Agriculture and Food Development Authority

Teagasc Soil Fertility Dashboard and Report 2025

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Table of Contents

Introduction

Soil testing underpins sustainable crop and grassland production by supporting optimal soil pH and balanced nutrient levels while enabling efficient nutrient use and reducing environmental impacts. Teagasc has played a central role in soil analysis and nutrient management advice for Irish agriculture since the 1950s and continues to provide a national soil testing and online nutrient management planning service.

As a low-cost and widely accessible technology, soil testing enables more efficient nutrient use, reduces environmental impacts such as nutrient losses to water and greenhouse gas emissions, and supports soil biodiversity by facilitating the application of nutrients at the right rate, time, and place. Soil testing also plays a critical role in supporting compliance with national and EU environmental policy objectives, including the Nitrates Action Programme, the Water Framework Directive, and Ireland's Climate Action Plan.

Teagasc maintains a large national soil database, analysing between 30,000 and 75,000 soil samples annually. Sample numbers are influenced by factors such as participation in agri-environmental schemes and advisory programmes. Since 2006, approximately 817,458 samples have been processed through the Teagasc soil testing service, providing a valuable resource for tracking trends in soil pH, P, and K over time. While samples are not linked to individual farms on a year-to-year basis, the scale and continuity of the dataset provide a robust basis for identifying medium- to long-term trends in soil fertility. To support appropriate interpretation, Teagasc has published dedicated reports examining changes in soil fertility status in recent years.

In 2026, Teagasc transitioned from a static written report to an interactive Power BI dashboard to improve the accessibility, clarity, and usefulness of national soil analysis results. This transition reflects a broader shift towards more responsive, data-driven advisory and policy support. The soil fertility dataset and dashboard are intended to support farmers, agricultural advisors, researchers, and policymakers in understanding national and regional soil fertility trends and to enable more informed, evidence-based decision-making.

The dashboard allows users to interactively explore multi-year datasets, enhancing transparency and consistency in reporting while enabling more timely updates as new data become available.

The purpose of this report and associated dashboard is to summarise current soil fertility status, highlight emerging trends, and support informed nutrient management decisions at farm, advisory, and policy levels.

The Soil Analysis Status and Trends Power BI Dashboard

Within the new Soil Fertility Dashboard, soil fertility trends are presented graphically for the period 2006 to 2025. The dashboard displays the distribution of soils across soil pH categories and phosphorus (P) and potassium (K) indices within individual years, selected time periods, or across the full analysis window. Results can be viewed at both national and county level, and within each context can be further disaggregated by enterprise type (dairy, beef, sheep, equine, horticulture, and tillage).

A new feature of the dashboard is the introduction of searchable variables including crop category (grazing, silage, extensive grassland, arable, fruit, vegetable and other) and soil textural class (sand, loam, clay, and peat). Although peat soils are analysed and reported using the standard phosphorus index system (Index 1-4), soils classified as P Index 1 or 2 on peat are managed in practice as Index 3. This approach reflects the inherently low phosphorus retention capacity of peat soils, which limits their ability to store applied phosphorus. As a result, additional phosphorus applied to peat soils is unlikely to contribute to a build-up of soil P reserves and instead presents a high risk of loss to water, with little or no agronomic benefit. However, in the interest of accurate reporting, the dashboard presents the distribution of peat soils across the four phosphorus indices, as determined by soil analysis, alongside their classification according to recommended management categories.

Historically, soil fertility reporting has included an indicator of nutrient sufficiency, defined as soils with P and K in the adequate or high category (Index 3 or 4) and a soil pH greater than 6.2. This represents soils that are neither nutrient-deficient nor acidic to restrict nutrient uptake, as pH 6.2 is generally considered the threshold above which soil acidity is unlikely to limit nutrient availability for most grassland systems. During the development of the new dashboard, an error was identified, which had resulted in an underestimation of 'optimal fertility' in previous reports. This error has now been corrected within the Power BI platform, and the 2024 results presented in this report have been recalculated in line with the corrected methodology.

The dashboard also introduces a balanced fertility subset of the nutrient-sufficient category. This represents the proportion of soil samples within the previously defined nutrient-sufficient group after applying additional constraints. Samples with soil pH greater than 7 and those with phosphorus (P) and potassium (K) levels above the target agronomic range (Index 3), which represents the recommended maintenance level for crop production, have been excluded. This is to focus on soils meeting recommended fertility levels without elevated nutrient status or alkaline conditions. High soil pH can reduce the availability of certain nutrients and can disproportionately influence measured P due to limitations of the Morgan's P extraction method, which may overestimate plant-available phosphorus under alkaline conditions. Soils with P or K above Index 3 are also excluded, as nutrient levels above the agronomic target increase the risk of nutrient loss to the environment, detrimentally in the case of P, without providing additional production benefit.

This balanced fertility subset has been included primarily as an indicator rather than a universal target, as it is most applicable to intensive grassland systems. Achieving this balanced status on extensive or semi-natural grasslands could be detrimental to biodiversity. It may also be more difficult for certain soil types to achieve and maintain this balance because of inherent properties, including the influence of underlying parent material, low cation exchange capacity (CEC) and greater nutrient loss risk in sandy and peat soils, and higher buffering capacity in clay-rich soils, which can make adjustment and maintenance of target fertility more challenging.

Summary of national soil fertility data for 2025

In 2025, Teagasc analysed a total of 39,033 soil samples, of which 90% were derived from grassland systems.

The following is a summary of the main changes for soil pH, P and K in 2025 relative to 2024.

Sample set

- The overall number of soil samples analysed declined by 44% relative to 2024, with reductions observed across all major farm enterprises.
- Dairy farms accounted for 18,241 samples, representing a 13.5% reduction compared with 2024.
- On tillage farms, 3,797 soil samples were analysed, representing a 20% decline year-on-year.
- A total of 16,452 samples were analysed from drystock farms, 14,503 beef and 1,949 sheep, corresponding to a 62% decrease relative to the previous year.

Fertility Status

- A notable improvement in overall soil fertility was recorded in 2025, with soils classified as having sufficient fertility increasing to 25% (up 5% compared with 2024). These soils have phosphorus (P) and potassium (K) levels in the adequate to high range (Index 3 or 4) and a soil pH greater than 6.2, indicating soils that are neither nutrient-deficient nor sufficiently acidic to restrict nutrient uptake.
- Soil pH levels improved, with 44% of soils testing below pH 6.2, representing an 8% reduction on the 52% recorded in 2024.
- The proportion of soils at suboptimal phosphorus levels (P Index 1 and 2) declined to 43% (a 9% reduction compared with 2024).
- Similarly, suboptimal potassium levels (K Index 1 and 2) showed a slight reduction, decreasing to 41%, a 2% drop on 2024.

Enterprise specific performance

Looking at the individual results from main production enterprises:

Dairy

- 34% of soils exhibited sufficient fertility (pH > 6.2 and P & K at Index 3 or 4), representing a 2% increase on 2024.
- 37% of soils had a soil pH below 6.2, a 2% reduction relative to 2024.
- 35% of soils were at P Index 1 or 2, reflecting a 4% decrease year-on-year.
- 35% of soils were at K Index 1 or 2, a 2% reduction compared with 2024.

Drystock

- 15% of soils had sufficient fertility (pH > 6.2 and P & K at Index 3 or 4), representing a 2% improvement on the 2024 analysis.
- 59% of soils recorded a soil pH below 6.2, a 4% reduction relative to the previous year.
- 51% of soils were at P Index 1 or 2, reflecting a 7% reduction compared with 2024.
- 48% of soils were at K Index 1 or 2, representing a 2% increase year-on-year.

Tillage

- 30% of soils exhibited sufficient fertility (pH > 6.2 and P & K at Index 3 or 4), consistent with levels recorded in 2024.
- 36% of soils recorded a soil pH below 6.5, a 3% decrease relative to 2024.
- 27% of soils had a pH >7 (4% increase on 2024), disproportionately higher than grassland systems ~11%.
- 54% of soils were at P Index 1 or 2, a 2% reduction year-on-year.
- 37% of soils were at K Index 1 or 2, reflecting a 4% increase compared with 2024.

Overview of Soil Fertility trends in recent years

In 2025, Teagasc analysed 39,033 soil samples, the majority of which were derived from grassland systems, providing an updated national overview of soil fertility status across the main farming enterprises. While the total number of samples declined substantially compared with 2024 largely due to the impact of the agri-environmental scheme ACRES, the results indicate improvements in soil pH together with an increase in the proportion of soils reaching the target agronomic ranges for phosphorus (P) and potassium (K). These changes should be interpreted within the broader context of national fertiliser use trends, whole-farm nutrient balances, enterprise characteristics, and the multi-year nature of soil fertility development. Progress was evident across most enterprises, although differences remain between production systems, particularly between dairy and drystock farms.

National fertiliser sales data show that following the substantial decline in fertiliser use associated with the 2022 price shock, there has been only a partial recovery in nutrient inputs. Recovery has been strongest for nitrogen, while phosphorus and potassium use remain below historical norms. The modest improvements observed in soil P and K indices indicate that soil fertility can continue to progress during periods of reduced chemical fertiliser use due to the cumulative nature of soil nutrient dynamics. Residual effects of previous fertiliser applications, nutrients imported in concentrate feeds and recycled through organic manures, improved targeting of fertiliser applications, and enhanced nutrient availability associated with increased lime use can partially offset reduced fertiliser inputs in the short to medium term. Nonetheless, the persistence of a large proportion of soils at P and K Index 1 and 2 indicates that, for many farms, current nutrient inputs remain insufficient to fully address legacy deficits or sustain long-term fertility without continued investment.

Improvements in soil pH observed across enterprises are likely associated with increased lime use in recent years, supported by national liming initiatives and advisory programmes. Increased proportions of intensive grassland soils above pH 6.2 are agronomically significant, as soil pH strongly influences nutrient availability and nitrogen use efficiency, and soil acidity can substantially reduce crop productivity. Conversely, the occurrence of soils with pH values above 7.0 highlights the importance of aligning lime applications with soil test recommendations to avoid excessive pH and potential nutrient availability constraints.

The impact of imbalanced soil fertility on nitrogen use efficiency remains an important consideration. Where soils remain deficient in P, K, or pH, the efficiency of applied nitrogen may be reduced, limiting both productivity gains and environmental performance improvements. Addressing soil fertility constraints therefore represents a key opportunity to improve nitrogen use efficiency while supporting climate and water quality objectives.

Interpretation of the results must also consider the nature of the sampling dataset and potential sources of bias. Participation in the Teagasc soil testing programme is influenced by advisory engagement, farmer decision-making, and agri-environment scheme requirements, meaning the sample population may not represent a fully random or nationally representative cross-section of farms. Changes in participation levels, including the reduction in sample numbers in 2025 relative to 2024, may therefore affect year-to-year comparability. In addition, soil fertility reflects cumulative management over multiple years, so current soil indices are more strongly influenced by historical nutrient balances than by short-term changes in fertiliser purchases.

Enterprise differences observed in the dataset are consistent with national farm performance analyses and can be partly explained by differences in whole-farm nutrient balances. Dairy farms typically operate with higher phosphorus surpluses than drystock systems due to higher fertiliser inputs, greater stocking intensity, and the importation of nutrients in purchased concentrate feeds, which are subsequently recycled through organic manures. In contrast, drystock farms generally import lower quantities of concentrate feed and often operate with neutral or negative phosphorus balances due to lower fertiliser inputs and ongoing nutrient offtake in animal products. Over time, such nutrient deficits contribute to declining soil P and K status and help explain the higher proportion of soils at lower fertility indices observed in this enterprise group.

Interpretation of soil fertility results within drystock systems must also recognise the influence of land type and habitat management objectives. Many drystock farms include areas of marginal land, semi-natural grasslands, or peat soils where inherently low soil pH and nutrient status are characteristic ecosystem features. In some cases, maintaining lower fertility levels is necessary to support biodiversity and habitat conservation objectives, and these areas would not be expected to achieve conventional agronomic fertility targets. The inclusion of such land types within the soil sample dataset may therefore contribute to lower average fertility indices without necessarily indicating suboptimal management.

Tillage systems may also experience nutrient deficits where crop nutrient offtake exceeds nutrient inputs, particularly during periods of reduced fertiliser use. Soil pH levels within these systems are generally adequate and, in some regions, elevated due to calcareous parent materials associated with limestone-derived soils, in addition to routine liming practices. Despite favourable pH conditions, long-term phosphorus and potassium deficits remain evident, likely reflecting high nutrient removal in harvested crops, soil texture effects on nutrient supply and retention, and more limited access to organic nutrient sources compared with livestock enterprises. One factor that may help explain the relatively weaker soil fertility performance in some tillage systems is land tenure. A significant proportion of tillage land is farmed under short-term rental or conacre arrangements, which can limit the incentive to invest in longer-term soil fertility improvements, particularly building soil phosphorus. Management decisions may prioritise short-term crop returns over sustained soil fertility investment, potentially contributing to the persistence of lower nutrient indices associated with this sector.

Across all systems, soil fertility outcomes are influenced not only by management decisions but also by structural characteristics such as enterprise profitability, production intensity, access to organic nutrient sources, and overall input capacity. These factors help explain persistent differences in soil fertility status between enterprises and highlight that improvements in soil fertility require both agronomic and economic considerations.

Overall, the findings suggest gradual improvement in Irish soil fertility despite recent disruptions to fertiliser inputs, supported by increased lime use and partial recovery in nutrient inputs. However, substantial nutrient deficits persist, particularly within tillage and drystock systems, where lower nutrient imports, economic constraints, and limited access to organic manures contribute to weaker soil fertility status.

Improving national soil fertility remains a central component of sustainable agricultural intensification in Ireland. Targeted actions to address soil nutrient deficits, particularly within drystock systems, have the potential to deliver simultaneous gains in farm profitability, nutrient use efficiency, water quality protection, and greenhouse gas mitigation. Continued alignment between advisory programmes, financial supports, and farm-level decision-making will be critical to achieving these outcomes.