



**The Potash
Development Association**

23. POTASH FOR ORGANIC GROWERS



Principles of manuring-organic and conventional

The principles of manuring are the same whatever the production system. Organic production and conventional farming have many common objectives & are working with the same basic resources. It is most regrettable that promotion and advocacy of the different systems emphasises differences and suggests conflict.

The **objectives** of organic production as stated by the Soil Association are:- *the operation of a sustainable relationship between the health of soil, plants, animals people and the biosphere to produce healthy food whilst protecting and enhancing the environment.*

With regard to **plant nutrition** the organic aims are:-

- to work within natural systems and cycles
- to maintain or increase long term fertility
- as far as possible to use renewable resource in preference to non-renewable resources
- to use other specific materials when extreme need arises

In practice this mean:-

- optimising nutrient recycling by using manures to best effect
- balancing nutrients within the rotation
- feeding the soil rather than the plant

For **phosphate** and **potash** these also represent the aims of conventional farmers-nutrients from manures are taken into account when deciding fertiliser use and fertiliser phosphate and potash are applied to replace the nutrients removed in the crop in order to maintain soil nutrients above specified critical values depending upon the crop and soil type. Critical soil P or K levels are the same for organic or conventional farming systems.

The main difference between an organic and conventional approach occurs with **nitrogen** which although provided to the plant in the same form, as nitrate, has different emphasis on sourcing between the different systems. Organic systems rely on soil and legume N, conventional systems rely on purchased fertiliser N in addition to these sources. It is a poor conventional farmer who does not properly take account of nitrogen in the soil as a result of past cropping and natural organic release.

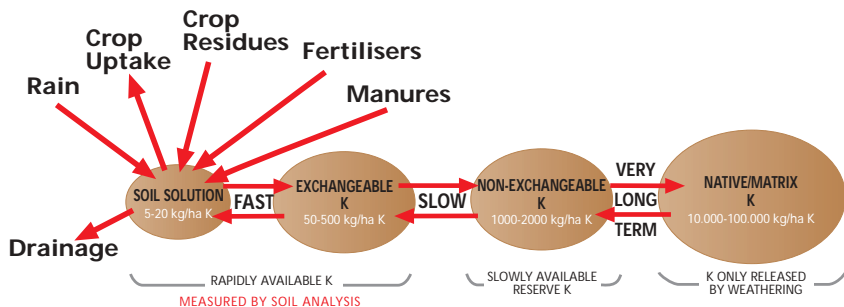
All systems need to be keenly attentive to minimising **nutrient losses** for both financial and environmental reasons. With organic systems, emphasis is also placed on maximising root and biological activity in the soil but the importance of such aspects is also recognised by conventional farmers - for example consider the care taken by the most intensive potato growers to prepare deep beds of well structured soil to maximise the rooting and soil exploration of this shy-rooting crop.

Organic standards favour the use of natural, untreated products but this can often be difficult. Conventional farmers may normally be guided more by the cost of materials but this often reflects the degree of processing, energy requirement, transport and convenience.

Potash - a natural nutrient

Potassium (K) is the most natural major plant food because potassium salts (potassium chloride, sulphate, nitrate etc.) are found so abundantly and so widely distributed in nature. In soils and plants these salts, which are all water soluble, separate into the potash cation K^+ and the relevant anion Cl^- , SO_4^{2-} , NO_3^- etc. Potash in manures is also mainly (70-90%) in water soluble form with a small amount bound into the organic material which is released into the soil solution as the organic matter is mineralised. Potash from manures thus operates in the K cycle shown below in an identical manner to fertiliser potash and there is no reason to distinguish between these materials in terms of K supply. Potassium fertilisers are not associated with any environmental or health concerns. None of the forms of these materials provide any harmful effects, unless like any substance, they are used in excess. Farmers should therefore use all potash materials with care and responsibility whatever the farming system. In particular excess potash applications can cause scorch at seedling stage and crops grown artificially under cover require the sulphate form.

The potash cycle



The sources of potash to the plant are indicated in the diagram which indicates some deposition from **rain**, but amounts are small - generally less than 5kg/ha/year. Some K occurs naturally in **drainage** from most soils - normally less than 5mg/l, but this is not increased by properly managed farming systems. Studies indicate that potassium loss is related to rainfall with approximately 1kg K loss for every 100mm of through drainage applicable for most soils. Potash loss is higher from dung & urine patches in grazing (because of the very high concentrations in these areas) and from large FYM applications (where unevenness of material also results in areas of great concentration) than from correctly managed fertiliser or slurry dressings.

Manures contain useful amounts of potash depending upon the type of livestock and litter/straw (if any) from which they are derived. Potash from these sources behaves in exactly the same way in the soil as from fertiliser sources. Methods of manure storage are also important as K losses can be considerable - up to 50%. Unless imported from another farm, manures are only recycling nutrients within the farm and do not replace nutrient which is removed in the products sold.

It is of course the **soil** itself which feeds the crop and additions of fertiliser or manure are only supplementing this source of supply. Most soils contain very large quantities of potassium - up to 100 t/ha - but most of this is not available to the plant. Plants take up potassium (as K^+) from the **soil solution** which contains only small quantities - less than 25 kg/ha K_2O . This is supplemented by K^+ held by the clay in the soil. (Clay minerals are negatively charged and thus attract the positively charged cations - potassium, calcium, magnesium, sodium etc.) Depending upon how strongly it is bonded to the clay, K^+ may be released rapidly (**exchangeable K**), slowly (**non-exchangeable K**) or by weathering over long periods of time (**matrix K**). The diagram shows the relative quantities in each form but these will differ between different soils depending on the type and quantity of clay and other potassic minerals present.

Careful cultivation, conservation of organic matter and improvement of biological activity will maximise the total availability of potash from all these sources according to the individual nature of each specific soil. Even under ideal management however, the natural release of potash may not be sufficient to maintain the necessary available nutrient levels in the soil and extra supplementation from the sources listed below will be required.

Soil analysis

Soil analysis measures **soil solution** plus **exchangeable K**. Unfortunately it is difficult to measure or predict the release of **non exchangeable K** although a commercial test exists to give a general indication of how large these reserves are for heavy soils. (See PDA leaflet 19)

Whilst all these categories are shown in the diagram as discrete forms and quantities of K, in the living soil there are no sharp divisions and the entire system is dynamic with potash becoming more or less available according to many varying factors.

Soil analysis provides the best practical guide to the adequacy of nutrient for plant growth and the need for nutrient supplementation.



Sustainable nutrient management

All systems of production should maintain an adequate supply of available potash to the plant. Nutrient management must balance inputs with outputs and losses

Aims common to all systems are:-

- to maintain good soil structure
- to maximise soil volume available to the plant
- to conserve organic matter
- to promote biological activity in the soil

“Critical levels” of available soil potash for different crops have been derived from field experiments and for soils at these levels, additions of potash (fertilisers or manures) must be given to replace that removed by cropping. Failure to do so will affect crop performance and is not sustainable management. Sandy soils with low clay content will be most rapidly affected. Where available potash is above critical levels, fertilisers and manures should be reduced or omitted. (See PDA leaflet 8.)

On some heavy soils, the release of potash from non exchangeable reserves is sufficient to provide all the needs of combinable crops without other additions, but where high demand crops such as roots and forage crops are grown, additional potash will need to be applied in order to maintain available K levels.

Penalties of low potash

If potash is limiting, response to nitrogen will be reduced, N fixing bacteria will be less active in legumes and crop health, vigour, and resistance to stress will suffer. Such aspects are of particular importance in organic production where natural resistance through balanced nutrition is an integral aspect of overall husbandry in the absence of agro-chemical protection. Potash is very involved with the water relations in the plant and a deficiency will be especially serious under dry conditions.

Around 45-50% of grassland soils and 20-25% of arable soils are below the critical levels for potash referred to previously.

Attention to this nutrient is therefore vital to organic and conventional growers.



Sources of fertiliser potash

The main sources of potassium in the world are in the clay minerals of the soils & rocks, in the water of the oceans and in the rock salt deposits containing the crystallised minerals from long dried up seas. Potassium salts - chloride, sulphate and nitrate derived from these evaporite rocks (and from salt pans which are in current use in certain parts of the world) are the most common forms of fertiliser potash - all of these being naturally water soluble.

Perhaps the oldest form of potash fertiliser is wood ash but supplies of this material are obviously no longer practical or sustainable.

Various process wastes containing potassium (such as lime kiln dusts) have been considered as sources of K but these vary in K availability, can contain undesirable contamination and suffer from irregularity of supply.

Finely ground primary soil minerals, for example feldspars, are offered as "rock potash" fertiliser but the plant availability of such materials depends on the origin and the mineralogy of the parent material. It is possible, as with matrix K in soils, to have K content but no available release except over a geological timescale.

Green wastes, seaweed products and composts also represent alternative minor potash sources. Animal feeds bought onto farm also represent a supply of nutrient.

Organic standards for potash materials

The current classification of potash materials for organic production is based on consideration of a number of characteristics which relate to the objectives listed previously:-

Solubility

Natural or manufactured

Sustainability

Chloride content

Solubility Most potash materials - manures & fertiliser forms - are soluble and rapidly add K to soil solution (see table P10). Excess usage of all these forms can result in luxury uptake.

Chloride content is included because it has been suggested to be undesirable on the basis that some plant species are more sensitive to high Cl^- levels than others. It has also been asserted that excess chloride may be deleterious to micro organisms and earthworms, but no experimental evidence has been found in support of this belief.

Chloride (Cl^-) occurring in rainfall, fertilisers and manures is an essential plant material and must not be confused with chlorine gas, hyperchlorite used as a sterilant, or other forms which do not occur in soils or plants.

Certification of sources of potash

EU Council Regulations (EEC) NO. 2092/91 June 1991 sets out the rules for organic production for all countries in the EU. The UK Register of Organic Food Standards (**UKROFS**) is responsible for its implementation in the UK. Growers must register with an individual certification body and comply with the requirements of that body (which may be stricter than the EU legislation). The certification bodies are:-

UKROFS
Soil Association
Organic Farmers and Growers
Organic Food Federation
Biodynamic Agriculture Association
Scottish Organic Producers Association
Irish Association of Organic Farmers

The regulations permit unrestricted use of organic material from organic holdings to maintain, or improve where appropriate, (potash) fertility of the soil. Other potash source materials are classified as follows:-

Prohibited materials

Manures from factory farming or intensive non organic units

Muriate of Potash (KCl)

60% K₂O soluble salt

Natural, mined, crushed, separated, compacted and screened product

Easily spread 2.6-4mm high quality compacted granular product

Fibrophos marketed by John Hatcher & Co Ltd

14-24% K₂O 70-100% available

Powdered slag like bi-product of poultry litter power stations

Also contains useful levels of phosphate and a range of other nutrients

This material is **allowable** where it is derived from litter from organic, non intensive production units

Compounds, blends, solution & suspension fertilisers

Prohibited where they contain other prohibited materials

Permitted materials

* Manures from non organic but extensively run holdings

Variable potash content
60-90% of total K_2O immediately available
Sustainable, natural, not manufactured materials
Variable chloride content
Also provides organic matter & other nutrients

Wood products not chemically treated after felling (ash, sawdust, bark)

Variable, low potash content 1-7% K_2O
60-90% of total K_2O immediately available
Natural materials
Also contain some other nutrients

Products and bi-products of plant origin

Straw (own or imported from any other farm)

Variable, low potash content 1-2% K_2O
60% of total K_2O immediately available
Sustainable, natural
Also provides some organic matter & limited other nutrients

* Kali Vinasse

40% K_2O as K_2SO_4 . Also contains 45% SO_3 and traces of other nutrients
Totally soluble. Nil chloride Fine powder
Imported bi-product from sugar beet molasses industry
Marketed as **Cumulus K**™ W.L.Dingley Ltd in a range of pelleted products containing 5-26% K_2O with other nutrients.

* Composts free from prohibited materials

* Seaweed and seaweed products low K_2O content

Stone meal (rock potash)

* MSL-K marketed by Mineral Solutions Ltd - Manchester University

Imported by-product from stone industry 8% K_2O
Powder slag-like form (Field Grade) and fine ground form (Standard Grade)
Natural release of K from mineral form
Availability is claimed to be 10 times better than other rock potash
Not a soluble salt. Nil chloride

* Highland potash marketed by Glenside Organics

Adularian shale feldspar mined in Scotland
Total K content 9-11% K_2O
Very limited availability by conventional measurement

Crude potassium salts

**** Sylvinite & Meadowsalt** marketed by Cleveland Potash Ltd

21% K₂O. Soluble salt

Natural, mined, crushed and screened UK product

Contains NaCl + KCl and some trace elements

***** Kainit** marketed by Potash Ltd.

11 - 13% K₂O Soluble salt

Natural, mined, crushed and screened product

Contains NaCl + KCl and some trace elements

**** Sulphate of potash (K₂SO₄)**

50% K₂O Soluble salt. Also contains 45% SO₃

Imported manufactured product

Easily spread 1.6 -4 mm high quality granulated product

Nil chloride

- * *Permitted where need is recognised by the inspection body*
- ** *Permitted by Soil Association only on soils with less than 20% clay and where K index is less than 2. Permitted by other inspection bodies where need is recognised*
- *** *Prohibited by Soil Association, permitted by other inspection bodies where need is recognised*



Comparison of main potash products

Product	£/t guide price	p/kg K ₂ O	%K ₂ O	% water soluble	%Na	%S	%Cl	kg Cl/ 100kg K ₂ O	other nutrients	Production Process
Muriate of potash	115	19	60	100	-	-	46	76	No	mined crushed separated
Sulphate of potash	210	42	50	100	-	18	-	0	No	Muriate treated with sulphuric acid
Sylvinite	95	45	21	100	19	tr	45	214	Trace	Mined crushed
Kainit	80	66	12	100	15-22	tr	44	366	Trace	Mined crushed
MSL-K										
Standard grade	180	225	8	0	-	-	-	0	-	Fine ground ground
Field Grade	100	125	8	0	-	-	-	0	-	
Cumulus K	240	92	26	100	1.8	12	-	0	Yes	Process bi-product
Manures	Na	Na	0.5-1.8	70-90	tr	tr	tr-2	tr-300	Yes	-

Practical approach

The correct approach in practice for both organic and conventional systems is to monitor soil fertility every 4-5 years by soil analysis. Allocation of manures and use of fertiliser materials should then be undertaken to maintain the level of available soil potash appropriate to the crops grown with due consideration to the soil type. (See PDA leaflet 8 Principles of Manuring). Where soil potash is satisfactory, nutrient policy should simply replace nutrients removed using estimates based on the standard offtake (See PDA leaflet on Standard removals). It should be noted that even the most efficient storage and recycling of organic manures may not be adequate replacement because of the loss of potash in products sold off the farm and retention of some of the applied nutrient in non available reserves.





Other PDA leaflets

- | | | |
|---|---|--|
| 1 Role of Potash (out of print) | 11 Cereals and Potash | 22 N & K top dressing for arable crops |
| 2 Potash - Maintaining the Balance (out of print) | 12 Potash for Sugar Beet | 23 Potash for Organic Growers |
| 3 Potash for Quality (out of print) | 13 Oilseed Rape and Potash | 24 Effective use of Soil Analysis |
| 4 Potash manuring for Arable Crops | 14 Potash for Grassland | 25 What you should know about fertilisers |
| 5a Results from Cereal Demonstration Plots | 15 Potash for Potatoes | 26 Nutrient requirements of forage crops |
| 5b Results from Grass Demonstration Plots | 16 Fodder Beet - Fertiliser Requirements | 27 Fodder Beet - P & K offtake |
| 6 Potash, Magnesium & Sodium Fertilisers for Grass | 17 Forage Maize - Fertiliser Requirements | 28 Why Maintain Soil Potash Reserves? |
| 7 P & K Balance for Cereals | 18 Grain Legumes need Potash | Grassland Calculator |
| 8 Principles of Potash Use | 19 Potash for Heavy Soils | Arable Calculator |
| 9 Potash for Silage | 20 Potash & Biosolids | P&K Offtake Standards |
| 10 Potash & Cereal Straw | 21 Cutting Fertiliser Costs (out of print) | 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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