Interactions between agricultural practice, mobility and retention of P in soils

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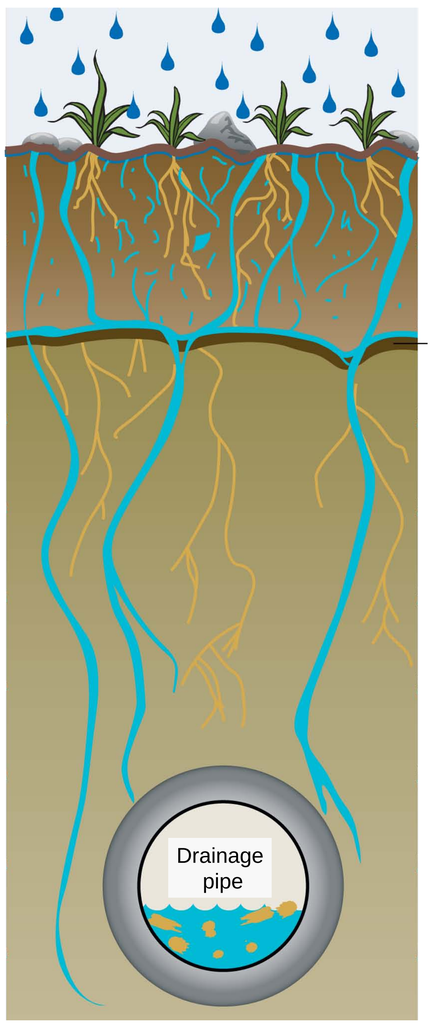
Denmark



Background

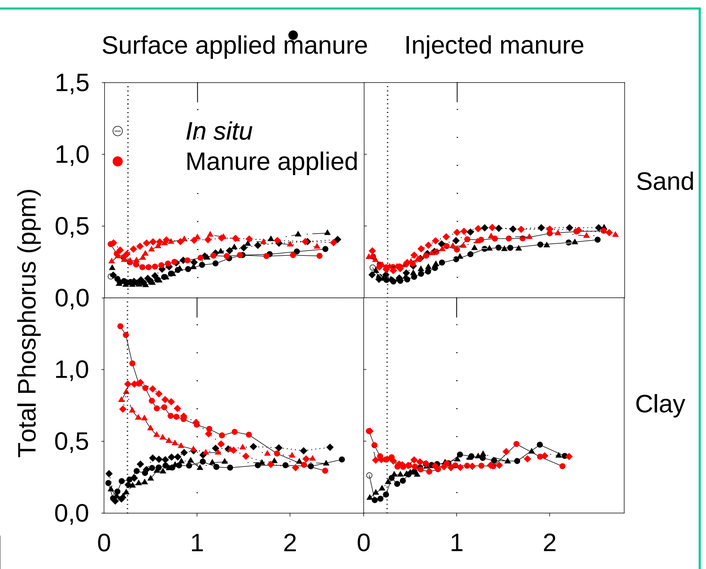
In Denmark 1400 kg P per ha have accumulated in agricultural soils during the last century. This P is an important resource for agricultural production, but it has also raised the potential for P export to the aquatic environment – an export which should be reduced.

We investigated

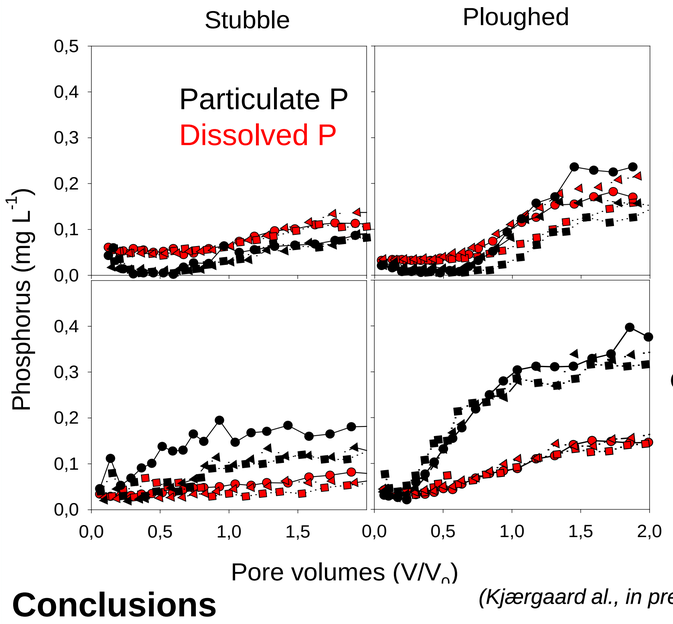
- Phosphorus leaching from the plough layer as affected by manure application method, soil tillage and liming
- How the accumulated P distributes in the soil profile
- How the Olsen soil P test changes with time in response to different P input scenarios at different soils.

P leaching

Studies were carried out on intact soil columns (20 20 cm) from the plough layer. The Precipitation rate was 2 mm h^{-1}.
We applied permanent suction (-5 hPa) at the bottom of the columns.



(Glæsner et al., 2011)



(Kjærgaard al., in prep)

Results

Application of animal manure increase the risk of P leaching, but the risk is reduced by manure injection.

The effect of manure application and application method is more pro-nounced on the loamy soil.

Ploughing increases risk of leaching.

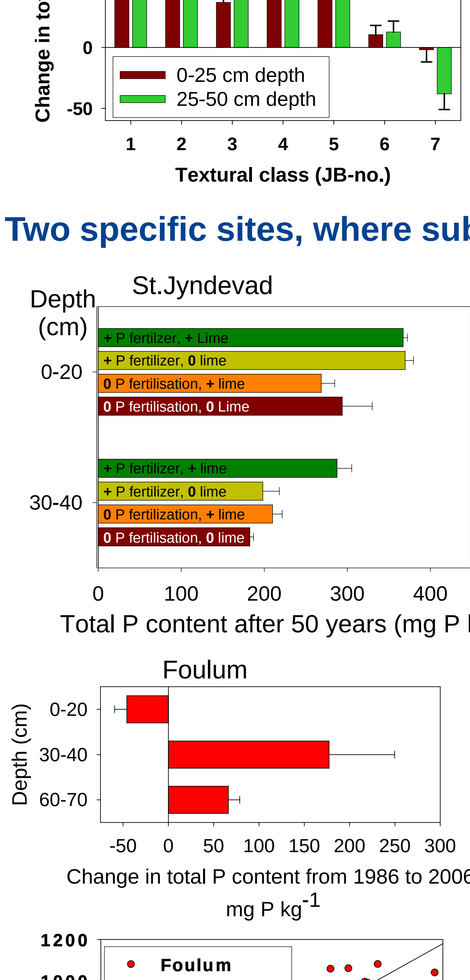
The effect of ploughing depends on soil type.

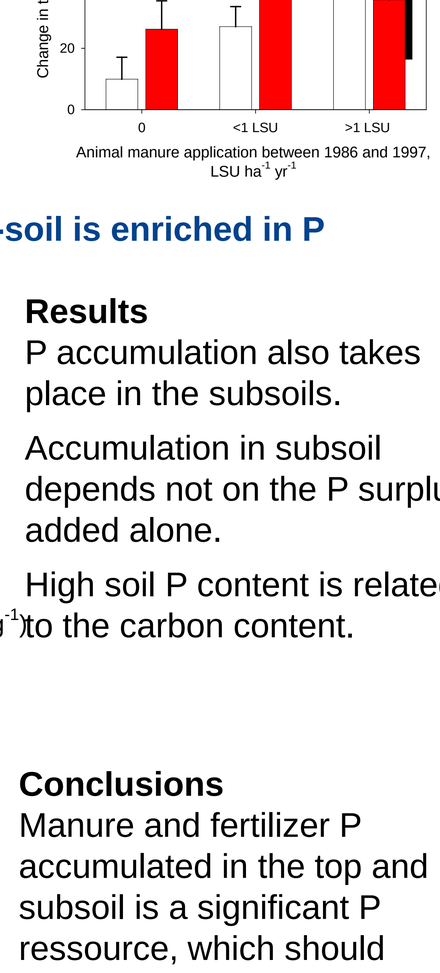
Conclusions

The risk of P leaching from the plough layer can be reduced by timing of field activities such as soil tillage and by manure injection. The reduction depends on soil type, which can be taken into account when sececting mitigation strategies

P distribution in the soil

P enrichment in Danish soils from 1987 to 1998, 337 sites





Two specific sites, where sub-soil is enriched in P

Results

P accumulation also takes place in the subsoils.

Accumulation in subsoil depends not on the P surplus added alone.

High soil P content is related to the carbon content.

Conclusions

Manure and fertilizer P accumulated in the top and subsoil is a significant P ressource, which should utilised in crop production.

The processes leading to the observed transfers of P between top- and subsoils are poorly understood.

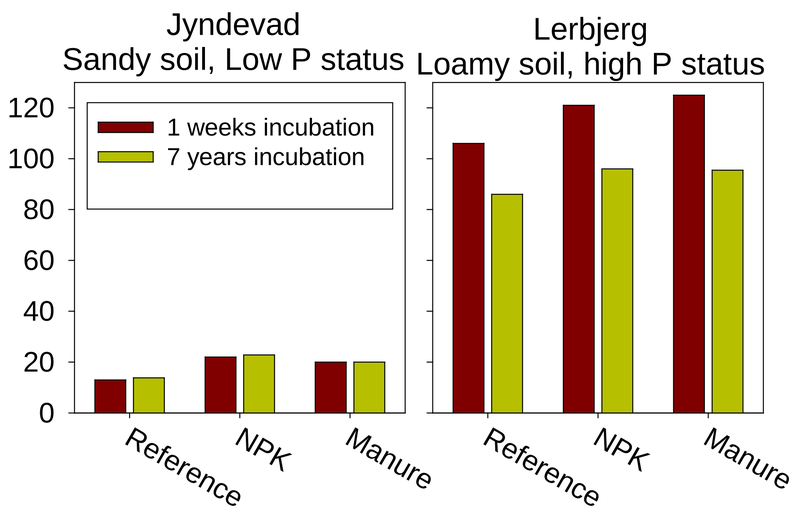
(Rubæk et al., in prep)

Trends in Olsen P

Soils were incubated for 7 years under ambient climate conditions.
Equal amounts of P were added initially as NPK fertilizer or animal manure (100 kg P ha^{-1}). Plant growth were prevented.

Results

Increases in Olsen P were similar for NPK and manure.
The longterm effects of P additions depended on soil type and initial soil P status.



(Rubæk et al., in prep)

Further work

Based on this study and other datasets, we will develop a model predicting Olsen P from knowledge of P input, soil type and initial P status.

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