Chapter 5

Pesticide sales

This chapter reviews the environmental performances of agriculture in OECD countries related to pesticide sales. It provides a description of the policy context (issues and main challenges), definitions for the agri-environmental indicators presented, and elements related to concepts, interpretations, links to other indicators, as well as measurability and data quality. The chapter then describes the main trends of the agri-environmental indicators, using available data covering the period 1990-2010 and based on a set of tables and figures.

5.1. Policy context

The issue

Pesticides are major inputs for agriculture that facilitate lowering the risks of yield losses. As agriculture is the major user of pesticides it is also a significant source of risk of pollution into water systems and of concern for human and wildlife health and the functioning of ecosystems. This concerns all OECD countries, and as a result there is an extensive range of policy instruments used by countries to address human and ecosystem health concerns and pesticide pollution of water (Chapter 9; and OECD, 2012) and air in terms of the sales of methyl bromide (Chapter 12), notably: regulatory instruments (e.g. human health and environmental risk assessment prior to marketing and the sale of pesticides); payments to encourage adoption of practices that lower use and lead to more accurate application; pesticide taxes to encourage greater use efficiency by farmers; and farm advice and information.

Main challenges

The main challenge is to reduce the risks to human health, ecosystems and water systems from excessive exposure to pesticides, while maintaining and increasing the level of crop productivity. This requires taking into account the different factors affecting pesticide risks in the environment, for example, the handling and storage of pesticides on-farms, the toxicity and persistence of pesticides in the environment, and weather conditions during the field application of pesticides.

5.2. Indicators

Definitions

The indicator related to agricultural pesticide sales includes the change in:

- Pesticide sales, in tonnes of active ingredients.

Concepts, interpretation, limitations and links to other indicators

There exist different types of pesticides according to their chemical composition and their targets: biocides, insecticides, fungicides, etc. Pesticide sales data are a proxy measure of potential environmental pressure, since it does not convey information on the real levels of risk exposures for ecosystems and human health, which depend on other factors including toxicity, mobility and persistence. The indicator of pesticide sales tracks trends over time in the overall quantity purchased by agriculture (data refer to sales of active ingredients of insecticides, fungicides, herbicides and other pesticides including plant growth regulators and rodenticides).

Care is required when comparing absolute levels of pesticide sales across countries, because of differences in climatic conditions and farming systems, which affect the composition and level of usage (OECD, 2008). Variability of climatic conditions (especially temperature and precipitation), may markedly alter annual pesticide use, while changes in

the mix of pesticides can reduce active ingredients applied but increase adverse impacts. The indicator does not recognise the differences among pesticides in their levels of toxicity, persistence and mobility. In addition, the greater use by farmers of pesticides with lower potential risk to humans and the environment because they are more narrowly targeted or degrade more rapidly, might not be revealed by any change in overall pesticide sale trends, and possibly even show an increase.

This indicator is not expressed in terms of the quantity of pesticide sales per hectare of agricultural land (or crop land), unlike that which commonly appears in many studies. This is because the application of pesticides varies widely for different crops, both within and across countries, and is sometimes used in the cultivation of forage crops, but limited cross country time series data exist in this regard (OECD, 2008). A limitation in the use of the indicator as a comparative index across countries is that the definition and coverage of pesticide sales data vary across OECD countries, as discussed in the following section.

At present, despite the limitations of assessing pesticide impacts on human health and the environment with the pesticide sales indicator, there are no alternative indicators currently available. A few OECD countries have developed risks indicators, but despite many years of international effort by OECD and other organisations to develop a harmonised and comparable set of pesticide risks the goal remains elusive (OECD, 2008). Even so, the pesticide sales indicator has been used in a policy context by some OECD countries, for example, where pesticide taxes have been introduced or in pesticide reduction plans, such as the French *Ecophyto* plan which aims to reduce pesticide sales by 50% in France by 2018 (OECD, 2012). In addition, this indicator is now widely used by a diverse group of national governments, international governmental organisations and non-governmental organisations, in their regular reporting and monitoring of environmental trends.

As an environmental driving force, the pesticide sales indicator links to the *state* (or concentration) of pesticides in water bodies (Chapter 9), and emissions of methyl bromide which has the potential to deplete the ozone layer (Chapter 12).

Measurability and data quality

In most OECD countries, the available data refers to pesticide sales, which provides an imperfect proxy of agricultural pesticide use or consumption on farms. This is because, first, pesticide sales may be different from pesticide use because of farmers' storage of pesticides. Second, pesticide sales not only cover the agricultural sector but also other activities such as sales for urban use (e.g. road and rail verges), private gardens, golf courses and forestry. For example, in the **United States**, the total amount of pesticide active ingredient sales have been estimated to be shared between 80% purchased by agriculture, 12% by industry, commercial and government purposes, and 8% by home and garden owners. In **Belgium**, agriculture accounts for about 65-70% of sales (EPA, 2011; OECD, 2008).

For all countries, the data represent pesticide sales, except for **Korea** and **Mexico** which are national production data and the **United Kingdom** where data concern the amount of active substance applied on-farm, i.e. usage. Pesticide sales covers agriculture and non-agricultural sales (e.g. forestry, gardens), except for the following countries which only include agriculture: **Belgium**, **Denmark** and **Sweden**. Data are not available for **Israel**, while **Luxembourg** is included in Belgium.

5.3. Main trends

Overall OECD pesticide sales diminished by -1.1% per annum over the period 2000-10, which contrasts to a small per annum increase over the 1990s of +0.2% per annum (Figure 5.1). Much of the declining sales of pesticides over the last decade was accounted for by the **EU15** and the **United States**, which together accounted for 70% of total pesticide sales by 2008-10 (Figure 5.1). A number of other major users of pesticides across OECD also experienced a reduction or no change in pesticide sales over the most recent period, including **France**, **Italy**, and **Japan** (Figures 5.1 and 5.2).

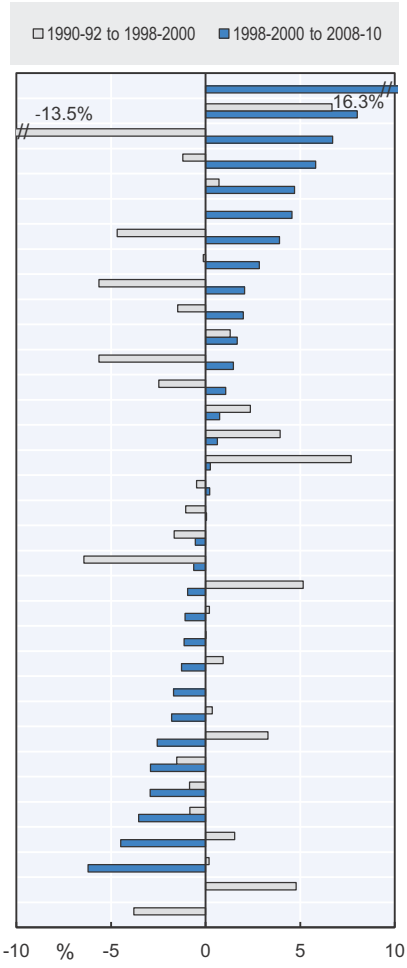
Nearly all EU transition economies (notably **Estonia**, the **Czech and Slovak Republics** and **Hungary**, revealed a strong growth in pesticide purchases over the 2000s, compared to the 1990s when in many cases sales declined (Figures 5.1 and 5.2). Following the reductions in pesticide sales for these countries in their move toward a market economy over the 1990s, the period beginning from around the late 1990s saw some recovery of the agricultural sectors in most EU transition countries, with the consequent increase in production and farm input sales, including pesticides.

The growth in pesticide sales for some countries over the past decade has been mainly driven by increasing crop production, but especially the horticulture and vine sub-sectors, for example, this in part explains recent increases in pesticide sales for **Chile**, **Estonia**, **Finland**, **Hungary**, **Iceland**, **Mexico**, **New Zealand**, **Spain** and **Turkey** (Figures 5.1 and 5.2). For some other countries, for example **Finland**, the switch to agri-environmental payments requiring adoption of environmental farm management practices, such as conservation tillage which usually correlates with greater sales of herbicides, has been a major influence in increasing pesticide sales. This development, however, has to be viewed in terms of other environmental benefits from conservation tillage, such as lowering soil erosion rates.

There is evidence that for a growing number of countries, ***the growth in crop production has been decoupled from the sales of pesticides.*** In other words crop production has been increasing at a faster rate over the period since 2000 than the change in pesticide sales (Figure 5.3 Panel A and Panel B). This development, which suggests improvements in the efficiency of pesticide sales per tonne of crop output, was already evident for some countries over the 1990s, but has become more widespread for other countries over the past decade, such as **Australia**, **Belgium**, **Canada**, **France**, **Italy**, **Japan**, **Korea**, **Mexico**, **Netherlands**, **Portugal**, **Slovenia**, the **United Kingdom** and the **United States** (Figure 5.3 Panel B). The correlation between crop production and pesticide sales, however, needs to be treated cautiously as, for example, it does not take into account the toxicity of pesticides, and site specific conditions, such as soil, weather and pest pressures.

The apparent improvements in pesticide sales efficiency for a growing number of OECD countries can be explained by a combination of factors which vary in importance between countries. The main factors include: farmer education and training; the overall decoupling of support from production and input related support (Figure 2.2, Panel A and Panel B; and Figure 2.3); the use of payments to encourage adoption of beneficial pest management practices; pesticide taxes; the use of new pesticide products in lower doses and more targeted; and the expansion in organic farming (Figure 3.7) (OECD, 2012; OECD, 2008). Some countries made earlier progress in the 1990s in adopting these measures. They made such improvements as adopting new pesticide products or pest management practices to reduce the sales of pesticides at a faster rate than the change in crop production, notably (e.g. **Austria**,

Figure 5.1. **Pesticide sales, OECD countries, 1990-2010**



	Average (tonnes of active ingredients)			Average annual % change	
	1990-92[1]	1998-2000[2]	2008-10[3]	1990-92 to 1998-2000	1998-2000 to 2008-10
Chile	..	26 833	57 058	..	16.3
Estonia	164	227	491	6.7	8.0
Hungary	18 554	5 832	11 176	-13.5	6.7
New Zealand	3 490	3 182	5 294	-1.2	5.8
Turkey	11 967	12 550	18 130	0.7	4.7
Iceland	..	4	5	..	4.6
Finland	1 688	1 150	1 688	-4.7	3.9
Spain	36 849	36 476	43 154	-0.1	2.8
Czech Republic	6 699	4 212	5 166	-5.6	2.1
Slovak Republic	3 694	3 330	4 059	-1.5	2.0
Ireland	2 035	2 256	2 661	1.3	1.7
Denmark	4 948	3 111	3 602	-5.6	1.5
Austria	4 206	3 440	3 824	-2.5	1.1
Mexico	31 551	38 037	39 741	2.4	0.7
Greece	8 337	10 921	11 332	3.9	0.6
Australia	19 323	34 963	35 496	7.7	0.3
Germany	32 618	31 402	32 084	-0.5	0.2
Norway	772	709	713	-1.1	0.1
Sweden	1 897	1 660	1 572	-1.7	-0.5
Netherlands	17 354	10 191	9 568	-6.4	-0.6
Portugal	13 190	16 132	14 947	5.2	-0.9
OECD	**908 959**	**923 075**	**826 688**	**0.2**	**-1.1**
United States	325 226	325 377	300 429	0.0	-1.1
Italy	79 843	83 629	75 483	0.9	-1.3
Slovenia	..	1 344	1 172	..	-1.7
EU15	**339 207**	**348 739**	**291 032**	**0.3**	**-1.8**
Canada	32 775	42 500	36 358	3.3	-2.6
Japan	89 112	78 741	60 291	-1.5	-2.9
Korea	26 425	24 676	18 312	-0.9	-2.9
Belgium	10 204	9 538	6 648	-0.8	-3.5
France	95 281	107 649	68 053	1.5	-4.5
United Kingdom	30 754	31 182	16 418	0.2	-6.2
Poland[4]	6 254	8 672	19 520	4.8	n.c.
Switzerland[5]	2 120	1 557	2 188	-3.8	n.c.

..: not available; n.c.: not calculated.

Notes: Countries ranked in descending order according to average annual percentage change 1998-2000 to 2008-10.

For all countries, the data represent pesticide sales, except for the following countries: Korea and Mexico (national production data) and United Kingdom (amount of active substance applied on-farm).

The data are expressed in tonnes of active ingredients except for Chile for which data are expressed in tonnes of formulated product.

Pesticide sales cover agriculture and non-agricultural sales (e.g. forestry, gardens), except for Finland which does not include forestry and for the following countries which only include agriculture: Belgium, Denmark and Sweden.

The following countries are not included in the figure: Israel (time series incomplete), Luxembourg (included in Belgium).

The OECD total does not include: Chile, Iceland, Israel, Poland, Slovenia and Switzerland.

For Israel, sales were 6 946 tonnes for 2008-10.

1. Data for 1990-92 average equal the 1991-93 average for Greece, Norway, Poland and Slovak Republic; the 1993-95 average for Estonia and Turkey; the 1995-97 average for Italy; and the 1996-98 average for Portugal.
2. Data for 1998-2000 average refer to the 1999-2001 average for Iceland; the 2000-02 average for Italy, Portugal, Slovenia and Turkey; and the 2001-03 average for Chile.
3. Data for 2008-10 average refer to the 2004-06 average for Australia, Canada, Greece, Mexico and Spain; the 2005-07 average for the United States; the 2006-08 average for Chile and Iceland; and the 2007-09 average for Japan and New Zealand.
4. Break in time series from 2005, data not comparable.
5. Break in time series from 2006, data not comparable.

Source: OECD Environmental Compendium Database 2008, www.oecd.org/environment; Statistical Office of the European Community (EUROSTAT), *http://epp.eurostat.ec.europa.eu*; and national data.

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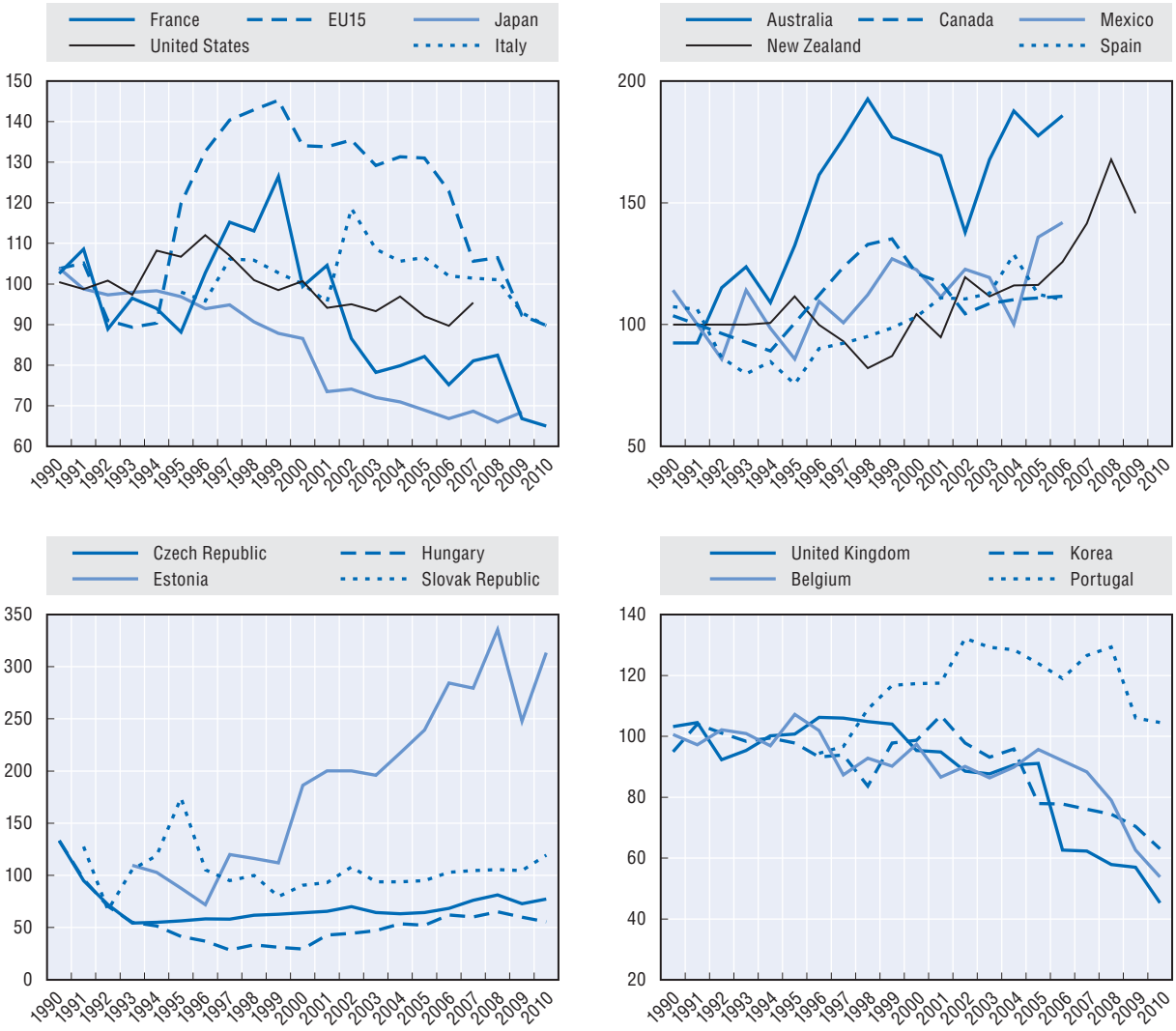
Figure 5.2. **Pesticide sales index, OECD countries, 1990-2010**

Index 1990-92 = 100



Notes: Caution is required in comparing trends across countries because of differences in data definitions, coverage and time periods.

The Index 1990-92 = 100 equals the 1991-93 = 100 for Slovak Republic; the 1993-95 = 100 for Estonia; the 1996-98 = 100 for Portugal; and the 1995-97 = 100 for Italy.

For all countries, the data represent pesticide sales, except for the following countries: Korea and Mexico (national production data) and United Kingdom (amount of active substance applied on-farm).

Pesticide sales cover agriculture and non-agricultural sales, except for Belgium which only includes agriculture.

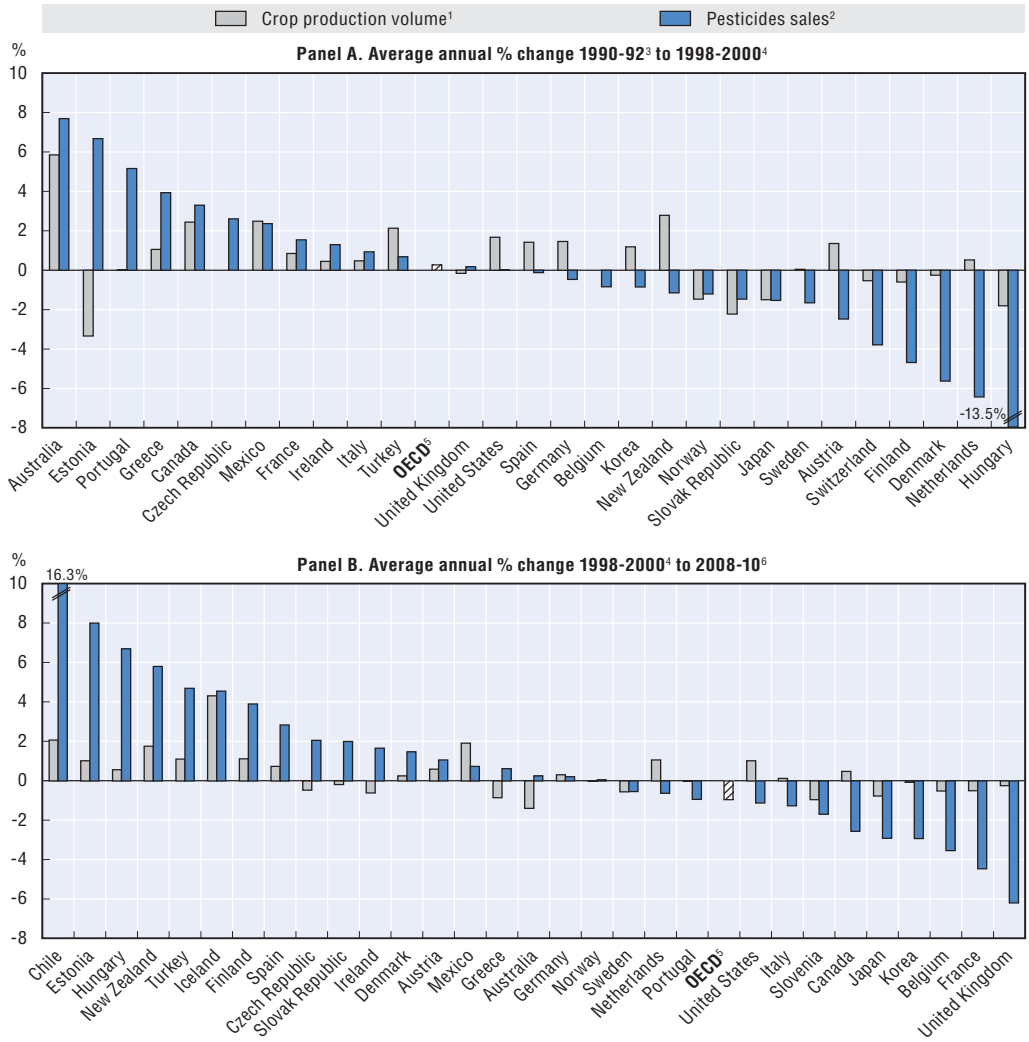
Source: OECD Environmental Compendium Database 2008, *www.oecd.org/environment*; Statistical Office of the European Community (EUROSTAT), *http://epp.eurostat.ec.europa.eu*; and national data.

StatLink http://dx.doi.org/10.1787/888932792787

Denmark, **Finland**, **Germany**, **Hungary**, **Korea**, **Netherlands**, **New Zealand**, **Norway**, **Slovak Republic**, **Spain**, **Sweden**, **Switzerland**, **Turkey** and the **United States**) (Figure 5.3).

There are no comparable cross country data on the risks to human health and the environment from the use of pesticides in agriculture, although there is a considerable body of research in the area, and a few countries have developed their own pesticide risk indicators (OECD, 2008). This lack of information on pesticide risks is further compounded in terms of a lack of comprehensive knowledge and information on the health and environmental effects

Figure 5.3. **Pesticide sales and crop production volume, OECD countries, 1990-2010**



Note: Countries ranked in descending order according to average annual percentage change in pesticide sales for 1990-92 to 1998-2000 and 1998-2000 to 2008-10, respectively.

1. The FAO indices of crop production show the relative level of the aggregate volume of crop production for each year in comparison with the base period 2004-06. They are based on the sum of price weighted quantities of different crop commodities produced after deductions of quantities used as seed and feed weighted in a similar manner. The resulting aggregate represents, therefore, disposable production for any use except as seed and feed. All the indices at the country, regional and world levels are calculated by the Laspeyres formula. Production quantities of each commodity are weighted by 2004-06 average international commodity prices and summed for each year. To obtain the index, the aggregate for a given year is divided by the average aggregate for the base period 2004-06. Due to technical reasons it is not possible to provide an OECD or EU average.
2. Pesticide sales cover agriculture and non-agricultural uses (e.g. forestry, gardens), except for Finland which does not include forestry and for the following countries which only include agriculture: Belgium, Denmark and Sweden. For all countries, the data represent pesticide sales, except for the following countries: Korea and Mexico (national production data) and United Kingdom (amount of active substance applied on-farm). The data are expressed in tonnes of active ingredients except for Chile, for which data are expressed in tonnes of formulated product. The following countries are not included in the figure: Israel (time series are incomplete), Luxembourg (included in Belgium), Poland (break in time series from 2005, data not comparable), and Switzerland (break in time series from 2006, data not comparable).
3. Crop production and pesticides data for 1990-92 average equal the 1991-93 average for Greece, Norway, Poland and Slovak Republic; the 1993-95 average for Estonia and Turkey; the 1995-97 average for Italy; and the 1996-98 average for Portugal.
4. Pesticide sales data for 1998-2000 average refer to the 1999-2001 average for Iceland; the 2000-02 average for Italy, Portugal, Slovenia and Turkey; the 2001-03 average for Chile; and the year 2000 for Belgium for crop production data.
5. The OECD total for pesticides sales does not include Chile, Iceland, Israel, Slovenia and Switzerland.
6. Pesticide sales data for 2008-10 average refer to the 2004-06 average for Australia, Canada, Greece, Mexico and Spain; the 2005-07 average for United States; the 2006-08 average for Chile and Iceland; and the 2007-09 average for Japan and New Zealand.

Source: FAOSTAT (2012), *http://faostat.fao.org*; *OECD Environmental Compendium Database 2008*, *www.oecd.org/environment*; Statistical Office of the European Community (EUROSTAT), *http://epp.eurostat.ec.europa.eu*; and national data.

StatLink *http://dx.doi.org/10.1787/888932792806*

with the release of mixtures of pesticides rather than a single pesticide product. Moreover, there is also little understanding of the potential risk implications of the interaction in the environment between pesticides and other chemical contaminants (e.g. veterinary medicines, human pharmaceuticals, personal care products and industrial chemicals) (OECD, 2012). In most OECD countries, however, regulatory processes are removing older, more persistent and toxic pesticides, from the market, such as DDT.

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