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Evaluation of Canadian Bee Mortalities in 2013 Related to Neonicotinoid Pesticides

Interim Report as of September 26, 2013

Canada 



Overview of 2012 Honey Bee Mortalities

In the spring and summer of 2012, Health Canada's Pest Management Regulatory Agency (PMRA) received an unusually high number of reports of honey bee mortalities from beekeepers in corn growing regions of Ontario and Quebec. The reports involved over 42 beekeepers and more than 242 different bee yard locations. The timing and location of these incidents coincided with the planting of corn seed treated with insecticides.

An [evaluation of the information from the 2012 incidents](#) led to the conclusion that planting of corn seeds treated with neonicotinoids contributed to the majority of the bee mortalities that occurred in corn growing regions of Ontario and Quebec in Spring 2012, with the likely route of exposure being insecticide contaminated dust generated during the planting of treated corn seed. The unusual weather conditions in the spring of 2012 were also thought to be a contributing factor.

As a result of the investigation, in collaboration with stakeholders, [Best Management Practices](#) were developed and communicated to growers and beekeepers to reduce honey bee exposure to dust generated during planting of treated corn seed before the 2013 planting season. Other measures were initiated that would be put into effect as soon as possible, including labelling of treated seed, a treated seed dust standard, and development of technical solutions to reduce dust (developments in the areas of seed coating quality, seed flow lubricants, planting equipment, and disposal of treated seed bags).

Overview of 2013 Honey Bee Mortalities

In contrast to the unusual weather conditions experienced in 2012, the weather in 2013 was more typical of normal spring and summer conditions. Corn and soybean planting occurred during the typical planting season (late April to mid-May).

In the spring and summer of 2013, even with the more typical weather patterns, the PMRA continued to receive reports of honey bee mortality from beekeepers in Ontario, Quebec and Manitoba. As of August 29, 2013, the PMRA has received reports from 79 beekeepers in these three provinces, involving more than 322 different bee yard locations (Table 1). The timing and location of the initial 2013 reports coincided with the planting of corn and soybean seed treated with insecticides, however, beekeepers have continued to report effects on their honey bees throughout the summer outside of the planting season (Table 2).

According to the Canadian Association of Professional Apiculturists (CAPA), the Ontario overwintering losses for 2012-2013 (37.9%) were higher as compared to 2011-2012 overwintering losses (12%). The 2012-2013 level was within the range of overwintering mortality experienced over the past five years in Ontario (12 – 43%). CAPA considers 15% to be an acceptable level of winter loss with the national level of 28.6% for 2012-2013 exceeding this.

The PMRA has been working with the Ontario Ministry of the Environment (MOE) and the Ontario Ministry of Agriculture and Food (OMAF) to evaluate the role pesticides



may have played in these bee losses. Initial analysis of the circumstances surrounding the bee losses indicates that there was no pesticide misuse.

In both 2012 and 2013, beekeepers reported varying levels of mortality and other symptoms consistent with pesticide exposure (twitching, unable to fly, extended proboscis). At the time of the honey bee losses the bees were said to be foraging and the foraging bees found dead in the bee yard were often observed to have pollen on their legs, indicating bees were behaving normally prior to the mortalities. In 2013, some beekeepers also reported a notable unexplained absence of foraging bees from hives as opposed to large numbers of dead bees. Along with the absence of bees, there was evidence that the hives were healthy and bees had been recently present. The colonies had fresh pollen and honey along with brood, however, there was a lack of adult bees required to maintain the hive and account for the fresh brood, pollen and nectar present in the hive. Some beekeepers have monitored their affected yards over the season and have reported additional mortalities, lack of recovery and effects on queens. Monitoring of affected hives is ongoing.

Samples of dead bees were collected for pesticide residue analysis along with live bees, comb with pollen and honey stores, vegetation, water, and soil (Table 3). Preliminary residue results show that approximately 75% of the dead bee samples had detectable residues of neonicotinoid insecticides used to treat corn and soybean seed. Residues of neonicotinoid insecticides were detected in samples from approximately 80% of the beekeepers for which samples have been analyzed. Clothianidin and/or thiamethoxam were detected in > 90% of the comb pollen samples from affected yards and were also detected in some water, soil, and comb honey samples (Table 3). Additional collected samples are in the process of being analyzed.

Some beekeepers have reported that they have noticed mortalities in their hives for years, but they had not made the link to pesticides being the cause until the acute kills that were observed in 2012. Additional data continues to be collected by Health Canada and provincial partners which includes on-going investigation of new and continued effects and surveys with growers near affected bee yards.

Interim Conclusions Based on Two Years of Honey Bee Mortalities (2012 and 2013)

Following the evaluation of the 2012 honey bee mortalities it was concluded that the planting of corn seeds treated with the nitro-guanidine insecticides clothianidin and/or thiamethoxam contributed to the majority of the bee mortalities that occurred in the corn growing regions of Ontario and Quebec. The likely route of exposure was insecticide contaminated dust generated during the planting of treated corn seed. The unusual weather conditions were thought to have been a contributing factor.

Based on the detailed analysis that has been completed for the 2012 honey bee mortalities and the information available (as of September 26, 2013) for the 2013 mortalities there are similarities in the information reported. The mortalities occurred in the same areas and most coincided with the start of corn planting. Levels of residues detected in samples collected in 2013 were similar to levels found in 2012.



There was an increase in the number of reports received by Health Canada in 2013, however, it is not clear if this was due to an increase in incidents or an increase in reporting since Health Canada actively promoted the channels to report honey bee mortality after the experience of 2012.

Preliminary information indicates that there may be differences in the information reported for the 2013 incidents which included losses of field force; steady decline in population; and more reports of lack of recovery and chronic or on-going effects such as queen and brood effects.

The information evaluated to date, suggest that clothianidin and/or thiamethoxam contributed to many of the 2013 bee losses. However, there is sufficient information to indicate that at least four of the bee mortality incidents that were reported to the PMRA are not related to neonicotinoids. Evidence exists that some of the four were related to pests and diseases, while others were related to spray events. Additional information continues to be collected for consideration in the PMRA's evaluation.

Conclusions from the 2012 honey bee mortalities suggested that the unusual weather patterns during that spring were a contributing factor; however, in 2013 with more typical weather patterns the PMRA continued to receive a significant number of pollinator mortality reports. Consequently, the PMRA has concluded that current agricultural practices related to the use of neonicotinoid treated corn and soybean seed are not sustainable. The PMRA intends to implement additional protective measures for corn and soybean production, and issued a [Notice of Intent on September 13, 2013 outlining action to protect bees from exposure to neonicotinoid pesticides](#) with a closing date for public comment of December 12, 2013.



Table 1: Summary of number of beekeepers reporting for 2012 and 2013

	2012		2013 (as of Sept 20, 2013)		
	Ontario	Québec	Ontario	Québec	Manitoba
Beekeepers	42	1	74	4	4
Bee yards	242	8	319	5	9
Affected Hives	>4550* + to 5890	788	>3789 to 6639**	201	275
Crop link	corn, soy	corn	corn, soy	corn	corn
Sites	Corn growing regions		Same general location as 2012		
Notes:	*unknown for 34 bee yards from 5 beekeepers + estimate if all hives in yards were affected		**unknown for 114 bee yards from 35 beekeepers, 3789 is the # of hives known to be affected as of Sept 20, 2013; the upper estimate calculated based on 25 hives per bee yard (3789 + 114 yard x 25) = 6639		



Table 2: Number of calls received early in the season versus late in the season (as of Sept 26, 2013)

Province	early or late*	# of affected yards reported	# of Beekeepers
MB	early	9	4
ON	early	213	56
	late	106	18
ON Total		319	74
QC	early	3	2
	late	2	2
QC Total		5	4
Grand Total		333	82

*early = May and June (corn and soy planting occurred during this period); late = July – September



Table 3: Summary of residue analysis to date

Sample type	Affected/unaffected	Ontario 2012		Ontario 2013 (as of Sept 26, 2013)		
		Clothianidin and/or thiamethoxam detections (%)	Range of levels (ppm)	Clothianidin and/or thiamethoxam detections (%)	Range of levels (ppm)	
Dead bees	Affected	93/127 (70%)	COD = < LOQ – 0.024 THE (2 samples QC only) = < LOQ	77/102 (75%)	COD = 0.001 – 0.071 THE = < LOQ – 0.168	
Live bees	Affected	No samples taken		5/26 (19.2%)	COD = < LOQ – 0.0098 THE = < LOQ	
	Strong hive – affected yard	1/20 (5%)	COD = 0.001	1/19 (5.2%)	COD = 0.049	
	Unaffected	No samples taken		ND/19	ND	
Comb pollen	Affected	12/14 (75%)	COD = < LOQ – 0.0041 THE = < LOQ	37/53 (69.8%) IMI (1/38; 3%)	COD = < LOQ – 0.032	
					# < LOQ	1
					# > LOQ	28
					THE = < LOQ – 0.0395	
					# < LOQ	6
					# > LOQ	25
	Strong hive – affected yard	ND/2	ND	20/22(90.1%)	IMI = < LOQ	
					COD = < LOQ – 0.0077	
					# < LOQ	1
					# > LOQ	17
Unaffected	No samples taken	2/5 (40%)	THE = < LOQ – 0.0182			
			# < LOQ	4		
			# > LOQ	10		
Comb Honey	Affected	8/9 (89%)	COD = < LOQ – 0.0028	20/37 (54%)	THE = < LOQ – 0.0012	
					# < LOQ	1
					# > LOQ	1
					COD = < LOQ – 0.004	
	# < LOQ	8				
	# > LOQ	7				
Strong hive – affected yard	ND/1	ND	1/5 (20%)	THE = < LOQ – 0.0047		
				# < LOQ	7	
Unaffected	No samples taken	2/6 (33%)	THE = < LOQ			
			# > LOQ	5		
Water	NA	No samples taken		11/38(28.9%)	COD = < LOQ – 0.0033 THE = < LOQ	
Soil	NA	No samples taken		6/14 (42.9%) IMI 1/6 (17%)	COD = 0.0055 IMI = < LOQ	



Vegetation	NA	ND/9	ND	20/28 (72%)	COD = < LOQ – 0.0237 THE = < LOQ – 0.0734
COD = Clothianidin; THE = Thiamethoxam; IMI = Imidacloprid NA = not applicable ND = not detected LOQ = 0.005 ppm (soil); 0.001 ppm (all other matrices) QC = Québec					