Feb 2015
20 year revision

FORMIC ACID USE HANDBOOK AND MANUAL OF TREATMENTS

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MiteGone®

FORMIC ACID USE HANDBOOK

HOW TO MAKE FORMIC ACID TREATMENTS WORK IN ALL KINDS OF BAD WEATHER: HUMID, WET, DRY, OR COLD.
THE BASIC RULES FOR ANY ACID OR EVAPORATION BASED TREATMENTS.

THE CANADA, USA, AND WORLDWIDE EXPERIENCE:

The writer is a professional engineer who, in 1980, became a bee breeder and inventor of many technical innovations. He holds the patents for the discovery of a biological control for the Varroa mite, and MiteGone formic acid treatment.

Between October 2002 and spring of 2007, my wife Lee and I travelled to New Zealand and did 30 seminars on both islands. We also did 50 in USA, 30 in Canada, 5 in Europe, and 7 in Argentina. We met many beekeepers! We are extremely grateful to have had this opportunity to examine many different conditions, weather patterns, successes and problems of our **MiteGone**® method. The experience allowed us to modify the instructions for MiteGone adapting this treatment to most weather conditions and management practices.
In turn we provided beekeepers with the knowledge required to perform a successful formic acid treatment.

Use this to quiz yourself. Please check off *"Yes"* or *"No"* in the boxes provided and count up the number of yes and no answers at the end.

MAN MADE PESTICIDES

SUMMARY OF THE SITUATION
Mite resistance is building fast and is spreading even faster. You will have to learn how to use formic acid soon.

☑ **Fluvalinate** resistance is now common in most of USA and parts of Canada.

☑ **Coumaphose:**
An organophosphate that was allowed in the USA under emergency section 18. In lay terms it is a war measure act, "We are losing the war, let's use the Atom bomb." Some states built full resistance to Coumaphose in only 2 years and organophosphate residues are not accepted in "healthy food"
.

☑ **Amitraz–** American mites were partly resistant to Amitraz in 2000 even though the substance had not been approved for general use at that time.

☑ **: All above pesticides are based on second world war nerve gases**

NATURAL SUBSTANCES HAVING ABILITY TO CONTROL MITES:
Essential oils – Menthol, Thyme, Oxalic, and Formic acids have various levels of success and records of performance. The best records are for formic acid.

Formic Acid: The use of formic acid requires knowledge and testing. This handbook and manual will provide you with the knowledge you require.

ADVANTAGES of Formic acid:
- Kills Tracheal and Varroa mites
- Organic treatment 70-100% efficacy
- Does not build resistance
- Can be used several times a year
- Delays resistance to pesticides
- Increases hygienic behavior
- Reduces Nosema by 80%
- Cleans colonies of Chalk Brood
- Deters the Lesser Wax moth and Small Hive Beetle
- Causes bees to liquefy & utilize old crystallized honey
- Inexpensive & available in a variety of treatments and,
- METHODS which are adaptable to various weather & hive conditions.

DISADVANTAGES:
All disadvantages are a result of poor application methods, carelessness, and misinformation.

- Dangerous acid
- Unreliable treatment
- Corrosive liquid

Overdose and 85% acid symptoms:

- Queen and colony losses
- Queen stops laying
- Drone sterility
- Brood mortality and removal

All of these problems can be avoided through education, following safety rules, using proper equipment and methods with 65% formic acid.

Alternating Treatments
I used fluvalinate in late summer and formic acid in spring. Since 1995 this treatment has kept my mites below a damaging level and resistance had not been detected until 2005 at 40%. Since 2006 I use formic acid ONLY.
You cannot avoid mite resistance to Man made PESTICIDES

Did you know that?	***YES***	***NO***

I will not use Coumaphose. Due to organophosphate residues, contaminated honey is not permitted in Europe and wax is banned from cosmetic use.

SIDE BENEFITS OF FORMIC ACID observed with MiteGone®
Any Varroa treatment takes care of the Tracheal mite too. According to Czech bee research, hives treated with acid are 80% less affected by Nosema and chalk brood. I witnessed all chalk mummies being removed in 2 days after an application of acid treatment. The lesser wax moth also disappears. Old stores of honey are liquefied and moved or utilized, and combs are cleaned and fixed. Formic acid triggers high hygienic behavior in bees.

HOW DOES FORMIC ACID KILL MITES?
Formic acid is believed to act as an asphyxicant. However, one German researcher believes formic fumes kill mites (but not bees) because a mite's exoskeleton or skin is much thinner than that of a bee, allowing the fumes to penetrate their bodies.
In low dose treatments Sub lethal fumes break mite's foot pads they loose grip on bees and fall off in to pool of acid fumes on bottom board.

The **Formic acid fumes** will kill 75-100% of the mites outside cells in each mite brood cycle. Perhaps the young mites are more resistant or the old ones go through several exposures being protected in capped brood cells. Or they were missed in no evaporation days. There is no scientific knowledge or proof as to how formic acid kills the mites but most scientists believe:

The minimum treatment must be over 3 mite reproduction cycles = 3 bee brood cap (7 day) brood cycles which is 21 days.
The higher the infestation, the multiple or stronger treatments are required.
The likeliness of mites becoming resistant to formic acid is very low. After 55 years of use in Europe, no resistance has been found. Therefore, multiple and stronger treatments during one year are possible without causing resistance.

FORMIC ACID APPLICATION METHODS:

BLAST / FLASH METHODS

- Short: 3-4 day treatment repeated 5-7 times every 5-6 days.
- Prolonged Extended: Usually 21 day treatments.
- Applied at the top or bottom of hive.
- These methods are weather dependent and prone to overdose symptoms.

Large blasts of acid in levels exceeding the necessary dose force bees to ventilate to reduce this concentration to a level below damage to the adult bees but creating **mite killing concentration of fumes. Small damage to brood and emerging bees is a sign of this concentration.**
If bees cannot achieve the reduction The hive may be damaged or killed.

Short Blast Methods**:**
Are applications of 25 to 30 grams, ml, or cc to the bottom board or top bars with napkins or butcher pads called mite wipes. These methods have to be repeated 5 to 7 times or more with high infestations. This type of treatment is LABOR EXTENSIVE also prone to weather changes and mistakes.
One northern beekeeper using the napkin method delivering 25cc could not measure cc so he went to neighbors and asked for help in conversion, "25cc is 250ml," the neighbors said.

The beekeeper poured a quarter litre of 85% acid onto his hives (half a pint instead of an ounce). His hives rusted and half died.
I asked what miracle saved the others hives.
65% acid has specific gravity of 1.15g per 1ml or 1cc.

Did you know that?	***YES***	***NO***

Prolonged Blast Methods:

- American Gel Pack
- Canadian Mite Away.
- German Kramer plates.
- Canadian Zip Lock bag with newspaper or Owen Mitts and slots.

These are 21-day treatments with a preset evaporation rate relying on the outside temperature changes to emit treatment blasts. Therefore they are weather dependent and all require extra space and equipment. They are reliable only when used under similar conditions as they have been designed for. They may not be adaptable to various sizes of colonies and various weather conditions. Queen and brood losses are common and killing of small colonies are not unusual.

LOW DOSE CONTINUOUS RELEASE METHODS:

- 21 day treatment or longer treatments.
- Applied between and beside frames.
- Use hive's controlled inside temperature and humidity.
- THEY ARE NOT WEATHER DEPENDANT

HOW THEY WORK?

They work on the principle of evaporating a steady flow of sub lethal concentration of acid fumes contained at the bottom board.
The sub lethal concentration damages Mites' foot pads knocking the mites off and killing them in the pool of heavy acid fumes on the bottom board.
These methods do not cause overdose symptoms and are not weather dependent.

Gadgets:

- Nassenheider, Popodi, and many other evaporators are usually plastic molded gadgets replacing one frame near the brood nest and having an adjustable evaporation system. They require filling and pouring acid into small containers, and are not suitable for commercial beekeepers.

However, these designs exploit the great ability of bees to maintain temperature and humidity in the hive between the combs.

Did you know that?	***YES***	***NO***

MiteGone®

I did not like any of the above mentioned methods, so in the early 90's I embarked on designing: **MiteGone®** I borrowed the idea of LOW DOSE CONTINUOUSE RELEASE METHOD, location, and set up goals: I wanted the product to be cheap, easy to handle in a commercial operation, fit into the existing bee space and provide a prolonged treatment for low and high infestations, as well as be reusable, disposable, and safe.
After years of research and testing in 1994, I came up with and patented a dry dispenser and the method called **MiteGone®** the pad is 3/8" thick so it can fit into the bee space between the comb and wall of the hive body..

The pads are manufactured with zillions of elongated cells functioning like capillary tubes in the direction of the 5" length of the pad.

Pads are shrink wrapped in PVC tubing. Both ends of pad are exposed at the end creating the evaporation or suction surfaces. Therefore no one can put them in hives wrong.
When soaked with acid, a four-gram 5" pad will absorb 126 grams of acid and hung vertically, the capillaries will keep the liquid in the pad without dripping and gravity will pull down the acid to replace acid evaporated at the bottom.
Under controlled conditions of 24 °C (76ºF) and 55% humidity, a four-inch wide pad will emit six grams of acid a day.
Using 1, 2, 3 or more pads allows treating colony of any size housing and infestation.
Re-soaking allows multiple lengths of treatments, and cutting pads into different shapes treatment of baby nukes.

After20 years of use:
THE RULE OF THUMB IS ONE 5" PAD FOR EVERY 5 FRAMES OF BEES.
It works everywhere.

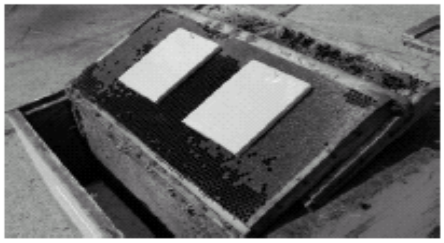
Did you know that?	***YES***	***NO***

MiteGone was designed as a spring treatment in temperate climates against the Varroa and Tracheal mite and to retard mite resistance to fluvalinate.

Acid is a finicky material and each colony will react to it differently. While 95% of the test colonies in our experience took the **MiteGone®** application well, some colonies attacked it, chewing it, and plugging it with propolis.

Some hives ventilated vigorously making the acid disappear at a rate of more than 20 grams or more a day. Surprisingly, all colonies finish with very low Varroa infestation.
Also, since the 1990 presence of the Tracheal mite in the Okanagan Valley, we still test negative - below the detectable level.

The application of our standard treatment is simple. In late August: Take 3 pre-soaked pads out of kit. Pin the pads to the outside honey frame, and put the combs back in the hive. Leave them in until April, than throw them out and put 2 new in.



We made the pads at home by hand. Since 1994 this treatment worked for me and my neighbors in British Columbia. It even worked in the humid Vancouver area without a problem. A scientific evaluation was completed in the summer of 2000. (Information available at www.mitegone.com) Scientific Evidence Link.

In 1999 John Gates, our provincial bee wizard, persuaded me to look into commercial production and sales. In 2001 **MiteGone®** Enterprises Int. was formed and manufacturing and distribution was established.
In 2002, 34,000 Original 10"pads were sold in Canada, 5000 to Argentina, and 6500 to New Zealand. The report came back from some users in Quebec and New Zealand that treatment did not take place in 21 days, as the acid had not fully evaporated.
I immediately started additional evaporation tests and went to New Zealand to find out why.

I apologize but I did not know, nor did I have a reason to doubt the treatment as it worked for us well for 7 years since 1994. We ran into the old story that what works in one place may have problems elsewhere.

I guess I should send **MiteGone®** into the world with a warning sign. If you have my video put a sign on it that reads:

Warning: This video shows application of MiteGone in a semi arid climate of British Columbia using Bill's equipment and his management.
UNTIL NOW THE GOOD LORD WAS WITH US, AND WE WERE ABLE TO FIND SOLUTION FOR ALL CLIMATES AND BEE MANAGEMENTS.
You will just have a different number of pads at different time of year... See "Treatment Selection."

If you do not have a video you can order it in DVD or VHS from us.

THE CURENT VIDEO 2011 EDITION IS 95 MINUTES LONG AND IS A SHORTER BUT UPDATED VERSION OF MY SEMINARS See;
http://www.mitegone.com/video.asp

FOR COMPLETE INFORMATION Visit our Web site Revised in January 2015 and updated frequently. Please throw out old literature and print new documents from the web at www.mitegone.com. (Print Literature link)

THE GOOD NEWS IS THAT MITEGONE PADS CAN BE ADAPTED TO ANY ADVERSE CONDITIONS IF YOU KNOW AND UNDERSTAND THE PRINCIPLES OF EVAPORATION IN BEEHIVES.

Principle No. 1:
TEMPERATURE AND HUMIDITY
When I designed MiteGone I measured external and internal temperatures of the hive in October, March, April, and May. To make the story short, I went to the hives at the following times:

- 5am the outside temperature was 5ºC (41ºF) and 90% humidity. Inside it was 22ºC (72ºF) and 55% humidity.
- 11am the outside temperature was 16ºC (60ºF) and 40% humidity Inside it was 24ºC (76ºF) and 55% relative humidity..
- 3pm the outside temperature was 28ºC (82ºF) and 20% humidity. Inside it was 26ºC (78ºF) and 55% relative humidity.

Those temperatures were recorded on typical hives with 30,000 bees, a full 10-frame box of bees, and 2-3 frames of brood. On hives of smaller strength during the spring's winter bee die-off period, the internal temperature was 16-20ºC and relative humidity varied between 40-65%.
Since I intended to treat during the spring pollination prep time when I had to manage my colonies to the pollination standard of:
10 frames of bees including 3-4 frames of brood. I designed the MiteGone pad to emit of 6 grams per pad, in continuous flow over 24 hours, to be able to treat colonies of different sizes.

If you want to treat with the FIXED evaporation method your colonies must be the same strength or your treatment must be adjustable.

Did you know that?	***YES***	***NO***

HIGH INTERNAL HUMIDITY:
At 24ºC (76ºF) and 85% relative humidity inside the hive, the **evaporation rate per pad** drops to half, equaling 3grams. This drop in evaporation cannot deliver a **sufficient concentration of fumes** and explains why the treatment was not successful. But I needed to answer the question as to why hives can have 85% internal humidity when in my tests the humidity was a constant 55%. Then I reflected back to my university days and the grafting house queen-rearing rules.

The laws of physics state that – as many times as the temperature is raised, that many times the relative humidity is lowered.

Did you know that?	***YES***	***NO***

The first rule of the grafting house is that you have to keep temperatures above 24ºC (76ºF) and the relative humidity above 55%, otherwise your larva will dry out and you will not get cells and Queens.

Did you know that?	***YES***	***NO***

That explains the constant temperature and humidity in the hives. Bees keep it at that minimum otherwise the larva will die.

- The morning air, with a temperature of 5ºC (41ºF) and 90% humidity, will be heated by bees at least 4 times to 20ºC (68ºF) and the humidity lowered 4 times to 22%. Bees will still have to evaporate water to reach 55% humidity.
- The same happens midday, 16ºC (60ºF) and 40% humidity will result in 24ºC (76ºF), and 20% humidity. Again bees will have to evaporate water and heat the air.
- In the afternoon the 28ºC (82ºF) and 20% humidity does not require bees to heat air; on the contrary they use the high heat to evaporate water, lowering temperatures to 26ºC (79ºF) and again raising humidity to 55%.
- In our general area and in interior of America it is virtually impossible to get higher humidity inside the hives. In coastal areas with low temperatures and high humilities, the humidity is reduced to 55% by bees heating the air to brood temperatures.

What happens if the air is warm and the humidity is high; is a different story.

The air is not heated and extra humidity is just fine with bees; in addition they do not have means to lower the humidity.

It is the RELATIVE humidity inside the hive that controls evaporation. Laundry in Canadian prairies will dry at temperatures below -40ºC (-40ºF) and 10% humidity.

Did you know that?	***YES***	***NO***

I measured the humidity in wet areas of the NZ North Island outside and inside hives getting a surprisingly constant inside temperature of 22-24ºC (72-76ºF). The lowest humidity inside a hive was 63% and a maximum humidity of 83%. On our way from Wanganui to Awakino we encountered outside temperatures of 22ºC (72ºF) and close to 90% humidity. It was humid and very wet; nothing would dry or evaporate in those conditions.

I really wondered what to do. Do we have a problem? What will happen at 90% inside relative humidity?
In reality – nothing.
Acid will not evaporate. Mites will not go away. The status quo will be maintained. When the weather changes the process resumes, acid evaporates and mites die. ***You just experience no treatment days.***

Did you know that?	***YES***	***NO***

Therefore do not bother to take the pads out. It really does not matter if a 21-day treatment takes 35 days or more as long as the mites are killed.

Did you know that?	***YES***	***NO***

When we reached hives in Awakino, the hives were sitting in tall grass in a deep ravine; it was drizzling rain at 22ºC (72ºF) and 89% outside humidity. To my surprise inside the hive it was 23ºC (74ºF), and 83% humidity. In these conditions the rate of evaporation would drop by half per pad. How can the **daily dose** rate be reached? It is simple. Just cut the pad into 4 quarters and double the amount of evaporation surface to reach the same **daily dose** as with two 5"pads at 24ºC (76ºF) and 55% humidity or use 3-4 pads. That led to:

GREAT NEWS:
After 15 years of use we found:
That 3 -5" PADS WILL PRODUCE GOOD RESULT IN Normal hive of 10 -15 frames of bees if left in long enough.
WE LEAVE AUGUST PADS IN TILL APPRIL and APPRIL PADS TIL END OF MAY. Do not leave pads in over summer.

Can you do that?	***YES***	***NO***

Principle No. 2:
HIVE LOCATION AND WEATHER
Crossing New Zealand we found many hives in yards overgrown by grass and brush. I sometimes could not even see them. I understand the flat land is at a premium in many places. At Coromandel I sometimes wondered how the hives even got to where they were. On the other hand on both islands we found yards clear of brush, hives lifted on pallets and arranged in groups of 4 in circles. This shows that some beekeepers have read the same research that I have.

The temperature in the grass at ground level is lower and humidity is higher. It can be colder and up to 15% more humid than a foot or 30cm above the ground.

Did you know that?	***YES***	***NO***

When I started beekeeping in 1980, research, in many places, was being done on pollination practices, as pollination was becoming one of the most important aspects of the bee industry and a major source of income. The findings in Maryland and Canada were that:

Hives lifted off the ground at least a foot (30cm) will start to work earlier and fly longer (1 to 2 ½ hours).

Did you know that?	***YES***	***NO***

Hives in small groups will fly earlier and later. If placed side-by-side and back-to-back they will start and finish at the same time. They would also keep higher temperatures at adjacent walls.

Did you know that?	***YES***	***NO***

Placing hives in a circle eliminates or compensates for drifting. I confirm this as we have no drifting in our hives; all my hives sit in circles in packs of 4 with entrances facing in and out of the circle.

Did you know that?	***YES***	***NO***

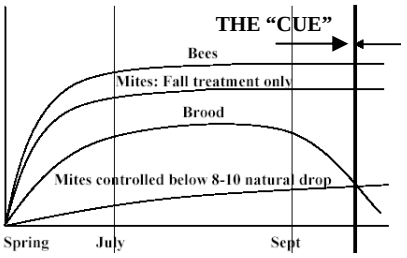
During pollination our hives sit in 4 packs on inverted apple bins, 2 feet (60cm) off the ground to induce early flight.
This helps evaporation of acid treatment during pollination. We adapted this advantage for our honey producing and wintering yards, they are clear of grass, and hives sit on double high pallets.

This set-up ensures drier and warmer air enters the hives providing easier evaporation during treatment.

Did you know that?	***YES***	***NO***

GOOD NEWS: The type of yard I have just described is the best defence against the **small hive beetle**. You will be able to spray the ground to prevent the beetle larva to pupae.
I have had a lot of exposure to the beetle from my fungus research in Florida. The beetle needs warm, sandy, moist, deep soil for the larva to finish its life cycle and emerge as a beetle.
But don't count on it. The beetle larva can survive and mature in debris on your bottom board too.

Principle No. 3:
HOW AND WHEN TO TREAT
TREATMENT YEAR STARTS IN AUGUST.-MISSING THE CUE:



Graph:
Population Growth for Bees & Mites

KEEP MITES BELOW 8-10 MITES

Spring & fall natural drop prorated to 24 hours. Treat twice per year

- **In the late summer** treat before mites cause damage to brood that will become winter bee stock. Leave pads in until spring.
- **In the spring** treat before extensive brood build up, when you are reversing hives or preparing for pollination.
- **In sub-tropical climates**, treat hives at the beginning and at the end of the driest part of the year.
- **The tracheal mite:**

21 day treatment in the spring or fall will eliminate this pest from your operation.

IN THE LATE SUMMER: The colonies are approximately 30,000 bees, 10 frames of bees including 2-4 frames of brood. Usually bees will be in the lower box and the honey stored for winter will be in the top box. Don't wait for that extra kilo of honey; take off your honey supers. If there is still a flow steal some honey from the top brood chamber (box) and give the bees empty comb to fill.

Colonies must be treated at least 21 days before the winter bees enter the capped stage. **"This is THE CUE"** You all saw the graph of the mite build up and brood reduction. Those thousands of mites need to reproduce. **Unless you kill them** they will enter the winter bee brood and damage all of the winter bees. The crippled winter bees with only partial wings, legs, and bodies will be thrown out of the hive.
These damaged bees are unable to sustain the colony through the winter. As a result, when the summer bee die-off happens, you will find dead colonies or only a handful of bees and many mites. Even if you treated and you missed **"THE CUE",** nothing will save the hives as the damage was already done.

- **IN THE SPRING** you should treat just before the main brooding period. Generally the hives at that time have 30,000 bees, 10 frames of bees, including 2-4 frames of brood. Reverse your hives and move the brood to the bottom box and put the empty combs in the top box. The treatment pads will go into the top box. If your colonies are smaller (6-8 frames) and your management allows, reduce the colony for 21-day short treatment into one box, you will save money by using half the amount of the pads and acid. (You do not have to remove the empty second box.) Just seal it off with plastic or carpet on top of the lower box and put the pads in the box with the bees.

Colonies that are smaller than one box must be boosted to the above strength or moved into smaller nuke housing and treated with a smaller **daily dose often one pad will do.**

Bees in clusters or four frames of bees in two otherwise empty boxes will not ventilate the acid fumes properly and therefore the hive will not be successfully treated.

- **IT IS IMPERATIVE THAT HIVES ARE TREATED BEFORE MITES CAUSE DAMAGE TO WINTER BEES DURING THE LAST BROOD CYCLE.**

- **LATE SEPTEMBER OR OCTOBER TREATMENTS IN TEMPERATE CLIMATES ARE TOO LATE. THE DAMAGE TO WINTER BEES HAS ALREADY BEEN DONE!**

Did you know that?	*YES*	*NO*

- **BY TREATING TWICE A YEAR AND KEEPING THE PRORATED NATURAL DROP BELOW 8-10 MITES YOU CAN AVOID "MISSING THE CUE" EFFECT, AS THERE WON'T BE ENOUGH MITES TO CAUSE DAMAGE TO YOUR WINTER BEES.**

Did you know that?	*YES*	*NO*

RE-INFESTATION:
Based on my opinion and experience, re-invasion is an excuse for missing **"THE CUE"** in the situation where you treated and 3 weeks later you found your hives dead.
I live in a warm miraculously protected valley with as many "bad" beekeepers and feral colonies as there are in New Zealand or elsewhere. Re-invasion has never killed my hives. There are just not enough mites outside the hive that would enter your hive and kill it. However, I have experienced missing **"THE CUE",** and have witnessed hives die regardless of the treatment used.

Simple math rules out the possibility of re-infestation as the cause of the problem. In a Hamilton meeting a New Zealand researcher presented the fact that after a chemical treatment that resulted in a zero drop in a hive without capped brood, they discovered a chemical drop of 60 mites the next day. They attributed it to re-invasion from other hives. I completely agree with his finding and would not be surprised if someone finds a higher re-infestation rate. On the other hand, most of the research (Saskatchewan and US) claims that hives with a 6% infestation will not need treatment in the fall and they can be treated in the spring.
A typical hive of 30,000 bees that has 6% infestation would tolerate 1800 mites. At a re-infestation rate of 60 mites per day, it would take 30 days to reach the 6% level, **which does not require treatment**. The question is then why did hives die in 2-3 weeks? The answer is that the beekeeper missed **"THE CUE", did not treat at the right time and his own mites killed his winter bees.**

I hate to advocate "Draconian Rules" but we desperately need someone to force the beekeepers in the same area to perform the same treatments at the same time.
I send my foreman to assist all of my neighboring hobby beekeepers to ensure that all hives are treated properly. This preventative measure is much cheaper than fighting their mistakes. If you want my advice, use acid twice a year and stop worrying about resistance to pesticides. Get together with your neighbors and agree on timing.

Waiting until everyone else has treated so you do not get re-infested will usually result in missing "THE CUE", and you will lose your hives.

Did you know that?	*YES*	*NO*

ORGANIC TREATMENT:
From the information I gathered, formic acid is the only choice for organic growers in both spring and late summer treatments. Make sure that you do not miss "THE CUE".

Principle No. 4 – HIVES AND OTHER EQUIPMENT
TO ENSURE 95-100% efficacy for all evaporation treatments, the fumes, which are heavier than air, must be retained inside the hive forming a pool of fumes at the

bottom, preventing the free flow of fumes out of the hive but still allowing ventilation

Did you know that?	*YES*	*NO*

That brings me to the different arrangements of the hives and equipment starting at the top of the hive:

Wooden top inner covers are not used in our operation. We use carpets that seal instantly; using a piece of plastic will work just as well to seal the hive from the top. Wooden inner covers never seal instantly but under normal conditions bees will seal them with wax and propolis. However, with a formic acid application, the bees will not seal these gaps and use them for ventilation.

After all, bees are like people, why would you stay in a "stinky" bottom environment if you could let it out through an open window at the top?

I saw the inside of a metal top cover made rusty entirely from condensation of fumes. This rust is proof that bees ventilate through the cracks between the inner cover and the box rather than sealing them.

Did you know that?	*YES*	*NO*

CORROSION:

If you treating with formic acid, using blast methods or pouches where acid will drip in a liquid form onto metal parts it will create a rust problem. Fumes condensing on "unprotected" metals will cause rust. However, most of the metal parts in hives are coated by wax and propolis and are warm. That seems to be enough protection from the acid fumes to prevent corrosion. The MiteGone pads do not drip and some of our units go into pollination with metal queen excluders with pads in the top box. No rust had been found since our queen excluders are wax coated from previous use.

MiteGone concentration of fumes does not rust wax coated metals.

Did you know that?	*YES*	*NO*

☑ **The Boxes**: All auger holes, knotholes, and broken corners will create the same ventilation problems as gaps under a top cover. You have to seal any openings with duct tape, mud, or play dough. If you do not plug these holes, your treatment will LOOSE SOME EFICACY and you may have to use extra pad to off-set it.

Did you know that?	*YES*	*NO*

THE BOTTOM ARRANGEMENTS:

Pollen Traps In Nelson, we ran into pollen traps. With 1000 hives, removal of pollen traps for the treatment period is not a viable option. We examined the traps and decided that the front of the traps could be duct taped and cracks sealed. The traps were big, the size of a shallow super; therefore, they will have to be filled with heavy fumes to the entrance and air intake. This will require a much larger **daily dose** of acid especially if the traps still leak. There is a test we tried with screened bottom boards that will work with pollen traps. **With water, fill the "bottom arrangement" (trap or screen bottom board) sealed the way you think is best to the level of the bottom of the hive body. Install an entrance raiser block. Have an extra bucket of water ready to replenish any water lost. If the bucket of water runs through your arrangement in less than 2 minutes so will the acid fumes & your treatment will be in 85% efficacy.**

Did you know that?	*YES*	*NO*

Bottom Boards: In the Hamilton areas were two yards within a few miles, in the same weather region and hive arrangement. One yard had good treatment and solid plywood bottoms; in the other (LOW treatment yard) we found that **"the solid bottom board"** was made of several straight planks with ¼" gaps between the planks. The fumes leaked through the gaps and kill grass rather than the mites.

If the grass and plants under your hives are brown and dying, it is a sign of heavy fumes leaking. The fumes exhausted from hives by bees will not cause plants to die.

Did you know that?	*YES*	*NO*

GREAT NEWS:

In 2008 the CZECH research institute run a series of test with fully open screen bottoms REACHING 87% EFFICACY if that's a worst case, you do not have to worry about sealing screened bottoms.

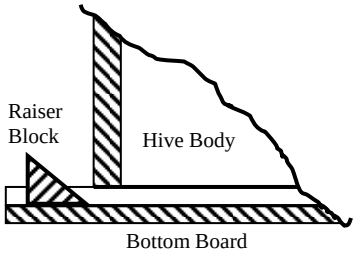
Screen Bottoms: The effectiveness of screened bottom boards either open or with monitoring, trapping arrangements is limited. While I agree with most research findings, I also agree with the general result saying that on their own the screen bottom boards will not do the trick and some other treatment like Fluvalinate or Coumaphose would be required to help. In that combination pesticide treatments can be less frequent. It appears to me that we all forget the fact that our mites are becoming resistant to those chemicals and only treatments with formic acid, thyme, or fumigation with essential oils or other natural substances are the only methods left to use. So before you convert your 1000 hives into screen bottoms you may want to consider the following and learn from the New Zealand experience.

Most of the screen bottom designs will hamper acid treatment and sealing them requires removal of boxes.

We spent hours trying to seal the monitoring inserts and we developed the water test I mentioned earlier. Unfortunately, the water ran through the "sealed" screen bottom board very quickly. A few things to consider if you plan on using screen monitoring or open bottom boards:

1. I have counted many mites and I'm tired of it. I only test 20 hives using sticky boards in the spring and I test 20 more hives twice in late summer. I cannot see counting and monitoring being done on 1000 hives.
2. If you are using boards as traps you will have to reapply sticky material to the surfaces frequently to keep the boards moist so they trap the mites **or use acid pads in food trays**.

THE KEY TO SUCCESSFULLY RETAINING FUMES IS A RAISER BLOCK IN THE HIVE ENTRANCE.



The section above shows the raiser block forming an inclined entrance and tray with the sealed bottom board. This tray confines the heavy acid fumes in a pool on the bottom board and the bees are forced to ventilate through this pool delivering the fumes to the brood area resulting in a successful treatment. Appropriate size of entrance reducer for size of colony or foam blocks with a 3-4" gap in the centre will do adequately.

Principle No. 5:
FORMIC ACID FUMES– DAILY DOSAGE & EVAPORATION RATE

Acid is sold at an 85 – 95% concentration. At this concentration, acid evaporates faster introducing acid at a damaging rate exceeding the bees' ability to ventilate and causing losses of young and old queens as well as brood. At 73%, formic acid and water evaporate equally at the evaporating surface. At 65% water evaporates faster. Evaporation of water at the evaporating surface creates a gentle introduction of acid into the hive and eliminates young queen losses and brood mortality. *(Carrey Clark, Dawson Creek, Canadian Research, early 90's.)* Mixing 1 part water with 3 parts of 85% or 2 parts of 95% acid will produce 65% acid. It is much safer to do the thinning by weight at ground level rather than by volume at eye level.

Dilution % is not critical with concentration between 63-67% losses of young queens are rare.

Did you know that?	***YES***	***NO***

Mite killing concentration of fumes IS USED BY BLAST METHODS:

- It is the concentration of fumes that will kill mites but not the adult bees.
- It is recognized by slight mortality to young emerging bees and drones as well as brood.
- Initially, when the treatment is introduced, bees will increase ventilation, a roaring sound may be heard, and bees may climb out of the hive; however, they will settle down in 15-20 minutes.
- Bees staying out and large amounts of larva being thrown out of the hive is a sign of overdose.

IF this is happening to your hives YOU PUT TOO MUCH IN.

Did you know that?	***YES***	***NO***

Comparing the natural drop with the acid induced drop in first 24 hours, is a better way to check your treatment. If your acid induced drop is 5 to 10 times the natural drop, your treatment is working well.

You can check any late summer acid treatment this way.

Did you know that?	***YES***	***NO***

Daily Dose: is the amount of acid required to provide treatment. It must be delivered by slow continuous evaporation over a period of 24 hours and it will vary with:

- The size and arrangement of your hive. More space and more leaks will require more acid for each day.
- Also the size, strength, position of colony, brood nest, and ventilation will have an effect.

COLONY STRENGTH & TIMING

Only colonies of similar strength and in the same housing can be treated with the same method and **daily dose**. It is important to incorporate acid treatment into your regular hive management routine.

AFTER 15 YEARS OF WORLD WIDE USE THE RULE OF THUMB FOR AVERAGE HIVE WITH MITEGONE TREATMENT ARE:

IF your infestation is below 20 mites natural drop

- Use one **5" PAD** for every five frames of bees.
- Use a minimum of three pads for the August treatment of 2 high colonies.

IF your infestation is above 20 mites natural drop

- For higher infestations, add extra pad, or re-soak pads after 20 days.

FOR DETAILS SEE INTRUCTIONS FOR YOUR CONDITION.

ATTENTION
YOU CANNOT TREAT TOO POPULOUSE COLONIES IN JUNE JAMMED WITH BEES AND READY TO SWARM

Like most in May or after almond pollination.
These colonies require a lot of oxygen for the bees and will ventilate vigorously blowing all acid fumes out.

Did you know that?	***YES***	***NO***

The 6 grams per five frames of bees is only a starting point for designing your own treatment. See "Treatment Selection."

Did you know that?	***YES***	***NO***

GOOD NEWS! Contrary to other methods, the **MiteGone®** dry dispenser allows for simple sizing of the **daily dose**. The beekeeper can design a treatment for 21 to 80 days by re-soaking pads and using one or more pads to deliver the **required concentration of fumes** under your local circumstances, weather, and management. See "Other Uses of pads."

Did you know that?	***YES***	***NO***

SEE: www. Mitegone.com FOR DETAILS OF STANDARD TREATMENT, MODIFYING TREATMENT AND ACID REQUIREMENTS.

VERIFICATION TESTING IS A MUST – YOU MUST KNOW WHAT YOU HAVE!

TEST THE SAME HIVES IN THE FALL AND SPRING

WITHOUT TESTING, YOU ARE PLAYING RUSSIAN ROULETTE!

The main goal in acid treatment is to keep your mite numbers down.
I stop testing new applications because tests require a natural drop of 20 or more mites. Since 2006 I have been using an acid treatment in August and April, this keeps my mites in a 0-8 drop range and I have to do verification tests only.

Did you know that?	***YES***	***NO***

FOR THE FULL VERIFICATION TESTING, SEE THE TESTING SECTION

WARNING TIPS

In Tauranga we saw a drop board where only one half was covered with mites. You could not see the sticky board under the mites, and it felt like sand paper. The other half was clean with no mites. ***Interpolating or cutting half boards or counting 2-3 squares and multiplying it by the number of squares is wrong and will cost you hives.***

Did you know that?	***YES***	***NO***

"Core Flu" as sticky boards:

I know the origin of its use it came from Canada. I apologize but even "Canucks" can be wrong. The edges and holes are great containers and retainers of bottom board debris easily transferring diseases.
Gluing the edges with duct tape proved to be even more successful as glue on pealed tape works much better at collecting the crap. Please do not use this material for sticky boards.
In North America: rigid PVC called STYRENE 0.305" will do the trick and one sheet of 4x8 feet will make 24 boards. That is all the boards I needed for my 500 hives.

Did you know that?	***YES***	***NO***

Sticky board screens:

We saw many styles of screens from various metals to plastic nettings used for propolis collection.
The plastic netting has flat spots that will contain mites but it also sags in the middle. The metal 8 squares to an inch hardware cloth raised by ribs 3/8" (10mm) above the sticky board are best. 24 of these are sufficient for my operation. A sketch of sticky boards, screens and applicator lifter is available in Testing on our website.

PARASITIC MITE SYNDROME

I call PMS "funny brood." The first time I saw it , I was confused and tried to treat it with everything from antibiotics to queen replacement and boosting with whole nukes but it persisted in staying in the hive.

It is not necessary to save each colony. Colonies displaying this syndrome are obviously more susceptible to Varroa infestation.

You do not want that strain of bees in your operation, do you?	***YES***	***NO***

Suffocate all bees including the queen and drones and move the comb into quarantine, check for real AFB. Keep the comb over the winter and put it on strong colonies in the next spring as second or third box in a quarantined bee yard.

Within 2 weeks you will know if you missed AFB or if it really was PMS – Parasitic Mite syndrome will be cleaned out of the comb and you will not see it again. AFB will persist.

Did you know that?	***YES***	***NO***

Contamination of honey:

Generally pesticides are not to be used when honey is collected, so direct and time your treatment to periods with little or no honey flow and when treating let the collected nectar serve as brood food.

Formic acid will not harm bees since acid is already found in honey. Remember that formic acid is already used as an flavoring in many human food products as flavoring and as a preservative. It is also used to preserve livestock green feed.

Formic acid may alter the taste of your honey for better or worse, you can be the judge. We observed during treatment that bees utilized stale crystallized honey that normally would be thrown out of the hive.

Did you know that?	***YES***	***NO***

PRACTICALITY IN SAFETY FOR BEEKEEPERS

For installing filled pads from kits into hives only rubber gloves are required.
For thinning Acid, filling kits, reuse and handling of liquid Formic acid:
Respirators, rubber gloves, boots and

- Thin rubber (rain) pants under your overalls are required..
- All acid must be handled at ground level below the knees; never above the waistline. Never do any thinning or measuring at eye level. (It is not necessary with MiteGone to handle acid above the waistline.)
- Use properly designed ready-to-fill kits. See www.mitegone.com
- Always use a scale on the ground for thinning and measuring in grams, kilos or pounds rather than measuring volume.
- The only safe way to transport acid is in thick walled containers that the acid is sold in and approved by regulations.
- Incorporate the preparation for treatment into your hive management. Prepare all hives in the bee yard for treatment so you only put the respirator on once and do acid work only while wearing the respirator for a short time.
- Carry the filled pads below your waistline in soaking/dripping baskets or latch boxes.

First aid: water

Have a hose with clean running water or two pails of water, one open and one sealed in case an open one spills. Have a pitcher ready to dilute any spills of acid.

Did you know that?	***YES***	***NO***