

**AGRICULTURAL RESEARCH FOUNDATION  
FINAL REPORT  
FUNDING CYCLE 2014 – 2016**

**TITLE:** Evaluation of an Alternative Pollinator for Oregon Blueberries

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**COOPERATORS:** Growers in the Willamette Valley

**SUMMARY:**

Blueberry crops are vital to the economy of Oregon. For ensuring high yields and good quality of berries, pollination by bees is critical. Growers rent 2-5 honey bee hives per acre but honey bees are believed to be less efficient than native bees as pollinators of blueberries as they do not like to forage when it is cold and windy, conditions that prevail when blueberries are in bloom in western Oregon. In addition, honey bees do not buzz pollinate, a process that facilitates pollination in blueberries. Hence, our goal was to identify an alternative pollinator for Oregon blueberries. One bee species, the 'blueberry bee' is considered a specialist of blueberries for pollination. The species has been reported from SW Oregon but not the Willamette Valley. If detected, it can be developed as an alternative pollinator for this crop, besides other bees such as bumble bees. In studies conducted in 2015, trap nests were set up at various locations in blueberry fields. However, mason bees, which are related to the blueberry bee, were recorded but the targeted blueberry bee was not detected in any trap nest. In a second study, visual observations were made of bees foraging on blueberry flowers in each of 12 fields in 2014 and 2015. In all fields, in both years, the greatest numbers of foragers were honey bees. A few bumble bees were recorded but mason bees and blueberry bees were not observed. Thus, the study suggests that the blueberry bee is likely not adapted to conditions in the Willamette Valley and hence cannot serve as an alternative pollinator to honey bees. Meanwhile, in a separate study funded by a different grant, we recorded considerable blueberry pollen on the bodies of honey bee foragers collected from Oregon blueberry fields. This suggests that, contrary to what researchers believe, honey bees do contribute extensively to pollination of this crop. Thus, an alternative pollinator is not needed for Oregon blueberry pollination. However, honey bee health needs to be promoted to ensure that Oregon blueberry growers continue to achieve high yields.

**OBJECTIVES:**

*Osmia ribifloris*, called the blueberry bee in western USA, is present in SW Oregon. This bee species is normally found in dry semi-mountainous habitat where it pollinates manzanita, which is related to blueberry and has a similar flower shape. The blueberry bee is considered a specialist of blueberries for pollination. Hence, our objective was to determine if we could detect its presence in Oregon blueberry fields to develop it as an alternative pollinator for blueberry pollination due to declines in honey bees.

## **PROCEDURES:**

Trap nests: The blueberry bee and other related solitary bees nest in cavities. For determining the presence of the blueberry bee in the Willamette Valley, trap nests were set up in spring 2015. Typically, trap nests are used to detect the presence of cavity nesting bees such as the blueberry bees, blue orchard bees and leafcutter bees. These bees vary in the materials such as mud, leaves, etc. from which they build their nest cells.

In this study, for the trap nests, we used Phragmite reeds of varying diameters to attract a range of different bee species. Reeds were placed in tube shelters on 11 farms; 9 farms had 4 shelters containing 12-15 nests each, while on 2 farms there were 6 shelters. Shelters were set up from the beginning of blueberry bloom to midsummer for detection of cavity nesting bees whose activity period coincided with and extended beyond blueberry bloom. These later bees are likely to over-winter as pre-pupae. *Osmia* species over-winter as adults inside their cocoons. The cocoons were maintained over the winter for emergence of adults.

Foragers: In 2014, 12 blueberry fields were monitored during bloom for examination of all bees foraging on the crop. Visual observations were made of bees on flowers during visits to each field made once per week for three weeks during April-May. Bee foragers were monitored during 10 minute periods while walking along rows of blueberry bushes at 4 locations in each field. Only bees that were visiting flowers for pollen were collected. These foraging bee observations were repeated in 2015.

## **SIGNIFICANT ACCOMPLISHMENTS:**

Trap nests: We used the characteristics of the nest construction material, the presence of cocoons or pre-pupae, and the cocoon shape, to make our initial identification of the nest inhabitants. Unlike most other mason bees, the western blueberry bee uses leaf pieces to form the partitions.

Most of the nests produced in 2015 were likely those of the blue orchard bee (*Osmia lignaria*) (Table 1). Many of these *O. lignaria* nests came from a farm where experiments have been run examining their efficiency in pollinating blackberries and raspberries. There were seven nests with pre-pupae, so these are non-*Osmia* bees.

We did not find any nests that could potentially be the blueberry bee. Two nests produced bees that were probably some other *Osmia* species. After spring (2016) emergence of all the bees we will identify them to species.

Foragers. In both 2014 and 2015, the greatest numbers of foragers on blueberry flowers were honey bees (Figure 2). A few native bees including bumble bees were recorded but these did not include the blueberry bee.

Table 1

Number of Farms with nesting bees	6
Number of nests used by bees	26
Number of total cocoons	73
Initial Identification of nest occupants by nest	# Nests
<i>Osmia lignaria</i>	9
Small cocoons but probably <i>O. lignaria</i>	6
Megachilids overwintering as pre-pupae, used mud partitions	7
non-BOB cocoons, used mud partitions	2
Potential <i>O. ribifloris</i> cocoons	0
All larvae dead/diseased	2

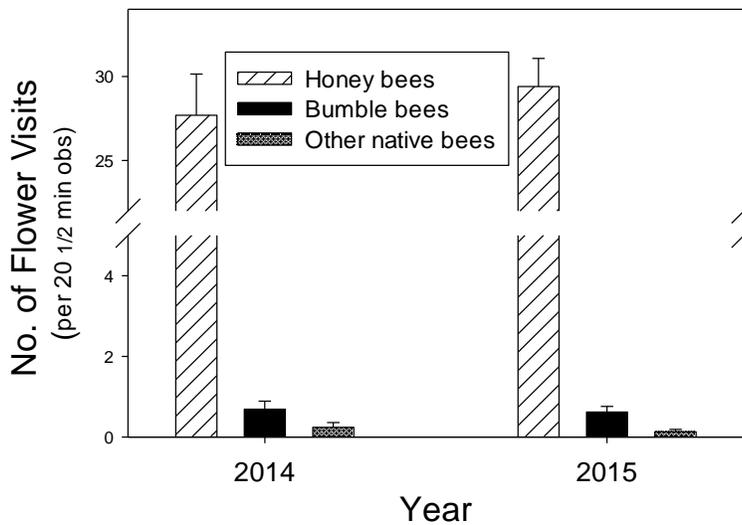


Figure 2. Number of flower visits on blueberry flowers by various bee species.

Based on our two year study, the blueberry bee does not forage on blueberry flowers in the Willamette Valley and hence this species cannot serve as an alternative pollinator to the honey bee. The blue orchard bee, *O. lignaria*, is also unlikely to be a good pollinator of blueberries because of its large size relative the opening of the flower, and the manner in which it collects pollen. This was confirmed by examining unused nectar and pollen provisions in *O. lignaria* nests. Of the 13 provisions we examined for the presence of blueberry pollen 10 contained no blueberry pollen. Of the three provisions that did, the percent blueberry pollen was, 0.64, 2.21, and 98.7. Bumble bees do forage on blueberry flowers but their numbers are low compared with honey bees.

Thus, the two year study showed that no alternative bee is available for blueberry pollination in the Willamette Valley. However, honey bees actively forage on the crop and collect pollen on various body parts. Hence, they are excellent pollinators of blueberries in western Oregon and no alternative pollinator is currently needed.

### **Presentations:**

Hoffman, G. and Rao, S. 2015. Project integrate crop pollination in Oregon blueberries.

Proceedings 74<sup>th</sup> Annual PNW Insect Management Conference, Portland OR, pp 27-28.

Hoffman, G. and Rao, S. 2016. Pollination limitation in Oregon blueberries. Proceedings 75<sup>th</sup> Annual PNW Insect Management Conference, Portland OR, pp 35-36.

### **Workshop for blueberry growers:**

Bee Aware: Pollinator Protection in Ornamental and Blueberry Systems, October 29, 2015.

North Willamette Research and Extension Center, Aurora, OR; 50 attendees.

### **BENEFITS & IMPACT:**

The study showed that honey bees are the dominant forager in blueberry fields in western Oregon. While they do not buzz pollinate, in a related study we recorded considerable blueberry pollen on the bodies of honey bee foragers in Oregon blueberry fields. This suggests that, contrary to what researchers believe, honey bees contribute extensively to pollination of this crop. Thus, an alternative pollinator is not needed for Oregon blueberry pollination, but it is critical that honey bee health is promoted to ensure growers are able to continue to achieve high berry yield.

### **ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM:**

The following funding was received for related projects:

1. USDA-NIFA: \$337,195 for developing sustainable pollination strategies for blueberries.
2. ODA: \$ 90,670 for evaluating impacts on honey bees and bumble bees of pesticides used on blueberries.

### **FUTURE FUNDING POSSIBILITIES:**

Our recent research has documented that while honey bees are considered to be inefficient as pollinators of blueberry as they do not buzz pollinate, they are able to pollinate by collecting pollen on various body parts. Hence future funding will be focused on increasing pollination by honey bees rather than develop an alternative pollinator for Oregon blueberries. We are seeking funding from the Oregon Blueberry Commission for a study entitled: Honey bee pollination behavior and effectiveness in relation to blueberry variety flower shape.