

SOIL TILLAGE METHODS TO REDUCE EROSION

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Description

Soil tillage is a main management factor that contributes to increased risk of soil erosion and losses of phosphorus (P). The risk of soil erosion is highest during autumn, winter and spring and hence reduced tillage or no till in autumn is one of the main methods to mitigate phosphorus and soil losses in arable cropping.

Rationale, mechanism of action

Compared to soil tillage, reduced tillage will lead to lowering of erosion risk due to:

- Soil is covered with stubble or plant residues on the soil surface.
- Improved stability of soil aggregates.
- Increased content of organic matter in surface soil stabilizing the soil.
- Increased microbial activity causing improved soil structure.
- Reduced plough pan and hence better infiltration compared to ploughing.

The difference in erosion risk for different systems of soil management has been evaluated [1] based on plot experiments during 1994-2000 in southeast Norway.

Table 1. Management-factors for different soil management systems and different soils (12-13% slope), evaluated based on long term plot studies (Lundekvam, 2007)

Soil management method*	Management factors		
	Levelled silty clay loam, high erodibility	Clay	Loam with high aggregate stability, low erodibility
Spring cereal, autumn ploughing, harrowing in spring	1.0	1.0	1.0
Winter wheat, ploughing and harrowing in autumn	1.3	0.70	
Harrowing in autumn and spring	0.47	0.66	
Ploughing and harrowing in spring, no till in autumn	0.11		0.59
Harrowing in spring, no till in autumn	0.10		
Direct drilling in spring, no till in autumn		0.19	
Ploughing across the slope	0.70		

*Spring cereals are grown on all systems and tillage is along the slope unless otherwise stated.

Applicability

Reduced soil management is mainly applicable to areas of high to very high erosion risk. On areas with medium and low erosion risk the effect is less. Furthermore this mitigation method is only applicable in arable cropping.

Effectiveness, including certainty

Soil management is one of the most efficient methods to mitigate soil erosion and particle associated pollutants. There are uncertainties related to the use of reduced soil management on soils with low erosion risk and P loss has been shown to increase by reduced tillage in some studies on areas with low erosion risk [2].

Time frame

The effect of soil management on soil erosion and phosphorus losses occurs immediately.

Environmental side effect

Reducing soil erosion may cause increased need for use of pesticides and subsequently problems of pesticide leaching.

Relevance, potential for targeting, administrative handling, control

There is a large potential for targeting high risk areas of erosion with this mitigation method. In Norway, the highest subsidies for reduced tillage are given to areas of high erosion risk.

Costs: investments, labour

Costs of reduced soil management includes cost of machinery, possible reduction in yields, increased labour at odd times and often cost of pesticides and spreading of pesticides. The costs of machinery may be positive or negative. Less energy is needed for reduced tillage or no till.

References

- [1] Lundekvam, H. 2007. Plot studies and modelling of hydrology and erosion in southeast Norway. *Catena* 71, 200-209.
- [2] Gaynor, J.D. & Findlay, W.I. 1995. Soil phosphorus loss from conservation and conventional tillage in corn production. *J. Environ. Qual.* 24, 734-741.