

Innovative washing system helps extend potato product life and reduce water use

Potatoes are a high waste product in the supply chain and in the home. The way they are packaged and stored – washed, packed in transparent bags, and exposed to warm and light conditions on the shelf and in the home – conspires to shorten product life from months to days because of bacterial infection.

Following particularly wet growing and harvesting seasons in 2007 and 2008, which led to considerable spoilage, potato grower Greenvale AP was determined to address the bacterial infection of its potato crop. The main problems to be solved were:

- poor shelf life, which caused excessive waste throughout the supply chain; and
- high water consumption at the company's washing plants, which was costly and resulted in huge lagoons around the plants for the treatment of contaminated water.

Typically, the potato harvest is from July to the end of October. Greenvale starts accumulating unwashed potatoes from the beginning of September in one tonne boxes. These are kept in dark stores at between 3°C and 3.5°C and can be supplied until the following spring.



Greenvale's Cambridgeshire cascade washing plant
(Source: Greenvale AP)

Potato production

In the UK, the most common bacterium that causes potatoes to rot is *Pectobacterium carotovorum*, commonly known as *Erwinia*. It is almost always present on the surface or in lenticels and wounds of harvested potatoes.

Erwinia thrives in warmer, wetter soils and attacks the potato flesh. When infected seed potatoes break down in the soil huge numbers of bacteria are released. This creates a risk of cross-contaminating other crops and, where potatoes are batch washed following harvesting, a build-up of bacteria in the water can spread the infection. Continual replenishment of the washwater from the mains and disposal of the infected water are expensive and environmentally damaging.

In storage, potatoes require cool, dry, dark conditions to minimise the risk of danger from bacterial attack. Historically, this requirement was met in the supply chain by not washing the crop, and by supplying in bulk form or packed in brown paper bags. The potatoes were then kept by the householder in a cool storage room.

However, in the modern retail environment, potatoes are washed to remove all soils from the skins. They are then exposed to warm, light conditions on the shelf and in people's homes.



Examples of bacterial infection and soft rot in potatoes.
(Source: Defra Factsheet 2009)

Furthermore, potatoes are generally packed in transparent polythene bags, which contributes further to bacterial breakdown of the product largely through the build-up of condensation inside the pack.

Technical innovation

In 2009, Greenvale AP worked with equipment suppliers Mobile Separation Equipment to design and build a revolutionary cascade washing system at its Tern Hill site in Shropshire. Following its successful commissioning, a larger system was installed at the company's Floods Ferry site in Cambridgeshire.

As they are needed, the potatoes are taken out of the stores and put through the new washing system to control bacterial infection.

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When the potatoes have been washed, the washwater is cascaded through a series filtration stages to remove soil, debris and wood. Following this, coagulation is used to remove fines (in a similar way to that used to purify drinking water). The water is then chilled and a disinfectant is added prior to it passing through a self-cleaning sand filter that clarifies the water. This cycle takes 2 hours, after which the water goes back to the initial washing stage at a temperature of approximately 9°C.

Only 5% of the water used in each cycle is lost in the process, and all residues are dried and composted. The whole process is fully automated, with continual computer-controlled balancing of the system parameters.

Reducing food waste

Each year, Greenvale grows and sells 280,000 tonnes of potatoes, and most are sold to Sainsbury's and Tesco. The most common line (about 20% to 25% of all potatoes sold) is the '2.5kg bag of whites'. Retailers demand that this particular product arrives at depots with 'pack plus six' (that is, six days life remaining). At the point of bagging (and exposure to light and warmth), this product has a life of around eight days. Thus, the minimum life on receipt (MLOR) is 75% (6 days).

'The implementation of the cascade washing system has reduced "customer care" complaints due to quality issues (such as damage, rot and out of specification product) by 50%, and this figure continues to fall.'
Martin Lewis, Greenvale

The technical improvements to control bacterial infection have resulted in a reduction in potato spoilage.

Further benefits include:

- speed of delivery to retailers – Greenvale's supply chain 'from field to customer shelf' is a maximum of 48 hours and MLOR infringement is zero;
- minimising bacterial build up in the potato skin through the chilling and washing process which has extended storage life significantly; and
- slower degradation in the home resulting in a considerable reduction in domestic food waste.

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Resource use

Two other major benefits arise from the installation of the cascade system. The first is the significant reduction in water use. The company was using about 273,000 litres of mains water a day at its Cambridgeshire plant. This figure is now down to less than 45,500 litres. The second benefit is the lower energy required to chill the washwater. With conventional batch systems using mains water, which can have a temperature as high as 20°C in summer months, considerable energy is required to chill each load. The recirculating water in the cascade system is maintained at a low temperature throughout, thereby reducing energy consumption by up to 50%.

Greenvale is now planning to install a third cascade system at its Duns potato packing site in Berwickshire.

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Other applications

In addition to its use in the processing of potatoes, the cascade system can be used to wash a range of other root crops.

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