Pollinator Protection for Pesticide Applicators

Gary Fish  
Maine Board of Pesticide Control  
28 SHS  
Augusta, ME 04333-0028  
207-287-7545  
gary.fish@maine.gov
Life with bees....

Marla Spivak, University of Minnesota
... and without bees

Marla Spivak, University of Minnesota
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Who Are the Pollinators?

Honey bees are relied on to perform most of the commercial pollination.
Major Migratory Routes of Honey Bee Colonies for Pollination

Marla Spivak, University of Minnesota
Importance of Pollinators

- Fruit and seed production needed for the survival of the majority of flowering plants in our environment.
- Essential to the production of more than 85 crops.
- 1 out of every 3 bites of food can be attributed to pollinators.
What organisms serve as pollinators?
Honey Bee Colony Losses in the U.S., winter 2009-2010*
(2010 – 2011 results similar)

- Responding beekeepers attributed their losses to
  - Starvation 32%
  - Weather 29%
  - Weak colonies in the Fall 14%
  - Mites 12%
  - Poor queens 10%

- Only 5% of beekeepers attributed Colony Collapse Disorder (CCD) as the major cause

Bee Decline from the beekeeper point of view - 2011-2012 winter losses

<table>
<thead>
<tr>
<th>Factor</th>
<th>% Selecting That Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor Wintering Conditions</td>
<td>36.71</td>
</tr>
<tr>
<td>CCD</td>
<td>35.99</td>
</tr>
<tr>
<td>Pesticides</td>
<td>33.72</td>
</tr>
<tr>
<td>Varroa</td>
<td>25.64</td>
</tr>
<tr>
<td>Nosema</td>
<td>25.13</td>
</tr>
<tr>
<td>Weak in the Fall</td>
<td>24.10</td>
</tr>
<tr>
<td>Queen Failure</td>
<td>21.81</td>
</tr>
<tr>
<td>Don't Know</td>
<td>21.58</td>
</tr>
<tr>
<td>Starvation</td>
<td>20.89</td>
</tr>
<tr>
<td>Small Hive Beetle</td>
<td>19.78</td>
</tr>
</tbody>
</table>
Winter Loss Survey Results Over 7 Years

Managed honey bee colony losses in the US

Percent total colony winter loss

Acceptable range

+9.2 pt. mortality

Year:
- 2006-2007
- 2007-2008
- 2008-2009
- 2009-2010
- 2010-2011
- 2011-2012
- 2012-2013
National Stakeholders Conference
Key Findings

* Parasites and disease are major factors
* Increased genetic diversity is needed
* Poor nutrition has a major impact on bee and colony longevity
  * Mono-cropping may contribute to dietary deficiencies
* Need to improve collaboration and information sharing
* Additional research is needed to determine the pesticide risks
Undernourished or malnourished bees appear to be more susceptible to pathogens, parasites, and other stressors, including pesticides and other environmental contaminants.

- Research is needed on forage, pollen quality, artificial and natural food sources, and food processing and storage in the hive.

- Federal and state partners should consider actions affecting land management to maximize available nutritional forage to promote and enhance good bee health and to protect bees by keeping them away from pesticide-treated crop acreage.
Pathogens and parasites have major negative impacts on colonies. The management of the parasitic Varroa mite and viruses needs special attention.

More outreach to farmers on managing potential exposure of honey bees to pesticides is needed.

Efforts would benefit from involvement of beekeepers, crop consultants, pesticide manufacturers, pesticide applicators, state lead agencies and extension agents.
Varroa destructor mite

sucks bee blood and circulates viruses

Marla Spivak, University of Minnesota
Best management practices associated with bees and pesticide use exist, but are not widely or systematically followed by members of the crop producing industry.

* We need informed and coordinated communication between growers and beekeepers and effective collaboration between stakeholders.

Beekeepers accentuated the need for accurate and timely bee kill incident reporting, monitoring, and enforcement.

Breeding should emphasize traits such as hygienic behavior that confer improved resistance to Varroa mites and diseases (such as American Foulbrood).
Varroa mite is vector of Israeli Acute Paralysis Virus (IAPV) which is a potentially serious problem

Sentinel apiary study –
* Bee mortality increases as Ag land % increases
* 6.2 pesticides on average found in bee pollen
* 130 different pesticide residues found but no trend associated with bee mortality
* High levels of varroa = high levels of IAPV = low populations of adult bees and brood
High degree of cross-infection of viruses between honey bees and native bumble bees

Possible bee susceptibility to interactions (synergism) between agricultural insecticides and fungicides

Some of those fungicides include, chlorothalonil, boscalid, captan, propiconazole and myclobutanil

Acetamiprid is not very toxic to bees on its own, but when combined with propiconazole it becomes 900 times more toxic
Bee kills are in the news! Legislators are asking for bans or moratoriums all over the country.

This case involved “Safari,” which is dinotefuran.

Growers must be extremely careful.
Pesticide applicators must reduce risks to honey bees and other pollinators.

Read the label
Use IPM
Follow Best Management Practices
What Can You Do…?

As an applicator…

- Choose an insecticide with low hazard to bees
- Communicate with beekeeper
- Timing of application
- Avoid drift
- Be aware of blooming plants in the area when applying pesticides
- Mow blooming weeds around application sites before application, when possible
Did You Know?

• Most **pesticides** are not acutely toxic to honey bees and other pollinators.

• As a general rule: **insecticides** pose greater concerns to pollinators than fungicides and herbicides.
  
  — However, **not all insecticides are toxic to pollinators**.

• New research shows that some combinations of insecticides and fungicides can be very toxic to bees.

• Any pesticide that is toxic to insect pollinators will have warnings on its label.
Different Formulations may affect pollinators...

- Granules
- Emulsifiable concentrates vs Wettable powder
- Dusts & Microencapsulated
- Oil sprays
- Mixing miticides with insecticides
- Some fungicides with insecticides
Pollinator Protection Checklist

1. Read and follow the label.
2. Determine if the pesticide is toxic to pollinators.
3. Understand local pollinator visitation habits.
4. Use Integrated Pest Management.
5. Follow pesticide stewardship practices.
6. Cooperate and communicate with others.
7. Know symptoms of pesticide exposure to bees.
8. Check local ordinances pertaining to pollinators.
Pollinator Protection Checklist

1. Read and follow ALL pesticide label directions and precautions.

✓ Must reduce risk of pesticide exposure to honey bees and other pollinators.
Many insecticides have specific label warnings

**BEE CAUTION:** May kill honeybees and other bees in substantial numbers. This product is highly toxic to bees exposed to direct treatment or residues on crops or weeds in bloom. Notifying beekeepers within 1 mile of treatment area at least 48 hours before product is applied will allow them to take additional steps to protect their bees.

Limiting applications to times when bees are least active, e.g., within 2 hours of sunrise or sunset, will minimize risk to bees.

*For crops in bloom (except corn and soybeans):*
Do not apply this product to target crops or weeds in bloom.

*For corn and soybeans:*
If application cannot be avoided when target crop or weeds are in bloom, limiting applications to times when bees are least active, e.g., within 2 hours of sunrise or sunset, will minimize risk to bees.
Look for the bee icon on new labels

* Products with acute or residual toxicity to pollinators will have the bee icon on their labels

* The new warnings will be next to that icon
Pollinator Protection

THE NEW EPA BEE ADVISORY BOX
On EPA’s new and strengthened pesticide label to protect pollinators

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.

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 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 be immediately reported to the State/tribal lead agency. For contact information for your state, go to: www.aspoce.org. Pesticide incidents can also be reported to the National Pesticide Information Center at: www.npic.or.org or directly to EPA at: beekill@epa.gov

Alerts users to separate restrictions on the label. These prohibit certain pesticide use when bees are present.

The new bee icon helps signal the pesticide’s potential hazard to bees.

 Makes clear that pesticide products can kill bees and pollinators.

Bees are often present and foraging when plants and trees flower. EPA’s new label makes it clear that pesticides cannot be applied until all petals have fallen.

Warns users that direct contact and ingestion could harm pollinators. EPA is working with beekeepers, growers, pesticide companies, and others to advance pesticide management practices.

Highlights the importance of avoiding drift. Sometimes, wind can cause pesticides to drift to new areas and can cause bee kills.

The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA’s new label will help protect pollinators.

Read EPA’s new and strengthened label requirements: http://go.usa.gov/jHH4
Pollinator Protection Checklist

2. Determine if the pesticide may be toxic to pollinators.

– The Environmental Hazard section of a label will indicate if a pesticide is moderately or highly toxic to bees that contact the pesticide.

– There is also a “practically non-toxic to pollinators” category of pesticides.
Even pesticides approved for organic grower use can be highly toxic to pollinators

Toxicity of Common Organic-Approved Pesticides to Pollinators

<table>
<thead>
<tr>
<th>PESTICIDE</th>
<th>NON-TOXIC</th>
<th>LOW TOXICITY</th>
<th>HIGHLY TOXIC</th>
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</thead>
<tbody>
<tr>
<td>Insecticides/Repellants/Pest Barriers</td>
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<td></td>
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<tr>
<td>Bacillus thuringiensis (Bt)</td>
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<tr>
<td>Beauveria bassiana</td>
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<tr>
<td>Cydia pomonella granulosis</td>
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<tr>
<td>Diatomaceous Earth</td>
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<td>Garlic</td>
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<tr>
<td>Insecticidal Soap</td>
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<td>Kaolin Clay</td>
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<td>Neem</td>
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<td>Horticultural Oil</td>
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<td>Spinosad</td>
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<td>Herbicides/Plant Growth Regulators/Adjuvants</td>
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<tr>
<td>Corn Gluten</td>
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<tr>
<td>Gibberellic Acid</td>
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<tr>
<td>Horticultural Vinegar</td>
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<td>Fungicides</td>
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<td>Copper</td>
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<tr>
<td>Copper Sulfate</td>
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<td>Lime Sulfur</td>
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<tr>
<td>Sulfur</td>
<td></td>
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</tr>
</tbody>
</table>

Soaps and Oils, only when directly sprayed upon the pollinator

Eric Mader – The Xerces Society for Invertebrate Conservation
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.

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 on to 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.ornst.edu or directly to EPA at:
beekill@epa.gov
New use directions – Ag products

DIRECTIONS FOR USE

1. FOR CROPS UNDER CONTRACTED POLLINATION SERVICES

Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen unless the following condition has been met.

If an application must be made when managed bees are at the treatment site, the beekeeper providing the pollination services must be notified no less than 48-hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying.
New use directions – Ag products

2. FOR FOOD CROPS AND COMMERCIAL GROWN ORNAMENTALS NOT UNDER CONTRACT FOR POLLINATION SERVICES BUT ARE ATTRACTIVE TO POLLINATORS

Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen unless one of the following conditions is met:

- The application is made to the target site after sunset
- The application is made to the target site when temperatures are below 55°F
- The application is made in accordance with a government-initiated public health response
- The application is made in accordance with an active state-administered apiary registry program where beekeepers are notified no less than 48-hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying
New use directions – Ag products & Non-Ag products

- The application is made due to an imminent threat of significant crop loss, and a documented determination consistent with an IPM plan or predetermined economic threshold is met. Every effort should be made to notify beekeepers no less than 48-hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying.

3. Non-Agricultural Products:

Do not apply [insert name of product] while bees are foraging. Do not apply [insert name of product] to plants that are flowering. Only apply after all flower petals have fallen off.
Residual Toxicity

Definition:
Residues on plants which can harm pollinators that visit the area after the treatment is dry or absorbed by the soil.

Some pesticides have extended residual toxicity to bees and other pollinators.
Residual Toxicity

If the pesticide does not have extended residual toxicity:

The pesticide can still harm pollinators exposed to direct treatment; during or shortly after the application while the plants are still wet.

Can often be applied after evening pollinator foraging is complete without harming pollinators that arrive the next day.
2. FOR FOOD CROPS AND COMMERCIAL GROWN ORNAMENTALS NOT UNDER CONTRACT FOR POLLINATION SERVICES BUT ARE ATTRACTIVE TO POLLINATORS

Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen unless one of the following conditions is met:

- The application is made to the target site after sunset
- The application is made to the target site when temperatures are below 55°F
- The application is made in accordance with a government-initiated public health response
- The application is made in accordance with an active state-administered apiary registry program where beekeepers are notified no less than 48-hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying
- The application is made due to an imminent threat of significant crop loss, and a documented determination consistent with an IPM plan or predetermined economic threshold is met. Every effort should be
Residual Toxicity

Environmental conditions can affect residual toxicity.

– Examples: Low temperatures or heavy dews for the night or early AM after application may increase residual toxicity.
Pollinator Protection Checklist

3. Understand local pollinator visitation habits.

- Pollinators are at most risk when ANY vegetation is blooming.

- Observe application timing on the label relative to the blooming stage of crop and other plants.

- The right timing may be reduced by extended bloom or unfavorable weather conditions.

- Evening or nighttime applications are generally the least harmful to honey bees.
During Application

• Watch for bee activity.
  – Stop spraying if bees are present at the application site.

• Be careful with refill or mixing/loading operations.
  – Clean up any spills.
  – Don’t contaminate any standing water.
Pollinator Protection Checklist

4. Use Integrated Pest Management (IPM)
   
   – Consider all suitable practices for managing pests.
   
   – Use cultural practices that discourage pests from using a crop or landscape as a habitat.
   
   – Carefully diagnose your pest problems.
   
   – Monitor and assess pest populations to determine when levels warrant pesticide treatment.
Pollinator Protection Checklist

4. Use Integrated Pest Management (IPM)

- Determine your best combination of management options.

- Use the recommended pesticide at the lowest appropriate labeled rate, based on the life stage of the pest/infestation level with the proper timing and placement.

  • Using rates below the labeled rate may cause loss of control or development of pest resistance.

<table>
<thead>
<tr>
<th>Crops</th>
<th>Insects</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broccoli</td>
<td>Loopers, Diamondback Moth</td>
<td>1 1/2 - 3 **</td>
</tr>
</tbody>
</table>
Pollinator Protection Checklist

5. Always follow pesticide stewardship practices.

- Minimize spray drift.
- Minimize volatility.
- Minimize off-site drift of seed treatment materials.
Minimize Spray Drift

Establish appropriate buffers.

Check weather forecast.

Shut off the sprayer when making turns and near ponds and other sources of water.

Choose low pressure or low-drift nozzles.

C. Black, Spain 2013
Minimize Vapor Drift

More prone to pesticides formulated as **emulsifiable concentrates**.

Spray during **cool temperatures**.

Soil-incorporate volatile products.

Use relatively **coarse spray droplets**.
Minimize Off-Site Drift of Seed Treatment Materials

Specific label information takes precedence.

Always buy and use high quality seed, free from excessive dust.

When the pesticide needs to be coated onto the seed, always use an appropriate coating system to keep abrasion of coated pesticide to a minimum.
Minimize Off-Site Drift of Seed Treatment Materials

Follow planter manufacturer recommendations for use of talc, graphite, or other flow agent.

– Avoid excess to minimize dust.

Avoid releasing dust from seed treatments into the air that could expose pollinators.

– Be careful when opening seed containers and when filling, emptying, or cleaning the planting equipment.
After Application

• Properly dispose of leftover tank mix, rinsates and wash waters.
  – Bees are attracted to water sources.
  – Cover, drain, or dispose of any puddles or pools.
• Store unused pesticides in a secure facility.
Pollinator Protection Checklist

6. Cooperate and communicate with others who are concerned about preserving beneficial insects, including pollinators.

– Beekeepers
– Custom applicators
– Neighboring growers
Pollinator Protection requires COMMUNICATION!

Growers

Applicators

PROTECT THE POLLINATORS

Beekeepers
What Can You Do...?

As a Beekeeper...
- Notify applicator of the location of hives
- Have your contact information on the hives
- All bee medications, even organic ones, (miticides) can also contribute to these problems. Minimize your use
- When highly toxic & long residual pesticides are applied nearby: consider moving hives
- When highly toxic & short residual pesticide are applied nearby: confine your bees
Pollinator Protection Checklist

7a. Know the common symptoms of honey bee exposure to pesticides

7b. Know what other stressors impact bee health.
Common Symptoms of Honey Bee Exposure to Pesticides

Excessive numbers of dead bees in front of hives.
Lack of the usual numbers of foraging bees, if not weather-related.
Bees in front of hives that appear disoriented and unable to fly.
Common Other Stressors to Bee Health

Colony starvation and nutritional deficiency.

Excessive cooling or heating of the colony and brood.

Parasites.
Pollinator Protection Checklist

8. Check for specific local ordinances pertaining to pollinators, especially beehive locations or designated preserves.
What we all can do to improve pollinator survival?

- Grow plant for pollinators
- Convert lawns and fallow field areas to bee gardens or bee pastures
- Simply planting clovers, sunflowers or asters can make a big difference

### Bloom Timing of Native Plants Attractive to Beneficial Insects

<table>
<thead>
<tr>
<th>Native plant</th>
<th>Natural enemies</th>
<th>Bees</th>
<th>Bloom Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>wild strawberry</td>
<td>**</td>
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<td></td>
</tr>
<tr>
<td>golden Alexanders</td>
<td>***</td>
<td>**</td>
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<tr>
<td>Canada anemone</td>
<td>***</td>
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<tr>
<td>penstemon</td>
<td>**</td>
<td>**</td>
<td></td>
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<tr>
<td>angelica</td>
<td>***</td>
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<tr>
<td>cow parsnip</td>
<td>***</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>sand coreopsis</td>
<td>***</td>
<td>*</td>
<td></td>
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<tr>
<td>shrubby cinquefoil</td>
<td>***</td>
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<tr>
<td>Indian hemp</td>
<td>***</td>
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<td></td>
</tr>
<tr>
<td>late figwort</td>
<td>**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>swamp milkweed</td>
<td>**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>Culver's root</td>
<td>**</td>
<td>**</td>
<td></td>
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<tr>
<td>yellow coneflower</td>
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<tr>
<td>nodding wild onion</td>
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<tr>
<td>meadowsweet</td>
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<tr>
<td>yellow giant hyssop</td>
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<td>horsemint</td>
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<tr>
<td>Missouri ironweed</td>
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<tr>
<td>cup plant</td>
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</tr>
<tr>
<td>pale Indian plantain</td>
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<tr>
<td>boneset</td>
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<tr>
<td>blue lobelia</td>
<td>****</td>
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<tr>
<td>pale-leaved sunflower</td>
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<tr>
<td>Riddell's goldenrod</td>
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<td>New England aster</td>
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<tr>
<td>smooth aster</td>
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</tbody>
</table>

**KEY**

- * good
- ** better
- *** best

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Attracting Beneficial Insects with Native Flowering Plants by Doug Landis, Rufus Isaacs
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- Environmental Protection Agency (slides 8, 12, and 30).
- iStockphoto.com (slides 25 and 27).
- Penn State Pesticide Education Program (slides 5, 7, 24, and 28).

Resources:
- Pollinator Protection web page, U.S. EPA. http://www.epa.gov/pesticides/ecosystem/pollinator/
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Penn State Extension
Pesticide Education Program
Other contributors to this presentation

- Frank Drummond – University of Maine
- Tony Jadczak - MDACF
- Sherm Takatori – Idaho Department of Agriculture
- Thia Walker - Colorado State University
- Carol Black – Washington State University
- Jack Peterson – Arizona Department of Agriculture
- Kerry Richards – Penn State University
Resources

* http://www.beeccdcap.uga.edu
* http://pesticidestewardship.org/PollinatorProtection/Pages/default.aspx
* http://www.epa.gov/opp00001/ecosystem/pollinator/
Questions?

* That’s all folks!