Final SARE Farmer Grant Report

Project:

A Middle Entrance for Beehives
SARE number: FNE09-672

Researcher:

Dave Stewart
34 Cape May Ave.,
Dorothy, NJ 08317
609 476-2891
djtrawets@msn.com

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Goals:

We expect to demonstrate improvements in honey bee colony health and strength through using a middle entrance.

By relocating the hive entrance from the bottom of the hive to above the brood nest, we expect to reduce the population of Varroa mites in the hive. Mites do fall off bees, but in a typical hive, they land on the bottom board, and may catch a ride back into the brood nest on another bee. By putting an entrance above the brood nest there will be fewer free rides.

We plan to carefully monitor 20 new colonies for one year, monitoring Varroa population using the 24hr natural fall method, and hive weight, to assess the comparative efficacy of a middle entrance as a mite control alternative.

Our Apiary:

We are part-time beekeepers providing pollination to small farms in the Vineland N.J. area. Blueberries and garden market crops predominate the local agriculture, but there are also strawberries, apples, peaches and corn nearby. Some request that no harsh chemicals be used on the bees or hives to keep in line with their natural and organic ideas. We respect this, and strive to find ways to stay ahead of the mites.

We also sell queens and starter hives (nucs) to other beekeepers interested in obtaining local bees which have survived without chemical treatments. As the efficacy of chemical treatments continues to be questioned, especially in view of indirect contamination in the hive, we find a strong demand for our bees.

Method:

We started 20 new colonies in early summer 2008 for this experiment. They were divided into 5 groups of 4 colonies. In each group there was one hive of each of the following configurations:

Solid bottom, bottom entrance – the standard hive
Screen bottom, bottom entrance – typical mite control
Solid bottom, middle entrance
Screen bottom, middle entrance

Progress:

We began our project by obtaining the 20 special hive bottoms for counting mites from a beekeeping supplier, Mann Lake. They have a large screened opening in the bottom, and a tray that can be inserted below the screen on which the fallen mites will land. To assist in counting mites we made white pages with 1 inch squares marked on them for each tray. See Photo 1. We used self-stick clear shelf liner to laminate the paper to the tray. Also we made up pages with the same number of squares to facilitate recording the mites. With 20 hives being monitored every 2 weeks for a year, we made 540 photocopies, and put them in 3-ring binders, one binder for each group.

Photo 1: Bottom Board for mite detection

This shows a screened bottom board, painted yellow, the mite collection tray with grid lines to the right, and a plywood false bottom board on the left. The front of the hive is at the left. The bottom is supported on the hive stand.

When the tray is removed, the bottom of the hive is open and any mites that fall will land on the ground. To simulate a solid bottom hive pieces of 1/8" plywood were cut to slip in on top of the screen. This is actually an unpleasant operation when the bees are active, as the board is slipped in their guarded entrance, but even more unpleasant is

removing the plywood false bottom when it is covered with bees.

A carrying rack was also constructed, which allowed for transportation of the trays from various pollination yards.

To weigh the hives a special stand was built for each hive. It is shaped like an H made of 2x4s, laying crossways under the hive, so the long ends extend past both sides of the hive. Three pieces of pressure treated 1x6 deck boards were attached across the H to keep it off the ground, and provide support for the scale tower.

We used a hanging spring scale attached to a 2x4 tower with a rope and pulleys. The pulleys allow the operator to exert half the force, and have more control, than a single rope. A chain from the bottom of the scale hooks under the side of the hive, and is long enough that the operator can read the scale at eye level. The base of the scale is made to fit inside the H of the hive stand, resting on the pressure treated boards. The weight from each side of the hive is added to obtain the total hive weight. With this setup hives up to 300 lbs. can be weighed.

Photo 2: Scale Tower sitting in Stand

The construction of the hive stand can be clearly seen. The base of the scale tower provides stability and consistent positioning. The hook on the end of the chain is in an eye, to reduce swinging during positioning, which can arouse the bees by banging on the hive.

The weight of the hive equipment is subtracted from the total weight, so that adding another hive box doesn't show up as a sudden weight gain. We will refer to 'live weight' as the total weight minus the equipment weight. Equipment weight includes the weight of the undrawn frames and foundation. Ritecell foundation was used, and most equipment was purchased from Harvey's Honey, Monroeville, NJ. We took care to weigh the hives at dusk, so that we would not miss the weight of the foraging bees – although sometimes a few bees don't return home for the night.

Photo 3: Dave Weighing a Hive

Photo 4: Middle Entrance

The help of another beekeeper with a decent woodshop was obtained in crafting the ten middle entrances. The entrances consist of a ¾" rim the size of the beehive box, but extending out the front about 3 inches. A landing board is attached across the bottom of the front extensions. Through the middle area 3/8" thick slats about 1" wide cross the hive, with 3/8" spaces between them, filling the space so the bees don't build unwanted comb. The slats are kept back from the front of the hive so there is plenty of space for the bees to enter and leave the hive.

In anticipation of starting the hives for the experiment we raised queens and established an isolated mating yard to provide sets of sister queens mated to drones from one colony, thus reducing the variability of the queens in the experiment. We also purchased one set of 4 queens from another supplier (Purvis Brothers Apiaries, Georgia) which claims to have Varroa resistant bees.

The new colonies were started in July 2008. For each group a large hive was split into 4 hives, trying to have a balance of bees and brood, and a queen was introduced to each. Frames from the large colony which did not have brood were not used. The rest of the box was filled with foundation frames. The middle entrances were placed on top of the first hive box.

Photo 5: Middle Entrance in place

Photo 6: Complete Hive

The mite loads on the large hives was not high, meaning that there were some mites that could be found, but bee health did not seem to be affected.

We had the opportunity on July 19, to host a meeting of the local South Jersey branch of the New Jersey Beekeepers Association, and demonstrate setting up one group of hives.

We began feeding the hives immediately, using 1 gallon quail waterers placed in boxes on top of each hive. We fed them HFCS from a local fountain soda distributor. We continued feeding until early October. Two groups were placed at a small farm with mixed crops and a 2 acre garden area. Two groups were placed near a cornfield, where pollen was readily available. The last group stayed at the home apiary, which is mostly woodlands with small family clearings, some having gardens. The new hives were not strong enough to be considered for pollination work.

The hives were all brought back to the home apiary for the winter months, through to February 9. Local beekeepers do very little winter modifications to their hives. Normally placing the hives in a sheltered sunny location is sufficient. Some prefer to use telescoping outer covers, but we just used the same plywood migratory cover that is used in summer, with a patio block to keep the wind from blowing it loose.

In early February the hives were fed pollen patties to stimulate spring growth. During the next six weeks the hives can build up from a small winter colony to a strong colony filling a whole box, and be ready for pollination contracts. Sometimes things can go wrong, and colonies can starve or freeze. Continued weight loss is normal, as the hive converts stores into bees. This year there were a few exceptionally cold nights in March, separated by about a week of normal temperatures. During the warm weather the colonies expand the brood nest, laying more eggs and raising more larva, but on the very cold nights the bees cannot keep all the brood warm. Repeated brood loss depleted the colony strength and some hives perished.

Spring pollination began in early April. The late March frosts affected the strawberry blossoms and our expectations of pollinating the strawberry farm was

cancelled. We moved some hives to a farm with an apple orchard and blueberry field. The others were moved to a mixed farm. There is often some surplus honey produced during this time. Controlling swarming is a concern at this time of year. Swarming occurs when a hive feels strong enough to split itself, and start up another new colony. The queen flies away with many of the bees, leaving special larvae - queen cells - for the remaining bees to raise. Usually when there is signs of swarm preparation the beekeeper will split the hive into two or three hives, rather than loosing bees in a swarm. Alternatively the queen cells can be removed diligently by the beekeeper, (about every 4 days) and more space made available to the bees, until they give up. We chose the second method, as we did not want to interrupt the mite growth.

Late May through early July is usually the honey production period. The spring fruit pollination contracts are over, and clover is in bloom. Swarming is still a concern. This year the first two weeks of June were unusually wet and cloudy, which is not good for a honey crop.

July is the summer pollination period. We moved all the remaining hives to a field of winter squash on July 3rd. Squash flowers do not provide extra nectar for the bees, and usually the hives loose weight, unless there is some additional nectar sources nearby. Some years beekeepers feed syrup to the hives to keep them active. This year there were sufficient summer rains to keep other plants healthy, especially clovers. The squash farmer had made successive plantings, which extended the pollination period into August.

September and October is fall feeding time, to build up stores for winter, and promote healthy bees for best survival.

Results:

Feeding Stage - July to October 2008

Feeding was stopped in early October, but to analyze the fall peak in mite counts we extended the period to the end of October.

Not all hives or groups gained weight at the same rate. One hive, #20, failed to gain weight. We suspect the queen was not capable of laying well. Data from it was set aside from analysis. Typically the hives gained 6 lbs for every gallon of syrup. One hive, #6, gained 90 lbs, but 60 was average. The group (hives #1 to #4) at the home apiary gained weight much slower than the others, 40 lbs typical, which could be due to lack of good pollen sources, as there were other stronger hives competing for resources, or due to the hives being positioned in a shadier location. No apparent differences of weight were noted when hive configurations were compared.

The mite counts were not as we expected. The mite population should grow as the hive grows, and there was that trend to it. Generally the heavier hives had more mites. Average mite fall at the start was about 3.5, and at the end was about 9. More apparent than the trend were the variations. A hive could have no mites fall one time, and have the

most of any in the group on the next count. This is very important for beekeepers which would try to rely on natural mite fall counts to determine treatment strategies. Due to these variations, we averaged the two highest mite counts of each hive for our analysis.

Hive configuration appears to affect mite count. Screen bottom hives had about 35% fewer mites than solid bottom board hives. Middle entrance hives had about 20% more mites drop than bottom entrance hives.

Table 1: Average fall weights and mite counts, by configuration

Configuration	Weight	Mite Count
Solid bottom, bottom entrance	63	10.5
Screen bottom, bottom entrance	60	6.2
Solid bottom, middle entrance	61	11.8
Screen bottom, middle entrance	61	8

Table 2: Average fall weights and mite counts, by group

Group	Weight	Mite Count
Hives 1 through 4 at home	38	7
Hives 5 through 8 at mixed farm	74	15
Hives 9 through 12 at cornfield	67	13
Hives 13 through 16 at cornfield	68	6
Hives 17 through 19 at mixed farm	58	4

Winter Stage - November 2008 to February 2009

We had some hive losses during the winter.

Hive #20, which did not gain weight, perished early, in November. We could predict that, but we did not interfere. The little honey which they had collected was robbed out by the others on warm days. It had a screen bottom, and middle entrance.

Three of the hives (#2, #3, and #4) which were raised in the home yard perished one cold night in early January. Although there were still over 20 lbs of stores in each, the number of bees was too small for the cluster to stay warm. The other hives began raiding the generous provisions on the warmer days. The hive that survived (#1) had screen bottom and middle entrance configuration. It had gained more weight than the others, reaching 50 lbs.

Hive #5 died due to a loss of queen, probably from transporting the hive in the fall. It had several emergency queen cells built, and apparently hatched, but queens can't fly to mate in the cold weather. Without a mated queen the colony dwindled in number until it died in late January. It was a screen bottom hive with bottom entrance.

In late January hive #11 with an open bottom and middle entrance perished. It had clustered in a portion of the hive which did not have honey near it. It still had about 40 lbs of honey available.

The analysis only uses data from the 14 hives which survived to the end of the period.

This period lasted 18 weeks, and average weight loss was 24 lbs. Some larger hives lost 30 lbs. The average live weight of the remaining 14 hives is about 45 lbs. Of the hives that perished, 3 had screen bottom, 3 had closed bottom, 3 had middle entrances, 3 did not. No apparent difference in hive weight or weight loss is noted between different hive configurations.

The mite drop rate plummeted in November, and average was around 1 from the end of November through the middle of January. We suspect that this coincides with the cessation of the bee brood rearing. Some hives began to drop a few more mites in late January, and are increasing in February. In this area it is not uncommon for the hives to begin brood rearing in January. In our analysis we averaged the two counts in January.

Table 3: Average winter weight loss and January mite counts, by configuration

Configuration	Weight Loss	Mite Count
Solid bottom, bottom entrance	23	1.3
Screen bottom, bottom entrance	25	0.8
Solid bottom, middle entrance	24	1.4
Screen bottom, middle entrance	25	0.8

Table 4: Average winter weight loss and January mite counts, by group

Group	Weight Loss	Mite Count
Hive 1	17.5	0
Hives 6, 7, 8	22.7	1.7
Hives 9, 10, 12	24.5	0.9
Hives 13, 14, 15, 16	26.4	1.1
Hives 17, 18, 19	23.0	0.8

Table 5: Average spring weight and January mite counts, by configuration

Configuration	Weight	Mite Count
Solid bottom, bottom entrance	49	1.3
Screen bottom, bottom entrance	42	0.8
Solid bottom, middle entrance	42	1.4
Screen bottom, middle entrance	39	0.8

Table 6: Average spring weight and January mite counts, by group

Group	Weight	Mite Count
Hive 1	30	0
Hives 6, 7, 8	53	1.7
Hives 9, 10, 12	47	0.9
Hives 13, 14, 15, 16	42	1.1
Hives 17, 18, 19	36	0.8

Spring Buildup - February 2009 to April 2009

One hive (#1) perished in mid February. It outlasted the others in it's group by about a month, but without pollen stores available earlier it had not begun to raise brood.

Two hives (#7, #18) suffered brood loss from late hard frosts, and perished in early April. Both hives had a solid bottom and middle entrance. There were sufficient stores of honey, but little pollen remaining.

Some hives were beginning to show signs of swarm preparations.

Hives were moved out for pollination in the middle of April. The cooler March weather seems to have delayed the plants.

Weight loss continues at a similar rate as during winter, until the honey flow begins in May. Weight loss and mite counts will be summarized at that point.

Spring Pollination - Mid April 2009 to End of May 2009

We found this period to be especially busy, as most of the hives were intent on swarming. Colonies were increasing in size rapidly, and we began adding additional medium size boxes to the hives for the bees to work into. However, in an effort to handle each hive equitably we used only undrawn foundation frames (the cells were not started). The bees were hesitant to move up into these boxes and make more comb, and they began raising new queen cells.

We tried to diligently remove all the cells individually, but that took much time. We also once removed all frames with queen cells (and recorded their weights) hoping to slow the colonies down a little, and keep them from swarming. This was done on April 18 to hives #14 and #15, and on April 27 to hives #12 and #9. Hives #9, #14 and #15 had solid bottoms. Hives #9, #12 and #14 had bottom entrances.

To make the bees use the new boxes we inserted them between the other boxes. Once they had begun making the cells and using them the new box could be relocated to the top of the hive. Despite our efforts most of the strong hives did swarm.

Normally beekeepers would split the hives down a little, perhaps sharing some frames of brood with weaker hives or starting new colonies, and drawn comb would be used instead. We tried to keep all the bees in the box, but that is against their nature, and eventually they won. However, we have the opportunity to assess the mite response to swarming, and we can measure hive weight losses due to swarming.

During this period there is often surplus nectar available for the bees to collect, and the hives begin to build up weight again. The average date for lowest weight was April 25. Variations of this date between hives reflect on the hives strength. The weight loss was determined from the maximum fall rate to the minimum weight.

Average mite counts for May are also shown. Notice that mite counts are increasing. Some beekeepers recommend treating for mites if more that 30 fall in 24 hours, some suggest 50 is the threshold level to begin treatment. Many treatments have a temperature range limitation, or a prohibition of use while collecting harvestable honey, so timing is a consideration when considering mite levels and treatment.

Table 7: Average weight loss and May mite counts, by configuration

Configuration	Weight Loss	Mite Count
Solid bottom, bottom entrance	38	50.0
Screen bottom, bottom entrance	39	14.5
Solid bottom, middle entrance	34	35.0
Screen bottom, middle entrance	42	12.1

Table 8: Average weight loss and May mite counts, by group

Group	Weight Loss	Mite Count
Hives 6, 8 at mixed farm	41	36.2
Hives 9, 10, 12 at apple & blueberry	38	50.0
Hives 13, 14, 15, 16 at mixed farm	40	24.0
Hives 17, 19 at apple & blueberry	32	10.0

Table 9: Average lowest weight and date, by configuration

Configuration	Weight	Date
Solid bottom, bottom entrance	35	April 26
Screen bottom, bottom entrance	28	April 21
Solid bottom, middle entrance	31	April 08
Screen bottom, middle entrance	31	May 17

Table 10: Average lowest weight and date, by group

Group	Weight	Date
Hives 6, 8 at mixed farm	38	May 17
Hives 9, 10, 12 at apple & blueberry	34	April 12
Hives 13, 14, 15, 16 at mixed farm	31	April 26
Hives 17, 19 at apple & blueberry	22	April 21

Honey Production – June 2009

After a very warm and sunny May, we had two weeks of exceptionally rainy weather in early June. This coincided with the mating period for the new queens in the hives which had swarmed. The queens mate numerous times on the wing during a three day period at the end of their first week after emerging from their cells. With inclement weather the success of mating is reduced, as the queen prefers not to hazard being lost due to chill or rain. Unmated queens will lay eggs, but they will only produce drone bees. Without worker bees, the hive is doomed. Sometimes poorly mated queens will lay worker eggs for a while, then after the supply of semen is expended only drone eggs are produced. Sometimes the hive can detect the failing queen and begin another queen cell, starting from a fertile egg. Other times other worker bees begin to lay, but this is also only drone brood. When drone layer hives are found, many beekeepers consider it expedient to break up the hive and use it to augment hives which have good queens. Hives 9 and 12 were found to be drone layers in late June. Their weight is included in the analysis, but the mites were not counted.

The weight gain for this analysis will be the weight at the end of June, minus the lowest weight recorded in the previous time period. The mite count is from measurements at the end of June. Some groups were measured on June 29th, and some on July 1st.

We notice that hive 8 still loses weight. It has a small brood area, and few mites. It is a screen bottom, middle entrance hive.

Table 11: Average weight gain and June mite count, by configuration

Configuration	Weight Gain	Mite Count
Solid bottom, bottom entrance	39	40
Screen bottom, bottom entrance	26	37
Solid bottom, middle entrance	63	148
Screen bottom, middle entrance	33	1

Table 12: Average weight gain and June mite count, by group

Group	Weight Gain	Mite Count
Hives 6, 8 at mixed farm	15	24
Hive 9,10, 12 at clover	43	227 (only hive 10)
Hives 13, 14, 15, 16 at mixed farm	57	31
Hives 17, 19 at clover	19	45

Summer Pollination, July and August 2009

All the hives were taken to a field to pollinate squash. Although the farmer claims to not use insecticides on that field of squash, the bees visit other fields of crops around, which had been sprayed with insecticides. Other beekeepers in the same field reported hive losses. Our hives appeared normal when we brought them back, but shortly after we found one hive (#14, solid bottom, bottom entrance) had no bees, brood, or honey left. A sharp weight loss was noted on the Aug 10 weight, and we expect that the hive had suffered from external influences, and robbing had already begun. It's data is not used in the analysis.

Due to consistent rains the clover flowers, and many others, continued to bloom through July. Often a summer drought dries up all nectar sources for bees, and sometimes they must be fed. This year some hives continued to add weight. We will compare weights between the end of June and August 10th, and the mite counts at that date.

The mite counts are of interest here, as they show the difference between a solid bottom and a screen bottom in summer mite control.

Table 13: Average summer weight gain and August mite count, by configuration

Configuration	Weight Gain	Mite Count
Solid bottom, bottom entrance	5	392
Screen bottom, bottom entrance	1.5	9
Solid bottom, middle entrance	7.5	511
Screen bottom, middle entrance	11	38

Table 12: Average summer weight gain and August mite count, by group

Group	Weight Gain	Mite Count
Hives 6, 8 at squash	-1	220
Hive 10 at squash	6	749
Hives 13, 15, 16 at squash	5	113
Hives 17, 19 at squash	16	168

Fall Feeding 2009

The remaining 8 hives were removed from the squash fields on August 7th, and brought to a mixed farm location. We began feeding syrup to build up stores for winter on Sept 26th, feeding until the hive weight indicated 60 pounds of stores. We noticed that hive 6 and 19 did not consume the syrup as quickly as others.

On September 14th: Hive 17 had perished, leaving a handful of dead bees.
Hive 16 the queen was only laying drone brood.

On September 26th: Hive 13 the queen was laying only drone brood.

On October 19th: Hive 15 had absconded, all the bees had left.

On November 3rd: Hive 19 had absconded, all the bees had left.

On November16th: Hive 6 had perished, leaving a handful of dead bees in the hive.

On December 1st: Hive 10 had absconded, all the bees had left.

On December15th: Hive 8 had perished in the cold, leaving 2 frames of dead bees.

The hive configuration and mite count compared to the mechanism of hive loss is compared in table 13. We used the last mite count data available while the hive was alive. The mite count has reduced from the summer peak, but the bee population and brood nest size also declines in the fall. The higher mite load in the solid bottom hives correspond to higher incidences of absconding. Screen bottom hives show a higher rate of perishing.

Table 13: Fall loss and mite load, by configuration

Configuration	Drone Layer	Perish	Abscond	Mite Count
Solid bottom, bottom entrance		1	1	129
Screen bottom, bottom entrance	1	1		8
Solid bottom, middle entrance			2	120
Screen bottom, middle entrance	1	1		34

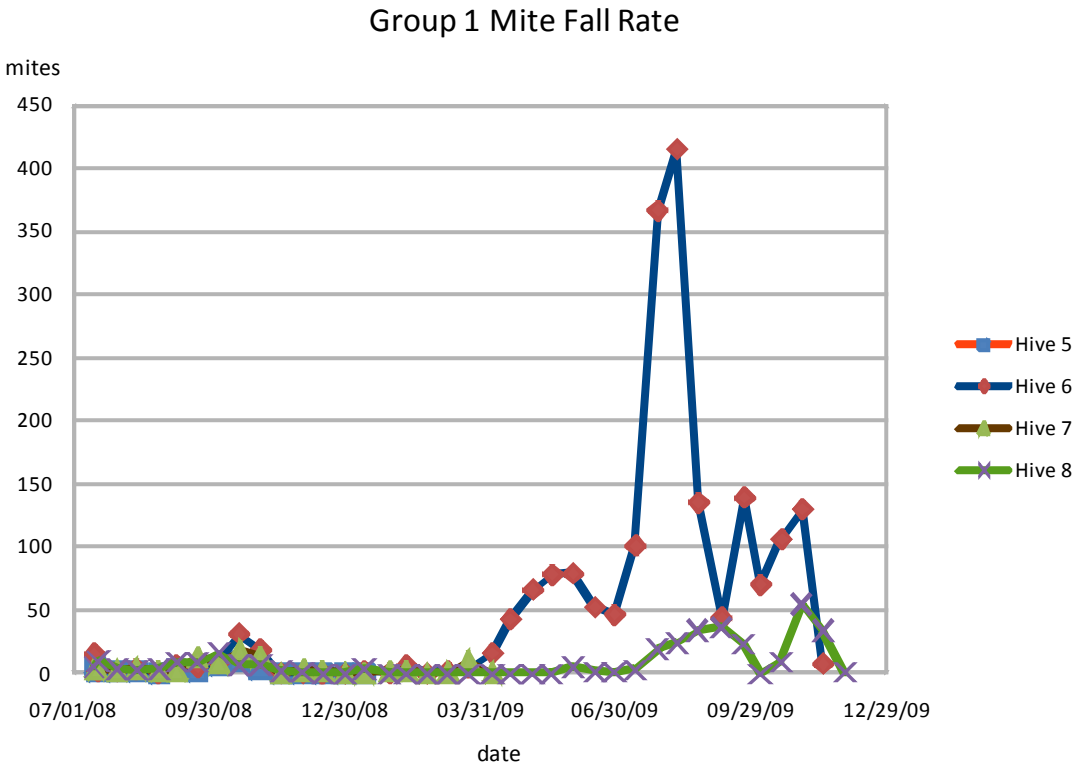
Overview of Hive Performance:

The following graphs show hive weights and mite counts over the whole time period of the experiment. Some further points of interest are noticed when looking at the whole time period, as compared to dicing it into small sections.

In graph 1 different mite population behavior can be noticed. First, notice the beginning of mite buildup during the first summer, suddenly dropping for winter.

The spring buildup in hive 6, a conventional hive with solid bottom and bottom entrance, starts early in the spring, and so does the mite population. We expect that the dip in June may be an attempt of the hive to combat the mites. However, the mite load suddenly explodes. The variations in September and October would suggest that a single measurement of mite load using natural mite fall rates is not reliable. The final drop to zero indicates the complete loss of colony.

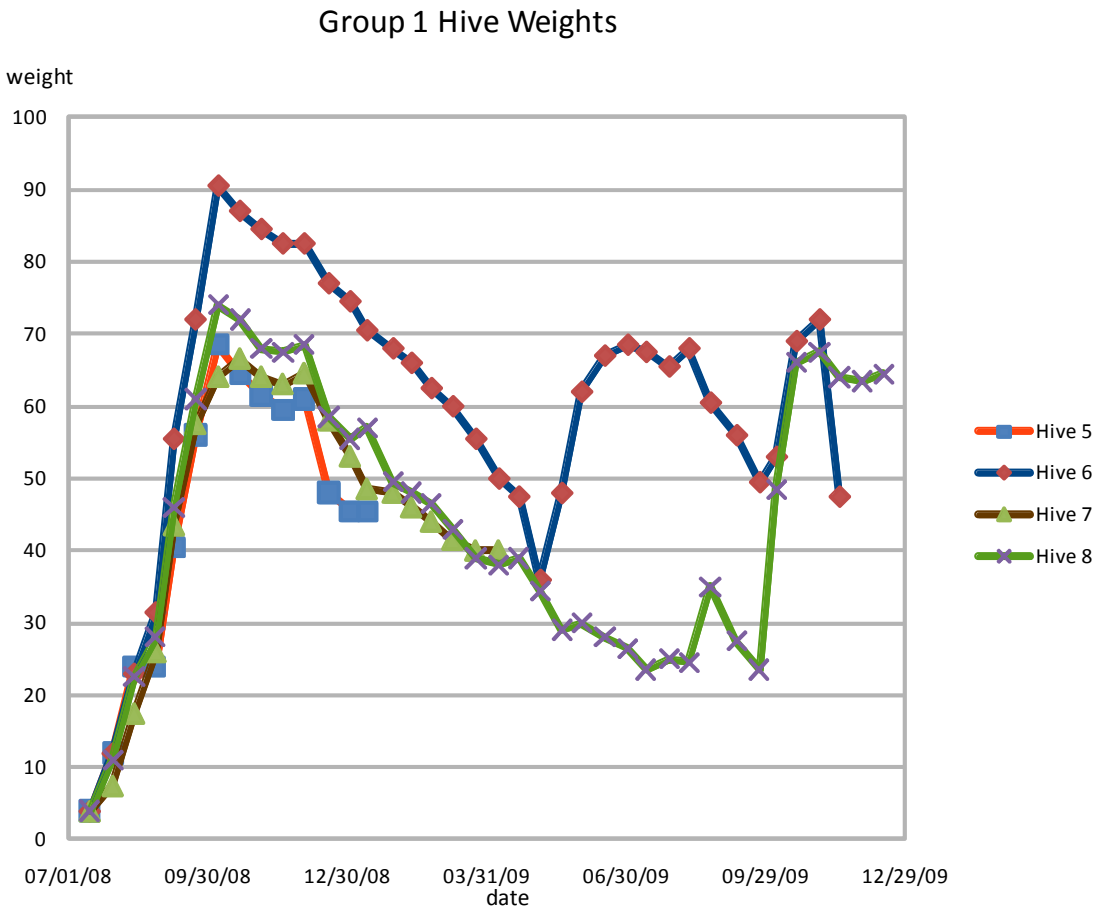
Hive 8, with a middle entrance and screen bottom, does not have a mite buildup until July, which it seems to control, but the mites build up again in fall, while the colony strength is diminishing, which may have contributed to the hive loss.



Graph 1: Mite fall rates for hives in group 1

The hive weights, in graph 2, show more information on the hive conditions. All four hives gained weight well the first fall, and had a similar weight loss rate. However, we notice hive 6 is stronger, gaining more weight in the fall, and using it faster through the winter.

In the spring hive 6 made honey in June, shown in the rise of hive weight, and, as is typical in this area, lost weight in August. Hive 8 was not productive. The colony did not expand soon enough to take advantage of the honey flow. It did gain a little weight in midsummer, when the hive was at peak strength. It was able to take in feed in September, and prepare for winter.

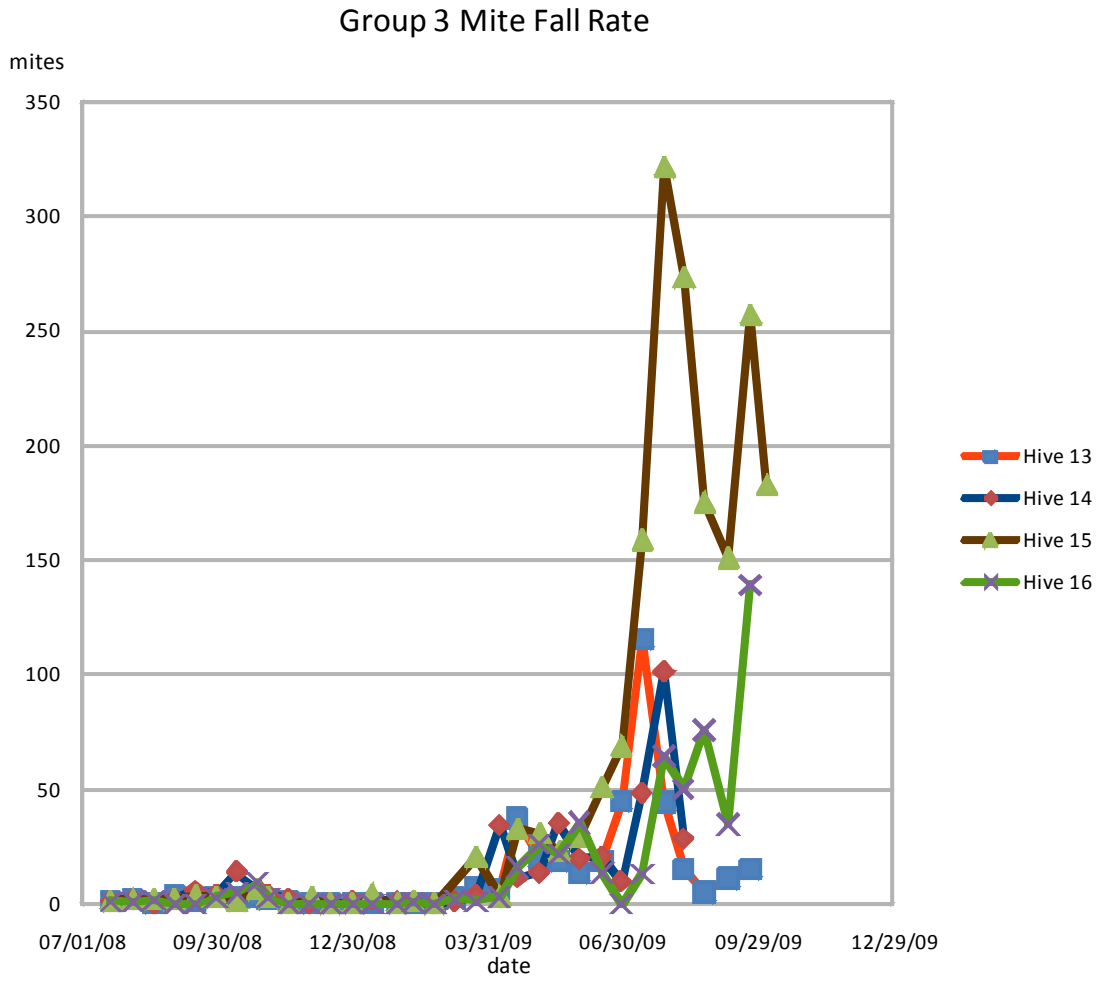


Graph 2: Hive weights for group 1

In group 3 all the hives survived through to the second summer, and each hive configuration can be readily compared in graphs 3 and 4.

Hive 14, the standard hive, with solid bottom and bottom entrance, shows better weight gain the first fall, a normal weight loss during winter, and a quick weight gain in the honey flow. The mite load is moderate, and varying, in April through June, jumps in late July, but the hive perished in August. We expect that the mites would have continued to increase.

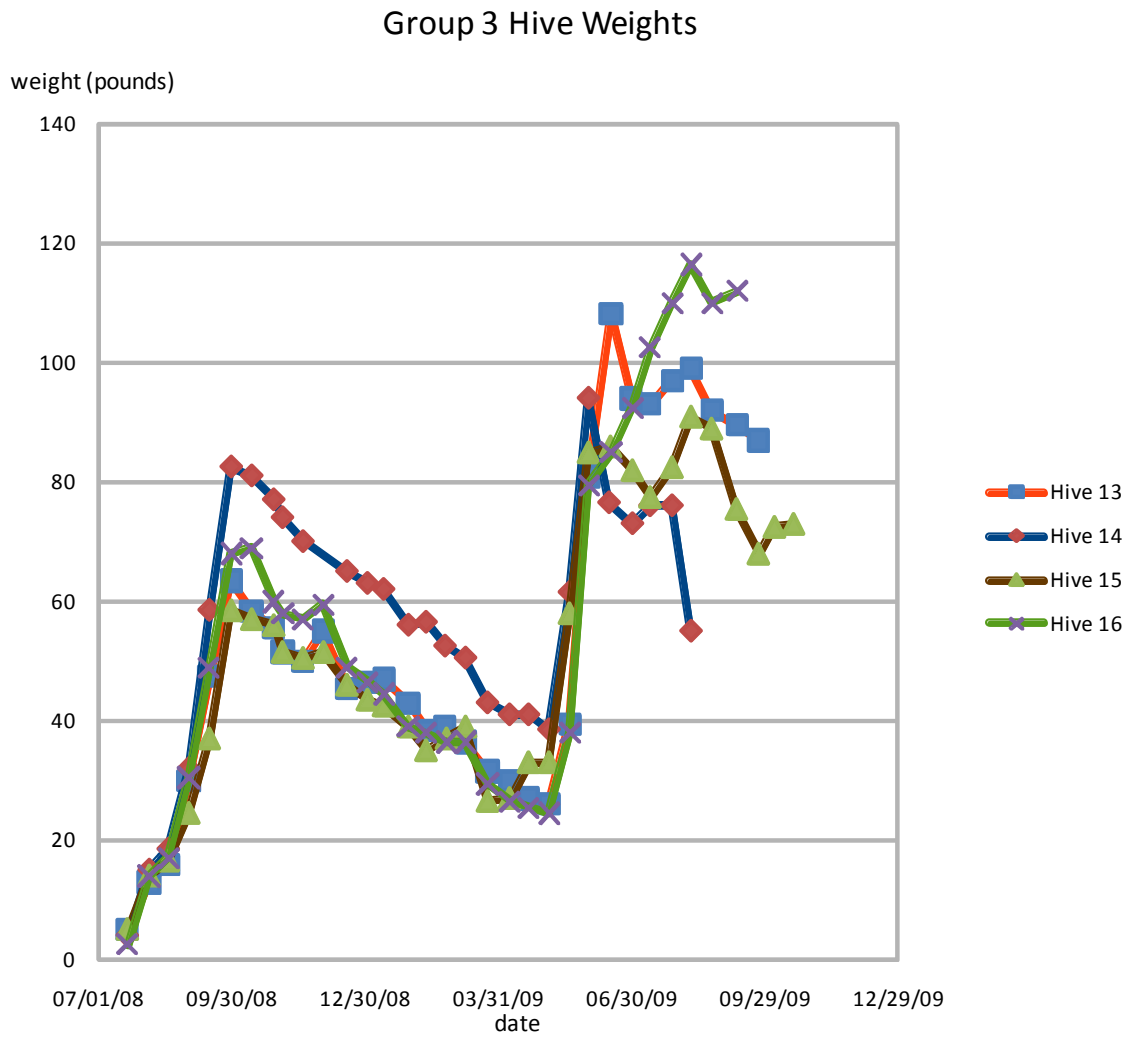
Hive 13, the normal screen bottom hive, is a little later on the honey flow in June, but does well. The mite load is moderate in the spring, takes a little jump in July, and drops off quickly. If the queen hadn't quit laying worker brood the hive would have had a good chance to succeed.



Graph 3: Mite fall rates for hives in group 3

Hive 15, with a solid bottom and a middle entrance, had a productive honey flow, but the mites took over. In October, the bees left.

Hive 16, with the screen bottom and middle entrance, had a slightly delayed, slower, prolonged honey flow, in the end outperforming the other hives, posting a gain of 90 lbs. The mites were kept to a moderate level until September. Unfortunately the queen had quit laying worker brood, and the hive perished. The spike in mite count at the end could be due to a combination of reduced workforce and surplus drone brood due to the failing queen. Mites can multiply more effectively in drone brood, as there is a longer development time before the drones emerge.



Graph 4: Hive weight for hives in group 3.

Conclusions:

The summer mite count difference between solid bottom and screen bottom hives is statistically significant in this experiment. Other variations were not.

Winter survival seems to be reduced with middle entrances.

Spring buildup seems to be earlier with solid bottom hives and bottom entrance hives.

Weight gain seems to be increased with middle entrances.

The mite fall rate in winter is so low that using a screen bottom during winter is unlikely to have any benefit. Mites that land on the bottom will likely perish from the cold

long before they find a way back to the bee cluster.

Farming Conditions:

The unusually rainy spell in early June 2009 affected the mating of queens from some of the hives which swarmed. This resulted in some hive losses in the fall.

We would also like to particularly express that, in order to not affect the results of the experiment, we have tried to refrain from using a wide variety of beekeeping techniques which could have improved our colony survival rate. Common practices would include dividing hives to reduce swarming, moving frames of brood to balance hive strengths within groups, swapping hive locations to balance field strength, and replacing poor queens. Do not use our methods as an example of good beekeeping practice.

Unfortunately the statistical validation of results is difficult with a reduced experiment population.

Continued ideas:

Our work has provided a deeper understanding of seasonal changes in Varroa loads in honeybee colonies, and appropriate beekeeper response.

1: Winter: Varroa fall is minimal, thus there is little benefit to screen bottom boards. Screen bottoms may have reduced winter survival rate. Middle entrances delayed spring buildup, perhaps chilling the hive too much. Hives used 40 lbs of stores through the winter.

2: Spring: Mite loads increase. Screen bottoms are beneficial, and middle entrances may be helpful too. Natural mite fall rates are rather variable during this time, so more than one sample should be taken to evaluate the true mite load.

3: Honey flow: Mites can multiply dramatically as the hive is busy with harvest. Mite control should have begun before this time. Screen bottoms reduced harvest, middle entrances increased harvest.

4: Summer: Mite loads remain high, but lower with screen bottom. Middle entrances prolonged harvest.

5: Fall: High mite loads are fatal to colonies.

We have demonstrated a noticeable reduction in Varroa load in hives during the summer by using the screen bottoms, but this does not seem to be sufficient for good control. Benefits of middle entrances in mite control are not as significant. These tools may also be useful in conjunction with drone brood trapping and other cultural techniques.

Thanks for your interest, and thanks to Tim Schuler, NJ State Apiarist, for involvement as advisor.

Outreach:

We had an openhouse for South Jersey beekeepers in July 2008, and introduced our project and methods to local beekeepers. Many expressed interest in evaluating the benefits of these cultural non-chemical alternatives in mite control.

We have had updates of our experiment published in the New Jersey Beekeepers Newsletters.

We have had opportunity to present our findings to over 100 beekeepers at the New Jersey beekeepers meeting in May 2010. This was a 'hands on' display of our equipment and methods, showing how to test for mites and use the screen bottom in the hives, as well as introduce others to the concept of a middle entrance. Many expressed interest in our experience with mite control, and understanding the mite growth pattern in New Jersey.

Dave Stewart,
February 28, 2011