

Teagasc Signpost Programme

Soil Fertility Report 2021



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Signpost Programme Soil Fertility Summary

Introduction

The Signpost Farm programme is a multi-annual campaign to lead climate action by all Irish farmers. All the farms included in the Signpost Farm programme are in general productive farms relative to the general farm population in their respective farming enterprises. On these farms participating in the programme various agronomic, financial and environmental indicators will be measured and benchmarked to help improve sustainability levels. Soil nutrient analysis is a low cost technology and critical nutrient management and environmental indicator that can be used to increase the plant availability and nutrient use efficiency of stored soil nutrients and freshly applied nutrients. Soil nutrient analysis as a basis for nutrient management planning also provides information to help farmers reduce potential gaseous emissions and nutrient losses to water while improving profitability and the overall sustainability of farming enterprises. The Signpost Farm Programme aims to transition the participating farms to achieving 90% optimum soil fertility over the next 4 years of the programme.

All soil samples (0-10 cm depth) were taken in the autumn / winter of 2021 / 2022 as per the standard Teagasc soil sampling protocol. A total of 2,993 soil samples were taken across 96 farms participating in the programme. There was 49 dairy, 33 beef, 8 sheep and 6 tillage farms sampled in phase 1. On these farm fertiliser plans have been completed, based on these field-by-field soil analysis results. The farmers will be supported by advisory services to implement the field specific nutrient management recommendations to optimise crop production and manage soil fertility levels of their soils.

The results from the initial soil fertility survey of the Signpost farms are presented in this status report. Soil test results are reported for dairy, beef, sheep and arable farms and relate to indicators of soil acidity (Soil pH & Lime Requirement (LR)), major plant available nutrient in the soil (Morgan P & Morgan K) and soil organic carbon (SOC) levels in the top 10cm of soil. The agronomic optimum and sustainable soil fertility levels are also presented across the different farm enterprises. The agronomic optimum takes into account soils with sufficient soil nutrient available to sustain optimum plant growth i.e. P and K Index ≥ 3 , while the sustainable soil fertility excludes soils with very high levels of P (P Index 4) which pose a higher risk for P loss to water. The SOC results from these farms are also presented and discussed relative to the different farm enterprises.

Table of Contents

1. Introduction	2
2. Signpost soil test result highlights 2021	4
3. Summary of all Signpost soil results for all farms	5
4. Summary of Signpost dairy farm soil Results	7
5. Summary of Signpost beef farm soil test results	9
6. Summary of Signpost sheep farm soil test Results	11
7. Summary of Signpost tillage farm soil test Results	13
8. Soil carbon results	15

Highlights from Signpost soil test results

Summary of overall results from across all farms from this soil fertility survey are presented as follows;

- 39% of soils sampled had agronomic optimum soil fertility levels to support crop and grassland production, while just 5% had sustainable soil fertility levels in order to reach both agronomic and environmental outcomes.
- On average 47% of soils sampled had below optimum soil pH, which is a key soil parameter for regulating plant nutrient availability and nitrogen use efficiency (NUE).
- 37% and 24% had below optimum P and K (i.e. Index 1&2) respectively, which may limit crop and grass production potential and lead to lower crop & forage quality and NUE
- 35% of soils sampled had high levels of P (Index 4), which increases the risk of P loss to water.
- On average 98% of soils sampled had SOC > 2% threshold below which soil are considered degraded. The mean SOC across mineral grassland soils was 5%, across mineral arable soils was 3% and for soils with SOC > 14% (i.e. peat soils) was 23%

Managing and improving soil fertility takes time but is a critical step towards achieving sustainable production, financial and environmental performance on all farms over the next 4 years of the programme.

Summary of Signpost Farm Soil Test Results 2021 (All Farms)

For all Signpost farms 39% of soil with agronomic optimum pH, P & K while 5% of soils were within sustainable soil fertility ranges for these parameters. The national average agronomic optimum soil fertility level on Irish farms indicated by the Teagasc National Soil Fertility database is just 16%. For the soils tested annually in the last 3 years, 63% and 76% had P and K \geq Index 3 respectively. Of these, 35 and 49% where P and K index 4, respectively, which offers the opportunity to omit P and K applications on significant areas of farms in order to reduce fertiliser costs, while potentially bringing benefits for water quality simultaneously.

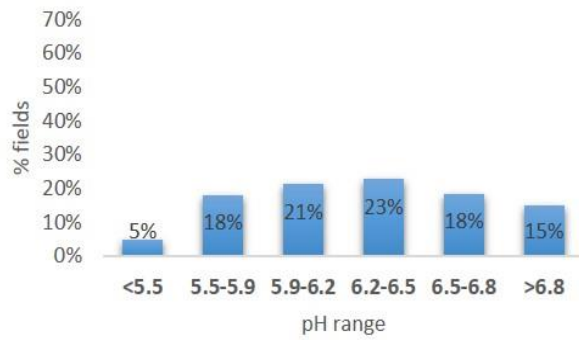
- 39% of soils have optimum soil fertility for crop and grass production
- 5% of soils have sustainable soil fertility for achieving both agronomic and environmental targets
- 56% of soils with a soil pH >6.2
- 37% of soils at P index 1 & 2
- 63% of soils at P index 3 & 4
- 24% of soils at K Index 1 & 2
- 76% of soils at K Index 3 & 4

All results are summarised in Figure 1.

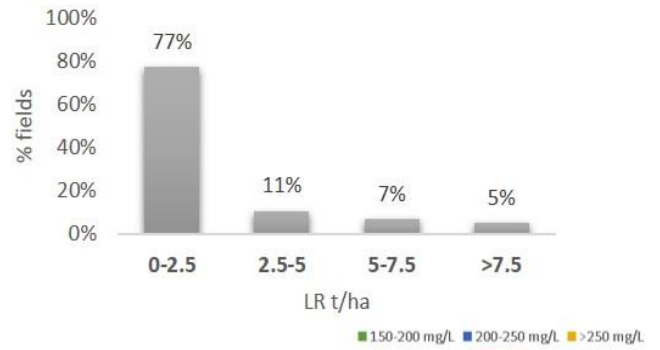
Actions

1. Continue to build and maintain soil pH levels based on soil test results
 - a. 44% of soils require lime, however 88% of these soils only require a small quantity of lime (<5 t/ha) as to maintain soil pH
 - b. Additionally 33% of soils had soil pH >6.5
2. 35 to 49% of soils Index 4 for P & K opportunity to reduce fertiliser costs (figure 1 c & d)
 - a. 66% of soils with soil P > 10mg/l
 - b. 54% of soils with soil K > 200mg/l
3. 39% and 24% of soils at P and Index 1 and 2 respectively and will require additional P and K applications to build soil fertility to agronomic index 3.
4. Opportunity to make P and K savings at P & K Index 4 to increase the % of soils with optimum sustainable soil fertility
5. Target slurry / Super 16% P or MOP 50% K to low P & K Index soils
6. 39% of soils with optimum lime, P & K

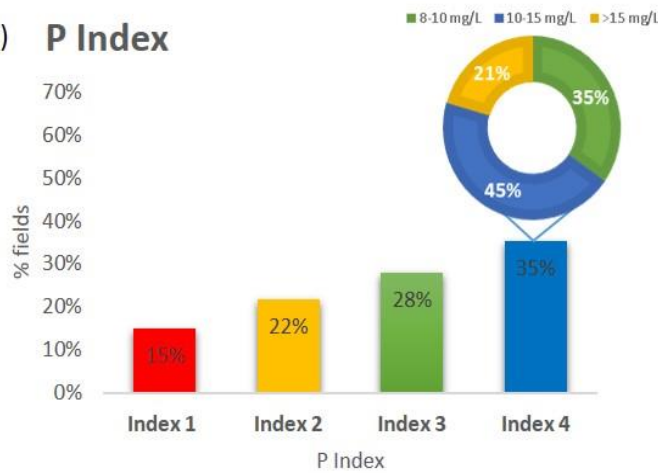
(a) pH



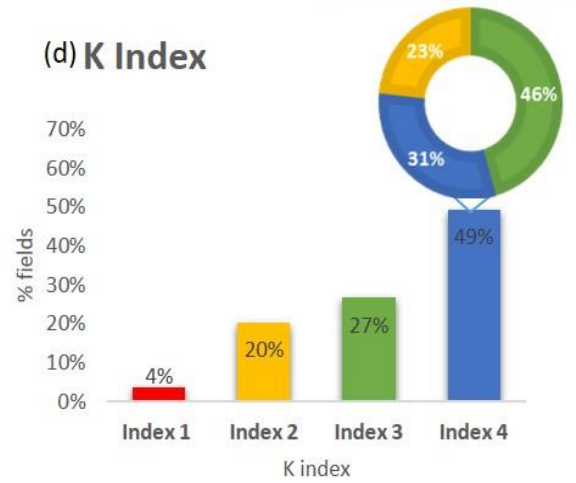
(b) Lime Requirement



(c) P Index

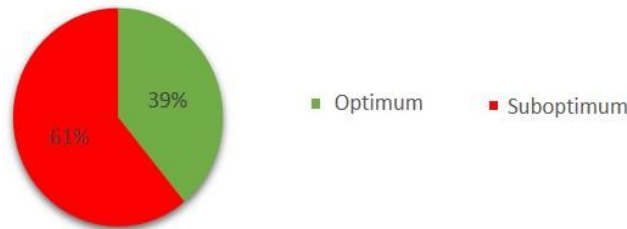


(d) K Index



(e)

Production optimised Fertility



(f)

Sustainability optimised Fertility

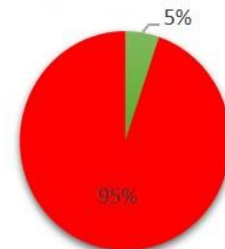


Figure 1 Soil Results for all Farms. (a) pH; (b) Lime Requirement; (c), (d) P Index, Pie Charts show a breakdown of soils at phosphorus (P) index 4 and potassium (K) index 4. (e) Fertility Reports Chart based on Soil pH >6.3, P & K Index 3 and 4. (f) Fertility Reports Chart based on Soil pH >6.3, P & K Index 3.

Summary of Signpost Dairy Farm Soil Test Results 2021

Dairy

Across the dairy Signpost programme farms 42% of soils sampled with agronomic optimum for pH, P & K compared to 16% of farms nationally.

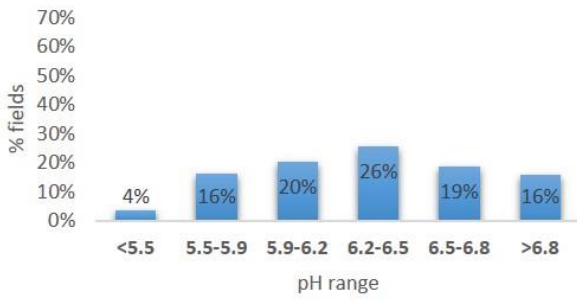
- 42% of soils have agronomic optimum soil fertility
- 6% of soils have sustainable soil fertility
- 60% of soils with a soil pH >6.2
- 33% of soils at P index 1 & 2
- 67% of soils at P index 3 & 4
- 25% of soils at K Index 1 & 2
- 75% of soils at K Index 3 & 4

All results are summarised in Figure 2.

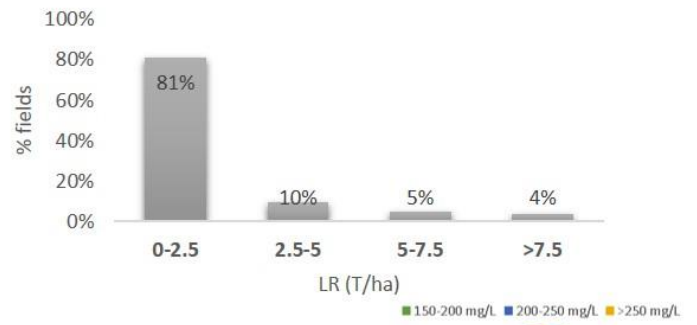
Actions

1. Continue to improve and maintain soil pH levels
 - a. 50% of soils require lime of which 91% is a maintenance application (0 to 5.0t/ha)
 - b. 35% of soils with soil pH >6.5
2. 36 to 42% of soils Index 4 for P & K omit fertiliser (figure 2 c & d)
 - a. 64% of soils with soil P > 10mg/l
 - b. 54% of soils with soil K > 200mg/l
3. Target slurry / Super 16% P or MOP 50% K to low P & K Index soils
4. 39% of soils with optimum lime, P & K – On grassland farms aim to establish clover / multi-species swards if not already done on these areas of the farm

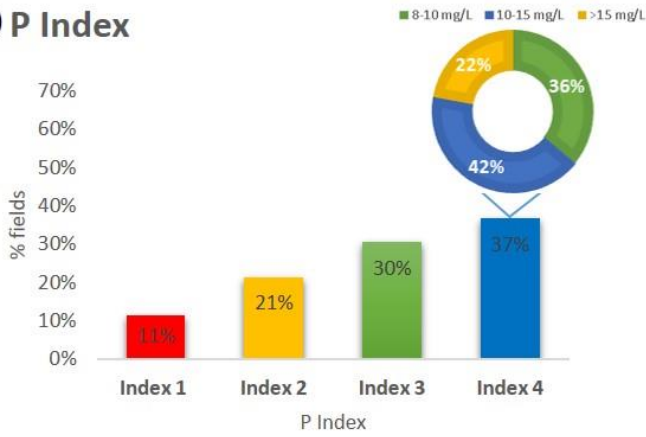
(a) pH



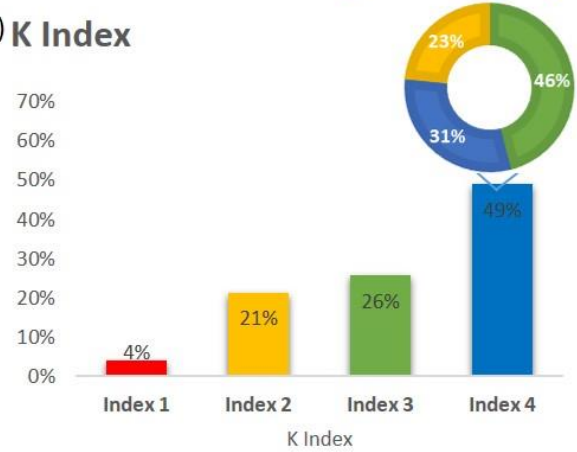
(b) Lime Requirements



(c) P Index

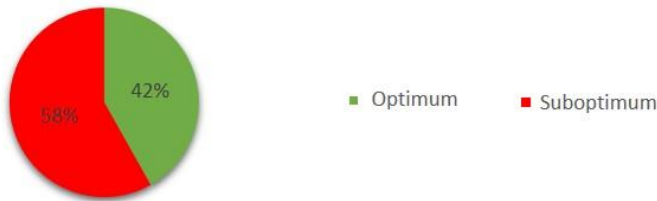


(d) K Index



(e)

Production optimised Fertility



(f)

Sustainability optimised Fertility

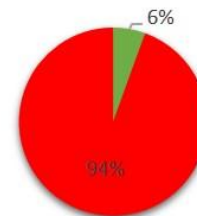


Figure 2. Soil Results for all Dairy Farms. (a) pH; (b) Lime Requirement; (c), (d) P Index, Pie Charts show a breakdown of soils at phosphorus (P) index 4 and potassium (K) index 4. (e) Fertility Reports Chart based on Soil pH >6.3, P & K Index 3 and 4. (f) Fertility Reports Chart based on Soil pH >6.3, P & K Index 3.

Summary of Signpost Beef Farm Soil Test Results 2021

Across the beef Signpost Programme farms have 25% of soils sampled has agronomic optimum pH, P & K compared to 13% national average.

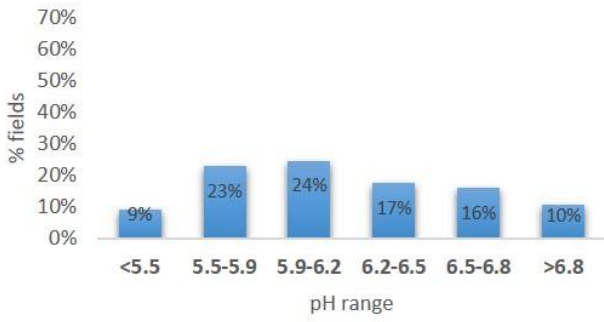
- 25% of soils have optimum pH, P & K
- 3% of soils have optimum sustainable soil fertility
- 43% of soils with a soil pH >6.2
- 51% of soils at P index 1 & 2
- 49% of soils at P index 3 & 4
- 28% of soils at K Index 1 & 2
- 72% of soils at K Index 3 & 4

All results are summarised in Figure 3.

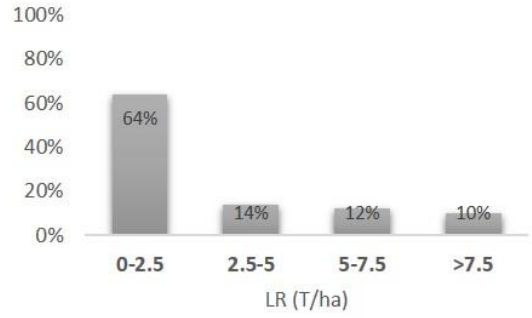
Actions

1. Priorities lime applications to correct soil pH
 - a. 56% of soils require lime
 - b. 84% is a maintenance application (0 to 5.0t/ha)
 - c. 22% require build lime applications
 - d. 25% of soils with soil pH >6.5
2. 26 to 42% of soils Index 4 for P & K omit fertiliser (figure 3 c & d)
 - a. 66% of soils with soil P > 10mg/l
 - b. 53% of soils with soil K > 200mg/l
3. Target slurry / Super 16% P or MOP 50% K to low P & K Index soils

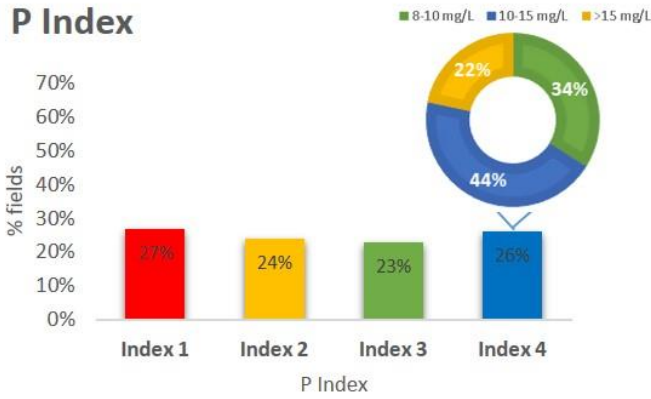
(a) pH



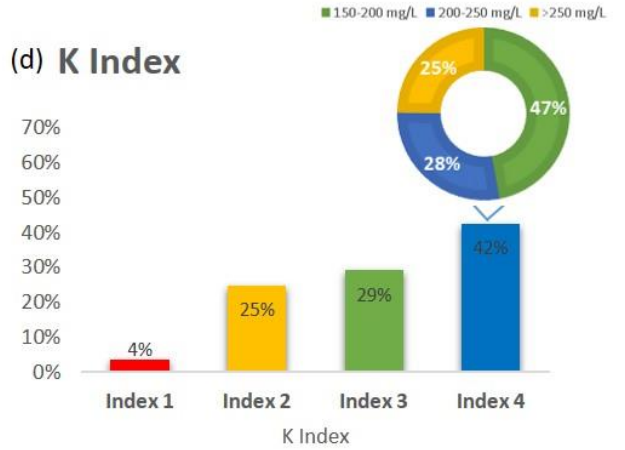
(b) Lime Requirements



(c) P Index

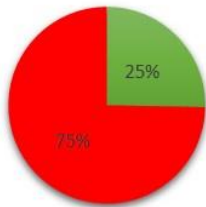


(d) K Index



(e)

Production optimised Fertility



■ Optimum ■ Suboptimum

(f)

Sustainability optimised Fertility

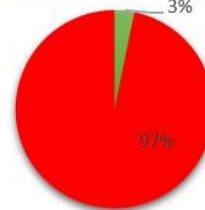


Figure 3 Soil Results for all Beef Farms. (a) pH; (b) Lime Requirement; (c), (d) P Index, Pie Charts show a breakdown of soils at phosphorus (P) index 4 and potassium (K) index 4. (e) Fertility Reports Chart based on Soil pH >6.3, P & K Index 3 and 4. (f) Fertility Reports Chart based on Soil pH >6.3, P & K Index 3.

Summary of Signpost Sheep Farm Soil Test Results 2021

Across the sheep Signpost Programme farms have 16% of soil with optimum pH, P & K compared to 13% national average.

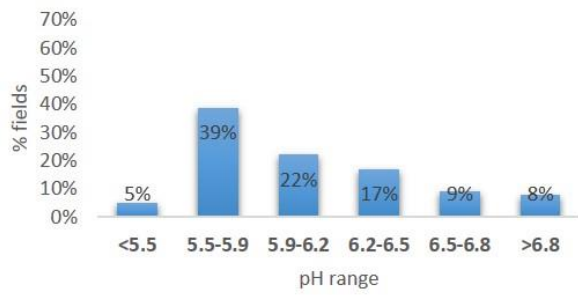
- 16% of soils have optimum pH, P & K
- 5% of soils have optimum sustainable soil fertility
- 34% of soils with a soil pH >6.2
- 61% of soils at P index 1 & 2
- 39% of soils at P index 3 & 4
- 29% of soils at K Index 1 & 2
- 71% of soils at P index 3 & 4

All results are summarised in Figure 4.

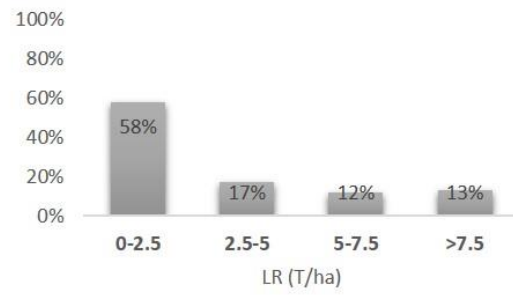
Actions

1. Building soil pH levels is a priority
 - a. 56% of soils require lime
 - b. 75% is a maintenance application (0 to 5.0t/ha)
 - c. 25% require build-up lime applications
 - d. 34% of soils with soil pH >6.5
2. 16% and 38% of soils Index 4 for P & K omit fertiliser (figure 4 c & d)
 - a. 68% of soils with soil P > 10mg/l
 - b. 44% of soils with soil K > 200mg/l
3. Target FYM /slurry / Super 16% P or MOP 50% K to low P & K Index soils

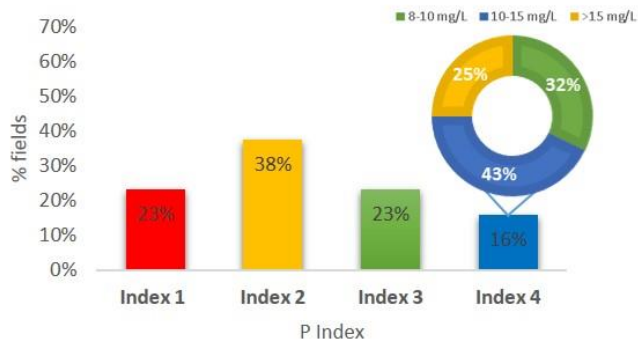
(a) pH



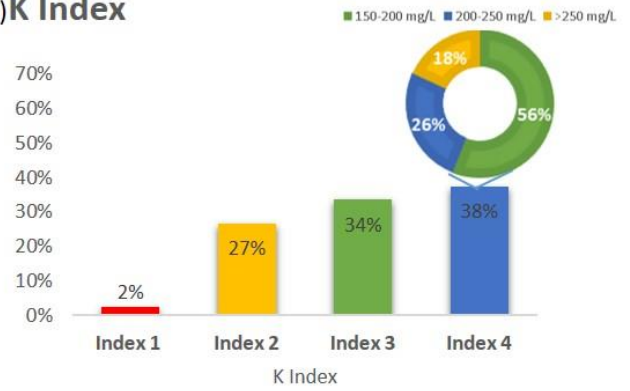
(b) Lime Requirements



(c) P Index



(d) K Index



(e)

Production optimised Fertility



(f)

Sustainability optimised Fertility

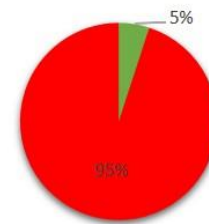


Figure 4 Soil Results for all Sheep Farms. (a) pH; (b) Lime Requirement; (c), (d) P Index, Pie Charts show a breakdown of soils at phosphorus (P) index 4 and potassium (K) index 4. (e) Fertility Reports Chart based on Soil pH >6.3, P & K Index 3 and 4. (f) Fertility Reports Chart based on Soil pH >6.3, P & K Index 3.

Summary of Signpost Tillage Farm Soil Test Results 2021

Across the tillage Signpost Programme farms have 42% of soil with optimum pH, P & K compared to 18% national average

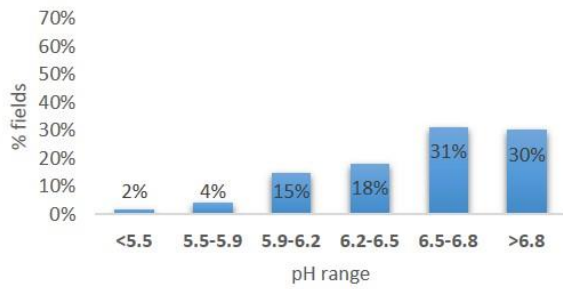
- 42% of soils have optimum pH, P & K
- 8% of soils have optimum sustainable soil fertility
- 61% of soils with a soil pH >6.5
- 32% of soils at P index 1 & 2
- 68% of soils at P index 3 & 4
- 29% of soils at K Index 1 & 2
- 71% of soils at K Index 3 & 4
- 19% of soils have a soil carbon <2.0%

All results are summarised in Figure 5.

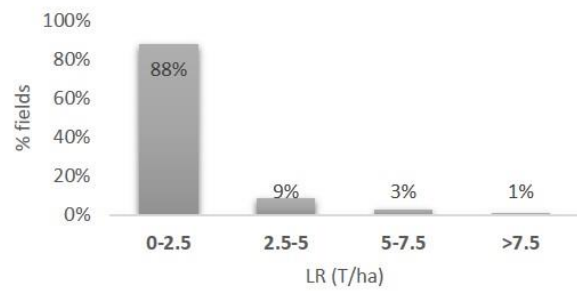
Actions

1. Apply recommended lime to maintain soil pH levels
 - a. 39% of soils require lime
 - b. 95% is a maintenance application (0 to 5.0t/ha)
 - c. 4% require build-up lime applications (>5.0t/ha)
 - d. 61% of soils with soil pH >6.5
2. 36% and 43% of soils Index 4 for P & K omit fertiliser (figure 5 c & d)
 - a. 67% of soils with soil P > 10mg/l
 - b. 42% of soils with soil K > 200mg/l
3. Target low P & K index soils with Super P 16% or MOP 50% K or suitable fertiliser blend
4. Where available organic manures offer good opportunity to replace expensive fertilisers and supply valuable soil carbon to continuous tillage soils

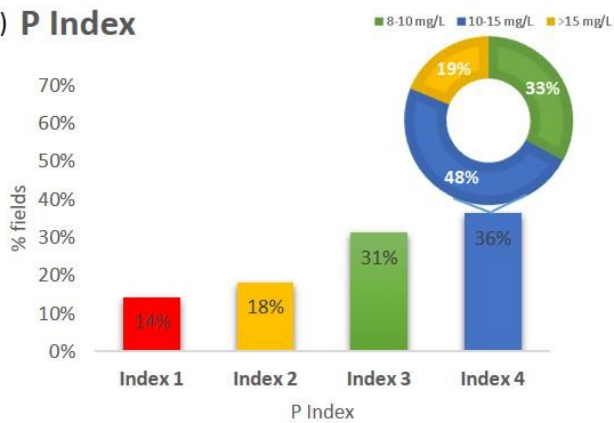
(a) pH



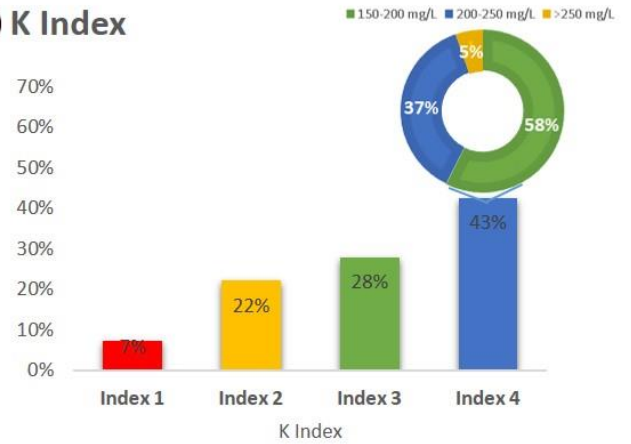
(b) Lime Requirements



(c) P Index

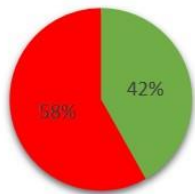


(d) K Index



(e)

Production optimised Fertility



■ Optimum ■ Suboptimum

(f)

Sustainability optimised Fertility

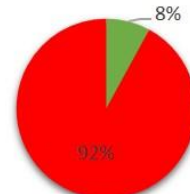


Figure 5 Soil Results for all tillage Farms. (a) pH; (b) Lime Requirement; (c), (d) P Index, Pie Charts show a breakdown of soils at phosphorus (P) index 4 and potassium (K) index 4. (e) Fertility Reports Chart based on Soil pH >6.5, P & K Index 3 and 4. (f) Fertility Reports Chart based on Soil pH >6.5, P & K Index 3.

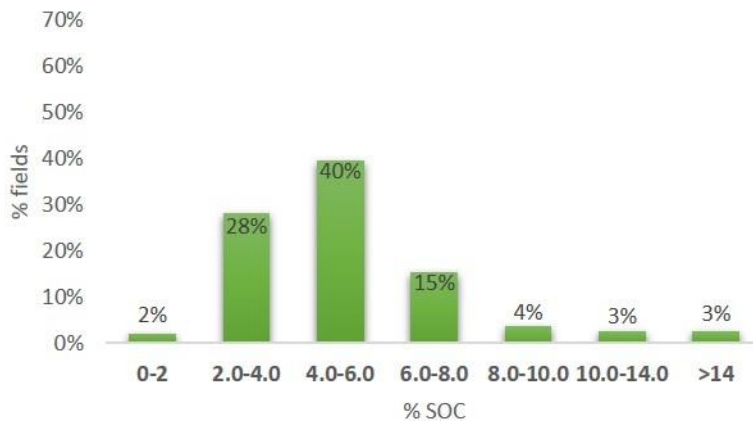
Soil Carbon Results

Soil carbon is an essential nutrient that promotes healthy soils in term of good soil structure, biological activity, nutrient recycling and storage. Grass based livestock systems tend to build or accumulate soil carbon levels due to non-disturbance of the top soil and the return of organic manures. On the other hand, tillage systems are associated to losses of carbon due to more intensive agriculture operations and higher exploitation of nutrient resources.

The following graphs present soil carbon levels for the different farming enterprises.

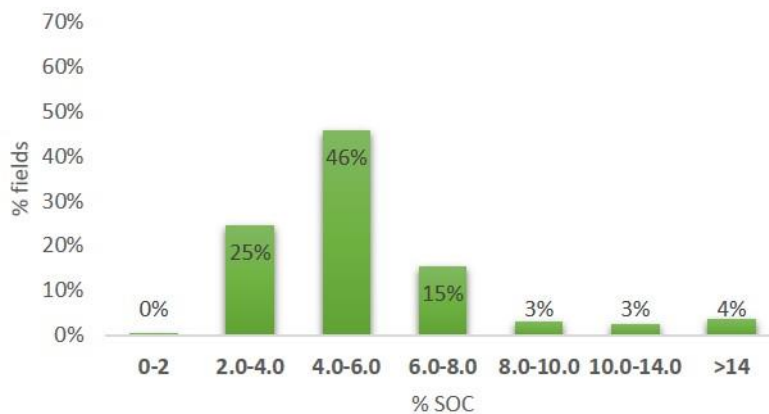
1. All soil samples

- 83% of soils are between 2 to 6% soil carbon
- Only 6% of soils between 8 to 14% soil carbon and 3% greater than 14% carbon (peat soils)



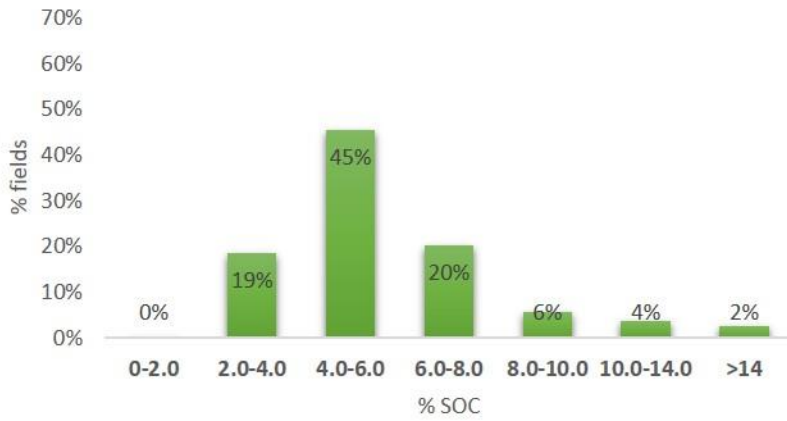
2. Dairy

- 86% of soils are between 2 to 8% soil carbon
- Only 6% of soils between 8 to 14% soil carbon and 4% greater than 14% carbon (peat soils)



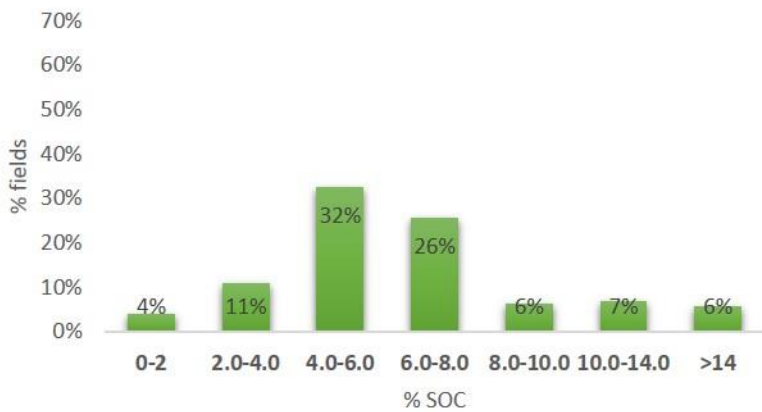
3. Beef

- 84% of soils are between 2 to 8% soil carbon
- Only 10% of soils between 8 to 14% soil carbon and 2% greater than 14% carbon (peat soils)



4. Sheep

- 69% of soils are between 2 to 8% soil carbon
- Only 13% of soils between 8 to 14% soil carbon and 6% greater than 14% carbon (peat soils)



5. Tillage

- 19% of soils are between 0 to 2% soil carbon
- 81% of soils are between 2 to 6% soil carbon

