PAAG
Professional Agricultural Analysis Group

Collation of data from routine soil analysis in the UK

2016/2017

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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 1st 2016 to May 31st 2017) results for around 188,000 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 16% of arable samples (17% in 2015/16 and 19% in 2014/15) and <5.5 in 18% of grass samples (19% in 2015/16 and 21% in 2014/15). A slow but steady downward trend in soil pH at a rate of around 0.02 pH units/year stabilised around 2007/08. Nevertheless, there seems a need to address liming on significant proportions of arable and grassland areas.

As in previous years, only around 30% of all samples were at target Index of 2 for P and 29% were at target Index of 2- for K. Just 9% of all samples were at target Indices for both P and K and there has been no evidence for convergence of P and K indices on target values since PAAG data were first collated. Some 90% of samples indicated the need for adjustment of P or K Index giving clear support for the need to base fertilizer use on regular soil analysis.

In the current year 16% of arable samples and 4% of grass samples were in Mg Indices 0 or 1 where application of magnesium might be recommended for some crops.

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 collation of analytical data provided by participants for the period 1st June 2016 to 31st May 2017. The same general format has been used for all annual reports since 2009/10.

2. Data provided

Data comprised results of soil analyses - Olsen method 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 thousand samples. Some provided data that could be broken down by arable and grass. Datasets were constructed for current year UK data and for data broken down into grass and arable where this was possible. Where they could be identified, data from amenity trees, top fruit, coppice, gardens, top-soil, protected crops and non-UK sites were excluded. Data for amenity grass of all kinds (including horse paddocks) were excluded from the grassland dataset. Data for current arable crops following a ley were included in the arable dataset. Data for current arable crops and forage maize following permanent grassland or grazed grass were included in the grassland dataset. 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 identifiable grass and arable sample records do not equal the total number for all samples.

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, 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 1st 2016 to May 31st 2017. 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 186703 (pH), 188262 (P), 188322 (K) and 188322 (Mg) samples were available for the current year.

Mean soil pH was 6.47, 29% of samples were below 6.00 and 44% were between 6.00 and 7.00.

Only 29-30% of samples were at target soil P or K Index (2 and 2- respectively). Soil P was lower than target Index in 27% of samples and soil K was lower than target in

33% of samples. Soil Mg Index was lower than 2 in 11% of samples (Table 2, Fig 1). These percentages are very similar to those in 2015/16.

Table 2 Soil pH and Indices - all samples

				Percentage of samples in class:				
Soil pH	**<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**
	1	8	20	25	19	12	10	5
				Percentage of samples in class:				
P Index	**0**	**1**	**2**	**3**	**4**	**5**	**>5**	
	7	20	30	28	11	3	1	
				Percentage of samples in class:				
K Index	**0**	**1**	**2-**	**2+**	**3**	**4**	**5**	**>5**
	5	28	29	18	16	4	1	0
				Percentage of samples in class:				
Mg Index	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**>6**
	1	10	33	31	12	7	5	1

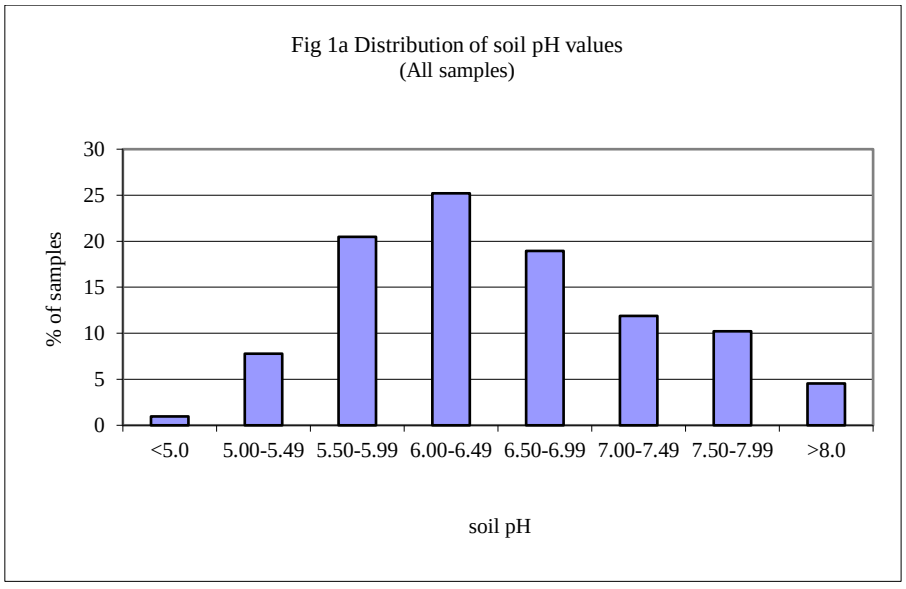


Fig 1b Distribution of soil P Index values
(All samples)

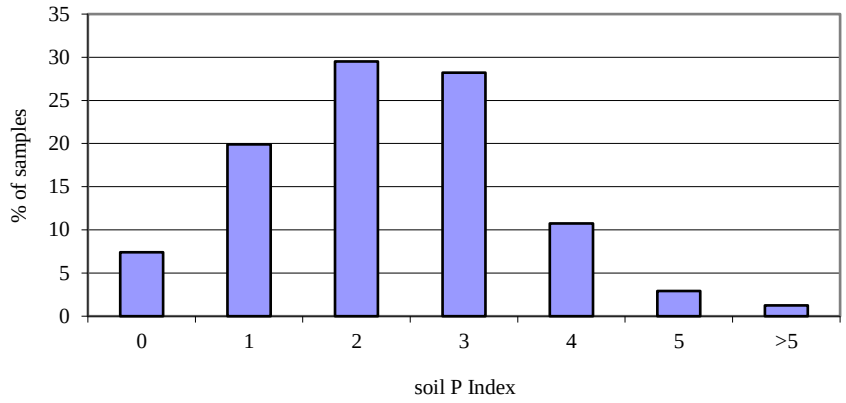


Fig 1c Distribution of soil K Index values
(All samples)

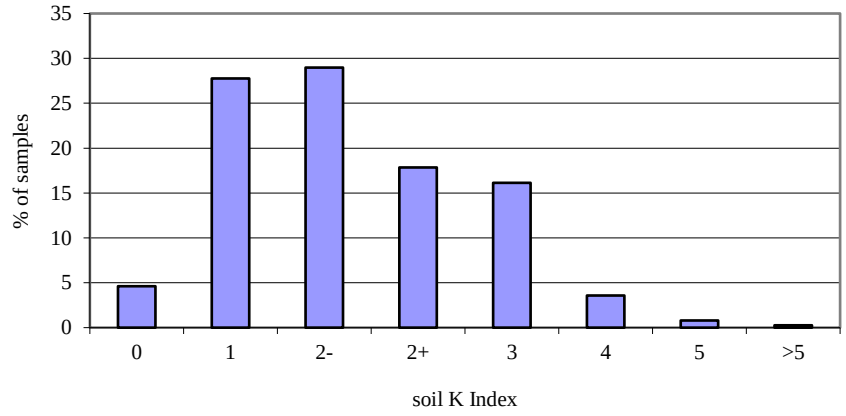
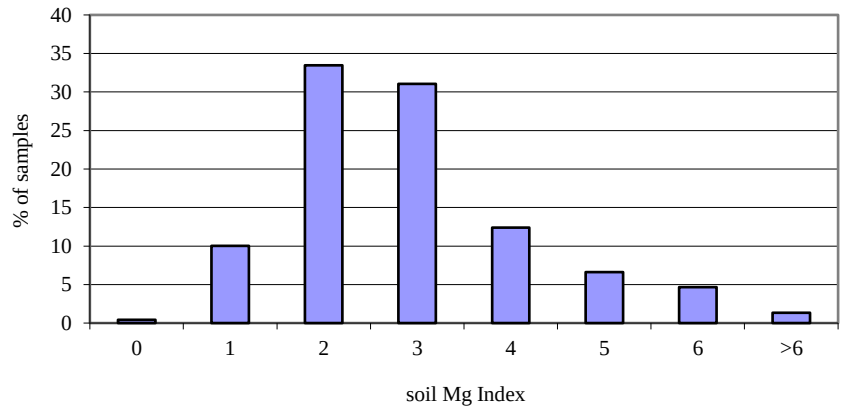


Fig 1d Distribution of soil Mg Index values
(All samples)



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 (around 64000 samples for arable and 67000 for grass) are summarised in Table 3 and Fig 2.

Mean pH for arable samples was 6.73 and for grass 6.02.

The distribution of soil P values was similar for arable and grass with mean values of 31 mg/l (Index 3) for arable and 25 mg/l (Index 2) for grass. Only 26-31% of arable and grass samples were at target Index 2 with 22% (arable) and 34% (grass) in Indices 0 or 1.

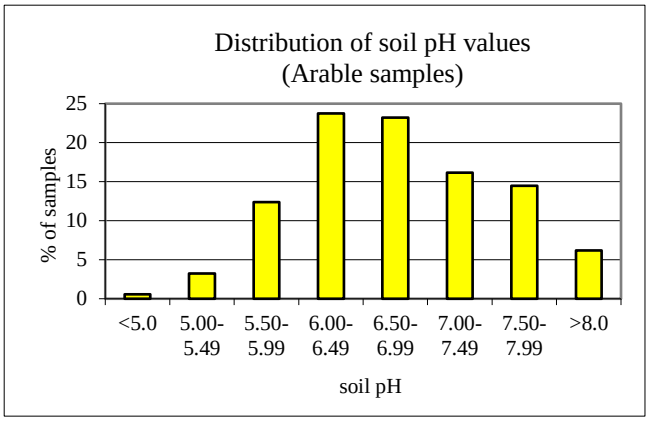
The distributions of soil K values also were somewhat similar with means of 186 mg/l (Index 2-) for arable and 163 mg/l (Index 2-) for grass. Only 32% of arable and 27% of grass samples were at target Index 2- and 29% (arable) and 43% (grass) were in Indices 0 or 1.

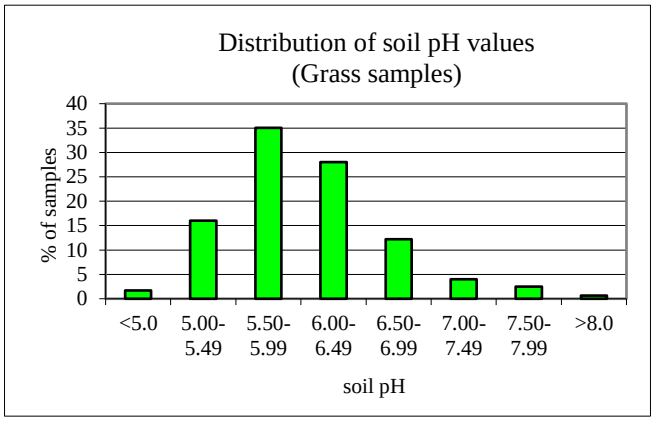
There was a more noticeable difference between arable and grass in soil Mg. Mean value was lower for arable (133 mg/l, Index 3) than for grass (161 mg/l, Index 3). Only 4% of grass, but 16% of arable, samples were in Mg Indices 0 or 1.

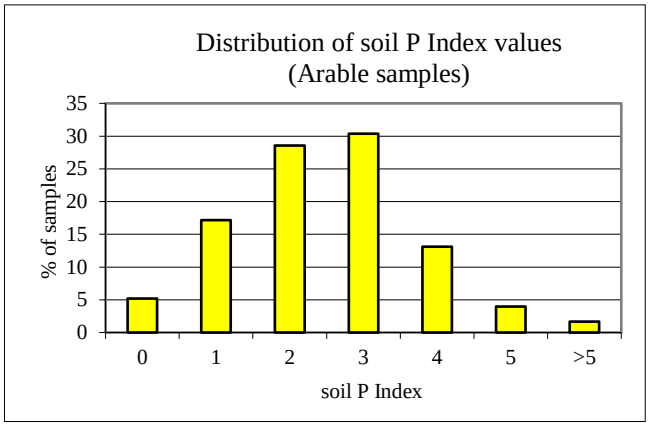
Table 3 Soil pH and Indices – arable and grass

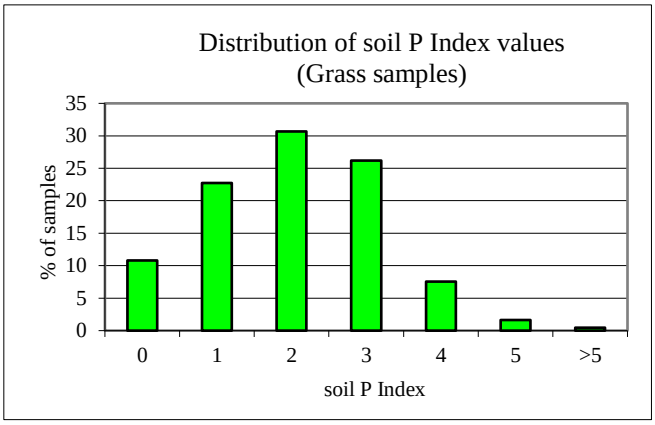
				Percentage of samples in class:				
Soil pH	**<5.0**	**5.00-5.49**	**5.50-5.99**	**6.00-6.49**	**6.50-6.99**	**7.00-7.49**	**7.50-7.99**	**>8**
Arable	1	3	12	24	23	16	14	6
Grass	2	16	35	28	12	4	2	1
				Percentage of samples in class:				
P Index	**0**	**1**	**2**	**3**	**4**	**5**	**>5**	
Arable	5	17	29	30	13	4	2	
Grass	11	23	31	26	8	2	0	
				Percentage of samples in class:				
K Index	**0**	**1**	**2-**	**2+**	**3**	**4**	**5**	**>5**
Arable	3	26	31	19	17	3	1	0
Grass	8	35	26	14	12	3	1	0
				Percentage of samples in class:				
Mg Index	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**>6**
Arable	1	15	36	27	10	6	4	1
Grass	0	4	30	37	14	7	5	2

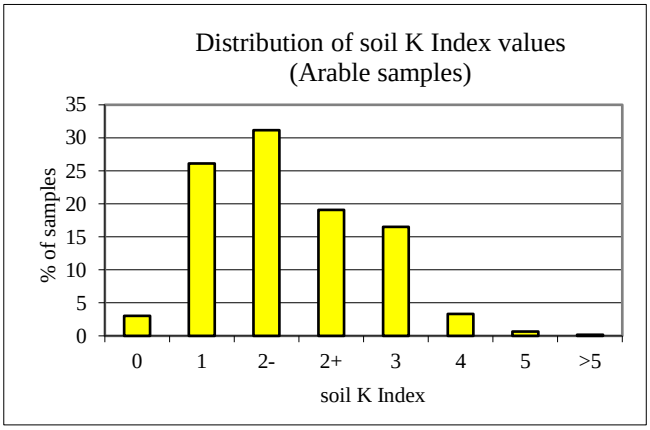
Fig 2 Distributions by arable and grass

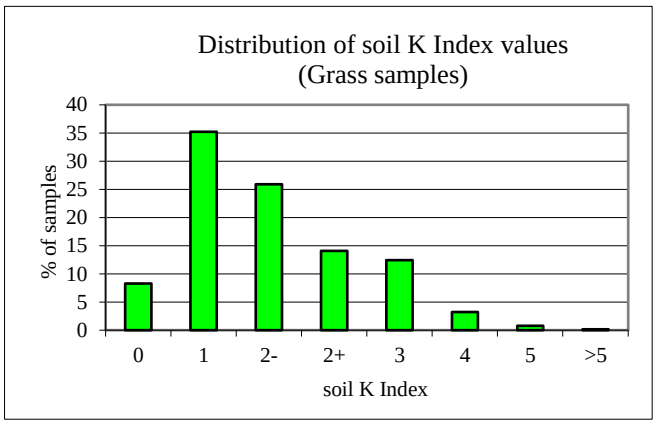


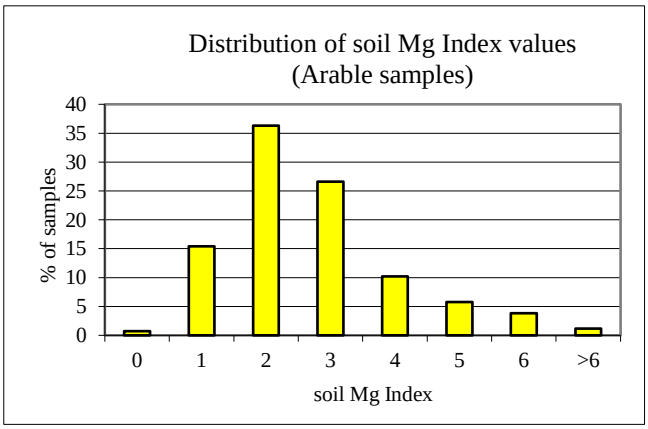


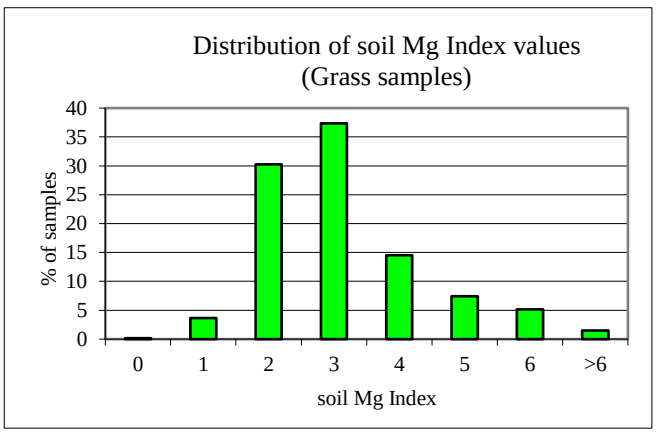












A matrix was constructed showing percentages of all samples falling into different P and K Indices. A summary of results is shown in Table 4 and more detailed results are in Appendix 1.

Only 9% of samples were at target Indices for both P and K. This percentage has been almost unchanged since 2009. Not calculated at the time, the matrix for 2008/2009 data also shows 10% of all samples at target indices for both P and K. Detailed results for 2008/09 also are in Appendix 1 and look remarkably similar to those in 2016/17. It is a reasonable conclusion that the percentage of samples submitted to laboratories that are at target indices for both P and K has been around 10% for at least eight years.

Table 4 Percentages of all samples in P and K Indices
(total 188256 samples)

	P index			
K index	<target	target	>target	
<target	12	10	10	32
target	8	9	12	29
>target	7	11	21	39
	27	30	43	100

Appendix 1 Percentages of samples in P x K Indices

All samples 2016/17 (188256 samples)

P Index

K Index	0	1	2	3	>3	Total
0	1	1	1	1	0	5
1	3	7	8	7	2	28
2-	2	6	9	8	4	29
2+	1	3	5	6	3	18
3	1	2	4	5	4	16
>3	0	0	1	1	2	5
Total	7	20	30	28	15	100

All samples 2008/09 (102324 samples)

P Index

K Index	0	1	2	3	>3	Total
0	1	2	2	1	0	6
1	3	8	10	8	3	33
2-	1	6	10	9	4	29
2+	1	2	5	6	3	16
3	0	1	3	4	3	13
>3	0	0	0	1	1	
Total	6	19	30	29	15	100