Bee Pollination in Vermont Northern Highbush Blueberries

Updated on April 29, 2022 by Laura Johnson, Pollinator Support Specialist

Blueberry pollination basics:

Northern highbush blueberry (*Vaccinium corymbosum*) is an economically important crop in Vermont. The flower is uniquely shaped, hangs downward, and has a tubular corolla. The flower contains the anthers and has a small opening from where the stigma extends. Bushes can produce berries when there is limited or no pollen transfer by bees, however, those berries will be small, ripening will be delayed, early fruit drop may result, and most berries would not meet market standard quality. Blueberry pollen is relatively heavy and does not move by wind, making insect mediated pollination essential for marketable fruit quality and yield. Blueberry flowers should be pollinated within the first 3 days of opening for successful fruit set and are unlikely to turn into fruit after 5-6 days[1]. Pollen receptivity changes with high temperatures. If temperatures are in the high 70s°F and 80s°F, pollination receptivity may be reduced to 1-2 days. At temperatures above 95°F, pollen germination and growth are further restricted, and fertilization of the ovary may not occur. General queues of successful pollination are flower drop, leading to a white carpet under bushes. Dull, brown flowers on the bush can be an indicator of poor pollination[2].

Bumblebee on a Blueberry Blossom. Image credit: Bre LaRow, Flickr Creative Commons

Cultivar considerations and pollinator needs:

Northern highbush blueberries are generally self-compatible, meaning they can be fertilized by pollen from the same cultivar and be productive. Additionally, some varieties benefit significantly from cross-pollination across cultivars by increasing fruit yield and quality[3]. Different cultivars have differing needs with regards to cross-pollination effectiveness and optimal marketable yield, from low, intermediate, and high dependence. Those cultivars with intermediate and high dependence will likely benefit from greater bee abundance and diversity to ensure effective cross pollination and optimal harvests.

Pollination by bees:

The required number of flower visits for successful insect mediated pollination depends on the specie of pollinator and their foraging behavior. Most Vermont blueberries are pollinated by wild bumble bees (*Bombus spp*). Bumble bees are an example of buzz pollinators, along with mining bees (*Andrena spp*) and sweat bees (*Halictid spp*), who are other significant pollinators of blueberries in Vermont[4]. These

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This material is based upon work supported by USDA/NIFA under Award Number 2021-70027-34693.

species vibrate their wing muscles to release pollen from the anthers of certain plants like blueberries, creating a loud "buzz." Buzz pollination efficiently stimulates pollen grains to fall out of a pair of pores at the blueberry flower's anther tip[3,5]. It takes one visit by a buzz pollinator or three visits by a non-buzz pollinating species, such as the honey bee, to pollinate a single flower that will produce marketable fruit. Buzz pollinators and other wild bees readily forage in diverse weather conditions, including adverse cool, damp, weather. Species diversity of wild populations may safeguard risk associated with potential annual fluctuations in insect abundance and activity that naturally occurs. This expected variability of wild pollinators may be further buffered with wild bee habitat. Habitat targeted for wild bees is insurance for successful pollination of your crop and cultivar yield expectations. Alternatively, buying in bumble bees to compliment wild bee pollination services is also possible.

Honey bees can be used for blueberry pollination and are widely utilized in commercial blueberry production across the country. However, certain challenges can be associated with honey bee pollination in northern highbush blueberries in Vermont. In the diversely vegetated landscape of Vermont and many parts of the northeast, honey bees tend to be attracted to flowers other than blueberry flowers. This is a result of honey bee anatomy, flower preference, and their tongue length, which makes it difficult to reach the nectar that is located deep inside northern highbush blueberry blooms. Blueberry flowers also have relatively low nectar rewards, which is a driver of honey bee foraging activity. In fact, honey bees (and carpenter bees) are known to rob flowers by cutting slits in sides of blueberry flowers and extract nectar without entering through the flower's true opening; therefore, avoiding contact with the pollen containing anthers and receptive stigma[6].

When a honey bee does enter through the true opening and comes in contact with a blueberry flower's reproductive parts, some pollen is indeed released with slight pressure to the anther. However, due to the required multiple flower visits as compared to buzz pollinators, it is arguable that honey bees may be considered less efficient on an individual basis for pollination services. Also, honey bee foraging activity is optimal in calm, warm weather and is limited and significantly reduced in windy (>12mph), damp weather, and at temperatures below 60°F[7].

<u>Bees in spring: emergence and pollinator activity considerations for pollination success:</u>

Predicting early spring bee activity for crop pollination services is difficult. Monitoring soil temperatures could be an important tool for predicting spring emergence since many bees that provide crop pollination services live in the ground. However, locations of bee nest are variable, and therefore the range of conditions are also. Temperatures in deep soil as compared to more shallow compost heaps, or direct sunshine to complete shade, will influence emergence and activity.

There are some key phenological events that can be used to queue bee emergence and activity regardless of other limitations for prediction. One rule of thumb for emergence timing of spring queen bumble bees is by noting the timing of earlier blooming plants. Queen bumble bees tend to come out at about the same time as flowering is observed in maples and willows. Note that this is a predictor of

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emergence and does not necessarily help to predict pollinator activity on a crop. Also, bumble bee sightings in the early spring does not mean they are yet actively foraging. Their first task is to find a new nest. Nest searching behavior is displayed by low flying, near the ground, back and forth. Signs of active foraging and pollination is indicated by the sight of bumble bees carrying pollen on their hind legs, which means they have found a nest and are actively foraging provisions for their colony.

Assessing pollinator activity in your crop can be aided with annual monitoring. Keep pollinator activity records. Record pollination strategies (e.g., pollinators used, habitat enhancements) and yield outcomes, ideally for each field or orchard and cultivar. Record weather conditions during crop bloom. If managed bees are used, monitor hive or colony strength and bee activity. Monitor crop bloom for pollinator visitation, including what types of bees are visiting the crop (e.g., honey bees, orchard mason bees, other wild bees, etc.). Annual monitoring can help grow your familiarity with your local pollinator populations.

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This material is based upon work supported by USDA/NIFA under Award Number 2021-70027-34693.