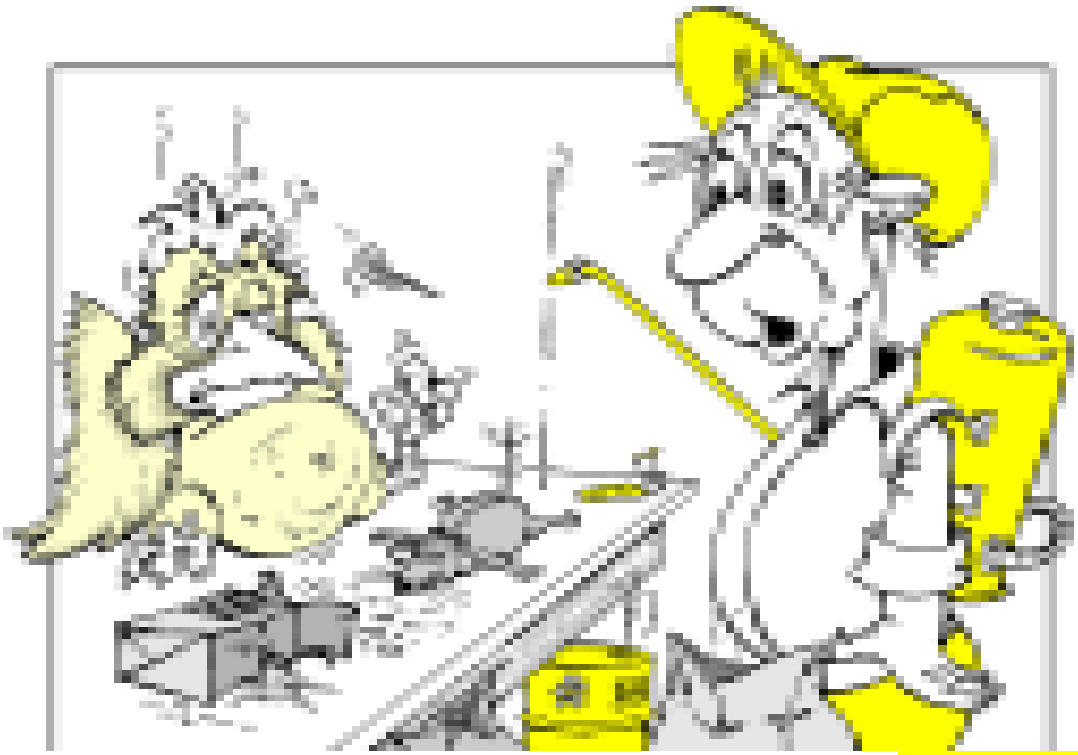
4. PLANT PROTECTION



4.1. INTRODUCTION

Plant protection is a branch of crop production that studies biology and ecology of harmful organisms of agricultural crops, and develops methods to control and to prevent the damage to crops and losses of yield.

Different methods – biological, agrotechnical, chemical, mechanical, integrated – are used for the control of pests and diseases of agricultural crops.

Biological methods – use of biological plant protection products (PPP) in order to control and prevent damage of crops by harmful organisms, to improve conditions for natural enemies of pests, and use of biologically active compounds to attract and control pest insects, use of the biological active compounds with antagonistic properties against plant pathogens in agrocenosis. However, any possible indirect adverse impact on the environment should be taken into account in use of biologically active compounds.

Agrotechnical methods – use of resistant varieties against pests and diseases. Implementation of a proper crop rotation system, of appropriate soil tillage technologies to prevent reservation of pests and diseases in plant residues and weeds. Management of crop growing conditions – optimal fertilisation, optimal sowing time, and harvesting – improves the competitiveness of crops against pests, diseases, and weeds.

Mechanical method – mechanical collection and elimination of pests and diseased plants, mechanical weeding and other kinds of mechanical control of harmful organisms.

Chemical method – use of synthetic chemical PPP in order to control harmful organisms for agricultural crops. In most cases the synthetic chemical compounds are not environmentally friendly. Thus, it is necessary to consider the risk of environment pollution caused by PPP, that directly or indirectly endangers human health, flora and fauna.

Integrated plant protection includes all mentioned specific crop protection methods. It is based on a sound knowledge about biology of pests, diseases, weeds, and management of growth conditions to improve the competitiveness of crops against pests, diseases, and weeds.

Integrated pest management including agro-technical, mechanical and biological methods uses *chemical PPP* as little as possible as compared to the chemical method. It involves a chemical control if it is not possible to prevent yield losses and the decrease in yield quality. Applying PPP the most selective products should be carefully chosen. The decision to use PPP must be based on forecasting and warnings of the development of pests and diseases and their critical economical thresholds to decrease the negative impact on the flora and fauna as much as possible.

Control measures planned for each field separately can significantly reduce the necessity of treatments with pesticides. Unclear questions should be discussed with plant protection specialists and advisors.

Information provided by forecasting and diagnostic services and weather information should be used regularly to reduce unnecessary treatments of fields with PPP.

First of all the following issues should be analysed and solved both on the State level and on level of individual farms to ensure compliance with Latvian legislation, EU Directives, and HELCOM Recommendations: **Registration of PPP, application and storage of PPP, quality of spraying equipment, alternative plant protection methods in order both to decrease the use of PPP for the protection of agricultural crops and to reduce the amount of PPP residues in agricultural production.**

4.2. REGISTRATION AND TRADING OF PLANT PROTECTION PRODUCTS

56. It is allowed to use only registered PPP that are included in the list of permitted plant protection products.[15]

New registered products are included in the list of permitted PPP once a year.

57. All users of plant protection products shall be familiar with Plant Protection Law[6] and with Rules of Application and Trading of Plant Protection Products.[16]

4.3. APPLICATION OF PLANT PROTECTION PRODUCTS

58. Only specially trained persons and organisations that have obtained a certificate of competence may work with pesticides. Their training and knowledge shall be regularly complemented to avoid any risk in applying PPP.

Practical guidelines

Farmers and experts of agricultural service organisations should attend special courses on new registered products annually.

Assessment of harmful organisms and economically critical threshold in agricultural production should be carried out in each farm.

Once the PPP use is decided in a farm, every user shall be well acquainted with information

[15] Register of PPP
[6] Law of Plant Protection
[16] Rules of trading and applying PPP

regarding each particular product:

- recommended dose and concentration of spraying liquid;
- spraying time or the stage of crop growth when PPP can be used;
- selection of specific diseases, pests, and weeds;
- timing of PPP application;
- time lag between last application and harvesting;
- time lag between last application and handwork;
- all recommended safety measures should be noticed to avoid exposure of PPP;
- emergency first aid.

Pesticides shall be chosen with consideration of the specific diseases, pests, and weeds and with the minimal harm to the environment. The use of selective PPP is recommended when possible.

The use of pesticides is not advisable when plants are in lack of water, because the effectiveness of PPP depends to a great extent on weather conditions.

The most of the pesticides should be applied early in the morning or in the evening in conditions of high air humidity and low air temperature.

The use of PPP is forbidden within the 10 m protection belts of wells, water supply zones, surface waters, and surface reclamation ditches[5].

It is forbidden to treat the flowering plants with pesticides, except treatment of winter rape with pyrethroids, if it is done early in the morning before bees are in the field.

Bee-keepers shall be informed personally by the farmer about the place and time of field treatments at least in the radius of 2 km.

During the use of herbicides it is important to consider the direction of wind to protect the nearby sensitive crops from drift of herbicides.

If it is possible, application of PPP should be localised on the field edges or habitation sites of harmful organisms.

On large fields rates of pesticides shall be differentiated considering the intensity and location of diseases and pests. For crops cultivated in rows, if technologically possible, herbicides should be applied row by row, significantly reducing the amount of herbicides.

Mixing different pesticides or mixing pesticides with liquid fertilizers if it is technologically possible and if not against recommendations and instructions for use can reduce the times of treatment.

The PPP liquid for spraying should be prepared on the field according to the instructions of the distributing company.

The treated seed shall be cultivated into the soil very accurately to avoid poisoning of the wild animals.

The amount of liquid for spraying should be exactly calculated. Avoid excessive spraying of liquid. Empty containers shall be rinsed and the used water shall be added to spraying liquid.

Foam markers should be used to avoid double spraying.

Technological tracks should be established for cereals and rape in the fields.

59. All data about the applied plant protection products shall be registered in a special diary.

Additional information

Additional information about the system of recording is available at the Regional Plant Protection Inspectorate.

[5] Law of Protection Belts

Practical guideline

All data about the plant protection treatment, i.e. crops, area, spraying time/date, agent and dose, should be adequately registered.

Doses for herbicide spraying should be determined only after registration of the specific type of weed in the field, as well as after assessment of the spread of dominant weed plants per square metre.

Before spraying against diseases it should be examined whether the economically critical thresholds are exceeded.

4.4. STORAGE OF PLANT PROTECTION PRODUCTS

60. Pesticides shall always be stored in a storage that is accessible only for the user. The storage has to be constructed to eliminate any risk for the environment. The PPP should be stored only in the original containers.

Practical guidelines

Storage for pesticides shall always be locked to prevent children and strangers from entering. All members of family should be informed about the purchased PPP.

The storage shall be fireproof.

Any leakage from damaged packages shall be collected in the storage, thus to eliminate any risk for the environment. Instructions for the disposal of empty containers are provided on the label of the specific product.

Containers shall not be burnt, buried in the ground or disposed of with other wastes.

Empty containers cannot be used for other purposes.

Pesticides shall not be stored together with food, drinks, and forage.

4.5. SPRAYERS

61. Only specially trained and qualified persons that possess a certificate shall work with pesticides on the fields.

Authorised service stations should be established in local municipalities for a regular control and maintenance of sprayers, and to issue certificates for their use.

Practical guidelines

The prospective user shall be very familiar with the functioning of each particular device, i.e. nozzle, spraying angles, and a proper distance to the crop.

Considerable attention shall be maintained during the whole treatment.

The amount of liquid spread on the square unit is very important to observe, and it differs for different crops and products.

Before farming season calibration of nozzles shall be carried out with clean water. The volume of the sprayed liquid should be measured by switching on the pump for 1 minute.

After use it is mandatory to wash the equipment. It should be carried out on the treated field, and washing water shall be spread on the same field.

Sprayers should be filled far enough from any watercourses or drainage systems with no risk for polluting through spilling.

Water for the sprayer should be available from a tank on the field of the treatment.

All instructions and safety measures shall be strictly observed.

4.6. ALTERNATIVE CROP PROTECTION METHODS

62. Agricultural production should be managed in a way to prevent plants from diseases, pests, and weeds in the due time thus decreasing the necessity for the use of pesticides.

All alternative plant protection methods should be practised.

Qualitative seed should be used on healthy soil to prevent a fast development and spread of diseases and to avoid unnecessary use of pesticides.

Crops most suitable to the specific soil type, topography, and the climatic conditions should be preferred.

A balanced crop rotation and an improvement of the growing conditions is an important prerequisite to limit the use of pesticides.

Crops should be chosen considering the level of their resistance to diseases, pests and weeds.

The work on the fields should be performed at the optimal time.

The treatments should not be implemented without a thorough analysis on their necessity.

The treatment should be based on the principle of thresholds. Non-use of chemicals should be considered as a priority. At least twice a week estimation of the field's condition should be performed. Lower rates of pesticides can be applied in early stages of development of weeds and diseases.

All treatments should be performed to consider the risk for environment pollution.

Biological PPP should be used whenever possible.

4.7. SAFETY MEASURES

63. All information about safety measures and emergency first aid must be available before starting work with PPP.

Practical guidelines

Farmers can obtain information about safety measures during the compulsory courses.

Instruction on the label should be read before opening a package or container. It is recommended to read it several times. All instructions and safety measures shall be observed.

All individual safety means and clothing should be obtained and used.

All family members should be informed about pesticide treatment time and place.

Detailed information about pesticide treatments shall be recorded in a journal.

5. WATER RESOURCES

5.1. INTRODUCTION

Agriculture is the main source of the river run-off pollution contributing nitrogen loads to the Gulf of Riga and the Baltic Sea. Also a considerable part of phosphorus loads is of an agricultural origin. The nutrient run-off causes pollution of surface and groundwater with nitrates and contributes eutrofication or development of water plants, mainly algae. Thus, it decreases the water quality. Pollution from silo effluents, slurry and pesticides, is very dangerous for the water-bodies.

***Table 16.* Biological oxygen demand of pollution sources (mg/l)**

Pollution source	BOD, mg/l
Treated municipal waste water	5 – 70
Untreated municipal waste water	300 – 400
Run-off from settlements	45 – 115
Agricultural run-off	5 – 190
Leakage from pig slurry storage	3100 – 3500
Pig slurry	20000 – 30000
Leakage from cattle slurry storage	2100 – 2300
Silage	50000 – 52000

Nutrient and other pollutant leakage with run-off depends from water balance. Deep percolation is typical for soil water balance in Latvia.

Water balance includes precipitation, evapotranspiration, run-off and water storage in the soil. Average precipitation in Latvia is 700 mm; evapotranspiration – 450 mm. Excess water causes run-off (about 250 mm in a normal year). In some years the soil water storage increases, in other years decreases, therefore run-off might be smaller or greater than the net precipitation. Total run-off consists of surface run-off, drainage run-off and flow from groundwater. Water balance has temporal variations within a year. In the figure below the monthly net precipitation (run-off and water deficiency) is depicted for three regions of Latvia.

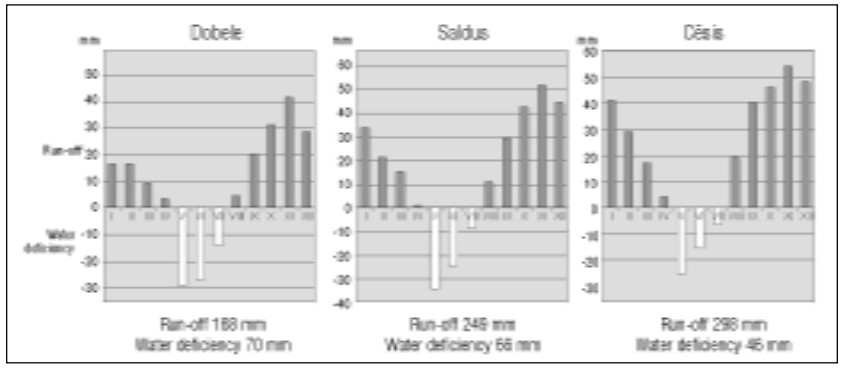


Figure 6. Run-off and water deficiency in different regions of Latvia

Leakage of the plant nutrients means the nutrient transport away from the crop root zone due to the water flow in soil. It is natural to all soils in Latvia, and considering the deep percolation most intensive leakage occurs during spring and autumn. Intensive agriculture, application of fertilizers, and land drainage increase the leakage of plant nutrients. Light (sandy) soils with low content of organic

matter and higher acidity have the highest leakage potential. During the water percolation through the soil many chemical elements are transported, and the amounts of elements depend on the buffering capacity of the soil. The evaluation of the environmental impact and agricultural considerations indicates that the leakage of nitrogen and phosphorus has the most negative impact.

5.2. MANAGEMENT OF THE WATER RESOURCES

In most cases, all human activities have impact on the water resources, i.e. water quantity and quality. Thus, restrictions on water use have been implemented for preservation and control of the water resources. 'Water use' relates to the operations fostering a decrease in the water quality or quantity characteristics.

64. All human activities regarding water use that have impact on the water resources, i.e. waste water treatment and discharge, water use for irrigation, construction of reservoirs, extraction of groundwater, etc., have to be examined. Water Use Permits must be received from the Regional Environmental Boards or Environmental State Assessment Board.

Practical guidelines

Water Use Permit is mandatory if

- the use of surface water is more than 20 m^3 day^{-1};
- the abstraction of groundwater exceeds 20 m^3 day^{-1} or extraction depth is more than 20 m;
- the point discharge of waste water is more than 5 m^3 day^{-1};
- the aforementioned limitations have not been exceeded, however an essential impact on the environment or water resources quality or quantity could appear.

5.3. DRAINAGE

Drainage is an important precondition for agricultural use of land. About 75–90 % of arable land in Latvia depending of crop conditions has imperfect drainage status. Moreover, drainage systems provide appropriate circumstances in the exploitation of roads, residential areas, forests, etc. Average drainage run-off is 210 mm in spring and autumn of a normal year. Of course, in wet years the need for land drainage might be considerably higher.

For stable and high yields most of the arable land in Latvia has to be drained with tile drains. Drainage construction is expensive. However, a regular maintenance and reparation of the drainage systems is cheaper to compare with reconstruction or renovation of damaged drainage systems.

The land reclamation systems relating to their use and ownership are as follows:

- **state** land reclamation systems and structures: rivers, water reservoirs, dams, pump stations, floodgates, and other significant structures that are maintained by state land reclamation services;
- **public** land reclamation systems and structures: main channels and hydro technical structures used for land drainage of several owners;
- **private** land reclamation systems and structures: channels, subsurface drainage, drainage channels, interception channels, and structures used for land drainage of a single farm.

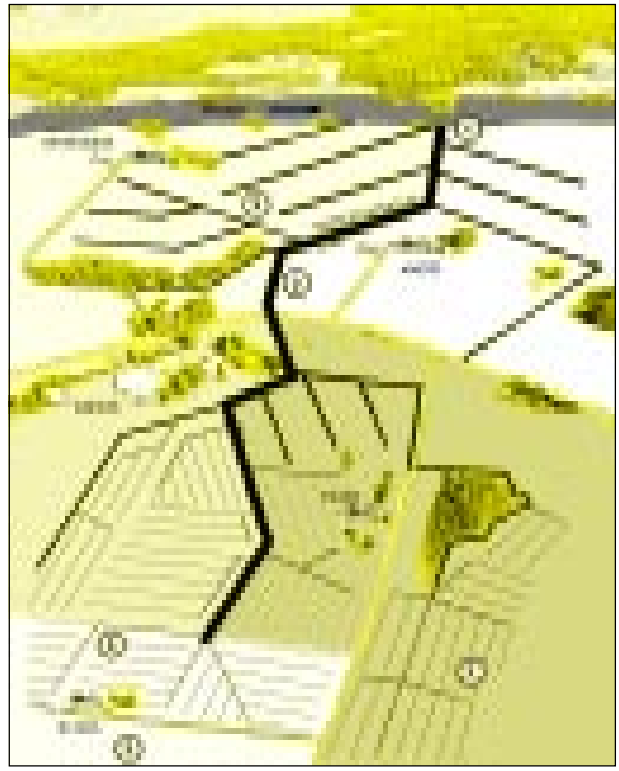


Figure 7. Types of land reclamation systems: *1 – state; 2 – public; 3– private.*

During the land privatisation a landowner has to receive a passport of the drainage systems with the Instructions on Maintenance of the Land Reclamation Systems and Structures.

65. The landowner (user) is responsible for a proper use and maintenance of the drainage systems in his ownership. The disposal of excess water to neighbouring land, if this action can have a negative impact on the natural drainage situation, is not allowed. The landowner (user) has a right to hold and use the stream flow on his land (except public rivers), if this action does not interfere with drainage of other ownership or cause the damage to other owners.[17]

Practical guidelines

The Drainage Associations shall be established for maintenance and repair of the public and private land reclamation systems and structures. The most common maintenance works in the drainage systems of farmland are following:

- regular removal of the sediments and sludge from drainage chambers and filters. Sediments can enter pipe and clog the main lines of drainage. Drainage chambers should be covered with lid to protect from litter and prevent animals from falling in;
- a supervision of the drained area should be performed every year after spring floods. Surface evidences of failure of tile drains (seepage of water, permanent wetness of the soil, water erosion holes) should be investigated to find damaged tile drains. Drainage outlets should be controlled every year after spring floods. Water seepage along the pipes and washout of soil has to be prevented, silt should be cleaned from the outlet. Drainage reparation should be carried out during dry season, when it is easy to excavate the trench in damaged drainage lines;
- removal of sediments and litter from channel bed, cutting of grass, and reparation of the washouts in slopes of channels;
- surface run-off control with proper soil management, land levelling and furrows for interception of run-off, installation of additional filters for surface water on drain lines.

Use of heavy machinery should be avoided during periods with high soil moisture conditions. Otherwise a compaction of soil, decrease of the water percolation through soil, and direct damage to the drainage lines could occur.

5.4. IRRIGATION

In Latvia the crop water needs are not covered by natural rainfall in dry summers or during dry periods in the summer. Water deficiency depends also from the plant available moisture in soil and groundwater table.

It is essential to evaluate the economic viability of irrigation considering the intensity of agricultural land use. Most common irrigated profitable crops in Latvia are vegetables, greenhouse crops, and in some cases pastures and orchards.

66. During irrigation surface run-off causing pollution of water sources and water leakage deeper than root zone should be avoided.

[17] Law on Land Reclamation

Practical guidelines

Sandy soils and vegetables have the highest demand for irrigation. The net irrigation requirement in a normal year (frequency of occurrence is every second year) is 60–150 mm year^{-1} (1 mm = 10 m^3/ha). The exact irrigation requirement can be calculated taking into account crop rotation and the specific climatic region of Latvia.

Sprinkler irrigation is the most common irrigation method used in Latvia. According to the method irrigation water is applied several times during the vegetation period. Irrigation rate depends from soil and crop conditions. Recommended irrigation rates during the first stages of crop vegetation are 10–25 mm, but after crop cover is established – 20–40 mm. The upper limit of the irrigation rate could be recommended for the soils with greater moisture capacity – loam, clay, and in soils rich of organic matter

High irrigation rates causing surface run-off or percolation of water in the deeper sub-soil should be avoided. Surface run-off might cause water erosion and loss of the soil. Water leakage to the sub-soil promotes nutrient leaching from plant root zone.

In favourable site conditions (low slopes, light soils, and sufficient water resources) subsurface irrigation with water table management (with control structures) is recommended. Drainage systems after construction of water level regulation structures can be used for subirrigation.

The drip irrigation and micro sprinklers are recommended in the greenhouses.

5.5. SOIL EROSION

Soil erosion is a natural phenomenon affecting the water quality always and everywhere. Agriculture like other human activities can increase the erosion. Plant nutrients (nitrogen, phosphorus) together with loosed soil particles cause eutrofication of the water sources. Sedimentation of soil particles threatens the spawn ground places of valuable fish species. Turbid water decreases the recreation value of the water sources. Water or wind can also cause erosion (see chapter 1.3.).

67. In areas sensitive to wind erosion formation of large continuous fields should be avoided. Moreover, the woodland has to be preserved and shelterbelts have to be used to decrease the wind erosion.

Practical guidelines

In flat topography sites in Latvia the field size is not recommended larger than 20–60 ha, but in the areas with undulating topography – 10–30 ha. The optimal proportion between margins of the fields is from 1:3 to 1:5.

The shelterbelts contribute to the improvement of the microclimate by increasing of soil and air t°, and by preserving soil moisture that decreases evapotranspiration. Negative impact of the shelterbelts might be observed in spring due to the slower drying of the soil. Roots of the trees also hinder soil tillage close to the shelterbelts. However, the trees and bushes should be preserved wherever it is possible. Location of field borders, channels, roads, and farm buildings have to be considered in the design of the shelterbelts. The effect of the shelterbelts can be measured as a distance equal to 25–30 times average height of trees (250–300m). In the shelter belts trees and bushes shall be arranged in three rows with

distance between trees of 1,25–1,5 m, fast growing species of trees such as black alder should be combined with slow growing trees (oak, maple, ash). Moreover, shade resistant bushes shall be combined with trees to cover the soil and prevent weeds. The shelterbelts improve biodiversity in the rural areas and constitute the habitat for birds and valuable insects.

68. Water erosion by surface run-off should be avoided by ensuring that water from rainfall or snowmelting can percolate in soil or in the drainage systems.

Practical guidelines

Good soil drainage and well maintained drainage systems such as filters and chambers for capture of the surface run-off can decrease erosion. Further surface drainage improvement through land smoothing and shaping decreases surface water flow. Furrows covered with grass are recommended for the interception of surface run-off. Black fallow has the highest erosion risk and is not recommended also from the farming viewpoint because bare soil without vegetation further increases the nutrient leaching.

Consequences of water erosion – run-off of soil particles into water sources might be reduced by the protection belts covered with vegetation (perennial grass, trees, and bushes). Uncultivated protection belts, at least 1,0–1,5 m wide, are recommended along drainage channels.

5.6. PROTECTION OF WATER RESOURCES

Protection belts

Protection belts are designed in certain land areas for protection of different objects from unacceptable outside impact, for their safe maintenance, and for prevention of possible side effects on the environment and human beings.

69. Law determines a list of territories as protection belts in the Baltic Sea and the Riga Gulf coastline and along the rivers and lakes, where landowners and users must follow regulations regarding the environmental protection.[5]

70. The construction of stores for animal feed (except existing hay storages), mineral fertilizers, plant protection products, fuel, oil, chemical substances, wood materials, and storage's of other materials and substances is not allowed in the protection belts of dunes, rivers and lakes.[5]

[5] Law of Protection Belts

Law restricts the construction of new buildings or objects in the protected areas. The construction of manure storages in the protection belts of dunes, rivers, and lakes also should be avoided.

Table 17.* The width of the protection belts in the rural areas

Place	Width of protection belts, m
The Baltic Sea and Riga Gulf coastline (measured from the point where vegetation begin)	300
Dunes of the Baltic Sea and Riga Gulf coastline	Full width of dunes, but not less than 300 m
Daugava, Gauja from Lejasciems to the sea, lakes more than 1000 ha	500
Gauja from headwater to Lejasciems, Lielupe, Venta and other rivers longer than 100 km, lakes of the size from 101 to 1000 ha,	300
Rivers with the length of 25–100 km, lakes of the size from 25 to 100 ha	100
Rivers with the length of 10–25 km, lakes of the size from 10 to 25 ha	50
Rivers with the length up to the 10 km, lakes of the size up to 10 ha	10
Streams and lakes with floodplain	Not less than the width of the floodplain

** the protection belts are established along both banks of the river*

71. Clean cut is prohibited in the belt of dunes as well as in an area of 50 m along rivers and lakes. The land reclamation is not allowed in the belt of dunes and in the area of 10 m along rivers and lakes without a permission of the environmental authorities.[5]

The clean cuts along rivers and lakes could cause soil erosion, nutrient leakage, and pollution of water-bodies. The construction of the land reclamation systems could change the water regime and have an influence on landscape and biological diversity.

72. The placement and construction of buildings, water supply facilities, water level and other hydro technical structures, bathing-places, landing stages for boats and ships, as well as application of fertilizers and plant protection products are prohibited in the protection belt of 10 m along rivers and lakes.[5]

Practical guidelines

Following restrictions are recommended as additional measures for the environmental protection in the agricultural lands, not already prescribed by Law on Protection Belts:

- 7 application of fertilizers and plant protection products along the drainage channels, drainage chambers and surface run-off filters;
- 7 application of fertilizers in the flooded areas with the forecasted spring flood probability of up to 25 % (flooding risk once in 4 years). Application of fertilizers in such areas is allowed only during vegetation period when nutrient uptake of crops is high.

5 Law of Protection Belts

5.7. WETLANDS

A wetland is a permanently or periodically water-saturated or covered area. Wetland consists of marshes, mires, bogs, shallow lakes, river coastlines, and the sea coastline. Wetland reclamation for agricultural use is problematic both from the technical and the economical viewpoint.

73. Wetlands that play key environmental role by contributing to flow regulation, removal of plant nutrients, and preserving of biodiversity should be protected and restored.

Practical guidelines

Due to the poor natural drainage in many wet areas of the agricultural land in Latvia construction of ponds and water reservoirs for self-purification of run-off is recommended. Simple hydrotechnical structures can be used to regulate water level and to promote restoration of wetlands. It is also useful to create the sedimentation basins in the drainage channels through deepening and widening of some parts of the channel bed.

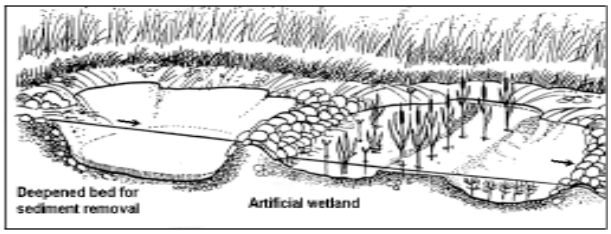


Figure 8. Sedimentation basin with artificial wetland

In the sedimentation basins soil particles transported by run-off get settled and water quality is improved through plants uptake of nutrients. Sedimentation basins have to be cleaned from sediments once in 3-5 years.

5.8. DRINKING WATER SUPPLY

Generally open wells and artesian walls are used for drinking water supply in farms. Open well has a depth of 4-8 m and the shallow ground water is used for abstraction of the drinking water. The shallow ground water is poorly protected against pollution. The water quality depends on hydrogeological and sanitary conditions as well as on the design of the well. The main pollutants of the groundwater are slurry, wastewater and agricultural chemicals. Sandy soil's and other light soils with high percolation of water are most sensitive against pollution. One of the most important drinking water quality characteristics is nitrate nitrogen that can have an agricultural origin and is harmful for human health.

74. The concentration of nitrate in drinking water should not exceed 50 mg/l NO_3

Practical guidelines

When finding the place for an open well it is necessary to take into account the depth and the quantitative availability of water as well as the location of the animal barns, manure storage, and waste water treatment facilities. Location closer than 25 m to such structures is not recommended.

During construction of wells connections between concrete rings have to be filled and the seepage of surface water around the top ring of well has to be prevented. For these purposes densely packed clay has to be used. The well should be covered with a lid.

The pollution and sediments in the bottom of the well decrease quality of the drinking water. Removal of sediments and cleaning of the open well is recommended once in 10–20 years.

An artesian well is recommended to secure a stable and good quality drinking water supply. Drinking water from artesian wells is extracted from deeper groundwater aquifers. The quality of water in artesian wells is considerably higher, although the construction costs of wells are high as well.

75. There should be a 30 – 50 m sanitary protection zone around an artesian well.

5.9. WASTEWATER IN FARMS

With the improvement of living standards in the farms the water supply and sewage systems will be introduced. It will increase the water use for human consumption and the discharge of wastewater causing the problem of wastewater treatment in farms.

Practical guidelines

The amount of the produced wastewater depends on the number of inhabitants and the level of water use in a farm. The wastewater output corresponding each water use pattern is presented in the following table.

Table 18. **Wastewater discharge per capita, day^{-1} in the farm**

Type of housing	Water discharge per capita per day, litres
Living houses with water supply lines and a sewage system without bathroom	80–100
Living houses with water supply lines and a sewage system with bathroom, local water heating	150
Living houses with water supply lines and a sewage system with bathroom, central hot water supply	300

76. Wastewater from farms should be treated before the discharge in the watercourses.

A full-scale wastewater treatment system includes both mechanical and biological treatment.

Practical guidelines

A single household mechanical wastewater treatment system with a septic tank is recommended for settlement of larger solids and sediments. The concrete rings or other concrete structures are used for the construction of the septic tank. The volume of the septic tank must be at lest 3 times larger than the wastewater discharge calculated according the number of inhabitants and the water use per person. For discharge of up to 1 m^3 per day one chamber tank is necessary. If discharge is greater, the septic tank should be divided in two sections. Recommended volume of the first section is ¾ of the total volume. Solids must be periodically pumped out of the tank depending on the load.

77. After the mechanical treatment in appropriate conditions biological treatment is recommended as a secondary treatment.

Practical guidelines

Simple and cheap methods for nutrient removal and recalculation are recommended for wastewater biological treatment In small systems. After a treatment in a septic tank the wastewater could be further cleaned in sand filters, filtering chambers, filtration trenches, and soil filters with perforated pipes.

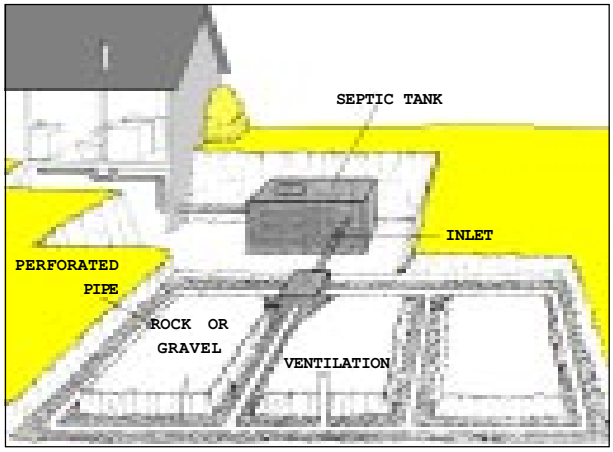


Figure 9. Wastewater treatment with infiltration in soil

The use of above mentioned treatment systems is recommended in light soils (sand, sandy loam, loam), if the groundwater level is deeper than 1,5 m below the soil surface.

Vegetation filters (artificial wetlands) can be used for biological treatment. The approximate size of the vegetation filter for a single family farm should be 20-30 m^2.

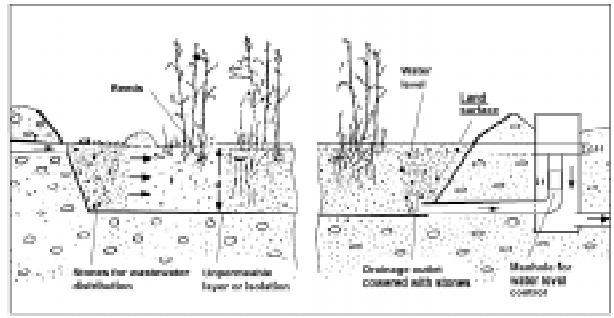
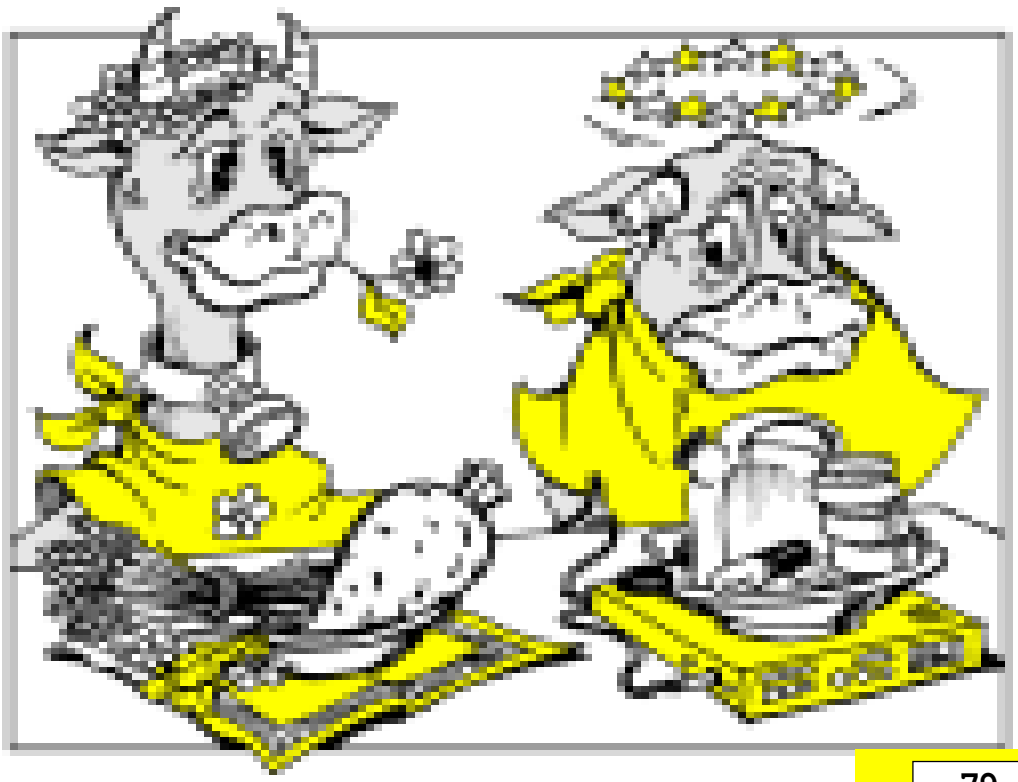


Figure 10. **Vegetation filter for wastewater treatment**

6. AGRICULTURAL SYSTEMS



6.1. TYPES AND SELECTION OF AGRICULTURAL SYSTEMS

Agricultural system – set of sectors and methods as well as technological tools where with soil as the main production resource crops, animals, fruits and vegetables are produced. Composition of sectors can be different from farm to farm. Agricultural systems in Europe are divided into following according to technologies used and their relationships to other systems.

Agricultural systems are closely linked to economical, environmental, and social issues. Solution of these issues is the most important prerequisite to a sustainable agricultural system. Philosophy and education, economic and environmental conditions of each individual define preference to the agricultural system.

78. The following main criteria should be used for the evaluation of agricultural systems:
- high production level and quality;
- production costs are reasonable to keep production competitive;
- reasonable stability of production from year to year, by sector, farm and field;
- friendly relationships to the main nature resources (soil, water, plants, animals, landscape) and their conservation for future generations;
- the chosen specialization and production structure maintain flexibility – ability to react on changes in supply and demand in the market;
- equilibrium among economical, ecological and social requirements in a long – run in order to develop sustainable agricultural systems.

Sustainable agriculture should also cope with social issues in rural areas:
- employment;
- development of infrastructure and preservation and development of cultural heritage;
- development of roads and communications.

In organising agricultural production decisions taken by local municipalities should also be taken into account. This is supported by paragraph 8 of the Law for Territorial planning.

Understanding of sustainable agriculture is not related to just five – ten year's period. Preservation of national, regional and global nature sources is of greatest importance. Therefore fulfilment of *the Code of Good Agricultural Practice* is one of the prerequisites for future generation to live in undegraded and non-polluted environment.

Table 19. **Division of agricultural systems**

Agricultural systems	Characteristics of agricultural systems
Sustainable	Intensive production of competitive products with friendly relations to the environment. Very often term *"integrated systems"* is used due to the application of chemicals, preventative and biological means. Farms are multi sector producers.
Conventional	Intensive production of competitive products with the emphasis on the concentration of production and deep specialization. Mineral fertilizers and chemicals are widely used in crop production. This type of systems still has a limited use in Latvia. It may leaves a negative impact on the environment.
Biological	Production of competitive produce is possible. Environmentally friendly methods of production. Mineral fertilizers and pesticides are not used for crops. Certification of technologies is required for the product quality control. Deliver the products to a special market

6.2. SUSTAINABLE AGRICULTURAL SYSTEMS

Sustainable (integrated) agricultural systems are characterised by multi sector production when crop production always goes hand-in-hand with animal production. The following is required for intensive production of competitive produce under sustainable agricultural systems:

- 7 wide scope of crops. Perennial grassland is required for animal production. Legumes are to make nitrogen balance positive. Intermediate crops are used in specialised crop schemes to minimise negative consequences of monoculture and nitrogen leakage;
- 7 compost, manure, and green manure crops in combination with mineral fertilizers are used for the maintenance of soil fertility. Fertiliser rates are based on nutrient balance calculations avoiding groundlessly high fertilizer rates. Fertilisers should gain high yields without harm to the environment;
- 7 prophylactic and biological protection means shall be used as widely as possible, by limiting the use of chemicals. Crop ability to inhibit spread of weeds is to be of great importance as well as high quality mechanical treatment for the prevention of weeds;
- 7 animal production shall promote rational and protection use of natural grassland, pastures, and areas undergoing erosion. Feeding must be in accordance to productivity of stock, manure storage and handling rules that shall be applied in order to minimise pollution. The number of animals should correspond to the area of the arable land of the farm;
- 7 protection and preservation of water basins, landscape, biodiversity and other elements of the environment shall be taken into account in farm planning. Ecological and social aspects have to be accounted for besides the economic aspect of the business;
- 7 while the overall certification of technologies is not yet performed, conformity of produce shall be checked against requirements.

79. Sustainable agriculture should become a part of state agrarian policy.

Sustainable agricultural systems is the most perspective kind of farming widely used in rural areas finding integrated solution to economical, social, and environmental issues.

80. Fulfilment of all rules of the Code of GAP should be determined by the adhesion to sustainable agriculture. Besides a farm should have a farm management plan (crop rotation and fertilising plan) and accounting according to law.

6.3. CONVENTIONAL AGRICULTURAL SYSTEMS

They are characterised by deep specialisation of production that allows intensifying production and minimizing production costs. Mineral fertilizers and pesticides are widely used in crop production and horticulture. Very often animal production is not a part of the farm's business, therefore it is difficult to include perennial grassland in crop rotation. Such grassland is most important to maintain the fertility of soil. Compost and manure are not utilised for the reproduction of the soil. Predominance of certain crops in crop rotation is widespread therefore very common is to plan monoculture by using high fertilizer rates and chemicals.

As a result an impact risk of environmental pollution is often observed.

In this type of farms economic values play a major role, but protection of environment is only concern in order to follow legislative regulations. Individual interests in farming are most important, ethics of farming and farming as the "way of living" is regarded as out -dated. Agriculture is just a rural business. Large influence from advance in research and technology development. Large farms and concentration of land, processing, capital and labour. Generally, this type of farming does not correspond to the principles of sustainable development.

6.4. BIOLOGICAL AGRICULTURE SYSTEMS

Biological (ecological, organic, bio-organic, bio-dynamic farming) agriculture is a type of production to solve issue of the negative impact of agriculture on the environment and product quality. In these systems natural substances and minerals replace mineral fertilizers, pesticides, drugs, and growth stimulators.

Lower outputs are common. But viable economic return can be obtained when the produce is sold in special markets for higher prices.

Objectives of biological agriculture are:

- to produce high quality products in a sufficient quantity and preserve their natural features;
- to minimise environmental pollution and maintain biological diversity and long term soil fertility;
- to create living conditions for food producers which would satisfy their needs, guarantee safe working environment, allow to get income, give satisfaction of work, and maintain life's harmony to nature.

Biological agriculture creates conditions for the development of natural ecosystems and most fully provides sustainability of agricultural systems. All biological agriculture systems have common requirements.

81. Crop rotation should be taken into account consistently in the biological agriculture systems. Cultivation providing maintenance of soil fertility should be applied. Organic fertilizers and well-prepared compost can be used for increasing and maintaining soil fertility. Maximum benefit should be gained from micro-organisms: growing nitrogen fixative plants, reproduction of nutrients in soil to more available forms for plants by using micro-organisms, earth – worms and plant roots. A balanced harmony between crop production and animal husbandry should be created.

Possible loses of nitrogen from soil should be minimized by biological agriculture systems by fertilizing soil with organic fertilizers, by utilizing nitrogen fixative plants (legumes) and stimulating the action of micro-organisms in soil. This can be achieved by less intensive cultivation techniques, correct time intervals, inclusion of intermediary crops, and application of organic fertilizer.

If mineral fertilizers are not used for a longer time, the balance of nutrients in soil might be negative. Biological production shall be planned to ensure a long time nutrient balance and regular soil analysis should be carried out. Using fertilizer kinds that are allowed for biological agriculture can compensate limiting nutrients.

82. Control of weeds, pests and diseases should be carried out only with prophylactic, mechanical or biological means. Natural ability to inhibit the spread of weeds by crop should be used as widely as possible.

Production techniques are approximated to nature processes. Local landscape, biodiversity of species and protection and preservation of other environmental elements shall be taken into account in the farm planning. Besides economic criteria, environmental and rural social issues are to be highly considered.

83. Animals should be kept according to their natural needs (pastures, exercise, light etc.). Purchased fertilizer and feed should not exceed 10% of the total amount. Stocking rate should not exceed 1,7 livestock units per hectare agriculture land.

Competitive biological agricultural systems use recent advances in research. This allows producing high quality agricultural products. However, production level is lower than in conventional and sustainable farming. Developing biological agriculture, in order to preserve the total volume of production, the area of arable land has to be increased. Cupertino for processing and marketing of biological products is essential among farmers due to the limited level of the development of processing plants.

One of the types of biological agriculture is biodynamic agriculture. Rhythms of planets, primarily Earth and Moon are taken into account. Specific methods are applied.

There were 200 biological farms in 1998 producing vegetables, grain, seasonings, fruits, bee products, and animal products. Farms are certified, e.g. production process is checked thoroughly against the standards of biological agriculture.

84. Following criteria should be applied to qualify for biological agriculture:

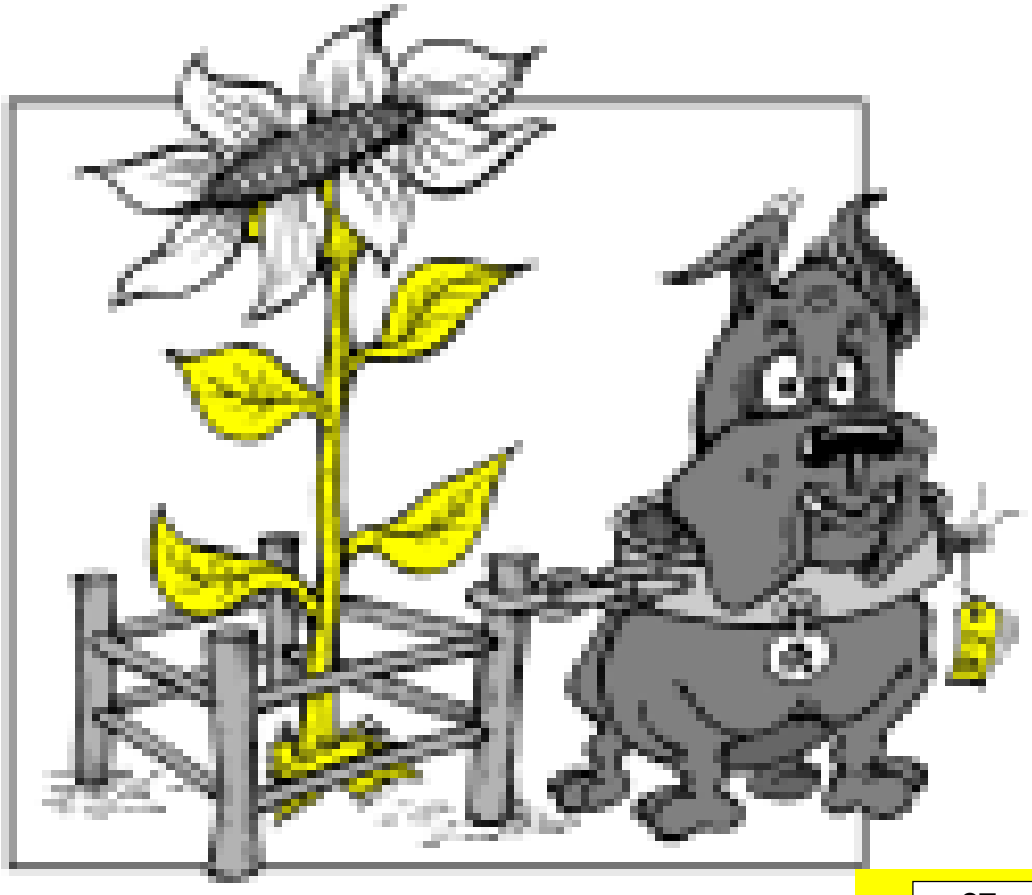
- the farm must be certified;
- the farm must have management plans (crop rotation and lend fertilization plan) and accounting according to the law.

Biological agriculture methods are sustainable systems. Therefore, all biological farms should fulfil requirements of sustainable agriculture regarding product quality and technologies of production and their impact on the environment.

Latvian Standards for the certification of biological agriculture determine requirements for production, processing, marketing, and documentation of agricultural produce. Production and certification of biological agricultural products are voluntary. Control is obligatory part of certification. Advanced requirements have to be fulfilled to get internationally accepted certificates (*OTCA, Demeter etc.*). It is required to become a member of biological agriculture organization, to attend theoretical and practical

training, to restructure the farm according to standards of biological agriculture, and to implement biological agriculture technologies. Certificates are issued by Certification Committee of the Latvian Association of Organizations of Biological Agriculture.

7. BIOLOGICAL DIVERSITY AND LANDSCAPE



7.1. INTRODUCTION

Biological diversity means the diversity of living organisms on land and in waters. It includes diversity both within and between the species. A relation of a mutual interdependence exists between species in the nature and in various ecosystems. Even a loss of one species may cause undesirable changes in the whole system. Biological diversity increases the stability and the total productivity of any system, therefore it is an important precondition for a sustainable agriculture. The necessity to secure and maintain the maximal biological diversity is recognised world wide as well as in the legislation of the Republic of Latvia.[18] As the biological diversity is possible only on a diverse landscape, it is very important that the landscape itself is protected. The intellectual and material culture in Latvia has also developed concurrently with its cultural landscape. Therefore, it is important to preserve the landscape, the cultural and historic heritage as a precondition for a sustainable development. A real threat to the present, still relatively rich natural environment and landscape of Latvia appears with the growing intensification of the economic activity. The main threats are:

- contamination of the environment;
- destruction and denudation of the habitat for wild species;
- the interruption or destruction of the migration routes of animals;
- the destruction or degradation of the aesthetic landscape;
- the destruction or mutilation of items of cultural or historic heritage.

For Latvia it is equally important to protect its own natural resources as well as to be ready to fulfil the conditions required by international law and conventions. The agricultural policy of the EU envisages promotion and stimulation of the agricultural use of land in a manner that is compatible with the preservation and protection of the landscape and biodiversity.

The rural landscape is the most important habitat, as well as a protection and sustenance of the various natural life forms of plants, animals, insects, and different microorganisms. Therefore it is very important that the development of a strategy for a sustainable agriculture would include the maintenance and preservation of the most diverse natural environment. It must begin at the level of the each individual farmer and land user. Every homestead is unique, not duplicated and not repeating, and each has its place in the totality of the biome. These individual households should be (but often are not) at the forefront in determining conditions for the preservation and protection of the most diverse biological landscape.

7.2. SECURING OF BIOLOGICAL DIVERSITY AND LANDSCAPE PROTECTION

The following preconditions must be fulfilled to protect the biological diversity and landscape:

85. Land use on farms should be diversified.

[18] Environmental Protection Law, Law on Specially Protected Nature Territories, Law on Protection Speaces and Biotopes (draft).

The ecological principle that soil has a "right" to a crop cover should be followed. It means that in the natural conditions of Latvian climatic biotype the soil is covered with diverse vegetation during the growing season. It fosters soil self-renewal and protects it from erosion. This principle is not adequately followed in agricultural production. The soil is frequently exposed without any vegetation for long time periods (for example, fields left in rotational fallow, after potato or root crop harvest, etc.) or the same crop is continually cultivated that depletes the soil. However, the negative impact can be avoided by introducing green manure or vegetative intercrop as well as a proper crop rotation sequences.

86. Habitat of wild species should be protected.

On a farm various species of wild animals and plants can always inhabit areas not used for cultivation of crops. Roadsides, drainage ditches, balks, wetlands, meadows and pastures, a yard, a stream bank, and a pond – all provide habitat of a diverse wild life and thus they should be protected.

87. Protection of species should be guaranteed.

The protection of wild as well as domesticated and cultivated species is one of the crucial measures for the securing of biological diversity. The necessity to protect species is prescribed by the Environmental Protection Policy Plan of the Republic of Latvia.[19] Protection of species and the environment can be implemented in every farm and rural household. It is important to recognise the significance of protection of the environmental quality.

88. Historical and cultural heritage should be protected and maintained.

Over centuries Latvia has experienced changes in population numbers, density, distribution and in economic activity. These changes and their intensity initiated diverse impact on the biome and the natural landscape. Forests have been felled, fields and pastures cultivated, orchards and gardens erected. Our ancestors thus significantly contributed to the present day landscape that is unique and will never be repeated. The landscape is the witness and the record of the history of the Latvian people ant cultural heritage.

Practical guidelines

The yard and the orchard.

The farmhouse, the yard, and the orchard constitute a united system that exists as a part of a larger natural environment. With simple means it is possible to create appropriate conditions for the life f small mammals, reptiles, birds, and insects within the presence of human activity:

- avoid the use of blacktop concrete and other watertight material because they poison the lane way. Gravel paths are very good to provide a dry and ecologically friendly yard;
- green the walls of your buildings;
- set up bird-cages and try to save old and hollow trees;
- create compost piles of the organic waste – it provides a valuable fertilizer and a habitat for many small animals;
- create hedges of appropriate local species;
- try to preserve traditionally locally grown fruit trees, vegetables or decorative plant varieties;

[19] Environmental Protection Policy Plan for Latvia; R., 1995.

- prevent the spreading of rapidly reproducing introduced foreign species (Heracleum mantegazzianum, Impatients glandulifera and others);
- cultivate rich wild flower lawns instead of the mowed lawns where possible.

Fields.

Maintain a singular environment, where the dominant plant species is regularly replaced. The number of species on fields is limited, therefore considering the biological diversity environmentally friendly activities are of great importance:

- avoid too early tilling of an overly moist soil that could result in soil compaction, thus threatening the survival of soil inhabiting organisms;
- avoid often and regular use of cutter type soil tillage equipment that could injure and kill soil organisms;
- supply soil with the organic matter, thus stimulating activities of earthworms;
- perform soil tillage as early as possible to allow the wild animals to find their habitat;
- mow as late as possible to avoid killing of young animals;
- leave boundaries between fields;
- carry out harvesting from the middle of the field outwards the sides, and provide the combine harvesters with equipment for alarming animals.

Meadows and pastures.

Both are dominant elements of the rural landscape. Biological diversity is larger there than in fields, particularly in natural meadows and pastures. In order to protect these original ecosystems and their characteristic large biological diversity:

- do not fertilize and do not perform any other maintenance works in the natural meadows with unproductive soils during their blooming;
- do not start a premature tilling of an overly moist soil that might facilitate soil compaction thus threatening the habitat of soil inhabiting organisms;
- save and preserve single large trees and shrubs in the fields, in particular if they are fruit or berries producing species e.g. wild apple trees, pear trees, sweet briar, oak and other species that supply wildlife with food and shelter;
- preserve natural pastures for long term pasturing and haying to avoid frequent ploughing;
- leave some patches of pastures not tilled;
- mow parts of sloughs and floodplains by hand where it is impossible to use machinery;
- start anew a low intensity pasturing on old pasturelands even if it is not economically profitable, such as juniper covered hillsides, forest pasturing, areas and floodplains of lakes or rivers;
- pasture on the hillsides, lake shore slopes, steeper river valleys, infertile sandy areas and calcareous soil areas by keeping few sheep for this purpose;
- do not allow overgrazing and maintain optimal balance between the herd size and the capacity of the available land area and conditions;
- start haying from the middle of the field and outwards the side, and equip machinery with devices to scare away animals that often hide in the not mowed part of the field.

Roadsides and ditches:

- plant hedges, trees, shrubs and alleys along the roadsides. Use locally grown food and seed bearing plants that provide habitat for animals;
- leave single natural trees, shrubs and tall succulent vegetation patches along the roadsides where planting is not feasible;
- prevent mowing of roadside ditches before the young animals have grown, i.e. end of July;
- do not burn the dry grasses of previous seasons in the spring.

The aquatic ecosystems.

The aquatic ecosystems are standing or running waters like sloughs, ponds, lakes as well as ditches, streams, creeks, and rivers. They contribute to the beauty of the landscape, and provide a habitat for many plants, animal, insect, and microorganism species. In order to preserve and to maintain biological diversity and landscape:

- create ponds and plant its banks with trees, shrubs and grass;
- save and improve the natural vegetation along the banks of lakes, streams, and rivers;
- do not allow any unwarranted regulation of stream and river beds.

Try to leave the natural flow of rivers and streams unaltered as it has developed in a balance with the whole environment. If possible, attempt to repair already damaged natural channels and restore the biological diversity of these biotas as a vital part of the biologically and geomorphologically developed total natural environment.

Appendix 1

Calculation of fertilizer plan for one field on your own farm

Fertilizer needs per ton yield for different crops are roughly will be assessed according to Table 9. The amount of manure and plant nutrients in it will be assessed from Table 8. See example on Table 12.

	Calculation	Amount	Plant nutrients, kg		
			N	P_2O_5	K_2O
1	Norm* (need) per ha (Table 10)				
2	Norm (need) per ___ ha (line 1 x ___ ha)				
3	Manure from _____ (Table 9)				
4	Effective fertilizing value of the manure, % (estimate dependent on application time and technique, etc.)				
5	Effective fertilizing value of the manure, kg (line 3 x line 4 / 100)				
6	Difference, to be applied as mineral fertilizer (line 2 – line 5)				
7	Plant nutrient content in used fertilizers _____				
8	_____ to comply with the rest need of nitrogen (line 6 / line 7x100), kg				
9	_____ to comply with the rest need of P_2O_5 (line 6 / line 7x100), kg				
10	_____ to comply with the rest need of K_2O (line 6 / line 7x100), kg				

**The norm is determined from the standard normative (Table 9), adjusted for field history – here under the fertilizing effect of previous crop, pH of the soil, soil type, soil analyses – here under N_{min} analyses, and for the climate in the region.*

This table is prepared for use of different types of mineral fertilizers, as there usually are used more than one type.

Appendix 2

Calculation of number of Livestock Units and livestock density on your own farm

Housing system	Manure type	LU per animal	Number of animals	LU in total
1	2	3	4	5=3x4
Sow with 18 piglets to 20 kg weight				
Solid floor	Solid manure	0,21		
Slaughter pigs produced, 20 – 100 kg live weight				
Slotted floor	Slurry washing	0,10		
	Periodical flush	0,09		
Solid floor	Slurry	0,12		
	Solid manure	0,15		
Dairy cow, milk yield 3500 – 5000 kg per year				
Tie up, solid floor	Solid manure	0,6		
	Slurry	0,5		
Dairy cow, milk yield 5000 – 7000 kg per year				
Tie up, solid floor	Solid manure	0,8		
	Slurry	0,6		
Dairy cow, milk yield above 7000 kg per year				
Tie up, solid floor	Solid manure	1,0		
	Slurry	0,8		
Young stock (cattle), up to 6 month old				
Tie up, solid floor	Solid manure	0,14		
	Slurry	0,11		
Tie up, deep litter	Solid manure	0,18		
Heifer, 6 to 24 month				
Tie up, solid floor	Solid manure	0,37		
	Slurry	0,33		
Tie up, deep litter	Solid manure	0,41		
Bulls, from 6 months up to 450 kg live weight (26 months)				
Tie up, solid floor	Solid manure	0,52		
	Slurry	0,45		
Slotted floor	Slurry	0,45		
Free, deep litter	Solid manure	0,63		
Horse				
Tie up, solid floor	Solid manure	0,4		
Sheep				
Deep litter	Solid manure	0,07		
Hens				
Deep litter	Solid manure	0,01		
Battery	Slurry	0,01		
TOTAL NUMBER OF LIVSTOCK UNITS				
Ha of agricultural land				
LIVESTOCK DENSITY, LU per ha agricultural land				

Appendix 3

Calculation of the required manure storage capacity on your own farm

Housing system sistēma	Manure type	Tonnes manure produced per animal per year	Number of animals	Tonnes manure in total
1	2	3	4	5=3x4
Sow with 18 piglets to 20 kg weight				
Solid floor	Solid manure	4,6		
Slaughter pigs, 20 – 100 kg live weight				
Slotted floor	Slurry washing	8,7		
	Periodical flush	3,4		
Solid floor	Slurry	3,6		
	Solid manure	2,6		
Dairy cow, milk yield 3500 – 5000 kg per year				
Tie up, solid floor	Solid manure	13,0		
	Slurry	22,0		
Dairy cow, milk yield 5000 – 7000 kg per year				
Tie up, solid floor	Solid manure	15,5		
	Slurry	27,0		
Dairy cow, milk yield above 7000 kg per year				
Tie up, solid floor	Solid manure	17,5		
	Slurry	30,0		
Young stock (cattle), up to 6 month old				
Tie up, solid floor	Solid manure	2,6		
	Slurry	6,0		
Tie up, deep litter	Solid manure	4,0		
Heifer, 6 to 24 month				
Tie up, solid floor	Solid manure	6,7		
	Slurry	15,0		
Tie up, deep litter	Solid manure	9,0		
Bulls from 6 months up to 450 kg live weight (26 months)				
Tie up, solid floor	Solid manure	11,1		
	Slurry	20,5		
Slotted floor	Slurry	20,5		
Free, deep litter	Solid manure	15,0		
Horse				
Tie up, solid floor	Solid manure	8,0		
Sheep				
Deep litter	Solid manure	0,9		
Hens				
Deep litter	Solid manure	0,1		
Battery	Slurry	0,1		
Additional effluents				
From silage clamps, m^3				
From milking parlours, m^3				
From rainfall, m^3				
From washing of stables, m^3				
From other sources, m^3				
TOTAL AMOUNT OF ANIMAL MANURE PER YEAR, TONNES				
Months storage capacity				
REQUIRED SIZE OF MANURE STORAGE, M^3				

LEGISLATION IN AGRO – ENVIRONMENTAL SECTOR IN LATVIA

21.06.1991	Law on Land Use and Survey
06.08.1991	Environmental Protection Law
02.03.1993	Law on Specially Protected Nature Territories
30.03.1993	Law on Hazardous Waste
20.04.1993	Law on Land Reclamation
05.02.1995	Instruction on Register Order of Plant Protection Producte in Latvia
30.06.1995	Regulations on Trade and Use of Plant Protection Productes
10.08.1995	Building Law
14.09.1995	Law on Restitution of Ownership's Rights on Land in Especially Protected Nature Objects
14.09.1995	Natural Resources Tax Law
02.05.1996	Law on Subsoil
20.06.1996	Order of Adaptation of the Norms of Nature Resource Tax – Regulations of the Cabinet of Ministers
24.10.1996	Law on Agriculture
03.12.1996	Conception Latvian rural development policy – Accepted by Cabinet of Ministers
05.02.1997	Law on Protection Belts
01.04.1997	General Building Regulations, Regulations of the Cabinet of Ministers
22.04.1997	Water Use Permit Regulations, Regulations of the Cabinet of Ministers
12.08.1997	Regulations of Council of Ministers about permits for Land Use Type Transformation
21.10.1997	Regulations and General Provisions for the Protection and Use of Specially Protected Nature Territories – Regulations of the Cabinet of Ministers
01.11.1997	Regulations on the Use of Sewage Sludge in Soil Fertilizing and Development of Territories – Regulations of the Cabinet of Ministers
1997	List on Record of P Protection Produce in Latvia, year1995 – 2005
1997	Regulations of Council of Ministers about Transformation Agriculture Land to Forestland
27.01.1998	Latvian National Conception of Territory Planning, Accepted by Cabinet of Ministers
14.02.1998	Territory Planning Regulations of Council of Ministers No. 62
14.10.1998	Law on Environmental Impact Assessments
15.10.1998	Law about Territory Planning
17.12.1998	Plant Protection Law
1998	Standarts of Biological Agriculture Sertificates. Association of Latvian Biological Agriculture institutions, Riga, p.28.
1998	Country Development Program
1998	Pedigree record normative documents, 1 volume. Ministry of Agriculture
07.09.1999	Regulation on Distribution, Storage and Use of Plant Protection Productes
05.10.1999	Regulation on Register Order of Plant Protection Products
Draft in 1999	Law on Protection of Species and Biotopes
	Law on Fertilizers
	Law on Veterinary