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Liming for optimum soil fertility

MARK PLUNKETT, TEAGASC JOHNSTOWN CASTLE, CO. WEXFORD

Soil pH plays a key role in soil fertility. Maintaining the soil pH at the optimum level will increase the microbiological activity of the soil, and result in better soil nutrient recycling and release. Soil pH is also critical for maximising the availability of nutrients applied in organic and chemical fertilizers.

Lime is continually being lost from the soil and needs to be replaced as part of a nutrient management programme. For example drainage water can remove between 250 and 625 kg/ha, depending on the soil type, of lime each year. Light free draining soils will lose lime more quickly than heavier soils.

Therefore, light land may need extra attention; particularly in areas limestone is not present in soil parent material or bedrock. Crops and livestock also remove lime.

For example, a crop of first cut grass silage removes approximately 190 kg/ha/yr of lime equivalent. Nitrogen fertilizers also have an acidifying effect.

Each 1 kg of N applied as CAN or Urea will generate acidity that will require approximately 2 kg of lime to neutralise.

The target soil pH for a range of crops is shown in Table 1. Aim to maintain soil pH close to the target level and apply lime as recommended on the soil test report.

The lime requirement is calculated in the laboratory based on a test that measures the buffering capacity of the soil. Buffering capacity is a measure of how much lime it takes to change the soil pH.

Therefore, soils that are returned with the same soil pH may be shown to have different lime requirements. This is because the soils have different buffering capacities require more lime to achieve the same increase in pH.

Soils that are heavier textured or higher organic matter contents tend to have higher buffering capacities and higher lime requirements as a result.

However, while these soils may require more lime following the soil test, the higher buffering capacity should result in the soil retaining lime better in the future once it has been applied.

Table 1: Optimum soil pH for grassland and tillage crops on mineral soils

Crop	Optimum soil pH
Grass	6.3
Grass (Max. on high molybdenum soils)	6.2
Clover	7.0
Cereals	6.5
Beet, Beans, Peas, Oilseed Rape	7.0
Potatoes	6.0
Note: Optimum pH for peat soils pH 5.5	

Calcium limestone is the most common form of ground limestone available. Magnesium limestone (also called dolomitic limestone) can also be used, and are recommended where soil test magnesium levels are less than 50 mg/L.

LIMING GRASSLAND SOILS

Soils maintained close to the target pH will have benefits of increased grass yields; more efficient utilisation of applied fertilizers and manures; and better persistence of more productive species in the sward such as perennial ryegrass and clover. Limed soils also tend to release more N from the soil organic matter. Increases in N release of between 50 and 70 kg/ha/yr of N have been estimated previously. This would be worth approximately €60-85/ha at current fertilizer N prices.

Aim to maintain the soil pH for grassland at or above pH 6.3. To achieve this, the advice is to apply lime to increase the soil pH to approximately 6.5. This allows for the soil pH changes that occur after liming and the gradual lime loss after the target soil pH has been reached. Liming up to pH 6.5 means that liming need not be done each year. Where lime advice exceeds 7.5 t/ha, it is recommended to split the application and apply 7.5 t/ha in the first application, and the remainder after two years. This approach will help avoid trace element imbalances occurring due to high lime application rates and excessive and rapid changes in soil pH.

In grassland soils that are high in molybdenum (Mo), it is recommended to maintain the soil pH at or below a pH 6.2. Increasing the soil pH above 6.2 increases the availability of Mo which reduces the availability of Cu in bovines.

Where is there either a history or a risk of soils or herbage being high in Mo, it is recommended to reduce the lime recommendation by 5t/ha. However, this is a crude estimation, and can be tailored for each situation depending on pervious experience.

Problems with high Mo tend by more common on wetter soils (or in wetter years); in swards with low ryegrass and/or high clover content; and where annual rates of N fertilizer application are low. Where high Mo is an issue, it is best to apply lime on a rotational basis for example 20% of the farm each year rather than the whole farm. Therefore, elevated Mo in herbage in a section of the farm due to lime may be somewhat diluted across the whole farm.

LIMING TILLAGE SOILS

The optimum soil pH is 6.5 for cereals and maize, and pH 7.0 for beet, peas and beans. Potatoes and oats are more tolerant of low pH and pH 6.0 is adequate to produce a good crop. Lime should be applied to tillage soils based on the most sensitive crop to lime in the rotation. Where potatoes are grown in rotation it is best to apply lime after the potato crop, as the risk of common scab is increased where lime is applied within the previous two years.

TIMING OF LIME APPLICATION

Lime can be applied at any convenient time of the year. For lime sensitive crops such as beet, cereals, maize, apply lime 2 years before sowing. If lime has not been applied it should be spread after spring ploughing so that it can react with the soil and be thoroughly mixed with soils during spring cultivations.

For grassland, it is preferable to apply to fields with very little grass cover, and to avoid grazing or cutting until sufficient rainfall has occurred to wash the lime off the herbage. For silage swards apply lime before mid-march for first cut or within one week after cutting on land being closed for a second cut. Applying lime to heavy covers of grass intended for silage can reduce the silage quality if the lime is not washed off the grass by rain.