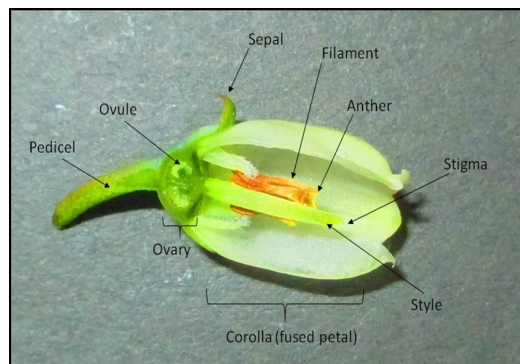


Highbush Blueberry Pollination in the Pacific Northwest



What is Pollination?

- Pollination is the movement or transfer of pollen from male to female reproductive organs (i.e., pollen-bearing anthers to the stigma) of plants.
- Pollination enables fertilization to take place and is required for good berry development and size.

What is Fertilization?

- Fertilization is the union of gametes and is required for seed development.
- The ovule contains the female gamete, while pollen contains and releases the male gamete.
- Pollen grains must germinate and grow down the style to the ovule for fertilization to occur.

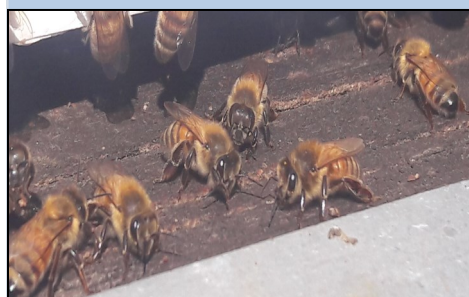
What About Northwest

Pollination?

- Blueberry is an economically important crop in the USA and in the Pacific Northwest (PNW).
- Pollination can be chronically low in some important growing regions.

What leads to poor pollination?

Honey bee (*Apis mellifera ligustica*) is the primary commercial pollinator in PNW blueberry. The foraging activity of honey bee is reduced at temperatures below 65°F, in moderate winds (>12 mph), and with precipitation (Woyke et al., 2003). The bloom time of highbush blueberry in the PNW often coincides with the described weather conditions that limit honey bee activity. The bloom period of many commercially important cultivars is also relatively short and sometimes lasts only 5-12 days (Dogterom et al., 2000). Additionally, honey bees have a short [relative to bumble bees (*Bombus* sp.)] average tongue length (approximately 6.5 mm), further constraining foraging in flowers with long corolla tubes (Balfour et al., 2013).



By: Weixin Gan, Matthew Arrington and Lisa DeVetter (lisa.devetter@wsu.edu)*.

*Corresponding author.

Department of Horticulture, Washington State University
Northwestern Washington Research and Extension Center,
Mount Vernon, WA; November 2017

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What is the recommended honey bee hive density in highbush blueberry ?

- The traditional recommendation for 'Duke' highbush blueberry in the PNW is 3-4 hives/acre placed in fields at 10-15% full bloom.
- Commercial honey bee hives have typically been stocked with *Apis mellifera ligustica*, but with increasing regional honey bee diversity, this is not always be true.
- Pollination efficacy can be estimated by counting the number of bees/bush/minute, being careful to only count "legitimate" visits, or visits where pollination is taking place.
- In other production regions, 4-6 bees/bush/minute during the warmest part of the day is needed for optimum pollination. This is the recommendation for Michigan and was generated by Dr. Rufus Isaacs's program. Please check his website: <http://www.isaacslab.ent.msu.edu/>.
- Studies in Washington showed increasing honey bee hive densities to 8 hives/acre led to larger berry size and increased yields in 'Duke' (Arrington and DeVetter, 2018).
- Yield improvements from increased hive densities resulted in an estimated **\$360 net gain/acre** in 'Duke'.
- Increased honey bee stocking densities may provide additional pollinators during years when weather is not conducive for their foraging. Further trials in other commercially important cultivars are pending.



What other production aspects may improve pollination and fruit set in highbush blueberry in the PNW?

Pollinator Timing

Hive boxes are typically stocked between 10% and 15% full bloom. Hives are left in the field through bloom until petal fall.



Hive Distribution

Traditionally, hives have been placed in a common location where they would warm quickly in the morning. However, preliminary research suggests there may be a benefit to dispersing hives more evenly throughout a planting.

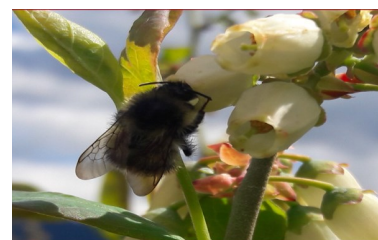


Native Pollinators

Bumble bees (*Bombus* sp.) are a native pollinator of blueberry and are more adapted to effectively pollinate blueberry compared to honey bees. There is presently no-to-very-limited commercial supply of native bumble bees in the PNW, but non-natives are used in other production regions. Promoting populations of bumble bees and other native pollinators may promote blueberry pollination.

Future Directions

Pollination remains an important component for efficient and profitable production. Exploring the effectiveness of honey bee attractants and benefits of hive placement and modified densities will help future data-driven recommendations on promoting pollination and yields in PNW blueberry.



Reference:

1. Dogterom, M.H., M.L. Winston, and A. Mukai. 2000. Effect of pollen load size and source (self, outcross) on seed and fruit production in highbush blueberry cv. 'Bluecrop' (*Vaccinium corymbosum*; Ericaceae). *American Journal of Botany* 87:1584-1591.
2. Arrington, M.A. and DeVetter, L.W. 2018. Increasing honey bee hive densities promotes pollination and yield components of highbush blueberry in western Washington. *HortScience*. *In Review*.
3. Delaplane, K.S., D.R. Mayer, and D.F. Mayer. 2000. *Crop pollination by bees*. CABI. Wallingford, UK: CAB International.
4. Balfour, N.J., M. Garbuzov, and F.L. Ratnieks. 2013. Longer tongues and swifter handling: why do more bumble bees (*Bombus* spp.) than honey bees (*Apis mellifera*) forage on lavender (*Lavandula* spp.)? *Ecol. Entomol.* 38(4):323-329.