Proposed Special Review Decision PSRD2021-02

Special Reviews: Potential environmental risk related to squash bee (*Peponapis pruinosa*) exposure to Clothianidin, Thiamethoxam and Imidacloprid used on cucurbits

Consultation Document

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This document is published by the Health Canada Pest Management Regulatory Agency. For further information, please contact:

Publications
Pest Management Regulatory Agency
Health Canada
2720 Riverside Drive
A.L. 6607 D
Ottawa, Ontario K1A 0K9

Internet: canada.ca/pesticides
hc.pmra.publications-arla.sc@canada.ca
Facsimile: 613-736-3758
Information Service:
1-800-267-6315 or 613-736-3799
hc.pmra.info-arla.sc@canada.ca

Canada

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1.0 Introduction

Pursuant to subsection 17(1) of the *Pest Control Products Act*, Health Canada initiated special reviews in 2014 on pest control products containing clothianidin, thiamethoxam, and imidacloprid used on cucurbits such as pumpkin and squash (REV2014-06). These special reviews were initiated based on a preliminary analysis of the information received under subsection 17(4) of the *Pest Control Products Act*.

Pursuant to subsection 18(4) of the *Pest Control Products Act*, Health Canada has evaluated the aspect of concern that prompted the special reviews which is related to potential environmental risk.

This document includes the resulting proposed special review decisions for public consultation, pursuant to section 28 of the *Pest Control Products Act*.

2.0 Aspects of concern that prompted the special review

Based on an analysis of the information received with the request for special reviews under subsection 17(4) of the *Pest Control Products Act*, Health Canada identified the aspects of concern that prompted the neonicotinoid squash bee special review as:

- Potential for environmental risk related to squash bees, *Peponapis pruinosa*, from exposure to clothianidin, thiamethoxam or imidacloprid when used on cucurbits.

3.0 Cucurbit uses of clothianidin, thiamethoxam, and imidacloprid in Canada

Clothianidin, thiamethoxam and imidacloprid are systemic neonicotinoid insecticides registered for commercial use in Canada on a variety of agricultural crops, including cucurbits. All currently registered pest control products containing clothianidin, thiamethoxam or imidacloprid for use on cucurbits are considered in this special review. See Appendix I for all currently registered products that include cucurbit uses, and Appendix II for details on all currently registered cucurbit uses.

Since the initiation of this special review in 2014, the cucurbit registered use pattern has been reviewed as part of the following re-evaluations and special reviews.

- Pollinator Re-evaluations (Clothianidin, Thiamethoxam, Imidacloprid)
    - Clothianidin and Its Associated End-use Products: Pollinator Re-evaluation (PRVD2017-23; RVD2019-05)
    - Thiamethoxam and Its Associated End-use Products: Pollinator Re-evaluation (PRVD2017-24; RVD2019-04)
    - Imidacloprid and Its Associated End-use Products: Pollinator Re-evaluation (PRVD2018-12; RVD2019-06)

- Aquatic invertebrate special reviews (Clothianidin, Thiamethoxam)
    - Special Review of Clothianidin Risk to Aquatic Invertebrates (PSRD2018-01; SRD2021-03)
    - Special Review of Thiamethoxam Risk to Aquatic Invertebrates (PSRD2018-02; SRD2021-04)
- Imidacloprid cyclical re-evaluation (birds and mammals, aquatic organisms, human health and value; excluding pollinators)
    - Re-evaluation, Imidacloprid (PRVD2016-20; RVD2021-05)

Many of these reviews resulted in changes to the cucurbit registered use pattern.

The special reviews on squash bees consider the currently registered use pattern on cucurbits, taking into consideration changes since 2014 when the special review was initiated, including additional mitigation measures put in place by the above registration decisions.

Table 1 presents an overview of the changes over time in the clothianidin, thiamethoxam, and imidacloprid cucurbit registered uses from 2014 when the special review was initiated, to the current registration status being evaluated in this special review.

Table 1 Overview of changes to the neonicotinoid registered uses on cucurbits over time since 2014.

Neonicotinoid	Cucurbit uses (Crop group 9: cucumber, melon, squash) At time of special review initiation in 2014 (REV2014-06)	Changes to registration based on mitigation for cucurbit uses following pollinator re-evaluation decisions (RVD2019-04; RVD2019-05; RVD2019-06)	Changes to registration based on mitigation for cucurbit uses following aquatic invertebrate special reviews and imidacloprid re-evaluation (SRD2021-03; SRD2021-04; RVD2021-05)	Registration status of cucurbit uses considered for this special review (as of 31 March 2021) (incorporating registration decisions since 2014)
Imidacloprid	Soil application (outdoors)	Cancelled use (outdoor)	N/A	No longer registered for soil use on cucurbits
	Soil application (greenhouse)	No change (greenhouse)	No change	Registered
	Seed treatment	No change	Rate reduction	Registered
Thiamethoxam	Soil application (outdoor)	Cancelled use	N/A	No longer registered for soil use on cucurbits
	Seed treatment	No change	No change	Registered
Clothianidin	Foliar application (pre-bloom only)	Reduced number of applications to one pre-bloom application	Rate reduction	Registered
	Seed treatment	No change	Rate reduction	Registered

4.0 Evaluation of the aspects of concern

4.1 Context of the special review

In late 2013, the PMRA received a request to conduct a special review to assess the potential risk to the solitary ground-nesting squash bee (*Peponapis pruinosa*) from exposure to clothianidin, thiamethoxam, and imidacloprid products that are registered for use on cucurbits such as pumpkin and squash. The pollinator re-evaluation had already been initiated in 2012 (REV2012-02), and would consider all bees, including squash bees, and potential risk from uses on cucurbits. However, as the re-evaluation was not yet completed, and because of legislative requirements in place at the time, it was necessary to also initiate the special review on squash bees. A 2019 amendment to the *Pest Control Products Act* allows the PMRA to address the identified aspects of concern through an existing post-market review where appropriate, avoiding duplication, instead of initiating a separate special review (see PMRA Guidance Document, *Approach to Special Reviews of Pesticides*). The current special review was initiated under re-evaluation note REV2014-06.

In order to evaluate the aspects of concern for clothianidin, thiamethoxam and imidacloprid, Health Canada considered currently available relevant scientific information, which includes the existing Health Canada assessments, particularly the pollinator re-evaluations, (see Section 3.0), all relevant registrant submitted data, and open literature, including the semi-field hoop house study.

The pollinator re-evaluations initiated in 2012 were based on a new risk assessment framework, *Guidance for Assessing Pesticide Risks to Bees*, which considered risk to all bees, including *Apis* bees (honey bees) and non-*Apis* bees such as bumble bees and solitary bees. This included squash bees, a type of solitary bee found on cucurbit crops. The re-evaluation assessed the registered uses of all three neonicotinoids, including foliar, seed treatment, and soil applications for potential risk to bees and included the cucurbit uses (clothianidin PRVD2017-23 and RVD2019-05; thiamethoxam PRVD2017-24 and RVD2019-04; and imidacloprid PRVD2018-12 and RVD2019-06).

An extensive data set from open literature and the registrant was considered for the pollinator re-evaluations. This included pollinator toxicity information (acute and chronic toxicity endpoints for adults and larvae, as well as higher tiered studies, on *Apis* and non-*Apis* bees). This also included extensive pollen and nectar residue data for cucurbits, along with associated use information on the application types and rates.

A group of Ontario researchers was conducting studies on risk to squash bees from pesticides, and provided periodic updates to Health Canada on their work and publications. In 2017 they started a three-year semi-field (hoop house) study on the potential effects of neonicotinoid use on squash bees when used on cucurbits. The treatments examined included imidacloprid as a soil treatment, thiamethoxam as a seed treatment, and a foliar treatment using a non-neonicotinoid insecticide. Health Canada considered this research relevant to the special review. As squash bees were already considered in the 2019 pollinator re-evaluation decisions (PRVD2017-23 and RVD2019-05; PRVD2017-24 and RVD2019-04; PRVD2018-12 and RVD2019-06), this research data was considered important for Health Canada to review in order to confirm whether

the 2019 decisions remained protective of the squash bee. Health Canada received the final data from the three-year hoop house study in the winter of 2021 and has considered it in the special reviews for squash bees.

4.2 Squash bee biology

The squash bee, *Peponapis pruinosa,* is a soil-nesting, solitary species found across most of North and South America. This is the only squash bee species present in Canada and is widespread in southern Ontario. The squash bee is thought to have arrived from Central America following the cultivation of squash. There are no native cucurbit plants in Canada that may be used by the squash bee during their life cycle. Cucurbit species utilized by squash bees are represented only by cucurbit agricultural crops including pumpkins, squashes, and gourds (PMRA# 2520703).

Throughout their life cycle, the squash bee has a specialized relationship with cucurbit crops. The squash bee feeds on pollen only from cucurbit crops and on nectar from cucurbits as well as other sources, if available (PMRA# 2520703). Each cucurbit blossom lasts only one day, opening early in the morning and wilting by early afternoon. Most of the squash bee foraging is done early in the morning within a couple of hours of sunrise before honey bees would typically begin foraging.

Female squash bees make nests in the soil in large groupings in and around cucurbit crop plantings or nearby nesting sites. They produce only one generation per year. Nests of the squash bee usually have four to six cells containing eggs and cucurbit pollen mixed with nectar. They are constructed 12-22 cm below the soil surface (PMRA# 2520703). Male squash bees and female bees that have not yet nested sleep inside the closed flower overnight and chew their way out early the next morning to meet up with female squash bees and to feed. The adult bees emerge from their soil nests from late July to August, with the males emerging before the females (PMRA# 2520703). The bees emerge when cucurbit crops are in bloom. Approximately two to three weeks after emergence, they build nests until early September. The eggs laid in the soil nests develop from egg to larvae to pre-pupae in a two-week period. Squash bees overwinter as a pre-pupae in the ground and then pupate the following summer from mid-June to mid-July. The lifecycle is then repeated when the adult bees emerge from late July to August (PMRA# 2520703).

Squash bees tend to nest in groupings close together. The choice of a successful squash bee nesting location and the survival of nests has been linked to areas that have little soil disturbances and lower clay content (PMRA# 2520703). Soil that is not disturbed and has a low clay content is often not used for cucurbit crop production but is found in field margins. In Canada, the primary growing region of cucurbits is Ontario. Commercial fields of summer squash are cultivated or tilled numerous times and are typically grown on raised beds with plastic mulch early in the growing season (PMRA# 2520703). The majority of growers in Ontario are using some form of tillage in winter squash and pumpkin production, either in the spring prior to planting, or in the fall to prepare the seedbed for cover crops (PMRA# 2520703). Therefore, successful squash bee nesting areas are typically in field margins or other undisturbed areas near fields of cucurbit crops.

4.3 Squash bee risk assessment

4.3.1 Risk assessments from the pollinator re-evaluations

In 2019, Health Canada completed three pollinator-focused re-evaluations and published its decisions (see Section 3.0). These re-evaluations were conducted according to the *Guidance for Assessing Pesticide Risks to Bees*, and assessed the registered uses of all three neonicotinoids, including foliar, seed treatment, and soil applications. The assessments followed a tiered approach considering acute and chronic oral and contact laboratory data for adult and larval bees, as well as higher tier semi-field (tunnel) studies, colony feeding studies and full field studies. The higher tier studies were designed to evaluate risk to bee colonies (adults and brood) following exposure to treated crops in either tunnels, or in the field. For these tunnel and field studies, treatment of crops included soil, foliar and seed treatment applications. Colony feeding studies were designed to evaluate risk to bee colonies (adults and brood) following a range of exposure concentrations in feeding solutions over a 6-week period in hives in the field. In addition, residue studies were conducted to determine the amount of neonicotinoid that was in pollen and nectar following applications in the field for soil, foliar and seed treatment applications. These plant residues were then compared to both the laboratory toxicity data on individual bees, and the doses that caused colony level effects from the colony feeding studies.

Additionally, as part of the exposure characterization, the pollinator attractiveness of crops was taken into account. Crops with blooms that are highly attractive to *Apis* and/or non-*Apis* bees are expected to result in high exposure.

The risk assessment considered potential risk to *Apis* and non-*Apis* bees such as bumble bees and solitary bees. The results showed that there were varying degrees of risk to bees, depending on the type of application (soil, foliar, seed treatment), use rates, application timing, and the crops. Where risks were identified to bees (*Apis* and/or non-*Apis*), mitigation was required to reduce exposure.

Specifically for cucurbits, risk was evaluated considering available *Apis* and non-*Apis* toxicity and effects information, and also taking into consideration the special relationship of squash bees and cucurbits. Residue data in pollen and nectar was available for cucurbits for soil treatments, foliar treatments, and seed treatments. This pollen and nectar residue data was compared to acute and chronic toxicity endpoints for individual adult and larval bees, as well as colony level effects endpoints for *Apis* and non-*Apis* bees. As well, the potential for exposure through soil for squash bees nesting in cucurbit areas was qualitatively considered in the risk characterization. For certain cucurbit uses, risk was identified to *Apis* and non-*Apis* bees from exposure through pollen and nectar residues in cucurbits, and risk mitigation was required.

Risk mitigation resulting from the pollinator re-evaluation risk characterizations included changes to the ways the neonicotinoids can be used on cucurbit crops:

- Clothianidin (as outlined in PRVD2017-23 and RVD2019-05):
  - Seed treatment use on cucurbits remained registered based on acceptable risk to bees.
  - Foliar use on cucurbits was restricted to only one pre-bloom application. With only one pre-bloom application, risk to bees was considered acceptable.
- Thiamethoxam (as outlined in PRVD2017-24 and RVD2019-04):
  - Soil application on cucurbit crops was cancelled based on unacceptable risk to bees.
  - Seed treatment use on cucurbits remained registered based on acceptable risk to bees.
- Imidacloprid (as outlined in PRVD2018-12 and RVD2019-06):
  - Soil application on cucurbit crops was cancelled based on unacceptable risk to bees.
  - Seed treatment use on cucurbits remained registered based on acceptable risk to bees.

4.3.2 Relevant research on squash bees

Chan et al. 2019 publication

Following consultation of the proposed imidacloprid pollinator re-evaluation decision (PRVD2018-12), an early pre-print version of the Chan et al. 2019 study was published (15 March 2019) and considered in the final imidacloprid pollinator re-evaluation decision (RVD2019-06). Since then, the study was published as a final version with additional information added.

In summary, this study presented a risk assessment for the potential exposure of squash bee and other ground-nesting bees to pesticides, including exposure through soil residues. The squash bee (*Peponapis pruinosa*) was used as a model organism for other ground-nesting bees in order to estimate pollen and nectar consumption and the amounts of soil handled by bees. Laboratory-based adult honey bee acute contact and/or oral endpoints were used to determine if lethal effects were expected based on the pesticide exposure levels through pollen, nectar and soil. Both the honey bee endpoints, and the honey bee endpoints divided by an uncertainty factor of 10 (to account for potentially greater toxicity to solitary bees), were used in the assessment. Acute and chronic assessments for soil exposure differed in the estimates of the amount of soil handled by a female nest-building squash bee. The acute assessment considered estimates of soil handled in a 48-hour period, whereas the chronic assessment considered estimates of soil handled in a 30-day period. Translocation of neonicotinoid insecticide residues from soils to female ground-nesting bees as they construct nests was estimated as 100%, and also at lower levels of 75%, 50%, 25% and 10% for comparison. Risk was determined by comparing toxicity endpoints to the geometric mean pollen, nectar and soil residue exposure values. As well, measured soil residues were used in a probabilistic risk assessment to assess acute and chronic risk from soil exposure. For the probabilistic soil exposure assessment, the study authors identified risk to squash bee when the soil exposures exceeded the toxicity endpoints 5% or more of the time.

The Chan et al. 2019 study included exposure estimates based on pesticide residues measured in 2016 from cucurbit crops (pollen, nectar, soil residues), which included measurements of clothianidin, thiamethoxam and imidacloprid. The method of application was not identified. Residues of thiamethoxam and clothianidin were not detected in pollen and nectar of cucurbit crops. In soil, thiamethoxam was not quantifiable, and clothianidin was 1.95 ng a.i./g. Imidacloprid was detected in soil (2.99 ng a.i./g), pollen (4.3 ng a.i./g) and nectar (0.88 ng a.i./g). Based on this data, no acute or chronic risk was identified by the study authors for exposure through pollen and nectar residues in cucurbits. However, the study authors' identified a potential acute or chronic risk to squash bees from clothianidin and imidacloprid soil exposure in cucurbit crops using certain assumptions. Predicted risk varied depending on the toxicity endpoint used (honey bee or honey bee divided by uncertainty factor), the soil exposure scenario (acute or chronic), and the translocation scenario from residues in soil to bees (100% or lower estimates). In general, the risk was higher for chronic soil exposure scenarios, higher estimates of translocation of residues from soil to bees, and when using the toxicity endpoint with the uncertainty factor.

The assessments in this study are scientifically sound but have some limitations in the context of this special review. For certain toxicity and exposure assumptions, the study authors identified potential for risk to squash bee from exposure to residues in soils. There was no information provided on the type of applications (soil, foliar, seed treatments) to cucurbit crops in fields where the soil, pollen and nectar residues were sampled. There remain unknowns regarding the actual exposure through residues in soil and whether this risk would occur in the field. For example, it is unknown how much of the total neonicotinoid residues in soil may be bioavailable and could result in contact toxicity to squash bees during nest building. Additionally, the assessments were conducted with soil pesticide residues that were collected in 2016. Since then, the use pattern of neonicotinoids on cucurbit crops has changed to be more restrictive, with soil uses no longer registered.

It is noted that in Health Canada's pollinator re-evaluations, additional information was considered in the risk assessment. This included additional pollinator toxicity information (acute and chronic toxicity endpoints for adults and larvae, as well as higher tiered studies, on *Apis* and non-*Apis* bees). This also included more extensive pollen and nectar residue data for cucurbits, along with associated use information on the application types and rates.

Chan and Raine 2021 publication

A semi-field (hoop house) study published in 2021 evaluated the effects of imidacloprid and thiamethoxam on nest establishment, foraging behaviour and reproduction in the hoary squash bees (*Peponapis pruinosa*).

The study conducted included data from 2017 and 2018 on squash bees. In the study, acorn squash seeds were planted in late May 2017 in covered hoop houses. The acorn squash were treated with one of three different systemic insecticides: imidacloprid applied to the soil, thiamethoxam applied as a seed treatment (which breaks down into clothianidin in the environment) and a non-neonicotinoid insecticide applied as a foliar spray. Untreated squash plants were planted as a control for comparison. Below are the treatments tested in the study:

1. Admire (imidacloprid 240 g/L; Reg. No. 24094) was applied as an in-furrow treatment at the time of seeding at the highest label rate of 18 mL/100 m row (0.528 g a.i./hoop house) in three hoop houses.

2. FarMoreFI400 a US product that contains Cruiser 5FS (thiamethoxam 47.6%; Reg. No. 27045) was applied as a seed treatment at the time of seeding at approximately 0.75 mg a.i./seed in three hoop houses.

3. A non-neonicotinoid insecticide applied as a foliar spray at the 5-leaf stage of plant in three hoop houses.

4. Control acorn squash that was planted without any pesticides applied.

In August 2017 after the acorn squash plants were established, 96 mated female squash bees were introduced into the covered hoop houses. The squash bees were confined and could not escape to gather nectar or pollen to eat, or nest anywhere else outside of the hoop houses. The bees remained in the hoop houses to feed on squash nectar and pollen, and to nest and lay eggs that later developed into larvae, pre-pupae and pupae in the soil. In 2018, additional acorn squash plants were planted and treated with the same test pesticides at the same time of year as the plants in 2017. Later in August, the offspring of the original 96 mated female squash bees emerged from the soil. These newly emerged adult squash bees were then also confined to the hoop houses to feed on squash nectar and pollen, to mate, and then to nest and lay eggs in the soil. In 2019, untreated squash plants were then planted in the hoop houses in early spring. No pesticide treatments were applied to the 2019 squash plants. The adult squash bees that emerged in 2019 were counted and collected. The bees that emerged in 2019 had spent their entire lifecycle confined to the hoop houses where they fed, mated, nested and reproduced under the exposure of the pesticide treatment applied.

In 2017 and 2018, observations were made on nest initiation, total number of male and female squash flowers, the number of pollen grains remaining unharvested in the flowers, squash fruit set and the number of fruit growing to marketable size. The total number of bees collected at the end of the 2018 and 2019 season was used as a measure of offspring production for the previous years of 2017 and 2018, respectively.

Soil samples were analysed for insecticide residues to estimate soil exposure levels. Samples were taken in 2017 and 2018 at periods that were before bee activity (8 June 2017 and 23 May 2018) and during activity (17 July, 4 and 18 August 2017; 18 July, 15 and 23 August 2018). The limit of detection (LOD) for the samples was equal to 1 ppb for clothianidin, thiamethoxam and imidacloprid.

Imidacloprid conclusions

Squash bees exposed to imidacloprid soil residues of up to 230 ppb, had an 85% and 89% statistically significant reduction in the number of nests and the number of offspring observed, respectively. An 84% statistically significant reduction was seen in the amount of pollen grains left unharvested after exposure to imidacloprid soil residues of 18.7–60.3 ppb in 2017.

The imidacloprid soil residues increased over time with repeated in-furrow applications of approximately 180.3 g a.i./ha (0.528 g a.i./hoop house) in 2017 and 2018.

Thiamethoxam conclusions

No statistically significant reduction was seen in the number of nests or offspring produced by squash bees exposed to two years of thiamethoxam seed treatment soil residues. The seed treatment applications resulted in soil residues of up to 6.2 ppb clothianidin and 54 ppb thiamethoxam. Clothianidin is a break down product of thiamethoxam.

The thiamethoxam soil residues increased over time with repeated planting of thiamethoxam treated seed at 0.75 mg a.i./seed in 2017 and 2018.

The clothianidin soil residues decreased slightly over time with repeated planting of thiamethoxam treated seed at 0.75 mg a.i./seed. It should be noted that all hoop house locations including the control had clothianidin residue detections prior to squash bees being placed into the houses for experimentation. This may explain the decrease in clothianidin soil residues from 2017–2018.

4.3.3 Overall conclusions

Evaluation of available scientific information related to the aspects of concern indicated that the potential environmental risk to *Peponapis pruinosa* (squash bee) through exposure to clothianidin, thiamethoxam and imidacloprid used on cucurbits are considered acceptable with the mitigation measures described in RVD2019-05, RVD2019-04 and RVD2019-06, which have already been implemented.

The pollinator re-evaluations determined that for certain cucurbit uses, there were unacceptable risks to *Apis* and non-*Apis* bees from exposure through residues in cucurbit pollen and nectar, and risk mitigation was required. This mitigation was also considered protective for soil-nesting solitary bees in cucurbit crops, including the squash bee. Risk mitigation resulting from the pollinator re-evaluations included changes to the ways the neonicotinoids can be used on cucurbit crops. Soil applications of imidacloprid and thiamethoxam on cucurbits were cancelled and foliar applications of clothianidin to cucurbits were reduced to a single pre-bloom application only. There were no changes to seed treatment uses for clothianidin, thiamethoxam and imidacloprid as risk to pollinators was acceptable.

The additional published information considered in this special review suggests that the mitigation measures implemented through the re-evaluation are protective of squash bees.

The 2019 Chan et al. study generally suggested a potential risk to squash bees nesting in cucurbit field soils based on residue data collected in 2016 and using certain exposure and toxicity assumptions in a probabilistic risk estimate. The type of applications used in cucurbit fields were not known, the exposure data was collected prior to use changes resulting from the pollinator re-evaluations, and there were limitations with the exposure and effects estimations.

Given that soil applications result in the highest soil concentrations in fields, the cancellation of the soil uses in cucurbits through the pollinator re-evaluations is expected to protect the squash bee from the highest soil residues.

When moving to a more realistic exposure scenario, the semi-field study by Chan and Raine (2021) showed chronic reproductive risk to squash bees exposed to cucurbit plants treated with soil applied imidacloprid. Chronic risks were not seen when squash bees were exposed to cucurbit plants grown from thiamethoxam-treated seed. Clothianidin was not tested in this study.

The results of the 2021 semi-field study were consistent with the pollinator risk conclusions related to the soil use of imidacloprid on cucurbits, for which unacceptable risk to non-*Apis* bees was identified as outlined in the imidacloprid re-evaluation (PRVD2018-12; RVD2019-06). Furthermore, the soil use of thiamethoxam on cucurbits was also cancelled based on unacceptable risk to bees as outlined in the thiamethoxam re-evaluation (PRVD2017-24 and RVD2019-04). Currently, there are no soil uses of neonicotinoids on cucurbits.

The results of the 2021 semi-field study have confirmed that thiamethoxam use as a seed treatment on cucurbit crops are acceptable as recommended in PRVD2017-24 and RVD2019-04. The results from the 2021 semi-field study did not find risk to squash bees from cucurbits grown from thiamethoxam-treated seed, and therefore are in agreement with the acceptable risk recommendation from the pollinator re-evaluation.

Based on this risk assessment, additional risk mitigation measures are not required. The risk to squash bees is acceptable based the risk mitigation already implemented for neonicotinoids through the pollinator re-evaluations completed in 2019. These measures continue to be protective in managing the risks to squash bees and are consistent with the new research considered in this special review.

5.0 Incident reports

Incident reports involving clothianidin, thiamethoxam and imidacloprid were considered for the 2019 pollinator re-evaluation decisions. Since publication of the re-evaluation decisions, no incidents involving *Peponapis pruinosa* (squash bees) exposed to clothianidin, thiamethoxam or imidacloprid through use on cucurbit crops were submitted to Health Canada.

6.0 Proposed squash bee special review decisions

Evaluation of available scientific information related to the aspects of concern indicated that the potential environmental risks to *Peponapis pruinosa* (squash bee) through exposure to clothianidin, thiamethoxam and imidacloprid used on cucurbits are considered acceptable when used according to the current conditions of use.

On this basis, Health Canada's Pest Management Regulatory Agency, pursuant to subsection 21(1) of *the Pest Control Product Act*, is proposing continued registration of clothianidin, thiamethoxam and imidacloprid products for sale and use on cucurbits in Canada. No further mitigation measures are proposed.

These proposed special review decisions are a consultation document.[1] Health Canada will accept written comments on this proposal up to 45 days from the date of publication of this document. All comments are to be directed to Publications.

7.0 Next steps

Before making a final decision on the special reviews of clothianidin, thiamethoxam and imidacloprid used on cucurbits and their potential risk to squash bees, Health Canada will consider all comments received from the public in response to this consultation document. A science-based approach will be applied in making a final decision on these special reviews. Health Canada will then publish a special review decision document, which will include the decision, the reasons for it, a summary of the comments received on the proposed decision, and Health Canada's response to these comments.

[1] "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

List of abbreviations

a.i.	technical active ingredient
g	gram(s)
ha	hectare(s)
L	litre(s)
LOD	limit of detection
mg	milligram(s)
mL	millilitre(s)
ng	nanogram(s)
ppb	parts per billion
Reg. No.	Registration number

Appendix I Registered products containing Clothianidin, Thiamethoxam or Imidacloprid for cucurbit use in Canada subject to special review

Table 1 Registered commercial class products containing clothianidin, imidacloprid and thiamethoxam in Canada[1]

Registration Number	Registrant	Product Name	Formulation Type	Active Ingredient
29382	Valent Canada Incorporated	Clutch 50 WDG Insecticide	Water Disperable Granules	50% Clothianidin
29384	Valent Canada Incorporated	Clothianidin Insecticide	Water Disperable Granules	50% Clothianidin
30972	Bayer CropScience Incorporated	Sepresto 75 WS	Wettable Powder	56.25% Clothianidin; 18.75% Imidacloprid
25636	Bayer CropScience Incorporated	Merit 60 WP Greenhouse And Nursery Insecticide	Wettable Powder	60% Imidacloprid
27357	Bayer CropScience Incorporated	Intercept 60 WP Greenhouse Insecticide	Wettable Powder	60% Imidacloprid
27045	Syngenta Canada Incorporated	Cruiser 5FS Seed Treatment	Suspension	47.6% Thiamethoxam

[1] as of 31 March 2021, excluding discontinued products or products with a submission for discontinuation. Reg.No. 24094 is not included as the soil use on cucurbit vegetables was cancelled in the Re-evaluation Decision RVD2019-06, *Imidacloprid and Its Associated End-Use Products: Pollinator Re-evaluation*.

Appendix II Registered uses of Clothianidin, Thiamethoxam or Imidacloprid for cucurbit use in Canada subject to special review

Table 1 Registered cucurbit uses of clothianidin, imidacloprid and thiamethoxam in Canada as of 31 March 2021

Active	Site(s)	Pest(s)	Reg. No.	Formulation Type	Application Methods	Application Rate[1]	Maximum Number of Applications per year
Imidacloprid	Greenhouse cucumber (mature plants)	Aphids, whiteflies	25636 27357	Wettable Powder	Ground application: soil drench	9.6 g a.i./1000 plants	1
Clothianidin co-formulated with imidacloprid	Crop Group 9 Cucurbit Vegetables	Aphids, thrips	30972	Wettable powder	Seed treatment: Seeds are not treated in Canada	Clothianidin: 0.75 g a.i./1000 seed Imidacloprid: 0.25 g a.i./1000 seed	1
Thiamethoxam		Cucumber beetle	27045	Suspension		0.25 – 0.75 mg a.i./seed	
Clothianidin		Cucumber beetle, squash bug, tarnished plant bug	29382 29384	Water dispersible granule	Ground application: Foliar spray	70 g a.i./ha	1

[1] g = gram; mg= milligram; a.i. = active ingredient; L = litre; ha = hectare; kg = kilogram

References

Registrant Submitted Studies/Information

Unpublished Information

PMRA Document Number	Reference
2520703	2015, Industry Response to the PMRA Special Review (REV2014-06): Potential Environmental Risk Related to Peponapis pruinosa Exposure to Clothianidin, Imidacloprid and Thiamethoxam Used on Cucurbits, DACO 9.9
2520705	2015, Personal communication with OMAFRA Vegetable Crop Specialist (sweet corn, cucurbits, beans, peas, asparagus), DACO 9.9

Additional Information Considered

Published Information

PMRA Document Number	Reference
3212319	Chan, D.W. and Raine, N.E. 2021. Population decline in a ground‑nesting solitary squash bee (*Eucera pruinosa*) following exposure to a neonicotinoid insecticide treated crop (*Cucurbita pepo*). *Sci Rep* 11, 4241. DACO 9.2.4.9 https://www.nature.com/articles/s41598-021-83341-7
3212321	Chan, D.W. et al., 2019. Assessment of risk to hoary squash bees (*Peponapis pruinosa*) and other ground-nesting bees from systemic insecticides in agricultural soil. *Sci Rep* 9, 11870. DACO 9.2.4.9 https://www.nature.com/articles/s41598-019-47805-1

Supporting unpublished information (for the 2021 Chan and Raine article)

PMRA Document Number	Reference
3183473	2017, University of Guelph Laboratory Services, LC-MS/MS multiresidue screen Method ID:TOPS-142. 2017 June 20, DACO 9.2.4.6
3183479	2018, University of Guelph Laboratory Services, LC-MS/MS multiresidue screen Method ID:TOPS-142. 2018 July 05, DACO 9.2.4.6

Health Canada's published regulatory documents

PMRA Document Number	Reference
2490924	2014, Re-evaluation Note REV2014-06. Initiation of Special Reviews: Potential environmental risk related to *Peponapis pruinosa* exposure to Clothianidin, Imidacloprid and Thiamethoxam used on cucurbits. https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/reevaluation-note/2014/peponapis-pruinosa-exposure-clothianidin-imidacloprid-thiamethoxam-rev2014-06.html
2883899	2018, Proposed Re-evaluation Decision PRVD2018-12. Imidacloprid and its Associated End-use Products: Pollinator Re-evaluation. https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/proposed-re-evaluation-decisions/2018/imidacloprid/document.html
2988088	2019, Re-evaluation Decision RVD2019-06. Imidacloprid and its Associated End-use Products: Pollinator Re-evaluation https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/reevaluation-decision/2019/imidacloprid.html
2835084	2017, Proposed Re-evaluation Decision PRVD2017-23. Clothianidin and its Associated End-use Products: Pollinator Re-evaluation. https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/proposed-re-evaluation-decisions/2017/clothianidin-associated-end-use-products-pollinator-re-evaluation.html
2986810	2019, Re-evaluation Decision RVD2019-05. Clothianidin and its Associated End-use Products: Pollinator Re-evaluation https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/reevaluation-decision/2019/clothianidin.html
2835088	2017, Proposed Re-evaluation Decision PRVD2017-24. Thiamethoxam and its Associated End-use Products: Pollinator Re-evaluation. https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/proposed-re-evaluation-decisions/2017/thiamethoxam-associated-end-use-products-pollinator-re-evaluation.html
2987668	2019, Re-evaluation Decision RVD2019-04. Thiamethoxam and its Associated End-use Products: Pollinator Re-evaluation https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/reevaluation-decision/2019/thiamethoxam.html
3215936	2021, Special Review Decision SRD2021-03. Special Review Decision: Clothianidin Risk to Aquatic Invertebrates. https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/special-registration-decision/2021/clothianidin.html

PMRA Document Number	Reference
3215938	2021, Special Review Decision SRD2021-04. Special Review Decision: Thiamethoxam Risk to Aquatic Invertebrates. https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/special-registration-decision/2021/thiamethoxam.html
	2021, Re-evaluation Decision RVD2021-05. Imidacloprid and its Associated End-use Products.