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managing-pests-disease

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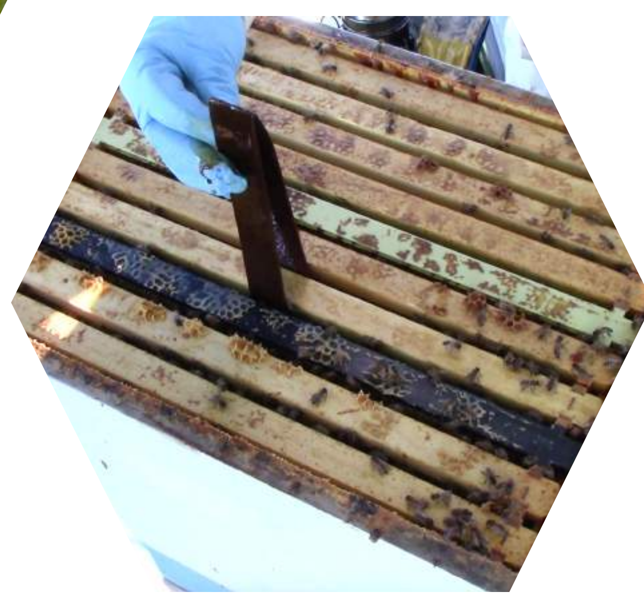
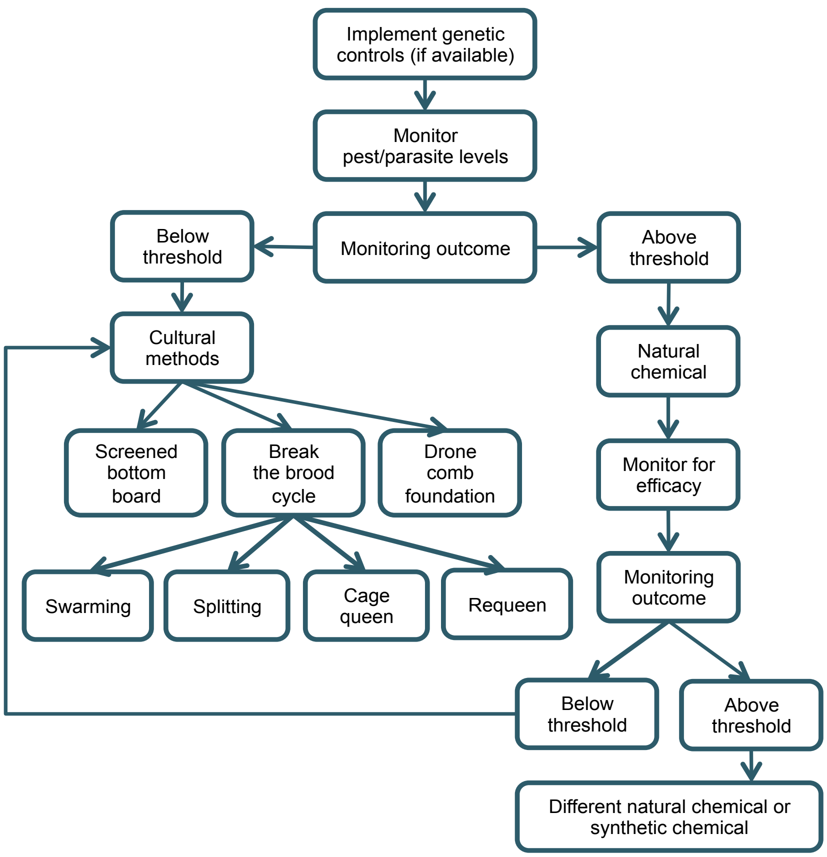
Resources for Integrated Pest Management (IPM) and Varroa Mite Control



Integrated Pest Management

Integrated Pest Management (IPM) is a strategy for maintaining a pest or parasite population below its economic threshold through the coordinated use of one or more methods. The economic threshold is the pest/parasite density at which one can expect economic damage (loss in honey production or colony death) if the beekeeper does not intervene with treatments or other control methods.

IPM Decision Making Tree for *Varroa*



IPM Programs Minimize Treatments

IPM programs seek to minimize the use of chemical treatments and antibiotics and to eliminate their use when possible. Minimizing chemical treatments ensures the purity of hive products, extends the time it takes for parasites to develop resistance to treatments, and limits potential negative impacts on bees and the environment. IPM can prolong the time it takes for pests to reach the economic threshold that requires chemical treatment.

Beekeepers can use genetic controls at all times, regardless of the pest population levels. Monitoring regularly is key to IPM, as treatments should only be applied when colonies need them. Cultural practices can be implemented to reduce parasite and pathogen loads. Finally, chemical treatments (natural or synthetic) should be used only when pest levels exceed the economic threshold.

Monitoring again post-treatment will inform you of the efficacy of the treatment used.

Monitoring Frequency

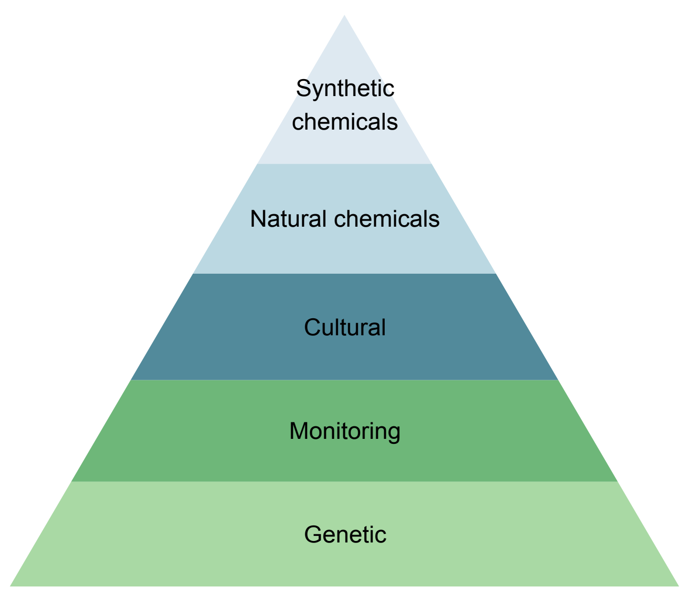
***Varroa* mites:** Monitor once every month between April and October. There are three options that have been shown to reliably correlate with overall mite population in the colony. These methods are the ether roll, the powdered sugar shake, and the alcohol wash.

***Nosema*:** Monitor once in the spring (before supering) and once in the fall (after removing honey crop).

American Foulbrood: Monitor once in the spring, once following honey crop removal, and once before winterizing colonies.

Samples can be sent to the USDA Beltsville Bee Lab in Maryland for a free analysis of *Varroa*, *Nosema* and American Foulbrood.

Pyramid of IPM Practices



Using genetic stocks to reduce *Varroa* mite loads

Stock	Description of the behavior	Institution that selected or imported stock	Mite life stage affected
Varroa-sensitive hygienic (VSH) bees	• Bees uncap and remove or chew infested pupae; immature mites die	USDA Bee Breeding Laboratory in Baton Rouge, Louisiana Minnesota Hygienic Line, University of Minnesota	Reproductive
Grooming behavior bees	• Bees remove mites from their own bodies and/or their nestmates' bodies • Stocks with grooming behavior also tend to express VSH behavior	Clemson University, South Carolina (still in development)	Phoretic
Ankle Biter bees	• Bees remove mites from their bodies and bite mites' legs off; mites can no longer attach onto bees	Purdue University, Indiana	Phoretic
Russian bees	• Russian bees encountered mites nearly a century ago and have had more time to naturally develop tolerance • They have increased VSH behavior and cease brood production (causing a break in the brood cycle) in times of food shortage	Imported by the USDA Bee Breeding Laboratory in Baton Rouge, Louisiana	Reproductive

Notes:
Phoretic mites: adult mites present on bee bodies
Reproductive mites: reproducing mites present in capped pupae

Q. I'm only going to try new stock in some of my colonies. How do I introduce this new stock?

When introducing new stock in a subset of your colonies, it will be most effective if these colonies are kept in a separate yard from colonies with non-*Varroa* tolerant/resistant stock. Having these colonies in the same yard can reduce the stock efficacy as drifting and robbing can introduce high mite pressure into resistant/tolerant stock colonies.

Q. I like my current bees and prefer local stock. Can I select for my own mite resistant stock?

Yes! There are two ways to do this:

Option 1: When monitoring *Varroa* mites in your bee yard, move any colonies that are above the treatment threshold to a separate yard and treat them individually. Keep low mite colonies in your original yard; these low mite colonies will be the ones from which you raise queens. Continue to move high mite colonies to this separate yard for 1-2 years, each time that you find some are above the economic threshold. You will be left with some colonies (now your breeder queen colonies) in your original bee yard that have maintained low levels of mites for 1-2 years.

Option 2: When monitoring *Varroa* mites in your bee yard, move any colonies that are above the treatment threshold to a separate yard - **isolated by a few miles from other colonies** - but do not treat them. Continue to monitor these moved colonies for 1-2 years. Any colonies that are able to survive the mite pressure may have begun developing resistance to mites. Raise queens from these colonies.

Important note for both options: Having colonies with high mite loads near other colonies can be a risk to those colonies with low mite loads. Drifting and robbing can introduce mites into colonies. It is important to keep colonies for breeding separate from your other hives and your neighbors' hives.

Varroa mite cultural practices

Method	How It Works	Months	Notes
Drone comb frame	• Mites prefer to reproduce in drone comb and crawl inside right before cells are capped. • Insert frame in position 2 or 3 of brood nest. Remove while drones are capped (between day 10 and 24). Freeze the frame for 24 hours and reinsert.	April – August	• Don't forget to remove the frame before drones emerge or you will accidentally increase mite levels. • Drones are produced most in spring and early summer and less in late summer and autumn. • This method is not ideal if your goal is queen rearing. A surplus of drones is needed for mating.
Removing drone brood	• Mites prefer to reproduce in drone comb. While inspecting colonies, destroy/scrape off any drone comb with your hive tool.	April – August	• Drones are produced most in spring and early summer and less in late summer and autumn. • This method is not ideal if your goal is queen rearing. A surplus of drones is needed for mating.
Screened bottom board	• Screened bottom board sits beneath the hive in place of bottom board. It catches mites that fall off bees and prevents them from crawling back up onto bees. • This approach is only effective together with other *Varroa* control methods.	April – October	• Screened bottom board provides additional ventilation. • In the Northeast it is recommended to remove screened bottom board before winter. In warmer regions, or areas protected from wind, screened bottom boards may be left on all year round
Small colonies with few honey supers	• Colonies that have small populations in smaller cavities produce less brood and have reduced mite levels.	Year round	• This method is not ideal if your goal is honey production.
Colony spacing	• Drifting bees comprise around 30% of bees in colonies that are close together. Wild colonies are spaced far apart in nature. Crowding hives close together increases mite levels. • Spacing colonies more than 10 feet apart can help reduce mite transmission.	April – November	• This method is dependent on land availability and may be more appropriate for hobbyists or sideliners with fewer hives. • Colonies can be overwintered close together, as there is no drifting/robbing during this time.
Brood interruption techniques			
Swarming	• Allowing colonies to swarm provides a natural break in the brood cycle.	April – June	• Most swarms occur in spring and early summer, fewer occur in late summer and early fall. Swarms must be caught.
Splitting	• Strong colonies can be split into two smaller colonies. The colony without the original queen experiences a brood break. Many beekeepers will requeen both colonies.	April – July	• Colonies split in late summer or early fall might be too small to overwinter successfully.
Requeening	• Requeening colonies offers a break in the brood cycle. The break is longest if a queen cell is introduced instead of a mated queen.	April – July	• Benefits are maximized if requeening with tolerant/resistant stock.
Caging the queen	• Cage queen for 1-2 weeks to break the brood cycle. Release the queen after this time to allow her to return to egg laying.	April – July	• Caging the queen in late summer or early fall can interrupt the production of winter bees.

Varroa mite control options and considerations

Essential oil   Organic acid   Synthetic chemical

Chemical	Active Ingredient	Method	Efficacy when used appropriately	Cost per colony ($)	Treatment duration	Can you treat with supers on?	Time to wait after treatment ends before you can super
Apiguard®	Thymol	Tray with gel sits on brood frames	74-95%	3.30 - 6.80	28 days	No	Can super immediately after treatment ends
Api Life Var®	Thymol, eucalyptus oil, menthol	Tablets placed on the corners of the brood nest	70-90%	4.48 – 7.12	26-32 days	No	1 month
MiteAway Quick Strips®	Formic acid	Pads placed on brood nest	61-98%	4.40 – 7.25	7 days	Yes	Supers can be left on during treatment
Oxalic Acid	Oxalic acid dehydrate	Dribble brood nest or vaporize entrance	82-99%	0.25 – 0.37	10 minutes	No	2 weeks
Hop Guard II®	Hops beta acids	Strips inserted in brood nest	75-99%	3.33 – 3.80	30 days	Yes	Supers can be left on during treatment
Apivar®	Amitraz	Insert strips into brood nest	95%	5.00 – 6.90	42-56 days	No	2 weeks
Apistan®	*Tau*-fluvalinate (pyrethroid)	Insert strips into brood nest	95-99%	4.19 – 6.79	42-56 days	No	Can super immediately after treatment ends

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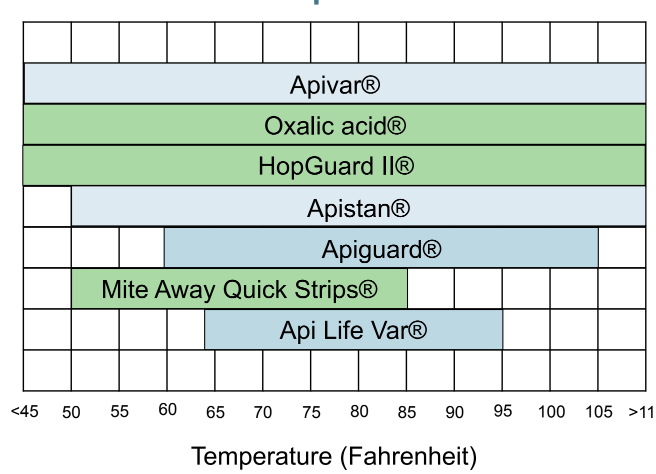
- There have been cases of resistance in Apistan®. *Varroa* mites can develop resistance to any treatment, therefore it is important to rotate treatments, remove treatment strips promptly, and practice Integrated Pest Management to reduce the likelihood of resistance developing. Make sure you monitor following treatment (or regularly every month) to determine efficacy.
- Efficacy levels are cited from **Honey Bee Health Coalition, 2017. Tools for *Varroa* management: a guide to *effective Varroa* sampling and control, 5th edition.**
- Treatment costs per colony vary depending on supply companies and order size.

Treatment Temperature Windows



Varroa mite control options throughout the year

☐ honey supers not present ☐ honey supers present

Month	Colony conditions	Threshold (mites/100 bees)	Cultural/Genetic Options	Natural chemicals	Synthetic chemicals
April	Colony population increase Brood present Drone production	2	Requeen with hygienic stock Drone brood removal Splits/artificial swarms Colony spacing Cage queen	Apiguard® Api Life Var® MiteAway Quick Strips® Oxalic acid (packages only	Apivar® Apistan®
May	Colony population increase Brood present Drone production	2	Requeen with hygienic stock Drone brood removal Splits/artificial swarms Colony spacing Cage queen	Apiguard® Api Life Var® MiteAway Quick Strips® Oxalic acid on packages only	Apivar® Apistan®
June	Colony population increase Brood present Drone production	2	Requeen with hygienic stock Drone brood removal Splits/artificial swarms Colony spacing Cage queen	MiteAway Quick Strips® Hop Guard II®	
July	Colony population peak Brood present Drone brood present	2	Requeen with hygienic stock Drone brood removal Splits/artificial swarms Colony spacing Cage queen	MiteAway Quick Strips® Hop Guard II®	
Aug	Colony population peak Brood present Fewer drones produced	3	Requeen with hygienic stock Colony spacing Cage queen	MiteAway Quick Strips® Hop Guard II®	
Sept	Colony population peak Brood present Fewer drones produced	3	Requeen with hygienic stock Colony spacing Cage queen	MiteAway Quick Strips® Apiguard® Api Life Var® Hopguard II®	Apivar® Apistan®
Oct/ Nov	Population decrease Little to no brood	3	Colony spacing Cage queen	Oxalic acid Hop Guard II®	
Dec - March	Bees are clustering Broodless Too cold to open colonies	3		Oxalic acid (fumigation only)	

Notes:
HopGuard II® and Oxalic acid are most effective when colonies are broodless