Varroa Treatments: Efficacy and Economic Impact: 2014 - 2015 Almond Pollination

Project No.: **14-POLL9-Ahumada**

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Objectives:

The main objective of this research project was to determine the efficacy of selected mite treatments during two almond pollination seasons and analyze their economic impact. The treatment selection and experimental design was based on results obtained in13-POLL9-Ahumada.

The treatments tested were: Apiguard, HopGuard II, Mite Away Quick Strips and Apivar.

1. Determine the efficacy of the treatments on mite levels: almond pollination 2014 through 2015.
2. Determine the treatment effect on colony strength and behavior: almond pollination 2014 through 2015
3. Determine the economic impact of the treatments: almond pollination 2014 through 2015.

Interpretive Summary:

Varroa destructor continues to be a threat for the beekeeping industry despite the efforts by beekeepers to control it. The focus of the research project was to determine the efficacy of selected mite treatments during two almond pollination seasons and analyze their economic impact. The data collected during project **13-POLL9-Ahumada** enabled us to determine and select the treatments to be used in this study. The field study was set up in March 2014 in Fresno, CA and Mr. Gene Brandi provided 48 colonies. Colony assessment, mite counts and queen marking were performed in all colonies before the first spring treatment application and periodically for the duration of the study. Apiguard (Thymol), HopGuard II (HGII), Mite Away Quick Strips (Formic acid - MAQS) and Apivar (Amitraz) were applied in the spring and fall of 2014. Due to lack of product availability, HGII colonies received only two full treatments during the study and for this reason were not included in the statistical analysis. Mite levels were recorded throughout the study and Tukey's repeated-measures was used as the statistical analyses method. The average fold increase in mite levels was significantly different among the treatments in summer and fall 2014, with Apivar showing the lowest level of mite increase. Mite levels increased over the winter and March 2015 levels showed no significant differences in all treatments. The statistical analysis performed on frames of bees and brood over time

demonstrated that Apivar and Apiguard treated colonies showed no significant differences but MAQS colonies were significantly less than Apivar. Queen losses were recorded along the study and varied among the treatments. The highest queen loss percentage was observed in June 2014 in Apivar and MAQS colonies. Total colony losses recorded from March 2014 through March 2015 showed a yearly average loss of 50% that can be attributed to lack of forage, high mite infestation and other factors.

Plans are the results obtained can be incorporated into an Integrated Mite Management Program.

Materials and Methods:

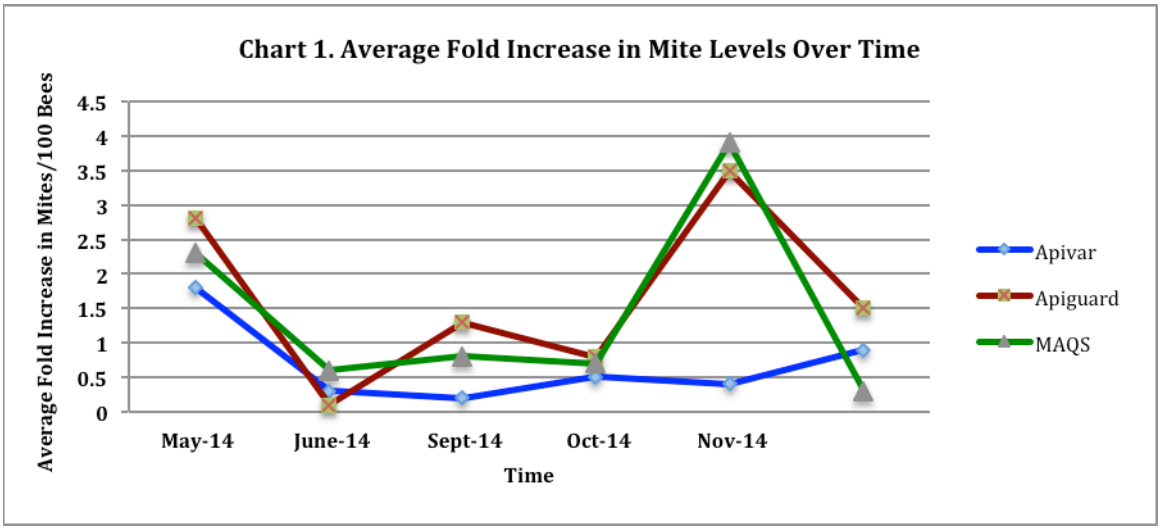
The field study was set up in March 2014, in Fresno, CA and Mr. Gene Brandi provided 48 full size colonies. Alcohol washes were performed in all colonies to determine pre-treatment mite population. A set of twelve colonies with equalized strength and mite levels was randomly assigned to each treatment group. Colonies were marked with numbered yellow tags for easy identification. All queens were marked at the beginning of the study and their presence was accounted for on every colony inspection. Frames of bees and brood were recorded for all colonies before the first treatment application and periodically throughout the study. Colonies were moved to a berry farm in Monterey County in the summer and remained there for the duration of the study. Apiguard (Thymol), HGII* (Hopguard), MAQS^{+} (Mite Away Quick Strips – Formic acid) and Apivar (Amitraz) were applied following manufacturer's instructions. During the study Apivar colonies received 3 treatments, MAQS colonies 4 treatments and Apiguard colonies 5 treatments. Any adverse post-treatment effect on bees and/or brood was noted. Queens were replaced as needed but subject to availability. Alcohol wash was the method used to determine monthly mite levels. 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.

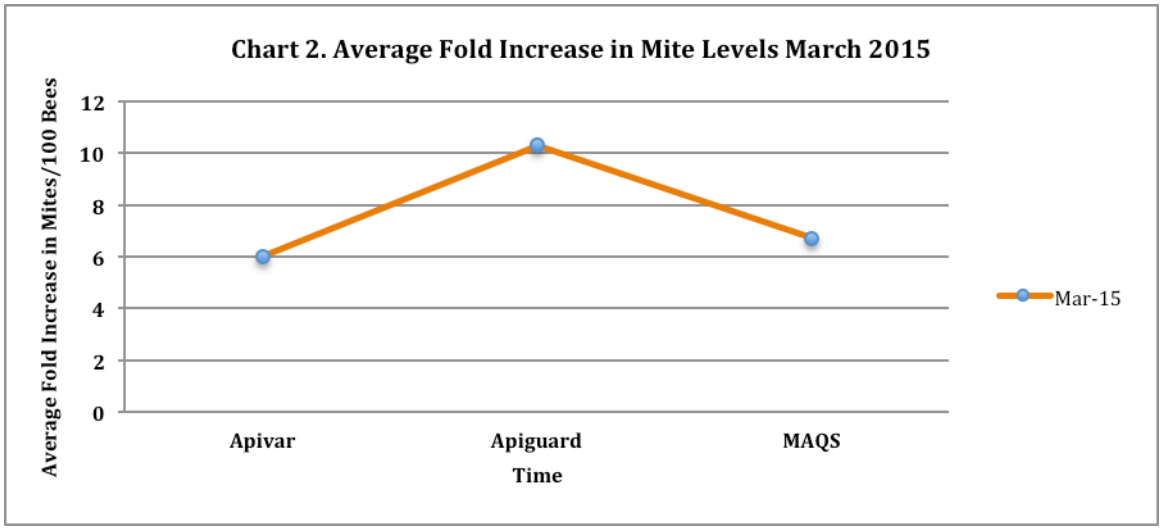
Significant differences among treatments were determined by a two-way analysis of variance using proportional changes in colony size and sample time as factors. Significant differences in mite levels were determined by Tukey's repeated-measures. A detailed expense record log was kept to calculate the financial costs at the end of the study. This allowed us to analyze the total costs and determine the economic impact of the treatments on the beekeeper's operation.

Results and Discussion:

Mite levels were monitored from March through November 2014 and treatments were applied in spring and fall. The results showed that mite levels started to increase in the summer achieving their highest peak in late August. At this time, the first set of fall treatments was applied followed by consecutive treatments to reduce mite levels before the winter season. The average fold increase in mite levels was significantly different among the treatments in

summer and fall 2014 with Apivar showing the lowest level of mite increase. The results are shown in **Chart 1**. Mite levels recorded in March 2015 showed no significant differences in all treatments as shown in **Chart 2**. The number of frames of bees and brood were recorded monthly during the study but due to high 2015 overwinter colony losses the data was analyzed up to October 2014 as shown in **Charts 3** and **4**. Frames of bees in MAQS colonies were significantly less than Apivar in the fall. Frames of brood in Apiguard and MAQS were not significantly different from each other. Colony losses were recorded for all treatments throughout the study and the highest percentages were observed in fall and overwintered colonies as shown in **Chart 5,** with Apivar having the lowest loss. Queen losses were also recorded and the highest percentage was observed in June in MAQS and Apivar colonies (**Chart 6)**.





* HGII colonies received half of the recommended dose in March, May and September due to lack of product availability.

+ MAQS: the recommended dose is 2 pads/colony but the study colonies received only 1 pad/colony due to Mr. Brandi's colony configuration.

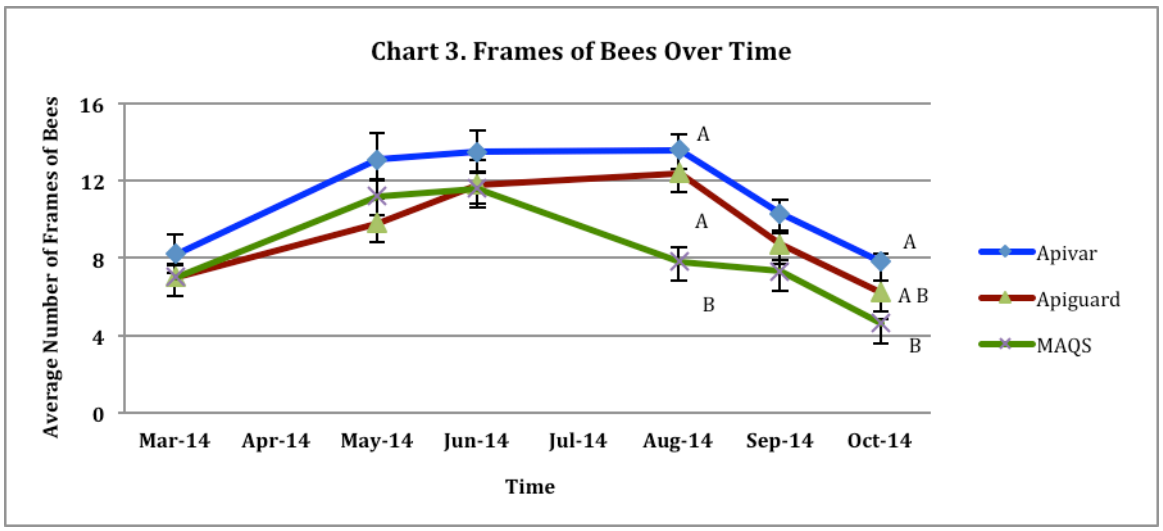


Chart 3. Frames of Bees Over Time
Average Number of Frames of Bees
16
12
8
4
0
A
A
A
A B
B
B
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Time
Apivar
Apiguard
MAQS

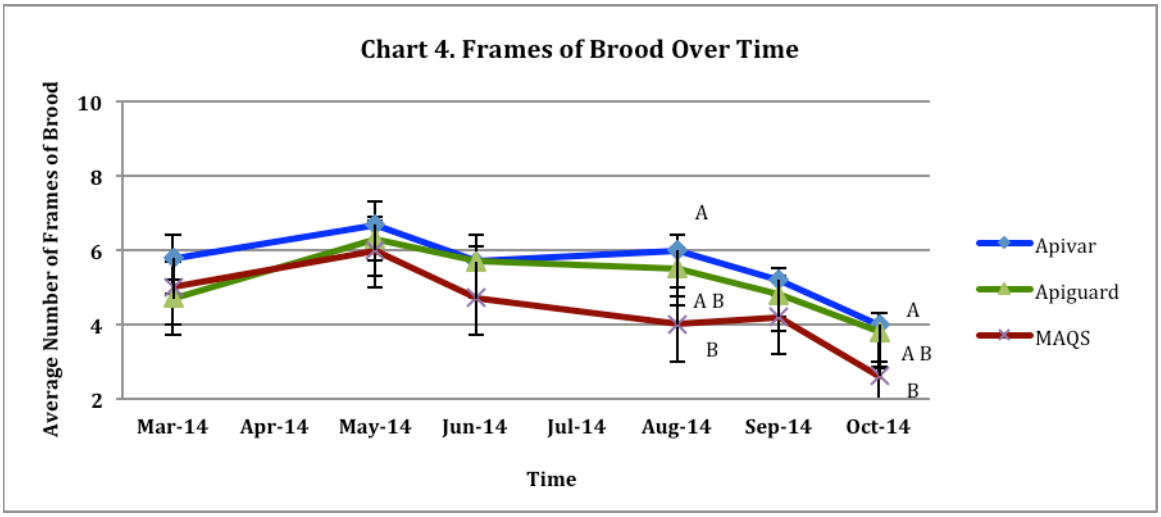


Chart 4. Frames of Brood Over Time
Average Number of Frames of Brood
10
8
6
4
2
A
A B
B
A
A B
B
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Time
Apivar
Apiguard
MAQS

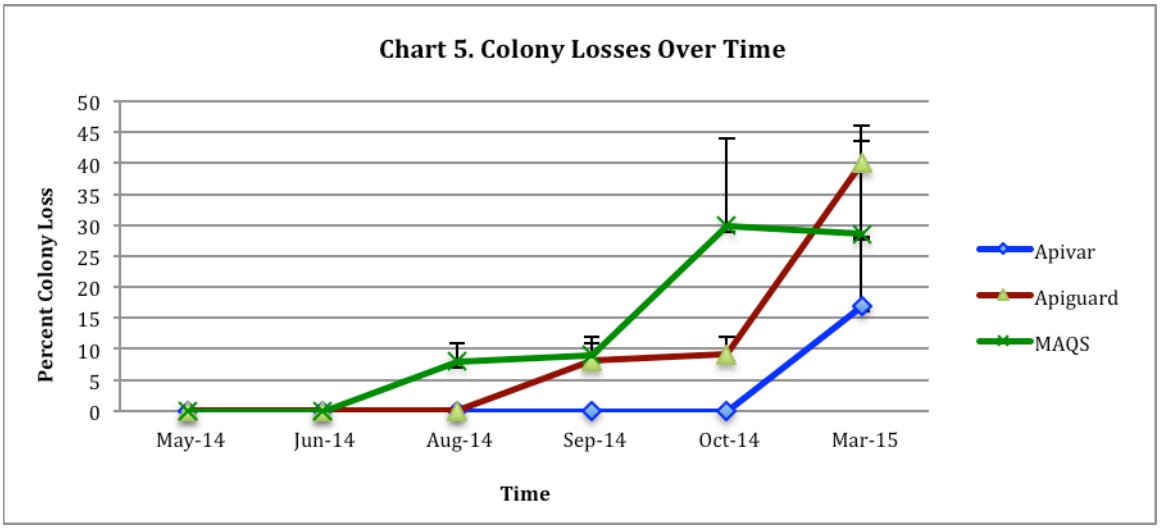
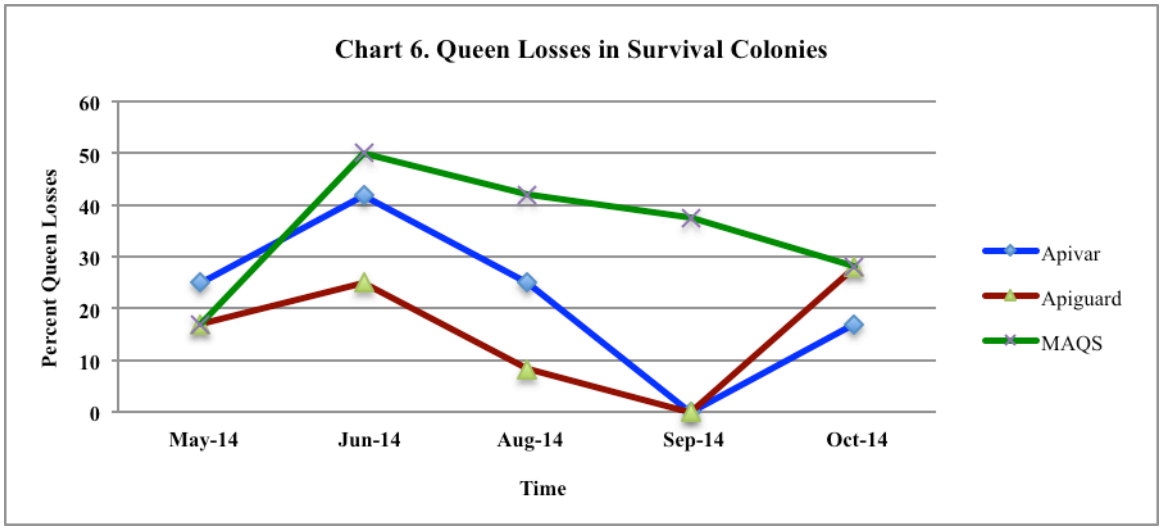


Chart 5. Colony Losses Over Time
Percent Colony Loss
50
45
40
35
30
25
20
15
10
5
0
May-14
Jun-14
Aug-14
Sep-14
Oct-14
Mar-15
Time
Apivar
Apiguard
MAQS



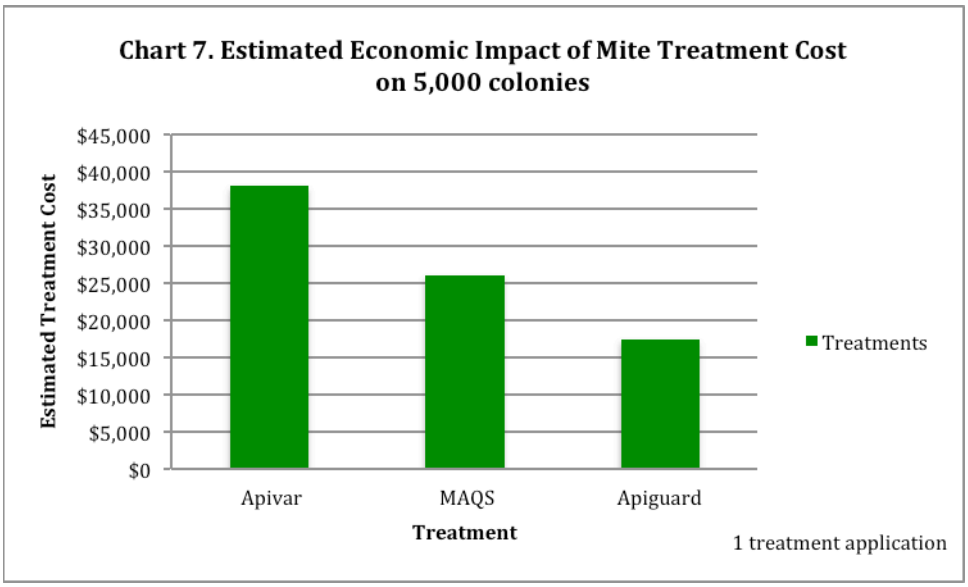
An expense report log was kept and the total cost of the treatments per colony is shown in **Table 1.**

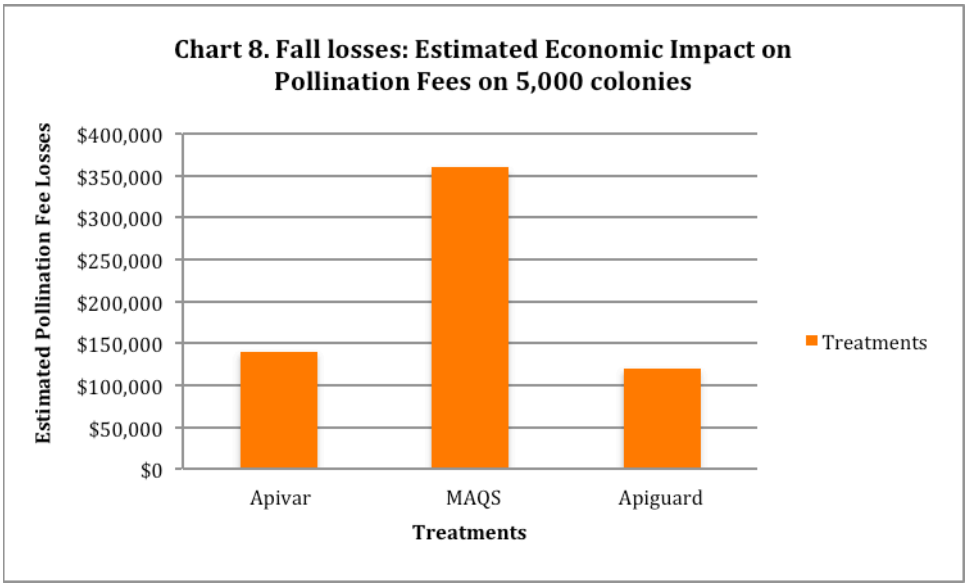
Table 1. Treatment costs.

Treatment	Treatment dose	Treatment cost+labor /colony	Number of treatments	Total cost/colony
Apivar	2 strips/brood chamber	$7.62	3	$22.86
Apiguard	100 gr	$3.52	5	$17.60
MAQS+	1 pad	$2.82	4	$11.28

+ The cost reflects half-dose application.

An estimated economic analysis was performed for each of the treatments, except for HGII. Colony and queen losses can deeply impact the beekeeping industry at different times of year. Spring losses affect honey production and the capability for making colony divides. Fall and overwinter losses affect almond pollination, reflecting in pollination fee losses. As part of the economic analysis, an estimated economic impact was calculated for a commercial operation with 5,000 colonies using data from our study. The average fall colony+queen loss for Apiguard was 12%, 14% for Apivar and 36% for MAQS. An estimated mite treatment cost for a one time application on 5,000 colonies can range from $18,000-$37,000 as shown in **Chart 7**. An estimated pollination fee losses for 5,000 colonies is shown in **Chart 8.**





The results from this study have shown that the fold increase in mite levels was significantly different among the treatments in summer and fall 2014. The results from March 2015 have shown that mite levels were not significantly different in all three treatments. Frames of bees and brood among the treatments were significantly different in the fall. Overwinter colony losses were high for all three treatments and some of the losses could be attributed to lack of forage and insufficient mite control.

This study allowed us to gather information that can be used to implement an IPM *Varroa* program through a treatment rotation regime to improve the efficacy of the current miticides and minimize mite resistance development.

Research Effort Recent Publications:

The results from this project have not yet been published.

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