Winter Bee Losses of Oregon Backyard Beekeepers for 2021-2022

by Dewey M. Caron with Jenai Fitzpatrick

Overwintering losses of small-scale Oregon backyard beekeepers decreased to 28% this winter 10 percentage points lower than last year and a 20 percentage point survival improvement of two years ago. This report presents the results of our 13th season of Oregon hobbyist/backyard beekeeper surveys. This annual survey is conducted at www.pnwhoneybeesurvey.com. Herein we discuss the data provided by 243 Oregon beekeepers. For unknown reasons this is nearly 1/4th fewer respondents compared to last year when 328 Oregon beekeepers sent back a survey. Results of the 80 Washington respondents completing surveys (down over ½ from last year) are included in a separate loss report. Washington average loss was 35%.

2021 -22 State/Club Losses

Club results of 10 local Oregon associations and both Oregon and Washington state-wide (+ "other" category for Oregon) are shown in Figure 1. Colony numbers ranged from 1 to 42 colonies in Oregon (average 5.44 colonies slightly higher than last year; medium number = 3 colonies, same as last year) and 1 to 39 in Washington (Average 6.16 colonies, up one percentage point from last year Median number = 3, same as last year). The number of respondent individuals is listed next to the association name. The bar length is the average club loss percentage for the year.

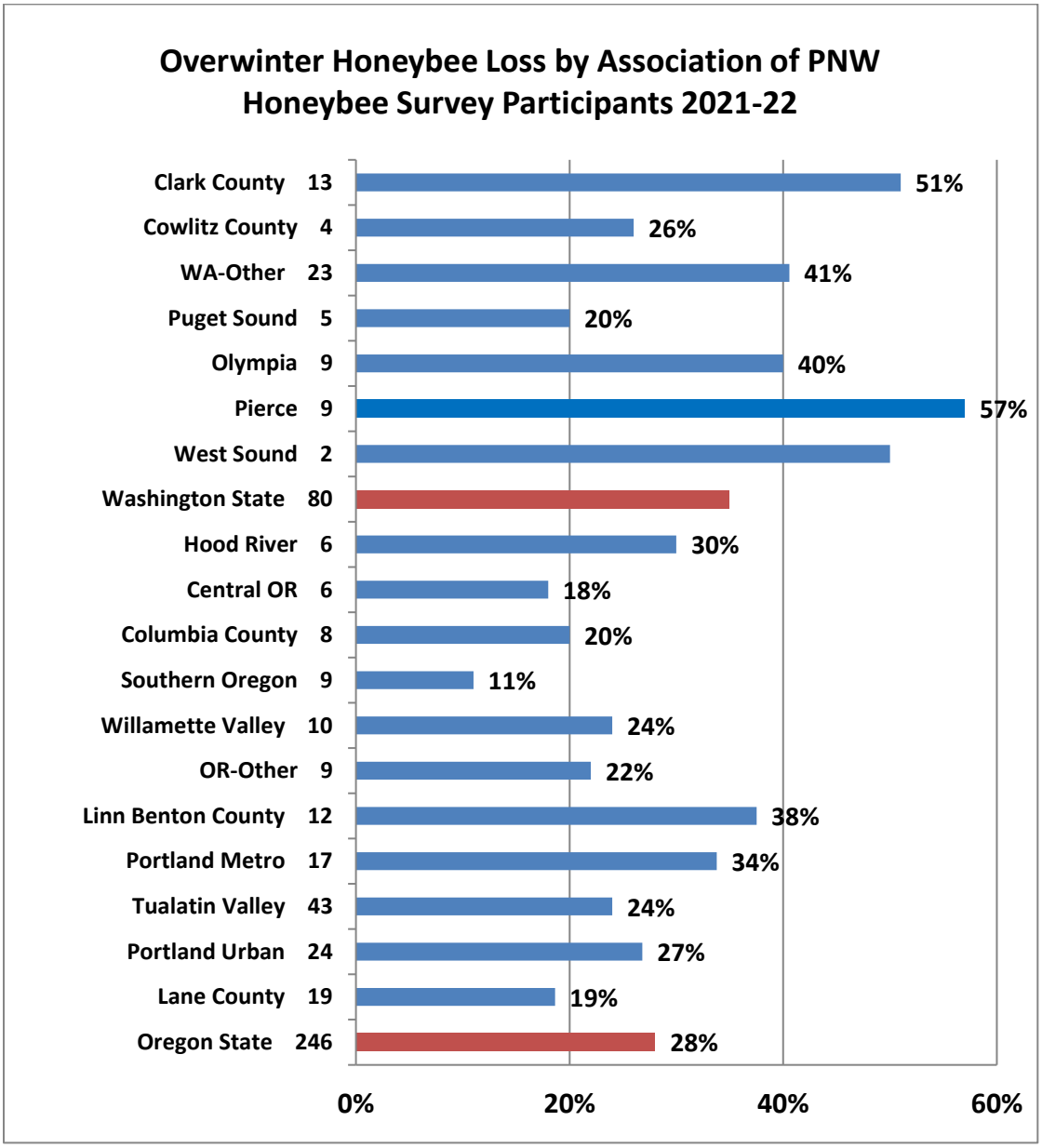


Figure 1

Overwinter losses of members of different organizations varied from a low of 11% for the 9 Southern Oregon beekeeper respondents to a high of 38% for the 12 Linn Benton Association. The 3X+ range of losses, was same as last year but less than the previous year (4X difference). The difference between the two states – 28 percentage point average loss in Oregon (246 respondents) versus 35% average loss for 80 respondents in Washington has occurred most years – last year with a 2 percentage

point difference was the exception. The 9 “OR-other” includes single beekeeper respondents from Central Coastal and Tillamook 2 beekeepers in both Coos Co and Klamath Basin Co and 3 South coastal beekeepers. Ninety one point five of our Pacific Northwest Honeybee Survey Oregon respondents keep bees along the I-5 corridor between California and Washington.

2020-2021 Overwinter Losses by Hive Type

The loss statistic was developed by asking number of fall colonies and surviving number in the spring by hive type. Respondents had 1,338 fall hives (226 fewer than last year) of which 963 survived to spring (375 lost), equating to a 28% loss (or 72% survival). This was an improvement of 7 percentage points over the previous winter loss rate. Ninety-one percent of hives were 8-frame or 10-frame Langstroth hives or (38) long hives which had an overall survival rate of 28%. There were 61 fall nucs (49% loss rate). Among non-traditional hive types were 41 top bar hives (24% loss) and 9 Warré hives (44% loss). Among 14 other hive types, 4 were nuc, and another 4 long hive types leaving 6 others that might have been non-traditional hives (other hive type not identified). Thus, at most, 56 (4% total) of hives were non-Langstroth-frame hives.

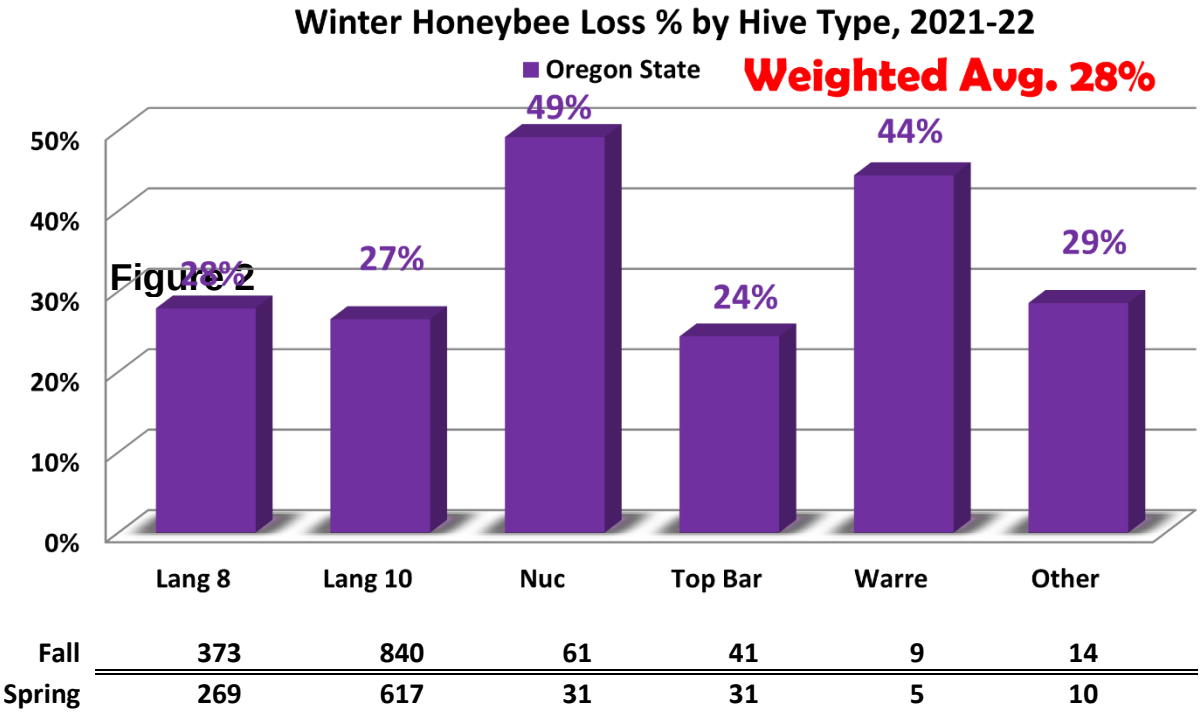


Figure 2

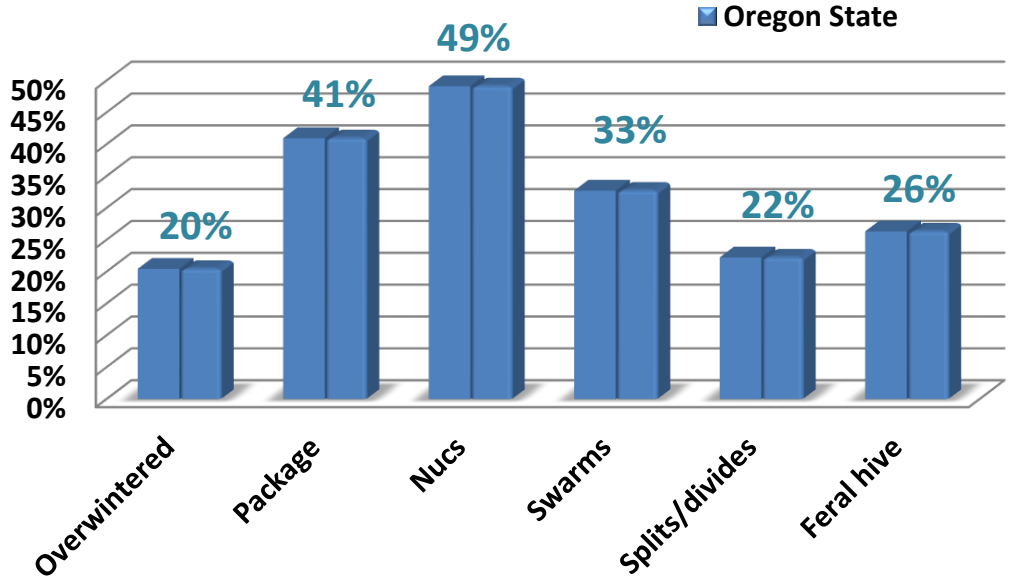
The winter losses of PNW 8-frame Langstroth hives was a single percentage point greater compared to the 27% loss rate of 10-frame and larger Langstroth hives. The loss rates of Langstroth 8 and 10 frame hives over the past 8 years has averaged 36% for 8 frame Langstroth hives and 40% loss for 10 me hives respectively. Nuc losses are typically higher than losses of 8 or 10 frame Langstroth hives; this year almost double the larger frame hives. The Nuc 8-year average loss is of 47%. This year’s

Top Bar hive loss of 10 colonies (24%) is ½ as high as the 8-year average top bar hive loss of 54%. The 2022 Warré hive loss rate of 44% is within a single percentage point of the 7-year average of 43%. It is interesting that each survey year non-traditional hive numbers stay about the same this year (4%) compared to slightly over 5% of total hives the last few years.

2020-2021 Loses Based on Hive Origination

We also asked survey respondents to characterize their loss by hive origination. The result is graphically presented below in Figure 3. Overwintered colonies obviously had the best survival (20%) with the splits and 19 feral transfers also with excellent survival. Packages (49%) and nucs were higher with package bee survivals exhibiting double the losses of the overwintered colonies. The origination loss percentages are relatively the same each year.

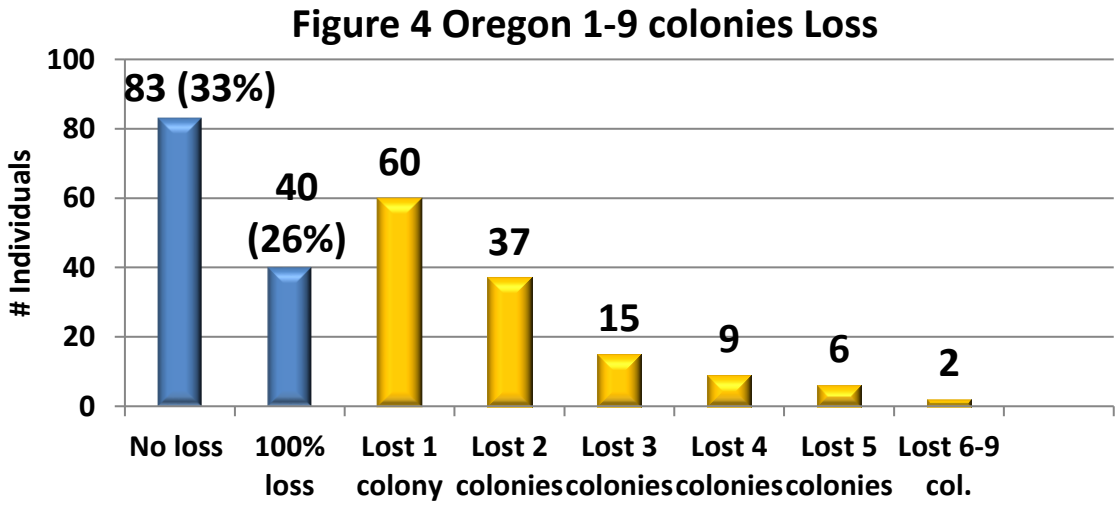
Figure 3 Honey Bee Loss by Origination 2021-22



	Overwintered	Package	Nucs	Swarms	Splits/divides	Feral hive
Fall	651	127	167	272	198	19
Spring	518	75	85	183	154	14

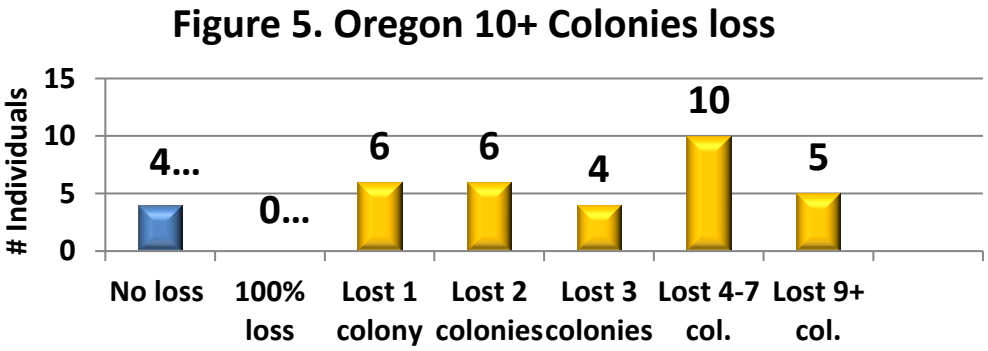
2021 -22 Individual Hive Losses

Thirty-five percent (87 individuals) of Oregon respondents had NO LOSS overwinter, whereas 26% (40 individuals) lost 100% of fall colonies. Figure 4 below shows loss of individuals with 1 to 9 colonies and figure 5 shows loss of individuals with 10+ colonies. The loss of a single colony (by 66 individuals) represents 41.5% of total individuals reporting loss. Nine individuals (5.5%) lost 7 or more



colonies. Highest loss by a single beekeeper was 12 colonies. Loss numbers are reflective of the fact that backyarders keep on average 3 colonies. Eighty point five percent (80.5%) of individual colony loss statewide consisted of 1, 2 or 3 colonies this past winter. Individuals with 1-3 colonies lost 38% of their colonies while individuals with 10+ colony numbers lost 22% of their colonies.

Graph 5 includes losses of individuals who had 10 to 42 colonies. This group lost 138 total colonies which is 37% of total losses. Thus individuals with 10 to 40 colonies (Averge colony number=17) lost 1 to 12 colonies; 4 of these indivdiuals had no loss. This group lost a smaller percentage of colonies 3.7 colonies per individual and a smaller percentage of colonies (22%) than the overall statewide group (28%) and the individuals with 1-3 colonies (38% loss average).



Survey respondents are primarily small colony number beekeepers – 51% had 1-3 colonies but they vary considerably in their years of beekeeping experience. Looking at losses by colony holding numbers, the 125 individuals who had 1-3 colonies had 39% loss level, the 57 individuals with 4-6 fall colonies (23% of respondents) had a 34% loss level, the 29 individuals with 7-9 fall colonies (12% of individuals) had a 36% loss level and the 35 individals with 10+ colonies (14% of respondents) lost 28% of their colonies. Numbers are nearly identical to last year.

By years of experience, the 100 individuals who had 1 to 3 years bee experience (40% of total respondents) had 65% colony loss level, the 79 individuals with 4-6 years experience (30% of survey takers) had a 39% loss level, the 27 individuals with 7-9 years experience (10% of respondents) had a 28% loss level and those 53 individuals (20% of respondents) with 10+ years experience had a 24% loss level. This is shown graphically in Figure 6. The arrows show that as colony numbers increase the percent loss level decreases but colony loss percent and years of experience seems to vary only very slightly.

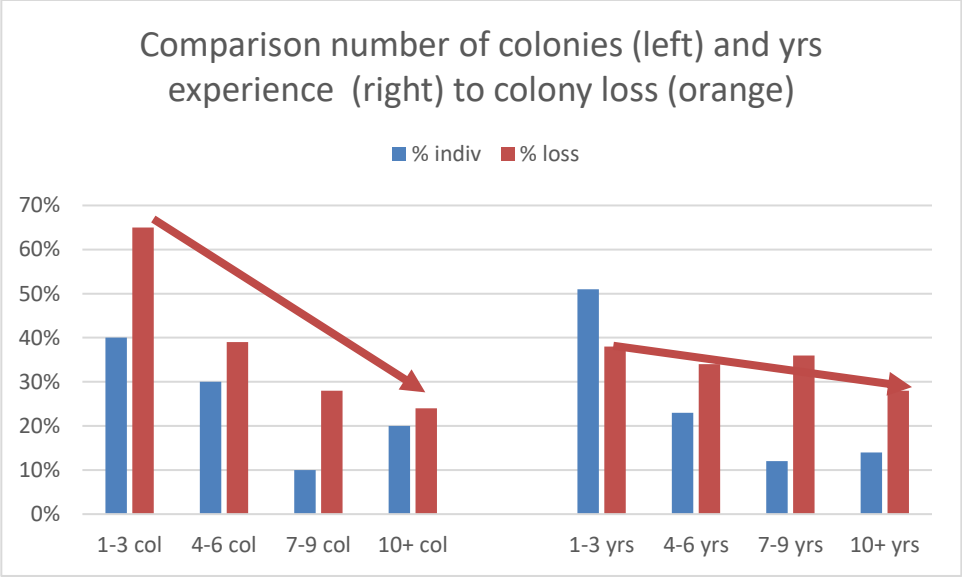
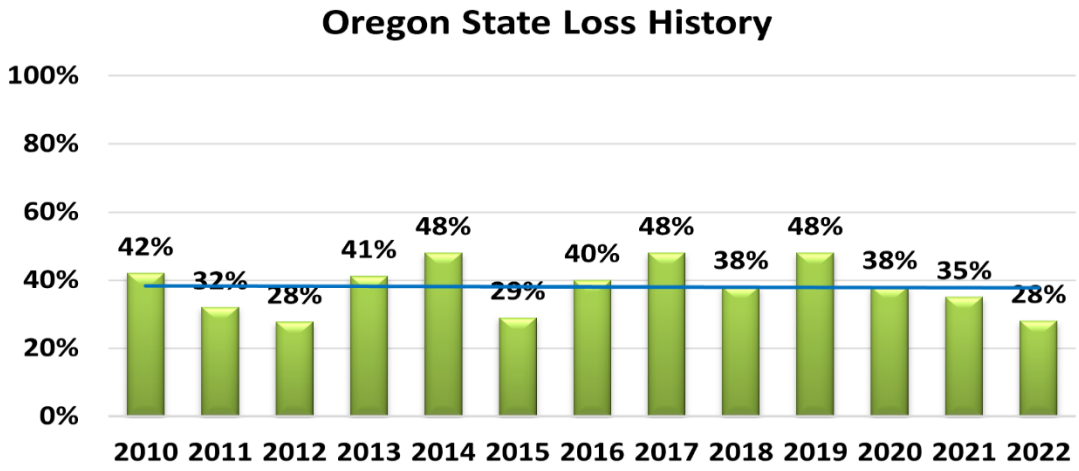


Figure 6

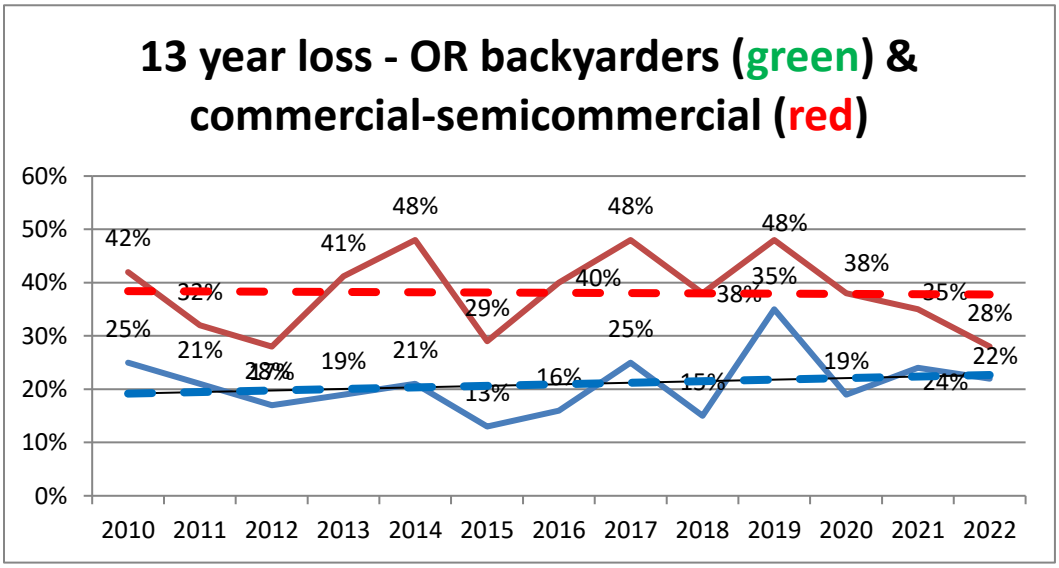
Overwinter Losses the Past 12 Seasons



The losses of the past 12 years are graphed above in Figure 7. Despite the lower losses the past 2 seasons. the average loss by Oregon beekeepers is 40%. This average loss has changed little in the past 12 years, although seasons with heavier loses have occurred.

Comparing the annual losses of backyarders with commercials is shown in Figure 8. The commercial losses are obtained from a different paper survey distributed by Oregon State University. Ten Oregon commercial and semi-commercial beekeepers, one fewer than last year with 26,957 fall colonies, (approximately XX% of the estimated total number of colonies in the state) reported overwinter losses of 22%. Interestingly, losses of the four semi-commercial (sideliner) beekeepers (average colony number 263.5) this year were 9.8% and losses of the 8 commercial beekeepers (average colony number 3237, nearly ½ of last year) were higher, 22.9%. The normal progression is commercial losses lowest followed by sideliner then small-scale beekeepers with 10+ colonies (this year 22%, Figure 5) and finally the backyard beekeepers with heaviest losses. Small scale (backyard) beekeeper losses have ranged from six to 20 percentage points greater compared to losses of commercial/semi-commercial beekeepers over the last 13 years as shown in Figure 8. Thirteen-year average Backyard =38% loss and 12-year commercial/semi-commercial loss = 20.7%. The dashed lines are loss trend.

Figure 8



Some Other Numbers

Thirty individuals (12%) had more than a single apiary location, Comparison of loss levels at 2nd and 3rd apiary sites to the one listed as primary revealed no greater or lesser hive loss at other apiary sites. Seventy-six point five percent (76.5%) of respondents said they had a mentor available as they were learning beekeeping. Nine percent (9%) had more than one hive type. And, finally, 19 individuals (8%) moved their bees. Two moved within property (sunnier, better siting), 3 moved swarm capture/nuc to different location, 1 moved to reduce swarming and another for better summer

location, 2 moved their hives several miles (defensive bees), 3 moved for pollination and 3 for better forage opportunity and one person relocated so moved bees to new homesite.

Perceived Colony Death Reason and Acceptable Level

The survey asked individuals that had colony loss (83 individuals had no loss) to estimate what the reason might have been for their loss (multiple responses were permitted). There were 276 total listings, 1.7/individual. Varroa (67 selected - 41% of respondent choices, 24% of responses), followed by Weak in the fall (51 choose, 37% of respondent choices, 19% of total choices) were most commonly indicated. Queen Failure (38 selected, 23.5% of respondents) and starvation (37 chose, 23% of respondents) were essentially the same and I don't know (31 indicated this choice) were next most commonly indicated. The remaining selections with 10 or more individuals selected this estimation of reason for loss were poor wintering (both 14 individuals chose, yellow jackets (11 selected) and other. Among other, robbing, wind knocking colony over, swarming/absconding issues, virus and error (one said stupidity) by beekeeper were included.. See Figure 9 (% means % of 276 total respondent choices).

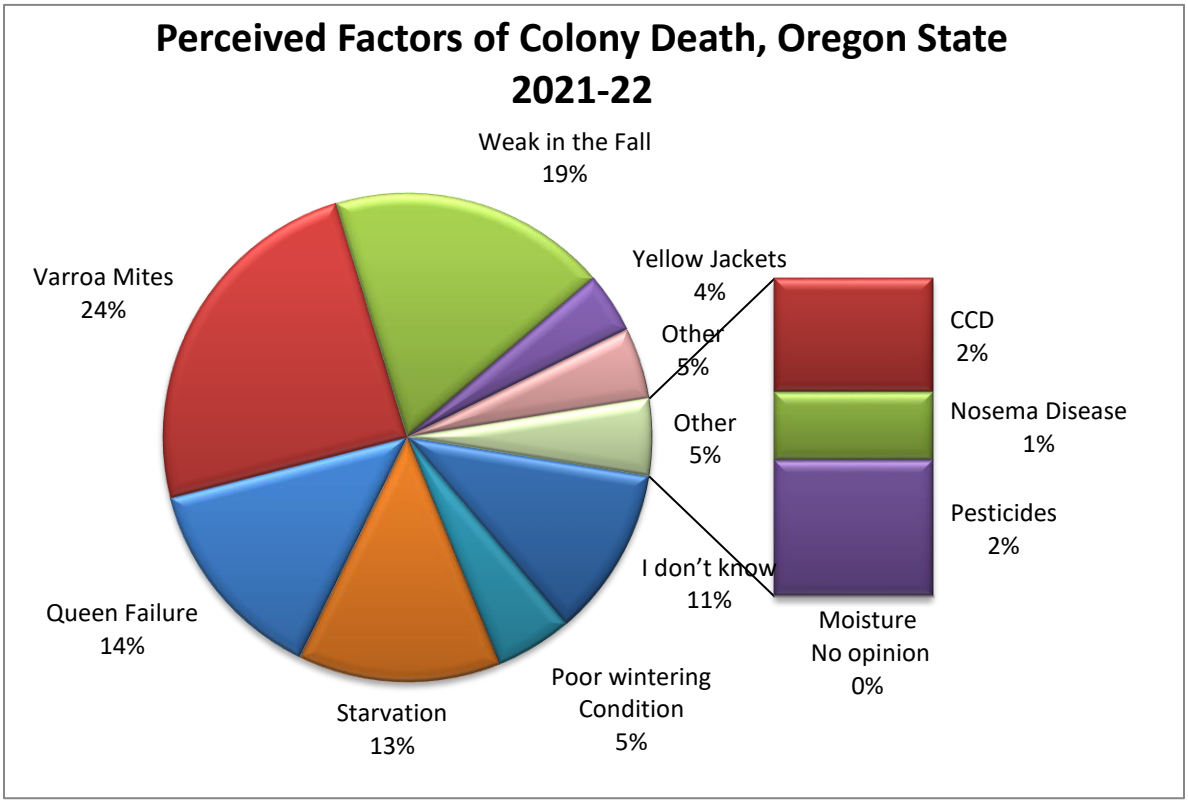


Figure 9

Acceptable loss: Survey respondents were asked reason for loss. Thirty (13%) indicated zero (no loss). Forty four percent of individuals indicated 15% or less; 20% was medium choice, as has been case for several years. The most common response was 25%. Sixteen percent said 50% or greater was an acceptable loss level; two each said 75 and 100% acceptable. See table below.

Oregon State during 2021-22											
Loss level	**5%**	**10%**	**15%**	**20%**	**25%**	**33%**	**50%**	**75%**	**100%**	**None**	**Other**
#	15	41	23	27	45	16	34	2	2	30	4
%	6%	17%	10%	11%	19%	7%	14%	1%	1%	13%	2%

Why colonies die?

There is no easy way to verify reason(s) for colony loss. Colonies in the same apiary may die for several reasons. Examination of dead colonies is at best confusing and, although some options may be ruled out, we are often left with two or more possible reasons for losses. A dead colony necropsy can be of use. Opinions vary 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. Individual choices varied from zero to 100%, with medium of 20%.

Major factors in colony loss are thought to be mites and their enhancement of viruses especially DWV (deformed wing virus), VDV (Varroa destructor Virus (also termed DWV B) and chronic paralysis virus. But we do not have a test for these viruses; 2 individuals indicated virus as possible reason for loss. It was interesting in that varroa and queen problems were nearly equally indicated as were weak in the fall and starvation as the estimated reason for loss.

Declining nutritional adequacy/forage and diseases, especially at certain apiary sites, are additional factors resulting in poor bee health. Yellow jacket predation is a constant danger to weaker fall colonies. Management, especially learning proper bee care in the first years of beekeeping, remains a factor in losses. What effects our changing environment such as global warming, contrails, electromagnetic forces, including human disruption of them, human alteration to the bee's natural environment and other factors play in colony losses are not at all clear.

There is no simple answer to explain the levels of current losses nor is it possible to demonstrate that they are necessarily excessive for all the issues our honey bees face in our, and their environment. It was encouraging to see from survey responses that losses this past year 28% were the lowest level in past several years and tie the lowest loss level (2012) in the 13 years of PNW survey activity. More attention to colony strength and possibility of mitigating winter starvation will help reduce some of the losses. Effectively controlling varroa mites will help reduce losses.

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

FEEDING: Oregon survey respondents checked 711 feeding options = 2.9/individual. Twenty - seven individuals (11%), other than those who indicated no feeding, selected a single choice and had 34% loss, 58 (25% of respondents) indicated 2 choices (27%, loss), 78 (the greatest number and medium) indicted 3 choices (they had 30% loss); 44 individuals (19%) had 4 choices with 24% loss, 21 had 5 choices (30% loss). The remainder (7 individuals) had 6 selections for feeding management with 27% loss.

The choices, with number of individuals making that selection is in ( ) in Figure 10; bar length indicates loss level of individuals doing this management. Those bar lengths to left of 28% **green dashed** marker had better survival while those to right had greater loss level.

Eleven individuals (decrease of 3 individuals over previous year) said they did NO FEEDING. They had 30 fall colonies, lost 10 for a 33% loss. For individuals indicating one or more feeding managements, feeding sugar syrup was the most common feeding option of respondents (206 individuals, 88% of respondents who indicated the management). Their loss rate was 27%, essentially same as overall average. Individuals feeding protein had no better survival rate but those feeding dry sugar had slight improvement in survival; some selections, most notably frames of pollen and dry pollen and hard and drivert sugar feeding, had low losses (better survival) than the average overall loss rate. The latter two experienced a 7-percentage point higher loss than average.

Summary: Statewide for the last 6 years individuals doing no feeding had 6 percentage point higher losses (average 47%) i.e. poorer survival, compared to average loss rate of 39%. Average percent doing no feeding = 7% of individuals – this year it was 4%). Individuals statewide that fed sugar syrup had a 5-percentage point lower loss level (average for the 5 years);this year it was one percentage point greater survival. Those feeding honey (as frames or liquid) had lower loss only during 2 of the past years (2018 and 2020). Individuals feeding non–liquid sugar (in any of the forms) had lower losses five of six past winter seasons; this year it was a 3 percentage point difference mainly due

to the 13 drivert and 83 hard sugar candy feeding individuals. Dry sugar feeders had slightly better or equal survival all 6 past winters while hard candy feeders had a much-improved survival 5 of 6 past winters (including this past winter) (=31% average survival); fondant feeders had better survival 3 of the 6 past winters, but not this season.

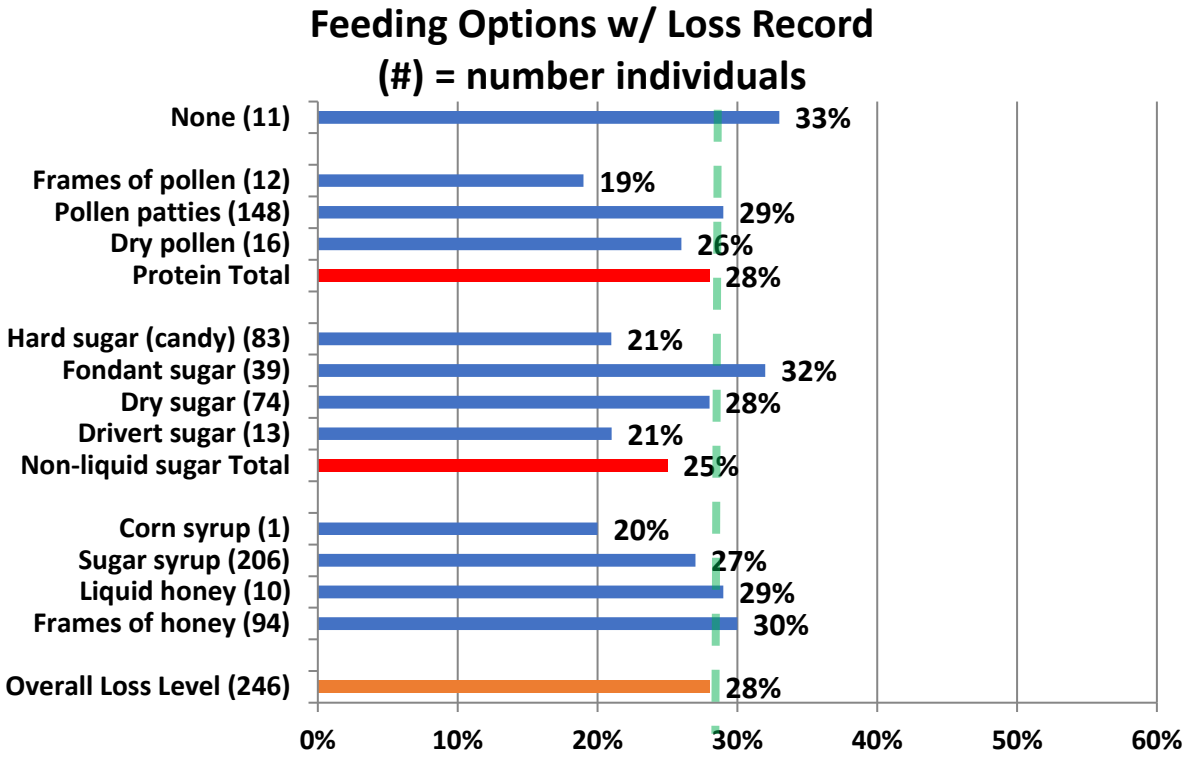


Figure 10

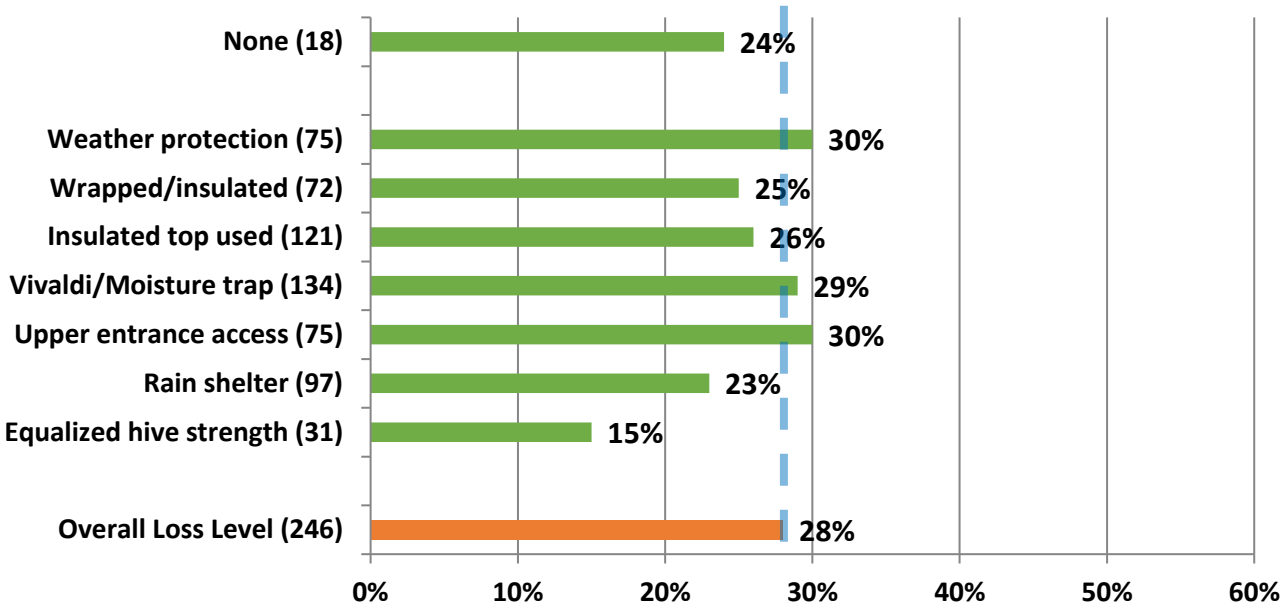
For individuals feeding protein, the protein patty users showed better survival 5 of 6 years (this year losses were a single percentage point poorer; dry pollen feeders had better survival in three of the past six years though losses for these three years were close to the overall yearly average.

WINTERING PRACTICES: We received 634 responses (2.8/individual) about OR beekeeper wintering management practices (more than one option could be chosen). Eighteen individuals (7%) of the respondents indicated doing none of the several listed wintering practices; these individuals had a better than average 24% winter loss, 4 percentage points lower loss than overall loss of 28%. For those indicating some managements, 44 (19%) did one single thing, (38% loss), 73 (the median number) did 2 (31% loss), 52 did three (27% loss), 32 did 4 (18% loss), 20 did 5 (32% loss) and 7 did 6 with 20% loss. The greater the managements practiced generally resulted in better survival.

The most common wintering management selected was ventilation/use of a quilt box at colony top (134 individuals (59%), 9 percentage points lower compared to previous year) followed by insulated top (121 individuals, 53% of respondents an increase of 12 percentage points from the previous year). Figure 11 shows per cent of individual choices and bar length shows percent winter

loss of each selection. Bars to left of green dashed line means better survival than overall. Wrapping, weather break, equalizing colony strength and insulated top all improved survival but not by large percentages. Doing nothing showed the greatest loss level.

Figure 11 Winter Management Options w/ Loss Record
(#) = number individuals



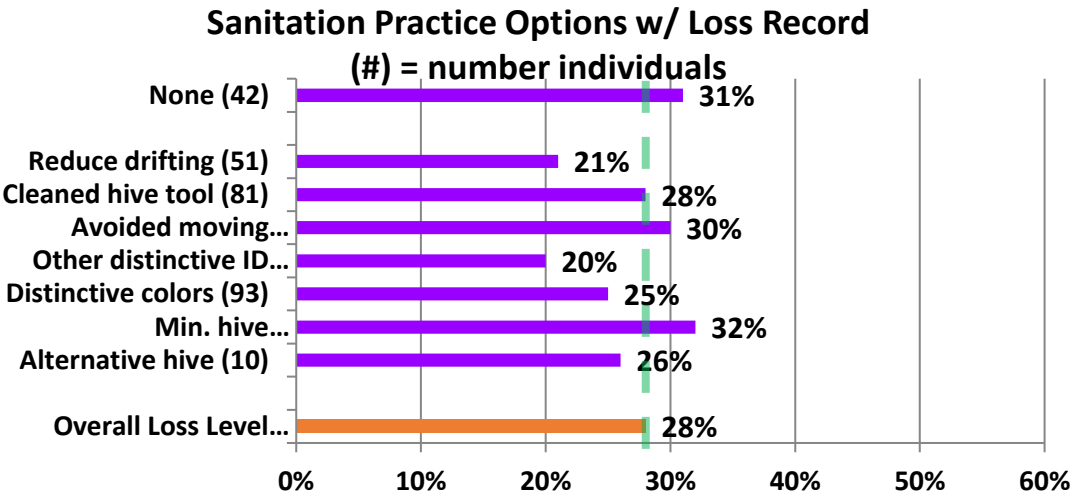
Over the past five years individuals that did no winterizing practice (average 12% of individuals) averaged 41.5% loss compared to 39.2% overall average loss of last 5 years, only a 2.3 percentage point poorer survival rate. Only 2 winterizing managements improved survival all 5 years – wrapping (28.2% lost rate, a 11-percentage point improvement) and upper insulation (30.8%, an 8.4-percentage point improvement). Vivaldi/quilt box, upper entrance (most Vivaldi boards have an upper entrance built into the equipment) and wind/weather protection had only slightly improved survival rates and were not noted in all past 5 years. Equalizing hive strength was the best management to improve survival this past year.

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 531 responses for this survey question 2.6/individual. Forty-one individuals said they did not practice any of the 6 offered alternatives; they had a loss rate of 31% compared to overall rate of 28%. Over past four-years those indicating doing none had a 46.1% percent loss rate, 7 percentage points higher than the average loss rate of 39.2% over the same time period. Sixty-three (31 %) individuals had 1 selection with 26% loss, 55 (24%) had 2 choices (the median number) with 31% loss level, 59 selected 3

managements (25% loss level), 24 had 4 (37% loss level) and 9 had 5 to 6 selections with a mere 9% loss level. As with feeding and winterizing managements, several actions improve survival.

Minimal hive intervention (111 individuals) was the most common option selected, as it has been for the last 4 years. 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 demonstrate improved winter survival; the loss rate for this group the past 4 years was 45.1%, 7.8 percentage points above the average 5-year loss of 37.3% loss rate compared to those individuals that did nothing.

Figure 12

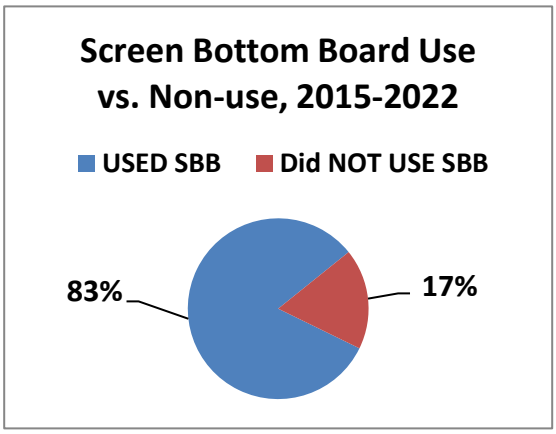


Avoiding moving frames and reducing drifting were the two sanitation choices that demonstrated better average survival the past five years – 5-year loss rate was 34.8% for not moving frames which is 2.5 percentage points better survival (this year it was 2 percentage points higher than average) and 32.2% for reducing drifting a 5 percentage point improvement in survival. Other distinctive measures to reduce drifting had an 8 point improvement in survival this year; it has been a good sanitation in past years as well. Overall sanitation appears to be relatively minor toward improving survival.

SCREEN BOTTOM BOARDS (SBB)

Although many beekeepers use SBB to control varroa, BIP and PNW surveys clearly point out they are not a highly effective varroa mite control tool. In this recent survey, statewide 38 individuals

(15%) said they did not use screen bottom boards (last 2 years it was 10 and 11% respectively not using SBB). Average non-use for last eight years is 17%, vs 83% use, on some or all colonies. Figure 13 right.



This past overwintering season, the 38 non-SBB users had winter losses of 103 of 27% loss. The 47 beekeepers using SBB on all or some of their colonies had 29% loss. **Examining the seven-year average of SBB use, loss level of the 83% using SBB on all or some of their colonies had a 34.7% loss level whereas the 17% not using SBB had loss rate of 38%, a 3.3-percentage point positive survival gain for those using SBB versus those not using them. Screen bottom boards offer a minor improvement for overwinter survival.**

We asked if the SBB was left open (always response) or blocked during winter. This past season, 66%, 163 individuals, said they always blocked SBB during winter; 38 individuals statewide said they blocked some of the SBBs. Statewide those who blocked always or sometimes had 704 colonies in the fall and lost 273, a 39% loss rate. Figure 14 shows that those who never blocked had a 42% winter loss, a 3-percentage point difference. As in past years there was a slight advantage **in favor of closing the SBB over the winter period to improve survival.**

Screen bottom board use has a slight survival advantage. For those using SBB, the advantage appears to be to close, partially or completely, the screen over the winter period.

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, nor do they necessarily do the same thing to all the colonies in their care. We do know the inability of bees to manage moisture overwinter kills bees, so we recommend hives be located in the sun out of the wind. If colonies are in an exposed site, providing some extra wind/weather protection and wrapping/insulating colonies might improve survival.

Feeding, a common management, appears to be of some help statewide in reducing losses. Feeding fondant sugar, a hard sugar candy or dry sugar during the winter means lower loss levels. Providing frames of honey and feeding sugar syrup also yields lower losses for some individuals. Such feeding management is of great value for spring development and/or development of new/weaker colonies as well as for colony rearing of bees to overwinter. Feeding protein in form of dry pollen and 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 and in the fall to build the fat bee population needed for successful overwintering. To determine if feeding might help monitor what sources your bees are visiting and manage accordingly.

Winterizing measures that apparently helped lower losses for some statewide beekeepers were a moisture trap (Vivaldi board or quilt box) and upper insulation and wrapping the colonies (or otherwise adding some insulation to provide added protection against the elements). Spreading colonies out in the apiary and 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 to bolster weak colonies and start new divides might be greater than a minor advantage in survival.

It is clear that doing no feeding, winterizing or sanitation resulted in the heaviest overwinter losses.

Replacing standard bottom boards for screened bottoms 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 Oregon hives monitored for mites during the 2021 year and/or overwinter 2021-22, 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. 163 individual respondents (66%), seven percentage points below the previous year, said they monitored all their hives. Losses of those individuals monitoring was 37 %. Forty-five individuals (1%), 1 percentage point less, reported no monitoring; they had a higher loss rate of 42% loss. 38 individuals reported monitoring some of their colonies; they had a 27% loss.

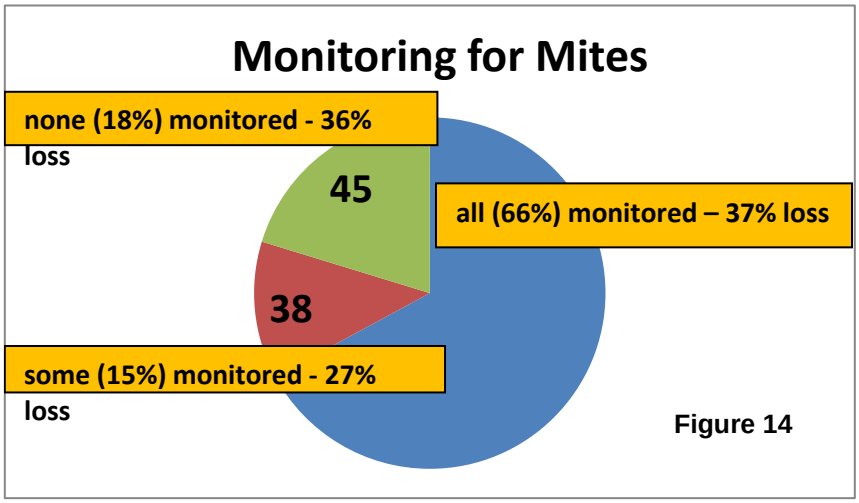


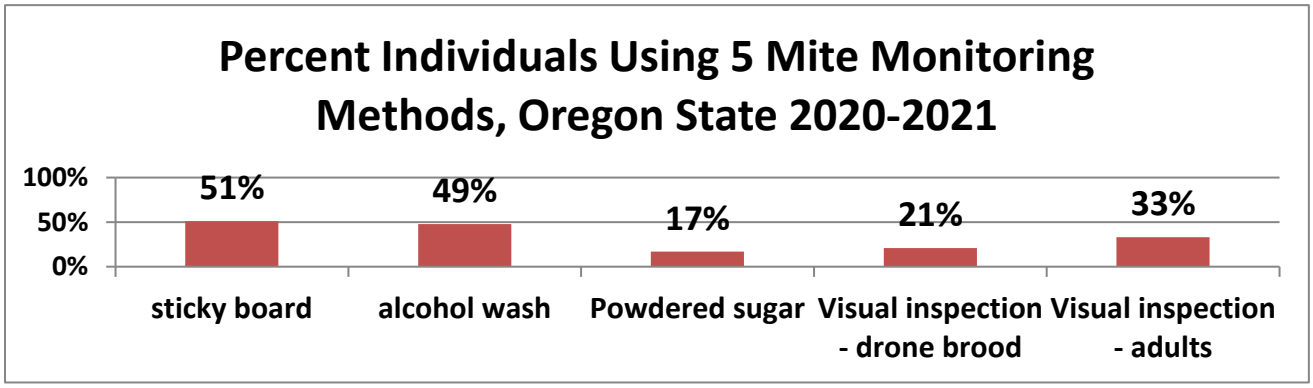
Figure 14

	ALL Colonies Monitored % individuals	% Loss	SOME Colonies Monitored % individuals	% loss	No colonies Monitored % individuals	% loss
2022	66%	37%	15%	27%	18%	42%
2021	73%	34 %	11%	36%	17%	36%
2020	67%	33%	13%	16%	20%	49%
2019	67%	51%	15%	50%	18%	59%
2018	63%	38%	14%	26%	26%	49%
2017	63%	43%	15%	60%	22%	48%
6 year loss avg		39%		36%		47%

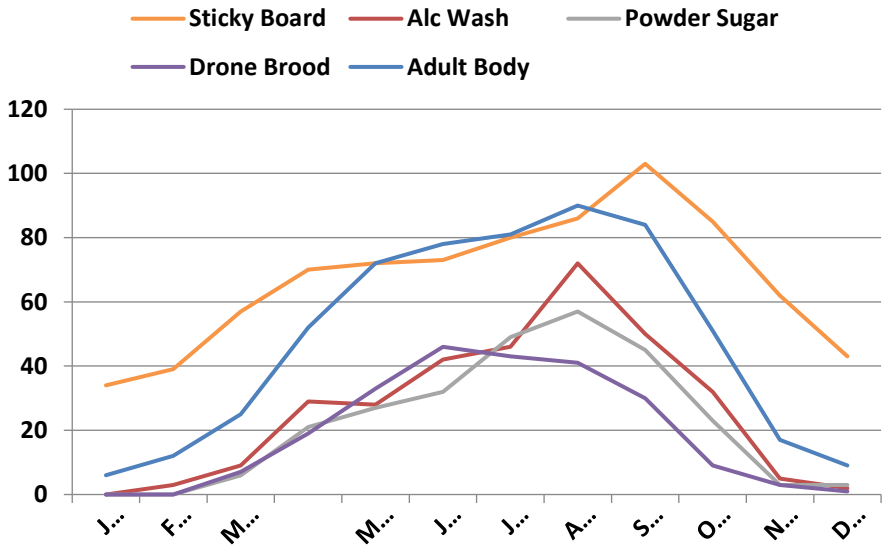
Monitoring alone is a means towards improved winter survival. The table below compares % individuals and % winter loss for individuals who monitored all colonies compared with those who monitored none. Five-year difference is 8 percentage point better survival monitoring all colonies. The 13-15% who monitored some colonies was variable, averaging 3 percentage points lower than those monitoring all colonies.

Individuals indicated use of 1.9 monitoring techniques on average. In total choices, in order of popularity of use, 102 individuals used Sticky boards, 51% total of 203 individuals who did some or all monitoring of colonies. Ninety-seven individuals used alcohol wash to monitor (48% of total number of individuals who monitored), 42 individuals (30% of individuals) used powdered sugar monitoring; visual inspection of drones (51 individuals) and visual inspection of adults (81 individuals) were also indicated (Figure 16). In past 5 years, the use of sticky boards has decreased in use and both alcohol wash and powdered sugar shake have increased in use.

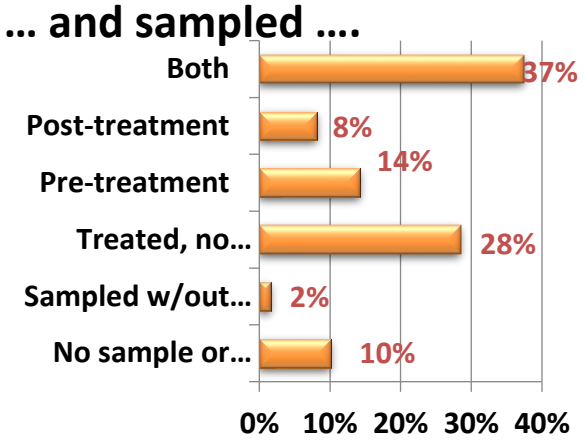
Figure 15



Whatever technique used most sampling to monitor mites was done in July – September, as might be expected since mite numbers change most quickly during these months and sampling results key control decisions. Figures 16 illustrates monthly sampling with five methods.



The most common sampling of respondents is both pre- and post-treatment (37% average). Sampling pre-treatment percentage has been decreasing while post treatment sampling has slowly been increasing. It is important to know if the treatment works so post treatment should not be avoided. Treatment without sampling has been steadily increasing (28% this past year, more than double 5 years previous). Sampling data for last four years in Figure 17 right.

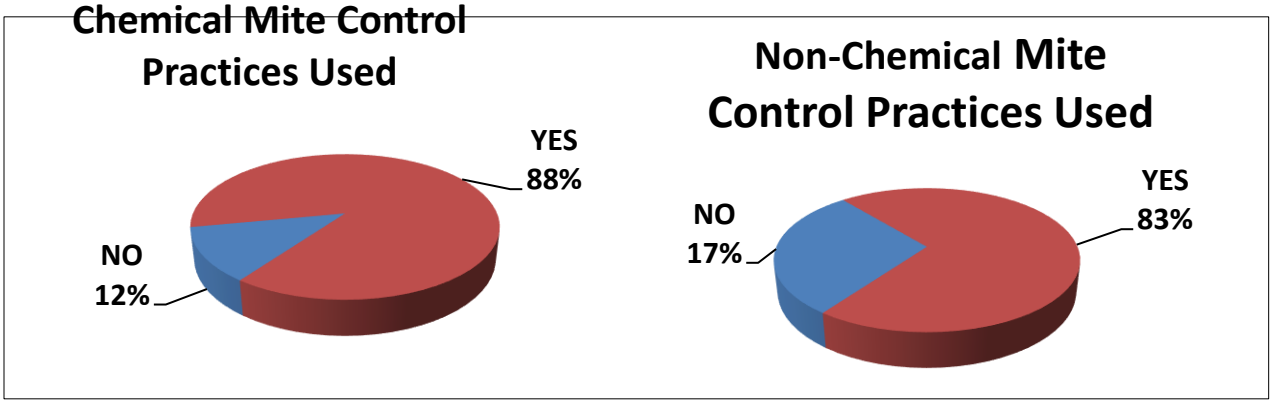


It is important to KNOW mite numbers. Less effective mite monitoring methods include sticky (detritus) boards below the colony. Often so much detritus drops onto a sticky board that counting the mites can be hard, especially for new beekeepers). Sticky boards used for a single day pre- and post-treatment can help confirm the effectiveness of a treatment, if numbers drop post treatment. Visual sampling is not accurate: most mites are not on the adult bees, but in the brood, especially when there is a lot of brood and the adult mites are NOT on the adult body where they can be observed (over 90% are on the lower abdomen, tucked within the overlapping bee sternites). Sampling 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 2-3% during the fall months when bees are rearing the fat fall bees that will overwinter. It is also the most challenging 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.

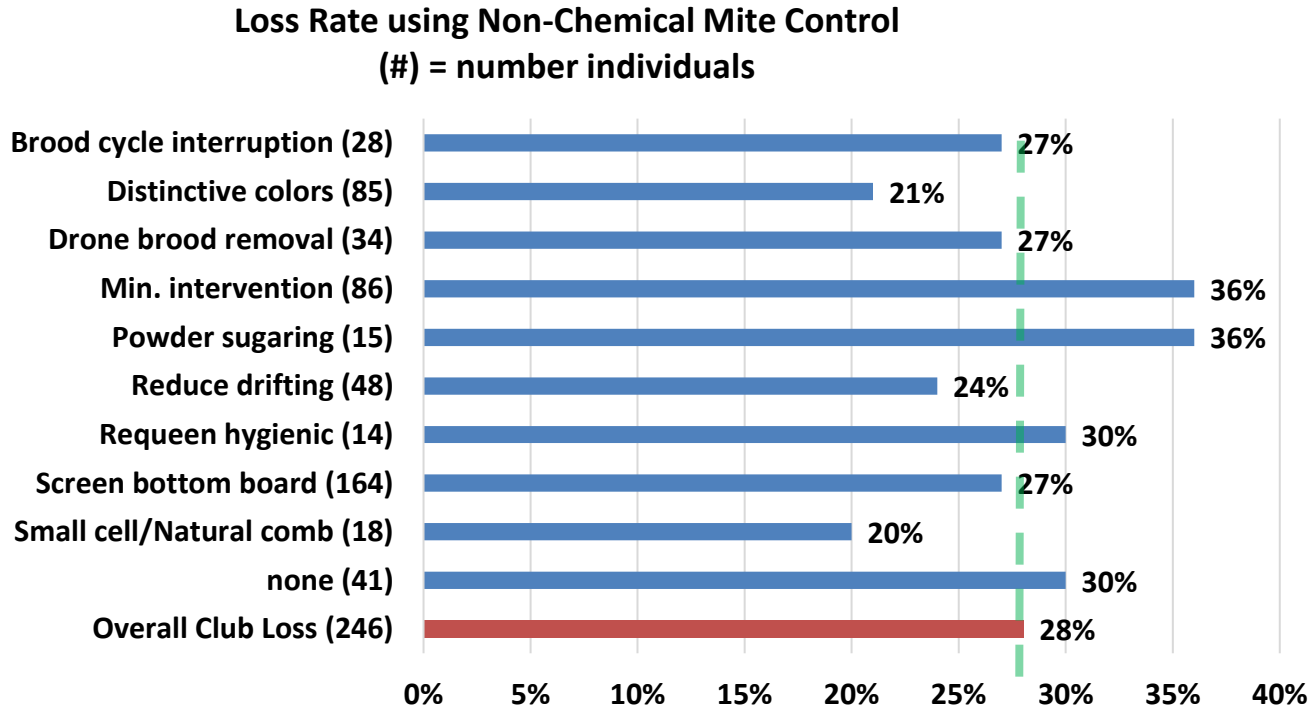
Mite Control Treatments

The survey asked about non-chemical mite treatments and also about use of chemicals for mite control. Forty-one individuals (17%), three percentage higher than last year, said they did not employ a non-chemical mite control and 29 individuals (12%), 7 percentage point fewer compared to last year, did not use a chemical control. See Figure 20. Those 41 individuals who did not use a non-chemical treatment reported a 30% winter loss, while those who did not use a chemical control lost 49% of their colonies. The individual options chosen for non-chemical control are discussed below.



Non-Chemical Mite Control: Of nine non-chemical alternatives offered on the survey (+ other category,) 58 individuals (28%) used one method, 61 used two, 49 used three, 26 used 4, 7 used 5 and 6 individuals used 6 plus used or 7. Individuals using a single method had 31% loss rate, those using 2 had a 28% loss rate, those with 3 had a 29% loss, the 2 dozen+ using 4 had 25% loss and the smaller number using 5 (19%), 6 (16%) and 7 (0 loss) did better. Clearly using more than one method/tool improves success.

Figure 19



164 individuals (68% of total respondents) listed use of screened bottom board. The next most common selections were distinctive colors (86 individuals) and minimal hive inspection (85 individuals). The use of the remaining selections is shown in Figure 19; number of individuals in ( ), bar length represents average loss level of those individuals using each method. Those left of **green dashed** line had improved survival.

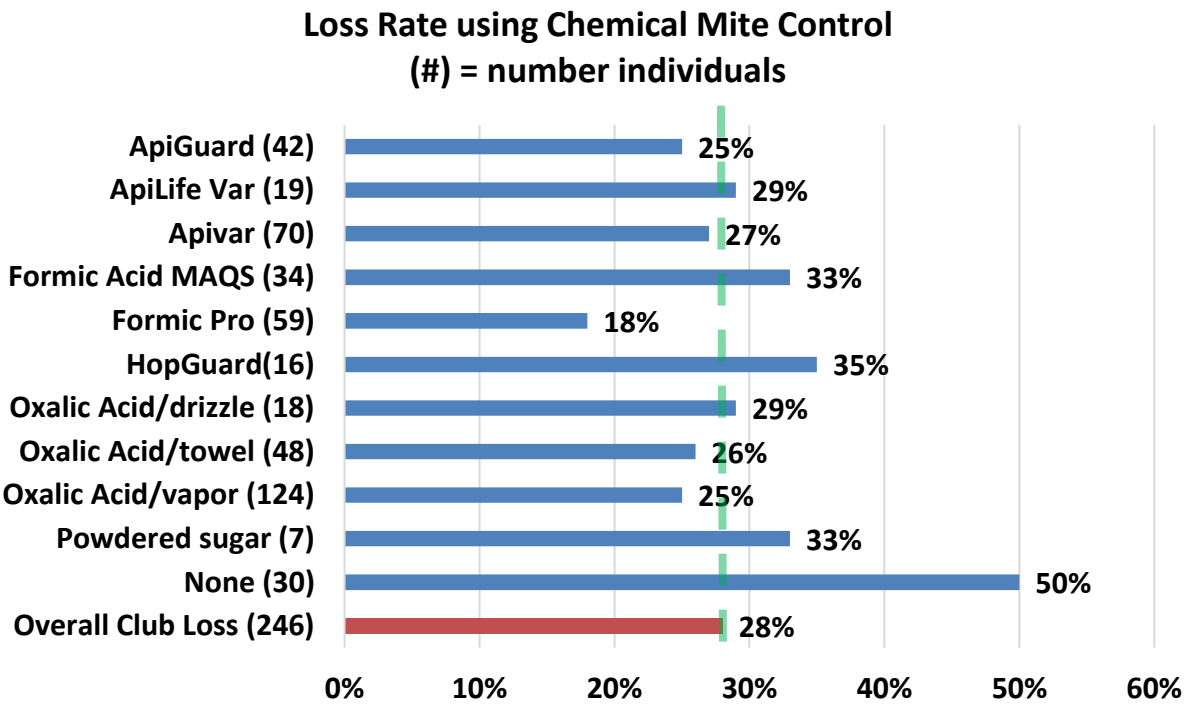
Three of the non-chemical alternatives have demonstrated reduced losses over past 6 years. Reducing drifting such as spreading colonies (31% loss average for 4 years – question not asked in 2016-17 survey) and brood cycle break (34.5% average) have consistently year after year demonstrated somewhat better survival than average loss (37% average loss last 4 years and 39% loss last 6 years respectively 37%). Different colony colors in apiary 37.7% average loss and drone brood removal (38.7% average loss) were just slightly better than average 6-year loss (39%). Some non-chemical control alternatives demonstrate an advantage on one or two years (such as small cell/natural comb this past season) but overall show no improvement.

Chemical Control: For mite chemical control, 30 individuals (12% of total respondents) used NO chemical treatment. They had a loss level of 50%. Those using chemicals used at rate of 1.9/individual. Eighty individuals (37%) used one chemical (had 31% loss level), 94 used two, 24 used 3, 16 used 4 and 5 used 5. Loss levels declined for those using 2, (loss 23%) and 5 (loss 18%) but less so for those using 3 or 4 chemical treatments – loss level was 28%.

One hundred twenty-four respondents (57%) indicated they used oxalic acid vapor (OAV) and ninety-three OR Beekeepers (43% of total individuals using a chemical) indicated they most commonly utilized MAQS or Formic Pro (formic acid). Both chemicals improved survival. Forty-eight said they made their own formulation of extended Formic (OAE) and had only a single percentage point lower survival (compared to OAV). Oxalic acid drizzle (18 individuals) was one percentage point lower survival compared to average and 4 percentage points lower than OAV. All three api's- Apivar, Apiguard, ApiLifeVar – had average survival rates. Figure 20.

Consistently the last 5 years five different chemicals have helped beekeepers improve survival. The essential oils Apiguard (average 6-year loss level 30.5%), Apivar (31.2% average 6-year loss level), Oxalic acid vaporization (31.3% average loss level over last 6 years – in contrast the oxalic acid drizzle average of last 5 years is 37.8% loss level is only 0.4 percentage points above the 5-year average of 37.4%), ApiLifeVar (34.4% average loss level over last six years) and formic acid MAGS formulation 39.4% loss level the last 6 years. Average loss level has been 39.2% the last 6 years. The extended OAE (absorbing oxalic acid and glycerin into sponges) had slightly better than average loss but this has not been the case in previous years. Formic Pro has steadily increased in use – it looks very promising at 25.3% loss level the past three years (when average loss was 36.5%).

Figure 20



The monthly use of Apivar (blue line), essential oil (red line) or an acid (green line) is shown in Figure 21 for 2019-20 season. Further review is needed to determine if the timing of treatments was more effective than at other times for the various chemicals.

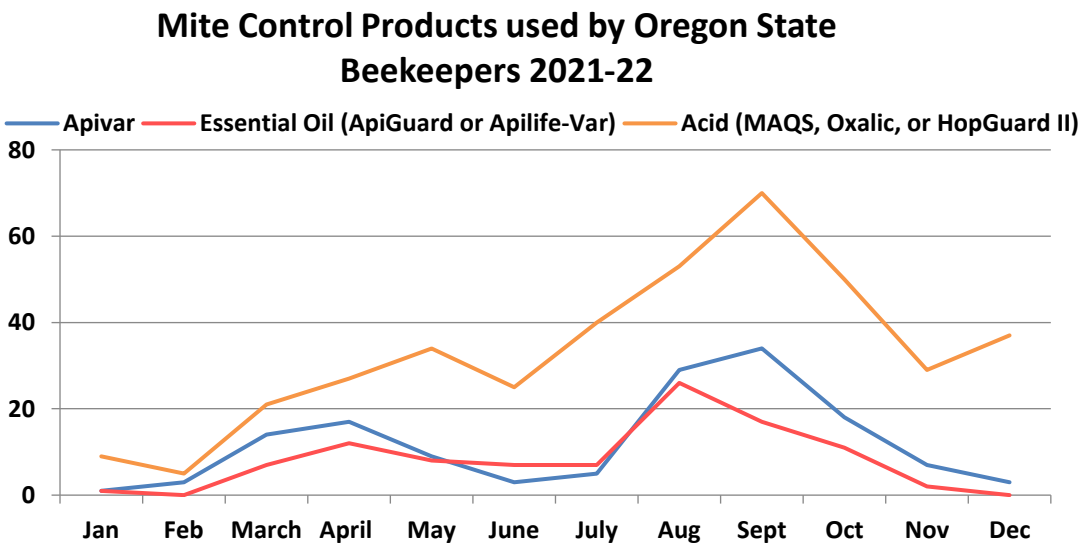


Figure 21

Antibiotic use

Seven individuals (2%) used Fumagillin (for Nosema control) and 2 individuals indicated use of terramycin. The terramycin users had a 37% loss level and those who used fumagillin had a 12% loss (total of 74 colonies for these 9 individuals).

Queens

We hear lots of issues related to queen "problems". Recall under the question asking the reasons why colonies didn't survive those 38 individuals, 23.5% of respondents with losses, noted queen failure as one of their selections (Figure 9). In Section 8 of the survey, we asked what percentage of loss could be attributed to queen problems. Sixty-one individuals said no and 36 said they didn't know. Fifty-nine individuals, nearly double the number of individuals who indicated queen problems in earlier survey question, indicated issues involving 10 to 100% queen issues – I have no idea why the difference? Figure 22 shows this data.

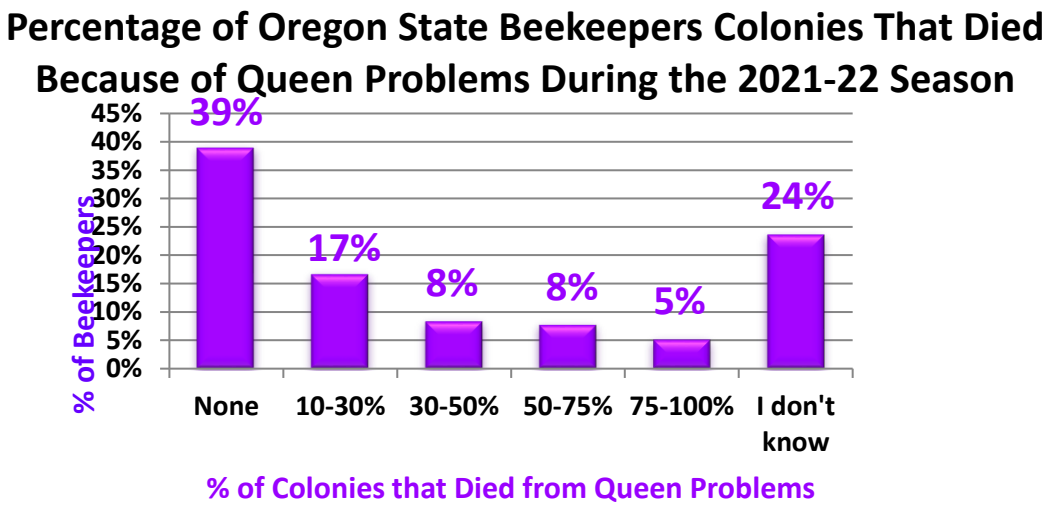


Figure 22

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. Ninety individuals (37%), an increase of 5 percentage point from last year, said yes. The related question then was 'were your hives requeened in any form?' to which 50% (122 individuals) said yes, 32% (79 individuals) said no and the remainder that responded (43 individuals) said 'not that that I am aware of.' If 1/2 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 233 responses. Sixty-one respondents indicated their bees were requeened with a mated queen (27%), 47 individuals 20% split (divided) hive (21%)s, 51 (23%) indicated it was the bees that requeened via swarming and 35 (16%) via supersedure. Six percent introduced queen cells and 2% introduced virgin queens.

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. Recall that the BeeInformed survey is measuring the larger scale OR beekeepers not the backyarders (See *American Bee Journal* April 2020 article by Dewey). Reports for individual bee groups 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 with Jenai Fitzpatrick, June 2022