

Summary

- The farming industry is committed to reducing P losses from farmland to surface waters.
- Soil compaction by grazing animals prevents rainwater soaking into soil resulting in increased overland flow and hence increased P transport from pastures into streams and rivers.
- Zero grazing, by reducing soil compaction, can decrease P loss from pasture land.

Background

Grassland used for intensive dairy production in Northern Ireland (NI) often has soils of relatively high phosphorus (P) status (Olsen-P Index 3 and 4) owing to high inputs of fertiliser and manure.

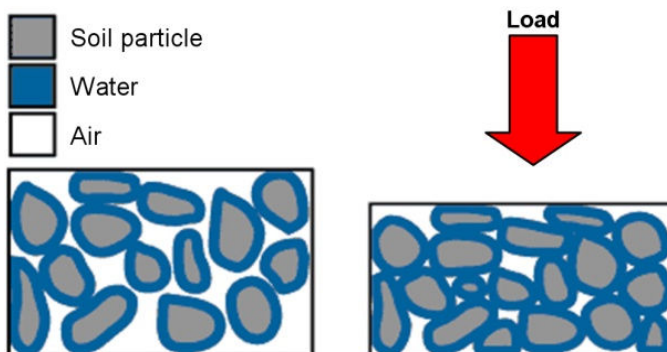
Under wet conditions, rainwater flowing over the surface of these high P soils carries some of the P into adjacent streams, rivers and lakes where it promotes algal growth - a major problem in NI. Anything that can reduce the amount of water flowing over the surfaces of pastures, therefore, ought to reduce the amount of P carried into streams and lakes.

One factor controlling rainwater flow over land is soil structure. Compacted soils prevent rainwater from soaking in, and so instead it flows over the surface. Anything that can reduce soil compaction therefore will reduce overland flow and hence P loss to streams.

A well known cause of soil compaction is excessive trafficking by farm machinery. Recent research has also shown that continual treading of pastures by dairy cattle compacts soil and increases P transport (export) from pastures into field drains and streams.



Soil Compaction by Dairy Cattle



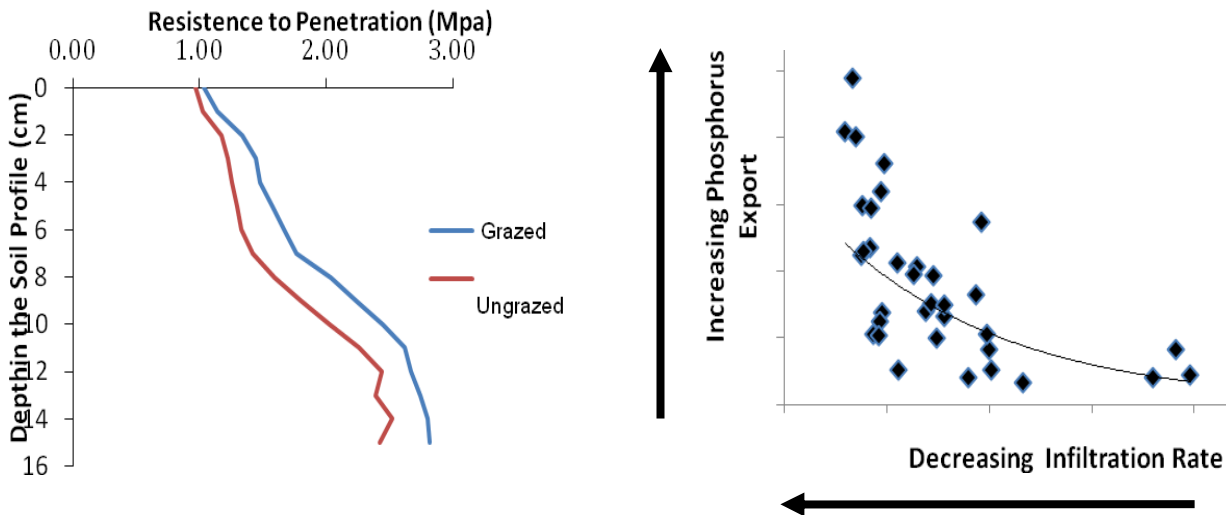
Top soil is made up of soil particles, water and air. When a heavy load, such as the hoof of a dairy cow, is placed on the soil surface, some air is squeezed out and the soil particles are compressed.



Over time, with continual treading, this compression can result in a compacted blue-green coloured layer of soil forming below the soil surface. This compacted layer prevents water penetrating into the deeper soil. As a result, the surface layer becomes saturated with water and additional rainwater flows overland into ditches and streams.

Benefit of Zero-Grazing

Research conducted by AFBI at Hillsborough showed that, following zero-grazing for one season, when paddocks were cut and the grass fed to housed dairy cows, the soil on these paddocks was significantly less compacted than it was on other paddocks where cows were allowed to graze.



Resistance to penetration is an indicator of how tightly soil particles are compressed together. The more tightly compressed the particles the greater the resistance to penetration.

As shown in the diagram above (left), resistance to penetration was greater on grazed than on ungrazed paddocks. Tightly compacted soil particles slow down rainwater infiltration allowing more P to be removed in surface runoff. As shown in the diagram above (right), decreased water infiltration caused by soil compaction, increased phosphorus export from grassland.

Recommendations

- Excluding grazing cattle from selected fields where soil Olsen-P status is high (Index 4) should help to decrease P losses to ditches and streams on intensive dairy farms.
- To maximise the benefits of zero grazing, regulations controlling the application of organic and inorganic fertiliser P should also be followed to prevent further build-up of P in soil.
- Following return of cattle to fields, good grazing management is required to ensure that compaction does not reoccur.