Implementing an Integrated Pest Management Program for *Varroa*

Project No.: **15-POLL9-Ahumada**

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Objectives:

The main objective of this research project is to implement an effective IPM *Varroa* program.
1. Determine the efficacy of various treatments for Varroa control.
2. Determine the efficacy of the miticides and the effect on colony strength.
3. Determine the economic impact of the miticides.
4. Implement an IPM *Varroa* program.

Interpretive Summary:

Varroa destructor is a chronic problem in the beekeeping industry and continues to be a threat despite the efforts by beekeepers to control it (Anderson et al; 2000). The main objective of this research project is to implement a cost-effective Integrated Pest Management (IPM) treatment regime by alternating natural and synthetic miticides throughout the year. This will minimize the development of resistance and residue deposits in the colony by decreasing the use of synthetic miticides. The development of an IPM program that alternates the use of “soft” and “hard” chemicals throughout the year can minimize the resistance development as well as decrease the rate of colony losses due to high mite infestation levels.

The high percentage of colony losses experienced by beekeepers in 2015 not only affected pollination services, but also queen rearing and package production, causing a direct impact on our study. Due to the lack of bee package availability at the time the study was set to begin we collaborated with Mr. Randy Verhoek who kindly provided split colonies to run the field test. The results presented in this progress report correspond to 2016 spring and summer only, as the study is ongoing and will conclude by the end of the year with the addition of an early fall and late fall treatment.

Materials and Methods:

The field study was set up in April 2016, in Danbury, TX and Mr. Randy Verhoek provided 78 newly split colonies that were divided into 4 groups. Sticky boards were inserted in all colonies to determine pre-treatment mite levels. Sets of nineteen and twenty colonies with equalized

strength and mite levels were randomly assigned to each treatment group. Colonies were marked with numbered colored tags for easy identification. Queen presence, brood, and frames of bees were recorded for all colonies before the first treatment application and periodically throughout the study. In the summer, colonies were moved to North Dakota for honey production and will be brought back to Texas in the fall. The treatments chosen were Apiguard, HopGuard® II and Apivar. Each group was assigned a treatment rotation schedule for spring, summer and fall as shown in **Table 1**. Control blank colonies will be treated in the fall.

Table 1. Seasons and Treatment Schedule

Groups	*Spring*	*Summer*	*Early Fall*	*Late Fall*
1	Apivar	HopGuard® II	Apivar	HopGuard® II
2	Apiguard	HopGuard® II	HopGuard® II	Apivar
3	HopGuard® II	HopGuard® II	HopGuard® II	Apivar
4	No treatment	No treatment	HopGuard® II	Apivar

Any adverse post-treatment effect on bees and/or brood was noted and colonies that became queen-less were removed from the study. The sticky board method was used to determine pre and post treatment 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 will be calculated by dividing the total cost by the number of applications per colony per year. A detailed expense record log will be kept to calculate the financial costs at the end of the study and determine the economic impact of the treatments on the beekeeper's operation.

Significant differences among treatments will be determined by a two-way analysis of variance using proportional changes in colony size and sample time as factors. Significant differences in mite levels will be determined by Tukey's repeated-measures.

Results and Discussion:

The results presented in this progress report correspond to 2016 spring and summer and the final results including the fall data will be presented at the Almond Conference in December 2016.

Colony strength and mite levels were recorded for all colonies throughout the study and treatments were applied following the schedule in **Table 1**. Pre-treatment mite levels in the spring were equal for all groups but post-treatment mite levels were significantly different among the groups. Spring treatments were applied to hives as shown in **Table 1**. Apivar and HopGuard®II strips were not removed from the colonies after treatment. The results are shown in **Chart 1** and the groups that do not share the same letter are significantly different. In the summer a HopGuard®II treatment was applied to groups 1, 2, and 3 only. Mite levels had increased during the summer and the results in **Chart 2** show that the change in mite levels (post/pre-treatment) was significantly different between groups after the summer treatment. The lowest change in mite levels was observed in groups 1 and 4 and the highest in groups 2 and 3. In the case of Group 1, the small change in mite levels between summer post and pre-treatment could be due to the fact that Apivar strips remained active in the colonies since the spring, thus continuously decreasing mite levels during this period. The opposite was observed in Groups 2 and 3 as there were no active products left in the colonies after the spring

treatment, resulting in a mite level increase in the summer. No changes in mite levels (post/pre-treatment) were seen in Group 4 as it had not received any treatment in spring or summer. Frames of bees were recorded to monitor colony strength in the spring and summer and no significant differences were found within each group as shown in **Chart 3**. Summer colony losses for groups 1, 2, and 3 was 10%, and 26% for Group 4 which has not been treated in the spring.

These preliminary results certainly point out the importance of a spring mite treatment as the highest percent of colony losses were observed in Group 4, which were most likely due to mite damage. As stated above, colony strength has not been affected by the treatments or lack thereof, although we anticipate significant differences in strength and colony losses in the fall. Mite levels are also expected to be higher in the fall and by the end of the study we will be able to determine which treatment regime was the most effective at reducing mite levels and colony losses.

Chart 1. Spring Average Mite Drop

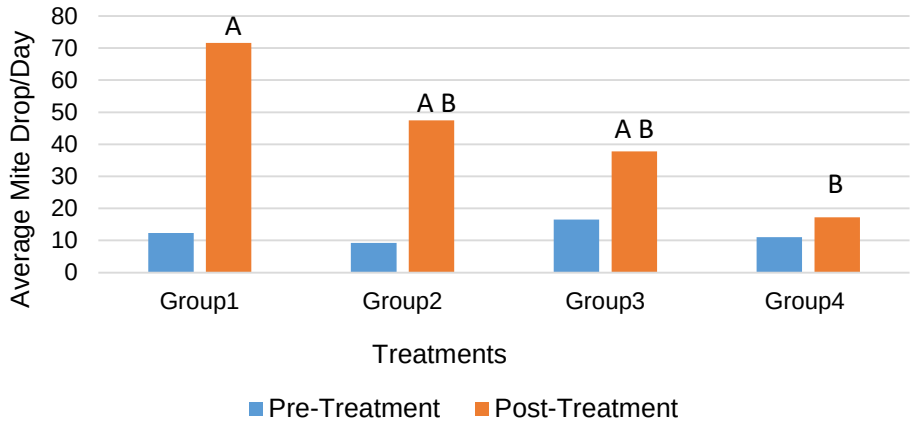
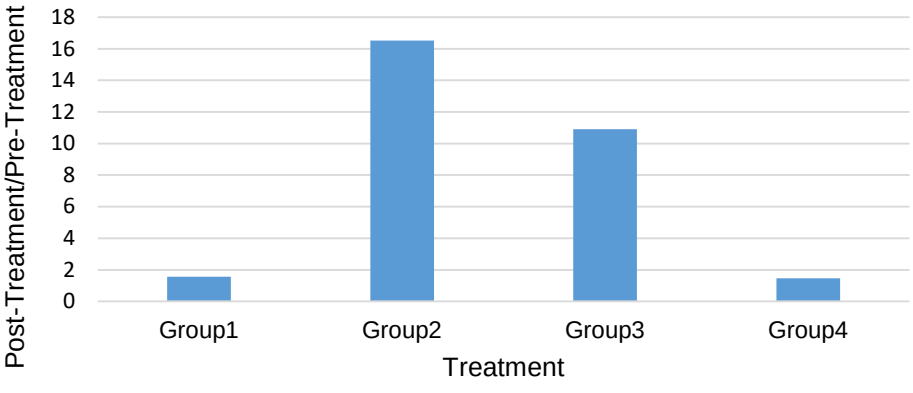
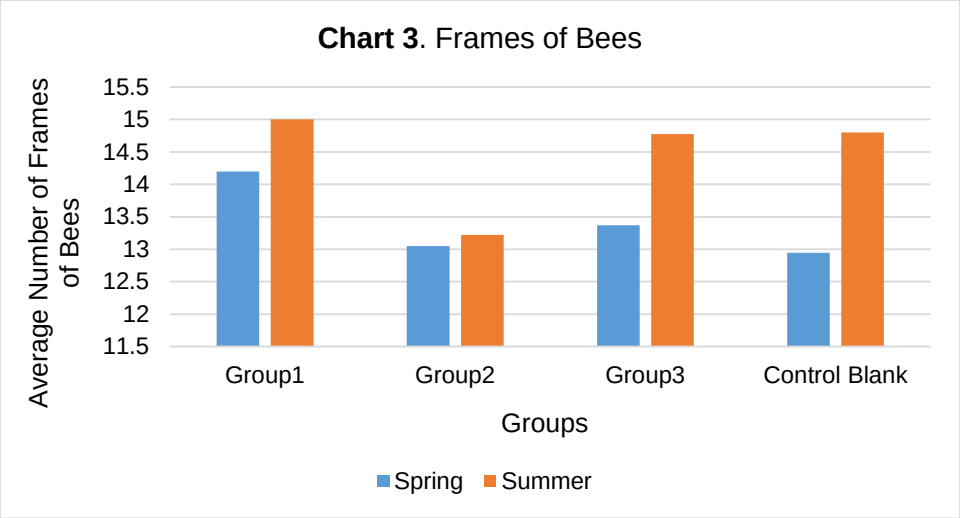


Chart 2. Change in Mite Levels After Summer HopGuard®II Treatment





Research Effort Recent Publications:

The results from this project have not yet been published.

References Cited:

Anderson, D. L., and J.W.H. Trueman. 2000. *Varroa jacobsoni* (Acari: Varroidae) is more than one species. Exp. Appl. Acarol. 24: 165-189.

Ellis, J. D., Evans, J. D., Pettis, J. 2010. Colony losses, managed colony population decline, and Colony Collapse Disorder in the United States. Journal of Apicultural Research 49 (1): 134-136.

Danka R.G., Rinderer T.E, Spivak M., Kefuss J. 2013. Comments on: "Varroa destructor: research avenues towards sustainable control". Journal of Apicultural Research 52(2): 69-71.

Elzen, P. J., Baxter J. R., Spivak M., Wilson, W. T. 2000.Control of *Varroa jacobsoni* Oud. resistant to fluvalinate and amitraz using coumaphos. Apidologie 31: 437-441.

Sammataro D., Hoffman G.D., Wardell G., Finley, J., Ostiguy N.2004. Testing a combination of control tactics to manage Varroa destructor (Acari: Varroidae) population levels in honey bee (Hymenoptera: Apidae) colonies. International Journal of Acarology 30(1): 71-76.

Imdorf Anton, et al. March 1996. Alternative *Varroa* control. American Bee Journal. 189-193.

Mullin, C. A., M. Frazier, J. L. Frazier, S. Ashcraft, R. Simonds, D. vanEngelsdorp, and J. S. Pettis. 2010. High levels of miticides and agrochemicals in North American apiaries: implications for honey bee health. PLoS One 5: (3) e9754.

Vandervalk L.P., Nasr M. E., Dosdall L. M. 2014. New Miticides for Integrated Pest Management of *Varroa destructor* (Acari: Varroidae) in Honey Bee Colonies on the Canadian Prairies. J. Econ. Entomol. 107(6): 2030-2036.

Wu, J.Y., Anelli, C.M., Sheppard, W.S. 2011. Sub-lethal effects of pesticide residues in brood comb on worker honey bee (*Apis mellifera*) development and longevity. PLos One 6(2) e9754