The Potash Development Association

19. POTASH FOR HEAVY SOILS

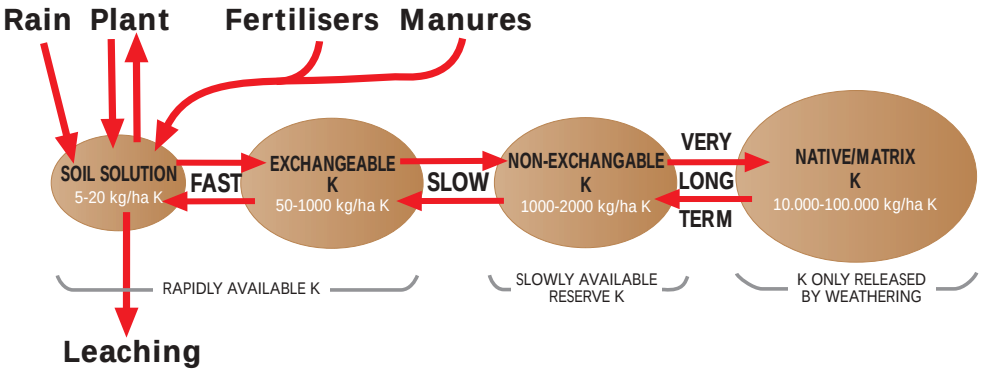
Introduction

There is a general belief that heavy soils are rich in potash. Certainly this element is abundant in specific clay minerals which occur in some soils. Other clay minerals are less rich in K.

	Feldspars	Micas	Illite	Montmorillonite/Vermiculite
K content	**12-17%**	**10%**	**4-6%**	**less than 1%**

Heavy soils differ in the amount and type of clay which they contain and this is reflected in the quantity of their potash reserves. Fertiliser use must be adjusted according to the characteristics of individual soils and this note outlines the principles and possible strategies for different situations.

Potash cycle for Heavy Soils



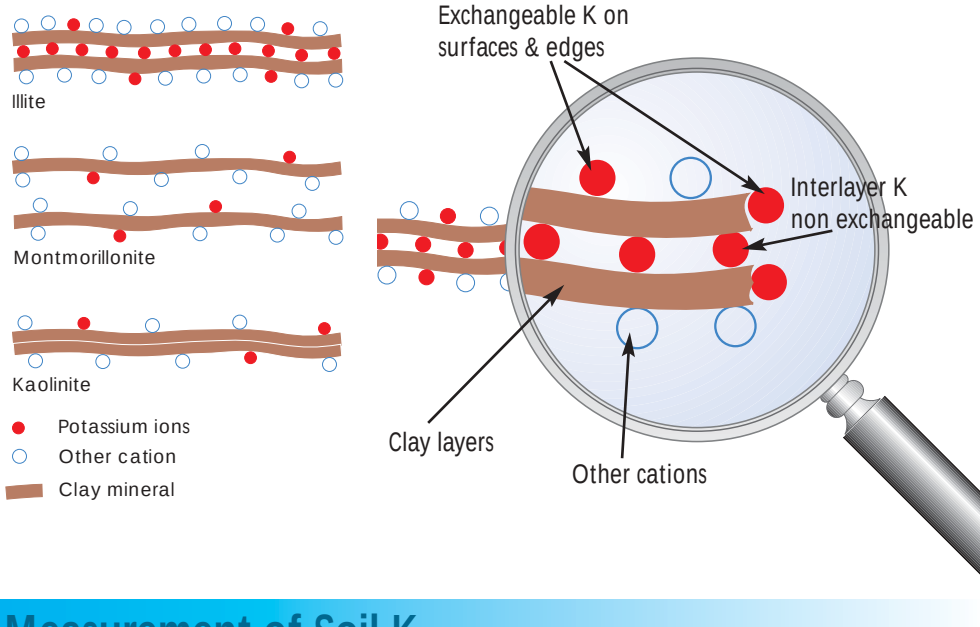
As can be seen the quantity of immediately available K in soil solution is very small and this is replenished rapidly from exchangeable forms in response to plant demand. By comparison the non exchangeable K reserves in heavy soils are very large indeed but tend to be more slowly available.

The cover picture was kindly provided by Dowdeswell Engineering

Clay Minerals

Clay minerals consist of lattices and layers and cations are held in various positions in and around the layers. Different cations are held with different strengths according to their electrical charge:-

$$Al^{+++}, Ca^{++}, Mg^{++}, K^{+}, NH_4^{+}, Na^{+}$$



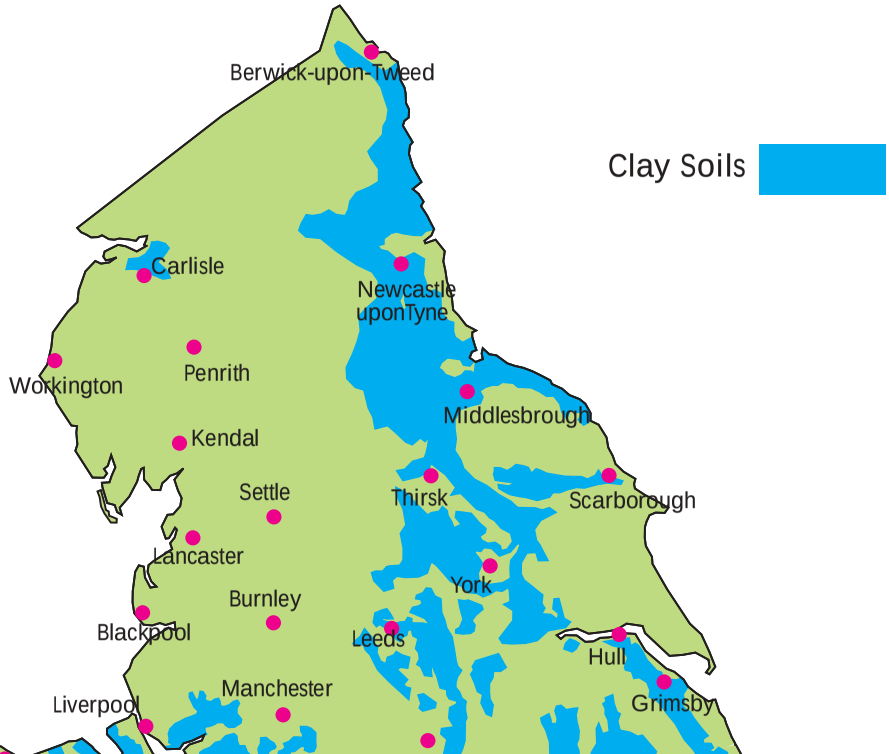
Measurement of Soil K

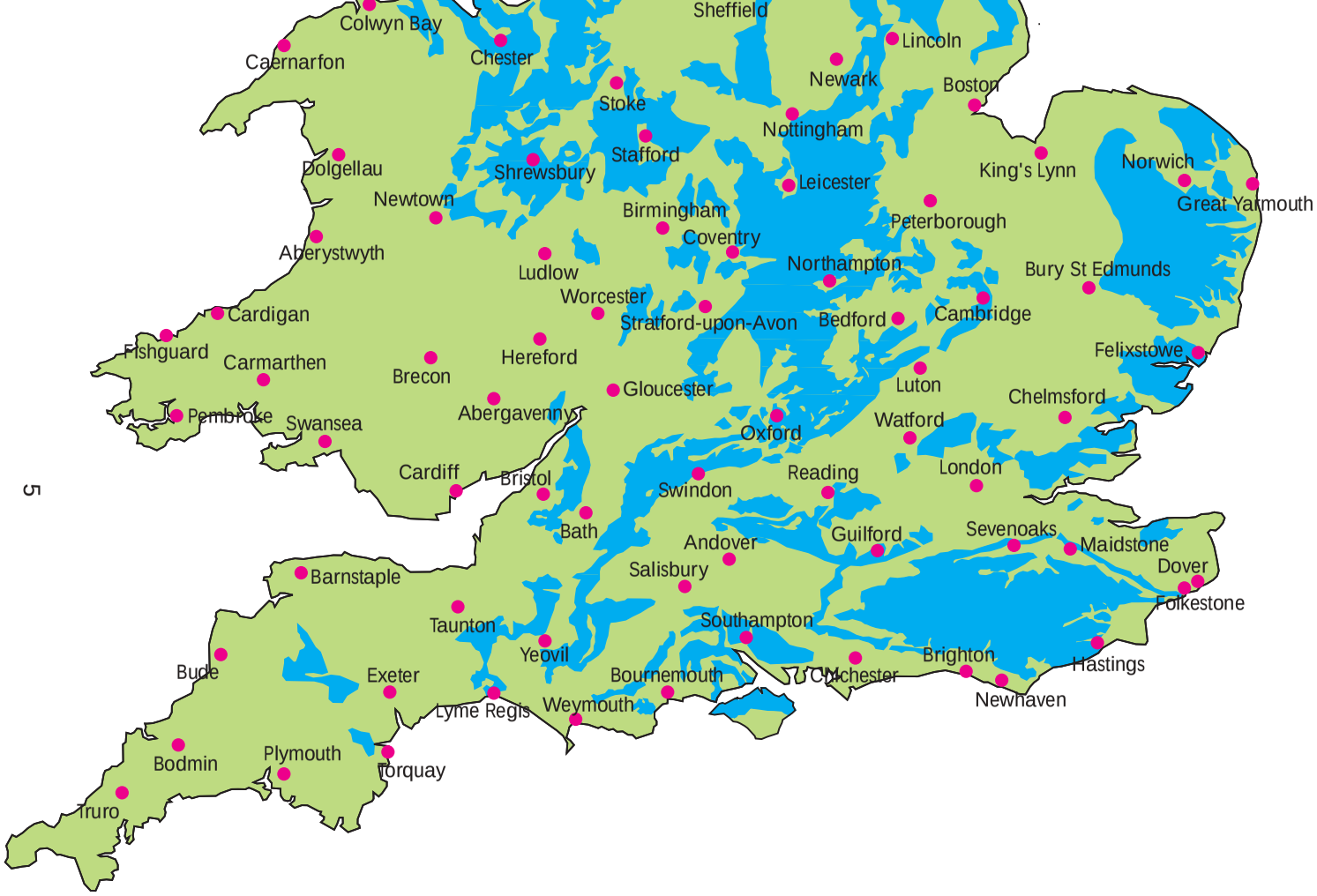
When a soil is analysed a chemical extractant (usually ammonium nitrate) is used to remove a proportion of the K+ ions from the clay lattice. The amount "exchanged" by the extr actant is similar to the amount of potash that a plant would be able to obtain from that soil. This quantity together with the soil solution K is the measure of the K fertility of the soil. The nutrient level is measured in mg/l and frequently shown on an index basis to give very broad indications as to whether the level is deficient (0), low (1), satisfactory (2), good (3) or high (4 or above).

Some of the K+ held more strongly by the clay lattice (non-exchangeable) may be released slowly during the season and this will add to the exchangeable supply. On soils with large non-exchangeable reserves the amount released may well be sufficient to maintain exchangeable soil levels so as to fully sustain combinable crops for a number of years. The quantity of non-exchangeable K+ released will depend upon the amount and type of clay and on other aspects such as - moisture, pH etc.

Distribution of heavy soils

The distribution of clay soils in England and Wales is shown on the map. Considerable local variation of soil type and texture will of course occur within these areas and even within fields. Precision technology may permit such localised variation to be identified and managed separately within fields. Where this is not possible, fertiliser policy should be adjusted to the average fertility of the field omitting the absolute extremes from soil samples.




Colwyn Bay
Caernarfon
Chester
Sheffield
Lincoln
Newark
Boston
Stoke
Nottingham
Stafford
Dolgellau
Shrewsbury
Leicester
King's Lynn
Norwich
Great Yarmouth
Newtown
Birmingham
Peterborough
Aberystwyth
Coventry
Ludlow
Northampton
Bury St Edmunds
Worcester
Cardigan
Stratford-upon-Avon
Bedford
Cambridge
Fishguard
Carmarthen
Hereford
Felixstowe
Brecon
Gloucester
Luton
Chelmsford
Pembroke
Swansea
Abergavenny
Watford
Oxford
Cardiff
Bristol
Reading
London
Swindon
Bath
Guilford
Sevenoaks
Maidstone
Andover
Dover
Barnstaple
Salisbury
Folkestone
Taunton
Southampton
Yeovil
Brighton
Hastings
Bude
Exeter
Bournemouth
Chichester
Lyme Regis
Weymouth
Newhaven
Bodmin
Plymouth
Torquay
Truro

Fertiliser Strategy for medium & light soils

For these soils, fertiliser policy should be based on soil analysis every 4 years or so (preferably at the same time of year and at the same point in the rotation - especially if this includes crops with a high potash demand e.g. roots, cut grass etc.) Soil index gives a general guide to soil fertility but it is more useful to monitor the actual nutrient values given in mg/l (ppm). This will permit changes in fertility to be identified more readily. Soil K differences of less than 10-20mg/l are unlikely to be significant.

The principle of manuring is to keep these soils above the critical minimum value relevant to the crops grown. In practice because soil nutrient levels cannot be raised and lowered over short periods, the appropriate status will be that for the most demanding crop grown in the rotation. Fertiliser policy should then maintain this level by replacing the nutrients removed by the rotation. For lighter soils applications must be annual or even split within the season. On medium or heavier soils rotational manuring may be followed, applying 2 or 3 years requirement before the most responsive crop e.g.. roots, legumes etc. Annual applications are normally advisable where grass is cut to avoid possible luxury uptake.

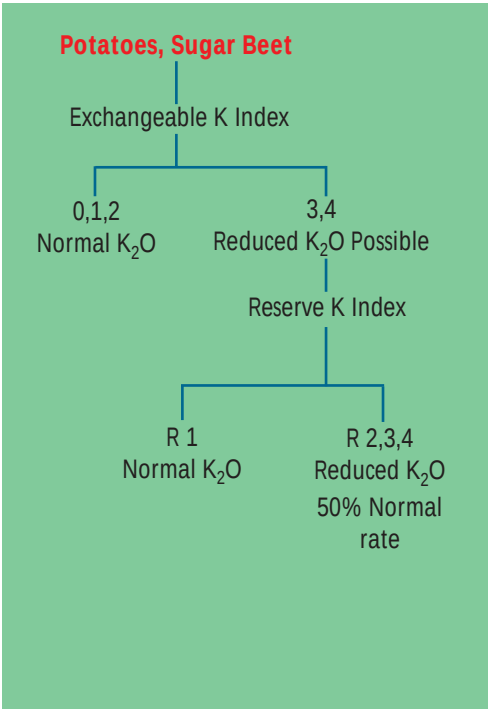
Strategy for Heavy Soils

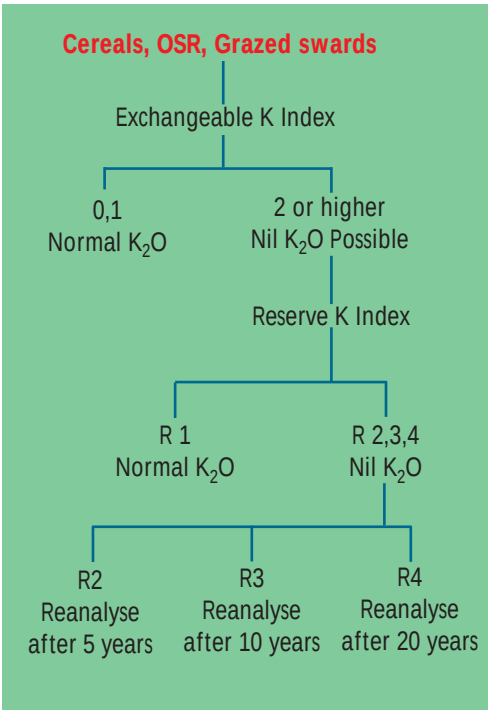
Some clay soils contain very large reserves of "non-exchangeable" K which are not revealed by normal soil analysis results. Unlike other soils however these soils can sustain combinable crops for many years without any reduction in exchangeable soil K because this is being topped up from non-exchangeable reserves.

Regular soil analysis may be undertaken every 4 years but an alternative strategy is provided by the **Reserve K Analysis**. This can be used to test typical blocks of land and indicates the number of years cropping possible without further soil analysis.

Levington Reserve K analysis*

Trials involving 40 soils showed that the longer term uptake of K by crops receiving no fertiliser could be related to the combined results of three separate soil tests. Different extractants are used to measure both available and reserve (non-exchangeable) K. Results of the tests are combined to give an index - R1 to R4 - indicating the level of reserve K in a soil. Lighter soils maybe in R1 whilst boulder clays are in R4.





**** Reserve K analysis is available from:-***
Levington Agriculture, Levington Park, Ipswich, IP10 OLU. Tel 01473 271818

Individual crop recommendations

For individual crop recommendations use the PDA PK Arable Kalculator and refer to individual crop leaflets.

Other PDA leaflets

1 Role of Potash
2 Potash - Maintaining the Balance
3 Potash for Quality
4 Potash manuring for Arable Crops
5a Results from Cereal Demonstration Plots
5b Results from Grass Demonstration Plots
6 Potash, Magnesium & Sodium Fertilisers for Grass
7 P & K Balance for Cereals
8 A New Approach to Fertiliser Policy
11 Cereals and Potash
12 Potash for Sugar Beet
13 Oilseed Rape and Potash
14 Potash for Grassland
15 Potash for Potatoes
16 Fodder Beet -Fertiliser Requirements
17 Forage Maize - Fertiliser Requirements
18 Grain Legumes need Potash
19 Potash for Heavy Soils
20 Potash & Biosolids
21 Cutting Fertiliser Costs (out of print)
22 N & K top dressing for arable crops
23 Potash for Organic Growers
24 Effective use of Soil Analysis
25 What you should know about fertilisers
26 Nutrient requirements of forage crops
27 Fodder Beet - P & K offtake
28 Why Maintain Soil Potash Reserves?

Grassland Kalculator
Arable Kalculator
P&K Offtake Standards
Nutrient Content of Manures

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The Potash Development Association is an independent technical organisation formed to support the efficient use of potash fertiliser in the UK.

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