PROJECT INTEGRATE CROP POLLINATION IN OREGON BLUEBERRIES

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Introducing Project ICP: The Rao lab at Oregon State University is part of a large Small Crop Research Intuitive grant on Integrated Crop Pollination. This involves multiple scientists across the United States and B.C., Canada, and crops ranging from apples and blueberries in MI, pumpkins in PA, blueberries and watermelon in FL, and almonds and melons in CA. At Oregon State University we are focused on blueberries.

There are six objectives that are part of the SCRI project; four are focused on research, and two on outreach and information dissemination. We are involved in three of the research objectives: 1) pollinator contributions to yield, 2) the impact of enhanced floral resources for pollinators, and 3) economics and modeling. We are working on 12 blueberry farms in the central part of the Willamette Valley to address these questions.

The primary component of the first objective is determining if blueberry yields are pollination limited, i.e., would yields be higher if each flower had received more bee visits. Honeybees are stocked at the rate 2-3 hives per acre, and we want to know if their pollination services, and those of native pollinators, are adequate for full yield. We are particularly interested in whether native bees are playing a significant pollination role in blueberries. We examined these questions by having three pollination treatments on each test plant: 1) Closed- clusters enclosed in a mesh bag, 2) Open- open to insect pollinators, and 3) Hand- open plus hand pollinated. In the Closed pollination treatment flower clusters are bagged to exclude pollinators just before the flowers open. The Open pollinated flowers are exposed to pollinators. 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 the all the flowers petals (corolla) drop.

We applied each treatment on ten plants at each of at 0, 25, 50 and 100 m distances into the field from a natural vegetation edge. Native bees 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 are also interested in how several landscape features may influence pollination services by honeybees and native bees. These are: the intensity of management activities within and adjacent to the blueberry fields, e.g., mowing frequency; fungicide, herbicide, and pesticide use; nearby crops; and nesting and flowering resources within a 2 km range of each field. The second primary objective is to examine whether flower resources (flower enhancements adjacent to

fields) will increase abundance of native bees and reduce any identified pollination deficits. We will not address these Project ICP components during this talk.

Initial Results: In this talk we will present our initial analysis of the pollination limitation study we ran on 12 farms in 2014. We will focus on differences among blueberry varieties (Bluecrop and Draper), and the three pollination treatments. We will address the Distance variable at a later time.

The first question is whether there are differences in the proportion of berries in the mature, intermediate and immature categories. We found significant differences between varieties and among the pollination treatments, and their interaction, for the percent of mature (marketable berries). Over both varieties Open and Hand treatments were higher than the Closed, but not from each other. The interaction term documented that percent mature berries was higher for Draper than Bluecrop in the Open and Hand treatments, but lower for Draper in the Closed.

Only the variety and pollination treatment affected the number of intermediate berries (marketable size but not ripe). There were more Bluecrop in this category in all three pollination treatments. The Open treatment had a greater percent intermediate berries than Closed or Hand. Only the pollination treatment affected the percentage of immature berries, the Closed treatment had around 3 times more immature berries than the Open and Hand treatments.

The Hand pollination treatment always showed the effect of the addition of extra pollen by having a higher mean percent mature berries, and fewer intermediate and immature berries, than the Open treatment; however the differences were generally not significant.

We also examined the average weight of the berries. Draper is known to have a larger berry, which showed up in our analysis, so that is not of much interest. We will focus on pollination treatment effects and their interaction with variety. For this analysis we combined the mature and intermediate berry categories. Draper berries were heavier than Bluecrop in the Open and Hand treatment, but not the Closed. The Open and Hand treatments were about 2.5 times heavier than the Closed. Over both varieties the Hand pollinated treatment was 6% heavier than the Open treatment, showing the benefit of the additional pollen deposition with our paint brushes.

These experiments will be repeated in 2015.

Conclusions:

1) Blueberries do require outcrossing pollination by insects in order to achieve marketable fruit. Draper is particularly is sensitive to self-fertilization, typically not producing even a tiny berry in the Closed treatment.
2) There is some evidence of pollination limitation in blueberries in Oregon. The mean percent of berries in the Mature category was higher in the Hand pollination treatment, although this was not significant. The higher weight of the berries in the Hand treatment was significant. These difference may have been greater if we were able to hand pollenate each flower 3 times (as planned), rather than just two.