Varroa Treatments: Efficacy and Economic Impact

Project No.: **13-POLL9-Ahumada**

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Objectives:

The main focus of this research project is to test the efficacy of commercially available mite treatments, particularly natural treatments, to determine how well they can control Varroa mite infestations and analyze their economic impact. Along with mite data collection, we are monitoring colony strength, queen survivorship and bee-treatment interaction.

The project objectives are as follows:

1) Determine the efficacy of the treatments on mite levels
   a. Mite monitoring
      1. Alcohol wash method
      2. Treatment application

2) Determine the treatment effect on colony strength and behavior
   a. Monitor colony strength
   b. Queen survivorship
   c. Bee-treatment interaction

3) Determine the economic impact of the treatments
   a. Treatment cost
   b. Queen replacement
   c. Colony loss cost
   d. Economic impact

Interpretive Summary:

The focus of the research project is to test the efficacy of commercially available natural treatments for mite control and their economic impact. The efficacy of treatments are being tested against Apivar as a standard. The field study was set up in September 2013 in Monterey County, CA and is in progress as planned until June 2015. Mr. Gene Brandi is the cooperator and has provided 48 colonies. Colony assessment, mite counts and queen marking were performed in all colonies before treatment application. The treatments are: Apiguard, HopGuard II, Mite Away Quick Strips (MAQS) and the Apivar standard. The first treatment was

applied September 4, 2013. After one month, mite levels had decreased in all treatments and were not significantly different from each other. Colonies overwintered in the same area and were moved in January to almond orchards. In March 2014, overwinter losses of 27 % were recorded for the test colonies. These colonies were replaced, data recorded, two spring treatments were applied (March 12, 2014 and May 8, 2014). Pre- post treatment mite counts recorded for each time. Colony survivorship was 100% for September-October 2013 and decreased to 67.3% in June 2014. These losses can be attributed to lack of forage and mite infestation. Queen survivorship was also 100% for September-October 2013 decreasing to 27% in June 2014. Mite levels along with frames of bees and brood are being recorded throughout this study and Tukey's repeated-measures statistical analyses has shown no significant differences among the treatments to date. A total of three mite treatments have been applied so far during this study except for HopGuard II colonies that received only two full treatments (March 12, 2014 and May 8, 2014) due to lack of product availability. For this reason, HopGuard II colonies were not included in the repeated-measures statistical analysis.

Materials and Methods:

The field study was set up on September 4th, 2013 in Monterey County, CA and Mr. Gene Brandi provided 48 full size colonies. Alcohol washes were performed in all colonies to determine pre-treatment mite population. Mite levels were equalized among treatment groups and a set of 12 colonies was assigned to each group. Frames of bees and frames of brood were recorded for all colonies before the treatment application and after each subsequent treatment. The mite treatments were applied following the manufacturer's instructions. Since Apiguard and MAQS are temperature sensitive, this was taken into consideration at the time of the treatment application. All queens were marked on their thorax with white paint prior to the start of the study. Queen presence was recorded at the time of each treatment application and at post-treatment. Queens were replaced as needed, depending on availability.

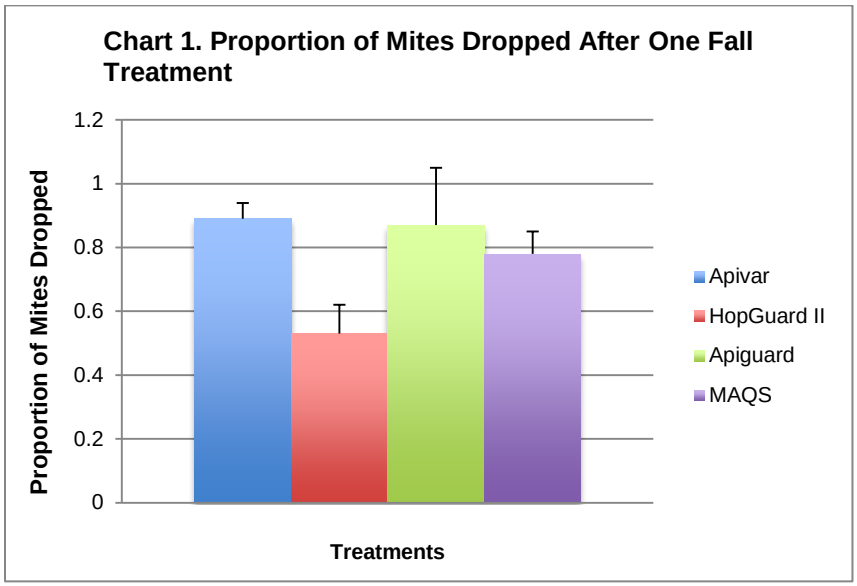
Colonies were marked with numbered yellow tags for easy identification. The treatments tested were: Apiguard, HopGuard II, MAQS and Apivar as a standard. The first treatment was applied on September 4th, 2013 with subsequent treatments on March 12, 2014 and May 6, 2014. After one month, post-treatment mite levels, queen survivorship and colony strength was recorded. HopGuard I was used for the first treatment instead of HopGuard II, which was not available at that time. Subsequent treatments were with HopGuard II. Alcohol wash was the method used to determine mite levels before and after each treatment application. Treatments were purchased for each of the proposed products and the total cost including labor and shipping was recorded. The cost per treatment was calculated by dividing the total cost by the number of applications per colony per year. As planned this study will continue until June 2015.

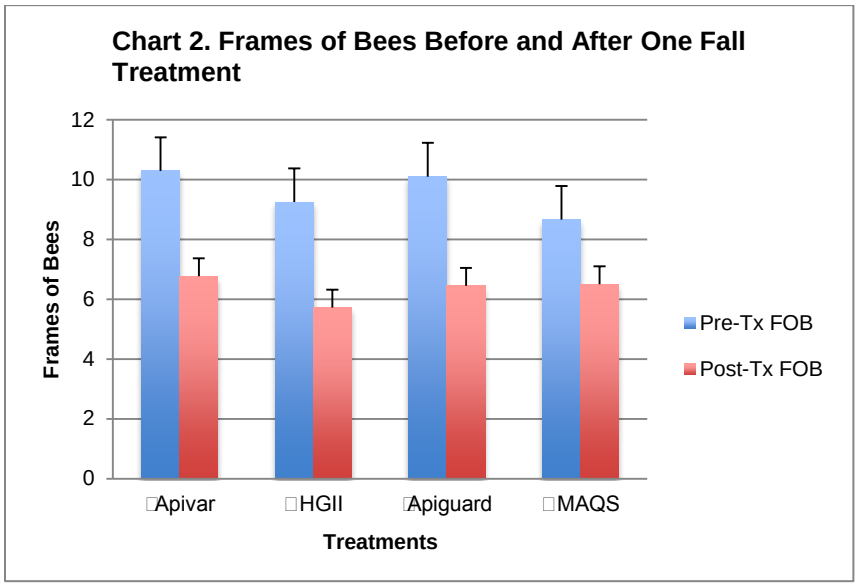
Any adverse effect of the treatments on bees and/or brood was noted. A detailed expense record log was kept to calculate the financial costs at the end of the study. This allowed us to analyze the total costs to determine the economic impact of the treatment on the beekeeper's operation.

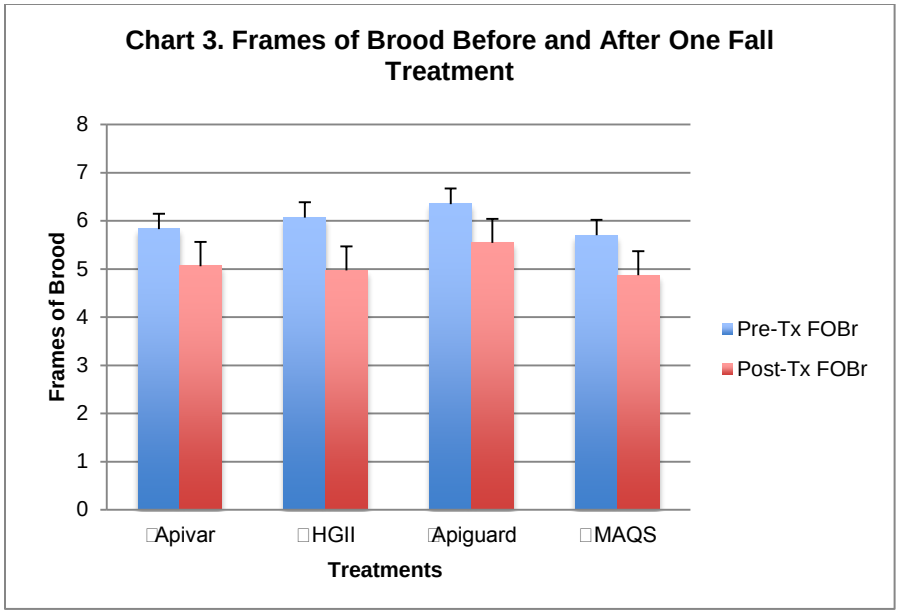
Results and Discussion:

Honeybee colonies were treated with Apivar, HopGuard I, Apiguard and MAQS on September 4th, 2013. Pre and post treatment mite counts, frames of bees and brood were recorded after

one fall application and a one-way ANOVA statistical analysis was performed on the data collected. Fall post-treatment colony and queen survivorship was 100% for all treatments. **Chart 1** shows the proportion of mites dropped in the colonies after one fall application; **Charts 2** and **3** show the frames of bees and brood before and after the fall treatment. There were no significant differences in mites dropped, frames of bees and brood in all colonies after the treatments. Some brood damage was observed on Apivar treated colonies where the strips were hung but not significant enough to have a negative effect in the colony.







Colonies were evaluated on March 12th, 2014 after almond pollination. Colonies that did not survive the winter (27%) were replaced and the queens marked. Total overwinter colony survivorship was 73% and 64.6% for queens; 11.4% of the colonies were re-queened. Mite counts, and frames of bees and brood were recorded. Colonies were treated with Apiguard, HopGuard II, MAQS and Apivar. In April 2014, colonies were moved back to Monterey County, CA and were monitored again on May 8, 2014 where colony data and mite counts were recorded. Total colony survivorship was 67.3% and 52% for queens; 18% of the colonies were re-queened. At this time, colonies were treated with Apiguard, HopGuard II, MAQS and Apivar. In mid-June 2014, colonies were moved to a berry farm and will remain there until late fall. On June 24, 2014 colonies were inspected and mite counts were recorded. Total colony survivorship remained at 67.3% and 27% for queens; 36.4% of the colonies were re-queened. No treatments were applied at this time. A total of three mite treatments have been applied during the study except for HopGuard II colonies that received only two full treatments due to lack of product availability at the time of the treatment. For this reason, HopGuard II colonies were not included in the statistical analysis.

The repeated measures analyses of variance were performed using the colony data and mite counts recorded on Apiguard, MAQS and Apivar treatments from September 2013 through June 2014. The repeated measures analysis showed no significant differences among the treatments in frames of bees, frames of brood and mite levels. The results are shown in **Charts 4, 5** and **6**.

Colony survivorship for Apiguard and MAQS was 83% and 75% for Apivar from September 2013 - June 2014. The results are shown on **Chart 7**.

Queen losses were recorded for each treatment; 42% of the queens were replaced in Apivar and Apiguard colonies and 67% in MAQS colonies from September 2013-June 2014. The results are shown in **Chart 8**.

A detailed expense report log was kept to analyze the total costs of the treatments, colonies and queens replacement. The costs are shown in **Tables 1** and **2**.

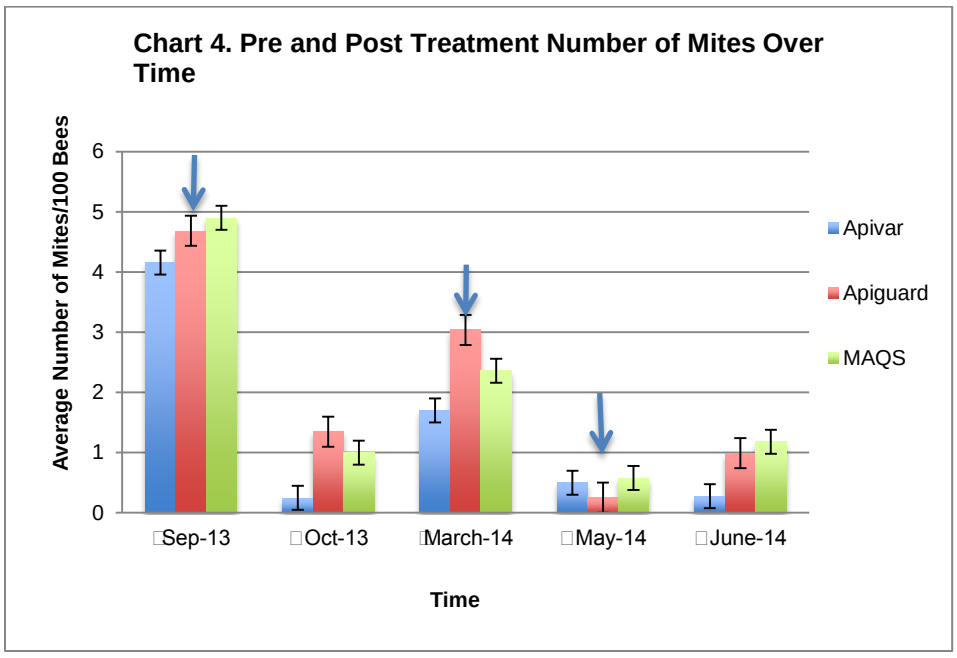


Chart 4. Pre and Post Treatment Number of Mites Over Time
Average Number of Mites/100 Bees
0
1
2
3
4
5
6
Sep-13
Oct-13
March-14
May-14
June-14
Time
Apivar
Apiguard
MAQS

= Treatment

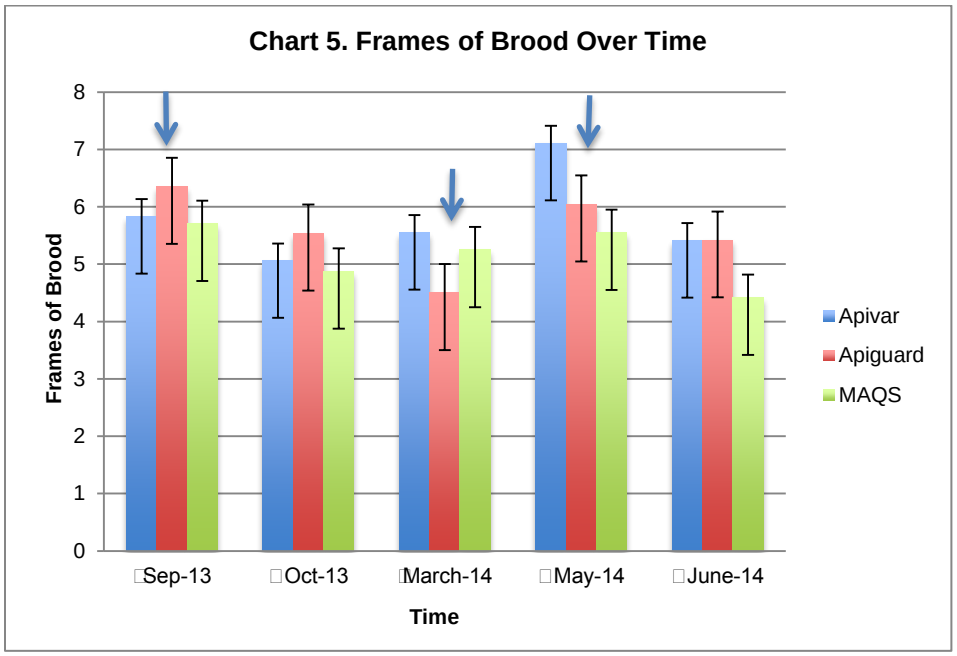


Chart 5. Frames of Brood Over Time
Frames of Brood
0
1
2
3
4
5
6
7
8
Sep-13
Oct-13
March-14
May-14
June-14
Time
Apivar
Apiguard
MAQS

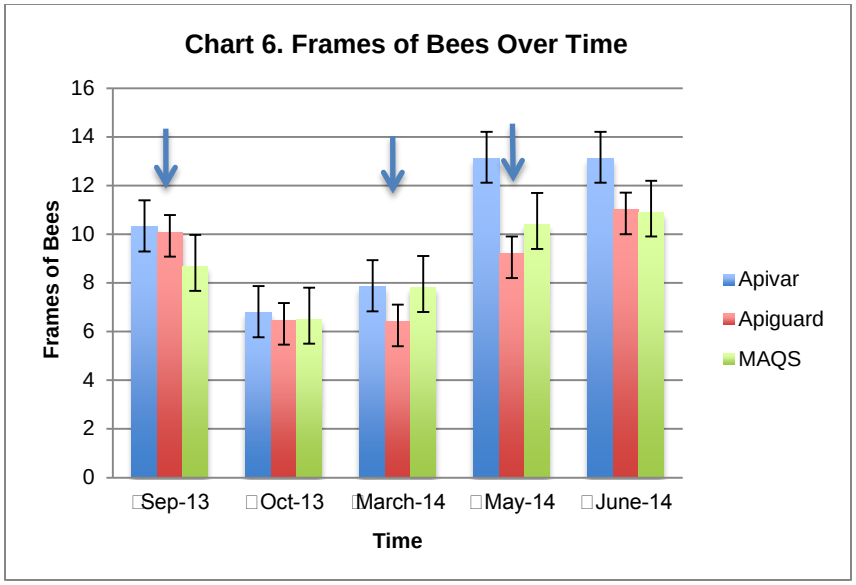


Chart 6. Frames of Bees Over Time
Frames of Bees
16
14
12
10
8
6
4
2
0
Sep-13
Oct-13
March-14
May-14
June-14
Time
Apivar
Apiguard
MAQS

= Treatment

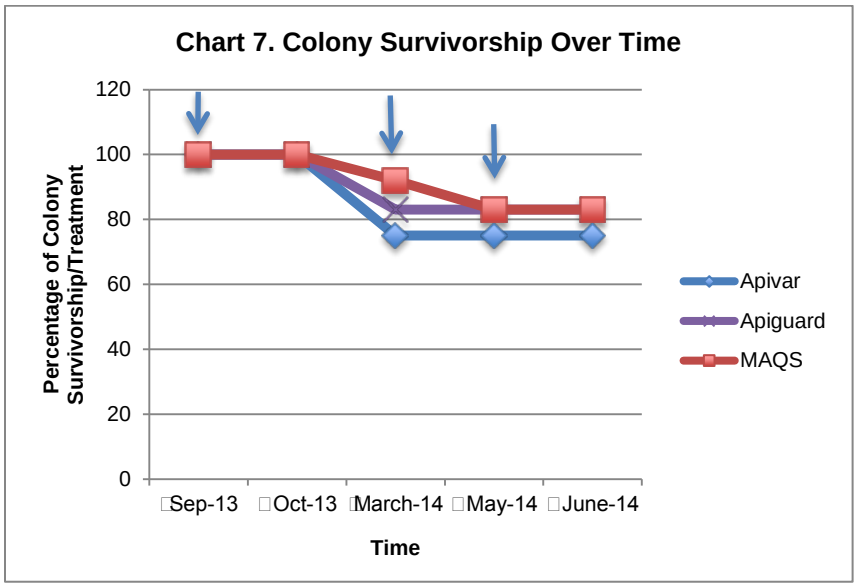


Chart 7. Colony Survivorship Over Time
Percentage of Colony Survivorship/Treatment
120
100
80
60
40
20
0
Sep-13
Oct-13
March-14
May-14
June-14
Time
Apivar
Apiguard
MAQS

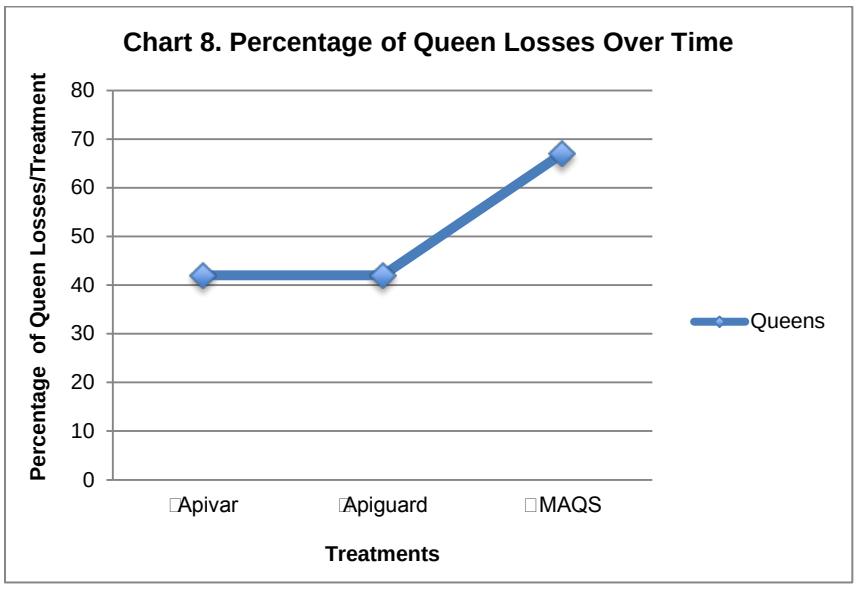


Chart 8. Percentage of Queen Losses Over Time
Percentage of Queen Losses/Treatment
80
70
60
50
40
30
20
10
0
Apivar
Apiguard
MAQS
Treatments
Queens

Table 1. Treatment costs

Treatment	Cost	Treatment dose	Treatment cost/colony	Number of treatments	Total cost/colony
Apivar	$35.95	2 strips/brood chamber	$7.19	3	$21.60
Apiguard	$95 (3Kg)	100 gr	$3.10	3	$9.30
MAQS	$47.95	2 pads	$4.80	3	$14.40
HopGuard II*	$42	2 strips/deep	$7.00 (4 strips applied)	2*	$14.00*

* HopGuard colonies received only two full treatment applications due to the lack of product availabilty.

Table 2. Colony and queen replacement costs

	Colonies Lost	Cost/Bee package	Queens Lost	Cost/Queen
	15	$ 75	35	$ 23
Total Cost		$ 1,125		$ 805

The results from the fall treatment have shown that the proportion of mites dropped and frames of bees and brood were not significantly different among Apiguard, HopGuard II, MAQS and Apivar. The results from the spring treatments have shown that Apivar, Apiguard and MAQS showed similar effects in mite control and colony sizes. Mite populations and frames of bees and brood did not differ in all three treatments. HopGuard II colonies received one spring treatment and were not included in the analyses. Colony survivorship was similar in the three treatments. Queen losses were higher in MAQS colonies compared to Apiguard and Apivar. Apiguard was the least expensive treatment per colony followed by MAQS and Apivar.

In summary, the spring data showed that these three treatments worked equally well. As planned this trial will continue to June 2015. Further studies will need to be performed to determine how many spring and fall treatments are needed to control mite populations and how the miticides should be rotated.

Research Effort Recent Publications:

The results from this project have not yet been published.

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