



**Soil is the most important asset on any farm. These tips will help you save money and protect the environment by better matching fertilizer and nutrient use with crop requirements.**

## Soil Fertility

Approximately 90% of the soils sampled in Ireland are lacking in either phosphorus (P), potassium (K) or lime, limiting their production potential.

Low soil fertility equates to a loss of more than 2.0t grass DM/ha/year, which is worth €275/ha/year.

Better soil fertility will support increased production, improve farm income and enhance environmental performance on the farm.

Correcting soil fertility can allow growth for 25% more grass.<sup>1</sup> Fertiliser losses can contribute to your farm's greenhouse gas emissions and impact on water and air quality.

Improving soil fertility through nutrient management can also have environmental benefits. If nutrients are applied where they are most needed on the farm, they will be more readily absorbed by the soil preventing losses to the air and water.

A tailored nutrient management plan & improving soil fertility can reduce greenhouse gas emissions and increase carbon sequestration in soils.

**Protected urea nitrogen fertiliser is the most important technology at present to help to reduce greenhouse gas and ammonia emissions in agriculture.**



## Soil Testing

If you don't know what nutrients are in your soil, you can't know how much extra nutrients it may need.

- Soil should be tested every 3-5 years to measure soil fertility levels.
- Soil samples should be taken between October and February and prior to fertiliser application (waiting 3 months after the last application of P or K before sampling).
- Soil tests are relatively cheap (€25/sample)<sup>2</sup> yet decisions on fertilizer (€300-€500/tonne) can be made without knowledge of soil nutrient levels. To spread costs, soil test a portion of the farm e.g. a quarter every year.
- Repeating soil analysis over time (3-5 years) is critical to monitor the effectiveness of the farm fertiliser strategy. New soil test results should be compared with past results to assess changes in soil fertility over time.

Soil testing can save you money by identifying what areas of land have low soil fertility and need extra fertilizer to improve productivity.

Soil testing allows your fertiliser programme to be tailored to the specific needs of the soil and grass growth.

Soil testing at €25/sample is money well spent. By getting the P, K and lime levels correct you can produce €300 worth of additional grass/ha each year.

## Soil pH & Liming

The pH status of a soil plays an important role in grass production as nutrients only become available to grass at certain pH levels.

Soil pH correction through liming is the first step of soil fertility improvement on the farm as it increases the availability and efficiency of the applied fertiliser and organic manures. Money spent on lime is one of the best investments a farmer can make.

Spreading lime to improve soil pH generates better grass growth.

A sub-optimal pH level costs money in wasted fertiliser.

- Lime is most effective when it is applied in late autumn/early spring. This will encourage grass growth in spring time.
- Apply lime in line with the advice given as per your soil test report.
- Aim to have the whole farm at pH 6.3 for grass-only swards and pH 6.8 for grass-clover swards.
- Lime should only be applied on silage fields in the autumn or 3 months before the silage is cut.
- Leave up to 3 months between applying lime and following with urea/slurry application. Alternatively apply urea/slurry first and after 10 days apply lime as recommended.
- If reseeding, any lime recommended should be applied and tilled into the seedbed before sowing commences.

An annual investment of just €120 per hectare in more targeted fertiliser application and in bringing soil pH to optimum levels will result in increased yields worth €360 per hectare, per annum.<sup>3</sup>

## Soil Nutrients

If you don't know about your soil fertility, spreading fertiliser may be wasteful and costing you money.

**Nitrogen (N)** is one of the most important nutrients for plant growth and crop production, however, when applied on soil with low soil fertility (pH, P or K), the recovery of nitrogen fertiliser inputs by grass or crops can be diminished.

**Phosphorus (P)** is important for crop establishment and root development and it also plays an important role in the nutrition of livestock. Phosphorus is central to plant energy and driving fast and efficient grass growth. Phosphorous is very important in reseeded fields to achieve good grass establishment.

**Potassium (K)** increases stem strength, improves drought resistance, cold tolerance and increases yield. Potassium is very important in silage fields.

**Sulphur (S)** is an important nutrient for grassland, and is closely associated with N uptake and efficiency, helping to maintain crude protein.

## Soil Index System

The soil index system is a ranking of soil fertility. A soil test report shows the index ranking of the soil from 1 to 4 (1 being the lowest fertility and 4 being the highest).

Aim to have optimum soil P and K (index 3) fertility levels in all fields.

Every €1 invested, in either lime, P or K, results in payback of €4 in extra production on low fertility soils.<sup>4</sup>

Soil Index	Index Description	Responsive to Fertiliser	Action Required
1	Very Low	Definite	Apply fertilizers to increase soil fertility levels as well as to feed the grass or crop.
2	Low	Likely	Apply fertilizers to increase soil fertility levels as well as to feed the grass or crop.
3	Medium	Unlikely	Aim to maintain soil in Index 3. Apply fertilizers to replace the nutrients removed by crops or animal produce. Only approximately 25% of soils in Ireland are currently in Index 3.
4	Sufficient	None	Soil has more nutrients than required to grow the crop. Additional fertilizers are usually not required, as the soil nutrients are sufficient to feed the crop. Applying additional P to Index 4 soils can lead to increased risk of P losses to water.





# Fertilisers

## 1. Fertiliser Planning

A tailored nutrient management plan ensures that the individual soils and field get the correct nutrient applications to sufficiently carry the farm's stocking rate or support a profitable crop yield.

This can optimise economic return from purchased nutrients while potentially reducing the negative impact of nutrient applications on the environment.

**With increasing fertiliser prices and tighter profit margins, it's essential that lime, slurry and fertiliser are used efficiently for maximum return.**

### A Nutrient Management plan will include:

- ✓ Soil test results.
- ✓ Crop requirements.
- ✓ Manure & slurry requirements.
- ✓ Fertiliser nutrient top-up needed

### A Nutrient Management plan should offer advice on using the:

- ✓ Right product
- ✓ Right rate
- ✓ Right time
- ✓ Right place

## 2. Manure & Slurry

Cattle slurry is a valuable source of nitrogen (N), phosphorus (P) and potassium (K).

The proper use of slurry can reduce fertiliser costs with best practice being more slurry applied on grassland in early spring when slurry-nitrogen utilisation is highest.

1. Target fields with low P and K levels and fields with high requirements, such as silage fields, to offset fertiliser costs.
2. Apply under cool & damp conditions ideally in Spring to help maximise the slurry N recovery.
3. Apply using low emission slurry spreading (LESS) techniques to help avoid N losses to the atmosphere.
4. Dilution with water will increase slurry N efficiency.
5. Test slurry to determine nutrient content and to help match slurry application rates to crop requirements.



### Low Emission Slurry Spreading (LESS)

Slurry application techniques such as trailing hose or trailing shoe reduce the surface area of the slurry and losses of N as ammonia gas to the air, compared to the splash plate applications.

The trailing hose will deliver up to 30% reduction and the trailing shoe 60% reduction in ammonia losses.

### Slurry Efficiency

A key factor in getting value from your slurry is timing. It is important to try to use as much of the slurry as possible in spring rather than summer, under suitable ground and weather conditions.

The benefits can be the equivalent of an extra six units of N per 1,000 gallons spread.

## 3. Protected Urea

Protected urea is urea which is treated with a urease inhibitor. It reduces both ammonia & nitrous oxides losses helping to reduce their impact on both air & water quality.

Extensive field and farm based trials have shown that levels of grass production will be maintained with protected urea similar the levels achieved using traditional N fertiliser.<sup>5</sup>





## Soil Carbon & Carbon Sequestration

Carbon sequestration is the process of capturing carbon dioxide (CO<sub>2</sub>) from the atmosphere and storing it in plant material or soil.

Carbon stored in soils is often called soil organic carbon (main component of soil organic matter) and it is good for soil health, improving soil workability, water holding capacity, productivity and protects soil from the effect of heavy trafficking with machinery or livestock leading to soil compaction.

### Ways to increase Soil Carbon Sequestration

1. Application of slurry and manure to grassland soils can help to replenish soil organic matter levels and increase carbon storage.
2. Improving soil fertility levels and improving grass productivity will increase carbon inputs to the soil through the grass root zone.
3. Plant more diverse grassland swards.
4. Minimising soil disturbance during re-seeding helps to protect existing soil carbon stocks.
5. Prevent poaching on the soil surface to maintain soil organic matter stored in the soil.
6. Incorporate clover and deep-rooting species (plantain or chicory) into swards to increase soil carbon storage deeper in the soil. These deeper rooting species also help to reduce N leaching.

Poaching is the breakdown of the soil structure under a heavy load for example from machinery.

## Acknowledgements

Smart Farming would like to thank Teagasc for their help and contribution to this guidance note.

## Footnotes

1. Correcting soil fertility will allow growth for 25% more grass which will mean approx. €100 additional profit per acre based on an average beef enterprise.
2. €12-25 per sample depending on the service provided (@€25: 5 acres sampled X 5 yrs until sampled again = Cost of €1 /acre /year).
3. Figures produced by Teagasc have shown that a total annual investment of just €120 per hectare in more targeted fertiliser application and in bringing soil pH to optimum levels will result in increased yields worth €360 per hectare, per annum. This could generate increased income of over €42,000 for the average 35 hectare farm over a five year period.
4. Every €1 invested, in either lime, P or K, results in payback of €4 in extra production on low fertility soils (pH <6.5 and P or K index ≤2). For example, grass has been shown to yield at least 2.0 t DM/ha more, which is worth €275, at soil P Index 3 compared to P Index 1, regardless of fertiliser inputs.
5. Trials have shown that there is no difference in annual production between the protected urea and traditional varieties, protected urea consistently yields as well as CAN in Irish grasslands with no difference in annual production between the two fertilisers.