Statistical Analysis of 4-Poster™ Data

Amber Foucha

Abstract: The prevalence of lone star tick nymphs has grown substantially in New York during the last two decades. The increase of ticks also increases the chance of disease spreading. The ticks main host is the white-tailed deer (*Odocoileus virginianus*) which is the basis for deployment of the 4-Poster™ tick management system. The device is used to control the population of ticks in a roughly 40-acre area by treating the deer with permethrin. To reduce the potential spread of disease among deer, half of the devices were serviced once every three weeks, while the other half were serviced under a normal weekly routine. T-test were used to determine if the altered treatment was effective for the years 2018 through 2021. The data used in each t-test was gathered from tick surveys and placed in to an excel spread sheet. Each the average of males, female, and nymphs were compared for each year to determine the amount of reduction in tick life form. Averages were then compared to the very first year results (2013) to see if the population of ticks continued to decrease. Photos from each site were also sorted for the presence of deer or no deer present. The photos indicate the amount of time deer visit the 4-Poster devices. The results concluded that the altered treatment was not as effective as the normal servicing. The 4-Posters™ that were treated every three weeks showed increases in females and nymphs with little overall reduction in the population of nymphs and female lone star ticks over the life of the experiment.

Keywords: *reduction, lone star tick, and 4-Poster*

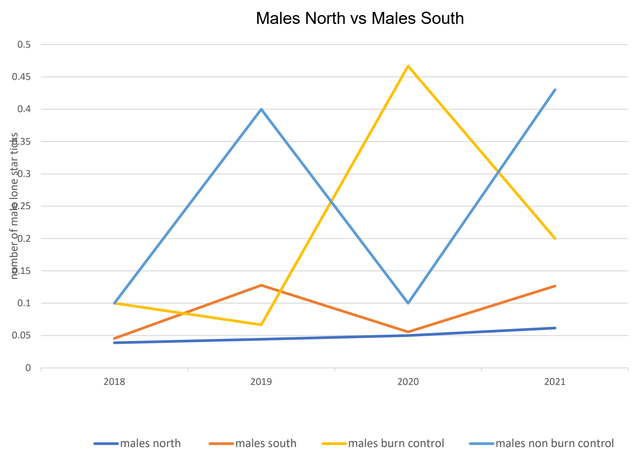

Figure 1. Comparison of female lone star ticks between treatments and to controls.

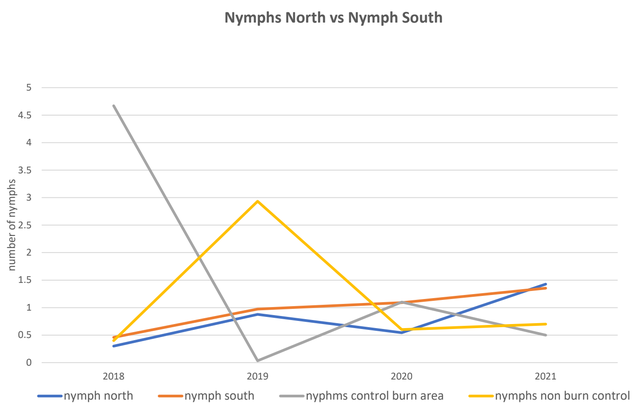

Figure 2. Comparison of nymphal lone star ticks between treatments and to controls.

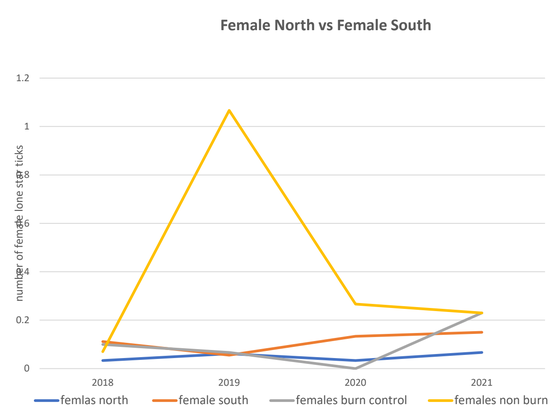

Figure 3. Comparison of female lone star ticks between treatments and to controls.

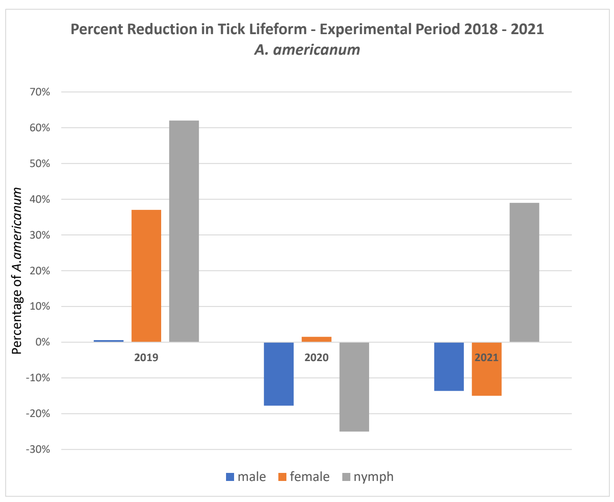

Figure 4. Percent reduction in tick lifeform during period of the experiment. Reduction shown compared to 2018. Negative reduction infers an increase in the number of ticks.

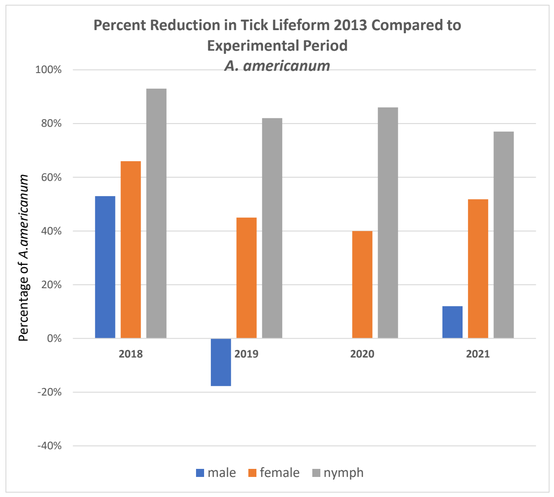

Figure 5. Percent reduction in tick lifeform during period of the experiment compared to 2013, the year devices were first deployed. Negative reduction infers an increase in the number of ticks.

Results and Discussion: The nymphs show the best record of effectiveness because they are the most prevalent lifeform. After 2018, the population of nymphs increased and continued to increase for the next three years. the nymph on the north group (weekly servicing) decreased showing the treatment was effective in 2018, and 2020. In 2018 and 2021 the north group had increases in the population of nymphs. In Figure 1 the population of male lone star ticks for the south group (servicing every 3 weeks) is higher than the north group. The results indicate that the weekly servicing is more effective than servicing every 3 weeks. In Figure 2 the 4-Poster™ device was ineffective on the south group for 2019, 2020, and 2021. The males burn control group show the population of male lone star ticks were decreasing in 2018, and 2019, but the number of ticks increased in 2020, and 2021. In Figure 1 the males non-burn control group show an increase from 2018 to 2019. There was a decrease in 2020, then an increase in population of male lone star tick in 2021. In Figure 3 the result shows the population of female lone star ticks for the north group has continued to decrease from 2018 to 2020 and a very small increase in 2020. The population of female lone star ticks in the south group decreased for two years 2018, and 2019 but in 2020 and 2021 the graph shows an increase in population. The females in the burn control decrease in 2018-2020. In 2021 the population increased. The females in the non-burn control group increased in 2018 and 2019 decreased in 2020 and continued to decrease in 2021. Figure 4 shows the percent decrease in tick lifeform from year to year during the period of our experiment, a negative percentage infers an increase in population. For nymphs the population decreased by 60% in the first year, but displayed decreasing effectiveness by 2021 with a decrease of 39% compared to 2018. In 2020 the number of males increased by 20% with the increase compared to 2018 being 14% by 2021. The number of females decreased by 35% in 2019 compared to 2018 but the effectiveness decreased resulting in a 15% increase by 2021. Figure 5 shows the percent reduction in tick lifeform of *A. Americanum* are compared to 2013 which was the first year that this research was conducted. Compared to 2013 there was an increase in the number of males in 2019 with an overall increase of 10% by 2021. Females *A. Americanum* showed an overall increase in population of 50% by 2021. The number of nymphs has served as the indicator of overall effectiveness of the 4-Poster™ tick management program. The reduction of nymphal ticks was at 92% in 2018 at the start of the current experiment. The effectiveness declined to a 78% reduction compared to 2013 by the end of the experiment in 2021. Reduced device servicing was used to reduce the potential spread of disease between deer while attempting to reduce the number of ticks that could transmit disease to humans. Statistical analysis has indicated that reduced servicing is not as effective, and our hypothesis is rejected. The goal of the current experiment was to reduce the population of ticks even with reduced servicing of the 4-Poster™ devices. Deer treated by devices serviced every week showed the continued effectiveness, while those visiting devices serviced every three weeks showed decreased effectiveness and in some instances an increase in the number of ticks. A potential alternative treatment would be to test servicing the devices every week, but use less corn, which would also mean the amount of permethrin would decrease as well but the application of permethrin to deer would occur more routinely.

Conclusion : In conclusion the northern group which were the deer that visited devices serviced every week showed a continued reduction in lone star tick numbers. The southern group which visited devices serviced every three weeks was not as successful with tick reduction, the southern group had an increase in numbers for nymphs and females.

Acknowledgements:

I would like to acknowledge Brookhaven National Laboratory and SULI for funding this project. My mentor Dr. Timothy Green, for his guidance through the duration of this program. I would also like to thank Dr. Kambhampati at Southern University at New Orleans for his willingness to assist me.

References

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