Minimizing the Impact of Pesticides on Pollinators

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Who Is Concerned About Pollinators?

- Farmers
- Scientists
- Consumers
- Lawmakers
- Regulatory Agencies
- Your customers



Minimizing Pesticide Impact

- What are pollinators and why should we be concerned
- Pollinator decline
- Pesticide exposure and toxicity
- Minimizing pesticide impacts



Pollinators

- Move pollen from flower to flower, making reproduction possible for ³⁄₄ of plants on earth
- Include bats, hummingbirds, birds, and insects such as beetles, butterflies, wasps and bees





Pollinators

- Bees are the most efficient pollinators
 - Only animal that purposefully collects pollen
- Pollen = Protein source, fed to immature bees
- Also collect nectar = carbohydrate, consume for energy and turn into honey





Many types of bees

- Honeybees are the most well known
 - Native to Europe
 - Managed for pollination services







Illustrations Marguerite Meum

Source: pollinator.org

Native Bees

50 species of bumble bees!

- Over 4000 species of **native bees** in the US!
 - Also valuable crop pollinators active even when cool and wet
 - Plus pollinate wild plants;
 Sustain native ecosystems









- Most are solitary
 - NOT aggressive!!!
 - Bumble bees live in small annual colonies
- Most nest in the ground
 - Some nest in wood or hollow stems

Leafcutter bees cut leaf segments to line their nests





Ground Nesting Bees

Attracted to areas with thin turf

Honey Bee Decline

Number of honey producing bee colonies (x 1 000 000)



The number of managed honey bee colonies in the US has declined by 50% in the past 60 years.

During this time, cropland requiring bee pollination has increased 300%

Data source: U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) NB: Data collected for producers with 5 or more colonies. Honey producing colonies are the maximum number of colonies from which honey was taken during the year. It is possible to take honey from colonies which did not survive the entire year.

Honey Bee Decline



Since 2007 and onset of CCD, winter losses have far exceeded 'acceptable' level

Source: https://beeinformed.org

Native Bee Decline

- Though not as well documented, native bee populations are also declining
- Xerces Society lists 57 species of native bees as vulnerable or imperiled
 - http://www.xerces.org/pollinatorredlist/



Native to the eastern US, the rusty patch bumble bee is at high risk of extinction. *Image by: Johanna James-Heinz*



Why Should We Be Concerned?

 Most fruits and vegetables require insect pollination



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Your breakfast with bees

Your breakfast without bees



30% of food crops can be attributed to pollinators.

Importance of Pollinators

- Essential to the production of more than 90 crops in the U.S.
- Value of crops in US that depend on pollination: >\$18.9 billion
- \$217 billion worldwide



Why Should We Be Concerned?

Local agriculture relies on pollinators **NC crops:**

- Apples
- •Blueberries
- •Cucumbers
- •Squash

•Pumpkin

- Watermelon
- Strawberries
- Peaches
- Blackberries
- Raspberries

Incomplete pollination of cucumber







Why Should We Be Concerned?

Ecosystems rely on pollinators

Food for wildlife

- Song birds
- Wild turkeys
- Bear
- Deer
- Rabbits
- Many more







Causes of Decline: Parasites and Diseases

- Parasite:
 Varroa destructor
- Most destructive pest
 of bees
- Introduced late 1980's, native to Asia
- Feeds on bee "blood"
- Spread debilitating virus diseases



Causes of Decline: **Poor Nutrition**

Dysfunctional food system

- Lack of diversity
 - Large fields of one species: monocultures
 - Flowerless landscapes
 - Overzealous weed control
 - Destruction of native plant communities
 - Lack of meadows and cover crops



Henbit – a valuable early nectar source and weed

Causes of Decline: Poor Nutrition

Dysfunctional food system

- Lack of year-round food source
- Pesticide contamination

Imagine having to walk to the grocery store when you have the flu only find all the food is contaminated with poison.



Honeybees are trucked in to almond orchards during bloom but have to be trucked out afterwards or they would starve



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Causes of Decline: Pesticides

- PSU study analyzed pollen taken from bee hives across US for pesticide residues
 - 98 different residues identified
 - Average: 7 per sample
 - Included insecticides, fungicides, herbicides







Pesticides:

- Insecticides kill insects
- Miticides kill mites
- Herbicides kill plants
- Fungicides control pathogens

Majority of **pesticides** are "relatively nontoxic" to bees





Insecticides

- Vast majority are toxic to bees
- Bees are more sensitive than pest insects
- Honeybee genome has less genes for pesticide detoxification compared to other insects



Herbicides and Fungicides

- Most are "relatively nontoxic" to bees, including:
 - Glyphosate (Roundup and generics)
 - 2,4-D, Dicamba
- Herbicide impact on pollinators is from loss of forage
 - "Weeds" provide important forage throughout the year



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Minimize Impact: Minimize Need for Pesticides

Integrated Pest Management

- An **integrated** approach
- Seeks balance, not eradication
- **ID pests** before deciding on control strategy
- Pesticides as last resort; use less toxic products when possible



Plant Selection

- Know the plants you care for
 - Bloom time, common pests
- Avoid and replace pest prone species!
 – Eg. Euonymus
- Plant a diversity of species



Scale infested Euonymus

Right Plant, Right Place

Choose ornamentals suited to site conditions

- Shade or sun
- Sand or clay
- Drainage



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Build Healthy Soils

- Alleviate compaction
- Till compost into the soil before planting
- Soil test to determine if lime is needed to raise pH
- Mulch!



Nutrient Management

- Add nutrients based on soil test results
- Over fertilized plants are attractive to pests
- Nutrient stressed plants less able to defend against pests



Aphids reproduce faster on heavily fertilized plants

Watering

- Water stressed plants are more susceptible to pest problems
- Watering during establishment is critical – minimum = first growing season
- Avoid wetting leaves to minimize foliage diseases



Beneficial Insects

- Learn to recognize all life stages of beneficials
- Diverse landscapes encourage beneficials – plant many different types of plants, including flowers
 - Bee friendly flowers are also beneficial friendly!
- Strive for a **balance** of good and bad insects.
- Minimize pesticide use!!!

Adults ladybug





Scout Regularly

- Catch pests before they become severe
- Remove small infestations
 - Prune out
 - Crush insects or eggs
- Spot treat
- NO calendar sprays



Fall Webworm

Before You Spray, Ask:

- Is the problem correctly identified?
- Does problem threaten
 plant health?
 - Many pests cosmetic, eg.
 Azalea lace bug
 - Many pests short-term, eg.
 Japanese beetles



Azalea Lace Bug Damage



Before You Spray, Ask:

- Is it the right time to treat?
- Is 1-2 applications likely to cure the problem?
- What products are effective:
 - Choose least toxic option
- READ and FOLLOW all label directions



Bagworm
When pesticides must be used, impact can be minimized by:

- Understanding pesticide exposure and toxicity
- Reading pesticide labeling
- Using less toxic products
- Timing sprays to minimize exposure
- Managing drift



Pesticide Exposure

- Why do bees visit plants?
- To collect pollen and nectar
- Where do pollen and nectar come from?
- Flowers!
- Bees most likely to be exposed when pesticides applied to flowering plants



Insecticides are most likely to be toxic to bees

- Many ways to classify:
 - Formulation: dust, granule, liquid
 - Characteristics of active ingredient
 - Toxicity
 - Residual activity
- Both affect level of impact on honeybees, pollinators and beneficial insects



Formulations

- Dusts are most harmful
 - E.g. Sevin dust
 - Easily transported back to hive
 - Most likely to drift
- Granules least likely to drift
 - Mainly used for soil dwelling (turf) insects/ants



Formulation

Liquid sprays:

- Greatest risk to field bees when sprayed on blooming plants during daytime
- High drift potential
- Residues may persist for several days



Active Ingredient

- The ingredient in the product responsible for pest control
- Some products have more than one
- Type of active ingredients affects:
 - Toxicity
 - Residual activity





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Pesticide Toxicity

Acute Toxicity

immediate death or death within a few hours of exposure

Residual Toxicity

Residues of some products remain toxic for several hours after application



Mass bee death due to improper insecticide application

Toxicity

- Refers to lethal effects
- Levels are based on honey bees, not native bee species
- Many native bees are smaller than honey bees
- Native bees potentially harmed at lower levels



EPA Pesticide Toxicity Groups: Toxicity to Honeybees

Highly Toxic

- Severe bee losses expected if used:
 - when bees present
 - Bees forage in treated area
 within a day
 after
 application
 - applied near hives

Moderately Toxic

- Can be used in vicinity of bees if:
 - Dosage, timing, and method of application are correct
- Should <u>never be</u> <u>applied directly</u> <u>to bees</u> in field or hive

Relatively Nontoxic

- Can be used around bees with a minimum of injury if:
 - Dosage, timing, and method of application are correct
- Never apply directly to beehive

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Extended Residual Toxicity (ERT)

Compounds that remain toxic to bees for an <u>extended</u> period of time (8 hrs +) following foliar applications are referred to as Extended Residual Toxicity or ERT



ERT pesticides may not be applied to blooming crops or weeds.

Insecticides With Extended Residual Toxicity

Families of insecticides most commonly associated with **residual toxicity** include:

Older Chemistries:

- **Organophosphates** (e.g. malathion, chlorpyrifos, acephate, "Orthene")
- **Carbamates** (e.g., carbaryl, "Sevin")

Broad spectrum products – kill many pests but very harsh on beneficials and pollinators

Insecticides with ERT: **Pyrethroids**

- Active ingredients end in "thrin"
 - Bifenthrin, Permethrin,
 Cyfluthrin
- **Brands:** Astro, Talstar, Onyx, Ambush, Pounce, Asana . . .
- Broad spectrum contact insecticides, harsh on beneficial insects, highly toxic to bees

Pyrethroids are synthetic versions of natural pyrethrins, derived from a species of Chrysanthemum

Exposure doesn't always result in death

Chronic Exposure

- "sublethal effects" = exposure to sublethal levels over extended period can impair foraging ability, reduce fertility, increase disease susceptibility
- Concern with systemic insecticides (neonicotinoids) and products with residual activity

Systemic products are absorbed into plant tissues

Insecticides with ERT: Neonicotinoids

- Imidacloprid Merit, Admire, Gaucho, generics, many homeowner products
 - Most widely used insecticide in the world
- Dinotefuran Safari, Venom
- Acetamiprid TriStar, Assail
- Thiamethoxam Flagship, Cruiser, Platinum and more
- Clothianidin Arena, Clutch

Control most <u>sap feeding insects</u> (scale, aphids, whitefly) and leaf feeding beetles **DO NOT control caterpillars** or ambrosia beetle borers

Neonicotinoids

- All are toxic or highly toxic- acute toxicity
- Systemic:

Transported to all parts of plant, including pollen and nectar – chronic exposure

This plant is protected from problematic APHIDS WHITE FLIES BEETLES Mealy BUGS and other unwanted pests by Neonicotinoids

Consumer concern has led some retailers to stop sales of plants treated with neonics.

Neonicotinoids

- Long residual life in soil
- When applied as soil drench or granules, levels persist and accumulate in the soil
- Chemical present in blooms months to years following treatment
 - Rhododendron sub-lethal levels 6 years after treatment
 - Amelanchier acute lethal levels 18 months after treatment

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Insecticides with ERT: Neonicotinoids

Bee deaths a result of pesticide Safari; count upped to 50,000 dead insects

WILSONVILLE, OREGON -- June 18, 2013 -- A dead bumblebee clings to a linden tree in a Wilsonville parking lot. The Oregon Department of Agriculture suspects they were killed by improper application of pesticide. Motoya Nakamura/The Oregonian

New Labeling: Neonicotinoids

If contain:

- Clothianidin,
- dinotefuran,
- imidacloprid
- thiamethoxam
- And labeled for outdoor foliar application

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PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators.

Bees and other insect pollinators will forage on plants when they flower, shed pollen or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications.
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

With so many products and brand names, how do you know what you are using?

Check the label for the active

ingredients (

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What else can the label tell you?

• Acute toxicity:

- "Highly toxic to bees"
- "Toxic to bees"
- If no bee caution, "relatively nontoxic"
- Found in:
 - Environmental Hazard
 Statement
 - Directions for Use

Sevin® 80 WSP

CARBARYL INSECTICIDE

ENVIRONMENTAL HAZARDS

BEE CAUTION: MAY KILL HONEYBEES IN SUBSTANTIAL NUM-BERS.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area. Contact your Cooperative Agricultural Extension Service or your local Bayer Environmental Science representative for further information.

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Foraging/Visiting

- Honey bees forage 2-4 miles from hive, temps over 55°F
- Native bees typically forage less than 1 mile from nest; capable of foraging at lower temperatures
- From sun-up to sun-down

If flowers are present, assume pollinators are foraging!

Pesticide Labeling

Subtle wording differences indicate products without and with residual activity

- NO Residual Activity: Do not apply while bees <u>actively</u> visiting treatment area
- With Residual Activity: Do not apply to plants in bloom; Do not apply if bees visiting treatment area

Pesticide Labeling

- As long as you know what words to look for, you can determine the relative toxicity of a pesticide to honey bees
- READ THE LABELS
- Compare products

 Choose least toxic option

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Toxicity Group	If Extended Residual Toxicity	If NO Extended Residual Toxicity
I = Highly Toxic	This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.	This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are actively visiting the treatment area.
II = Toxic	This product is toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.	This product is toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are actively visiting the treatment area.

III = Relatively Nontoxic – No bee caution required

Pesticide Labels

- Spectator
 Ultra
- Sevin SL
- CrossCheck
 Plus
- Safari
- Triple Crown

- Which contain a neonic?
- Which is relatively nontoxic to bees?
- Which have ERT?
- Which can be applied to bee pollinated plants in bloom?

Which contain a neonic?

- Spectator Ultra
- Sevin SL
- CrossCheck Plus
- ✓Safari
- ✓ Triple Crown

GROUP 4A INSECTICIDE

FOR FOLIAR AND SYSTEMIC INSECT CONTROL IN ORNAMENTAL PLANTS AND VEGETABLE TRANSPLANTS IN ENCLOSED STRUCTURES. FOR GREENHOUSE, NURSERY, INTERIOR PLANT-SCAPE AND OUTDOOR LANDSCAPE USE ONLY

Active Ingredient: Dinotefuran, [N-methyl-N'-nitro-N"- ((tetrahydro-3-furanyl)methyl)guanidine]	20%	
Other Ingredients Total:	<u>80%</u> 100%	/

PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

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This product can kill bees and other insect pollinators.

Bees and other insect pollinators will forage on plants when they flower, shed pollen or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications.
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

PROTECTION OF POLLINATORS (continued) When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product onto beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives or off-site to pollinator attractive habitat can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at: http://pesticidestewardship.org/PollinatorProtection/Pages/default.aspx. Pesticide incidents (for example, bee kills) should immediately be reported to the State/Tribal lead agency. For contact information for your State, go to: www.aapco.org/officials.html. Pesticide incidents should also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: beekill@epa.gov.

DIRECTIONS FOR USE

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

READ ENTIRE LABEL. USE STRICTLY IN ACCOR-DANCE WITH PRECAUTIONARY STATEMENTS AND DIRECTIONS, AND WITH APPLICABLE STATE AND FEDERAL REGULATIONS.

FOR COMMERCIALLY GROWN ORNAMENTALS NOT UNDER CONTRACT FOR POLLINATION SERVICES BUT ARE ATTRACTIVE TO POLLINATORS

- Do not apply this product while bees are foraging.
- This product is toxic to bees exposed to residue for more than 38 hours following treatment.
- Do not apply this product to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period, unless the application is made in response to a public health emergency declared by appropriate state or federal authorities.

Do not apply Safari® 20 SG Insecticide while bees are foraging. Do not apply *Safari* 20 SG Insecticide to plants that are flowering. Only apply after all flower petals have fallen off.

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.

Active Ingredients:	Wt.
Zeta-Cypermethrin*	2.70%
Bifenthrin**	7.87%
Imidacloprid	13.83%
Other Ingredients***:	75.60%
	100.0%

Which is relatively nontoxic to bees?

- ✓ Spectator Ultra
- Sevin SL
- CrossCheck Plus
- Safari
- Triple Crown

SPECTATO	2™
Ultrate FUN	IGICIDE
BROAD SPECTRUM AND SYSTEMIC DISE FOR TURF AND ORNAMENTALS	ASE CONTROL
ACTIVE INGREDIENT: Propiconazole OTHER INGREDIENTS: TOTAL Contains 1.3 ibs. active ingredient per ga	14.3% <u>85.7%</u> 100.0% lion

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish. 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 washwater.

Which have Extended Residual Toxicity?

- Spectator Ultra
- ✓ Sevin SL
- ✓ CrossCheck Plus
- ✓ Safari
- ✓ Triple Crown

- This product is toxic to bees exposed to residues for more than 38 hours following treatment.
- Do not apply this product to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period, unless the application is made in response to a public health emergency declared by appropriate state or federal authorities.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops, plants or weeds. Do not apply this product or allow it to drift to blooming crops, plants or weeds if bees are foraging in the treatment area.

Sevin[®] Brand SL Carbaryl Insecticide

ENVIRONMENTAL HAZARDS

This product is extremely toxic to aquatic and estuarine invertebrates. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from area treated. Do not contaminate water by cleaning equipment or disposal of wastes. Do not contaminate water when disposing of equipment washwaters.

BEE CAUTION: MAY KILL HONEYBEES IN SUBSTANTIAL NUMBERS.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area. Contact your Cooperative Agricultural Extension Service for further information.

Environmental Hazards

This pesticide is extremely toxic to fish and 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. Drift and run-off from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwaters. Care should be used when spraying to avoid fish and reptile pets in/around ornamental ponds.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow to drift to blooming crops if bees are visiting the treatment area.

Which can be applied to plants in flower?

- ✓ Spectator Ultra
- Sevin SL
- CrossCheck Plus
- Safari
- Triple Crown

SPECTATOR... Ultrated FUNGICIDE

BROAD SPECTRUM AND SYSTEMIC DISEASE CONTROL FOR TURF AND ORNAMENTALS

ACTIVE INGREDIENT:	
Propiconazole	14.3%
OTHER INGREDIENTS:	85.7%
TOTAL	100.0%
Contains 1.3 ibs. active ingredient per gallon	

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish. 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 washwater.

Minimize Impact

Identify pest – if treatment necessary:

Identify all control options

- Cultural, mechanical, biological, chemical
- Identify all products labeled for use
- Choose products that are relatively nontoxic if available
 - Check environmental hazard statement and directions for use
- Time applications to avoid bee activity and minimize drift



Read and follow all directions!

Identify All Products

NC STATE UNIVERSITY	CAMPUS DIRECTORY	LIBRARIES	MYPACK PORTAL	CAMPUS MAP
NC STATE UNIVERSITY				
NC State University A&I State University COOPERATIVE EXTENSION				NC Cooperative Extension Resources
Empowering People - Providing Solutions				Log la Print

2015 North Carolina Agricultural Chemicals Manual Introduction

2015 North Carolina Agricultural Chemicals Manual

Recommendations

These recommendations apply only to North Carolina. They may not be appropriate for conditions in other states and may not comply with laws and regulations outside of North Carolina. Unless otherwise noted, these recommendations were current as of November 2014. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county Cooperative Extension Service agent. The use of brand names and any mention or listing of commercial products or services in the publication does not imply endorsement by the North Carolina Cooperative Extension Service nor discrimination against similar products or services not mentioned.

Printed Manual

Click here to order copies of the printed version of this manual.

Table of Contents

ABBREVIATIONS

I. PESTICIDE USE AND SAFETY INFORMATION

http://content.ces.ncsu.edu/north-carolina-agricultural-chemicals-manual/

Caterpillars (such as armyworm, budworm, eastern tent caterpillar, fall webworm, orangestriped oakworm, leafrollers)

Chapter V: Insect Control

Table 5-15: Arthropod Management for Ornamental Plants Grown in Nurseries and Landscapes, Page 154

	acephate (Orthene)
1	acetamiprid (Tri-Star)
1	azadirachtin (Azatin)
	Bacillus thuringlensis kurstaki (DiPel)
	bifenthrin (Onyx, Talstar)
	bifenthrin + imidacloprid (Allectus)
	bifenthrin + clothianidin (Aloft)
	carbaryl (Sevin)
	chlorantraniliprole (Acelepryn)
	indoxacarb (Provaunt)
	insecticidal scap (various)
	novaluron (Pedestal)
	permethrin (Astro, Perm-up, Permethrin Pro)
	spinetoram + sulfoxaflor (XXpire)
	spinosad (Conserve SC)
	tebufenozide (Confirm)
-	

Relatively Nontoxic

- Organic/natural insecticides do not have ERT; some are relatively non-toxic:
 - Soaps, Oils,
 Neem/Azadirachtin, B.t.
- Some newer synthetic products



For Organic Use



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Insecticidal Soap

- Active Ingredient: 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



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Horticultural Oils

Mineral oils

- kill by smothering,
- kill all life stages (eggs must be exposed)
- great for scále, 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
- Slow acting
- Breaks down in sunlight



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



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Xxpire

spinetoram + sulfoxaflor



- Whiteflies, Aphids, Mealybugs, Lepidopterans (caterpillars), Lacebugs, Certain Scales, Thrips, others
- Controls chewing and sap-feeding insects
- Can be used in nurseries, greenhouses and <u>commercial</u> landscapes



- Active ingredient: Chlorantraniliprole
- Landscapes and turf (professional applicators)
- Systemic activity
- Caterpillars, Beetles, Leafminers, some Borers
- Sucking pests: lacebugs, aphids
- Granular formulation white grubs in turf



GROUP 22 INSECTICIDE



Insecticide

A water dispersible granular insecticide for the control of lepidopterous larvae (including armyworms, cutworms, sod webworms, bagworms, fall webworms, gypsy moth caterpillars, tent caterpillars, tussock moth caterpillars and yellownecked caterpillars) and other listed pests infesting landscape and recreational (including golf courses) turf grass and landscape omamentals.

Active Ingredient Indoxacarb* (S)-methyl 7-chloro-2,5-dihydro-2- Illmethoxycarbory)[4/trifluoromethoxy]	
phenyi]amino)carbonyi]indeno[1,2-e][1,3,4 4a-(3H)-carboxylate	I]oxadiazine-
Other Ingredients	70.0%
Total:	100.0%

*Indoxacarb belongs to the oxadiazine chemical class.

Active Ingredient: Indoxacarb

Controls: Caterpillars on landscape ornamentals and turf



Caterpillars (such as armyworm, budworm, eastern tent caterpillar, fall webworm, orangestriped oakworm, leafrollers)

Relatively Nontoxic Options?

Chapter V: Insect Control Table 5-15: Arthropod Management for Ornamental Plants Grow in Nurseries and Landscapes, Page 154

	acephate (Orthene)						
tern	acetamiprid (Tri-Star)						
	azadirachtin (Azatin)						
	Bacillus thuringiensis kurstaki (DiPel)						
	bifenthrin (Onyx, Talstar)						
	bifenthrin + imidacloprid (Allectus)						
	bifenthrin + clothianidin (Aloft)						
	carbaryl (Sevin)						
	chlorantraniliprole (Acelepryn)						
	indoxacarb (Provaunt)						
	insecticidal soap (various)						
	novaluron (Pedestal)						
wn	permethrin (Astro, Perm-up, Permethrin Pro)						
	spinetoram + sulfoxatior (XXpire)						
	spinosad (Conserve SC)						
	tebufenozide (Confirm)						

Using Pesticides: Best Management Practices

To minimize impact on pollinators:

- Minimize the need for pesticides
- Select least toxic products
- Avoid treating plants in bloom
- Time application to avoid bee activity
- Manage drift



Minimizing Impact

Most bee poisoning incidents occur when insecticides that are highly toxic to bees and that have residual activity are applied to bee-pollinated plants during the bloom period.





Empowe

Minimize Impact

- Never spray plants in bloom with bee toxic pesticides!
- Check adjacent plants and weeds
 - Mow weeds
 - Prune off flowers if necessary



Holly blossoms

Minimizing Impact: Neonicotinoids

- Never apply to plants in bud or bloom
- If necessary, apply only after flowering complete
 petals have shed
- Beware of soil residual build up





Minimize Impact: Application Timing

Honey bees forage sun up to sun down unless it's raining



Best time for pesticide application: Just after sun down



Minimize Impact

Minimize Drift

- Coarse droplet size, lower pressure
- Hold nozzle close to target
- Check forecast
- Don't spray if winds over 5 mph; temps over 85 F





Em

Minimizing Impact

Use Integrated Pest Management to reduce the need to spray and consider:

- What you spray
 - Consider acute and residual toxicity
 - Choose relatively nontoxic options when available
- When you spray
 - Time of day; Bloom cycle
 - Only when necessary no calendar sprays

Where you spray

Never open blossoms



North Carolina

Cooperative Extension

We have an Extension center in every county!

http://ces.ncsu.edu



to submit questions to our 'Ask an Expert' widget and to find your local Extension center

Chatham County Center

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