Organisation for Economic Co-operation and Development
Organisation de Coopération et de Développement Économiques

ENVIRONMENTAL PERFORMANCE OF AGRICULTURE IN OECD COUNTRIES SINCE 1990:

Chapter 1 Section 1.3
Pesticides

This document is an extract from Chapter 1 of the OECD publication (2008) ***Environmental Performance of Agriculture in OECD countries since 1990***, which is available on the OECD website which also contains the agri-environmental indicator time series database at: www.oecd.org/tad/env/indicators

This text should be cited as follows: OECD (2008), *Environmental Performance of Agriculture in OECD countries since 1990*, Paris, France, www.oecd.org/tad/env/indicators

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1.3. PESTICIDES

KEY TRENDS

Overall OECD pesticide use has declined by 5% over the period 1990-92 to 2001-03, but marked by a large variation in trends between countries (measured in terms of the quantity of active ingredients). While pesticide use has increased in some countries, pesticides have changed over time and many of them are today less environmentally harmful. But the persistence in the environment of some older pesticides (*e.g.* DDT, atrazine and derivatives) remains a concern, although these products are now banned in some countries.

Among the ***largest users of pesticides*** across the OECD pesticide use increased in Italy, Mexico and Spain and decreased in France, Japan and the United States. Together these countries accounted for around three quarters of total OECD pesticide use in 2001-03.

For ***countries where pesticide use increased*** by over 20% (Greece, Mexico, Poland, Portugal, Turkey), this can be largely explained by the expansion in crop production (especially Mexico and Turkey) and substitution of labour for pesticides, as these countries have a relatively large but contracting agricultural labour force.

Where ***pesticide use decreased*** by over 20% (Austria, Czech Republic, Denmark, Hungary, Japan, Netherlands, Norway, Switzerland), this is related to a combination of factors which vary in importance between countries, including: for most countries a decline in crop production; the use of incentives and taxes; the adoption of pest management practices; the use of new pesticide products used in lower doses and more targeted; the expansion in organic farming; and the sharp reduction in support for agriculture in the those countries that experienced the transition to a market economy (Czech Republic and Hungary), but since around the year 2000 pesticide use for these countries has begun to rise in the period towards EU membership.

For a limited number of OECD countries indicators over the past decade reveal that in most cases ***human health and environmental risk from pesticide use are declining.*** These indicators also suggest a link between a decrease (increase) in pesticide use and decreasing (increasing) risks. Some studies show that risks are not quantified on a major share of farm land treated with pesticides.

1.3.1. Pesticide use

Indicator definition:

- Pesticide use (or sales) in terms of tonnes of active ingredients.

Concepts and interpretation

Agricultural pesticides contribute to raising agricultural productivity but also pose potential risks to human health and the environment. The risks vary greatly depending on pesticide's inherent toxicity (or hazard) and exposure. Exposure depends on a number of variables, such as the application method, the weather after application, its environmental mobility and persistence, and proximity to water courses.

This indicator provides a proxy of the potential pressure, and not actual impacts, that the use of pesticides by agriculture may place on the environment and human health. The indicator of pesticide use tracks trends over time in the overall quantity of pesticide used by agriculture (data refer to active ingredients of insecticides, fungicides, herbicides and other pesticides including plant growth regulators and rodenticides). Unlike many other indicators of pesticide use this indicator is not expressed in terms of the quantity of pesticide used per hectare of agricultural land (or crop land). This is because the application of pesticides varies widely for different crops, both within and across countries, and is sometimes used to cultivate forage crops, but limited cross country time series data exist in this regard (OECD, 2005a).

A limitation to the use of the indicator as a comparative index across countries is that the definition and coverage of pesticide use data vary across OECD countries. Only a few countries have data on actual pesticide use, but nearly all OECD countries report data on pesticide sales, which can be used as a proxy for pesticide use, although ideally it should be supported by representative samples of the use data. In **Sweden**, for example, farmer questionnaires over the 1990s show pesticide use to vary around 5% above or below sales, although in some years farmers used substantially less pesticide than was sold, such as in 1994 when a levy was introduced at the end of the year and farmers most likely stocked pesticides in anticipation of a price rise (Swedish Chemicals Inspectorate, 1999). For a number of countries pesticide use data series are incomplete, including **Australia**, **Canada** and **Iceland**. A further problem is to identify pesticide use specific to agriculture, net of uses such as forestry, gardens, and golf courses. In the **United States**, for example, agriculture accounts for 75% of pesticide use, and about 65-70% in **Belgium** (Chapter 3). The OECD, in co-operation with Eurostat, has launched a process to help improve the collection of pesticide use data (OECD, 1999).

Care is required when comparing absolute levels of pesticide use across countries, because of differences in climatic conditions and farming systems, which affect the composition and level of usage. Variability of climatic conditions (especially temperature and precipitation), may markedly alter annual pesticide use but is less important over the 14 year time series examined here, 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 reveal any change in overall pesticide use trends, and possibly even show an increase. However, as revealed in Section 1.3.2 on pesticide environmental risk indicators, evidence from a limited number of OECD countries suggest correlation between a decrease (increase) in pesticide use and decreasing (increasing) risks.

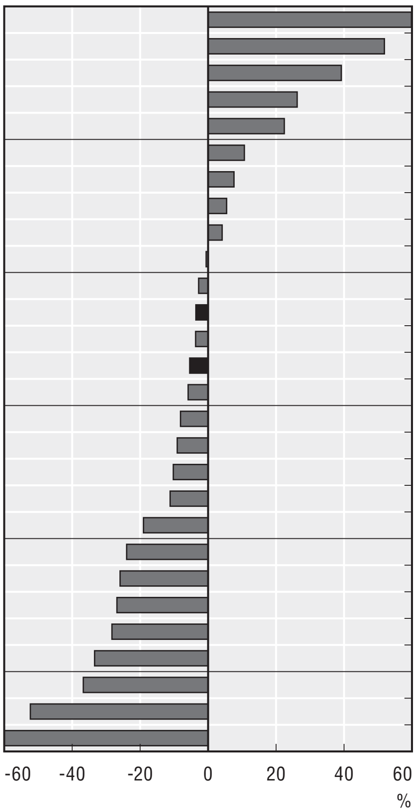
As an environmental ***driving force*** the pesticide use indicator, including the indicator of the use of methyl bromide which has potential to deplete the ozone layer (Section 1.7.2), is linked to pesticide risk indicators (Section 1.3.2) and the ***state*** or presence/concentration of *pesticides in water bodies* (Section 1.6.2). ***Responses*** to these changes in the state of the environment are revealed through indicators of *pest management* and *environmental farm planning*, including organic farming (Section 1.9).

Recent trends

Overall OECD pesticide use has declined by 5% over the period 1990-92 to 2001-03, but marked by a large variation in trends between countries (Figure 1.3.1). This reflects, in

Figure 1.3.1. **Pesticide use in agriculture**

Change in tonnes of active ingredients (%)



	Average[1, 2]		Change	
	1990-92[3]	2001-03	1990-92 to 2001-03	
	Tonnes		Tonnes	%
Turkey	11 967	19 128	7 161	60
Poland	6 507	9 882	3 375	52
Greece	8 337	11 605	3 268	39
Portugal	13 200	16 661	3 461	26
Mexico	31 551	38 621	7 070	22
Spain	36 849	40 783	3 933	11
Italy	79 844	85 920	6 075	8
Ireland	2 043	2 154	111	5
New Zealand	3 635	3 785	150	4
Slovak Republic	3 694	3 673	–22	–1
Sweden	1 897	1 844	–53	–3
EU15[4]	**339 515**	**327 372**	**–12 144**	**–4**
United States	325 226	313 281	–11 944	–4
OECD[5]	**867 588**	**820 826**	**–46 762**	**–5**
United Kingdom	34 060	32 064	–1 996	–6
Korea	28 097	25 821	–2 276	–8
Finland	1 727	1 570	–157	–9
France	95 281	85 531	–9 750	–10
Germany	32 629	28 982	–3 646	–11
Belgium	6 750	5 467	–1 283	–19
Austria	4 206	3 199	–1 008	–24
Norway	912	676	–236	–26
Japan	89 112	65 211	–23 900	–27
Switzerland	2 120	1 521	–600	–28
Czech Republic	6 699	4 462	–2 237	–33
Denmark	4 948	3 131	–1 817	–37
Netherlands	17 744	8 461	–9 283	–52
Hungary	18 554	7 394	–11 159	–60

StatLink http://dx.doi.org/10.1787/286683827028

Note: Caution is required in comparing trends across countries because of differences in data definitions, coverage and time periods. The following countries are not included in the figure: Australia, Canada, Iceland (time series are incomplete) and Luxembourg is included in Belgium.

1. For all countries the data represent pesticide sales except for the following countries: Korea and Mexico (national production data).
2. Pesticide use covers agriculture and non-agricultural uses (*e.g.* forestry, gardens), except for the following countries which only include agriculture: Belgium, Denmark and Sweden.
3. Data for 1990-92 average equal the: 1991-93 average for Greece and the Slovak Republic; 1993-95 average for Mexico, New Zealand and Turkey; 1995-97 average for Italy; 1996-98 average for Portugal.
4. The EU15 includes the 1996-98 average value for Portugal and OECD Secretariat estimated values for the following countries and years: Ireland: 2002 and 2003; Greece: 1991-93; Italy, Germany and Spain: 2003.
5. The OECD total includes OECD Secretariat estimated values for the following countries and years: 1990 for Greece and the Slovak Republic; 1990-92 for Mexico, New Zealand, Turkey; 2002 and 2003 for Ireland, Turkey, United States; 2003 for Germany, Mexico, Poland, Spain.

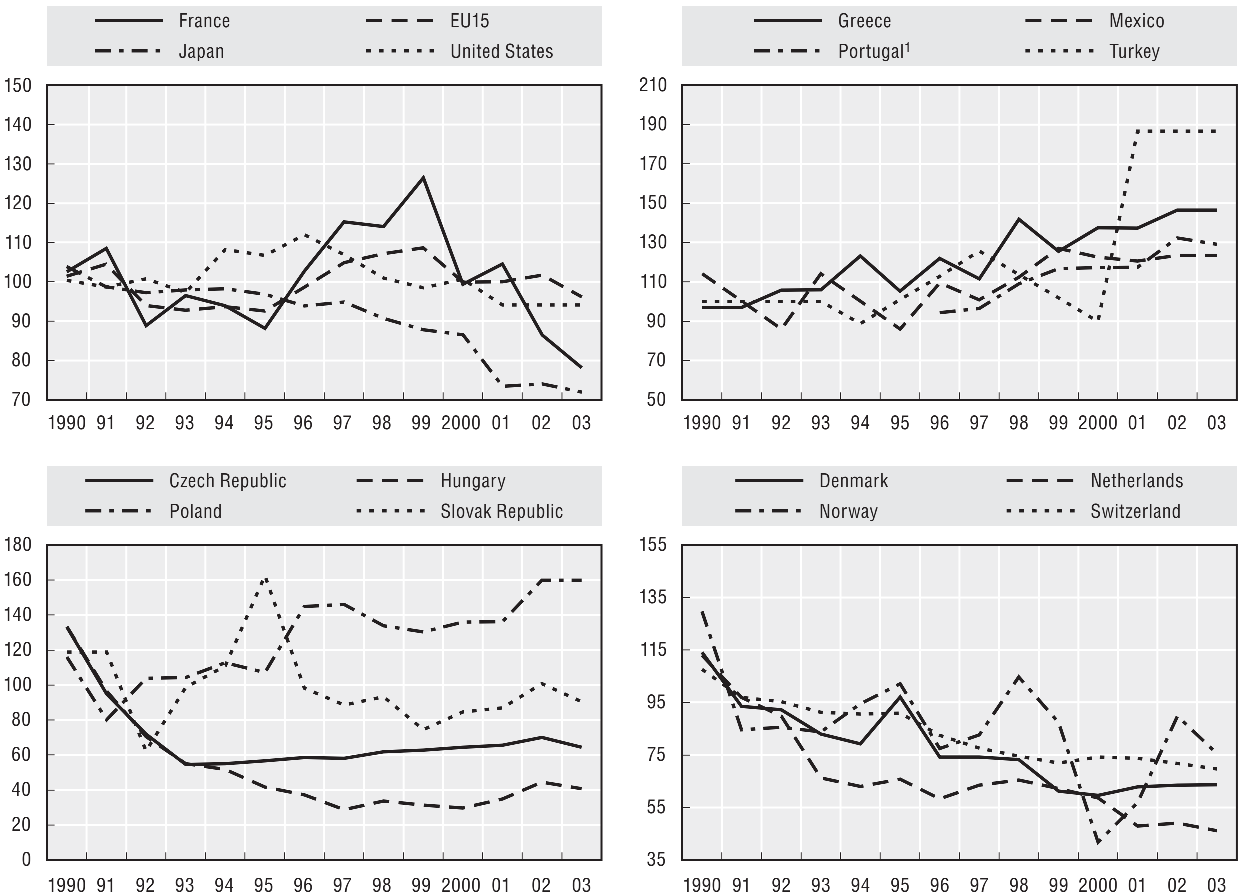
Source: OECD Environmental Data Compendium 2004, Paris, France; OECD Secretariat estimates; and national data sources.

particular, changes in the major OECD pesticide consuming countries, increasing for **Italy**, **Mexico** and **Spain**, and declining for **France**, **Japan** and the **United States**. Together, these countries account for around three-quarters of total OECD pesticide use.

Amongst ***major OECD pesticide users***, in the **United States**, the intensity of pesticide use in relation to crop production has declined, reflecting a 4% reduction in pesticide use (Figure 1.3.1) and a 13% rise in crop production over the period 1990 to 2003 (Figure 1.3.2, in Section 1.3.2). This was, in part, explained by pesticide regulations altering the mix of pesticides used by farmers, hence the rise in average pesticide prices to farmers (and in some years diminishing marginal returns to pesticide use), but also the high rate of adoption of non-chemical pest control management practices (Section 1.9). For **France** despite an overall downward trend in pesticide use the pattern was variable over the 1990s (Figure 1.3.2), although crop production expanded over this period (Figure 1.3.2, Section 1.1). In addition, French consumption of sulphuric and copper pesticide products declined by around 40% over the past decade, representing a 30% share of pesticide consumption, while there has been greater use of pesticides in lower doses. Despite the increase in **Italian** pesticide use, it has been declining over recent years, in part, because of

Figure 1.3.2. **Pesticide use for selected OECD countries**

Index 1990-92 = 100



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

1. Pesticide use index 1996-98 average = 100.

Source: *OECD Environmental Data Compendium 2004*, Paris, France; OECD Secretariat estimates; and national data sources.

the rapid growth in organic farming (Section 1.9). In **Japan**, pesticide use declined by 27% (Figure 1.3.2), while crop production declined by nearly 19% (Figure 1.3.2, Section 1.1), suggesting greater efficiency in pesticide use. However, less than 2% of Japanese farms use non-chemical pest control methods and under 1% of the agricultural land area is farmed organically (Section 1.9).

For those ***OECD countries revealing the highest growth rates in pesticide use*** over the 1990s (*i.e.* over 20%), this can be largely explained by the substantial expansion in crop production, for example, in **Greece** and **Turkey** (Figure 1.3.2, Section 1.1). In **Poland** although overall crop production declined the growth in horticultural output and yields plus the substitution of labour for pesticide inputs, especially since the mid-1990s, resulted in a major increase in pesticide use (Figure 1.3.2). For **Portugal** the rise in pesticide use is largely due to the growth in the horticultural sector, although the productivity of pesticide use per hectare has improved. While pesticide use volume data are not available for **Australia** given the rapid growth in crop production over the 1990s (Figure 1.3.2, Section 1.1), especially horticultural products (*e.g.* viticulture), it is likely that pesticide use has also risen.

A significant reduction in pesticide use occurred for the **Czech** and **Slovak Republics**, **Hungary** and **Poland in the early 1990s**, largely explained by their transition to a market economy (Figure 1.3.2), which led to: a collapse in agricultural support levels; the elimination of subsidies for pesticides; and increasing debt levels in the farm sector limiting farmers' ability to purchase inputs (OECD, 1998). However, in the more recent transition period towards EU membership, especially since around the year 2000, pesticide use for these countries has begun to rise (Figure 1.3.2).

For some other OECD countries where the reductions in pesticide use over the past 10 years have been significant (*i.e.* over 20%, Figure 1.3.2), this can be explained by a combination of factors. Frequently crop production has declined (*e.g.* **Denmark** and **Switzerland**); targets have been set to reduce usage (*e.g.* **Denmark**, the **Netherlands**); and taxes applied to dissuade pesticide use (*e.g.* **Denmark** and **Norway**). It can be difficult, however, to disentangle the effects of pesticide taxes from other policy effects on pesticide use (Pearce, 2003). Pesticide reduction has also been linked, in some countries, to the increasing area of crops under some form of pest management control, such as using less but better targeted pesticides and growing pest resistant crop varieties (*e.g.* **Austria**, **Norway** and **Switzerland**, Section 1.9). Also the rapid expansion in organic farming for some countries has reduced demand for pesticides. In **Austria, Denmark, Finland** and **Switzerland**, over 6% of the agricultural area is now under organic farming (Section 1.9).

1.3.2. Pesticide risk indicators

Indicator definition:

- Risk of damage to terrestrial and aquatic environments, and human health from pesticide toxicity and exposure.

Concepts and interpretation

A change in pesticide use may not be equivalent to a change in the associated risks because of the great variance in risks posed by different products. Changes in the herbicide market seen in the 1980s provide an illustration, as new herbicide products came on to the market that were much more biologically active than their predecessors and were therefore used in much smaller quantities. Pesticide use indicators for this period showed a substantial reduction in herbicide use. By contrast, risk indicators might show no change, or perhaps even an increase, in the environmental and human health risks associated with herbicide use. The greater use of pesticides which carry a lower risk to humans and the environment because they are more narrowly and accurately targeted or degrade more rapidly, might also not reveal any change in overall pesticide use trends, and possibly even an increase.

The OECD Pesticide Programme, which started in 1997, completed a project that analysed and compared six models that can be used to derive pesticide risk indicators (OECD, 2005b). All of the models evaluated in the OECD project are designed to report pesticide risk trends at the national level and five of the six models use the same basic formula:

exposure/toxicity (or toxicity/exposure) × total amount used

The sixth model uses a similar basic formula:

(amount sold/dose)/total arable land treated

The pesticide risk indicator models evaluated in the OECD project share a similar underlying structure. However, the models differ in how they estimate exposure and in how they weight different variables. These differences reflect the circumstances and understanding of risk in different countries. In this sense, pilot testing of these indicators conducted in the OECD project has provided information on evaluating possible widespread use of these indicators (OECD, 2005b).

Lack of data is one of the most important obstacles to using pesticide risk indicators (OECD, 2005b). Data on pesticide properties are generally available in national pesticide registration files, but the OECD project found that data in some areas, most notably long-term (chronic) toxicity, are incomplete. Moreover, even for short-term (acute) toxicity, the data show widely varying values. The OECD project concluded that use of a consistent approach from year to year was important for always selecting the highest, lowest, or average value, for example. Data on pesticide use (*e.g.* from farmer surveys), rather than sales data, are also lacking in many countries, although momentum is building to collect such data (Section 1.3.1). It was also concluded that distributing the national sales of a given pesticide among various crops on which it is registered (as most indicators require) can be difficult and time-consuming, and may require using a 3-year rolling average and limit analysis to major pesticides or crops to keep the project viable.

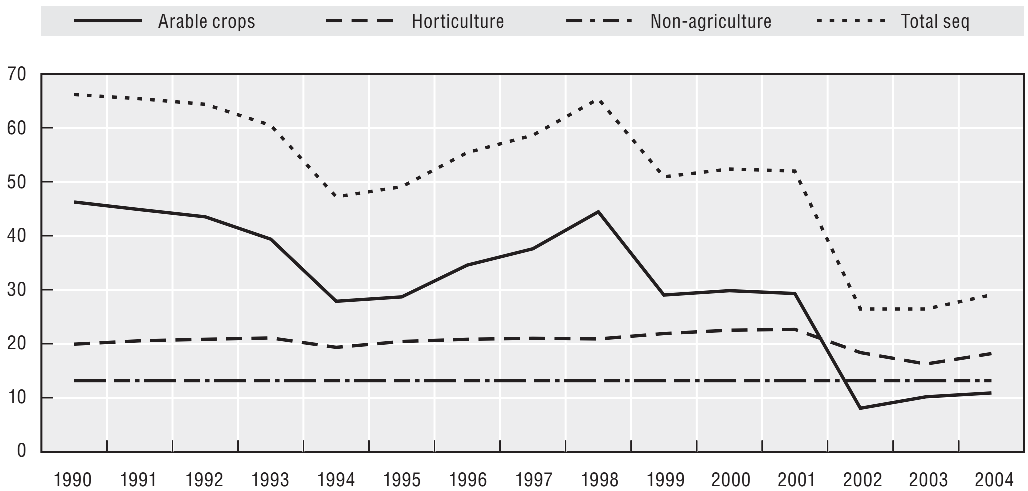
Recent trends

Evidence from a limited number of OECD countries shows that human health and environmental risk from pesticide use has declined over the past decade in most cases. These indicators also suggest a link between a decrease (increase) in pesticide use and decreasing (increasing) risks, however, some studies show that risks are not quantified on a major share of farm land treated with pesticides. These conclusions are drawn from information on pesticide risk indicator trends reported by: **Denmark, Netherlands, Norway** for risks to terrestrial organisms; **Belgium** and the **United Kingdom** for aquatic organisms; and **Germany** for both terrestrial and aquatic organisms (OECD, 2003). In addition, **Sweden** has completed a national project that has developed two pesticide risk indicators with the main objective to monitor the impact of pesticide policies nationally and follow up the trends at individual farm level. It should be noted, however, that these country examples cannot be used for cross country comparisons as the indices are relative not absolute values.

Belgium. A risk assessment of the use of pesticides for aquatic species has been made for Belgium (de Smet *et al.*, 2005). Pesticide use is weighted according to eco-toxicity and persistence in the environment because use in kilogrammes of active substances does not sufficiently represent environmental risks. The pressure on aquatic ecosystems, to be viewed as risk to aquatic species, is expressed as the sum of the spread (dispersion) equivalents (Σ Seq). The aquatic risk index (Σ Seq) for agriculture declined by 55% between 1990 and 2004 (Figure 1.3.3), *inter alia* because of the decreasing use of lindane (an insecticide) and paraquat (a herbicide). The Flemish Environmental Policy Plan, sets a 50 % reduction goal for Σ Seq in 2005 compared to 1990 for all pesticide users, including agriculture. With the prohibition of lindane in 2001 and some 40 other pesticide active ingredients (compared to an authorised total of 375) from 2003, the 50% reduction goal has been achieved since the sharp decline in 2002 of Σ Seq, especially that of arable crops (de Smet *et al.*, 2005).

Figure 1.3.3. **Belgium: Risk for aquatic species due to use of pesticides in arable land, horticulture and outside of agriculture**

Spreads equivalents in billions

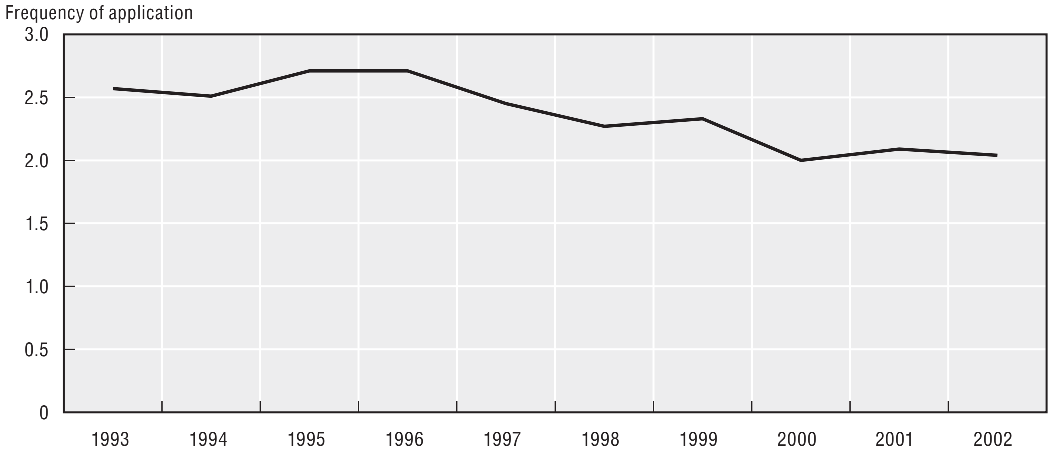


StatLink http://dx.doi.org/10.1787/286707848675

Source: Department of Crop Protection, University of Gent.

Denmark. The Danish indicator of frequency application, an indicator of spraying intensity and overall environmental impact of pesticides, has declined since 1993 (Figure 1.3.4), in parallel to a large reduction in pesticide use (Figure 1.3.2). The Danish Load Index is also used as a risk indicator, and reflects changes in inherent properties of pesticides such as toxicity to fish, birds, mammals, which may not be directly reflected in the Frequency of Application Index. Denmark has used the Load Index to track changes in pesticide load on a given organism as a result of the re-evaluation of pesticides carried out in the 1990s. The Load index showed a clear reduction with respect to acute and chronic toxicity for mammals, while values also declined for acute toxicity for birds and crustaceans, but for fish remained unchanged.

Figure 1.3.4. **Denmark: The annual trend in frequency of pesticide application**



StatLink http://dx.doi.org/10.1787/286736745071

Source: Gravesen (2003).

Germany. In Germany, the pesticide risk indicator model SYNOPS is used to assess and to analyse the environmental risk caused by pesticide use in agriculture (Table 1.3.1). To characterize the status quo, the risk potential (without consideration of risk mitigation measures as required by pesticide registration authority) of the mostly recently used pesticides for the crop years 2000, 2002, and 2004, is compared with corresponding risk indices caused by pesticides used in 1987. Table 1.3.1 shows the change of risk indices in per cent from the base year 1987 = 100.

Table 1.3.1. **Germany: Percentage risk indices**

1987 to 2004 (1987 = 100)

	Acute risk (%)					Chronic risk (%)			
	Earthworms	Daphnia	Fish	Algae	Bees	Earthworms	Daphnia	Fish	Algae
Herbicides	37	44	45	36	46	31	47	51	35
Fungicides	60	33	66	131	55	81	22	52	76
Insecticides	11	8	36	7	14	20	24	93	6

StatLink http://dx.doi.org/10.1787/301374302758

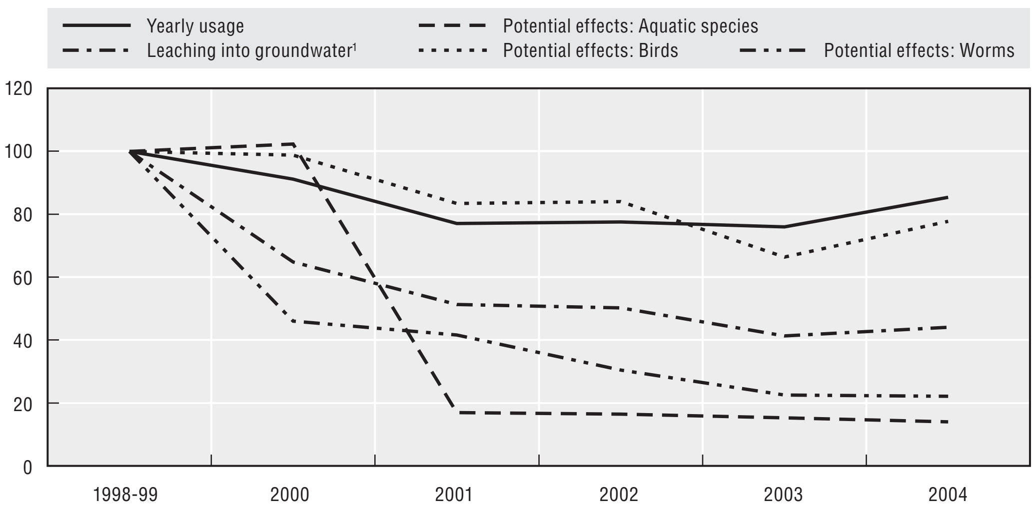
Source: Federal Biological Research Centre for Agriculture and Forestry, Berlin-Braunschweig.

To describe the status quo of the intensity of pesticide use in agricultural practice, the project NEPTUN was established in Germany. NEPTUN is a randomised and regionally stratified survey based on voluntary co-operation with farmers. The following crops were surveyed: arable crops (1999/2000), hops (2001), orchards (2001 and 2004), and vineyards (2003). In the future additional crops will be surveyed. *Inter alia* the survey results facilitate the calculation of normalised application indices for crops in terms of the number of pesticides used in a crop and normalised to the area treated and the ratio between the application dose used and the registered application dose. NEPTUN results also feed the risk indicator model SYNOPS and serve to analyse regional differences in the risk potential caused by the different use of pesticide as well as the different application conditions (landscape attributes) and crops.

Netherlands. The trend of pesticide risks for groundwater and organisms, developed in the Netherlands, was calculated for the period 1998-99 to 2004 (Figure 1.3.5). The yearly usage of pesticides shows a gradual decline over the entire period, except for a small increase in 2004 (Figure 1.3.2). The indicator values for potential chronic *toxic effects on birds and worms* also show a gradual decrease over the entire period. This decrease is somewhat larger than would be expected on the basis of the reduction of pesticide usage, which reflects the disappearance of some of the more toxic pesticide compounds from the market. Groundwater leaching and the potential chronic toxic effects towards *aquatic species*, after rising in 2000, showed a gradual decline in common with the other indicator scores (Figure 1.3.5).

Figure 1.3.5. **The Netherlands: Potential chronic effects scores for aquatic and terrestrial organisms and leaching into groundwater**

Index 1998-99 = 100



StatLink http://dx.doi.org/10.1787/286766744540

1. Groundwater leaching index is with reference to drinking water limits.

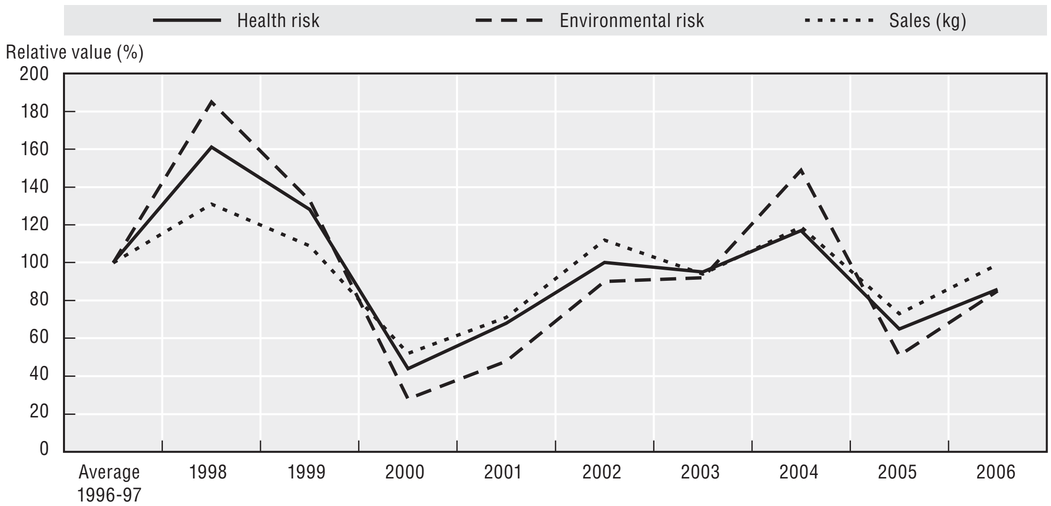
Source: Deneer *et al.* (2003) and RIVM.

Norway. The Norwegian environmental risk indicator is based on the toxicity of each pesticide to non-target species (birds, earthworms, bees and aquatic species). In addition, it takes into account leaching, persistence, bioaccumulation and formulation type, and uses scores (weighting factors) that are added together and multiplied (scaled) by the treated area. Since the sales data for the years 1996 to 2006 are strongly influenced by other factors than change in actual use (stockpiling to avoid increased taxes), it is difficult to use this as a basis for conclusions about risk. Compared to the sales curve, the risk indicators showed higher values for 1998 and 1999, which corresponds to the stockpiling of pesticides with the highest health and environmental risk (highest tax classes). For succeeding years the risk values are lower, reflecting both reduced imports/sales and less risk associated with the pesticides purchased by farmers (Figure 1.3.6).

A working group in Norway submitted, in 2003, its final evaluation of the *Action Plan for Pesticide Risk Reduction (1998-2002)* including an evaluation of the pesticide levy system, as this was one of the measures in the Plan. Comparing the average for 1996-97 with that of 2001-02, there was a slight drop in pesticide sales (8%), but a marked reduction in the risk to health (33%) and the environment (37%).

Figure 1.3.6. **Norway: Trends of health risk, environmental risk and sales of pesticides**

Average 1996-97 = 100



StatLink http://dx.doi.org/10.1787/286810015086

Source: The Norwegian Food Safety Authority.

Although care is required not to place too much weight on these data, the trend is still clear with a marked reduction in risk during the period of the Action Plan, both in terms of health and environmental risks. Changes to the pesticide levy system from 1999, with differentiated charges conditional on health and environmental properties, seems to have had the desired effect of moving users away from using hazardous pesticides to less harmful preparations.

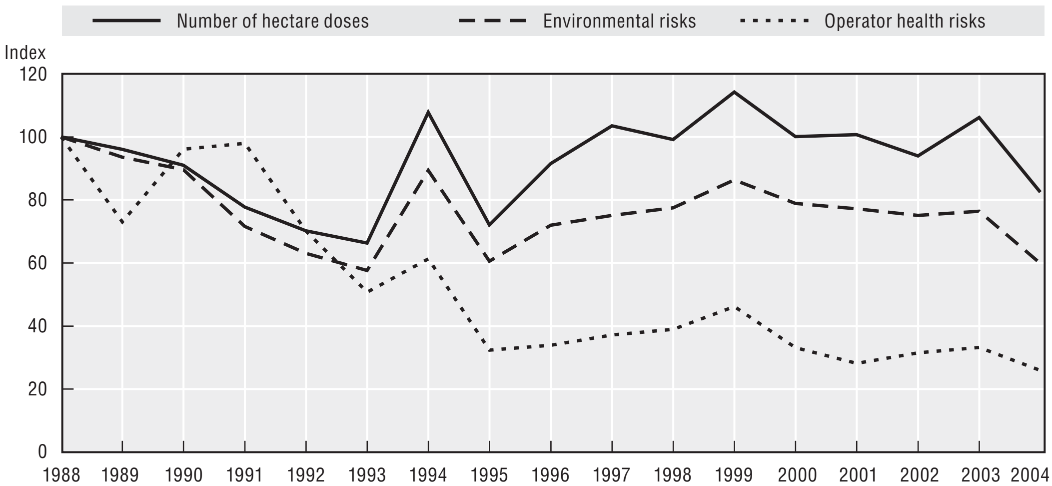
Even though trends are moving in a positive direction, the results from the monitoring programmes on foodstuffs and the environment indicate that the situation is still not entirely satisfactory. Between 2000 and 2006, pesticide sales steadily rose (allowing for some annual fluctuations) and as a consequence health and environmental risks also increased (Figure 1.3.6). The evaluation group emphasises the need for targeted efforts to further reduce the risk of damage to health and the environment through the use of pesticides and advises a new *Action Plan for Pesticide Risk Reduction* (2004-08) built on the equivalent main elements contained in the previous Plan.

Sweden. Sweden has developed two pesticide risk indicator systems to monitor the impact of pesticide risk reduction policies: at the national level (PRI-Nation) and at the individual farm level (PRI-Farm). Both models are based on the same approach, where data on hazard and exposure are scored based on field data where available, expert judgements or policy assessments, combined with data on use intensity (Bergkvist; 2004). Both PRI-Nation and PRI-Farm comprise two indicators that cover environmental risks and farm operator health risks respectively. The results are aggregated to a single score for each substance or treatment with the intention to indicate environmental and operator health risks respectively.

For PRI-Nation, Figure 1.3.7 indicates a clear downward trend in both environmental and operator health risks, while pesticide use intensity (*i.e.* the total number of doses per hectare) has been near stable since 1997. These improvements in pesticide risks are largely due to farm advisory services focusing on integrated and need based crop protection, successful regulatory activities and also pesticide product development (Bergkvist; 2004; Swedish Chemicals Inspectorate, 1999).

Figure 1.3.7. **Sweden: National level pesticide risk indicators and the number of hectare doses**

Index 1988 = 100

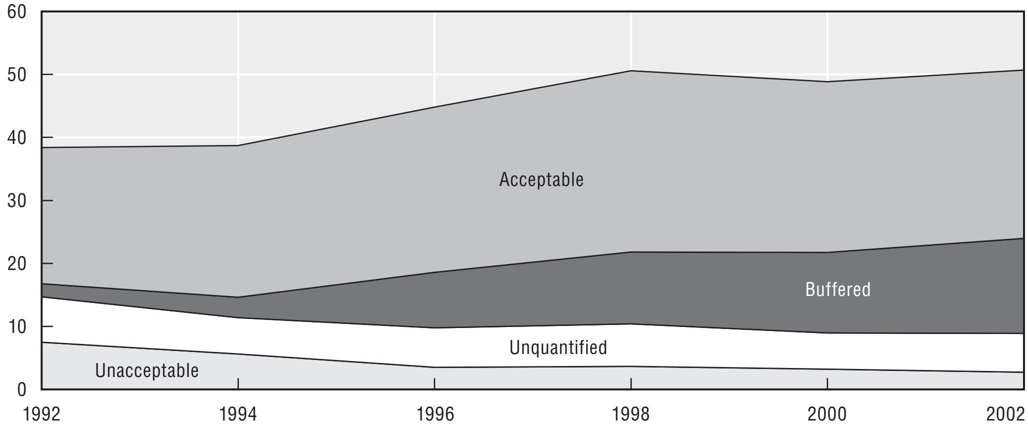


StatLink http://dx.doi.org/10.1787/286827123563

Source: Bergkvist, 2005.

United Kingdom. The United Kingdom has developed a "threshold" approach, which makes use of risk to aquatic life thresholds used in the regulatory assessment of pesticides. The threshold approach divides the total area of pesticide applications into different risk categories, and shows how these change over time. The results shown in Figure 1.3.8 indicate that the total area of pesticide applications increased steadily from 1992 to 2002. Over half of the area on which pesticides were applied qualifies as "acceptable risk", based on EU criteria. Since the early 1990s, if complied with, buffer zones are making an increasing contribution to reducing risks, but a large area is treated with pesticides for which the risk is unquantified and needs further assessment.

Figure 1.3.8. **United Kingdom (England and Wales): Total area of pesticide applications**



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Notes: ***Total area of pesticide applications*** for arable crops in England and Wales was obtained from the UK Pesticide Usage Survey. Multiple applications are added together, *e.g.* spraying one hectare with two pesticides counts as two spray hectares.

Acceptable risk: Pesticides either have toxicity-exposure ratios (TERs) for fish, daphnia and algae which fall within the thresholds defined in EU regulations, or have been subjected to a higher-tier assessment which shows they pose no unacceptable risks.

Buffered: Pesticides subject to buffer zones have TERs outside the EU thresholds, but have been assessed by the UK Pesticides Safety Directorate as posing acceptable risk provided no spray is applied within 6 metres of water bodies such as streams, ponds and ditches.

Unacceptable risk: Refers to the use of pesticides which have been shown by higher-tier assessment to pose unacceptable risk. In practice this applies to the historical use, without buffer zones, of pesticides now considered to require them.

Unquantified risk: Refers to pesticides which have TERs outside the EU thresholds, and have not yet been assessed under current regulations, or lack the necessary data for calculating TERs. It is therefore not known whether the risk they pose is acceptable or unacceptable by modern standards.

Source: Hart *et al.* (2003).

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