A Beekeeper's Primer on Varroa Destructor

Massively **I**rritating **T**iny **E**ight-legged

Brad Price

What is the most likely killer of your bees?

1. The Beekeeper!!!

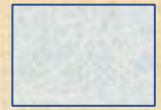
2. Varroa Destructor

Sources:

Slide Key

- Marion Ellis – Professor Emeritus University of Nebraska
  - Effective Use of Oxalic Acid to Suppress Varroa https://www.youtube.com/watch?v=q4WvPNmS7uc

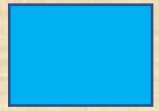
- Ralph Büchler Kirchhain Bee Institute 2019 National Honey Show
  - Varroa Resistance Characters and Selection Protocols https://www.youtube.com/watch?v=KwuR3uMkMF0
  - Environmental Adaptation of Honey Bees https://www.youtube.com/watch?v=4DVm_L7Fkqc&t=3s
  - Sustainable Varroa Management https://www.youtube.com/watch?v=tuJlgzcQWAg&t=404s
  - Understanding Bee Colony Biology https://www.youtube.com/watch?v=1mC9R1e-tn4&t=179s



- Meghan Milbrath - Michigan State University
  - Why Did My Honey Bees Die? https://www.youtube.com/watch?v=ZWtSbVXqO_Y&t=995s
  - Understanding Varroa Risk https://www.youtube.com/watch?v=4Ulul1iUN88
  - Making A Plan For The Varroa Mite https://www.youtube.com/watch?v=km541EtCjbY

- Randy Oliver – Scientific Beekeeping
  - http://scientificbeekeeping.com/varroa-management/
  - http://scientificbeekeeping.com/how-to-perform-an-alcohol-wash/
  - http://scientificbeekeeping.com/oxalic-acid-treatment-table/

- Judy Wu-Smart – UN-L Bee Lab
  - http://www.abfconference.com/images/2020/Presentations/Small-ScaleSideliner_SIG_-_Integrated_Pest_Management_for_Varroa_Mites_-_Judy_Wu-Smart.pdf



How to effectively and safely use oxalic acid to reduce varroa populations

Marion Ellis

Professor Emeritus

University of Nebraska

Department of Entomology

Varroa mite

- *Varroa destructor*
- First detected in U.S. in 1987
- Obligate parasite of honey bee
- Feeds on both adult bees and brood
- Loss of feral bee population
- Injury to managed bees

Deformed Wing Virus

Ralph Büchler

Kirchhain Bee Institute

2019 National Honey Show

Varroa Resistance Characters and Selection Protocols:
https://www.youtube.com/watch?v=KwuR3uMkMF0

Environmental Adaptation of Honey Bees

https://www.youtube.com/watch?v=4DVm_L7Fkqc&t=3s

Sustainable Varroa Management

https://www.youtube.com/watch?v=tuJlgzcQWAg&t=404s

Understanding Bee Colony Biology

https://www.youtube.com/watch?v=1mC9R1e-tn4&t=179s

Varroa Resistance Characters and Selection Protocols (Part 1 of 4) Ralph Büchler

Press Esc to exit full screen

Landesbetrieb Landwirtschaft Hessen

Varroa resistance in *Apis cerana*

- Grooming
- Unattractiveness & removal of worker brood
- Seasonal reproduction in drone brood
- Entombing of parasitized drone cells
- Swarming & absconding

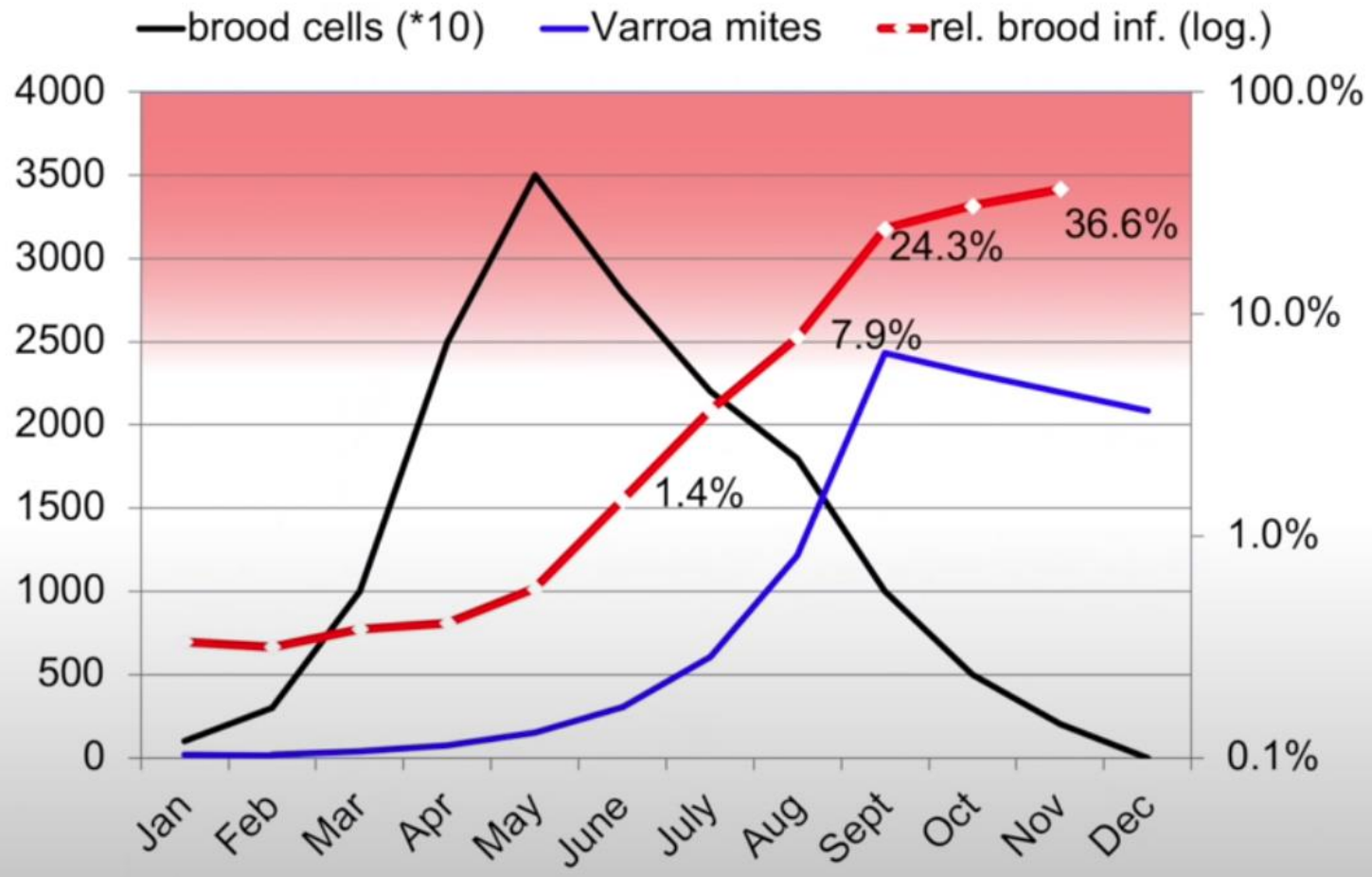
www.LLH.hessen.de

Kompetenz für Landwirtschaft und Gartenbau LLH

5:44 / 1:01:50

Landesbetrieb Landwirtschaft Hessen

Development of brood and mite infestation in non swarming hives



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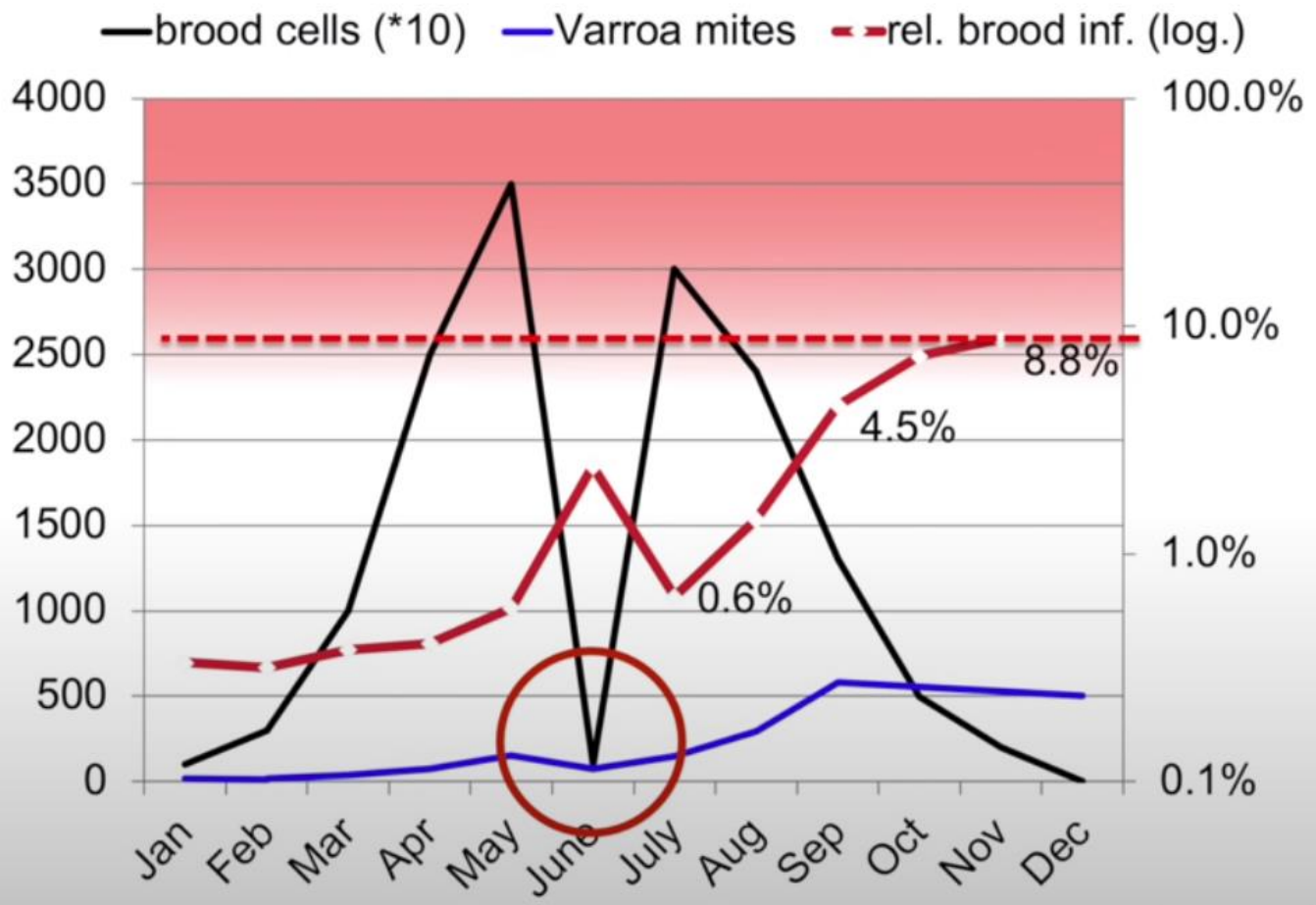
We should learn from natural swarming



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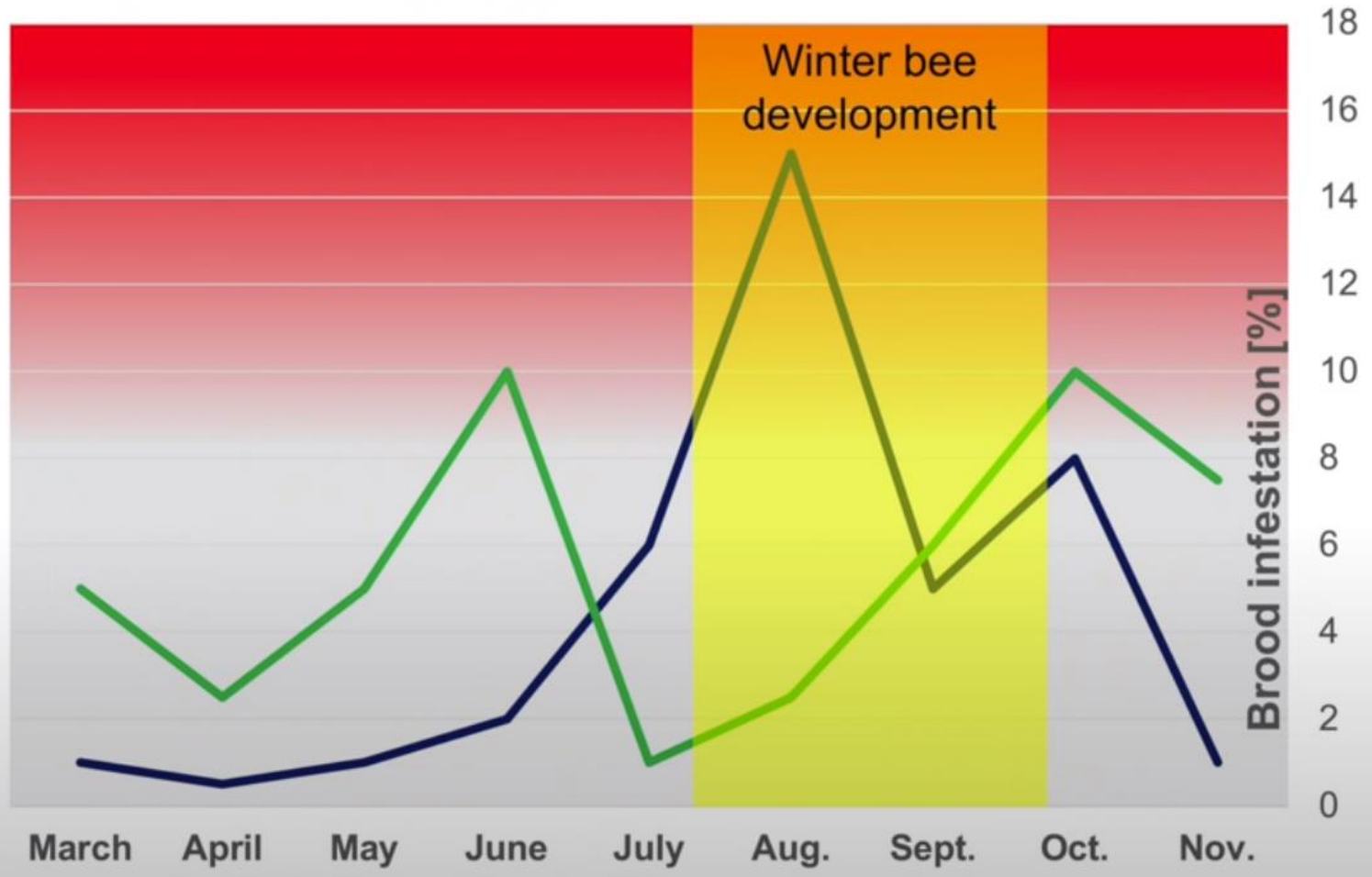
Landesbetrieb Landwirtschaft Hessen

Comparison of classical and near-natural treatment



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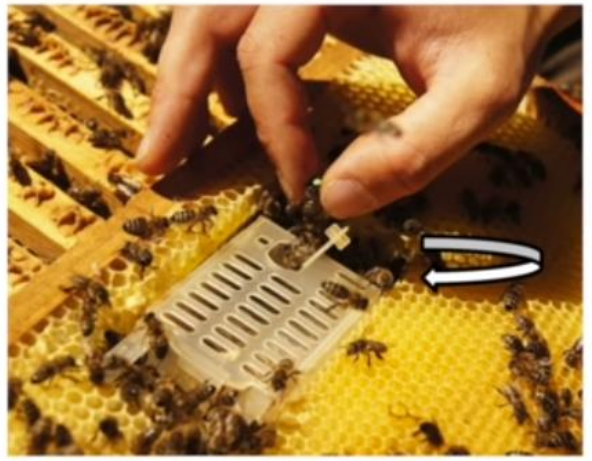
Queen caging combined with a treatment

Caging of the queen

Brood interruption

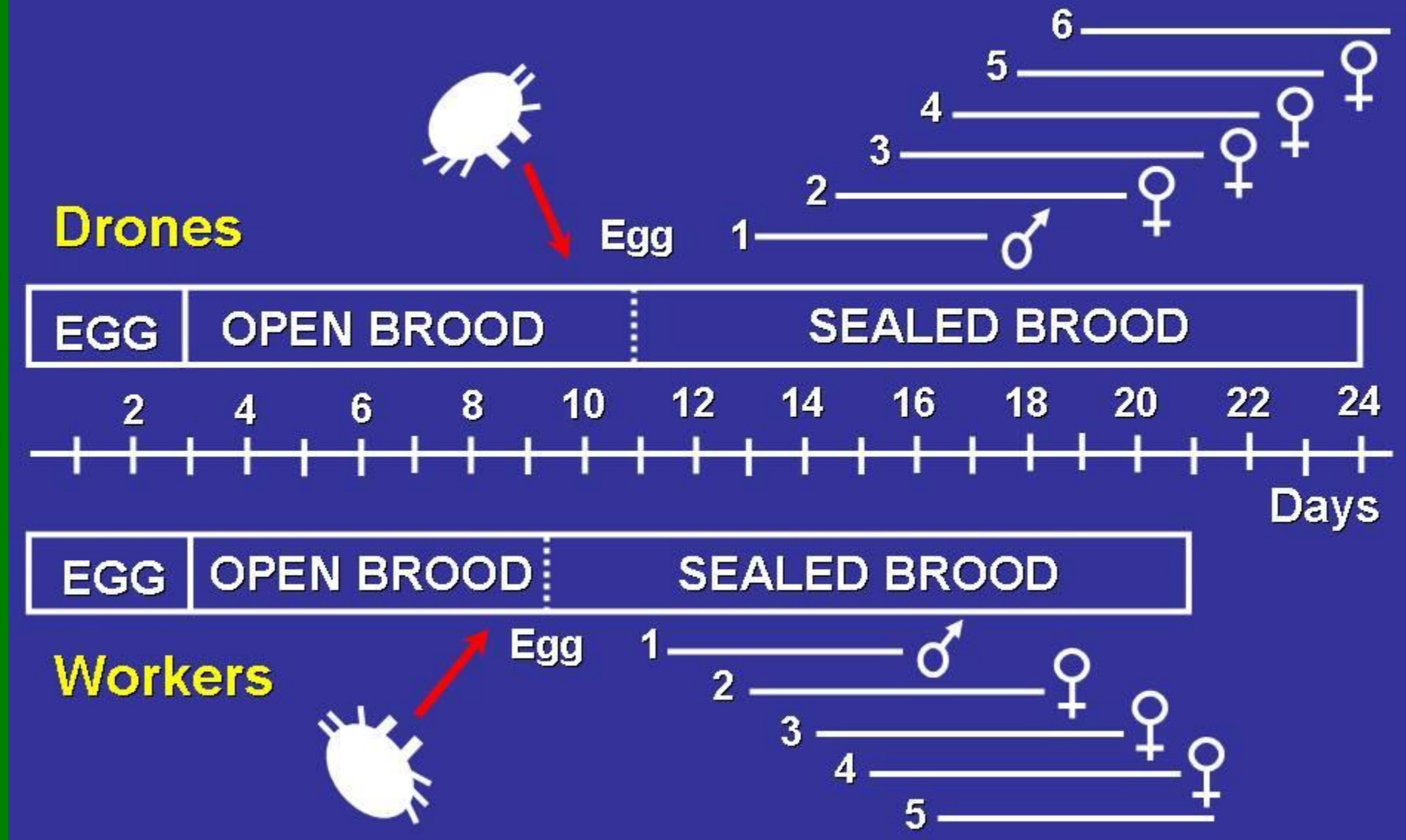


25 days caging period

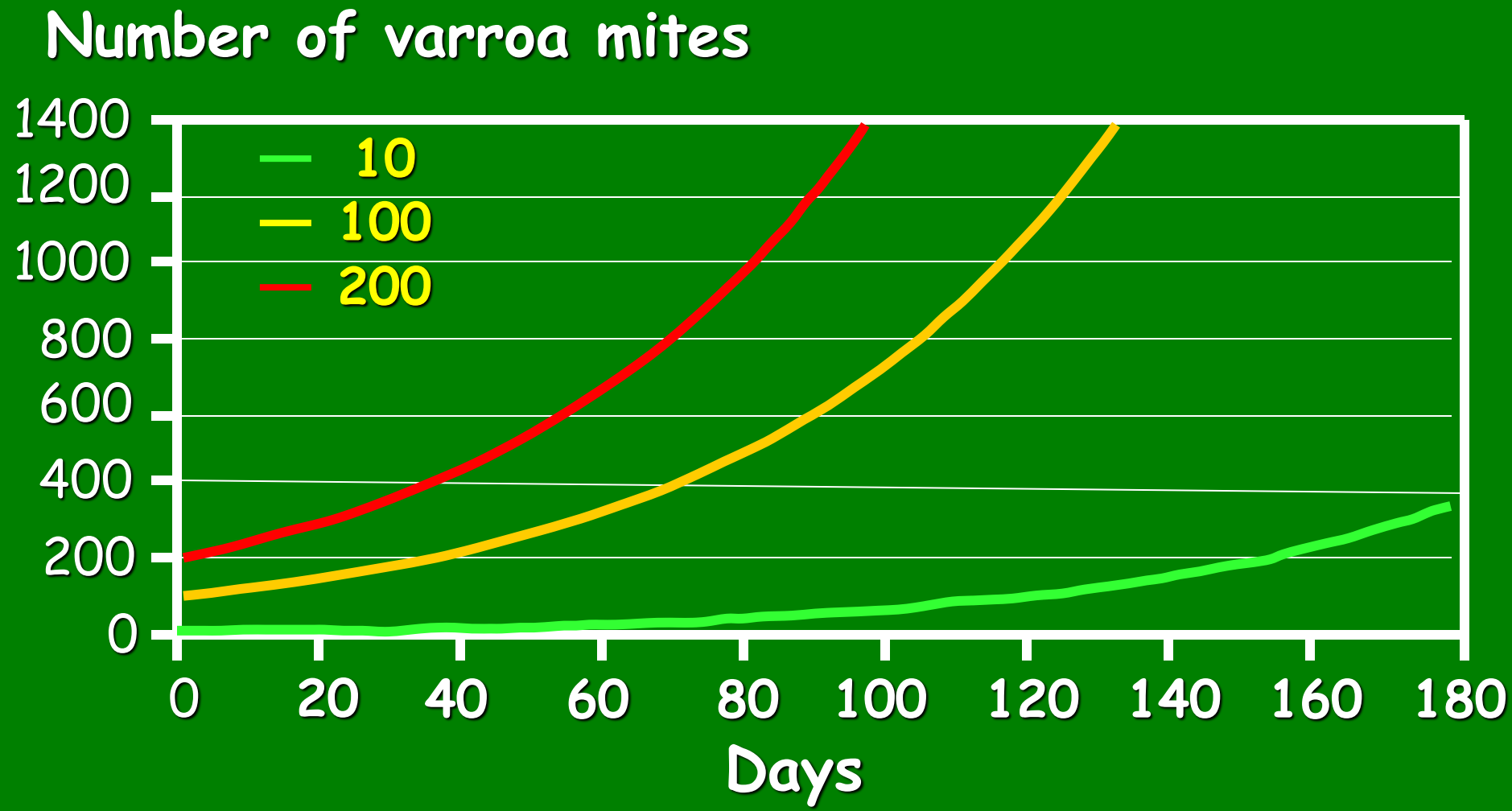
Treatmant of

Oxalic acid

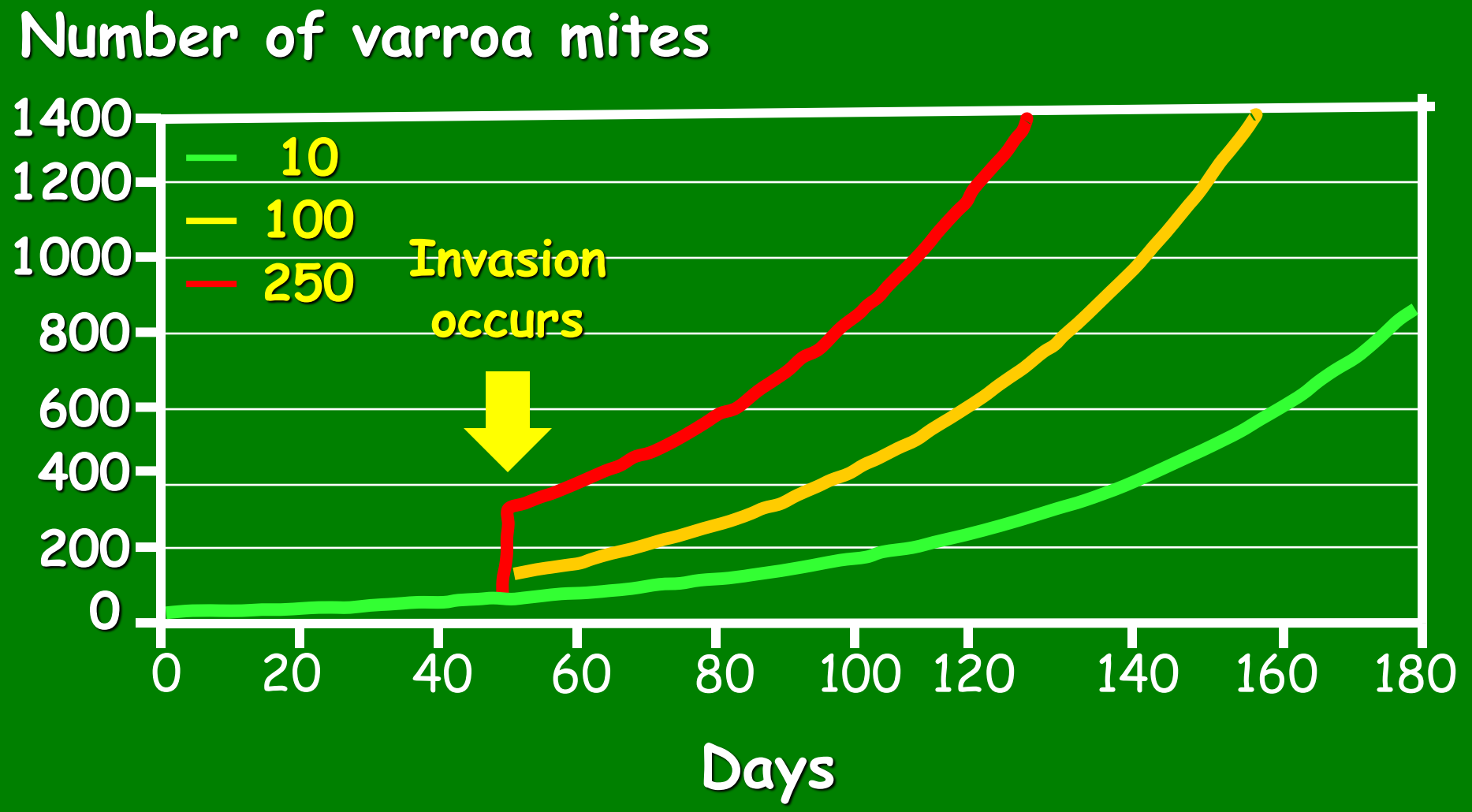
brood free colony


Drones
Egg
1
2
3
4
5
6
EGG
OPEN BROOD
SEALED BROOD
2
4
6
8
10
12
14
16
18
20
22
24
Days
EGG
OPEN BROOD
SEALED BROOD
Workers
Egg
1
2
3
4
5

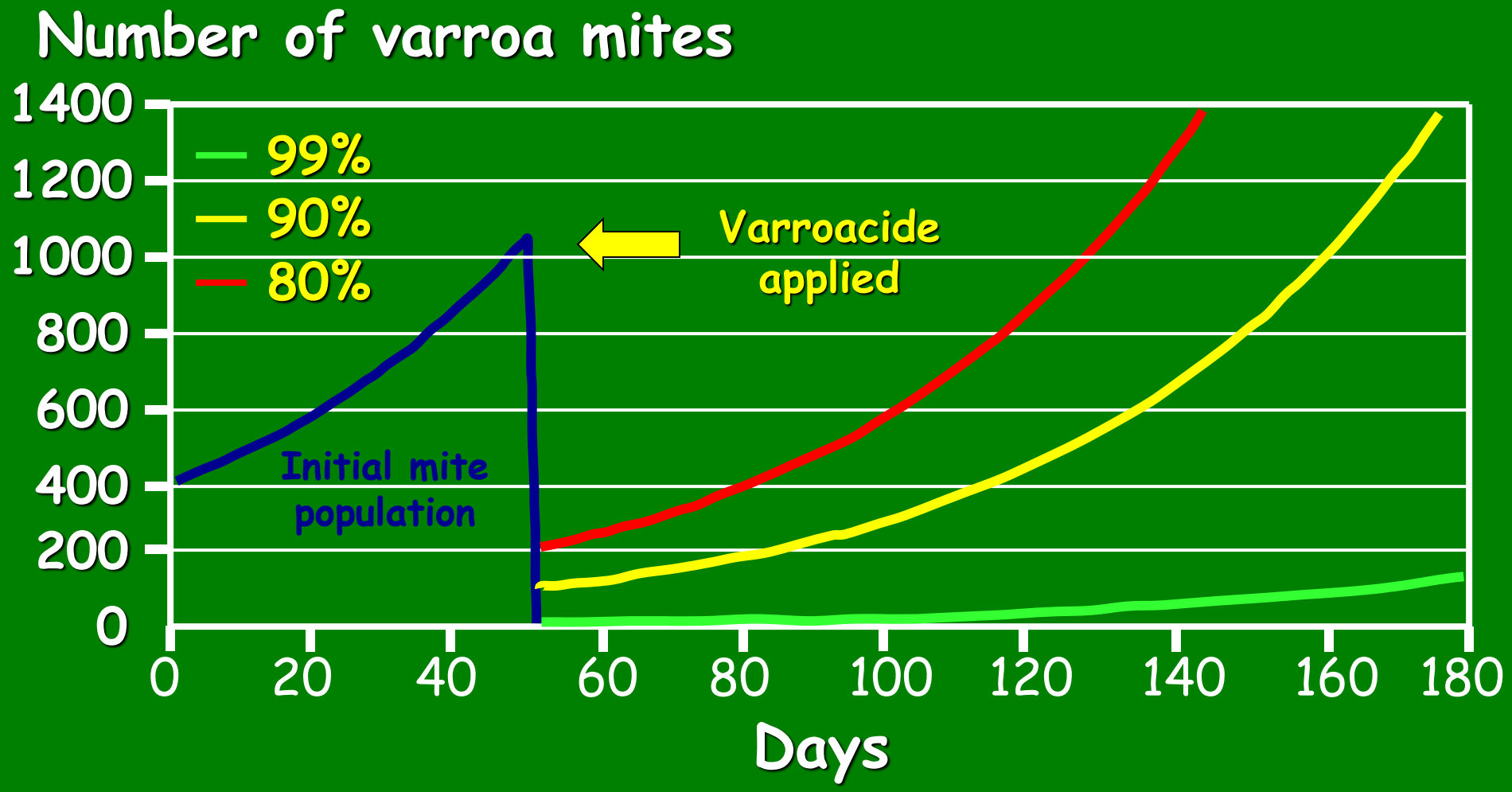
Initial mite numbers and subsequent population growth

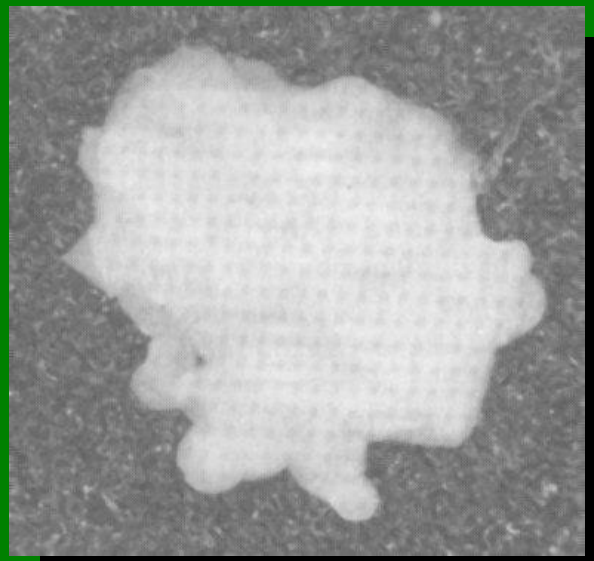


Effects of mite invasion on subsequent mite population growth



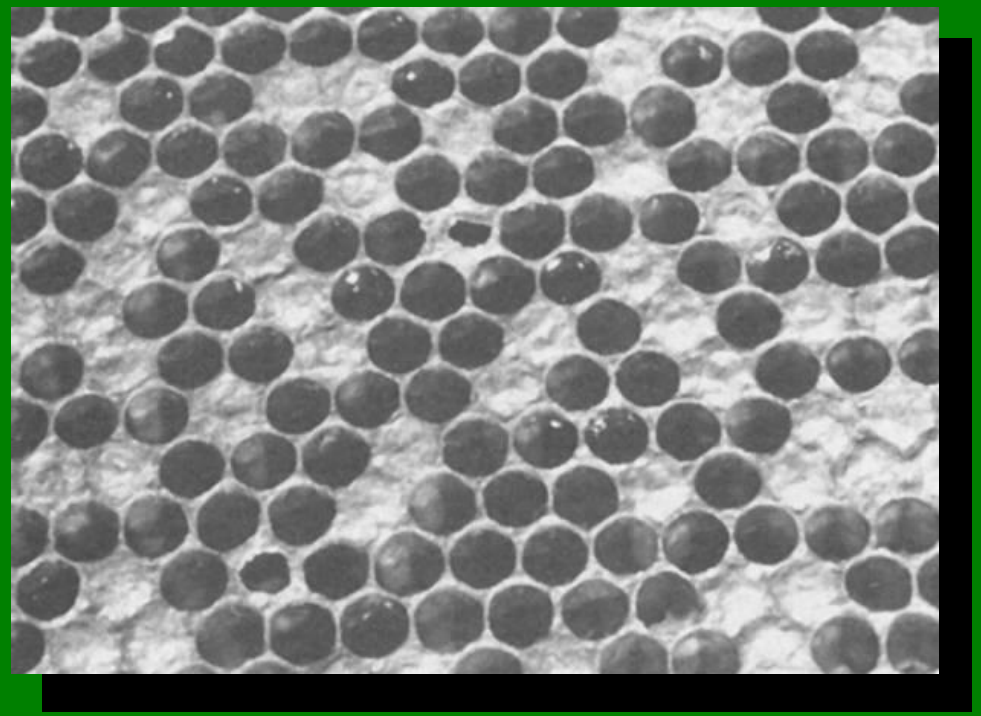
Effects of treatment efficacy on subsequent mite population growth



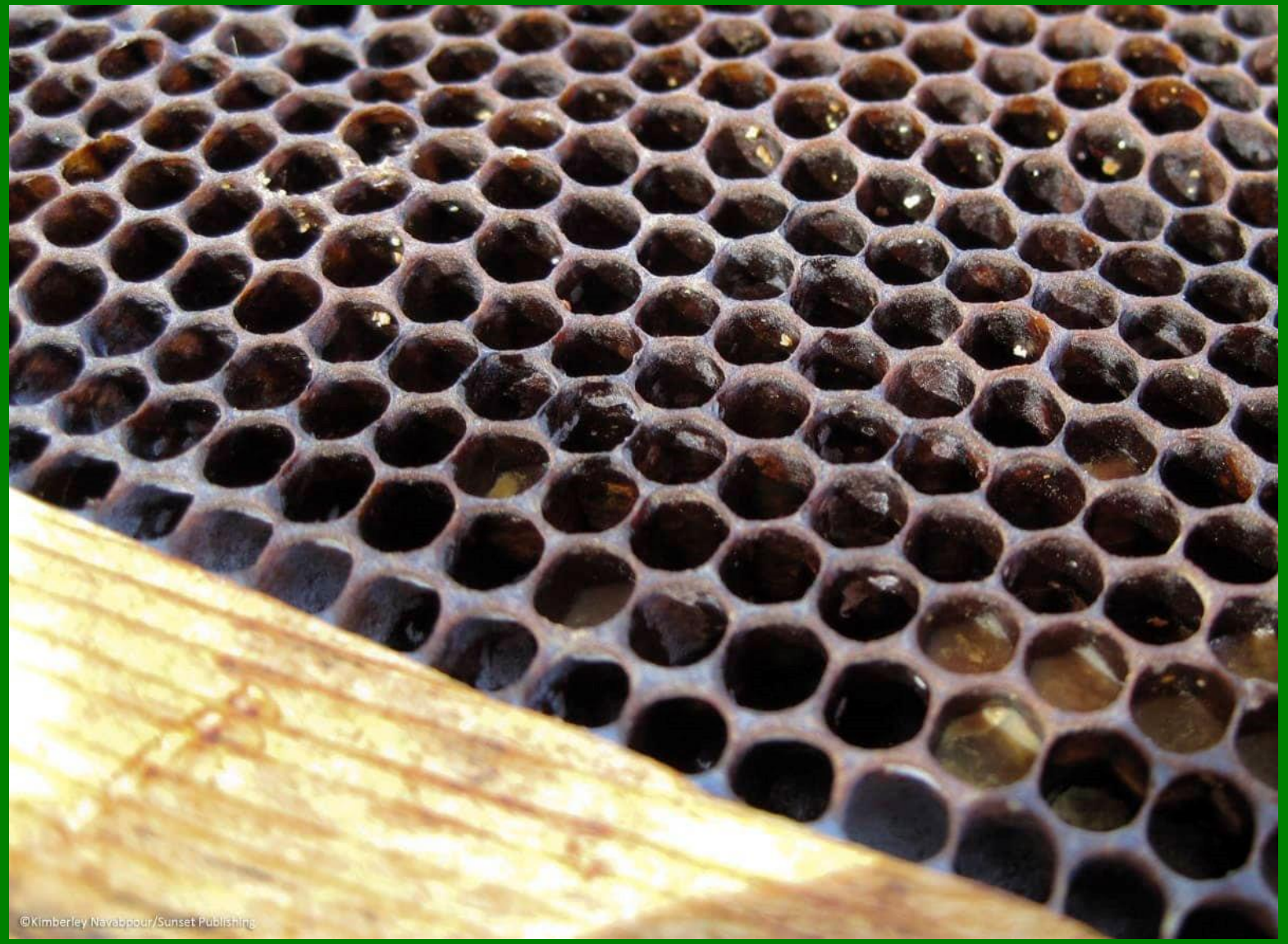


Dead colony assessment

Varroa feces, a white amorphous mass



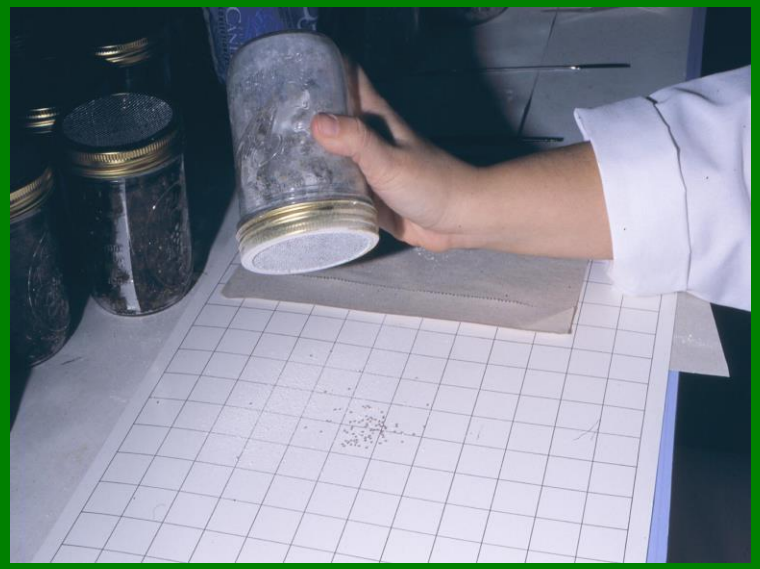
Feces are deposited on the ceiling of the cell wall

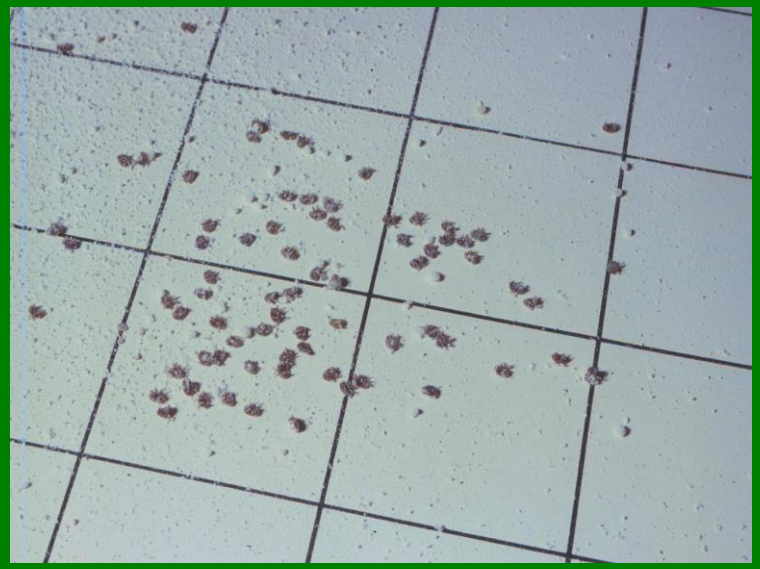

©Kimberley Navabpour/Sunset Publishing

Varroa Monitoring and treatment

1. Monitor
   - Alcohol wash
   - Sugar roll
   - If above 3% (9 mites per 300 bees)
2. Treat
   - Chemical methods
   - Non-chemical methods
3. Monitor

Live colony assessment
Sugar Roll





https://pollinators.msu.edu/resources/beekeepers/varroa-mite-monitoring1/

Live Colony Assessment
Alcohol Wash

Approximately 300 bees will die during this test …

http://scientificbeekeeping.com/varroa-management/

http://scientificbeekeeping.com/how-to-perform-an-alcohol-wash/

https://www.betterbee.com/instructions-and-resources/how-to-use-the-varroa-easycheck-sampling-method.asp

OA in plants & insects

- Defensive chemical
  - Insect repellent in some plants (rhubarb, broccoli, turnips, kale, radishes)
  - Predator repellent in some insects (box elder bug)
- Some vegetables contain between 300 and 17,000 mg/kg oxalic acid

EMEA 2004

OA in residues honey & wax

- Natural constituent of honey (8 to 300 mg/kg)
- Many vegetables contain much more oxalic acid than honey
- Low risk of residues in honey
- Hydrophilic (not found in beeswax)

Bernardini and Gardi 2001

Methods of application

- Oxalic acid is applied by trickling, or evaporating
  - Trickling is the preferred application method in Europe and Canada
  - Effectiveness greater than 90%
- Mechanism of acaricidal action has not been determined

Directions for use - trickling

- Prepare a solution by dissolving 35 grams of oxalic acid in 1 liter of lukewarm sugar water (1:1 solution)
- Treat in autumn or early spring (when little or no brood is present)
  - Most effective in broodless colonies
  - Treat when temperature is between 35 – 55 F. (when bees are in a loose cluster)
  - Wear protective equipment

OA Trickle Treatment considerations

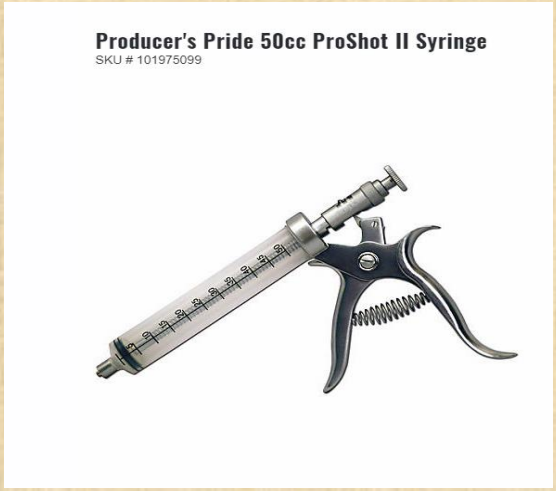
- Mix fresh
- Do not treat weak or starving colonies
- Do not use thick syrup (use 1:1)
- Treatments when brood is present are ineffective
- Treat when temps are above freezing and below 55 F (when loosely clustered)
- Do not mix and store for more than a week
- Do not treat when honey supers are in place

Trickle treatment

5-6 ml trickled between occupied frames

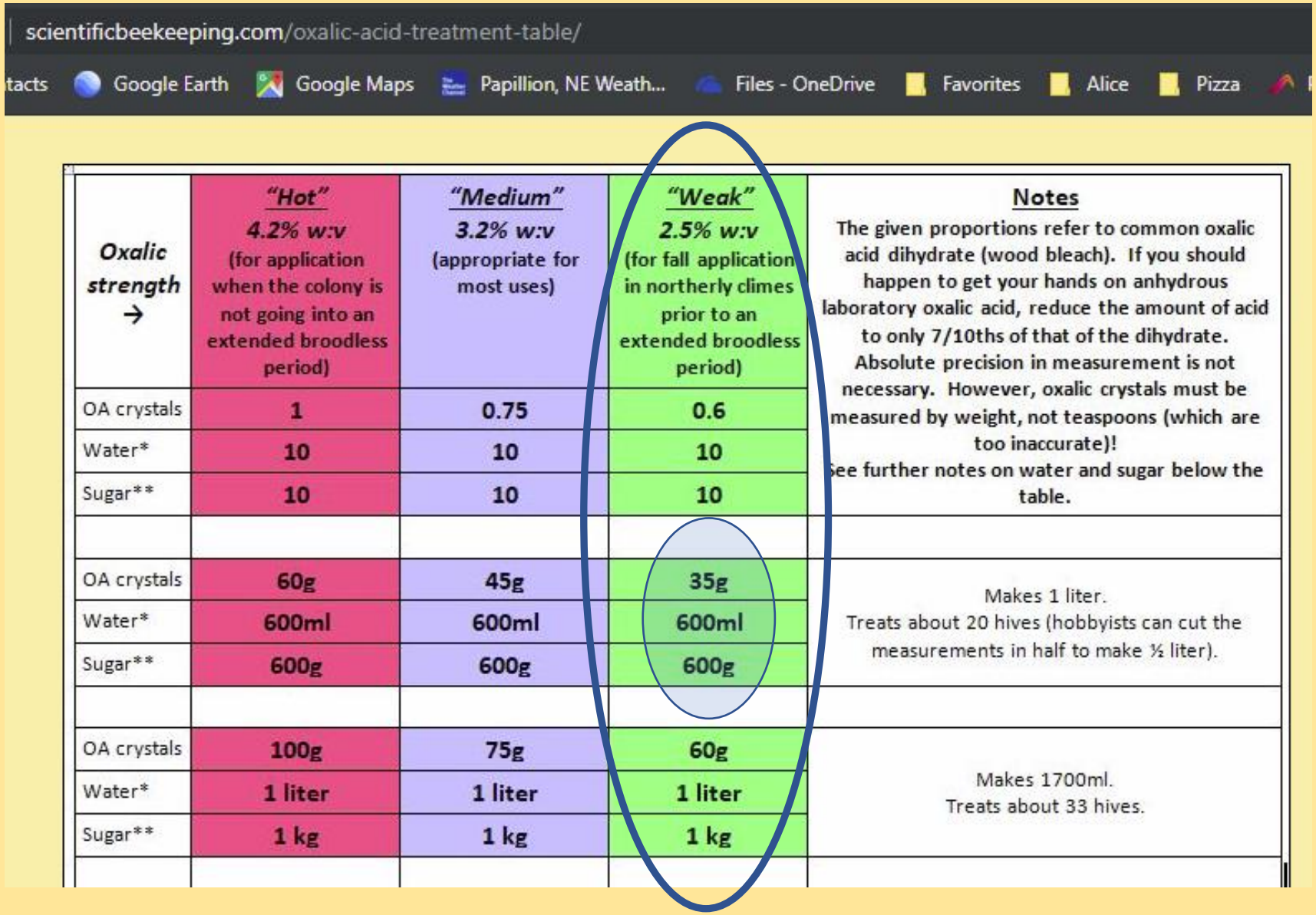
1.5 minutes per colony to apply

Oxalic Acid Dribble



https://www.dadant.com/catalog/medications/oxalic-acid-m01758

Mixing Oxalic Acid for Winter Treatment



Oxalic strength →	"Hot" 4.2% w:v (for application when the colony is not going into an extended broodless period)	"Medium" 3.2% w:v (appropriate for most uses)	"Weak" 2.5% w:v (for fall application in northerly climes prior to an extended broodless period)	Notes
OA crystals	1	0.75	0.6	The given proportions refer to common oxalic acid dihydrate (wood bleach). If you should happen to get your hands on anhydrous laboratory oxalic acid, reduce the amount of acid to only 7/10ths of that of the dihydrate. Absolute precision in measurement is not necessary. However, oxalic crystals must be measured by weight, not teaspoons (which are too inaccurate)! See further notes on water and sugar below the table.
Water*	10	10	10	
Sugar**	10	10	10	
OA crystals	60g	45g	35g	Makes 1 liter. Treats about 20 hives (hobbyists can cut the measurements in half to make ½ liter).
Water*	600ml	600ml	600ml	
Sugar**	600g	600g	600g	
OA crystals	100g	75g	60g	Makes 1700ml. Treats about 33 hives.
Water*	1 liter	1 liter	1 liter	
Sugar**	1 kg	1 kg	1 kg	

http://scientificbeekeeping.com/oxalic-acid-treatment-table/

Amount of solution to apply

- Five frame nucleus – 30 ml
- Single story colony – 40 ml
- Double story colony - 50 ml

How is OA distributed in colony

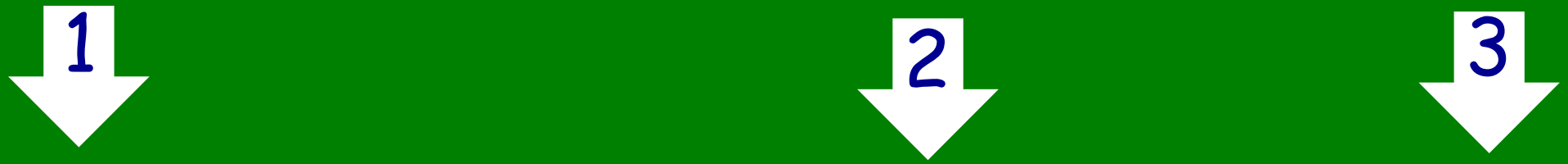
- Treated syrup is not consumed intentionally
- Treated syrup spilled on top bars will be there untouched the next day
- Syrup makes solution adhere to bee's bodies
- OA in water beads off bees and is ineffective

Oxalic acid vaporization

- 1 gram singles, 2 grams doubles
- ¼ teaspoon = 1 gram
- Seal entrances while treating and for 15 minutes post treatment
- Allow 2.5 minutes to evaporate (be sure to disconnect power when done)
- Cool thoroughly before reloading

Oxalic acid vaporization

How to create a break in the brood cycle using a mated queen



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

1. Cage queen on day 1
2. Release queen day 14
3. Treat day 21

How to create a break in the brood cycle using a queen cell

21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

4

1. Remove queen day one
2. Cut out queen cells days 4 and 8
3. Insert ripe queen cell day 8
4. Treat day 21

2

3

1

Meghan Milbrath
Michigan State University

Why Did My Honey Bees Die?

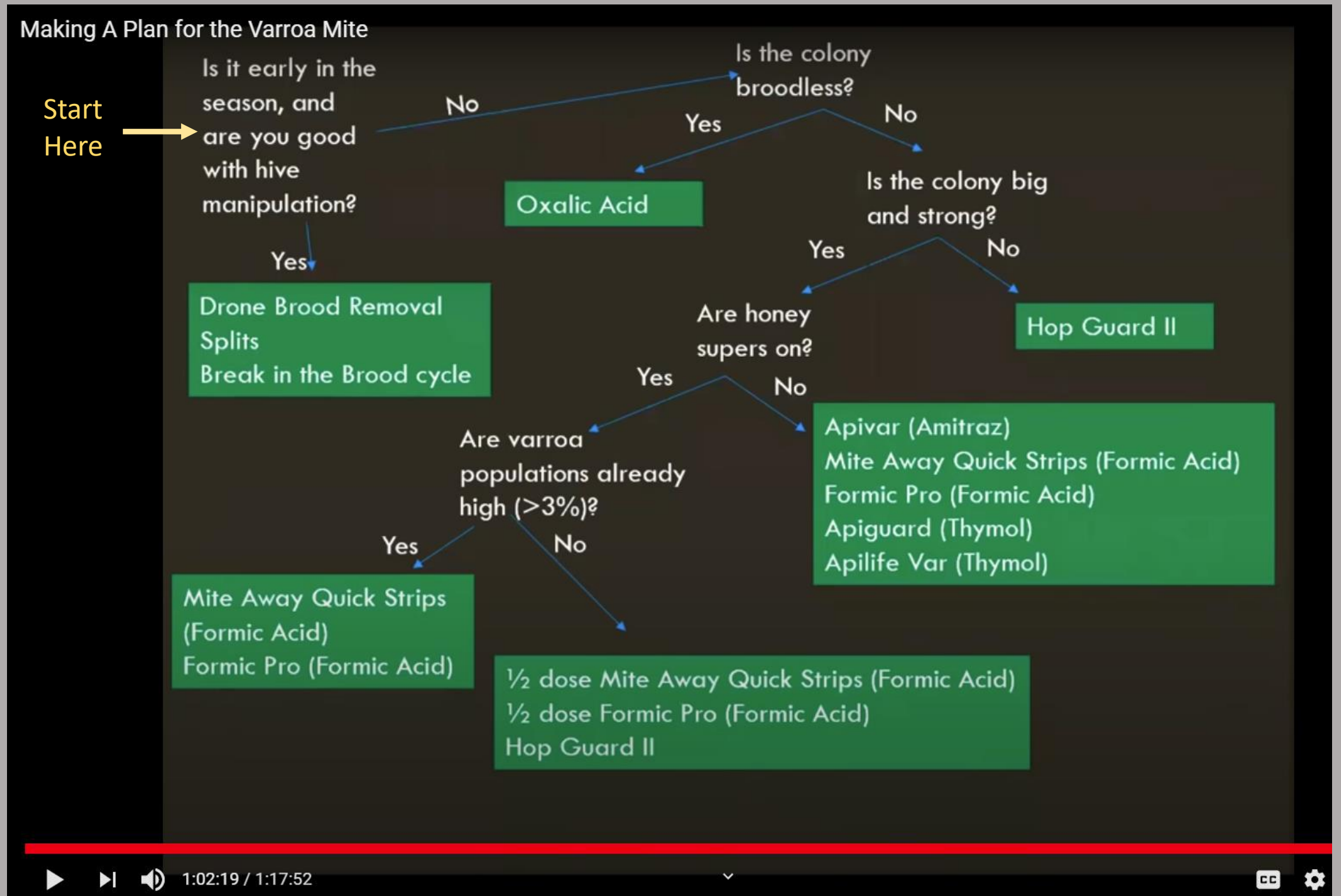
https://www.youtube.com/watch?v=ZWtSbVXqO_Y&t=995s

Understanding Varroa Risk

https://www.youtube.com/watch?v=4Ulul1iUN88

Making A Plan For The Varroa Mite

https://www.youtube.com/watch?v=km541EtCjbY


Making A Plan for the Varroa Mite
Start Here
Is it early in the season, and are you good with hive manipulation?
No
Is the colony broodless?
Yes
No
Oxalic Acid
Is the colony big and strong?
Yes
No
Yes
Drone Brood Removal
Splits
Break in the Brood cycle
Are honey supers on?
Hop Guard II
Yes
No
Are varroa populations already high (>3%)?
Apivar (Amitraz)
Mite Away Quick Strips (Formic Acid)
Formic Pro (Formic Acid)
Apiguard (Thymol)
Apilife Var (Thymol)
Yes
No
Mite Away Quick Strips (Formic Acid)
Formic Pro (Formic Acid)
½ dose Mite Away Quick Strips (Formic Acid)
½ dose Formic Pro (Formic Acid)
Hop Guard II
1:02:19 / 1:17:52

http://www.abfconference.com/images/2020/Presentations/Small-ScaleSideliner_SIG_-_Integrated_Pest_Management_for_Varroa_Mites_-_Judy_Wu-Smart.pdf

Chemical Controls

- Synthetic compounds (residues accumulate)
  - Apivar – Amitraz
  - Apistan – fluvalinate
  - Checkmite+ - Coumaphos
- Organic products (less/no residues in comb)
  - Mite-Away Quick Strips – Formic acid
  - Oxalic Acid
  - Hopguard II – hops beta acids
- Essential Oil-based products (residues)
  - Apiguard – Thymol
  - Api Life Var – Thymol+ eucalyptol, menthol, camaphor

https://m.box.com/shared_item/https%3A%2F%2Funl.box.com%2Fs%2Fqp4x6fug0nhm9j83xtphwvtewohjsc9d

US Approved Varroa Chemical Treatments

Product	Active ingredient	Class	Mode	Formulation	Manufacturer	Effectiveness	Honey supers on during Tx?	Resistance issues?[1]	Effective on mites in capped brood?	Supplemental feed while Tx?	Treatment (Tx)	Length of Tx	Adverse effect on honey bees?	Est. Tx cost/hive ($s based on 1 deep 10 frame brood box, prices as of revision)[2]	Restrictions	Available from[4]			
																Dadant	Mann Lake	Betterbee	Kelley
Apiguard	thymol	essential oils	fumigant	gel	Vita beehealth	74-95%	No	No	No	Yes/No[3]	2x Tx 10-14 days apart	24-28 days	May decrease queen egg laying activity and may increase adult and young larvae mortality	$3.33-$7.00	Temp 59 to 105°F for Tx	X		X	X
Apilife Var	thymol, camphor, menthol and eucalyptol oil	essential oils	fumigant	tablet	Veto-Pharma	70-94%	No	No	No	?[5]	3x Txs required. 2nd Tx day 7-10, 3rd Tx 7-10 after 2nd and left on for 12 days. Single wafer broken into 1/4s and placed on frames at periphery. Recommended no wafer directly over brood.	26-32 days	Use at >95°F may cause agitation to adult bees and brood deaths.	$4.68-$7.43	Temp 65 to 95°F for Tx. Recommend start Tx late afternoon. No more than 2x Tx per yr. Not available CA or HI.		X		
Apistan	tau-fluvalinate (synthetic pyrethroid)	synthetic chemical	contact	impregnated strips	Zoecom	95-99%	No	Yes	No	?[5]	2 strips per Tx, single Tx	45 days	Decreased queen and drone reproductive health	$4.18-$6.70	>50°F for Tx	X	X	X	X
Apivar	amitraz (formamidine)	synthetic chemical	contact	rigid polymer strip	Veto-pharma	95%	No	Yes	No	?[5]	1 strip per 5 bee covered frames in brood camber per Tx, single Tx	42 days		$6.40-$7.10	No more than 2x Tx per yr	X	X	X	X
Check Mite +	coumaphos (organophosphate)	synthetic chemical	contact	impregnated fabric strip	Bayer	85-99%	No	Yes	No	?	1 strip for 5 combs of bees, single treatment.	42-45 days	Negatively affects reproductive health of queens, queen rearing and drones (sperm production)	$6.40-$7.99	Do not super for 14 days after removal of strips. No more than 2x Tx per yr.		X		X
Formic Pro	formic acid 42.25%	organic acid	fumigant	saccharide gel strip/paper laminated	NOD Apiary Products USA	83-97%	Yes	No	Yes	No	2 Tx protocols: 1) 2 strips for 14 days 2) 1 strip for 10 days, replace with 2nd strip for additional 10 days	14 or 20 days	Brood and queen mortality, especially if >92°F. Bee bearding common.	$5.08-$7.75	Recommended Tx temp 50 to 86°F. Increase ventilation. No more than 2x Tx per yr. PPE recommended.	X	X	X	X
HopGuard II	potassium salt (16%) of hops beta acids	organic acid	contact	folded cardboard strips	BetaTec	75-79%	Yes	No	No	Yes	1 strip per 5 frames of bees per TX in each brood box for 14 days. Repeat in 1-2 weeks if needed.	14 days or 37-42 days		$4.16-$5.99	Recommended Tx temp 52 to 92°F. Required Tx temperature > 50°F. With high mite loads repeat Tx 1-2 weeks apart. Max use up to 3 times per year. Corrosive. Use PPE to avoid skin and eye contact.		X	X	
Mite-Away Quick Strips (MAQS)	formic acid 46.75%	organic acid	fumigant	saccharide gel strip/paper laminated	NOD Apiary Products USA	61-98%	Yes	No	Yes	Yes[6]	2 Tx protocols: 1) full dose, 2 strips for 7 days 2) half dose, 1 strip for 7 days with 2nd strip 14 days after for 21 days total.	7 or 21 days	Brood and queen mortality, especially if >92°F. Bee bearding common.	$5.15-$7.38	Temp 50 to 85°F for Tx. Use not recommended <50°F. Increase ventilation. PPE recommended.	X	X	X	X
Oxalic Acid	oxalic acid dihydrate	organic acid	fumigant	crystals for vaporization	ApiBioxal	82-99% (no brood)	No	No	No	Yes	2 Tx protocols (1g per brood box per Tx): 1) on broodless colonies, single treatment 2) on colonies with capped brood, 3-5 treatments 5-7 days apart	1 day or 15-35 days	Requires closed hive 10 to 15 minutes post Tx	$0.11-$0.20	Requires PPE including respiratory filter with acid/particulate cartridge. Temperature >37°F at time of application and for 30 minutes after.			X	
Oxalic Acid	oxalic acid dihydrate	organic acid	contact	crystals for drip/drench	ApiBioxal	82-99% (no brood)	No	No	No	Yes	Drip 50ml per hive (5 ml per bee occupied inter frame space) of 35g in 1 liter 1:1 sugar solution	1 day	May chill adult cluster. Harder on bees than oxalic acid vaporization.	$0.19-$0.35	PPE Recommended. Recommended no more than single Tx yearly on dormant bees.			X	

Information from "Tools for Varroa Management: a guide to effective varrora sampling & control," Honey Bee Health Coalition, revised First Edition 2015 and Manufacturer's inserts and information

Revision 09/18/2019

[1] No history of resistance developing. Recommendation is to rotate Txs.

[2] Range of cost primarily dependent on number of Txs in packaging, not source of purchase

[3] Feeding during treatment is at users discretion per Manufacturer's supplemental information

[4] Listed availability of product is not a recommendation for purchase. May be available from other sources.

[5] No information provided by Manufacturer

[6] Community feeding during Tx. No feeding in contact with internal or external parts of a hive

Summary

- Varroa Mites will kill your bees!!!
  - Monitor
  - Treat
  - Monitor
- Educate yourself about Varroa
- Timing – ensure your winter bees raised in August/September are healthy
- Never, ever, ever, ever, ever, ever put chemicals in your hive based on someone's Facebook post

Q/A

- Varroa
- General questions