PAAG.
Professional Agricultural Analysis Group

Collation of data from
routine soil analysis in the UK

2011/2012

CLa Country Land & Business Association
RURAL ECONOMY IS OUR BUSINESS

LEAF
LINKING ENVIRONMENT AND FARMING
Integrated Farm Management

NFU

aic
agricultural
industries
confederation

A clear solution
for farmers
CATCHMENT SENSITIVE FARMING

<div align="center">

Professional Agricultural Analysis Group

</div>

<u>**Commercial Laboratories**</u>:

- **Alliance Technical Laboratories (Suffolk)**
  Tel: 01449 721192 www.alliancetechnical.co.uk
  Needham Chalks, Ipswich Road, Needham Market, Ipswich, Suffolk, IP6 8E
- **Anglian Soil Analysis (Lincs)**
  Tel: 01205 460590 www.angliansoil.co.uk
  OneWay Street, Sutterton, Boston, Lincolnshire PE20 2JQ
- **Eurofins Food Testing UK**
  Tel: 01902 627245 www.eurofins.co.uk
  Valiant Way, Pendeford, Wolverhampton, WV9 5GB
- **Fast Analytical (Kent)**
  Tel: 01795 533225 www.fastltd.co.uk/fastLaboratory.html
  Crop Technology Centre, Brogdale Farm, Brogdale Road, Faversham, Kent ME13 3XZ
- **Hill Court Farm Research (Gloucs)**
  Tel: 01452 840693 www.hillcourtfarm.co.uk
  Hill Court Farm, Frogsmarsh Corse Lawn, Gloucestershire GL19 4PW
- **John Marsh Granta Processors**
  Tel: 01223 499473
  Mill Lane, Whittlesford, Cambridge CB22 4XL
- **Lancrop Laboratories (York)**
  Tel: 01759 305116 www.lancrop.com
  Manor Place, Wellington Road, The Industrial Estate, Pocklington, York YO42 1DN
- **Natural Resource Management (Bracknell)**
  Tel: 01344 886338 www.nrm.uk.com
  Coopers Bridge, Braziers Lane, Bracknell, Berks RG42 6NS
- **OMEX Agriculture (Kings Lynn)**
  Tel: 01553 760011 www.omex.co.uk
  Estuary Road, Kings Lynn, Norfolk PE30 2HH
- **Richard Austin Associates (Lincs)**
  Tel: 01205 722755
  32 Station Road, Kirton, Boston, Lincolnshire PE20 1LD

<u>**Research Laboratories:**</u>

- **Aberystwyth University**
  Tel: 01970 823086 www.aber.ac.uk
- Institute of Biological, Environmental & Rural Sciences, Gogerddan, Aberystwyth, Ceredigion SY23 3EB
- **Rothamsted Research**
  Tel: 01582 763133 www.rothamsted.ac.uk
  Harpenden, Hertfordshire AL5 2JQ

<div align="center">

New members are welcome to join
Please contact jane.salter@agindustries.org.uk for further details

</div>

Contents

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 2011 to May 31st 2012) results for 170,000 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 20% of arable samples (29% in 2009/10) and <5.5 in 22% of grass samples (21% in 2009/10). This supports the need for regular soil analysis to maintain pH.

As in previous years, only 30% of all samples were at target Index of 2 for P and 29% were at target Index of 2- for K. Just 10% of arable samples and 8% 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, as in 2010/11, 12% of samples were in Mg Indices 0 or 1 where application of magnesium might be recommended for some crops. This was a decrease from 16% in 2009/2010.

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 1st June 2011 to 31st May 2012.

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 amenity grass, Christmas trees and top fruit 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 1st to May 31st 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 1st 2011 to May 31st 2012. 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 171045 (pH), 175502 (P), 167986 (K) 175502 (Mg) samples were available for the current year.

Mean soil pH was 6.61, 26% of samples were below 6.00 and 37% 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 28% 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).
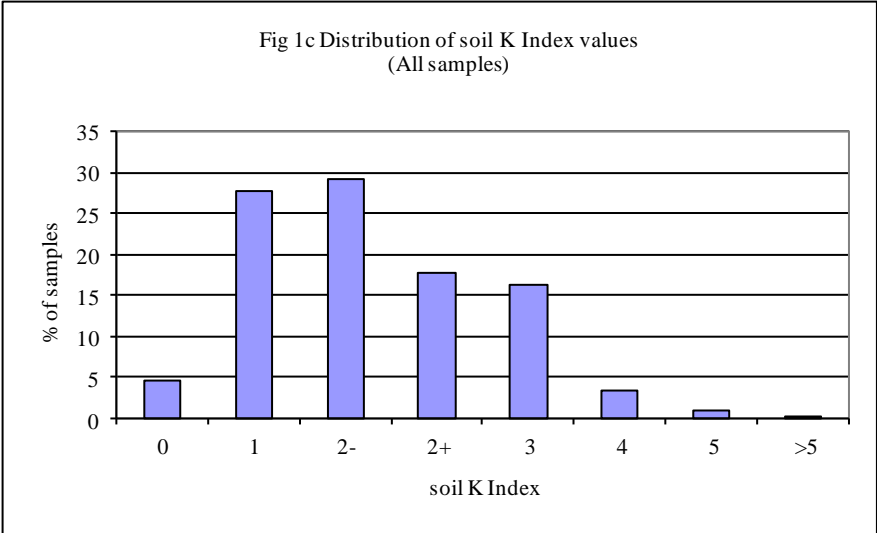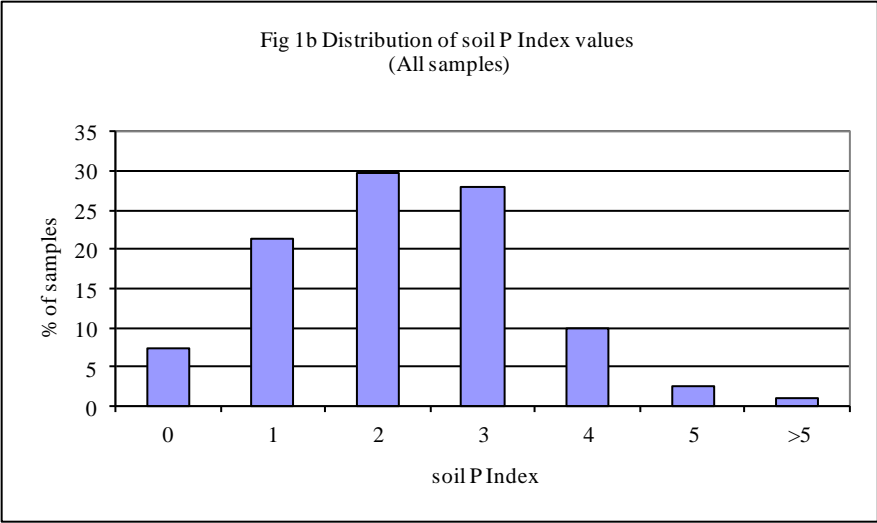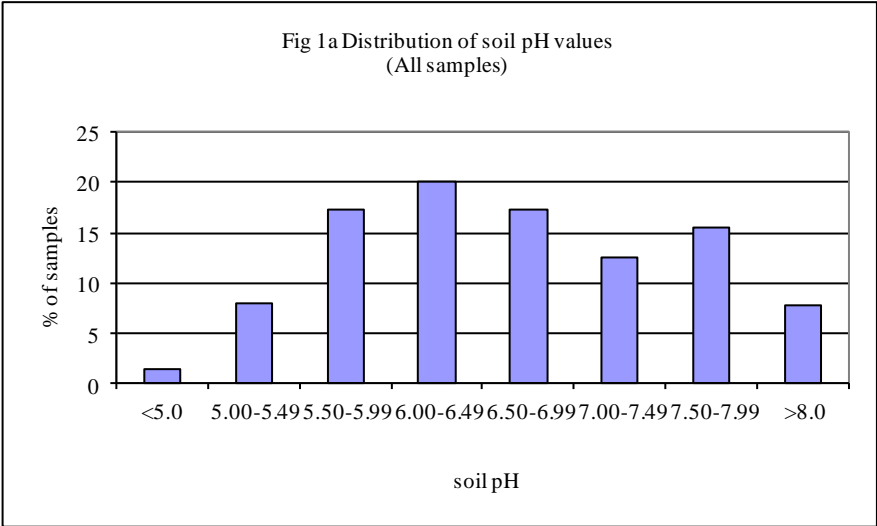
Table 2 Soil pH and Indices - all samples

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	>8.0
				Percentage of samples in class:				
All samples	1	8	17	20	17	13	16	8

P Index	0	1	2	3	4	5	>5	
				Percentage of samples in Index:				
All samples	7	21	30	28	10	3	1	

K Index	0	1	2-	2+	3	4	5	>5
				Percentage of samples in Index:				
All samples	5	28	29	18	16	3	1	0

Mg Index	0	1	2	3	4	5	6	>6
				Percentage of samples in Index:				
All samples	0	11	33	29	13	8	5	1

Fig 1a Distribution of soil pH values
(All samples)

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)
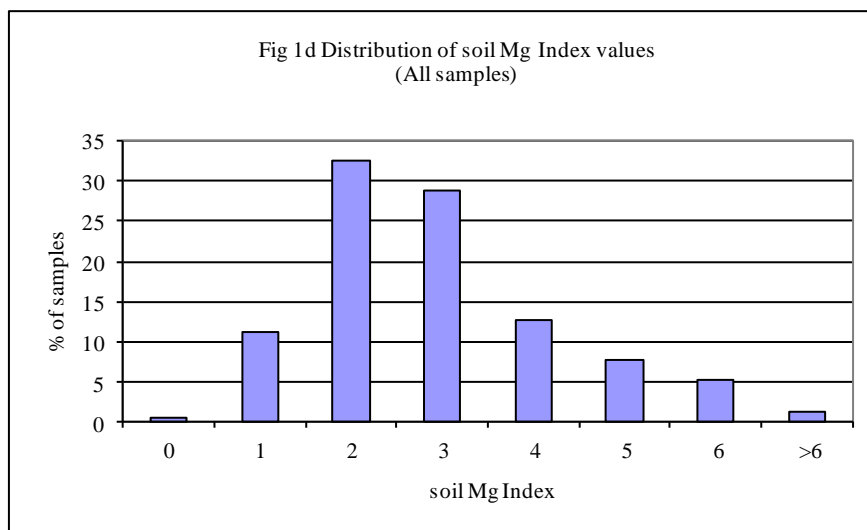
Two laboratories provided large amounts of data for individual samples in every year (>45000 samples each) and three laboratories in 2009/2010 (>45000 samples for A and B, >4500 samples for C). These were used to calculate correlation coefficients between pairs of measured variables (Table 3). For P, 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.

Table 3 Correlation coefficients for soil variables

| | 2008/09 | | 2009/10 | | 2010/11 | | | 2011/12 | |
Laboratory:	A	B	A	B	A	B	C	A	B
pH and P	-0.026	-0.012	0.020	0.037	0.086	-0.043	0.074	0.034	0.008
pH and K	0.185	0.276	0.209	0.286	0.071	0.207	-0.011	0.171	0.305
pH and Mg	-0.203	0.022	-0.147	0.028	-0.308	-0.021	-0.410	-0.193	0.031
P and K	0.371	0.290	0.404	0.300	0.289	0.251	0.571	0.263	0.211
P and Mg	0.012	0.005	0.013	0.083	-0.014	-0.043	-0.019	0.051	-0.076
K and Mg	0.284	0.177	0.251	0.269	0.078	0.207	0.548	0.201	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 (61000-69000 samples for arable and 38000 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 6.70 and for grass 5.99.

The distribution of soil P values was similar for arable and grass with mean values of 30 mg/l (Index 3) for arable and 24 mg/l (Index 2) for grass. Only 29% of arable and grass samples were at target Index 2 with 23% (arable) and 38% (grass) in Indices 0 or 1.

Soil K values also were somewhat similar with means of 179 mg/l (Index 2-) for arable and 168 mg/l (Index 2-) for grass. Only 31% of arable and 26% of grass samples were at target Index 2- and 31% (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 (148 mg/l, Index 3) than for grass (179 mg/l, Index 4). Distributions were strongly skewed with median values of 89 mg/l (Index 2) for arable and 130 mg/l (Index 3) for grass. Only 2% of grass, but 13% of arable, samples were in Indices 0 or 1.

Table 4 Soil pH and Indices by arable and grass

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
Arable	1	5	14	21	21	16	16	6
Grass	3	19	31	25	12	5	3	1

P Index	Percentage of samples in Index:						
	0	1	2	3	4	5	>5
Arable	5	18	29	32	12	3	1
Grass	12	26	29	24	7	2	1

K Index	Percentage of samples in Index:							
	0	1	2-	2+	3	4	5	>5
Arable	3	28	31	19	16	3	1	0
Grass	7	35	26	14	14	3	1	0

Mg Index	Percentage of samples in Index:							
	0	1	2	3	4	5	6	>6
Arable	0	13	34	26	12	8	5	1
Grass	0	2	23	38	18	10	7	2

Fig 2 Distributions by arable and grass
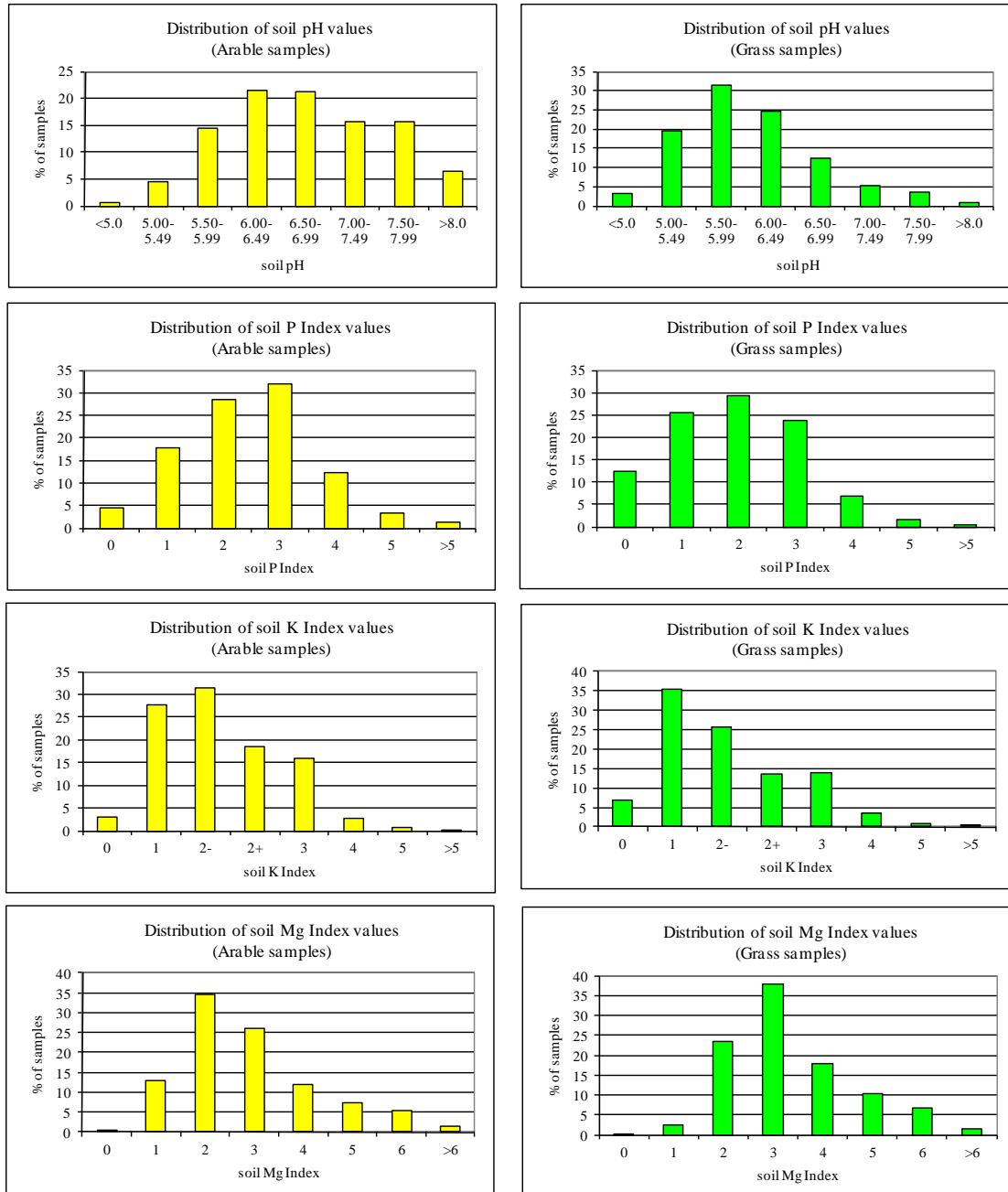
5.4 P x K Index matrices

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 10% of arable samples and 8% of grass were at target Indices for both P and K.

Table 5 Percentages of samples in P and K Indices
(total 60042 samples)

K Index	P Index		
	<target	target	>target
<target	10	9	12
target	7	10	15
>target	7	11	20

Table 6 Percentages of grass samples in P and K Indices
(total 38266 samples)

K Index	P Index		
	<target	target	>target
<target	20	12	10
target	10	8	8
>target	7	9	15

Appendix 1 Percentages of samples in P x K Indices

Arable samples

K Index	P Index					
	0	**1**	**2**	**3**	**4**	**4+**
0	0	1	1	1	0	0
1	2	7	8	8	3	1
2-	1	6	10	10	4	1
2+	1	3	5	6	3	1
3	1	2	4	5	2	1
4	0	0	1	1	0	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	6	11	10	6	1	0
2-	3	7	8	6	1	0
2+	1	3	5	4	1	0
3	1	2	4	5	2	0
4	0	0	1	1	1	0
4+	0	0	0	0	0	0

Available from:

www.nutrientmanagement.org
Support and advice, Soils
Also in the library: see PAAG

© PAAG 2012