wrap

Material change for
a better environment

Quality compost

Using quality compost to benefit cereal crops

WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change.

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What is quality compost?

Compost is a natural product which results from the controlled biological decomposition of biodegradable materials, such as garden and food waste. Compost helps retain moisture in the soil, provides vital, 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.

The BSI PAS 100 compost certification scheme provides a baseline quality standard for compost, ensuring that it is consistent, safe and reliable to use. In 2007, the Quality Protocol for Compost (QPC) was launched in England and Wales to provide a clear regulatory framework for the production and supply of quality compost. It builds on BSI PAS 100 and clarifies which waste materials can be used in quality compost production, reinforcing traceability throughout the production process. QP compliant compost is classed as a product, not a waste, and therefore does not require an exemption for its use on agricultural land providing certain records are kept. The QPC is not relevant in Scotland, where BSI PAS 100 compost can be used without further regulation in accordance with good agricultural practice, providing NVZ regulations are adhered to, where relevant.

Soil organic matter

The importance of soil organic matter

- Organic matter is a key indicator of soil quality. It improves the water-holding capacity of sandy soils and aids drainage and workability in heavy soils. The risk of soil slumping, capping and erosion by water is reduced at higher soil organic matter contents. Maintenance of soil organic matter status is a cross compliance requirement under the Single Farm Payment Scheme and, in England and Wales, maintenance of soil organic matter status is also a component of the Soil Protection Review, which must be updated annually. The soil's biological activity from micro-organisms and fungi through to earthworms is also increased, which helps to maintain soil fertility.

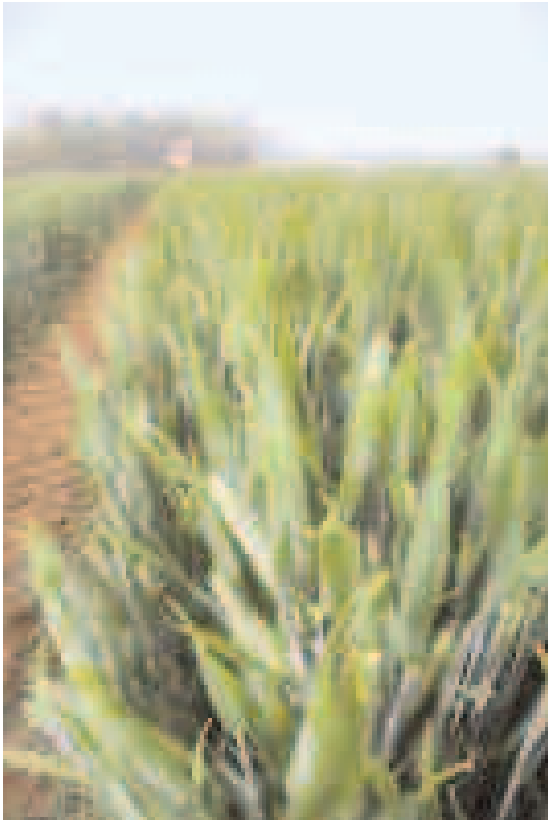
- 30t/ha of green compost (a typical field application rate supplying the maximum amount of total manure nitrogen allowed in Nitrate Vulnerable Zones (NVZs) of 250kg/ha) applies approximately 6-7t/ha of organic matter. Food derived compost would typically be applied at around 20t/ha in NVZs, supplying approximately 5-6t/ha of organic matter.

- A high proportion of the organic matter is in a lignified (stabilised) form, so it is likely to have a longer-lasting beneficial effect in soil than other organic materials, such as farm manures and paper crumb.

Regular use of compost will help to maintain and enhance soil organic matter levels and will be of particular value for cereal crops grown on lighter soils in drier parts of the UK.

How can quality compost benefit cereal crops?

- Helps to maintain and enhance soil organic matter levels.
- Improves soil water holding capacity and workability.
- Supplies crop-available nutrients and trace elements.
- Can help improve crop establishment and long-term yields.



Winter wheat trial using PAS 100 compost

Nutrient supply from composts

Compost provides crop available nutrients which can help to build up natural soil fertility and provide savings in the use of inorganic fertilisers; it is a particularly good source of potash.

Based on the analysis of a large number of green compost samples, typical nutrient content data are summarised in the table below. Typical analysis data are also summarised for food derived compost, although the summary is based on more limited sample numbers. The nutrient content of compost products will vary depending on the feedstocks and treatment process. Compost suppliers will be able to provide specific nutrient content data for their compost.

Typical total nutrient contents (fresh weight basis)

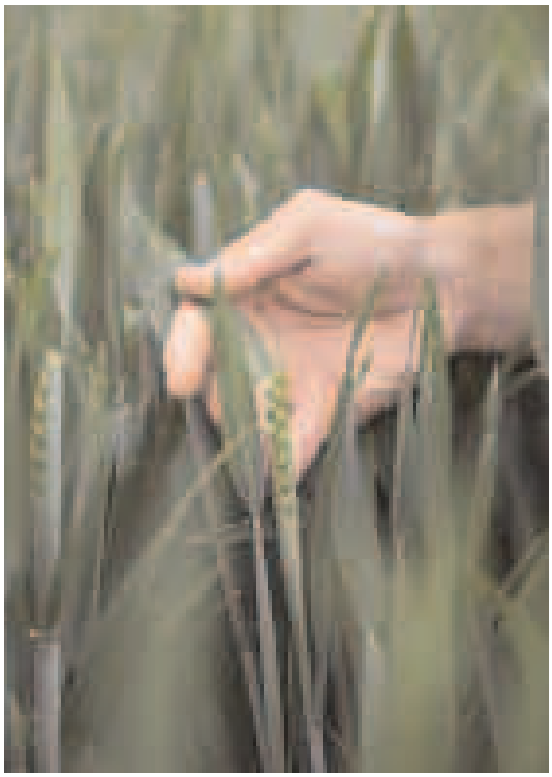
Compost type	Dry matter (%)	Nitrogen (kg/t)		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (SO_3)	Magnesium (MgO)
		Total	Available	Total	Available	Total	Available	Total	Total
Green	60	7.5	<0.2	3.0	1.5	5.5	4.4	2.6	3.4
Food derived	60	11	0.6	3.8	1.9	8.0	6.4	3.4	3.4

Nutrient management and compost fertiliser replacement values

Field experimental data indicate that green compost supplies only very small amounts of crop available nitrogen (N) and that inorganic fertiliser N application rates should not be changed for the next crop grown after the initial compost application. For food derived compost around 5% of the total N applied is available to the next crop grown (irrespective of application timing). Following the repeated use of green and food derived composts, long-term soil N supply will be increased.

Around 50% of the phosphate in compost will be available to the next crop grown, with the remainder being released slowly over the crop rotation. Around 80% of compost potash is in a soluble form and is readily available for crop uptake.

As for other organic materials, allowance should be made for the phosphate (P_2O_5) and potash (K_2O) supplied by compost applications when calculating inorganic fertiliser requirements (see Defra Fertiliser Manual, RB209 - 2009). At lower soil indices (e.g. ADAS P and K Indices 0/1, SAC low) inorganic fertiliser will also generally need to be applied to support optimum crop needs and quality. The sulphur (S) and magnesium (Mg) content of compost will also contribute to the maintenance of soil reserves. Compost also has a small liming value that can help to balance the acidifying effects of inorganic fertiliser nitrogen.



Winter wheat trial crop near Sleaford, Lincolnshire

Based on recent fertiliser prices (December 2008 i.e. 110p/kg N, 130p/kg P_2O_5 and 100p/kg K_2O) the typical fertiliser replacement value of green compost is around £9-10/tonne (around £13/tonne for food derived compost). The price of inorganic fertilisers is likely to remain high for the foreseeable future.

Example: Green compost applied at 30t/ha prior to Winter Barley, Soil Nitrogen Supply Index 0 (NVZ previous crop or grass group 1 in Scotland), P Index 2 (SAC moderate P status in Scotland), K Index 2-, straw removed (SAC moderate K status in Scotland)

	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)	Financial saving
1. Estimate total nutrients in green compost (kg/t)	7.5	3.0	5.5	
2. Estimate available nutrients in green compost (kg/t)	0	1.5	4.4	
3. Total nutrients supplied by 30t/ha compost	0	90	165	
4. Value of nutrient supply from compost over rotation	**0**	**£117**	**£165**	**£282/ha**
5. Nutrient requirements of barley crop (kg/ha)	160 (180 in Scotland)	70	95	
6. Nutrients supplied by 30t/ha compost available for barley crop (kg/ha)	0	45	132	
7. Inorganic fertiliser needed allowing for compost nutrients	160 (180 in Scotland)	85	143	
8. Actual saving for barley crop from compost use	**0**	**£91**	**£95**	**£186/ha**

If food derived compost was used at 20t/ha rather than green compost at 30t/ha the NPK value would be around £270/ha.

The evidence: trials of compost on cereals

- Long-term trials as part of the Greenleaf Project in East Anglia demonstrated higher organic matter levels on plots treated with compost (13-17% higher than control). Soil workability tests on the clay/loam soil showed a reduction in draught force requirement of around 8% on compost treated plots. These trials indicate that, in the long-term, use of compost could help to reduce cultivation requirements and therefore crop establishment costs.

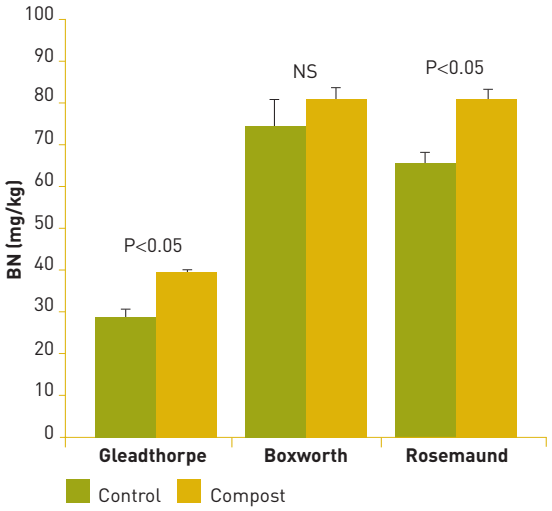
- Long-term cereal trials in Eastern England, funded by Grantscape and Applied Research Forum and now WRAP (Waste & Resources Action Programme), have demonstrated significant yield increases from the use of compost as well as increased soil organic carbon, improved soil structure, plant establishment and water infiltration rate.

- A 3 year trial in Co. Meath (Southern Ireland) demonstrated that using compost at 22t/ha, plus a reduced rate of inorganic fertiliser nitrogen (100kg/ha), produced winter wheat yields comparable to the standard fertiliser programme, but with significant savings in bag fertiliser costs. This trial also showed reduced levels of Take All disease where compost was applied, possibly due to stronger plant root systems in improved soil.

"The benefit in tonnes of grain due to soil improvement from the regular use of compost on our soils has been comprehensively shown. Soil organic carbon has been increased, soil colour, soil life and structure all improved showing that yields and sustainable farming practices can go hand in hand. We have also found that we can reduce inorganic fertilisers, especially P and K. Nitrogen rates can be fine tuned according to the N supply from the compost and as organic matter builds up in the soil."

Phil Wallace,
Technical Director, Enviros

Biomass nitrogen (BN) on plots with and without compost



- A trial with organic oats on a sandy loam soil in north-east Scotland, with low soil P and K status, showed a significant yield increase where green compost was applied. The extra yield on the plots treated with 28t/ha compost was worth £156/ha which covered the cost of the 0-40mm grade compost used. The use of compost is particularly valuable on organic farms with low soil P and K levels and limited animal manure availability.

- The ACORE experiments (Compost Research Ltd), on three contrasting soil types (i.e. sandy, medium loam and clay) in England, showed that winter wheat yields on plots receiving annual applications of food derived compost (at around 28t/ha) and a slightly reduced bag N rate were as good as those receiving the full recommended inorganic N rate. N availability from the food derived compost additions was around 5% of the total N applied. Measurements have also shown significant increases in soil microbial community size, measured as biomass nitrogen (BM) on compost treated plots.

Using quality compost in practice

Where to get hold of compost

There are now over 160 producers on the BSI PAS 100 certification scheme so to find a compost supplier near you please visit **www.wrap.org.uk/composting** and follow the link to the online compost suppliers' database.

What you need to know before applying compost:

- When using compost, as with other organic material inputs, you must comply with Nitrate Vulnerable Zone (NVZ) rules where relevant (i.e. the field spreading limit of 250kg/ha total N from organic manures per year, which equates to around 30t/ha for most green composts, and around 20t/ha for most green/food derived composts). You should also take account of guidance in the Defra Codes of Good Agricultural Practice to Protect Water, Soil and Air Quality (England and Wales) or the Prevention of Environmental Pollution from Agricultural Activity (PEPFAA) Code in Scotland. As compost is low in readily available nitrogen it is not subject to closed spreading periods in NVZs.

- An exemption from the Environmental Permitting Regulations is not needed for BSI PAS 100 certified compost if it also complies with the Quality Protocol. In Scotland, BSI PAS 100 compost is not regarded as a waste and can be used without further regulation in accordance with good agricultural practice.

- In England and Wales, when using compost which complies with the Quality Protocol, the farmer/land manager is required to provide certain information e.g. where the compost was applied, the rate used, date of application and soil analysis. This data can be input via the webtool: **http://qualitycompost.org** with the assistance of a FACTS (Fertiliser Advisers Certification & Training Scheme) or similarly qualified adviser.

- Composts containing any animal by-products (e.g. catering wastes) are subject to stringent processing requirements and covered by restrictions on use in accordance with the Animal By-Products Regulations (ABPR); this ensures that they are safe and fit for purpose.

Organic oats growing at Murtle Farm, West of Aberdeen, as part of a WRAP/SAC trial

- As composts supply available N at low levels this should be fully considered where grain nitrogen/protein levels are important for certain markets (e.g. for malting barley or milling wheat).
- Customer requirements, such as Assured Produce crop protocols, must also be considered.

How to apply compost

It is important that compost is applied evenly and at a known application rate. An adapted manure spreader with a rear discharge can be used. The aim should be to apply evenly with a coefficient of variation (CV) of less than 25%. This should be possible as long as application equipment is well maintained and calibrated. Application rates can be calculated from knowledge of the capacity of the spreader and the number of loads applied per field and the field area. Spreading costs are typically £2-3/tonne.

Compost can be applied at any time of year when soil conditions are suitable, although there are some restrictions on applications of composts for certain options in Entry/Higher Level Stewardship (e.g. no compost allowed on uncropped cultivated 6m margins and no compost allowed on over-wintered stubbles until 15 February).

Harvesting winter wheat in Hampshire

Further sources of information

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

For further information about the benefits of quality compost and compost trials visit **www.wrap.org.uk/composting**

Links to relevant reports:

OCAE Ballinderry Winter Wheat Trial:
http://www.wrap.org.uk/downloads/Report_Winter_Wheat_Irish_trial.106b857a.6221.pdf

SAC Murtle Farm Organic Oats Trial:
http://www.wrap.org.uk/downloads/Murtle_Farm_Product_Trial.fc006188.5829.pdf

Greenleaf Trials:
http://www.wrap.org.uk/downloads/Report_Greenleaf_project.59528ff9.6219.pdf

Other useful sites:

- The Association for Organics Recycling (formerly the Composting Association) **www.organics-recycling.org.uk**
- Defra **www.defra.gov.uk**
- The Environment Agency **www.environment-agency.gov.uk**
- Scottish Environmental Protection Agency **www.sepa.org.uk**
- Composting Research Ltd **www.compostresearch.com**
- ADAS UK Ltd **www.adas.co.uk**
- SAC (Scottish Agricultural College) **www.sac.ac.uk**
- Enviros Consulting Ltd **www.enviros.com**
- Organic Resource Agency **www.o-r-a.co.uk**

*Green compost = garden waste such as grass cuttings, prunings and leaves. Food derived compost = household kitchen waste fit for human consumption.

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