Pesticide residue monitoring in fruits and vegetables in the Canary Islands: Coordinated Program 2017

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INTRODUCTION

The Canary Islands, an oceanic archipelago belonging to Spain, is one of the European Outermost Regions. The geographical, climatic and social characteristics of the Canary Islands are considerably different from those of mainland Spain. In this effort we have carried out a monitoring program of pesticide residues in fresh vegetables in the Islands, following the guidelines of the European coordinated program 2017. For this monitoring program, sampling of products from local origin and imported products was carried out in the Islands with the goal of a comparison between the presence of pesticide residues in products of local origin and those from import. A total of 168 fresh fruits and vegetables samples were collected at the points of sale to the consumer during the course of 2017. The commodities sampled and analyzed were: cauliflower (24 samples, 12 local + 12 import), kiwi (14, 0+14), orange (27, 13+14), potato (29, 17+12), carrot (2813+15), pear (15, 0+15) and onion (31, 14+17). For kiwi and pear there is no local production, so all samples were imported, from mainland Spain and from international origins. For cauliflower commodity the imported samples were all frozen.

EXPERIMENTAL

The pesticide residue analysis was carried out using a multirresidue method (MRM): AOAC acetate buffered Quechers followed by GCMSMS (Ion Trap) and LCMSMS (QQQ) determination, addressing 94 and 57 different pesticide analytes respectively. The residues of fungicides belonging to the dithiocarbamate family were analyzed following the carbon disulfide single residue method (SRM).

Table 1. Origin of the samples analyzed

Commodity	Samples				
	Local	Imported			
		Total	Spain	International	
Onion	14	17	16	1	*Chile*
Cauliflower	12	12	12		
Kiwi	0	14	0	14	*Italy(1); Portugal(2); Chile(3); New Zealand(8)*
Orange	13	14	14		
Potato	17	12	0	12	*Israel(5); United Knigdom(7)*
Pear	0	15	10	5	*Belgium(2); Netherlands(3)*
Carrot	13	15	11	4	*Italy(2); Israel(2)*

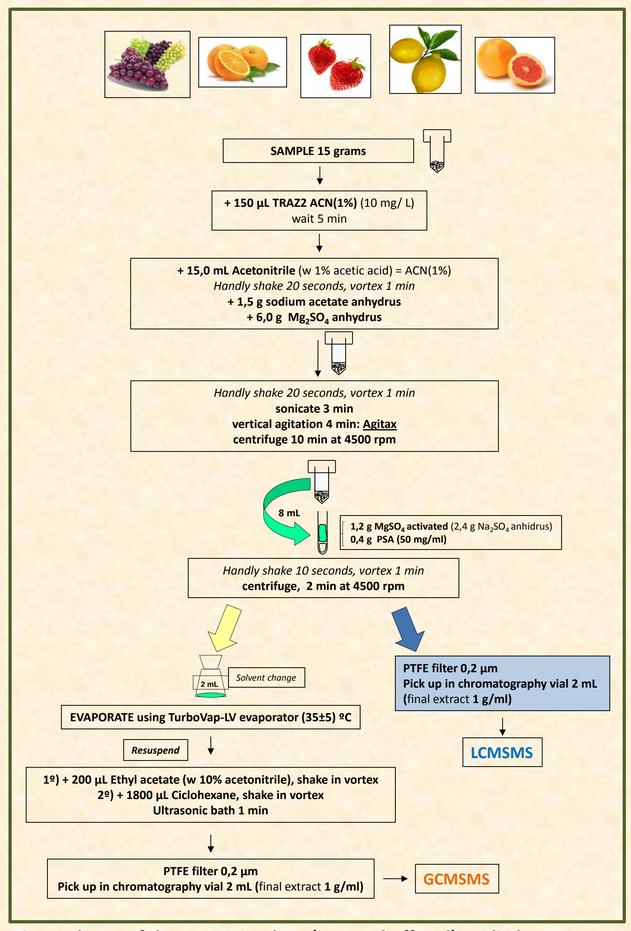

Fig 1. Scheme of the AOAC Quechers (acetate buffered) applied

RESULTS AND DISCUSSION

The average presence of pesticide residues in the total of the 168 samples analyzed was 1,00 residues per sample. This average has been significantly different from one commodity to another and between local and imported products. The commodity with the lower pesticide/sample ratio was onion (0,03), finding only 1 of 31 samples with residues, while the highest ratio was found in pear (3,47). Considering the differences between local and imported products, we have found that the average residue content in local products is 0,72while the average residue in imported products is 1,19, meaning that for each pesticide residue found in a local product we found 1,67 residues in an imported product. The detailed analysis by commodities shows that for those vegetables analyzed (onion, cauliflower, potato and carrot, 112 samples) the presence of residues is greater in local products: 0,52 pesticide residues/sample vs 0,23 for import, while in fruits (kiwi, orange, pear, 56 samples) the presence of residues is higher in imported products: 2,44 pesticide residues/sample vs 1,69 for local. The Canary Islands need to import fresh fruits and vegetables to supply local food markets. The dependence on imports is more important in the case of fruits. The presence of pesticide residues in fruits consumed in the Islands is 6,13 times higher than for vegetables. A total of 10 MRL violations have been found in this monitoring effort: 9 violations for locally produced vegetables and 1 violation for an imported fruit (origin: Spain). These 9 MRL violations in local products affect to 3 crops and 4 insecticides. In the case of methomyl, there is not any plant protection product (PPP) authorized in Spain to be used in cauliflower crops. However, Fosthiazate, Chlorpyriphos and Cypermethrin have authorized PPPs in Spain to be used in potato and carrot crops, finding in these cases an incorrect use of PPPs. This results points towards that in the Canary Islands it is necessary to pay careful attention to the use of PPs in local cultivation of vegetables with the objective of minimizing the use of pesticides.

Table 5. MRL violations

COMMODITY	PESTICIDE	MRL	VALUE	ratio	Local / Import
Cauliflower	Methomyl	0,01	0,04	4	local
Potato	Chlorpyrifos	0,01	0,03	3	local
Potato	Fosthiazate	0,02	0,07	3,5	local
Pear	Imazalil	2,00	2,13	1,1	imported
Carrot	Cypermethrin	0,05	0,13	2,6	local
Carrot	Cypermethrin	0,05	0,07	1,4	local
Carrot	Chlorpyrifos	0,1	0,33	3,3	local
Carrot	Chlorpyrifos	0,1	0,3	3	local
Carrot	Chlorpyrifos	0,1	0,28	2,8	local
Carrot	Chlorpyrifos	0,1	0,26	2,6	local

Table 2. Pesticide residue monitoring results

	ONION			CAULIFLOWER			KIWI			ORANGE			POTATO			PEAR			CARROT			ALL SAMPLES		
	local	*imported*	*Total*	*local*	*imported*	*Total*	*local*	*imported*	*Total*	*local*	*imported*	*Total*	*local*	*imported*	*Total*	*local*	*imported*	*Total*	*local*	*imported*	*Total*	*local*	*imported*	*Total*
Samples	14	17	31	12	12	24		14	14	13	14	27	17	12	29		15	15	13	15	28	69	99	168
Samples with residues	0	1	1	1	2	3		8	8	10	12	22	3	1	4		13	13	9	6	15	23	43	66
% with residues	0%	6%	3%	8%	17%	13%		57%	57%	77%	86%	81%	18%	8%	14%		87%	87%	69%	40%	54%	33%	43%	39%
residues	0	1	1	2	2	4		11	11	22	42	64	4	1	5		52	52	22	9	31	50	118	168
residues/sample	0	0,06	0,03	0,17	0,17	0,17		0,79	0,79	1,69	3,00	2,37	0,24	0,08	0,17		3,47	3,47	1,69	0,60	1,11	0,72	1,19	1,00
samples with 1 res.		*1*	*1*	*2*	*2*	*4*		*5*	*5*	*4*	*5*	*9*	*2*	*1*	*3*		*1*	*1*	*3*	*5*	*8*			
samples with 2 res.								*3*	*3*	*1*	*3*	*4*	*1*		*1*		*4*	*4*	*4*		*4*			
samples with 3 res.										*4*	*7*	*11*					*3*	*3*						
samples with +3 res.										*1*	*7*	*8*					*5*	*5*	*2*	*1*	*3*			
residue > 50% MRL										**1**		**1**	**1**		**1**							**2**		**2**
MRL violations				**1**		**1**							**2**		**2**		**1**	**1**	**6**		**6**	**9**	**1**	**10**

Table 3. Pesticide detailed data

		ONION			CAULIFLOWER			KIWI			ORANGE			POTATO			PEAR			CARROT		
Pesticides	**Residues**	MRL	**local**	**imported**	MRL	**local**	**imported**	MRL	**local**	**imported**	MRL	**local**	**imported**	MRL	**local**	**imported**	MRL	**local**	**imported**	MRL	**local**	**imported**
Acetamiprid	1										0,9	1 (0,01)										
Azoxystrobin	4																			1	3 (0,02)	1 (0,02)
Benalaxyl	1																			0,05	1 (0,01)	
Boscalid	9	5,0		1 (0,01)*													1,5		7 (0,14)	2,0		1 (0,02)
Chlorpyrifos	18				0,05	1 (0,01)					0,3	5 (0,12)	3 (0,03)	0,01	**1 (0,03)**					0,1	**8 (0,33; 0,30; 0,28; 0,26)**	
Chlorpyrifos-methyl	5										0,5		5 (0,10)									
Cyfluthrin	1																0,2		1 (0,01)			
Cypermethrin	3													0,05	1 (0,01)					0,05	**2 (0,13; 0,07))**	
Cyprodinil	3																2,0		2 (0,15)	1,5		1 (0,02)
Difenoconazole	4							0,1		1 (0,02)							0,8		2 (0,02)	0,4		1 (0,03)
Diflubenzuron	1																5,0		1 (0,01)			
Dinocap	1																			0,02	**1 (0,01)**	
Dithiocarbamates	6										5,0		2 (0,12)				5,0		4 (0,21)			
Etofenprox	5										1,0	**3 (0,59)**	2 (0,05)									
Fenhexamid	1							15,0		1 (1,37)												
Fenoxycarb	1																1,0		1 (0,03)			
Fenvalerate (Esfenvalerate)	1																0,1		1 (0,01)			
Fludioxonil	13							15,0		4 (1,23)	10,0		2 (0,54)				5,0		6 (2,25)	1,0		1 (0,03)
Fosthiazate	2													0,02	**1 (0,07)**					0,02	**1 (0,01)**	
Imazalil	17										5,0	3 (1,54)	11 (2,10)				2,0		**3 (2,13)**			
Imidacloprid	12										1,0	4 (0,03)		0,5		1 (0,01)	0,5		5 (0,19)	0,5	2 (0,06)	
Iprodione	9				0,5		1 (0,02)	5,0		4 (0,50)							6,0		2 (1,63)	10,0	2 (0,46)	
Kresoxim-methyl	1																0,2		1 (0,01)			
Lambda-Cyhalothrin	3										0,2	1 (0,01)					0,1		2 (0,02)			
Linuron	6																			0,2	2 (0,01)	4 (0,02)
Methomyl	1				0,01	**1 (0,04)**																
Myclobutanil	1										3	1 (0,01)										
Oxyfluorfen	1										0,05		1 (0,01)									
Permethrin	1													0,05	**1 (0,04)**							
Propiconazole	1										9,0	1 (0,23)										
Pyraclostrobin	7																0,5		7 (0,08)			
Pyrimethanil	9										8,0		6 (1,10)				15,0		3 (2,48)			
Pyriproxyfen	3										0,6	1 (0,03)	2 (0,02)									
Spinosad	1				2,0		1 (0,10)															
Tebuconazole	4										0,9	1 (0,03)					0,3		3 (0,07)			
Thiabendazole	9										7,0	1 (0,13)	8 (0,70)									
Thiacloprid	2							0,2		1 (0,03)							0,3		1 (0,10)			

**Number of findings (max value)*

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