

SPREADING OF SLIGHTLY POLLUTED SEDIMENT ON AGRICULTURAL LAND

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INTRODUCTION

In the Dutch water management system, ditches have an important function in discharge of surplus of water during wet periods and supply of water during dry periods in the growing season in summer. Without maintenance of the system they become silted up by caving in of the bank, sedimentation of particles present in water coming from other areas, and from residuals of vegetation. Vegetation in most ditches is removed yearly, and the sediment in the ditches is dredged every 6-10 years. In the past, spreading of dredged sediments was not a problem, for dredged sediments have a fertilising function and are used to level fields. Sediments are spread on the banks of the adjacent agricultural fields in a layer of several to about 20-30 cm (depending on dredging method and density of the sediment). When the sediment is dewatered and partly ripened the farmer spreads levels the field (grassland), plough the soils and grows crops on it (arable land).



Spreading of sediments on agricultural land

Since we know that sediments contain contaminants such as PAHs and heavy metals (sediments act as a sink for contaminants) it is not allowed anymore to spread all available dredged sediments. Spreading is limited to clean or slightly contaminated sediments. It is questionable if spreading of slightly contaminated sediment is sustainable as it may lead to accumulation of contaminants in agricultural land and may have impact on the quality of the agricultural products. This research has been started to determine the effect of spreading of sediment on soil quality.

METHOD

Locations were selected in regions with clay soils where slightly contaminated sediments have been spread during last decades (based on data present at Water Boards).



Storage of sediment in a depot

We selected the locations where according to the Water Boards the sediments had the highest levels of contamination (within the Dutch regulation for spreading). On every selected location the sediment, the part of the agricultural field where sediment has been spread and the part where no sediment has been spread (Reference) were sampled. Spreading of sediment is the only difference in the samples taken on the agricultural field and all other activities were responsible for the background in both areas.

In regions with peat soils the practise of

spreading sediment has changed and sediments were collected on relative low-lying fields, in order to elevate the level (depots). After ripening of the sediment the elevated fields are taken into agricultural practise again. The elevated fields and reference neighbouring fields have also been sampled.

Samples were analysed on heavy metals and organic contaminants. Special attention has paid to the bioavailability of the contaminants. Bioassays were used in a selection of the samples.

Results of the practical study were supported by a model study in which accumulation is calculated as the results of all inputs (e.g. sediment, air, manure) and outputs (e.g. leaching, uptake by crops, biodegradation).

RESULTS

Clay areas

- The sediments spread are relatively clean, maximum allowable concentration are mostly not present and very often concentration are just above the criteria for clean sediments.
- The effect of spreading on the accumulation of heavy metals is not recognizable on most locations. The background concentration (Reference) is the most important factor for the concentration found. Increase of the actual bioavailable amount is observed, which could be explained by the pH.
- For PAHs, accumulation could be observed. The bioavailability of the PAH is low, which means that biodegradation is a slow process and the degradation is not fast to eliminate the addition of new PAHs in after spreading of new sediment. On the other hand a low bioavailability also means a low risk.
- Modeling results show that accumulation is stronger with a large difference in quality between sediment and soil on the agricultural land. The model is suitable to do simulations with different sediment qualities.

Peat areas

- In the depots a thicker layer of sediment is used and no dilution occurs due to mixing with the original soil. The sediment quality is also the quality of the soil obtained after ripening (heavy metals)
- Content of PAHs slowly decreases due to the low bioavailability
- The actual availability of heavy metals strongly increases due to decrease of the pH, which is caused by oxidation of FeS present in the sediment.

CONCLUSIONS

The practise of spreading of light contaminated sediments has not created large problems, due to the fact that most sediment are relatively clean and local background values are responsible for the soil quality. Local background values are often much higher than the natural levels. Negative effects are explainable (pH change) and consequently manageable. Model results shows that acceptance of spreading of more contaminated sediments (looking for the borders) may lead to decrease of the quality of agricultural land.