3. SOIL LIMING AND FERTILISATION

3.1. INTRODUCTION

Cultural plants can normally grow and yield a good harvest only in soils of non-acid reaction, that have sufficiently enough plant available nutrients. The optimal soil reaction level providing most favourable conditions for crop growth are determined for every crop species and crop rotation.

According to the data of the last, fifth (1985-1995 year), soil agrochemical survey, about 18.7 % of Lithuanian agricultural land are acid and almost 1 mln. ha are inclined to acidify, more than half – 63.8 % have very small amount (up to 50 mg/kg) and small (up to 100 mg/kg) of mobile phosphorus, and about 43 % have very small or small amount of mobile potassium, about one third has low humus level. Willing to achieve profitable yield of the most valuable crop, acid soils have to be limed. Soils that have small amount of nutrients have to be fertilised with organic and mineral fertilisers.

Use of lime as well as use of organic and mineral fertilisers is related to environmental non-point source pollution. According to data of lysimetric analysis, about 400 kg of calcium, about 17 kg of nitrogen, about 1.5 kg of phosphorus and about 12 kg of potassium are leached from one hectare every year on average. Nutrient losses and environmental pollution at the same time may be reduced due to correct storage of lime and fertilisers, proper rate, optimal application time period and most suitable way.

3.2. IMPORTANCE OF LIMING OF ACID SOILS

Soil liming ensures effectiveness of all other agrotechnical measures especially fertilisation. Liming leads not only to neutral soil acidity, but also to good soil structure, water regime, low resistance to agricultural equipment, higher amount of mobile phosphorus, potassium, nitrogen, sulphur, calcium and magnesium, and lower amount of mobile aluminium that is hazardous for plants. Liming activates beneficial, especially N-fixing, microorganisms and stimulates activity of ferments. Soil liming is also useful from environmental protection point of view. Lime neutralises acid residues of mineral fertilisers, hinders penetration of radionuclides and heavy metals into plant products. Liming also prevents drainage system from overgrowth with horsetail.

3.1
Very and medium acid soils (up to 5.0 pH) used for growing of cultural plants should be limed. Fields with slightly acid (pH 5.1-5.5) soils should be limed if winter wheat, fodder beets, leguminous cereals, clover and other crops sensible to acidity of a soil are to be grown there.

Very abundant liming is not needed. Too abundant liming especially applied only once, is sometimes even harmful. After strong liming boron is uptaken with difficulty and therefore, yield of seeds of sugar and fodder beets, flax and leguminous grasses may be reduced. Besides, there are plants that yield a tolerable harvest in weakly acid soils (Annex 3.1.). If there is no possibility to lime the soil, it is possible to choose such crops that will thrive under more acid conditions.

3.3. SELECTION OF AREAS FOR LIMING

Areas for liming are preliminary selected using field pH meter or according to low yield of crops that do not tolerate acid reaction, like clover, wheat and beets, and according to weeds growing in the field. If a lot of field spurries, field horse-tails, the small sorrels and annual knawel grow on field, it means that the soil is acid (Fig. 3.1). But more exactly soil acidity and necessity for liming could be determined by agrochemical analyses. Agrochemical Research Centre of the Lithuanian Institute of Agriculture carries out these analyses.

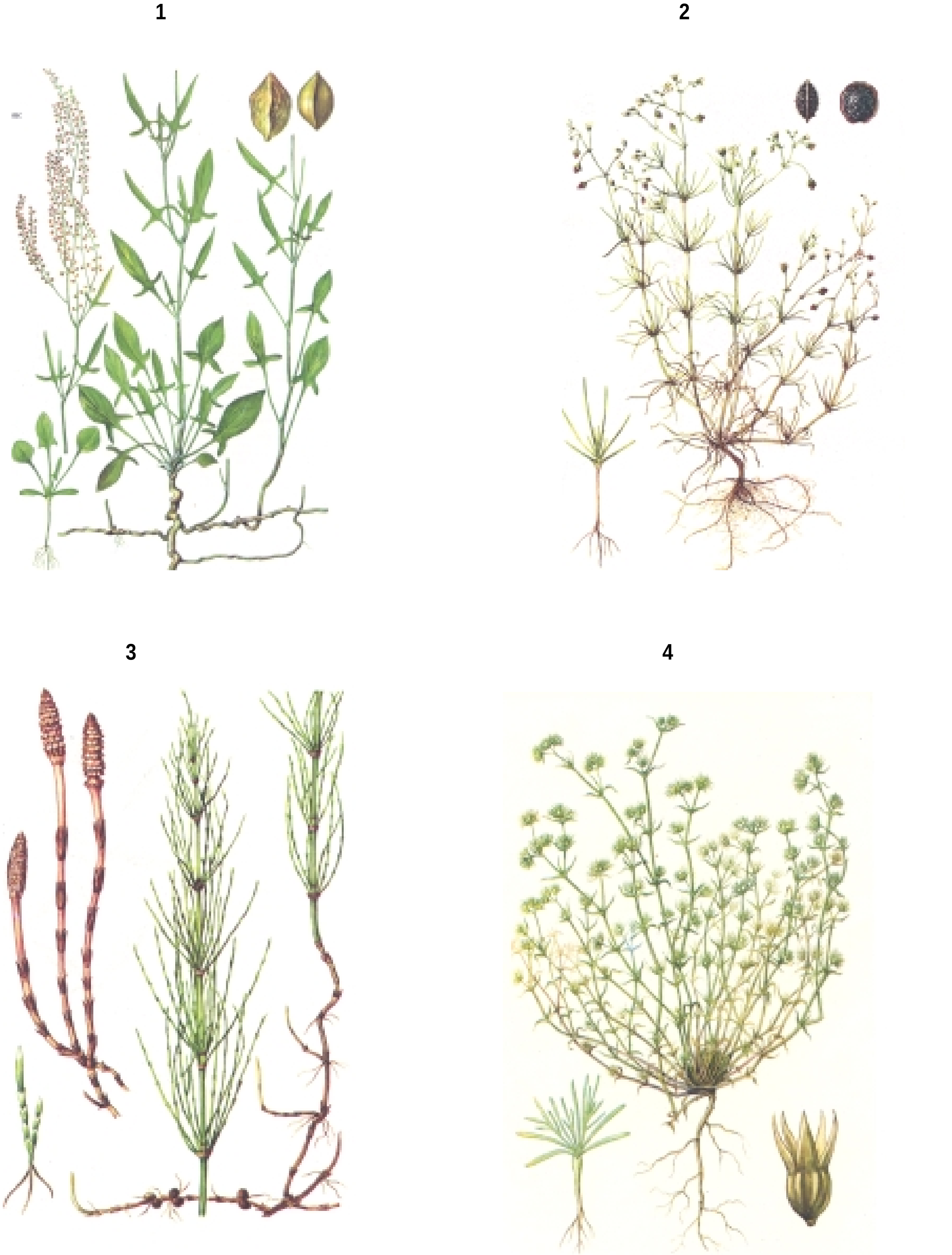

Fig. 3.1. Plants characteristic for acid soils: 1 – the small sorrel; 2 – field spurry; 3 – field horse-tail; 4 – annual knawel

3.4. CALCULATION OF LIME RATE

Calcium rate is the amount of $CaCO_3$ being a need for neutralisation of acidity in soils. Calcium rate depends on many factors; the most important of them is soil texture. There is indicated half of the norm according to hydrolytic soil acidity for sand and loamy sand soils, 0.75 of the norm for sandy loam and loam, and full norm according to hydrolytic acidity for other soils (Annex 3.2). Liming norm ($CaCO_3$) is usually indicated in acidity cartogram after agrochemical analyses of acid area have been performed. Evaluation of $CaCO_3$ rate in physical liming materials may be performed with help of the following coefficients: 1.2 for screened limestone (including dusting), 1.5 for ground dolomite, 1.3 for cement dust, 2.0 for local liming materials.

3.5. LIMING TECHNOLOGY AND QUALITY REQUIREMENTS

The most rational and effective under local conditions spreading technology should be chosen taking into consideration chemical and physical properties of liming material and their effectiveness.

Areas not occupied by crop are chosen for liming during warm period when there is still a possibility to incorporate liming material successfully. The most suitable fields for liming are fallow or on stubble after harvesting in early autumn. It is possible to lime in early spring spreading the lime even on areas assigned for potatoes or rye as neutralisation of acidity will be low in that year. In such case forecrop before crop, which is vulnerable to soil acidity, is limed.

Quality of application of liming material depends on soil levelling, calibration of spreading equipment and proper state. If the work is performed by land-user himself, these requirements are usually fulfilled. When a hired worker performs liming, land-user together with contractor evaluates work quality. Spreading width of lime is checked first. Powdered liming material is spread at a working width of 10-12 meters, dolomite and other ground material at 8-10 meters. It is checked up if there are any plots at the edges of field and places with limited approaching that were left not limed or if liming material is not left at the places of filling and storage.

Evenness of spreading is checked at the beginning of work. Special quadratic boxes of $0.25m^2$ size are needed for this purpose. They are laid out in a line perpendicularly to the movement direction of spreader. Empty places are left for wheels of the machine. The average weight (in grams) of lime fallen into one box is multiplied by 0.04 and the average spreading rate is obtained (t/ha). Spreading unevenness is determined multiplying deviation of lime mass of every box from average by 100. Average norm of liming material has to be poured out at the coincident places of spreading widths. Deviation from the norm of 30% is allowed for pneumatic spreaders and 25% for centrifugal spreaders of mineral fertilisers.

Evenly spread lime may be insufficiently effective if it is badly incorporated into soil. The main requirement is to mix it with arable layer of soil as evenly as possible. It is not suitable at all to plough the lime in deeply. The lime is best mixed with soil with help of disc harrow or rotary cultivator. Later during ploughing the lime is totally mixed with the whole arable layer. It is recommended to lime soil for perennial grasses, pastures and meadows before sowing of covercrop or grasses. Besides, pastures and meadows may be also limed without incorporation of liming material into soil.

3.6. IMPORTANCE OF FERTILISATION TO CROP YIELD

Plants grow and mature using nutrients, which are present in soil and are obtained through organic and mineral fertilisers. The more fertile soil is and the more nutrients are available, the less nutrients have to be given in a form of fertilisers.

Fertilisation rate and effectiveness depend also on texture, reaction and water regime of soil, fertilisation time, fertilisation type, and other factors. When plants take up more nutrients they reduce its leaching and soil erosion by water; in this way environmental pollution is prevented.

3.2
Agrochemical characteristics of arable layer: pH, the amount of humus, mobile phosphorus and mobile potassium should be analysed every five years at least in order to regulate plant nutrition properly and to control changes in soil fertility.[1]

The most effective is combined organic and mineral fertilisation when in addition to mineral fertilisers that are applied every year, organic fertilisers are also applied every three four years on light soils and every four five years on heavy soils. Organic fertilisers have a high agroecological value; they are a source of humus. Beneficial soil microorganisms that help plants to take up nutrients use this organic material. Organic fertilisers stabilise water and heat regime in soil, improve structure, and reduce mobility of harmful substances (heavy metals et al.)

3.7. TYPES OF ORGANIC FERTILISERS AND THEIR FERTILISATION VALUE

The most important and valuable fertiliser is manure. Manure consists of solid and fluid faeces of livestock or of their mixture with bedding material (straw, forage residues, sawdust) or with water. Manure may be with bedding material *(littered manure)* and without bedding material *(non-littered manure*) depending on housing technology of animals. Manure can be *solid, semi-solid and liquid* depending on the amount of dry material in the manure.

Solid manure is manure with at least 20 % of dry matter. The solid manure is usually stored in deep barns with a big amount of bedding material. It may be heaped up and compressed. This kind of manure has lowest nitrogen evaporation and losses of nutrients washout and leaching. Use of the solid manure is less related to environmental pollution than use of non-littered or liquid manure.

Semi-solid manure is a mixture of excrements and urine with remains of feed and a little of bedding material. Semi-solid manure has 12-20 % of dry material. It cannot be heaped up. It has to be stored in manure storage until it is taken out to the fields.

Slurry arises in barns without bedding. It is a mixture of animal excrements and urine. In old manure removal systems where water is used for washing down of excrements to reservoir there the dry matter content of manure and its fertilisation value depend on the amount of water. Slurry has less than 12 % of dry material. Such slurry can be pumped, transported by pipes.

Liquid manure is animal's urine together with fluid that separates during decay of manure with bedding material. On average about 10-15 % of not overrotten manure mass become liquid manure. About 170 l of liquid manure arise from 10 tons of trampled down and not overrotten manure in 4 months. The less of bedding material is in manure, the more liquid manure is made.

In order to reduce environmental pollution by biogenic elements of organic fertilisers it is needed to use technologies that accumulate solid littered manure. Part of slurry and liquid

[1] HELCOM 1986 February 11. Recommendation 7/2. Measures aimed at the reduction of discharges from agriculture

manure should be used for compost production.

Some other types of material, despite of livestock manure, may be used for soil fertilisation on farms. Such fertilisers may be poultry manure, various composts, domestic and industrial wastes, wastewater sludge, green fertilisers, sapropel and other organic material.

3.3
Farms with manure stores over 500 m^3 should determine fertilisation value of manure by a quick test method or in a laboratory immediately before spreading. Slurry or liquid manure has to be well mixed before the test. It is enough to analyse fertilisation value of manure one time if manure storage technology does not change. If possibilities to analyse manure composition do not exist, then normative average chemical indices for manure accumulated by corresponding technologies are used (Annex 3.3).

All nutrients needed for plants are present in manure: macro- and microelements and ferments. Nutrition elements are in a form of organic compounds that are used by plants after mineralisation. Intensity of this process varies according to the type of organic fertilisers and soil texture. Plants can quickly take up nutrients present in slurry, urine. Small amount of humus is formed in soil fertilised by these fertilisers. When these fertilisers are used in big amounts more nutrients may be leached or washed out by rainwater.

Littered solid manure (FYM) mineralises slowly; therefore plants fertilised by such manure take nutrients gradually. Such manure is of great importance for humus formation.

In one ton of mixed littered manure (this kind of manure is most common on farmers farms) that has about 22 % of dry material there is about 5 kg of nitrogen, about 2.1 kg of phosphorus (P_2O_5) and about 4.7 kg of potassium (K_2O). It also has microelements, a lot of manganese, zinc and copper and some molybdenum. Data for annual manure production per one animal and the amount of nutrients in manure are presented in Annex 3.3.

Nitrogen is in solid as well as in liquid fraction of manure. However, it is most available for plants when it is in liquid fraction. Nitrogen compounds from solid faeces and litter are available for plants only after mineralisation. It is determined that plants take about 35 % of nitrogen from littered manure in first year on average.

Phosphorus is in solid fraction of manure and in litter. It is almost absent in liquid fraction. Plants take up manure phosphorus easier than phosphorus that has been applied in a form of mineral fertilisers. During first year plants take about 45 % of manure phosphorus and only about 15-20 % of phosphorus that is in mineral fertilisers.

Potassium is mostly found in liquid fraction of manure. The most important is that manure potassium is without chlorine. Therefore, it is a very good fertiliser for plants vulnerable to chlorine. However, when manure is used, there is no risk to pollute soil and waters with this biogenic element. During first year plants take up potassium most in comparison with other macroelements – about 60-70 % (Table 3.1).

Table 3.1. Coefficients for utilisation of nitrogen, phosphorus and potassium in manure

Uptake Year	Manure with bedding material		
	N	P_2O_5	K_2O
1 year	0.35	0.45	0.65
2 year	0.25	0.15	0.15
3 year	0.10	0.05	0
Total effect	0.70	0.65	0.80

Normative of uptake of nutrients present in manure during first and next years is approximate and depends on manure storage technologies, manure type, incorporation technology, et al.

Liquid manure is called as potassium and nitrogen fertiliser as it has a small amount of phosphorus. Usually about 2-4 kg of nitrogen, about 4-6 kg of potassium and only 0.1-0.2 kg of phosphorus get into soil with 1 ton of orderly stored liquid manure. These characteristics of manure and liquid manure are very important for determination of fertilisation rate and time that are most rational and most appropriate from environmental point of view.

3.8. FERTILISATION NORMS

3.4
Mineral fertilisers and manure should be applied according to official fertiliser norms that are based on crop need for the planned yield. Nutrients taken out with crop yield should be restored in a form of organic and mineral fertilisers [2].

This rule should be followed reducing nutrient application, developing sustainable agriculture, determining the amount of mineral nitrogen in soil and calculating nitrogen balance. Various crops require different amount of nutrients (Annex 3.4).

The taken out nutrients have to be brought back in order to maintain soil fertility. The amount of nutrients given in a form of fertilisers have to be bigger than the amount of taken out nutrients because plants are not able to take up the whole amount.

High concentration of nutrients in soil has to be avoided as losses of leaching and washout escalate and risk for pollution of groundwater and water bodies increases. It is very important that as low as possible amount of mineral nitrogen would remain in soil after harvesting in autumn.

It is not always useful to try to obtain maximal yield, because such yield requires more investments that are seldom worth, i.e. additional yield is obtained not often. Besides, abundant use of chemical and other compounds is risky from environmental point of view. Moderate, economical use of fertilisers increases their effectiveness, reduces yield cost and preserves environment from pollution. It is suggested to apply fertilisers according to fertilisation plans for the individual fields as well as for the farm as a whole (Code 2.1).

It is recommended to prepare fertilisation plans for expected yield using computer program made up by the Lithuanian Institute of Agriculture and Lithuanian Agricultural Advisory Service. Rate of organic fertilisers is restricted in conventional as well as in organic farms. The amount of fertiliser, introduced with manure, can not exceed 170 kg/ha of nitrogen on average for total area of agricultural land on the farm.

This rate might be exceeded for crops of long growing season and crops with high nitrogen uptake. Fodder and sugar beets are considered as crops of long growing season while maize and perennial ear grasses – as crops with high nitrogen uptake.

Rate of organic fertilisers depends on their nutritive value, crop type and soil texture. Knowing of nutritive value of manure and especially its concentration of nitrogen is very important for rational manure use from agronomic and also ecological point of view. If there is no possibility to perform chemical analysis, corresponding normative indices has to be followed (Annex 3.3). According to the indices, in medium and heavy soils annual rate of littered manure (FYM) should not exceed 50 t/ha for row crops, 40 t/ha for winter cereals, and in light soils 40 and 30 t/ha correspondingly. Maximal liquid manure rate (its nitrogen is easily taken up by plants) applied in one time is 15-20 t/ha in any type of soil. It is not useful to increase manure and liquid manure rate, because losses of nitrogen and other nutrients followed by risk for environmental pollution may become higher.

---

[2] HELCOM 1986 February 11. Recommendation 7/2. Measures aimed at the reduction of discharges from agriculture

Uptake of nitrogen, which is in mineral fertilisers, depends mostly on storage of mineral nitrogen in soil. It has been determined that when the amount of mineral nitrogen increases, fertiliser nitrogen effectiveness reduces and pollution risk increases, and on the contrary – more benefit from fertiliser can be gained in soils that has less mineral nitrogen (Fig. 3.2).

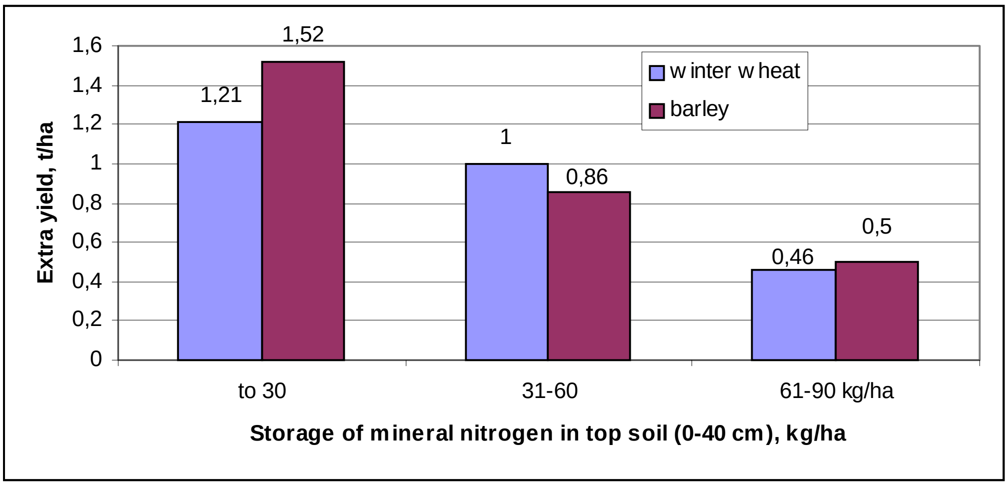

Fig. 3.2. Extra yield of winter wheat and barley t/ha in soils with different mineral nitrogen content when fertiliser rate is 60 kg/ha of nitrogen (LIA).

When about 60 kg/ha of mineral nitrogen is in 0-40 cm soil layer and nitrogen fertilisers are not added, then it is possible to harvest about 3.46 t/ha of cereal grains. When more mineral nitrogen is present (about 120 kg/ha) and winter wheat is fertilised only with phosphorus and potassium, the yield can reach 5 t/ha.

Maximal rate of mineral nitrogen is recommended for soils that have only up to 60 kg/ha of mineral nitrogen in 0-40 cm layer. Fertilisation expenses in soils, which have average and big amount of mineral nitrogen (60-90 kg/ha), limit nitrogen application rate; therefore, it does not exceed environmental friendly rate.

When manure is applied, the amount of nutrient taken up from manure is subtracted from nutrient norm of mineral fertilisers.

Lithuanian Agricultural Advisory Service when it prepares the fertilisation plans for farmers and agricultural companies and differentiates the rate according to agrochemical characteristics of every field and farmers when prepare the fertilisation plans themselves by an example given in Annex 3.5 have to follow the established maximal nitrogen norm.

3.9. TERM FOR FERTILISATION BY ORGANIC MANURE

3.5
Organic fertiliser (manure, sewage sludge, composts, etc.) should be spread from drying up of soil in spring to freezing of soil in autumn. Organic fertiliser should not be spread from 15 November to 15 March (on soils that are frozen, water saturated or are covered with snow).[4]

The highest amount of manure is accumulated during winter. If it is not spread in spring, it has to be stored over summer. Therefore, there appear quite big nitrogen losses. In order to achieve higher benefit, manure has to be handled with regard to the time when

[4] HELCOM 1998 March 26. Recommendation 19/6. Amendments to Annex III of the Helsinki Convention concerning regulations on prevention of pollution from agriculture

experienced nitrogen losses are lower, soil structure is less destroyed and crops are less injured at the time of fertilisation (Fig. 3.3).

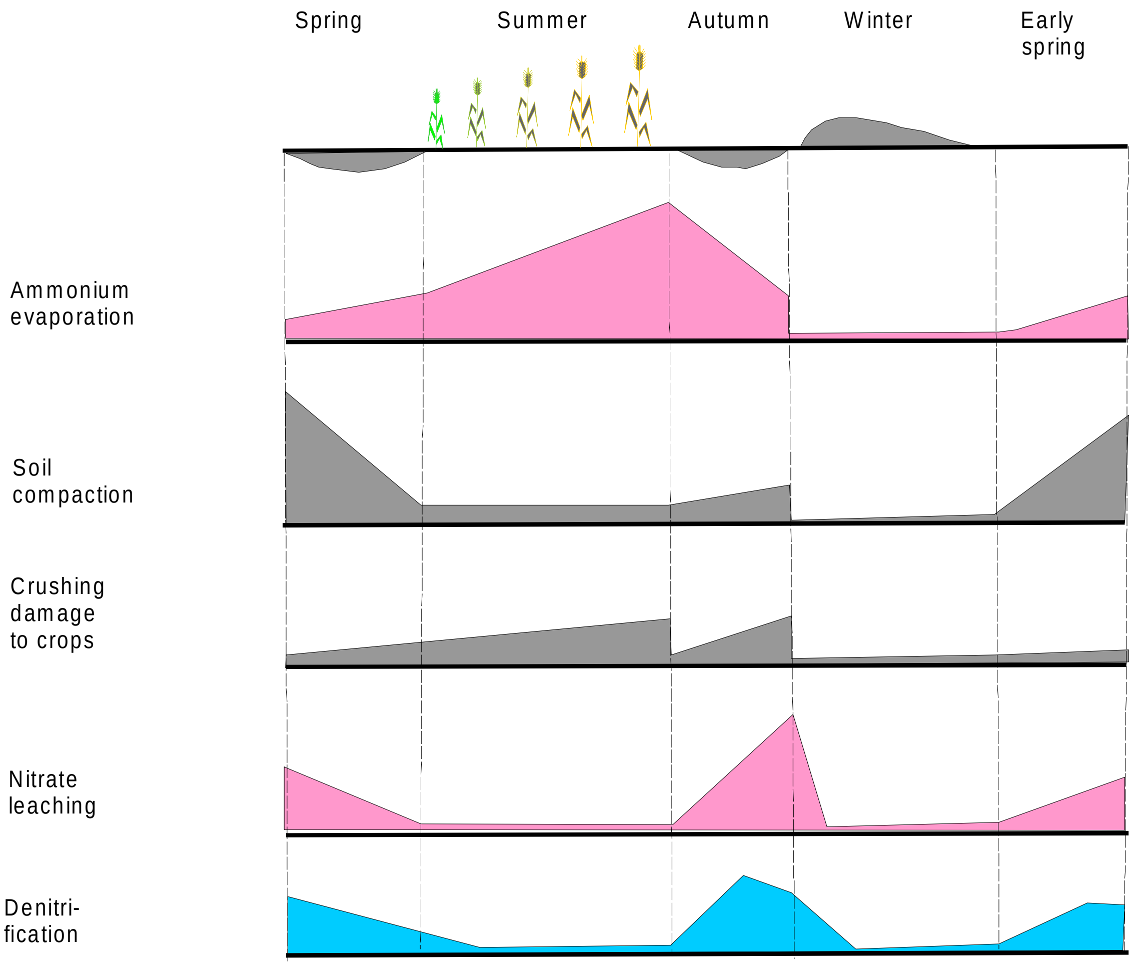

Fig. 3.3. Effect of manure spreading on nitrogen losses, soil compaction and crop damage.

Manure should be spread at more humid, colder and less windy time in order to reduce nitrogen losses. It is very important to spread manure evenly. Spreader with vertical discs (Fig. 3.4) spreads sufficiently qualitative FYM.

3.6
Solid manure should be incorporated into the soil within 6 hours after application.[5]

About 30 % of nitrogen may be lost in 6 hours after spreading FYM on ground and before its incorporation. But if it is incorporated into soil directly then nitrogen losses reach only 10 %. The most appropriate way to incorporate FYM is to plough it over. If fine peat or chopped straw were used as litter then the FYM may be incorporated by disc harrow. The highest nitrogen losses occur when FYM is applied on perennial grasses in summer. Therefore, application of FYM on pastures, meadows and grasses in crop rotation fields is not recommended.

---

[5] HELCOM 1992 February 6. Recommendation 13/8. Reduction of ammonia emissions from manure during field fertilisation

Fig. 3.4. FYM spreader with vertical discs JF AV 4000H.

3.7
Slurry and liquid manure should be spread in crop fields by trailing hoses. Having not such equipment, such manure should not be applied in crop fields. Slurry and liquid manure should be spread on bare soil by trailing hoses or broadcast spreaders and incorporated by cultivator with harrow within 6 hours after application.[6]

Nitrogen losses from slurry fluctuate from 3 to 50 %. If slurry is poured in dry warm period but not incorporated then the losses are highest. But if it is spread in late autumn and not introduced then only about 10 % of nitrogen are lost per day. Liquid manure, which is spread in early spring and not incorporated, may loose to 10 % per first hour, to 20 % per day and to 40 % of ammonia nitrogen if not incorporated at all. Therefore, the quicker manure and liquid manure are incorporated, the less nitrogen is lost. In lighter textured soils slurry and liquid manure can be successfully incorporated by rod harrow, but in heavier soils cultivator with harrow will better incorporate the fertilisers.

Minimal nitrogen losses occur when special sprinklers incorporate slurry and liquid manure.

In order to reduce crop losses caused by heavy machinery of slurry application it is needed to choose such time when soil has dried up and the dew has fallen from plants. The best is if fertilisation and plant protection machinery can use non-sown ruts and technological ruts made during first riding of the machinery.

Liquid manure and slurry may be successfully (with lowest nitrogen losses) spread on bare and covered soils by two types of hose urine spreaders constructed at Lithuanian Water Management Institute that are attached to urine machines MZT-6 or MZT-10. These spreaders apply slurry and liquid manure very evenly – with unevenness of not more than 5.7 %. Watering rate may be regulated from 14 to 80 m^3/ha depending on driving speed (Fig. 3.5).

---

[6] HELCOM 1992 February 6. Recommendation 13/8. Reduction of ammonia emissions from manure during field fertilisation

Fig. 3.5. Hose slurry and liquid manure spreader attached to urine machine MZT-6.

3.10. TERMS FOR FERTILISATION BY MINERAL FERTILISERS

Mineral nitrogen fertilisers are soluble and they have a quick effect; therefore, they have to be spread during crop vegetation. In crop fields of winter crops and perennial grasses nitrogen fertilisers are spread after vegetation has renewed and soil has dried up allowing movement of machinery.

3.8
Storage of mineral nitrogen in 0-40 cm layer should be determined prior to fertilisation in order to find out the exact needed amount of nitrogen fertilisers. 90 kg/ha and higher nitrogen rate should be given in two times at an interval of 25-30 days.

Main nitrogen fertiliser norms for spring crops are recommended to be applied in spring and incorporated by pre-sowing soil tillage measures.

Sometimes it is needed to apply nitrogen fertilisers additionally during vegetation. Plants take up more nitrogen if they are fertilised at smaller doses (in dry or liquid form) few times during vegetation. Lower leaching, washout and evaporation losses occur then.

Cereals are additionally fertilised in phase of ear emergence, row crops approximately 1 month after first fertilisation. The most appropriate nitrogen rate of the additional fertilisation is 30-45 kg/ha for cereals and 30-60 kg/ha for row crops.

Nutrient balance for the farm field where fertiliser was applied should be calculated (Code 2.1). Balance of nutrients, mainly nitrogen, is a comparison of input of this element to soil with its output by harvest. The balance is calculated for every field and for entire farm. The balance is positive if more nutrients are incorporated than taken with harvest, and it is negative if more of them are taken than incorporated. The balance helps to give scientific proof and to regulate resources of crop harvest and soil fertility, to forecast fertiliser demand and to regulate environmental protection.

Balance intensity is considered as normal when 100-120 % of the taken out amount of nitrogen is incorporated. But if fertility is very big (more than 5000 fodder units per ha) then 120-150 % may be incorporated. High intensity of nitrogen balance is not favourable for environment due to higher possible leaching and washout losses.

3.11. FERTILISATION TECHNOLOGY

Farm has to choose such fertiliser application technology that shall ensure higher fertiliser effectiveness and lowest negative effect on crops and environment. Fertiliser application technology comprises organisational measures, choice of appropriate machinery, their proper adjustment and qualified work control. If scattered way of fertilisation is used on fields, then mineral fertilisers have to be necessarily spread as even as possible. Soil cultivation machinery for incorporation of the fertiliser has to be chosen so that the placed fertiliser nutrients would fall closer to roots and would be more easily taken up by plants. If fertilisers (usually nitrogen fertilisers) are spread unevenly cereals lodge in rows, rear differently and the established maximal fertiliser rate is exceeded in some places. Unevenness of spreading of mineral fertilisers cannot exceed ±10 % of the established rate.

The quality of spreading of mineral fertilisers depends on construction and calibration of machinery for fertiliser spreading, quality of fertilisers, field conditions, skills of tractor-driver, etc. Understanding and assessment of these factors allow to spread fertilisers well. Besides, operation of fertiliser spreaders has to be periodically followed and if there is a need, properly calibrated. When fertiliser flow is properly regulated according to discs and needed working width is set with regard to fertiliser type, then spreading unevenness of fertiliser spreader Bogballe EX does not exceed 5 % (Fig. 3.6).

Fig. 3.6. Mineral fertiliser spreader Bogballe EX.

Local fertilisation is more environmental friendly and economical than scattered fertilisation. Fertilisers for cereals, potatoes and sugar beets that are applied in the local way are placed besides and deeper than crop seeds, the crops take up them quicker, and effectiveness of fertilisers increases. Then the lower amount of fertilisers gives the same yield. This reduces soil and groundwater pollution by surplus compounds (Fig. 3.7).

It is useful from agronomic and environmental point of view to use liquid non-evaporating fertilisers (carbamide-ammonium saltpetre, fertiliser KAS, carbamide solutions) more widely, which may be evenly sprayed on ground and crops.

Fig. 3.7. Sugar beet seedier TUME KOMBI – 7, which places fertiliser locally.

3.12. FERTILISER STORAGE

It is possible to buy needed fertilisers at any time during the year. Therefore, they shouldn't be stored on a farm. But fertiliser prices rise continually and they are differentiated according to fertilisation season. Therefore, farmers and agricultural companies gain when they buy cheaper fertilisers in advance. In such case fertilisers have to be stored for some time.

3.9
Mineral fertilisers should be stored in their original (put in factory) package and unpacked fertiliser - in separate stores protected of humidity.

Storehouses of mineral fertilisers have to be built leeward from dwelling houses and barns. Walls, roof and floor of the fertilisers' storehouses should be made of fireproof materials. It is not recommended to floor the material that can strike fire (stones, gravel, broken stones) or easy inflammable material (wood). Ammonium saltpetre, nitro-phosphate and nitro-ammo-phosphate should be stored in the storage separated from other fertilisers by brick wall. It is not allowed to store fodder, metal, fuel and other inflammable material in the fertiliser storehouse.

Very important requirement for fertiliser storage is to preserve fertiliser from moisture and from leakage to environment. It is important that storage building would be leak-proof and that surface water and rainwater would not get into it. Locality has to be well drained.

Gutters and effluent reservoir have to be concreted around the storehouse that solutions formed out of spilled fertilisers would not leak to ground and would not flow to water bodies. When the reservoir becomes full, the effluent is pumped out and poured on fields. It is not allowed to wash machines of fertiliser loading or spreading in open water bodies.