PNW Tech Transfer Team to Serve Commercial Beekeepers in the Pacific Northwest

Project No.: **15-POLL5-Sagili/vanEngelsdorp**

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Objectives:

1) Provide routine evaluation of colony health for beekeepers by taking numerous samples over time.
2) Reduce pesticide exposure issues experienced by colonies in different cropping systems.
3) Create recommendations for management decisions based on field observations and controlled sampling efforts.

Interpretive Summary:

There are six regional Tech Teams that partner with commercial beekeepers to monitor colony health throughout the year. 77 beekeepers currently collaborate with the Tech Teams, which collectively represents about 20% of managed colonies in the United States. Tech Teams are a program of the Bee Informed Partnership (BIP). From 2011 to 2015, commercial beekeepers participating in the BIP Tech Transfer Team program lost, on average, 36% fewer colonies than those commercial operations who did not participate

The Pacific Northwest (PNW) Tech Team was launched in 2014 because of the overwhelming interest from the beekeeping community in Idaho, Oregon, and Washington. Currently, the team has grown to serve 22 beekeepers in the region. The team regularly samples colonies for *Varroa* mites, *Nosema* spp., viruses, protein content, and pesticide levels and delivers the results in a timely manner. We hope to convey powerful insights to serve the concerns of participating beekeepers by gathering information from accumulated samples and field observations. Over the last several years, we have identified distinctive needs of the commercial beekeepers involved in the PNW Tech Team. They include: 1) routine colony monitoring, 2) reducing pesticide exposure issues in different cropping systems, and 3) provide recommendations for management decisions based on field observations and controlled sampling efforts.

Materials and Methods:

Objective 1. Routine colony monitoring

The PNW Tech Team aims to deliver actionable information via routine colony monitoring. There are two full-time professionals that operate the PNW team. Both team members travel around the region to sample 22 beekeepers. Each beekeeper is typically visited 4 times every year. This typically includes one site visit in late winter during almond pollination followed by a spring, summer and fall site visit. Each site visit includes a) standardized colony evaluation and b) colony samples for further analysis of various pests and disease. Each colony evaluation consists of adult population, queen quality, and presence of pests and brood disease observations. In addition to evaluation, the team takes samples from each colony. The most common type of sample is the collection of approximately 300 bees in saline solution to quantify levels of both *Varroa destructor* (parasitic mite) and *Nosema* spp. (gut pathogen). Other types of samples include adult bees for virus and nutritional analysis as well as hive products (pollen or bee bread) for pesticide residue analysis. We also have one queen producer that participates in our team, and we offer freeze-kill brood assays for his breeder colonies to assess hygienic behavior.

Objective 2. Reduce pesticide exposure issues

Many PNW beekeepers provide pollination services for almonds and other valuable crops. Through communication with the beekeeper, the Tech Team will visit colonies that have undergone suspected acute pesticide poisoning. The team responds to these incidences with a standardized inspection and sampling protocol performed to facilitate documentation of the event.

The Tech Team also routinely samples for pesticide exposure levels in the various pollination crops that PNW colonies frequent. In previous years, the team has trapped pollen pellets from colonies in 15 different pollination crops. This year, they took samples of fresh bee bread in 14 selected locations in the San Joaquin Valley (CA) during the almond bloom. The samples were then analyzed by the EPA to look at relative pesticide residue levels.

Objective 3. Recommendations for management decisions

The Tech Team works with beekeepers on an individual basis on specific management concerns through field experiments. On a larger scale, the data is stored anonymously in the BIP database. Beekeepers and researchers will be able to access aggregate summaries of these records to give context to disease loads in specific seasons and locations. BIP is also writing a commercial beekeeper reference guide by compiling the field observations of all Tech Team members as a means to layout recommendations for best management practices.

Results and Discussion:

Objective 1. Routine colony monitoring

Sample results from each site visit are presented to the beekeeper in a report. In collaboration with the UMD Diagnostic Lab, we are able to provide beekeepers with a 7-10 day turnaround time for sample analysis. Thus by providing results to beekeepers in near real time, we are able to assist them in determining the efficacy of their management practices. We sample the same colonies during each site visit when possible. With longitudinal monitoring, we are able

help beekeepers understand seasonal trends in the pest and disease levels within their colonies.

At the end of each sampling period (winter, spring, summer, and fall), we provide each beekeeper with a seasonal summary report of their pest levels. This allows them to anonymously compare their sample results among others'. The report expands the information on both a regional and national level while still maintaining the confidentiality of beekeepers' identity. **Figure 1** is an example of how this is achieved. At the end of each annual year, we provide each beekeeper with additional trend report. This report allows each beekeeper to look at annual fluctuations within their own operation through the samples the team has taken over time. **Figure 2** is an example of this report.

Since we started this team in May 2014, we have taken over 9,500 samples for *Varroa* and *Nosema* levels for participating PNW beekeepers. **Figure 3** shows monthly *Varroa* levels from all samples taken by the PNW Team compared to the average of all Tech Teams within the last year.

Objective 2. Reduce pesticide exposure issues

In the beginning of 2015, we developed the Bee Informed Partnership (BIP) Pesticide Response Plan. This plan outlines our protocol for documenting and sampling colonies with suspected acute pesticide damage. The procedure is intended to standardize the reporting of these incidences and help beekeepers utilize resources, such as the National Pesticide Information Center and U.S. Environmental Protection Agency. The Tech Team also distributed copies of Oregon State University's updated version of the pesticide manual. This manual outlines the label listings of relative toxicity levels for commonly applied pesticides on honey bees (Hooven et al., 2013). Although these resources come with limitations, we hope this process will assist in preventative measures taken to reduce reoccurrence of these issues.

In an effort to assess non-acute pesticide exposure levels, the Tech Team sampled colonies placed in almonds during full bloom. 37 samples of fresh bee bread were taken within 14 separate locations in the San Joaquin Valley of California. These samples are in the process of being analyzed by the EPA, and results will be communicated to each beekeeper.

Objective 3. Recommendations for management decisions

Collecting management data allows us to help beekeepers develop effective management strategies. However, we need multiple years of data to make this information available to our beekeepers. Thus, results are still pending at this time. By providing this information to beekeepers, they will be able to make more informed decisions that lead to improve colony health and survival rates.

Research Effort Recent Publications:

Lee, K. V., Steinhauer, N., Rennich, K., Wilson, M. E., Tarpy, D. R., Caron, D. M., ... & Sagili, R. (2015). A national survey of managed honey bee 2013–2014 annual colony losses in the USA. Apidologie, 46(3), 292-305.

References Cited:

Hooven, L., Sagili, R. R., & Johansen, E. (2013). How to reduce bee poisoning from pesticides. Oregon State University Extension Service.

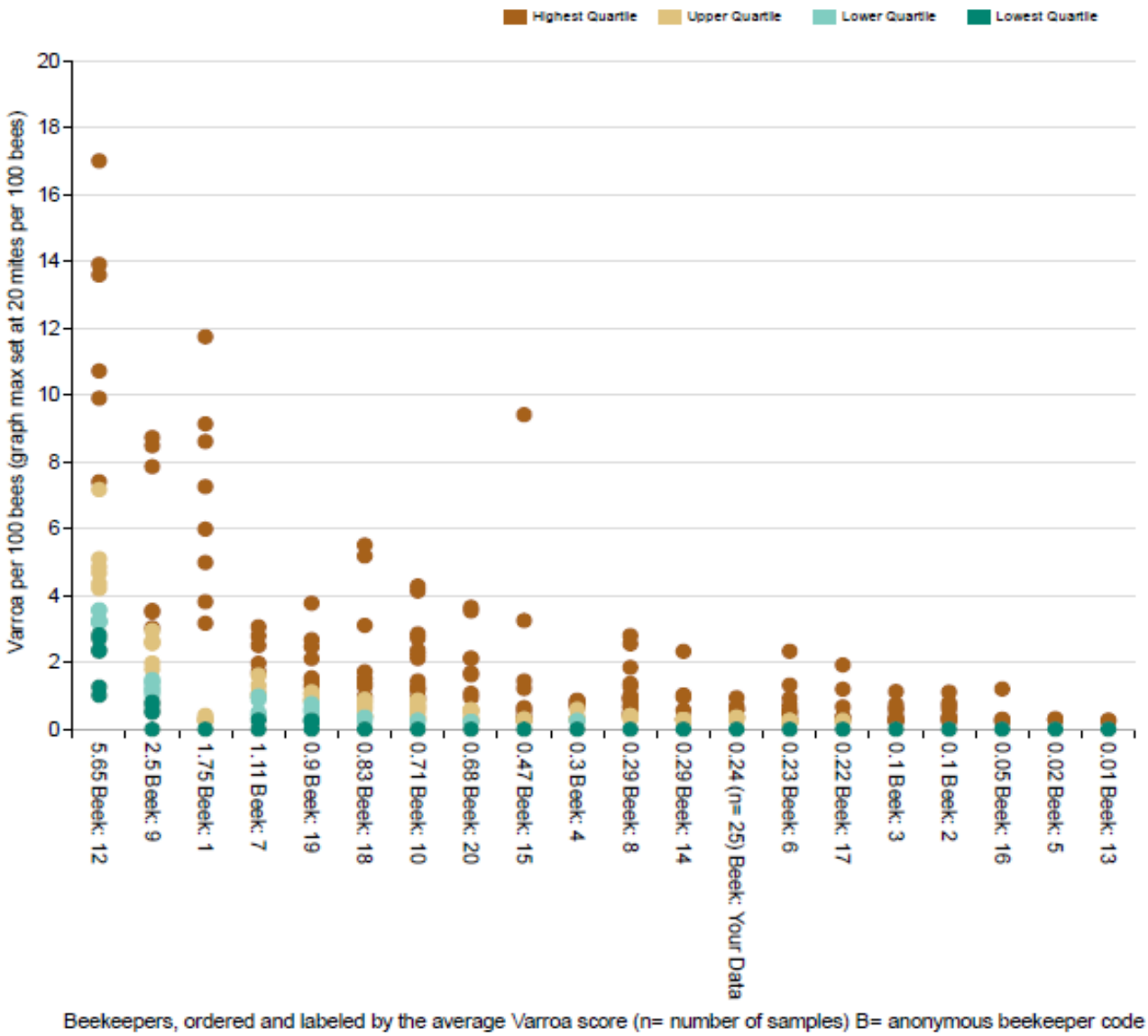

Figure 1. An excerpt of a seasonal summary report for participating beekeepers that compares Varroa mite levels of the recent spring sampling interval (May and June 2016).

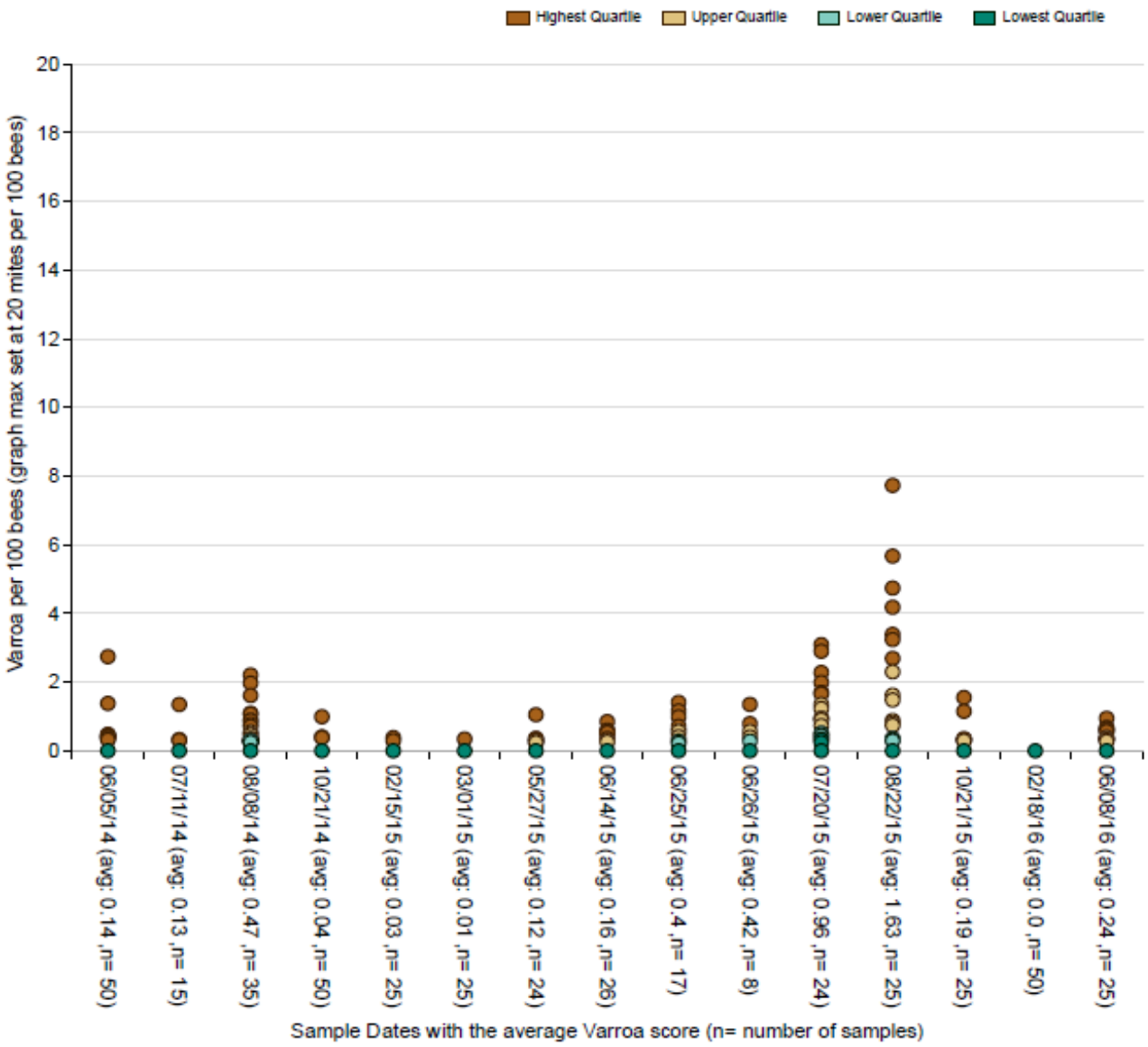

Figure 2. An example of a trend report that displays the history of a beekeeper's Varroa mite levels (2014 to 2016).

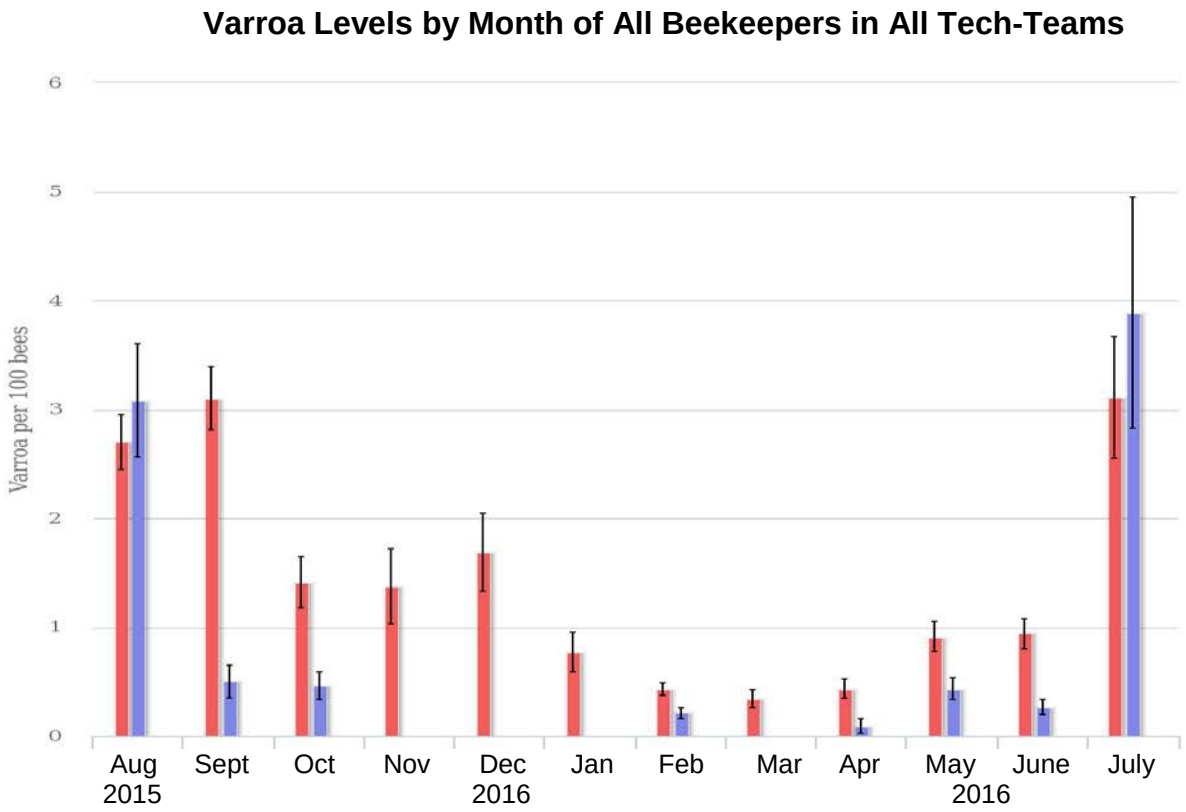

Figure 3. An excerpt from a seasonal summary report for participating beekeepers that compares monthly Varroa mite levels between a) PNW Tech Team (listed as Your Tech-Team) and b) All Tech Teams (listed as Nationally) from August 2015 to July 2016.