Pesticide use in European agriculture
The case of apple production

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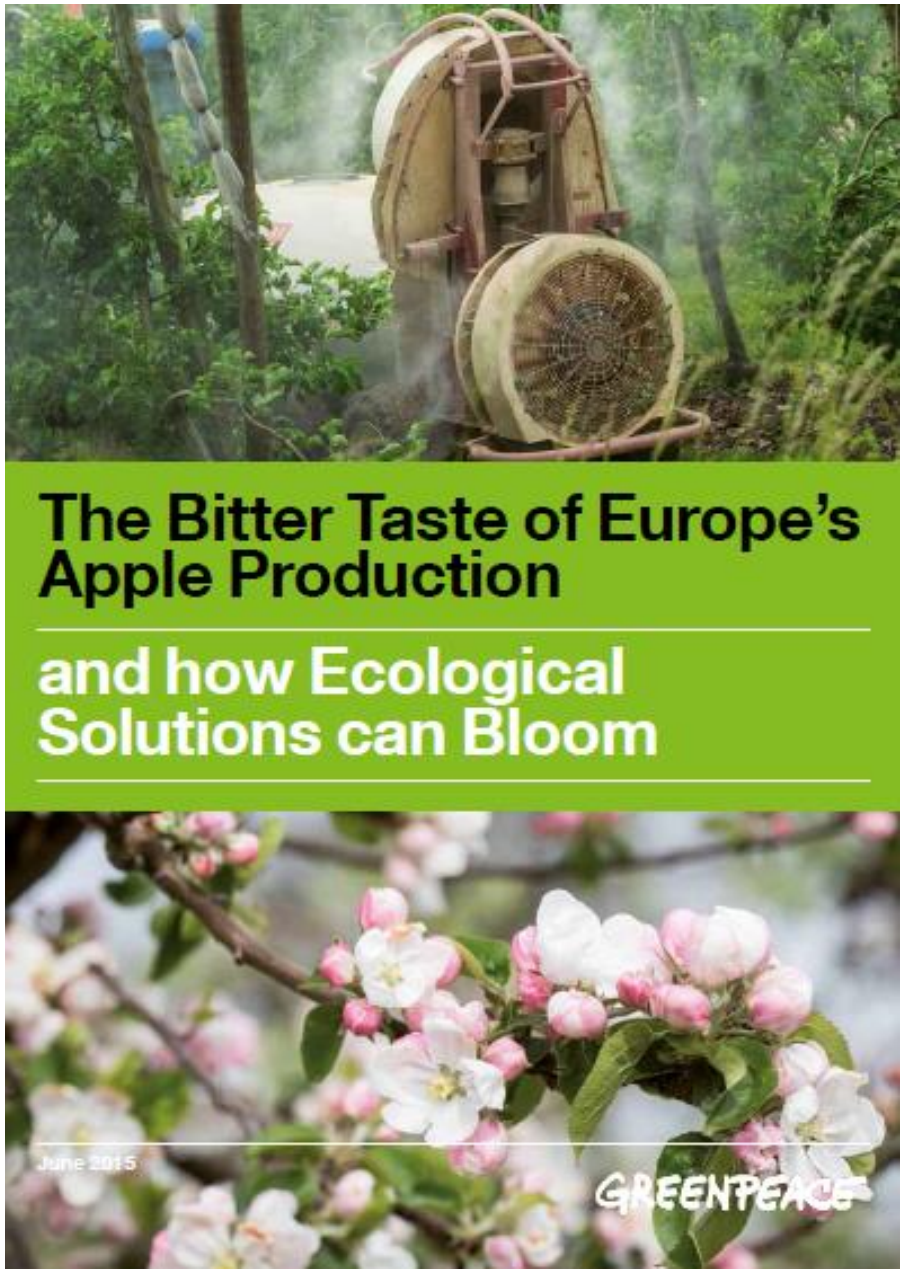


Soil and Water testing

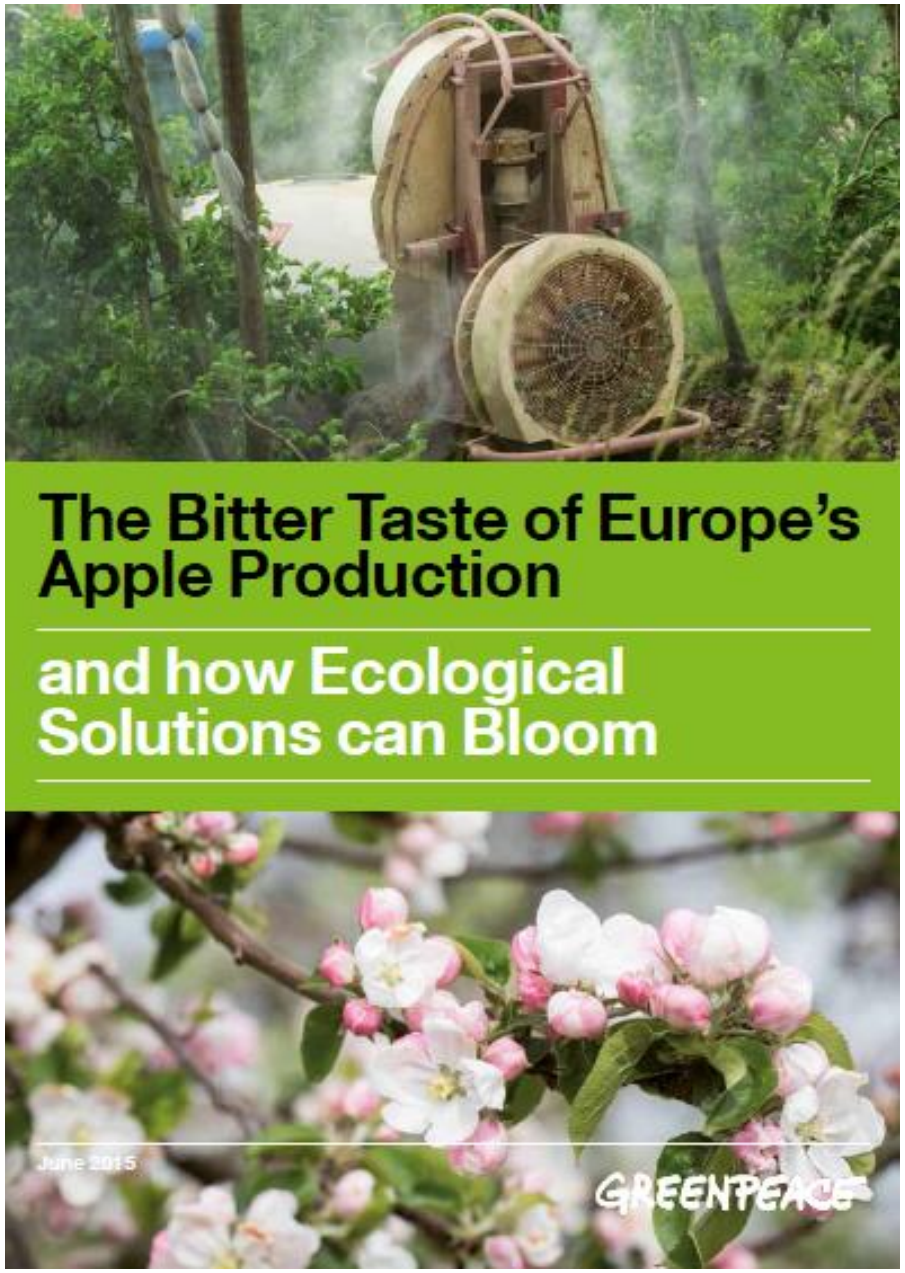
85 samples in 12 countries: **53 different pesticides**

78% soil 72% water samples: residues at least one pesticide

56% samples: two or more residues (5 samples ≥ 10)

- **Italy** (**18 pesticides** 3 samples);
- **Belgium** (**15 pesticides** 3 samples);
- **France** (**13 pesticides** 6 samples)

Cocktails of pesticides detected all over Europe



Soil and Water testing

70% of pesticides found: very high overall toxicity to human and wildlife

8 pesticides in water highly toxic to aquatic organisms

5 water samples exceed Environmental Quality Standards High Priority Contaminants WFD

20 pesticides very persistent

8 pesticides highly toxic to bees

Snapshot at the start of blossoming

The Bitter Taste of Europe's Apple Production

and how Ecological Solutions can Bloom

June 2015

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02

Materials & Methods

Sampling

Apple Orchard Soil and Surface waters

Soils from apple orchards (Table 1) , along with surface waters either from within or adjacent to apple orchards (Table 2), were sampled in 12 countries (Austria, Belgium, France, Germany, Greece, Hungary, Italy, Netherlands, Poland, Slovakia, Spain, Switzerland) during April 2015, either just before blossoming or during the early stages of flowering. These samples, accordingly, allow the determination of a snapshot of agricultural substances present in media other than harvested products at a specific point in the cultivation and production cycle of apples. Soil samples (n=49) were taken using stainless steel trowels, cleaned between sites to avoid cross-contamination, and were a composite of samples (0-5 cm) taken diagonally through each orchard (rather than at the edges). These composite samples were placed in a 500 ml bottle supplied by the analysing laboratory. Water samples (n=35) were taken from streams, ditches, canals or puddles either in the orchards or directly adjoining them, using a clean 1 l glass bottle supplied by the analysing laboratory. Samples were immediately sent for analysis and were processed by the receiving laboratory within 2 weeks of receipt.

Table 1: Details of soil samples from apple orchards including country and area

Country	No. of soil samples	Area
Austria	3	2 x Puch bei Welz, 1 x Itzlsi
Belgium	3	3 x Haspengouw
France	6	2 x Limousin, 2 x Provence-Alpes-Côte d'Azur, 2 x Midi-Pyrénées
Germany	5	5 x Alles Land
Greece	3	1 x Korinthia, 1 x Imathia, 1 x Arkadia
Hungary	6	6 x Kiskunsag
Italy	3	2 x Val di Non, 1 x Valtellina
Netherlands	5	1 x Veldzicht, 1 x Waardenburg, 1 x Middelweert, 1 x Lutlegeest, 1 x Markvesse
Poland	3	1 x Wierzchucice, Kujawsko-pomorskie voivodeship, 1 x Świniskiesz Dworski, Łódzkie voivodship, 1 x Wólka Łęczeszycka, Mazowieckie voivodship
Slovakia	3	2 x Nitriansky kraj, 1 x Trnavsky kraj
Spain	2	2 xCatalufia
Switzerland	7	7 x Lake of Bodensee region (Katon Thurgau)
Total soil sample from apple orchards	**49**	

Table 2: Details of water samples from apple orchards including country, area and type of water collected.

Country	No. of water samples	Type of water body	Area
Austria	1	Puddle	1 x Itzlsi
Austria	1	stream between orchard fields	1 x Puch bei Welz
Austria	1	pipe draining orchard field	1 x Itzlsi
Belgium	1	stream draining apple orchard	1 x Haspengouw
France	2	lake water	2 x Limousin
France	3	surface water	2 x Provence-Alpes-Côte d'Azur, 1 x Midi-Pyrénées
Germany	5	closed ditch	5 x Alles Land
Greece	1	stream running through orchard	1 x Korinthia
Greece	1	Puddle	1 x Imathia
Italy	2	Canal	1 x Val di Non, 1 x Valtellina
Netherlands	3	ditch within orchard field	1 x Veldzicht, 1 x Middelweert, 1 x Lutlegeest
Netherlands	2	ditch between orchard fields	1 x Markvesse, 1 x Waardenburg
Poland	3	Water	1 x Wierzchucice, Kujawsko-pomorskie voivodeship, 1 x Świniskiesz Dworski, Łódzkie voivodship, 1 x Wólka Łęczeszycka, Mazowieckie voivodship
Slovakia	3	puddle water	2 x Nitriansky kraj, 1 x Trnavsky kraj
Spain	1	puddle water	1 x Catalufia
Switzerland	1	surface runoff water	1 x Lake of Bodensee region (Katon Thurgau)
Switzerland	5	drainage pipe runoff water	5 x Lake of Bodensee region (Katon Thurgau)
Total no. of water samples from apple orchards	**35**		

Analysis and Treatment of Results

All samples were analysed at a laboratory in Europe using accredited (ISO/IEC 17025:2005) multi-residue analysis methods targetting a wide range of pesticides and their metabolites (500 parameters in soils and 600 parameters in waters). Details of extraction methods (where appropriate) and analytical methodologies are given in Annex A. Where pesticides were reported as the applied pesticide with no metabolites, no summation was necessary. Where pesticides were present as the applied substance and/or as metabolites, they were summed as outlined in Annex B.

Apple testing

126 apple samples 11 EU countries
23 supermarket chains
109 conventionally grown apples

- All organic apples free of residues
- 17% conventional free of residues
- 39 pesticides residues detected
- 60% containing 2 or more pesticides
- **Below MRLs**

20 fungicides 16 insecticides

- THPI (76)
- Captan (20)
- Boscalid (19)
- Pirimicarb (18)
- Chlorpyrifos-ethyl (15)

Apple testing

Toxic Load Indicator database (TLI)

Highest TLI ranking (10):

- 14 toxicity to aquatic organisms
- 15 toxicity to beneficial insects
- 8 toxicity to bees
- 13 persistence
- 7 bioaccumulation

Once released into the environment, break down slowly and can be taken up and accumulated by organisms throughout the food web

Pesticide application as routine in EU apple production

October 2015
Greenpeace Research Laboratories Technical Report 06-2015

GREENPEACE

02
Methods and Materials

A total of 126 samples of apples were obtained from 11 European countries and, of these, 17 samples were declared to be of organic provenance. Samples were bought between the 24th of August and the 17th of September, depending on the local conditions and with the aim to coincide sampling with entry of the new season's crop coming from national production into the retail chain. All of the apples were dessert apples grown for human consumption and covered 43 different varieties, from the more common ones like Elstar or Royal Gala to less well known varieties like Gravensteiner or Summered. The number of samples collected in each country were as follows:

Austria 10 samples; Belgium 4 samples; Bulgaria 5 samples; Switzerland 8 samples; Germany 39 samples; France 13 samples; Italy 10 samples; Netherlands 5 samples; Poland 10 samples; Slovakia 8 samples; Spain 14 samples

Analysis of apples was carried out at an independent laboratory in Germany, using a modified QuEChERS (DIN EN 15662) analytical protocol. Pesticides were analysed using a multiresidue GC-MS/MS and LC-MS/MS method covering 500 different substances, with a detection limit (LOD) of 3ug/kg and a limit of quantification (LOQ) of 10ug/kg for most compounds.

In summary, 10ml of acetonitrile (HPLC Gradient Grade, VWR) was added to 10g of sample, together with an internal standard solution (containing isoproturon-d6 for LC-MS/MS analysis, and anthracene-d10 for GC-MS/MS analysis). After addition of 4g of anhydrous magnesium sulphate, 1g of sodium chloride, 1g of trisodium citrate dihydrate, and 0.5g of disodium hydrogen citrate sesquihydrate, the whole mixture was shaken and was then separated using a refrigerated centrifuge.

7ml of the supernatant was transferred to a tube containing 1g of anhydrous magnesium sulphate and was then briefly shaken by hand and centrifuged again. An aliquot of the supernatant was removed and, after addition of 10µl of 5% formic acid solution per ml of extract as an analyte preservative, was analysed by LC-MS/MS.

300mg of PSA cleanup sorbent were added to the remaining solution, and the mixture was then shaken and centrifuged in a refrigerated centrifuge. Two aliquots of the supernatant were then transferred to two vials, and, after addition of 10µl 5% formic acid solution per ml of extract, were used for GC-MS/MS analyses.

Table 2: Ranges of concentrations of pesticides detected in apple samples and their current approval status within the EU

Pesticide name	Number of detections	Frequency of detection in %	Concentration range in mg/kg where found (min – max)	Approved for use in the EU	Pesticide type
Acetamiprid	2	1.6	0.022-0.056	Y	I
Boscalid	19	17.4	0.012-0.183	Y	F
Bupirimate	1	0.9	0.011	Y	F
Captan	20	18.4	0.01-0.106	Y	F
Chlorantraniliprole	7	6.4	0.012-0.042	Y	I
Chlorpyrifos(-ethyl)	15	13.8	0.015-0.209	Y	I
Chlorpyrifos(-methyl)	3	2.8	0.016-0.179	Y	I; A
Chlorothalonil	1	0.9	0.013	Y	F
Cyhalothrin, lambda-	1	0.9	0.019	Y	I
Cypermethrin	1	0.9	0.023	Y	I
Cyprodinil	5	4.6	0.011-0.06	Y	F
Difenoconazole	1	0.9	0.065	Y	F
Diflubenzuron	1	0.9	0.03	Y	I
Diphenylamine	1	0.9	0.017	N	GR; F; I
Dithianon	4	3.6	0.013-0.057	Y	F
Ethirimol	1	0.9	0.036	N (but metabolite of Bupirimate)	F
Fenoxycarb	1	0.9	0.031	Y	I
Fenpyroximate	1	0.9	0.01	Y	A
Flonicamid	7	6.4	0.01-0.059	Y	I
Fludioxonil	8	7.3	0.017-0.111	Y	F
Fluopyram	3	2.8	0.012-0.078	Y	F
Folpet	2	1.8	0.760-0.936	Y	F
Imazalil	1	0.9	0.777	Y	F
Imidacloprid	1	0.9	0.045	Y	I
Indoxacarb	2	1.8	0.012-0.023	Y	I
Iprodione	1	0.9	0.023	Y	F
Methoxyfenozide	10	9.2	0.013-0.064	Y	I
Myclobutanil	1	0.9	0.01	Y	F
Phosmet	3	2.8	0.012-0.139	Y	I; A
Pirimicarb	18	16.5	0.01-0.09	Y	I
Pyraclostrobin	12	11	0.012-0.053	Y	F
Pyrimethanil	2	1.8	0.023-0.118	Y	F
Spirodiclofen	6	5.5	0.013-0.036	Y	A
Tebuconazole	6	5.5	0.01-0.074	Y	F
Tebufenozide	3	2.8	0.015-0.046	Y	I
Thiacloprid	2	1.8	0.011-0.016	Y	I
Thiophanate-methyl	1	0.9	0.014	Y	F
TPPI (Metabolite of Captan/Captafol)	76	69.7	0.01-0.369	Y	-
Trifloxystrobin	11	10.1	0.01-0.044	Y	F

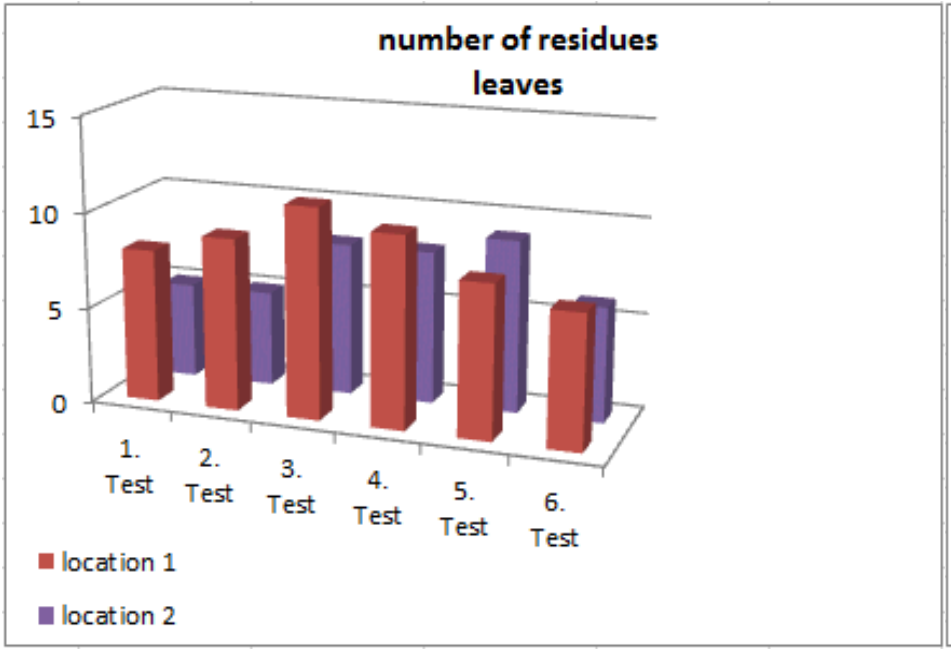
Table 2: Ranges of concentrations of pesticides detected in apple samples and their current approval status within the EU. According to the Pesticide Properties Database, some of the detected pesticides may not be approved at the level of individual countries despite being approved for use at EU level (see: http://sitem.herts.ac.uk/aeru/ppdb/en/).
Key:
I = Insecticide; GR = Plant Growth Regulator; F = Fungicide; A = Acaricide

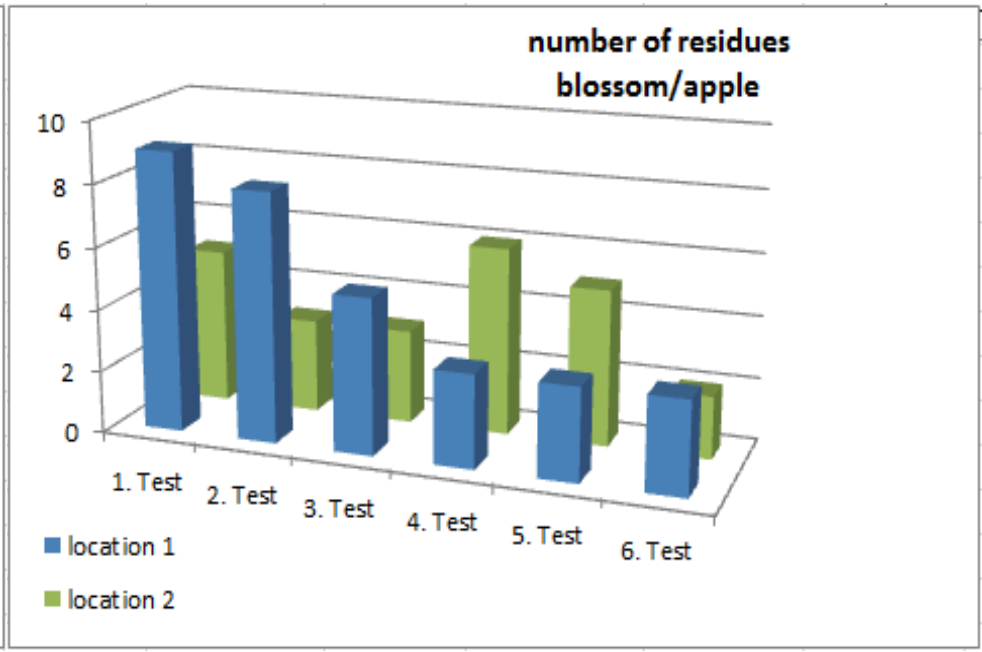
Table 3: Overview of the retail sources of purchased apple samples

Country	No. of samples conventional / organic	Retailers
Austria	9 / 1	4x Aldi/Hofer, 4x Rewe, 2x Spar
Belgium	3 / 1	1x Delhaize, 1x Carrefour, 1x Colruyt, 1x Delhaize
Bulgaria	3 / 2	3x Billa, 1x Gimel, 1x Lidl
France	12 / 1	2x Auchan, 3x Carrefour, 2x Casino, 2x Intermarché, 2x Leclerc, 2x Super/Hyper U
Germany	33 / 6	6x Aldi, 1x Almatura, 3xEdeka, 6xEdeka, 6xNeho, 2xLidl, 6xRewe
Italy	9 / 1	3x Auchan, 3x Lidl, 3x Carrefour, 1x Naturasì
Netherlands	5 / 0	1x Albert Heijn, 2x Aldi, 2x Lidl
Poland	10 / 0	5x Auchan, 2x Intermarché, 3x Leclerc
Slovakia	8 / 0	3x Rewe/Billa, 2x Carrefour, 1x Gastrotelly, 2x Lidl
Spain	11 / 3	2x Auchan, 3x Carrefour, 2x Lidl, 2x Leclerc, 2x Mercadona, 2x Naturasì
Switzerland	6 / 2	1x Aldi, 3x Coop, 1x Lidl, 3x Migros

German testing

- Orchards Atles Land 6 visits May-Sept.
- 4 samples each visit 2 on leaves 2 on apples
- 17 different pesticides found - 11 in one leave sample
- Captan at **193 mg/kg** leaves - MRL on apples **3 mg/kg**
- Flonicamide **4.9mg/kg** leaves - MRL on apples **0.2mg/kg**





European and national data

Germany - Treatment Frequency Index

(number of full dose pesticide applications per crop)

- Since 2001 the index increased in arable and fruit crops (apples and grapes)
- In 2014 TFI reached value 34 in apple orchards = 34 full doses of pesticides on apples in one growing season.

Übersicht zu Behandlungsindizes

alle Maßnahmen - BI (gesamt)

	Winterweizen	Wintergerste	Winterraps	Kartoffeln	Mais	Zuckerrüben	Hopfen	Apfel	Wein
2011	4,9	3,8	6,2	10,8	1,9	3,7	11,0	32,2	15,3
2012	5,2	4,1	6,5	12,2	1,9	4,2	9,3	32,6	16,6
2013	5,2	4,1	6,6	11,2	1,8	3,8	8,0	31,9	17,2
2014	5,7	3,9	6,7	12,6	2,0		11,1	33,7	19,8
2015									

NL - Pesticide use in agriculture: crops and applications

Gebruik gewasbeschermingsmiddelen in de landbouw; gewas en toepassing

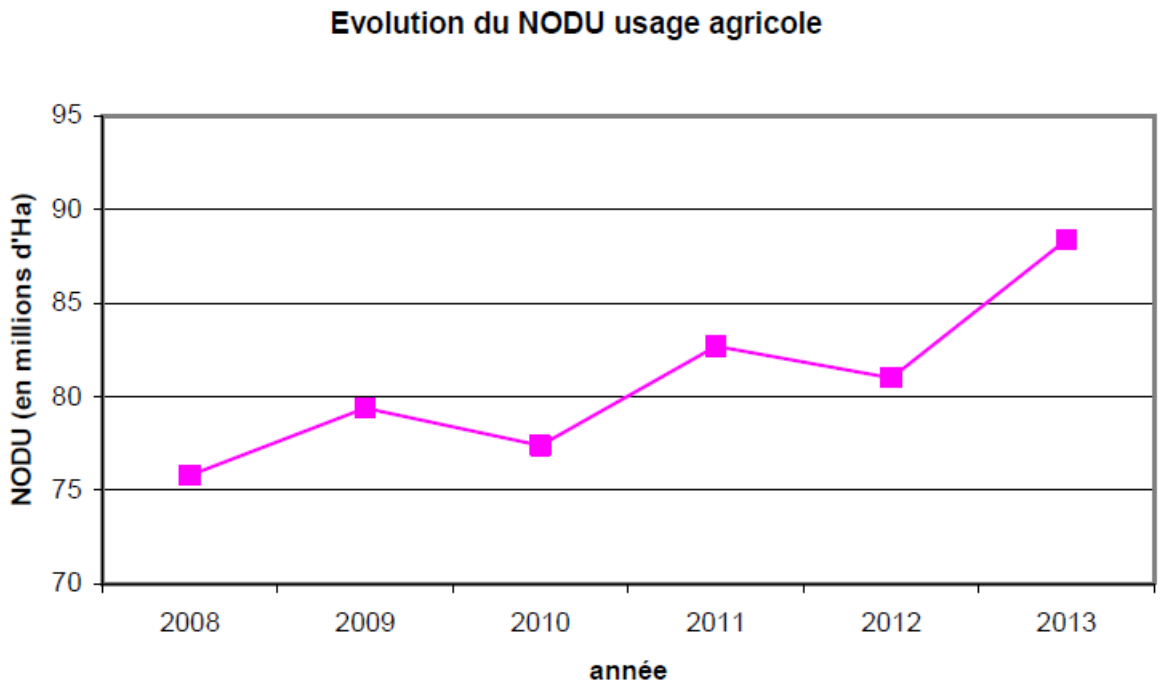
03 juli 2015 | meer info

Toepassingsgroepen	Teeltsectoren en gewassen	Onderwerpen / Perioden	Oppervlakte met gebruik (ha)	Gebruik per jaar (kg)	Gebruik per hectare (kg/ha)
Totaal gewasbeschermingsmiddelen	Aardbeien open grond (productie)	2000	1 746	15 687	9,0
		2004	2 012	21 427	10,1
		2008	1 200	7 278	5,8
		2012	1 299	15 476	10,4
	Appels	2000	12 839	231 976	18,1
		2004	10 217	264 363	25,9
		2008	9 213	261 114	28,1
		2012	7 748	240 250	30,2
	Peren	2000	6 019	104 177	17,3
		2004	6 493	225 292	34,7
		2008	7 476	209 511	28,0
		2012	7 731	183 763	22,5
	Tomaten	2000	1 133	30 014	26,5
		2004	1 352	19 587	14,5
		2008	1 553	25 167	15,7
		2012	1 642	22 144	13,1
	Rozen	2000	932	57 194	61,4
		2004	848	57 306	67,6
		2008	578	51 149	87,7
		2012	406	43 254	106,2

ÉCOPHYTO

RÉDUIRE ET AMÉLIORER L'UTILISATION DES PHYTOS

Evolution of NODU and QSA indicators = «**Strong tendency to increase pesticides use**»



Average pesticides use went up 5 % between 2008 – 2013

Increase in pesticides use by 9,2% in 2013 compared to 2012

ÉCOPHYTO

RÉDUIRE ET AMÉLIORER L'UTILISATION DES PHYTOS

Apples

2011 growing season, 98 % of growers said they treated their trees.

«*Apples are the fruit that receives most phytosanitary treatments:* ***35,1 on average***»

«*Insecticides and acaricides are used on average close to three treatments for apricots and cherries and* ***up to nine treatments for apples***»

ISPRA 2014 National Report on Pesticides in Water

- **27.995 samples** = **175 pesticides** found (> previous years)
- **56,9% surface water** contaminated
- **31% groundwater** contaminated
- 253 samples (17,2%) surface water exceed Envi Quality Standards
- 152 samples (6,3%) groundwater exceed Envi Quality Standards
- 18% surface water at least 2 pesticides, up to 31, average 3
- 13% groundwater at least 2 pesticides, up to 36, average 3.5

- "***The overall results indicate a wide spread of contamination***"
- Monitoring gaps: "*200 substances currently in use are not included into monitoring programmes, 44 of them are classified as dangerous, in particular 38 are dangerous for acquatic organisms*"

eurostat

Explanatory texts (metac

Pesticide sales

Last update: 16-07-2015

Table Customization show

TIME | GEO

Unit of measure: Kilogram

GEO \ TIME	2011	2012	2013
Belgium	658,820	563,187	[illegible]
Bulgaria	: (c)	83,058	[illegible]
Czech Republic	285,044	280,514	[illegible]
Denmark	46,218	89,049	[illegible]
Germany (until 1990 former t	875,344	1,029,492	[illegible]
Estonia	19,383	20,608	[illegible]
Ireland	48,280	42,414	[illegible]
Greece	109,297	910,678	[illegible]
Spain	7,879,608	7,512,575	6,695,557
France	2,149,732	2,327,347	2,244,126
Croatia	:	:	[illegible]
Italy	7,927,733	6,927,822	2,102,842
Cyprus	: (c)	: (c)	[illegible]
Latvia	34,167	44,516	[illegible]
Lithuania	24,995	42,296	39,926
Luxembourg	: (c)	: (c)	[illegible]
Hungary	522,094	609,657	[illegible]
Malta	2,994	3,319	3,387
Netherlands	270,422	244,973	[illegible]
Austria	242,483	246,270	238,197
Poland	991,417	1,286,326	[illegible]
Portugal	877,774	809,679	[illegible]
Romania	807,802	827,576	626,348
Slovenia	38,493	41,621	[illegible]
Slovakia	63,693	65,157	[illegible]
Finland	31,419	30,876	[illegible]
Sweden	28,825	28,986	27,674
United Kingdom	2,871,359	454,220	643,151
Norway	5,098	4,387	[illegible]
Switzerland	95,300	69,300	64,518

EUROSTAT
Pesticide sales
insecticides and acaricides

Eurostat – All pesticides sales 1997-2008

Tonnes of active ingredient

geo \ time	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU (28 countries)	:	:	:	:	:	:	:	:	:	:	:	:
EU (27 countries)	:	:	:	:	:	:	:	:	:	:	:	:
Euro area (18 countries)	:	:	:	:	:	:	:	:	:	:	:	:
Euro area (17 countries)	:	:	:	:	:	:	:	:	:	:	:	:
Belgium	9,276	9,861	9,521	9,953	8,845	9,204	8,822	9,1[illegible]	9,776	:	:	:
Bulgaria	:	:	:	:	:	:	:	:	:	:	:	:
Czech Republic	:	:	:	:	:	:	:	:	:	:	:	:
Denmark	3,757	3,673	2,929	2,889	3,127	2,912	2,991	2,941	3,299	3,254	[illegible]354	4,051
Germany	30,721	33,644	30,231	30,331	27,885	29,531	30,164	28,753	29,512	31,819	[illegible]883	34,664
Estonia	197	191	184	306	329	329	322	357	393	[illegible]	459	:
Ireland	2,356	2,534	2,102	2,133	2,486	2,796	2,913	3,104	2,776	2,874	:	:
Greece	9,034	11,479	10,153	11,1[illegible]	11,111	:	:	:	:	:	:	:
Spain	34,023	35,070	33,614	34,5[illegible]	35,700	:	:	:	:	:	:	:
France	109,792	107,753	120,501	94,694	99,535	82,448	74,524	76,099	78,265	71,6[illegible]2	77,255	:
Croatia	:	:	:	:	:	:	:	:	:	:	:	:
Italy	84,796	84,526	82,048	79,831	76,346	94,711	86,705	84,292	85,[illegible]73	81,450	:	:
Cyprus	:	:	:	:	:	:	:	:	:	:	:	:
Latvia	:	:	:	284	369	339	418	597	733	2,23[illegible]	1,052	:
Lithuania	:	:	:	:	:	:	:	:	:	:	:	:
Luxembourg	332	430	421	:	:	:	:	:	:	:	:	:
Hungary	5,314	6,230	[illegible]	5,473	6,431	8,232	8,726	[illegible]941	9,676	11,523	11,178	12,084
Malta	:	:	:	184	217	222	243	:	:	:	:	:
Netherlands	10,399	10,721	10,196	9,655	7,987	8,073	[illegible]	9,071	[illegible]	9,41[illegible]	10,740	:
Austria	3,690	3,341	3,419	3,563	3,133	3,080	3,386	3,302	3,404	[illegible]	[illegible]	:
Poland	9,501	8,699	8,469	8,848	8,855	10,358	7,184	8,726	16,039	[illegible]02	15,303	:
Portugal	12,750	14,365	15,396	15,469	15,491	17,435	17,046	16,938	16,346	15,703	[illegible]	17,060
Romania	:	:	:	:	:	:	:	:	:	:	:	:
Slovenia	:	:	:	1,469	1,399	1,164	1,361	1,560	1,384	1,281	:	:
Slovakia	:	:	:	:	:	:	:	:	:	:	:	:
Finland	999	1,164	1,141	1,146	1,424	1,620	1,667	1,489	1,4[illegible]	1,645	:	:
Sweden	1,608	1,629	1,698	1,652	1,738	1,711	2,049	942	1,5[illegible]	1,707	:	:
United Kingdom	24,489	25,382	25,299	23,601	23,526	23,526	22,564	23,463	23,[illegible]91	21,151	:	:
Iceland	:	:	:	:	:	:	:	:	:	:	:	:
Liechtenstein	:	:	:	:	:	:	:	:	:	:	:	:
Norway	754	954	796	378	518	818	658	824	511	690	720	:
Switzerland	:	:	:	:	:	:	:	:	:	:	:	:
Montenegro	:	:	:	:	:	:	:	:	:	:	:	:
Former Yugoslav Republic of Macedonia, the	:	:	:	:	:	:	:	:	:	:	:	:
Albania	:	:	:	:	:	:	:	:	:	:	:	:
Serbia	:	:	:	:	:	:	:	:	:	:	:	:
Turkey	:	:	:	:	:	:	:	:	:	:	:	:

EFSA 2015 report
Pesticide residues in food

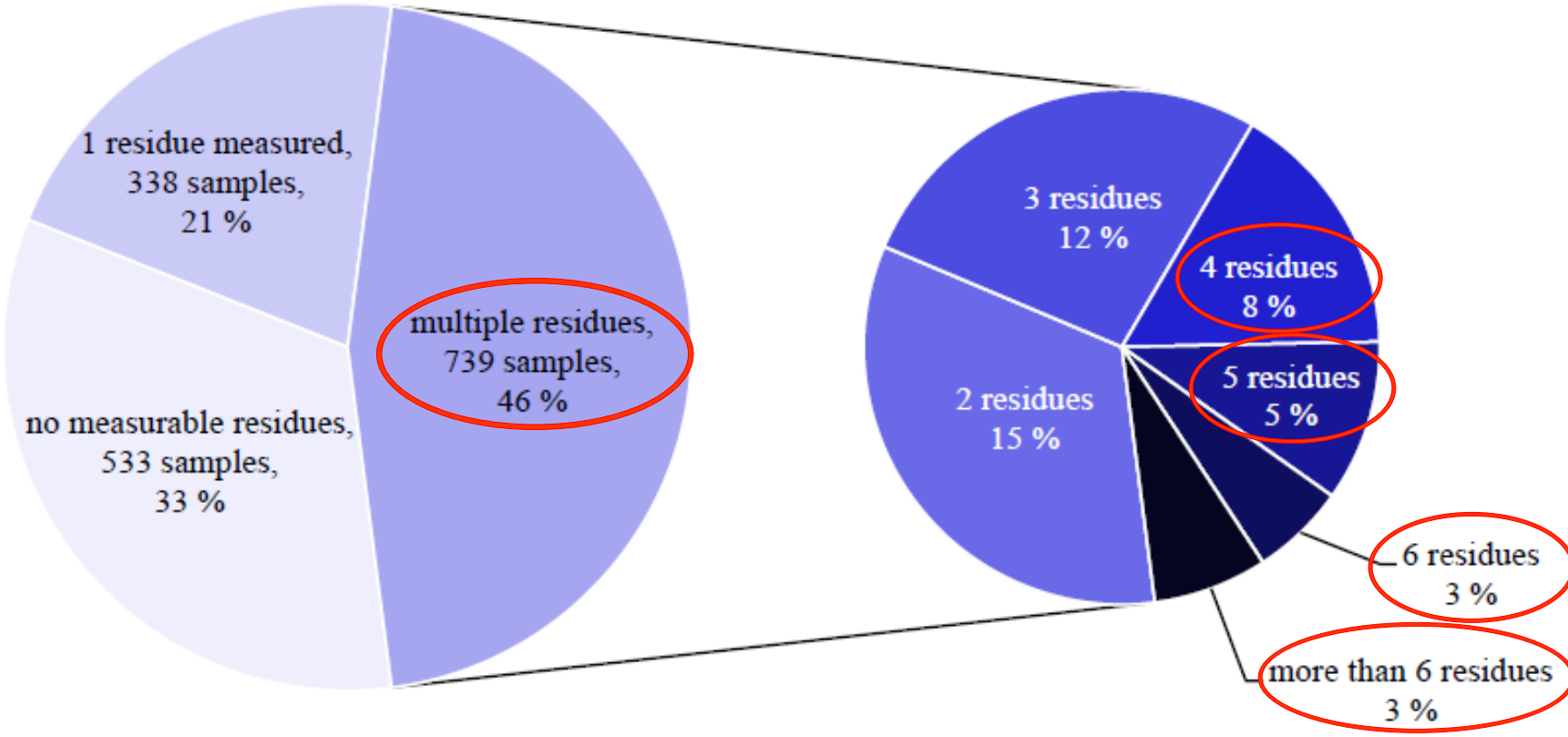


Figure 2-3: Number of detectable residues in individual apple samples

Mixture effects

Additive (1+1=2) and **synergistic** (1+1≥2) effects have been scientifically documented

- Acaricides **tau-Fluvalinate** and coumaphos used in beehives = increase in toxicity to bees
- Cypermethrin and **chlorpyrifos-ethyl** = much higher toxicity to earthworms even for chronic effects.
- Mixture of insecticides (**endosulfan** and **chlorpyrifos-ethyl**) killed 99% of one frog species
- Chlorothalonil and **atrazine** = synergistic impact on water fleas reproduction
- Exposure to **imidacloprid** and thiacloprid = synergistic impacts on newborn water fleas
- Addition of **atrazine** (10 µg/l) increased toxicity of terbufos to water fleas

Testing of pesticides during the authorization process is performed on single substances not on mixtures

Health impacts data gaps

Table 8: Human health issues associated with pesticides detected in analysed apples

pesticide name	Pesticide Type	Carcinogen	Mutagen	EDC	Reproduction/ development effects	Cholinesterase inhibitor	Neurotoxicant	Respiratory tract irritant	Skin irritant	Eye irritant	Other
Acetamiprid	I	N	-	-	-	N	N	N	Y	Y	
Boscalid	F	?	-	N	?	N	N	N	N	?	
Bupirimat	F	N	-	N	?	N	N	-	N	Y	skin sensitiser, poss. liver, thyroid toxicant
Captan	F	Y	N	N	-	N	N	-	Y	Y	may cause contact dermatitis
Chlorantraniliprole	I	N		N	N	?	N	-	N	?	Possible liver toxicant
Chlorpyrifos(-ethyl)	I	N	N	?	?	Y	Y	N	?	?	skin sensitiser, cardiovascular and blood toxicant
Chlorpyrifos(-methyl)	I, A	N	-	N	-	Y	Y	N	Y	N	as above
Chlorthalonil	F	Y	N	N	Y	N	N	Y	Y	Y	skin sensitiser, poss. contact dermatitis
Cyhalothrin, lambda-	I	N	N	N	?	N	?	Y	?	?	skin sensitiser; immune, thyroid toxicant if susceptible
Cypermethrin	I	?	N	?	?	N	N	Y	Y	Y	Highly toxic
Cyprodinil	F	N	N	-	?	N	N	Y	Y	Y	Skin sensitiser
Difenoconazol	F	?	-	N	?	N	N	N	Y	Y	Liver, heart,thyroid, kidney toxicant
Diflubenzuron	I	N	N	N	N	N	N	Y	N	?	Reported to cause methaemoglobiaemia
Diphenylamin	GR;F;I	N	N	-	Y	N	?	Y	Y	Y	Gastrointestinal cardiovascular, kidney, liver toxicant, may cause methaemoglobiaemia and splenic congestion
Dithianon	F	?	-	-	?	N	N	-	N	Y	Skin sensitiser, toxic, poss liver,kidney toxicant
Ethirimol	F	N	-	-	-	N	N	-	N	Y	
Fenoxycarb	I	?	N	Y	?	?	?	Y	Y	Y	Poss. liver, kidney, thyroid toxicant
Fenpyroximat	A	N	-	-	Y	N	N	-	Y	Y	Poss. sensitiser
Flonicamid	I	?	-	-	?	N	N	N	N	N	Poss. liver, kidney toxicant
Fludioxonil	F	?	-	-	?	N	N	N	Y	Y	
Fluopyram	F	?	-	-	Y	-	N	-	N	N	Poss. liver, thyroid, blood toxicant
Folpet	F	Y	?	-	-	N	N	?	Y	Y	Poss. skin sensitiser
Imazalil	F	?	N	N	Y	N	N	Y	N	Y	Poss. Liver, kidney toxicant. Moderate skin sensitiser
Imidacloprid	I	N	?	-	Y	N	?	N	?	?	Potential liver, kidney, thyroid, heart, spleen toxicant. Moderately toxic
Indoxacarb	I	N	-	?	?	N	Y	N	Y	Y	Poss. kidney, liver, spleen, CNS toxicant. Prob. skin sensitiser. Moderately toxic
Iprodion	F	Y	-	?	-	N	N	Y	Y	Y	May cause pulmonary problems
Methoxyfenozid	I	N	N	?	N	N	N	-	?	?	Potential endocrine effects on thyroid and adrenal glands at high doses
Myclobutanil	F	N	-	-	?	N	N	N	N	N	Liver toxicant
Phosmet	I;A	?	N	-	Y	Y	Y	-	N	Y	Highly toxic by all routes
Pirimicarb	I	?	-	-	N	Y	Y	N	?		Highly toxic, may be fatal by inhalation, ingestion, skin absorbtion
Pyraclostrobin	F	N	-	-	-	N	N	N	Y	?	
Pyrimethanil	F	N	-	?	N	N	N	-	N	?	Poss. liver, kidney, adrenals, bladder and thyroid toxicant
Spirodiclofen	A	?	-	-	?	N	?	-	N	N	Possi. adrenal gland toxicant, skin sensitiser
Tebuconazol	F	?	-	-	Y	N	N	N	N	Y	Targets liver/blood system
Tebufenozid	I	N	-	-	N	N	-	-	N	N	Blood, liver, kidney toxicant
Thiacloprid	I	?	-	-	-	N	-	N	N	N	Poss.liver, thyroid toxicant
Thiophanat-methyl	F	?	Y	-	Y	N	-	Y	?	?	Skin sensitiser, Mutagenic potential
THPI (Metabolite Captan/Captafol)	-	-	-	-	-	-	-	-	-	-	
Trifloxystrobin	F	N	-	-	Y	N	N	-	Y	N	Skin sensitiser

Key:
Y = Yes, known to cause a problem, N = No, known not to cause a problem, ? = possible issue status not identified, - = No data
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Considerations

Apples residues below MRLs

Multiple pesticide use in conventional apples

Known hazards of individual substances

Information gaps on single substances impacts

Knowledge gaps Health and Envi impacts of cocktails

Farmers victims of the toxic burden

Recommendations (1)

1. Implement ecological farming principles

Preventive approaches

- **Improve soil management**, fertilisation, cover crops, pruning practices (improve apple trees growth less disease susceptible)
- **Diversify agricultural systems**
  - increasing resilience to pests and diseases
  - benefiting natural enemies (pollen/nectar predatory wasps)
- **Choose disease-resistant cultivars** (Smart breeding - MAS)
- **Monitoring** pests and weather conditions for timely responses

Pests and diseases emergence

- **Implement biological pest controls**, pheromone disruptors
- **Granulosis virus** against caterpillars.
- **Horsetail extract** stimulating natural defences of apple trees.

Recommendations (2)

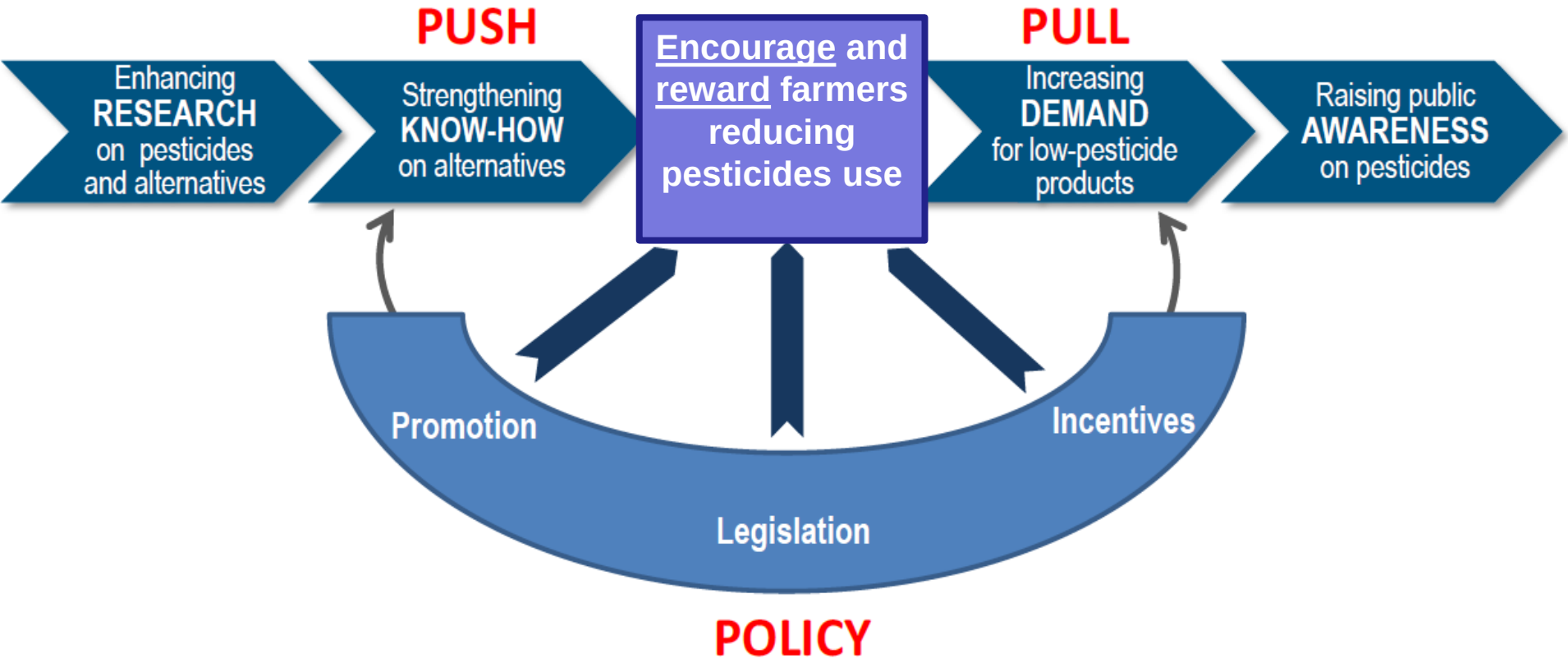
2. **Implement the Sustainable Use of Pesticides Directive**
- Concrete measures and ambitious targets as required by EU law

3. **Strengthen pesticide risk assessment**
- Resolve uncertainties on health and envi pesticides impacts
- Assess effects of pesticide cocktails
- Assess whole formulations
- Rigorous post-market monitoring (use and impacts)

4. **Scale up R&D** of non-chemical alternatives

5. **Promote dissemination of ecological farming** (EIP);

6. **Phase out synthetic-chemical pesticides** (carcinogenic, mutagenic, toxic to reproduction, EDC, neurotoxic)



THANK YOU

Source: HELVETAS Swiss Intercooperation 2015