



A Farmer's Toolbox for Integrated Pest Management

AGRI/2020/OP/0003

Case study - Quebec

Abstract

The Canadian province of Quebec has a long experience with policies to reduce pesticide use in the agricultural sector. Since almost 30 years, Quebec has a phytosanitary strategy in place. For the first time in 1997, an objective to increase the adoption of IPM by farmers in Quebec was introduced in the Strategy. This objective was further strengthened in the Strategy 2011-2021, and new measures to support this objective were established. However, the objectives of the successive strategies were not always reached and had to be readjusted. As the last phytosanitary strategy is coming to an end in 2021, it appears that although significant efforts have been put in place to overcome the well identified barriers to the adoption of IPM by producers, many obstacles remain. It remains to be seen how the newly introduced Sustainable Agriculture Plan for 2020-2030 in Quebec will address these barriers.

1. Introduction

The agricultural and agri-food sector is a major contributor to the Canadian economy. Canadian primary agriculture is an economic driver highly diversified across the country and its Provinces¹. In the Province of Quebec, agriculture is a significant economic sector. In 2020, Quebec's agricultural sector generated about 10 billion of Canadian dollars of monetary income. 55% of this income came from dairy and livestock, and 39% from plant production². The sector employs about 42 000 people in Quebec, and there are some 29 000 agricultural businesses established on Quebec's territory. However, only 2% of the total area of Quebec is devoted to agriculture³.

In Canada, the Province of Quebec is at the forefront of Integrated Pest Management (IPM) promotion, with a phytosanitary strategy in place since 30 years. The strategy evolved over time and its objectives and target were adapted to reduce the use of pesticides and the health and environmental risks associated with the use of pesticides, as well as to increase the uptake of IPM practices among farmers. It is really since 1997 that IPM is promoted by the Quebec strategy, to encourage agricultural producers to adopt techniques that reduce the environmental pressure associated with the use of pesticides. Since then, a number of measures and tools were put in place to support the uptake of IPM by farmers in Quebec, such as financial support to farmers, research and development programmes and advisory services.

This case study investigates how IPM strategies are carried out outside the EU context. Moreover, the study provides an overview of the measures put in place to increase the uptake of IPM techniques in the Province of Quebec, together with an analysis of the obstacles faced by farmers when adopting such techniques.

2. Research theme

The objective of this case study is to report on what Quebec has done over the last decade to reduce its pesticide use and increase the adoption of Integrated Pest Management practices. As mentioned in the introduction, it aims to describe the measures put in place in Quebec to increase the uptake of IPM by farmers, the objectives of the strategy and its results. It also aims at identifying the obstacles to IPM adoption in Quebec and the solutions put in place to overcome these barriers. Lastly, the analysis performed in this case study will help identifying other practices and approaches for the uptake of IPM by farmers than the ones developed in the EU.

The research questions that guided the investigation in this case study cover the following aspects:

- What are the policies and strategies in place in Quebec to reduce pesticides use and increase IPM adoption and what are the results of these policies and strategies?
- What is the approach to IPM in Quebec and what are the means in place to support the adoption of IPM and the reduction of pesticide use?

¹ <https://agriculture.canada.ca/en/canadas-agriculture-sectors/overview-canadas-agriculture-and-agri-food-sector>

² <https://www.mapaq.gouv.qc.ca/fr/md/statistiques/Pages/production.aspx>

³ <https://www.upa.qc.ca/fr/statistiques/>

- What are the main barriers to IPM adoption in Quebec?
- What are the solutions to overcome these barriers and what are the future developments in Quebec's IPM strategy?

3. Methodology

In order to gather information about the Integrated Pest Management strategies and policies in place in Quebec, extensive desk research has been conducted, based on sources recommended and provided by a contact from the Canadian Agriculture Ministry and based on additional official sources from the Quebec Ministry (e.g. provincial strategies, policy evaluations, reports, studies, etc.). The documents consulted can be found in the source section.

Moreover, alongside desk research, an interview was organised with representatives of the Quebec Ministry for Agriculture (MAPAQ) involved with IPM in Quebec and with a representative of the Canadian Centre for Pest Management⁴.

A substantial part of the information reported in this case study comes from the analysis of the available sources collected through the desk research. The interview complemented this analysis by confirming its results, filling in certain data gaps and better defining certain mechanisms behind the policies and measures introduced in Quebec.

4. Activities and results

4.1 Background and objectives

4.1.1. Regulatory Framework

Agriculture is a shared federal-provincial responsibility in Canada. Therefore, jurisdiction over the management of pesticide use is shared between the federal government, territorial and municipal governments.

At federal level⁵, the Canadian government controls the registration, marketing and labelling of pesticides. Pest control products that are imported, sold, or used are regulated under the 2002 Pest Control Products Act and its regulations. The Health Canada's Pest Management Regulatory Agency (PMRA) is responsible for administering the Act, registering pest control products, re-evaluating registered products, and setting maximum residue limits in food.

In Quebec⁶, at the provincial level, the Ministry for the Environment and for Combating Climate Change can regulate the sale, use, storage, transportation, and disposal of federally registered pesticides. Quebec's provincial government has the authority to restrict or prohibit the use of

⁴ The Canadian Pest Management Centre conducts research activities with regards to pest management. Its research priorities are determined in partnership with the grower community, provincial governments, scientific experts and the crop protection industry by identifying critical weed, insect and disease pest problems and matching them with potential solutions. The centre does not provide advice on pest management to farmers or homeowners, which is instead generally provided by provincial government specialists.

⁵ Commission de l'agriculture, des pêcheries, de l'énergie et des ressources naturelles, *Examiner les impacts des pesticides sur la santé publique et l'environnement, ainsi que les pratiques de remplacement innovantes disponibles et à venir dans les secteurs de l'agriculture et de l'alimentation, et ce en reconnaissance de la compétitivité du secteur agroalimentaire Québécois* – Recommendations, February 2020, pp 3-4.

⁶ Ibid.

registered products within their jurisdiction⁷. Since 1987, the management of pesticides is governed by the Pesticides Act in Quebec. Two regulations specify its application:

- The Pesticides Management Code sets out the standards for the storage, sale and use of these pesticides.
- The Regulation on permits and certificates for the sale and use of pesticides establishes the classification of pesticides according to their level of risk, a licensing and certification regime, and requires a sales register for sellers.

The Quebec Ministry for Agriculture, Fisheries and Food (MAPAQ) is responsible for supporting farmers in their activities to reduce the use and risks of pesticides, by:

- Providing funding for applied research and knowledge development activities and their transfer to the farm;
- The development of decision support tools for farmers and agricultural advisors;
- The provision of financial assistance to agricultural businesses for advisory services, for the acquisition of equipment and biological agents that reduce the risk of pests and diseases.

In Canada, the adoption of IPM by farmers is voluntary. The federal and provincial authorities each have their defined role and responsibility when it comes to the support, delivery, and implementation of IPM. The role of the federal government lies mainly in establishing and delivering policies and programmes that support the viable and competitive sectors by setting overall growth and sustainability goals (e.g. in the federal programmes, there is a large support dedicated to Research and Innovation (R&I) to enable scientific and technological advances leading to development and delivery of innovative IPM solutions, including tools, products and practices). The federal government of agriculture works very closely with provinces and territories and industry partners in the development and delivery of these policies and programmes⁸.

In the end, it is the responsibility of provinces and territories to assist the sectors with IPM implementation and in general to advance uptake of new technologies. Provinces sets their own goals and targets and develop their own strategic plans and approaches and deliver their own IPM programmes to support their growing communities, while addressing various sectors priorities. Provinces have their own Research and Development (R&D) programmes to support IPM tools and practices. Provincial governments also support pest surveillance programmes; they provide extension services and expert guidance; and they offer pesticide training courses⁹.

4.1.2. Quebec's strategy to reduce pesticide use and increase IPM adoption

In 1992, Quebec's Ministry of Agriculture, Fisheries and Food (MAPAQ) developed its first Phytosanitary Strategy. This strategy aimed, at the time, to reduce the use of pesticides in agriculture by 50% by the year 2000 in the agricultural sector¹⁰. It was really in 1997, when

⁷ Webpage of the Quebec Ministère de l'Environnement et de la Lutte contre les changements climatiques. Available at: <https://www.environnement.gouv.qc.ca/pesticides/inter.htm>

⁸ IEEP Webinar, Life on Farm: Long-term sustainability through integrated pest management. Available at : <https://www.youtube.com/watch?v=r5Og11-U9JM>

⁹ Ibid.

¹⁰ Stratégie phytosanitaire québécoise en agriculture 2011-2021.

the Phytosanitary Strategy was refocused, that the objective to increase the adoption of integrated pest management in Quebec was introduced. A 2007 report¹¹ shows that pesticide sales in Quebec have remained relatively stable in the agricultural sector since the strategy was implemented (they decreased by 0.3% from 1992 to 2007), despite the increase in the agricultural area dedicated to annual crops. Over the same period, the environmental pressure index for agricultural pesticides (measured in kilograms of active ingredients sold per cultivated hectare) decreased by 26.5%, from 3.89 to 2.86 kg/ha. Thus, the original objective of the Strategy – i.e. to reduce the use of pesticides in agriculture by 50% - has only been partially achieved. However, the progress made since 1992 was undeniable¹², as a considerable decrease of pesticide use was observed and measures to promote the adoption of IPM techniques were put in place

In 2008, MAPAQ and its partners in the agriculture, environment and health sectors decided to initiate a new process to define a new Phytosanitary Strategy¹³ for the 2011-2021 period. This strategy is the result of the partners' reflection and of the comments gathered following a consultation of many Quebec stakeholders interested in plant protection. This strategy has therefore been redefined to better respond to the concerns and expectations of Quebec society.¹⁴

Quebec's Phytosanitary Strategy 2011-2021

The Strategy aims to increase the adoption of integrated pest management (IPM) and reduce the risks of pesticides to health and the environment while ensuring the economic viability of agricultural production. While focusing on the adoption of integrated pest management to achieve its objectives, it is supported by various research and development, training, and information activities.

The strategy sets out two overarching objectives (which are then broken down into thematic orientations and accompanying specific objectives):

- Reduce the health and environmental risks associated with the use of pesticides in agriculture by 25% by 2021.
- Increase the adoption of IPM.

Regarding the objective of increasing the adoption of IPM specifically, the strategy aims at:

- Accelerating the development of knowledge in IPM (Direction 5)
- Strengthening the adoption of agricultural practices that promotes IPM (Direction 6)
- Accelerating knowledge transfer and encourage the dissemination of information (Direction 7)

The strategy is put into operation through Actions Plans (2011-2014, 2014-2018 and 2018-2021) to implement, track and evaluate the impact of the strategy

Furthermore, in 2018, a new concept of agronomic prescription was introduced into Quebec pesticides regulations. This concept prescribes that the five most risky pesticides can only be purchased and used if their application is justified and prescribed in advance by an agronomist member of the Quebec Agronomists' Order¹⁵.

¹¹ GORSE, I., et S. DION (2010). Bilan des ventes de pesticides au Québec pour l'année 2007, Québec, ministère du Développement durable, de l'Environnement et des Parcs, 81 p

¹² Stratégie phytosanitaire québécoise en agriculture 2011-2021.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ Communiqué de presse, Mise en œuvre de la Stratégie québécoise sur les pesticides – Meilleure protection pour la santé, l'environnement et les abeilles, 19 February 2018. Available at : <https://www.environnement.gouv.qc.ca/infuseur/communiqu.asp?no=3921>

Following the adoption of its own initiative mandate to examine the impacts of pesticides on public health and the environment as well as innovative alternative practices available, the Committee on Agriculture, Fisheries, Energy and Natural Resources (CAPERN) delivered its report in February 2020¹⁶. Taking stock of the current situation, the report found that although alternative practices, including IPM practices, exist for several types of crops and pests, not all producers adopt them, for various reasons, including the lack of financial and technical support (the barriers to IPM adoption in Quebec are explored more in details in Section 4.4. below). To overcome this, the report concludes by recommending that the government of Quebec “further support the implementation of measures that encourage the use of alternative methods to pesticides use, in particular by promoting IPM and biological control”.

In 2020, the Quebec government put in place a new Strategy for Sustainable Agriculture for the period 2020-2030¹⁷, answering the findings and recommendations from the CAPERN report.

Quebec's Plan for Sustainable Agriculture 2020-2030

The new plan in effect sets more ambitious targets for reducing the use and the risks of pesticides for the environment and health by 2030 (Objective 1). The new objectives are:

- To reduce by 500 000kg pesticides sales.
- To reduce by 40% the health and environmental risks associated with the use of pesticides.

Going beyond the objectives of the Phytosanitary Strategy, the Plan not only focus on further reducing the pesticide risks, it also aim to reduce the use of pesticides, a novelty compared to the Strategy 2011-2021.

4.2 IPM principles and implementation in Quebec

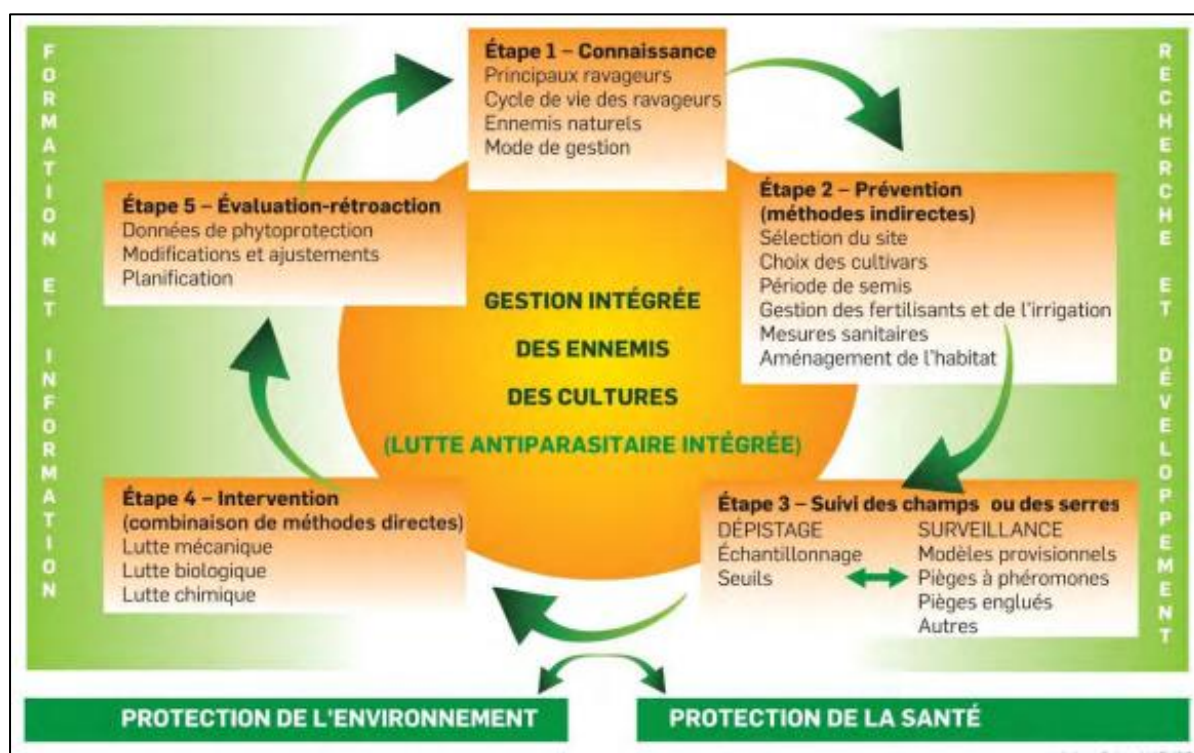
4.2.1 IPM principles

In Quebec Phytosanitary Strategy 2011-2021, Integrated Pest Management is defined as “a decision-making approach to use all necessary techniques to reduce pest populations in a cost-effective manner, while respecting health and the environment”. Its implementation follows the following five steps (Figure 1): Knowledge, Prevention, Monitoring, Intervention, Evaluation-Feedback. Moreover, implementation of IPM is supported by various R&D, training and information activities.

¹⁶ Commission de l'agriculture, des pêcheries, de l'énergie et des ressources naturelles, *Examiner les impacts des pesticides sur la santé publique et l'environnement, ainsi que les pratiques de remplacement innovantes disponibles et à venir dans les secteurs de l'agriculture et de l'alimentation, et ce en reconnaissance de la compétitivité du secteur agroalimentaire Québécois* – Recommendations, February 2020

¹⁷ Plan d'agriculture durable 2020-2030.

Figure 1: IPM components in Quebec



Source: Stratégie phytosanitaire québécoise en agriculture 2011-2021

4.2.2. Monitoring the uptake of IPM

One of the overall objectives of the Phytosanitary Strategy is to increase the uptake of IPM practices by 2021. To measure the progress toward this objective, Quebec is performing a regular survey addressed to producers in eight different sectors. The evolution of the adoption of IPM practices is assessed through its IPM indicator (Indicateur de la GIEC). The IPM indicator is the result of an initiative of the MAPAQ, the Ministry for Health, the Ministry of the Environment and the Fight against Climate Change (MELCC) and the Union of Agricultural Producers (UPA).

The achievement of the IPM indicator is linked to four objectives:

- Assessing the level of adoption of IPM on Quebec's farms and monitor its evolution;
- Updating farm practices;
- Orienting technology development and transfer activities;
- Establishing priority intervention for the development of sectoral action plans.

This indicator takes the form of a score – from 0 to 10 – that shows the level of adoption of IPM practices. It is divided into four levels (Figure 2):

- Transition to IPM (0 to 2,5): in the majority of cases, farms rarely or never use IPM practices.
- Basic IPM (2,6 to 5): In the majority of cases, farms rarely use IPM practices.
- Intermediate IPM (5,1 to 7,5): in the majority of cases, farms rarely or mostly use IPM practices.
- Advanced IPM (7,6 to 10): In the majority of cases, farms most of the time or always use IPM practices.

Figure 2: Levels of IPM uptake

Transition	GIEC de base	GIEC intermédiaire	GIEC avancée
Dans la majorité des cas, les exploitations utilisent rarement ou n'utilisent jamais les pratiques de la GIEC.	Dans la majorité des cas, les exploitations utilisent rarement les pratiques de la GIEC.	Dans la majorité des cas, les exploitations utilisent rarement ou la plupart du temps les pratiques de la GIEC.	Dans la majorité des cas, les exploitations utilisent la plupart du temps ou toujours les pratiques de la GIEC.
Score de 0 à 2,5	Score de 2,6 à 5	Score de 5,1 à 7,5	Score de 7,6 à 10

Source: MAPAQ. Indicateurs de la gestion intégrée des ennemis de cultures, résultats 2012.

An evaluation of the progress in IPM adoption was performed in 2012¹⁸ and in 2017¹⁹. Another evaluation will be performed in 2021.

4.2.3. Resources to support the uptake of IPM and the reduction of pesticide use

To achieve the objectives of the Phytosanitary Strategy, the Quebec government put in place different tools and means to support the efforts of producers.

In Canada and in Quebec, IPM is adopted by farmers on a voluntary basis and nor the federal nor the provincial authorities are issuing official guidelines for implementing IPM, differently to the EU where Member States must put in place such guidelines. In Quebec, IPM is mainly promoted through advisory services, and counsellors play a crucial role in raising awareness and promoting alternative practices to pesticide use. The Quebec Order of Agronomists is issuing directives for IPM implementation which counsellors must follow when they provide advisory services to producers and growers. However, it is not mandatory for farmers to have a counsellor. When a farmer makes use of the services of a counsellor, this one can provide recommendations on IPM – based on the directives issued by the Order – which the farmer can choose to follow or not.

The Quebec government is significantly supporting this counsellors/advisor's approach, which is believed to be a great instrument for promoting IPM and increasing its uptake by farmers. This counsellor system is organised in the following way: "first line counsellors" are certified agronomist from the Order, which are working on the field with farmers. "Second line counsellors" are working within the MAPAQ and their mandate is to support the first line counsellors. Guidance and crop or sector specific technical fiches and good practices on IPM are produced by research centres but also by the MAPAQ and are distributed and disseminated to farmers via the Réseau d'Avertissement Phytosanitaire (RAP). Second line counsellors are involved with knowledge transfer. Moreover, when a farmer decides to use the services of an independent counsellor (i.e. not an counsellor from the industry or pesticides seller), the government is funding up to 90% of the price of the services.

While is not possible to draw a definite causal link between the establishment of this counsellor system and the increase of IPM adoption in Quebec, certain trends were identified. Notably, the surveys performed in 2012 and 2017 as part of the monitoring of IPM adoption shows that for several sectors, IPM adoption is higher when the farmer use an independent counsellor.

¹⁸ MAPAQ, Indicateurs de la gestion intégrée des ennemis des cultures, Résultats 2012.

¹⁹ MAPAQ, Indicateurs de la gestion intégrée des ennemis des cultures, Résultats 2017.

Furthermore, a pilot project²⁰ was conducted in 2017 with more than 100 producers in a region in Quebec where counsellors supported and closely followed them to adopt alternative practices in order to reduce the pesticides risks. This project showed that, on average, farmers were able to reduce the risks from 25 to 50% with the use of alternative techniques and advisory support. The pilot project aimed at demonstrating and promoting the implementation of already existing and efficient techniques (such as pesticides substitution with the use of lower risks pesticides, such as biopesticides; or by implementing techniques such as nets for apples and strawberries or mating disruption). The successes of the project reinforced Quebec's conviction that peer to peer transfer of knowledge and information is an efficient way to promote the uptake of IPM by farmers.

The counsellor approach is complemented by a broad range of advisory and support services put in place by the Quebec government. Support services for producers are provided, for instance by providing free and open access to a network of advisers: the "Réseau d'avertissement phytosanitaires"²¹ acts as 'warning system' to inform on the presence and evolution of pests in a region and about the most appropriate strategies and practices of intervention to put in place in the context of IPM. Moreover, an advisory programme²² is put in place by the provincial government, where producer can benefit from a tailored support. Other tools and information points are available for supporting producers, such as:

- The online tool IRIIS²³, to help producers identifying or gaining more knowledge on pests.
- The crop protection diagnostic laboratory²⁴, which provides expertise and diagnosis on pests or diseases affecting crops.
- SAgE-Pesticides²⁵, a free and open database which gathers all the information necessary for the proper management of pesticides, particularly the treatments to be used.
- Service Action-Regulation²⁶, which aims to improve the adjustment of crop protection sprayers to increase the quality of applications.
- A pesticide information kit²⁷, which presents good pesticide management practices to protect the environment and human health, as well as Quebec Regulations.
- Various publications²⁸ produced with funding from the support of the Prime Vert programme.

Furthermore, for delivering its extension services, Quebec relies on a large network of crop specialists and agro-environmental consultants, as well as organised extension service providers such as PRISME Consortium²⁹, which offers services and advice on IPM to producers in the form of crop scouting and monitoring, support to comply with regulations,

²⁰https://www.mapaq.gouv.qc.ca/fr/Regions/monteregie/articles/agroenvironnement/Pages/diminuer_risques_pesticides.aspx

²¹<https://www.mapaq.gouv.qc.ca/fr/Productions/Protectiondescultures/Pages/reseau.aspx>

²²<https://www.mapaq.gouv.qc.ca/fr/Productions/md/programmesliste/gestionagricole/Pages/Programmeservices-conseils.aspx>

²³<http://www.iriisphytoprotection.qc.ca/>

²⁴<https://www.mapaq.gouv.qc.ca/fr/Productions/Protectiondescultures/diagnostic/Pages/diagnostic.aspx>

²⁵<https://www.sagepesticides.qc.ca/>

²⁶<https://www.mapaq.gouv.qc.ca/fr/Productions/Agroenvironnement/reductionpesticides/soutien/Pages/Programmeactionreglage.aspx>

²⁷<https://www.mapaq.gouv.qc.ca/fr/Productions/Protectiondescultures/mauvaisesherbes/Pages/Trousseinformati onsurlsesticides.aspx>

²⁸https://www.agrireseau.net/agriculturebiologique/documents/SPOA_publications.pdf

²⁹<https://prisme.ca/>

implementation of new technologies and practices, implementation of research projects. Moreover, the Centre of Excellence for IPM (PELI)³⁰, which was established in 2012, brings together stakeholders in the vegetables sector around a common vision. PELI's mission is to promote alternative practices to pesticides and to promote inspiring initiatives, their results and benefits. In order to better promote IPM among agricultural producers and the general public, the PELI recently launched Agrobonsens³¹, a database of IPM techniques and enterprises committed to reducing pesticides use.

Last but not least, financial support is offered to farmers for implementing IPM, mainly through the "Prime-Vert" programme³². This programme aims to increase agri-environmental practices from agricultural businesses. One of the intervention areas of the programme is the reduction of pesticide use and its risks. Through the programme, producers can for instance receive funding for equipment and practices aimed at reducing risks related to pesticides³³. Via the programme, four main practices which have proved their efficiency are promoted and funded: Trichogramma for corn, mating disruption, sterilisation of insects, and potassium bicarbonate against apple scab. The programme is also funding R&D activities in line with the Phytosanitary Strategy.

4.3 Results (and successes)

Already in 2016, the General Auditor of Quebec, in its report of verification of agricultural pesticides³⁴, noted that the phytosanitary strategy had not yet produced its expected results. Indeed, pesticides sales in Quebec continued to increase, and the associated risk indicators were on the rise in 2014, despite the adoption of the first phytosanitary strategy in 1992. A more recent report from the CAPERN³⁵ found that total annual pesticides sales had increased overall, particularly since 2008, reaching a peak in 2014 where they were about 32% higher than in 1992. Since 2014, sales have declined, reaching an annual total in 2017 10% higher than in 1992. Phytosanitary strategies since 1992 are not effective because it lacks actions targeting the reduction of pesticide use. Furthermore, the General Auditor report notes a lack of resource to support the implementation of the strategy.

Moreover, these reports note that the Quebec Ministry for Environment and Climate draws up an annual report on pesticides sales in Quebec, which is produced from data provided by wholesale pesticide permit holders. As this annual report is a compilation of sales, it does not represent a true portrait of the use of pesticides. In fact, it does not make it possible to establish links between the products used, the crops for which these products are used, and the producers.

Regarding IPM, the General Auditor underlined that while the general objective of the strategy is to increase the adoption of IPM practices, the strategy does not set out a precise target to this end. Furthermore, out of 77 Actions put forward by the strategy, only 14 are targeting the reduction of pesticides use. Besides, the indicators used to measure the progress on these

³⁰ <http://agrobonsens.com/qui-est-le-peli/>

³¹ <http://agrobonsens.com/>

³² <https://www.mapaq.gouv.qc.ca/fr/Productions/md/programmesliste/agroenvironnement/Pages/Prime-Vert.aspx>

³³ <https://www.mapaq.gouv.qc.ca/SiteCollectionDocuments/Formulaires/ProgrammePrime-Vert2018-2023.pdf>

³⁴ Rapport du Vérificateur général du Québec à l'Assemblée nationale pour l'année 2016-2017, Rapport du commissaire au développement durable Printemps 2016, Chapitre 3, Pesticides en milieu agricole.

³⁵ Commission de l'agriculture, des pêcheries, de l'énergie et des ressources naturelles, *Examiner les impacts des pesticides sur la santé publique et l'environnement, ainsi que les pratiques de remplacement innovantes disponibles et à venir dans les secteurs de l'agriculture et de l'alimentation, et ce en reconnaissance de la compétitivité du secteur agroalimentaire Québécois – Recommandations*, February 2020.

actions are usually not measuring results and do not have targets, but rather focus on activities to perform (e.g. performing studies or establishing guidelines). Therefore, these indicators are not adequate to measure the progress on the reduction of pesticides.

Furthermore, the Quebec government does not have a complete overview of the pest management practices used by farmers. Indeed, farmers are not obliged to provide information in this respect nor to keep a register of their pesticide use. In fact, the only source of information regarding IPM practices is a survey which was performed by the MAPAQ in 2012 and in 2017 as part of the monitoring exercise of the progress towards the objective of IPM adoption set by the phytosanitary strategy. In 2012, the survey was performed with about 1 500 producers of 8 production sectors³⁶, and indicated that only 27% of producers use IPM most of time or always. In 2017, the survey was performed with about the same number of producers. Overall, in 2017, an improved level of adoption of IPM compared to 2012 was observed. In 2017, one sector scored “advanced IPM” (Cranberry, with 7.6 points compared to 7.5 in 2012). 6 out of the 8 sectors scored “Intermediate IPM” (between 5.1 and 7.5) according to the IPM indicator. The field crops sector scored “basic IPM” (with 4.6 points, compared to 4.3 in 2012). Overall, most of the sectors increased their IPM scores in the 2017 survey, except potatoes (6.7 points in 2017 against 6.8 in 2012) and apples (6.7 in 2017 against 6.9 in 2012). The results of the next survey, scheduled for 2021, will make it possible to measure the extent of the changes and the evolution of the degree of adoption of IPM on Quebec farms for the 8 sectors. The usefulness of these surveys lies in its capacity to identify trends in agricultural practices in Quebec, which can be a starting point for guiding and prioritising future actions to increase IPM adoption.

4.4 Barriers to IPM adoption in Quebec and solutions

In 2012, in the context of the objective to increase the adoption of IPM to reduce the use of pesticides, a study³⁷ was performed to identify the barriers and leverages to IPM adoption in Quebec. In a nutshell, the study found three principal barriers:

- Firstly, **producers lack adequate support to help them implement IPM**. In particular, the number of trained advisors who are independent of pesticide companies is insufficient.
- Secondly, **the technical complexity of IPM** is a limit to its use. While IPM proved to bring many benefits, its use often reveals ineffective for farmers due to the lack of knowledge and skills of its users. Research on IPM methods is insufficient in many cases, and there is a lack of transferring research results to the field and enabling advisors and producers to appropriate new techniques developed.
- Finally, the **risks of financial loss and the lack of perceived benefits for producers** is another barrier to the adoption of IPM. The profitability of various IPM techniques is not sufficiently documented, as a result, farmers are not convinced of the benefits that it could bring. On one hand, the use of advisory services to develop IPM as well as the techniques themselves present an additional cost which require the mobilisation of resources from the farmers. On the other hand, agricultural products produced through IPM techniques are rarely recognised by a higher market price or a recognition of its

³⁶ The sectors of production targeted by the IPM indicator are: Cranberry, Vegetable crops, field crops, ornamental nurseries, small fruits, apples, potatoes, ornamental greenhouses.

³⁷ Eco-Ressources Consultants, *Contexte d'adoption de la gestion intégrée des ennemis des cultures*, June 2012.

environmental and health benefits. All of these obstacles contribute to the perception of risk and reluctance to adopt new practices.

Almost 10 years later, as Quebec Phytosanitary strategy is coming to an end, it appears that although significant efforts have been put in place to overcome these barriers, many obstacles remain to the adoption of IPM by producers in Quebec.

4.4.1 Ineffectiveness of the means put in place to support IPM adoption

While evidence suggests that pesticides use is slowly decreasing and IPM adoption is slowly increasing, several reports reveal the ineffectiveness of the means put in place to encourage farmers to adopt sustainable agricultural practices. Indeed, while the Quebec government put in place various tools and advisory services to support producers in their IPM activities (as described in Section 4.2.3), these tools are not always known and used by farmers and producers. For instance, in 2017, almost 30% of producers surveyed declared never using the information from the Réseau d'avertissements phytosanitaires (RAP). Similar results were obtained in 2012. Another example, in 2017, 51% of the producers surveyed declared never using the SAgE pesticides tool (in 2012, it was 64% of producers). Additionally, advisory services put in place in Quebec and funded by the government (about 10 millions of dollars per year is dedicated to the advisory programme for agri-environment³⁸) is not used by the majority of producers³⁹. However, the 2017 IPM indicator survey⁴⁰ reveals that producers obtain better results of IPM adoption when they make use of these advisory services. Other producers do not use advisory services or use advisory services from the agricultural industry. In fact, the costs are higher when using the independent advisory services offered by the Ministry (MAPAQ), as about 30% of the price must be borne by the producers, whereas the cost of the non-independent services from the industry is included in the price of the product sold to producers⁴¹.

4.4.2 Financial barriers and lack of economic incentive

Many contributions to the 2020 CAPERN Evaluation Commission Report⁴² point out to the lack of financial support given to producers to support their IPM approaches. Indeed, financial support programmes for producers are deficient, for instance several government programs do not promote crop diversity in Quebec, which leads to higher use of pesticides due to the high presence of monocultures. In addition, the report notes that insurances do not cover crops grown from non-certified seeds. Furthermore, the general auditor already outlined in its 2016 report that the polluter pays principle was not applied for pesticides in Quebec. As a matter of fact, farmers who are using the riskiest pesticides do not pay for the damage caused to health and environment. On the other hand, organic farmers who do not use pesticides pay for their

³⁸ This advisory programme is not specific only to pesticide management.

³⁹ Rapport du Vérificateur général du Québec à l'Assemblée nationale pour l'année 2016-2017, Rapport du commissaire au développement durable Printemps 2016, Chapitre 3, Pesticides en milieu agricole.

⁴⁰ MAPAQ, Indicateurs de la gestion intégrée des ennemis des cultures, Résultats 2017.

⁴¹ Rapport du Vérificateur général du Québec à l'Assemblée nationale pour l'année 2016-2017, Rapport du commissaire au développement durable Printemps 2016, Chapitre 3, Pesticides en milieu agricole.

⁴² Commission de l'agriculture, des pêcheries, de l'énergie et des ressources naturelles, *Examiner les impacts des pesticides sur la santé publique et l'environnement, ainsi que les pratiques de remplacement innovantes disponibles et à venir dans les secteurs de l'agriculture et de l'alimentation, et ce en reconnaissance de la compétitivité du secteur agroalimentaire Québécois* – Recommandations, February 2020.

annual organic certification. If a tax was applied on pesticides, the money collected could be used to support producers in the adoption of IPM practices for instance.

In its contribution to this report, the Quebec centre of excellence for IPM (PELI)⁴³ also highlights the financial factor to explain the reluctance of producers to adopt IPM. The risk associated to adopting alternatives to pesticides falls almost exclusively on producers. Alternative practices are generally perceived as costly and not as efficient as pesticides use. Furthermore, many producers see no financial benefit as there is no Ecolabel or other recognition. According to producers, the economic and financial incentives in place are not sufficient. Currently, the main financial support for the producers is the MAPAQ Prime Vert programme, which subsidise 70 to 90% of the costs associated with the adoption of several agri-environmental practices. However, there are restrictions, such as ceilings and cumulations limits for the financial help that a producer can obtain. In a nutshell, these subsidies are not always reducing the financial risks to an acceptable level for producers.

4.4.3 Knowledge transfer and information dissemination obstacles

The 2020 CAPERN report also points to the lack of technical support provided to producers. To overcome this, the Commission suggests that money should be invested in human and technological resources as well as in knowledge transfer.

For the PELI, one major challenge to the adoption of alternative practices to pesticides use is the difficulty to access knowledge. Despite the efforts of the last years, knowledge transfer and the dissemination of information towards producers are insufficient. It stresses the importance of supporting producers in the transition to alternative practices to pesticides and encourage the promotion of peer-to-peer learning and exchange among producers on IPM. Furthermore, the PELI highlight the lack of trained advisers and the uneven distribution of advisory centres on the territory.

4.4.4 Lack of research and funding for alternative practices

The CAPERN report highlight the crucial importance of research in the field of IPM to develop innovation and alternative practices, especially since adaptation to climate change is an additional challenge for pest management. It is therefore more than ever necessary to invest more in this sector of R&I.

According to the PELI, currently research and funding for alternative practices are not sufficient to support a massive transition to IPM.

4.4.5 Overcoming barriers to IPM adoption and the new Strategy for Sustainable Agriculture in Quebec

At the end of its report, the CAPERN formulated 32 recommendations for the Quebec government. The first one recommends that the government make the reduction of pesticide use a priority, notably by promoting the agri-environmental transition. Regarding IPM specifically, the report recommends that the government should further support the implementation of measures that encourage the use of alternative methods to pesticides, in particular by promoting integrated pest management and biological control.

⁴³ Contributions to the report are available here: <http://www.assnat.qc.ca/fr/travaux-parlementaires/commissions/CAPERN/mandats/Mandat-40773/memoires-deposes.html>

With the aim of increasing the adoption of IPM and reducing the use of pesticides, several options have been put forward by the various reports from the Auditor General and the CAPERN. Notably, both reports highlight the fact that agricultural funding is not conditional to the adoption of IPM. Therefore, an option could be to introduce cross-compliance or conditionality principles for IPM adoption in the current agricultural subsidy programmes of Quebec.

To answer the recommendations of the CAPERN, Quebec introduced its new Sustainable Agriculture Plan for 2020-2030. Regarding the use of pesticides, the plan is more ambitious than the Phytosanitary strategy. Indeed, in addition to its aims to reduce the risks associated with pesticides, the new plan also set targets to reduce the use of pesticides, with the objective to reduce by 500 000kg pesticides sales. The objective to reduce the risks is increased to 40% by 2030.

The new Plan is also innovative, as compared to the phytosanitary strategy, which was mainly led by the government, the Plan is making a great effort to involve all stakeholders (e.g. producers, regional authorities, etc.) in its implementation. Indeed, producers' association were involved in the establishment of the Plan and made non-binding commitments for themselves to reach within the next ten years. In total, 49 commitments⁴⁴ were put forward by 27 producer associations. The government will provide funding to support the actions to which they have committed to. Furthermore, regional stakeholders will also receive funding from the Quebec government to be involved in the reduction of the risks and of the use of pesticides.

To that end, the new Plan will put in place new means to support producers in their approach to reduce pesticides use. They include notably⁴⁵:

- A reward mechanism for environmental practices based on the achievement of results and on the risks shared, to recognise the efforts of producers (about 70 million dollars will be dedicated to this mechanism).
- A structured pathway for continuing education in the agri-environment for producers (about 25 million dollars).
- Increased professional support (including digital skills) – (about 25 million dollars will be dedicated to professional support, continuous education and technological transfer).

Quebec aims to establish the reward mechanism by spring 2022. Producers are invited⁴⁶ to contribute to the development of the mechanism via a pilot project launched in 2021. The results of the pilot project will feed into the design of the mechanism.

Under the new Plan will also be put in place discussion groups of producers to facilitate the exchange of experience and knowledge among peers. These groups will be funded by the new Plan, and they will aim at steering exchanges, sharing experiences and good practices in the different regions of Quebec.

⁴⁴ The producers' commitments can be found in the New Sustainable Agriculture Plan here: https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/agriculture-pecherie-alimentation/publications-adm/dossier/plan_agriculture_durable/PL_agriculture_durable_mise_en_oeuvre_2021_2025_MAPAQ.pdf?1630595126

⁴⁵ Webinar, MAPAQ, Bilan du projet pilote reduction des indices de risqué des pesticides, *Suite de la gestion intégrée des ennemis des cultures avec le Plan d'agriculture durable*. Available at: <https://www.youtube.com/watch?v=i00IGCx8LF4>

⁴⁶ <https://www.laterre.ca/actualites/politique/les-producteurs-consultes-sur-le-programme-de-retribution>

Last but not least, under the new Plan will be developed more pilot projects, building on the successes of the first pilot projects launched in 2017. These projects will be implemented in various regions of Quebec, and will aim at demonstrating alternative practices to reduce the pesticides' risks and use, and tackling various barriers to IPM adoption such as of the fear of change from producers, the perceived financial risks, etc.

5. Discussion and conclusions

To conclude, Quebec has a long experience with policies to reduce pesticides use in the agricultural sector and to increase the adoption of IPM by farmers, with strategies in place to that end since 1992. With very ambitious targets, the objectives of the successive strategies were not always reached and had to be readjusted.

Various lessons can be learnt from the implementation of Quebec's phytosanitary strategy 2011-2021 which has a strong focus on increasing the uptake of IPM by farmers. Firstly, identifying clear targets and choosing the right indicators to measure the progress in IPM adoption is crucial. Moreover, monitoring the adoption of IPM is a complex exercise. Indeed, the methods (i.e. via a survey) and indicators used in Quebec to monitor the progress in IPM adoption can provide an overview of the general trends in agricultural practices, however they do not provide a complete overview of the IPM practices used by farmers.

Regarding the barriers to IPM adoption, these are already well identified in Quebec (as identified by a 2012 study). It appears that overcoming these barriers is a long process which takes time. Indeed, as illustrated in this case study, Quebec put in place significant efforts to overcome the barriers identified, which resulted in a slow increase in IPM adoption by Quebec farmers. However, some of the means and tools put in place to overcome the barriers revealed to be ineffective or not fully effective. For instance, despite having advisory services in place, these are not necessarily known by farmers. The lack of financial support and financial incentives for farmers was also repeatedly mentioned as one of the main barriers that persists.

It will be interesting to follow the upcoming developments under the new Sustainable Agriculture Strategy for 2020-2030 in Quebec and to see how Quebec is learning from its experience and how it will answer to the recommendations made by the CAPERN to further support the implementation of measures to encourage the use of alternative methods to reduce pesticides use. In particular, the new rewards mechanism for farmers to increase the adoption of IPM by 2030, which is under currently being developed, seems promising, and can be of inspiration for the EU.

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