
  - **Competition for Water, Nutrients, & Light**
  - **Habitat for pests**

Proper spacing depends on mature size of plant *– most plants do best when leaves just touch at full size*

IPM: Exclusion

Floating row covers can keep **flying adult insects** from laying eggs on vegetables – e.g. Cabbage whites

Will also keep out pollinators – okay for leafy greens, not for fruiting crops

Cover when insects are active – stake down edges

Lay directly onto crop or install PVC supports

IPM: Sanitation

- Pull out infested plants
- Remove infected leaves
- Clean up ‘mummy’ fruit!
- Take away from the garden!

If only a few leaves are infected, remove them from the plant

Mummy berry survives in shriveled fruit that fall to the ground

IPM: Sanitation

- **Physically remove insects and eggs**
  - Squish or drop in sudsy water
- **Remove plant debris** (fallen fruit, twigs, and leaves)
  - Prevents insects and diseases from overwintering

Squash Bug Eggs

IPM: Diversity

- **Plant many different species!**
- Avoid placing all plants of one kind together in large groups
- Alternate groups of different plants within rows or patches in vegetable garden – include flowers and herbs!
- **Flowers help attract beneficials**

Encourage Beneficials – **Plant Flowers!**

- **Small flowers**
  - **Dill, Fennel, Basil**
  - Yarrow, Sedum
  - Goldenrod, Joe Pye Weed
- **Daisy flowers**
  - Purple Coneflower, Cosmos
- **Others**
  - Salvias, Mints, Asclepias, Zinnia

Goldenrod

Purple Coneflower

Hover Fly adults look like bees or wasps

Beneficials

- Learn to recognize all **life stages** of beneficials
- **Diverse landscapes** encourage beneficials
  - Plant many different types of plants, including flowers
- Strive for a **balance** of good and bad insects.

Hover fly larvae look like small slugs or caterpillars – voracious aphid eaters

Lacewing

Eggs

Juvenile – ‘Aphid Lion’

Adult

Parasitic Wasps

Ladybug

Larvae

Pupae

Adult

Assassin Bug

Control Weeds

- **Mulch** minimizes annual weeds
- **Hand weeding/hoeing**
  - Most effective for small annual weeds – pull before they set seed!
  - For perennials, will need to dig out roots
- Herbicides
  - Organic herbicides only effective on young weed seedlings

Weeds can harbor insects and pathogens

IPM: Pesticides

- **Use if other methods do not provide control**
- Choose the right product for the problem:
  - **Insecticides** = kill insects
  - **Fungicides** = kill fungi
  - **Herbicides** = kill plants
- **Always choose less toxic options first**
  - Soaps and Oils
  - Plant Derived
  - Microbial
  - Mineral based

Choosing the Right Product:
Must Know the Active Ingredient

Pesticides are much like OTC medications:

- Many brands
- Few different active ingredients
- Some products contain combo of 2 or more a.i.

Survey of Pesticides Available in Greater Wilmington Area, 2013: 280 products, 66 different active ingredients

Type	Brands	Active Ingredients
Insecticide*	110	23
Fungicide	58	15
Herbicide	122	28

* = Not including fire ant (13) and grub control (14) products

NOTE: some products fit in more than 1 category

SOME Products Containing Glyphosate

- Ace Concentrate Weed & Grass Killer
- Compare-N-Save Grass & Weed Killer
- Do It Best Grass and Weed Killer
- HDX Weed & Grass Killer
- Hi-Yield Killzall Weed & Grass Killer
- Martin’s Eraser Weed & Grass Killer
- Ranger Pro Herbicide
- Scott's Roundup Concentrate Weed & Grass Killer
- Scott's Roundup Pro Herbicide
- Scott's Roundup Super Concentrate Weed & Grass Killer
- Surrender Eraser Systemic Weed & Grass Killer
- Ultra-Kill Grass and Weed Killer
- Quick Kill Grass &Weed Killer
- Pronto Big N' Tuf Weed and Grass Killer

Key to understanding and selecting pesticides is understanding active ingredients:

Read the label!

Labels for almost every product can be found online but must have complete name of product to search!

Information Found On Labels And Labeling

- What is in this product?
- How much do I mix?
- Will this hurt my pet?
- How often do I spray?
- How soon can I harvest?
- How soon can I reseed?
- Can I spray _____?

Labels and Labeling

Brand Name

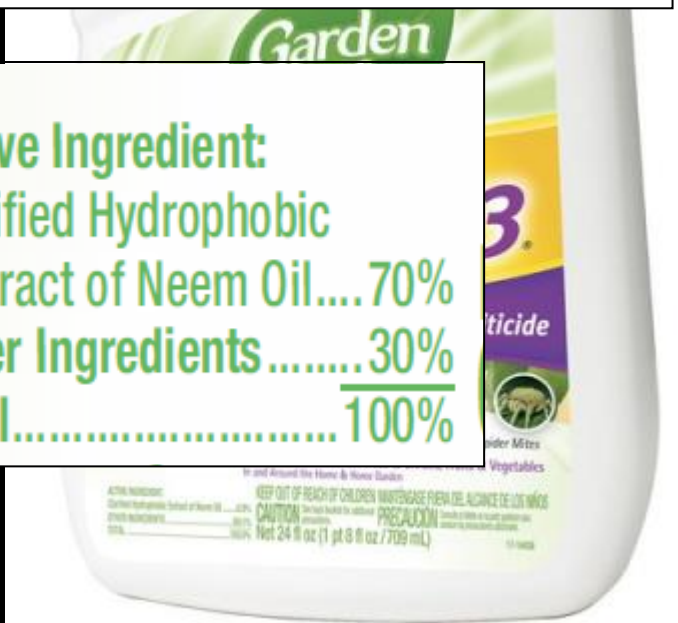
- E.g. Garden Safe Fungicide 3

Active Ingredient

- Net content % + inert ingredients
- E.g. Neem oil
  - RTU = 0.9 %
  - Concentrate = 70%

Mix 1-2 oz per gallon = 0.8-1.6%

ACTIVE INGREDIENT:
Clarified Hydrophobic Extract of Neem Oil 0.9%
OTHER INGREDIENTS 99.1%
TOTAL 100.0%



Signal Words

- **Danger** – highly toxic - Poison
  - Adult killed by a taste to a teaspoon
- **Warning** – moderately toxic
  - Adult killed by tsp to 2 tablespoons
- **Caution** – slightly toxic
  - Adult killed by ounce to more than pint
  - Most homeowner products

Does not indicate effect on pest!

Labels and Labeling

Precautionary Statements

- **Hazard to humans and domestic animals**
- **Environmental hazards**
  - Fish, birds, wildlife, etc.
  - BEE HAZARD
- **Physical/Chemical hazards**
  - Flammable, explosive
- **Statement of practical treatment**
  - First aid

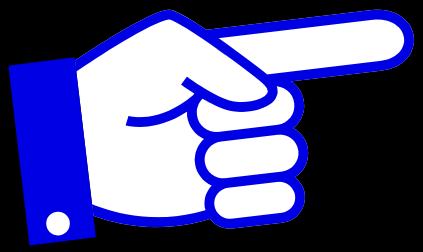
ENVIRONMENTAL HAZARDS

To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area.

BEE HAZARD • This product is toxic to bees exposed to direct treatment. Do not apply this product while bees are actively visiting the treatment area.

Directions for Use

- Pests to be used on
- Crop/animal/site to be used on
  - Must be labeled for site!
- How to apply
- How to mix, rate
- How often to apply
- Waiting periods, pre-harvest interval



The label is the law!!!
Always refer clients to the label for instructions on use

Active Ingredients Can Be:

- **Synthetic** = man-made
  - Often based on natural substances
- **Natural** = derived from naturally occurring materials
  - Minerals
  - Plants
  - Microbes
  - Soaps and Oils

Read and follow label directions for ALL products!

Residual Activity

- How long a pesticide remains active after it is applied
- Synthetics have much longer residual activity than natural products
  - **Good** = control pests longer
  - **Bad** = stay in environment longer, greater chance of impacting non-target species (people, pests, wildlife, pollinators, beneficial insects)
- Metabolites of synthetic pesticides often have long residual life

Pesticides and Beneficials & Pollinators

- **Insecticides most toxic** pesticides to beneficials and pollinators
- Check for beneficials before spraying
- Apply pesticides late in evening once bees have returned to hive
- Do not spray plants with open flowers
- Do not spray areas with flowering weeds
- Use natural products when possible – less residual activity

How Do You Know if a Product is Natural?

- **Active ingredients** listed on the label
- **OMRI listed** – approved for use by certified organic farmers
- **Some products have natural active ingredients but are not OMRI approved**

OMRI™
Listed
Organic Materials Review Institute

Active ingredients are listed on the label

Characteristics of Natural Pesticides

- **Not persistent**
  - Break down quickly, sometimes in a day
  - Most are less toxic to beneficials
- **No residual activity or systemic uptake**
  - Must reapply often
  - Wait until pest present to treat
- **Not as potent as synthetic pesticides**
  - Must be part of integrated system!
- **Many are very specific** = only work for certain pests
  - Correct pest ID essential!

Pine Sawfly larvae look like caterpillars but are not – B.t. will not control them.

Pesticide Formulations

- **Concentrates** – must be mixed with water
- **Ready to Use products** – often in spray bottle
- **Granules and Baits** – mostly fire ant products
- **Dusts** – most harmful to bees and pollinators; less effective than liquid formulations

Using Pesticides

- **Most effective when problem just starting!**
  - Monitor regularly, catch problem early
- **Must know the pest to choose a treatment!**
  - Correct identification essential!
  - Need a sample or a picture!
  - First, ID plant
  - Look up common problems for that plant

It is too late to save this tomato plant!

Herbicides

- More effective on small weeds!
- Large, flowering annual weeds difficult to kill
- Perennial weeds often require several applications!
- Few natural herbicides = all are contact herbicides, burn foliage

Dollarweed

Herbicides

- Pre-emerge
- Post-emerge
  - Contact
  - Systemic
    - Selective
    - Non-selective

Pre-Emergent Herbicides

- **Kill weedlings just after germination**
- Timing very important – must be applied before seed germinate
- Must be watered in, usually ½" of irrigation
- Form a seal or blanket over soil
- Last 10-12 weeks
- Must know what weeds targeting
  - Not effective for all weeds, do nothing to control established weeds or perennial weeds

Apply BEFORE weeds come up!

Pre-Emergent Herbicides

Usually granular

For landscape/vegetable beds:

- Trifluralin (Preen), 4 products
- Mainly control annual grasses and small seeded annual broadleaves

For lawns: crabgrass preventers

- Many brands – active ingredients: benefin, bensulide, dithiopyr, prodiamine, pendimethalin
- Stunt turf growth!

Post Emergent Herbicides

- Effective after plants have germinated
- Applied to foliage as spray
- **Most effective on young, actively growing plants**
- Plant stress (drought, cold) reduces effectiveness
- **Not very effective on mature blooming or seeding plants**

Henbit, winter annual

Post Emergent Herbicides

- Not very effective immediately after mowing
- Generally apply between 60 – 85 degrees
  - See label for specific directions
- Most of the time need 6 hrs before rainfall or irrigation unless ‘rainfast’ – check label

Post Emergents Can Be:
Contact

Kills only tissue it touches

- Work fast, but do not kill the root
- mainly effective on small, annual weeds
- **Soaps and Oils – Natural**
  - Not as effective as synthetic herbicides in most trials

Post Emergents Can Be: Systemic

- Are translocated by the plant to root system
- Most effective when plants actively growing
  - after rainfall
  - moderate temperatures
- Do not act as quickly as contact – can take several days to see effect, versus a few hours with contact herbicides
- Most post emergent herbicides are systemic
  - Eg. Glyphosate – Round Up

Florida Betony

Systemics Can Be:
Selective

Only kill certain types of plants:

NOT weeds versus ornamentals!

- **Monocots - Grasses**
  - Sethoxydim
  - Fluazifop-p
- **Monocots – Sedges**
  - Imazaquin – Image for nutsedge

Systemics Can Be:
Selective

- **Dicots – Broadleaf Weeds**
  - 2,4-D alone or in combination (majority of products!)
    - Mecoprop, & Dicamba – "3 Way Spray"
    - Many now "4-way", + carfentrazone
  - Atrazine – both pre and post emerge activity
  - Triclopyr = brush killer
  - Iron HEDTA = natural but not organic, for broadleaf weeds in lawns

Centipede and St. Augustine lawns are sensitive to 2,4-D – use sparingly!

Systemics Can Be: Nonselective

Kill most plants – absorbed by green tissue

- **Glyphosate** –
- May be combined with other a.i.:
  - Extended control herbicides: Imazapyr, Imizapic, Indaziflam = Be careful where you spray!
  - Contact herbicides: Diquat, Pelargonic Acid - faster burn down but may reduce effectiveness

- **Pre-emerge**
  - **Crab grass preventers, Preen**
- **Post-emerge**
  - **Contact**
    - **Natural Herbicides**
  - **Systemic**
    - **Selective**
      - **2,4-D based herbicides -** Kill broadleaf weeds only
      - **Sethoxydim; Fluazifop –** kill grasses only
    - **Non-selective**
      - **Glyphosate (Round Up)**

Insecticides

Complete eradication is not the goal!

- Need some pests to feed beneficials!
- There is no product you can drench the ground with in winter that will get rid of all the bugs!

Ladybug feeding on aphid

Insecticides

- Not all insects can be controlled
  - Heavy infestations, especially scale
  - Borers, once in the tree
  - Large hard bodied insects are more difficult
    - Beetles, true bugs (stink bugs, kudzu bugs)

Leaf Footed Bug

Insecticides

- More than one application may be needed
  - Especially for contact products (NOT systemic)
  - Especially for insects that are strong fliers:
    - E.g. Japanese beetles, kudzu bugs
  - Insect may be dead but still on plant – scale
- For pest prone plants, best option often is replacement!
  - Junipers and bagworm
  - Euonymus and scale ⟶

Insecticide Categories

- Systemic or Contact
- Chemistry:
  - Synthetic Pyrethroids
  - Neonicotinoids
  - Older chemistries
  - Naturally derived

Neonicotinoid,
Systemic

Systemic Versus Contact

Systemic = absorbed by the plant and moved throughout the plant

- In the plant tissue, not on the surface; persist for months
- Insects die when feed on leaf or sap; More effective for sap feeders
- New growth protected if soil applied

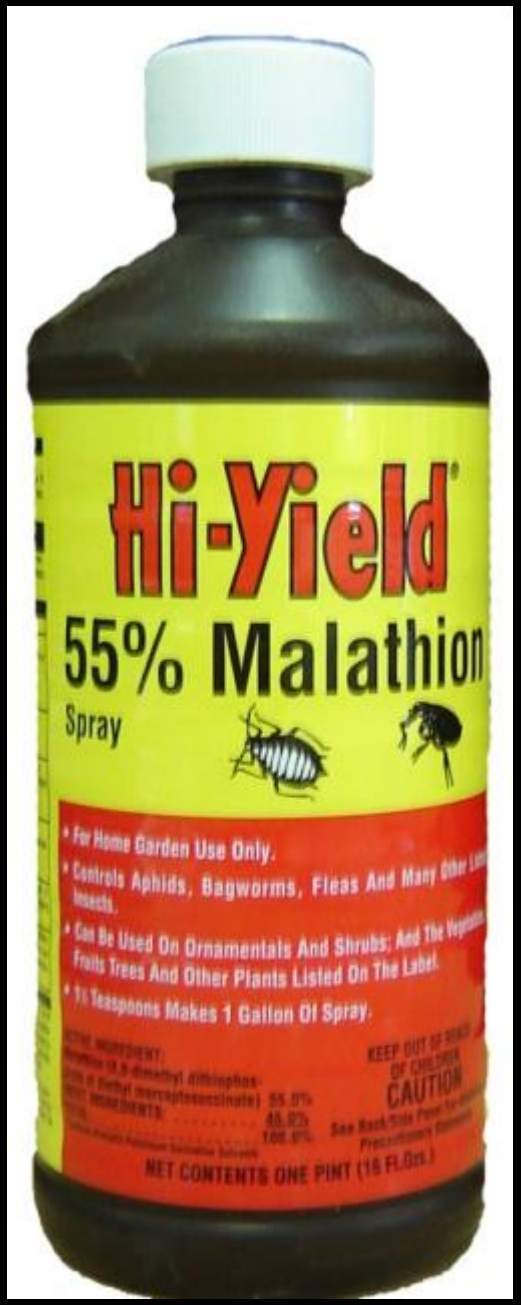
Contact = exists on plant surface, not absorbed into tissues

- Wash off easily; break down in sunlight; Persist for days to weeks
- Insects die when eat or come into contact with treated surface
- New growth not protected

Chemistry:
Synthetic Insecticides

Older products:

- Carbaryl (Sevin)
- Malathion
  - Contact, short residual
  - Broad spectrum, kill many different pests
  - Highly toxic to bees and beneficials
  - Will be phased out eventually



Chemistry:
Synthetic Pyrethroids

- Permethrin, Bifenthrin, Esfenvalerate
  - Older generation
- Cyfluthrin, Lambda-cyhalothrin, Gamma-cyhalothrin, Zeta-cypermethrin
  - Newer generation

Chemistry: **Synthetic Pyrethroids**

- Based on natural Pyrethrins; much longer residual (weeks)
- Broad spectrum: kill most types of insects when applied correctly
- Very harsh on beneficials
  - Often get flare up of secondary pests: mites, aphids, whitefly, etc.
- Highly toxic to bees within a day of application

Spider mite feeding causes stippling – populations often explode with repeated use of pyrethroids

Chemistry:
Neonicotinoids

- **Imidacloprid (Merit)**, most widely used insecticide in the world!
- Single most widely used insecticide in the world
- Other Neonics:
  - Acetamiprid (3 products)
  - Thiamethoxam
  - Thiacloprid
  - Clothianidin
  - Dinotefuran

Neonicotinoids

- Control most piercing sucking insects : aphids, whitefly, scale, lace bug
- Control leaf feeding beetles
- Does NOT control caterpillars
- Does NOT control ambrosia beetle borers, e.g. black twig borer

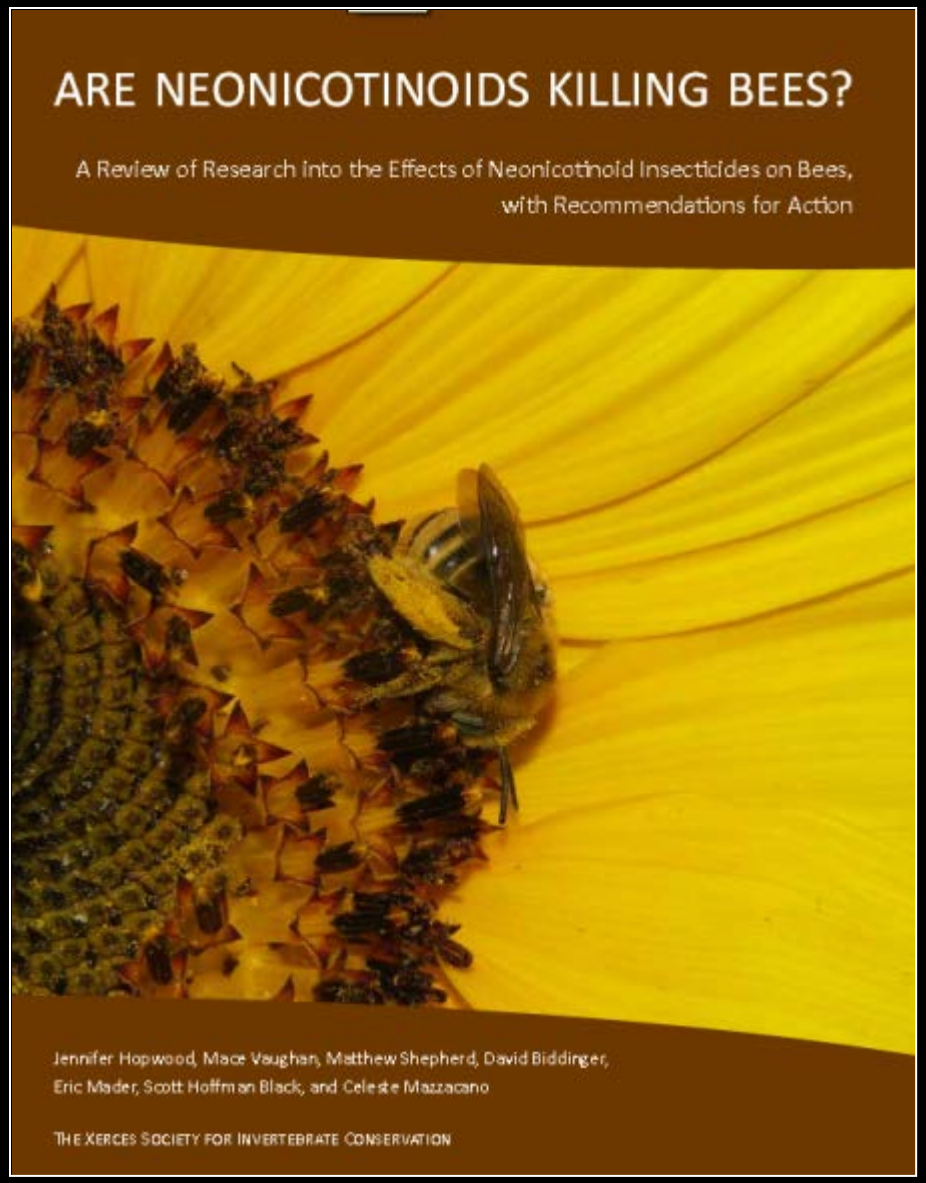
Neonicotinoids

Systemic

- Can be applied as granules (watered in), drench, or spray to foliage
  - Ground applications accumulate and persist in soil!!!
  - Levels build up with repeated applications: research indicates no need to treat every year!
- Bayer Advanced products often combine a Neonic and a Synthetic Pyrethroid

Neonicotinoids

- Systemic: Transported to all parts of plant, including pollen and nectar
- HARMFUL TO POLLINATORS
  - Most effects sub-lethal
  - Causes disorientation, reduced foraging efficiency, increased disease susceptibility
  - Do not soil apply to flowering plants



Xerces Society report – available online

Neonicotinoids

- Acetamiprid is less toxic to bees than imidacloprid
- Neonics are less harmful to beneficial insects than pyrethroids
- May cause flare up of secondary pests, particularly spider mites

Naturally Derived/ Less Toxic Insecticides

- **Insecticidal Soap**
- **Horticultural Oil**
- **Microbial**
- **Plant derived**

Hazardous if misused!

Read and follow all label directions

Insecticidal Soap

- Potassium Salts of Fatty Acids
  - kills soft body pests: aphids, whitefly, mites
  - Kills only what it contacts – not eggs
  - Repeated applications often necessary
- **No residual activity**

Horticultural Oils

Mineral oils

- kill by smothering,
- kill all life stages (eggs must be exposed)
- great for scale, spider mites, aphids, whitefly
- Can damage plants at high temperatures
- Older “dormant” oils = winter only

No residual activity

Plant oils (sesame, clove, canola, etc) **work similarly**

Neem Oil and Azadirachtin

- Derived from Neem tree seed
- Over 70 cmpds, **Azadirachtin** believed most active
- **Controls** aphids, mites, thrips, whitefly
- May help control powdery mildew
- Primarily acts as **growth regulator** – works best on immature insects
- Not quick knockdown – slow acting
- Breaks down in sunlight

Pyrethrum and Pyethrins

Tanacetum cinerariifolium, **Dalmation Chrysanthemum**

- **Pyrethrum** = Made from the dried flower heads of *Tanacetum cinerariifolium*
- **Pyrethrins** = active compounds
- Quick, knock down for wide range of insects
- **Breaks down rapidly in sunlight**
- Harsh on beneficials
- Secondary pests may flare up

B.t.– *Bacillus thuringiensis*

Naturally occurring bacteria effective for **caterpillar control**

- Most effective when pest are young/small
- Stop feeding within a few hours, slow death
- Spray in evening, breaks down in sunlight
- Separate strain for **Colorado potato beetle** control

Spinosad

- Developed from soil dwelling bacterium
  - Causes death within a few days
  - A little more persistent than B.t. and neem (3-5 days)
  - **Effective for**
    - **Caterpillars,**
    - **Colorado potato beetle,**
    - **Fire ants (baits)**

Fungicides

- Only control certain **fungal diseases** – not viral or bacterial
  - Primarily foliage diseases; e.g. leaf spots, mildews
  - Weather has huge impact on disease development
  - Wet weather = more disease pressure; exception is powdery mildew, more severe in dry weather

Leaf Spot

Powdery Mildew

Fungicides

- Symptoms do not disappear after treating; Instead new growth is clean
- Disease prone varieties = REPLACE!
- No products can treat root rot, canker, wilt diseases
- Most plant problems have abiotic/non-living causes!

Some varieties of Saucer Magnolia are extremely susceptible to powdery mildew;
By the time symptoms are noticeable, too late

Fungicide Categories

Protectants

- Only persist on surface of leaf;
- Wash off easily, must be reapplied often
- Older synthetics and all naturals

Penetrants

- Absorbed into leaf tissue but not moved systemically
- More effective and longer lasting
- Synthetic only

Synthetic Fungicides: Penetrants

- Myclobutinal
- Propiconazole
- Tebuconazole
- Triforine

- For leaf spot, mildews, leaf blight and other foliage diseases
- Make labeled to use where you wish to spray (vegetables, fruits, lawn, ornamentals/landscape)

Synthetic Fungicides: Protectants

- Chlorothalonil (Daconil)
- Thiophanate-methyl
- Mancozeb
- Captan – found in fruit tree sprays

For leaf spot, mildews, leaf blight and other foliage diseases

Natural Disease Control Products

- **Protect plants** from disease as part of integrated system
- **Do not cure problems –** only suppress them – must reapply as long as disease is active
- **Neem and oils** may have some effect on diseases, particularly powdery mildew

Early Blight on Tomato

Minerals

- **Sulfur** – fungal disease control
- **Copper** – fungal and bacterial diseases
  - Copper Octanoate
- Contact protectant
- **Apply carefully** - Leaf damage can occur

Natural Fungicides

- *Bacillus subtilis*
  - For leaf diseases, sold as ‘Serenade’
- **Potassium bicarbonate**
  - Especially effective for powdery mildew
  - Sold as ‘Remedy’ and other brands
  - May have to order online

IPM for Ticks

- Personal protection - when entering tick infested areas:
  - Repellants containing DEET
  - Tuck pant legs into socks
  - Wear long sleeves
  - Clothing treatment with permethrin
  - Avoid brushing against vegetation

Ticks climb up grass and shrubs to wait for prey – they must periodically climb down to avoid dehydration

IPM for Ticks: Landscape Modification

Reduce habitat for ticks:

- Ticks love leaf litter, groundcovers, tall grass and low shrubs
- Woodland edge is favored habitat
- Mow grass frequently
- Create 3'+ wide zone of bark mulch along woodland edge – not irrigated!

Traversing wide dry areas of exposed soil, stone or mulch is challenging for ticks

IPM for Ticks: Minimize Hosts

- Deer are single most important host for ticks
  - Deer thrive in urbanizing areas
- Mice and small mammals are also prime hosts
  - Tall grass and brush piles harbor mice

More deer = more ticks

IPM for Deer

- Landscape with deer resistant plants (class 6)
- **Repellents can help:**
  - Few registered for vegetables/fruits
  - Apply based on label directions
  - Deer Away, Bobbex, Repellex and Tree Guard most effective in Maryland study
  - Bars of soap suspended from trees/shrubs?

IPM for Deer

- Herd management at community level
- Fencing – to keep deer out
  - Electric most effective – deer prefer to climb under rather than jump over
    - Single strand for temporary fence
    - Double strand for permanent fence

Polytape is easier to work with than 17 gauge wire for electric fencing

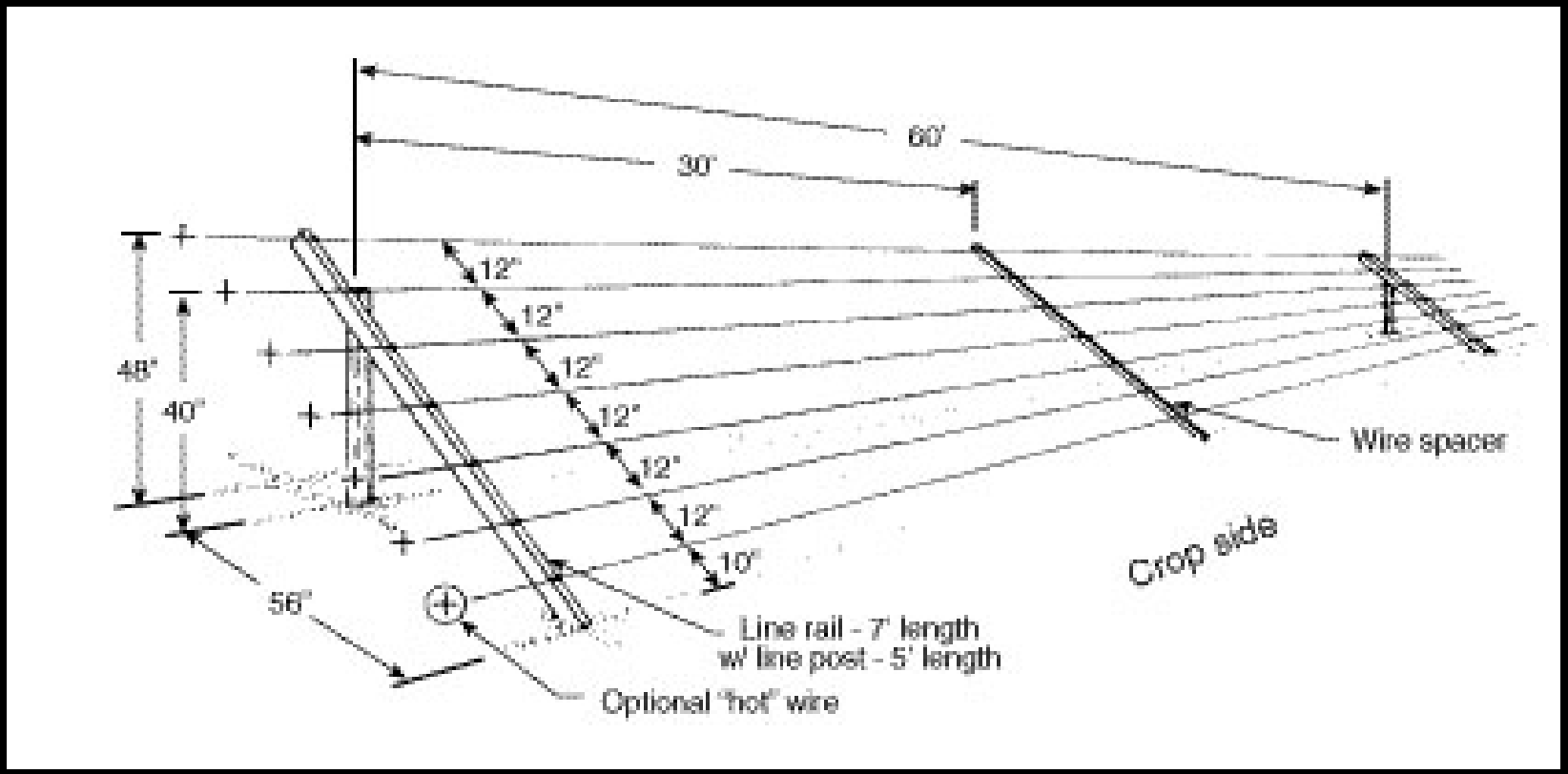
IPM for Deer: Fencing

- Offset/double fence
  - 2 wires, 15” and 43” from ground
  - Third single wire 52” away on inside, 30” from ground
- At least 8’ if vertical, not electric
- Slanted fence – 7 wires, 12” apart, fence 48” tall, 56” wide

For fence plans, see:

http://extension.missouri.edu/p/mp685

Slanted, 7-wire fence



Learn More About Active Ingredients:

- National Pesticide Information Center: http://npic.orst.edu/ingred/specchem.html
- Missouri Botanical Gardens: http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/help-for-the-home-gardener/advice-tips-resources/pests-and-problems/pesticides.aspx
- UC Davis – Pesticide Active Ingredient Database: http://www.ipm.ucdavis.edu/PMG/menu.pesticides.php

Extension Recommendations:

eXtension search engine

https://search.extension.org