2017 Tualatin Valley (TVBA) Winter Loss by Dewey M. Caron & Jenai Fitzpatrick

At the March and April TVBA meetings I encouraged TVBA members to participate in the 2016-2017 PNW overwintering loss survey. Members were directed to the online survey at www.pnwhoneybeesurvey.com, a continuing effort to define overwintering success.

I received 282 responses from Oregon (OR) backyarders, and an additional 52 from Washington beekeepers. Tualatin Valley members sent in 38 surveys, providing information on 174 fall colonies. This survey return was 11 more respondents than last year (reporting on 30 more fall colonies) but 5 fewer individuals than the preceding year. I was encouraged with the increased TVBA club return this year. As I began to summarize responses I found the respondents to be at opposite ends of the spectrum. Four individual owning 44% of the colonies, all with years of beekeeping experience had heavy losses in contrast to the remaining 34 individuals with only a few colonies and fewer years of bee experience. Thus this report utilizes the larger database of 282 OR small scale beekeepers to help determine managements that appear to make a difference in winter loss/survival.

Total overwintering losses of the 38 TVBA respondents was 72 colonies = 59% weighted loss rate. This loss is ten percentage points higher than the OR beekeepers and 2nd highest of all OR clubs in 2017. Losses this past winter were 4 percentage points higher than the terribly elevated loses of the 2013-2014 winter (55%) and 23 percentage points above the TVBA loss average of the previous 5 seasons of 36.5%. See Figure 1.

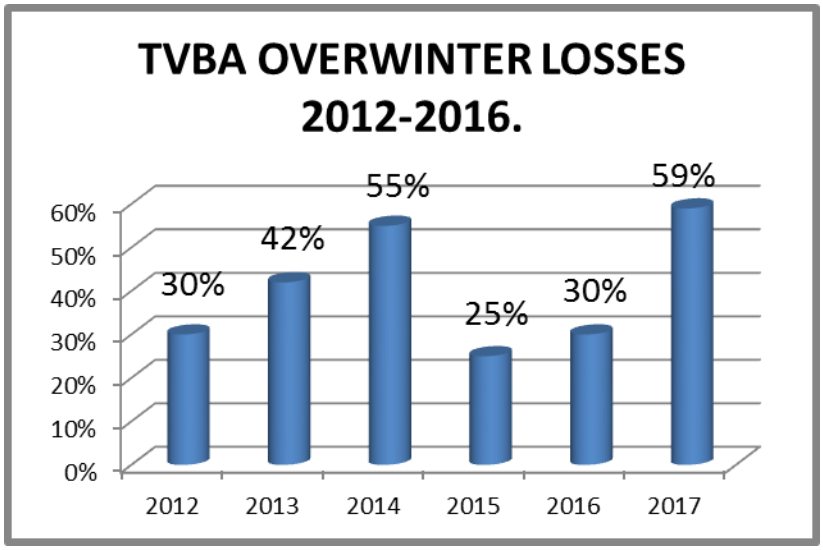
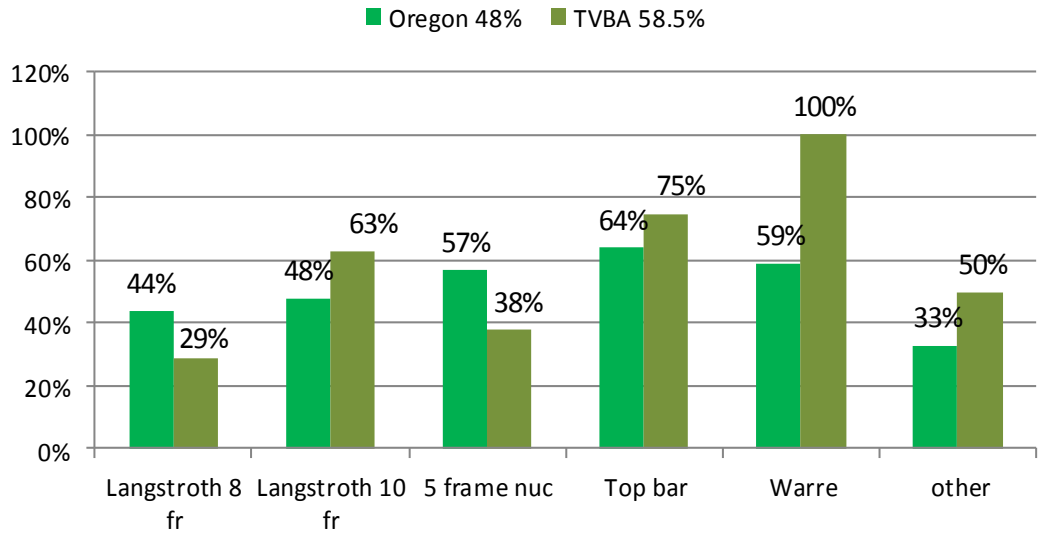


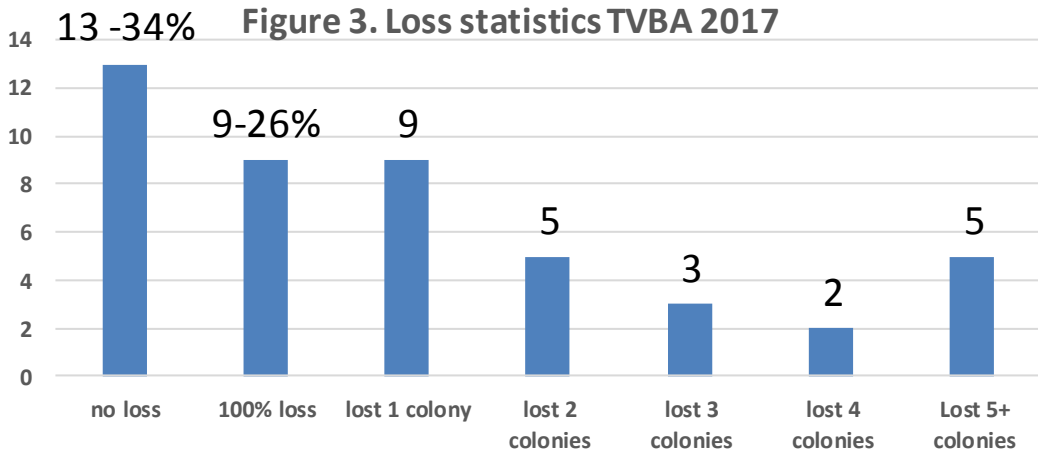
Figure 1

Loss rate was determined for 8 and 10 frame Langstroth hives, 5-frame nucs, Top bar and Warré hive types. TVBA members started winter with 128 Langstroth 10-frame hives (69% of total), 24 Langstroth 8-frame hives, 8 5-frame nucs, 8 Top bar colonies, 4 Warré hives and 2 “mini” hives. The accompanying Figure 2 shows percent loss for each hive type compared with statewide Oregon beekeeper data base (1318 colonies). Among TVBA hive types, only 8 frame Langstroth and 5-frame nucs had better survival rates than the overall OR beekeepers. All comparisons with last year are available to view on the website www.pnwhoneybeesurvey.com

Figure 2. Loss comparison OR and TVBA 2017

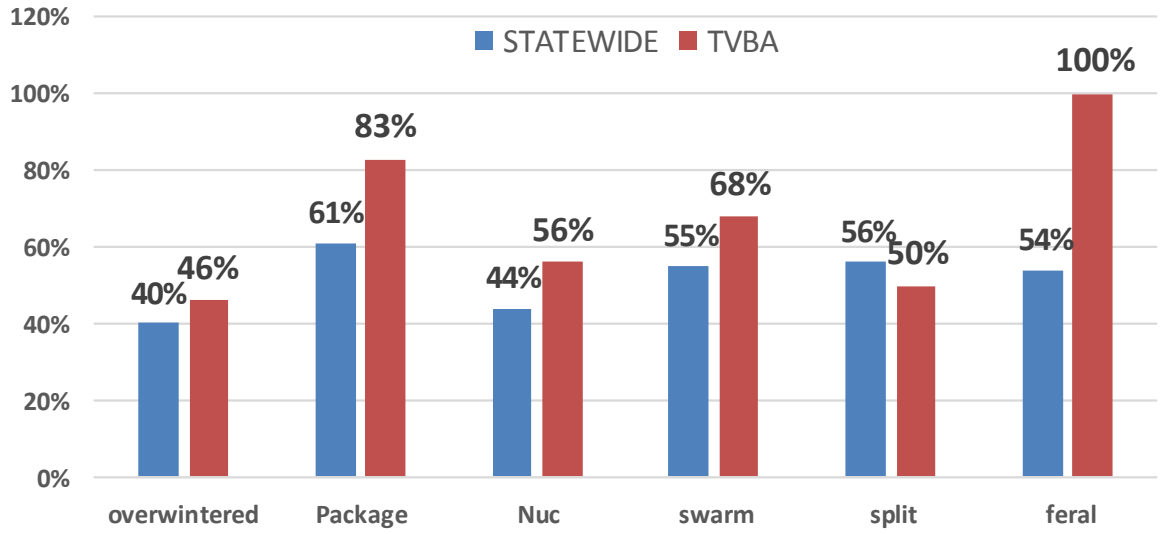


Not everyone had loss. Thirteen individuals (34%) reported total winter survival. Nine individuals (26%) lost 100% of their colonies. Ten individuals lost 1 colony, 5 individuals loss 2, 3 lost 3 and 2 lost 4 colonies. On the other extreme, five individuals lost 9 to 20 colonies, the heaviest loss by one individual. Six individuals started fall with 10 or more colonies with one having 22; 16 was greatest number of spring colonies. See Figure 3.



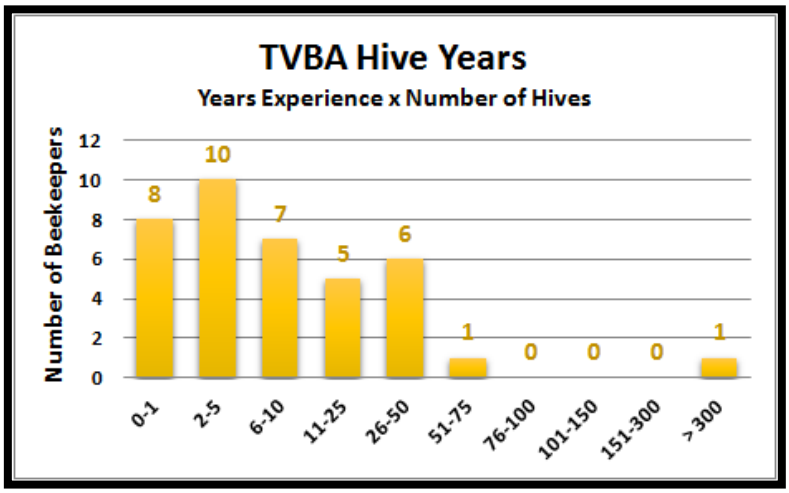
The survey also asked for hive loss by hive origination. Forty six of 85 overwintered TVBA member colonies were alive in the spring (46% loss rate), 6 percentage points higher loss than statewide survival of overwintering colonies. Respondents reported a higher loss level of newly installed packages, nucs, swarms and feral colonies with splits, only category with lower loss rate compared to stateside beekeepers. See Figure 4.

Figure 4. Percent winter loss by hive origination, TVBA and Statewide, 2017



Four individuals had 2 apiaries. Five TVBA individuals moved bees during the year, three for better forage, one for established colony purchase and one due to neighbor concerns.

TVBA survey respondents reported a wide range of beekeeping experience. Seven individuals (18%) had 10 years or more of bee experience, with the highest 50 years; 21 (54%) had 1, 2 or 3 years of experience. Hive Years shows the relationship of number of spring colonies and hive years experience.



When survey takers were asked to indicate where the majority of their beekeeping education was received, TVBA respondent numbers varied only slightly from statewide, with Books, journals and magazines listed first (24%) followed by Bee club meetings (22%), then Online reading and videos (20%). Bee Mentors (17%) and OR Master Beekeeping program (13%) were indicated next. Twenty TVBA respondents (53%) said they had a mentor available as they were learning beekeeping; statewide 67% said they had a mentor.

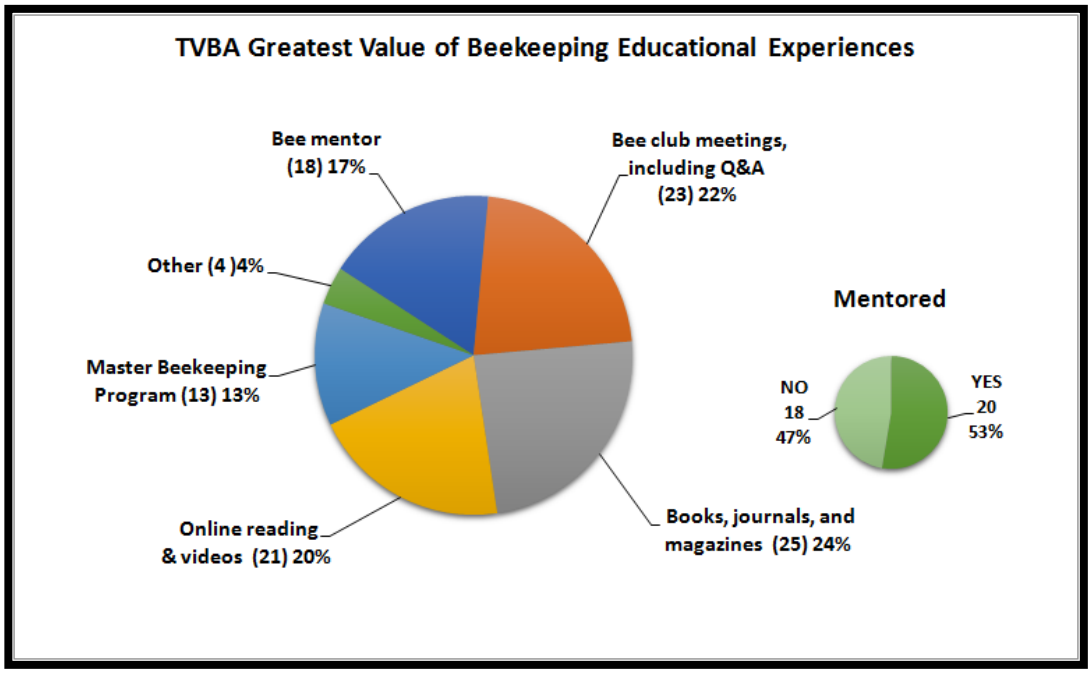


Figure 6

Reasons for/acceptable loss level

We asked for individuals that had colony loss to estimate what the reason might have been. Multiple responses were permitted. Thirteen TVBA beekeepers listed poor wintering conditions, 7 each listed varroa mites and Weak in fall. Starvation, queen failure yellow jackets, CCD and pesticides were also listed. Under other, PMS and I don't know were listed. When asked for an acceptable loss level 10 individuals said zero, 18 said up to 25%; 10 listed a higher acceptable percentage including one individual who said 100% was an acceptable loss level.

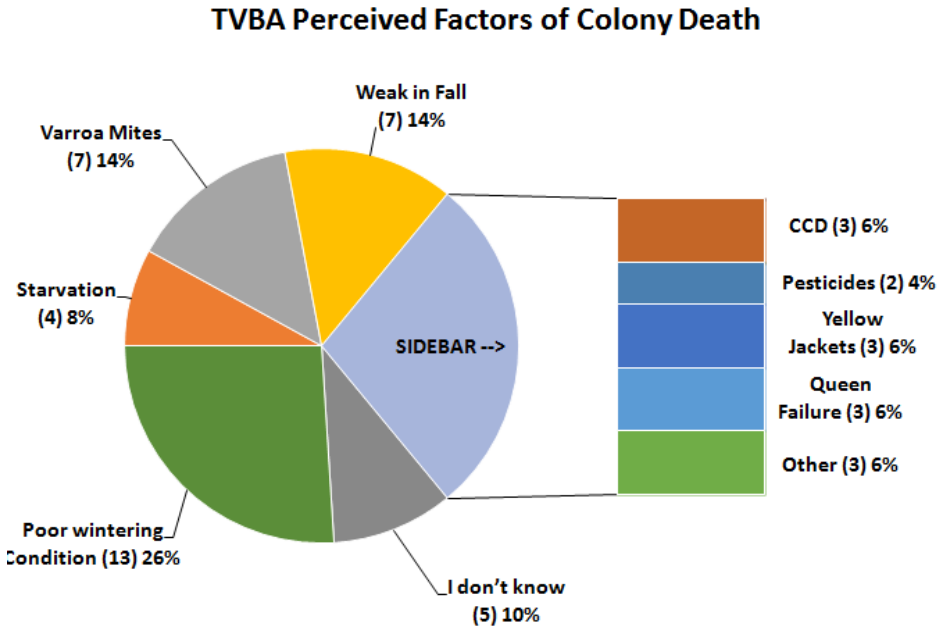


Figure 7

Why do colonies die? There is no easy way to verify reason(s) for colony loss, nor a consensus of an acceptable level. Colonies in the same apiary may die for different reasons. Major factors in colony loss are thought to be mites, pesticides, declining nutritional adequacy/forage and diseases, especially viruses and Nosema. **Doing the forensics is the first step in seeking to solve a heavy loss problem. More attention to colony strength and possibility of winter starvation will help reduce some of the losses. Control of varroa mites will also help toward loss reduction.** We are dealing with living animals which are constantly exposed to many different challenges, both in the natural environment and the beekeeper's apiary.

Management, especially learning proper bee care in the first years of beekeeping, remains a factor in losses. What effects our changing environment of things such as global warming, contrails, electromagnetic forces, including human disruption of it, human alteration to the bee's natural environment and other factors play in colony losses are not at all clear.

Langstroth a hundred and sixty years ago wrote about the importance of taking losses in fall management, saying if the beekeeper neglects such attention to his/her colonies 45% loss levels may occur, depending upon winter weather conditions. It can be argued that losses of 30, 40, 50% or more might be "normal." Older, more experienced beekeepers recall when loss levels were 15% or less. Larger-scale beekeepers have issues with replacing losses about 15% while smaller-scale backyard beekeepers either replace their losses or simply give up after losing their colony (ies). Honey production fluctuates each year but once again seems to be declining on average. Stress of movement of colonies to pollination rentals and finding suitable "clean" forage sites for both larger and smaller scale beekeepers is a challenge. Numbers of U.S. bee colonies have declined since the 1940s, returning to numbers of 100 years ago, while worldwide numbers of bee colonies are steadily increasing.

T**here is no simple explanation to explain the levels of current losses nor is it possible to demonstrate that they are necessarily excessive for all the issues facing honey bees in the current environment. Varroa mites and the virus they transmit are considered a major factor, but by no means the only reason, colonies are not as healthy as they should be.**

Management selections and losses

The survey inquired about feeding practices, wintering preparations, sanitation measures utilized, screen bottom board usage, queens, mite monitoring and both techniques (such as screen bottom board use, drone brood removal efforts, etc.) and chemical mite controls used. Individuals could check none or more than one response; most TVBA and OR beekeepers most often do not do just one thing/management to their colony (ies) to control mites toward improving overwintering success.

For the larger data base of OR beekeepers, feeding dry sugar or candy board, as well as adding top insulation, a moisture absorbent feature at top of colony and/or an upper entrance resulted in significantly fewer losses. Screen bottom board usage, monitoring with alcohol wash or powdered

sugar for mites and use of several of the chemical mite control options did likewise. See this analysis in the OR beekeeper report; www.pnwhoneybeesurvey.com. Comparisons to TVBA data results are included in this narrative.

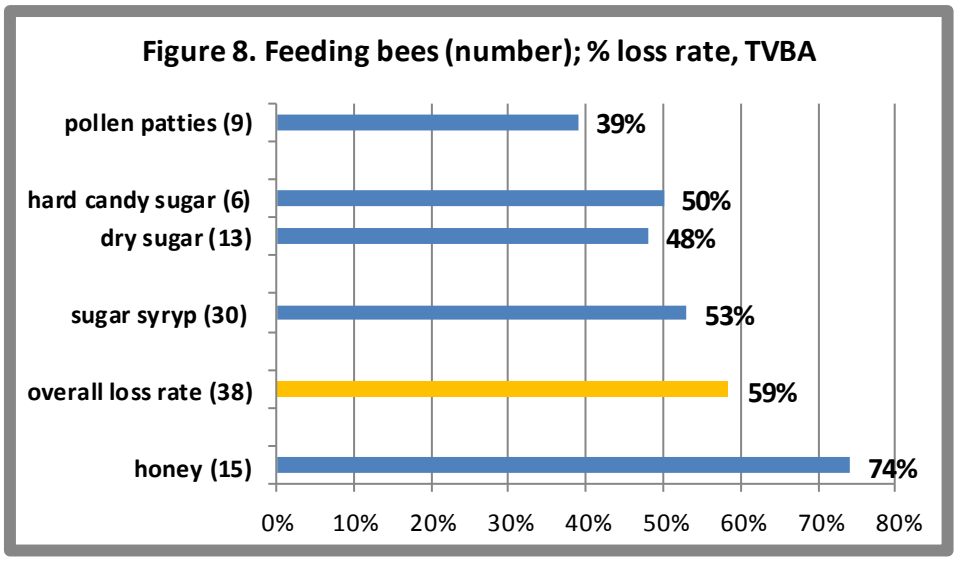
For TVBA, with 38 respondents, four individual beekeepers, each owning 10+ colonies (simple average 14.5 colonies/individual) accounting for almost 45% of total hive count of TVBA, had losses between 77-100%. These were experienced beekeepers, listing 10 to 50 years experience (simple average 26 years experience). Thus analysis of management practices within the data base of TVBA members, compared to the larger statewide OR data base, is misleading. In so far as possible the overall OR beekeeper data base better represents potential managements that might improve success overwinter.

FEEDING: Among TVBA respondents, 87 options were checked; the highest number was 5 choices selected by 1 individual; 3 individuals each selected 4 choices; 2 TVBA respondents checked none – their loss rate was 86%. Fifteen (39.5%) indicated they fed honey (14 as frames, 1 both honey frame and liquid and one as liquid); their overwinter loss was 74%. Thirty individuals (74%) fed sugar syrup; their loss rate was 53%, slightly better than the TVBA average of 58.5% loss. Statewide 79% of OR beekeepers fed sugar syrup and 41.5% fed honey but in either case loss levels were not different from the statewide loss level of 48%

OR Individuals who fed a form of dry sugar did have lower loses. Statewide, those beekeepers who fed hard candy and those feeding dry sugar (but not drivert or fondant) had better winter survival; among TVBA respondents, 13 individuals using dry sugar had a 48% loss and 6 who fed the hard sugar candy had a 50% loss, both slightly less than the average loss rate of 58.5%

Feeding protein as dry pollen or pollen patties meant better survival for OR beekeepers; for TV beekeepers, the 9 individuals who fed pollen patties (none fed dry pollen or pollen frames) had a 39% loss rate, an improvement in survival compared to total 38 TVBA respondents.

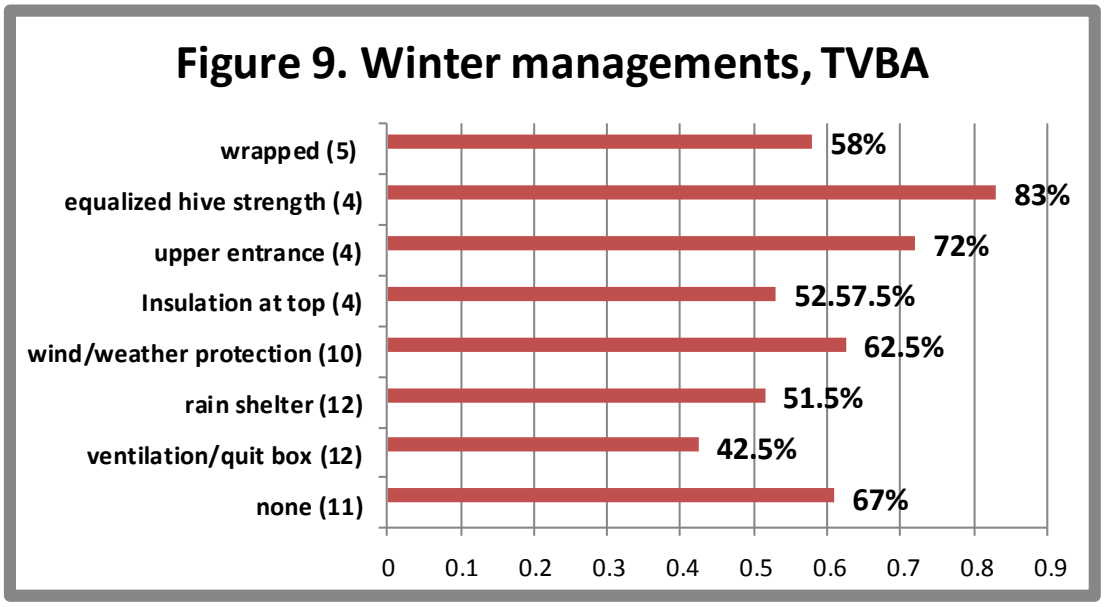
It appears feeding protein, dry pollen or a pollen patty, improves survivorship. Also feeding dry sugar or a hard sugar candy, typically the sugar feeding method most appropriate during later fall or over the winter period, improves survivorship. Feeding can apparently improve overwinter survival.



WINTERING PRACTICES: Statewide 538 responses about OR beekeeper wintering management practices were indicated (more than one option could be chosen). Forty-six individuals, 17.5% of the respondents responded they did not do any of the several listed wintering practices; these individuals had a 49.5% winter loss compared to overall of 48%. Among the TVBA respondents there were 57 choices indicated; 1 individual each had 5 and 4 selections; 11 had a single choice. Eleven individuals (29%) checked none; their winter loss rate was 61%, slightly higher than the overall TVBA rate of 58.5%.

The most common wintering management selected (12 TVBA members) was ventilation/use of a quilt box at colony top and a rain shelter (also 12 individuals), 6 of whom (of 10 total) also selected wind/weather protection). Figure 9 shows number of individual choices and percent of each selection for TVBA beekeepers.

Statewide, using a quilt/ventilation box slightly improved survival (45% loss rate versus 48% overall) while for TVBA the 12 individuals had a 42.5% loss rate, a big improvement in survival. Use of rain shelter (103 OR individuals) did not improve winter survival - 48% loss, same as total OR backyarders statewide; for TVBA, rain shelter users (12 individuals) had a 51.5% loss. The 10 individuals selecting wind/weather break had a 62.5% loss. Four Individuals used insulation at the colony top, 4 equalized hive strength and 7 used an upper entrance but none had reduced losses. The five individuals who wrapped their colonies for winter had 58% loss level. For other two individuals added screen bottom boards used overwinter.



The varieties of choices of these wintering selections demonstrate that backyard beekeepers are taking extra measures to help colonies survive winter conditions. It would appear that several winterizing managements might slightly improve winter survival and reduce beekeeper

losses; for TVBA beekeepers the only improvement was with use of the moisture capturing top (quilt/Vivaldi board).

SANITATION PRACTICES: It is critical that we practice some basic sanitation (some prefer use of term bee biosecurity) in our bee care. We should do more basic sanitary practices to help insure healthy bees. We received 512 statewide responses for this survey question. Fifty one survey takers (18%) said they did not practice any of the 6 offered alternatives; they had a loss rate of 46% compared to overall rate of 48%. For TVBA respondents, there were 75 choices indicated; 1 individual had 5 selections and 3 had 4 choices. Five TVBA individuals (13%) checked none; their winter loss rate was 17%, considerably lower than the overall TVBA loss rate of 58.5%.

Minimal hive intervention (22 individuals) was the most common option selected along with voiding moving frames between colonies (also 22 individuals – each 58% of the respondent beekeepers and 29% each of total choices. It could be argued that less intervention might mean reduced opportunity to compromise bee sanitation efforts of the bees themselves and that excessive inspections/manipulations can potentially interfere with what the bees are doing to stay healthy. This option however did not improve winter survival of statewide beekeepers (138 individuals); for the 22 TVBA Beekeepers the 22 individuals doing minimal hive intervention had a loss rate of 47%, better than overall loses among TVBA but the avoidance of moving frames loss rate for the 22 beekeepers was 78%.

Statewide the two hive sanitation choices that showed improved survival was providing hives with a distinctive ID + cleaning hive tool regularly; loss rate of this first option was 43% and hive tool cleaning was 41%, both slightly lower than the statewide loss of 48%. For TVBA, 12 individuals indicated they gave their hives a distinctive ID and they had loss of only 72%. The 9 individuals who reported cleaning hive tool had a loss rate of 67%. In TVBA, 4 individual respondents who indicated they arranged their apiary by spreading out colonies to help reduce drifting had an 82.5% loss rate.

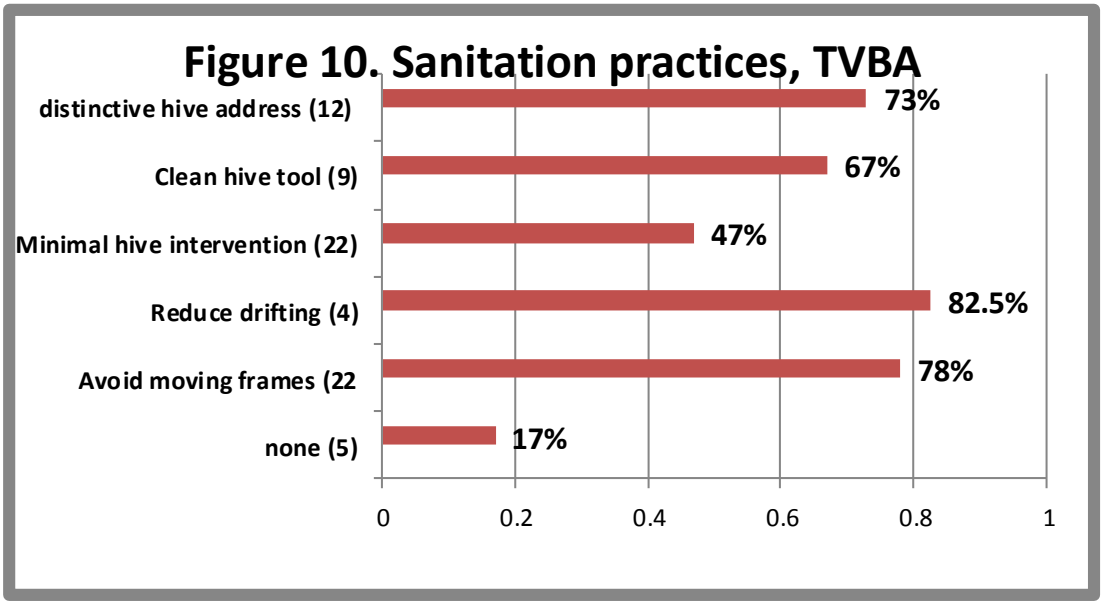


Figure 10 shows number of individual choices and percent of each selection. Results reflect that 4 individuals managing 45% of the colonies had extensive losses and not truly that some basic sanitation is of benefit and helps reduce losses.

SCREEN BOTTOM BOARDS: All but 9 TVBA individuals (69%l) used screen bottom boards; 7 who did not use SBB (with Langstroth hives) had an 81% loss rate. Statewide the 50 individuals not using a SBB, also had a higher winter loss rate, 58%, compared to those using them on 100% of their colonies - they had a loss rate of 45%. Eight TVBA beekeepers who blocked the screen during winter (always response) had a 50% survival rate compared to those 18 who indicted they never blocked the screens over the season (45% loss rate). Those individuals who sometimes blocked the screen had a 52.5% loss.

When use of screen bottoms was compared to non-use, there was a 5 pecentage point difference in improved survival overwinter last year (271 PNW beekeeper respondents) and a 12.5 improvement this year among OR beekepers (282 individuals). The difference was even larger (better survival) for Tualatin Valley beekeepers**. It does appear there may be an advantage to use of screen bottoms.**

Things that seem to improve winter success: It should be emphasized that these comparisons are correlations not causation. They are single comparisons of one item with loss numbers. Individual beekeepers do not necessarily do only one management nor do they necessarily do the same thing to all the colonies in their care. Analysis of the TVBA responses is not truly characteristic of the total area beekeepers as 4 individuals with 45% of the colonies had very heavy losses and the management activities of these 4 individuals mask the management of the remaining 34 TVBA respondents. Looking at the larger data base is more instructive.

We do know moisture kills bees, not cold, so we recommend hives be located out of the wind, in the sun, and, when exposed, providing some extra wind/weather/rain protection might improve survival. Use screened bottom boards leaving them open (or closed) as per your preference for ventilation. Use of insulted tops/quilt box with moisture collector such as burlap, straw, old towels, etc. with extra top ventilation to vent the moisture is also a good idea and helps improve survival. Feeding bees either sugar syrup or honey from other disease-free hives, helps insure enough food stores during early fall management. Once fall rains start, halt syrup feeding and switch to feed dry sugar or a hard sugar candy to avoid adding additional moisture stress to colonies. Finally, it would seem prudent to review basic sanitation measures, as anything we can do to help reduce sick bees and improve colony health, will improve overall survival.

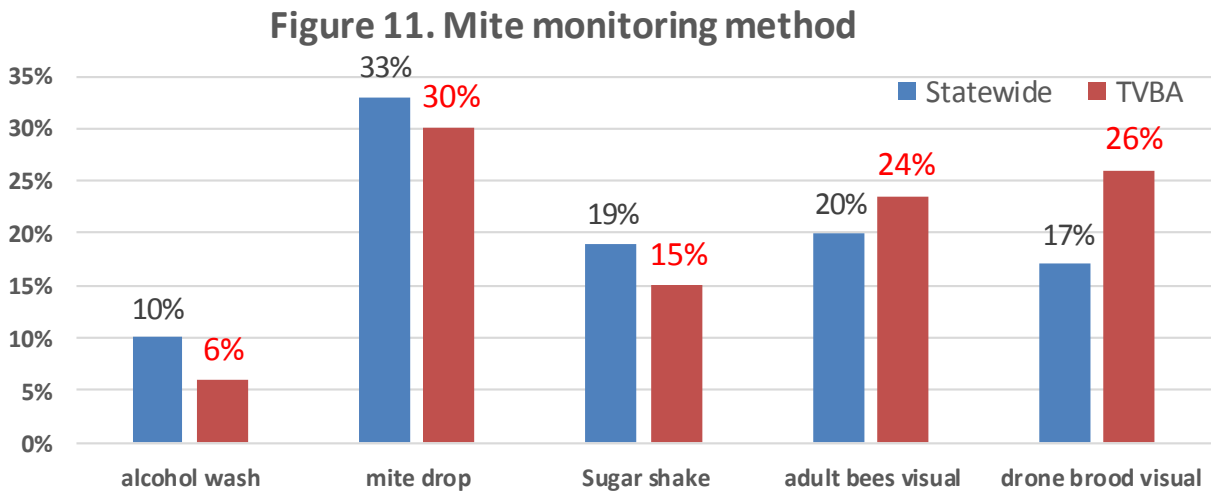
Mite monitoring/control

All OR bee hives have or will have varroa mites. It is important to know how many mites are present for the particular seasonal developmental phase of the colony as it provides an estimate of approximate risk to mites reducing winter survival or leading to total colony loss. Mites are not the only pest/predator/pathogen than can seriously weaken or kill colonies but studies point to their being the most significant.

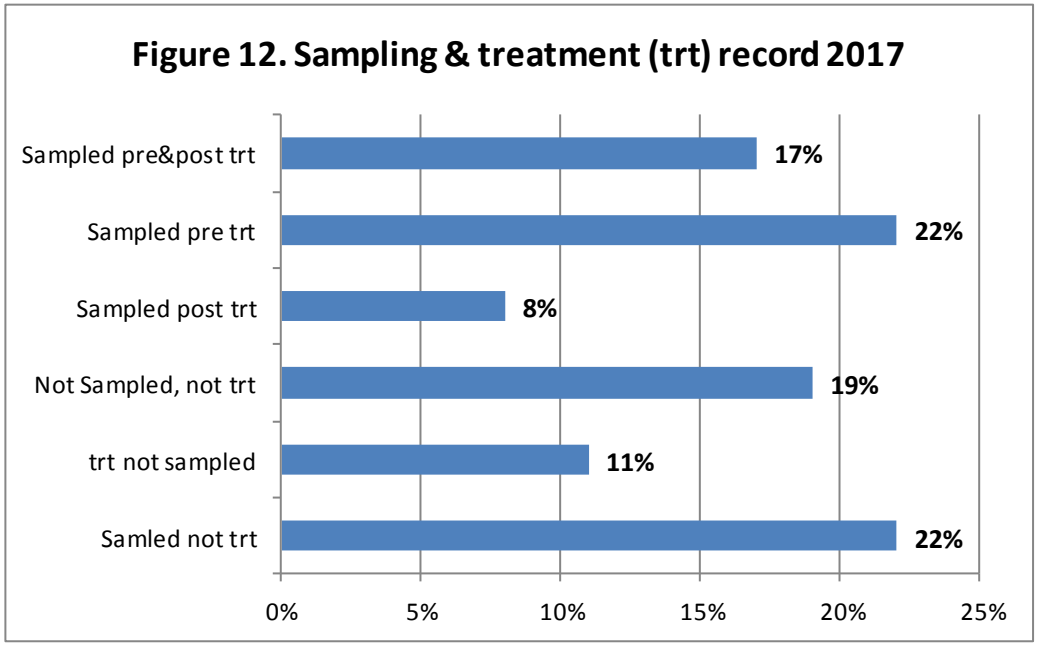
MITE MONITORING: To know how many, beekeepers need monitor/sample hives for mites. So the survey asked percentage of OR hives monitored for mites during the 2016 year and/or 2016-17 overwinter, whether sampling was pre- or post-treatment or both and, of the 5 possible mite sampling methods, what method was used including, when (month) it was employed. Statewide, 178 individual respondents (63%) said they monitored all their hives. Comparison of losses of those

individuals monitoring all their hives with those not monitoring along with those who indicated they monitored some of their hives, reveal a 43% loss of those monitoring all their hives, the 62 individuals (22%) who reported they did no monitoring had the statewide average loss of 48% loss and the 43 individuals reported monitoring some of their colonies had a 60% loss.

The comparable numbers for TVBA respondents make no sense due to smaller numbers of respondents; 17 monitoring all their hives had a 61.5% loss rate, 12 individuals doing no monitoring had a 39.5% loss while the 6 who monitored some of their hives had a 72.5% loss rate. When asked mite sampling methods, TVBA respondents, in order of popularity of use, sticky boards (14 individuals – 48%), visual (drone brood) 12 and visual of adults 11 (10 individuals checked both visual methods), powdered sugar (7 individuals) and alcohol wash, 3 individuals. Most sampling was done in August, September and October as might be expected but every month was indicated for visual; only May-September for powdered sugar and July, August and September for alcohol wash.



Six individuals monitored both pre and post treatment (6%); more TVBA individuals sampled pre-treatment than post-treatment (3 individuals). Eight individuals sampled but did not treat (19%).



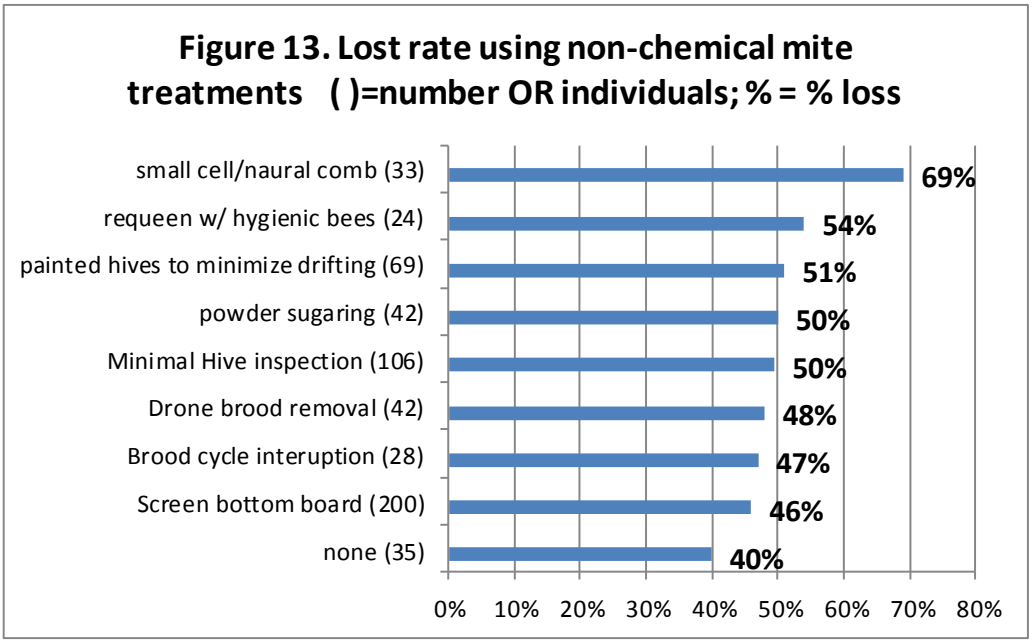
It is important to KNOW mite numbers. Less effective mite monitoring methods include sticky (detritus) boards below the colony (often so much detritus drops onto a sticky board that picking out the mites can be hard, especially for new beekeepers). Visual sampling is not accurate: most mites are not on the adult bees, but in the brood. Even looking at drone brood is not effective; if done, look at what percentage of drone cells had mites.

See Tools for Varroa Monitoring Guide www.honeybeehealthcoalition.org/varroa on the Honey Bee Health Coalition website for a description of and videos demonstrating how best to do sugar shake or alcohol wash sampling. The Tools guide also includes suggested mite level to use to base control decisions based on the adult bee sampling. A colony is holding its own against mites if the mite sample is below 2% in spring (i.e. 2 mites/100 adult bees) and below 5% (no more than 5 mites to 100 adults) when at its largest size during nectar flow following buildup. It is critical to not allow mite levels to exceed 2-3% during the fall months when bees are rearing the fat fall bees that will overwinter. It is also the most difficult time to select a control method (if one is deemed needed) as potential treatment harm may negatively impact the colony. We are seeing more colonies suddenly disappear (abscond?) during the fall, which may be related to the treatment itself.

NON-CHEMICAL MITE CONTROL: Survey questions asked about both non-chemical mite treatments and also about use of chemicals for mite control. **35 OR individuals statewide (12%) said they did not employ a non-chemical mite control; they had a 40% winter loss compared to the overall loss rate of 48%. Four TVBA individuals did not employ and they too had a smaller loss rate (50%) compared to the overall TVBA loss rate (59%). It is not clear why NOT using one of the techniques resulted in 15% better survival.**

Examining losses by individual options for statewide OR Beekeepers did not demonstrate that any non-chemical technique, except for a slightly lower rate for those using screen bottom boards, was useful to lower loss levels (See Figure 14 for statewide selections and loss percentages).

Two hundred OR individuals checked use of SBB and they had a 46% loss rate. Twenty-eight TVBA members checked the SBB option and their losses were 51.5% a better survival. TVBA individuals made 70 selections as follow: SBB 28, Minimum hive inspection 16, Painted hives distinctively to reduce drifting 8, powdered sugar 5, Requeen 5, small cell/natural comb 4, Drone brood removal 3, and brood cycle interruption 1. With few data points none of these provided improved survival. One individual had 5



selections, two had 4 selections and 12 had a single selection (minimum hive inspection and screen bottom board 4 each).

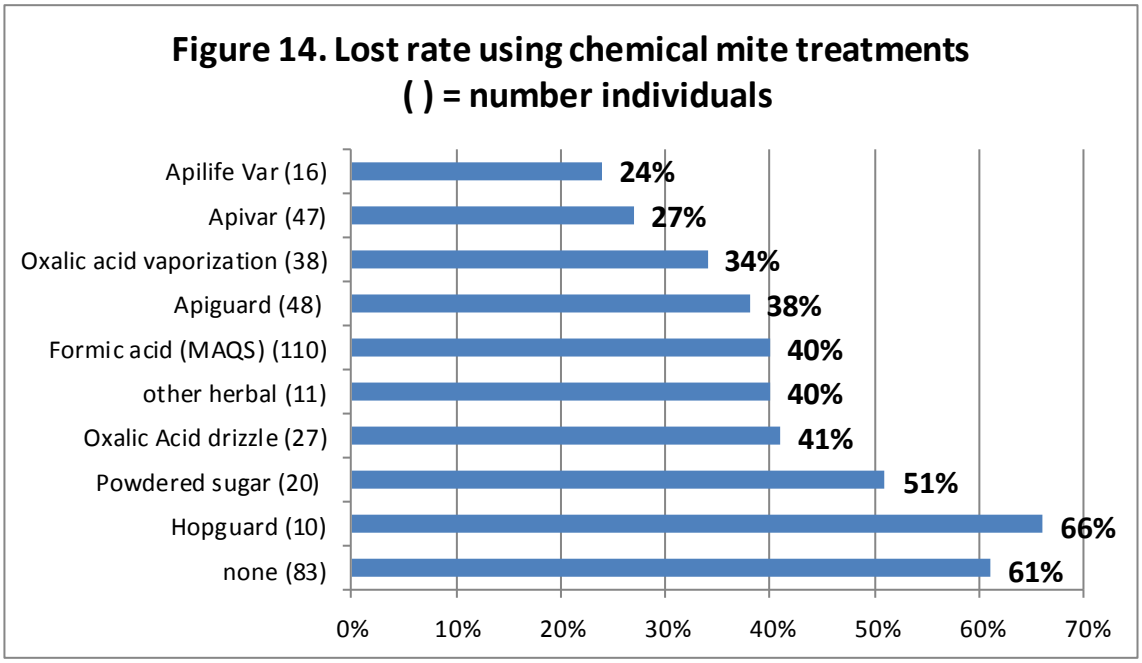
What works? The non-chemical technique alternative of drone brood removal is a non-chemical treatment that works in most colonies during spring buildup. You can buy a drone foundation frame or put a shallow frame into a standard brood box so the bees construct drone cells below the shallow frame bottom bar. The colony doesn't need that many drones so you harvest them in capped stage to discard with their mites. This technique only works during spring buildup.

Breaking the brood cycle, with requeening, especially if hygienic queen stock or local selected stock is used to requeen to replace removed queens, can also keep mite numbers at manageable levels in most bee colonies. Both the drone brood removal and especially breaking the brood cycle are a lot of work and new beekeepers should not seek to use such techniques until they have a better understanding of bee colony life cycles and queen event behaviors in colonies. Screen bottom boards help reduce losses some. Other techniques may or may not help under individual circumstances.

Chemical Mite control: There is a wide array of chemical treatments available to treat varroa mites and are often the best choices when colony mite populations are high as they can be very effective. Materials that can be used include acids such as formic acid (Mite-Away Quick Strips, or MAQS – especially the ½ dose treatment) and Oxalic or the Hopquard II product when there is little or no brood present, essential oils Apiguard or ApiLife-Var, under narrow temperature conditions and the highly effective synthetic miticide, Apivar (amitraz). All have possible serious negative effects to the beekeeper applicator and they can contaminate the beeswax and honey of the hive. Only use of MAQS is permitted when supers are on colonies. There may be significant queen or brood losses with many of the chemicals and post treatment sampling is recommended to insure the control has worked as expected. It is important to follow label directions. Consult Tools for Varroa Management from Honey Bee Health Coalition, available for free download from OSBA website or www.honeybeehealthcoaltion.org/varroa

Eighty-three OR individuals (29%) did not use a chemical control and had a 61% loss. Eighteen TVBA individuals did not use a chemical control; they had a 65.5% loss. Thirty total selections were made by TVBA members with two individuals indicated 3 chemicals, eight indicated 2 choices and 10 a single chemical, 8 of which were use of MAQS.

Statewide110 OR Beekeepers (35% of total chemical uses) indicated they most commonly utilized MAQS (formic acid), followed distantly by Apiguard (essential oil thymol, indicated by 15%). Oxalic acid vaporization (utilized by 38 individuals and oxalic acid drizzle (27 individuals) was also commonly used. Apivar (amitraz) use was indicated by 47 individuals. Figure 14 illustrates number of uses ( ) and bar length indicates the loss rate for those using that chemical. Apilife Var, although used by only 16 individuals, had the lowest loss rate of 24% overwintering colonies, ½ the average loss. Apivar also had a low loss rate by users (27% loss this year, 23% loss rate last year).



The most popular choice for TVBA individuals was MAQS (14 individuals) – their loss rate was 52.5%. The single individual using Apiguard had 10 fall colonies and all survived to spring, 0% loss. The two individuals using Apilife Var had loss of 3 colonies of 11 total, a 27% loss. One individual using Apivar and Oxalic acid dribble had 77% loss and with 22 fall colonies this data represents an 'outlier'; the remaining Apivar users (4) lost 4 colonies of 13 fall, a 23.5% loss rate and the 3 other Oxalic acid individual users (minus the 'outlier') had a 37.5% loss.

Twelve individuals (4%) used Fumigillan (for Nosema control); their loss rate was 52%. Three individuals indicated use of terramycin and 2 of tea tree oil. One TVAB individual used terramycin and another used fumigillan.

It is clearly evident that use of several chemical mite control materials reduced overwinter losses and improved survival. The non-chemical techniques may help reduce loses but to a lesser extent. As for using more than one, and which ones to use during a season, there appears to be NO one best combination. Control choices should be driven by monitoring, seasonal considerations and an estimation of size of mite population.

Queens

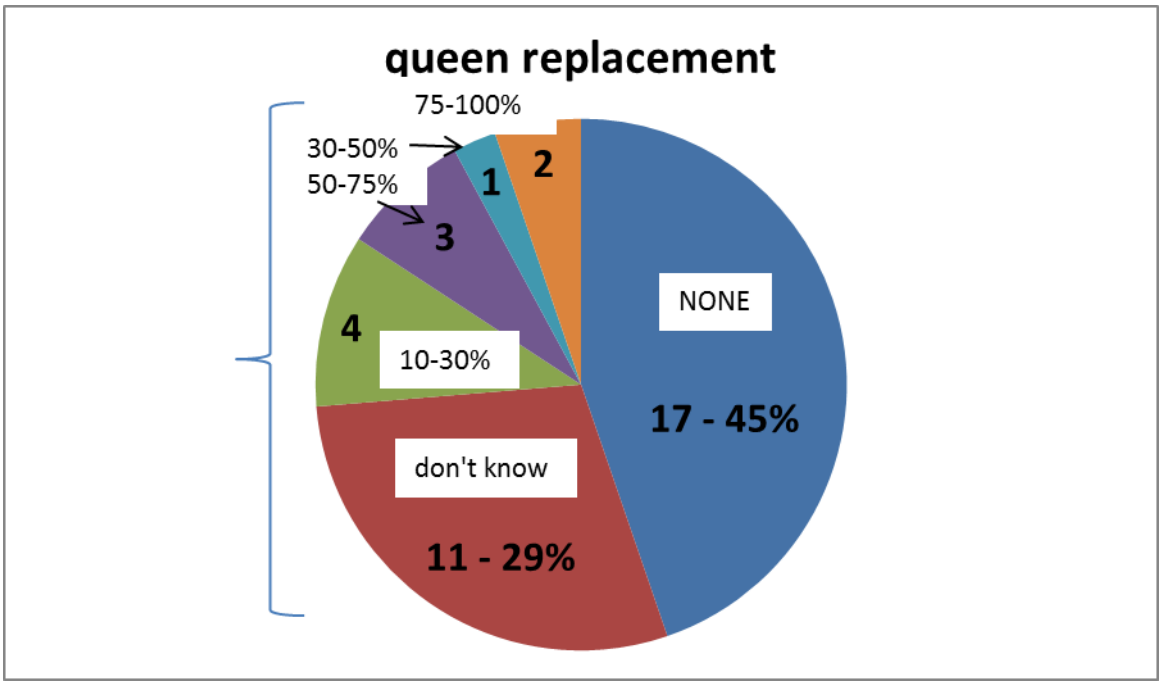
The PNW honey bee survey asks individuals with overwinter loss to what they attribute their loss. Fifty-five of the 282 OR respondents (13%) attribute at least some of the loss of their colonies to queen failure; among TVBA respondents, only 3 (6 %) indicated queen failure was one of the contributing reasons for their losses.

However, with the health and welfare of the queen (the 'heart of the hive') critical to bee hive development and success, we also have a survey section just covering queens. We ask specifically

what percentage of colonies might have been lost to queen related issues. For the total OR respondents, 127 (47%) said none and 66 respondents (24%) checked 'I don't know.' Twenty-nine percent (29%) responded that queen loss might have been a factor in colony losses.

Among TVBA respondents, 17 individuals (45%) said none of their losses were likely due to queen failure and 11 (29%) said they did not know. Ten TVBA individuals (26%) did attribute possible winter losses to queen failure, double the percent statewide. This last response required an estimate of the approximate percent of colony loss that might be attributable to queen failure. Four individuals (40%) said 10-30%, 3 indicated 30-50%, one said 50-75% and 2 (20%) felt 75-100% of their loss could be due to queen failure.

Figure 15



One non-chemical management technique to reduce mite buildup in a colony is to requeen/break the brood cycle so we also asked about how managed colonies are requeened. Seven TVBA individuals said their colony (ies) did not requeen and 3 said they did not know if their colony (ies) requeened. Thus 22 TVBA respondents (69%) reported their colony (ies) did requeen. Two individuals said colony queen replacement was via swarming and 2 others said it was via supersedure (=4, 18%), 14 (64%) said they requeened by introduction of a mated queen, 1 introduced virgin queens and 1 individual used queen cells. Two individuals said they split hives to allow the bees to requeen themselves.

We asked if queens were marked. Four TVBA individuals said yes. Marked queens are more expensive but are easier to find in a colony. Marked queens are also a means of tracking queen replacement. It would be difficult to be able to say yes or no if a hive requeened, with absence of queen marking, unless requeening was done by the beekeeper.

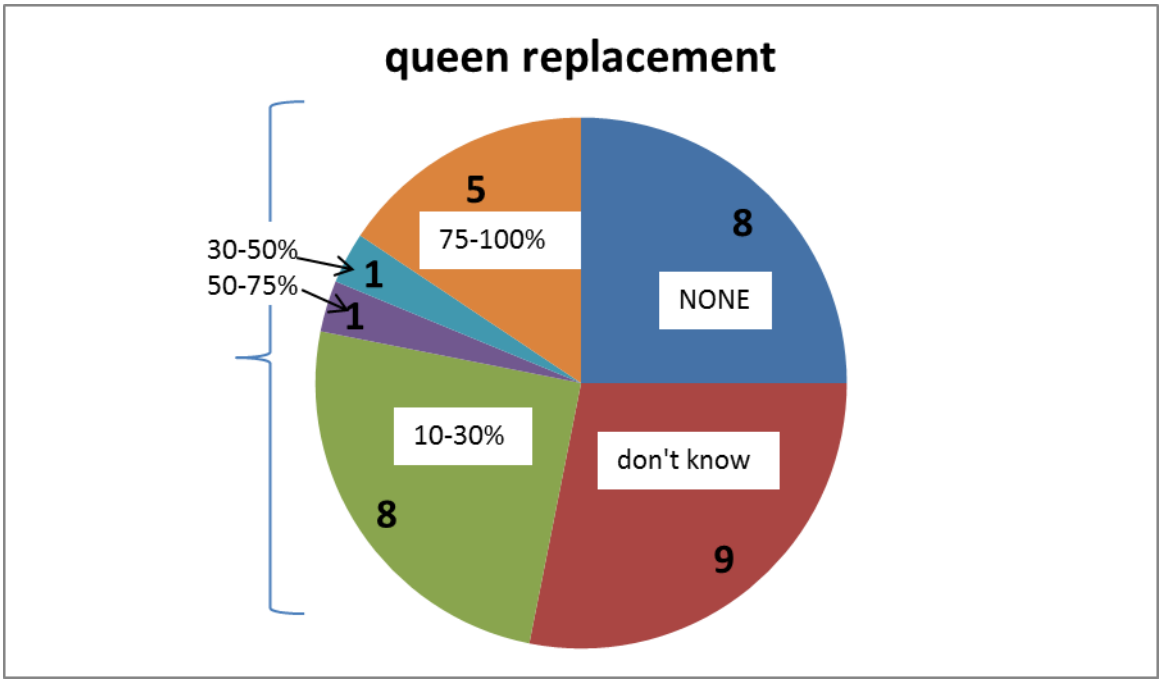


Figure 16

Closing comments: This survey is designed to 'ground truth' the larger, national Bee Informed loss survey. Some similar information is additionally available on the BeeInformed website www.beeinformed.org and individuals are encouraged to examine that data base as well. Reports for individual bee groups are customized. As they are completed they will be posted by the name of the group. Additionally analysis will be performed and these reports will be posted to pnwhoneybeesurvey as they are completed.

We intend to continue to refine this instrument each season and hope you will join in response next April. If you would like a reminder when survey is open please email us at info@pnwhoneybeesurvey.com with "REMINDER" in the subject line. We have a blog on the pnwhoneybeesurvey.com and will respond to any questions or concerns you might have.

Thank You to all who participated. If you find any of this information of value please consider adding your voice to the survey in a subsequent season. Dewey Caron June 2017