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THE WISCONSIN POLLINATOR PROTECTION PLAN

BEST MANAGEMENT PRACTICES FOR

Beekeeping to Maximize Pollinator Health

Give us your feedback on the plan with this 5 minute survey:
https://www.surveymonkey.com/r/MLGFGVV

Beekeeping is a rewarding venture, but new beekeepers may easily become overwhelmed by all the considerations that go into keeping bees. Habitat loss, nutritional deficiencies, pesticide exposure, parasites, pathogens, and harsh weather are some of the main causes of concern for bee health. Parasites, improper nutrition and pesticide exposure are compounding issues that can make colonies more susceptible to disease. The following practices are recommended to improve overall pollinator health and minimize hive loss in managed bees. Some practices apply only to the most common managed bee, the European honey bee (*Apis mellifera*), but many also apply to bumble bees kept for greenhouse pollination (typically *Bombus impatiens*).

Utilize good beekeeping practices to provide managed bees with adequate sources of food and water while minimizing the spread of disease among nearby hives and wild pollinator populations. Commercial honey bee hives are often transported across state lines from crop to crop throughout the growing season. Care must be taken to avoid dehydration and food stress during travel, and maximize hive exposure to floral diversity whenever possible. It is also important to consider pesticide use in the vicinity of hives to minimize harmful chemical exposure. As urban beekeeping gains popularity, new hobbyists should realize that all of these concerns—adequate pollen diversity, water availability, chemical exposure and disease control—apply in urban settings as well.

Habitat and nutrition

- Bees need a diverse mix of natural pollen and nectar. The best way to ensure adequate nutrition is to place bee hives in areas where at least three species of flowering plant are in bloom at all times from early spring through late fall.
- Honey bees, like most bees, are generalist foragers that will visit many different plant types. If you are interested in establishing habitat for your bees, Pollinator Partnership[1] and The Xerces Society[2] provide regional plant guides. See the BMPs for improving pollinator habitat in gardens and open spaces in the Wisconsin Pollinator Protection Plan.
- Avoid garden cultivars and hybrids that have been bred for size, color or extra petals and provide little or no nectar and pollen for bees.
- Bees need water. Make sure uncontaminated water sources are readily available.
- Protein patties and sugar (dry or syrup) can be provided when floral resources are inadequate.
- Density matters. Too many hives placed in one area can lead to inadequate forage as well as increasing the likelihood of disease and parasite spread.

Winter preparation

Honey bee colonies are perennial; the queen and many workers live through the winter by feeding on honey stores and “shivering” to keep warm. This differentiates honey bees from bumble bee colonies that instead produce new queens in the fall that hibernate while the rest of the colony dies. Beekeepers managing honey bees can minimize the likelihood of overwintering colony loss by preparing hives each fall:

- Assess honey bee hive strength before winter. Assess honey quantity, brood production, and worker mortality. Check for disease and mites. Small, healthy colonies can be combined, and queens with low fertility can be replaced with young queens, to increase probability of winter survival.
- Take steps to avoid starvation. Colonies in areas with cold winters need about 100 lbs. of honey stored to last the winter. If less than this is present in late fall, supplemental carbohydrates (sugar or candy board) can be fed to bees before winter. Sucrose supplement (syrup or candy) can be applied in late winter or spring if honey stores are light. High fructose corn syrup that is old, has been heated, or is no longer clear may contain levels of hydroxymethylfurfural (HMF) that are unsafe for bees. Do not feed bees starches which can cause dysentery over winter. Supplemental feeding with honey from an external source has been linked to disease spread.
- Keep the hive dry. Add ventilation near the top of the hive so humid air can escape.
- Keep the hive insulated and sheltered. Add insulation to the top of the hive, and keep the hive behind a windbreak and/or in a south facing location for the winter.
- Add an entrance reducer or mouse guard at hive entrances in the fall to prevent rodent damage.

Disease and pest management

Many pathogens are spread among managed colonies and from managed colonies to wild bees[3,4]. It is crucial to catch problems early, assess treatment effectiveness, and avoid unnecessary treatment. The following practices are recommended to track and prevent the spread of bee pathogens:

- Use a hive inspection sheet to keep track of regular hive health assessments[5]. The Wisconsin DATCP apiary program[6] offers free hive inspections May through October. Inspections include the identification of common pests and diseases as well as a visual check for exotic pests or diseases.
- Diagnose hive ailments and choose carefully among treatment options. A diagnostic field guide is available through Penn State University[7]. Disease diagnostic services are also available free of charge through the USDA Beltsville Bee Lab[8]. Read and follow all product label directions carefully when applying any disease or mite control products in beehives.
- Monitor for *Varroa* mite. *Varroa* mites weaken honey bees by feeding on their blood (hemolymph), and can transfer pathogens like deformed wing virus (DWV) and Israeli acute paralysis virus (IAPV) among colonies. Check for *Varroa* mites every 2-3 months using sticky boards, ether or powdered sugar rolls. As a suggested guideline, treat for *Varroa* when mite counts exceed 3-5 mites per 100 bees sampled. Visit the WDATCP Apiary webpage[9] for a list of current treatment options.
- Monitor for *Nosema* fungal pathogens. To check for *Nosema*, gut spores should be counted under a microscope; gut spore count > 1 million per bee warrants treatment.
- Monitor for foulbrood bacterial diseases. The mottled appearance of live intermixed with dead brood cells can indicate a number of ailments including European foulbrood and American foulbrood[10].
    - If foulbrood is suspected, contact the State Apiarist[6].
    - Foulbrood spores can remain viable for 40 years or more; burning the infected combs is the surest way to prevent its spread.
    - Resistance to the antibiotic Terramycin is a problem in some hives afflicted with American foulbrood. The USDA Beltsville Bee Lab[8] provides bee and comb testing for antibiotic resistance.
- Minimize pesticide use in hives. Pesticides added to the hive can accumulate in pollen, wax and honey[11]. Persistent use of miticides and other pesticides increases the likelihood of pesticide resistance, eventually rendering treatment ineffectual.
- Rotate out a portion of old brood comb every year to reduce pathogen buildup.

Communication with growers and neighbors

- Maintain positive and open relationships with growers who lease your hives for pollination.
- Negotiate a pollination fee, number of colonies per acre, and payment schedule.
- Agree upon timing of hive placement prior to crop bloom and colony removal after bloom.
- Discuss and determine the pesticide spray schedule and types of pesticides used (including insecticides, fungicides, and insect growth regulators (IGRs)). A helpful online tool[12] ranking pesticides and tank mixes by honey bee toxicity is available from University of California Statewide Agricultural & Natural Resources Integrated Pest Management Program (UC IPM).
- Use a contract that protects both the grower and beekeeper. A template contract based on USDA guidelines is provided by University of Florida Extension[13].
- Be aware of property boundaries. Public land agencies differ in their policies regarding managed species – some allow hives with a conditional use permit, and some do not allow them in any case. Public lands are often attractive areas for honey bee foraging, and beekeepers sometimes place hives on private land adjacent to natural areas.
- Be neighborly. If you are considering keeping hives near property lines, communicate your intentions with neighbors and be sensitive to their concerns about stings.
- Check with your local municipality for any beekeeping ordinances.

What is FieldWatch?

FieldWatch[14] is a non-profit organization that provides voluntary online mapping tools for crop producers, beekeepers, and pesticide applicators. Beekeepers can use the BeeCheck mapping tool to alert nearby pesticide applicators of their hives.

Additional concerns for commercial beekeepers

In addition to the management practices above, commercial and migratory beekeepers must also consider beehive stressors including long distance transportation, poor diets and overworking the bees.

- When transporting bees, maintenance of consistent temperature, ventilation and hydration are critical issues.
- Supplemental feeding of carbohydrates and/or protein may be necessary before and after crop bloom.
- Immediately report any suspected pesticide-related bee incidents to DATCP.
- No person may ship live honeybees or used beekeeping equipment into Wisconsin without first reporting the import shipment to DATCP in writing. The Honey Bee Import Report is available online[15]. Migratory beekeepers or bee haulers must be aware of Wisconsin and other state laws and regulations[16].

Other managed bee species

Several non-honey bee species are now commercially available for use in crop pollination. The bumble bee species *Bombus impatiens* is used in greenhouse crop pollination and solitary mason bee species (*Osmia spp.*) are used in orchard crops. Bumble bees are not affected by *Varroa* mite, but disease spread from managed bumble bees to wild bee populations is an issue[17,18]. See “Managing Alternative Pollinators” [19] for management considerations, and costs and benefits of managing alternative bee species.

Beekeeper survey data – Get involved!

In 2011, USDA's Bee Informed Partnership began surveying beekeepers across the U.S. to shed light on factors that may be associated with honey bee colony loss. See the table below for results compiled from five years of overwintering colony loss and beekeeping practices[20]. Note that these results describe correlations, and *cannot be used to show that certain practices cause or prevent loss.* Furthermore, results describe one-to-one correlations rather than the effect of multiple treatments together on colony loss. **This is an ongoing annual survey in which every beekeeper should participate (available each April at BeeInformed.org).**

This table is based on **Bee Informed Partnership surveys** for winter colony loss for years 2010/11 through 2014/15.

Note that these results describe correlations, and *cannot be used to show that certain practices cause or prevent loss.*

Below are practices that correlated, in at least three out of five years, with:

More colonies lost:	Fewer colonies lost:	No difference in number of colonies lost:
Supplemental feeding with honey frames Reusing old or diseased brood comb	*Varroa* mite treatment with thymol-based products (ApiGuard, ApiLife Var), oxalic acid, formic acid, or the miticide Amitraz *Varroa* mite treatment by removing drone brood or screen bottom board* Supplemental feeding with commercial protein patties Supplemental feeding with candy boards or dry sugar Small hive beetle traps Prepping hives for winter	*Varroa* mite treatment with coumaphos (CheckMite), fluvalinate (Apistan), Sucrocide, powdered sugar, or mineral oil *Varroa* mite treatment using comb with small cell size Foulbrood treatment using antibiotics Terramycin or Tylan Nosema treatment using Fumagillin or Nosevet Tracheal mite treatment with MiteAThol or grease patties Leasing colonies

*Keeping the screen bottom board in for the whole year was not correlated with higher losses than when removed for the winter.

Additional support

Organizations:

Wisconsin DATCP webpage with links to beekeepers' organizations: https://datcp.wi.gov/Pages/Programs_Services/ApiaryLinks.aspx

Local chapters of Wisconsin Honey Producers Association: http://wihoney.org/local-chapters

Get to know your local bee club. Some clubs hold workshops for new beekeepers, have equipment for rent, can assist in swarm removal, and are invaluable sources of information.

The University of Minnesota Bee Lab provides beekeeping courses, a how-to video series, research database, and more: http://www.beelab.umn.edu/

The California-based *Project Apis m.* provides a newsletter with updates on newest developments in beekeeping, as well as BMPs and a research database: http://projectapism.org/

Books and How-to's:

General handbook for new and experienced beekeepers:

- Sammataro, Diana, and Alphonse Avitabile. 2011. *The beekeeper's handbook, 4th ed.* Cornell University Press.

For beekeepers using bees for crop pollination:

- Delaplane, Keith S., Daniel R. Mayer, and Daniel F. Mayer. 2000. *Crop pollination by bees*. CABI.
- Almond Board of California. *Honey Bee Best Management Practices for California Almonds.* http://www.almonds.com/sites/default/files/content/attachments/honey_bee_best_management_practices_for_ca_almonds.pdf

USDA Pollination Handbook

- http://www.ars.usda.gov/SP2UserFiles/Place/20220500/OnlinePollinationHandbook.pdf

References

[1] Pollinator Partnership regional planting guides – use the “Eastern Broadleaf Forest Continental” guide for southern Wisc. and the “Laurentian Mixed Forest” guide for northern Wisc. http://pollinator.org/guides.htm

[2] The Xerces Society plant lists. http://www.xerces.org/pollinator-conservation/plant-lists/

[3] Colla, S. R., et al. 2006. Plight of the bumble bee: pathogen spillover from commercial to wild populations. *Biological Conservation*, *129*(4), 461–467.

[4] Graystock, Peter, et al. 2015. "Parasites in bloom: flowers aid dispersal and transmission of pollinator parasites within and between bee species." *Proc. R. Soc. B*. Vol. 282. No. 1813. The Royal Society.

[5] Example hive inspection sheet from Dadant & Sons, Inc.: http://pemibakerba.org/wp-content/uploads/2012/08/Hive-Inspection-Sheet.pdf

[6] To schedule an inspection for the upcoming season, contact Elizabeth Meils, State Apiarist, Wisconsin Department of Agriculture, Trade and Consumer Protection, PO Box 8911, Madison WI 53708-8911, (608) 224-4572, elizabeth.meils@wisconsin.gov

[7] Pennsylvania State University field guide for diagnosing hive ailments: http://extension.psu.edu/publications/agrs-116/view

[8] The USDA Beltsville Bee lab can test bees and comb for diseases and antibiotic resistance: http://www.ars.usda.gov/Services/docs.htm?docid=7473

[9] Wisconsin DATCP Apiary Program. “Pest & Disease Management of Honey Bees” https://datcp.wi.gov/Pages/Programs_Services/PestsDiseaseMgmtHoneyBees.aspx

[10] De Graaf, D.C., et al. 2006. “Diagnosis of American foulbrood in honey bees: a synthesis and proposed analytical protocols.” Letters in Applied Microbiology. http://naldc.nal.usda.gov/download/28123/PDF

[11] Mullin, Christopher, et al. 2010. "High levels of miticides and agrochemicals in North American apiaries: implications for honey bee health." *PLoS one* 5.3: e9754.

[12] University of California Statewide Integrated Pest Management Program. “Bee precaution pesticide rating” online tool: http://www2.ipm.ucanr.edu/beeprecaution/

[13] Template pollination agreement from University of Florida Extension, adapted from that found in the USDA Agriculture Handbook 496 and from *Crop Pollination by Bees*, by Delaplane and Mayer, 2000. https://edis.ifas.ufl.edu/aa169

[14] FieldWatch, DriftWatch and BeeCheck voluntary mapping tools: http://www.driftwatch.org/

[15] Wisconsin DATCP Apiary Program. “Wisconsin Honey Bee Import Report.” https://datcp.wi.gov/Pages/Programs_Services/MovingBeesintoWI.aspx

[16] Apiary Inspectors of America. “Laws and Regulations.” http://www.apiaryinspectors.org/laws/index.html

[17] Morkeski, A. and A.L. Averill. 2010. “Managed pollinator CAP-coordinated agricultural project: Wild bee status and evidence for pathogen ’spillover’ with honey bees”. American Bee Journal. http://www.beeccdcap.uga.edu/documents/CAPArticle11.html

[18] Otterstatter, M.C., and J.D. Thomson. 2008. "Does pathogen spillover from commercially reared bumble bees threaten wild pollinators?." *PLoS One*3.7: e2771.

[19] Mader, Eric, Marla Spivak, and Elaine Evans. 2010. "Managing Alternative Pollinators : A Handbook for Beekeepers, Growers and Conservationists." http://www.sare.org/Learning-Center/Books/Managing-Alternative-Pollinators

[20] Bee Informed Partnership annual beekeeper survey results. https://beeinformed.org/results/