Minimizing the Impact of Pesticides on Pollinators

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COOPERATIVE EXTENSION
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Minimizing Pesticide Impact

- **Pollinators in decline:** Why we should be concerned
- **Pesticide exposure**
- **Minimizing impact:**
  - Minimizing need for pesticides
  - Best management practices
- **Planting pollinator gardens**

Pollinators

- Move pollen from flower to flower, making reproduction possible for **¾ of plants on earth**
- Include bats, hummingbirds, birds, and insects such as beetles, butterflies, wasps and bees

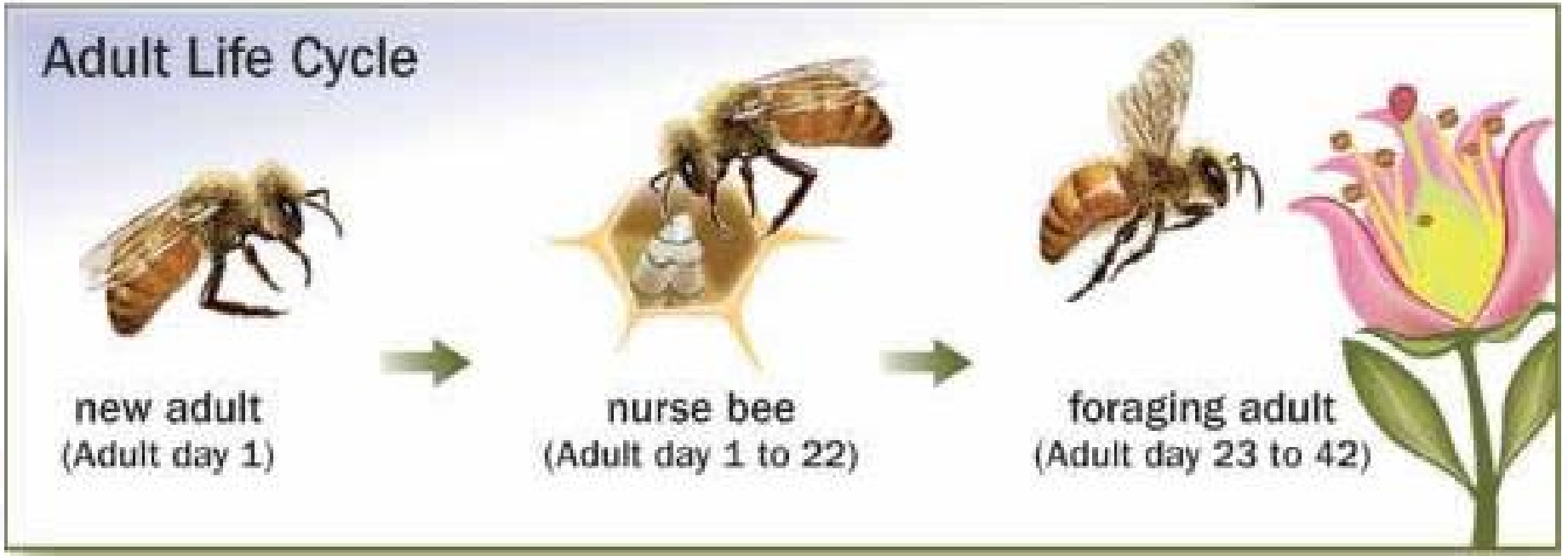
Pollinators

- **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

Worker Bee Life Cycle



Illustrations: Marguerite Meyer

Source: pollinator.org

Native 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

50 species of bumble bees!

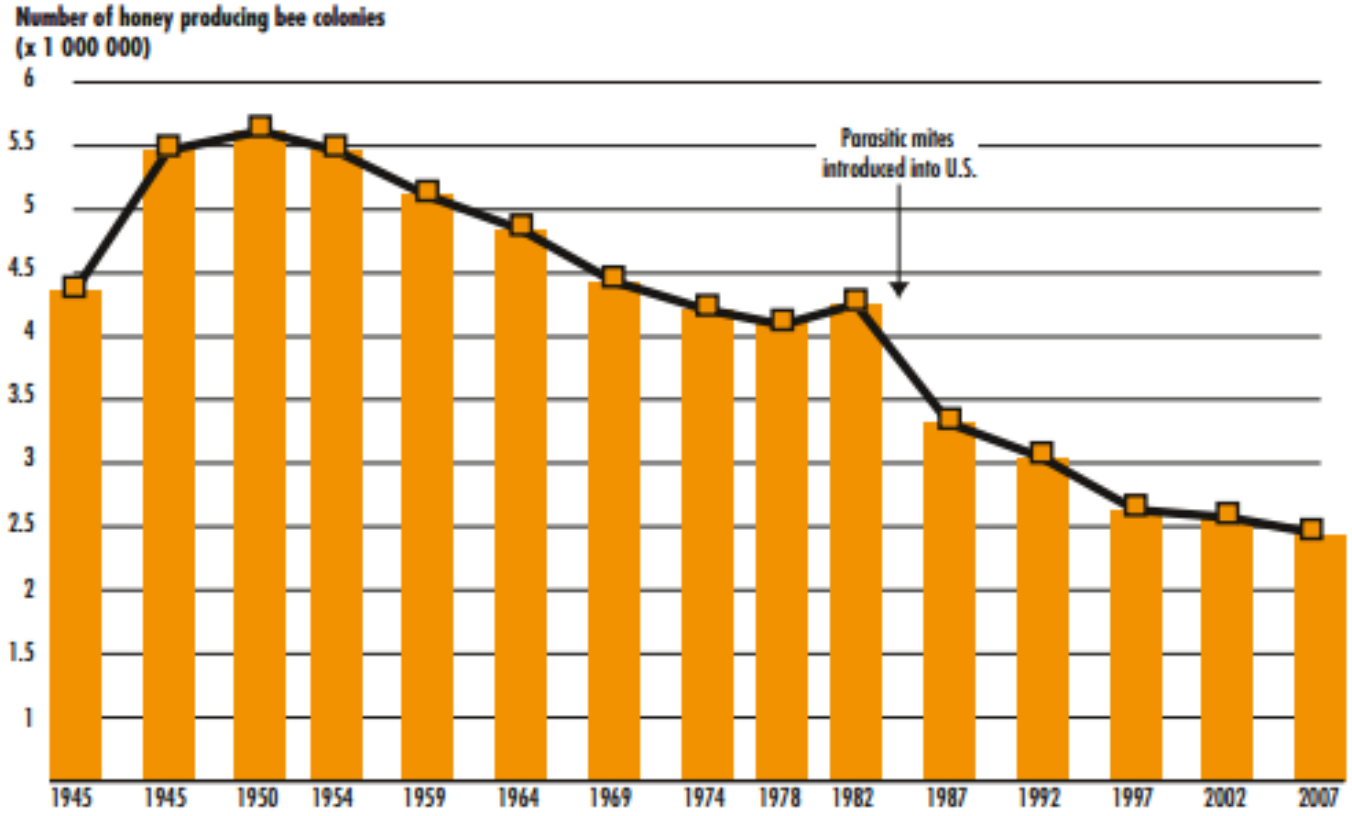
- **Most are solitary**
  - NOT aggressive!!!
  - Bumble bees live in small annual colonies
- **Most nest in the ground**
  - Some nest in wood or hollow stems

Leafcutter bees cut leaf segments to line their nests

Ground Nesting Bees

Attracted to areas with thin turf

Honey Bee Decline

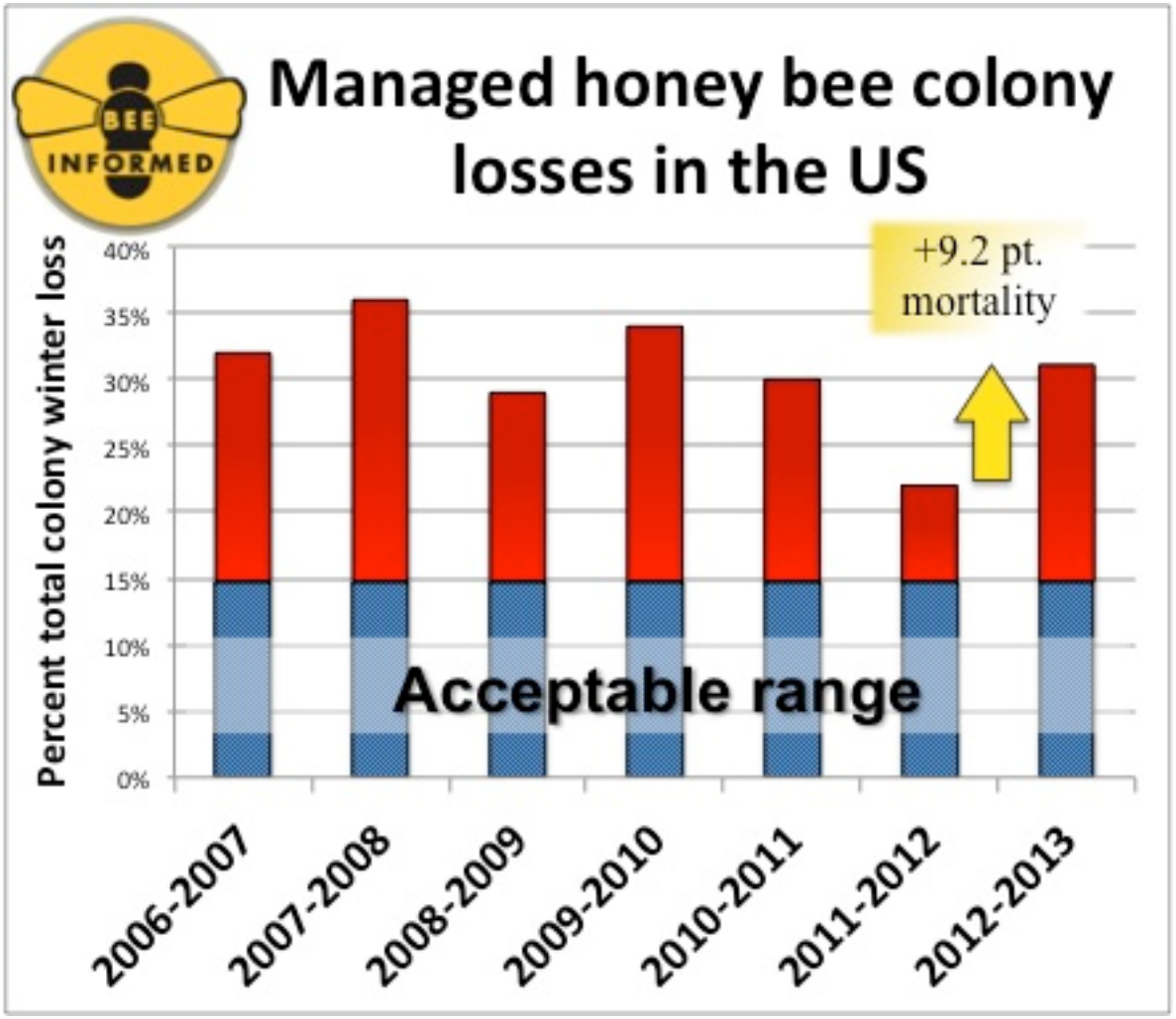


Data source: U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) NB: Data collected for producers with 5 or more colonies. Honey producing colonies are the maximum number of colonies from which honey was taken during the year. It is possible to take honey from colonies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

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%**

Honey Bee Decline



Since 2007 and onset of CCD, winter losses have far exceeded the 15% 'acceptable' range

2013-14 saw 23% losses

Source: http://beeinformed.org/2013/05/winter-loss-survey-2012-2013/

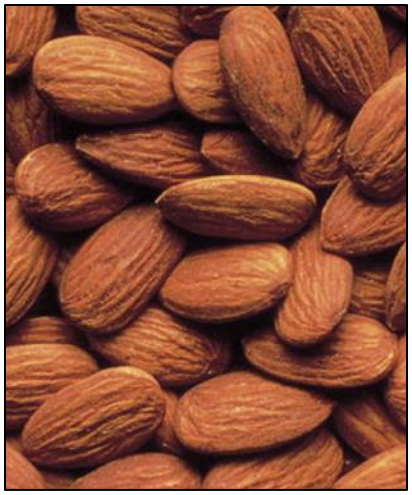
Native Bee Decline

- 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/pollinator-redlist/

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

Your breakfast with bees

Your breakfast without bees

Scientific American April 2009

1 out of every 3 bites of food we eat daily 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

In NC…

- Apples
- Blueberries
- Cucumbers
- Squash
- Pumpkin
- Watermelon
- Strawberries
- Peaches
- Blackberries
- Raspberries
- Others

Incomplete pollination of cucumber (top)

Why Should We Be Concerned?

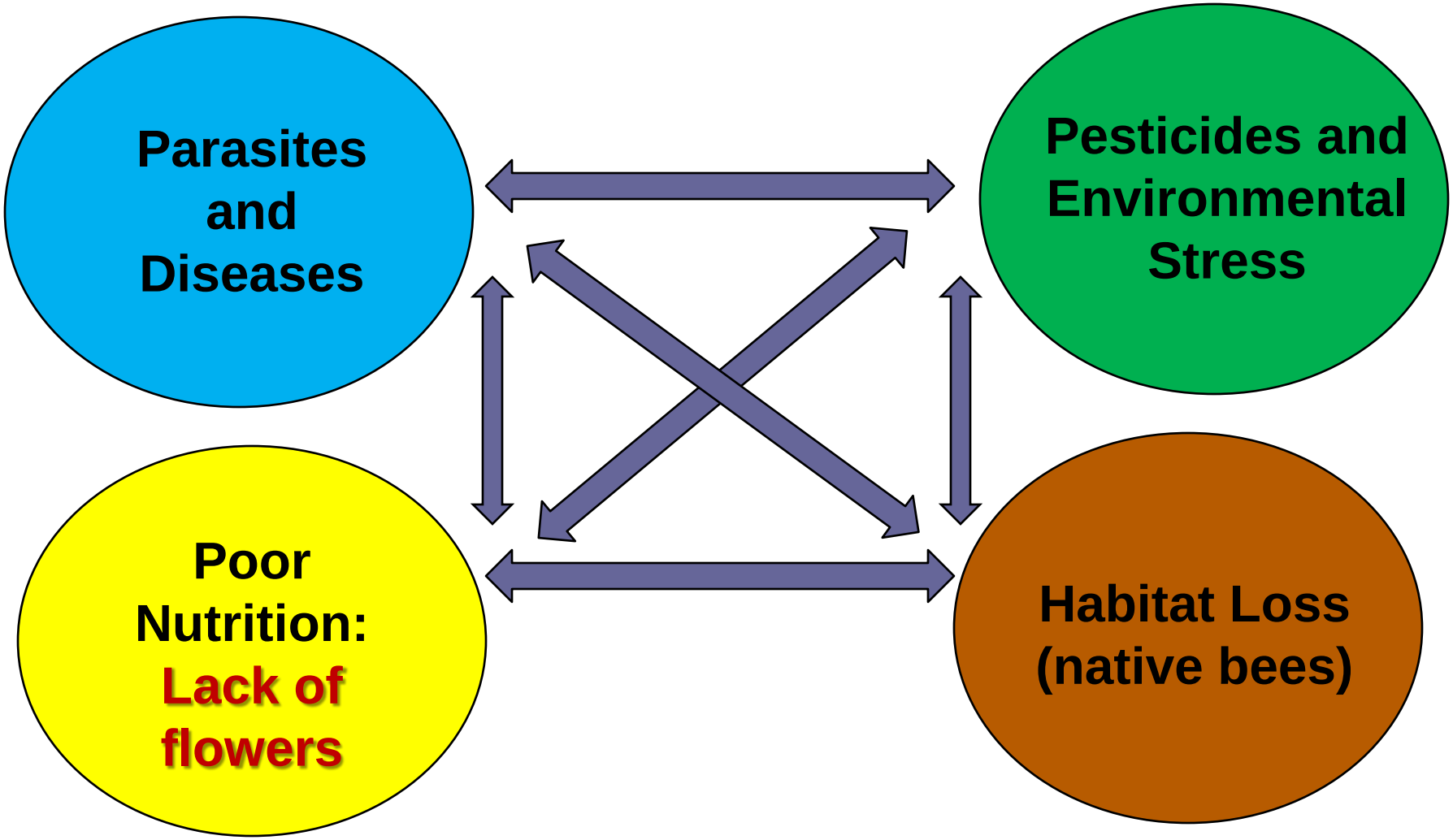
- Ecosystems rely on pollinators

Fruit and seed production needed for the survival of the majority of flowering plants in our environment.

Food for wildlife

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

Causes of Bee Decline: Complex and Interacting



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

Pesticides Exposure

- **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
- Forage from **sun-up to sun-down**

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

Pesticide Exposure

- Majority of **pesticides** are relatively nontoxic to bees
- **Pesticides:**
  - Insecticides
  - Fungicides
  - Herbicides
  - Miticides
- **Insecticides** generally more toxic than fungicides and herbicides

Mass bee death due to improper insecticide application

EPA Pesticide Relative Toxicity to Honeybees

- **Category 1: "Highly Toxic to Bees"**
  - The Acute Contact LD_{50} is less than or equal to 2 micrograms per bee
- **Category 2: "Toxic to Bees"**
  - LD_{50} is less than 11 but greater than 2 micrograms per bee
- **Category 3: "Relatively Nontoxic"**
  - LD_{50} of the pesticide is greater than 11 micrograms per bee; **no bee caution statement is required on the label**

Pollinator poisoning can occur from:

- **Direct exposure** during application
- **Residues** picked up through foraging (pollen and nectar) and taken back to the hive
- **Residues** from non-target plants (ground cover, weeds, etc.)

Residual Toxicity

Some pesticides remain toxic to bees for some time after the application is made via contact with residues on the treated plant, including blooms. **This is residual toxicity.**

Extended Residual Toxicity (ERT)

Compounds that remain toxic to bees for an extended 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.

Pesticides With Extended Residual Toxicity

Families of pesticides most commonly associated with ERT include:

- **Organophosphates** (e.g., acephate, chlorpyrifos, malathion)
- **Carbamates** (e.g., carbaryl)
- **Neonicotinoids** (e.g., imidacloprid)
- **Pyrethroids** (e.g., deltamethrin and cyfluthrin)

How Can You Tell?

- **Read the label!**
  - Environmental Hazard Statement
  - Directions for Use
- **Relative toxicity:**
  - “Highly toxic to bees”
  - “Toxic to bees”
  - **If no bee caution,** “relatively nontoxic”

Sevin® 80 WSP

CARBARYL INSECTICIDE

ENVIRONMENTAL HAZARDS

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 or your local Bayer Environmental Science representative for further information.

Residual Toxicity?

- **If NO: "Actively visiting the treatment area"**
  - Refers to bees you see on plants
- **If YES: "Visiting the treatment area"**
  - Refers to bees that may visit the plants after treatment
- "Visiting" replaced with "**FORAGING**" on newer labels

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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

New Labeling: Neonicotinoids

- **If contain:**
  - Clothianidin,
  - dinotefuran,
  - imidacloprid
  - thiamethoxam
- And labeled for **outdoor foliar application**

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.

Pesticide Labels

- **Safari**
- **Talstar**
- **Azatin**
- **Conserve**

- Which is a neonic?
- Which is relatively nontoxic to bees?
- Which has ERT?
- Which is toxic to bees but does not have residual toxicity?

Pesticide Labels

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- **Which is toxic to bees but does not have residual toxicity?**
  - **Conserve**

Minimizing Impact

Most bee poisoning incidents occur when insecticides that are **highly toxic** to bees and that have a residual hazard longer than 8 hours are applied to bee-pollinated crops during the bloom period.

Minimize Impact

- **READ AND FOLLOW ALL LABEL DIRECTIONS**
- Choose products that are **relatively nontoxic** whenever possible
  - Soaps, Oils, Neem/Azadirachtin, B.t.
- **NEVER apply products with ERT during bloom!**
- Use lowest appropriately labeled rate

Minimize Impact

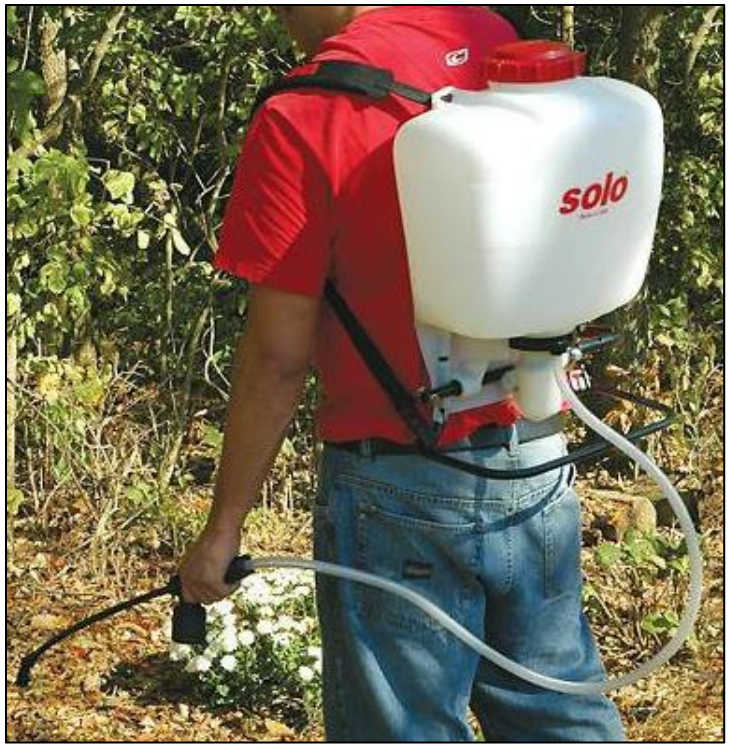
- **Avoid spraying plants in bloom!**
- **Check adjacent plants and weeds**
  - Mow weeds
  - Prune off flowers if necessary

Holly blossoms

Minimize Impact

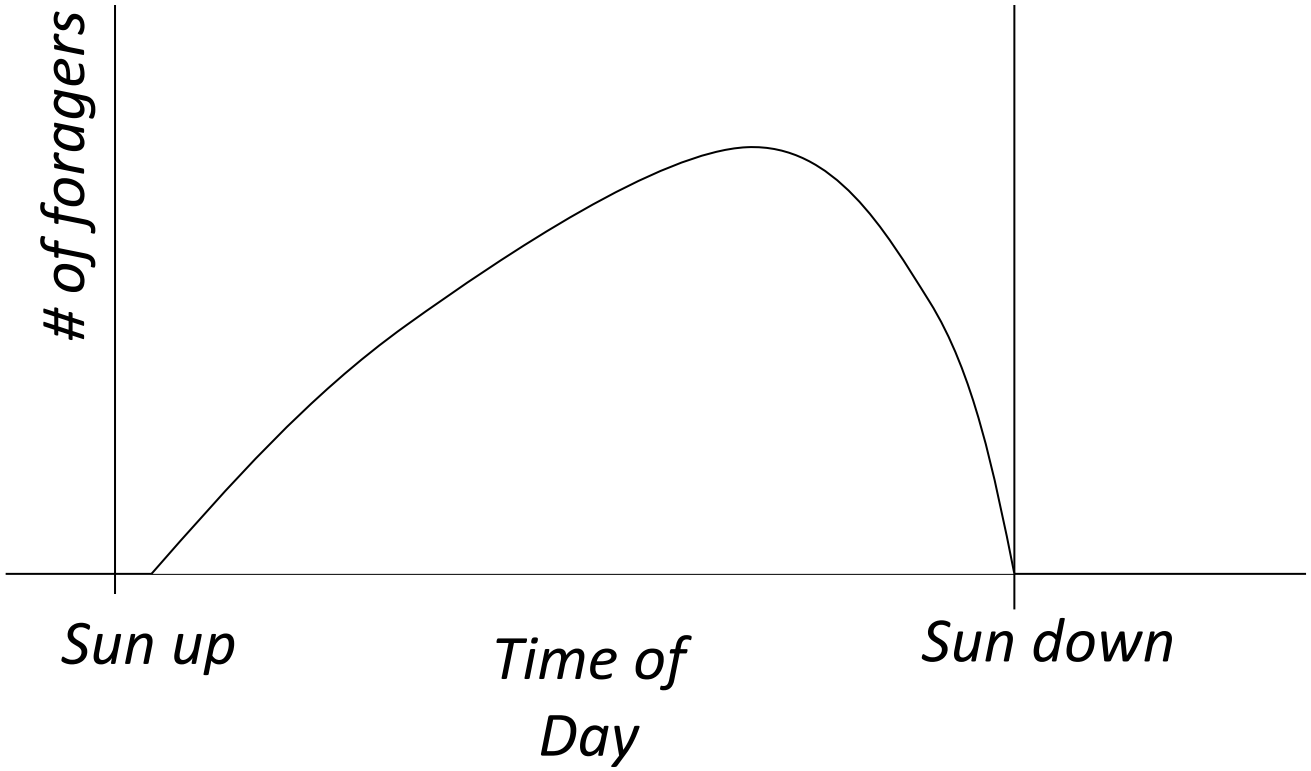
Minimize Drift

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



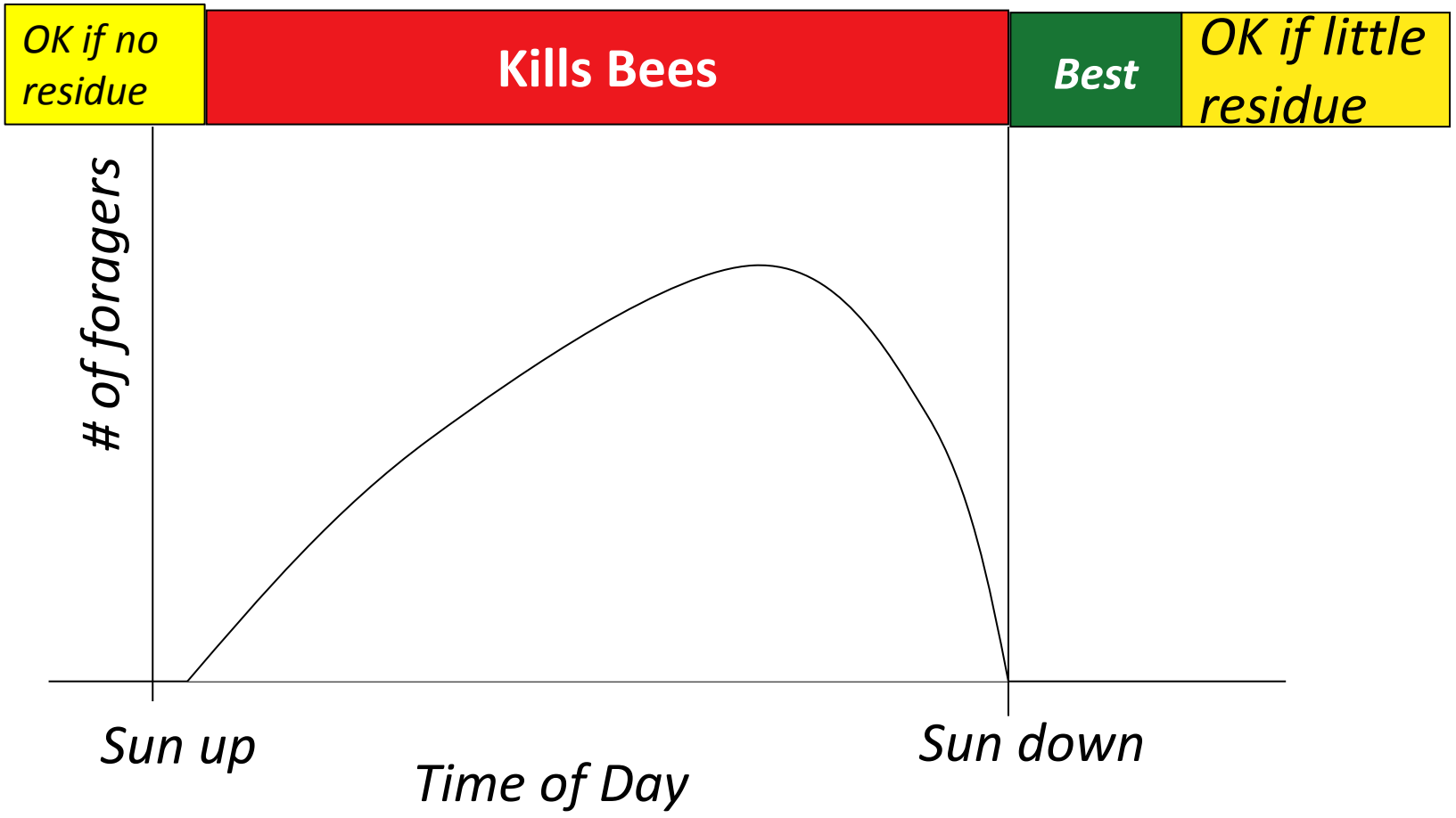
Minimize Impact:
Spray late evening

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



Source: Marla Spivak, UMinn

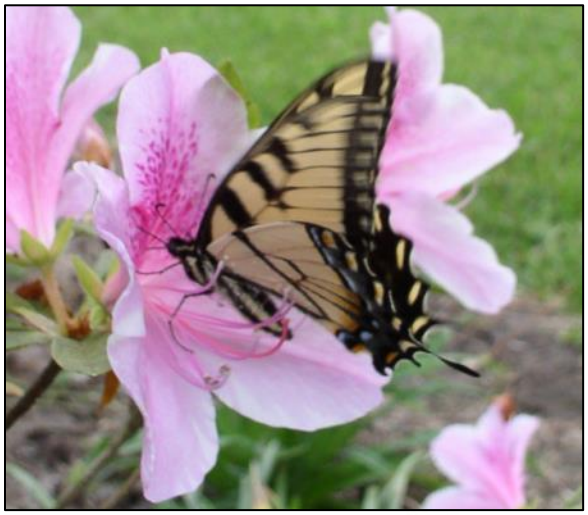
Best time for pesticide application: **Dusk to Dawn**



Source: Marla Spivak, UMinn

Minimizing Impact: **Neonicotinoids**

- **Never apply to plants in bud or bloom**
- Apply after blooming complete – **petals have shed**
- Beware of soil residual build up

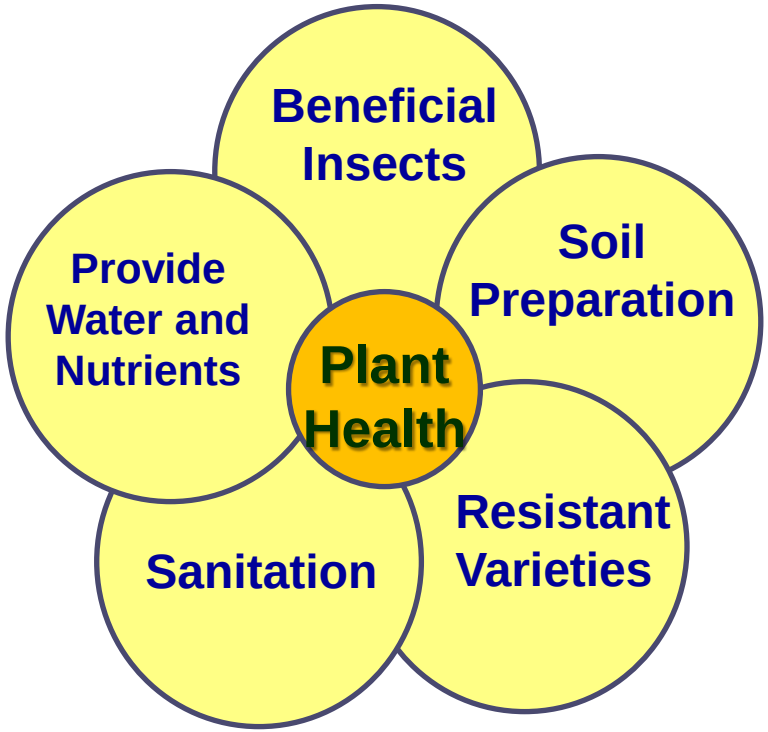


Minimizing Impact

- **Minimize Pesticide Exposure**
  - Follow Best Management Practices
  - Practice Integrated Pest Management
- **Plant Forage = Flowers!**

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

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

Adults ladybug

- 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**!!!

Ladybug larvae

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

Preserve Nesting Habitat

- **70% of native bees nest in ground**
  - Favor well drained, sunny areas with sparse vegetation
- **Preserve natural areas**
  - Do not disturb existing nesting areas

Planting for Bees

- **Sun**: at least 6 hrs/day
- **Masses** – groups of at least 3 of each variety
- **Diversity** - 10+ different species
- **Flowers** from early spring – late fall
- **Perennials** – reliable year after year and richer nectar sources

Mass plantings are easier to find and increase forage efficiency

Plant Flowers!

- **Colors:** White, yellow, blue, purple, violet
- **Fragrance:** floral or herbal
- **Shapes:** daisy/coneflower/ sunflower; shallow tubular; legume (bean/clover); or lots of small flowers together
- Plant **single** instead of double varieties

Pollen and nectar are less accessible in double flowered varieties

Planting for Bees: Maximize What You Have

- **Leave weeds to bloom when possible** – clover, henbit, dandelion
- **Identify 'dearth' times (no blooms)** – plant to fill these times
- Many native bees prefer native flowers

Planting for Bees

- These practices also create perfect habitat for **beneficial insects**, **birds**, and other **wildlife**

The hover fly is a bee-mimic. Adults feed on nectar (above); larvae feed on aphids (left).

Learn More!

- **June 25 workshop** – details and registration coming this spring!
  - www.protectpollinators.org
  - Plant lists by Debbie Roos, Chatham County Cooperative Extension
- **Xerces Society for Invertebrate Conservation**
  - http://www.xerces.org/
- **Pesticide Environmental Stewardship**, http://pesticidestewardship.org/

Pollinator Paradise Garden, Chatham Mills

Resources

Pollinators and Pesticide Stewardship. Penn State Pesticide Education Program. extension.psu.edu/pesticide-education

Protecting Pollinators, A Training Module for Certified Pesticide Applicators. North American Pollinator Protection Campaign.

Marla Spivak, PhD, University of Minnesota.

Presentation for the **Private Applicator Recertification Program**, 2015-2017. By Bill Skelton, Haywood County Cooperative Extension and Wayne Buhler, NC State Univ.

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