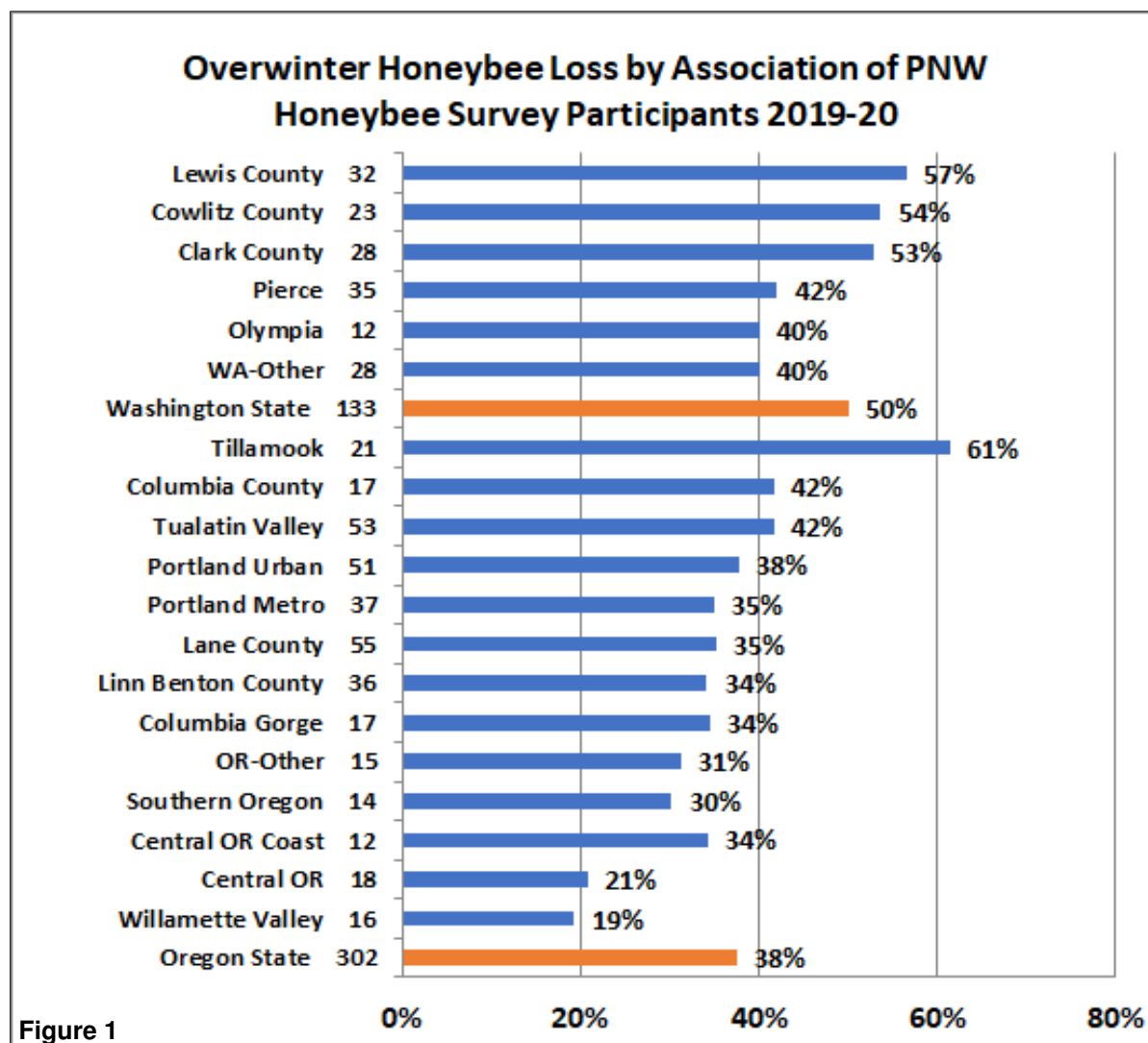


Winter Bee Losses of Washington Backyard Beekeepers for 2019-2020

by Dewey M. Caron and Jenai Fitzpatrick

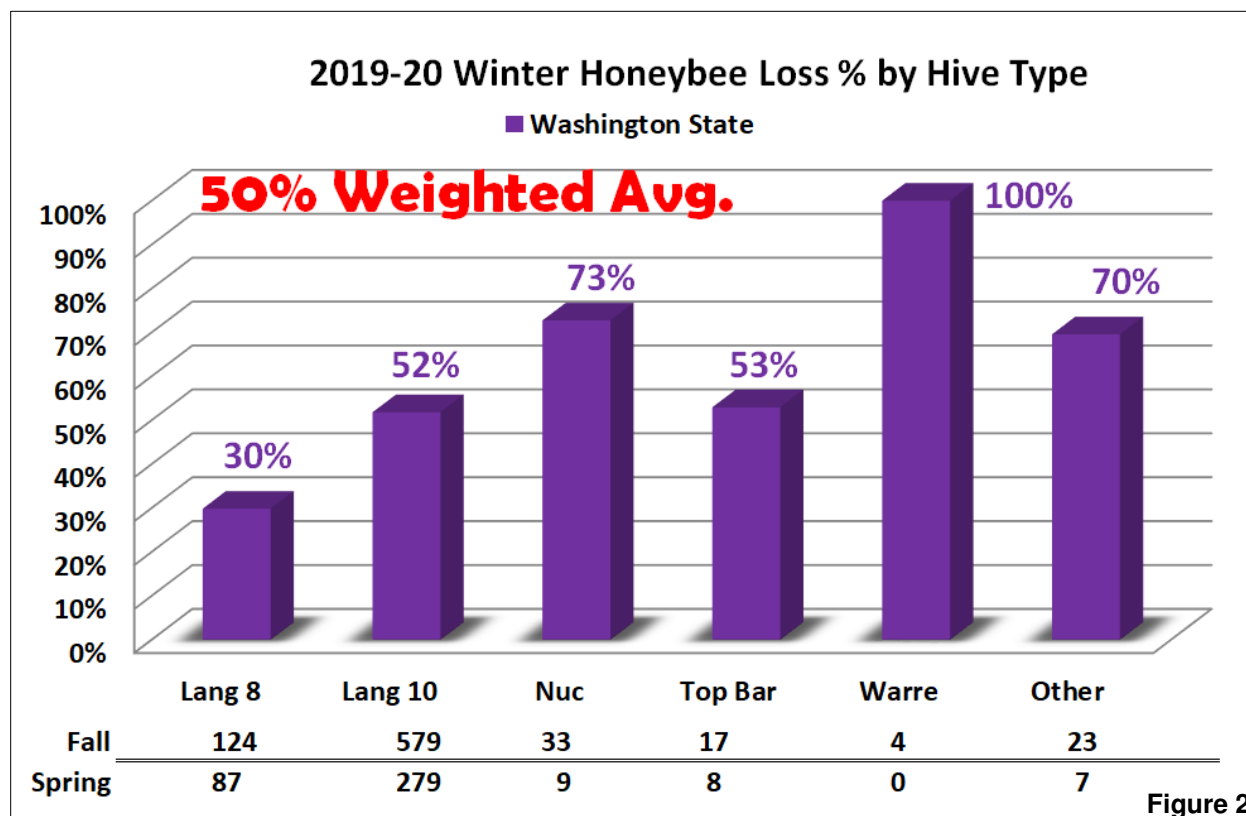
Overwintering losses of small-scale Washington backyard beekeepers decreased this past winter, dipping one percentage point below the 5-year loss average. One hundred thirty-three Washington beekeepers (35 more than last year) supplied information on winter losses and several managements related to bee health with an electronic honey bee survey instrument www.pnwhoneybeesurvey.com.

Response by local Oregon (OR) & Washington (WA) association varied as indicated by blue bars in Figure 1. Statewide loss level is highlighted with Orange bar. The number of respondent individuals is listed next to the association name. The bar length is the average club loss percentage for the year. Total fall colony response was 302 OR and 133 WA individuals; survey included 780 fall Washington beekeeper colonies. Total WA backyard beekeeper overwinter loss = 50% loss.



2019-2020 Overwinter Losses by Hive Type

The Washington survey overwintering loss statistic was developed by subtracting number of spring surviving colonies from fall colony number supplied by respondents by hive type. Results, shown in Figure 2 bar graph, illustrate overwintering losses of 133 total WA beekeeper respondents. Langstroth 8 and 10 frame beehives (90% of total) had lower average losses (48%) than the 21 Top Bar and Warré hives (62%). In the category other, there were 4 AZ hives and 4 horizontal hives; remainder were not identified.



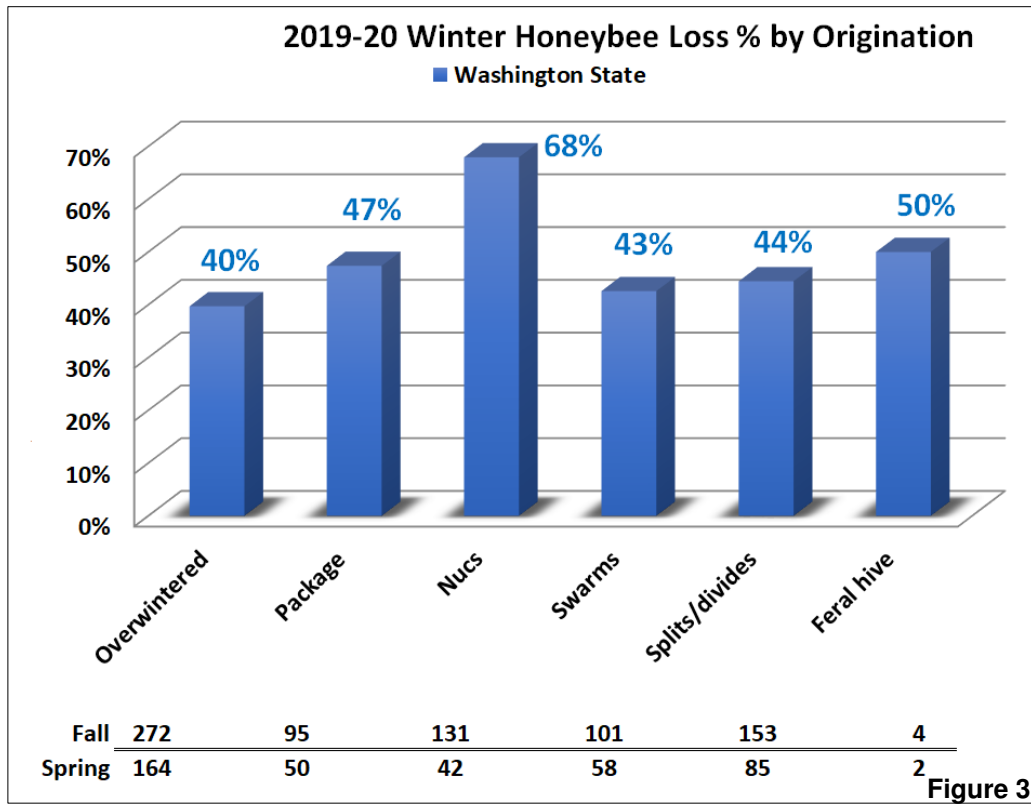
The WA respondents to the electronic survey managed up to 45 fall colonies. Twenty individuals had 1 colony, 33 respondents had 2 colonies (the greatest number) and 19 individuals had 3 colonies (72 individuals, 54% of total respondents had 1, 2 or 3 colonies), 30 individuals had 4 to 6 colonies, 11 had 7-9 colonies, 12 individuals had 10-19 colonies and 7 individuals had 20+ colonies. When loss levels were compared, the 1-3 colony owners had a 50% loss; the 10+ individuals had 47% loss of colonies in 2019-20 overwintering period.

Fifty nine individuals (44% of respondents) had 1, 2 or 3 years of experience; 39 individuals (29% of total respondents) had 4 – 6 years' experience (medium number = 4), 12 individuals had 7-9 years experience and 23 had 10+ years with 61 the greatest. When loss level was correlated to experience, the 59 individuals with 1-3 years experience had 55% loss level and the 10+ years experience group (23 respondents) had a 47% loss.

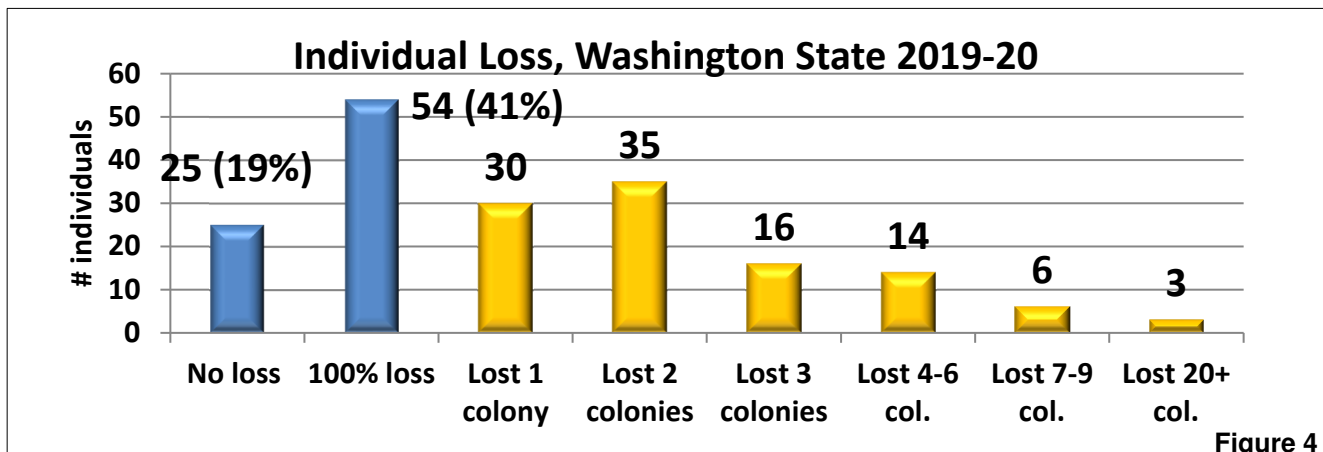
Ninety six (76%) of WA beekeepers had an experienced beekeeper mentor available as they were learning beekeeping. This percentage was up from 73% the previous year.

Survival Based on Hive Origination

We also asked about hive loss by origination. Data shown in Figure 3. All but nucs had similar loss level; overwintered hives exhibited slightly greater survival. The 303 Oregon beekeepers had the same situation with losses overwinter from nuc origination being more likely than the remaining originations (see OR statewide report).

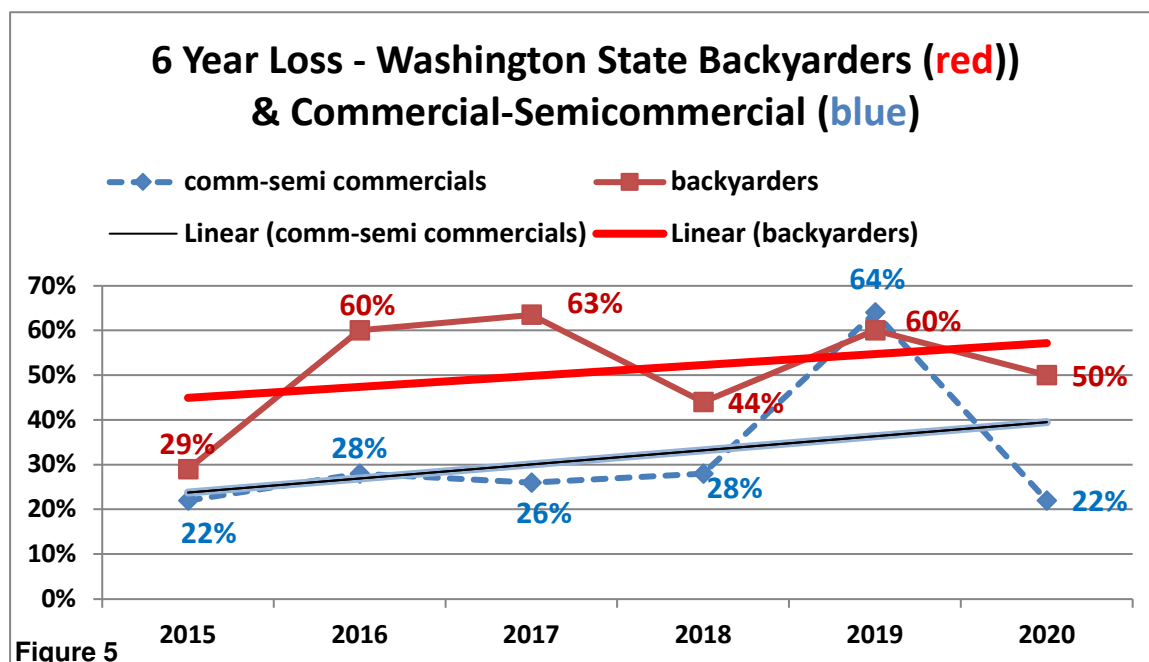


Among 133 WA beekeepers 19 individuals (14%) maintained more than one hive type. For the total WA beekeeper respondents, 25 (19%) had no loss and 54 individuals (41%) had total loss. Thirty WA individuals lost 1 colony, 35 individuals lost 2 colonies and 16 individuals lost 3 colonies (75% of individuals with losses). Nine individuals lost 10 or more colonies; highest loss was 30 colonies. Data in Figure 4. Twenty individuals (15%) had 10 or more colonies. They lost 47% of their colonies compared to 50% overall loss for Washington beekeepers.



Comparison to Larger-Scale Beekeeper Losses

A different (paper) survey instrument was mailed to Pacific Northwest (PNW) semi-commercial (50-500 colonies) and commercial beekeepers (500+) asking about their overwintering losses. Comparison is shown in Figure 5 below with approximate number of colonies represented by the commercial/semi-commercial beekeepers and number of individual backyarder survey respondents. Also shown is the trend line of losses of both groups. Average loss level for Washington backyarders=51% and for Washington commercial/semi-commercial beekeepers = 33%.



# Comm hives	~40,000	33,200	16,604	29,015	~20,000	20,500
# backyarders	31	52	101	104	98	135

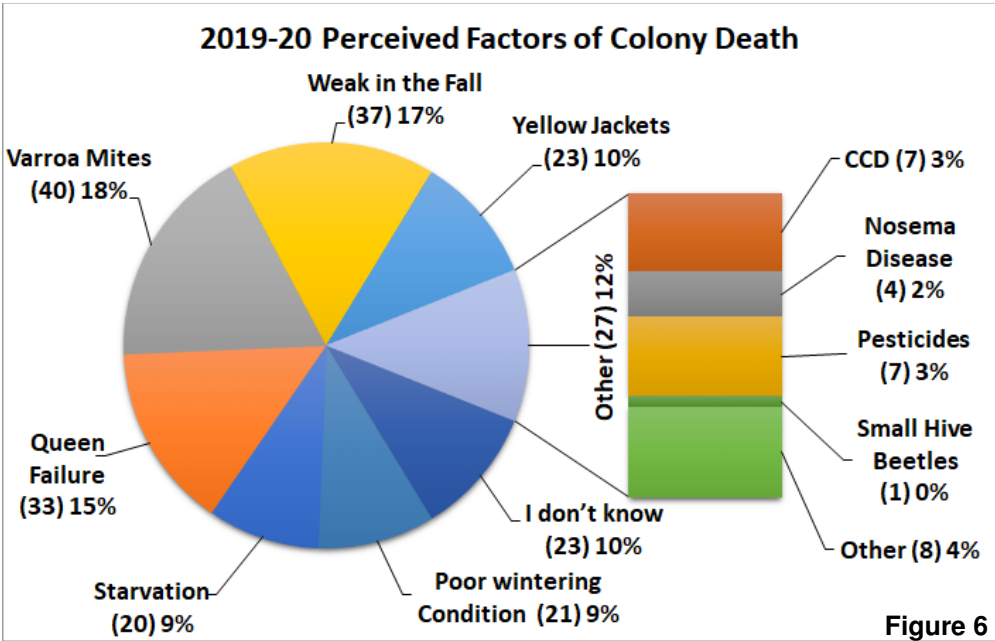
Backyard losses have consistently been higher, in some years double the losses of larger-scale beekeepers but in 2018-19 the commercial losses were higher than backyarder losses. Number of colonies of the commercial keepers returning surveys were essentially the same this past season (returns were an estimated 26% of the NASS estimate of 77,000 colonies in the state). The reasons backyarders have had higher losses 4 of the past 5 years are complex. Commercial and semi-commercial beekeepers examine colonies more frequently and they examine them first thing in the spring as they take virtually all of their colonies to pollinate almonds in February. They also are more likely to take losses in the fall and are more pro-active in varroa mite control management.

The PNW survey was conducted in part to “ground truth” the annual BeelInformed Survey (BIP) also conducted during April. The BIP survey includes a mailed survey to larger-scale beekeepers and an electronic survey to which any Washington beekeeper can submit their data. Losses reported include colonies of migratory beekeepers who reported WA as one of their yearly locations. The BIP survey for the 2015-19 annual surveys (2020) data not yet available) reports receiving responses from 90 to 95% of respondents exclusive to Washington but loss is computed on no more than 4% of the

colonies exclusive to Washington state, indicating the BIP tally is primarily of commercial beekeepers (whom almost exclusively move to CA for pollination of almonds). Average 5-year BIP WA loss is 23.7%. To access this data see <https://beeinformed.org/take-survey/>

Colony Death Perceived Reason and Acceptable Level

We asked survey takers who had winter losses for the “reason” for their losses. More than one selection could be chosen. In all there were 188 WA selections (1.75/individual) provided. Weak in the fall (37 individual choices), Varroa mites (40) and queen failure (33 selections) were most common choices. Figure 6 shows the number and percent of factor selections.



Acceptable loss: Survey respondents were asked reason for loss. Nineteen (14%) indicated zero (no loss). Twenty eight percent of individuals indicated 15% or less. 20% was medium choice. Twelve percent said 50% of greater was an acceptable loss level. See table below.

5%	10%	15%	20%	25%	33%	50%	75%	100%	None	IDK
8	22	7	23	19	14	12	2	2	19	3

Why do colonies die? There is no easy way to verify reason(s) for colony loss. Colonies in the same apiary may die for different reasons. There appears to be no single reason for loss and a good deal of variance in opinion as to what might be an acceptable loss level. We are dealing with living animals which are constantly exposed to many different challenges, both in the natural environment and the beekeeper’s apiary. Major factors are thought to be mites, pesticides, declining nutrition adequacy of the environment and diseases, especially viruses and Nosema. Management, failure to do something or doing things incorrectly, remains a factor in our losses. More attention to colony strength and checking stores to help avoid winter starvation will help reduce some of the losses. **So there is no simple answer to explain the levels of current losses nor is it possible to demonstrate that they are excessive for all the issues facing honey bees in the current environment.**

Colony Managements

We asked in the survey for information about some managements practiced by respondents. The survey inquired about feeding practices, wintering preparations, sanitation measures utilized, screen bottom board usage, mite monitoring, both non-chemical and chemical mite control techniques and queens. Respondents could select multiple options and there was always a none and other selection possible. This analysis seeks to compare responses of this past season to previous survey years.

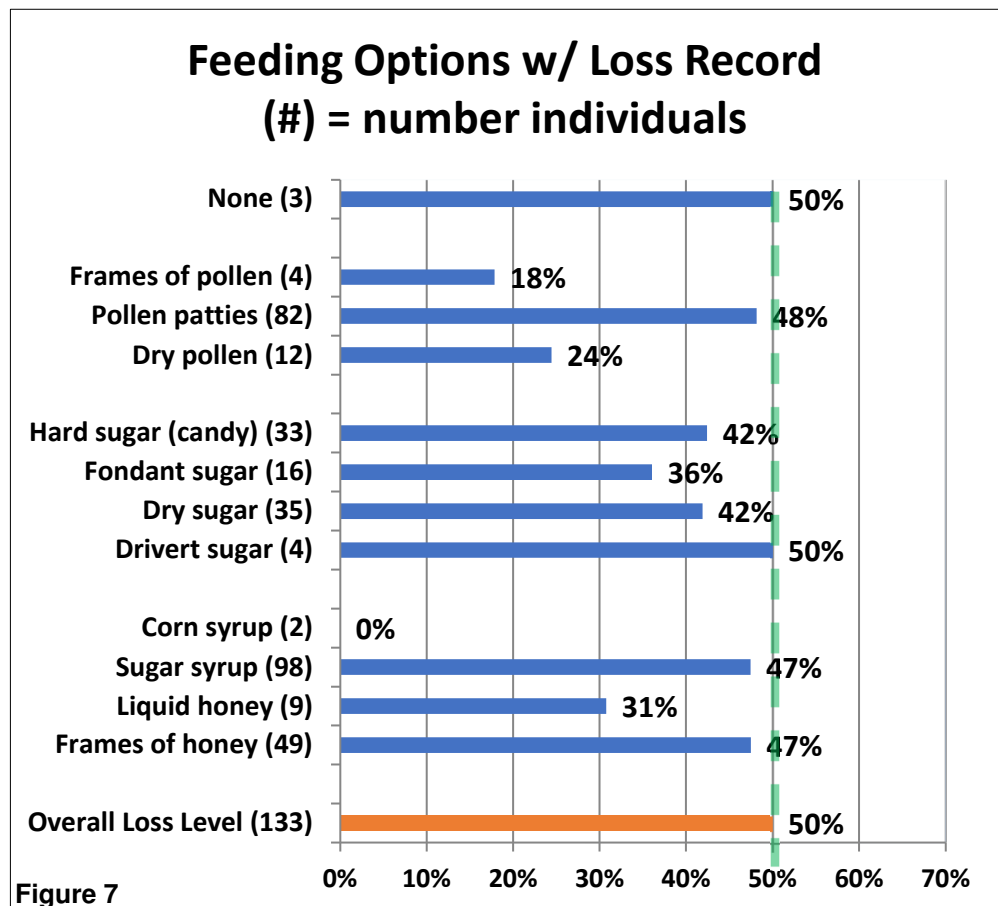
Most Washington beekeepers do not perform just one management to their colony (ies) toward improving colony health and overwintering success. This analysis however compares a single factor equated with loss level. Such analysis is correlative and doing a similar management as fellow beekeepers does not necessarily mean you too will improve success.

FEEDING: Washington survey respondents checked 348 feeding options = 3.1/individual. Three individuals made no selections – they had 50% loss. Twenty one selected a single choice and had 66% loss level, 35 indicated 2 choices and had a 57% loss, 37 (the greatest choice and also the median) made 3 choices and reported a 49% loss level. Twenty-eight respondents had 4 choices with a 53% loss and 6 individuals had 5 – 7 choices with the lowest loss level 12%.

The choices, with number of individuals making that selection is in (), bar length indicates loss level of individuals doing this management. Those bar lengths to left of 54% (green dashed line) had better survival while those to right had greater loss level.

For individuals indicating one or more feeding managements, feeding sugar syrup was the most common feeding option of respondents (98 individuals, 76% of respondents). Their loss rate was 47%,

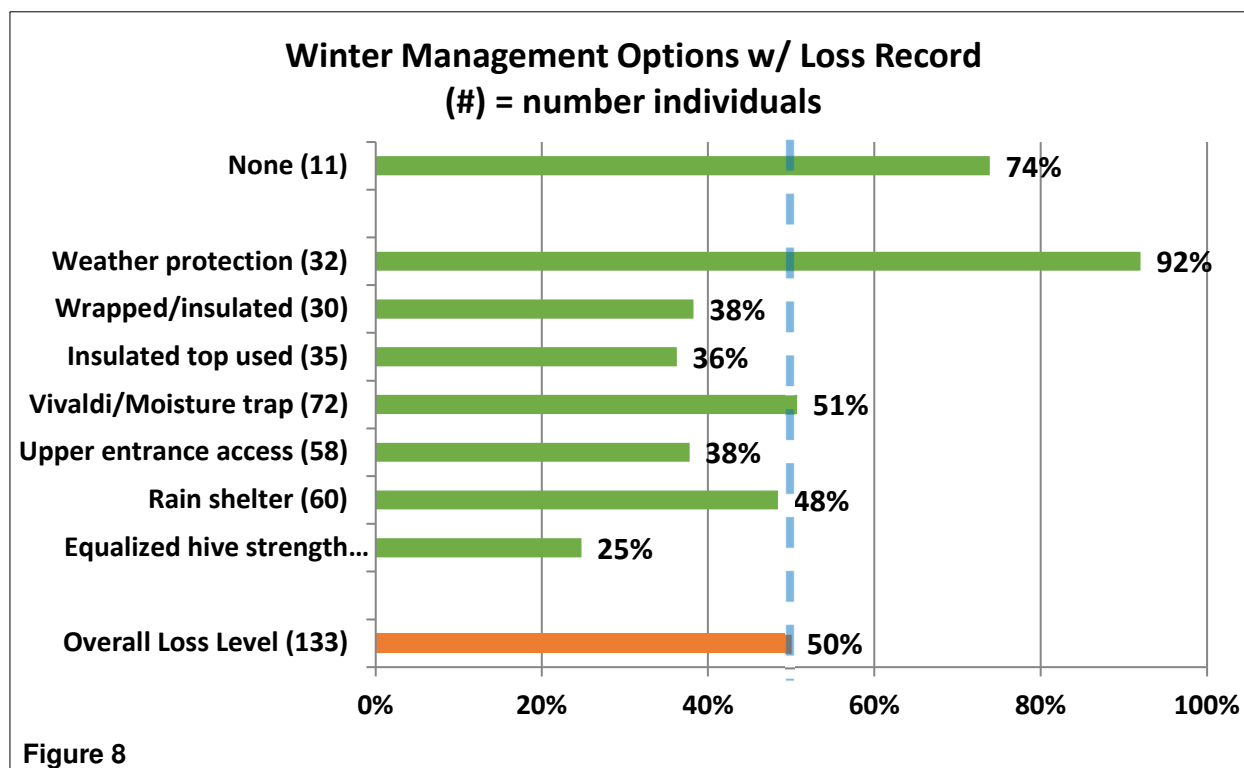
statistically same as overall average. Eighty two individuals fed pollen patties (61%) and had same loss level. The managements that showed best survival included feeding fames of pollen and dry pollen, feeding non-liquid sugar and feeding liquid honey. The two corn syrup feeders had no loss.



For the last 3 years of losses individuals doing no feeding had poorer survival all 3 years; this year they had average loss. Individuals that fed sugar syrup had marginal lower loss level in 3 of four years as did those using frames of honey to feed bees. Individuals feeding non-liquid sugar in the form of fondant and hard candy likewise had lower losses in at least two years, including this most recent survey year; hard candy improved survival in three of the four years. For individuals feeding protein, protein patty users showed slightly better survival in 3 of 4 years; dry pollen feeders had significantly better survival in three of the four years, including this past year when 12 individuals had only a 24% loss, one-half overall loss.

WINTERING PRACTICES: We received 312 responses (2.5/individual) about WA beekeeper wintering management practices (more than one option could be chosen). Eleven individuals (8%) indicated none of the several listed wintering practices was done; these individuals had a 74% winter loss, 24 percentage points higher loss than overall loss of 50%. For those indicating some managements, 27 did one single thing had 50% loss level, 32 respondents doing 2 had 53% loss, 28 had 3 choices with a 41% loss (the medium choice), 21 did 4 (47% loss) and 8 made 5 or 6 choices had lowest loss level of 21%.

The most common wintering management selected was ventilation/use of a quilt box at colony top (72 individuals (51% loss), followed by rain shelter provision (60 individuals 48% loss) and upper entrance bee access (58 individuals, 38% loss). Figure 8 shows number of individual choices and percent of each selection. Bar length below 50% (blue dashed line) had better than average winter survival.

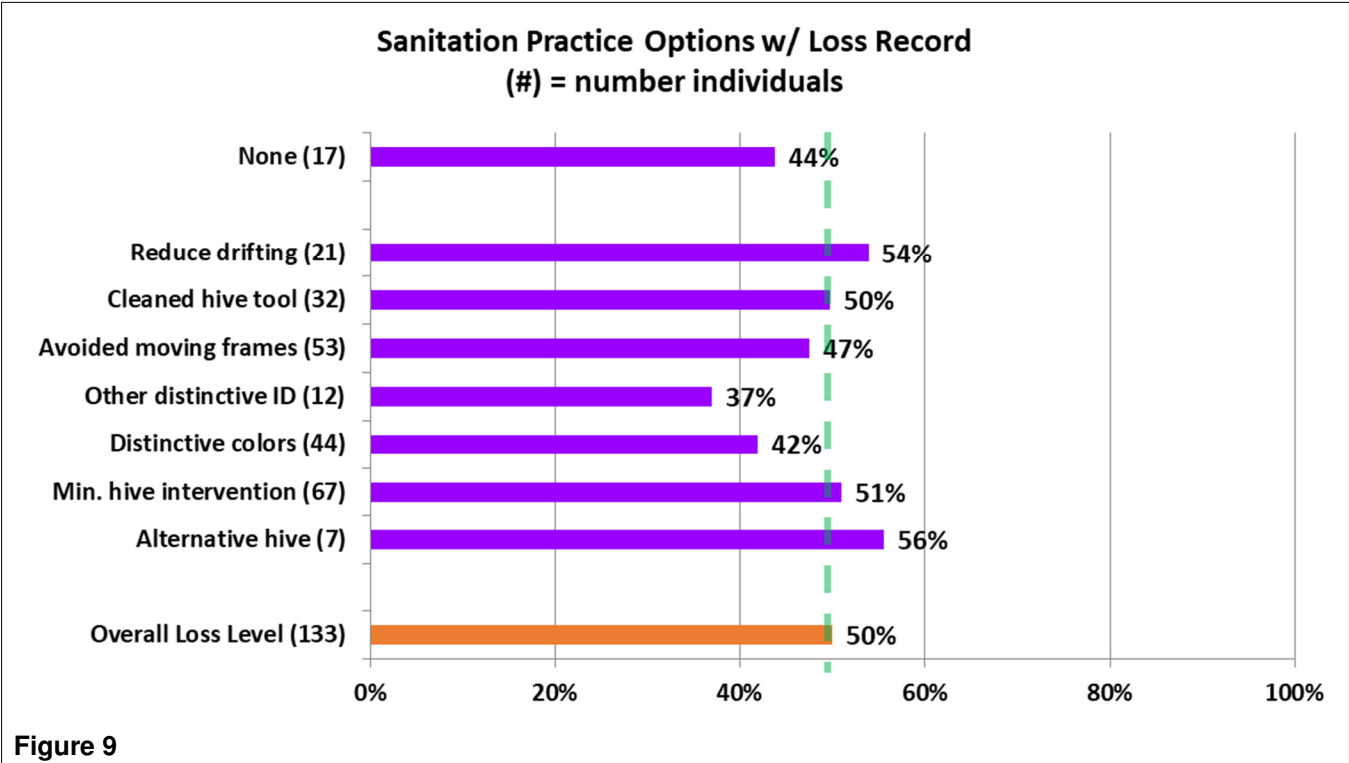


Over the past three years a couple of winterizing management improved survival. Those doing no winterizing had higher losses all 4 years. Equalizing hive strength in the fall demonstrated lower loss levels in all four recent winter periods (only 25% loss this past winter). Top insulation has demonstrated lower loss in three of the four years, in the most recent winter 35 individuals realized a 14 percentage point improvement. Ventilation above the colony (Vivaldi Board/quilt box)

demonstrated improved survival two of the four winters but not this past one (1 percentage point higher loss).

SANITATION PRACTICES: It is critical that we practice some basic bee sanitation (some prefer use of term bee biosecurity) in our bee care to help insure healthy bees. We received 158 responses for this survey question 2.2/individual. Seventeen individuals (13%) said they did not practice any of the 6 offered alternatives; they had a loss rate of 44% compared to overall rate of 50%. Forty individuals had 1 selection and had 42% loss, 26 had 2 choices with 50% loss, 34 selected 3 managements with 67% loss; ten had 4 and 5 selection (34% loss).

In three of four years doing none of these managements resulted in improved survival; this was the case this past winter when the 17 individuals doing nothing had losses of 44%. Using an alternative hive resulted in lower losses in two of four winters but not this past year. Providing hives with color, distinctive hive ID measures were helpful managements this past winter but not in the previous two seasons, though their loss level was same as or similar to overall loss level (these three choices were not always available in previous survey years).

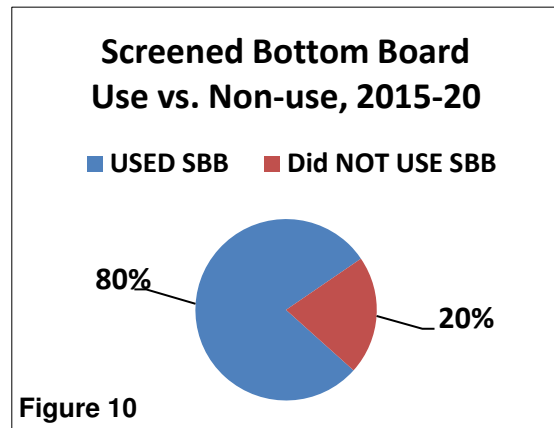


SCREEN BOTTOM BOARDS (SBB)

Although many beekeepers use SBB to control varroa mites, BIP and PNW surveys clearly point out they are not or at best not a very effective varroa mite control tool. In this recent survey 20 Washington individuals (16%) said they did not use screen bottom boards; they lost 78% of their colonies. Those 80 beekeepers using SBB on all of their colonies had 60% loss. The 24 individuals using SBB on some of their colonies had 34% loss.

In 5 survey years 20% said they did not use SBB and 80% did use SBB on some or all of their colonies, see Figure 10.

Examining the five year average of SBB use, loss level of those using SBB on all or some of their colonies had a 42.8% loss level whereas for those not using SBB had loss rate of 44.2% (a 3% positive survival gain for those using SBB versus those not using them). They are very minor in improving overwinter survival.



We asked if the SBB was left open (always response) or blocked during winter (bottom Figure 10). This past season 66 individuals (53%) said they always blocked SBB during winter. They had a 44% loss rate, average loss rate for statewide. Thirty six individuals (29%) said they never blocked SBB and had loss rate of 60%. Thirteen individuals (10%) blocked them on some of their colonies. Their loss rate was 79%.

There is no good science on whether open or closed bottoms make a difference overwinter but some beekeepers “feel” bees do better with it closed overwinter. **Comparing the always and sometimes left open with the closed in winter response reveals a 16 percentage point difference in favor of closing the SBB over the winter period.. This relationship has been consistent over the past five years averaging nearly a 10 percentage point advantage when the SBB is closed during the winter.** An open bottom, at least during the active brood rearing season, can assist the bees in keeping their hive cleaner and promote good hive ventilation.

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 do only one management option nor do they necessarily do the same thing to all the colonies in their care. We do know moisture kills bees, not cold, so we recommend hives be located in the sun out of the wind. If exposed, providing some extra wind/weather protection might improve survival.

Feeding, a common management appears to be of some help in reducing losses. Feeding fondant sugar or a hard sugar candy during the winter meant lower loss levels. Providing frames of honey or sugar syrup, the most common selection, also meant slightly lower losses for some individuals but these basic managements are useful in other ways such as for spring development and/or development of new/weaker colonies besides insuring better winter survival.

Feeding protein in form of pollen patties did slightly improve survival. The supplemental feeding of protein (pollen patties), might be of assistance earlier in the season to build strong colonies.

Winterizing measures that apparently helped lower losses for some beekeepers was equalizing strength, providing an upper entrance, a moisture trap (Vivaldi board or quilt box) and some attention to adding protection against the elements. Spreading colonies out in the apiary and

painting distinctive colors or doing other measures to reduce drifting also appeared to be of some value in reducing winter losses. Avoiding movement of frames from one colony to another might also improve survival but the gain over what this interchange might accomplish might be greater than a minor advantage in survival.

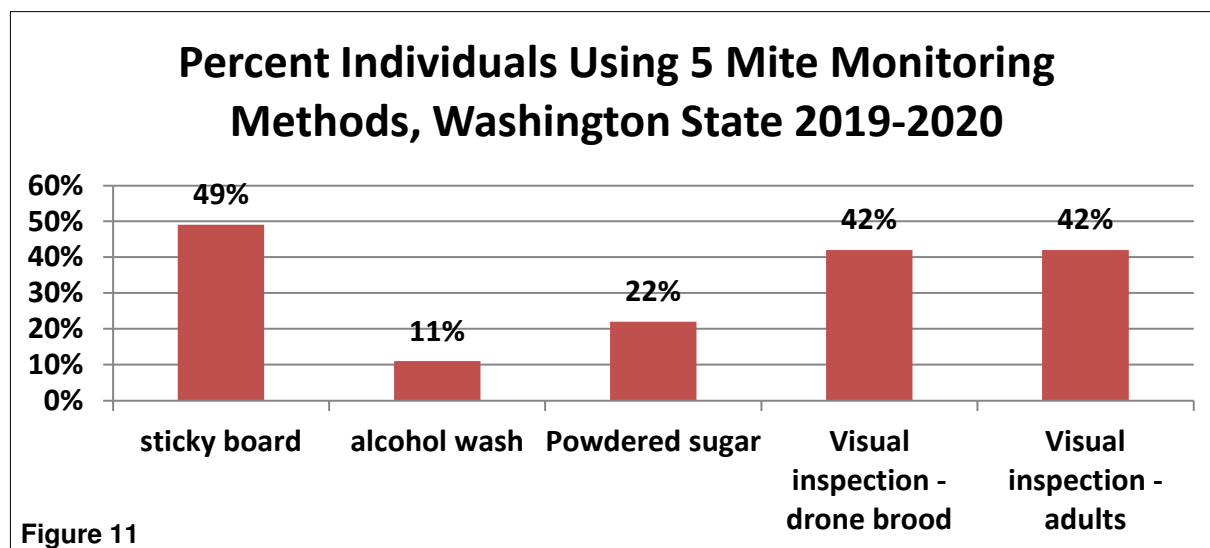
It is clear that doing nothing for feeding or winterizing or this past season in sanitation resulted in the heaviest overwinter losses.

Replacing standard bottom boards for screened bottoms only marginally improved winter survival. It is apparently advantageous to close the bottom screens during winter.

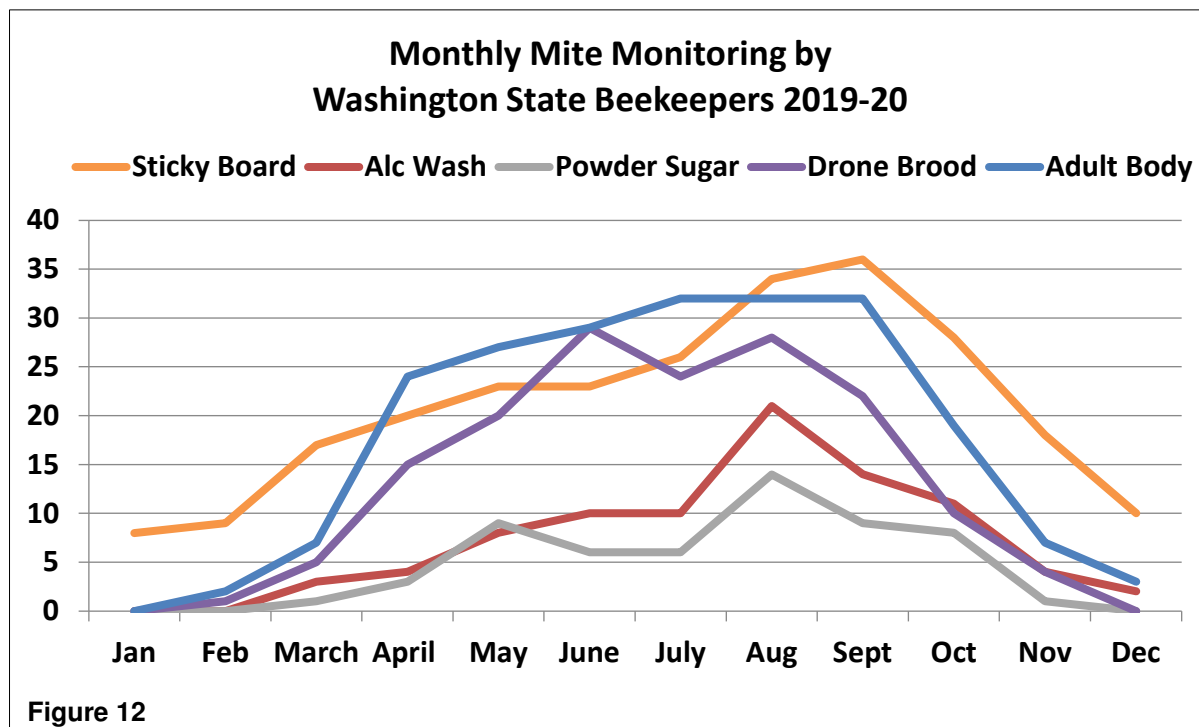
Mite monitoring/sampling and control management

We asked percentage of Washington hives monitored for mites during the 2019 year and/or overwinter 2019-20, whether sampling was pre- or post-treatment or both and, of the 5 possible mite sampling methods, what method was used and when it was employed. Eighty six individual respondents (65%) said they monitored their hives. Losses of those individuals monitoring was 44%. Thirty three (25%), reported no monitoring; they had a higher single percentage point higher loss rate of 45%. Thirteen individuals monitored some with loss rate 70%.

In order of popularity of use, Sticky boards were used by 49 individuals, 49% total of 99 individuals who did some or all monitoring of colonies, followed by 42 individuals (42% of individuals doing monitoring) that used both visual inspection of adults and visual inspection of drones brood. The two most accurate means of determining mite load, alcohol wash was used by 11 individuals (11%) and powdered sugar was employed by 22 respondents (22%). Individuals were able to select more than one option and averaged 1/7/individual. Figure 11.

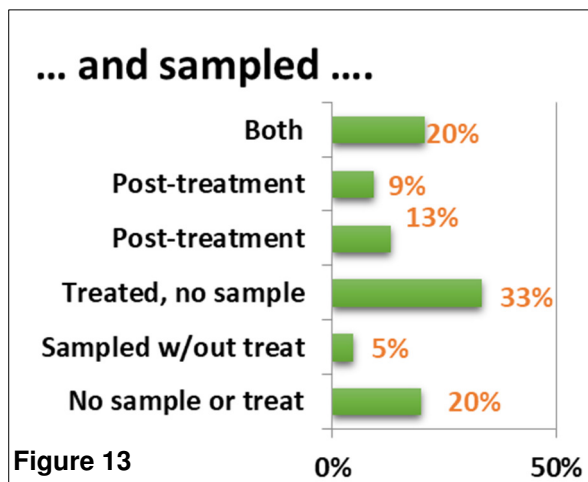


Most sampling to monitor mites was done in July – September, as might be expected since mite numbers change most quickly during these months and results of sampling can most readily be used for control decisions. See Figure 12 below for number of months each of the 5 sampling methods were used.



The most common sampling of respondents in 2018-19 was treated but did not sample (33% individuals) followed by both and not sampling nor treating. Thirteen indicated sampling pre and 9% post. Selections shown in Figure 13 to right.

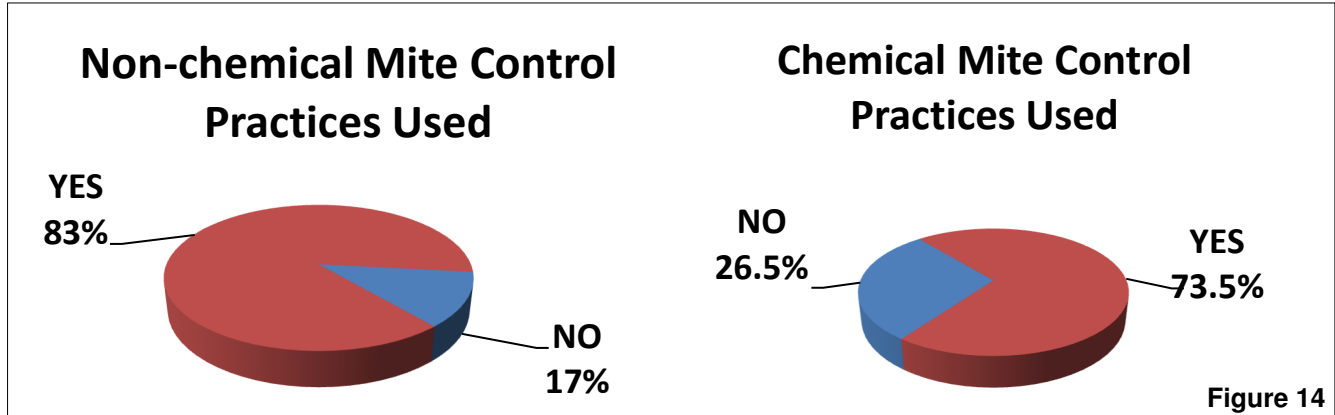
It is important to KNOW mite numbers. Less effective mite monitoring methods include sticky (detritus) boards below the colony (often so much detritus drops onto a sticky board that picking out the mites can be hard, especially for new beekeepers) but sticky boards used for a day can help confirm the usefulness of a treatment when inserted post treatment. Visual sampling is not accurate: most mites are not on the adult bees, but in the brood. Unfortunately looking for mites on drone brood is also not effective as a predictive number but can be used as an early warning that mites are present; if done, look at what percentage of drone cells had mites.



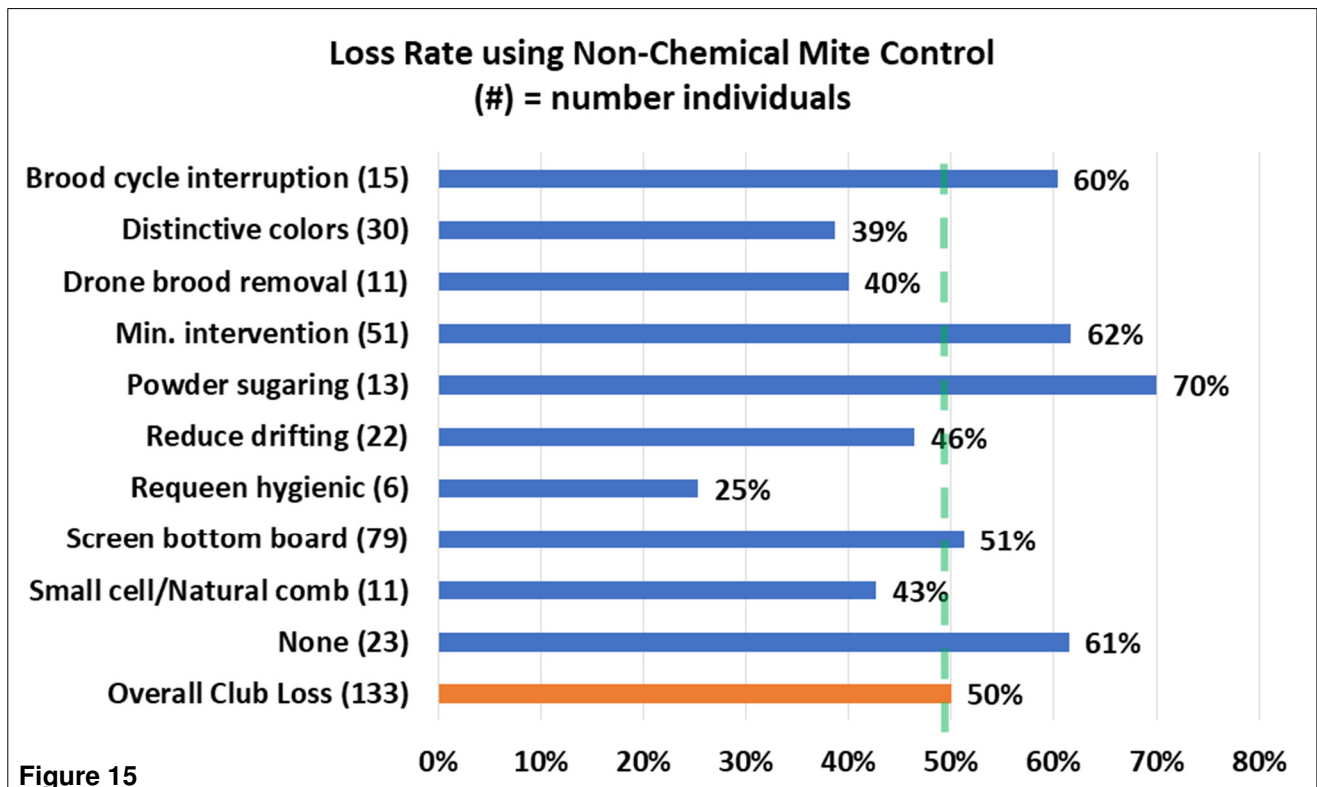
See **Tools for Varroa Monitoring Guide** www.honeybeehealthcoalition.org/varroa on the Honey Bee Health Coalition website for a description of and to view videos demonstrating how best to do sugar shake or alcohol wash sampling. The Tools guide also includes suggested mite level to use to base control decisions based on the adult bee sampling. A colony is holding its own against mites if the mite sample is below 2%. It is critical to not allow mite levels to exceed 2% 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.

Mite Control Treatments

The survey asked about non-chemical mite treatments and also about use of chemicals for mite control. Twenty three individuals (17%), 5 individuals more than last year, said they did not employ a non-chemical mite control and 35 individuals (26½%), fifteen more than last year, did not use a chemical control. See Figure 14. Those 23 individuals who did not use a non-chemical treatment reported a 61% winter loss, while those who did not use a chemical control lost 63% of their colonies. The individual options chosen for non-chemical and chemical control are discussed below.



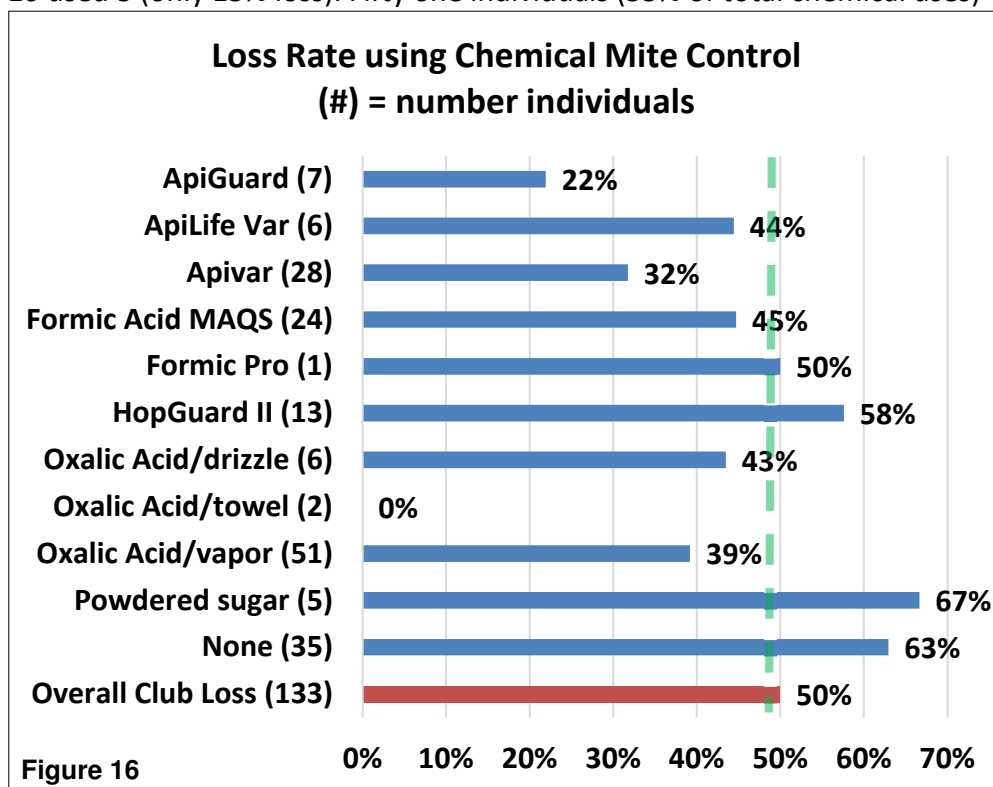
Non-Chemical Mite Control: Of nine non-chemical alternatives offered on the survey (+ other category,) 39 individuals used one method and had a 39% loss, 28 used two (52% loss level), 37 used three (60% loss) and 12 used 4 or 5 (42% loss). Total selections were 240 2/individual. Use of screened bottom board was listed by 79 individuals. They had average losses. The next most common selection was minimal hive inspection (51 individuals) and they had 12 percentage point higher losses. The use of the remaining 7 selections are shown in Figure 15; number of individuals in (), bar length represents average loss level of those individuals using each method. Those to left of **green dashed line** had better than average survival.



Five of the non-chemical alternatives demonstrated reduced losses this past year – requeening with hygienic queens has not been showing better survival in previous years while drone brood removal (11 individuals) and painting hives distinctive colors has resulted in better survival in each of past two survey years. Small cell/natural comb likewise has not been demonstrating better survival although this year there was a 7 percentage point improvement in survival for the 11 individuals using this technique.

Chemical Control: For mite chemical control, 35 individuals (26 ½ % of total respondents) used NO chemical treatment; these individuals had a 63% loss level. Those using chemicals used at rate of 1.5/individual. Fifty two individuals (56%) used one chemical and had 50% loss, 31 used two and also had 50% loss, 10 used 3 (only 15% loss). Fifty one individuals (55% of total chemical uses)

indicated they most commonly utilized Oxalic acid vaporization and had improved survival. Six used Oxalic drizzle and two the oxalic with shop towel application and they too had better survival. Apiguard and Apivar users had improved survival. Figure 16 illustrates number of uses () and bar length indicates the loss rate for those using that chemical.

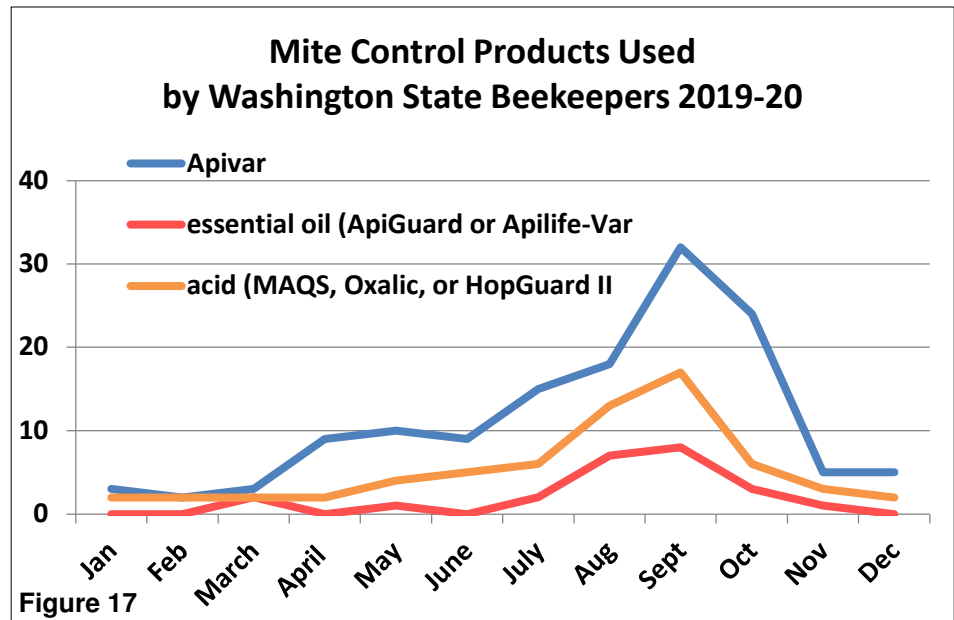


Consistently the last 3-4 years five different chemicals have helped beekeepers realize better survival. The essential oils Apiguard and ApiLifeVar have consistently demonstrated the lowest loss level. Apiguard has a 31% better survival and ApiLifeVar has a 30% better survival record over past 4 years. Apivar use, the synthetic (amitraz), has demonstrated a 29% better survival over past 4 years (2016-19). Oxalic acid vaporization over past 3 years has a 13% better survival (the survey did not differentiate Oxalic vaporization from drizzle in 2016). Formic acid demonstrated a 14% better survival but this product has changed and how we use it is changing so this information is more difficult to tease out of the data. This past season for example Formic Pro seemed to perform better than the traditional formic MAQs pads, although the one identified user of Formic Pro did not have improvement this year.

The monthly use of Apivar (blue line), essential oil (red line) or an acid (green line) is shown in Figure 17. Further review is needed to determine if the timing of treatments was more effective than at other times for the various chemicals.

Antibiotic use

Five individuals (9%) used Fumigilium (for Nosema control); their loss rate was 53%, slightly higher than overall loss level. Two used nosevet in addition (43% loss, slightly less than average). Three individuals indicated use of terramycin (7% loss) and one said they used Tylan (zero loss) for bacterial brood disease control.

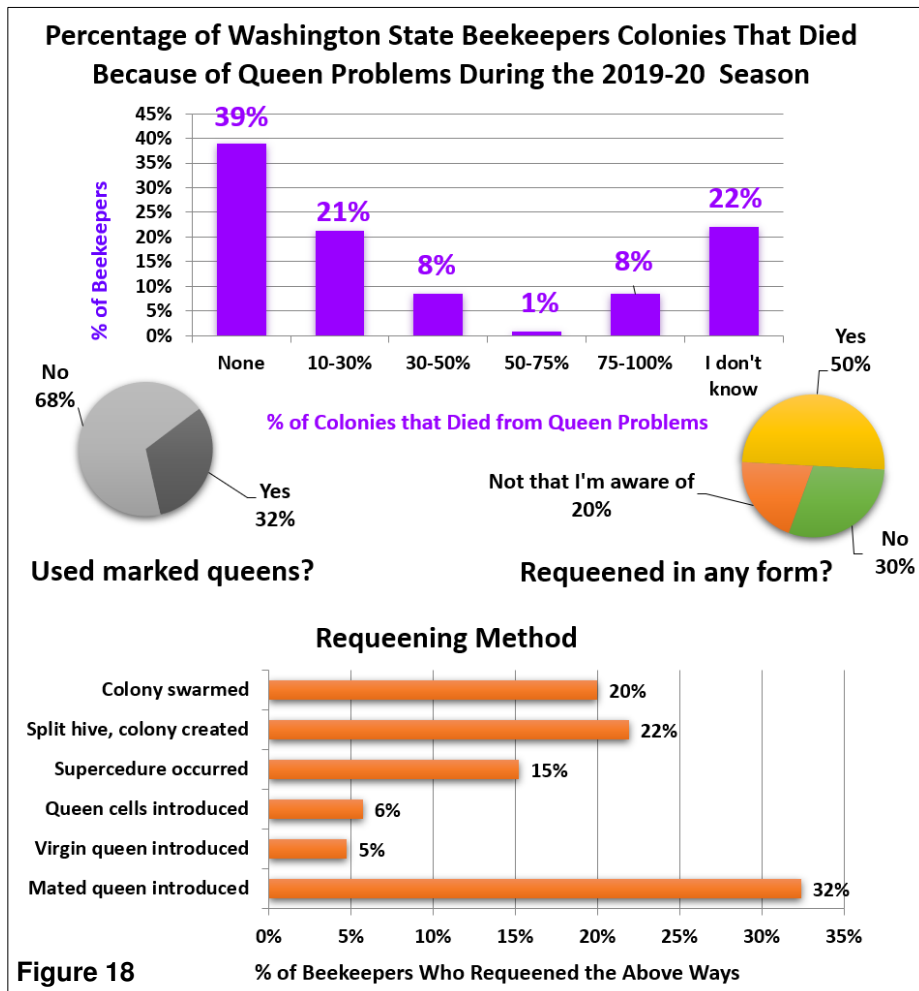


Queens

We hear lots of issues related to queen “problems”. In Section 8 of the survey we asked what percentage of loss could be attributed to queen problems. Forty six individuals (39%) subdivided queen related issues from 10 to 100% of their hives; the majority (25 individuals) indicated 10 to 30%.

Forty six individuals also said none; an additional 26 individuals (22%) said they didn’t know. The number of respondents and percent losses of each is shown in Figure 18 to left.

Queen events can be a significant factor contributing to a colony not performing as expected. We asked if you had marked queens in your hives. Only 28% said yes. The related question then was ‘were your hives requeened in any form?’ to which 50% (64 individuals) said yes, 30% said no. and the remainder ‘not that that I am aware of.’ May we then pose the obvious question ... If 2/3rds of the beekeepers are not marking their queens then how can they be sure their loss was due to queen problems?



One technique to reduce mite buildup in a colony is to requeen/break the brood cycle. The question “How did bees/you requeen” received 92 responses (more than one option could be checked). as illustrated in Figure 26. Twenty three individuals indicated they requeened with a mated queen and they had a 51% loss level, seven used a virgin queen (43% loss) and 8 used a queen cell (45% loss). A higher percentage (54 instances vs 38) said the bees requeened via Supersedure (15 instances, 46% loss), splitting (21 individuals, 63% loss) or swarming (18 individuals, 42% loss). With the exception of use of mated queen and splitting, loss levels were very similar.

Closing comments

This survey is designed to ‘ground truth’ the larger, national Bee Informed loss survey. Some similar information is additionally available on the BeelInformed website www.beeinformed.org and individuals are encouraged to examine that data base as well. Recall that the BeelInformed survey is reporting losses of the larger scale WA beekeepers not the backyarders (Figure 5). Reports for individual bee groups with 18 or more respondents are customized and posted to the PNW website.

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 & Jenai Fitzpatrick, June 2020