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Bee Conservation in Maine
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Introduction:

Without honey bees and bumblebees, many of Maine's commercial crop industries would collapse, as would industries elsewhere in the United States and around the world (Elke 2010). Over seventy-five percent of the world's crops and eighty percent of all flowering plants are pollinated by animals, roughly eighty percent are bee pollinators (Abrol 2011). The major economic and environmental losses due to the application of pesticides in the USA were: public health, \$1.1 billion year; pesticide resistance in pests, \$1.5 billion; crop losses caused by pesticides, \$1.4 billion; bird losses due to pesticides, \$2.2 billion; and groundwater contamination, \$2.0 billion (Pimentel et al. 2009). There is little to no actual specific data like this for Maine or other individual states.

Estimated honey bee loss and pollination from wild bee loss in the U.S., approximately 500 million kg of more than 600 different pesticide types are applied annually resulting at a cost of about \$10 billion dollars each year (Pimentel et al. 2009). Colony loss per year from pesticides is about \$13.3 million year, honey and wax losses \$25.3 million per year, loss of potential honey production \$27.0 million per year, bee rental for pollination \$8.0 million per year, pollination losses \$210.0 million per year, and the total is 293.6 million per year (Pimentel et al. 2009).

There are about 4,000 species of bees in the U.S. and Maine is home to over 270 native species (Drummond 2003). Maine is the second largest importer of honey bees, about 85,000 hives per year, each hive consists of 50,000 bees, each hive cost about 100\$, in one year, the state of Maine spends around 8.5 million dollars in importing honey bees. It is estimated to lose about 3.4 million dollars in Maine for honey and wild bees per year (Pimentel et al. 2015).

Bees also contribute to the pollination of other plants creating biodiversity, which is the variety of life on Earth, all organisms depend on one another in some way. It has been surmised that once bees are gone, mankind won't last long either since bees help produce all of our food in one way or another (Elke 2010).

The Problem:

Over the past 25 years, there has been more than a 60 percent decrease in the overall bee population. Last year, 20 percent more bees died off than scientists expected. Bees are critical pollinators, they pollinate 70 out of the 100 crop species that feed 90 percent of the world. Bees are responsible for 30 billion dollars worth of crops each year. We would lose the plants that the bees pollinate and all the animals that eat those plants and so on up the food chain.

Contributing Factors:

In recent years the decline of bees has accelerated in the past few years parallel with the overuse of pesticides (Abrol-2011). I analyzed over 15 peer reviewed research and meta-analysis papers, which looked into how different pesticides affect different bee species, particularly bumblebees and honeybees. They all concluded with the harmful effects of pesticide to bees neurological health and residue in the bees tissues.

Pesticides and insecticides are chemical sprays that are designed to kill pests, unfortunately, bees are also affected by those chemicals (Abrol-2011).

Solutions:

One option is to decrease the use of pesticides or use pesticides that have a low toxicity to bees.

There are also several strategies for farmers can utilize to increase the "friendliness" of their land to pollinators, such as, installing pollination reservoirs adjacent to their fields. These are simply areas they set-aside, in order for plant pollen and nectar-rich flowers to feed bees. During other times of the season in many fields, there is little to no forage available for wild bees. In homogenous landscapes such as blueberry fields, this can be a big limiting factor for the wild bee population. By providing food for wild bees when it is otherwise scarce, growers can enhance populations of wild bees in their fields, and receive more wild bee crop pollination.

Another strategy that will increase the "friendliness" of land to pollinators is, Integrated crop management is an approach to sustainable agriculture. It considers the situation across the whole farm to achieve the most suitable and safe approach for long-term benefit. One web based app and tool called Beemapper, This app collects, maps and displays Honeybee hive locations across the United States and around the world. Viewing the Map it displays a central location with a 3-mile radius ring indicating honeybee flight range, as well as information about the hive.

The last strategy is one that directly can help decrease the negative effect on bees from pesticides. Is a guideline that MOFGA uses as well, which is to not use pesticides while bees are actively foraging, spray crops either in the early morning or late evening when the temperature is below 55 Fahrenheit bees are not actively foraging or flying at that temperature.

Evaluation of Policy Options:

Spraying crops in the early morning or evening when the temperature is below 55 degrees Fahrenheit is a good policy option. Spraying pesticides when bees are actively flying and foraging can cause direct harm and sometimes lethal effects upon bees.

Through evolution, pests build up a resistance to pesticides, causing the need for reapplication of other pesticides or the use of more than one type of pesticide on crops. One individual pesticide can be harmful to bees and other wildlife, but when multiple pesticides are used their effects become detrimental.

Also to select pesticides with low toxicity to bees is a way to still use pesticides but with a lower negative affect to bees.

Policy Implications:

My policy recommendation would be to combine two of the solutions together. While all pesticides are harmful to bees and have been linked numerous times to the decline of bees both in Maine and the World. The use of multiple pesticides together is even more detrimental to bees. I think that commercial farmers should combine the discontinued use of combining multiple pesticides to spray on crops. And adapt to spraying crops in either the early morning or evening when the temperature is below 55 degrees Fahrenheit.

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