POLLINATION LIMITATION IN OREGON BLUEBERRIES

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Last year we introduced Project Integrated Crop Pollination (ICP), a Small Crop Research Intuitive grant involving multiple scientists across the United States and B.C., Canada. The fruit crops ranged from apples and blueberries in MI, pumpkins in PA, blueberries and watermelon in FL, to almonds and melons in CA. At Oregon State University we are focused on blueberries.

We are involved in three of the Project ICP research objectives: 1) pollinator contributions to yield; 2) the impact of enhanced floral resources for pollinators; and 3) economics and modeling. Today I will be talking about objective 1; focusing on pollination limitation and the contribution of honey bees and native bees to blueberry pollination. This work is taking place on 12 blueberry farms in the central part of the Willamette Valley.

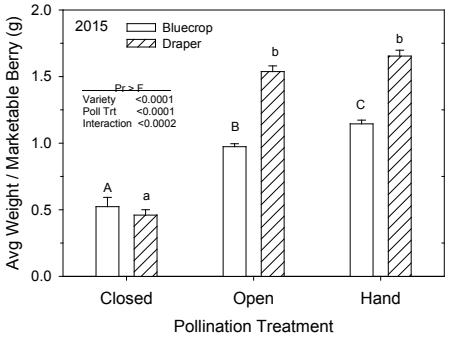
Pollination limitation describes the reduction in fruit weight (and the number seeds) in flowers that have received less than the optimal number of pollinator visits / pollen transfer. Honey bees are stocked at the rate 2-4 hives per acre in blueberries, and we want to know if their pollination services, and those of native pollinators, are adequate for maximum yield. We examined these questions by having three pollination treatments on each test plant: 1) Closed- flower clusters enclosed in a mesh bag prior to flower opening; 2) Open- flowers open to insect pollinators; and 3) Hand- open plus hand pollinated. In the the Hand pollination treatment flowers have additional pollen placed on the stigma (female part) 2 or 3 times during the bloom period. This is done with a tiny paint brush dipped in blueberry pollen. The latter two treatments are bagged after all the flowers drop.

In this talk we present our analysis of the pollination limitation studies in 2014 and 2015. We applied each treatment on ten plants at each of 0, 25, 50 and 100 m distances into the field from a natural vegetation edge. Native bees often utilized natural vegetation adjacent to production fields for nesting sites and food resources, and are likely to be visiting blueberry flowers near the field edge. We documented the visitation of all pollinators at each distance several times throughout blueberry bloom.

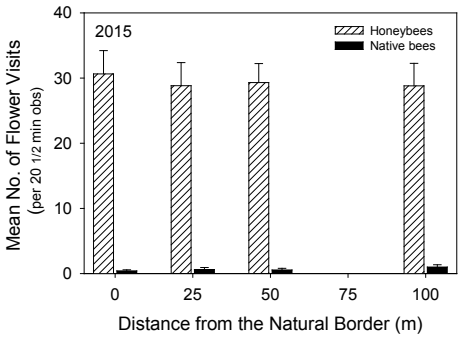
We will focus on differences among blueberry varieties (Bluecrop and Draper), distance from the field edge, and the three pollination treatments. The variables of interest are the percent of berries that are of marketable size, the average weight of those berries, and the number of seeds per fruit (both mature and immature). The number of seeds has a direct influence on the size of the blueberry fruit.

Selected 2014 and 2015 Results. We will start by saying there was no distance effect for any of our variables.

In 2014 and 2015 we found significant differences between varieties and among the pollination treatments, and their interaction, for the percent of marketable-size berries. There were about three times more marketable berries in the Open and Hand pollinated treatment than the Closed. Draper was more sensitive to lack of pollinators than Bluecrop. i.e., Bluecrop self-pollinated more readily in the Closed treatment. Those berries that were produced in the Closed treatment were of barely marketable size. In 2014, Closed treatment berries were less than half the weight of the Open and Hand treatments. In 2015, Bluecrop berries in the Closed treatment were again less than half the size of the Open treatment, while the Draper was approximately one-third the weight of the other two treatments. Berries in the Hand pollinated treatment were always larger than in the Open treatment, but only in 2015 for Bluecrop were those differences significantly different (Figure 1).



The number of mature seeds per berry was influenced by variety in 2014, with more seeds in the Bluecrop fruits across all pollination treatments. Pollination treatment was significant in 2014 and 2015. There were from 4 to 8 times more mature seeds in the Open and Hand Pollination treatments compared to the Closed treatment. In 2014 there were significantly more mature seeds in the Hand versus Open treatment for both varieties, while in 2015 there were only more mature seeds in the Hand pollination treatment for Bluecrop.



What potentially accounts for these patterns? In both 2014 and 2015 there were 45-50 times more honey bee visits to blueberry flowers than visits by native pollinators. The number of honey bee visits from 0 m (field edge) to 100 m was the same (Figure 2). These visit numbers were equivalent to approximately 240 honey bee visits per plant per hour in the afternoon, and these rates appeared to be sufficient to produce close to the potential maximum berry size.

In both 2014 and 2015 there was a less impact of the variety and pollination treatments on berry weight compared to seed number. This can be explained by looking at the relationship between seed number and berry weight. Figure 3 shows that for Bluecrop in 2015, as mature seed number increased so does berry weight, up to around 40 mature seeds per fruit. Above 40 seeds there is no further increase in fruit weight. A similar relationship holds for Draper. For Bluecrop the number of immature seeds was also important in determining berry weight. So after a point, more bee visits results in more mature seeds, but not larger fruits. Also note the large "unexplained" variability in berry weight.