International Journal of Food Science and Agriculture, 2021, 5(2), 210-213
http://www.hillpublisher.com/journals/jsfa/
ISSN Online: 2578-3475
ISSN Print: 2578-3467

The Pervermac II Project and Its Actions Regarding the Sustainable Use of Pesticides on Agricultural Production, Food Safety and Consumers Health in Azores

David João Horta Lopes[1,*], Paulo Fernandes[2], Andreia Aguiar[3], Ana Dias[4], Maria Bettencourt[4], Elisa Tarantino[1]

[1]Azorean Biodiversity Group (GBA, CITA-A) and Platform for Enhancing Ecological Research & Sustainability (PEERS), University of Azores, Faculty of Agricultural Sciences and Environment, Rua Capitão João D'Ávila, 9700-042 Angra do Heroísmo, Terceira, Azores, Portugal.
[2]Regional Veterinary and Food Safety Laboratory, Regional Directorate for Agriculture and Rural Development, Regional Secretariat for Agriculture and Rural Development, Funchal, Madeira, Portugal.
[3]Terceira Island Health Unit (USIT), Angra do Heroísmo Health Centre (CSAH), Terceira, Azores, Portugal.
[4]School of Health, Department of Nursing, Mental Health and Gerontology, Angra do Heroísmo-Terceira, Azores, Portugal.

How to cite this paper: David João Horta Lopes, Paulo Fernandes, Andreia Aguiar, Ana Dias, Maria Bettencourt, Elisa Tarantino. (2021) The Pervemac II Project and Its Actions Regarding the Sustainable Use of Pesticides on Agricultural Production, Food Safety and Consumers Health in Azores. *International Journal of Food Science and Agriculture*, 5(2), 210-213.
DOI: 10.26855/ijfsa.2021.06.001

Received: February 20, 2021
Accepted: March 18, 2021
Published: April 12, 2021

***Corresponding author:** David João Horta Lopes, Azorean Biodiversity Group (GBA, CITA-A) and Platform for Enhancing Ecological Research & Sustainability (PEERS), University of Azores, Faculty of Agricultural Sciences and Environment, Rua Capitão João D'Ávila, 9700-042 Angra do Heroísmo, Terceira, Azores, Portugal.
Email: david.jh.lopes@uac.pt

Abstract

The overall objective of Pervermac II project is to promote a sustainable use of pesticides in the agricultural production and ensure food security in the Macaronesian region (Azores, Madeira, Canaries and Cape Verde). The aim is to ensure farmer's safety and health with special regards to those who apply pesticides in field through the quantification of residues level in the vegetable and fruits locally produced and imported and, at the same time, decreasing environmental contamination which could represent a risk for consumer health. The level of residues in agricultural products collected during the last four years (2017 to 2020) were been analysed in order to safeguard food safety for the Azorean population. There were also made food surveys to obtain the real proportion of vegetable and fruits in our diet and the correlated level of pesticides residues in the food intake by humans. On most of the products analysed, no pesticide residues were found. Pesticides residuals were found only on a small portion and in this case, the limit allowed by law was never been reached. Activities to raise awareness about the adoption of good diet and promoting actions concerning the implementation of organic production and consumption were conducted with students and Azorean consumers. Actions of knowledge increasing and technology transfer to farmer and the technicians ensured the adoption and implementation of integrated protection measures, promoting the sustainable use of pesticides by the farmers that implemented alternative means of protection against the major crop's phytosanitary problems. This work has been funded by the European Fund for Regional Development (FEDER), articulated through the Territorial cooperation MAC 2014-2020.

Keywords

Residues, Pesticides, Health, Food Safety, Sustainable Practices

1. Introduction

Pervermac II is a research and development cooperation project in agriculture and food security field. This project intends to achieve a major impact on security food and ensure safety to consumer food by making some sampling to the pesticide residues monitoring as well as mycotoxins and heavy metals on agricultural products produced and imported within the geographical scope of Azores Madeira, Canary Islands and Cape Verde archipelagos.

The main objectives are:

• Sampling and analyse of phytosanitary residues on products, mycotoxins and heavy metals on fruits, vegetables and cereals that represent the base of the food pyramid in the Azorean archipelago population.

• Promote technical assistance and farmers training in different partner's regions to support and improve local production, based on minimum incidence of residues from of plant protection products application.

• Development of educational actions with students of different degrees at the school level and for consumers by promoting a healthy diet based on the consumption of fruits and vegetables with the pesticide's lowest possible residues content [1-2].

2. Methods

During the first three years of the project (2017, 2018, and 2019) 120 samples of fruits, vegetables, cereals and wine were collected (Figure 1) in Terceira and other islands of Azores archipelago. In 2020, 25 samples have been collected only on Terceira Island in supermarkets and then analysed in order to investigate the presence of pesticide residues. These samples are included in the National Surveillance Plan for residues in agricultural products and were part of the official annual sampling plan for the Autonomous Region of the Azores.

Figure 1. Food collection in supermarket.

The level of exposure for consumers to pesticides application was determined using the sampling methodology recommended in Directive 2002/63/EC of 11 July 2002. The analysis of residues in fruits and vegetables collected, was performed by GC-ECD, GC-NPD, GC-MS and LC-MS (/MS), based on the methodologies developed by the European Union Reference Laboratory (CVUA-Stuttgart), using extracts from the QuEChERS method and, for very pesticides polar, QuPPe method extracts.

The analyses of the dithiocarbamate pesticides were performed by using an internal method, based on the CEN 12396-2: 1996 standard [3]. The samples were thus submitted to other methods of analysis: QuEChERS and its adaptations involves the addition of a salt and a buffer and uses the partition liquid-liquid with acetonitrile, followed by a DSPE purification step (dispersive solid phase extraction). The extracts obtained were subsequently analysed by liquid chromatography coupled with triple quadrupole mass spectrometry, operated in MRM (multiple reaction monitoring), positive and negative ESI mode. The extracts injected by gas chromatography were previously taken up in isooctane: toluene. For the QuPPe method, the extracts are processed in methanol with direct injection after centrifuging and filtering. For samples with a higher lipid content, an additional purification step was needed and involves the application of cold with additional filtration and purification by DSPE with C18. The analysis of dithiocarbamate was performed by GC-MS, through headspace injection of the headspace after acid digestion of the samples.

The activities conducted to raise awareness of farmer, technicians and population about safer food consuming and a more sustainable agriculture, have concerned knowledge transfer, specific training of farmers and the preparation of handling and calibration manuals for devices for the application of plant protection products. The effects of pesticides on human health were quantified and identified analysing toxic substances in human urine and blood [4].

3. Results and discussion

The results obtained from the residues analysis from the sampled vegetables and fruits allowed the quantification of some active substances of plant protection products in the analysed products [5-6]. Most of the samples showed levels below the Maximum Residue Limit (MRL) established by law. Only in 2017, the 9% of samples had detected with violations (Figure 2) and this value in 2018 increased to 16% (Figure 3) mainly due to the increase in the number of substances officially researched.

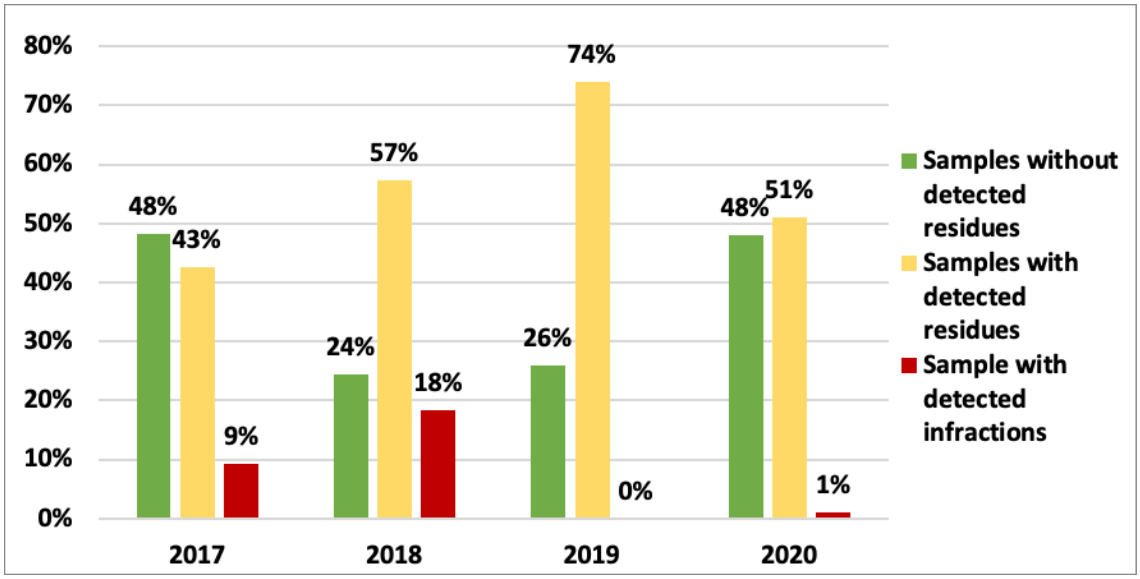

Figure 2. Infractions and residues relative percentage detected in food and drinks analysed from 2017 to 2020.

Major importance is chlorate residues detection. Since this compound starts to be detected, the 86.6% of the recorded occurrences are related to the exclusive presence of chlorates above the MRL.

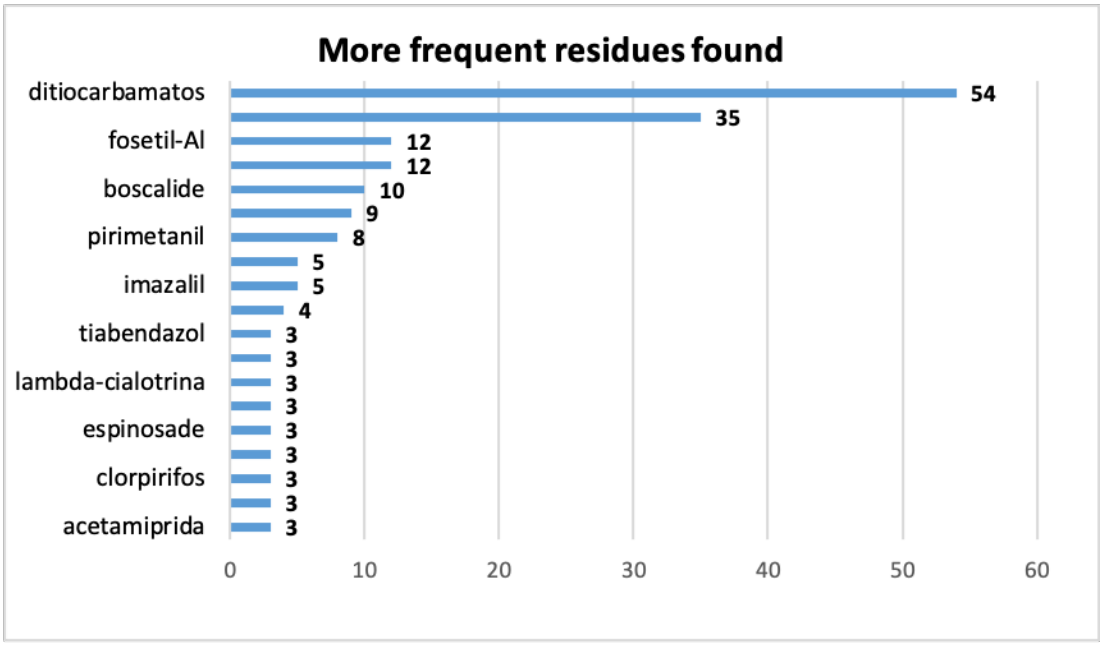

Figure 3. More frequent residues found in samples.

The presence of chlorate in analysed samples might be associated with potable/drinking water used during products washing or biocides used in one or more stages of the production chain. In 2020, although some of the samples collected involved a significant part of biological and dietary products (ex: quinoa, chia, goji, etc.), no samples with residues above the legally defined MRL were identified.

For dithiocarbamate o carbamates residues, 5 samples in 2017 and 15 in 2018, presented residue values above the MRL. It should be noted that on the values found in most of the samples analysed in relation to the dithiocarbamates, their analysis is performed based on the determination of carbon sulfide (CS2). This substance can occur naturally in various products such as cabbages or turnips, making impossible to distinguish those who are exclusively released from decomposition and natural release from those resulting from heavy fungicide applications on this culture from agricultural practice by the farmer.

During 2018, recurrent detection of residues above the MRL in the turnip were as well as new detections of fluroxypyr in peppers, chlorpropham in broccoli, chlorate in pineapples, bananas, melons, strawberries, peppers, tomatoes and table grapes. The chlorpropham might be as origin in contamination process by storage of these vegetable products with potatoes.

4. Conclusion

In this project, a change towards the adoption of more sustainable agricultural practices is promoted by knowledge transfer and fewer pesticides use, encouraged by the technician involved in this project and also the production of fruits and vegetables free from the application of phytosanitary products will be encouraged.

The real target of these activities is the Azorean population, which will learn through all the work developed in this project the real impact on the health of the pesticides applied on their staple food crops.

The preparation of leaflets and a manual of good practices will rise a new mentality in the producers which will allow to achieve a better and sustainable production, free of pesticides. Monitoring of residues in locally produced and imported agricultural products is a very important way of ensuring food security and health of Azorean population. Regarding the farmer and the technician, the knowledge and technology transfer actions provided by the specific demonstration and training activities will ensure the implementation of integrated production, reinforcing the organic production method, promoting sustainable agriculture and the use of alternative means for deal with phytosanitary problems in Azorean cultures.

Also promoting the dissemination, of all the information obtained from the investigation and the practical work carried out in this Pervemac II project, through the media, newspapers, radio and television to the population of the islands involved will allow to know the real impact of the applied pesticides to fight crop pests and diseases ensuring by these project activities a greater consumer food security.

Acknowledgements

We are grateful to the Regional Service of Agriculture and Agrarian Development of Terceira, in the person of Eng. Luísa Ornelas and Eng. Cristina Moules, for all the logistical support in the collection, official registration and packaging of samples.

We thank also FRUTER for the free preparation and packaging of samples made at its facilities and for the logistical support provided in the storage of the samples.

This work was supported by the European Regional Development Fund (ERDF), articulated through the INTERREG V-A-MAC 2014-2020 territorial cooperation program (MAC/1.1.a/049).

References

[1] MS. (2011). *Guia de Avaliação de Estado Nutricional Infantil*. Ministério da Saúde. Instituto Nacional de Saúde Doutor Ricardo Jorge, Lisboa, Portugal.

[2] Rito, A. I., Carvalho, M. A., Ramos, C., and Breda, J. (2013). Program Obesity Zero (POZ)—a community-based intervention to address overweight primary school children from five Portuguese municipalities. *Public Health Nutrition*, vol. 16, n. 6, pp. 1043-1051. https://doi.org/10.1017/S1368980013000244.

[3] Fernandes, P. (2015). *Método de análise DAR-QuEChERS com determinação por LC-MS e GC-TOF-MS IT*. DSLA.03.43, p. 6.

[4] Luzardo, O. P., Almeida-González, M., Ruiz-Suárez, N., Zumbado, M., Henríquez-Hernández, L. A., Meilán, M. J., Camacho, M., and Boada L. D. (2015). Validated analytical methodology for the simultaneous determination of wide range of pesticides in human blood using GC-MS/MS and LC-ESI/MS/MS and its application in two poisoning cases. *Science & Justice*, vol. 55, n. 5, pp. 307-315. https://doi.org/10.1016/j.scijus.2015.04.007.

[5] Lopes, D. J. H., Andreia Aguiar, A., Dias, A., Bettencourt, M., Dutra, R., and Pimentel, R. (2018). The importance of the Pervermac II project in the sustainable use of pesticides on fruit production in Azores. IOBC/wprs Bulletin, vol. 132: 17-24.

[6] Lopes, D. J. H., Aguiar, A., na Dias, A., Bettencourt, M., Fernandes, P., Dutra, R., and Reinaldo Pimentel, R. (2018). A importância do projeto Pervemac II no uso sustentável de pesticidas e seu impacto na saúde humana na Macaronésia. O caso dos Açores, Revista de Ciências Agrárias, 41(SPE): 156-163.