# Institute of Organic Training & Advice

## *Results of Organic Research: Technical Leaflet 6*

# A Guide to Nutrient Budgeting on Organic Farms

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## Introduction

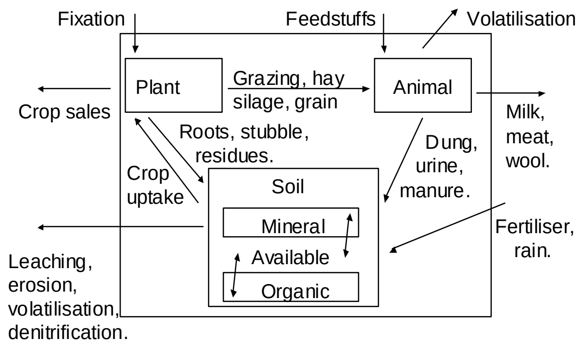
Organic farmers aim to balance the inputs and outputs of nutrients in the farm or horticultural system (Figure 1). Nutrient management in such systems has a longer perspective than a single season or crop, due to the use of crop rotations and the inclusion of animals within the system. Where nutrient budgets can be simply and rapidly compiled for farms then they can be used both to assess potential deficits or surpluses of nutrients and to provide guidelines for nutrient management decisions.

Nutrient budgets are commonly used in the following circumstances:

- As a tool to allow farmers and growers to make optimum use of available nutrients.
- To design and evaluate the viability and sustainability of arable and horticultural crop rotations by organic advisers.
- To assess an arable or horticultural rotation or whole farm system against organic production standards by an inspector.
- To indicate likely surpluses of nitrogen in the farm or horticultural systems and therefore risk of losses by leaching to ground and surface water, especially in Environmentally Sensitive Areas or Nitrate Vulnerable Zones.

Inputs and outputs for each nutrient and the surplus or deficit are calculated (by applying the concept of mass balance). Although the types and amounts of inputs and outputs of nutrients vary between fields, farming systems and regions, nutrient budgets provide a framework that can be applied systematically across a range of systems and scales, for single fields, across complete rotations or for whole farm systems. Published figures are available for the nutrient content of harvested crops and for the inputs used. Measurements and estimates have also been made of the nitrogen fixed by leguminous crops. Although these figures are based on laboratory analysis of a large number of samples and will be correct on average across the UK, there are considerable variations in crop quality and yield, nutrient contents of manures and in the actual amounts of nitrogen fixed by legumes in any season. Consequently budgets cannot be used to give exact recommendations and the results should be interpreted carefully.

***Figure 1 :*** *Nutrient flows in a farming system. Pools of nutrients in the soil, plants and animals are transferred in and out of the farm system and processes within the farm system link the pools.*




*This Technical Leaflet is one of a series commissioned and prepared by the Institute of Organic Training & Advice (IOTA) as part of its Defra-funded PACARes (Providing Access, Collation and Analysis of Defra Research in the organic sector) project. The PACARes project aims to improve awareness and uptake of organic research by farmers. For more information go to www.organicadvice.org.uk/pacares.htm*

*The Leaflets aim to provide a summary of the key practical recommendations for organic farming, drawing on the findings of research including IOTA's own Research Reviews commissioned for the PACARes project. Other Leaflets in the series include: Composting, Dairy Cow Nutrition, Financial Management for Organic Farms, Organic Beef and Sheep Nutrition and Soil Analysis.*

defra
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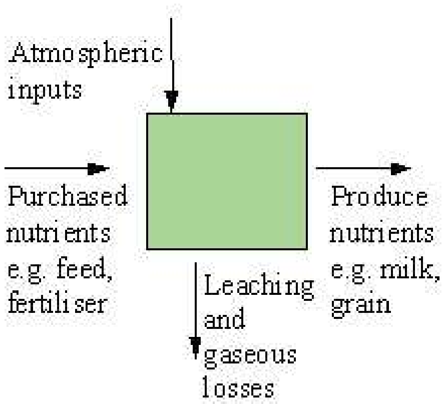
## Soil Analysis

Ideally, nutrient budgets should be used in conjunction with a regular programme of soil analysis. Soil analyses measure the levels of available nutrients in the soil and can be used alongside budgets to plan the levels of additional nutrients required or to assess the long-term sustainability of the system. However, there is no simple way of measuring the potentially available nitrogen content of soil or the release rates of other nutrients into available forms in the soil. Nutrient budgets are therefore an important method to assess the viability of a rotation.

Nutrient budgeting has not been used in the UK to any great extent, except by professional consultants where it has been used in the design of conversion plans. In other parts of the European Union, the method is more commonly used, both as a management tool and for regulatory purposes. In Denmark, 'budgets' must be produced at each inspection to be assessed by the inspection body. In the Netherlands, surpluses of nitrogen and phosphorus are calculated using nutrient budgets for all farming systems and large surpluses of nutrients are taxed.

Defra has produced a guidance document which sets out the means by which soil fertility should be maintained in organic systems. This is available at the following weblink: http://www.defra.gov.uk/farm/organic/standards/pdf/guidance-document-dec2008.pdf Further guidance is available from individual certification bodies.

***Figure 2:*** *Farm-gate budget, which accounts for inputs and outputs to the farming system, but disregards internal cycling of nutrients. This budget requires information on purchases and sales, it requires limited management information on cropping areas, stock numbers, housing and manure practices.*




**Extract from Council regulation (EEC) (834/2007)**

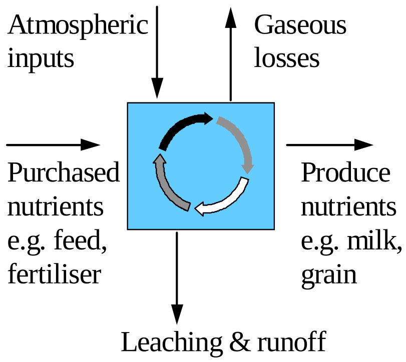
"The essential elements of the organic plant production management system are soil fertility management, choice of species and varieties, multiannual crop rotation, recycling organic materials and cultivation techniques. Additional fertilisers, soil conditioners and plant protection products should only be used if they are compatible with the objectives and principles of organic production."

With increasing pressure from the EU and the Compendium for organic systems to become more self-sufficient and to reduce their reliance on brought-in manures, inspection bodies will in future be making greater use of nutrient budgets to determine whether the standards are being met. Producers, advisers and inspectors will need to become familiar with the techniques involved in producing nutrient budgets and interpreting the results.

In this Leaflet, we will give a basic introduction to nutrient budgeting. Procedures for the compilation of the simplest type of budget, sometimes known as a farm-gate budget, are provided (Figure 2) and an example of a whole farm nutrient budget is provided in Table 1 (page 6). These budgets are a useful first step in examining the nutrient flows of a field, rotation or farming system and require only the type of farm management information that should be readily available to most farmers. Care must be taken to ensure that the units of measurement used throughout a budget calculation are consistent. Within this Leaflet, kilogrammes and tonnes are predominantly used as measurements of weight and hectares for measurement of area.

More complex budgeting approaches are necessary to examine the full environmental impact of farming systems or to test the effects of changes in farm management strategies. These more complex budgets also examine the internal flows of nutrients within the farming system through crop residue and manure management etc. (Figure 3). The principles outlined in this guide also apply in these more complex budgets, but the calculation steps are more intricate and the use of computer programmes to compile such data is recommended.

***Figure 3:*** *Complex budgeting approach, which accounts for inputs and outputs to the farm system and estimates internal cycling. This allows an assessment of environmental impact and the testing of alternative management strategies.*




## Nutrient Inputs

Nutrient inputs to a farm or horticultural system come mainly through nitrogen fixation by bacteria in the root nodules of legumes, purchased inputs (feeds, bedding, animal manures and permitted fertilisers) and in rainfall and deposition from the atmosphere (see Figure 1).

The possible nitrogen fixation under various types of legumes is given in Table 2 (page 7). Values are given per tonne of crop harvested. However, the actual amount of nitrogen fixed is notoriously difficult to assess and the figures given are the median values of a range of measured values. Legumes will exploit the available nitrogen in the soil in preference to fixing atmospheric nitrogen, so amounts of nitrogen fixed will depend on soil fertility as well as the success of the association between the legume and its accompanying nitrogen-fixing bacteria. This often leads to lower total amounts of nitrogen fixed under grazed than cut leys, due to increased returns of nitrogen in excreta during grazing.

Other atmospheric inputs in rain and dry deposition, vary across the UK (Figure 4). Atmospheric inputs may also be increased in close proximity to intensive animal production units due to increased deposition of ammonia.

Inputs of nutrients in seed are given in kilogrammes of nutrient per kilogramme of seed in Table 3 (page 8).

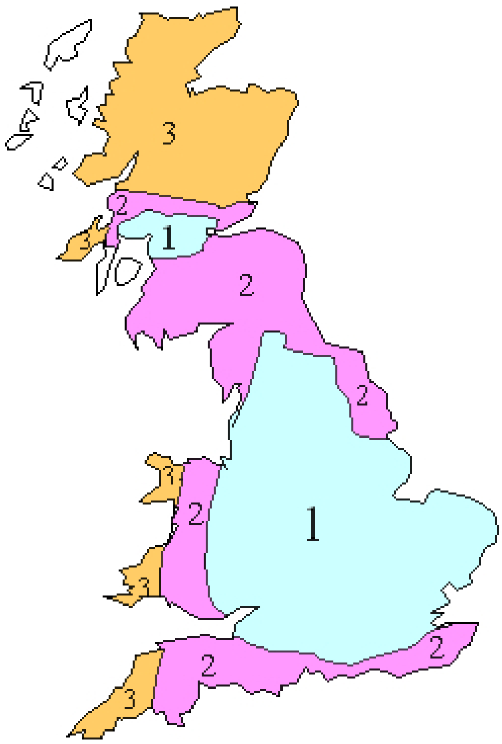
Tables 4 (a and b, page 9) shows the contents of nitrogen, phosphorus, potassium, sulphur and magnesium in kilogrammes per tonne, for manures and fertilisers. Although average values are given for sources of bulky organic matter, nutrient contents of manures are very variable depending on animal type, diet, production level, bedding, housing and manure handling. Nutrient contents of green-waste and municipal composts are also variable due to different sources of raw materials and composting procedures. It is therefore recommended that manures and composts are analysed for nutrient content before application to land; actual values can then be used in the calculation of nutrient budgets..

Table 5 (page 10) shows the nutrient contents of some bought-in feeds. The nitrogen content of feeds can be calculated from the crude protein contents, as each kilogramme of protein contains 0.16 kilogrammes of nitrogen. Wherever possible, actual analyses of feeds should be used to replace the average values given in the table.

## Nutrient Outputs

Nutrient outputs from farms and horticultural systems occur principally through sales of crop and animal products (see Figure 1). Losses from the system occur by volatilisation of ammonia occur during animal housing, from animal excreta during grazing and during manure handling, leading to losses of nitrogen in animal-based and mixed systems.

***Figure 4 :*** *Three zones of the UK differing in the amount of nutrients deposited on the land surface:*
***Zone 1:*** *35 kg N, 0.1 kg $P_2O_5$, 5 kg $K_2O$*
***Zone 2:*** *25 kg N, 0.06 kg $P_2O_5$, 4 kg $K_2O$*
***Zone 3:*** *15 kg N, 0.03 kg $P_2O_5$, 3 kg $K_2O$.*



Losses of nutrients may occur when soil is lost by water or wind erosion. However, such losses should be minimised in the UK by maintaining soil cover and avoiding cultivation of steep slopes, especially on light soils. Losses of nitrogen by denitrification and losses of all nutrients by leaching depend on the availability of nutrients in the soil at vulnerable periods and can be estimated from the nutrient surplus calculated in nutrient budgets.

Nutrient outputs are given in Table 6 (page 11). Values are given per tonne of crop harvested. Typical yields for crops grown in organic situations are also indicated (derived from the Organic Farm Management Handbook). However, actual yields will vary widely depending on the season and soil type and where possible actual yields or estimates gained from local experience should be used in place of average yields. The tables provided are not comprehensive and where a crop is not listed, using the figures for the nearest equivalent will give an estimate.

Nutrient outputs for animal products are given in Table 7 (page 12). Actual or anticipated levels of farm production should be used. Include data for livestock sales and purchases.

Volatilisation of ammonia from manure occurs particularly during spreading. This can be minimised by incorporating manure quickly into the soil. Losses of nitrogen by leaching in an organic rotation are likely to be at their greatest following the ploughing of a ley and at a minimum under a long-term cut ley. Grazed leys or permanent pasture can also show significant losses of nitrogen by leaching. However, the nitrogen losses by leaching should be low when averaged over a complete rotation. Leaching of phosphorus, which may be a major cause of eutrophication of surface waters, is unlikely to be significant unless levels of available phosphorus in the soil are very high. However, significant leaching losses of potassium are possible on light soils or under uncovered manure heaps.

## Nutrient budgeting

A nutrient budget can be compiled for any one or all of the plant nutrients. Nitrogen is often the nutrient limiting crop growth and therefore it is often the first nutrient assessed when planning rotations. Where phosphorus or potassium levels are low in the soil, use of nutrient budgets may allow the use of supplementary fertilising materials to be planned. Calcium and magnesium are less important and can, if required, be ignored unless potential deficiencies make them significant, e.g. in fruit growing, glasshouse tomato production or with livestock. In practice, the extra effort involved in completing a budget for all five nutrients is often negligible. Budgets are commonly compiled for an arable or horticultural rotation but can also be drawn up for whole farm systems.

## Calculations and data use

A simple format can be constructed which can be used to calculate either a farm-gate budget for the whole farm or for a specific crop rotation within the farm. An example of a whole farm nutrient budget is provided in Table 1.

When calculating whole farm budgets only include the nutrient inputs and outputs of products which pass the farm gate e.g. include milling wheat sales and straw sales but do not include own cereals fed to own livestock. When calculating a rotation budget use the input and output of products which pass the borders of that block of land e.g. include cereals fed to own stock, straw used for bedding and application of own manure as well as sales of milling wheat.

All the calculations and data presented in this guide are in kilograms or tonnes per hectare. Care should be taken to adjust yields or application rates recorded in other units before using the calculations outlined. Average yields or production levels can be used to make the calculations, for instance this may be necessary in planning a conversion or rotation. However, wherever possible, actual yields should be used. Values are provided in the tables for the nutrient content of inputs and outputs to the system. However, although these are the results of many laboratory determinations and may appear precise, actual nutrient contents may vary significantly due to soil type, season and disease. So care is needed when interpreting the values produced by such budget calculations.

## Nitrogen fixation

The area of nitrogen fixing leys, permanent pasture, leguminous green manures and pulses should be recorded and the nitrogen fixed calculated from the data in Table 2.

## Crops

The area of all crops should be recorded, together with yields of crop sold off farm/rotation, together with the input/output data and the total nutrient input/off-take for the farm rotation. For whole farm budgets, straw should only be included if sold off farm. Where crops on different fields are managed identically and give similar yields, then they can be treated as a single crop.

## Inputs

Seed or transplant rates should be entered and the nutrient inputs in seed calculated from Table 3. Additional inputs of fertilisers or manures should be itemised and nutrient inputs calculated using measured values or the values from Table 4. Purchased livestock feed should be recorded and inputs calculated from the data in Table 5. For a farm-gate budget, all fertilisers are included, but only purchased manures, seeds and feeds are included. However, in a rotation budget, inputs to that rotational block of land will include fertilisers, own and purchased manures and seeds plus any purchased animal feeds, which will be allocated to a separate livestock budget unless fed while at grazing.

For farm-gate budgets, crop outputs are only recorded where the crop product leaves the farm. Grain is not recorded as an output if it is fed to farm livestock. However, where grain, straw or silage etc. are sold then they should be recorded and the crop output calculated using Table 6. For rotation planning, crop outputs may be recorded where the crop leaves the field e.g. where straw is removed for own livestock bedding or sold.

## Livestock

Separate livestock groups may be included where they are managed differently or have different production levels. For a farm-gate budget, only the movement of animals or milk or wool on or off that farm are recorded.

## Summary

The farm-gate nutrient budget for the whole farm can then be calculated, including nitrogen fixation, crop sales off-take and nutrient inputs, including purchased seeds, manures, fertilisers, feeds and straw plus atmospheric deposition together with livestock input/off-take. The results should be calculated on the basis of whole farm and on a per hectare basis.

The whole farm nutrient budget in Table 1 includes all the nutrients leaving and entering the farm gate in a 12 month period. It shows a surplus of Nitrogen of 51kg per hectare, a Phosphate surplus of 1kg per hectare and a Potassium deficit of 19kg per hectare per year.

A budget for a specific farm rotation can also be calculated which needs to include all manure use and any exchange of nutrients between farm enterprises. This should also be expressed per hectare and for the rotational unit as a whole.

## Interpretation

Although the calculations outlined above lead to answers that appear precise, they only give a rough guide to what is happening within the farm system and should be interpreted with care. Soil analysis is an essential part of the assessment process and should be made at least once in every rotation cycle; at the same stage in the rotation and at the same time of year to aid interpretation of the results. A good time to take samples for soil analysis is at the beginning of the fertility-building phase when nutrient levels are likely to be at their lowest. Interpretation of a nutrient budget must take account of the soil type, including its nutrient reserves, susceptibility to leaching and suitability to the planned rotation and stocking. Changing farm management in response to the results of nutrient budget should only be undertaken with careful professional advice.

## Nitrogen

The surplus should be around 30kg nitrogen/ha/year where this is expressed for a complete rotation or whole farm. This nitrogen may be used to build soil fertility. However, most of the nitrogen surplus will be lost from the farm system by leaching or denitrification. Surpluses of nitrogen significantly greater than 30kg per hectare may indicate that the farm system is a pollution risk, depending on climate and soil type.

## Phosphorus and potassium

Phosphorus and potassium should show a surplus close to zero. Potassium and phosphorus surpluses are likely to lead to a build up in the reserves of these nutrients held in the soil and only where the levels of available nutrients are already high are losses of phosphorus likely to occur. Potassium is more readily lost by leaching, especially on sandy soils. Many soils in the UK show high reserves of phosphorus and potassium in the soil and in these cases it may be acceptable for a farm system to show a deficit for phosphorus or potassium as these unnecessarily high reserves are used. However, such a situation should be carefully monitored. The combination of nutrient budgeting with soil analysis is especially important for phosphorus and potassium.

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## Tables

(Please note all values are approximate and where appropriate a range of values has been given)

***Table 1: Example farm-gate annual nutrient budget: mixed cattle and arable***

(2 years ley, 1 year winter wheat, 1 year spring beans, 1 year winter oats, 10 ha permanent pasture. Total 60 ha.)

| | | | **Total** | **Input/output data used** | | | **Kg. nutrients in/out** | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **In/out** | **N** | **P** | **K** | **N** | **P** | **K** |
| **Nitrogen fixation** | **ha.** | | | **Kg/hectare** | | | **Kg/farm** | | |
| WC Ley grazed | 10 | | | +150 | | | +1500 | | |
| WC Ley cut | 10 | | | +150 | | | +1500 | | |
| P Pasture | 10 | | | +150 | | | +1500 | | |
| S Beans | 10 | | | +100 | | | +1000 | | |
| **Crop off-take** | **ha.** | **t/ha** | **Tonne** | **Kg/tonne** | | | | | |
| W Wheat grain sold | 10 | 5 | 50 | -13 | -3 | -4 | -650 | -150 | -200 |
| Straw sold | 10 | 2 | 20 | -4 | -1 | -9 | -80 | -20 | -180 |
| W Oats grain sold | 10 | 4 | 40 | -14 | -3 | -4 | -560 | -120 | -160 |
| Straw used on farm | | | | 0 | 0 | 0 | | | |
| S Beans | 10 | 3 | 30 | -58 | -8 | -34 | -1740 | -240 | -1020 |
| **Inputs** | **ha.** | **t/ha** | **Tonne** | **Kg/tonne** | | | | | |
| Seed wheat purchase | 10 | 0.2 | 2 | +13 | +3 | +4 | +26 | +6 | +8 |
| Seed oat own | 10 | 0.2 | 2 | 0 | 0 | 0 | | | |
| Seed beans purchase | 10 | 0.25 | 2 | +58 | +8 | +34 | +116 | +16 | +68 |
| Rock P | 15 | 0.3 | 4.5 | 0 | 118 | 0 | | +531 | |
| Manure purchase (cattle) | | | 50 | +6 | +1.5 | +5.5 | +300 | +75 | +275 |
| Feed purchase (rape meal) | | | 5 | +58 | +10 | +13 | +290 | +50 | +65 |
| Straw purchase | | | 0 | | | | | | |
| Atmospheric deposition | 60 ha. | N P K per ha: | | +25 | +0.06 | +4 | +150 | +4 | +24 |
| **Livestock** | **No.** | **t/head** | **tonne** | **Kg/tonne** | | | | | |
| Cattle store purchase | 40 | 0.3 | 12 | +25 | +8 | +2 | +300 | +96 | +24 |
| Cattle sold | 40 | 0.6 | 23 | -25 | -8 | -2 | -575 | -184 | -46 |
| | | | | | | | **N** | **P** | **K** |
| ***Total farm nutrients in/out*** | | | | | | | ***+3077*** | ***+64*** | ***-1142*** |
| ***Ave. nutrients per/ha in/out*** | | | | | | | ***+51*** | ***+1*** | ***-19*** |

***Table 2: Nitrogen fixation in selected crops.***

| Crop | Fixation (kg/t product) | Typical yield (t DM/ha) | Fixation (kg/ha) |
|---|---|---|---|
| **Grass/white clover ley** | | | |
| Grazed | 20 | 12 | 100-200* |
| Silage | 30 | 8 | 100-200* |
| Hay | 30 | 8 | 100-200* |
| **Grass/red clover ley** | | | |
| Grazed | 25 | 10 | 200-300 |
| Silage | 35 | 10 | 300-400* |
| **Other** | | | |
| Permanent pasture | 15 | 10 | 150 |
| Peas | 55 | 3.5 | 50-100* |
| Winter beans | 68 | 3.7 | 100-200* |
| Spring beans | 68 | 3 | 100-200* |
| Lucerne | 35 | 10 | <500* |

* ***Source:*** *Defra project OF0316. The development of improved guidance on the use of fertility building crops in organic farming (CTE0204): http://orgprints.org/6751/*

**Table 3: Inputs of nutrients in seeds.**

| Crop | Seed rate kg/ha | N | P | K |
|---|---|---|---|---|
| | | *Kg nutrient/kg seed* | | |
| Winter wheat | 200 | 0.013 | 0.003 | 0.004 |
| Spring wheat | 250 | 0.013 | 0.003 | 0.004 |
| Winter barley | 180 | 0.017 | 0.003 | 0.004 |
| Spring barley | 200 | 0.015 | 0.003 | 0.004 |
| Winter oats | 195 | 0.014 | 0.003 | 0.004 |
| Spring oats | 240 | 0.014 | 0.003 | 0.004 |
| Rye | 185 | 0.013 | 0.003 | 0.004 |
| Triticale | 210 | 0.013 | 0.003 | 0.004 |
| Winter field beans | 210 | 0.053 | 0.008 | 0.034 |
| Spring field beans | 250 | 0.058 | 0.008 | 0.034 |
| Perennial ryegrass | 15 | 0.020 | 0.002 | 0.004 |
| Grass/white clover | 36 | 0.030 | 0.002 | 0.008 |
| Forage rye | 160 | 0.020 | 0.002 | 0.004 |
| Forage peas | 100 | 0.054 | 0.008 | 0.026 |
| Table swedes | 1 | 0.010 | 0.002 | 0.008 |
| Main crop potatoes | 3000 | 0.003 | 0.006 | 0.005 |
| Early crop potatoes | 3500 | 0.003 | 0.006 | 0.005 |

***Source:*** *Various*

***Table 4 (a): N, P and K in fresh manures .***

| | Dry matter (%) | N | P | K | Sulphur ($So_3$) | Magnesium (MgO) |
|---|---|---|---|---|---|---|
| Solid manures | | Kg/t fresh weight | | | | |
| Cattle farm yard manure[1] | 25 | 5.9 | 1.4 | 5.5* | 2.3 | 1.6 |
| Pig farm yard manure[1] | 25 | 6.5 | 2.7 | 5.5* | ND | 1.7 |
| Slurries/liquids | | Kg/m3 | | | | |
| Cattle[2] | 6.0 | 2.0 | 0.4 | 1.9 | 2.6 | 0.4 |

*[1] Values of N and $K_2O$ will be lower for FYM after long periods stored in the open.*

*[2] Values for typical diluted slurries, pro-rata adjustment for nutrient content can be based on slurry dry DM.*

** Based on English data, European data suggest a $K_2O$ content of 8 kg/t.*

*ND = no data; values can be reduced after composting.*

*Based on Shepherd et al. 2001, Managing manure on organic farms.*

***Table 4 (b): N, P and K in fertilisers.***

| Material | P | K |
|---|---|---|
| | Kg/t | Kg/t |
| Ground rock phosphate | 117.8 | 0 |
| Reddzlagg | 139.6 | 0 |
| Cumulus K | 0 | 215.8 |
| Meadowsalt | 0 | 174.3 |
| MSL-K | 0 | 66.4 |
| Silvinite | 0 | 174.3 |
| Kalivinasse | 0 | 332.0 |
| Rock potash, eg. Adularian shale | 0 | 83.0 |
| Sulphate of potash | 0 | 415.1 |

**Source:** *Various*

***Table 5: N, P and K in bought-in feeds.***

| Feedstuff | N | P | K |
|---|---|---|---|
| | *Kg/t fresh* | | |
| Soya bean meal or cake | 69.9 | 6.6 | 22.2 |
| Rapeseed meal or cake | 57.7 | 10.2 | 12.9 |
| Beans | 45.3 | 4.5 | 11.5 |
| Peas | 35.2 | 5 | 9.5 |
| Fishmeal | 105 | 33.3 | 8.5 |
| Bran & other offals of wheat | 25.4 | 10.3 | 12.4 |
| Maize gluten 60% | 96.8 | 2.5 | 1 |
| Brewers and distillers grains (wet) | 10.7 | 1 | 0.2 |
| Brewers and distillers grains (dry) | 34.2 | 4.5 | 0.5 |
| Hay | 14.9 | 2.2 | 17.9 |
| Dried Grass | 28 | 3.2 | 24.2 |
| Grass Silage | 6.9 | 0.8 | 6.6 |
| Dried sugar beet pulp (molasses) | 15.5 | 0.7 | 15.9 |
| Pot ale syrup | 25.2 | 9.9 | 10.4 |
| Molasses (sugar cane) | 6.5 | 0.9 | 28.4 |
| Compound cakes and meals for each 1% crude protein | 1.6 | 0.2 | 0.4 |

***Source:*** *Based on conventional values in SAC Farm Management Handbook. Further information on crude protein content of organic purchased feeds can be found in Lampkin et al. 2008.*

***Table 6: Nutrient offtake for a crop product (kg / tonne fresh weight). Grain and straw have been assumed to be 15% moisture content. Data from various sources.***

| Crop Product | Component | Approx Yield | N | P | K |
|---|---|---|---|---|---|
| | | *t/ha* | *Approx offtake Kg/t fresh weight* | | |
| Winter wheat | Grain | 5.0 | 12.7 | 2.9 | 3.6 |
| | Straw | Variable | 4.1 | 1.7 | 9.8 |
| Spring wheat | Grain | 4.0 | 12.6 | 3.0 | 3.6 |
| | Straw | Variable | 4.2 | 1.4 | 10.7 |
| Winter barley | Grain | 4.5 | 17.0 | 3.0 | 3.5 |
| | Straw | Variable | 5.6 | 1.4 | 9.6 |
| Spring barley | Grain | 4.0 | 15.3 | 3.0 | 3.6 |
| | Straw | Variable | 5.8 | 1.6 | 11.6 |
| Winter Oats | Grain | 4.5 | 14.5 | 3.0 | 3.5 |
| | Straw | Variable | 3.0 | 2.2 | 19.9 |
| Spring Oats | Grain | 4.0 | 14.5 | 3.0 | 3.5 |
| | Straw | Variable | 3.1 | 2.1 | 15.2 |
| Rye | Grain | 3.5 | 12.8 | 3.0 | 3.5 |
| | Straw | Variable | 3.0 | 4.3 | 12.7 |
| Peas | Grain | 3.5 | 54.0 | 7.9 | 26.0 |
| Winter beans | Grain | 3.0 | 53.4 | 7.9 | 33.5 |
| Spring beans | Grain | 3.0 | 58.5 | 7.9 | 33.6 |
| Fodder beet | | 60.0 | 0.3 | 0.1 | 0.6 |
| Potatoes | Maincrop total | 36.0 | 2.7 | 0.6 | 4.9 |
| Kale | Fodder | 60.0 | 1.0 | 0.1 | 1.0 |
| Lucerne | Pure stand | | 8.4 | 1.0 | 4.7 |
| Maize | Silage | 35.0 | 9.0 | 2.0 | 8.7 |
| Cabbage | | 30.0 | 3.4 | 0.4 | 10.0 |
| Calabrese | | 7.0 | 2.3 | 0.3 | 22.2 |
| Lettuce | | 20.0 | 1.4 | 0.2 | 25.0 |
| Leek | | 12.0 | 2.8 | 0.4 | 8.2 |
| Onion | | 20.0 | 1.4 | 0.3 | 9.6 |
| Carrot | | 36.0 | 1.2 | 0.3 | 8.3 |
| Swede | | 30.0 | 1.1 | 0.4 | 9.1 |

*(updated July 2010)*

***Table 7: Nutrient outputs per kg livestock product.***

| | N | P | K |
|---|---|---|---|
| | *Kg/t* | | |
| Dairy cows: milk | 5.3—5.6 | 0.9—1.0 | 1.0—2.0 |
| Dairy cows: meat | 27.5 | 10 | 2 |
| Suckler cows | 25—28 | 6.3—10 | 1.7—2.0 |
| Calves/beef <100 kg | 32 | 8 | 2 |
| Calves/beef >100 kg | 25 | 8 | 2 |
| Breeding ewes: wool | 114—178 | 1.3—1.6 | 1.5—1.7 |
| Breeding ewes: meat | 16—24 | 5.5—6.0 | 1.4—3.0 |
| Lambs | 28 | 6 | 18 |
| Pigs | 10 | 1.8 | 2.9 |
| Chickens: meat | 43 | 2.0 | 2.2 |
| | *g/egg* | *Mg/egg* | *Mg/egg* |
| Chickens: eggs | 1 | 67 | 103 |

***Source:*** *Various*

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