



# Mechanical loosening of compacted soil layers in grassland fields

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- **DESCRIPTION:** Mechanical loosening involves the use of an aerator (i.e. spiker/slitter) to disrupt a surface compacted layer (0- 10 cm depth) or a disc, tine and packer-roller combination (e.g. a ‘sward lifter’) to lift and shatter a sub-surface compacted layer in the topsoil or upper subsoil (between approximately 10 and 30 cm depth). These operations should be carried out when the compacted layer to be disrupted is in a ‘friable’ condition and, in the case of ‘sward lifting’, when the soil surface is moist so as not to damage the grass sward.



Fig.1: Example of an aerator or spiker/ slitter

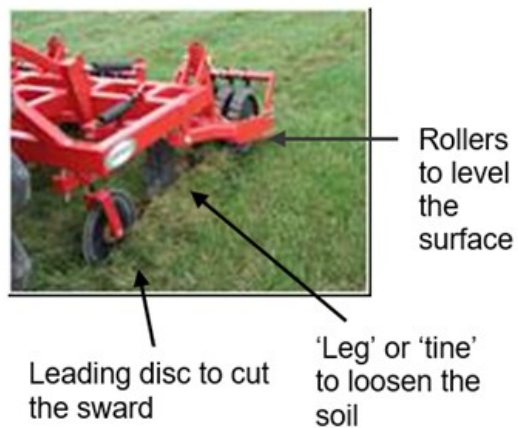


Fig.2: Example of a sward lifter



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- RATIONALE:**

Compacted soil layers reduce the infiltration of rainwater and slurry. Disrupting these compacted layers allows more rapid percolation of rainwater/slurry into the soil and allows the soil to dry out more rapidly. This reduces the risk of pollutants being transported to watercourses in surface runoff and provides more opportunities (through the year and in the growing season) for livestock grazing and field operations such as silaging and hay making without damaging the soil. This in turn can reduce the number of days when livestock need to be housed, thereby reducing the overall costs of production associated with feeding livestock indoors and managing manures.

- MECHANISM OF ACTION:**

Trampling by livestock (both cattle and sheep) and the passage of heavy farm machinery can compact grassland soils in both grazing and silage fields. Compaction due to grazing activities is usually found somewhat higher in the profile and has more opportunities for natural recovery. Machinery compaction is usually deeper and takes longer for natural recovery. Compaction may build-up over a number of years and persist in the long-term. Topsoil loosening and shallow spiking/slitting can break up compacted layers and allow more rapid rainwater and slurry infiltration, thus reducing surface runoff. In addition, soil aeration can be improved and result in roots being able to penetrate deeper into the soil, which will increase nutrient uptake from deeper soil layers. Sward lifters operate in a similar way to a subsoiler by lifting and shattering the compacted layer. The packer roller behind the blade/leg ensures that the field operation results in an even ground surface.

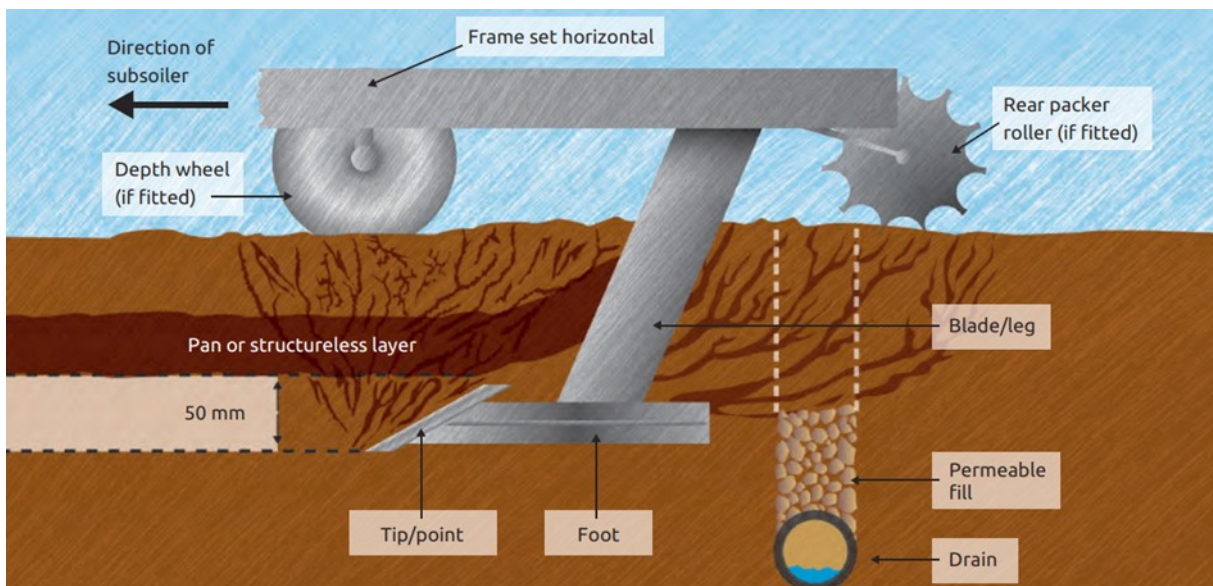


Fig.3: A grassland sward lifter operates in a similar way to a subsoiler, but at shallower depth.

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## Potential for applying the management option

The method is potentially applicable to many grassland farms that graze livestock or operate heavy machinery when soils are moist or wet, particularly those with high stocking rates. However, in many extensive livestock grazing systems, mechanical loosening will not be necessary and, if carried out when there are no clear signs of soil compaction, is likely to do more harm than good.



## Practical considerations

The method can be difficult to apply on stony or shallow soils or steeply sloping fields. Indeed, on some stony or shallow soils, particularly those with large stones, such an operation is ill-advised due to the risk of damage and wear to machinery and the inevitable lifting of stones that can cause significant damage to the sward. Nevertheless, where soil compaction has been identified mechanical loosening can result in a three- to ten-fold increase in water infiltration rates and result in a significant improvement in drainage and land versatility for grazing and cutting.



## Support

No external incentives are needed, although mechanical loosening has been incentivised through capital grants in some agri-environment schemes. This can be beneficial on farms where soil compaction is commonplace. However, it could be detrimental to soil health where soils are in good condition. Any financial support should therefore be accompanied by technical support to ensure that mechanical loosening is well targeted and well timed, i.e. where, how and when (see guidelines below). Where soil compaction has been identified, the costs associated with mechanical loosening can be more than paid for by the improved drainage and increased ability to graze animals in the early spring and late autumn.



Fig. 4: Ground surface and sward after sward lifting



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## Guidelines for the use of topsoil looseners or 'sward lifters' on mineral grassland soils in the Atlantic region:

Adapted from ADAS Technical Briefing notes (ADAS, 1984; 1987):

1. Do not use topsoil looseners unless there are clear signs of soil compaction, and the moisture content is suitable:
  - Examine the soil by digging holes to find out the nature and depth of any compacted layers, as well as the moisture content and friability of the soil.
  - Topsoil loosening in dry conditions is likely to lead to the formation of large clods, sward tearing and excessive surface heave giving an uneven surface finish.
  - Topsoil loosening in conditions which are too wet will potentially lead to increased soil damage through smearing and wheel slip.
2. Topsoil loosening is not recommended in poorly drained soils if there is no drainage system present, as this is likely to cause excessive wetness in low lying areas which will potentially be at further risk of poaching and re-compaction. In these situations, and on heavy textured soils, moling may be more effective in improving the soil drainage status than topsoil loosening.
3. Topsoil loosening should be carried out in the autumn when grass growth is declining. If carried out in the spring or summer when grass is growing rapidly and is often under moisture stress, disturbance to the root system can lead to severe sward death.
4. Use the appropriate equipment and set it up correctly. The depth of compaction will dictate the depth of working required - make sure the compacted layer is above the critical working depth of the implement used and examine the extent of shatter of a trial run, adjusting the equipment if necessary.
5. Recently loosened soil is very sensitive to re-compaction and it is important to allow the newly loosened structure to be stabilised by root activity and natural soil processes:
  - Cut or graze the site immediately before treatment.
  - Avoid grazing after loosening and conserve rather than graze in the first spring after treatment.
  - If late growth needs utilising, use sheep rather than cattle to minimise re-compaction damage.
  - Do not spread slurry on recently loosened fields.

