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SYNTHESIS NOTE ON THE CODE OF GOOD AGRICULTURAL PRACTICES DEVELOPMENT

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Beneficiaries

Ministry of Agriculture, Regional Development and Environment

Responsible EU member state consortium EUWI+ project leader

Mr Alexander Zinke, Umweltbundesamt GmbH (AT)

EUWI+ country representative in Moldova

Mr Victor Bujac

Responsible international thematic lead expert

Pierre Henry de Villeneuve, Office International de l'Eau

Responsible national thematic lead expert

Iurie Bejan, OIKUMENA Public Association

Authors

Iurie Bejan, Vladimir Mogîldea, Lucia Căpățînă, OIKUMENA Public Association

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Umweltbundesamt GmbH	Office International de l'Eau (IOW)
Spittelauer Lände 5	21/23 rue de Madrid
1090 Vienna, Austria	75008 Paris, France

Responsible IOW Communication officer:

Ms Chloé Déchelette c.dechelette@oieau.fr

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1 SYNTHESIS NOTE

Agriculture is one of the basic branches of the economy of the Republic of Moldova. Agricultural land, including arable land, grassland, multiannual plantations represents about 74% of the total area of the country. The assessment of pollution sources indicates that agricultural lands are the main cause of the risk for not achieveing the environmental objectives for surface water bodies, and for some groundwater bodies too (especially for the groundwater horizon). Among other associated risks with agricultural activity, which influence the state of water resources, we mention animal manure, the use of mineral fertilizers and pesticides, the agriculture practices on slope lands (as a result could occure soil washing/soil erosion) etc.

The Nitrates Directive (91/676/EEC), and above the Water Framework Directive (60/2000/EC) partially transposed in the Republic of Moldova legislation through Water Law No. 272 of 23.12.2011 and Government Decision No. 836 of October 29 2013 for approvement of the Regulation on the prevention of water pollution from agricultural activities, aim to protect water quality by preventing pollution of surface and groundwater bodies against nutrient pollution.

Most of agro-zootechnical farms (mainly small pig farms) do not have waste storage stations. On medium-sized dairy cows farms or on mixed farms, existing storage capacities are insufficient and in many cases there is a lack of specialized storage facilities for liquid effluents. On large farms, waste storage facilities are often inadequate and can lead to leaks. Problems related to the quality of groundwater in rural areas are often caused by the storage of animal manure directly on the ground or in inappropriate conditions. Periodically, animal manure mixed with household waste is stored in unauthorized places. As a result, large areas of agricultural lands are occupied by waste that pollutes soils and waters. Under these conditions, the leachate seeps into groundwater or drains into surface water.

Manure managed adequally is a natural resource of exceptional importance for agriculture, but often through its uncontrolled storage and misuse on agricultural lands, especially those with excess moisture and outside the optimal periods of administration or in inappropriate doses, creates a real risk of pollution of water bodies.

The Code of Good Agricultural Practices for the protection of waters against nitrate pollution from agricultural sources is a key tool for the protection of waters against pressures from agricultural activities.

However, an important prerequisite is the need for development and implementation of the Code of Good Agricultural Practices, which will be a priority task in order to have a reference for reducing water pollution from the listed sources.

The Code of Good Agricultural Practices aims to recommend the most useful practices, measures and methods possible to be applied by every farmer for the protection of waters against pollution with fertilizers (especially nitrates) from agricultural activities. Practical implementation of the measures, practices, methods, etc. by farmers included in this code is necessary: farmers must be aware that their economic interests in obtaining profitable production must be harmonized with the requirements for the protection and conservation of the environment.

The code is addressed primarily to farmers from areas vulnerable to nitrate pollution. Action programs are mandatory for these areas and include a series of measures to prevent and reduce water pollution by nitrates. It constitute a recommendation in other area.

The Code of Good Agricultural Practices developed and approved by the order of the Minister of Agriculture, Regional Development and Environment no. 160 of 27.07.2020 (attached) covers the following issues:

The Code indicates the periods when fertilizer application in the field is prohibited. In the pedoclimatic conditions of the Republic of Moldova these periods depend on the land use (arable, pastures), the type

of crops (autumn, spring crops) and the type of fertilizer used (mineral, organic solid and organic liquid) and can vary from October 1 to March 15. On sloping arable lands, it is recommended to maintain the share of weeding crops, dense crops, perennial grasses in crop rotation in an optimal ratio specific to the slope category. On sloping lands, fertilization should only involve incorporating fertilizers into the soil, taking into account weather forecasts (it is not recommended to apply fertilizers, especially liquid manure, during heavy rainfall). In most areas of the Republic of Moldova, during the cold period of the year, for 3-5 months, the land is periodically frozen or covered with snow. Accordingly, the application of organic fertilizers of animal origin is prohibited on soils that are saturated with water, flooded, frozen or covered with snow. This is due to the high risk of nitrate leaching or runoff to groundwater or surface water.

In order to reduce runoff and contamination of water with nitrates on the lands near watercourses, protection zones and buffer strips (protection strips) are established in which the development of agricultural activities is prohibited, including the application of any kind of fertilizer or pesticide. The width of the protection zones depends on the width of the watercourse, the water resource type and the destination or hydrotechnical arrangement. Should be mentioned that according to the normative provisions in force, the following are forbidden in water protection zones:

- the application of pesticides on strips within 300 metres from the edge of the riparian slope of the riverbed;
- the location of farms and livestock farms;
- the construction, location and operation of deposits for mineral fertilizer and pesticide storage; the preparation of pesticide solutions and the supply of these solutions; wastewater collections from farms and livestock farms.

Proper management of livestock manure is a key condition for preventing water pollution with nitrates. The storage capacity required for liquid manure produced from livestock farms is determined taking into account the number of animals and the mode of transport of manure to tanks, basins and storage platforms. Livestock and liquid manure must be stored in tanks made of suitable, waterproof, corrosion-resistant materials.

The annual amount of nitrogen from the application of organic fertilizers of animal origin on agricultural land must not exceed 170 kg nitrogen/ha/year. This quantity must be determined so as not to compromise the achievement of the main objective of reducing and preventing water pollution caused by nitrates from agricultural sources and eutrophication of surface water, in the context of achieving good water status.

The Code presents the land management methods, including the use of crop rotation systems to limit nitrogen losses into surface or groundwater bodies (nitrogen content in groundwater and surface water should not exceed the limits allowed by technical regulations).

It is also recommended to introduce intercropping of native species (ryegrass, vetch, red clover) in monocultures or mixtures, resistant to cold and frost, with strong root systems, that can quickly occupy the land and form a dense and homogeneous vegetative carpet to protect the soil from the effect of autumn-winter rainfall. The Code contains the information about the required documents to record the taking measures of action programme in vulnerable zones to nitrate pollution.

In order to make them more efficient, the implementation of measures, practices, methods contained in this Code of Good Agricultural Practices requires a joint effort of all stakeholders involved and interested, central and local public authorities, farmers and practitioners, the scientific community.

The program of measures for the protection of waters against pollution by nitrates from agricultural sources implements the provisions of the Code for the protection of waters against pollution by nitrates from agricultural sources.

The program sets up the specific responsibilities for structures operating under the Ministry of Agriculture, Regional Development and Environment, as well as local public administration authorities on the application of measures to protect waters against pollution with nitrates from agricultural sources.

The measures are mandatory for Nitrate Vulnerable Zones and refer to:

I. Measures taken at the level of the River Basin (water body).

1. Identification of significant point source pressures in agriculture:

i. livestock farms covered by the Integrated Pollution Prevention and Control Directive - 96/61/EC (IPPC Directive) - including units that are listed in the European Pollutant Emission Register (EPER), which are relevant for the environmental factor - water;

ii. farms discharging dangerous substances (lists I and II) and/or priority substances beyond the limits of the legislation in force (according to the requirements of Directive 2006/11/EC replacing Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment);

iii. other agricultural units with point discharge and which do not comply with the legislation in force on the environmental factor water;

2. Identification of significant diffuse pressures in agriculture:

i. land use;

ii. agro-zootechnical farms that do not have appropriate manure storage/use systems, communes (localities) identified as vulnerable or potentially vulnerable to nitrate pollution from agricultural sources, other agricultural units/activities that may lead to significant diffuse emissions.

3. Optimization of Monitoring Programs for surface and groundwater bodies to nitrate content.

4. Development of an in-depth study of eutrophication of surface waters, using the most relevant practices developed by the international scientific community.

II. Measures taken at agro-zootechnical farm level:

1. Prohibition of the application of organic and/or mineral fertilizers during periods when the crop requirements for nutrients are low (when the average air temperature is below 5^0C) or when the risk of percolation/surface runoff is high.

2. Determining the capacity of animal manure storage tanks; this capacity must exceed the storage requirements in all vulnerable zones, taking into account the longest periods of prohibition of the application of fertilizers in the field, unless it can be demonstrated to the competent authorities that any quantity of fertilizers of animal origin, in excess of current storage capacity, it will be treated in a way that does not harm the environment;

3. Limiting the number of field applications of fertilizers in accordance with good agricultural practices and taking into account the characteristics of the vulnerable zone, especially on:

a) land slope, soil characteristics and type, climatic conditions, irrigation etc.;

b) agricultural practices and land use, including the crop rotation system. Field application of fertilizers is based on a balance between:

b1) estimating-forecasting the nitrogen requirement of the crop;

b2) nitrogen contribution to crops by soil and fertilizer, which must be justified on the basis of:

- the amount of nitrogen in the soil in relation to the needs of the crop;
- nitrogen contribution by net mineralization of soil organic nitrogen reserves;
- the contribution of nitrogen compounds by field administration of animal fertilizers;

- the contribution of nitrogen compounds by the administration of chemical fertilizers and other fertilizers.

These measures will ensure that for each farm or livestock unit the amount of fertilizer of animal origin applied annually on the land, including that left by the animals, does not exceed the specific norm per hectare. The specific norm per hectare is represented by the amount of fertilizer administered, which contains 170 kg of nitrogen. Exceptions can be made from this amount for the first 4 years action program, when a specific limit of 210 kg nitrogen could be allowed.

The Ministry of Agriculture, Regional Development and Environment, through the competent units under its subordination (Environment Agency, Environmental Inspectorate) can establish at local level the quantities of fertilizers, based on the registered livestock.

d) A graph on terms most likely it is expected that the effects of measures action programs on water pollution by nitrates reach expected results, while also indicating the level of uncertainty of this estimate.

e) The Code of Good Agricultural Practices with the program of measures will be updated according to the progress in the field and the emergence of new technologies and agricultural practices with low impact on the environment (not less than once in 4 years).

The implementation of the Code of Good Agricultural Practices provided by the 91/676/EEC Directive requires the following actions by authorities:

- approval of the background arguments for identifying vulnerable zones and approval of the zones themselves;
- development of legislative framework for an enforcement regime to ensure compliance;
- development and implementation of the program of measures regarding the reduction of nitrate pollution in vulnerable zones, with clear attributions and responsibilities for the different authorities involved;
- transposition, publication and dissemination of CoGAP in an accessible form to rise farmers' awareness;
- implementation of a national plan including farmers financing mechanism;
- development of nutrient balance calculation references for optimal crop rotation management and analyzing the impact of performance on small farms to optimize awareness rising;
- implementation of a specific nitrate monitoring program for vulnerable zones;
- adaptation to the standards' requirements of laboratory equipment for the determination of nitrates;
- establish a methodology for analyzing and verifying the effectiveness of measures;
- The the program of measures for the Code of Good Agricultural Practices implementation will be updated according to the progress in the field and the emergence of new technologies and agricultural practices with low impact on the environment (not less than once in 4 years).

Are presented below the annexes developed during the study:

1. **Content of the main deliverables**
2. **Methodological note which explains the choices made**
3. **List of institutions involved in the consultation and approval process**
4. **Workshop summary help on 23.10.2019 (full report also available)**
5. **Ministerial order for the adoption of the code**
6. **The code developed and adopted translated in English**

2 ANNEXES

Annex 1 Content of the main deliverables

The characteristics of the deliverables mentioned above are presented below. It provides an idea of the minimum information required for each of them, which remains subject to the availability of data and information.

1) Revision of the Code of Good Agricultural Practices in the Republic of Moldova

The Code of Good Agricultural Practices is designed to promote sustainable agricultural practices while maintaining high water quality. Objectives may exceed those strictly required by the Nitrates Directive to take account of local issues or specific national regulations. A first draft was submitted before the workshop, so that the participants can prepare for the consultation. The draft Code of Good Agricultural Practices includes:

Introduction: key data on agriculture and the regulatory environment in the Republic of Moldova (national legislation and Nitrates Directive). Code of Good Agricultural Practices (CoGAP) in Moldova. Presentation of the sources used and the proposed adaptation to the Moldovan context.

2) Proposal of regulatory initial text for preparation to the adoption

To support the ministry in the full transposition of the Nitrates Directive, the consultant proposed an initial option on the points to be introduced in the legislation to define CoGAP and in which area the code will be applied based on the ADA/SDC study and international practice.

Based on this initial assessment, the current selected option is a ministerial order and informative note that has to be validated before being submitted to the beneficiary.

3) The workshop was organized on 23.10.2019 with the support of the EUWI + East project, with the contribution of the consultant and ensured the participation of MARDE departments, experts and stakeholders to share their opinion.

Annex 2 Methodological note which explains the choices made

The Republic of Moldova is in the process of harmonization in line with European legislation in the field of environmental protection. In October 2013, the new Water Law entered into force, partially harmonized with the Water Framework Directive (60/2000/EC Directive), but also with other related directives, including the Nitrates Directive (91/676/EEC Directive).

The legislative context. Council Directive 91/676/EEC (Nitrates Directive) aims to reduce water pollution with nitrates from agricultural sources and to prevent any further pollution of this type. The control and management of nutrients, introduced into the water due to the excessive use of fertilizers in agriculture, is a significant environmental policy challenge, promoted by the implementation of the Water Framework Directive and the Nitrates Directive.

The Nitrates Directive sets out a number of measures that need to be considered:

- water monitoring in all types of water bodies in terms of nitrate concentration and trophic status;
- identification of polluted waters or at risk of pollution, based on the criteria defined in Annex I to the Directive;
- designation of nitrate vulnerable zones, namely zones that supply waters and contribute to pollution;
- establish some codes of good agricultural practices, implemented voluntarily;
- establish action programs that include a series of measures to prevent and reduce water pollution with nitrates and that are mandatory to apply in designated nitrate vulnerable zones or throughout the national territory;
- review and, if necessary, revise the list of designated nitrate vulnerable zones and action programs at least every four years.

Republic of Moldova, by the Water Law no. 272 of December 23, 2011, provides the implementation of the Nitrates Directive, and the Regulation on the prevention of water pollution from agricultural activities, approved by Government Decision no. 836 of October 29, 2013, establishes the requirements for the Action Program on the prevention of water pollution from agricultural activities and for the Code of Good Agricultural Practices.

Information sources: As support provisions for the elaboration of the Code of Good Agricultural Practices were used the Water Law no. 272 of December 23, 2011, the Regulation on the prevention of water pollution from agricultural activities, approved by Government Decision no. 836 of 29 October 2013 which sets up the requirements for the program of actions for the prevention of aater pollution from agricultural activities and the Code of Good Agricultural Practices. European normative acts were also consulted - Directive on the protection of waters against pollution caused by nitrates from agricultural sources and the Water Framework Directive. As a structural model of the Code of Good Agricultural Practices has been consulted the Romanian model.

The statistical data of the National Bureau of Statistics and the Environmental Inspectorate (data on the livestock, the amount of chemical fertilizers used); Agency for Land Relations and Cadastre (data on agricultural areas); Environmental Inspectorate (amount of animal manure stored); Environmental Agency (data on surface water monitoring); Agency for Geology and Mineral Resources (groundwater monitoring data), but also other relevant data were used as statistical sources.

Annex 3 List of institutions involved in the consultation and approval process

1. Environment Agency
2. Inspectorate for Environmental Protection
3. State Hydrometeorological Service
4. „Apele Moldovei" Agency
5. Agency of Geology and Mineral Resources
6. Institute of Pedology, Agrochemistry and Soil Protection „Nicolae Dimo"
7. Departments with agricultural profile of the MARDE

Annex 4 Workshop summary help on 23.10.2019 (full report also available)

- International experts presented France's experience in implementing Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- MARDE presented the current status on the implementation of Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources in the Republic of Moldova, mentioning that the first steps in this regard were the elaboration and approval of the Regulation on prevention of water pollution from agricultural activities (approved by the Government Decision No. 836 of 29.10.2013), the Methodology regarding the identification and delimitation of the Nitrates Vulnerable Zones (in process) and the Code of Good Agricultural Practices.
- NGO OIKUMENA expert presented the current situation regarding the delimitation of the nitrate vulnerable zones in the Republic of Moldova and asked for the opinion related to declaring the whole territory as a nitrate vulnerable zone, or some specific areas.
- It was presented the stages of elaboration, approval and implementation of the Code of Good Agricultural Practices in France, as well as the Program of measures on the protection of waters against pollution with nitrates from agricultural sources for vulnerable zones (priority zones) and their monitoring.
- The Code of Good Agricultural Practices in Moldova and the Program of measures on the protection of waters against pollution caused by nitrates from agricultural sources were presented.
- It was presented the steps to be follow in order to promote and approve the Methodology regarding the identification and delimitation of nitrates vulnerable zones and the Code of Good Agricultural Practices.

Annex 5 Ministerial order for the adoption of the code

MINISTERUL AGRICULTURII, DEZVOLTĂRII REGIONALE ŞI MEDIULUI AL REPUBLICII MOLDOVA

МИНИСТЕРСТВО СЕЛЬСКОГО ХОЗЯЙСТВА, РЕГИОНАЛЬНОГО РАЗВИТИЯ И ОКРУЖАЮЩЕЙ СРЕДЫ РЕСПУБЛИКИ МОЛДОВА

O R D I N
mun. Chişinău

„27" iulie 2020 Nr. 160

Cu privire la aprobarea Codului de bune practici agricole pentru protecţia apelor împotriva poluării cu nitraţi din surse agricole

În temeiul prevederilor art. 43 alin. (2) lit. b) al Legii apelor nr. 272/2011 (Monitorul Oficial al Republicii Moldova, 2012, nr.81, art. 264), cu modificările ulterioare, Cap. V al Hotărîrii Guvernului nr.836/2013 pentru aprobarea Regulamentului privind prevenirea poluării apelor din activităţi agricole (Monitorul Oficial al Republicii Moldova, 2013, nr. 243-247, art.942),

O R D O N:

1. Se aprobă Codul de bune practici agricole pentru protecţia apelor împotriva poluării cu nitraţi din surse agricole (în continuare Cod de bune practici), conform anexei.

2. Autorităţile publice locale, producătorii agricoli, se vor conduce de recomandările din prezentul Cod de bune practici în scopul protecţiei şi prevenirii poluării resurselor acvatice cu nitraţi proveniţi din surse agricole.

3. Prezentul ordin va fi publicat pe pagina web a ministerului şi a autorităţii de gestionare a apelor.

Ministru **Ion PERJU**

Annex 6 The Code of Good Agricultural Practices in Moldova

Annex to
MARDE Order no. 160 of 27.07.2020

CODE OF GOOD AGRICULTURAL PRACTICE TO PREVENT THE POLLUTION OF WATERS BY NITRATES FROM AGRICULTURAL SOURCES

1. Introduction

Agriculture is one of the key sectors of the economy of the Republic of Moldova. Agricultural land, including arable land, grassland, and multiannual crops, represents about 74% of the total area of the country. The livestock sector also has an important role. Although the activity of animal husbandry has decreased in the last decades (from 2 times for poultry to 8 times for cattle), the amount of manure produced remains significant representing about 4 million tonnes per year.

In this context, the contribution of nutrients from agricultural land and livestock farms that reaches surface and underground waters can have a considerable negative impact on the quality of aquatic resources. At the same time, the surface hydrographic network crosses agricultural land and drains into it, making both the water supply and groundwater (aquifers) potentially vulnerable to pollution, especially from agricultural sources.

Pollution from agricultural activities can be caused by point or diffuse sources. Agricultural point source pollution can be caused by:

- semi-liquid and liquid animal manure;
- solid manure;
- silage effluent;
- non-collected untreated or partially/insufficiently treated wastewater;
- leakage from mineral and organic fertilisers deposits.

When these sources of pollution directly reach water bodies, they can affect the aquatic life of surface waters, making them unsuitable for use as sources of drinking water. In addition, agricultural activities involving the use of chemicals lead to diffuse pollution of water bodies as a result of nutrient loss (nitrogen and phosphorus) and their penetration into surface and / or groundwater bodies. The main effect of nitrate pollution of surface and groundwater is represented by decreasing water potability and the eutrophication of water bodies.

The Code of Good Agricultural Practices (CoGAP) concerning the protection of waters against pollution caused by nitrates was elaborated according to art. 43 paragraph (2) lit. b) of Water Law no. 272 of 23.12.2011 and Chapter V of Government Decision no. 836 of 29.10.2013 for the approval of the Regulation on the prevention of water pollution from agricultural activities, and contains provisions regarding:

- the periods when the application of fertilizers on land is not recommended;
- the specific features of application of fertilizer on steeply sloping ground;
- the application of fertilizer on water-saturated, flooded, frozen or snow-covered ground;

- the conditions for the application of fertilizer on land near water courses;

- the construction and capacity of storage vessels for livestock manure, including measures to prevent water pollution from run-off and seepage into the groundwater and surface water of liquids containing livestock manure and effluent from stored plant materials;

- the conditions for applying both chemical fertilizer and livestock manure on land in order to maintain an acceptable level of nutrient loss from water;

- land use management, including the use of crop rotation systems and the proportion of the land area devoted to permanent crops relative to annual tillage crops;

- the maintenance of an optimum quantity of vegetation during rainy periods to take up nitrates from the soil, thus preventing water pollution from nitrates;

- the establishment of fertilizer plans and the keeping of records on fertilizer use by individual farmers;

2. Basic terms

- "soil amendment" - material added to the soil, whose main function is to improve the physical and / or chemical properties and / or its biological activity;

- "fertilizer application" - general term for all procedures for applying fertilizers to certain crops through incorporation into soil, onto soil, or both (the term covers spreading, spraying, dusting, and specific application methods consisting of injection into the soil and the combined sowing, in rows, of seeds and fertilizers, which can also be extended to the techniques of foliar spraying and adding fertilizers into irrigation water);

- "manure" - a mixture of solid and liquid waste products excreted by livestock with litter and food waste, which gives it a solid consistency;

- "buffer strips" (protection strips) - grassy, forested or cultivated land surfaces with perennial grass or leguminous plants, located near surface water protection areas;

- "crop requirements" – all of the physical, chemical and biological factors necessary for crop growth and development and to form the main and secondary production;

-"nitrogen compound" - any nitrogen-containing substance except for gaseous molecular nitrogen;

- "cover crop" - a crop which is planted for the purpose of consuming nitrogen from the soil and preventing soil erosion and which is not harvested;

- "autumn crops" - crops planted between August and October, using classic methods or directly in the stubble;

- "liquid manure" - natural organic fertilizer, which consists of a mixture of liquid and solid livestock manure, with rainwater or sewage, peat dust, sawdust, etc. and the fodder remaining from livestock feed;

- "denitrification" - process of biochemical reduction of nitrates or nitrites into gaseous forms of nitrogen, either as molecular nitrogen (N2) or as nitrous oxide;

- "application dose"- the mass or volume of fertilizer, soil amendment or nutrient applied to the unit of cultivated area or to the unit of mass or unit of volume of treated seed;

- "silage effluents" - liquids that leak from preserved fodder by silage processes from silos;

- "nutrient" – the essential chemical element for plant growth;

- "eutrophication" - process of excessive enrichment of surface waters in soluble nutrients, especially in nitrates and phosphorus;

- "hayfield"- grassy, natural or sown soil, maintained with or without periodic over-sowing, whose vegetable production is mowed;

- "soil fertility" – all of the physical, chemical and biological properties of the soil that ensure the growth of crops by accumulating vegetation factors (light, air, water, heat, nutrients and biological activity) and maintaining the conditions for these factors to be used in correct and sufficient quantities;

- "livestock manure" - residual excreted product (solid and liquid manure) from animals, mixed with material used as litter, food waste, water;

- "complex fertilizer" - a compound fertilizer, obtained by a chemical reaction, in solution or in a solid state, by granulation, which contains at least two main nutrients in a proportion to be declared. In the solid state, each granule contains all of the nutrients in the declared composition;

- "compound fertilizer" - a fertilizer having a declarable content of at least two nitrogen plant nutrients, and which has been obtained chemically or by blending, or both;

- "nitrogen fertilizer" - any substance which contains a compound of nitrogen and which is administered on / in the soil to enhance plant growth;

- "foliar fertilizer" - fertilizer intended for application on the foliage of plants for foliar absorption of nutrients;

- "liquid / fluid fertilizer" - fertilizer in suspension or in solution, a term also used for liquefied ammonia;

- "mineral fertilizer (inorganic / chemical)" - fertilizer whose known nutrients are in the form of mineral salts obtained by extraction and / or by physical and / or chemical industrial processes (sulphur, calcium cyanamide, urea and its condensation and association products, and bone superphosphate may, by convention, be classified as mineral fertilizers);

- "organic fertilizer" - fertilizer containing organic and mineral substances from waste products excreted by livestock, sewage treatment plants or material of vegetable origin. Organic fertilizers can be solid to liquid in consistency;

- "organo-mineral fertilizer" - fertilizer in which declared nutrients are of both organic and mineral origin obtained by mixing and/or chemical combination of organic and mineral fertilizers;

- "simple fertilizer" - a fertilizer having a declarable content of only one of the main nutrients (nitrogen, phosphorus or potassium);

- "fertilizer"- all products intended for improvement of soil fertility and plant nutrition, applied to both soil and plants, such as soil amendments, chemical fertilizers, organomineral fertilizers, biological fertilizers and growth stimulants;

- "macroelement", "primary nutrient" – nitrogen, phosphorus and potassium only;

- "mineralization" - the microbial decomposition of soil organic matter, with the release of nutrients in assimilable form;

- "secondary nutrient" - calcium, magnesium, sulphur or sodium;

- "trace elements" - boron, cobalt, copper, iron, manganese, molybdenum and zinc, which are essential for plant growth in relatively small quantities compared to the amount of primary and secondary nutrients;

- "pasture"- grassy or naturally moistened or sown land, maintained with or without periodic over-sowing and used for grazing animals;

- "percolation" - process in which water from rainfall together with the substances it contains passes from top to bottom through the soil;

- "solubility of a fertilizer nutrient" - the quantity of a given nutrient, extracted in a specific medium, under specified conditions, expressed as a percentage by mass of the fertilizer;

- "livestock" - all domestic animals kept for use or profit;

- "grassy land" - land areas, other than permanent meadows on which the predominant vegetation consists of spontaneous or cultivated herbaceous plants;

- "fertilizer unit" - the unit mass of a fertilizer nutrient;

- "Large Livestock Unit (LSU)" (applied for to cows) - a standard measurement unit established for the equivalence of different species and categories of animals, based on nutritional requirements and the amount of waste products excreted by livestock by reference to the nutritional requirements and manure produced by one or more animals, accumulating 500 kg live weight (equivalent of a cow);

- "protection zone" –areas near watercourses, water management works, buildings and related facilities subject to prohibitions or restrictions in order to ensure the stability of the banks to prevent water resources pollution;

- "nitrate vulnerable zone" - areas of agricultural land in the entire territory of the country subject to drainage of polluted or threatened waters that contribute to nitrate pollution.

3. General description of the principles for establishing zones vulnerable to nitrate pollution from agricultural sources

The following criteria are used to identify waters affected or likely to be affected by nitrate pollution from agricultural sources:

– surface fresh waters that are used or will be used as a source of drinking water and contain or are likely to contain nitrate concentrations higher than 50 mg NO3/l.

– groundwater that contains or is likely to contain nitrate concentrations higher than the maximum permissible limit of 50 mg/l, unless protective measures are taken.

– freshwater from natural lakes or other freshwater sources (reservoirs, channels), coastal and marine waters that is eutrophic or may become eutrophic in the near future if no protection measures are taken.

For the protection of waters against nitrate pollution from agricultural sources, the recommendations set out in this Code will be applied voluntarily, the main objective being to reduce and prevent pollution of waters with nitrates from agricultural sources and eutrophication of surface waters to achieve good water quality.

4. General principles on the dynamics of fertilizers in soil and their transfer to the aquatic environment (underground and surface)

The dynamics of fertilizers in the soil-plant-hydrosphere system depend on the interaction mechanisms between the fertilizer components and the colloidal matrix of the soil, as well as on the flows of the soil solution in which the mobile forms of mineral fertilizers are dissolved.

The transport to the surface waters of the substances contained in fertilizers is done through the specific processes of water flow to the soil surface. In general, these processes occur due to heavy rainfall, sudden melting of snow, or when the water content of the soil is between field capacity and saturation.

If more fertilizers are applied than the plant needs, there is a risk that some of them (especially nitrates) will be entrained under the depth of the root front and directed to the groundwater aquifer, which leads to the accumulation of nitrates in groundwater.

The climate, characterised by successions of dry years followed by rainy years, leads, in dry years, to the accumulation of nitrates in the unsaturated area between the root layer and the groundwater, and in rainy years, to the transfer of nitrates to the free groundwater layer (piston effect). In this way, the annual losses of nitrates, although low in dry years, can lead, by accumulation, to considerable pollution of the groundwater aquifer in years with excess rainfall.

5. Periods when fertilizer application in the field is prohibited

The application of organic and/or mineral fertilizers is prohibited during periods when the crop requirements for nutrients are low, namely, when the average air temperature is less than + 5oC. This interval corresponds to the period when the requirements of the agricultural crop for nutrients are reduced or when the risk of percolation / surface runoff is high.

In the pedoclimatic conditions of the Republic of Moldova, the periods with high risk of percolation or runoff from the cold interval (autumn-spring) depend on the type of land use (arable, pasture), the type of crops (autumn or spring crops) and the type of fertilizer used (mineral, solid organic and liquid organic). The prohibition periods for the application of nitrogen fertilizers are presented in table no.1.

Table No. 1

Prohibition periods for the application of nitrogen fertilizers in fields

<table>
<tr><th colspan="3">Specification</th><th>Period of prohibition</th></tr>
<tr><td>Solid organic fertilizer</td><td colspan="2">Arable land and pastures</td><td>November 1 – March 15</td></tr>
<tr><td rowspan="3">Liquid organic fertilizer and mineral fertilizer</td><td rowspan="2">Arable land</td><td>Autumn crops</td><td>November 1 – March 1</td></tr>
<tr><td>Other crops</td><td>October 1 - March 15</td></tr>
<tr><td colspan="2">Pastures</td><td>October 1 - March 15</td></tr>
</table>

In addition, the storage capacity of manure must be designed for a period of time longer than one month after the prohibition period for the fertilizers' application. The manner for storing manure is described in point 9 of this document.

6. Conditions for soil application of fertilizers on sloping lands

On sloping land there is an increased risk of nitrogen loss through surface runoff, which depends on a number of factors such as:

- the slope of the land,
- soil characteristics (especially water permeability),
- cultivation system,
- anti-erosion arrangements,
- the rainfall amount.

On sloping lands, fertilization should only involve incorporating fertilizers into the soil, taking into account weather forecasts (it is not recommended to apply fertilizers, especially liquid manure, during heavy rainfall).

On sloping arable lands, it is recommended to maintain the share of weeding crops, dense crops, perennial grasses in crop rotation in an optimal ratio specific to the slope category.

Immediately after application to these lands, organic fertilizers are incorporated into the soil (no later than 24 hours).

At the same time, there is a potential maximum risk when fertilizers are applied superficially followed by a period of heavy rainfall. Particular attention should be paid to fruit and vine crops (see Table 2), usually located on such land, where the processes of soil erosion and, implicitly, the dangers of nutrient loss by runoff, are more frequent and more intense.

Table No. 2

The optimal ratio between agricultural crops on slopes, in%

Slope	Share of crop rotation			Level of soil protection to erosion
	Weeding crops	Dense crops	Perennial grasses	
<1o	50-60	25-30	10-15	100
1-3o	40-50	30-35	15-20	69
3-5o	30-40	35-45	20-25	73
5-7o	20-25	45-50	25-30	83
>7o	-	30-35	65-70	93

It is also important to mention that spaces should be established when the crops are planted to manoeuvre agricultural machines for chemical treatments. If this is not possible due to the cultivation system of the plant, then it is recommended to apply a surface tillage system behind the wheels of agricultural machines, which will help reduce the compaction of the area and thus the risk of erosion and nitrate runoff.

At the same time, when using the reversible plough and ploughing perpendicular to the slope, it is recommended that the furrow be turned upstream to reduce erosion and slow movement (slipping) of the soil. Crop sowing, like all other agricultural operations on sloping land, must be carried out perpendicular to the direction of runoff.

7. Soil fertilizer application on water-saturated, flooded, frozen or snow-covered land

In most areas of the Republic of Moldova, during the cold period of the year, for 3-5 months, the land is periodically frozen or covered with snow. Accordingly, the application of organic fertilizers of animal origin is prohibited on soils that are saturated with water, flooded, frozen or covered with snow. This is due to the high risk of nitrate leaching or runoff to groundwater or surface water.

Thus, on water-saturated, flooded, frozen or snow-covered soils, it is forbidden to apply organic fertilizers of animal origin due to the high risk of their infiltration. For the same reasons, it is forbidden to store livestock manure in flooded areas.

On soil periodically saturated with water or in flooded areas, fertilizer application should take place only when the soil has a humidity corresponding to the field capacity, thus avoiding the loss of nitric nitrogen with percolation waters and runoff.

8. Soil fertilizer application near watercourses or drinking water abstractions

On land near the watercourses, protection zones and buffer strips (protection strips) are established, in which the development of agricultural activities is prohibited, including the application of any kind of fertilizer or pesticide.

The protection zones are determined under the guidance of the Law no. 440 of 27.04.1995 regarding the water protection zones and strips of rivers and water basins and the Regulation on the sanitary protection zones of water abstractions, approved by Government Decision no. 949 of 25.11.2013.

The width of the protection zones depends on the width of the watercourse, the water resource type and the destination or hydrotechnical arrangement, namely:

- along river banks and water basins, water protection zones are established at least 500 metres from the edge of the riparian slope of the riverbed on the banks, till the watershed.
- along the banks of streams/brooks (with permanent or temporary water flows), water protection zones must have a width of at least 15 metres on both banks;
- the width of the water protection zones of the Dniester, Prut and Danube rivers is at least 1,000 metres.

According to the normative provisions in force, the following are forbidden in water protection zones:

- the application of pesticides on strips within 300 metres from the edge of the riparian slope of the riverbed;
- the location of farms and livestock farms;
- the construction, location and operation of deposits for mineral fertilizer and pesticide storage; the preparation of pesticide solutions and the supply of these solutions; wastewater collections from farms and livestock farms.

In river and water basin protection zones, grazing is allowed exclusively in the part of the river furthest from the protection zone, and is carried out according to the rules and regime of grazing capacity. The local public authorities are responsible for ensuring the respect of norms and the grazing capacity regime.

Similarly, the application of mineral and organic fertilizers inside the 300-metre strip from the edge of the riparian slope of the riverbed is allowed only under the furrow.

9. Storage and management of livestock manure and effluents from agro-zootechnical farms

According to their activities, zootechnical farms are divided into 2 categories:

- breeding farms;
- livestock farms for production.

Organic fertilizers from agro-zootechnical farms have a variety of physical conditions and compositions: livestock manure, sludge, urine, liquid manure, compost.

Proper management of livestock manure involves designing storage systems that can be individual, communal or a combination.

The following requirements apply to the correct storage of manure:

- location outside areas with high risk of pollution and away from water sources;
- sufficient storage capacity;
- appropriate construction, encompassing all safety and protection systems;
- safe, optimal and efficient operating conditions;
- appropriate access routes;
- fire protection;
- protection against possible leaks.

Livestock manure storage capacity depends on:

- the type and size of the group of animals, taking into account the system used to organise the farm and the quality of the management applied;
- duration of the storage period;
- type of storage;
- manure handling and storage method;
- the degree of dilution of manure due to rain, runoff or other types of water.

The storage must have enough capacity to ensure storage for a period longer than one month after the prohibition interval for the application of organic fertilizers on the field, defined by the period when the average air temperature is below + 50C.

Manure storage and conservation must be done on specially designed platforms. Thus, platforms must be hydro-isolated at the basement, waterproofed, and provided with high retaining walls, which should also be waterproofed. Depending on the solution chosen, in order to prevent pollution of water resources, the platforms may have effluent retention thresholds and drainage channels into a retention basin.

The capacity of the collection basin is determined according to the capacity of the platform and the rate of discharge of the sludge (once or several times per year). In general, a requirement of 4-5 m3 can be approximated for every 1 tonne of fresh manure.

The storage capacity required for liquid manure produced from livestock farms is determined taking into account the number of animals and the mode of transport of manure to tanks, basins and storage platforms. Where possible, manure dilution should be avoided, as this causes an unpredictable fertilizer value and the need for larger storage capacities.

Effluent from the silage platforms should preferably be stored together with liquid manure, and the volume of the silage effluents should be taken into account when designing the storage capacities. Livestock manure production and storage capacity are presented in table no. 1 of annex no. 1.

Liquid manure must be stored in tanks made of suitable, waterproof, corrosion-resistant materials. In order to assemble the installations and storage spaces, it is necessary to comply with the following conditions:
- the location and area in which they are built should be chosen taking into account the nearby river network and the existing forests;
- it should be located near agricultural land;
- it should be designed according to the existing livestock number;
- all storage spaces, installations, pumping networks and means of transport should be watertight;
- appropriate construction materials should be used; installations should be reliable and of high quality.

10. Conditions for applying chemical fertilizers and manure in soil to maintain the loss of nutrients in water at an acceptable level

Most agricultural soils contain too little naturally available nitrogen to meet the needs of a crop throughout the growing season. Therefore, it is necessary to naturally supplement the nitrogen content in the soil each year. Applying the right amount of nitrogen at the right time is the basic requirement for good fertilizer management.

Considering the economic aspects, as well as the restrictions imposed by environmental protection, the quantities of nitrogen applied must be dimensioned to ensure that the existing mineral nitrogen stock in the soil is completed to the level necessary to obtain profitable production while conforming to standards for surface water and groundwater protection from nitrate contamination by agricultural activities.

These requirements can be met through the proper management of soil nitrogen, which takes into account the dynamics of this nutrient in the agricultural ecosystem that the soil and crop belong to.

Therefore, the doses determined on the basis of the nitrogen requirement for the formation of an expected crop are calculated using the following formula:

$$DN = Nc - (Ns + Na + Nb + Nr) + (Ni + Ng + Nl)$$

in which:

DN – is the nitrogen dose (amount) from the fertilizer (organic + mineral) for the expected harvest, in kg/ha;

Nc – is the required nitrogen for the expected harvest, in kg/ha;

Ns - is the nitrogen released from the soil during the growing season, in kg/ha;

Na - is the nitrogen from irrigation water and the atmosphere (powder, rainfall), in kg/ha;

Nb - is the biological nitrogen fixation, in kg/ha;

Nr - is the nitrogen from the mineralization of previous-vegetable crop residue, in kg/ha;

Ni - is the loss of nitrogen through immobilization by soil microorganisms, in kg/ha;

Ng - is the loss of nitrogen by volatilization, including denitrification, in kg/ha;

Nl - is the loss of nitrogen by leaching and entrainment with surface runoff, in kg/ha.

In order to achieve a suitable fertilization plan, at the level of an agricultural land where organic fertilizers from animals are used, it is particularly important to evaluate the amount of nutrients in the manure produced on the farm.

The amount of nutrients in manure produced on a farm depends on many factors, including:

- number, species and the structure of livestock,
- fodder and feeding systems,
- livestock manure storage and management system,
- the volume of waste water produced in the farm,
- the amount of water coming from rainfall that penetrates into the manure storage facilities,
- the amount of fodder used for animal bedding, etc.

It is recommended to measure the nutrient content of manure produced on the farm to be applied on agricultural land. The analyses should be performed by a specialised agrochemical laboratory, and the analysis protocols should be kept by the farmer and used to calculate the fertilizer dosage to be applied to the farmland. If no measurements of the nutrient content of the farm waste are made, their values can be evaluated on the basis of average coefficients established by methodologies based on the generalisation of experimental data obtained under controlled conditions.

The livestock manure production and storage capacity required for various animal maintenance systems, and the values calculated for the amount of nitrogen from the manure of a specific animal species during a specific year, are presented in Annex no. 1

The calculation of the required capacity for the storage of livestock manure is based on the amount of manure produced by animals, the amount of bedding used, the drinking water used for animals, and the water used for sanitation.

For different species and categories of animals, based on national requirements and the amount of manure they produce, the Large Livestock Unit (LSU) (applied for cows) is used. As mentioned above, this standard unit of measurement is established by reference to the nutritional requirements and manure produced by one or more animals, accumulating 500 kg live weight (equivalent to a cow). The conversion of the number of animals into LSUs determines the required livestock manure storage capacity.

In order to express these values in LSUs, it is considered that 1 LSU corresponds to the amount of nitrogen in the solid manure produced by a medium-sized dairy cow from an on-farm manure storage system. Coefficients for the conversion of the number of animals into LSUs in terms of the manure volume are presented in Annex no. 1, table no. 3.

The following are examples of how to calculate the amount of nitrogen to apply as manure on farmland:

- if a farm has 10 pigs (household system), and the livestock manure is stored in the ground in solid form in temporary storage, then according to the data from Annex no. 1, table no. 4.– column 1, the amount of nitrogen that will be applied on the field from solid manure is:

10 (pigs) x 7.65 kg N / animal / year = 76.5 kg N /year.

- if a farm has: 2 dairy cows raised in the household system and 5 pigs raised on the farm throughout the entire life cycle, and in the farm there is a storage system of manure in accordance with Annex no. 1, table no. 4, column 3, then the amount of nitrogen in the solid manure applied to the field is:

• dairy cows (household system)

2 (dairy cows) x 36.42 kg N / animal / year = 72.84 kg N / year

• pigs (household system)

5 (pigs) x 6.39 kg N / animal / year = 31.95 Kg N / year

• Total

72.84 kg N / year + 31.95 kg N / year = 104.79 Kg N / year

The total amount of nitrogen in the solid manure applied to the field, expressed in LSUs will be:

104.79 kg N / year: 40 kg N / LSU / LSU = 2.62 LSU.

11. Maximum limit for the application of organic fertilizers of animal origin

The annual amount of nitrogen from the application of organic fertilizers of animal origin on agricultural land must not exceed 170 kg nitrogen/ha/year. This quantity must be determined so as not to compromise the achievement of the main objective of reducing and preventing water pollution caused by nitrates from agricultural sources and eutrophication of surface water, in the context of achieving good water status, which is justified by the application of objective criteria such as:

- long periods of vegetation;
- crops with strong nitrogen absorption;
- high net rainfall in the vulnerable zone;
- soils with a very high denitrification capacity.

In order to comply with the maximum limit for the application of organic fertilizers of animal origin, farmers must assess the amount of nitrogen excreted by farm animals and correct it with nitrogen gas losses in the shelter or during manure storage.

The amount of mineralised nitrogen depends on the history of organic fertilizer application on the tested land. In the case of applying the same amount of nitrogen in the form of organic fertilizer of animal origin each year, on average the percentage of mineralised nitrogen compared to the total nitrogen in the fertilizers is:

- Year 1 - 10%
- Year 5 - 40%
- Year 10 - 54%
- Year 15 - 64%
- Year 20 - 74%
- Year 25 - 80%
- Year 50 - 94%

Thus, if 170 kg N/ha of organic fertilizers of animal origin are applied every year, then the amount of mineralised nitrogen from the fertilizers will be:

- Year 1 - 17 kg N/ha
- Year 5 - 68 kg N/ha

- Year 10 - 92 kg N/ha
- Year 15 - 109 kg N/ha
- Year 20 - 126 kg N/ha
- Year 25 - 136 kg N/ha
- Year 50 - 160 kg N/ha.

In addition, the amount of mineral fertilizers with nitrogen that can be applied in the field is given by the difference between the value imposed by the maximum standard and the amount of mineralised nitrogen in organic fertilizers of animal origin applied in the field (0.54 x the amount of nitrogen in the livestock manure applied in the field). If the amount of mineralised nitrogen in organic fertilizers of animal origin is higher than the value required by the maximum standard, then no mineral fertilizers are applied.

12. Land use management, including the use of crop rotation systems to limit nitrogen losses into surface or groundwater bodies

Nitrate losses from the soil are more intense in seasons with heavy rainfall, when the soil is devoid of vegetation. In the specific conditions of our country, after the harvest of annual crops, about 50% of the nitrogen applied remains in the soil. To counteract this phenomenon, crop rotation plays an essential role.

Thus, it is recommended to intercalate in rotation with the main crop a fast-growing crop that is capable of capitalising the residual nitrogen and that can be used in spring as a natural fertilizer for spring-summer crops.

It is also recommended to introduce intercropping of native species (ryegrass, vetch, red clover) in monocultures or mixtures. These native crops are resistant to cold and frost, have strong root systems, and can quickly occupy the land and form a dense and homogeneous vegetative carpet to protect the soil from the effect of autumn-winter rainfall.

Means of reducing residual nitrogen include:

- minimising the periods when the soil is uncultivated;
- introducing rotations in which to include an autumn crop;
- rotating crops with a shallow root system and short growing periods (fruit and vegetables: spinach, lettuce, strawberries, onions, leeks; some field crops: potatoes, peas, beans), including second crops or cereals that extract residual mineral nitrogen from the soil;
- introducing intercropping of native species that are resistant to cold and frost, have strong root systems, can quickly occupy the land and form a dense and homogeneous vegetative carpet to protect the soil from the effect of autumn-winter rainfall;
- introducing other crops into legume rotations to capitalise on the biological nitrogen fixation left in the soil as a result of the legume crop;
- ensuring proper management of plant residues containing significant amounts of nitrogen, by recycling them, and their subsequent use as sources of natural fertilizers.

13. Maintenance of optimal vegetation during rainy periods, contributing to absorption of nitrates from the soil and thus preventing water pollution with nitrates

Soil cover with vegetation in autumn-winter

This measure is recommended for all arable land. In addition, after sowing crops in autumn, rolling is not recommended, especially on land vulnerable to erosion and in conditions of high humidity.

During the winter, it is recommended that the soil be covered with vegetation (autumn crops) or remain unprocessed as stubble, or covered with vegetable mulch. Among the plants that can be used as cover crops are: peas, vetch, rapeseed or colza, mustard, lupine, sulfine or melilot, and autumn radish. Fields sown with autumn cover plants reduce soil erosion and take up excess nitrogen from the soil. Sowing cover crops helps to reduce nitrogen and phosphorus losses.

Green crops

These are set up immediately after the main crops have been harvested, in summer or autumn. The land is prepared according to the requirements of the crops that will be established in the spring of next year.

During this period, the cover crops absorb surplus mineral elements from the soil, which would otherwise drain down the slopes towards the river and lake network, or percolate into free aquifers. It is generally recommended to use spring cover crops as natural fertilizers.

14. Specific aspects of balanced fertilization under irrigation conditions

On irrigated land, in certain situations, the risk of water pollution with nitrates can increase when they are carried deeper into the soil. This is either due to higher doses of fertilizers applied to irrigated crops, or the existence of optimal humidity conditions in the soil for a longer period that favour the mineralisation of organic matter and the formation of nitrates.

Under irrigation conditions, there is a high risk of water pollution from nitrates, depending on a number of factors, such as the abundance of nitrates in the soil, the amount of water applied, the irrigation method used, the soil characteristics (especially permeability and retention capacity of water), as well as the amount of nitrates taken up by the crop.

The more permeable the soil and the lower its retention capacity, the higher the risk of nitrate pollution. Such conditions are found on coarse-textured soils (sandy soils) when the groundwater level is shallow (about 2 m), and when crops are intensively cultivated and receive high doses of nitrogen fertilizers. They are usually found in river meadows exposed to flooding. On irrigated soils, with medium and fine texture, where groundwater is located at depths more than 2 m, the risk of dissipation of nitrates into the environment is much lower.

To prevent nitrate pollution on irrigated land, the following measures are recommended:

- the irrigation technique and quantities of water applied should be chosen according to the soil characteristics;
- irrigation should be applied as evenly as possible to avoid the formation of areas with excess water, where surface leaks may occur;

- the time of irrigation should be chosen so that the crop suffers from a slight water deficit, because in such a situation the applied water is consumed very intensely;

- measures should be applied to stimulate the formation of a highly developed root system, able to explore a larger volume of soil and to use water and nutrients more intensively;

- a more suitable irrigation method should be adapted to reflect the soil and topography of the land, the quantity and quality of available water, crop requirements and climatic conditions in the area;

- on soils with high permeability, gravity flow irrigation is not recommended, with a preference for localised drip irrigation or mini-sprinklers.

15. Required documents to record measurements in zones vulnerable to nitrate pollution

It is recommended that evidence documents of agricultural lands be prepared and completed so as to allow the authorities responsible for state supervision and control in the field of environmental protection and natural resources to establish:

- the surface area of the farm;
- for each land parcel included in the farm:
    - the type and quantity of any chemical fertilizer applied in the field, the amount of nitrogen contained and the date of application;
    - the type and quantity of any organic fertilizer applied in the field (other than that left by the animals) and the date of application;
- each type of organic fertilizer applied (other than that left by the animals), specifying its nature (compost, livestock manure, urine, sludge, liquid manure, semi-liquid manure, liquid organic fertilizer, sewage sludge) and the species of livestock from which it comes;
- all crop types, the date on which they were sown and the date of harvest;
- the farm's herds by species and category of production, their identification and registration, the records of the herds, as well as the period of time in which the animals are kept on the farm;
- the quantity of any type of fertilizer of animal origin and its nature (manure, urine, sludge, liquid manure, semi-fluid manure, liquid organic fertilizers, sewage sludge) exported / imported from/on the farm, date of export/import as well as the name and address of the recipient/supplier;
- storage capacities for livestock manure (at farm level and/or on communal landfills, permanent / non-permanent landfills) correlated with the minimum requirements imposed by the periods of interdiction in the fertilizers' application.

It is also recommended that each farm have the following documents:

- a document that confirms the ownership of the livestock farm, property;

- an information sheet (or factsheet) detailing the livestock farm, property according to Tab. no. 1, Annex no. 2;

- a description sheet (or factsheet) of the livestock farm, property according to Tab. no. 2, Annex no. 2;

- a calculation sheet (or factsheet) of the amount of manure produced by the livestock farm, property according to Tab. no. 3, Annex no. 2;

- a bordereau (detailed statement) with a record of the organic fertilizers distributed outside the farm, property according to Tab. no. 4, Annex no. 2;

- an annual fertilization plan according to Tab. no. 5, Annex no. 2.

It is also recommended that any record relating to the farm should be kept for a period of 5 years from the last registration made in the document.

Annex no. 1

Table 1.

Manure production and required storage capacity for various livestock maintenance systems - table taken from the "Manure storage system. Farm standards" Guide

Manure production in various cattle maintenance systems					
Livestock category	Maintenance system	Bedding [kg/livestock /day]	Type of livestock manure result	Manure production, including bedding [kg/ livestock/day]	Storage capacity1 [m3/ livestock / month]
Free lairage					
Calves	Deep litter, collective boxes	1 - 2	Solid livestock manure	6 - 10	0.25 - 0.40
	Grill floor, animal care in groups	-	Semi-liquid manure	7 - 12	0.25 - 0.45
Heifers	Deep litter	3 - 5	Solid livestock manure	20 - 25	0.75 - 0.95
	Deep litter in the rest area, concrete floor in the defecation area	2 - 4	Solid livestock manure	20 - 26	0.70 - 0.90
	Individual berths with bedding, concrete floor in the defecation area	2 - 3	Solid livestock manure	18 - 26	0.65 - 0.95
Steers	Deep litter	3	Solid livestock manure	28 - 38	1.10 - 1.4
	Deep litter in the rest area, concrete floor in the defecation area	2 - 3	Solid livestock manure	28 - 40	1.0 - 1.3
	Grill floor	-	Semi-liquid manure	30 - 40	0.9 - 1.3

	Deep litter, self-cleaning floor with 8% slope	2 - 3	Solid livestock manure	28 - 38	1.05 - 1.4
Dairy cows	Deep litter in the rest area, concrete floor in the defecation area	4 - 5	Solid livestock manure	40 - 50	1.4 - 1.8
	Deep litter in the rest area, grill floor in the defecation area	3 - 5	Solid livestock manure + semi-liquid manure	30 - 35 oct.15	1.1 - 1.3 0.3 - 0.5
	Deep litter in the rest area, self-cleaning floor	4 - 6	Solid livestock manure	45 - 50	1.6 - 1.9
	Individual berths with bedding, concrete floor in the defecation area	2 - 3	Solid livestock manure	45 - 50	1.6 - 1.9
	Individual berths, grill floor in the defecation area	-	Semi-liquid manure	40 - 52	1.20 - 1.60
Tied lairage system					
Calves	Deep litter (in group)	1 - 2	Livestock manure	6 - 10	0.25 - 0.40
	Grill floor (in group)	-	Semi-liquid manure	7 - 12	0.25 - 0.45
Steers	Stalls with bedding	1 - 2	Livestock manure	28 - 35	1.0 - 1.3
	Stalls without bedding, channel covered by grill	-	Semi-liquid manure	30 - 40	0.9 - 1.2
Heifers	Stalls with bedding	1 - 2,5	Livestock manure	18 - 23	0.8 - 1.0
	Stalls with bedding, channel covered by grill	-	Semi-liquid manure	20 - 27	0.6 - 0.8
Dairy cows	Stalls with bedding	2 - 3,5	Livestock manure	45 - 55	1.5 - 1.9
	Stalls without bedding, continuous self-cleaning system covered with grills	-	Semi-liquid manure	40 - 45	1.2 - 1.5

1 the capacity of liquid fractions is included

Manure production in various porcine maintenance systems					
Livestock category	Maintenance system	Bedding [kg/livestock/ day]	Manure type	Manure production, including bedding [kg/ livestock/day]	Storage capacity [m3/livestock/ month]
Boar	Solid floor with bedding	3 - 4	Solid livestock manure	12 - 16	0.5 - 0.7
Dry pregnant sows	Deep litter	2 - 3	Solid livestock manure	10 - 14	0.45 - 0.6
	Deep litter in the rest area, concrete floor in the defecation area	0,8 - 1,2	Solid livestock manure	12 - 17	0.45 - 0.65
	Solid floor in the rest area, grill floor in the defecation area	0,1 - 0,25	Semi-liquid manure	10 - 15	0.3 - 0.45
Farrowing sows	Solid floor in the rest and defecation area	4 - 5	Solid livestock manure	14 - 16	0.6 - 0.7
	Floor partially or completely covered with grill.	0,05 - 0,1	Semi-liquid manure	15 - 20	0.45 - 0.6
Weaners	Deep litter	0,5 - 1	Livestock manure	2 - 3	0.15 - 0.2
	Rest area with bedding, solid floor in the defecation area	0,15 - 0,3	Livestock manure	1.5 - 2.5	0.1 - 0.15
	Grill floor	0,05 - 0,1	Semi-liquid manure	1 - 2	0.09 - 0.1
Pigs	Deep litter	1 - 3	Livestock manure	4 - 7	0.25 - 0.35
	Rest area with bedding, solid	0,3 - 0,5	Livestock manure	3 - 5	0.2 - 0.4

	floor in the defecation area				
	Floor partially covered with grill	0,05 - 0,1	Semi-liquid manure	5 - 8	0.15 - 0.25

Manure production in various poultry maintenance systems					
Poultry category	Maintenance system	Bedding [kg/livestock/ day]	Manure type	Manure volume, without bedding [m3 /1.000 poultry/month]	Storage capacity2 [m3/1.000 poultry/month]
Broilers	On the ground	0.080	Solid manure	3.0	3.8
Grower chickens	On the ground	0.120	Solid manure	4.7	5.0
Layer chickens	in batteries	0.220	Collected manure (no bedding)	8.2	8.2
Mature ducks	On the ground	0.500	Collected manure (no bedding)	20.6	22.0
Broiler ducks (at the end of fattening)	On the ground	0.500	Collected manure (no bedding)	18.7	18.7
Broiler ducks (at the end of fattening)	On the ground	0.500	Solid manure	18.7	20.0
Mature Turkeys	On the ground	0.430	Solid manure	16.0	18.0
Yearling Turkeys	On the ground	0.350	Solid manure	13.0	14.8
Mature geese	On the ground	0.960	Solid manure	36.00	41.0
Broiler geese (at the end of fattening)	puddle	0.900	Collected manure (no bedding)	33.0	33.0
	On the ground	0.900	Solid manure	33.0	36.0

2 Straw has been considered as bedding

Manure production in various equidae maintenance systems					
Livestock category	Shelter system	Excrement + bedding	Manure type	Manure production, including bedding	Storage capacity

		[kg/live-stock/ day]		[kg/live-stock/day]	[m3/live-stock/ month]
Yearlings over one year (400 kg)	Bedding	17 + 5 kg bedding	Manure	22	1.0
Mares, stallions, geldings (600 kg)	Bedding	25 + 5 kg bedding	Manure	30	1.38

Manure production in various sheep maintenance systems					
Livestock category	Shelter system	Bedding [kg/live-stock/ day]	Manure type	Manure production, including bedding [kg/live-stock/day]	Storage capacity [m3/live-stock/ month]
Lambs of 3.5 months	Bedding	0.3	Manure	1,5	0.050
Sheep of 12 months	Bedding	0.4	Manure	2,5	0.083
Ewes, rams and wethers of 12 months	Bedding	0.5	Manure	2,8	0.093
Rams and wethers	Bedding	0.4	Manure	4	0.133
Livestock category	Shelter system	Bedding [kg/live-stock/ day]	Manure type	Manure production, including bedding [kg/live-stock/day]	Storage capacity [m3/live-stock/ month]

Table 2.

Standard weight, number of days of rearing, total amount of nitrogen excreted by an animal during a year corresponding to different species of animals and rearing systems

Livestock species/ Rearing system	Typical weight (kg)	Number of days of rearing (zile)	Amount of excreted nitrogen per day kg N day-1 (1,000 kg animal)-1	Total amount of nitrogen excreted by an animal during a year (kgN year-1)
1	2	3	4	5
Dairy cows - intensive system	500	365	0.48	87.6
Dairy cows – medium system	500	365	0.4	73.0
Dairy cows - household system	500	365	0.35	63.9

Dairy cows-buffaloes	500	365	0.32	58.4
Heifers	350	365	0.47	60.0
Bullocks – male bovines over 2 years	500	365	0.35	63.9
Cattle - bovines 1-2 years	375	365	0.44	60.2
Calves – bovines less than 1 year	250	200	0.384	19.2
Piglets under 20 kg	20	70	1.785	2.5
Pigs 20-50 kg - household system	40	50	0.9625	1.9
Pigs 20-50 kg - medium system	40	50	0.9275	1.9
Pigs 20-50 kg - intensive system	40	50	0.8925	1.8
Gilts and sows - household system	175	365	0.46	29.4
Gilts and sows - medium system	175	365	0.44	28.1
Gilts and sows - intensive system	175	365	0.42	26.8
Fattening pigs - household system	70	120	0.55	4.6
Fattening pigs - medium system	70	120	0.53	4.5
Fattening pigs - intensive system	70	120	0.51	4.3
Sheep	50	365	0.9	16.4
Goats	40	365	1.28	18.7
Equidae	500	365	0.3	54.8
Broilers - intensive system	1.6	60	0.55	0.05
Broilers - medium system	1.5	90	0.6	0.08
Broilers - household system	1.4	120	0.6	0.10
Layer chickens - intensive system	1.8	365	0.96	0.63
Layer chickens - medium system	2	365	0.85	0.62

Layer chickens - household system	2.2	365	0.82	0.66
Other chickens/ young/ roosters - intensive system	3	305	0.82	0.75
Other chickens/ young/ roosters - medium system	2.8	275	0.82	0.63
Other chickens/ young/ roosters - household system	2.6	245	0.82	0.52
Turkeys (toms / hens)	10	170	0.74	1.26
Ducks	3.5	365	0.85	1.09
Geese	6	365	0.82	1.80

Table 3.
Coefficients for the conversion of the number of animals into Large Livestock Units (applied for cows) in terms of manure volume - table taken from the "Manure storage system. Farm standards" Guide

Livestock category	Average body weight (kg)	Coefficient of conversion
BOVINE		
Dairy cows	500	1
Dairy cows	600	1.2
First-calf heifers	450	0.9
Heifers of 12-18 months	350	0.7
Heifers of 6-12 months	250	0.5
Calves of 6 months	100	0.2
Steers of 12 months	375	0.8
Bulls	900	1.8
PORCINE		
Sows	175	0.35
Boars	200	0.4
Piglets less than 8 weeks	10	0.02
Weaners of 2-4 months	35	0.07
Pigs	70	0.14
EQUIDAE		
Stallions	600	1.2
Mares and geldings	600	1.2

Yearlings over 2 years		500	1
Yearlings over 1 year		400	0.8
Yearlings of 6-12 months		300	0.6
Yearlings less than 6 months		150	0.3
SHEEP			
Ewes, rams and wethers of 12 months		60	0.15
Lambs of 3.5 months		25	0.05
Sheep of 12 months		50	0.1
Rams and wethers		100	0.2
POULTRY			
Adult layer chickens		1.8	0.0036
Adult chickens for slaughter		3.2	0.0064
Broilers		1.6	0.0032
Adult turkeys, type/ average weight			
•	Toms	13	0.026
•	Hens	7	0.014
Adult Ducks		3.5	0.007
Adult Geese		6	0.012

Table 4.

Total amount of nitrogen in the livestock manure applied to fields during a year, corresponding to the different species of animals and rearing systems

Livestock species	Amount of nitrogen from freshly applied manure in the field without storage period (during permitted periods)		Amount of nitrogen in the manure plied to fields	
	Solid	Liquid	Solid	Liquid
	KgN/year	KgN/year	KgN/year	KgN/year
(1)	(2)	(3)	(4)	(5)
Dairy cows - intensive system (farms with more than 50 cows)	64.77	72.07	45.90	51.07
Dairy cows - medium system (farms with 10-49 cows)	54.49	60.64	40,00	44.36
Dairy cows- household system (farms with 1-9 cows)	48.27	53.80	36.42	40.59
Dairy cows-buffalos	44.50	49.54	33.66	37.48
Heifers	41.84	46.55	29.83	33.19

Bullocks – male bovines over 2 years	44.40	49.48	31.62	35.24
Cattle – bovines between 1-2 years	41.96	45.83	29.92	32.67
Calves – bovines less than 1 year	25.15	20.20	18.14	14.57
Farrowing sows with piglets - household system (farms with 1-49 pigs)	27.09	30.13	23.47	26.10
Farrowing sows with piglets-medium system (farms with 50-999 pigs)	27.35	30.40	23.07	25.35
Farrowing sows with piglets - intensive system (farms with over 1,000 pigs)	27.48	30.57	22.62	25.15
For farms specialising in raising pigs only on a certain weight segment				
• Pigs under 20 kg weight	2.29	2.54	1.84	2.04
• Pigs 20-50 kg - household system (farms with 1-49 pigs)	1.58	1.75	1.34	1.49
• Pigs 20-50 kg - medium system (farms with 50-999 pigs)	1.61	1.80	1.33	1.48
• Pigs 20-50 kg - intensive system (farms with over 1,000 pigs)	1.64	1.82	1.31	1.46
• Fattening pigs (over 50 kg) - household system (farms with 1-49 pigs)	3.78	4.21	3.21	3.57
• Fattening pigs (over 50 kg) - medium system (farms with 50-999 pigs)	3.86	4.31	3.18	3.56
• Fattening pigs (over 50 kg) - intensive system (farms with over 1,000 pigs)	3.93	4.36	3.15	3.50
For farms that raise pigs for the entire life cycle				
• Pigs - household system (farms with 1-49 pigs)	7.65	8.50	6.39	7.1
• Pigs - medium system (farms with 50 - 999 pigs)	7.05	7.87	5.85	6.53
Sheep	13.96		13.96	
Goats	15.88		15.88	
Horses	46.54		46.54	

Broilers - intensive system (farms with over 3000 birds)	0.03		0.03	
Broilers - household and medium system (farms less than 3,000 birds)	0.05		0.05	
Layer chickens - intensive system (farms with over 3,000 birds)	0.32		0.32	
Layer chickens - household and medium system (farms less than 3,000 birds)	0.30		0.30	
Other chickens (hens)/ chickens/ roosters - intensive system (farms with over 3,000 birds)	0.38		0.38	
Other chickens (hens)/ chicken/ roosters - household and medium system (farms less than 3,000 birds)	0.24		0.24	
Turkeys	0.57		0.57	
Ducks	0.49		0.49	
Geese	0.81		0.81	

Annex No. 2

Table 1.

Information sheet (or Factsheet) of the farm, property

Commune, village		
Farm, owner		
Area of agricultural land, ha of which:		
by category of use	arable	
	pastures	
	grassland	
	vines	
	orchards	
Number of plots making up the agricultural land area		
Farm, property type		Vegetable, animal husbandry etc.
Range/variety of agricultural crops used		
Animal species raised		- bovine

	- pigs - sheep + goats - equidae - poultry

Table 2.

Property, farm livestock (as livestock herd) description sheet (or Factsheet)

Commune		
Farm, owner		
ANIMAL SPECIES THAT REPRESENT LIVESTOCK HERD		
Adult bovines	number	
Young bovines		
Pigs		
Sheep+goats		
Equidae		
Poultry		
the livestock and poultry breeding system		

Table 3.

Sheet (Factsheet) for calculating the amount of manure from the property, farm livestock

Commune, village					
Farm, owner					
Species	Number	The resulting amount of manure in 24 hours, kg/per capita	Total amount of manure, tonnes/year	From which:	
				During the lairage period, tonnes/year	during grazing periods, tonnes/year
Adult bovines					
Young bovines					
Pigs					
Sheep+goats					

Equidae					
Poultry					
Total					

Table 4.

The bordereau (detailed statement) with a record of the organic fertilizers distributed outside the farm, property

A. Producer	
First and last names	
Address	
Amount of fertilizer delivered, tonnes	
Type and origin of fertilizer	
Delivery date	
B. Acceptor	
First and last name	
Amount of fertilizer accepted, tonnes	

Table 5.

Fertilization plan

Farmer's first and last names/ Trading company _____

Farmer's residence/ headquarter of the company (village, commune, district) _____

Farm (name, address) _____

Parcel		Crop	Amount of nitrogen planned (kg N)	Nitrogen fertilizers applied							Date of application
				Organic			Mineral			Amount of nitrogen applied (kg N)	
Nr.	Area (ha)			Type	Amount (tonnes)	Nitrogen (kg N)	Type	Amount (tonnes)	Nitrogen (kg N)		
1	2	3	4	5	6	7	8	9	10	11	12

Total											

Note for calculating the amount of nitrogen:
- The amount of nitrogen planned (column 5) means the maximum amount of nitrogen that can be applied on agricultural land in accordance with the maximum standards for the application of nitrogen fertilizers provided by the Code of Good Agricultural Practices.
- The amount of nitrogen in the organic fertilizers applied (column 8) = The amount of organic fertilizers applied (column 7) x specific nitrogen content (kg N s.a./tonne);
- The amount of nitrogen in the mineral fertilizers applied (column 11) = The amount of mineral fertilizers applied (column 10) x specific nitrogen content (kg N s.a./tonne).
- The total amount of nitrogen applied to agricultural land (column 12) = The amount of nitrogen in the organic fertilizers applied (column 8) + the amount of nitrogen in the mineral fertilizers applied (column 11);
- The average amount of nitrogen applied per unit area - kg N s.a./ha (column 13) = Total amount of nitrogen applied to agricultural land related to the area of agricultural land fertilized with nitrogen (column 12: column 3).

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