Quality Compost: benefits to potato production & soil quality

Quality Compost: benefits to potato production, soil organic matter and plant available water supply

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WRAP’s vision is a world without waste, where resources are used sustainably.

We work with businesses and individuals to help them reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way.

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1.0 Introduction

150,000 hectares of cropland are dedicated to growing potatoes across the UK\(^1\). A large proportion of these crops are grown on light, sandy soils where crops are particularly vulnerable to reduced growth rates or failure during dry conditions. Quality compost is an excellent source of organic matter and using it will improve soil structure and increase the soil’s water holding capacity, helping to protect crops and reduce irrigation requirements during dry spells. Heavier soils will also benefit as improved drainage can result in better germination and early root development.

2.0 What is quality compost?

Quality compost is a natural product resulting from the controlled biological decomposition of biodegradable materials such as garden waste and waste food. The BSI PAS 100 compost certification scheme provides a baseline quality standard for compost, ensuring that it is consistently safe and reliable to use. The Quality Protocol for Compost provides a clear framework for the production and supply of quality compost. It builds on BSI PAS 100 and stipulates which waste materials can be used in quality compost production.

3.0 Fertility building

Quality compost provides crop available nutrients which can help to build up natural soil fertility and provide savings in the use of inorganic fertilisers. This is particularly true for potash, a key nutrient for potatoes.

<table>
<thead>
<tr>
<th>Compost Type</th>
<th>Dry Matter %</th>
<th>Nitrogen (kg/t)</th>
<th>Other Nutrients (total, kg/t)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Readily Available</td>
</tr>
<tr>
<td>Green</td>
<td>60</td>
<td>7.5</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Green/Food</td>
<td>60</td>
<td>11</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Defra RB209 Fertiliser Recommendations (2010)

4.0 Recent research

WRAP has supported a number of research projects to investigate in more detail the benefits of using quality compost in potato production:

- Branston Potatoes have undertaken two projects in Perthshire, one on ware potatoes\(^2\) and one on salad potatoes\(^3\).
- In Herefordshire, ADAS investigated the use of quality compost on crisping potatoes\(^4\).
- At two sites in East Anglia, a consortium led by Enviros investigated the use of quality compost on potato production as part of a long-term trial looking at improving soil health\(^5\).

In addition to the field trials supported by WRAP, independent research into the benefits of compost has been funded by Defra through the ‘Soil-QC’\(^6\) project and examined separately by ADAS through the ‘ACORE’ project. These projects have looked at consecutive compost applications over two to four years and provide valuable results on the longer term use of these materials in farming. Some of the results are used in this summary.

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\(^1\) Defra Agriculture in the UK (2009).

\(^2\) Project OAV023-002.

\(^3\) Project OAV023-016.

\(^4\) Project OAV023-009.

\(^5\) Project OAV023-010.

\(^6\) Project SP0530.
5.0 Increasing soil organic matter

Compost additions are a valuable means of replenishing soil organic matter and can provide long-term benefits to soil structure and water holding capacity. Compost can also be used to improve drainage on heavy soils, opening up troublesome fields for healthy crop growth. Depending on total nitrogen content, green compost is typically applied at 30t/ha to comply with NVZ limits. This would supply 4-5 t/ha of organic matter. Due to its higher organic content, a typical application of green/food compost would also supply about 5 t/ha of organic matter, although the total application rate might be only 20 t/ha.

The organic matter supplied by quality compost tends to be more long lasting than that in manures and other materials which are commonly applied to agricultural soils. This is because compost contains high levels of lignin which is a more stable, durable form of organic matter (see Figure 1). As a result, repeat applications of quality compost will increase soil organic matter levels more quickly than manures and slurries.

Figure 1. Lignin content of a range of organic materials applied to agricultural land

![Lignin content of organic materials](image)

Data from Defra SOIL-QC project (SP0530).
Soil organic matter (SOM) has been measured in research projects on a variety of crops, including potatoes. Using quality compost over periods of between 2 and 10 years was found to increase SOM levels by an average of 12%, when compared with soils not receiving any organic matter (Figure 2).

Figure 2. Effect of repeated compost additions on soil organic matter levels (0-15cm depth).

6.0 Increasing plant available water supply

Increasing plant available water capacity (AWC) can have important benefits for crop yields, water use efficiency and farm profits, particularly on the sandy soils which are commonly used for growing potatoes and which have low AWC. Using quality compost improves the ability of crops to withstand periods of drought and decreases the need for irrigation.

AWC was measured across nine of the experimental sites and repeated applications of quality compost over 2-10 years were found to increase AWC by an average of 5% (range 1-13%) (see Figure 3). The yield response of potatoes to applied irrigation water on sandy textured soils is approximately 0.25 t/ha/mm. A 5% increase in plant AWC is equivalent to an additional water supply of 3 mm in the top 30 cm of soil. For un-irrigated (or under irrigated) potatoes, this ‘additional’ water would result in 0.75 t/ha of extra yield.

Figure 3. Effect of repeated compost additions on topsoil (0-15cm) plant available water capacity (AWC)
7.0 Commercial impact of using quality compost

7.1 Effects on potato yield

In all four WRAP projects, using quality compost either increased yields or had no impacts when compared with farmers standard treatments. In the Perthshire and Herefordshire trials, manufactured fertiliser applications were reduced to take account of the crop nutrients supplied by the compost, and potato yields remained comparable to the control plots which received full rates of manufactured fertiliser. In the Branston trial, using compost was found to reduce wastage and resulted in higher yields of saleable potatoes, although this result was not statistically significant over the short lifetime of the project.

7.2 Effects on potato quality

Analysis from the WRAP trials showed that using both green and green/food quality compost has no negative impact on crop quality. In some cases, using compost was found to improve potato quality when compared with control plots of potatoes grown using conventional fertiliser practice. Notably, a reduction in common scab was found in one study (OAV023-16) and a reduction in waste potato tubers of c.4% was noted in another (OAV023-002).

Under the BSI PAS 100, compost is tested for the presence of physical contaminants. Under the new 2011 version, compliant composts must contain less than 0.25% sharps (glass, metal and plastic). Even with this level of control in place, there are still some concerns that using compost may pose a risk of sharps contaminating potato crops and end products. In order to address this concern, the Branston project carried out industry recognised routine cook tests on sampled potatoes and demonstrated a negative result for sharps contamination.

7.3 Cost-benefit analysis

Quality compost is a sustainable source of plant nutrients, particularly P and K, and its use can help reduce fertiliser bills. Three of the projects included a cost-benefit analysis which showed that, even taking into account purchase price, haulage and spreading costs, using compost in combination with a reduced rate of manufactured fertiliser rates can save £35-£110 per hectare.
8.0 Further information

For further information about the benefits of quality compost and compost trials, visit www.wrap.org/agriculture

For up-to-date figures on the fertiliser replacement value of quality compost and anaerobic digestate (biofertiliser), visit http://www.wrap.org.uk/farming_growing_and_landscaping/compost_calculator.html

To find a compost supplier near you, visit http://compostsuppliers.wrap.org.uk/
www.wrap.org.uk/agriculture