

**PAAG**●

Professional Agricultural Analysis Group

**Collation of data from  
routine soil analysis in the UK**

**2012/2013**

**TRIED  
&  
TESTED**



## Professional Agricultural Analysis Group

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## Summary

Results are reported for statistical collation of soil analytical data provided by participants in the Professional Agricultural Analysis Group. For the current year (June 1<sup>st</sup> 2012 to May 31<sup>st</sup> 2013) results for around 250,000 samples were available (different numbers for pH, P, K and Mg).

Some participants provided data that could be broken down by arable and grass as the current crop and datasets were constructed to allow collation within this breakdown.

Conclusions should be drawn cautiously as the data were not necessarily representative of all UK fields and data collations were not statistically rigorous.

Soil pH was <6.0 in 19% of arable samples (20% in 2011/12) and <5.5 in 19% of grass samples (22% in 2011/12). This supports the need for regular soil analysis to maintain pH.

As in previous years, only 29% of all samples were at target Index of 2 for P and 30% were at target Index of 2- for K. Just 9% of arable samples and 9% of grass samples were at target Indices for both P and K. This was clear support for the need to base fertilizer use on regular soil analysis.

In the current year 14% of samples were in Mg Indices 0 or 1 where application of magnesium might be recommended for some crops.

As in previous years, there were statistically significant but weak positive correlations between Olsen P and ammonium nitrate extractable K. Soils with high P Index tended also to have a high K Index.

## 1. Background

The Professional Agricultural Analysis Group (PAAG) was established in 2009 to help ensure a common quality standard amongst participating laboratories and to promote the benefits of soil analysis for efficient nutrient management. One of the early actions agreed by the PAAG was the collation of their UK soil analytical data to show breakdown by pH class and by P, K and Mg Indices.

This report covers the fourth collation of analytical data provided by participants for the period 1<sup>st</sup> June 2012 to 31<sup>st</sup> May 2013.

## 2. Data provided

Data comprised results of soil analyses - Olsen for P, ammonium nitrate extraction for K and Mg and 2.5:1 water:soil for pH. The amount and breakdown of data varied among participants. Data provided by some participants derived from several tens of thousands of samples, those from others derived from a few hundred samples. Some provided data that could be broken down by arable and grass. Some provided individual sample data, others aggregated data. Where they could be identified, data from gardens, amenity grass, Christmas trees, top fruit and horse paddocks were excluded from the collation. Datasets were constructed for current year UK data and for data broken down into grass and arable. Data from every participant were allocated to the various datasets to the greatest extent possible. Consequently, sample record numbers vary among datasets and the sums of grass and arable sample records do not equal the UK total.

## 3. Dataset classes

For every dataset, numbers of sample records in different pH classes and soil Indices (Table 1) were counted and expressed as percentages of the total number of samples in that dataset.

Table 1 Classes used for the collation

pH	P Index	K Index	Mg Index
<5.00	0	0	0
5.00-5.49	1	1	1
5.50-5.99	2	2-	2
6.00-6.49	3	2+	3
6.50-6.99	4	3	4
7.00-7.49	5	4	5
7.50-7.99	>5	5	6
>7.99		>5	>6

Only data that could be allocated to these classes, either directly or from concentrations in mg/l, and to the June 1<sup>st</sup> to May 31<sup>st</sup> year were used in the analyses.

## 4. Interpretation of the data

Particular care is needed when drawing conclusions from the data. Firstly, soil samples submitted to laboratories are not randomly selected from the total population of fields. Technically aware farmers probably are more likely to use soil analysis in decision-making and their soils may be maintained at higher levels of available nutrients than are present in the population mean. Secondly, amounts and sources of

data differed between the various datasets used. Several laboratories contributed to the collation of total samples for the UK. Fewer provided data for grass and arable soils separately. The collation of the data therefore was not statistically rigorous. Nevertheless, broad trends can be identified and some conclusions drawn.

## 5. Collation of data

### 5.1 Datasets

The current year was June 1<sup>st</sup> 2012 to May 31<sup>st</sup> 2013. Data sets were established for:

UK data across all crops and grass  
 UK data for arable samples  
 UK data for grass samples

### 5.2 UK data across all crops and grass

Results for 245968 (pH), 252440 (P), 244737 (K) 252504 (Mg) samples were available for the current year.

Mean soil pH was 6.70, 26% of samples were below 6.00 and 40% were between 6.00 and 7.00.

Only 28-30% of samples were at target soil P or K Index (2 and 2- respectively). Soil P was lower than target Index in 28% of samples and soil K was lower than target in 34% of samples. Soil Mg Index was lower than 2 in 13% of samples (Table 2, Fig 1).

Table 2 Soil pH and Indices - all samples

Soil pH	Percentage of samples in class:							
	<5.0	5.00-5.49	5.50-5.99	6.00-6.49	6.50-6.99	7.00-7.49	7.50-7.99	>8.0
All samples	1	7	18	22	18	14	14	8

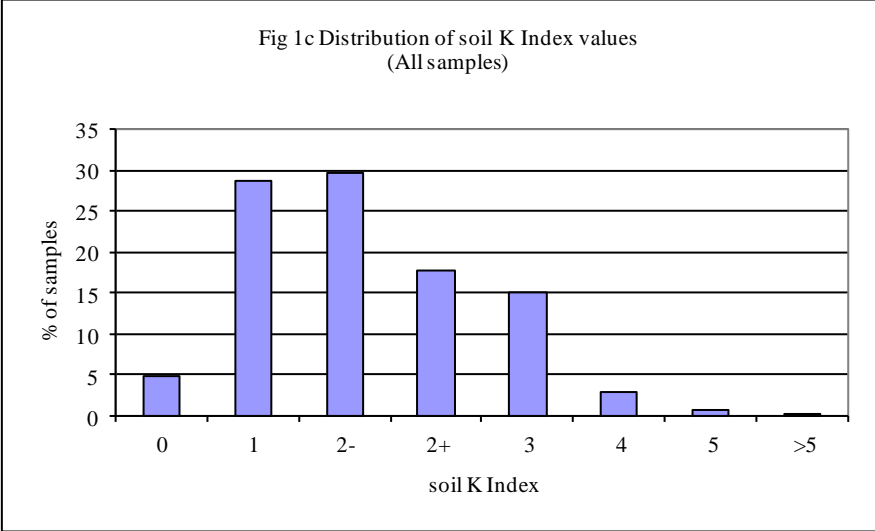
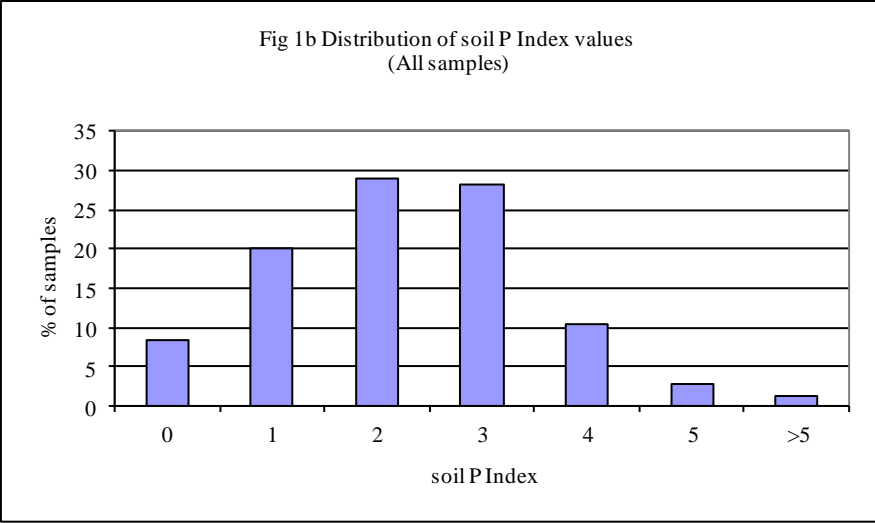
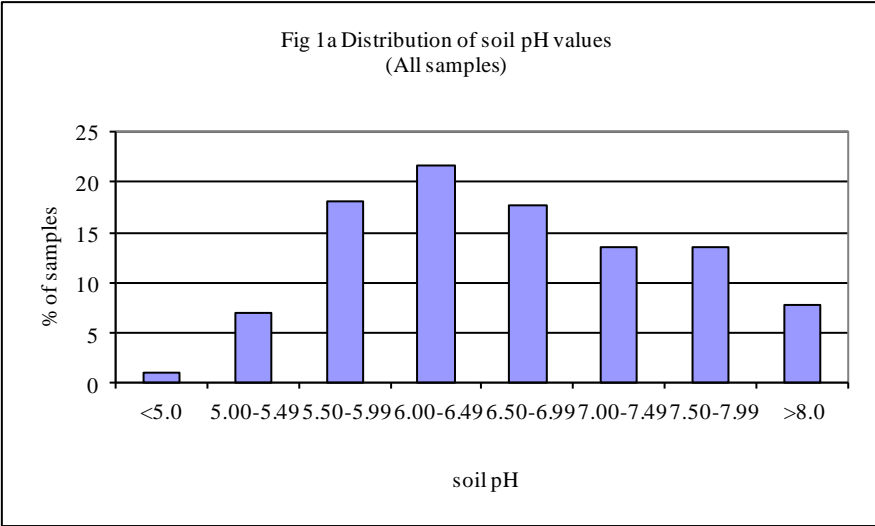
P Index	Percentage of samples in Index:						
	0	1	2	3	4	5	>5
All samples	8	20	29	28	11	3	1

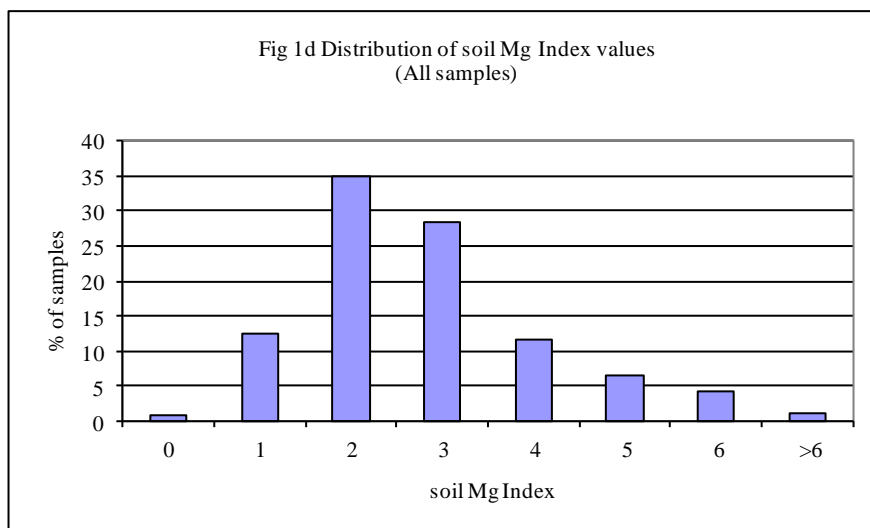
  

K Index	Percentage of samples in Index:							
	0	1	2-	2+	3	4	5	>5
All samples	5	29	30	18	15	3	1	0

Mg Index	Percentage of samples in Index:							
	0	1	2	3	4	5	6	>6
All samples	0	13	35	28	12	6	4	1





Two laboratories provided large amounts of data for individual samples in every year (>45000 samples each) and three laboratories in 2009/2010 (>45000 samples for A and B, >4500 samples for C). These were used to calculate correlation coefficients between pairs of measured variables (Table 3). For P, K and Mg, data as mg/l were used. Owing to the large numbers of samples, nearly all of the coefficients shown in Table 3 were statistically significant ( $P < 0.01$ ). None of the correlations was strong but there was consistently a positive correlation between Olsen-P and ammonium nitrate-extractable K and a somewhat weaker positive correlation between ammonium nitrate-extractable K and ammonium nitrate-extractable Mg.



Table 3 Correlation coefficients for soil variables

<b>Laboratory:</b>	<b>2008/2009</b>		<b>2009/2010</b>		<b>2010/2011</b>			<b>2011/2012</b>		<b>2012/2013</b>	
	<b>A</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>A</b>	<b>B</b>	<b>A</b>	<b>B</b>
pH and P	-0.026	-0.012	0.020	0.037	0.086	-0.043	0.074	0.034	0.008	0.021	-0.020
pH and K	0.185	0.276	0.209	0.286	0.071	0.207	-0.011	0.171	0.305	0.200	0.315
pH and Mg	-0.203	0.022	-0.147	0.028	-0.308	-0.021	-0.410	-0.193	0.031	-0.174	0.012
P and K	0.371	0.290	0.404	0.300	0.289	0.251	0.571	0.263	0.211	0.368	0.177
P and Mg	0.012	0.005	0.013	0.083	-0.014	-0.043	-0.019	0.051	-0.076	0.032	-0.083
K and Mg	0.284	0.177	0.251	0.269	0.078	0.207	0.548	0.201	0.241	0.277	0.241

### 5.3 UK data by arable and grass

Some participants provided data where the past crop could be identified as arable or agricultural grass. These data (190000 samples for arable and 49000 for grass) are summarised in Table 4 and Fig 2.

Soil pH tended to be higher in arable than in grass and, as in previous years, there was an indication of a double population in arable samples with peaks at 6.0-7.0 and at 7.5-8.0. This could be due to samples from calcareous soils that probably were predominantly arable. Mean pH for arable was 6.80 and for grass 6.01.

The distribution of soil P values was similar for arable and grass with mean values of 29 mg/l (Index 3) for arable and 24 mg/l (Index 2) for grass. Only 29-30% of arable and grass samples were at target Index 2 with 28% (arable) and 34% (grass) in Indices 0 or 1.

Soil K values also were somewhat similar with means of 180 mg/l (Index 2-) for arable and 163 mg/l (Index 2-) for grass. Only 30% of arable and 27% of grass samples were at target Index 2- and 32% (arable) and 42% (grass) were in Indices 0 or 1.

There was a more noticeable difference between arable and grass in soil Mg. Mean value was lower for arable (132 mg/l, Index 3) than for grass (171 mg/l, Index 3). Distributions were strongly skewed with median values of 96 mg/l (Index 2) for arable and 136 mg/l (Index 3) for grass. Only 3% of grass, but 16% of arable, samples were in Mg Indices 0 or 1.

Table 4 Soil pH and Indices by arable and grass

		<b>Percentage of samples in class:</b>							
<b>Soil pH</b>	<b>&lt;5.0</b>	<b>5.00-5.49</b>	<b>5.50-5.99</b>	<b>6.00-6.49</b>	<b>6.50-6.99</b>	<b>7.00-7.49</b>	<b>7.50-7.99</b>	<b>&gt;8.0</b>	
Arable	1	4	14	20	19	16	17	10	
Grass	2	17	35	27	12	5	3	1	

		<b>Percentage of samples in Index:</b>							
<b>P Index</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>&gt;5</b>		
Arable	8	20	29	28	11	3	1		
Grass	11	23	30	26	8	2	0		

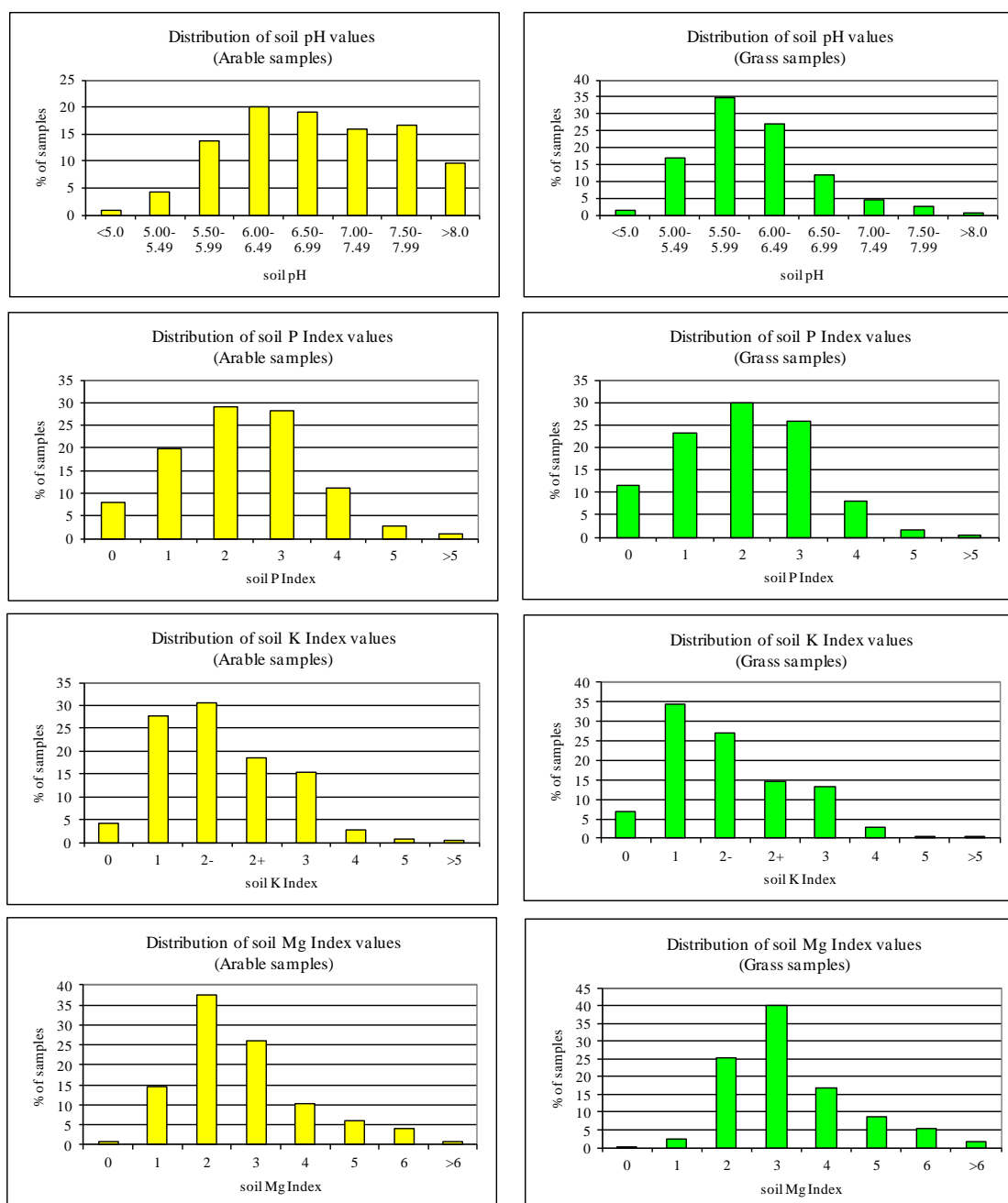
  

		<b>Percentage of samples in Index:</b>							
<b>K Index</b>	<b>0</b>	<b>1</b>	<b>2-</b>	<b>2+</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>&gt;5</b>	
Arable	4	28	30	18	15	3	1	0	
Grass	7	35	27	15	13	3	1	0	

		<b>Percentage of samples in Index:</b>							
<b>Mg Index</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>&gt;6</b>	
Arable	1	15	37	26	10	6	4	1	
Grass	0	3	25	40	17	9	5	2	

Fig 2 Distributions by arable and grass



#### 5.4 P x K Index matrices

Matrices were constructed showing percentages of samples falling into different P and K Indices for arable and, separately, for grass samples. A summary of results is shown in Tables 5 and 6 and full results are in Appendix 1.

Only 9% of arable and grass samples were at target Indices for both P and K.

Table 5 Percentages of samples in P and K Indices  
(total 213615 samples)

K Index	P Index		
	<target	target	>target
<target	12	9	12
target	9	9	12
>target	8	10	19

Table 6 Percentages of grass samples in P and K Indices  
(total 48668 samples)

K Index	P Index		
	<target	target	>target
<target	19	12	10
target	9	9	9
>target	6	9	17

## Appendix 1 Percentages of samples in P x K Indices

### Arable samples

K Index	P Index					
	0	1	2	3	4	4+
0	1	1	1	1	0	0
1	3	7	8	7	2	0
2-	2	7	9	8	3	1
2+	1	3	6	5	2	1
3	1	2	4	5	2	1
4	0	0	1	1	1	0
4+	0	0	0	0	0	0

### Grass samples

K Index	P Index					
	0	1	2	3	4	4+
0	1	2	2	1	0	0
1	5	10	11	7	1	0
2-	2	6	9	7	2	0
2+	1	3	5	5	2	0
3	1	2	3	5	2	1
4	0	0	0	1	1	0
4+	0	0	0	0	0	0



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