

Using quality compost to benefit crops



WRAP works in partnership to encourage and enable businesses and consumers to be more efficient in their use of materials and recycle more things more often. This helps to minimise landfill, reduce carbon emissions and improve our environment.

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“Compost could prove a valuable tool to help farmers meet soil management standards required for the Single Payment Scheme. It’s widely acknowledged that compost has the ability to provide valuable nutrients to the soil, improve yield, increase organic matter and aid structural stability.”

Robert Caudwell, Lincolnshire Farmer and NFU Waste Issues Spokesperson.

Introducing compost

Compost is a natural product made from locally sourced garden and food waste. A number of scientific trials have been running over recent years to examine the extent to which compost can play an important role in crop production.

Compost helps retain moisture in the soil, provides crucial, slow release nutrients to crops and can lead to long-term yield increases. Importantly, using compost made from recycled resources is sustainable and can increase soil organic matter and water holding capacity. Compost can also be a useful tool to help farmers meet GAEC (Good Agricultural and Environmental Condition) requirements for their soils. Something to consider when preparing a soil protection review.

This booklet is designed to show how you and your farm can benefit from using compost.

Why consider compost?

Adding nutrients

Compost provides slow release nutrients which complement traditional fertilisers and help to gradually build natural soil fertility. The long-term application of compost can lead to a reduction in the use of inorganic fertilisers, which can help to reduce input costs.

According to guidance compiled by ADAS, the typical fertiliser replacement value from 30t/ha of compost in the first year is at least £90/ha. Farmers should undertake soil analysis every three to five years to accurately plan fertiliser needs.¹

The nutrient content of compost will vary according to the feedstock so users should obtain details from their compost supplier. Typically, however, one tonne of compost can contain:

	Nitrogen (N)	Potassium (K)	Phosphorus (P)
Kg/T	8	6	3

- The rate at which Nitrogen is released from compost can vary depending on soil and climate conditions. Typically the Nitrogen provided by compost is released slowly through the process of mineralisation, which reduces the possibility of it leaching away. Between 5% and 10% of the total nitrogen provided by compost is released in the first year of application, which means that when applied at a rate of 250kg/ha total N, approximately 15kg/ha of N will be released in year one.
- Repeated applications of compost can increase the level of Potassium in the soil over the long-term. Potassium is an essential nutrient as it controls the water content of cells, can help crops retain moisture for longer periods and supports increased crop growth.



¹ ADAS, 'Making the most of Compost in Agriculture and Field Horticulture'.

- It is estimated that 80% of Potassium in compost is in water soluble and exchangeable forms which can be utilised by crops over one to three years, depending on crop uptake demand.
- Compost can also help counter a general decline in Phosphorus in the soil. Phosphorus is vital for crops as it is associated with the transfer and storage of energy and is essential for successful crop establishment and early growth.
- Approximately 50% of the Phosphorus in compost will be available to the crop grown in the first year. The rest is slowly released over the rotation.

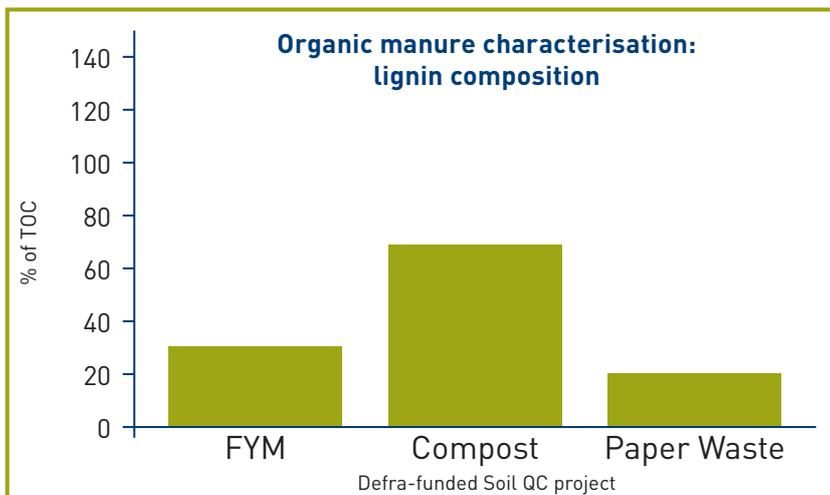
A number of trials run in the UK have demonstrated that compost made from recycled garden waste is an effective way of maintaining levels of organic matter and supplying sufficient amounts of nutrients to the soil. Three of these trials are detailed later in this booklet and more about organic matter is detailed in the next section.

Organic matter

Well-managed soils are an important element of sustainable farming practice. Organic matter is a key indicator of soil health. Good organic matter levels can increase the workability and fertility of soils, improve soil structure and reduce the risk of erosion. This can help increase yields and the quality of crops and pastures, as well as reduce the risk of damage to the environment.

Compost can help improve soil management by providing a good supply of valuable organic matter:

- 30 t/ha of compost (about 250 kg/ha of total N) applies approximately 6 t/ha of organic matter; and
- a high proportion of this is in a lignified (stabilised) form, so the organic matter in compost has a long-lasting beneficial effect in soil. The graph below shows lignin as the percentage of Total Organic Carbon (TOC) in compost, farm yard manure (FYM) and paper waste.



“Compost has many benefits for farmers including its low available nitrogen content – typically 5% N in the first year – and its lignified form of organic matter. These combined benefits mean that nitrogen leaching can be less of a problem for farmers, and the organic matter can last longer in the soil than that provided by many animal manures. Although the cost of spreading compost is about £2.50-£3.00/tonne, farmers can easily recoup these costs from the nutritional value that compost delivers.”

Susie Holmes, Senior Principal Scientist at ADAS.

“With three quarters of Scotland’s land mass under agricultural production, it is vital that Scottish soils are protected and productivity maintained. The application of high quality composts made from recycled green waste is an important way of ensuring this while at the same time reducing the amount of organic waste sent to landfill.”

Dr. Peter Olsen, Scottish Environment Protection Agency’s Senior Policy Officer on the National Waste Strategy.

Quality compost

The BSI PAS 100 compost certification scheme was introduced in 2002 to provide a baseline quality standard for compost. The scheme ensures that compost producers are manufacturing a product that is consistent, safe and reliable, and provides the foundation upon which producers can further develop their products. Building upon the BSI PAS 100 certification scheme, WRAP, the Environment Agency, The Composting Association and The Environmental Services Association worked together to launch the Quality Protocol for Compost in May 2007. The Quality Protocol applies in England and Wales and provides a clear framework for the production and supply of quality compost. It clarifies which waste materials can be used in quality compost production and reinforces traceability throughout the production process by ensuring accurate record keeping.

Since the BSI PAS 100 certification scheme was introduced, more than 100 producers have joined and together they produce more than 1.1 million tonnes of quality compost at production sites across the UK.

For complete listings of BSI PAS 100 compost suppliers visit www.wrap.org.uk/composting and follow the link for WRAP’s online searchable producer database.

For farmers in England and Wales, the Quality Protocol signifies an easing of regulation for the use of compost, and effectively removes its ‘waste tag’ from compost. When using quality compost it is no longer necessary to apply for a waste management license exemption from the Environment Agency, so long as producers and users conform to the requirements of the Protocol.

To ensure environmental safety and to meet the Protocol’s requirements, farmers need to analyse their soil for potentially toxic elements and track any changes over time by keeping records of where compost was used, how much was applied, and when. Farmers need to share these records with their compost supplier. As with all organic material inputs, it is necessary to comply with Nitrate Vulnerable Zone (NVZ) rules, the DEFRA Code of Good Agricultural Practice and the Scottish Government’s PEPFAA Code (Prevention of Environmental Pollution from Agricultural Activity).

Applying compost

A rear discharge, moving floor spreader, also used for spreading manure, is ideal for applying compost. About 30 t/ha may be applied every year in areas classified as nitrate vulnerable zones. In areas outside NVZs, higher rates of compost can be applied, but should not exceed crop nutrient requirements.

The website addresses below give full information on NVZ requirements around the UK.

- For England, visit www.defra.gov.uk/environment/water/quality/nitrate
- For Scotland, visit www.scotland.gov.uk/Topics/Agriculture/Environment/NVZintro
- For Wales, visit www.countryside.wales.gov.uk
- For Northern Ireland, visit www.ruralni.gov.uk/environment/countryside/environmental_legislation/water_protection.htm

For Defra’s code of Good Agricultural Practice visit www.crosscompliance.org.uk

For the PEPFAA Code visit www.scotland.gov.uk/publications



Assessing the benefits – compost trials

Crop advisers and farmers across the UK have been working together to assess the benefits of applying quality compost.

There are currently 13 trials underway to assess the value of compost in agriculture. Here are just three examples of ongoing projects.

1. Park Farm, Suffolk

Enviros Consulting Ltd has been running long-term scientific trials to assess the benefits of using compost as part of a soil improvement programme for crop growth. The trials have been running since 2000 – the most comprehensive tests ever undertaken in the UK – and have proven numerous benefits including:

- a reduced need for inorganic fertilisers;
- a long-term improvement in soil structure; and
- increased yield on a range of crops.

The trials began in 2000 and initially involved two quarter hectare sites in Suffolk. By 2002, early success led to the expansion of the trials into six more sites which allowed them to assess the benefits of compost on a wider range of crops including, barley, wheat, carrots, sugar beet and potatoes.

The method

Each trial involved eight different treatments to compare the benefits of compost and each was replicated four times to ensure that conclusions were based on statistically significant data. The trials consisted of:

- two treatments with compost applied respectively at 30t/ha annually and 60t/ha biennially;
- an untreated, control treatment;
- a treatment using traditional NPK fertiliser;
- treatments of compost in conjunction with standard levels of Nitrogen; and
- treatments of compost in conjunction with reduced levels of Nitrogen.



“These trials are a landmark for both farmers and the composting industry. They prove the commercial added value that compost can provide, through reducing fertiliser cost, increasing yield, increasing soil workability and irrigation management. Plus compost provides a range of environmental benefits by looking after the health of the soil.”

Phil Wallace, Technical Director at Enviros Consulting.

The results

Following repeated applications of compost over the seven year period, the following conclusions could be drawn:

- compost applied with reduced levels of Nitrogen was as effective as compost with standard levels of Nitrogen and both were more effective than NPK fertiliser alone;
- an average increase of 7% in crop yield was found – for example, the potato crop, typically growing at 50 t/ha, increased to 53.5t/ha over the period of the trial when compost was used; and
- farmers could increase profit margins – for example, comparing the costs and benefits of using standard NPK fertiliser to the costs and benefits of using compost with reduced Nitrogen over a five-year rotation, the average net saving was £116.00/ha every year.²

Many of the benefits derive from the fact that compost adds organic matter to the soil which means that repeat applications can cause long-term improvements in soil structure, making it more workable, providing better seedbed conditions, and supporting the retention of both nutrients and moisture for longer periods.

The picture below right shows how the long-term application of compost on these sites has transformed cloddy soil by adding organic matter, aiding the crumb structure, and making the soil more workable.

Before compost application



After compost application



2. Organic Resource Agency's Trials in East Anglia

Other arable trials across the country have backed up the results from the Enviros trials and reported further benefits.

Independent consultancy Organic Resource Agency (ORA), started work on the Greenleaf Project in 2001. The project, administered by the Environmental Projects Agency, provided a selection of local farmers with compost every year to assess the effect of compost application on the soil. The objective was to divert organic waste away from landfill and to use compost as a means of improving the productivity of farmland as part of a programme of sustainable land management.

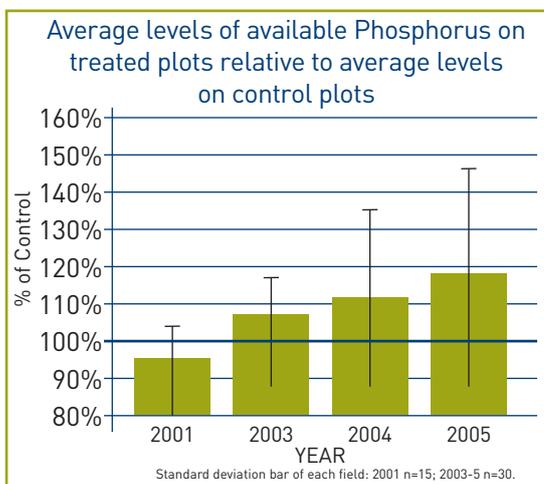
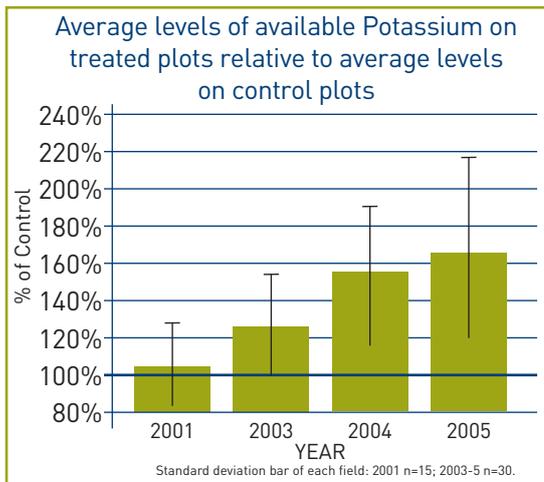
² This is based on a farmer paying £2.50/t for delivered compost and £1.50/t for spreading.

Ten fields on four different farms were treated with different applications of compost to grow sugar beet, winter barley, potatoes, winter wheat, and beetroots. The farms were chosen because of their different soil types and all fields had three different compost treatments:

- 25t/ha;
- 50t/ha;
- 75t/ha; and
- one specified control plot to clearly compare the benefits of compost application.

Similar to the Park Farm trial run by Enviro, the levels of organic matter in the soil were tested annually and these trials also showed the levels of organic matter rose in seven out of the ten fields. This led to a noted increase in workability by farmers, particularly on heavy soils.

The trials also tested the levels of vital macro nutrients such as Potassium, Phosphorus, Magnesium and Sulphur. There was a clear and steady increase in both Potassium and Phosphorus in the soils, relative to the controls, resulting from the compost application.



“This trial demonstrated that with repeated applications of compost there are not only improvements in levels of soil nutrients and organic matter, but there can also be improvements in crop yields.”

Hugh Davison, Organic Resource Agency, who oversaw the trials and calculations.

The release of Phosphorus was slower than that of Potassium and trials showed that the Phosphorous in compost could provide long-term benefits.

Levels of both Magnesium and Sulphur in the soils tested were also aided by compost application.

The commercial value of the nutrient increases resulting from repeated compost use was assessed and found that farmers could make significant savings by using compost in conjunction with traditional fertilisers. ORA concluded that farmers could be saving more than £55 per hectare per year by complementing traditional fertilisers with compost.

3. Trialling compost on top fruits

Trials undertaken in Kent have also shown that compost has a valuable role to play in field horticulture.

ReMaDe Kent and Medway managed a series of WRAP-funded trials on top fruit and other horticultural crops in Kent. A total of 12 farms took part in the trials growing a wide range of crops, including strawberries, Victoria plums, cherries, Cox and Braeburn apples, blackcurrants and hops.

Compost as a mulch

The main focus of the trial was on the role of compost as a mulch for young fruit trees. Compost mulches work by allowing rainfall or irrigation water to penetrate into the soil to the tree roots whilst reducing the water losses from evaporation from the soil surface. More water therefore becomes available to the trees, reducing stress and improving growth.

Water retention and early establishment of the trees

Early establishment of young maiden trees is critical for maximum growth and fruit yields in later years, so reducing environmental stress factors such as water availability is of great importance in this early phase. Traditionally, organic mulches such as straw have been used to retain moisture and control weeds, and this project set out to demonstrate the effectiveness of quality compost as an alternative mulch.

North Court Farm

One of the trials was run by Robert Balicki of North Court Farm near Canterbury. Robert farms 100 hectares of fruit, made up of 60 hectares of dessert apples (Cox, Braeburn and Gala), 30 hectares of Bramley apples, and 10 hectares of pears (Conference, Comice and Concorde). Before using compost, Robert used straw as a mulch to protect his trees from moisture stress.





Applying the mulch

The compost mulch was first applied in June 2004 as a surface layer at the base of the trees one metre wide and 7 to 10cm deep, (equivalent to approximately 4 tonnes of mulch per 100 metres of row). Rows of fruit trees treated with straw mulch (standard practice) were used as control plots for comparison purposes. Some of the trial highlights were as follows:

- much lower leaf stress on the trees that had compost applied than control plots, despite the lower than average rainfall over the ten month growing period of the trial;
- the compost-mulched Cox apple rows showed a 36% increase in the number of new shoots per tree and a doubling of total shoot length when compared to straw treated rows;
- the Braeburn fruit size had increased from 69mm to 75mm, thereby further ensuring the suitability of the fruit for large retailers with fruit size requirements. The average weight of the fruit was also 20% higher in the compost treatments; and
- compost lasted for two years rather than one as it was not blown away, removed by animals or birds and did not present a fire hazard to the crop.



“Fruit production depends heavily on maintaining the correct moisture regime for the trees. Mulches, such as the compost trialled at my farm, undoubtedly have a vital role to play in the future, especially in the light of ongoing constraints on water usage.”

Bob Balicki, North Court Farm owner, was very impressed with the results throughout the trial.

Examples of current agricultural trials being undertaken by WRAP across the UK and Ireland:

- **Scottish Biofuels & Envar, Clackmananshire, Scotland** - compost is being incorporated into the soil for the production of short rotation coppice as well as being used as a mulch. Report is due for publication in Summer 2008;
- **Velcourt Ltd, Cambridge** - compost and biosolids are being used on winter wheat and rape to examine their combined potential as a substitute for traditional fertilisers. Report is due for publication in Summer 2008;
- **Ballinderry Farms, Co. Meath, Eire** - compost has been incorporated into the soil for the growth of winter wheat. Trial report is available via the WRAP website;
- **SCRI, Eastern Scotland** - benefits of quality composted products on barley and potato crops are being assessed on two farms, one conventional and the other organic. Report is due for publication in Summer 2008;
- **Scottish Agricultural College & Murtle Farm, East of Aberdeen, Scotland** - benefits of compost as a soil conditioner are being assessed in an organic oat trial. Report is due for publication in Spring 2008; and
- **Langmead Farms, Chichester** - compost is being used to improve quality and yield of salads and vegetable crops. Report is due for publication in Summer 2008.



Further sources of information

As the benefits of quality compost continue to be realised, this sustainable, locally sourced product looks set to become a regular choice for many farmers in the future.

To find a compost supplier near you go to www.wrap.org.uk/composting and follow the link to the online compost suppliers database.

For further information about the Quality Protocol for Compost visit www.wrap.org.uk/composting/quality_protocol.html

To learn more about the compost trials detailed in this booklet please visit:

- www.compost.me.uk for Enviros' trials in Suffolk;
- www.o-r-a.co.uk/reports.html for complete results of ORA's trials on Crown Point Farm; and
- www.egeneration.co.uk/remade_06/projects/WRAP.asp for Remade Kent and Medway's trials.

Other useful sites:

- ADAS at www.compostresearch.com;
- The National Farmers' Union at www.nfuonline.com/environment.xml;
- Scottish Environmental Protection Agency at www.sepa.org.uk;
- Sustainable Organic Resource Partnership at www.sorp.org;
- The Composting Association at www.compost.org.uk; and
- The Environment Agency at www.environment-agency.gov.uk.

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