Solving Plant Problems III:
Making Pesticide Recommendations

EMG Advanced Training

March 20, 2014

Focus for Today

March 20: Recommending Pesticides

- What is available locally
- Product brand names versus active ingredients
- Pesticide labels
- Characteristics of different active ingredients
  - Pests controlled
  - Contact or systemic
  - Impacts on bees and beneficials

What is available locally?

- March 2013 Pesticide Survey
- Locations visited:
  - **Wallace:** Southern States
  - **Burgaw:** Burgaw Milling, Rooks, Lanier Hardware
  - **Hampstead:** Pender Pines, Ace Hardware, Lowe's
  - **Wilmington:** Farmer Supply, Home Depot, Progressive Gardens, Lowe's (Porter's Neck)

Information Recorded

Type of product:

- **Herbicide** = weed killer
- **Insecticide** = insect killer
- **Fungicide** = disease control

As well as:

- Brand name
- Active ingredient

Type of product:

Insect control = Insecticide

Brand Name:

Bayer Advanced 12 Month Tree and Shrub Insect Control II, concentrate

Active Ingredient:

BAYER ADVANCED™

100% SATISFACTION BAYER GUARANTEED

Treats Twice as Much

Fórmula para parques - Doble efectividad

¿HABLA ESPAÑOL? VEA EL PANEL TRASERO

- Kills insects including Emerald Ash Borer
- Prevents new infestations

Treated

Untreated

Active Ingredients:
Imidacloprid 2.94%
Other Ingredients 97.06%
Total 100.00%

KEEP OUT OF REACH OF CHILDREN

CAUTION See back panel for additional precautionary statements

Not for sale, sale into, distribution and or use in Nassau, Suffolk, Kings, and Queens counties of New York

6064204 R.0

Merit®

NET CONTENTS 1 GAL (3.78L)

FINDINGS:
Pesticides are much like over-the-counter medications

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

FINDINGS: 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

Example: Herbicides:

122 brands, 28 active ingredients

- **45% Lawn herbicides = 55 brands, 13 a.i.**
  - 38 contain 2,4-D as main ingredient
  - 31% of herbicides on shelf
- **55% Other herbicides = 67 brands, 15 a.i.**
  - 40 contain Glyphosate as main ingredient!
  - 33% of herbicides on shelf!

If you understand these 2 active ingredients, you understand over 60% of herbicides!

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 recommending 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

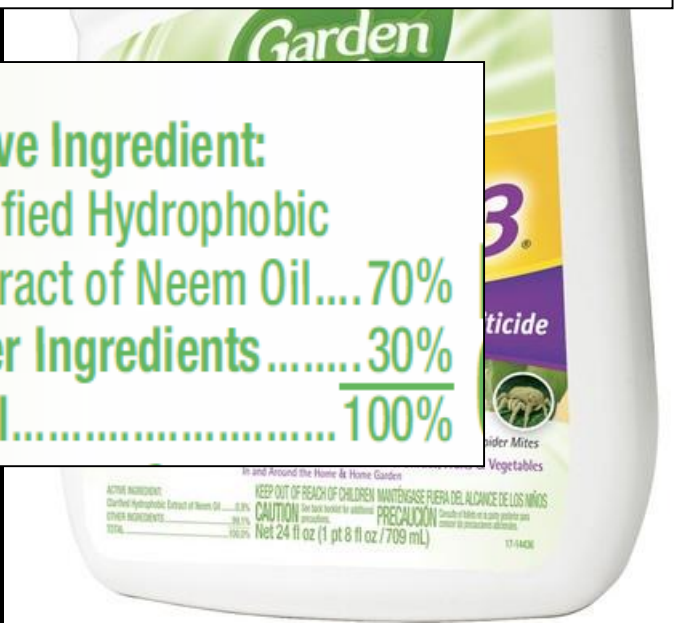
- E.g. Garden Safe Fungicide 3

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

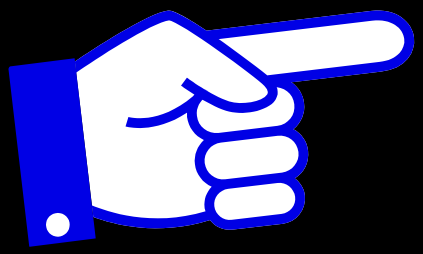
ENVIRONMENTAL HAZARDS

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

Find the Active Ingredient

For each label:

- Complete product brand name
- Active ingredient

Example:

- Bayer Advanced 12 Month Tree and Shrub Insect Control II, concentrate
- A.I. = Imidacloprid

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!

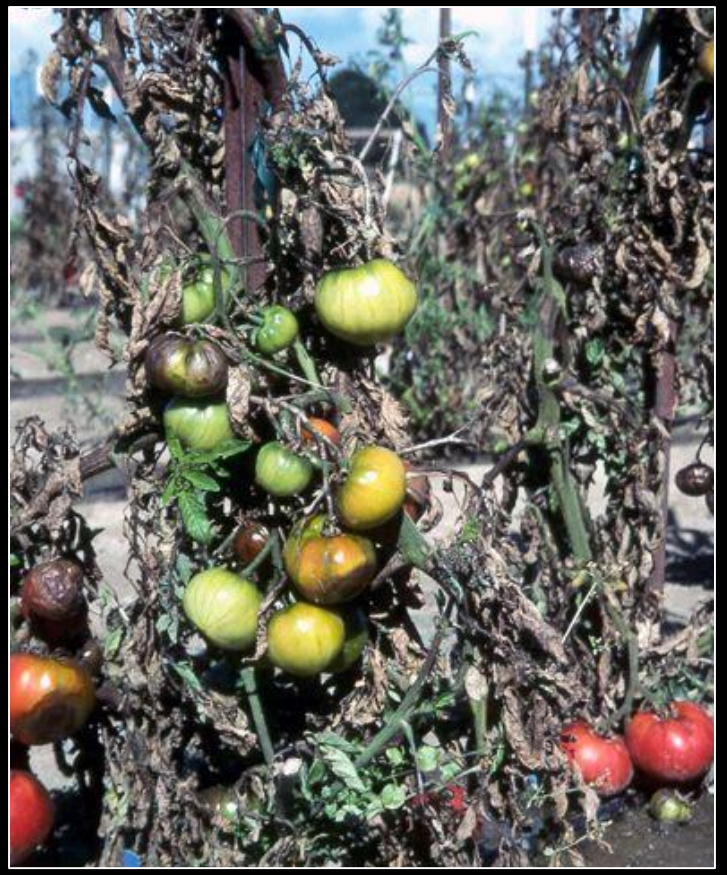
Pine Sawfly larvae look like caterpillars but are not – B.t. will not control them.

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

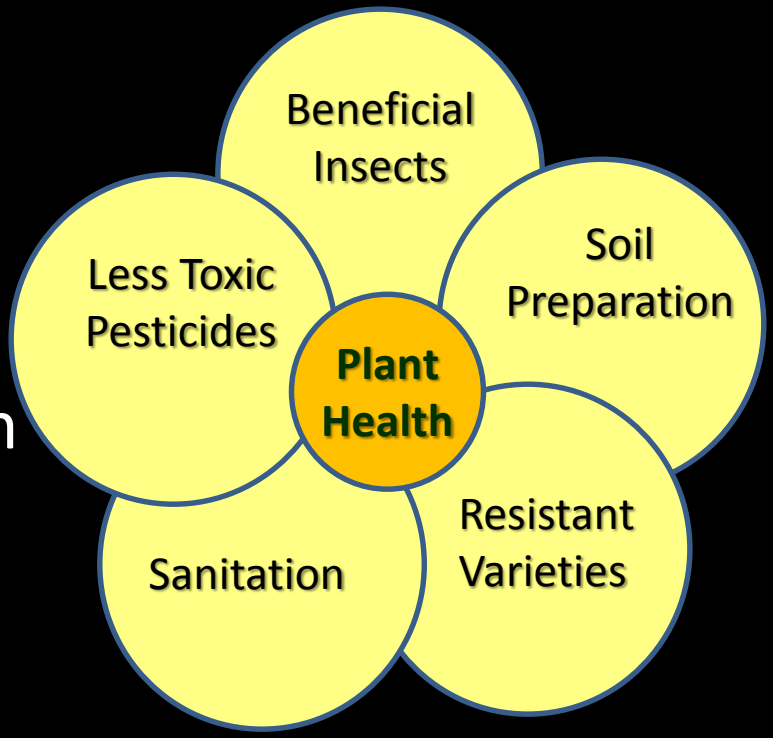
- **Most effective when problem just starting!**
  - Monitor regularly, catch problem early
- **Must know the pest to choose a treatment!**
  - Correct identification essential!
  - Need a sample or a picture!
  - First, ID plant
  - Look up common problems for that plant



It is too late to save this tomato plant!

Integrated Pest Management

- Pesticides are only part of a pest management plan!
  - Should be last resort
- Also practice:
  - Right plant for the site
  - Reduce stress: proper fertilization & soil preparation
  - Sanitation: remove pest plants/parts
  - Encourage beneficial insects!



Non chemical control

- https://www.youtube.com/watch?v=D0foMKAxCww

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

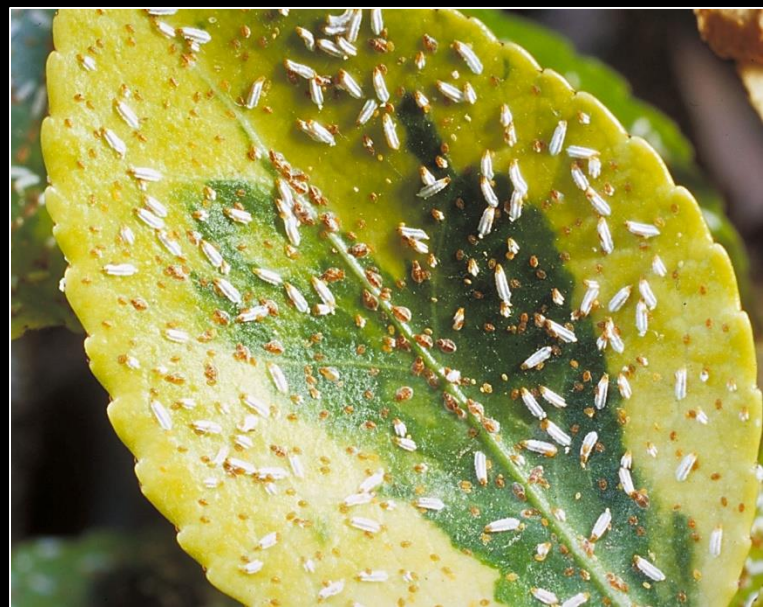
Insecticides

- 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

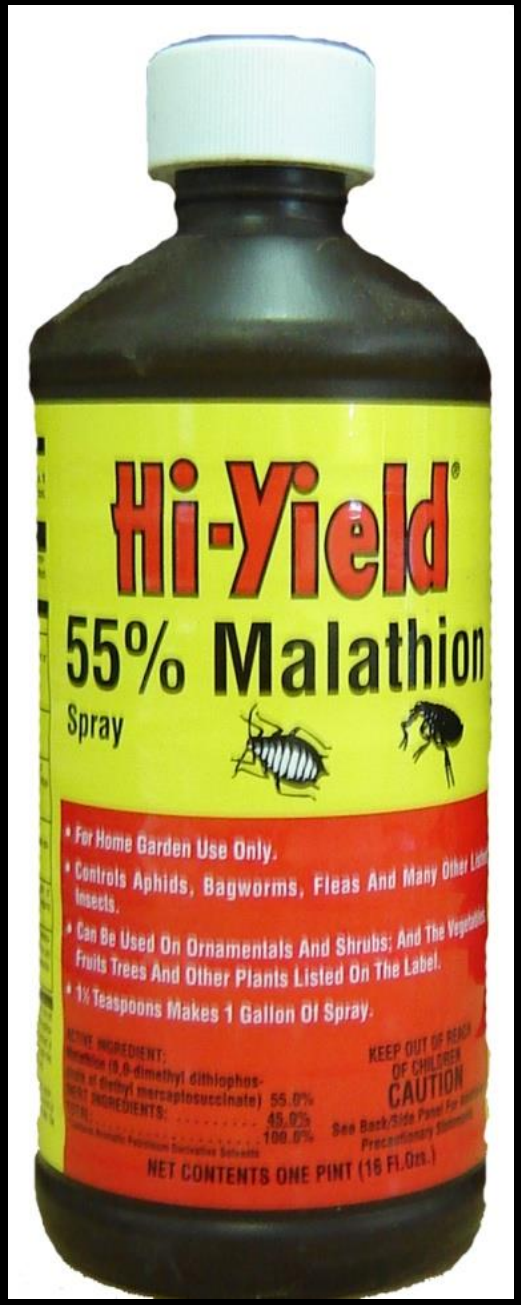
Contact = exists on plant surface, not absorbed into tissues

- 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) - 8 products
- Malathion – 8 products
  - Contact, short residual
  - Broad spectrum, kill many different pests
  - Highly toxic to bees and beneficials
  - Will be phased out eventually



Chemistry:
Synthetic Pyrethroids

- 22% of survey insecticides
- Permethrin*, Bifenthrin, Esfenvalerate
  - Older generation
  - * = most common, 12 out of 24 S.P. products
- 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 common insecticide a.i. in survey: 15 of 110 products
- 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

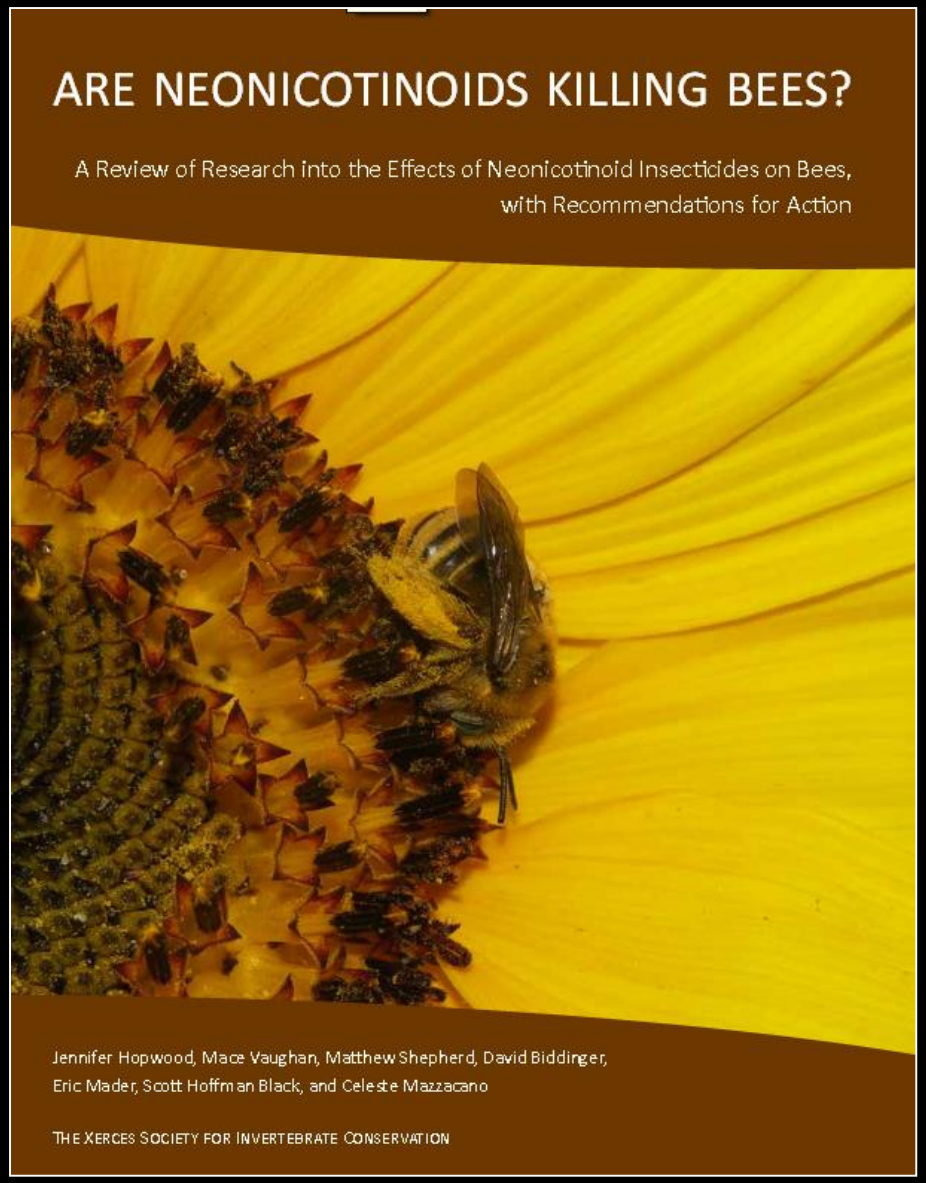
Neonicotinoids

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, 6 products
  - 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 (2 products)

- 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 (7 products; sesame, clove, canola, etc) **work similarly**

Neem Oil and Azadirachtin

- 10 products
- 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**

- **13 products,** usually combined with other natural ingredients
- **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*

5 products; 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

- 5 products – “Captain Jack’s Dead Bug Brew”
- 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 – 6 products
- Propiconazole – 4 products
- Tebuconazole – 5 products
- Triforine – 2 Rose products

- For leaf spot, mildews, leaf blight and other foliage diseases
- **Use product that is most effective for disease --- RESEARCH!**

Synthetic Fungicides: Protectants

- Chlorothalonil (Daconil) – 8 products
- Thiophanate-methyl – 2 lawn products
- Mancozeb – 1 product
- Captan – 3 products (fruit tree sprays)

- For leaf spot, mildews, leaf blight and other foliage diseases
- **Use product that is most effective for disease --- RESEARCH!**

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
  - 5 products
- **Copper** – fungal and bacterial diseases
  - 4 products; Copper Octanoate
- Contact protectant
- **Apply carefully** - Leaf damage can occur

Natural Fungicides

- *Bacillus subtilis*
  - For leaf diseases, sold as ‘Serenade’
  - 2 products
- **Potassium bicarbonate**
  - Especially effective for powdery mildew
  - Sold as ‘Remedy’ and other brands
  - Not available locally

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: 122 Products

- 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!

- Corn gluten not effective!

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

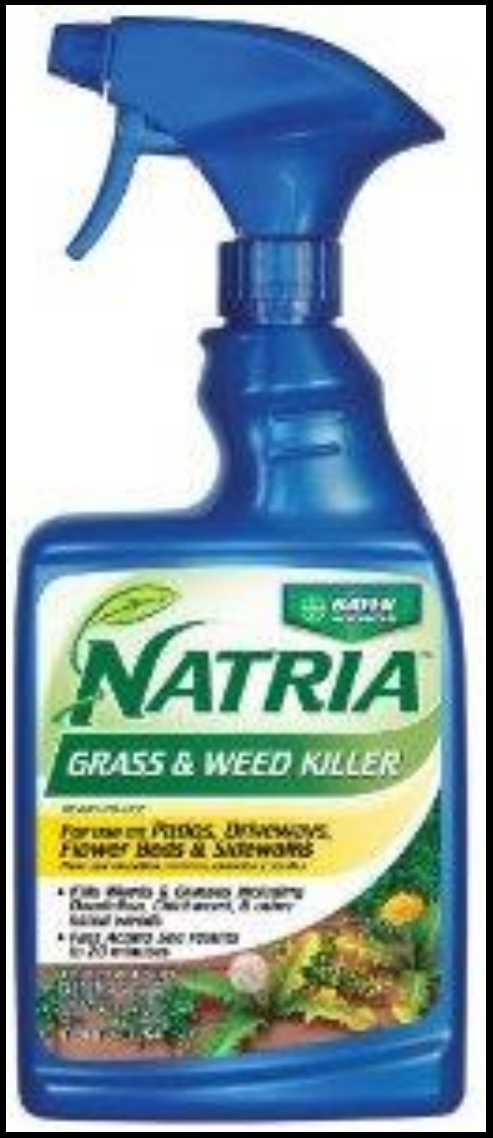
- Not very effective immediately after mowing
- Generally apply between 60 – 85 degrees
  - See label for specific directions
- Most of the time need 6 hrs before rainfall or irrigation unless ‘rainfast’ – check label

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, 6 products**
  - 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 (2)
  - Fluazifop-p (3)
- **Monocots – Sedges**
  - Imazaquin (2) – Image for nutsedge

Systemics Can Be:
Selective

- **Dicots – Broadleaf Weeds**
  - 2,4-D alone or in combination (38 products!)
    - Mecoprop, & Dicamba – "3 Way Spray"
    - Many now "4-way", + carfentrazone
  - Atrazine (8) – both pre and post emerge activity
  - Triclopyr (5) = brush killer
  - Iron HEDTA (1) = natural, 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** – 40 products, e.g. Round-up
- Often 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)**

Learn More About Active Ingredients:

- National Pesticide Information Center:
- http://npic.orst.edu/
- Missouri Botanical Gardens
- http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/help-for-the-home-gardener/advice-tips-resources/pests-and-problems/pesticides.aspx
- Cornell
- http://pmep.cce.cornell.edu/profiles/index.html

Extension Recommendations:

eXtension search engine

https://search.extension.org

Search for problems of specific plant:

- Camellia problems
- Camellia diseases
- Camellia insect pests