

The background of the slide is a vibrant, close-up photograph of various fresh fruits and vegetables. In the foreground, there are several yellow and red apples, a large green leafy vegetable (possibly chard or spinach), and a bunch of purple and white onions. The produce is fresh and appears to be in a market or farm setting. The overall color palette is rich and natural, with a lot of green, yellow, and red tones.

# SECTOR GUIDANCE NOTE: PREVENTING WASTE IN THE FRUIT AND VEGETABLE SUPPLY CHAIN

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## SECTOR GUIDANCE NOTE: PREVENTING WASTE IN THE FRUIT AND VEGETABLE SECTOR

The fruit and vegetable sector has been identified as the second biggest sector in the food, drink and tobacco industry in terms of waste arisings<sup>1</sup>. It accounts for 13% of waste arisings, second only to meat and poultry at 25%. This represents a significant business opportunity for organisations throughout the supply chain.

This sector guidance note presents key results from WRAP research and other information on reducing waste in the fruit and vegetable sector. It is designed to highlight the issues and show the key actions that organisations in the sector's supply chain can take to prevent waste being produced and save money.

### Headlines

- Between 5% and 25% of a fruit or vegetable crop might not get through the supply chain to retail customers – although the percentage will vary for different products and in different seasons<sup>2</sup>.
- The main cause of product loss is 'out-grading' against the customer's specification, but loss can also arise in the field, in storage and when packing<sup>3</sup>.
- Process improvements using lean manufacturing principles<sup>4</sup> to reduce loss and waste could help to save between £400 million and £500 million a year<sup>2</sup>.
- Annually, about 90,000 tonnes of fresh produce is needlessly sent to landfill with all the embedded carbon and water<sup>2</sup> (excluding household waste).
- Packaging optimisation, including labelling on product storage advice for consumers, will reduce quantities of product and packaging waste.

### Key data and research

Annually, UK households waste 1.9 million tonnes of vegetables and 1.1 million tonnes of fruit, around half of which is avoidable (i.e. could have been eaten). Potatoes, apples and bananas account for 40% of this avoidable waste. Most fruit and vegetables are wasted because they are not used in time<sup>5</sup>.

Fresh produce supply chains are often short and exhibit a high degree of customer awareness. There is also considerable vertical integration and consolidation in the sector. Collaborative relations are also well developed to deliver year-round supply<sup>2</sup>.

The fruit and vegetable sector is highly localised, primarily in England, but Scotland has significant plantings of some crops. The UK's self-sufficiency in fruit and vegetables has declined and we now import about 60% of the total supply<sup>6</sup>.

Sales for certain products are very seasonal and weather dependent. Some products, such as strawberries, do not store, while others, such as potatoes, can be stored nearly all year round.

To investigate waste arisings in the supply chain, WRAP developed 'resource maps' for 11 products chosen because of their importance in household shopping baskets, inherent differences in storage capability and differences in shelf-life. These products are apples, strawberries, raspberries, citrus fruit, tomatoes, avocados, bananas, broccoli, onions, potatoes and lettuce<sup>2</sup>.

An example for onions is shown in Figure 1<sup>2</sup> (next page).

1. Waste arisings in the supply of food and drink to households in the UK [www.wrap.org.uk/content/waste-arisings-supply-food-and-drink-uk-households](http://www.wrap.org.uk/content/waste-arisings-supply-food-and-drink-uk-households)

2. Fruit and Vegetable Resource Maps, WRAP 2011 [www.wrap.org.uk/content/resource-maps-fruit-and-vegetable-sector](http://www.wrap.org.uk/content/resource-maps-fruit-and-vegetable-sector)

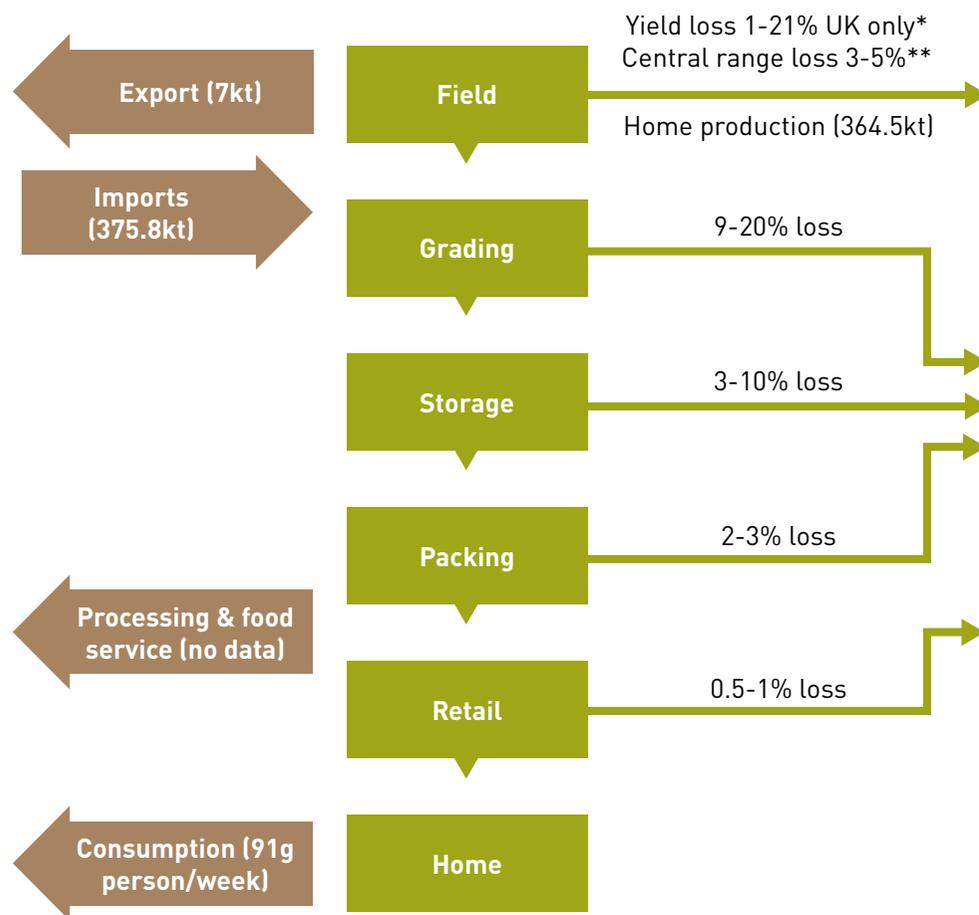
3. Product that is out-graded will obtain a lower return from secondary markets like processing, wholesale and animal feed.

4. The Lean Enterprise Academy [www.leanuk.org/](http://www.leanuk.org/)

5. WRAP announced a reduction in total household food and drink waste of 1.1 million tonnes in November 2011 ([www.wrap.org.uk/hhfwfacts](http://www.wrap.org.uk/hhfwfacts)). Avoidable food and drink waste reduced by 950,000 tonnes annually, and the associated value and environmental impact figures have been updated. Research to update estimates for individual food and drink categories has not yet been carried out. Therefore, all figures relating to the breakdown of avoidable food waste should be regarded as approximate. However, these remain the best estimates available.

6. Report of the Fruit and Vegetables Task Force, Defra 2010 <http://archive.defra.gov.uk/foodfarm/food/policy/partnership/fvtf/index.htm>

Figure 1 WRAP resource map for onions



### Main causes of field loss and waste

1. Harvest damage - affected by weather - small windows of opportunity to harvest (N.B. wet weather during 2008 harvest inhibited access into fields with heavy machinery) but no problems in 2009.
2. Weather affects storage potential.

### Main causes of grading, storing and packing less and waste

1. Specifications (especially visual) are too high and lead to high wastage during grading.
2. No market for small red bulbs (<less than 40 mm diameter).
3. Storage losses due to water loss (increases with duration but dependent on storage regime) and internal defects (bacterial rots).
4. Reliance on storage to cope with small fluctuations in forecast and demand.
5. Much of loss is unavoidable e.g. skins, roots, tops and soil.

### Main causes of retail waste

1. Colder weather slightly increases demand. Hot weather reduces shelf life and increases home waste.
2. Vertical-fill films may actually be increasing waste (at home) due to 'sweating' [RH% too high], yet in-store damage is minimal due to robustness of product.

### Destination and uses of loss and waste

Different markets: primary wholesale, processing (e.g. ready meals) and animal feed (principally for cattle, but mixed with other foodstuffs due to possible risk of meat taint).

Alternative markets: composting (>70% of waste, used on arable land not onion land).

Physical waste: minimal (retail only).

\* No data on field or other losses associated with imported onions.

\*\* % ranges given in the loss stream were sourced from four principal onion suppliers which make up ca. 81% market share.

Grading against customer specifications causes the greatest loss in the supply chain. Products that are 'out-graded' for retail customers can be channelled into secondary markets such as processing operations, wholesale markets and animal feed.

Field losses mostly reflect climatic and growing conditions (which are increasingly affected by variability in weather patterns); although all growers err on the side of caution to ensure they can supply customers, which can lead to overproduction.

While in storage, products dry out, which results in a weight loss of about 1% per month<sup>2</sup>.

Retail waste is between 1% and 3%, although it has not been possible to identify the extent of 'mark downs' and how much produce was sold this way<sup>2</sup>.

Waste that retailers and suppliers typically send to landfill for disposal is, increasingly, being diverted to anaerobic digestion (AD) plants.

### Taking action

The biological nature of fresh products, seasonal crop cycles, growing conditions, and the difficulties of harvesting and storing produce under optimum conditions is a challenge for the whole supply chain and requires strong management and collaboration.

The development of key performance indicators (KPIs)<sup>7</sup>, data capturing systems in companies and benchmarking will lead to improved resource efficiency practices.

The practices on the following pages are designed to prevent waste in the supply chain from field to fork.



7. Key performance indicators. Evidence shows that establishing KPIs leads to good performance because measurement helps to identify areas to improve and target setting gives team members an incentive to improve.

## 1. Review customers' specifications

Consumer expectations of quality have increased continually. However, recent research<sup>8</sup> shows that food waste is the most important environmental concern of shoppers. Despite some awareness that misshapen fruit and vegetables are perfectly edible, other quality defects (e.g. rots and greening on potatoes) would result in the produce being rejected by the shopper or thrown away<sup>9</sup>.

Losses at grading, which can vary between 5% and 25%, can be based on aesthetic appearance or rudimentary control measures (for example, Brix tests that measure sugar content) that are recognised by the scientific community as not being appropriate for some fruit and vegetables. Although the crop is fully used, in that small and diminishing amounts are sent to landfill, there is an opportunity for increased financial returns by changing certain management practices.

### Solutions

- While value lines have proved to be successful, they have not resulted in significant changes to specifications (except, perhaps, on size), which remain above European marketing standards. However, there may be potential to introduce new value lines for certain fruit and vegetables, and review the specifications without compromising key quality criteria.
- Natural variability in products arises for climatic and other reasons. There needs to be greater flexibility to take these variations into account, particularly in the transition between seasons and hemispheres, and between storage regimes.
- The current economic climate provides an opportunity to reintroduce promotion campaigns for misshapen fruit and vegetables<sup>10</sup>.

## 2. Improve process efficiency

Harvesting, washing, grading and packing are standard operations that can all be improved by more widespread use of 'lean manufacturing' principles<sup>4</sup>. In particular, studies show that 'overall effective efficiency (OEE)' measures are not widely collected. However, when this is done, they indicate that performance could be improved<sup>11</sup>. The wider application of lean improvement tools could help reduce waste and save money without impacting on quality.

### Solutions

- There is no substitute for measuring waste and understanding why it arises. Use a tool such as value stream mapping in the first instance – WRAP can help you understand and apply mapping to your supply chain: [www.nwlean.net/toolsCD/VSM/4%20steps%20to%20VSM.pdf](http://www.nwlean.net/toolsCD/VSM/4%20steps%20to%20VSM.pdf)
- Find your waste hotspots and apply lean tools (e.g. 5S, standard operations, OEE and Takt time) to improve performance<sup>4</sup>.
- See case studies<sup>12</sup> and learn how others have applied and benefitted from lean production techniques<sup>11</sup>.

8. Environmental Sustainability, IGD Shopper Track (2011). <http://shoppervista.igd.com/Hub.aspx?id=26&tid=5&dcid=2237>

9. Reducing supply chain and consumer potato waste, WRAP 2011. [www.wrap.org.uk/content/reducing-supply-chain-and-consumer-potato-waste](http://www.wrap.org.uk/content/reducing-supply-chain-and-consumer-potato-waste)

10. [www.waitrose.presscentre.com/Press-Releases/New-Ugly-Apples-Prove-Beauty-Is-Only-Skin-deep-7f8.aspx](http://www.waitrose.presscentre.com/Press-Releases/New-Ugly-Apples-Prove-Beauty-Is-Only-Skin-deep-7f8.aspx)

11. Applying lean thinking to the fresh produce industry [www.igd.com/index.asp?id=1&fid=5&sid=45&cid=979](http://www.igd.com/index.asp?id=1&fid=5&sid=45&cid=979)

12. Getting in Control of Waste by Weight [www.igd.com/index.asp?id=1&fid=5&sid=43&tid=158&foid=127&cid=1705](http://www.igd.com/index.asp?id=1&fid=5&sid=43&tid=158&foid=127&cid=1705)

### 3. Optimise packaging

Skins and peel act as 'natural packaging' to protect many fresh products. However, most products can be easily damaged and require robust support. When given a choice, consumers prefer prepacked produce over loose. Packaging can extend shelf-life, which can reduce food waste. Packaging optimisation needs to consider the whole supply chain, including the home and ultimate disposal.

Loose products can often be damaged. However, careful merchandising (for example, the banana hammock developed by Tesco) can protect fruit and, in the case of bananas, display them at various stages of ripeness.

#### Solutions

- Optimising packaging reduces quantities of product and packaging waste. It includes redesign<sup>13, 14</sup> (e.g. heat sealing in place of clip-on lids), pre-printed film in place of paper labels, and using more post-consumer waste in trays and punnets. Compostable punnets can now be made from a wide range of biodegradable material to light-weight and improve recyclability.
- Technical improvements to secondary and tertiary packaging are evolving. For example, research into modified atmosphere liners have shown their potential when correct temperature regimes are managed in storage<sup>15</sup>. Research on ethylene control could be further exploited across a wider range of products<sup>16</sup>. This means keeping abreast of key research programmes at academic institutions – see also WRAP's database on innovations<sup>17</sup>. Microporous layers at the base of punnets are extending shelf-life.
- Several retailers now provide advice on how best to store products at home. This can take the form of, for example, 'best kept' stickers used by Morrisons to advise on whether food is best kept in the fridge, in a cool dark place or at room temperature. Storage instructions indicate the optimum conditions under which products should be kept to maintain freshness.

13. Seal Technology on Salad Bags [www.wrap.org.uk/content/optimising-film-packaging](http://www.wrap.org.uk/content/optimising-film-packaging)

14. New Pack Format [www.igd.com/index.asp?id=1&fid=5&sid=43&tid=158&foid=127&cid=1724](http://www.igd.com/index.asp?id=1&fid=5&sid=43&tid=158&foid=127&cid=1724)

15. Using packaging technology to reduce fresh fruit wastage, WRAP 2011 [www.wrap.org.uk/content/optimising-film-packaging](http://www.wrap.org.uk/content/optimising-film-packaging)

### 4. Supply chain communications

Few, fully dedicated supply chains exist for the 11 products studied in the WRAP project. Good supply chain communication between retailer, packer and grower is an important factor. A whole crop cycle approach will involve crop planning based on consumer trends and business objectives, planting plans and ongoing discussions throughout the growing season, particularly if the crop is ahead of or behind schedule.

#### Solutions

- Over planting (other than to allow for climatic uncertainties) can be avoided if there is good crop planning agreed by all stages of the supply chain.
- Flexibility (e.g. introducing a promotion if there is an unexpected glut or a change in specification because the crop has not matured as planned) can result from good two-way communications.
- Involving all stages of the supply chain in forecasting and agreeing one common approach.
- Fixed order quantities can be effective at reducing waste and have worked well in horticulture.

### 5. Data transparency

Clear accountability is a prerequisite for managing waste. Organisations that have a person responsible for waste management tend to have a much better understanding of the scale and causes of the waste problem. Measurement is a first step for reducing waste. It can lead to better understanding of the causes of waste and can promote best practice.

Companies such as Produce World have started to publish resource efficiency indicators. More openness and the use of a common metric (e.g. tonnes) helps to share best practice.

16. Ethylene and microbial hotspots in the fresh produce supply chain, WRAP [www.wrap.org.uk/content/ethylene-and-fungal-control-strategies-reduce-waste-fresh-produce](http://www.wrap.org.uk/content/ethylene-and-fungal-control-strategies-reduce-waste-fresh-produce)

17. [www.wrap.org.uk/content/resource-efficient-innovations-database-reid-0](http://www.wrap.org.uk/content/resource-efficient-innovations-database-reid-0)

# For further information on resource efficiency in the retail sector, please visit

[www.wrap.org.uk/retail](http://www.wrap.org.uk/retail)

or email

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