Garddwriaeth Cymru
Horticulture Wales

A practical guide for business
Shelf Life Extension for horticulture

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Shelf Life Extension for horticulture: A practical guide for business

About this guide

Shelf life is the length of time that a product remains suitable to be sold, and for food products that can be consumed without posing problems to human health.

For growers, this is about maintaining quality through good cultivation practices and harvest planning, then ensuring their produce reaches the customer in optimum condition throughout the year, through effective packaging, storage and transit.

This guide introduces practical information for horticulture businesses to consider ways to extend the shelf life of their produce. It is intended as one of suite of practical business guides that are currently being developed by Horticulture Wales.

Did you know?

The loss in profitability from spoilage or waste in fruit and vegetables varies between 4.8% and 15% of retail sales. (Buzby et al. 2015; Buck and Minvielle, 2013)

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1. Factors affecting Shelf Life

a. Quality and freshness

- **Maturity at harvest.** Identifying correct harvest dates for different varieties is likely to vary across different regions. Produce picked at the wrong time risks being susceptible to damage, shriveling and inferior texture and flavour.
- **Distance to market.** In general, the farther away the market is, the longer it will take for produce to arrive. This depends on the type of transport used. However, where demand from local customers can be developed it will ensure produce can be delivered quickly, with less reliance on packaging and storage.
- **Processing and preservation.** When fresh produce is used as an ingredient, for example in jam, it can impact on the life of the final product. Drying and dehydration are methods used for preservation and can also reduce transportation costs by reducing its weight.

b. Packaging

Packing is an important step in the journey from grower to consumer. The core function of packaging is to ensure that produce can be stored and delivered to customers safely and in the best possible condition.

By law, **food packaging** must carry certain information and warnings, including origin, grade, use by date, ingredients, allergen information, opening and storage instructions and nutritional information. It must also be manufactured from approved food grade material.

Many different methods are used to extend shelf life, they include:

- **Modified Atmosphere Packaging (MAP)** is a method of packaging that contains the right mix of oxygen, carbon dioxide, and nitrogen to preserve the freshness of produce. Gas packing machinery can be costly.
- **Vacuum Packaging** involves sealing the produce in an air tight pack and removing the air before the package is sealed. By reducing the levels of oxygen contained it restricts spoilage from micro-organisms and oxidation (that causes apples to turn brown for example). Whilst vacuum machinery is relatively low cost, it can distort different products and affect their presentation.
- **Active Packaging** is when additions such as sachets, inserts or labels are included in, or on, a package to extend shelf life or to monitor the quality of the product it contains. Most commonly these are used to preserve the freshness of produce by absorbing oxygen, odour or moisture. In many cases packaging fresh produce doesn't require the addition of chemicals or stabilizers to prolong shelf life and natural, clean and green replacements are increasingly being used.

A practical business guide on **clean and green additives for shelf life extension** is planned by Horticulture Wales. This will contain further information about the use of natural additives in horticulture.

- **Transport Packaging** is outer packaging that protects the packaging that is in direct contact with the produce. It is important that handling and storage along the supply chain are done correctly and transport packaging should carry sufficient information to ensure this happens.

However, single use packaging creates waste and steps should be taken to prevent this happening. For more detailed information about packaging Horticulture Wales have developed a Packaging for Horticulture Guide and a Biodegradable Packaging Factsheet, both resources are freely available online.

c. Storage and transit

Maintaining appropriate temperatures and humidity during storage and transit is critical to extend the shelf life of fresh produce.

In general, shelf life of fresh produce can be extended when stored at 0 degrees centigrade. Whereas the optimal humidity range can vary depending on the type of produce.

Did you know?

A 10 degree rise in temperature can shorten shelf life of fresh produce by two to three times. (A. Kader and R. Rolle 2004)

Ideally fresh produce should be cooled before or after packing and stored at optimum temperature and humidity until it is delivered to the customer.

Different **cooling methods** can be used:

- **Room cooling** is generally used for storing produce such as potatoes and cabbage in a refrigerated room.
- Packing fresh produce with crushed **ice** is limited to produce that are not harmed by direct contact with ice.
- **Hydro**-cooling is spraying or immersing produce that will tolerate water.
- **Vacuum** cooling is generally applied to leafy vegetables, such as lettuce.
- **Forced-air** cooling is where fans draw chilled air through produce packed in boxes or pallet bins and is applicable to most types of produce.

Additional steps that can be taken to control humidity include; regulating air movement and ventilation, damping down floors and having moisture barriers in storage and transit.

During **transit** appropriate temperatures should similarly be maintained. Loads should be stacked to enable air circulation and to avoid damage. Vehicles should be cooled prior to loading. Delays between cooling and loading should be avoided. Optimal temperatures should be employed when transporting different types of fresh produce and insulating covers can be used for protecting produce at temperatures below their threshold.

It is vital to regularly measure and monitor the temperature of the produce as a pose to the air temperature in storage and transit. Maintaining appropriate temperature and humidity are both critical to extending the shelf life of fresh produce.

Cooling and transporting produce uses energy. Energy that is derived from fossil fuels emits carbon and contributes to climate change. With the costs of energy forecast to rise it is vital to consider energy efficiency throughout this process.

A practical business guide on **energy efficiency and carbon reduction** is planned by Horticulture Wales. It will contain further information about managing energy use in horticulture.

2. Checklist

This checklist is a quick reminder of the key issues described in this guide. It is not a 'must-do' list but is intended to be used, alongside the links and references provided, to inform your own research when considering your options to extend shelf life.

Do you harvest your produce at the optimum time? The correct time for harvesting can vary for different varieties and in different regions. Unpredictable weather patterns can affect plans and should be factored in.

Can you increase the proportion of your produce sold locally? The time to get fresh produce to market can be critical. Generally, the less time it is spent in transit the better, and 'locally grown' can be an added value proposition.

Is the packaging you use fit for purpose? Does it adequately protect the produce it contains and ensure that it arrives with the customer in the best possible condition? Has consumer recycling and/or reuse been considered?

Have you optimised size and weight? Both the produce and its packaging can take up valuable shelf space and its overall weight can increase fuel use and costs of transit.

Have you considered natural ways to preserve fresh produce and avoid waste? Shelf life plays a key part in food and packaging waste prevention. With consumer interest at an all-time high natural, clean and green preservatives are increasingly available.

To what extent do you monitor temperature and humidity? The storage and transit of fresh produce often requires specific treatment. Regular monitoring of the produce can ensure that this is done effectively.

Have you considered ways to improve energy efficiency in storage and transit? Cooling and transporting fresh produce can use a lot of energy and fuel. With energy costs forecast to rise significantly this should be regularly reviewed to ensure costs are kept down by operating efficiently.

3. Acknowledgments and further reading.

Every effort has been taken to ensure the information contained within this guide is accurate and current at time of writing. Inevitably things do change - technology advances, new innovations happen, legislation changes. Horticulture businesses face unique challenges and many have individual needs so we hope that this guide can be used alongside your own research to help you take-action to extend the shelf life of your produce.

This guide is one of a suite of practical guides that **Horticulture Wales** are developing for the industry, these are freely available online at:
http://horticulturewales.co.uk/resources/packaging- and-waste-reduction/

The following web resources are also provided to help you on your way. Click on the links to access these external websites.

- The **Food and Drink Federation** represent the UK's food manufacturers. They have published guidance on product shelf life: http://www.fdf.org.uk/product-shelf-life-guidance.aspx
- The **Food Standards Agency** are a Government Department to protect public health and consumer interests in food safety. They have published guidance on vacuum and modified atmosphere packaging: https://www.food.gov.uk/business-guidance/vacuum-packaging
- The **United Nations Food and Agriculture Organisation (FAO)** have published resources about the basics of maintaining the quality and safety of horticulture produce: http://www.fao.org/3/y5431e/y5431e00.htm#Contents

Other useful sources of information

A huge variety of articles are available online, some useful ones are listed below:

- https://www.nfuonline.com/nfu-online/sectors/horticulture/nfu-report-fit-for-the-future/
- https://www.slideshare.net/mungereddy/shelf-life-in-horticultural-produce

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