Utah Department of Agriculture and Food

Specialty Crop Pollinator Health Survey

Tree Fruit Pollinator Health Survey — Year 1 Report

Abstract

The Utah Department of Agriculture and Food (UDAF) is conducting a two-year survey of honey bee health in tree fruit growing areas of Utah. The first year of data has been collected and is presented here. This data suggests that there are only subtle differences between the health of honey bees in fruit growing areas compared to areas where fruit is not grown. Notably however, the average percentage of Varroa mite infestations statewide is in excess of recommended levels (5% for hobbyists; 3% for commercial). In addition the rate of American foulbrood, the most devastating of brood diseases, may be high outside of fruit growing areas (in excess of 1%). If these trends continue to be apparent in 2015 data, it could influence future honey bee health educational outreach and inspection services of UDAF.

Introduction

Honey bees are key pollinators of eight different tree fruits, which are grown by over 300 operations on approximately 7,000 acres in the State of Utah (NASS, 2007). The products from these orchards yield over $14 million annually. This industry requires increased pollination services, yet honey bee health has been on the decline for decades (Kaplan, 2013). In 2014, UDAF began a two-year state-wide survey of honey bee colonies. The overall purpose of this survey is to evaluate the health of beehives in fruit growing areas of the state. Specific objectives outlined include:

- **Primary objective**: Establish a baseline level of American foulbrood (*Paenibacillus larvae*) in sampled areas.
- **Secondary objective**: Evaluate the general health of hives and monitor for exotic predators of honey bees in sampled apiaries.
- **Tertiary objective**: Increase tree fruit growers' abilities to maximize pollination of their crops and improve beekeepers' understanding of honey bee diseases and pests.

Methodology

The survey was conducted statewide, but it heavily sampled Box Elder, Davis, Utah and Washington counties. UDAF contacted and arranged inspections with most of the participants. Data was also collected from beekeepers that requested an inspection from the department. Beekeepers were asked a number of management questions, such as disease and mite management strategies and whether their apiary had increased, decreased or stayed the same size over the last year.

Inspection Protocol

Hives were surveyed for evidence of diseases and pests. At least three frames of brood were inspected in each colony for the diseases American foulbrood, European foulbrood (*Melissococcus plutonius*), chalkbrood (*Ascosphaera apis*), stonebrood (*Aspergillus spp*.) and sacbrood virus. A powdered sugar roll was performed on each hive inspected to estimate Varroa mite (*Varroa destructor*) loads. If a hive was dead, weak or exhibiting slow build up, a sample of adult bees was taken for Nosema (*Nosema apis; Nosema ceranae*) testing. Colonies were also inspected for the presence of exotic honey bee pests, such

as small hive beetle (*Aethina tumida)* and Tropilaelaps mites (*Tropilaelaps clareae; T. mercedesae*). If the apiary had 20 or fewer hives, all colonies were inspected (time permitting). If the apiary had more than 20 hives, either 10% of hives were inspected or five hives were examined, whichever was greater.

Data Interpretation

Compared to many other bees, honey bees can forage for extremely long distances. However the maximum foraging distance of the honey bee tends to not exceed four miles (Hagler et al. 2011; Beekman and Ratnieks 2000). Therefore a beehive inspected within a four mile radius of an orchard was considered to be in a "fruit growing buffer," whereas any colony more than four miles away was categorized as "outside a fruit growing buffer." This distinction was made in order to make a comparison of health between honey bees which may be pollinating orchards and those which are not providing specialty crop pollination.

Results

In total 194 apiaries containing 990 hives were inspected for the survey. 708 of those colonies were in fruit growing areas and 282 colonies were outside of fruit growing areas. The survey did not detect any Tropilaelaps mite or small hive beetle. Roughly 54% of apiaries surveyed inside the buffer increased in size compared to the last year; 57% of apiaries outside the buffer added colonies. The percentages of apiaries that stayed the same size or decreased in number were nearly the same within and outside the buffer. Numerous honey bee diseases were field diagnosed and lab confirmed.

American foulbrood

A minimum of nine colonies inspected were infected with American foulbrood. This number may have actually been higher because one of the diseased apiaries involved a situation where 16 hives were dismantled and intermixed into a single pile. This made it difficult to establish how many colonies were actually diseased. For the purposes of calculating survey data, the number of colonies infected in this case was only counted as one.

Less than 0.5% of colonies within the orchard buffer were infected with American foulbrood and more than 2% of hives outside the buffer were infected with the pathogen. The Apiary Program's goal is to keep American foulbrood below 1% statewide.

Nosema

Due to constraints of the survey's budget, Nosema (*Nosema apis; Nosema ceranae*) testing was not performed at all apiaries. Instead, adult bee samples were taken from hives that were weakened, dead or demonstrating overt symptoms of the disease. A total of 92 colonies were sampled for testing. The Nosema-positive data was divided into two groups: above one million spores per bee and below one million spores per bee. This division was made because the economic action threshold (the point at which a treatment should be administered) for *Nosema apis* is one million spores per bee (El-Shemy and Pickard, 1989).

Colonies within the buffer area that were dead, weak or exhibiting slow build up:

- Roughly 12% had spore load averages above one million per bee
- Approximately 16% had spore load averages below one million per bee
- In total, nearly 30% of bees had some level of infection

Colonies outside the buffer area that were dead, weak or exhibiting slow build up:

- Around 24% demonstrated spore load averages above one million per bee
- Almost 19% had spore load averages below one million spores per bee.

Varroa Mite and Parasitic Mite Syndrome

The Apiary Program recommends that hobbyist beekeepers do not let their mite load reach 5% of the population of honey bees in the colony and that commercial beekeepers keep their mite load below 3% of the honey bees in the colony. The average mite load of apiaries surveyed within the buffer was 6.6%; apiaries outside the buffer measured 5.6%. Therefore mite loads exceeded the recommended levels both within and outside the buffer areas. The level of parasitic mite syndrome, a condition associated with severe mite stress, was approximately 1.6% inside the buffer. This malady was found to occur at nearly double the rate outside the buffer (2.8%).

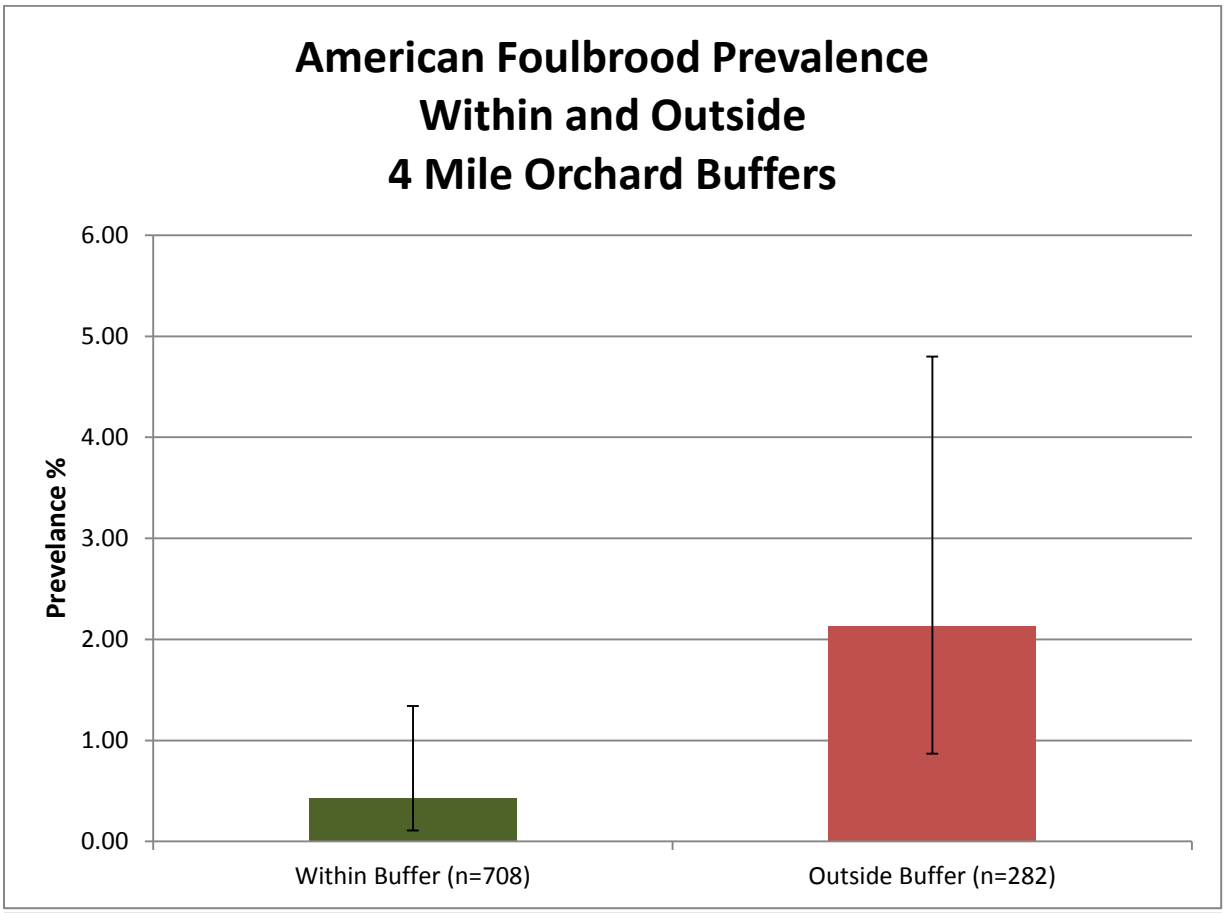
Other maladies

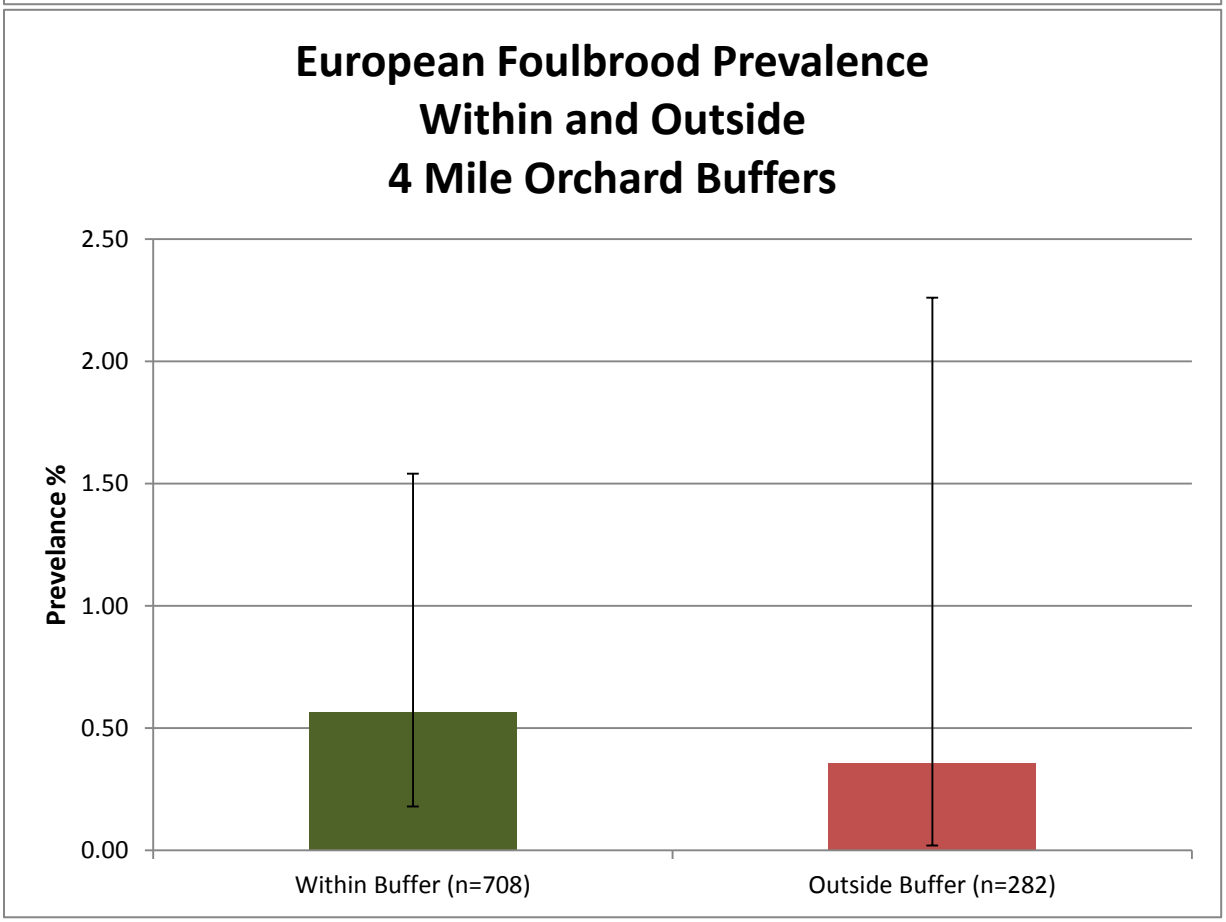
European foulbrood, chalkbrood and colonies with laying workers were detected in the survey. All were below 1% of colonies surveyed within the buffer area and outside the buffer area.

Discussion

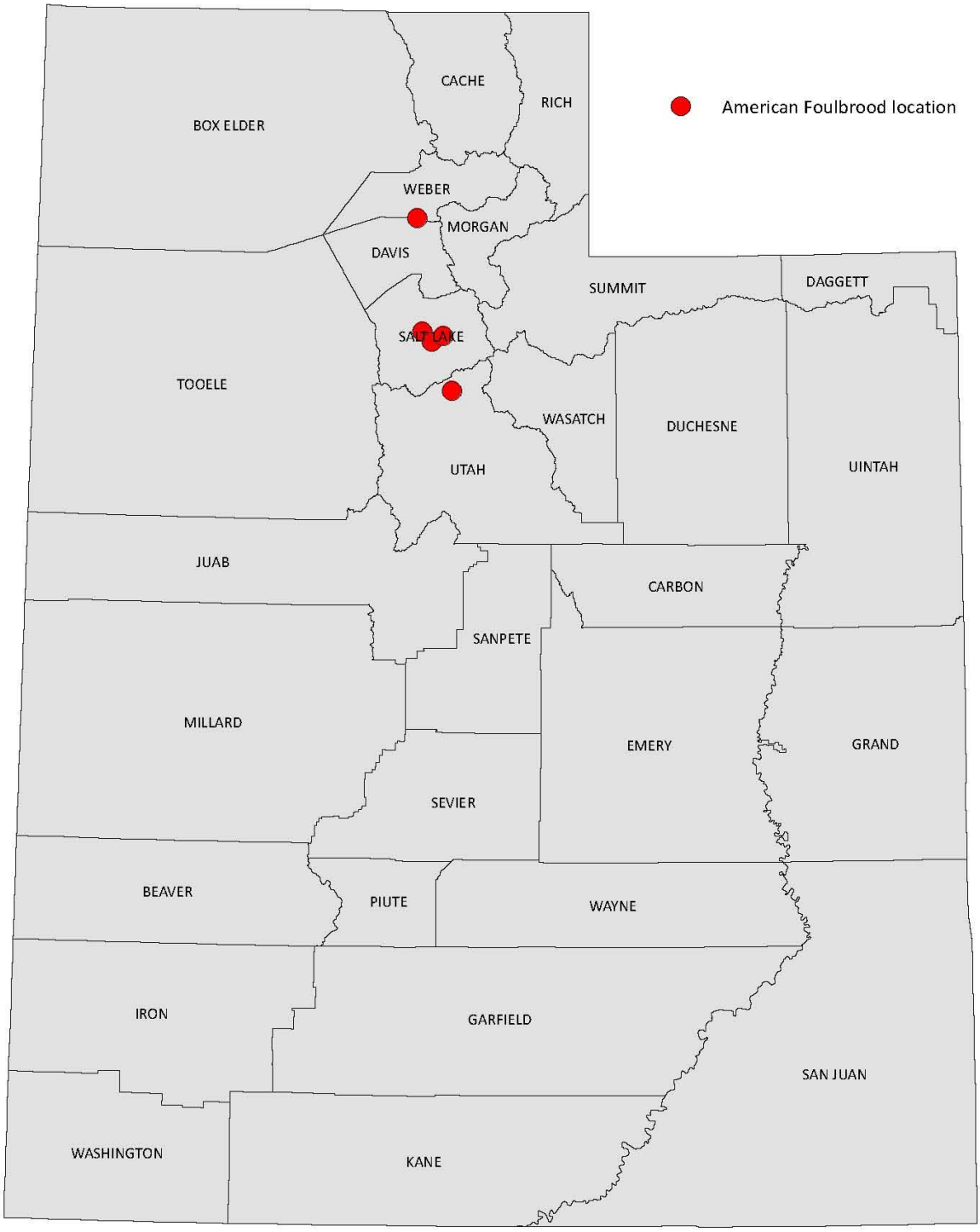
There appeared to be little difference between disease and pest incidence when comparing data from within the buffer and outside the buffer. This would suggest that the health of honey bees is relatively the same regardless of proximity to commercial fruit areas. Indeed when comparing apiaries within the buffer and outside the buffer, there were no significant differences between the groups statistically.

Despite the subtle variances in disease and pest occurrence between areas that grow fruit and those which do not, this data nonetheless illustrated some noteworthy points. The average Varroa mite load of colonies sampled was in excess of the Apiary Program's recommended levels; this could have significant negative implications on honey bee health in Utah. Also, the prevalence of American foulbrood in the fruit growing buffer is 0.4%, which is considered to be under effective control. However it is 2.1% outside of the buffer area, which is excessively high. The department's goal is to keep American foulbrood below the level of 1% of colonies statewide. This is because at a 1% rate, the disease is being created at quickly as cases are being eliminated or treated (Goodwin and Eaton 1999). If the rate exceeds 1%, then the disease will likely proliferate; if the rate is below 1% then it can be contained. If 2015 data continues to demonstrate high Varroa and American foulbrood incidence, future honey bee health outreach and inspection services may be redirected in affected areas.

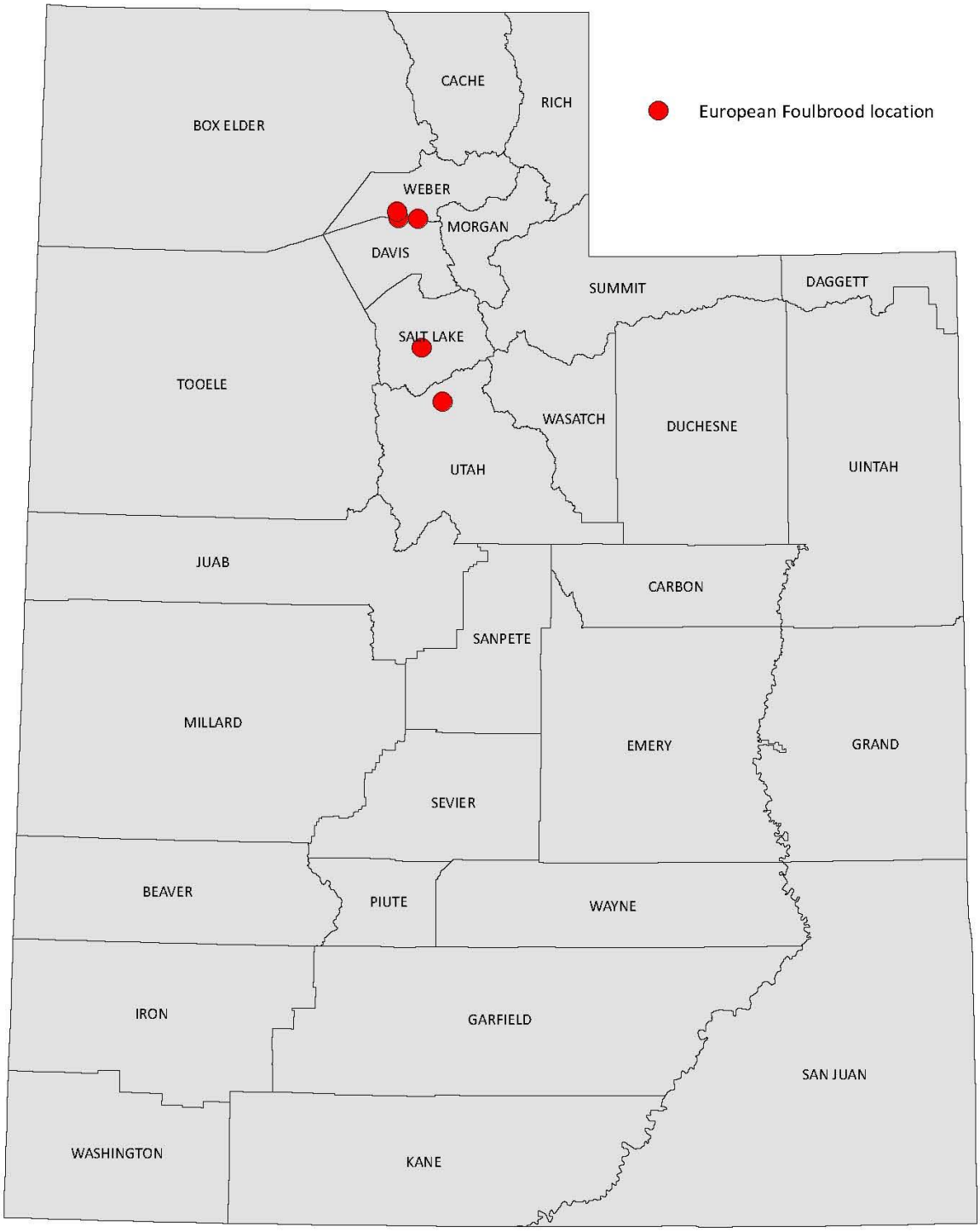

American Foulbrood Prevalence
Within and Outside
4 Mile Orchard Buffers
Prevelance %
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Within Buffer (n=708)
Outside Buffer (n=282)

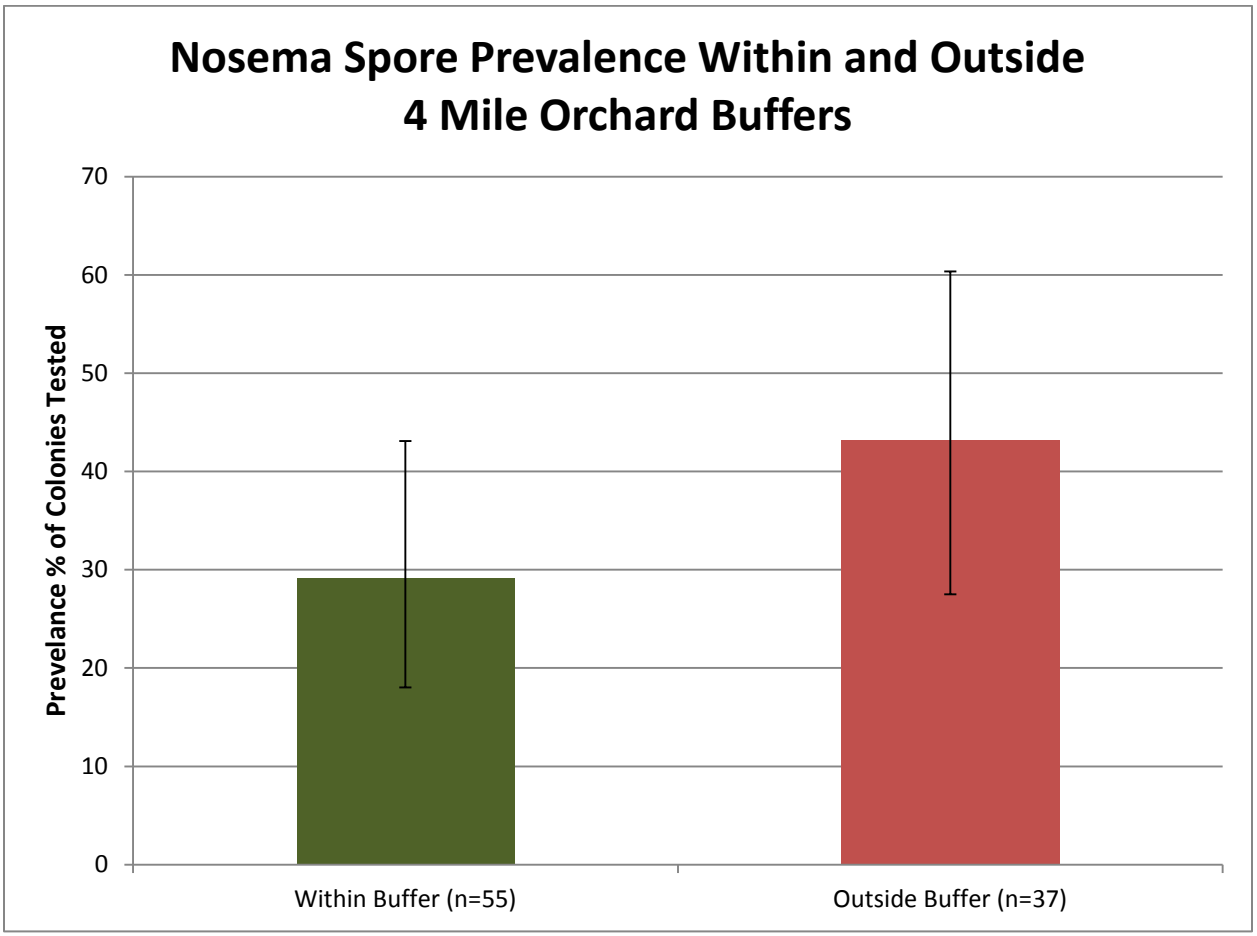

European Foulbrood Prevalence
Within and Outside
4 Mile Orchard Buffers
Prevelance %
2.50
2.00
1.50
1.00
0.50
0.00
Within Buffer (n=708)
Outside Buffer (n=282)

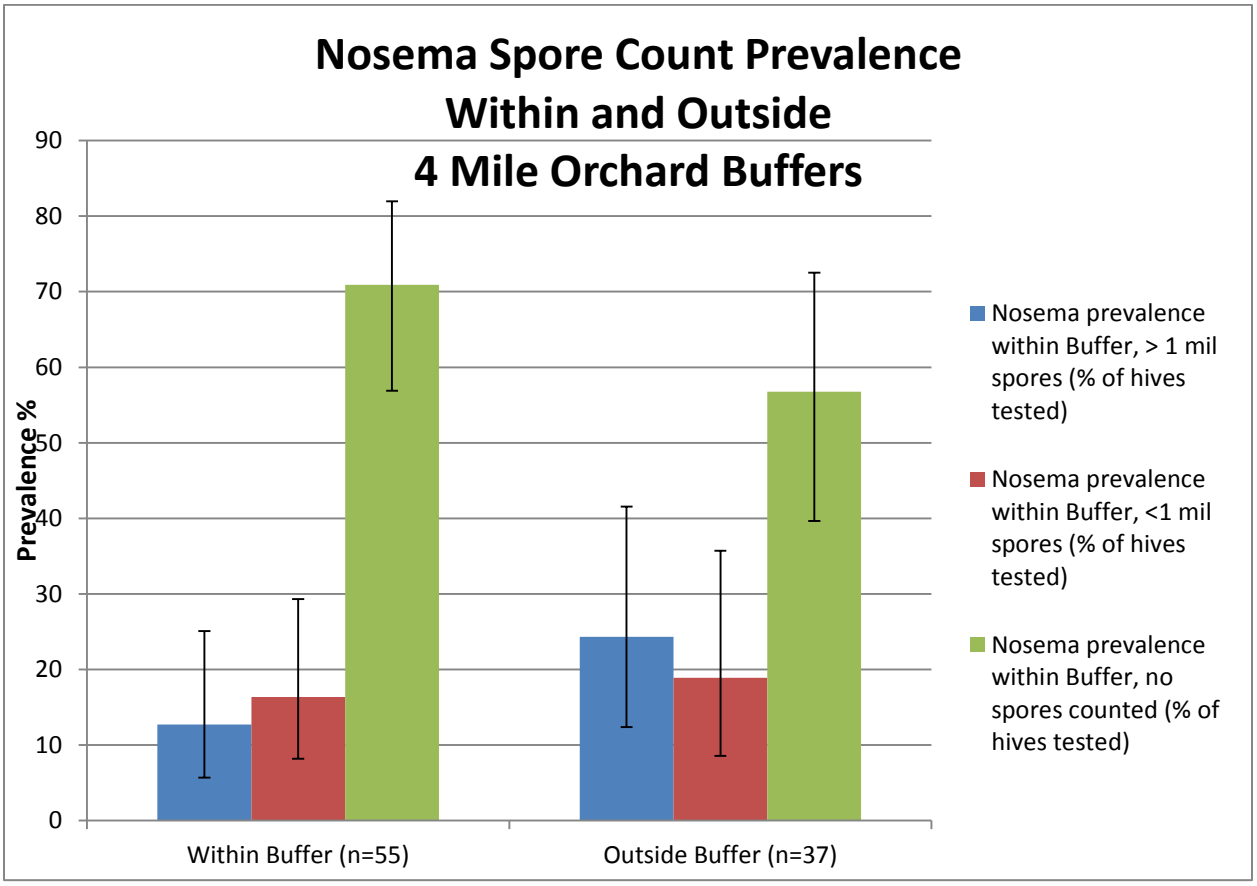
American Foulbrood Cases in Utah 2014

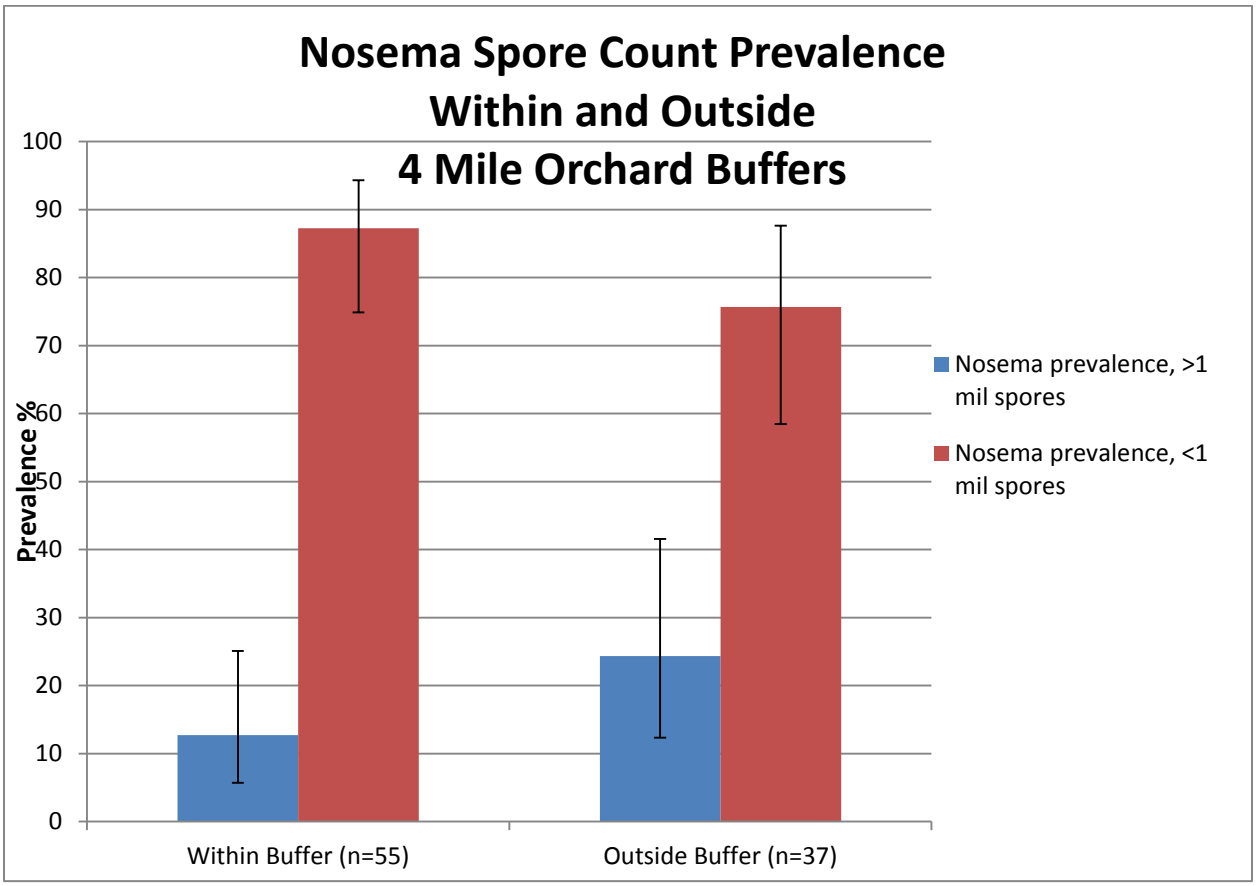


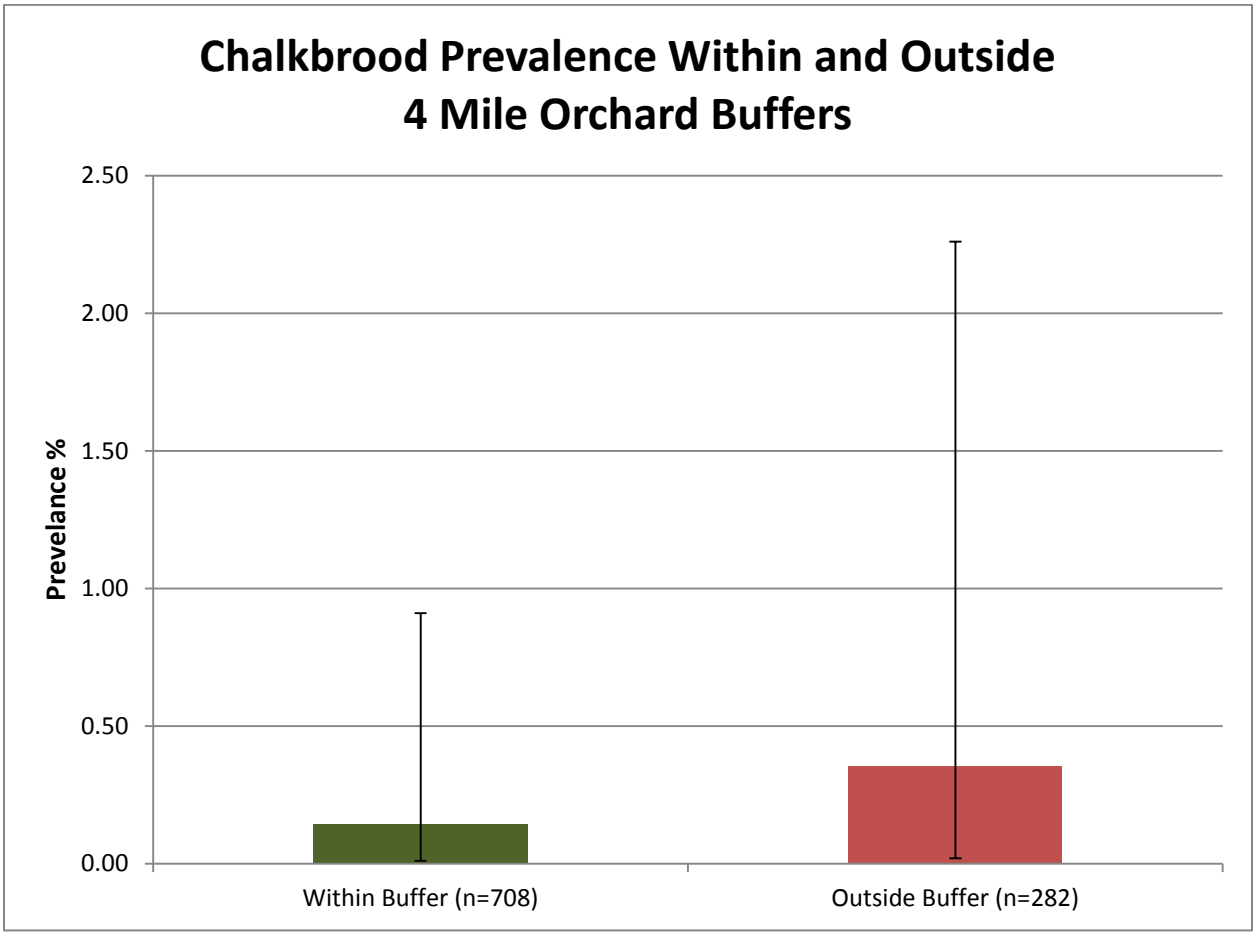
European Foulbrood Cases in Utah 2014



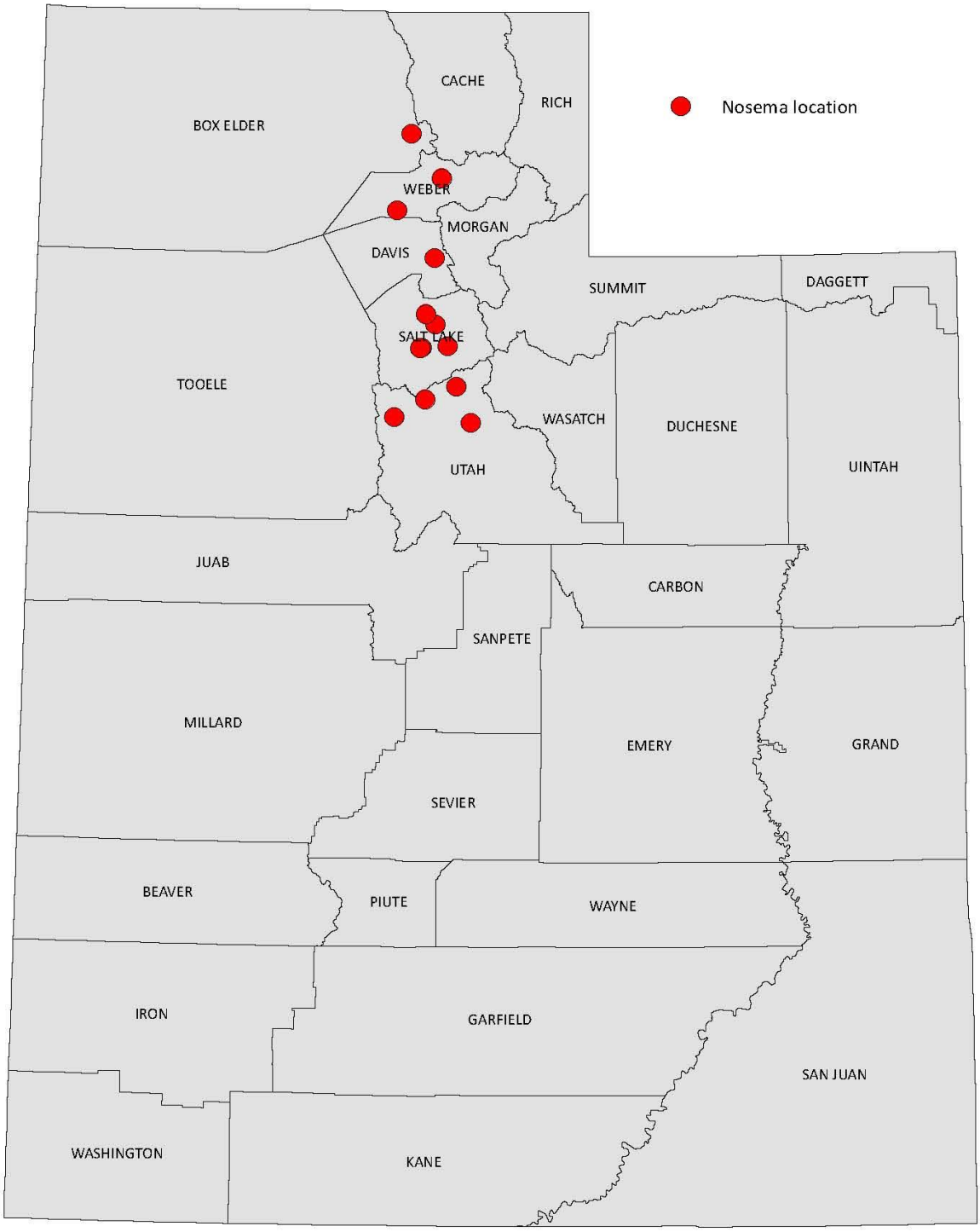

Nosema Spore Prevalence Within and Outside
4 Mile Orchard Buffers
Prevelance % of Colonies Tested
70
60
50
40
30
20
10
0
Within Buffer (n=55)
Outside Buffer (n=37)


Nosema Spore Count Prevalence
Within and Outside
4 Mile Orchard Buffers
Prevalence %
90
80
70
60
50
40
30
20
10
0
Within Buffer (n=55)
Outside Buffer (n=37)
Nosema prevalence within Buffer, > 1 mil spores (% of hives tested)
Nosema prevalence within Buffer, <1 mil spores (% of hives tested)
Nosema prevalence within Buffer, no spores counted (% of hives tested)

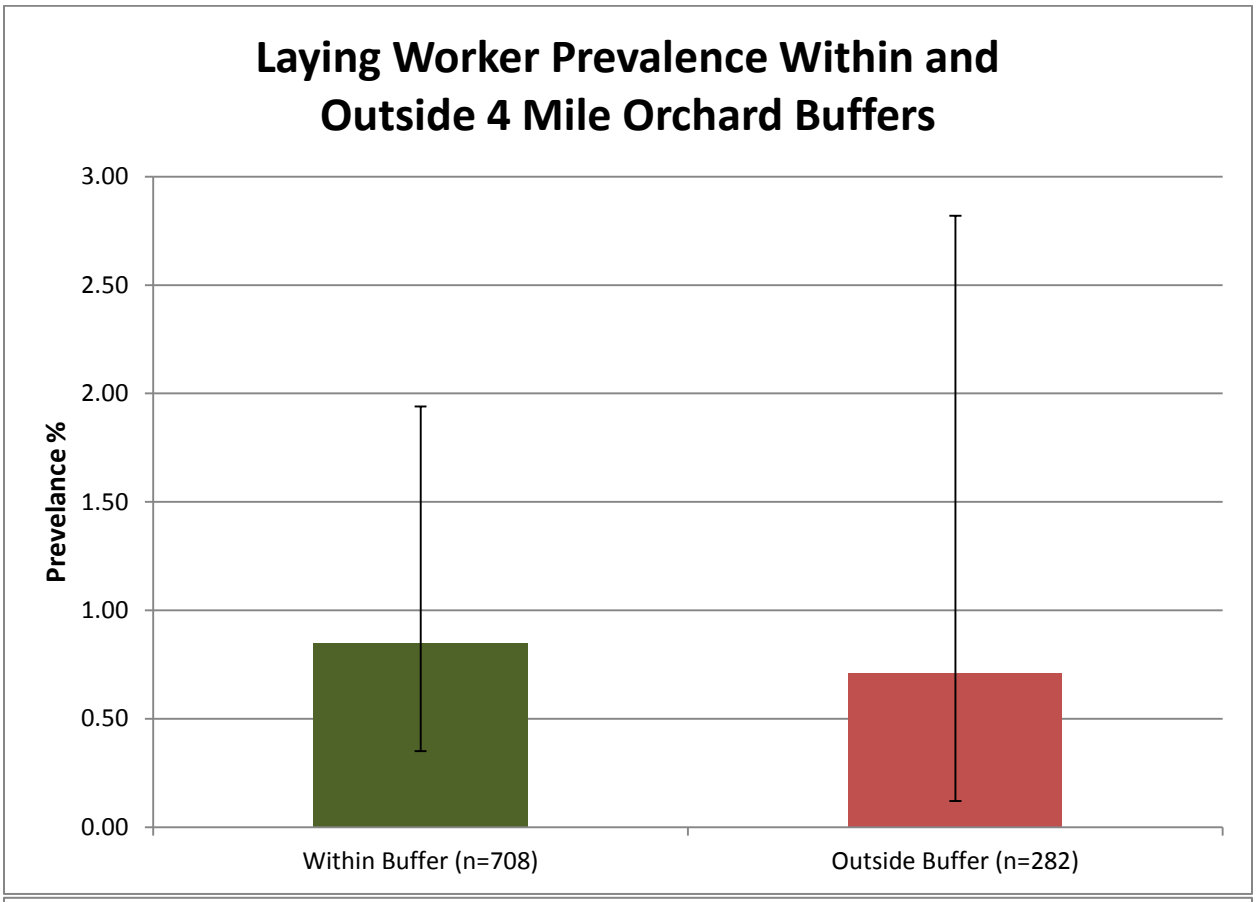

Nosema Spore Count Prevalence
Within and Outside
4 Mile Orchard Buffers
Prevalence %
100
90
80
70
60
50
40
30
20
10
0
Within Buffer (n=55)
Outside Buffer (n=37)
Nosema prevalence, >1 mil spores
Nosema prevalence, <1 mil spores

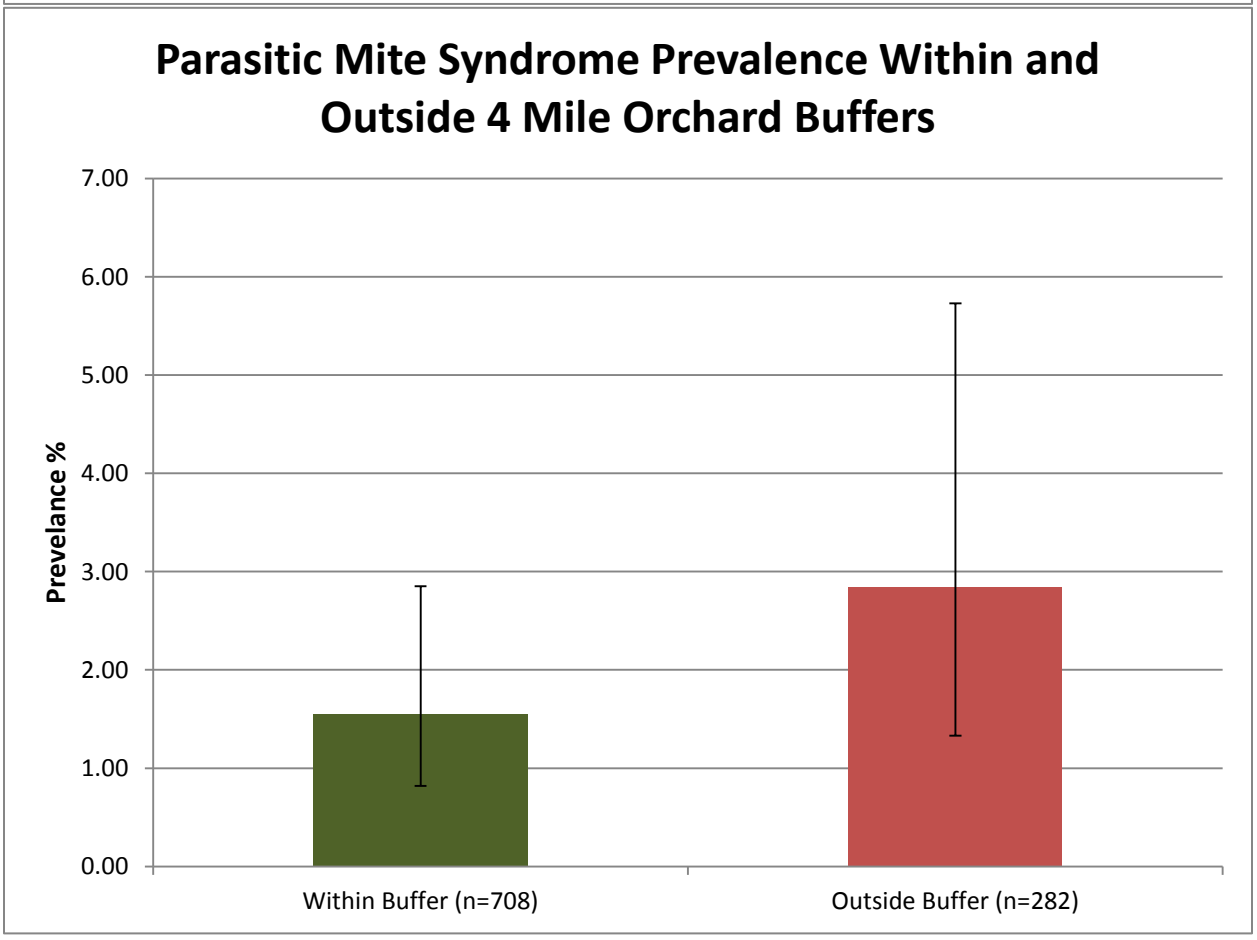

Chalkbrood Prevalence Within and Outside
4 Mile Orchard Buffers
Prevelance %
2.50
2.00
1.50
1.00
0.50
0.00
Within Buffer (n=708)
Outside Buffer (n=282)

Nosema Cases in Utah 2014

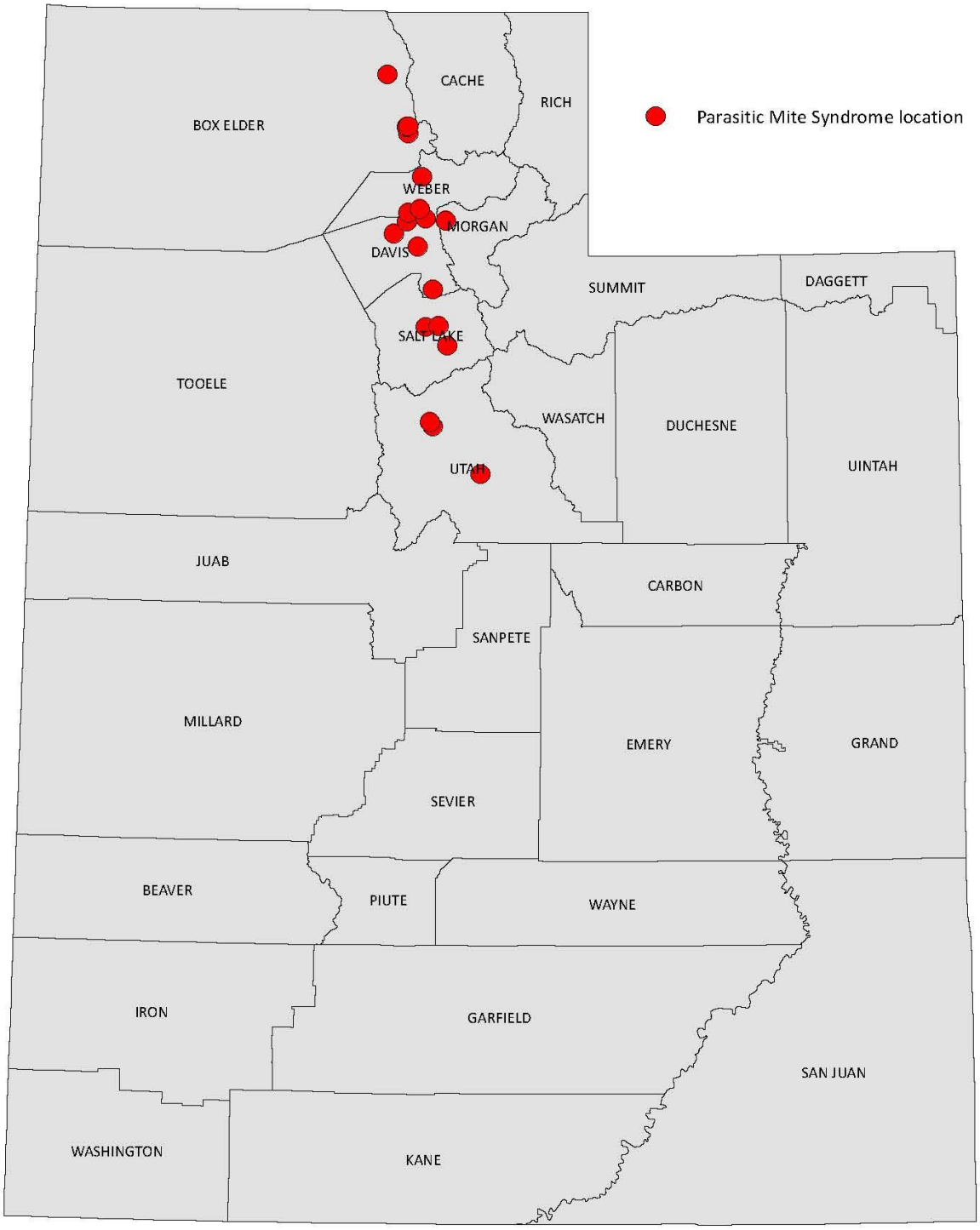


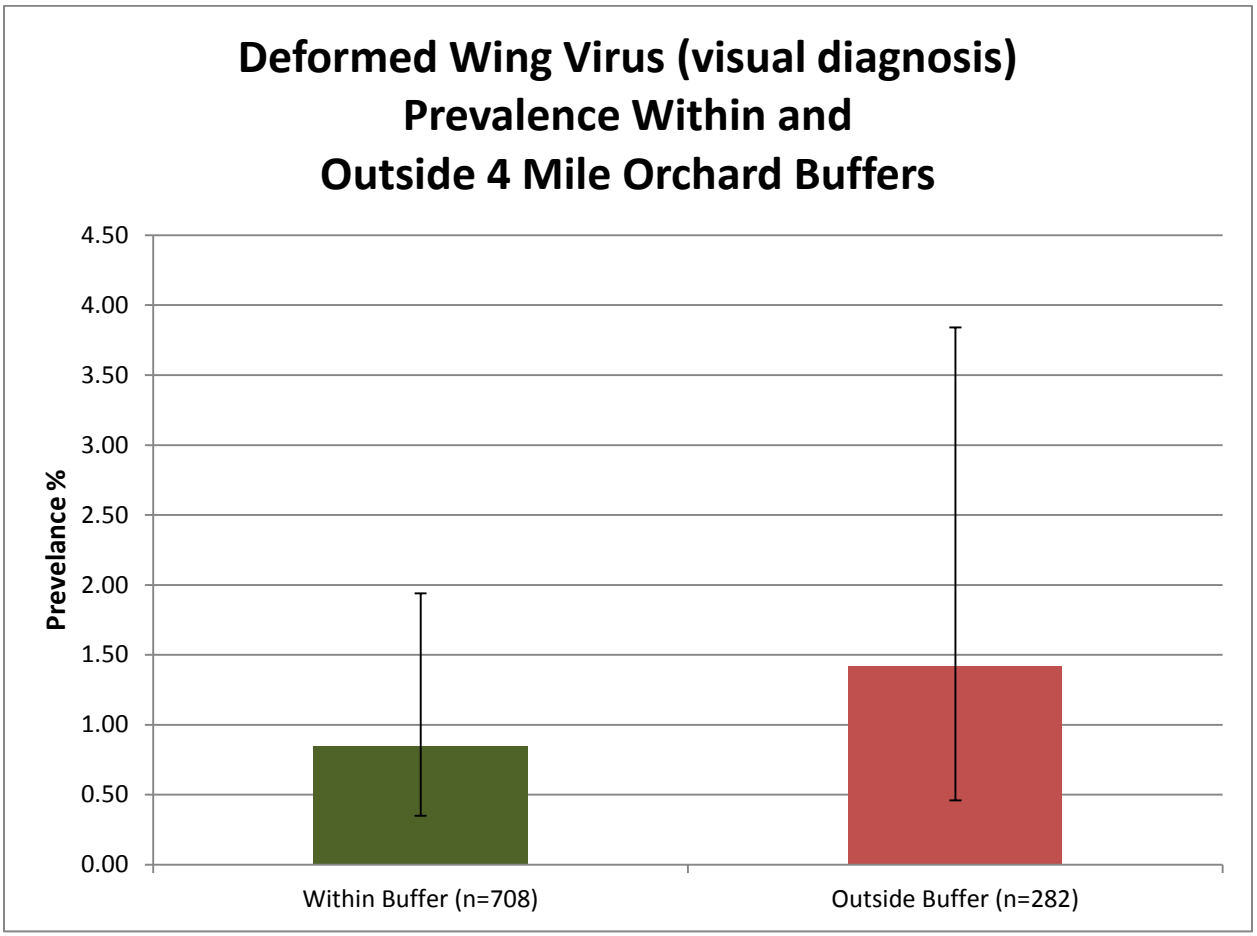
Chalkbrood Cases in Utah 2014

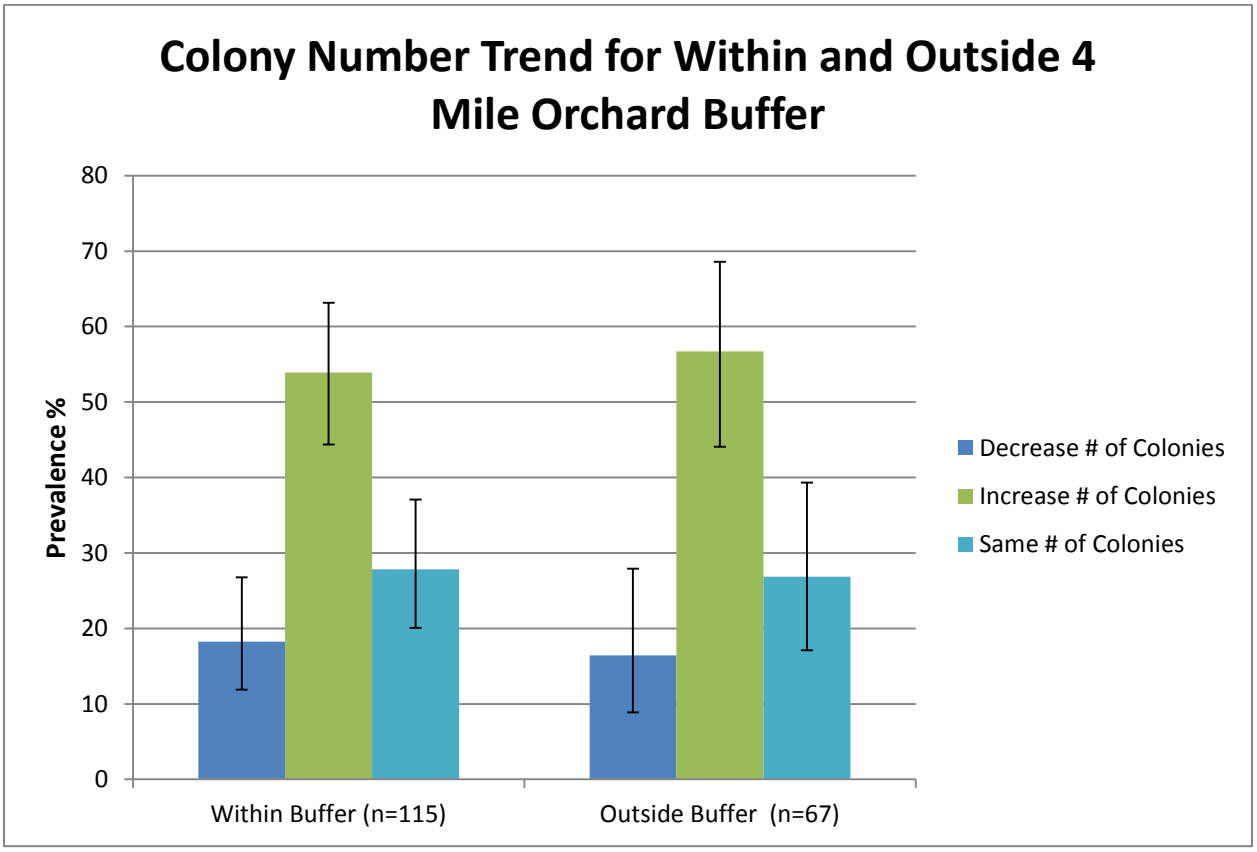

Laying Worker Prevalence Within and Outside 4 Mile Orchard Buffers
Prevelance %
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Within Buffer (n=708)
Outside Buffer (n=282)

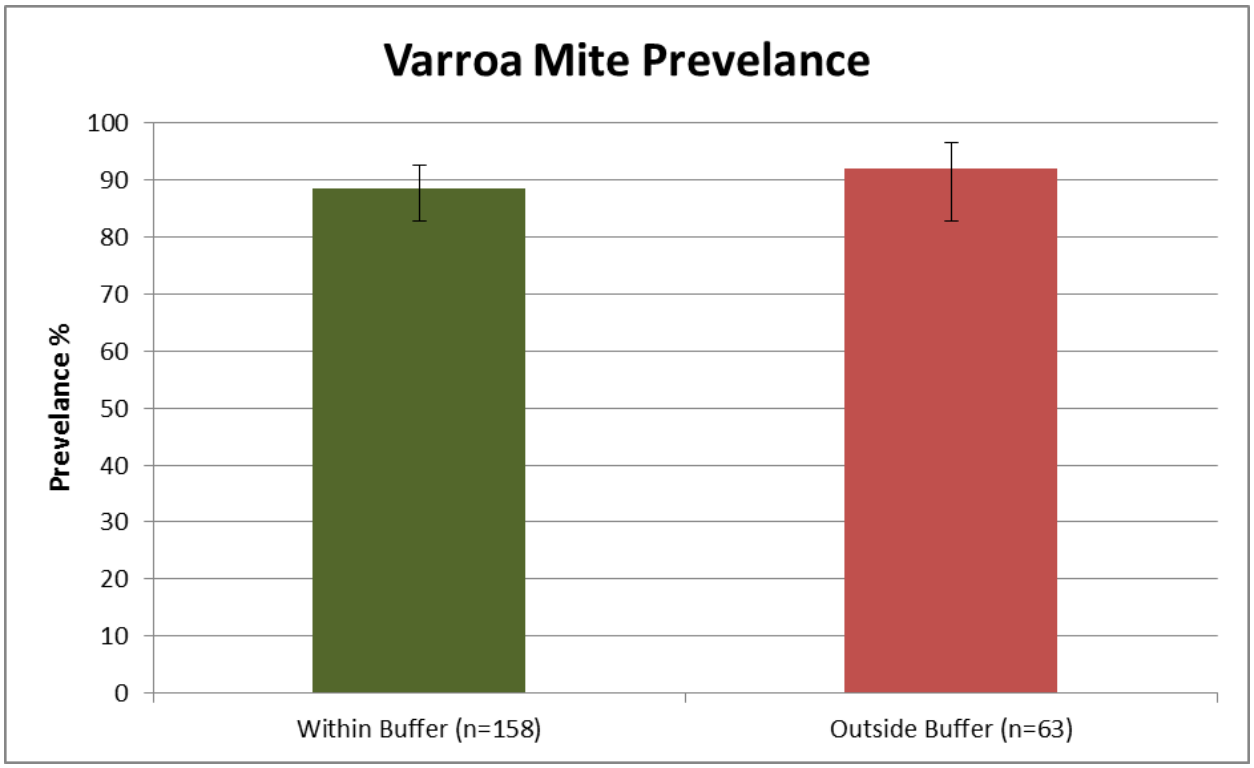

Parasitic Mite Syndrome Prevalence Within and Outside 4 Mile Orchard Buffers
Prevelance %
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Within Buffer (n=708)
Outside Buffer (n=282)

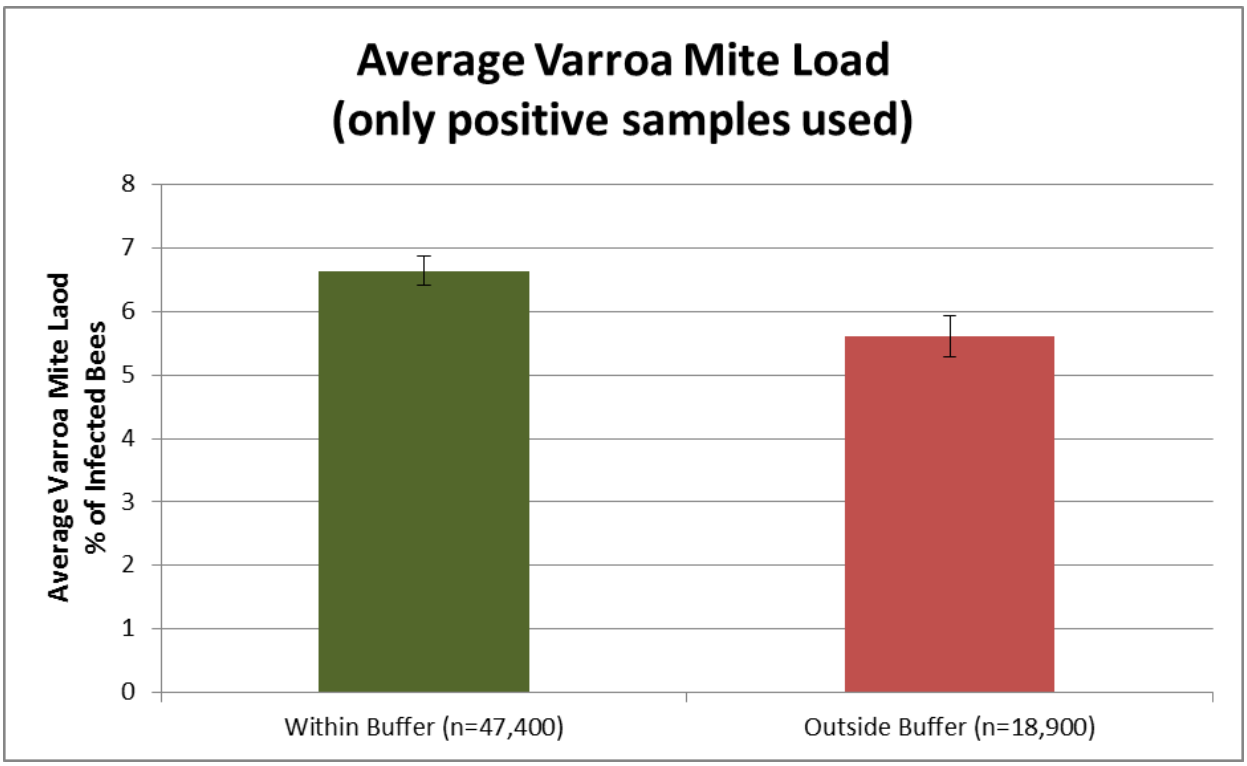
Parasitic Mite Syndrome Cases in Utah 2014



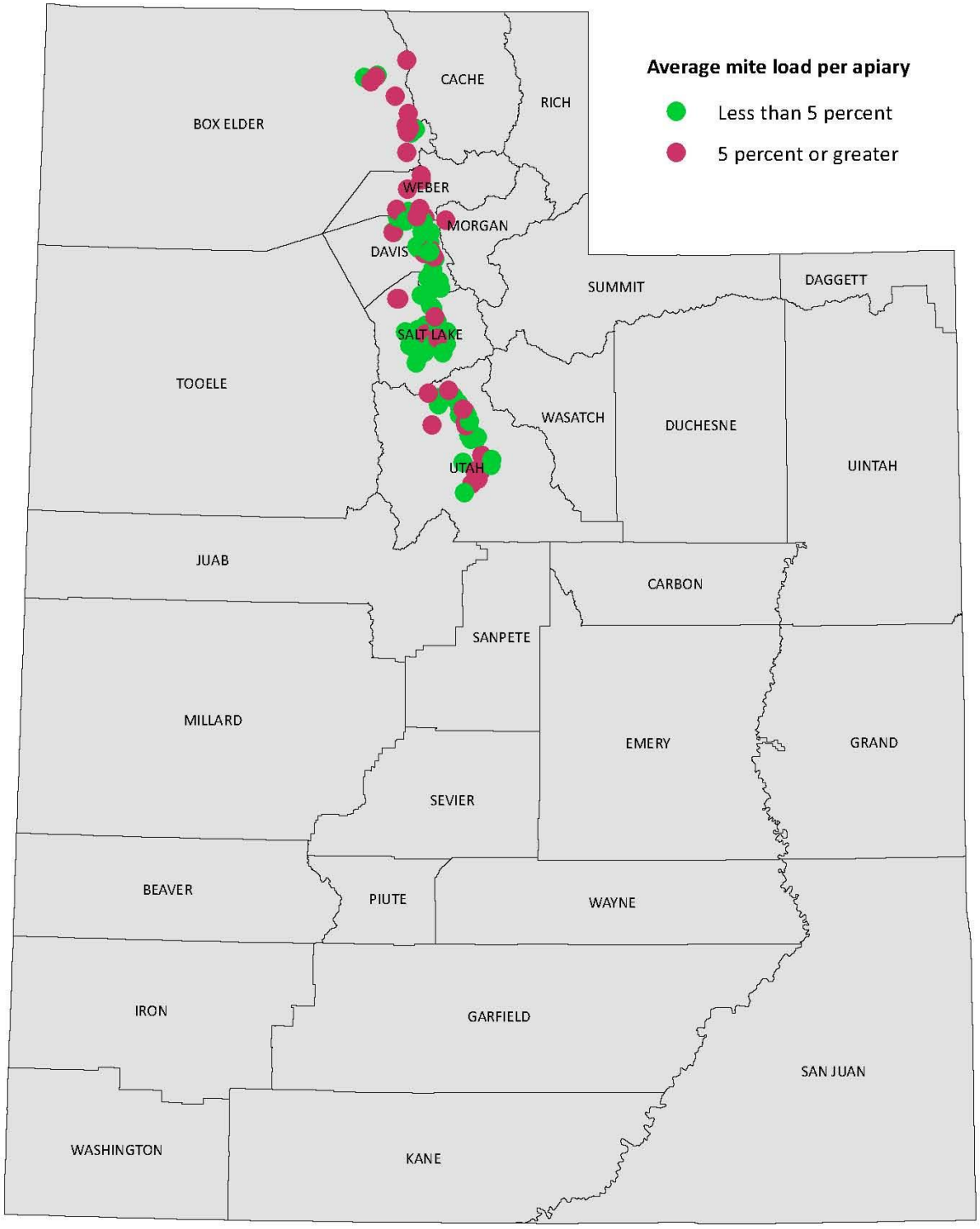

Deformed Wing Virus (visual diagnosis) Prevalence Within and Outside 4 Mile Orchard Buffers
Prevelance %
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Within Buffer (n=708)
Outside Buffer (n=282)


Colony Number Trend for Within and Outside 4 Mile Orchard Buffer
Prevalence %
80
70
60
50
40
30
20
10
0
Within Buffer (n=115)
Outside Buffer (n=67)
Decrease # of Colonies
Increase # of Colonies
Same # of Colonies


Varroa Mite Prevelance
Prevelance %
100
90
80
70
60
50
40
30
20
10
0
Within Buffer (n=158)
Outside Buffer (n=63)


Average Varroa Mite Load
(only positive samples used)
Average Varroa Mite Laod
% of Infected Bees
8
7
6
5
4
3
2
1
0
Within Buffer (n=47,400)
Outside Buffer (n=18,900)

Varroa Mite Cases in Utah 2014



Citations:

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