UNDP/GEF Danube Regional Project

Policies for the Control of Agricultural Point
and Non-point Sources of Pollution
&
Pilot Projects on Agricultural Pollution Reduction
(Project Outputs 1.2 and 1.3)

Inventory of Agricultural Pesticide Use in the Danube River Basin Countries

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Final Report

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in co-operation with Avalon

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Inventory of Agricultural Pesticide Use in the Danube River Basin Countries

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Preface

The UNDP-GEF Danube Regional Project supports through this Project Component the development of policies for the control of agricultural point and non-point sources of pollution and the conceptualization and implementation of pilot projects on agricultural pollution reduction in line with the requirements of the EU Water Framework Directive.

The Overall Objective of the Danube Regional Project is to complement the activities of the ICPDR required to strengthen a regional approach for solving transboundary problems in water management and pollution reduction. This includes the development of policies and legal and institutional instruments for the agricultural sector to assure reduction of nutrients and harmful substances with particular attention to the use of fertilizers and pesticides.

Following the mandate of the Project Document,

> **Objective 1** stipulates the "Creation of Sustainable Ecological Conditions for Land Use and Water Management" and under
>
> **Output 1.2,** "Reduction of nutrients and other harmful substances from agricultural point and non-point sources of pollution through agricultural policy changes",
>
> **Activity: 1.2-3** requires to "Review inventory on important agrochemicals (nutrients, etc) in terms of quantities of utilization, their misuse in application, their environmental impacts and potential for reduction"

The present document "Inventory of Agricultural Pesticide Use in the DRB" responds to this mandate in providing an analysis on the present use of pesticides, the existing mechanisms of regulation and control and proposed measures for policy reforms and their practical application in line with the requirements of the EU Directives and regulations.

The result of this study on the use of pesticides constitutes an essential contribution for the Summary Report on "Policies for the Control of Water Pollution by Agriculture in the Central and Lower Danube River Basin Countries" containing also the findings on the use of fertilizers as well as on the introduction of Best Agricultural Practices in the Danube River Basin countries

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Acronyms & Abbreviations

ai	active ingredient
BAP	Best Agricultural Practise
BPP	Best Plant Protection Practice
CAP	Common Agricultural Policy
DRB	Danube River Basin
DRP	Danube Regional Project
EAP	Environmental Action Programme
EC	European Commission
ECPA	European Crop Protection Association
EPPO	European and Mediterranean Plant Protection Organisation
EU	European Union
FAO	Food and Agriculture Organisation
GPPP	Good Plant Protection Practice
ICM	Integrated Crop Management
IPM	Integrated Pest Management
PAN	Pesticide Action Network
PIC	Prior Informed Consent
POP	Persistent Organic Pollutant
PUR	Pesticide Use Reporting
WB	World Bank
WFD	Water Framework Directive

Country Codes Used

BG	Bulgaria
BH	Bosnia and Herzegovina – consisting of 2 entities: FedBH – Federation of Bosnia and Herzegovina RS – Republic of Srpska
CZ	Czech Republic
HR	Croatia
HU	Hungary
MD	Moldova
RO	Romania
SK	Slovakia
SL	Slovenia
UA	Ukraine
YU	Serbia and Montenegro (previously the Former Republic of Yugoslavia)

Executive Summary

1. Overview

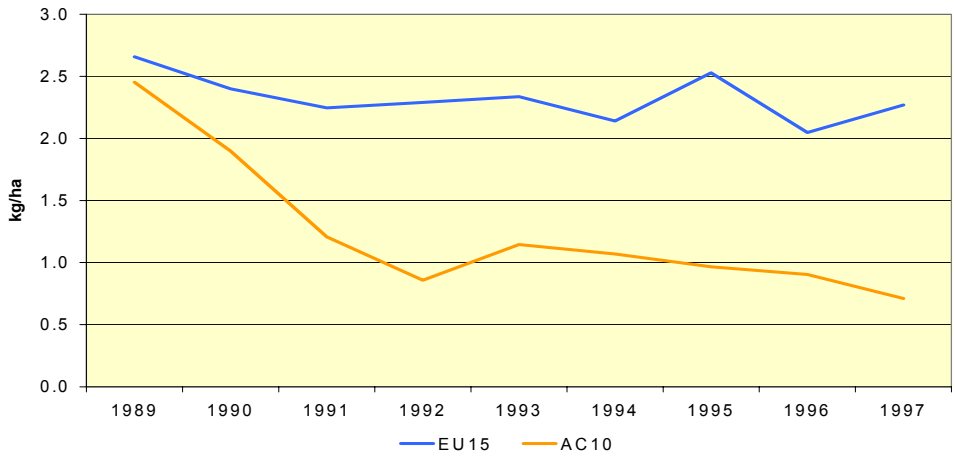
The use of pesticides has declined significantly in the countries of Central and Eastern Europe (CEE) since the political changes and sector reforms of the early 1990s disrupted the process of modernisation, specialisation and intensification of agricultural production that was characteristic of the centrally-planned economies in the region.

Reliable data on pesticide use in the CEE region are not available for the decades leading up to 1990. However, data from the FAOSTAT database show a strong decline in pesticide use in the CEE countries to about 40% of 1989 levels compared to a relatively small decrease in EU Member States during the same period (Figure 1).

There are indications, however, that the use of pesticides in the CEE region is increasing again with concerns especially that enlargement of the EU will further a trend towards the renewed intensification of crop production, particularly in the more productive regions of central Europe.

At the same time, there are many factors – including the risk of water pollution and the impact upon aquatic ecosystems – that are forcing much of European agriculture to rethink the use of pesticides, as well as many opportunities to promote new management approaches to pesticide use by farmers and policy-makers.

Summary Figure 1: Pesticide Consumption in CEE countries and the EU15[1]



Source: Data from the FAOSTAT database of the UN Food and Agriculture Organisation

2. Analysis of Priority Pesticides used in 11 DRB countries

The approach taken has been to focus upon so-called **priority pesticides** for the DRB. Studies of the water quality of the Danube River have found a number of polluting substances that regularly occur in the aquatic environment of the river. Some of these substances are of special concern for environmental and/or human health reasons and a list of "priority chemicals for the Danube River" has been prepared. According to Article 7 of the Danube River Protection Convention, which regulates

[1] The graph expresses mean consumption of pesticides (active ingredients classed as insecticides, herbicides, fungicides and others) per unit area of agricultural land.

emission limitations and water quality objectives and criteria, the discharge of hazardous substances from point and non-point sources shall be prevented or considerably reduced.

Annex II defines such hazardous substances and lists under Part 2 A (d) plant protection agents, pesticides and chemicals used for the preservation of wood, cellulose, paper, hides and textiles etc. Part 2 B of Annex II lists 40 single hazardous substances. In 2001, substances listed in Annex X of the European Water Framework Directive 2000/60/EEC were taken into account in revising the ICPDR list of priority substances. Altogether, the new list contains 41 single substances, thereof 25 chemicals which are used as pesticide **active ingredients,** and 5 chemicals which are used as **inert ingredients**.[2]

In the Danube River Basin 29 priority chemicals used in pesticide products and their regulatory status globally and in the European Union have been analyzed. Most substances, except for the inorganic compounds, are already regulated by international conventions or the European Union – including:

- **POPs Convention -** aims at the elimination or restriction of persistent organic pollutants (POPs),
- **EU Water Framework Directive No. 2000/60** - requires that measurements of dangerous priority substances aim at the phasing-out of these substances within 20 years after the adoption of measurements,
- **EU Authorisation under Directives No. 91/414 and 79/117-** only 2 of the Danube priority pesticides are fully registered in the European Union and listed in Annex I of Council Directive 91/414/EC. For three of the priority pesticides, registration will expire or has already expired and seven are still in the re-authorisation process. According to Directive 79/117, use of two of the priority pesticides is banned in the EU.

3. Regulation of Priority Pesticides

The analysis has shown that out of 25 pesticides only three priority pesticides are authorised for use in all of the DRB countries under study, while seven priority pesticides are not authorised in any of the countries. There are evidently also differences between the countries.

The Republic of Srpska authorised 15, Romania, Serbia & Montenegro and Slovakia 14 priority pesticides, while Bulgaria and Moldova authorised eight priority pesticides and the Ukraine only six.

In some countries, there are certain restrictions on specific pesticide products. For example, in Croatia, it is not allowed to apply Alachlor with a knapsack sprayer or a hand sprayer. It is also not allowed to use Alachlor on light soils after the maize has emerged. Use of Atrazine is limited to 1.5 kg ai/ha in humid and 1 kg ai/ha in arid areas. Endosulfan cannot be used in oil-seed rape and forestry. Use of Simazine is permitted only in maize monoculture. TrifIuralin use is not permitted in post-harvest sown soya bean and sunflower.

4. Use of Priority Pesticides

It has **to be stated that there is** little information available about the details of the distribution and use patterns of Priority Pesticides in the DRB countries. From the 11 countries under study, only three countries maintain pesticide use/sales tracking systems based upon retail sales:

- **Hungary** - collects sales data from wholesalers and local distributors twice a year. They have to submit data on the sales in kg as well as on the monetary amounts of individual formulated pesticide products. Sales data are publicly available in an aggregated format.

[2] 'Inert' ingredient: These are substances which can enhance the efficiency of the active substance, make a product more degradable or easier to use.

- **Czech Republic** - all professional pesticide users have to keep spray records for 3 years. Farms larger than 10 ha are required to submit summaries to the Department of Information. Farmers report on amounts applied by formulated product, crop and geographical region. Usage data are publicly available by crop and amount of active ingredient. Data on pest and disease infestations are also published. Pesticide sales data are also collected by the Czech Crop Protection Association.
- **Slovakia** - started a pesticide sales reporting system in 1999. All traders are required to report sales data annually: manufacturer, importer, distributors and retailers. They are required to report the name and amount of formulated products for agricultural and non-agricultural pesticides. Sales data are publicly available by amounts of active ingredient, chemical class, use type and by postal code3. All farmers have to keep detailed records of their pesticide use and are required to submit summaries to the Central Control and Testing Institute of Agriculture.

National data was analyzed for 8 countries showing that the reported total use of priority pesticides is highest in Hungary and the Czech Republic - which is probably due to the fact that these two countries have comprehensive pesticide use tracking systems. In Hungary, the reported use is 10 times higher than in the Czech Republic, with copper as the most widely used pesticide. This is probably due to the fact that Hungary cultivates approximately 99,000 hectares of vineyards plus a large area with fruits and vegetables, while the Czech Republic cultivates only approximately 11,000 ha of grapes. Copper is globally used in large amounts in vineyards and orchards to control fungus and is approved as a pesticide in organic agriculture according to EU regulations.

As part of the inventory, data was also collected on the main crops that pesticides are applied to. As might be expected, it is clear from this data that a high percentage of crops in the DRB countries do not receive any pesticide applications at all. The findings can be summarized as following:

a) The priority pesticides are high-use pesticides, accounting for over 20% of total pesticide use in some countries;

b) The use of priority pesticides is associated with specific crops:
   - Atrazine is mostly used in maize;
   - Alachor is used in maize, rape seed and sunflower;
   - copper compounds in vineyards, orchards and in vegetables, including potatoes;
   - 2,4-D is mostly used in cereals;
   - the insecticides Chlorpyrifos, Malathion and Endosulfan are used in orchards, vineyards, rape seed, alfalfa and vegetables.

c) The intensity of use in treated areas can be higher than the one commonly found in western European countries.

Since many soils in the Danube catchment area, particular those closer to the river, are very good for intensified crop production, it seems likely that these observations at a national level are all directly relevant to the DRB catchment and that pesticide use on cultivated soils in the catchment will most likely be higher than national averages reported.

5. Problems Associated with Pesticide Use

Although pesticide use is currently relatively low in the DRB countries (compared, for example, to the EU Member States), it is important not to be complacent about the risks of pesticide pollution since:

1. Priority pesticides, as well as other pesticides, are frequently detected in surface and ground water in the DRB catchment area and pose a serious hazard to the environment and human health.

[3] Communication with Martin Hajas (Central Control and Testing Institute of Agriculture) and Jozef Kotleba (Ministry of Agriculture).

2. Seven priority pesticides are not authorised in the Danube countries, some of them continue to be hazardous due to old stockpiles and residues in soils and sediments.
3. The uncontrolled and illegal trade of pesticide products leading to the use of banned pesticides (e.g. DDT) by farmers is reported as a problem in many countries – although this is a sensitive issue that is difficult to verify. There is particular concern that certain countries lacking an effective pesticide control system (e.g. Ukraine) are gaining a reputation as a "dumping market" for obsolete and illegal products.
4. There are reports of high pesticide use in certain areas and on certain high value crops - this includes priority pesticides that pose a serious hazard to the environment and human health. In particular, the priority pesticides 2,4-D, Alachlor, Trifluralin, Atrazine and copper compounds are high use pesticides in most of the DRB countries. They are mostly used on cereals, rapeseed, sunflower and maize, and in orchards and vineyards.
5. Poor storage of pesticides, including old pesticide stores, continues to be a problem in many countries. In the Ukraine, there are some 20,000 tons of obsolete pesticides still in storage often under bad conditions and posing a serious threat to human health and the environment (e.g. infiltration into groundwater). In Bulgaria, 35% of the pesticide storehouses are reported to be in bad condition. In Moldova, some 6,000 tonnes of obsolete pesticides are reported to be in storage on former State and Collective farms, including single stores containing up to 4 tonnes. Several countries maintain databases containing the location, amounts and storage conditions of the pesticides, including the use of GIS-based maps in Moldova and the Ukraine.
6. Whenever farmers apply pesticides, there are many examples of "bad practice" that contribute to the risk of pesticide pollution. Those most commonly reported by the national experts were:
    - **Use of pesticides in excess of recommended rates** – in particular, the over-application of maize with the herbicide Atrazine (up to 2-3 times the recommended rate) is consistently reported as a serious problem in the DRB countries. In many cases, over-application is due to lack of knowledge/training and the tendency to apply larger amounts in the belief that this will increase the effectiveness of the pesticide products – a tendency that is made worse now by the increasing occurrence of weed resistance to Atrazine. The overuse of Atrazine is arguably one of the most significant pesticide problems in the DRB and accentuated in countries where large areas of maize are grown and/or most of the maize is routinely treated with Atrazine – for example, in Croatia it is estimated that 87-100% of the 324,000 ha of maize grown is treated with Atrazine.
    - The **unauthorised use of pesticides on crops they are not registered for** (e.g. use of Lindane on vegetables) is reported to be a common problem in most countries.
    - The **cleaning of spraying equipment and disposal of unused pesticide, pesticide containers and "spray tank washings"** nearby to (or even in!) water courses such as rivers and ponds.
    - The **drift of pesticide spray to adjacent areas** due to the old spraying equipment used (most spraying equipment used in the DRB region is now more than 15 years old), plus poor knowledge and lack of operator training (e.g. spraying in windy conditions).
    - **Lack of knowledge of and/or compliance with obligatory "buffer zones"** for surface waters and other protected areas.
    - The **poor timing of pesticide application** due to poor knowledge and lack of operator training leads to inefficient application and increased risk of pollution.

6. Potential for Pollution Control

The current low use of agricultural pesticides in the countries of the DRB presents a unique opportunity to develop and promote more sustainable agricultural systems before farmers become dependent again upon the use of agro-chemical inputs.

However, pesticide use is always related to agricultural policy. Farmers grow those crops which are economically most viable - if agricultural policy, for example, supports subsidy schemes and market policies for a small number of crops, the range of crops grown by farmers will be limited, crop rotations be simple or non-existent and, consequently, pesticide use will increase.

There is, for example, concern that with EU enlargement and the expansion of the Common Agricultural Policy (CAP) into the DRB countries joining the EU there is a risk of increasing pesticide use due to:

- increasing areas cultivated with cereals and oilseeds due to the availability of EU direct payments for farmers growing these crops in the new Member States;
- increased intensification of crop production, including the greater use of mineral fertilisers and pesticides, particularly in the more favourable areas with better growing conditions;
- a reduction in mixed cropping and an increase in large-scale cereal monocultures in some areas which are dependent upon agro-chemicals for crop protection.

There are numerous policy instruments that can be used to control pesticide pollution such as:

- Use reduction (ICM and IMP standards),
- Advice and compulsory training,
- Performance standards (cut-off criteria, eco-audit),
- Design standards,
- Permits (also transferable permits),
- Taxes and subsidies,
- Crop insurance

These control instruments provide a framework that can be elaborated and filled with more detailed measures. However, the selection of the most appropriate policy instruments for the DRB countries will depend upon the establishment of a clear policy strategy for controlling pesticide pollution, together with clear policy objectives.

According to the aims of the Danube Protection Convention, the risk of pollution should be stopped at its source – with regard to pesticide use this is generally assumed to mean[4]:

a) **withdrawing approval** for the use of those pesticides that pose the greatest threats to public health and the environment;

a) **reducing the use** of those pesticides that remained approved for use;

b) **improving the management** by farmers of those pesticides that remain approved for use.

This can be achieved through a combination of necessary policy reforms and the promotion of appropriate practical action by farmers. However, the potential to achieve these outcomes varies greatly between countries in the DRB and is above all related to the fact whether a country is currently preparing for EU accession or not.

This review of pesticide use is undertaken during a period of great change in the Danube River Basin (DRB) with Hungary, Czech Republic, Slovakia and Slovenia being in the final stages of preparation for accession to the EU in 2004, followed by Bulgaria and Romania preparing for EU accession in 2007 or later.

[4] OECD (1995). *Sustainable Agriculture: Concepts, Issues and Policies in OECD Countries*. Organisation for Economic Co-operation and Development, Paris.

The policy-making context for agricultural pollution control in the DRB is therefore undergoing significant change and preparation for joining the EU is currently a major driving force for the reform of agricultural pollution control policies in the six mentioned countries.

In the European Union, there are several Directives addressing the **regulation of pesticides**, including:

- *Directive 79/117EC on the prohibition of pesticides;*
- *Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);*
- *Directive 80/778/EEC on the quality of water intended for human consumption (the Drinking Water Directive) – to be replaced by Directive 98/83/EC from 2003;*
- *Directive 91/414/EEC concerning the placing of plant protection products on the market;*
- *Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive).*

The Directive with the highest potential for the control of water pollution by pesticides is the Water Framework Directive 2000/60/EC (WFD). Similar to the previous Dangerous Substances Directive (76/464EC), which was repealed by the WFD, pollution control is based upon chemical lists. The list of main pollutants consists of chemical classes and use types, therefore it includes priority substances and priority hazardous substances *per se*.

The EU Rural Development Regulation 1257/1999 (the "second pillar" of the CAP) makes provision for Member States to encourage more environmentally-friendly farming methods, including practices and actions that reduce the risk of agricultural pollution.

This offers an opportunity for supporting the control of pesticide reduction in those DRB countries preparing to join the EU, by allowing them to develop EU co-financed schemes that:

a) offer grant-aided investment (up to 50%) in agricultural holdings;

b) provide training in organic farming or integrated crop management practices as well as training for farming management practices with a specific environmental protection objective;

c) introduce agri-environment schemes that offer area payments to support the adoption of organic farming and ICM in orchard, vine and vegetable production, the creation of uncultivated buffer strips, conversion of arable to pasture land and the introduction of more diverse crop rotations.

Another useful tool will be the "verifiable standards of Good Farming Practice (GFP)" that all farmers receiving payments from agri-environment and less-favoured area schemes funded by the Rural Development Regulation - the so-called CAP 'Second Pillar' - must comply with across the whole of their farm[5].

Good Farming Practice (GFP) is a relatively new concept to emerge within the EU and its practical implementation is still being tested in many Member States. Obviously, the interpretation of what constitutes a "reasonable" standard of farming will vary from country to country; however, it is generally assumed that it will consistently involve farmers following relevant existing environmental legislation, and not deliberately damaging or destroying environmental assets, including the pollution of watercourses.

GFP is likely to become an even more important element of agricultural policy in future and is very relevant to promoting the better use of pesticide use by farmers, especially on those areas of the farm that are not suitable for agri-environment payments and continue to be farmed relatively intensively.

[5] Section 9 of EC Regulation No. 1750/1999, which sets out the rules for several measures including agri-environment, states that: *"Usual good farming practice is the standard of farming which a reasonable farmer would follow in the region concerned.....Member states shall set out verifiable standards in their rural development plans. In any case, these standards shall entail compliance with general mandatory environmental requirements."*

While the four DRB countries (Czech Republic, Slovakia, Hungary and Slovenia) joining the EU in 2004 will shortly have the possibility to utilize the opportunities outlined above, the two remaining DRB countries of Romanian and Bulgaria are unlikely to join the EU before 2007. However, financial assistance is also available for these countries for developing and implementing similar measures with SAPARD co-funding - the special Pre-accession Programme for agricultural and rural development. Similarly, Croatia, Bosnia & Herzegovina and Serbia & Montenegro may use funding from the EU CARDS programme that supports implementation of measures in line with the requirements of the EU WFD.

7. Recommendations for Policy Reform

The national governments of all DRB countries should aim to effectively control pesticide pollution in order to minimise the risks presented to human health, the quality of environmental resources, and the integrity of natural ecosystems in the region.

The following objectives are recommended for all national strategies aiming to control pesticide pollution from agriculture, together with comments on policy instruments that should be adopted **where appropriate to the national context** (not all policy instruments are appropriate to all countries).

OBJECTIVE 1: Reduce the levels of harmful active substances used for crop protection by prohibiting and/or substituting the most dangerous priority pesticides with safer (including non-chemical) alternatives

1.1 **Pesticide Ban** - the use of Atrazine, Lindane, Diuron and Endosulfan needs to be banned immediately. Atrazine is the pesticide most often detected in the Danube basin, Lindane, Diuron and Endosulfan are toxic and persistent pesticides.

1.2 **Pesticide Phase-out** - the use of all other priority pesticides which are authorised should be reduced to a minimum, and the use should be phased out if possible, and substituted by less-dangerous pesticides, including non-chemical alternatives. Considering the current low levels of pesticide use and a lower dependency of farmers upon these chemicals in the DRB regions, the targets for further pesticide reduction can be ambitious.

1.3 **Cut-off Criteria** - in order to prevent the replacement of the priority pesticides which are going to be banned or phased out with other hazardous pesticides, cut-off criteria for the approval of other pesticides need to be defined. Pesticides with distribution coefficients (K_{oc}) below 300g/l (low absorption to soil, prone to leaching and run-off) and a half life greater than 20 days need to be regulated (prohibition, taxes and transferable permits are possible policy tools). Persistent pesticides should not receive authorisation.

OBJECTIVE 2: Improve controls on the use and distribution of pesticides

2.1 **Monitor Trade** - retailers, importers and distributors should be required to supply information on the amounts of all pesticide sold. Retail sellers need to keep records of their sales of pesticide products and to submit annual reports to national authorities.

2.2 **Control Trade** - all DRB countries must work towards stopping the uncontrolled and illegal trade of pesticides. The authorities at the borders should receive training on the issue of illegal pesticide trade. National legislation should enable authorities to effectively prosecute those selling illegal pesticides and to penalise them with high fines.

2.3 **Raise Awareness** – agricultural extension services and farmers should get access to information about the dangers of illegal and often unlabelled pesticides.

2.4 **Monitor Pesticide Use** – effective monitoring of pesticide use at the farm level is an essential tool for improving the control of pesticide use and distribution, as well as assessing environmental risks, developing non-chemical alternatives etc. Uniform record keeping by farming is essential for a functioning pesticide monitoring system. National regulation must require that pesticide use records are **kept** by all pesticide applicators (as in the Czech Republic and Slovakia) according to certain minimum standards and are **reported** to the relevant authorities.

2.5 **Elimination of Obsolete Pesticides** – all efforts must be made to immediately secure and remove stockpiles of obsolete pesticides.

OBJECTIVE 3: Encourage the proper use of pesticides by farmers and other operators

3.1 **Raise Farmers' Awareness** - simple and easy to understand information materials, combined with well-targeted publicity campaigns, can be very effective in raising farmers' awareness of the dangers of improper pesticide use and the importance of key issues such as the safe storage, handling, and disposal of pesticide products. Retail stores, extension services and other organisations working with farmers can serve as effective distributors of information material.

3.2 **Develop National Codes of Good Practice** – national authorities should agree upon clear and simple codes of good crop protection practice when using pesticides. There are numerous frameworks for such codes, but as a minimum they should provide guidance to farmers on:

- basic elements of crop protection;
- choice of chemicals available for crop protection, including obsolete/illegal pesticides;
- integrated crop management and non-chemical alternatives for weed, pest and disease control;
- quantity and types of pesticide product to use;
- pesticide storage;
- use of spray equipment, including cleaning equipment;
- disposal of surplus pesticides and spray mixture (diluted pesticide);
- disposal of empty pesticide containers;
- records of application;
- protective clothing and emergency procedures.

3.3 **Mandatory Farming Training** - comprehensive training is the most important instrument to prevent pesticide pollution at the farm level. All farmers and other operators (e.g. contract workers) who wish to purchase and apply pesticides should be required to have a licence confirming that they have participated in an approved training programme. As a minimum, training should highlight the possible adverse effects of pesticides and promote the National Code of Good Practice for the storage of pesticides, safe handling and application of pesticides, correct use of spraying equipment, disposal of unused pesticide and containers, and record keeping (see above).

3.4 **Develop Appropriate Extension Capacity** – agricultural extension services play a key role in raising awareness and improving the technical skills of farmers with respect to good crop protection practice, however they often require support in developing the necessary capacity to do this. National funding should be provided for the training of advisers in good practice and modern extension techniques, as well as the development of appropriate institutional frameworks for extension services (including the link to progressive and well-funded research programmes).

3.5 **Use Economic Instruments to Promote Good Practice** – where government schemes provide support to farmers, the principle of "cross-compliance" can be applied. This involves the establishment of certain conditions (e.g. compliance with verifiable standards of good agricultural practice) that farmers have to meet in order to be eligible for government support.

OBJECTIVE 4: Promote certified organic farming, together with integrated crop management (ICM) systems, as viable alternatives to conventional pesticide use

4.1 **Raise Farmers' Awareness** – viable alternatives to conventional pesticide use, such as organic farming and ICM, should be actively promoted to farmers through the preparation of simple and easy-to-understand information materials, combined with well-targeted publicity campaigns. Organic farming is the most developed of all alternative farming systems and has the highest potential for a reduction of the use of toxic pesticides (especially since the former intense use of copper compounds in organic vegetables and fruit has been controlled), plus there are a number of market opportunities available to organic farmers in the DRB countries.

4.2 **Develop Relevant Legislation** – the national legislation for the definition of organic farming systems in compliance with internationally recognised standards should be developed and implemented as a high priority (particularly those in accordance with EC legislation) in order to promote the development of domestic markets and international trade.

4.3 **Develop Appropriate Extension Capacity** – agricultural extension services and farm advisers play a fundamental role in the re-orientation of farmers towards new production systems, particularly systems such as organic farming and ICM, which require higher levels of technical knowledge and management. National funding should be provided for the development of appropriate extension capacity as 3.4 above.

4.4 **Develop On-farm "Quality Assurance Schemes"** - in addition to their growing interest in organic food and farming, the food processing and retail sectors of many European countries are developing additional "on-farm quality assurance schemes" that promote integrated crop management and the sale of food products that have been grown with reduced or minimal pesticide inputs. National authorities in the DRB should support the development of such "market-led" initiatives since they offer a potential market opportunity for DRB farmers and will contribute to reducing the risk pesticide pollution now and in the future.

4.5 **Use Economic Instruments to Promote Organic Farming and ICM** – farmers converting to organic farming and ICM techniques can incur certain additional costs associated with reductions in input, the establishment of new crop rotations, the adoption of new technologies etc. These costs can be a significant obstacle to farmers who decide to make the transition from a conventional farming system. Where national funds and/or other forms of co-financing are available, national authorities should encourage farmers to convert to organic farming and ICM by offering appropriate levels of compensatory payment.

1 Introduction

Overview

Pesticides are used to control a wide range of agricultural pests, diseases and weeds. They have become an integral part of modern European agriculture and their use is one of the most significant factors contributing to the high levels of agricultural productivity observed in many western European countries where most cultivated crops receive at least one, and usually many more, pesticide applications per year.

The development and widespread use of pesticides has largely taken place over the last 50 years with a succession of more sophisticated and effective pesticide products being introduced. Each of these pesticide products contains a number of constituents – including the **active ingredient** (ai) (or mixture of active ingredients) which is specifically intended to kill those pests, diseases or weeds that are considered noxious or unwanted in modern agricultural production.

Pesticides contribute to higher yields, improved crop quality and higher economic returns for farmers. Data on their use by farmers is, however, far from comprehensive and accurate data on their consumption is frequently missing from many European countries. This makes the assessment of trends in their use rather difficult, especially since the products used by farmers vary enormously between countries/regions according to seasonal, climatic, agronomic and geomorphological factors.

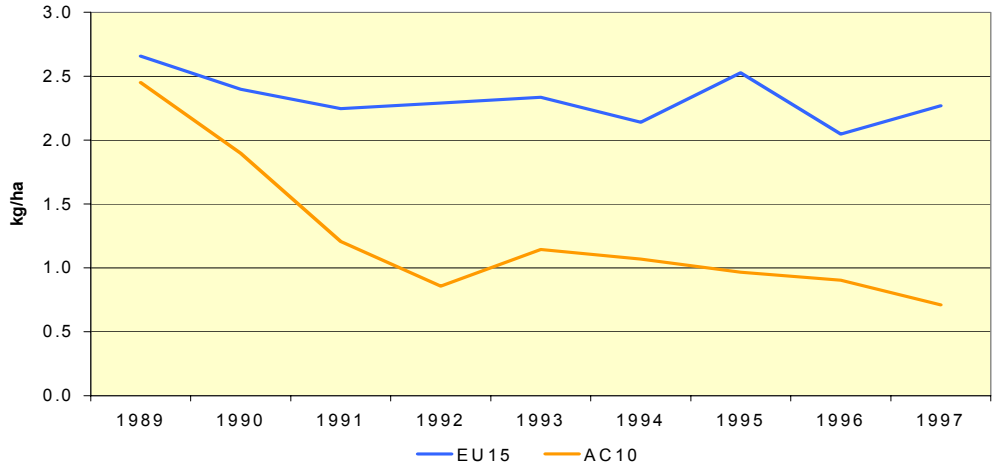
In spite of this, it is very clear that the use of pesticides has declined significantly in the countries of Central and Eastern Europe (CEE) since the political changes and sector reforms of the early 1990s disrupted the process of modernisation, specialisation and intensification of agricultural production that was characteristic of the centrally-planned economies in the region.

Reliable data on pesticide use in the CEE region are not available for the decades leading up to 1990. However, data from the FAOSTAT database show a strong decline in pesticide use in the CEE countries to about 40% of 1989 levels compared to a relatively small decrease in EU Member States during the same period (Figure 1).

There are indications, however, that the use of pesticides in the CEE region is again increasing, with concerns especially that enlargement of the EU will sustain a trend towards the renewed intensification of crop production, particularly in the more productive regions of central Europe.

At the same time it must be said that there are various factors forcing much of European agriculture to rethink pesticide use and many opportunities to promote new management approaches to pesticide use by farmers and policy-makers.

Figure 1 Pesticide Consumption in CEE countries and the EU15[6]



Source: Data from the FAOSTAT database of the UN Food and Agriculture Organisation

Aim of this Report

The aim of this report is to present an inventory of major pesticide use the Danube River Basin (DRB) countries, together with descriptions of observed misuse, potential impact upon the environment and potential for reduction.

The approach chosen has been to focus upon so-called **priority pesticides** for the DRB. Studies of the water quality of the Danube River have found a number of polluting substances that regularly occur in the aquatic environment of the river. Some of these substances are of special concern for environmental and/or human health reasons and a list of "priority chemicals for the Danube River" has been prepared.

According to Article 7 of the Danube River Protection Convention, which regulates emission limitations and water quality objectives and criteria, the discharge of hazardous substances from point and non-point sources is to be prevented or considerably reduced. Annex II defines such hazardous substances and lists under Part 2 A (d) plant protection agents, pesticides and chemicals used for the preservation of wood, cellulose, paper, hides and textiles etc. Under Part 2 B of Annex II, a number 40 single hazardous substances is listed. In 2001, substances listed in Annex X of the European Water Framework Directive 2000/60/EEC were taken into account in revising the ICPDR list of priority substances. Altogether, the new list contains 41 single substances of which 25 are chemicals which are used as pesticide **active ingredients** and 5 are chemicals which are used as **inert ingredients**.[7]

[6] The graph expresses mean consumption of pesticides (active ingredients classed as insecticides, herbicides, fungicides and others) per unit area agricultural land.

[7] 'Inert' ingredient: These are substances which can enhance the efficiency of the active substance, make a product more degradable or easier to use. 'Inerts' are mostly handled as trade secrets of the manufacturer, which means they are not labelled on the product.

Priority Pesticides in the Danube Region

				International Conventions		Status EU Water Frame Work Directive 2000/60		Status EU Directive 91/414 and 79/117
No.	**Ingredient**	**CAS Number**	**Use type**	**PIC**	**POP**	**Priority**	**Priority Dangerous**	
	Active Ingredients							
1	2.4-D	94-75-7	Herbicide					Annex I
2	Alachlor	15972-60-8	Herbicide			Yes		pending
3	Aldrin	309-00-2	Insecticide	Yes	Yes			banned
4	Atrazine	1912-24-9	Herbicide				Yes*	pending
	Copper compounds	7440-50-8	Fungicide					
5	Copper carbonate, basic	1184-64-1	Fungicide					Notified
6	Copper hydroxide	20427-59-2	Fungicide					Notified
7	Copper oxychloride	1332-40-7	Fungicide					Notified
8	Copper sulfate (basic)	1344-73-6	Fungicide, Algaecide					not listed
9	Malachite (copper equivalent 57%)	1319-53-5	Fungicide					not listed
10	Chlorfenvinphos	470-90-6	Insecticide				Yes	out 7/03
11	Chlorpyrifos	2921-88-2	Insecticide				Yes*	pending
12	DDT	50-29-3	Insecticide	Yes	Yes			banned
13	Diuron	330-54-1	Herbicide				Yes*	Dossier
14	Endosulfan	115-29-7	Insecticide				Yes*	pending
15	Endosulfan - alpha	959-98-8	Insecticide				Yes	not listed
16	Ethylene dichloride	107-06-2	Fumigant, Insecticide	Yes		Yes		not listed
	Hexachlorocyclohexanes							
17	Lindane (gamma-HCH)	58-89-9	Insecticide	Yes		Yes		out 6/02
18	delta-HCH	608-73-1	Insecticide	Yes			Yes*	not listed
19	Isoproturon	34123-59-6	Herbicide				Yes	Annex I
20	Malathion	121-75-5	Insecticide					Dossier
21	Pentachlorphenol (PCP)	87-86-5	Wood Preservative, Microbiocide,	Yes			Yes*	out 7/03
22	Simazine	122-34-9	Herbicide				Yes*	pending
23	Trifluralin	1582-09-8	Herbicide				Yes*	
	Zinc and its Compounds							
24	Zinc sulphide	7440-66-6	Herbicide					not listed
25	Zinc phosphide	1314-84-7	Rodenticide					not listed
	Inert Ingredients							
1	1,1,1-trichloroethane	71-55-6	Solvent					not listed
2	Chloroform, Trichloromethane	67-66-3	Solvent, Fumigant			Yes		not listed
3	Lead	7439-92-1	Inert				Yes	not listed
4	Methylene chloride	75-09-2	Solvent			Yes		not listed
5	Trichloro ethylene	79-01-6	Inert					not listed

* candidate priority dangerous substance

Sources: European Union (1991): Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market, Official Journal 230, Brussels, Belgium

United Nations Environmental Programme (UNEP) POPs website: www.chem.unep.ch/pops or Stockholm Convention (POPs Convention) website: www.pops.int/United Nations Environmental Programme (UNEP), website of Interim Secretariat for the Rotterdam Convention (PIC convention): www.pic.int

European Community, Official Journal L331/1, Entscheidung Nr. 2455/2001/EG Des Europäischen Parlaments und des Rates vom 20. November 2001 zur Festlegung der Liste prioritärer Stoffe im Bereich der Wasserpolitik und zur Anderung der Richtlinie 2000/60/EG, Brussels

European Council (1978): Council Directive of 21 December 1978 prohibiting the placing on the market and use of plant protection products containing certain active substances plus its amendments, Official Journals: L 33, 8.2.1979; L 296, 27. 10. 1990; L 159, 10. 6. 1989; L 212, 2. 8. 1986; L 71, 14. 3. 1987; L 212, 2. 8. 1986; L 152, 26. 5. 1986; L 91, 9. 4. 1983

U.S.Environmental Protection Agency, Inert Ingredients of Pesticide Products: http://www.epa.gov/opprd001/inerts/fr54.htm

Table 1 lists the 29 priority chemicals used in pesticide products and their regulatory status globally and in the European Union. The table shows that most substances, except for the inorganic compounds, are already regulated by international conventions or the European Union – including:

POPs Convention

The POPs convention aims at the elimination or restriction of persistent organic pollutant (POPs), while the PIC (prior informed consent) convention ensures that countries importing certain chemicals are informed prior to the import, and that information about the hazards of the particular chemicals is disseminated.

Water Framework Directive

The European Water Framework Directive 2000/60EC requires that measurements regarding dangerous priority substances aim at the phase-out of these substances within 20 years after the adoption of measurements. Regarding priority substances, a stepwise discontinuation of the pollution is required in the same timeframe.

EU Authorisation

Only two of the Danube priority pesticides are fully registered in the European Union and listed in Annex I of Council Directive 91/414/EC. For three of the priority pesticides, registration will expire or has already expired and seven are still in the re-authorisation process. According to Directive 79/117, the use of two of the priority pesticides is banned in the EU.

Table 2 shows that only three priority pesticides are authorised for use in all of the DRB countries under study, while seven priority pesticides are not authorised in any of the countries. There are also differences between the countries. The Republic of Srpska authorised 15, Romania, Serbia & Montenegro and Slovakia 14 priority pesticides, while Bulgaria and Moldova authorised eight priority pesticides and the Ukraine only six.

In some countries, there are certain restrictions upon specific pesticide products. For example, in Croatia it is not allowed to apply Alachlor with a knapsack sprayer or a hand sprayer. It is also not allowed to use Alachlor on light soils after the maize has emerged. Use of Atrazine is limited to 1.5 kg ai/ha in humid and 1 kg ai/ha in arid areas. Endosulfan cannot be used in oil-seed rape and forestry. Use of Simazine is permitted only in maize monoculture. Trifluralin use is not permitted in post-harvest sown soya bean and sunflower.

Authorisation Status of Danube Priority Pesticides in the 11 Danube Countries

	BH												
Active Ingredients	FedBH	RS	BG	HR	CZ	HU	MD	RO	YU	SK	SL	UA	No
2,4-D	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**12**
Copper sulphate (basic)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**12**
Trifluralin	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**12**
Alachlor	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	**11**
Copper hydroxide	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	**11**
Copper oxychloride	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	**11**
Chlorpyrifos	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	**11**
Atrazine	N	Y	Y	R	Y	Y	Y	Y	Y	Y	B	N	**9**
Malathion	N	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	**9**
Isoproturon	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	**9**
Endosulfan	Y	Y	N	R	Y[8]	Y	N	Y	Y	Y	Y	N	**9**
Simazine	N	Y	N	R	Y[9]	N	N	Y	Y	Y	Y	N	**6**
Zinc phosphide	N	Y	N	N	Y	Y	N	N	Y	Y	Y	N	**6**
Diuron	Y	N	N	N	N	Y	N	Y	N	N	N	N	**3**
Lindane (gamma-HCH)	N	Y	N	N	N	N	N	Y	N	N	B	N	**2**
Chlorfenvinphos	Y	Y	N	N	N	N	N	N	N	N	N	N	**2**
Malachite (copper equivalent 57%)	N	N	N	N	N	N	N	N	N	Y	N	N	**1**
Copper carbonate, basic	N	N	N	N	N	N	N	N	Y	N	N	N	**1**
Aldrin	B	B	B	B	B	B	B	B	B	B	B	B	**0**
DDT	B	B	B	B	B	B	B	B	B	B	B	B	**0**
alpha-endosulfan	N	N	N	N	N	N	N	N	N	N	N	N	**0**
Ethylene dichloride	N	N	N	N	N	N	N	N	N	N	N	N	**0**
delta-HCH	N	N	N	N	N	N	N	N	N	N	B	N	**0**
PCP (pentachlorophenol)	N	N	N	N	N	N	N	N	N	N	N	N	**0**
Zinc sulphide	N	N	N	N	N	N	N	N	N	N	N	N	**0**
Number authorised	**10**	**15**	**8**	**12**	**12**	**13**	**8**	**14**	**14**	**14**	**12**	**6**	

Y= Authorised; N= Not authorised; B= Banned; R= Restricted

[8] Endosulfan is authorised, but there is no registered product containing Endosulfan.

[9] Simazine is authorised, but there is no registered product containing Simazine.

2 Methodology

In line with the process developed in the Inception report, the international expert team hasd developed templates and guidelines for the collection and analysis of data and information related to the use of pesticides in 11 DRB countries. Also, information from existing data sources on pesticide use available at global and EU level have been collected to compare with the situation in the DRB. Under the guidance of the international expert team,, national experts in each of the DRB countries under study have been asked to undertake a survey and to collect:

1. data available on the **amount** of pesticides applied in DRB countries and **how** they are used (e.g. what crops are they applied to, number of applications etc.);
2. information available on **bad practice** by farmers and others regarding the use of these pesticides;
3. information on legal and control mechanisms and measures for compliance.

The experts mainly submitted data based upon sales data and on recommendations included in the pesticide product registration. Actual use data by location, crop and active ingredient were generally not available and could not be submitted. Therefore the figures presented in this report relate to general estimations of national usage of the priority pesticides, except for the Czech Republic where some sub-national data has been prepared.

The results obtained are summarised by country. Detailed information on registered products and their usage by country is presented in Annexes 2 - 11.

The section on environmental impact assessment includes chemical fact sheets for selected priority pesticides. Each fact sheet comprises physical and chemical properties related to environmental behaviour, environmental fate, environmental risk associated with them and human and environmental toxicity.

Based on the analysis of data and information received in the national survey, a first set of policy recommendations for reducing pesticide usage have been outlined.

These policy recommendations shall be further developed in Phase 2 of the Project to be introduced in national legislation, assuring a harmonized approach in the use and application of pesticides in the DRB, responding to the requirements of the EU WFD and to the objectives of the Danube River Protection Convention

3 Availability of Data on Pesticide Usage

Information on the amount and identity of pesticides applied, at a particular location, on a certain date can be extremely useful in the protection of human and environmental health and in pest management. Accurate information on pesticide use can help provide better risk assessments and illuminate pest management practices that are particularly problematic so that they may be targeted for the development of alternatives.

In spite of the fact that pesticides are among the most toxic substances released into the environment, little information is available about the details of their distribution and use patterns.

The following section briefly outlines available data collected:

- by the UN Food and Agriculture Organisation (FAO);
- in the European Union; and
- in three DRB countries Hungary, Czech Republic and Slovakia, operating pesticide use/sales tracking systems.

3.1 Food and Agriculture Organisation (FAO)

The FAO has collected data on pesticide usage and consumption for more than three decades. Data are collected for major groups (insecticides, herbicides, fungicides etc.) and chemical classes such as urea herbicides, organophosphate insecticides etc. Data usually refer to quantities of active ingredients sold or used in the agricultural sector. For some countries, data about uses/ sales to the non-agricultural sector are included. Some countries provide data by formulated products. The data collected are publicly available and present the most comprehensive globally database on pesticide use.

3.2 European Union

The common way to track data on pesticide use in the EU is the collection of sales data. The most recent data published by EUROSTAT are from 1999. For some Member States, these data include non-agricultural pesticide sales. Some Member States also include sales data of sulphur, sulphuric acid and mineral oil or gases which are used as pesticides in large quantities. Table 3 presents an overview of pesticide tracking systems in EU Member States.

In 2003, Eurostat published more detailed pesticide use data. For this data collection, Eurostat contracted the pesticide industry through the European Crop Protection Association (ECPA). The members of ECPA submitted data from their annual surveys and other market research panels. The publication covers the period 1992 - 1999 and includes pesticide sales data by chemical class for a number of crops. Even sales data for some active ingredients were made available. For each Member State, a list of the five top active ingredients per crop group was presented.

Overview of Agricultural Pesticide Use Tracking Systems in the 15 EU Member States

Member State	Collection of Sales Data	Pesticide Surveys	Mandatory Record Keeping	Pesticide Use Reporting
Austria	Volume active ingredients	not regular	no	no
Belgium	Volume formulated products	3-4 crops per year	for apples, pears and glass house crops	no
Denmark	Monetary value and volume of formulated products and active ingredients	no	yes	no
Finland	Monetary value and volume of formulated products and active ingredients (obligatory reporting)	no	no	no
France	Yes	no	no	no
Germany	Volume active ingredients	no	no	no
Greece	Volume formulated products	no	no	no
Ireland	Volume active ingredients	no	no	no
Italy	Yes	no	no	no
Luxembourg	Yes	no	no	no
Portugal	Monetary value and volume of active ingredients	no	no	no
Spain	Yes	no	no	no
Sweden	Monetary value and volume of formulated products	no	yes	no
The Netherlands	Volume of formulated products and active ingredients	monthly 1 crop	yes	no
United Kingdom	Monetary value	yes	yes	for aerial applications

Source: PAN Germany 2002[10], OECD 2000[11]

3.3 Selected DRB Countries

From the 11 DRB countries under study, only three countries maintain pesticide use/sales tracking systems based upon retail sales - Hungary, the Czech Republic and Slovakia.

Hungary

Hungary collects sales data from wholesalers and local distributors twice a year. They have to submit data on the sales in kg as well as on the monetary amount on the basis of individual formulated pesticide products. Sales data are publicly available in an aggregated format.

[10] L. Neumeister (2002): Pesticide Use Reporting; Legal Framework, Data Processing and Utilisation, Full Reporting Systems in California and Oregon, Pestizid Aktions-Netzwerk e.V. (PAN Germany), Hamburg, Germany.

[11] OECD Series on Pesticides, Number 7 (1999): OECD Survey on the Collection and Use of Agricultural Pesticide Sales Data: Survey Results, Paris, France.

Czech Republic

In the Czech Republic, all professional pesticide users have to keep spray records for 3 years. Farms larger than 10 ha are required to submit summaries to the Department of Information. Farmers report on amounts applied by formulated product, crop and geographical region. Usage data are publicly available by crop and amount of active ingredient. Data on pest and disease infestations are also published.

Sales data are collected by the Czech Crop Protection Association, which is an associate member of the ECPA.

Slovakia

Slovakia started a pesticide sales reporting system in 1999. All traders are required to report sales data annually: manufacturer, importer, distributors and retailers. They are required to report the name and amount of formulated product for agricultural and non-agricultural pesticides. Sales data are publicly available by amounts of active ingredient, chemical class, use type and by postal code[12].

All farmers have to keep detailed records of their pesticide use and are required to submit summaries to the Central Control and Testing Institute of Agriculture.

[12] Communication with Martin Hajas (Central Control and Testing Institute of Agriculture) and Jozef Kotleba (Ministry of Agriculture).

4 Pesticide Usage in the 11 Danube Countries

Due to the fact that pesticide use reporting systems only exist in a few Danube countries (Hungary, the Czech Republic and Slovakia), the GFA national experts were asked to provide (where available) national usage data for the priority pesticides.

Table 4 shows the total area of the Danube countries and their share of the territory of the Danube River basin. It shows that Romania, with 28% of its territory, has the largest share of the Danube Basin, and that 97% of the country belongs to the basin. National pesticide usage/sales data are equal to usage in the Danube basin for countries which belong almost entirely (Hungary, Romania, Slovak Republic) to the basin.

Notwithstanding this, the intensity of pesticide usage varies regionally. Agricultural conditions prevailing along the Danube river are particular suitable for crop growing, and pesticide use is most likely much higher than in less suitable areas.

0 gives an overview of pesticide use in Danube countries taken from the FAO database. Data for Bosnia & Herzegovina, Bulgaria and the Ukraine are not available from this source. In some cases, the latest data are from 1993, but even the most recent data are already 5 years old.

Areas of National Territories in the Danube Basin

Country	**Total Area of National Territory (km^2)**	**Area of National Territory in the DRB (km^2)**	**% of National Territory in DRB**	**% of DRB Occupied by National Territory**
Romania	238,391	232,200	97	28.4
Hungary	93,030	93,030	100	11.4
Serbia & Montenegro	102,173	88,919	87	10.9
Slovak Republic	49,036	47,064	96	5.8
Bulgaria	110,994	46,896	42	5.7
Bosnia & Herzegovina	51,129	38,719	76	4.7
Croatia	56,542	34,404	61	4.2
Ukraine	603,700	32,350	5	4.0
Czech Republic	78,866	21,119	27	2.6
Slovenia	20,253	16,842	83	2.1
Moldova	33,700	12,025	36	1.5
TOTAL	**1,437,814**	**663,568**		**100**

Overall Pesticide Consumption in Danube Countries (tonnes)

	Croatia 1996	Czech Republic 1998	Hungary [13] 1996	Moldova 1993	Romania 1998	Slovakia 1998	Slovenia 1998	FRY 1998
Fungicides & Bactericides								
Benzimidazoles	23	67	226	15			3	
Diazines, Morpholines	2	63	21	14			6	
Dithiocarbamates	239	291	329	114			240	
Inorganics	1.114	206	1.067				377	
Mineral Oils	60	11	135	51		4		
Other Fungicides	20	156	1.625	466			106	
Total Fungicides & Bactericides	*1458*	*794*	*3.403*		*6.500*		*741*	*880*
Herbicides								
Amides	555	556	1,227	292		487	16	
Bipiridils	7	30	202					
Carbamates Herbicides	24	72	557	11		111	3	
Dinitroanilines	11	105	1,123	216		88	34	
Other Herbicides	212	971	1,567	437		688	116	
Phenoxy Hormone Products	153	545	854	197		621	41	
Sulfonyl Ureas	8	26	49					
Triazine	483	204	711	19		321	33	
Triazoles, Diazoles	14	9	710	88			9	
Uracil			11					
Urea derivates	75	124	195	6			34	
Total Herbicides	*1,528*	*2,642*	*6,496*	*1,178*	*5,400*	*2,316*	*277*	*1,748*
Insecticides								
Botanical & Biological Products	2		2			2		
Carbamates Insecticides	24	14	57			8	1	
Chlorinated Hydrocarbons	6		129	62			2	
Organo-Phosphates	92	79	1,219	295		85	27	
Other Insecticides	17	16	466	27		37	40	
Pyrethroids	7	10	208	187		38	1	
Total Insecticides	*148*	*119*	*2,081*	*571*	*2,100*	*170*	*71*	*729*
Plant Growth Regulators	35	398	11					
Rodenticides								
Anti-coagulants			126					
Other Rodenticides			1.050	4			2	
Total Rodenticides		*33*	*1176*	*4*		*152*	*2*	
Total Usage	**3,123**	**4,079**	**13,866**	**2,450**	**14,000**	**3,075**	**1,091**	**3,357**

Source: FAOSTAT Database

[13] Formulated product.

0presents a summary of the national pesticide use data that was submitted by the national experts for eight countries. The table shows that the total use of priority pesticides is the highest in Hungary and the Czech Republic, which is probably due to the fact that these two countries have comprehensive pesticide use tracking systems. In Hungary, reported use is 10 times higher than in the Czech Republic, with copper as the most widely used pesticide. This is most likely due to the fact that Hungary cultivates approximately 99,000 of vineyards plus a large area with fruits and vegetables, while the Czech Republic cultivates only about 11,000 ha grapes.

Copper is generally used in large amounts in vineyards and orchards to control fungus and it is approved as a pesticide in organic agriculture according to EU regulations.

The data show that, in general, copper compounds contribute to the highest use, followed by Atrazine, 2,4-D and Trifluralin.

The pesticide usage data that were submitted are in general rather an estimation. They are based upon sales data (except for the Czech data) and often neglect trade. Uncontrolled trade into the country was reported in three countries.

The data collected present a picture of the situation at national level. An estimation of pesticide use in the Danube catchment is not possible, except for countries of which large parts are located in the catchment (Hungary, Romania, the Slovak Republic and Slovenia (83%)).

Usage of Priority Pesticides in 8 Danube Countries 2001-2002 (tonnes active ingredients, except for Slovenia – kg formulated product)

	BH										
	Fed BH	**RS**	**HR**	**CZ**	**HU**	**MD**	**YU**	**SK**	**SL***	**UA**	**Total****
	2002	**2001**	**2001**	**2002**	**2001**	**2002**	**2002**	**2002**	**2001**	**2001**	
Copper sulphate	15	4		47	10,093	1,129	7		13		11,295
Atrazine	1	73	406	145	520		115	85			1,344
Copper oxychloride		4		129	451	45	163	19	12		810
2,4-D	24	6	120	83	408	40	0	11	21	27	719
Alachlor		5	37	255	13			80			390
Trifluralin	1	2		100	111	4	96	25	3		339
Chlorpyrifos	13			111	48	8		38	2		218
Copper hydroxide	2	1		37	110	21	10	9	83		189
Malathion		3			9	5	124	0		15	155
Isoproturon				130	3			9	67		141
Endosulfan					82			0	2		82
2,4-D EHE				6				36			42
Diuron					21			0			21
Simazine							10	0	2		10
Zinc phosphide				3	2			2			7
Lindan		1						0			1
Total	**56**	**99**	**563**	**1,046**	**11,869**	**1,251**	**524**	**314**	**204**	**42**	**15,763**

* Data for Slovenia is presented as kg of formulated product

The data show that in none of the countries, 100% of the crops are treated with priority pesticides. However, the priority pesticides are high-use pesticides accounting for over 20% of the total use in some countries. Treatment data suggest that a high percentage of crops in Danube countries do not receive pesticide applications at all. However, soils in the Danube catchment and particularly those close to the river, are very good for intensified crop production. Pesticide usage in these areas is most likely higher than the national average.

The use of priority pesticides is associated with specific crops:

- Atrazine is mostly used in maize.
- Alachor is used in maize, rape seed and sunflower;
- copper compounds are used in vineyards, orchards and in vegetable production, including potatoes.
- 2,4-D is mostly used in cereals.
- The insecticides Chlorpyrifos, Malathion and Endosulfan are used in orchards, vineyards, rape seed, alfalfa and vegetables.

5 Problems Associated with Pesticide Use in the DRB

Although pesticide use is currently relatively low in the DRB countries (compared for example to the EU Member States) it is important not to be complacent about the risks of pesticide pollution since:

1. Pesticide use is reported to be high in certain areas and for certain high value crops - this includes priority pesticides that pose a serious hazard to the environment and human health.
2. Where farmers use pesticides, there are many examples of "bad practice" that contribute to the risk of pesticide pollution.
3. There is concern that with EU enlargement and the expansion of the Common Agricultural Policy (CAP) into the DRB countries joining the EU, there is a risk of:
   - increasing areas cultivated with cereals and oilseeds due to the availability of EU direct payments for farmers growing these crops in the new Member States;
   - increased intensification of crop production, including the greater use of mineral fertilisers and pesticides, particularly in the more favourable areas with better growing conditions;
   - a reduction in mixed cropping and an increase in large-scale cereal monocultures in some areas.

5.1 Bad Practice by Farmers

The national experts reported several significant problems associated with the use of pesticides:

- Wrong time of application due to poor education;
- Poor storage conditions;
- Overuse of Atrazine and Chlorpyrifos;
- Drift of pesticides to adjacent areas due to old spraying equipment and poor knowledge;
- Cleaning of spraying equipment close to surface or even in surface waters;
- Uncontrolled trade.

5.2 Environmental Impact of Pesticide Use

Pesticides can be released into the environment in many ways. After application, depending on their chemical and physical properties, they may run-off from fields and make their way into ditches, rivers, lakes. Ultimately, they reach the oceans through the water cycle. They may also leach into groundwater, which is then discharged into streams or is subsequently used for irrigation. Drift, evaporation and precipitation carry pesticides into both, nearby and far away habitats. Via the food chain, accumulated in animal tissue, persistent and bioaccumulative pesticides can travel far distances and arrive at places in which they were never applied. Figure 2 illustrates the behaviour of pesticides in the environment.

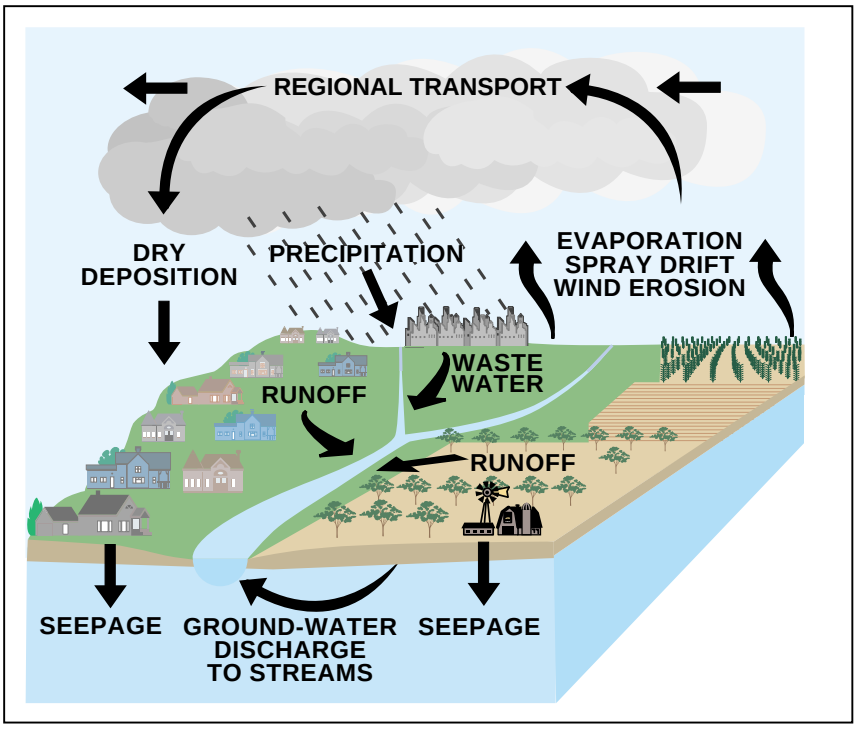


Figure 2 Environmental Fate of Pesticides[14]

In order to evaluate the environmental behaviour and possible impacts of the 25 priority active ingredients on human health and the environment in the Danube catchment area, scientific literature, the Internet and previous studies were searched. In addition, national experts in the 11 Danube countries were asked to provide information on:

- illegal use of a banned pesticides;
- poor storage of pesticides, including the problem of old pesticide stores;
- application rates that are higher than approved;
- 'spray drift' problems due to the use of old spraying equipment;
- poor disposal of containers, unused chemicals and "wash water" from spray equipment in the environment (e.g. streams and rivers).

One of the major sources was the study "*Strengthening sustainability of water quality management in the Danube Basin – Component VI, Identification of sources and amounts of pollution for substances on the EU List of Priority Chemicals (Programme No: ZZ 97 25)*[15]. This study looked into emission data, and national and international water monitoring programmes. However, the focus of the study was not limited to the EU List of Priority Chemicals.

Another valuable source was the technical report about the Joint Danube Survey conducted in August and September 2001. During this survey, a large number of water quality tests was conducted and samples of phytoplankton and zooplankton were taken and analysed[16].

[14] "Pesticides in Surface Waters," U.S Geological Survey, Fact Sheet FS-039-97, U.S. Geological Survey, 1997.

[15] Environmental Programme for the Danube River Basin (2000): Strengthening the sustainability of water quality management in the Danube Basin – Component VI, Identification of sources and amounts of pollution for substances on the EU List of Priority Chemical, Final Report (Programme No: ZZ 97 25), WRc Medmenham, Bucks, UK.

[16] ICPDR (2002): Technical Report of the International Commission for the Protection of the Danube River, Joint Danube Survey, Vienna.

Additional scientific literature was searched using the online catalogue of Elsevier Science, Wiley InterScience and the Online Library of Springer Publications. Altogether these publishers publish over 3,000 scientific journals such as: Agricultural Water Management, Agriculture, Ecosystems & Environment, Aquatic Ecosystem Health and Management, Aquatic Toxicology, Ecological Indicators, Ecological Modelling, Ecotoxicology and Environmental Safety, Environmental Impact Assessment Review, Environmental Pollution and Journal of Contaminant Hydrology.

Articles on environmental impacts of pesticides specific to the Danube catchment were not found, except for articles repeating the results of the study *Strengthening sustainability of water quality management in the Danube Basin – Component VI, Identification of sources and amounts of pollution for substances on the EU List of Priority Chemicals (Programme No: ZZ 97 25)*.

Publications on impacts of pesticides on aquatic organisms and the ecosystem of the Danube were not found. Possible reasons are: such studies do not exist, they do not exist in English language, and/or such studies are not accessible to the public.

The conclusion of the literature search was that a number of Danube priority pesticides are frequently detected in the Danube catchment, and that drinking water guidelines and target values for aquatic organisms are often exceeded. Organochlorine pesticides such as Lindan, DDT are often detected in sediments and animal tissue. The Joint Danube Survey found that no species of macrozoobenthos at all was found in the rivers Iskar, the Arges and the Olt, and concluded that toxic effects are possible reasons. What kind of chemicals are responsible for this impact, however, was not investigated.

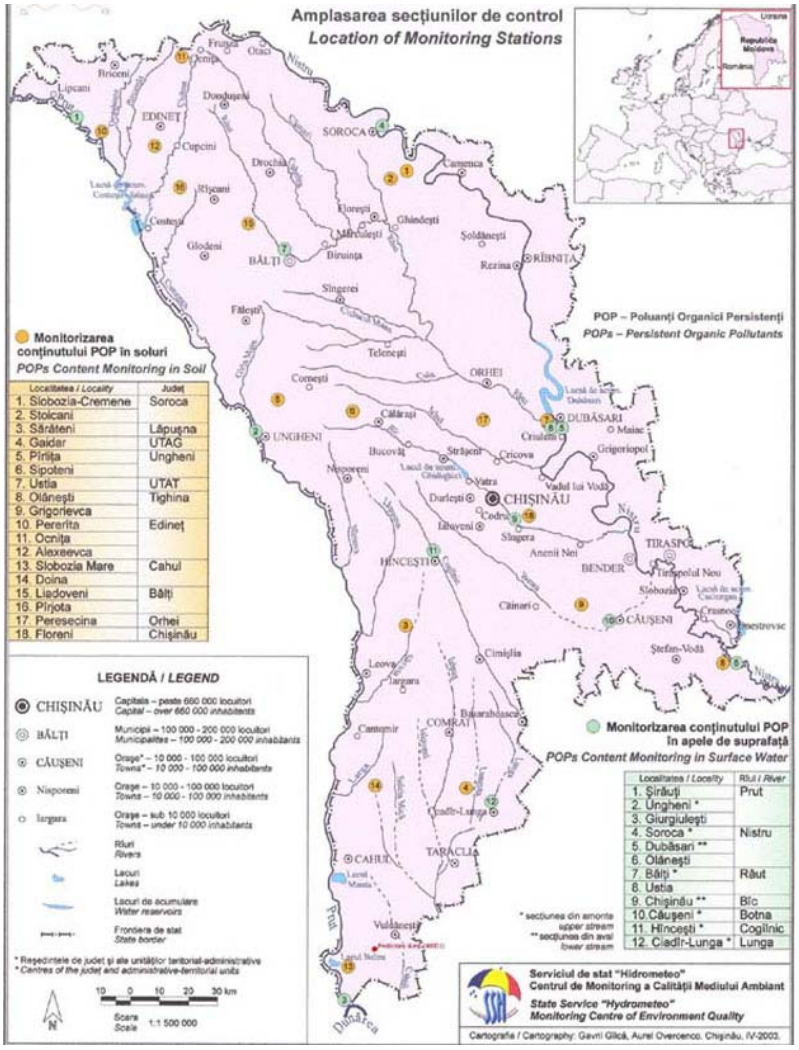
The results and conclusions of these studies will not be repeated in this report.

The national experts submitted information that the illegal use of a banned pesticide continues to be a problem in Ukraine and was a larger problem in Romania. Figures are, however, not available.

Poor storage of pesticides, including old pesticide stores also continues to be a problem. In the Ukraine, some 20,000 tons of obsolete pesticides are stored. Often stored under bad conditions, they seriously threaten human and environmental health (infiltration in groundwater).

In Bulgaria, 35% of the pesticide storehouses are in bad condition, and in the southern part of Moldova there is a pesticides dump site containing almost 4 metric tons of chemicals. Some 6,000 tons of obsolete pesticides are reported to be stored in Moldova. Figure 3 below shows a map of contaminated soils in Moldova. Several countries maintain databases with the location, amounts, storage conditions. In Moldova and the Ukraine, GIS-based maps are available[17].

[17] Information obtained form the 7th International HCH and Pesticides Forum in Kyiv, Ukraine, June 5th-7th 2003.



Localitatea / Locality	Județ
1. Slobozia-Cremene	Soroca
2. Stolicani	
3. Sărăteni	Lăpușna
4. Gaidar	UTAG
5. Pîrîța	Ungheni
6. Sipoteni	
7. Ustia	UTAT
8. Otănești	Tighina
9. Grigorievca	
10. Pererîta	Edineț
11. Ocnița	
12. Alexeevca	
13. Slobozia Mare	Cahul
14. Doina	
15. Liadoveni	Bălți
16. Pîrjota	
17. Peresecina	Orhei
18. Floreni	Chișinău

Localitatea / Locality	Rîul / River
1. Șîrăuți	Prut
2. Ungheni *	
3. Giurgiulești	
4. Soroca *	Nistru
5. Dubăsari **	
6. Otănești	
7. Bălți *	Răut
8. Ustia	
9. Chișinău **	Bîc
10.Căușeni *	Botna
11. Hîncești *	Cogîlnic
12. Ciadîr-Lunga *	Lunga

Figure 3 **Moldova: Map of Soils Contaminated with POPs Pesticides (Provided by: Andrei Isac, Ministry of Ecology Construction and Technical Development)**

National experts also often state that Atrazine is used in higher doses, sometimes up to twice the approved amount.

Spray drift and poor disposal are also mentioned to be a problem to adjacent rivers. Spraying equipment is old and often cleaned near or even in rivers and ponds.

In order to efficiently monitor and evaluate impacts of pesticides on non-target organism, usage data such as time, location and amount are very valuable. The next figure shows that pesticide use data in combination with toxicological, physical and chemical data plus geographical information can be used as input in field studies, Geographic Information Systems and environmental transport models to assess exposure and risks.

Pesticide use reporting systems exist in two Danube countries: Slovakia and the Czech Republic. However, in both countries, usage data collected are not utilised for targeted monitoring.

National sales data are not sufficient for targeted monitoring programmes. Sales data on the retail level are more useful since they allow assumptions between locations, amounts and kind of pesticides sold, provided retailers do not report anonymously.

In the absence of use data itemised by location, ingredient and amounts and the relation to sensitive areas, chemical fact sheets were developed to provide data on toxicity, physical and chemical properties.

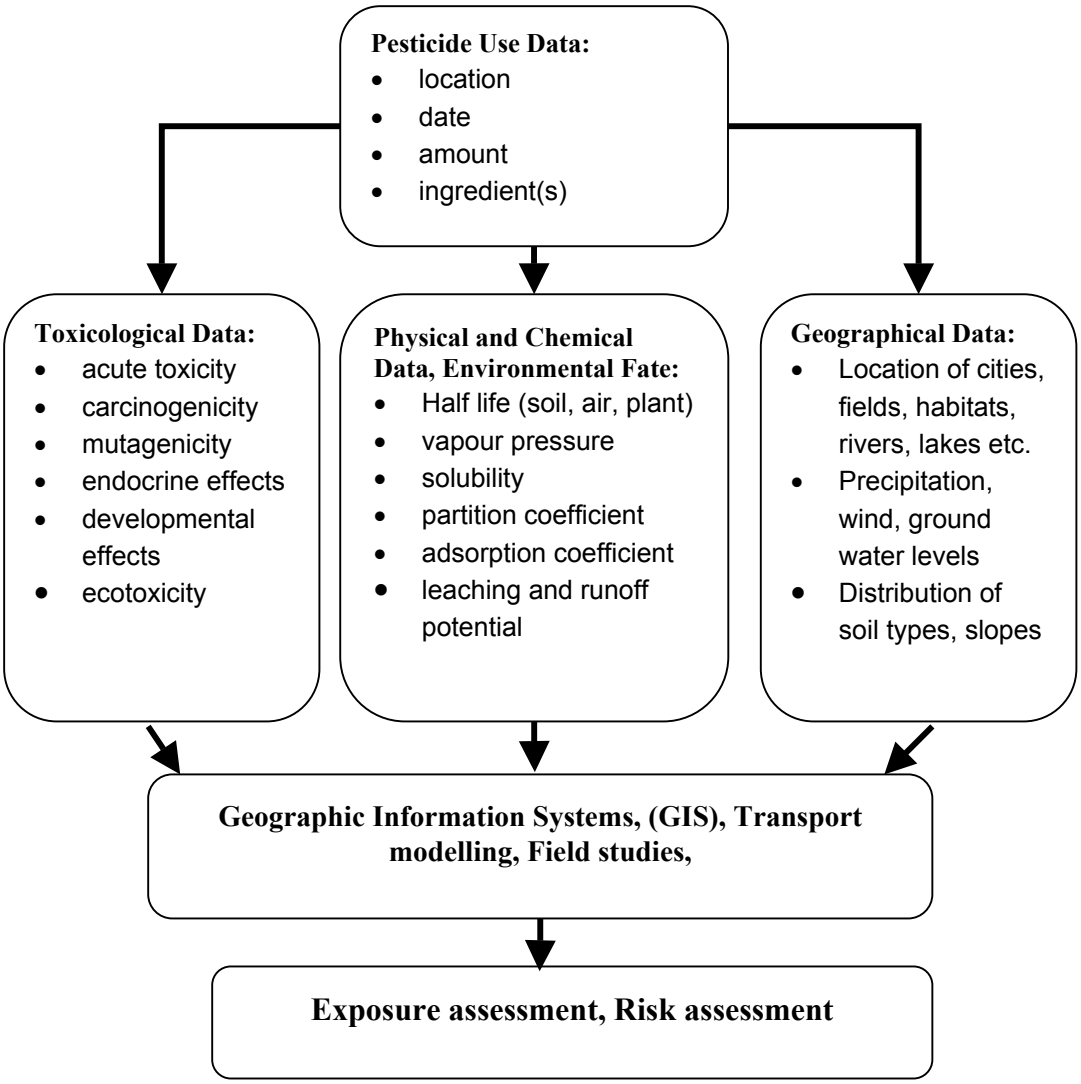


Figure 4 General Exposure Assessment Model based Upon Pesticide Usage Data[18]

In the absence of use data itemised by location, ingredient and amount, and the relation to sensitive areas, chemical fact sheets were developed to provide data on toxicity, physical and chemical properties.

0presents a summary of the environmental and human toxicity of synthetic priority pesticides which are still registered in Danube countries. Information was extracted from the chemical fact sheets. Data sources and details can be found in the chemical fact sheet (please refer to Annex 1).

The summary shows that all priority pesticides are hazardous, they are either highly acute toxic, are potential endocrine disruptors and/or are possibly carcinogenic.

[18] L. Neumeister (2002): Pesticide Use Reporting; Legal Framework, Data Processing and Utilisation, Full Reporting Systems in California and Oregon, Pestizid Aktions-Netzwerk e.V. (PAN Germany), Hamburg, Germany.

Environmental and Human Toxicity of Selected Priority Pesticides

Pesticide	Risk Symbol	Bird (HD_5 50%)	Aquatic Organisms	ED	Pers.	Acute Toxicity	EPA Cancer
2,4-D	Xn	132,9	slightly - highly	2		Moderately Hazardous	Unclassifiable, ambiguous data
Alachlor	Xn; N	330,42	moderately	1		Slightly Hazardous	
Atrazine	Xn; N	408,98	slightly	1	Pers	Unlikely to be Hazardous	C, Possible
Chlorfenvinphos	T+; N	2,73	highly –very highly			Highly Hazardous	
Chlorpyrifos	T; N	3,76	very highly			Moderately Hazardous	E, Unlikely
Diuron	Xn; N	193,04	highly - moderately	2		Unlikely to be Hazardous	Known/Likely
Endosulfan	T; N	9,53	very highly	2	Pers+	Moderately Hazardous	Not Likely
Isoproturon	Xn; N	313,4	slightly-nontoxic			Slightly Hazardous	
Lindane	T; N	10,5	highly – very highly	1	Pers	Moderately Hazardous	B2, Probable
Malathion	Xn	139,1	highly - moderately	2		Slightly Hazardous	Suggestive
Simazine	Xn; N	965,25	slightly-nontoxic	2		Unlikely to be Hazardous	C, Possible
Trifluralin	Xi; N	245,55	very highly		Pers	Unlikely to be Hazardous	C, Possible

Risk Symbol (EU 67/548EC): T = Toxic, T+ Very Toxic, Xn= harmful, N = Dangerous for the Environment, ED = Endocrine Disruption: 1= At least one study providing evidence of endocrine disruption in an intact organism. Not a formal weight of evidence approach. 2= Category 2: Potential for endocrine disruption. In vitro data indicating potential for endocrine disruption in intact organisms. Also includes effects in-vivo that may, or may not, be ED-mediated. May include structural analyses and metabolic considerations. Pers= Persistence: Pers= Persistent, Pers+= Very Persistent

Limitations of Toxicological, Chemical and Physical Data

The chemical fact sheets provided in this report will present toxicological data, chemical and physical property data and information on the environmental fate of the 25 priority active ingredients.

There are large numbers of data which vary depending on the source. Half-life of chemicals in soil and water depends on the type of soil, the exposure to sun light and oxygen etc.; exotoxicological data depend on the study type etc. For *chlorpyrifos* alone, AQUIRE, a Eco-Tox database for toxicological effects on aquatic life, maintained by the U.S. Environmental Protection Agency lists over 1,700 records, e.g. studies with different endpoints. However, even scientifically accurate toxicity studies do not necessarily reflect reality. The small number of test species and the limitation to one chemical and to mostly one (acute) endpoint (LC50) are severe limitations. Effects of multiple chemical exposure, which is reality in the Danube catchment, is not addressed by most studies.

Sublethal and chronic adverse effects such as impaired activity, endocrine disruption, cancer in fish, lower reproduction, or simply reduction in the food chain are usually not covered by these studies.

Additionally, to draw casual relationships between one particular pesticide and an adverse effect observed is rather impossible in the “chemical cocktail” of the Danube.

However, there are screening methods mimicking reality closer. For instance, in these tests, healthy water fleas (daphnia magna) are exposed to river water samples. Testing of the chemicals in water and the toxicological effects does allow to draw correlations, at least to a group of chemicals with the same mode of action such as Organophosphates[19] and N-methyl carbamates. A problem in these studies, and a general problem, are limits of detections, and the possible non-detection of toxic metabolites or other substances.

[19] Kikuchi, M., Sasaki, Y., Wakabayashi, M.; (2000): Screening of Organophosphate Insecticide Pollution in Water by Using Daphnia magna, Ecotoxicology and Environmental Safety, Volume 47, Issue 3, November 2000, Pages 239-245.

6 Potential Policy Reform for Pesticide Pollution Control

The following conclusions may be drawn from the data and information on pesticide use, environmental impacts and agricultural practices collected and reviewed during the preparation of this study:

- Overall pesticide use in the Danube countries is low in amounts compared to western European countries and with a view to the area treated.
- Intensity in treated areas, however, may be higher than in western European countries and overdosing of Atrazine, probably due to weed resistance, was frequently reported.
- Seven priority pesticides are not authorised in the Danube countries, some of them continue to be hazardous due to old stockpiles and residues in soils and sediments.
- The priority pesticides 2,4-D, Alachlor, Trifluralin, Atrazine and copper compounds are high-use pesticides in most of the Danube countries. They are mostly used in cereals, rapeseed and sunflower, maize and in orchards and vineyards.
- Priority pesticides as well as other pesticides are frequently detected in surface and ground water.
- Priority pesticides pose a serious hazard to the environment and human health. Most of them have already been regulated at international and EU level.

The current low use of agricultural pesticides in the countries of the Danube River Basin (DRB) presents a unique opportunity to develop and promote more sustainable agricultural systems before farmers become dependent again upon the use of agro-chemical inputs.

However, pesticide use is always related to agricultural policy. Farmers grow those crops which are most economically viable. If, for instance, agricultural policy supports subsidy schemes and market policies for a small number of crops, the range of crops grown by farmers will be limited, crop rotations will be simple or non-existent and, as a consequence, pesticide use will rise.

There are numerous different policy instruments that can be used to control pesticide pollution. 0gives a general overview of these instruments.[20] The control instruments presented in this table provide a framework which can be elaborated and filled with more detailed measures.

However, the selection of the most appropriate policy instruments for the DRB countries will depend on the establishment of a clear policy strategy for controlling pesticide pollution, together with clear policy objectives.

[20] Falconer, K.E. (1998): Managing diffuse environmental contamination from agricultural pesticides: An economic perspective on issues and policy options, with particular reference to Europe, Agriculture, Ecosystems and Environment 69 (1998) 37-54.

Instruments Aiming at the Control of Pollution by Pesticides

Control Instrument	Target	Control Techniques	Compliance Measures
Advice	Environmentally more-sound pesticide usage; farmers using and acting according to improved information	Improved advice and extension services; more crop protection research	None (voluntary measures by farmers)
Use reduction (ICM and IPM standards) Use restriction	Mode of use/ timing/ frequency of application/ maximum dosage/restrictions on use, prohibitions in certain conditions or generally	Statutory labelling of formulations	Spot-checks, farm records, fines for non-compliance; self-regulation
Compulsory training	More socially desirable levels and types of pesticide usage (e.g. mode of application, timing)	Improve farmers' knowledge and understanding of the necessity for treatments; increase decision rationality	Prohibit use or purchase of pesticides or spraying equipment without a certificate of competence
Performance standards (cut off criteria, eco-audits)	Soil loss/ pesticide run-off or leaching	Limits on pesticide losses	Environmental simulation or field measurements
Design standards	Pesticide application	Sprayer specifications, buffer strips along water courses, field margins etc.	Farm inspections, spot-checks
Permits	Inputs, emissions, treated area, crop area	Limits on farm input use/ emissions/ crop area	Farm records and inspections; coupons for pesticide input purchases, handed in at point of sale
Taxes	Input use, emissions, treated area, numbers of applications	Increase price of materials or applications, perhaps through a percentage levy or charge per unit, to encourage reduced pesticide usage.	Distributor and/or farmer records
Subsidies to change practices	Increased use of reduced dose/ non-chemical pest controls	Compensate farmers for financial losses resulting from changed practices	Farm inspections
Transferable permits	As above	Limits on total (for example, catchment) input use, emissions, crop area.	As above
Crop insurance	Reduced pesticide usage	Reduced prophylactic treatments	None (voluntary)

Source: Falconer modified

According to the aims of the Danube Protection Convention, the risk of pollution should be stopped at its source – with regard to pesticide use this means[21]:

a) withdraw approval for the use of those pesticides that pose the greatest threats to public health and the environment;
b) reduce the use of those pesticides that remained approved for use;
c) improve the management by farmers of those pesticides that remain approved for use.

Such objectives can be achieved through a combination of necessary policy reforms and the promotion of appropriate practical action by farmers. However, the potential to achieve these objectives varies greatly between countries in the DRB and is above all related to the fact whether a country is currently preparing for EU accession or not.

[21] OECD (1995). *Sustainable Agriculture: Concepts, Issues and Policies in OECD Countries*. Organisation for Economic Co-operation and Development, Paris.

6.1 Potential for Policy Reform in EU Context

6.1.1 Adoption of EU Pesticide Regulations

In the European Union, there are several Directives addressing the **regulation** of pesticides – see Table 9. A specific Regulation or Directive addressing the **use** of pesticides, however has not been developed.

The highest potential for the control of water pollution by pesticides is offered by the Water Framework Directive (WFD). Similar to the previous Dangerous Substances Directive (76/464EC), which was repealed by the WFD, pollution control is based on chemical lists. Three lists of substances were composed: an indicative list of main pollutants, a list of priority substances, and a list of priority hazardous substances. The list of main pollutants consists of chemical classes and use types, therefore it includes priority substances and priority hazardous substances per se.

The WFD could be a baseline for the overall water policy in the Danube basin. For **surface water,** the Directive aims at enhancing the protection and improvement of the aquatic environment, inter alias, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances.

For **groundwater,** the Directive wants to ensure the progressive reduction of pollution of groundwater and prevents its further pollution. Member States must implement the basic measure of prohibiting direct discharges of pollutants into groundwater. The European Parliament and the Council must adopt specific measures to prevent and control groundwater pollution.

The WFD is still not fully implemented. The European Commission did not come up with concrete measures and many of the priority hazardous substances are still defined as candidates. There is also a compliance issue between the WFD and the Directive 91/414. The herbicide Isoproturon is a candidate for being a priority hazardous substance, nevertheless it is listed on the positive list of Annex 1 of 91/414EC.

Legislation addressing pesticides in the European Union (except that regarding food safety)

Title of Legislation	Obligation(s) Arising from Legislation
Directive 79/117EC on the prohibition of pesticides	• The Directive was enforced in 1981 by the Member States and prohibits the placing on the market and use of plant protection products containing certain active substances. • The first pesticides prohibited were pesticides such as DDT and Aldrin, today known as POPs pesticides, but also mercury compounds. • Back then, Member States were allowed to authorize pesticides containing such ingredients in some cases. By 1990, these exceptions expired or were deleted, and a number of pesticides were added. The last pesticides were added in 1990. Currently, some 25 pesticides are prohibited. The production and export to third countries is not prohibited.
Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive)	• The Groundwater Directive establishes a framework for the protection of EU groundwater by prohibiting discharge to ground water of the most detrimental substances including pesticides. • It is intended to reduce the amount of pesticides reaching drinking water and thus is not primarily environmental legislation. However, insofar as the intention is to limit or largely exclude pesticides from water, this Directive contributes to meeting environmental objectives by reducing the environmental burden of pesticides. • The Directive places mandatory obligations on farmers relating to disposal of pesticide waste (including washing water), implemented in legislation described below. There are no other mandatory obligations on farmers, rather the obligation is on member states' to introduce sufficiently precautionary legislation to exclude pesticides from water. • By 2013, the Groundwater Directive will be repealed by the Water Framework Directive 2000/60.

Title of Legislation	Obligation(s) Arising from Legislation
Directive 80/778/EEC on the quality of water intended for human consumption (the Drinking Water Directive) – to be replaced by Directive 98/83/EC from 2003	• The Drinking Water Directive (80/778) lays down standards for the quality of water intended for drinking or for use in food and drink manufacture in order to protect human health. • The Directive does not impact upon farmers directly, but sets a maximum admissible pesticide residue level (0.1 parts per billion for individual pesticide Active Ingredients and 0.5ppb for all pesticide Active Ingredients) in drinking water that water suppliers must comply with. This requires the use of water treatment in some areas to ensure that the drinking water supplied is acceptable.
Directive 91/414/EEC concerning the placing of plant protection products on the market	• Directive 91/414 - the 'Authorisation Directive' - introduces a Community system to harmonise the authorisation and placing on the market of plant protection products, i.e. pesticides, to protect human health and the environment. • The Directive includes an EU wide common positive list of permitted Active Ingredients. However, the process of review to place substances on this list is not proceeding as planned, and interim measures in Member States result in different substances permitted in the Community. Thus producers in one Member State (and elsewhere) may be able to use products containing substances which are prohibited in another Member State (these may pose either more or less risk to the environment). There is a risk of illegal import of banned products. • The Directive places no mandatory obligations on farmers. The obligation is on the regulatory system to only approve products that pose an acceptable risk to human health and the environment. Detailed criteria and protocols have been devised. • This legislation provides the framework for the authorisation of pesticide Active Ingredients, which can only be included in the list if they meet certain conditions, particularly concerning the likely effects on human health and the environment. Only products containing active ingredients on the EC positive list can be authorised, initially for a maximum period of ten years. This process has recently been accelerated by Commission Regulation No. 2266/2000 which lays down the detailed rules for the necessary review procedures. • Directive 91/414 applies primarily to synthetic pesticides. However, at a late stage in negotiations, its scope was extended to cover authorisations of the marketing of pesticides containing or composed of GMOs. • The legislation also requires Member States to prescribe that pesticides '… must be used properly. Proper use will include compliance with any conditions attached to the product and specified on the label and the application of the 'principles of good plant protection practice, as well as, whenever possible, the principles of integrated control'.
Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive)	• The Directive has the overall environmental objective of achieving 'good water status' throughout the EU by 2010 and for it to be maintained thereafter. It sets out to establish a Community framework for the protection of surface and ground waters across the EU through a common approach, objectives, principals and basic measures. It establishes the river basin as the primary administrative unit for the purposes of water management. The Directive will have widespread and significant impacts. It brings together much of the existing water legislation into an overall framework establishing broad ecological objectives for water and provides an administrative framework to achieve these. • The Commission (via the OSPAR Convention agreement) has proposed a priority list of substances, which will be targeted with the aim of improving water quality. The pesticides in this list have been selected according to the risk they pose to aquatic life and to human health from polluted waters – this includes alachlor, atrazine, chlorfenvinphos, diuron, endosulfan, lindane, simazine and trifluralin. • This Directive places no direct obligation on farmers, but they influence the standards they must meet.

6.1.2 EU Environmental Action Programme (EAP)

In addition to legislation, the European Union addressed pesticide issues in the 5th and 6th Environmental Action Programme (EAP).

In 1993, the European Union acknowledged in its 5th Environmental Action Programme that the Common Agricultural Policy (CAP) has led to negative side effects, which include consequential over-intensification. It was recognised that the systematic use of plant protection products led to a relative resistance in parasites, increasing the subsequent frequency and costs of treatment and causing additional soil and water pollution problems.

Proposed objectives were:

- a significant reduction of pesticide use per unit of cultivated land until 2000; and
- farmers' conversion to methods of integrated pest control, at least in areas of importance for nature conservation.

Proposed actions were:

- registration and control of pesticides sales and use;
- promotion of integrated pest control and bioagriculture[22].

A significant reduction in pesticide use per unit of land was not achieved by 2000, and the European Union, in 2001, realises that the pesticide contamination problem is serious and growing.[23]

The 6th Environmental Action Programme, which was established in 2001, aims eventually at a legislation regarding the sustainable use of pesticides and, in its actions, suggests a Community Thematic Strategy on this issue.

Proposed actions regarding pesticides in the 6th EAP are:

- Development of a Code of Good Practice on pesticide use;
- Revision of Directive 91/414 on the authorisation of pesticides;
- Development of a Community Thematic Strategy on the sustainable use of pesticides that may include elements to:
  a) minimise the risk from the use of pesticides, which is principally linked to the toxicity of the substances, and monitoring progress; better control of the use and distribution of pesticides;
  b) substitute the most dangerous active substances with safer ones, including non-chemical alternatives;
  c) raise awareness of, and train users;
  d) encourage the uptake of low input or pesticide free agriculture and the use of Integrated Pest Management (IPM) techniques;
  e) encourage the introduction of fiscal incentives to reduce the use of the most dangerous pesticides such as a pesticides tax;
  f) link the award of Rural Development Funds to the uptake of the Code of Good Practice on pesticide use.
- Ratification of the Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade;

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[22] European Union (1993): Towards Sustainability, A European Community Programme of policy and action in relation to the environment and sustainable development, Official Journal of the European Communities C138/5, 17.05.1993.

[23] European Commission (2001): Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions on the sixth environment action programme of the European Community,'Environment 2010: Our future, Our choice' - The Sixth Environment Action Programme - Proposal for a Decision of the European Parliament and of the Council Laying Down, The Community Environment Action Programme 2001- 2010.

- Amendment of Community Regulation (2455/92) concerning the import and export of dangerous chemicals to bring it into line with the Rotterdam Convention, to improve some of its procedural mechanisms and to improve information to developing countries;
- Development / full implementation of Community programmes to improve chemicals and pesticides management in developing and accession countries, including for the elimination of stocks of obsolete pesticides;
- Support for research efforts aimed at the reduction and sustainable use of pesticides.

All of the proposed actions have the potential to reduce environmental contamination. The 6th Environmental Action Programme, however, ends in 2010 and so far no concrete and legally binding policy instruments have been introduced.

6.1.3 Financial Incentives for Pollution Control

The EU Rural Development Regulation No. 1257/1999 makes provision for co-financing to encourage more environmentally-friendly farming by:

- training farmers for the *"...application of production practices compatible with the maintenance and enhancement of the landscape and the protection of the environment"* ;
- offering grant-aided investment in agricultural holdings that helps to *"...preserve and improve the natural environment"* ;
- introducing agri-environment schemes that offer area payments to support *"...agricultural production methods designed to protect the environment and to maintain the countryside";* and
- other complementary actions under Article 33 concerned with *"...protection of the environment in connection with agriculture, forestry and landscape".*

EU Member States began implementing the first so-called "agri-environment programmes" in the 1980s and 1990s, and today such programmes cover over 20% of all agricultural land in the EU. These programmes pay farmers to modify their farming practices in order to benefit the environment.

Extensive monitoring of agri-environment programmes in EU Member States shows that they lead to significant benefits for the conservation of valuable semi-natural habitats, biodiversity, landscape, water and soil resources. The potential for agri-environment schemes to contribute to a wide range of rural development objectives, including environmental protection, is recognised by the fact that they are now the **only** compulsory measures for EU Member States to introduce under Regulation 1257/1999.

It will therefore be obligatory upon accession for all new Member States to introduce an EU co-financed agri-environment scheme that offers payments to farmers who change their methods of farming in ways *"...which are compatible with the protection and improvement of the environment, the landscape and its features, natural resources, the soil and genetic diversity"* – this includes support for a range of actions contributing to the control of pesticide pollution, including the adoption of organic farming.

While the four DRB countries (Czech Republic, Slovakia, Hungary and Slovenia) joining the EU in 2004 will shortly be implementing national agri-environment programmes, two DRB countries (Romania and Bulgaria) are unlikely to join the EU until at least 2007. In these latter countries, financial assistance is also available for developing and implementing "pilot" agri-environment measures with SAPARD co-funding – the Special Pre-accession Programme for Agriculture and Rural Development.

According to the SAPARD Implementing Regulation No. 1268/1999, EU co-financing support may be provided for all the agri-environment actions described in the Rural Development Regulation No. 1257/1999.

6.1.4 On-farm Quality Assurance Schemes

There is increasing interest shown by farmers, the food industry and food retailers in EU Member States to establish "on-farm quality assurance schemes" that offer consumers the assurance of food products having been grown with reduced or minimal pesticide inputs.

The most developed example is organic farming as defined by EC Regulation 2092/91. Organic farming has the highest potential for reducing the use of toxic pesticides. Many organic crops are grown without the use of any pesticide, and the former intense use of copper in organic fruits and vineyards is now regulated.

In addition, a number of other quality assurance schemes are being developed which are based upon "integrated crop management". For example, the Euro-Retailer Produce Working Group (EUREP) has developed a set of standards and procedures for inspecting and certifying farmers who follow so-called "good agricultural practice" (GAP).

The EUREP-GAP initiative[24] is a set of normative documents suitable to be accredited to international certification laws. Representatives from around the globe and all stages of the food chain have been involved in the development of these documents and a very robust, very challenging protocol has been produced which focuses the producer on the key issues that need to be addressed during the pre-farm gate stage.

0The next table summarises the mandatory requirements relating to pesticides for farmers and growers complying with EUREP-GAP Fresh Produce Protocol.

[24] EUREP website: www.eurep.org/sites/index_e.html.

Mandatory requirements relating to pesticides in the EUREP-GAP Fresh Produce Protocol

Basic Elements of Crop Protection • Protection of crops against pests, diseases and weeds must be achieved with the appropriate minimum pesticide input and with the minimum adverse environmental impact (volume/type of active ingredients) and with the appropriate employment of non-chemical methods (biological and cultural/mechanical). • Wherever possible, growers must apply recognised IPM techniques on a curative basis. Non-chemical pest treatments are preferred to chemical treatment.
Choice of Chemicals • The crop protection product utilised must be appropriate for the control required. • Growers must only use chemicals that are officially registered in the country of use and are registered for use on the crop that is to be protected. A current list of all products that are used and approved for use on crops being grown must be kept. This list must take account of any changes in pesticide legislation. Chemicals that are banned in the European Union must not be used on crops destined for sale in the European Union. In addition, growers must be aware of restrictions on certain chemicals in individual countries.
Advice on Quantity and Type of Pesticide • Recommendations for application of pesticides must be given by competent, qualified advisers holding a recognised national certificate. • Where such advisers are unavailable, growers must be able to demonstrate their competence and knowledge (e.g. through adequate training in pesticide usage and application).
Records of Application • All applications of pesticides must be recorded in a crop diary or equivalent. Records must include: crop, location, date of application, reason for application, technical authorisation, trade name, quantity of pesticide used, application machinery used, name of operator and pre-harvest interval.
Safety, Training and Instructions • Workers who handle and apply pesticides must be trained and able to demonstrate appropriate competence and knowledge.
Protective Clothing/Equipment • Workers must be equipped with suitable protective clothing in accordance with label instructions and appropriate to the posed health and safety risks. • Growers must be able to demonstrate that they follow label instructions with regard to protective clothing and equipment. • Protective clothing and equipment must be stored separately from pesticides.
Pre-harvest Interval • Pre-harvest intervals must be observed and under no circumstances should the recommended pre-harvest interval be ignored. • For crops that are continuously harvested over an extended period of time, there must be a plan for crop protection that does not compromise pre-harvest intervals.
Spray Equipment • Spray equipment must be suitable for use on the land in question and be kept in good condition, with annual calibration to ensure accurate delivery of the required quantity of spray. • When mixing chemicals, the correct handling and filling procedures, as stated on label instructions, must be followed. The correct quantity of spray mix for the crop to be treated and the proposed treatment type must be calculated, accurately prepared and recorded.
Disposal of Surplus Spray Mix • The quantity of spray mix must be calculated before mixing. This calculation must consider: velocity of application, surface area to be covered, pressure of application system.
Pesticide Residue Analysis • Growers and/or suppliers must be able to provide evidence of residue testing by laboratories accredited by a competent national authority

Pesticide Storage

- Pesticides must be stored in accordance with local regulations and include the following minimum standards.
- Pesticides must be stored in sound, secure, frost resistant, fire-resistant, well ventilated (in case of walk-in storage) and a well lit location which is sited away from other materials.
- The pesticide store must be able to retain spillage (e.g. to prevent contamination of watercourses).
- There must be adequate facilities for measuring and mixing pesticides.
- There must be emergency facilities (e.g. eyewash, plenty of clean water, a bucket of sand) to deal with operator contamination and accidental spillage.
- Keys and access to the store must be limited to workers with adequate training in the handling of pesticides.
- An accident procedure, a list of contact telephone numbers and the location of the nearest telephone must be available within the immediate vicinity of the store and next to the nearest telephone.
- Inventory, stock control and stock rotation documentation must be kept and readily available.
- All pesticides must be stored in their original package.
- Only chemicals approved for use on the crops produced in the crop rotation must be stored on the farm.
- Powders must be stored on shelves above liquids.
- Signs warning potential dangers must be placed on access doors.

Empty Pesticide Containers

- Empty pesticide containers must not be re-used and disposal of empty pesticide containers must be in a manner that avoids exposure to humans, and contamination of the environment.
- Empty containers must be rinsed via the use of an integrated pressure rinsing device on the sprayer, or at least three times with water, and the rinsate (wash water) returned to the spray tank.
- When rinsed, containers must be crushed or pierced to prevent re-use, or adequately labelled according to the rules of a collection system.
- Empty containers must be kept secure until disposal is possible.
- All local regulations regarding disposal or destruction of containers must be observed.

Obsolete Pesticides

- Obsolete pesticides must only be disposed of through a certified or approved chemical waste contractor or supplying company, however equipment achieving similarly environmentally sound disposal may be used.

6.2 Potential Policy Reform in Wider DRB Context

6.2.1 Pesticide Use Reduction

Research and Implementation of Integrated Crop Management (ICM) and Integrated Pest Management Standards - National Governments shall support research in order to define ICM and IPM standards for all major crops especially maize, wheat, vine, fruit and vegetables to promote a minimum use of pesticides. Such measures need to include detailed schemes of integrated crop management for each crop and crop rotation system (example in Annex 12).

National experts and authorities should define crop rotation systems prone to extreme pest, weed or disease development. Prohibition or financial incentives are possible instruments to stop crop rotation systems which are 'bad agricultural practices.'

Once the ICM and IPM standards are developed, they need to be disseminated to farmers. ICM and IPM standards should be legally binding – and a condition for agricultural subsidies.

6.2.2 Compulsory Training

Farmers' licence - farmers who apply pesticides need to have a licence. In order to obtain and hold a licence, farmers must attend a comprehensive training on:

- ICM and IPM (see above);
- non-chemical alternatives;
- the safe handling of plant protection products and spraying equipment (cleaning, safety distances);
- disposal of unused pesticide and containers;
- record keeping and use reporting.

The licences should be valid for 3 years. If farmers can proof that they attended a total of 48 hours training on ICM, preventive measures and non-chemical alternatives over the last 3 years, the licence will be prolonged.

Purchase of pesticides without a licence should not be possible.

Farm Adviser Licence – similar to the farmers, farm advisers should be required to possess a licence limited to 3 years. In addition to training on the safe handling of pesticide products and handling and adjusting application equipment, advisers should attend special training on ICM/IPM and practical measures to prevent and reduce pesticide use to obtain the licence. Farm advisers must be required to up-date their knowledge regularly, in order to prolong the licence.

6.2.3 Performance Standards & Cut-off-Criteria

Pesticide ban – the use of Atrazine, Lindane, Diuron and Endosulfan needs to be banned immediately. Atrazine is the pesticide most often detected in the Danube basin, Lindane, Diuron and Endosulfan are toxic and persistent pesticides.

Pesticides phase out – uses of all other priority substances need to be phased out in a time frame to be defined. The EU WFD sets a 20-year target in the EU. Considering the lower use of pesticide and a lower dependency on these chemicals in the Danube region, targets should be more ambitious.

Cut off criteria - in order to prevent the replacement of dangerous pesticides, which are going to be banned or phased out with other hazardous pesticides, cut off criteria for pesticides need to be defined. Pesticides with distribution coefficients (K_{oc}) below 300g/l (low absorption to soil, prone to leaching and run-off) and a half-life of more than 20 days need to be regulated (prohibition, taxes and transferable permits are possible policy tools).
Persistent pesticides should not receive authorisation.

Licensing of spraying equipment – all spraying equipment should be inspected every two years. Accurate spraying equipment should get a licence for two years.

6.2.4 Eco-Audit

Mandatory uniform record keeping is essential for a functioning pesticide monitoring system. National regulations must require that pesticide use records are kept by all pesticide applicators (as in the Czech Republic and Slovakia). The records must include, at the minimum, the following information about the applications:

- name and address of the applicator;
- community name/code, postal code or other identification of the treated field/site location;
- name and registration number (for the pesticide product(s) used;
- quantity of the pesticide product(s) applied;
- application method;
- date of the application;
- size of the field/site treated;
- acreage planted and treated;
- name/ code of the crop treated.

Based on mandatory record keeping, a flexible and expandable pesticide use reporting system can be developed. If all pesticide applicators have to keep the same type of record, the regulation concerning pesticide use reporting can differentiate what person is required to report what set of data in what frequency. In this way, all possible options are thinkable: full reporting, e.g. submitting all application record data, as well as the submission of summaries extracted from the records.

Pesticide use reporting should be required from all farmers using pesticide. National authorities must decide, what farmers have to report what information. (quarterly summaries, annual summaries by all farmers, by all farmer with farms larger 5 or 10 ha).

Sales reporting – Retailers, importers and distributors should be required to supply information on the amount of pesticides sold. In order to identify individual products, the bar codes could be used in the future. Retail sellers need to keep records of their sales of pesticide products and submit annual reports.

6.2.5 Subsidies to Change Practices

Defining water protection zones and sensitive areas – efforts should be made to define water protection zones and vulnerable areas. In these areas, no pesticide use should be allowed. Farmers in these areas need special training and must receive compensation for yield losses.

Spraying distances - to water courses and habitats often vary from pesticide to pesticide depending on the toxicity. Farmers often do not pay attention to the requirements. Pesticide use close to sensitive water bodies should be phased out. Fixed margins of a minimum of 10 m for arable crops, a minimum of 5 m for vegetables and a minimum of 50m for orchards and vineyards should be set.[25] The phase out and plantation of buffer stripes could be part of an agri-environment programme.

Disposal of old spraying equipment – old and unsafe spraying equipment needs to be replaced by environmentally friendly new spraying equipment. Funds should be allocated to support a fast technology change.

Disposal system for pesticide and containers – distributors and retailers should have the legal obligation to take back unused pesticides and empty containers. Unused pesticides and empty containers should be recycled in an environmentally friendly manner. The responsibility of the industry needs to be strengthened.

6.2.6 Other Instruments

Data improvement - countries with existing pesticides use reporting systems need to improve data quality and data evaluation. Collected pesticide use data are of enormous value if used in a appropriate way.

Targeted monitoring – monitoring of environmental impacts of pesticide in the Danube region needs to be intensified. Sampling should correlate with the time of the application. Toxicity of organophospates such as Chlorpyrifos and Diazinon to aquatic organisms should be observed more closely.

Elimination of obsolete pesticides – every effort must be made to immediately secure and remove stockpiles of obsolete pesticides.

[25] Based upon drift tables by the Federal Biological Research Centre for Agriculture and Forestry.

7 Proposed Practical Action for Pesticide Pollution Control

1. Choice of Site and Crop Rotation

The cropping site should be used so that it meets crop requirements on soil quality and climate. This allows optimum plant growth and reduces the risk of infestation with harmful organisms. Unsuitable or unsuitably shared sites weaken the vigour, resistance and competitiveness of the plant. Narrow crop rotations may lead to an accumulation of harmful organisms, which may have a negative impact on further cropping.

Growers must try to extend crop rotation by catch-crops and the integration of the areas set-aside.

A number of crops require the observance of crop-free periods to avoid accumulation of harmful organisms. For instance, sugar beet and potatoes require crop-free periods to contain or avoid infestation with nematodes. Recommendations regarding crop-free periods must be followed.

2. Soil Tillage

Soil tillage must fit the site and situation, and should be organised so as not to further infestation with harmful organisms.

Tillage has a great influence on the weediness of crop stands and infection of cereals with stem base diseases. Appropriate tillage may, for instance, reduce infestation with couch grass. No-plough soil tillage lessens erosion, but often entails more expenses for plant protection.

3. Choice of Cultivars and Origin

Resistance is an important criterion for the choice of cultivars, apart from yield potential, regional and specific suitability, and market demand.

Cultivars and origins which are resistant or have at least a certain tolerance of important site-specific harmful organisms and/or which are able to suppress weeds must be the preferred choice for cropping.

With harmful organisms being able to overcome resistances, the state of health of crops must also be carefully watched when resistant varieties are grown, so that any protection measures, should they become necessary, can be taken in time.

4. Hygienic Measures

The farmer must follow all hygienic measures in agriculture and horticulture to reduce the potential of harmful organisms and to prevent, or delay as much as possible, the first infection with harmful organisms. This is done by preventing the introduction and spread of harmful organisms, such as nematodes, Rizomania on sugar beet and ring rot on potato, by seed and planting stock, and the introduction via contaminated soil, substrates, propagation containers, tools, or diseased plants.

The most important hygienic measure to be taken by the farmer is to use healthy seed and planting material. This means regular purchase of certified seeds and planting stocks and confining replanting to seed and planting material from healthy and vigorous stocks.

If several farms share agricultural tools and machinery, these must be carefully cleaned to remove soil. Agricultural tools and machinery must also be cleaned after tillaging a disease or nematode infested field.

Combine harvesters may contribute to spreading weeds, such as oat-grass. They must be cleaned before entering a new field.

5. Planting and Sowing Time

Sowing and planting times must be chosen so as not to promote infestation with harmful organisms. The occurrence of certain harmful organisms can be influenced by the choice of the planting time.

Finding the best possible specific sowing and planting time for a site and a farm is an important condition for healthy and vigorous growth of the crops.

6. Supply of Nutrients

The supply of nutrients, including fertilisation, must be arranged so that it is balanced and meets the needs of the crops. Nutrient supply by fertilisation should not further any infestation with harmful organisms.

It must be noted that both want of nutrients and unbalanced supply of single substances is to the detriment of the crop, enhances its susceptibility to pests and pathogens and weakens its competitiveness with weeds.

Observation

Personnel involved in decision-making must be trained in the recognition of pests, diseases, weeds and beneficial insects: Routine monitoring is an essential element in the best agricultural practice. Retraining will be required to maintain knowledge levels and cover any pests, diseases or weeds which, because of changing circumstances, become more problematic.

Crops must be monitored for their development and health status. To examine the need for control, infestation with harmful organisms has to be assessed and classified as infestation which does not require control measures or infestation requiring control measures.

Assessment of the state of development and health of crops requires special knowledge, in particular about patterns of infestation and damage of the most important harmful organism. Special knowledge is also needed to know which infestation requires control measures.

In assessing crop health and the need for control of harmful organisms, growers must apply control thresholds, if available. To do this, farmers must first quantify the extent of the infestation by sampling or counting harmful organisms in the field.

For some harmful organisms, there are indirect methods of infestation assessment, such as

- yellow traps for pests of rape (cabbage stem flea beetle and stem weevils);
- glued colour traps in orchards and glasshouses;
- pheromone traps for noxious butterflies (turnip moth, gamma moth, pea moth, codling moth, fruit tortrix moth, grape-berry moth, nun moth, pine noctuid, etc.) and bark beetles; and
- electronic warning systems for apple scab and Peronospora in vineyards.

Some diseases, such as foot-rot of wheat, potato late blight, and fire blight of pome fruit do not allow any early visual recognition and assessment of the need for control. Advice must be obtained from official extension services which make infestation prognoses with the help of computer models and other indirect methods.

The farmer must keep a protocol of the observations. This protocol must include the:

- date;
- name/number of the site;
- crop and variety;
- quantity of each pest, weed, disease observed;
- previous weather conditions.

Experience and Decision Aids

In assessing the need for a particular control measure, growers must use their experience and observations from previous years, consider advice by official extension services and use other decision aids.

7. Non-Chemical Measure of Prevention and Control

Non-chemical measures of prevention and control, which have no adverse effects on the environment, they have to be preferred to others.

The decision to use a non-chemical plant protection measure depends on the site, situation and crop and is made upon consideration of its effectiveness, environmental compatibility, risk and costs. A consideration of occupational safety and health protection is also important. In making such decision, all available knowledge and decision aids such as information leaflets, information by warning services, meetings and information by the plant protection services have to be used.

Application of Non-chemical Measures of Plant Protection

Non-chemical measure of plant protection have to be preferred to chemical measures.

Mechanical weeding by hoeing and harrowing and other techniques are at the centre of non-chemical plant protection measures in agriculture and horticulture. The efficiency of mechanical weed control depends on the condition of the soil, the development of the crop stands and the degree of infestation with weeds as well as on the weather. In cereals, it may be between 30 and 70 % weed elimination, while it may be even higher in maize and potatoes.

Mechanical methods are also suitable to control noxious soil insects in farming.

Environmentally compatible preparations (Bacillilus thuringensis, granulose viruses, insect-pathogenic bacteria etc.) have to be preferred to others. A biological method which has proven to be effective in farming, is the use of Trichogramma egg parasites against the European corn borer. There are also Bacillus thuringiensis preparations against potato beetles, European corn borer, nun moth and other harmful organisms.

8. Use of Suitable Plant Protection Products

If there are no other practicable methods to prevent damage, the use of a suitable chemical plant protection product must be taken into account. Only plant protection products, which are registered for use in the country of the farmer are allowed to be used.

When selecting a pesticide, consideration must always be given to the effect the product will have on predators. Products such as those based on Bacillus thuringiensis are examples of products least likely to harm predators. The substitution principle must apply - the least toxic and least environmental hazardous product must be chosen.

Label directions must be read carefully and followed. This concerns for example safety precautions to protect users, specific use conditions or information about possible damage to beneficial organisms and earthworms. Possible effects on succeeding crops must be considered.

Soil disinfection and soil fumigation is not best agricultural practice.

Rate and Frequency of Applications

Using a product as a general precaution without first ascertaining the need for control is not best agricultural practice.

Products which are most suitable for the crop and the harmful organisms in question and which are least toxic and least hazardous to the environment must be used according to the situation, with the aim to use as little active substance as possible. Site conditions and weather conditions must be carefully noted to avoid run-off of plant protection products. In some cases, additives may enhance the efficiency of the product and thereby allow reduction of the application rate.

In the individual cases, the actual number of applications and application rates should fall below the maximum levels specified on the label. The supposition therefore is that the harmful organisms can be monitored and that the assessment of infestation is possible. All decision aids available should be used to this end.

Treatment of Field Patches, Field Boundaries and Single Plants

With weeds, insects and fungi often migrating into a field from the periphery, it is sufficient to treat only parts of the crop area or single plants. This is all the more the case with large fields. Sometimes it is also useful to treat field patches at the first signs of infestation to avoid later treatment of the whole field.

Treatments of field patches, boundaries or single plants often forestall extensive control measures.

9. Suitable and Safe Plant Protection Equipment

These principles must be followed when employing field sprayers:

Spraying equipment serves the purpose of evenly depositing plant protection products on target areas in exact doses and with as little loss as possible. Loss-reducing technology (drift-reducing nozzles, recycling equipment) need to be used. The water application per hectare must be determined before starting the operation. The water application rate depends on the product to be used, the growth stage of the crop and the weather.

The instructions for operation of the equipment must say everything necessary concerning the choice of nozzles, the adjustment of spraying pressure and driving speed, and a method of checking the dosage accuracy before the beginning of operation.

Empty plant protection product containers must be thoroughly rinsed. The water used for rinsing is added to the spray liquid. Chemical introduction bowls with integrated container-washing facility are very suitable for that purpose. Washed containers can be returned to product manufacturers free of charge.

To achieve an even horizontal and longitudinal distribution, the driving speed must be 6 km/h.

Spraying at wind speeds over 5 m/s, temperatures over 25 °C, or relative air humidity over 30 % will entail high losses through drift and volatilisation and is not best agricultural practice.

If any objects neighbouring the treatment area are at risk, the wind direction must be considered. When treating near water bodies and biotops, drift reducing measures have to be taken in addition to following the label instructions, namely slowing down the speed and applying proportionately less product, applying coarser drops, or switching off the outer nozzles. Buffer zones must be used to protect areas at risk such as residential areas, gardens, amenity and sports grounds, or pastures. If product drifts to neighbouring areas in spite of all precautions, the user of these areas must be immediately contacted and informed about special precautions, such as waiting periods or a ban on consumption, if necessary.

After finishing spraying, the spray residue in the tank should immediately be diluted by 1 : 10 with clear water and sprayed over the remaining untreated area. The residue which has remained in the pipes between controls and nozzles cannot be diluted, so that the first metres are sprayed with full concentration.

The outside of the sprayer should be cleaned somewhere in the treated field.

Sprayers should also be carefully cleaned and maintained in between the legal inspection dates to guarantee faultless operation and accuracy of dosage and distribution.

Aerial applications are not best agricultural practice.

These principles must be followed in addition to, or instead of the above-mentioned, when employing orchard, vineyard or hop sprayers:

According to the official recommendations, the sprayers must be adjusted to the crop (e. g., fruits, grapes, hops), crop growth stage, shape of crop plants and objects to be treated (e.g., round wood with bark), so as to produce precise application with little losses. Spray drift is naturally higher in elevated crops, which means that drift-reducing measures must get particular attention.

The consumption of water and plant protection products is adjusted depending on the crop growth stage in vineyards and hopgardens and depending on the crown height of fruit trees in orchards. In vineyards, the driving speed should not be more than 6 km/h.

If objects neighbouring the treatment area are at risk, spraying along the edge of the treatment area should be directed inside, as far as wind conditions allow this.

Aerial applications are not best agricultural practice.

10. Verification and Documentation of Success

Each chemical and non-chemical plant protection measure has to be followed by an inspection. This allows competent decisions about further steps and gathering experience about the effect of plant protection measures in certain situations.

Documenting plant protection measures serves to critically analyse and, in the long run, optimise plant protection at the location concerned.

Plant protection measures have to be documented in a way as to compile experience with regard to the location and situation.

Growers can document plant protection measures in different ways in the framework of general book-keeping, for instance

- in a logbook;
- in a field card index;
- in a computerised field card index.

It is recommended that growers collect and store the following data:

- name and address of the applicator;
- community name/code, postal code or other identification of the treated field/site location;
- name and registration number (for the pesticide product(s) used;
- quantity of the pesticide product(s) applied;
- application method;
- date of the application;
- size of the field/site treated;
- planted and treated acreage;
- date of the plant protection treatment;
- crop growth stage, age, variety;
- kind and purpose of treatment (target organism, pest density);
- assessment of efficiency;
- conditions of application (water application rate, temperature, wind speed and direction, etc.);
- particularities.

11. Storage, Disposal and Other Handling of Plant Protection Products

Storage of plant protection products must be limited to the necessary minimum in time and amount, and is subject to the duty of special care.

The store must be sound, secure, well ventilated, frost proof, have ease of access and have sufficient light to enable the spray operator to read the product label. General warning signs must be placed on access doors.

The store must be able to retain any spillages or have an adequate sump to prevent contamination of watercourses. It must have emergency facilities to deal with accidental spillages e.g. bucket of sand or absorbent granules. The store, including any doors but not the roof, must be made of materials which will resist fire for 30 minutes or longer.

The store must be away from other flammable materials. The store should have shelves made of non-absorbent materials. Pesticides must be stored in their original package, powders must be stored on shelves above liquids.

An inventory of pesticide stocks must be maintained and a copy held away from the pesticide store; existing stocks of pesticides have to be used before new stocks, the stock rotation has to be documented.

Safe disposal of redundant pesticides has to be planned and recorded, and obsolete pesticides only be disposed of through a certified or approved chemical waste contractor or the supplying company. When transporting plant protection products, special precautions must be taken to prevent damage to transport containers and contamination of the environment.

12. Crop Standards

Plant protection is very specific to crop and region. Following guidelines for crop specific Best Plant Protection Practices (BPP), build a framework for environmental protection and sustainable agriculture on farm level. National authorities, farm advisers, scientists and farmers must fill this frame in order to develop BPP standards for all major field crops, vine, fruits and vegetables. The BPP standards must focus on avoiding the use of chemical plant protection practices.

BPP standards for crops must include:

- a detailed description (lifecycle, habitus, time of occurrence, favourable conditions) of major pests diseases and weeds, specific for regions and their natural predators;
- diagnosis possibilities for major pests, diseases and weeds, specific for regions and their natural predators (light traps, yellow traps, coloured glue traps etc.);
- economic threshold values;
- possible preventive measures, basic strategies (reduced fertilising, tillage, delayed sowing etc.);
- biological means of control (support and/ or introduction of beneficial insect, use biological pesticides);
- chemical means of control;
- application time, frequency and equipment;
- measures to manage resistance.

BPP crop standards must be available to all farmers and they must be updated regularly. Fulfilment of BPP crop standards could be a condition for subsidy schemes to farmers.

An example of a first approach towards a BPP standard for wheat can be found in Annex 12 which contains major diseases, insect and weed and basic strategies for control. Specific strategies and thresholds which apply in Denmark are added. These examples are examples of Good Plant Protection Practice (GPP) developed by EPPO, the European and Mediterranean Plant Protection Organisation. The EPPO standards not specific to regions and control measure focus more on chemical control and on current common practice. EPPO standards have been developed for all major crops. These standards could potentially serve as starting points for BPP in DRB countries.

8 Recommendations for Policy Reform

The national governments of all DRB countries should aim to effectively control pesticide pollution in order to minimise the risks presented to human health, the quality of environmental resources, and the integrity of natural ecosystems in the region.

The following objectives are recommended for all national strategies aiming to control pesticide pollution from agriculture, together with comments on policy instruments that should be adopted **where appropriate to the national context** (not all policy instruments are appropriate to all countries).

OBJECTIVE 1: Reduce the levels of harmful active substances used for crop protection by prohibiting and/or substituting the most dangerous priority pesticides with safer (including non-chemical) alternatives

1.1 **Pesticide Ban** - the use of Atrazine, Lindane, Diuron and Endosulfan needs to be banned immediately. Atrazine is the pesticide most often detected in the Danube basin, Lindane, Diuron and Endosulfan are toxic and persistent pesticides.

1.2 **Pesticide Phase-out** - the use of all other priority pesticides which are authorised should be reduced to a minimum, and the use should be phased out if possible, and substituted by less-dangerous pesticides, including non-chemical alternatives. Considering the current low levels of pesticide use and a lower dependency of farmers upon these chemicals in the DRB regions, the targets for further pesticide reduction can be ambitious.

1.3 **Cut-off Criteria** - in order to prevent the replacement of the priority pesticides which are going to be banned or phased out with other hazardous pesticides, cut-off criteria for the approval of other pesticides need to be defined. Pesticides with distribution coefficients (K_{oc}) below 300g/l (low absorption to soil, prone to leaching and run-off) and a half life greater than 20 days need to be regulated (prohibition, taxes and transferable permits are possible policy tools). Persistent pesticides should not receive authorisation.

OBJECTIVE 2: Improve controls on the use and distribution of pesticides

2.1 **Monitor Trade** - retailers, importers and distributors should be required to supply information on the amounts of all pesticide sold. Retail sellers need to keep records of their sales of pesticide products and to submit annual reports to national authorities.

2.2 **Control Trade** - all DRB countries must work towards stopping the uncontrolled and illegal trade of pesticides. The authorities at the borders should receive training on the issue of illegal pesticide trade. National legislation should enable authorities to effectively prosecute those selling illegal pesticides and to penalise them with high fines.

2.3 **Raise Awareness** – agricultural extension services and farmers should get access to information about the dangers of illegal and often unlabelled pesticides.

2.4 **Monitor Pesticide Use** – effective monitoring of pesticide use at the farm level is an essential tool for improving the control of pesticide use and distribution, as well as assessing environmental risks, developing non-chemical alternatives etc. Uniform record keeping by farming is essential for a functioning pesticide monitoring system. National regulation must require that pesticide use records are **kept** by all pesticide applicators (as in the Czech Republic and Slovakia) according to certain minimum standards and are **reported** to the relevant authorities.

2.5 **Elimination of Obsolete Pesticides** – all efforts must be made to immediately secure and remove stockpiles of obsolete pesticides.

OBJECTIVE 3: Encourage the proper use of pesticides by farmers and other operators

3.1 **Raise Farmers' Awareness** - simple and easy to understand information materials, combined with well-targeted publicity campaigns, can be very effective in raising farmers' awareness of the dangers of improper pesticide use and the importance of key issues such as the safe storage, handling, and disposal of pesticide products. Retail stores, extension services and other organisations working with farmers can serve as effective distributors of information material.

3.2 **Develop National Codes of Good Practice** – national authorities should agree upon clear and simple codes of good crop protection practice when using pesticides. There are numerous frameworks for such codes, but as a minimum they should provide guidance to farmers on:

- basic elements of crop protection;
- choice of chemicals available for crop protection, including obsolete/illegal pesticides;
- integrated crop management and non-chemical alternatives for weed, pest and disease control;
- quantity and types of pesticide product to use;
- pesticide storage;
- use of spray equipment, including cleaning equipment;
- disposal of surplus pesticides and spray mixture (diluted pesticide);
- disposal of empty pesticide containers;
- records of application;
- protective clothing and emergency procedures.

3.3 **Mandatory Farming Training** - comprehensive training is the most important instrument to prevent pesticide pollution at the farm level. All farmers and other operators (e.g. contract workers) who wish to purchase and apply pesticides should be required to have a licence confirming that they have participated in an approved training programme. As a minimum, training should highlight the possible adverse effects of pesticides and promote the National Code of Good Practice for the storage of pesticides, safe handling and application of pesticides, correct use of spraying equipment, disposal of unused pesticide and containers, and record keeping (see above).

3.4 **Develop Appropriate Extension Capacity** – agricultural extension services play a key role in raising awareness and improving the technical skills of farmers with respect to good crop protection practice, however they often require support in developing the necessary capacity to do this. National funding should be provided for the training of advisers in good practice and modern extension techniques, as well as the development of appropriate institutional frameworks for extension services (including the link to progressive and well-funded research programmes).

3.5 **Use Economic Instruments to Promote Good Practice** – where government schemes provide support to farmers, the principle of "cross-compliance" can be applied. This involves the establishment of certain conditions (e.g. compliance with verifiable standards of good agricultural practice) that farmers have to meet in order to be eligible for government support.

OBJECTIVE 4: Promote certified organic farming, together with integrated crop management (ICM) systems, as viable alternatives to conventional pesticide use

4.1 **Raise Farmers' Awareness** – viable alternatives to conventional pesticide use, such as organic farming and ICM, should be actively promoted to farmers through the preparation of simple and easy-to-understand information materials, combined with well-targeted publicity campaigns. Organic farming is the most developed of all alternative farming systems and has the highest potential for a reduction of the use of toxic pesticides (especially since the former intense use of copper compounds in organic vegetables and fruit has been controlled), plus there are a number of market opportunities available to organic farmers in the DRB countries.

4.2 **Develop Relevant Legislation** – the national legislation for the definition of organic farming systems in compliance with internationally recognised standards should be developed and implemented as a high priority (particularly those in accordance with EC legislation) in order to promote the development of domestic markets and international trade.

4.3 **Develop Appropriate Extension Capacity** – agricultural extension services and farm advisers play a fundamental role in the re-orientation of farmers towards new production systems, particularly systems such as organic farming and ICM, which require higher levels of technical knowledge and management. National funding should be provided for the development of appropriate extension capacity as 3.4 above.

4.4 **Develop On-farm "Quality Assurance Schemes"** - in addition to their growing interest in organic food and farming, the food processing and retail sectors of many European countries are developing additional "on-farm quality assurance schemes" that promote integrated crop management and the sale of food products that have been grown with reduced or minimal pesticide inputs. National authorities in the DRB should support the development of such "market-led" initiatives since they offer a potential market opportunity for DRB farmers and will contribute to reducing the risk pesticide pollution now and in the future.

4.5 **Use Economic Instruments to Promote Organic Farming and ICM** – farmers converting to organic farming and ICM techniques can incur certain additional costs associated with reductions in input, the establishment of new crop rotations, the adoption of new technologies etc. These costs can be a significant obstacle to farmers who decide to make the transition from a conventional farming system. Where national funds and/or other forms of co-financing are available, national authorities should encourage farmers to convert to organic farming and ICM by offering appropriate levels of compensatory payment.