Ontario Federation of Agriculture

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March 7, 2016

Ontario Pollinator Health
Ministry of Agriculture, Food and Rural Affairs
Policy Division, Food Safety and Environmental Policy Branch
1 Stone Road West, Floor 2
Guelph ON N1G 4Y2

Re: EBR Posting: 012-6393

The Ontario Federation of Agriculture (OFA) welcomes this opportunity to provide comments and recommendations relating to Ontario's draft *Pollinator Health Action Plan*, dated January 2016.

OFA previously submitted comments on the discussion paper entitled *Pollinator Health – A Proposal for Enhancing Pollinator Health and Reducing the Use of Neonicotinoid Pesticides in Ontario*, released in November 2014. In addition, OFA commented on the proposed changes to Ontario Regulation 63/09 relating to Ontario's *Pesticide Act.*

Our initial thoughts on Pollinator Health remain valid and are expanded below.

OFA is pleased that the draft *Pollinator Health Action Plan* (Ontario, 2016) continues to emphasize that declines in the populations of both managed honey bees and wild pollinators relate to several "stressors" (p.5). In our earlier comments (2015) we included a section on "stressors" that explored in some detail the need to understand that pollinator health issues are complex. Literature cited in support of this, included:

- No single contributing factor to bee deaths has been identified (USDA, 2012)
- Bee deaths result from a complex set of stressors and pathogens (APVMA, 2014), and
- Researchers are increasingly using multi-factoral approaches to study causes of Colony Collapse Disorder (USDA, 2012, Krupke et al., 2012).
- The future of beekeeping will depend on a multi-factoral approach to address risks associated with honey bee health and industry development and sustainability in Canada *(CAPA, 2014).*

The reference from the Canadian Association of Professional Apiarists (CAPA) is of particular relevance, since it speaks directly to the managed honey bee sector in Canada. Given the importance that academics, government agencies and professional apiarists place on recognizing the complexity of bee health issues, OFA continues to advocate that pollinator stressors should not be grouped into four categories.

OFA maintains that doing so provides a disservice to the development of a 'comprehensive' pollinator health action plan by oversimplifying its complexity, as expressed in the references above. Ideally, each identified stressor will be rigorously studied to understand their unilateral impacts and, more importantly, their synergistic impacts.

In OFA's previous comments on bee health (OFA 2015), evidence from several sources, including the USDA / EPA report cited above, indicates there is no single contributing factor to bee deaths. CAPA (2014) was cited in the OFA submission on the basis that they concurred with the view that there were multiple risks associated with bee keeping and none of those risks emerged as primal. Specifically, CAPA stated:

> "*The future of beekeeping will depend on a multi-factoral approach to address risks associated with honey bee health and industry development and sustainability in Canada*."

It is noteworthy that CAPA expresses a vision dependent on a multi-factoral approach to risk management associated with honey bee health

OFA recommends the Province of Ontario fully acknowledge and enunciate each of the nine stressors previously identified by OFA and others and work towards addressing each of the stressors in accordance with respective impacts.

Pollinator Habitat

Ongoing land use changes in Ontario and elsewhere have resulted in a decline in the diversity and abundance of flowering plants and the foods they provide to pollinators (Vanbergen et al. 2013). The establishment and restoration of habitat suitable for pollinator species clearly is intended to address habitat loss that has resulted from urbanization and the concurrent need for energy and traffic corridors, as well as large contiguous tracts of field crops.

Pollinator habitat is a vital source of nutrition for wild pollinators, but also serves as a source for managed bee populations. Enhanced pollinator habitat results in improved nutrition which will aid both managed and wild pollinators to withstand the combined stresses of poor nutrition, pathogen infection and pesticide exposure associated with hive management (Alaux et al. 2010; Mao et al. 2011).

The Ontario Beekeepers Association (OBA) has expressed the view that honey bee mortality in Ontario can be attributed to a significant increase in hectares of corn and soy employing the practice of no-till farming.

OFA agrees that traditional bee habitat has changed over the past decade. For example, fields of red clover and buckwheat are rarely available these days. This is hardly the fault of the farmers involved but rather a function of markets, demand and economics. The beekeeping industry has adapted, to a degree, to this change by seeking habitat in areas of the province that can provide the essential nutrition required for sustainable beekeeping practices. Some hives and hive owners, however, may not be as mobile as others.

In this sense, it is important to identify opportunities for alternative habitat as well as provide information to beekeepers on the location of more suitable habitats.

The challenge relating to habitat management is planning at the landscape level to ensure that land managers work together for an effective spatial and temporal network of feeding sites both for wild and managed pollinators. This would need to include nesting sites for wild pollinators.

The development and integration of precision farming practices across Ontario cash cropping operations, as part of efforts to continuously improve production efficiencies in general and soil health in particular will present opportunities for the development of appropriate pollinator habitat. Benton (2012), for example, predicts that when the full potential associated with precision farming is realized it will include self-guided (through the use of both in-field sensors and remote sensing) robotic machinery capable of delivering site-specific management on the scale of single plants. This level of site-specific, individual plant management will enable farmers to identify fields or areas within a field better suited to alternative usage, such as pollinator habitat rather than crop production).

Public policy in support of pollinator habitat in Canada needs to be sufficiently flexible to accommodate developments in precision farming and the accompanying opportunities to provide viable, alternative pollinator habitat. The 2008 Farm Bill recognized the importance of pollinators by providing funding for farmers to increase and protect existing pollinator habitat on farmland (Biddinger and Rajotte 2015). Canadian and Ontario practices should be developed to enable optimum use of fields or parts thereof if that includes pollinator habitat.

OFA recommends establishing a program to provide incentives to farmers to establish pollinator habitat on uncultivated areas of farmland and on cultivated land deemed more suitable by the land owner as pollinator habitat.

Pollinator Nutrition

Pollinators, like other species, require an optimum nutrient balance to support growth and reproduction. It is known that nutritional regulation in worker honey bees is biased toward carbohydrates (Altaye et al. 2010), but it has yet to be determined how bees and other pollinators balance nutrient requirements by foraging on different nectar and pollen sources.

Poor nutrition to the point of starvation has been cited as a major contributing factor to mortality in managed hives by van Engelsdorp et al. (2007) and Steinhauser et al. (2014). It is noteworthy that the most recent report on honey bee wintering losses in Ontario (CAPA, 2015) indicates starvation as the leading cause. In all 3 studies cited above, it was beekeepers themselves who were reporting on managed bee mortality using standardized survey tools.

It has been demonstrated that poor nutrition also reduces immunity in managed bees, thus increasing their vulnerability to infection (Alaux et al. 2010). In a managed hive, these effects will be amplified at the colony level through the contagion effect. If poor nutrition has the same impact on wild pollinators then poor nutrition will contribute to declines in these populations as a result of disease.

Bees in managed hives develop biochemical mechanisms allowing them to detoxify acaricides used as a Varroa control. Studies conducted by Mao et al. (2011) have revealed that the biochemical mechanisms providing the ability to detoxify are sensitive to changes in diet and beekeeping practices that affect bee nutrition. The nutritional profile of the bee can either reduce or enhance bees' ability to detoxify pesticides used in hive management.

OFA concurs with the recommendation in the Pollinator Health Action Plan calling for training for beekeepers to address the high incidence of starvation within hives. This should not garner resistance from beekeepers given that starvation was ranked in the top 4 causes of winter losses by beekeepers in each of the nine provinces undertaking a bee health survey (CAPA, 2015).

With respect to wild pollinator populations, OFA recommends the investigation of the landscape structure on their foraging and dispersal patterns. This could draw on literature that has assessed the impact of mass-flowering cultivated crops, flower margins sown as part of an agri-environmental program, and invasive species (Vanbergen, 2013). The outcome would be a better understanding of how to manage pollinator stress associated with farmed landscapes.

For both managed and wild pollinators, OFA recommends an investigation of how nutrient availability and quality influences their vulnerability to such stressors as diseases and pesticides.

Pollinator Diseases

Honey bees are subject to an array of pathogenic diseases (viruses, bacteria, microsporidia) that are themselves linked to injury inflicted by the *Varroa destructor* mite. This link between diseases and pests that impact the honey bee has been described by Highfield et al. (2009). In fact, Runckel et al. (2011) has commented that “co-infection is the rule rather than the exception”. Specifically, the *Varroa* mite feeds on bee hemolymph thus suppressing the immunity of its host (i.e. bee) and increasing the virus load of its host (i.e. bee).

Pathogens associated with bee colony mortality tend to vary over the landscape. Vanbergen (2013) suggests that:

> “Multiple co-infections over time and space, interacting in complex, non-linear ways, are likely the root cause of pathogen-induced honey bee losses.”

It is noteworthy that many pathogens spread within and between populations of wild and managed bee species, and perhaps other pollinating insects as well (Core et al. 2012; Cameron et al. 2011).

Almost 20 years ago, a research team recommended reducing the dependency on honey bees for crop pollination services through the use of other bee species in order to minimize the risk of a species-specific disease outbreak compromising pollinator services provided by managed bees (Kearns et al. 1998). Clearly this recommendation has not been heeded, and there may be good reasons why it was not. Nevertheless, there is good reason to investigate means by which the risk associated with disease outbreaks among pollinators can be minimized.

OFA recommends that funding be available to researchers to investigate host-pathogen interactions and the role played by vectors and alternative hosts, such as wild pollinators and managed bees, in disease epidemiology.

Pollinator Genetics

The honey bee is a species that has had its genome mapped and is therefore an excellent candidate for genetic experimentation. For example work done 25 years ago by Yang and Cox-Foster (2005) provided a better understanding of how the *Varroa* mite alters honey bee gene expressions to reduce immunity.

The honey bee, however, is classified as a eusocial species meaning that the following characteristics are displayed:

- Cooperative brood care, with brood care of offspring being separate from that of adults;
- Overlapping generations within a colony of adults; and,
- Division of labour into reproductive and non-reproductive groups.

Because of the division of labour aspect, pollinators that are eusocial are often referred to as 'specialists', while those that are not are considered to be 'generalists'. Most wild pollinators are unlike honey bees in that they fit the generalist category. Consequently, behavioral studies with honey bees do not render results that can be applied to wild pollinators.

OFA recommends that research be funded to develop tools to enable the genome of Ontario wild pollinators such as *Andrenidae*, *Apidae, Colletidae, Halictidae and Megachilidae* (Chan, 2012) to be investigated.

Studies such as this will shed light on which species harbour which pests and pathogens, and which share new gene expressions and biochemical responses to particular pathogens and environmental toxins (Core et al. 2013; Singh et al. 2010).

OFA recommends that research funding be made available to bee breeders to develop managed queen bees with better survivability than those currently available to Ontario beekeepers. The annual CAPA survey to assess reasons for over wintering bee losses suffered by Ontario beekeepers consistently indicates 'poor queens' as a significant contributor to mortality within hives.

Extreme Weather

The distinction between extreme weather and climate change is difficult because an important characteristic of climate change is that it fosters an increase in the frequency and severity of extreme weather events. In this note extreme weather will refer to pollinator mortality that is linked to extremes of temperature, precipitation and wind.

CAPA reports over the years 2007, 2014 have often made reference to weather as a major factor contributing to winter loss for many beekeepers across Canada. In 2014, for example, the following weather-related comments were included in CAPA's annual statement on honey bee losses during overwintering:

- winter of 2013/14 was cold and long;
- spring weather was cold and wet in many areas creating unsuitable conditions for honey bee colonies to develop;
- cold starvation, the inability of bees to access stored honey in the hive, was cited frequently as a reason for bee mortality.

Testimony at the Standing Committee on Agriculture and Forestry (Canada, 2015) indicates that long, harsh winters, and/or cool, long springs result in high mortality in managed bee hives. During the foraging season, cold weather makes it difficult for bees to leave the hive for cleansing flights, making the colony more susceptible to disease. Unusual fall temperatures can also delay the use of disease treatments in managed hives and prevent adequate feeding of both managed and wild bees, which may affect bee health over the winter.

To address weather-related health issues associated with managed bees, OFA recommends funding of bee breeding research programs with the goal of developing managed bees ideally suited to Ontario's fluctuating weather patterns.

Climate Change

From a pollinator health perspective, the main issue with climate change is the impact that changes on plant flowering will have on the various pollinator species, be they wild or managed Bertin (2007). Phenology is a branch of science dealing with the relations between climate and periodic biological phenomena, such as plant flowering and pollination.

Phenological mismatches between the time of plant flowering and the readiness of pollinator species to engage in pollination activities can result in nutritional deficiencies for pollinator species, as well as disrupting the survivability of plant species that rely on pollinators for their survival. However, Parmesan (2007) suggests that predicting phenological effects of climate change will be difficult given that different plants and different insects respond differently.

OFA recommends the funding of research / monitoring that assesses phenological responses both of Ontario pollinator species and the plant species that are sources of pollen. An objective of these assessments will be to determine if observed phenological responses have predictive value.

OFA further recommends that plant breeders and bee breeders collaborate in an attempt to synchronize the flowering of cultivated plants with bee foraging activity.

Pesticide Exposure

Given that pesticides are an input used by farmers in the production of field and horticultural crops, and in management of bee hives, OFA has a particular interest in this particular pollinator health stressor.

A recent newsletter of the Canadian Environmental Law Guide contained an article (Walker 2015) that considered the question: Are neonics the cause of bee death? The answer referenced a 2012 report by the USDA and EPA as stating that:

> "the decline in bee health is likely due to a combination of factors, many of which are well known to beekeepers…Varroa mite and the multiple viruses it carries, bacteria, nutrition, genetics, loss of habitat, and pesticides."

The article then indicated that Ontario's Minister of the Environment and Climate Change cited many of the same factors as the US report but came to a different conclusion, that being:

> "there is a preponderant amount of research… that suggest[s] that [neonics are] certainly a significant factor in the cause of extraordinary levels of decline in bee populations and bee deaths (Global News, 2015).

OFA continues to question the prudence of the Government of Ontario isolating and addressing only one of several bee health stressors - that being exposure to neonicotinoids. The action was certainly disproportionate and delayed any action response to the other identified bee health stressors.

In OFA's previous comments on bee health (OFA 2015), evidence from several sources, including the USDA / EPA report cited above, indicates there is no single contributing factor to bee deaths. CAPA (2014) was cited in the OFA submission on the basis that they concurred with the view that there were multiple risks associated with bee keeping and none of those risks emerged as primal. The CAPA statement was:

> "*The future of beekeeping will depend on a multi-factoral approach to address risks associated with honey bee health and industry development and sustainability in Canada*."

OFA supports the judicious use of all pest control products and advocated to move, over time, towards a more comprehensive Integrated Pest management process. With respect to neonicotinoids, OFA agrees that their prophylactic use as a seed treatment for corn and soybean can be curbed through the establishment of IPM systems specific to corn and soybean production.

The value and the potential shortcoming of IPM systems is that they rely on pest scouting with pesticide usage determined on the basis of observed pest pressure. The development of robust IPM systems that growers can have confidence in requires time for field testing, refining and retesting.

In the horticultural sector IPM is a voluntary tool that has been widely adopted, but it took years to develop to the point that the majority of growers had confidence in the predictive abilities of IPM. To require through regulation that corn and soybean growers use an IPM system that is in its infancy, is a prescription for significant disruption and potential crop loss.

There is a real possibility that rushing the adoption of an immature IPM system, will result in the abandonment of IPM adoption by the field crop sector.

OFA recommends that the requirement to base the use of neonicotinoid-treated corn and soybean seed on IPM assessments confirming the presence of certain soil-borne insects be delayed until research and monitoring has confirmed that the IPM system is sufficiently robust to support the commercial farm sector.

OFA also believes that there is evidence that bee health issues related to neonic-treated corn and soybean seed is a function of fugitive dust generated during planting operations. As indicated in OFA's earlier submission on bee health (OFA 2015), much can and has already been done to address the fugitive dust issue. For example, testimony at the Senate Committee on Agriculture and Forestry (Canada 2015) by the Association of Equipment Manufacturers indicates manufacturers have started the design and development of planters which meet the new ISO standard aiming to minimize the effects of seed coating when mixed in the exhaust fan airflow.

The development of an ISO standard for pneumatic seeders has also been endorsed by Canada's Pest Management Regulatory Agency (PMRA, 2013). In fact, ISO 17962:2015 was published in July 2015, having been developed by ISO Technical Committee 23 – Tractors and Machinery for Agriculture and Forestry. The international standard provides guidance to individual companies to exercise engineering flexibility and encourages innovative solutions without compromising customer demands and expectations in performance (ISO, 2015). This is in addition to efforts that have been made to design dust deflectors for retrofitting seeders now in service. Efforts have also been made to improve the quality of the seed coat to prevent it from abrading from the seed surface (Krupke and Long 2015), and to devise a lubricant that reduces planting dust (Stokstad 2013).

OFA is disappointed that OBA and the Ontario government assign a disproportionate level of the blame for mortality in Ontario's managed bee hives to the use of pesticides by the field crop sector, while seemingly ignoring the use of pesticides in hive management. Work by entomologists at the University of Maryland, for example, has shown that hive treatment with oxytetracycline and acaricides for the prevention and treatment of disease and parasites has the potential for adverse interactions that contribute to high rates of honey bee mortality during the winter or early spring (Hawthorne and Dively, 2011).

Training in the use of pesticides and miticides by beekeepers would seem to be required and appropriate. **OFA recommends a thorough review of knowledge gaps in beekeeping practices with regards habitat, nutrition and the use of pesticides be undertaken and that a program be developed to provide better access to best practices across the sector.**

Conclusion

There is general agreement among the scientific community that bee health issues are a result of a complex set of interacting stressors. There is no simple solution for such a complex problem.

Recommendations provided throughout this note encourage the consideration of each individual stressor identified in the draft Pollinator Health Action Plan. The difficulty is that to better understand a bee health stressor it is necessary look at in isolation in order to uncover stressor-specific mechanisms. However, in a field situation many, if not all, of these stressors operate simultaneously. And that is the essence of the complexity inherent to bee health.

Respectfully submitted,

Don McCabe
President

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