

GUIDELINES ON THE PREVENTION AND CONTROL OF WATER POLLUTION FROM FERTILIZERS AND PESTICIDES IN AGRICULTURE

as adopted by the Committee on Environmental Policy at its second session (1995)

Introduction

1. These guidelines are intended to assist ECE Governments in developing and implementing plans, practices and other measures to prevent, control and reduce water pollution from fertilizers and pesticides. They aim to promote sustainable agriculture based on integrated farming. They are primarily addressed to relevant public authorities in ECE countries responsible for water management and agriculture, rather than to farmers.

2. The guidelines take up those aspects that have a high priority in the ECE region as a whole, and also offer a choice between different options. The most appropriate option may depend on the given socio-economic conditions in a country as well as on the different patterns of agricultural production related, *inter alia*, to climatic, hydrological, topographic and soil conditions in the country concerned.

3. These guidelines draw on the experience of environmental and agricultural experts designated by ECE Governments for the joint task force of the Committee on Environmental Policy and the Committee on Agriculture.⁶ They also build upon the report on the prevention and control of water pollution from fertilizers and pesticides (ECE/ENVWA/31), adopted in 1993.⁷

I. POLICY INTEGRATION

4. A new policy in agriculture should be strongly promoted to combine the application of strict legal and

⁶ The joint task force on the control of water pollution from fertilizers and pesticides in agriculture was led by Germany. The task force was composed of experts designated by the Governments of Austria, Croatia, France, Germany, Hungary, Netherlands, Slovakia, Spain, Sweden, Ukraine and United Kingdom. The delegations of Finland, Italy, Poland, Russian Federation and Switzerland, as well as the secretariat of the Food and Agriculture Organization (FAO) of the United Nations, and the European Community submitted written contributions. The ECE secretariat assisted the task force to draw up the guidelines.

⁷ Prevention and Control of Water Pollution from Fertilizers and Pesticides. In: *Protection of Water Resources and Aquatic Ecosystems*. Water Series No. 1. ECE/ENVWA/31. United Nations. New York, 1993.

regulatory measures and appropriate economic instruments for the protection of water resources against pollution by fertilizers and pesticides with voluntary actions to pursue good agricultural practice. It should encourage farmers to apply less intensive agricultural methods, and cut the use of fertilizers and pesticides. This requires a better coordination and ultimate integration of agricultural policy with environmental policy, land-use planning, and economic policy.

5. River-basin management, which guides all forms of land use within a catchment area, and environmental impact assessment of agricultural projects, plans and programmes should be promoted to prevent or minimize adverse effects on water resources and the environment in general.

6. Set-aside and extensification policies should not give rise to the intensification of agricultural production elsewhere. Moreover, all appropriate measures should be taken to ensure that set-aside land and extensification do not lead to adverse impacts on the environment through, for example, nitrogen release from fallow arable lands, soil erosion and the extra use of herbicides.

7. The polluter-pays principle should be effectively applied in combination with other measures to control pollution from point and diffuse sources in agriculture.

II. ASSESSMENTS AND MONITORING

8. The impact on the environment of proposed agrarian development strategies, policies in plan and livestock production, as well as relevant plans, programmes and regulatory proposals in the agricultural sector should be assessed. The scope and effects of such proposals on water, soil, air and the living environment should be examined in an integrated manner, rather than separately.

9. Up-to-date knowledge on the interaction between the input of nutrients through fertilizers and nutrient removal in crops and the influence of the soil/water characteristics on this process should be used to identify areas vulnerable to high nutrient loss. Topographic and climatic conditions should also be taken into account.

10. Information on the physico-chemical characteristics of a pesticide, together with other relevant information, such as: human health considerations; a pesticide's behaviour in soil and water, and its likely effects on birds, fish, earthworms, etc.; usage data; time of application; soil and climate conditions, should be obtained to evaluate the best way of applying pesticides so as to reduce the risk that they pose to surface waters and groundwaters. This implies, in particular, that there is a need to predict environmental concentration by fate modelling and compare the results with environmental standards and objectives.
11. A set of clearly defined environmentally-based criteria should be established, which pesticides, or their main degradation products, should meet before being authorized for use. These criteria should be established according to the precautionary principle, to account for uncertainties, long-term effects, combined toxicity of a number of pesticides and its ecological effects, rather than exclusively on the basis of the acute toxicity of pesticides. These sets of criteria should be harmonized at the regional level.
12. Risk assessments of pesticides should also be used to target monitoring resources better and to indicate where improvements in both monitoring programmes and analytical methodology are required. Feedback mechanisms are to be created to use such risk assessments in the reassessment of pesticides.
13. Monitoring programmes in water bodies should take into account the diffuse nature of pollution by nutrients and pesticides. Account should be taken of both the seasonal and local variations in the application of pesticides and of mineral and different organic fertilizers, such as farm manure and other organic waste. This may require, for instance, that the water quality should be monitored not only in major surface waters and groundwaters that might receive inputs of substances from diffuse sources, but also in small creeks and ditches hydrologically connected with those waters. Due to the high costs associated with monitoring, monitoring programmes should be optimized with regard to networks and sampling. Models based on the physico-chemical properties of pesticides should be used and pesticide usage surveys carried out.
14. Codes of good agricultural practice should be drawn up to provide guidance on how to reduce water pollution by fertilizers and pesticides. These codes should also include advice on methods and practices which considerably lower the need for pesticides and fertilizers, such as: biological methods for pest control; mechanical methods for the control of weeds; the production of disease-resistant cultivars; sound cultivation methods; proper crop rotation; and farming of crops that are adapted to the local conditions and site characteristics, and are of an appropriate quality. These codes should also address livestock farming.
15. Solid and liquid farm manure, such as slurry, and other types of organic wastes from agriculture, as well as sewage sludge, should be looked on as a resource of nutrients, not as a waste. The use of sewage sludge as fertilizer in agriculture should be the goal for all sewage sludge of the appropriate quality. Efforts should be made to standardize the fertilizer value per unit volume of slurry and per unit weight of solid farm manure. The production and use of solid manure, which is less likely to cause pollution than slurries and liquid manure, can be considered as a better solution to protect the environment in general and water resources in particular.
16. The plant's need for nutrient supply should be assessed in conformity with realistic yield expectations and the local cultivation conditions, such as previous cropping patterns, as well as soil and climatic conditions, and with the quality demands of the products. The nutrient content of soils should be regularly monitored and assessed.
17. In order to adjust fertilization to the actual demand at the different growth stages of a crop, application schemes should be drawn up field by field, taking into account the nutrient content of soils and all sources of nutrient input, such as mineral and organic fertilizers, green manure, crop residues and atmospheric deposition. To minimize the potential of leaching, the application of fertilizers should be split depending on the growth stage, the weather conditions, and the climate. An acceptable balance should be struck between the advantage of dividing the application and the higher operational costs involved.
18. By better using the nutrients contained in farm manure, losses to the environment can be limited. Manure should be applied only in appropriate weather conditions, in particular on overcast days, and in quantities which do not exceed the demand of the crop of grassland. In deep snow and on frozen soil, there should be no manure application. If applied on bare soil, manure should immediately be incorporated into the soil to minimize surface run-off and gaseous nitrogen losses.
19. Tilling methods should be modified to avoid the mineralization of nutrients within the subsoil. During the fertilizer application, direct inputs into surface waters, including field ditches, should be avoided, and care should be taken to minimize surface run-off.
20. Other protective measures include the provision of sufficient, safe and environmentally sound storage facilities for solid mineral fertilizers and solid manure. For liquid mineral fertilizers and slurries, special precautions should be taken in the design, construction and operation of tanks and, in particular, in the proper dimensioning of their storage capacity. For liquid fertilizers, special applicators should be used to avoid the dispersion of wind-blown droplets into surface waters.
21. In greenhouse farming, the general goal should be to achieve a closed cultivation system. The recirculation of drainage and condensation water to avoid discharges of contaminated water, as well as the use of drain water for irrigation, can help to minimize pollution.

III. CODES OF GOOD AGRICULTURAL PRACTICE

22. Safe handling, storage and disposal of pesticides, including the introduction of a disposal system for pesticide residues and washings, and the control of sprayers should be an integral part of any strategy to prevent and reduce the adverse environmental impact of pesticides. Strict precautions should be taken to prevent pesticides from spreading beyond the area treated, in particular, into water bodies.
23. In order to reduce the occurrence of pests or diseases, the use of high-quality, disease-free plant material or seeds should be encouraged; proper measures should be taken to prevent the spread of disease across different fields; the amount of fertilizers should be limited, since increasing quantities of fertilizers could lead to a high susceptibility to diseases; and the extensification of crop-rotation schemes should be promoted.
24. The use of pesticides should be reduced to the absolute minimum necessary for plant protection, as indicated by the damage threshold limit. Cultivation practices, including mechanical and biological methods, should be implemented to prevent or reduce weeds. Preventive pesticide applications should be the exception, rather than the rule.
25. Specific precautions should be taken to use the correct pesticide and the correct application rate. The aim should also be to use only pesticides which do not degrade into harmful metabolites and are not persistent.
26. The input of substances, in particular phosphates and heavy metals contained in fertilizers, as well as pesticides, into surface waters through soil erosion and surface run-off should be prevented through a set of measures which cover the improvement of soil characteristics to increase soil resistance against erosion, the prevention of mechanical destruction of the soil structure as a result of soil compaction, and the creation of conditions on agricultural land which minimize as far as possible the potential for the formation of surface run-off from these areas.
27. Measures to reduce soil erosion should cover green fallowing, the cultivation of catch crops and winter crops, as well as crops suitable to the site, reduced tillage techniques, suitably designed farm machinery, and, in some cases, the construction of systems of small ditches. Along surface waters, sufficiently broad vegetation zones, which act as filter strips, should also be established. These zones should be kept free from fertilizers and pesticides.
28. For hilly and mountainous areas, specific and appropriate soil management techniques, such as contour tillage, terracing and banking, should be applied in order to prevent soil erosion and, hence, reduce pesticide and fertilizer loss to the environment.
29. Remedial measures should be undertaken to restore the appropriate physical structure of the soils up to the necessary humus supply, determined by site-specific conditions, by increasing the organic complex through, for example, incorporating crop residues or green manure intercropping.
30. A permanent vegetation cover should be kept and the natural soil pattern conserved or improved. Permanent grasslands should not be ploughed in order to prevent the sudden release of nitrates and changes in the nitrogen balance of the soil. On arable land, intercropping should also be used to retain excessive nitrogen amounts.
31. All measures aimed at increasing soil permeability and reducing water-storage capacity, such as the construction of drainage systems, should be checked for their potential to increase leakage-based material inputs into water bodies.

IV. REGULATORY AND ECONOMIC MEASURES

32. The regulatory framework should cover in an integrated manner the major aspects of the use of solid and liquid fertilizers, including slurry and solid farm manure, and pesticides in agriculture, horticulture and greenhouse farming. The implementation of these regulations should be adequately monitored. Appropriate legal sanctions should be instituted for non-compliance.

33. The use of pesticides, all kinds of fertilizers and organic wastes should be restricted in water protection zones and sensitive areas. Stricter requirements, or even a ban, should be imposed if the quality of the receiving water or ecosystem within these areas so requires. These substances should not be used near to surface water bodies; on water-saturated and flooded ground; nor in vegetation strips which are established along surface waters to prevent inputs of substances through surface run-off. Moreover, there should be no application of fertilizers and organic wastes on frozen and snow-covered ground.

34. The threshold values for impurities in pesticides, as well as in mineral and organic fertilizers (e.g. cadmium in phosphate-based fertilizers, copper and zinc in pig slurries) should be set very cautiously.

35. Quality standards for sewage sludge should be adopted and monitored.

36. Legislation should provide either for the approval of pesticides for a limited period of time only, or for a regular review of the approval. The authorization of a new pesticide and the renewal of the review of older products should be based, *inter alia*, on the assessment of the risk that a pesticide poses to groundwater, surface water, biota and related ecosystems, as well as to human health and safety. Those pesticides with a proven adverse effect on water should be phased out.

37. The extensification of agrarian production should incorporate both economic and environmental considerations. In regulating market economic conditions, government authorities should ensure that environmental benefits are maximized. Moreover, economic instruments aimed at containing surplus production should be brought in line with measures to protect waters and the environment in general.

38. While the polluter-pays principle should play a central role in environmental and agricultural policies, there are cases in which payments to farmers for environmentally friendly behaviour are justified, or even necessary. This may be the case where environmental regulations affect clearly defined property rights related to land use, and where incentives prove to be more acceptable and thus more effective than measures which shift the cost burden to the farmers. Subsidies for agricultural practices should not give rise to adverse impacts on the aquatic environment.

39. Good agricultural practice should be adhered to by all farmers without any financial compensation. If farmers are required to make more substantial changes in agricultural production, going beyond good agricultural practice, such as restrictions in water protection zones and sensitive areas, extensification, and the restoration of flood plains and former wetlands, in order to meet specific environmental objectives, they may be compensated. Direct payments and other financial incentives should be made to farmers on condition that they comply with these environmental protection requirements.

40. The effectiveness of regulatory and economic measures to protect waters and the environment in general should be regularly assessed.

V. EXTENSION SERVICES AND RESEARCH

41. Advisory services for fertilizer application, plant protection and sprinkler irrigation established in the past should be revised in order to lay more emphasis on the consideration of water, soil and the overall environmental conditions and consequences when providing advice. Centres of expertise should be designated. As a rule, advice should be provided free of charge.

42. Competent administrative authorities and associations should cooperate closely to promote the development and use of sustainable farming practices and tech-

nologies, which do not adversely affect waters and the environment in general, and to further extension services. Such cooperation should also aim for responsibility sharing among policy makers, planners, managers, as well as farmers and other users of water.

43. Information on the consequences of the use of pesticides for the environment should be provided to farmers. Training in the correct use of pesticides, including methods for the control of pesticide-resistant species, should also be provided to farmers. Anyone wishing to work with pesticides should provide proof of his relevant skills and knowledge before receiving an authorization.

44. Research into alternative and/or integrated plan protection methods, appropriate fertilization methods, waste management, and efficient farming equipment should be promoted. Priority areas of research should cover, *inter alia*:

(a) Development of reliable techniques for sampling and analysis (including water, soil, air and plant samples), as well as improvement of methodologies for integrated monitoring;

(b) Further development of appropriate prognostic models on the dynamics of nitrogen compounds in the soil-water-plant system, including simplified models for day-to-day use under field conditions;

(c) Cropping systems allowing a more efficient use of the nutrients contained in fertilizers and particularly in farm manure;

(d) Model development and validation for pesticide transport through ecosystems, as well as the investigation of the fate and risk associated with the metabolites of pesticide degradation;

(e) Field management techniques to determine how various land management practices affect pesticide leaching;

(f) Disposal techniques designed to reduce the environmental impact of pesticide waste caused particularly by filtration and degradation.