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Hearing on Improving the ecological status of the Baltic Sea
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Improving the ecological status of the Baltic Sea through more sustainable agricultural practices

This talk by Finnish Central Union of Agricultural Producers and Forest Owners (MTK) is given from farmers view but also as a soil scientist and agronomist.

The Baltic Sea is eutrophicated due to high nitrogen and phosphorus input. The nutrient load to the Baltic Sea has gone down since 1990, now being at 1960 levels. This is primarily thanks to massive reductions in urban waste water treatment plants, but also due to reductions in other point sources and agriculture.

We need still find more efficient measures to decrease the load and cut the runoff. This recalls sustainable agricultural practices which both enable food production with high productivity without impairing competitiveness and reduce nutrient inputs to acceptable levels, after the EU Strategy for the Baltic Sea region.

Three main areas where agriculture has potential to further improve the ecological status of the Baltic Sea are addressed. These are:

- Erosion control on cultivated soils
- Best fertilization – efficient use of mineral and organic fertilizers including manure
- Management of vegetation along water courses adjacent to cultivated soils

Before we look into these measures in detail we need to recall some basics about cropping. We need to understand the ecosystem of cultivated land, which is always an ecosystem influenced by human activities.

In order to produce food we need to touch the soil. First, we need to prepare seedbed for cropping. The seedbed preparation and soil tillage activates soil microbes, which mobilize inorganic nitrogen from soil organic pool. Soil tillage thus makes soil vulnerable to nitrate leaching, but at the same time releases nitrogen becoming accessible to the plants to grow biomass.

Secondly, during cropping season, field management practices like mechanical weeding needs further soil tillage. Soil tillage breaks soil aggregates and makes soil more vulnerable to soil erosion. That means soil loss from fields with water or wind. Soil erosion means always phosphorus transport within soil particles.

Non-point, diffuse nutrient losses to the Baltic Sea from agriculture are linked to surface water runoff and thus depend on weather conditions. This makes reductions in nutrient losses most challenging in particular as the frequency of extreme events like heavy rains is increasing.

In most cases, nutrients will not leach during growing season. Nutrients are mainly transported with heavy rains in autumn and spring or by snow melting. E. g. in Finland, 90% of nutrient runoff from cultivated soils is occurring during winter and is due to soil erosion.

1) Erosion control

We need to protect our soils to avoid or minimize runoff and detachment of soil particles. Cultivated soil and its nutrients need to stay on land. In spite of considerable decrease - in Finland close to

80% - in phosphorus fertilizer rates since early 1990's, phosphorus load is still over 1 kg/ha and the major part is soil-bound phosphorus by erosion.

Primarily, erosion control needs well drained and non-compacted soil, which transports excess water deeper into soil without detaching soil particles. Good soil structure relies on soil organic material and microbiological activity. Soil organic material from plant residues and root systems are crucial for all farming systems.

Secondly, erosion control needs minimum tillage, unfortunately not suitable for all soil types. After harvest soils should be protected by leaving crop residues on soil surface or establish new crop cover as soon as possible. Stubble mulching and direct sowing are practices which enable erosion control and help farmers to keep the soil on land.

Additionally, vegetated buffer zones along water courses and on slopes efficiently decrease arable soil loss to waters. Vegetation around field plots also enhances biodiversity of the landscape.

In most vulnerable areas we can improve soil structure by chemical measures. Soil amended by e.g. gypsum has significantly decreased erosion and particle-bound phosphorus loss, up to 60% at the catchment scale.

2) Fertilizer use

Secondly, we need to focus on best available technologies and practices in use of both mineral and organic fertilizers. To attain a sustainable agri-environment, productivity and profitability, fertilizers should be given at right time, after plant needs and to the best place. The best place means below soil surface when applicable.

The nutrient source should allow nutrient use by plants during active root growth. Nutrient release from fertilizers should not be delayed. This fact challenges organic farming and organic fertilisation as nutrients take time to become available from organic sources and highly depends on soil microbiological activity and thus weather conditions.

In principle there is no difference between organic and conventional farming with respect to nutrient leakage from a certain area. Plant roots take nutrients in similar forms from both farming systems. Right timing of plant available nutrients is of utmost importance. Thus, when conducted by best available management practices, conventional farming is often even less risky for waters' quality, as it allows readily available salts for plan nutrition.

Especially phosphorus is essential in early season and for root development. Well developed root system will deplete nutrients from soils before harvest.

To enhance fertilizer use after plant needs we should promote split application after growth potential. The growth potential cannot be predict at planting. This is the case for nitrogen, especially, which is needed to the end of the growth.

Plant needs the essential nutrients like phosphorus and nitrogen. Restrictions of nutrient amounts below crop needs will cause leaching of other nutrients and reduce yields. Intensive cropping with best fertilizer use practises allows more land to natural ecosystems and forestry and mitigate climate change.

One big challenge is animal manure and its use in most efficient way to recycle nutrients. Regarding the need of cultivated plants, manure often contains far too much phosphorus in relation to nitrogen. Because of accumulated manure phosphorus, soil phosphorus increased in animal farms. Soils with high phosphorus content are vulnerable for phosphorus leaching.

To keep the amount of phosphorus within permissible limits, attempts have been made to limit the size of livestock production units, or the farmers must acquire more land to spread the manure with high phosphorus content in a larger field area. Manure storage and manure treatments are important part of sustainable agricultural practises which need to stress for better ecological status of the Baltic Sea.

3) Management of vegetation along water courses

The third practice we need to promote is a biomass harvest adjacent to fields and along water courses. The green biomass of vegetated buffer zones around fields contains easily dissolved phosphorus and nitrogen. If we harvested the biomass before winter we could effectively affect both nitrogen and dissolved phosphorus leaching to the Sea.

This demands extra efforts and cause costs. The measure would be one example of ecosystem services which farmers could provide for society.

Dear audience, today many farmers are aware of soil erosion control, they fertilize after crop demand and by soil supply by best management practices, and harvest green buffer zones.

In the context of the EU Strategy for the Baltic Sea Region, farmers of the Baltic Sea countries (MTK, SLC, LRF, L&F and DBV) have been proactive which has led to two flagship projects, Baltic Deal and Baltic Manure. These projects recall best practices without impaired competitiveness or food production. The farm, the farmer and the advisor are all in focus.

We are on the way in improving the ecological status of the Baltic Sea through sustainable farming practices: The reason why improvements are not so easily observed is the "long memory" of the Baltic Sea. Despite of nutrient load reductions from lands, internal phosphorus loading from the sediments activate algae growth anyway. Additionally, if we looked phosphorus input in dissolved phosphorus, instead of total phosphorus which is mainly soil particle-bound phosphorus of low (16%) accessible to algae, the negative role of agriculture on ecological status and eutrophication of the Sea would be much minor.

We can still improve and we need to improve farming practices. EU Strategy of the Baltic Sea Region has had an important role in mobilizing the agricultural sector that focus upon improved resource efficiency on the farms, for nutrients and manure.

With all the positive trends observed in the agricultural sector with respect to careful and wise nutrient use we are very optimistic. We need to address more efforts to erosion control and leakage from decaying biomass of vegetated buffer zones.

Meanwhile, we need patience as soil and nature reacts slowly.