wrap

Material change for
a better environment

Quality compost

Using quality compost to benefit vegetable and salad 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.

Contents

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 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 by ensuring accurate record keeping. QP compliant compost is classed as a product, not a waste, and therefore does not require an exemption for its use on agricultural land.

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 in heavy soils; it also makes the cultivation of heavy soils easier. The risk of soil slumping i.e. capping and erosion by water is reduced at higher soil organic matter levels. Maintenance of soil organic matter status is a cross compliance requirement under the Single Farm Payment Scheme, and in England and Wales is also a component of the Soil Protection Review, which must be updated annually. Soil biological activity, from microorganisms to earthworms, is also increased, which helps to maintain a healthy and fertile soil.

- A typical application of 30t/ha green compost, (applying 250kg/ha total nitrogen) supplies approximately 6t/ha of organic matter, a high proportion of which is in a lignified (stabilised) form. This is likely to have a longer-lasting beneficial effect in soil than other organic materials, such as solid 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 vegetables and salad crops grown on lighter soils.

Nutrient supply from composts

Data from field experiments indicate that green compost supplies only very low amounts of crop available N, and that inorganic fertiliser N application rates should not be changed for the next crop grown. In the case of food included compost, however, the experimental data indicate that 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 included composts, long-term soil N supply will be increased.

How can quality compost benefit vegetable crops?

- Helps to maintain and enhance soil organic matter levels.
- Improves soil water holding capacity and infiltration of water.
- Improves structure and workability.
- Supplies crop available nutrients (especially potash) and trace elements.
- Increases biological activity.
- Improves crop establishment and yields.

Cauliflowers at Marshalls Farms

Table 1: Typical total nutrient contents (fresh weight basis)

Compost type	Dry matter (%)	Nitrogen (kg/t)		Total (kg/t)			
		Total	Readily available	Phosphate (P_2O_5)	Potash (K_2O)	Sulphur (SO_3)	Magnesium (MgO)
Green	60	7.5	<0.2	3.0	5.5	2.6	3.4
Food included	60	11	0.6	3.8	8.0	3.4	3.4

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.

Composts also have a small liming value that can balance the acidifying effects of inorganic fertiliser N additions to soils.

Based on the analysis of a large number of green compost samples, typical nutrient content data are summarized in Table 1. Typical analysis data are also given for food included composts, although they are based on more limited sample numbers. The nutrient content of compost products will vary depending on the source materials and treatment process. Composts should be supplied with specific nutrient content data and other relevant information.

Nutrient management and compost fertiliser replacement value

The significant rise in worldwide fertiliser prices has made a stronger case for fertiliser replacement materials such as compost to be used on farm. The typical fertiliser replacement value of green compost is currently £8-9/t and £10-11/t for food included compost. With application costs at around £2-3/t contractor applied (£60-90/ha for 30t/ha applied green compost), the proximity to a composting facility, and the resultant haulage costs, is the limiting economic factor. Magnesium and sulphur supplied by the compost will also help to maintain soil reserves.

Table 2: Example - Green compost applied at 30t/ha prior to parsnips SNS Index 1, P Index 2, K Index 2+

	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)	Financial saving
1. Percentage available in the first year	0%	50%	80%	
2. Estimate available nutrients in green compost (kg/t)	0	1.5	4.4	
3. Nutrient requirements for parsnip crop (kg/ha)	100	100	150	
4. Nutrients supplied by 30t/ha compost available for parsnip crop (kg/ha)	0	45	132	
5. Inorganic fertiliser needed allowing for compost nutrients (item 3 minus item 4) kg/ha	100	55	18	
Total saving for parsnip crop from compost use in first year	**0**	**£62**	**£123**	**£185/ha**

Value taking December 2008 Fertiliser prices Farmers Weekly Interactive: P_2O_5 £1.38/kg and K_2O £0.93/kg

The evidence: trials of compost on vegetable and salad crops

Langmead Farms (West Sussex)

Over the last 20 years, Langmead Farms has developed into one of the largest green and baby leaf salad growers in Europe. In 2007 four fully replicated trials were established with Spinach and Romaine Lettuce grown with three different application rates of BSI PAS 100 quality green compost at 15, 30 and 45t/ha and a control of no compost additions. In addition, all treatments received a basal and top dressing of fertiliser. Fresh weight yield was consistently increased with increasing compost additions compared to untreated soils.

The trials were conducted on intensively cropped farms: two trials with baby leaf spinach established 11 April and 25 June 2007 on sandy loam soils at River Farms, Petworth, West Sussex; two trials with Romaine lettuce (varieties Frisco and Nunhems) established 25 April on medium loam soils at Manor Farm, Shripney and 20 July on sandy clay loam soils at Home Farm, Selsey.

In the first spinach trial there was a slight reduction in initial emergence possibly due to sodium within the compost. Despite the initial reduction, at the time of harvest there were no differences in the final plant population. This effect was not seen in the second spinach trial. The spinach plots where compost was applied appeared to self thin more quickly than without compost. Soil analysis showed soil sodium levels to increase with increasing compost application rate. It was recommended that compost is incorporated well to reduce the likelihood of this effect within the germination zone.

Compost additions appeared to have no effect on water holding capacity but crops were irrigated to field requirement so that water was not a limiting factor to crop growth.

Langmead Farms use partial budgets to analyse the feasibility of a new venture. The variable costs and revenue of a new system are compared to those of the current system. The partial budget showed spinach margin to be increased by £642 (trial 1) and £730 (trial 2) per hectare given the increased yield achieved.

For Romaine lettuce it was profitable to apply 30t/ha (£552/ha increase for trials 1 and 2) and 45t/ha (£552/ha trial 1 and £2,088 increase trial 2). To give an effective comparison, profit margin was calculated by taking the percentage yield increase from the hand harvested trial plot results and applying this to the crop yield achieved commercially in the rest of the field (1kg/m^2). The cost of the compost was £10/t and spreading cost £1.60/t. The approximate value of the spinach was set at £1.10/kg.

The full published report of the Langmead Farms trials can be found on the WRAP website at **http://www.wrap.org.uk/downloads/Report_-_Langmead_Farms_Ltd1.d287cba7.6220.pdf**

The Results

- Compost increased spinach yield by 9% in the first trial and 10% in the second (hand harvested crop).
- Romaine crops showed a 0.1, 6 and 7.2% yield increase with rising compost rate in the first trial and 2, 6 and 17% in the second trial.
- The following were unaffected by compost applications:
  - crop nutritional value (in terms of iron, vitamin A, C and folic acid);
  - heavy metal concentration within the crop;
  - shelf life and taste;
  - weed populations;
  - levels of nitrate within the crop (though increased within the soil at 45t/ha applied); and
  - no effect of compost on botrytis and tip burn levels.

Trial plots at Langmead Farms, 2007

The Results

- Improved soil bulk density, structure and soil crumb (less clods).
- Increased soil organic matter and nutrient levels after long term use.
- There was an adequate supply of P and K from the compost.
- Winter cabbage and salad potatoes appeared greener with a more even crop canopy, possibly due to additional soil nitrogen released from the compost.
- A 27% yield increase in onions in a difficult season.
- Nitrogen release was confirmed to be slow.
- 10% water savings (equivalent to extra 8mm in the 0 – 40cm profile).

"Nutrient supply is a particular issue for organic vegetable production and compost is a valuable source of potassium as well as adding organic matter to the soil to improve its structure. Trials conducted in 2008 showed a clear yield benefit when compost was applied to an organic parsnip crop in Norfolk."

Francis Rayns, Horticulture Research Manager, HDRA/Garden Organic

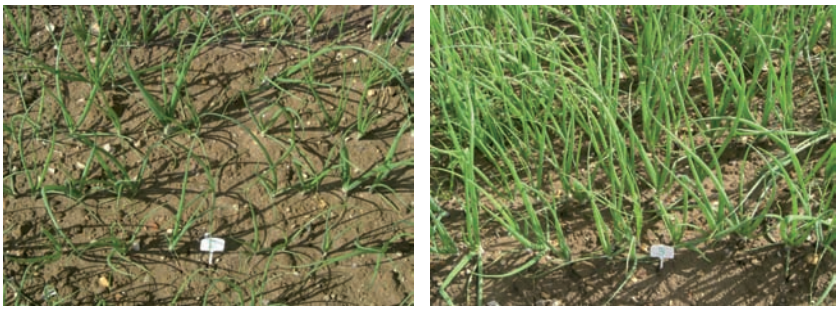
Westrope Farms (Suffolk)

Westrope Farming Ltd contract manages over 2,100ha of mostly light land in Suffolk and has been involved with long term field trials on compost use in agriculture since 1999. These trials, run for nearly 10 years on the same sites, provide a valuable insight to the long term effects of compost use on light sandy soils (with less than 18% clay).

"These trials showed really positive benefits from improved organic matter levels. The better soil porosity gave enhanced establishment and aeration of soils for the developing crop, in a difficult season. Moisture retention and rainfall infiltration helped water management on these high value crops."

Phil Wallace, Enviros Consulting, Westrope Trials (2007)

Onion Establishment at Westrope Farm



Fertilisers only **Compost annually**

Compost improved establishment in dry spring conditions in 2007

Onions were grown at Loudham in a difficult season. No rain fell for a month after the March planting. Where compost was applied the onions established more rapidly and used additional fertiliser, supplied in May, effectively. June and July were very wet but the improved aeration from better structure within the composted plots allowed crops to grow well. There was a 27% yield increase where compost had been applied compared to plots receiving standard fertiliser applications alone. Soil analysis showed improved organic matter and nutrient levels where compost had been used. In practical terms the 10% soil moisture increase seen is enough for a farmer to delay irrigation for 1-2 days in the summer and for the soil to take greater advantage of rainfall events.

The full published report of the Westrope trials can be found on the WRAP website at **http://www.wrap.org.uk/downloads/OAV011-005_ Report_-_Westrope.e3ee31f9.6410.pdf**

Current WRAP trials

Marshall Brothers Ltd, Butterwick, Lincolnshire

Warwick HRI Kirton – food included compost use on cauliflowers. Assessments are showing encouraging results which will be published later in 2009.

Bagthorpe Farm, Docking, Norfolk

Garden Organic (formerly HDRA) – green compost use in the organic sector on calabrese and parsnips.

Using quality compost in practice

Where to get hold of compost

There are now over 160 producers on the BSI PAS 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 per year, which equates to around 30t/ha for most green composts, and around 20t/ha for typical food included composts). You should also take account of guidance in the Defra Code 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 to the Environment Agency e.g. where the compost was applied, the rate used, date of application and soil analysis. This data is input via the web tool **http://qualitycompost.org**

- Customer requirements, such as Assured Produce Crop Protocols, must also be considered.

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.

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 per tonne.

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

> " In this year's trials at Marshalls Farms we saw a significant decrease in the numbers of unmarketable heads from the plots where compost was applied, with a perceived benefit in improved water holding capacity – results will be reported shortly."
>
> Dr Becky Turner, Warwick HRI Kirton

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**

Other useful sites:

- The Association for Organics Recycling
  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
- SCRI (Scottish Crop Research Institute)
  www.scri.ac.uk

For more information about Animal By-Products Regulations:
http://www.defra.gov.uk/animalh/by-prods/default.htm

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

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