How much poaching is acceptable?

Moisture probe takes out the guesswork

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During wet weather farmers are faced with the decision of turning cows out to grass or keeping them indoors and incurring higher costs. The decision varies from farm to farm, mainly due to differences in soil type but also due to the mind-set of the farmer.

Farmers are justifiably keen to avoid poaching damage because it has consequences for subsequent grassland productivity. However, there is no consensus as to what is, or is not, acceptable poaching damage. This is because there is a lack of knowledge of the long-term impact on grassland productivity.

Since 2008 we have conducted a number of experiments at the Teagasc Solohead Research Farm with the objective of quantifying the impact of poaching damage on grassland productivity on a heavy soil.

These long studies included 2009 and 2012, which were very difficult years for grassland management, primarily because an exceptionally high proportion of annual rainfall fell during the late spring and summer months.

The results of these studies indicate that poaching was less damaging to pasture productivity than anticipated. Perennial ryegrass has a considerable capacity to recover from poaching damage and is well adapted to cope with such conditions.

Cows performed better when they were outside on grazed grass even under very difficult conditions. During February and March 2016, for example, (Figures 1 and 2), cows on grass outperformed their comrades on silage and concentrates.

Chart 1
Annual rainfall at Solohead between 2013 and 2016 compared with long-term average

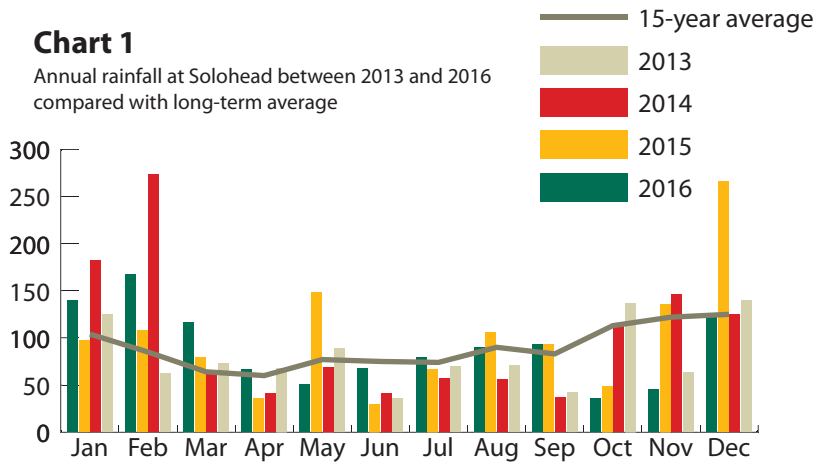
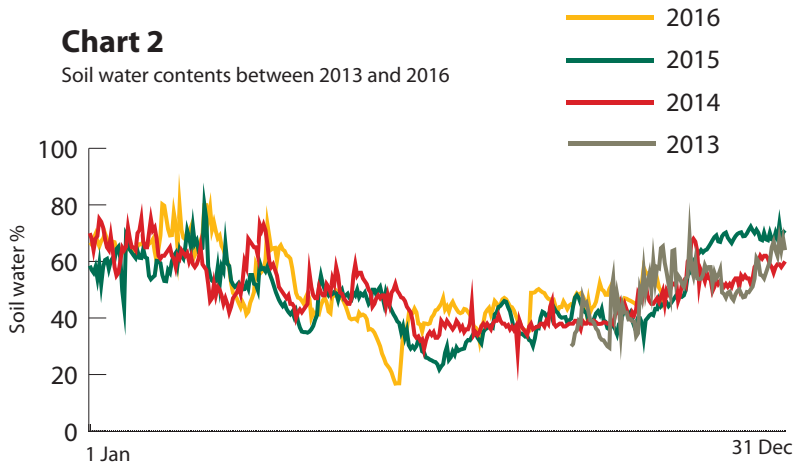


Chart 2
Soil water contents between 2013 and 2016



Soil structure and wetness

Soil is composed of sand, silt and clay, and the organic matter that binds them together in a particulate structure. This framework of soil particles comprises only 50 to 60% of total soil volume. The remainder is the space between the particles, which is filled with air and water. The ratio of air to water in the soil varies depending on rates of rainfall, evaporation, plant uptake and natural drainage from the soil.

By international standards, soil conditions in Ireland range between being wet and very wet and, generally speaking, excessive wetness is as or more likely to limit growth than drought. Nevertheless, such conditions ensure a long grass growing season, which gives us a competitive advantage in dairy production.

The space between the soil particles is never 100% filled with water or 100% filled with air. During drought conditions, when grass growth is limited by lack of water, the soil space can still contain 15 to 20% water. On the other hand, even where the soil is wet to the extent that there is ponding on the soil surface, only 80% of this space is filled with water; many small packets of air remain trapped in the soil. A soil moisture probe can be used to get an objective measure of soil wetness, which we used for managing experiments on poaching damage (Figure 3).

Although soil conditions at Solohead have been massively improved by artificial drainage over the years there are two fundamental problems that remain: (i) the water table is typically only 1 to 2 m below the soil surface and it doesn't take much rainfall to raise the water table up to the soil surface and (ii) the heavy soil has poor infiltration characteristics, which means that surface water is slow to drain away after heavy rainfall.

Soil wetness and poaching damage

When soils are dry the soil particles sit on top of each other in close contact and have a structure that is sufficiently weight-bearing to bear the weight of a dairy cow or silage harvesting machinery. When soils are wet the spaces between the soil particles contain a high proportion of water, which causes the particles to 'float' and have less contact with each other. This gives the soil a more malleable consistency, which makes it vulnerable to poaching damage.

Hooves can penetrate the soil surface mashing the grass into the soil and breaking up the network of grass roots. In the short-term, mashing the grass into the soil causes poor sward utilization whereas damage to the root network can have longer term consequences. Our experience

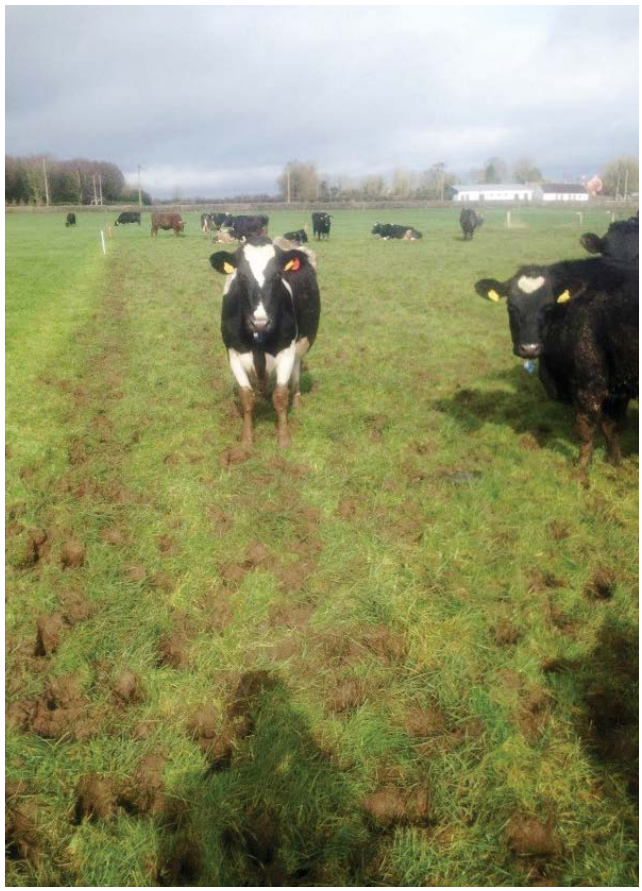


Figure 1: Pre-grazing sward showing ponding at the soil surface in low lying parts of the paddock and cows out fulltime on pasture on 23 February 2016.

has shown that there is little or no poaching damage when the soil water content is at or below 50%. Poaching damage progressively increases with increasing soil wetness above 50%.

Decision support

We have recently concluded a study looking at using soil water content as a decision support for turning cows out to pasture or keeping them indoors. In the study there were four grazing systems.

In system 1, cows were turned out the pasture full-time as they calved from early February and remained at pasture until late November or early December regardless of soil and weather conditions. In system 2, cows were turned out to pasture in February but were put on on-off grazing at any stage of the grazing season when soil water contents were above 60%. System 3 is similar to system 2 except that cows are on on-off grazing at any stage of the grazing season when soil water contents were above 50%.

In systems 2 and 3 on-off grazing involved allowing cows access to pasture for four hours after morning milking and for four hours after evening milking. They were housed for the remainder of each day and were not supplemented with silage.

In system 4 cows were housed full-time until soil water content dropped below 50% and were housed again in the autumn when soil moisture went above 50%, which is equivalent to turning cows out in April and housing them in October. This study was conducted over three years between autumn 2013 and autumn 2016.

The long term average annual rainfall at Solohead is 1075 mm. During the study there was above rainfall in 2014 (1202 mm) and 2015 (1214 mm) and below average rainfall in 2013 (975 mm). Despite an exceptionally wet winter and spring, rainfall during 2016 was close to average. The soil water contents during these years can be seen in Chart 1.

The herd of cows that was outside full-time, even under very difficult conditions (Figure 1 and 2), performed substantially better than the herd kept inside, with higher milk yield and protein percentage and, hence, higher milk solids production during this period.

There was little difference in performance of the herds on on-off grazing and the herd outside full-time although there was a trend for the cows out full-time to perform better particularly in terms of milk protein percentage. Furthermore, there was no different in grass growth between the four systems. On-off grazing increased labour requirement compared with keeping cows out full-time and keeping cows indoors substantially increased costs.

Keeping cows out full-time, albeit incurring some poaching damage (Figure 1 and 2) was more profitable than on-off grazing and substantially more profitable than keeping cows indoors until such time as there was minimal poaching damage.

Implications

There was no benefit to avoiding poaching damage. Perennial ryegrass is well adapted to coping with poaching; many of the swards at Solohead are up to 20 years old and contain over 80% ryegrass, which we attribute to the maintenance of good soil fertility over the years.

Even where the soil is completely churned up, with ryegrass roots turned downside up, the ryegrass can recover reasonably well from a once-off severe poaching event (Figure 2). However, repeated severe poaching can lower subsequent grass growth by 20%.

Damaging repeated poaching is most likely to occur during April and early May when soil water contents are still high and grazing rotations are short (21 days). In contrast, although soil water contents can be

Figure 2: Post-grazing damage and recovery of the sward seven days later.

very high in the early spring and autumn, longer rotations (42 days or so) at these times of the year means that the sward has a longer time to recover between grazings and this has a big bearing on subsequent pasture productivity. Likewise pastures badly poached in the autumn have plenty of time to recover during the winter to full productivity by the spring.

The best defence against inevitable poaching damage is the maintenance of soil fertility. Resting the sward and applying a compound fertilizer containing N, P and K is best way of recovering a damaged sward.

Oversowing with grass seed can benefit severely poached swards. Using a lighter breed of cow (jersey crossbred) offers a marginal advantage in avoiding damage. We have found the impact of rolling a poached sward to be far more damaging than the original poaching. Grass will grow equally well on a rough surface as on a level one. Allowing cows in to graze out a sward under good soil conditions (<50% soil water) is a very effective way of levelling a previously badly poached sward with minimal impact on subsequent grass growth.

Figure 3: Soil moisture probe.

Although there is no consensus on what is or is not acceptable poaching damage the soil moisture probe gives an objective measure of soil wetness. We have found that at, or below, a soil water content of 50% there is little or no poaching damage. Poaching damage increases with increasing soil water between 50% and 70% but with acceptable damage levels once the situation is managed with due attention, ie moving the cows to fresh grass after each milking etc.

The tipping point seems to be around a soil water content of 70%. At this point the soil is easily liquidified and a lot of damage can be done in a short time. At this stage it is better to keep cows indoors on silage and concentrates. There is a need to test the usefulness of the soil moisture probe for this purpose on commercial farms.

This work is supported by DAFM funding under RSF 11 151.

Table 1: Milk production per cow between October and May averaged over three years (SW = soil water content)

	Outside fulltime	On-off grazing until SW = 60%	On-off grazing until SW = 50%	Inside until SW = 50%	Difference
Milk (kg)	3027	2966	2979	2779	*
Fat (kg)	141	139	138	127	**
Protein (kg)	115	112	111	100	***
Milk solids (kg)	256	251	248	227	***
Fat (%)	4.66	4.74	4.65	4.63	ND
Protein (%)	3.80	3.77	3.68	3.61	***