Winter Bee Losses of Oregon Backyard Beekeepers for 2020-2021

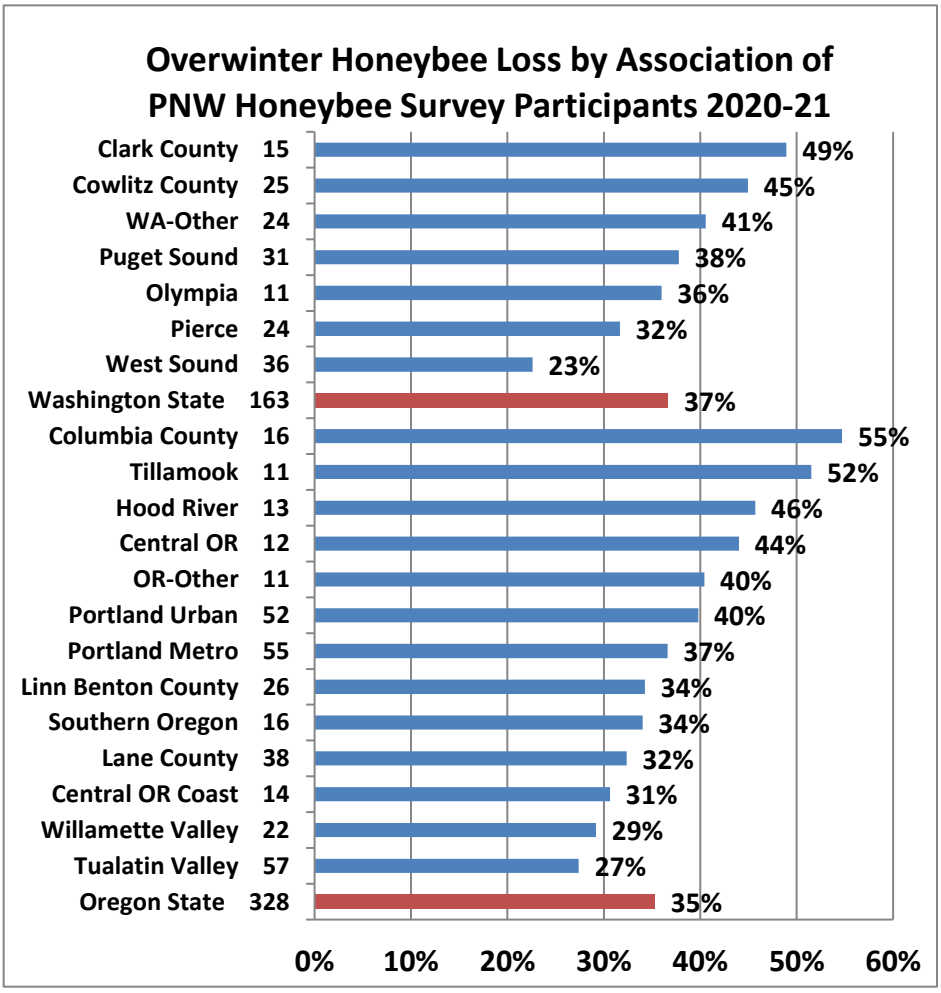
by Dewey M. Caron with Jenai Fitzpatrick

Overwintering losses of small-scale Oregon backyard beekeepers decreased to 35% this winter after the disastrous level of 48% colony losses two years ago and 38% last winter. This report presents the results of our 12th season of Oregon hobbyist/backyard beekeeper surveys. This annual survey is conducted at www.pnwhoneybeesurvey.com. Herein we discuss the data provided by 328 Oregon beekeepers, which is 26 more respondents than last year. Results of the 163 Washington respondents completing surveys (30 more than last year) are included in a separate loss report.

2020/2021 State/Club Losses

Club results of 12 local Oregon associations and 6 Washington associations (+ "other" category) are shown in Figure 1. Colony numbers ranged from 1 to 40 colonies in Oregon (Average 4.77 colonies, medium number = 3 colonies) and 1 to 39 in Washington (Average 5.16 colonies, Median number = 3). 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

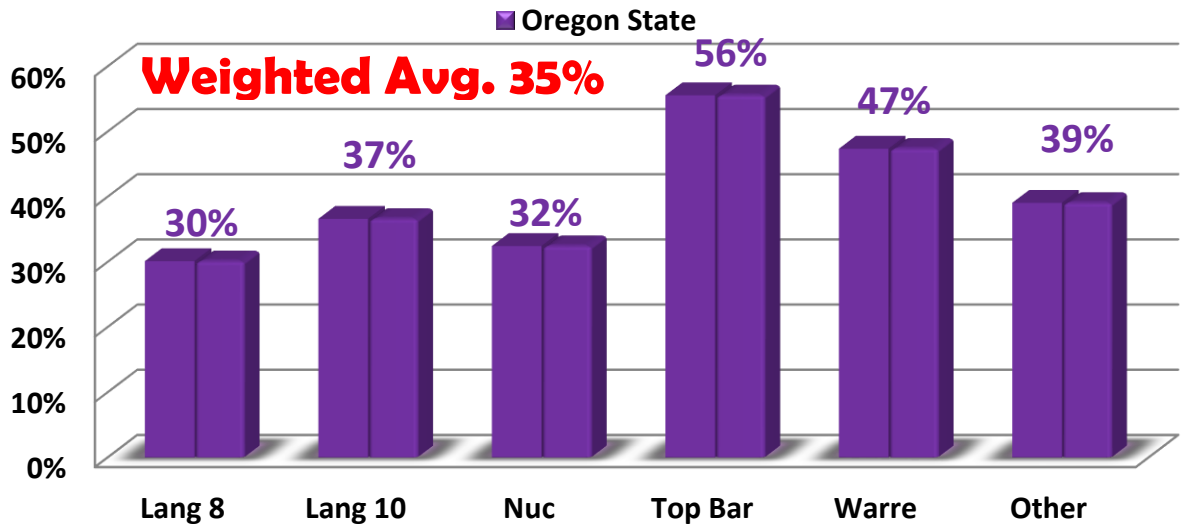


Overwinter losses of members of different organizations varied from a low of 27% for the Tualatin Valley beekeeper respondents to a high of 55% for Columbia Association. The 2X range of losses, was less than last year (4X difference) or the year before (3X difference). The difference between the two states – 2 percentage point higher loss rate in Washington - is the closest it has been in several survey years (last year Oregon loss rate was 38% and Washington loss rate was 50%). The 11 "OR-other" includes beekeepers In Coos Co, South coastal range, Douglas Co, + 6 in Klamath Falls area. The 24 "WA-other" includes beekeepers mostly west of the Cascade Range. The Puget sound east are beekeepers mostly in the Seattle area. Three quarters of our Pacific Northwest Honeybee Survey respondents keep bees along the I-5 corridor between Eugene and Seattle.

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 1,564 fall colonies (211 more than last year) of which 1012 colonies survived to spring, equating to a 35% loss (or 65% survival), an improvement of 3 percentage points over the previous winter (38%) loss rate. Eighty-seven percent of hives were 8-frame and 10-frame Langstroth hives which had a survival rate of 65%. There were 74 fall nucs (68% survival rate). Among non-traditional hive types were 45 top bar hives (44% survived) and19 Warré hives (51% survived). Among other hive types, 48 were horizontal hives (moveable comb) and up to 16 (not all other hive types were Identified) that included tree stump and other non-traditional hive types. Thus, at most, 80 (5% total) of hives were non-Langstroth-frame hives. One-half were from PUB group.

Figure 2 Winter Honeybee Loss % by Hive Type, 2020-21



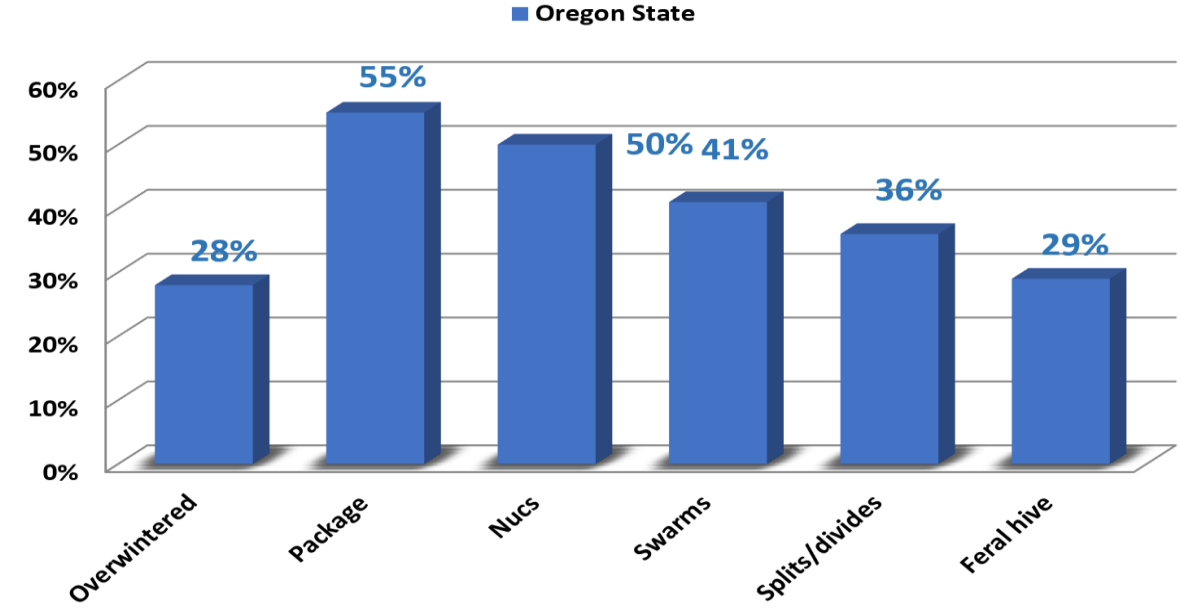
	Lang 8	Lang 10	Nuc	Top Bar	Warre	Other
# fall colonies	455	907	74	45	19	64

The 30% winter losses of PNW 8-frame Langstroth hives was slightly less compared to the 37% loss rate of 10-frame 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 frame hives respectively. **It suggests an advantage of 8 frame over 10 frame Langstroth for our area?** Nuc losses are typically higher than losses of 8 or 10 frame Langstroth hives but this year came in at 32% loss. The Nuc 8-year average loss is of 47%. This year's Top Bar hive loss (56%) is only 2 percentage points over the 8-year average loss of 54%. The 2021 Warré hive loss rate of 47% is a higher loss than the 6-year average of 42%. Although many beekeepers come and go, it is interesting that each survey year Top Bar and Warré hives numbers remain steady at slightly over 5% of total hives.

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 (28%) with the 29 feral transfers also with excellent survival. Splits, swarms 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 Winter Honeybee Loss % by Origination, 2020-21



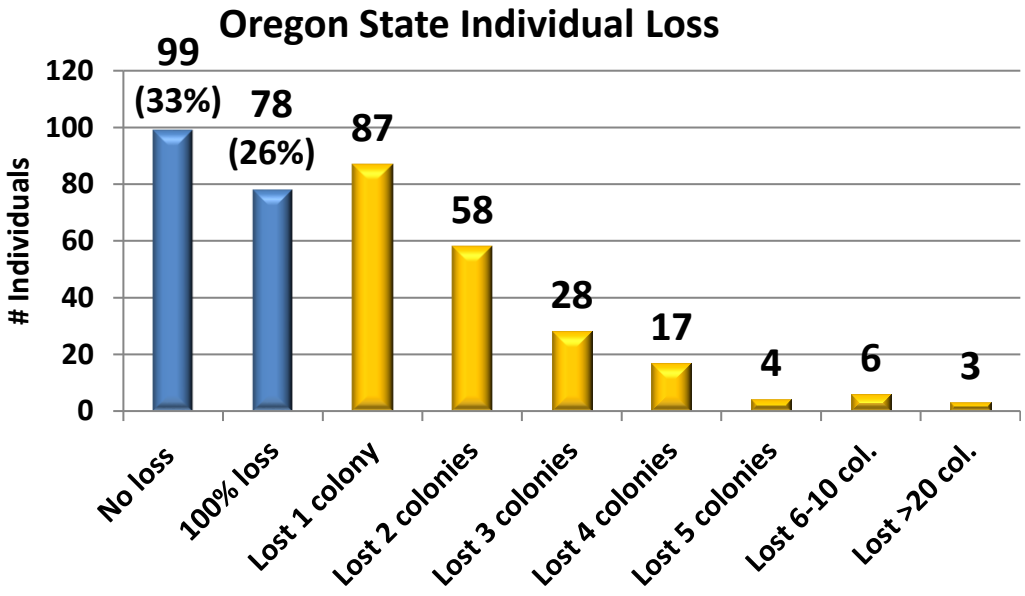
Fall	660	80	299	366	272	28
Spring	478	36	150	217	175	20

2020/2021 Individual Hive Losses

Thirty-three percent (99 individuals) of Oregon respondents had NO LOSS overwinter, whereas 26% (78 individuals) lost 100% of fall colonies. Figure 4 below shows loss of 1, 2, 3, 4 and 5 colonies + 5-9 and 10+ colonies by individuals; the loss of 1 single colony (by 87 individuals) represents

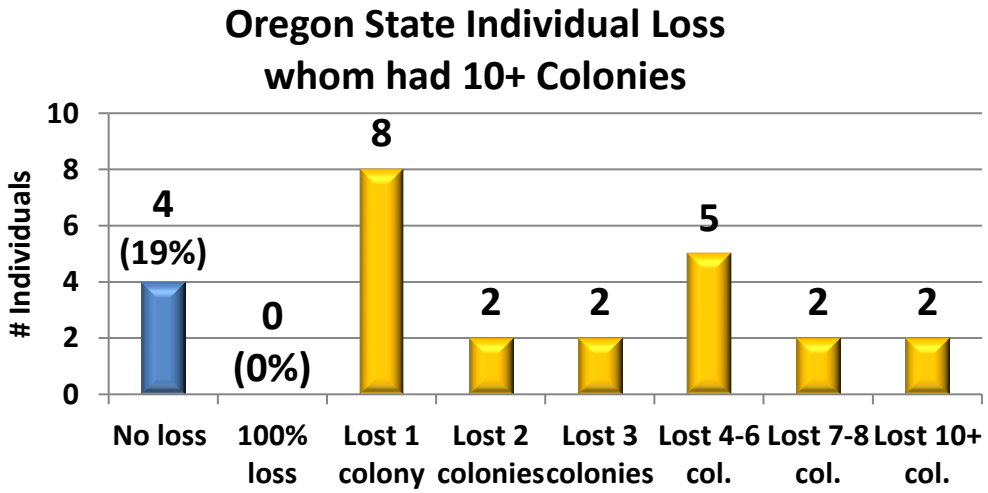
48% of total individuals reporting loss. Thirteen individuals (6%) lost 5 or more colonies. Highest loss by a single beekeeper was 13 colonies. Loss numbers are reflective of the fact that backyarders keep on average 3 colonies. Eighty-six percent (86%) of individual colony loss statewide consisted of 1, 2 or 3 colonies this past winter. Individuals with higher colony numbers lose fewer colonies percentage-wise.

Figure 4



Graph 5 looks at losses of individuals who had 10 to 40 colonies. This group lost 110 total colonies which is 19% of total losses. Thus individuals with 10 to 40 colonies (Averge colony number=16) lost 1 to 13 colonies; 4 of these indivdiuals had no loss. This gorup lost a smaller percentage of colonies 4.7 colonies per individual and a smaller percentage of colonies (29%) than the overall statewide group (35%) and the individuals with 1-3 colonies (49% loss average).

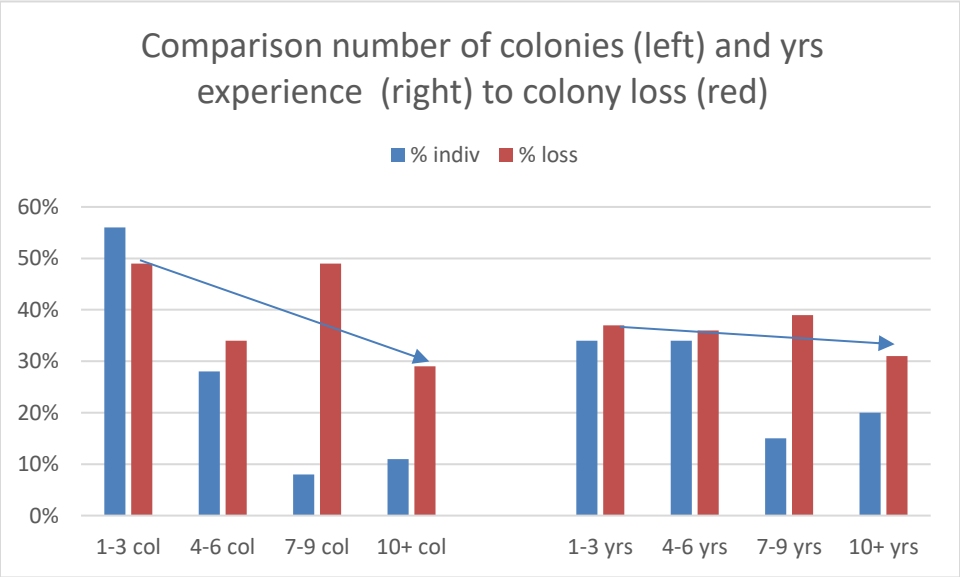
Figure 5



Survey respondents are primarily small colony number beekeepers but they vary considerably in their years of beekepeing experience. Looking at losses by colony holding numbers, the 365 individuals (56% of respondents) who had 1-3 colonies had 49% loss level, the 80 managers of 4-6 fall colonies (24% of respondents) had a 34% loss level, the 27 individuals with 7-9 fall colonies (8% of individuals) had a 49% loss level and the 37 individals with 10+ colonies (11% of respondents) lost 29% of their colonies.

By years of experience, the 110 individuals who had 1 to 3 years bee experience (34% of total respondents) had 37% colony loss level, the 112 individuals with 4-6 years experience (also 34%) had a 36% loss level, the 41 individuals with 7-9 years experience (13% of respondents) had a 39% loss level and those 57 individuals (17% of respondents) with 10+ years experience had a 31% loss level. This is shown graphically in Figure 6. The arrows show that as colony numbers increase the percent loss level decreases but as years of experience increase it does only very slightly.

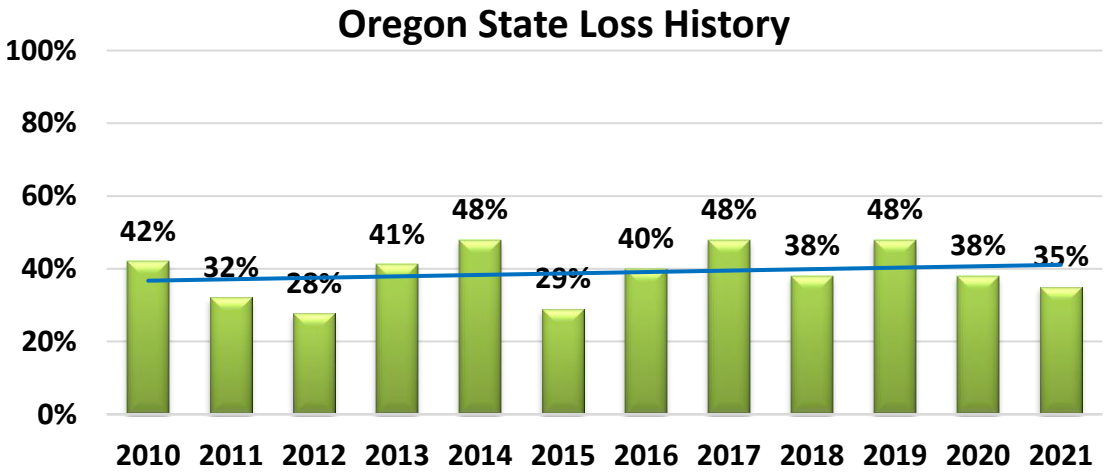
Figure 6



Overwinter Losses the Past 12 Seasons

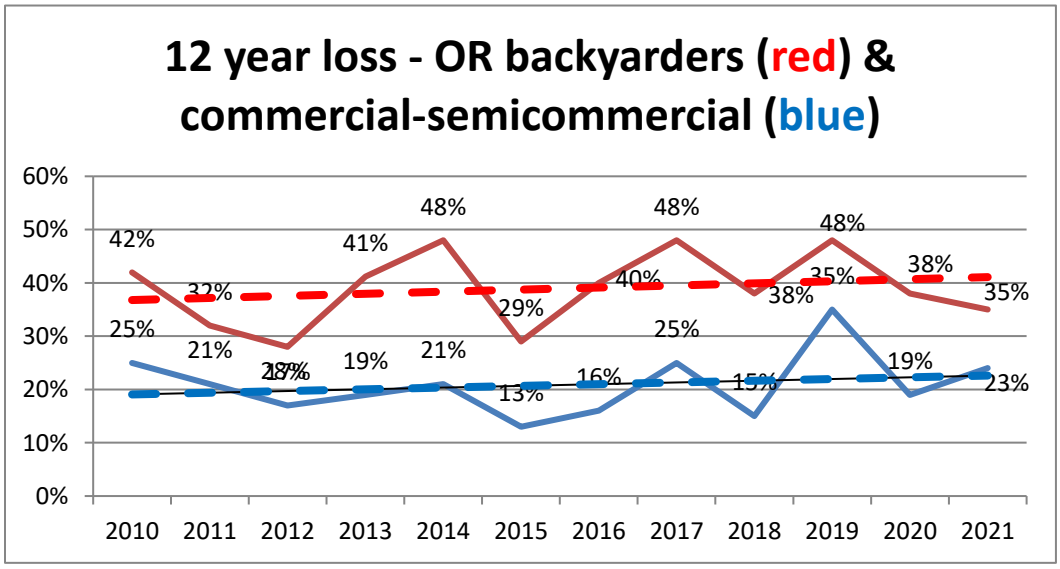
The losses of the past 12 years are graphed below in Figure 7. Despite the lower losses the past 2 seasons. the average loss by Oregon beekeepers is 40%. This average loss has changed little in the past 12 years, although seasons with heavier loses have occurred.

Figure 7



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. Eleven Oregon commercial and semi-commercial beekeepers (31,675 colonies, approximately 36 ½ % of the estimated total number of colonies in the state) reported overwinter losses of 23%. Interestingly, losses of the six semi-commercial (sideliner) beekeepers (average colony number 164) this year were 21% and losses of the commercial beekeepers (average colony number 6298) were slightly higher, 24%. The normal progression is commercial losses lowest followed by sideliner then small-scale beekeepers with 10+ colonies (this year 19%, 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 12 years as shown in Figure 8. Twelve-year average Backyard=40% loss and 12-year commercial/semi-commercial loss = 21%. The dashed lines are loss trend.

Figure 8



Some Other Numbers

Forty-four individuals (13%) 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 percent (76%) of respondents said they had a mentor available as they were learning beekeeping. Twenty one percent (21%) had more than one hive type. And, finally, 31 individuals (9 ½ %) moved their bees. Seven moved within property (sunnier, better siting, complaint from neighbor, separate nucs), a couple moved colonies within blocks (to friend's house), 5 moved their hives several miles (defensive bees, had to move), and 5 moved for pollination and 4 for better forage opportunity.

Perceived Colony Death Reason and Acceptable Level

We asked individuals that had colony loss (99 individuals had no loss) to estimate what the reason might have been for their loss (multiple responses were permitted). There were 451 total listings, 2/individual. Varroa (111 selected - 48% of respondent choices, 25% of responses), followed by Weak in the fall (82 choices, 34% of respondent choices, 18% of total choices), Queen Failure (69 selected, 29% of respondents), starvation and poor wintering (both 31 choices, 13% of respondents) were most commonly checked. 40 individuals chose Don't know (17% of respondents). Among other, 17 individuals listed yellow jackets, 12 fire/smoke, 11 pesticides, 9 moisture and 7 CCD. Other reasons written in under other included beekeeping error, small hive beetle, ants, mice, swarming, absconding and late colony hiving. See Figure 9 (% means % of 451 total respondent choices).

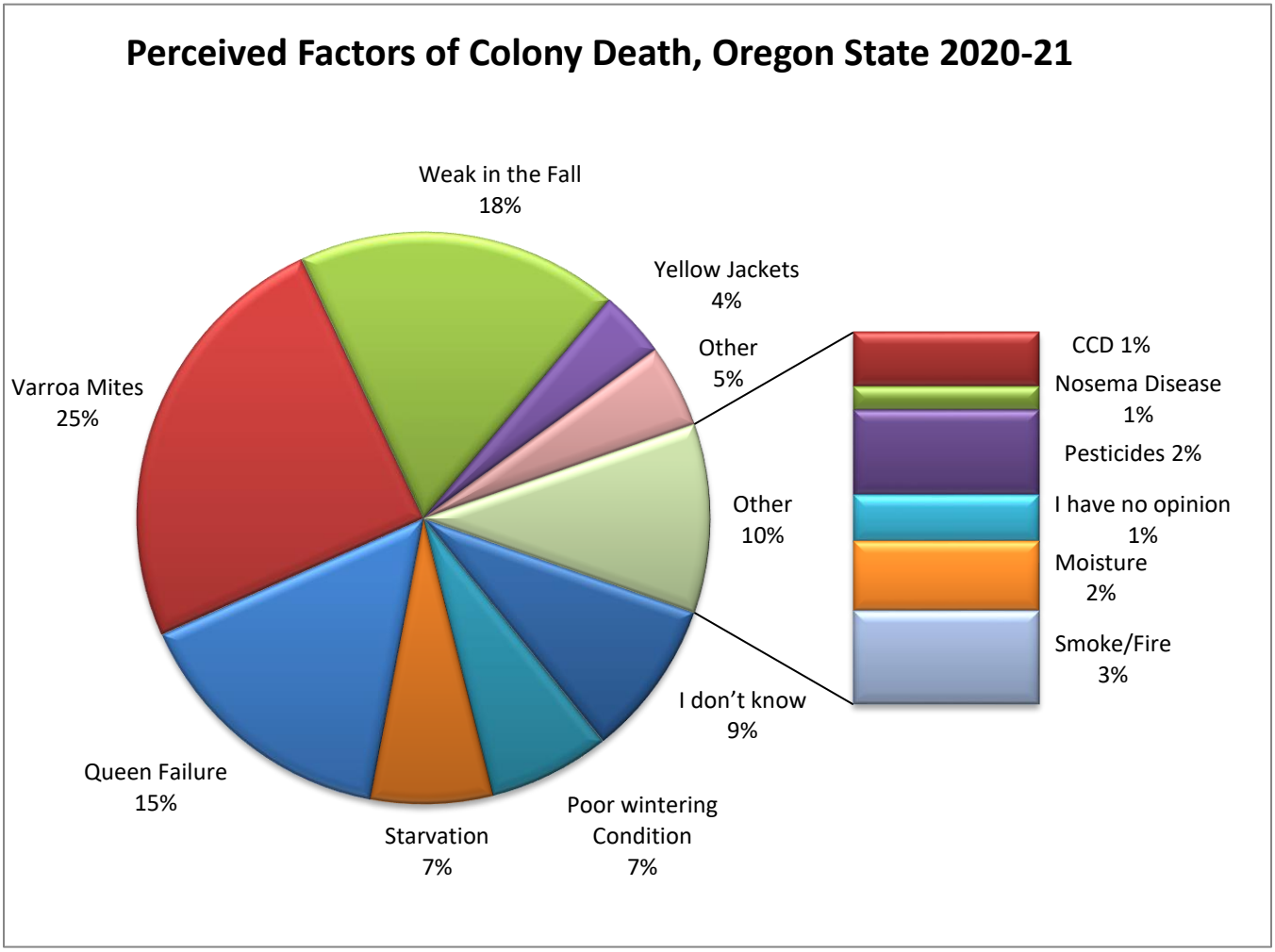


Figure 9

Acceptable loss: Survey respondents were asked reason for loss. Fifty (16%) indicated zero (no loss). Forty one percent of individuals indicated 15% or less; 20% was medium choice, as has been case for several years. Thirteen percent said 50% or greater was an acceptable loss level; one each said 75 and 100% acceptable. See table below.

Acceptable Overwinter Loss per 328 Beekeepers in Oregon State during 2020-21

Loss level	5%	10%	15%	20%	25%	33%	50%	75%	100%	None	Other
#	20	39	24	59	46	36	39	1	1	50	13
%	6%	12%	7%	18%	14%	11%	12%	0%	0%	15%	4%

Why colonies die?

There is no easy way to verify reason(s) for colony loss. Colonies in the same apiary may die for different 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. 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. 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

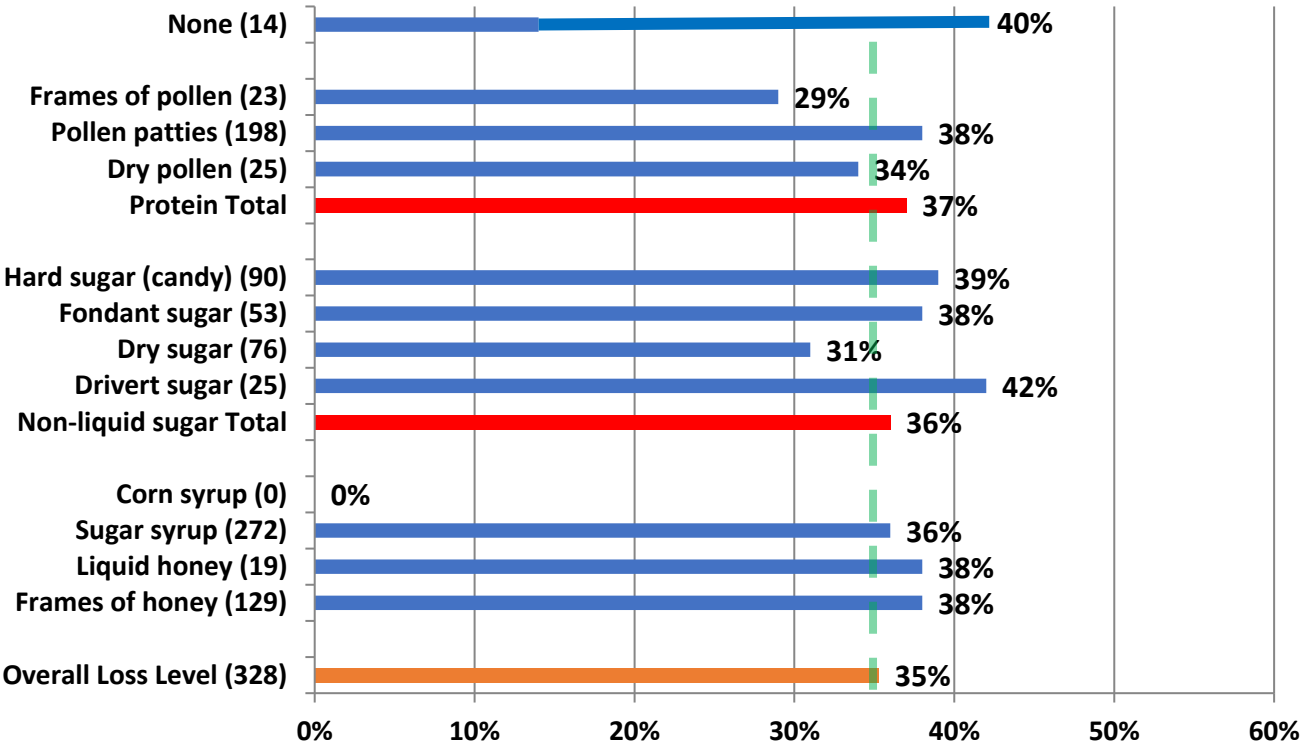
We asked in the survey for information about some managements practiced by respondents. The survey inquired about feeding practices, wintering preparations, sanitation measures utilized, screen bottom board usage, mite monitoring, both non-chemical and chemical mite control techniques and queens. Respondents 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 913 feeding options = 2.9/individual. Forty-three individuals (14%), other than those who indicated no feeding, selected a single choice and had 32% loss, 79 (25% of respondents) indicated 2 choices (34%, loss), 95 (the greatest number and medium) indicted 3 choices (they had 33% loss); 63 individuals (20%) had 4 choices with 9% loss, 23 had 5 choices (8% loss). The remainder had 6 with one making 8 selections for feeding management.

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 35% **green dashed** marker had better survival while those to right had greater loss level.

Figure 10 Feeding Options w/ Loss Record
(#) = number individuals



Fourteen individuals (decrease of 8 individuals over previous year) said they did NO FEEDING. They had 25 fall colonies, lost 15 for a 40% loss. For individuals indicating one or more feeding managements, feeding sugar syrup was the most common feeding option of respondents (272 individuals, 87% of respondents). Their loss rate was 36%, essentially same as overall average. Percent of individuals feeding protein was 65% and non-liquid sugar was 47%; both collectively had no better survival rate, although some selections, most notably frames of pollen and dry sugar feeding, had low losses (better survival) than the average overall loss rate. Drivert feeding had a 7-percentage point higher loss than average.

Summary: Statewide for the last 5 years individuals doing no feeding had 6 percentage point higher losses (average 47%) i.e. poorer survival, compared to average loss rate of 41%. Average percent doing no feeding = 8% of individuals).

Individuals statewide that fed sugar syrup had a 6-percentage point lower loss level (average for the 5 years) but this year it was one percentage point greater. 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 four of five past winter seasons (this was the year where it was not better), with 5 or 6 percentage point improvement from overall losses. Dry sugar feeders had slightly better survival all 5 winters (average= 37%) while hard candy feeders had a much-improved survival 4 of 5 past winters (this was the exception) (=33% average survival); fondant feeders had better survival 3 of the 5 (not this past winter, 37% 4-year average). Recall that average loss for past 5 years was 41%.

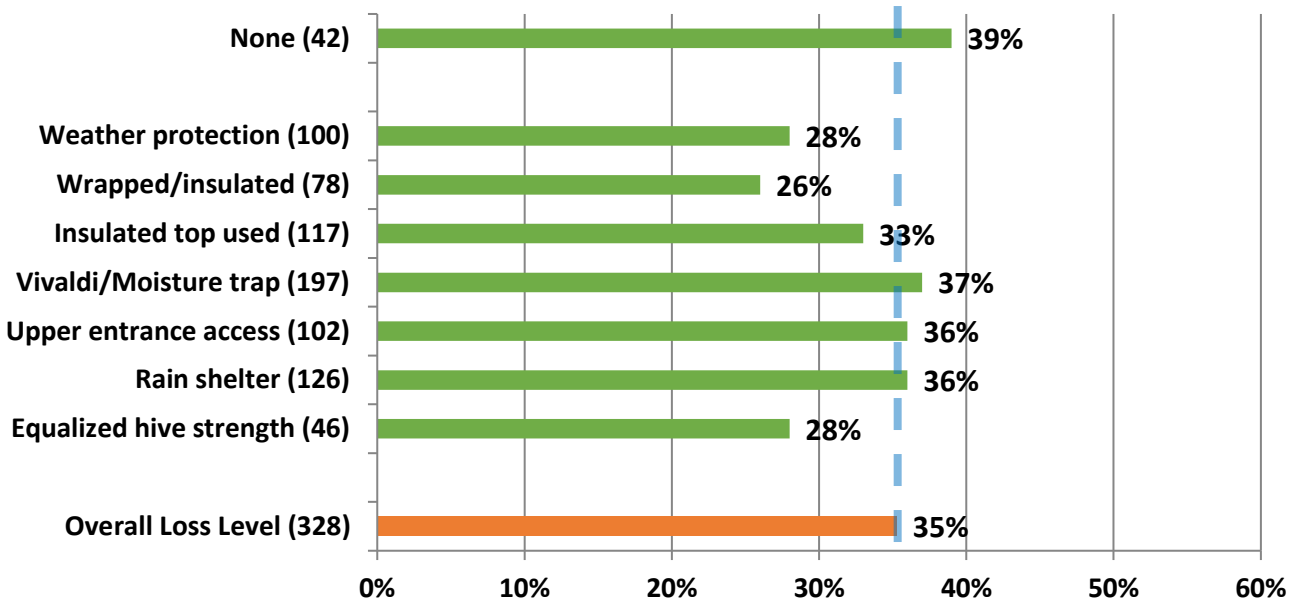
For individuals feeding protein, only the protein patty users showed better survival all 5 years; dry pollen feeders had much better survival in two of the past five years with losses the remaining three years, including the past one, close to the overall yearly average. Dry pollen feeders have had better survival some years, including 6 percentage points this year.

WINTERING PRACTICES: We received 823 responses (2.9/individual) about OR beekeeper wintering management practices (more than one option could be chosen). Forty-two individuals (13%) of the respondents indicated doing none of the several listed wintering practices; these individuals had a 39% winter loss, 4 percentage points higher loss than overall loss of 35%. For those indicating some managements, 101 (35%) did one single thing, (46% loss), 82 did 2, the medium, (33% loss), 68 did three (41% loss), 38 did 4 (36% loss), 25 did 5 (29% loss) and 10 did 6 to 8 with 27% loss, the best survival rate. More managements practiced generally resulted in better survival.

The most common wintering management selected was ventilation/use of a quilt box at colony top (197 individuals (69%), 9 percentage points higher compared to previous year) followed by rain shelter (126 individuals, 44%). These were the two last year that were the most highly indicated. 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.

Over the past four years individuals that did no winterizing practice (average 13.4% of individuals) averaged 46% loss compared to 42% overall average loss of last 4 years, a 4-percentage point poorer survival rate. Only 2 winterizing managements improved survival all 4 years – wrapping (29% lost rate, a 13-percentage point improvement) and upper insulation (32%, a 10-percentage point improvement). Vivaldi/quilt box (38%), upper entrance, also 38% (most Vivaldi boards have an upper entrance built into the equipment) and wind/weather protection (36%) had only slightly improved survival rates. Average loss rate for last 4 years was 42%.

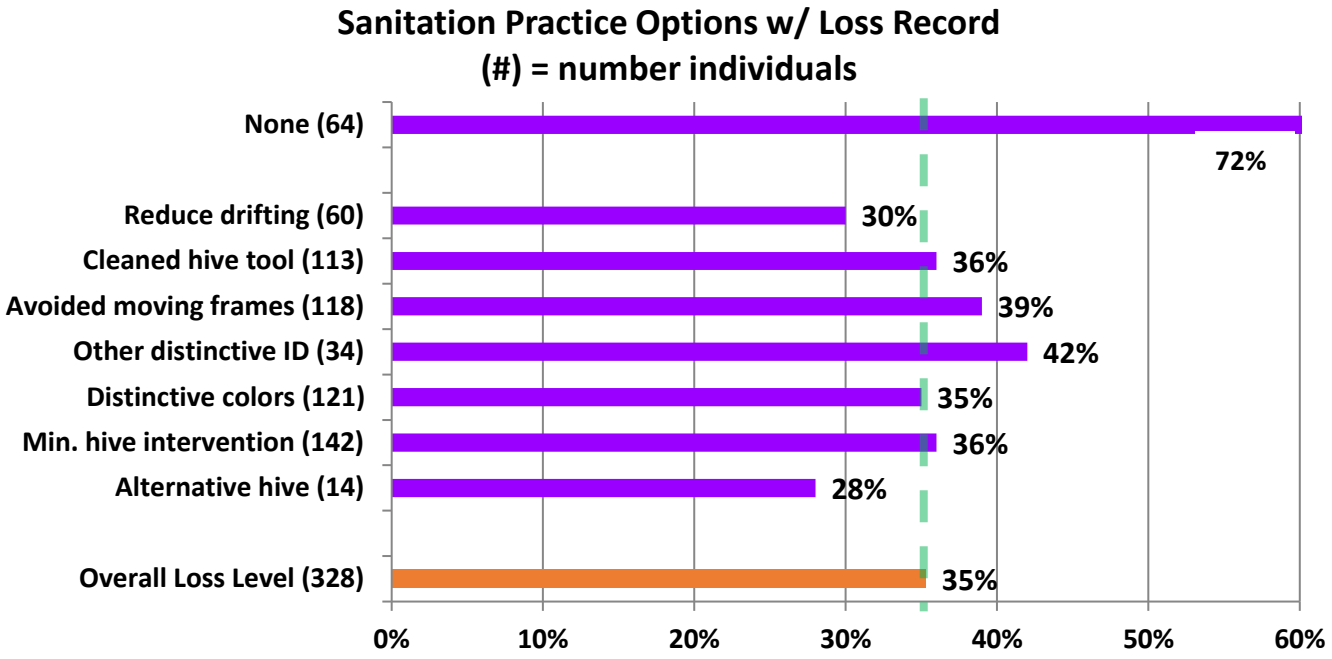
Figure 11 Winter Management Options w/ Loss Record
(#) = number individuals



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 671 responses for this survey question 2.5/individual. Sixty-four individuals said they did not practice any of the 6 offered alternatives; they had a loss rate of 72% compared to overall rate of 35%. Over past four-years those indicating doing none had a 52.5% percent loss rate, 10+ percentage points higher than the average loss rate of 42% over the same time period. Eighty (30 %) individuals had 1 selection with 38% loss, 87 (33%) had 2 choices (the greatest number and median) with 34% loss level, 59 selected 3 managements (42% loss level), 29 had 4 (30% loss level, the lowest) and 11 had 5 to 7 selections with a 38% loss level. As with feeding and winterizing managements, several actions improve survival.

Minimal hive intervention (142 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 3 years was 49.5%, 7.5 percentage points above the average 4-year loss of 42% loss rate compared to those individuals that did nothing.

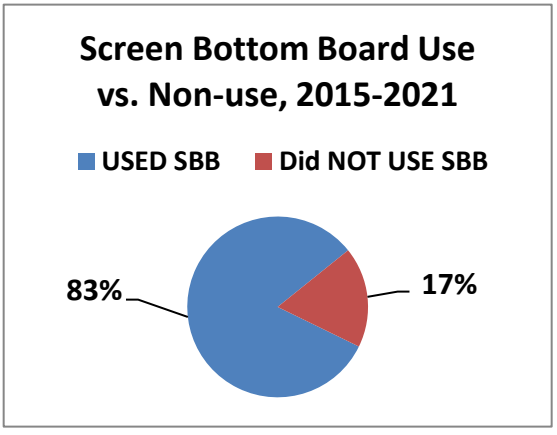
Figure 12



Avoiding moving frames and reducing drifting were the two sanitation choices that demonstrated better average survival the past four years – 4-year loss rate was 36% for not moving frames which is 6 percentage points better survival (this year it was 3 percentage points higher than average) and 35% for reducing drifting compared to overall rate of 42%. Alternative hive, 14 individuals, had the best survival this year, but it has not been over past 4 years. 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 very effective varroa mite control tool. In this recent survey, statewide 36 individuals (11%) said they did not use screen bottom boards (last year it was 10% not using SBB). This was the second lowest percent of respondent non-use of SBB in last 7 years. Average non-use for last several years is 17%, vs 83% use, on some or all colonies over the 7-year period. Figure 13 right.



This past overwintering season, the 36 non-SBB users (11% of respondents) had 165 fall colonies of which they lost 103 for 38% loss. The 292 beekeepers using SBB on all or some of their

colonies had 36% loss. **Examining the six-year average of SBB use, loss level of the 83% using SBB on all or some of their colonies had a 36% loss level whereas the 17% not using SBB had loss rate of 40%, a 4-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, 48%, 83 individuals, said they always blocked SBB during winter; 66 individuals statewide said they blocked some of the SBBs. Statewide those who blocked always or sometimes had 1139 colonies in the fall and lost 744, a 35% loss rate. Figure 14 shows that those who never blocked had a 38% winter loss, a 3-percentage point difference, a slight advantage **in favor of closing the SBB over the winter period to improve survival.** Figure 14 right.

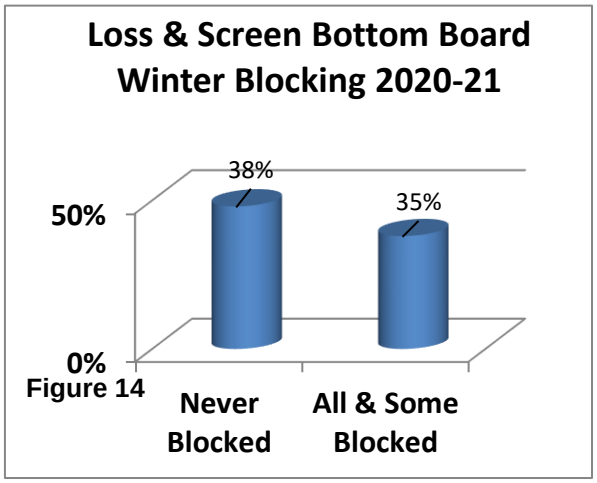


Figure 14

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 moisture kills bees, not cold, 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

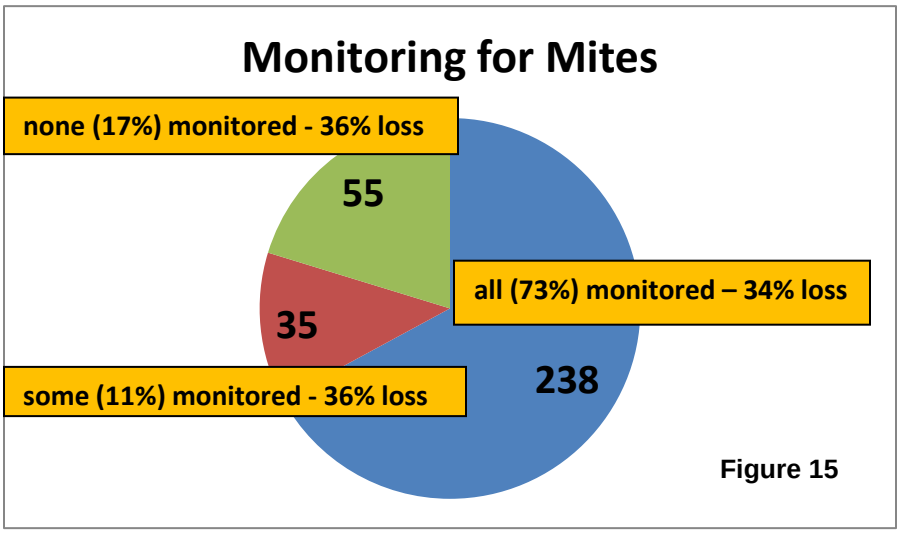


Figure 15

We asked percentage of Oregon hives monitored for mites during the 2020 year and/or overwinter 2020-21, 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. 238 individual respondents (73%), 6 percentage points over the previous year, said they monitored all their hives. Losses of those individuals monitoring was 34 %. Fifty-five (17%), 3 percentage points fewer than last year, reported no monitoring; they had a higher loss rate of 36% loss. 35 individuals reported monitoring some of their colonies; they had a 36% loss.

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.

	ALL Colonies Monitored % individuals	% loss	SOME Colonies Monitored % individuals	% loss	No colonies Monitored % individuals	% loss
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%
5 year loss ave		40%		38%		48%

Individuals indicated use of 1.9 monitoring techniques on average. In total choices, in order of popularity of use, Sticky boards were used by 138 individuals, 50% total of 273 individuals who did some or all monitoring of colonies. One hundred individuals used alcohol wash to monitor (37% of total number of individuals who monitored), 83 individuals (30% of individuals) used powdered sugar monitoring; visual inspection of drones (78 individuals) and visual inspection of adults (108 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.

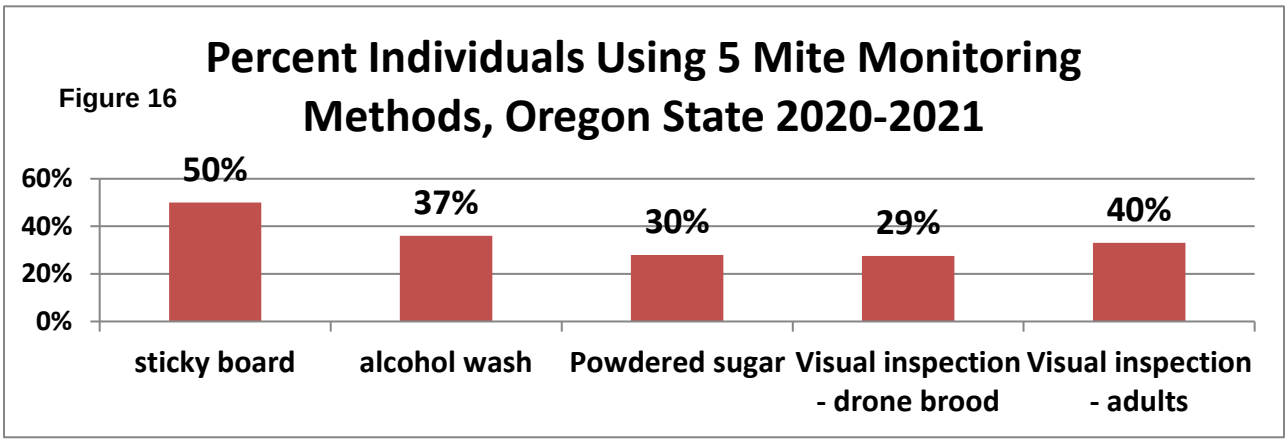


Figure 16

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 17 below illustrates monthly sampling five methods.

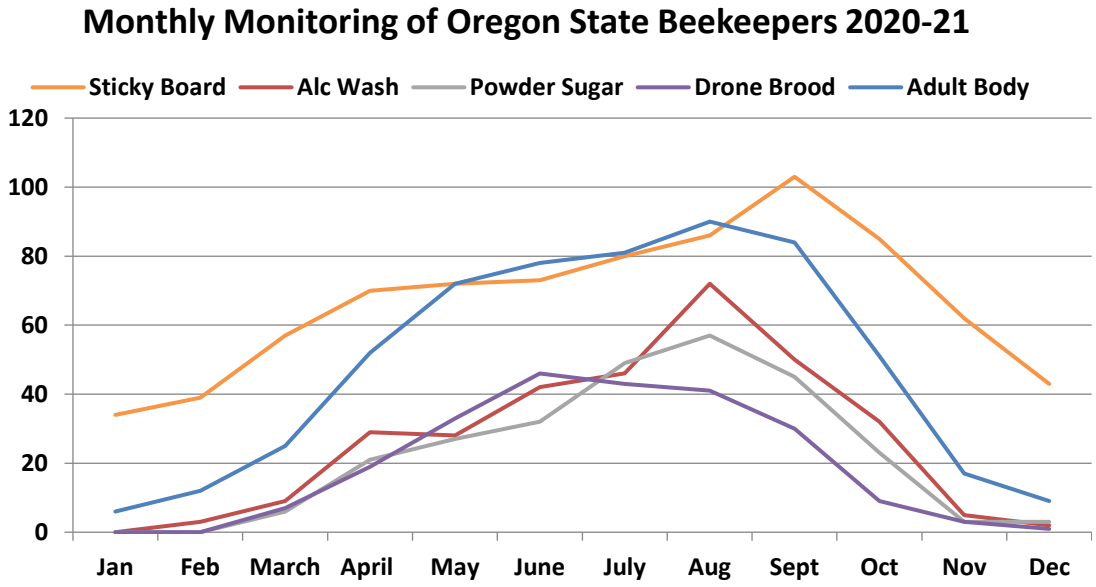
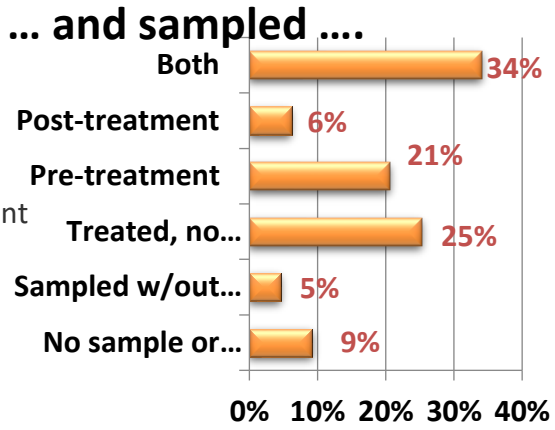


Figure 17

The most common sampling of respondents is both pre- and post-treatment (31% average last 5 years). 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 (25% this past year, more than double 5 years previous). Sampling data for last four years in Figure 18 right.

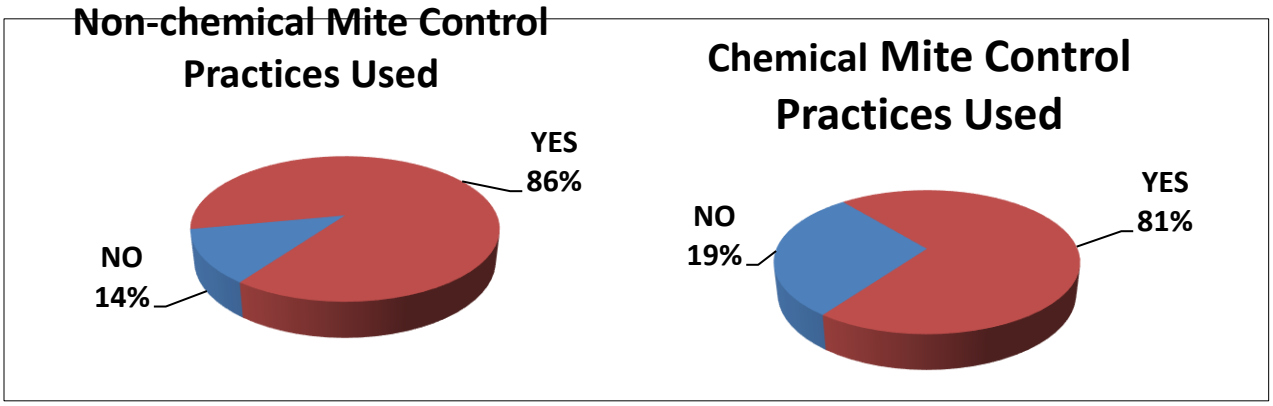


It is important to KNOW mite numbers. Less effective mite monitoring methods include sticky (detritus) boards below the colony. Often so much detritus drops onto a sticky board that counting the mites can be hard, especially for new beekeepers). Sticky boards used for a single day pre- and post-treatment 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 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.

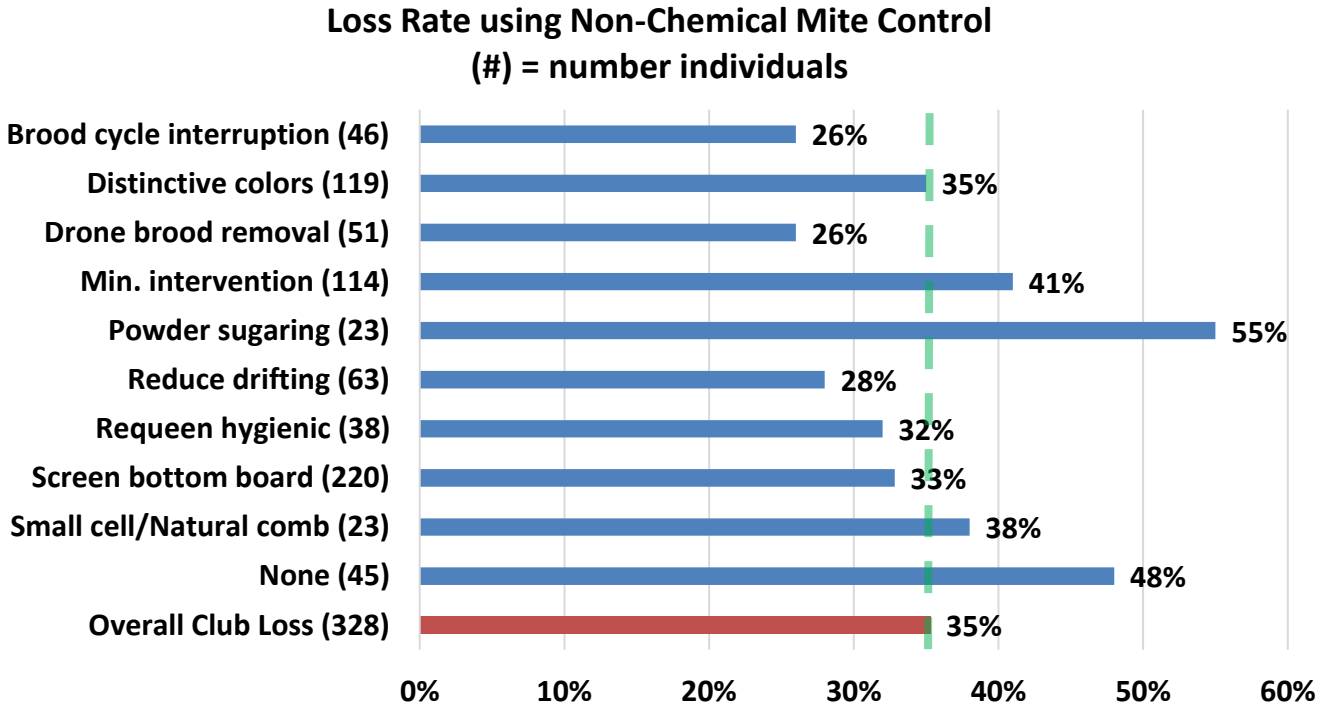
Mite Control Treatments

The survey asked about non-chemical mite treatments and also about use of chemicals for mite control. Forty-five individuals (14%), two percentage higher than last year, said they did not employ a non-chemical mite control and 62 individuals (19%), 1 percentage point fewer compared to last year, did not use a chemical control. See Figure 20. Those 45 individuals who did not use a non-chemical treatment reported a 48% winter loss, while those who did not use a chemical control lost 61% 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,) 71 individuals (25%) used one method, 85 used two, 69 used three, 35 used 4, 12 used 5 and 8 individuals used 6 or 7. Individuals using a single method had 16% loss rate, those using 2 had a 44% loss rate, those with 3 had a 33% loss, the dozen using 4 had 29% loss and the smaller number using 5 (21%) and the 6/7 a 26% loss. Clearly using one method with proper timing or using more than one tool improves success.

Figure 20



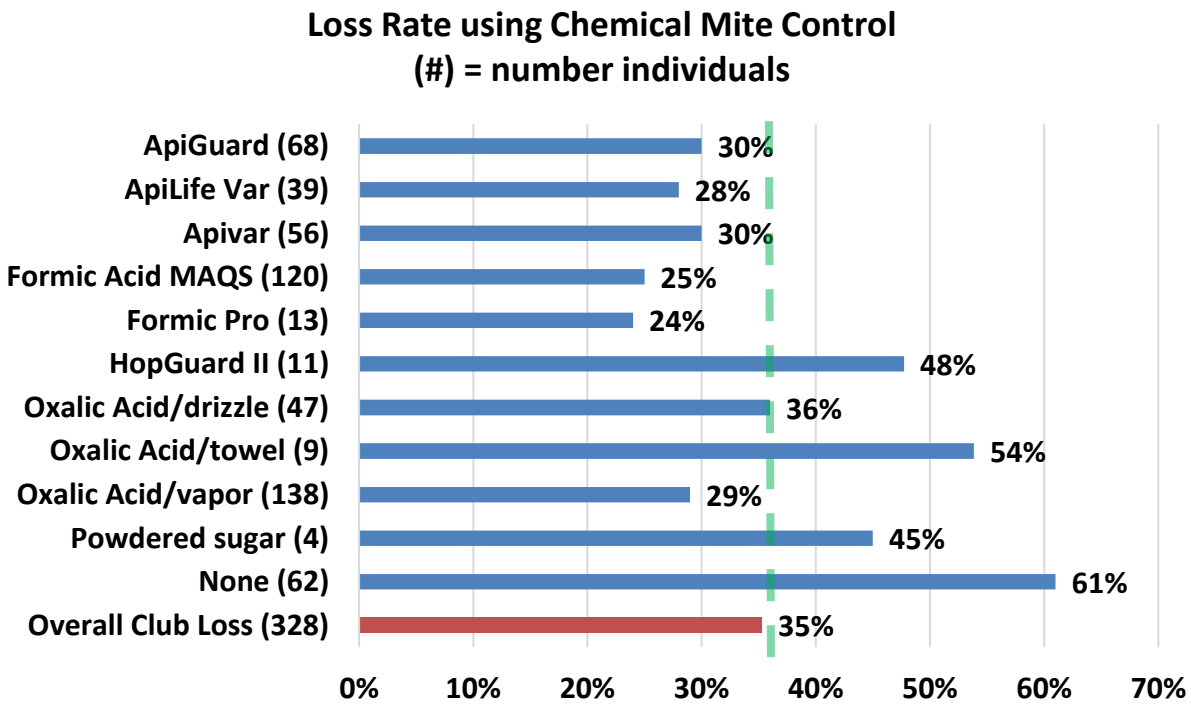
Use of screened bottom board was listed by 220 individuals (67% of total respondents), 18 individuals short of numbers that listed use of SBB in different section of survey (Figure 20). The next most common selections were distinctive colors (119 individuals) and minimal hive inspection (114 individuals). The use of the remaining selections are shown in Figure 20; 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 5 years. Reducing drifting such as spreading colonies (33% loss average for 3 years – question not asked in 2016-17 survey) and brood cycle break (36% average) have consistently year after year demonstrated somewhat better survival than average loss (41%). Different colony colors in apiary and drone brood removal were both 41%, 5-year average. Some non-chemical control alternatives demonstrate an advantage on one or two years (such as drone brood removal this past season) but overall no improvement.

Chemical Control: For mite chemical control, 62 individuals (19% of total respondents) used NO chemical treatment. They had a loss level of 52%. Those using chemicals used at rate of 2.2/individual. One hundred thirteen individuals (42%) used one chemical (had 44% loss level), 111 used two, 40 used 3 and 15 used 4. Loss levels declined with heavier usage; for those using 2, loss was 31%, those using 3, it was 26% and for those using 4 they had a 25% loss level.

Figure 21

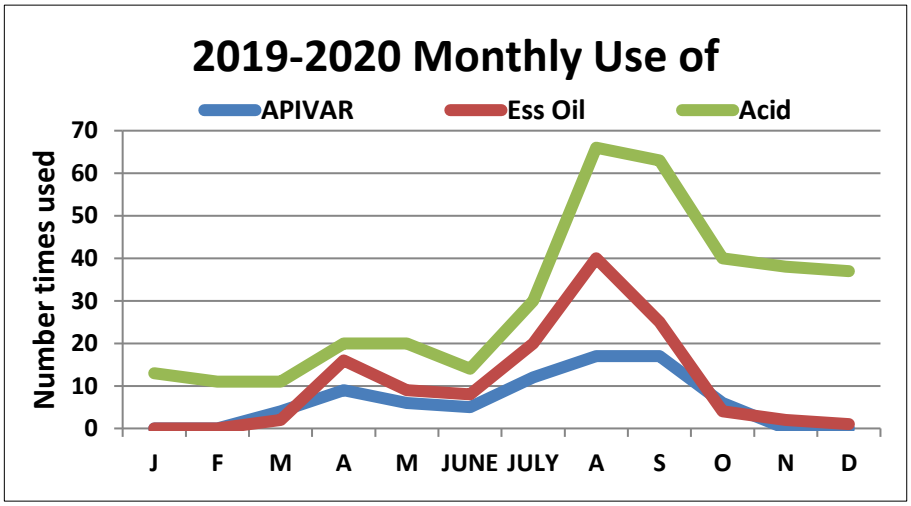


One hundred thirty-eight respondents (50%) indicated they used oxalic acid vapor and one hundred twenty OR Beekeepers (43% of total individuals using a chemical) indicated they most commonly utilized MAQS, formic acid. Both chemicals improved survival. At least 9 said they made

their own formulation to apply via shop towels (54% loss), plus an additional 13 used Formic Pro (with the best survival – loss rate of 24%, both a repeat of the previous year). Oxalic acid drizzle (47 individuals was one one-third as commonly utilized as vaporization (138 individuals); vaporization had a 7-percentage point better survival. All three api's- Apivar, Apiguard, ApiLifeVar - had once again very decent survival rates. Figure 21.

Consistently the last 5 years five different chemicals have helped beekeepers improve survival. The essential oils Apiguard (average 5-year loss level 31.6%), Apivar (32% average 5-year loss level), Oxalic acid vaporization (32.6% average loss level over last 5 years – in contrast the oxalic acid drizzle average of last 4 years is 40% loss level), ApiLifeVar (34.4% average loss level over last five years) and formic acid MAGS formulation 39.4% loss level the last 5 years. Average loss level has been 41% the last 5 years. Those who mix formic into shop towels have heavier losses. Formic Pro has increased in use – it looks very promising at a 25.3% loss level the past three years (when average loss was 40.3%).

The monthly use of Apivar (blue line), essential oil (red line) or an acid (green line) is shown in Figure 22 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.



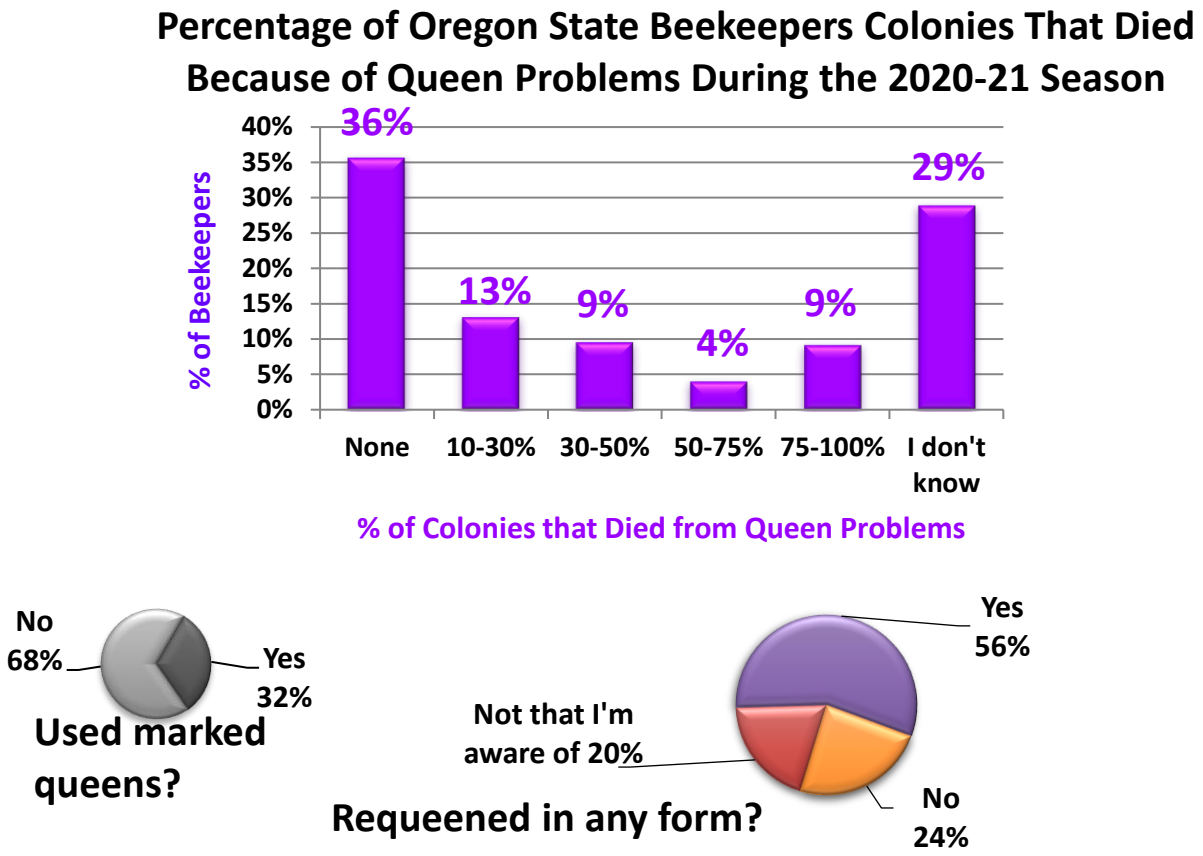
Antibiotic use

Seven individuals (2%) used Fumagillin (for Nosema control) and equal number indicated use of terramycin. The terramycin users had a 19% loss level and those who used fumagillin had a 26% loss.

Queens

We hear lots of issues related to queen "problems". Recall under the question asking the reasons why colonies didn't survive that 69 individuals, 29% 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. Thirty-one individuals, less than half of 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 23 shows that fourteen said none (31%); an additional 16 individuals (19%) said they didn't know. The remainder did not answer this survey section.

Figure 23



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. One hundred four individuals (32%), an increase of 1 percentage point from last year, said yes. The related question then was 'were your hives requeened in any form?' to which 56% (184 individuals) said yes, 24% (79 individuals) said no and the remainder that responded (20%, 65 individuals) said 'not that that I am aware of.' 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 337 responses One-third of respondents indicated their bees were requeened with a mated queen, 20% split (divided) hives, 18% indicated it was the bees that requeened via swarming and 14% via supersedure. Ten percent introduced queen cells and 3% 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, July 2021