Farming on soggy ground

Waterlogged soil lowers grass growth

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In an experiment conducted by John Mulqueen many years ago, grass growth where the watertable was close to ground level was 30% lower than where the watertable was maintained at deeper than one metre. Wet soils have lower load-bearing capacity and unavoidable grazing damage on wet soil can further lower herbage production by 20% or more. Overall, wet soil conditions can substantially lower grass growth and utilisation and this clearly affects profitably.

At Solohead Research Farm over the last 10 years, annual rainfall has ranged between 796mm and 1,336mm. Wet years caused higher costs and lower milk sales due to lower milk yield and constituents. In wet years, poor grass growth on the farm increased the need for bought-in feed; more concentrates in above-average years and silage or other forage substitutes in exceptionally wet years, such as 2008 and 2009. Difficult grazing conditions increase the length of time that cows are fed indoors on relatively expensive silage and concentrates.

After turnout, difficult grazing conditions and wet grass, sometimes as low as 10% DM, negatively affects animal performance and milk sales. Wet conditions impede silage making, delaying harvest and generally results in poorer nutritive value silage, which has a knock-on effect on cow condition over the winter and on herd fertility. Wet soils increase the incidence of fluke, worms and other diseases, negatively impacting on animal performance and milk sales even where good control procedures are in place.

The problem of wet soils is generally due to a combination of high rainfall, low evapo-transpiration and a low rate of percolation through the soil. Evapo-transpiration is the amount of water that is evaporated or transpired by plants and disperses into the atmosphere as water vapour. It is generally in the region of 450mm per year across the island of Ireland and does not vary much from year to year. It is a very important route for water removal from the soil. The lowest annual rainfall recorded at Solohead in the last 10 years was a little less than 800mm in 2001. Hence, evapo-transpiration (450mm) removed more than half of this from the soil; the remaining 350mm had to percolate down through the soil or flow over the soil surface into open drains.

Annual rainfall

The highest annual rainfall at Solohead was 1,336mm in 2009. In that year, nearly 1,000mm of water had to percolate down through the soil or flow off the soil surface, which was a threefold increase compared with 2001. The soil at Solohead has a high clay and silt content, which impedes the rate of percolation. In 2008 and 2009 annual rainfall was 1,228mm and 1,336mm, respectively, and the top soil remained waterlogged for 14 of this 24-month period, The watertable stayed close to the soil surface during the remaining months, which had a very negative impact on grass growth and caused many of the problems outlined above, including an increase in fluke and the first recorded incidences of rumen fluke on the farm.

A rising watertable is also a problem at Solohead. This is where rain falling on higher parts of the farm percolates down into the ground, moves underground and comes to the surface in low-lying areas. A system of deep underground drains was put in place during the 1980s and 1990s to intercept this rising water and the farm is well drained in this regard.

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Even so, the low permeability of the soils at Solohead remains a problem, particularly under high rainfall

Drainage to alleviate soil wetness promotes deeper rooting, allowing the sward to draw nutrients from a greater volume of soil which improves sward productivity. It also improves load-bearing capacity. In the past, another way of increasing sward productivity on wet soils was to apply more fertilizer. However, in recent years, fertilizers have become very expensive and high fertilizer use is less viable than it used to be. It also does not solve the problem of load-bearing capacity. On the other hand, the cost of land drainage has become more competitive than in the past mainly because of the substantial increase in the capacity of modern machinery to install drainage infrastructure.

The targets of Food Harvest 2020 require higher productivity from farms across the country. Soils with drainage problems account for 40% of the soils in Ireland. Taking this into account, along with the concerns of farmers experiencing problems on wet soils in recent years, at Solohead Research Farm we have started a programme of examining ways of improving the profitability of milk production on wet soils. The main focus of this research is on increasing the length of the grazing season and carrying capacity on heavy textured soil.

One experiment is looking at the effect of cow weight and stocking density on soil compaction and herbage production, comparing Holstein-Friesian (HF) and HF x Jersey (JX) cows at two stocking densities (2.35 and 2.65 cows per ha). Herds are equal in terms of EBI, age profile, calving date, etc. The main difference is liveweight. The HF cows average 610kg per cow compared with the JX average of 480kg per cow. It is still too early to draw firm conclusions, but the JX are clearly ahead of the HF in terms of the efficiency of turning grass into milk.

Despite cutbacks we have been able to set up a state-of-the-art system for evaluating different drainage systems, which include mole drains, gravel-filled mole drains and stone-filled trenches, which were installed during 2011. The process of mole ploughing loosens up the soil, which improves the rate of percolation of water through the soil, and the channel formed by the foot of the mole plough provides a route for the water to exit the soil into collector drains.

The moles and gravel-filled moles are 55cm deep at 1.1m spacing and the trenches are 1m deep at 10m spacing. These are being compared with undrained land. Overland flow, drain flow, watertable depth and herbage production are being measured to conduct an economic evaluation of the production response relative to the cost of the drainage. It was recommended in the 1970s that mole drains should last for three years to be economic. Under our circumstances, the gravel-filled mole drains cost 12 times as much to install as the mole drains. It will take a number of years to properly evaluate these different systems of drainage.

Another issue that we are investigating is whether or not it is beneficial to include a corrugated plastic drainage pipe in the stone-filled trench. Plastic pipes and the gravel used to surround them in the bottom of a trench are expensive. It is becoming increasingly common practice on farms not to include them and simply fill the trench with stone. We are evaluating how well trenches work without pipe and gravel. We are also evaluating the best kind of stone to use with and without a pipe. There can be big differences in the quality and the cost of different types of stone used for drainage.

An open day will take place at Solohead next summer when it will be possible to come and see this work.

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