

ON CLAY AND SILTY SOILS - SOIL CULTIVATION TO GET AN UNEVEN WINTER SOIL SURFACE

2011

Authors: B. Ulén, M. Bechmann, T. Krogstad

Description

After harvesting, compacted soils are cultivated with discs or tines to increase surface roughness and water infiltration.

Rationale, mechanism of action

This topsoil loosening technique primarily reduces surface run-off and soil erosion. It also involves leaving the autumn seedbed rough. This is achieved by avoiding power cultivation equipment or any use of heavy rollers. The topsoil should be loosened during dry conditions. This loosening disrupts any surface crusts and increases surface roughness. This can improve water infiltration into the soil rather than creating surface runoff and reduce the erosive energy. When soils are compacted or capped and there is little crop residue or vegetation to intercept rainfall, they are very susceptible to generation of surface runoff. Establishment of a vegetative cover through natural regeneration is the aim.

Applicability

Topsoil loosening is applicable where soils are compacted, particularly in high winter rainfall areas and when cultivating cereals and maize. Increasing seedbed roughness is applicable for winter cereal crops that can establish well in coarse seedbeds. Topsoil loosening is not suitable for oilseed rape, sugar beet or grass. The cultivation itself is straightforward for clayey soils. The opposite practice of using tillage packers has been demonstrated to increase the risk of surface runoff in southern Sweden [1]. However, for topsoil loosening to be effective, it should be carried out in the late summer or early autumn when there are many other competing work tasks to be carried out by the farmer.

Effectiveness, including certainty

Nitrogen: The effectiveness of topsoil loosening depends on the size of the compacted area. Nitrogen that is not taken up by the crop because of compaction will not necessarily be leached. In addition, cultivation of the compacted soils in autumn might even enhance the mineralisation of soil organic N and water infiltration rates into the topsoil. Thus, even a very small mixing of the topsoil in autumn tends to give increased mineralisation. This increases the risk of nitrate leaching by a small extent over the winter. On the other hand, stimulated germination of volunteer seed (e.g. rape) leads to it functioning as a catch crop that reduces N leaching. Increasing seedbed roughness has no effect on nitrate leaching.

Phosphorus: Including 'expert weighting', it was assumed that topsoil loosening achieved a 25% reduction in the soil component of P losses for a clay loam in UK. For increasing seedbed roughness the corresponding figure was also 25% [2].

Time frame

The long-term effects should be evaluated since if topsoil loosening is practised repeatedly a new topsoil structure is built up.

Environmental side-effects

A rough seedbed might have a positive side-effect since it can reduce the need for herbicides. A negative consequence might be that any subsequent traffic on the looser soil may cause aggregate breakdown and increased runoff and erosion from, for instance, tramlines [3].

Relevance, potential for targeting

The measure is easy to encourage but difficult for targeting.

Costs: Investment, labour

Active topsoil loosening involves additional labour and fuel costs.

References

- [1] Nätterlund, H. 2007. Countermeasures to Reduce Surface Water Erosion. Focus on Nutrients Team, Offset & Media, Malmö, Sweden, 16 pp.
- [2] Cuttle, S., Macleod, C., Chadwick, D., Scholefield, D., Haygarth, P., Newell-Price, P., Harris, D., Shepherd, M., Chambers, B. & Humphrey, R. (2006) An Inventory of Methods to Control Diffuse Water Pollution from Agriculture (DWPA) USER MANUAL. Defra report, project ES0203, 115 pp. p. 22-23 http://www.cost869.alterra.nl/UK_Manual.pdf
- [3] Withers, P.J.A., Hodgkinson, R.A., Bates, A. & Withers, C.M. 2006. Some effects of tramlines on surface runoff, sediment and phosphorus mobilization on an erosion-prone soil. *Soil Use Manage.* 22, 245-255.