

## **Economic Commission for Europe**

### **Steering Committee on Trade Capacity and Standards**

#### **Working Party on Agricultural Quality Standards**

#### **Specialized Section on Standardization of Fresh Fruit and Vegetables**

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#### **Sustainable Development Goal 12 and sustainable practices**

### **Code of Good Practice: reducing food loss and ensuring optimum handling of fresh fruit and vegetables along the value chain**

The following proposal was submitted by the delegation of Sweden, as the Rapporteur for the Working Group on developing an extended Code of Good Practice. The document is presented for information purposes to the Specialized Section.

#### **Introduction**

Fruit and vegetables are sold internationally, as well as locally, regionally and nationally. They are frequently traded over large distances and involve several actors. A continuous challenge is to reduce waste and losses, and this requires great care, attention and cooperation along all the entire value chain.

The perishable nature of most fruits and vegetables means that loss and waste of products can be high. The problem of waste, in particular, has received much attention in recent years because of the impact on the environment.

Much can be gained, including economically, from taking measures to reduce the losses and the waste. According to estimates, investments in measures to reduce losses and waste in food can give a 14-fold return.<sup>1</sup> A clear business case for the Food supply chain actors involved!

The Code of Good Practice supports the United Nations Sustainability Goal 12.3 on reducing food loss and waste: "By 2030, halve per capita global food waste at the retail and consumer level and reduce food losses along production and supply chains, including post-harvest losses."

This Code of Good Practice has been elaborated by the United Nations Economic Commission for Europe (UNECE) in order to provide guidance to the sector on how to reduce losses and waste in the sector. While the Code of Conduct<sup>1</sup> for food loss and waste, developed by the FAO, is a generic framework, this Code of Good Practice specifically addresses fresh fruit and vegetables. It contains actions and measures that public and private stakeholders are advised to take or put in place in order to contribute to reducing losses and waste of fresh fruit and vegetables. It is aimed at strengthening the work on reducing food losses waste and the associated costs that is already being done by many Food supply chain actors.

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<sup>1</sup> The Code of Conduct can be found at: [\[find link\]](#).

The Code of Good Practice sets out measures to be taken, at the stages in the value chain before the fruit and vegetables reach the consumer, i.e. from harvest to retail. It is intended to support continued improvement, step by step. Real improvement, however, can only be achieved if the Food Supply chain actors cooperate to improve their logistics, handling and planning, both inside countries and across borders. Communication will be a key factor. Measuring waste will give Food supply chain actors feedback on how well their work progresses.

The Code consists of four distinct chapters which focus on the four major segments of the fruit and vegetable supply chain – producers, traders and retailers, transport. The chapters can be used individually.

It is followed by XX annexes and a select list of reading matter that describes in detail the processes that regulate fruit and vegetable during growth, maturation, ripening and senescence and the best handling and storage practices.

## **1. Primary producers**

**Producers adhering to the Code of Good Practice undertake to do the following:**

### **1.1 Follow the principles of Good Agricultural, Hygienic and Manufacturing practices**

The following principles are designed to help reduce food loss and waste:

- **Good Agricultural Practices** – including dedicated farm techniques, such as conventional, organic or Integrated pest management principles that maximize yield, minimize losses in the field and lead to sound produce – are a collection of principles to apply for on-farm production and post-production processes including good post-harvest practices [1.2], resulting in safe and healthy food and non-agricultural products, while taking into account economic, social and environmental sustainability.
- **Good Hygienic Practices** are a set of quality assurance practices to ensure that hygienic processes are rigorously set and monitored.
- **Good Manufacturing Practices** are a set of quality assurance practices to ensure that manufacturing processes are rigorously set and monitored.

It is highly recommended to proceed in accordance with these principles at all stages from harvest to retailer.

### **1.2 Ensure proper training of staff**

Staff working with fresh fruit and vegetables at all stages of the distribution chain should be trained in how to handle the products and have a good knowledge of the consequences of shortcomings in handling and storing products. They should understand the impact of poor handling and storing practices on quality, shelf life and waste, and on loss of profit for the company. Producers are encouraged to provide training on proper product handling at harvest and post-harvest stages and to understand the consequences on environment, climate and profitability of not adhering to the recommendations.

Handling guides per product developed taking into account the level of education of the high-labour force turnover of harvesters may be a useful tool for this. The guides should highlight quality affecting key parameters and appropriate practices. Special attention must be paid to grading as this sets the waste in the chain pace. [include reference pages]

### 1.3 Plan production to demand

Production should meet market demand in terms of both quantity and quality. This means planning the produced volume to the expected demand, at different times, of a species, variety, size, colour and quality, as well as price level. It is also important to consider maturity stage at harvest, expected shelf life and type of product as some products may continue to develop added taste and aroma after harvest (climacteric fruit) whereas others do not (non-climacteric fruit)<sup>2</sup>.

On local markets, the direct communication between producer/seller and buyer will give the producer valuable information on the buyers' preferences and demands. In value chains stretching over country borders or even continents, good communication along the chain will help convey information on market demand to producers located far away from the final market.

International trade standards, which are drawn up with major input from the market, are commonly agreed descriptions of the quality expected and therefore provide valuable information on quality requirements. There may also be more detailed and often more stringent requirements in the specifications from the commercial buyer.

By collecting information on market demand and planning production based on the quality standards and specifications, producers reduce the risk of products remaining unsold at the farm, of products being rejected upon arrival at wholesale level or of not being chosen by the consumer and therefore remaining unsold.

### 1.4 Use the best possible harvest methods

The best possible harvest methods need to be used for product quality and shelf-life. Unless products are carefully handled and the correct equipment is used properly, products can easily be damaged during harvest. All mechanical impact on products – cuts, bruises, tearing, breakages, etc. – will reduce their quality, shorten their storage and shelf life, and increase waste.

For mechanical harvesting, it is very important to choose equipment that does not damage products. The quality of the harvested product will be influenced not only by the way the harvesting equipment is used but also by the experience and skill of the driver of a harvester.

If products are harvested manually, staff must be trained to handle products carefully. When products are cut, the use of sharp, disinfected knives or scissors that cut through a thin layer of cells will give a better result than blunt edges damaging a greater area in the cutting zone. And if boxes, bins and harvest bags are lined, potential damage to products will be minimized.

Soft-skinned fruit is particularly easy to damage. The careful handling at harvest and adherence of staff to personal hygiene is important. Studies have shown that even protruding fingernails can easily cause damage to soft-skinned fruit, reducing quality and increasing waste. The use of gloves when harvesting sensitive fruit can therefore help considerably.

Harvesters should also be trained on how to harvest produce items at the right stage of maturity. Due to the fast ripening process of tropical fruit harvesting at the right stage of maturity is particularly important for these fruits. Direct contact of immature fruit with more mature fruit can cause damage and quality losses.

Raising awareness and training staff in correct maintenance and use of equipment is important. For producers who do not own machines, wherever machinery is able to improve harvest results, it is recommended to consolidate amongst several producers.

<sup>2</sup> Climacteric fruit have a pronounced ripening stage where the fruit attains a softer texture and a change in taste and aroma. Non-climacteric fruit lack this pronounced ripening stage and ripening there are no major changes in texture and taste after harvest.

## 1.5 Harvest products at the best conditions

Time of day and weather conditions at harvest can affect the post-harvest quality of products. It is scientifically proven that harvesting early in the day while products are still cool from the night and before the sun is high and temperatures have risen is likely to limit water losses and reduce the rate of senescence (i.e. the ageing of the fruit and vegetables). Leafy products and other products with a high surface to volume ratio (f.ex. broccoli) that easily lose water benefit most from this. Nonetheless, it is important to highlight that this does not apply for fruits when they still have condensed moisture on their surface. For fruits and for fruit vegetables it is important that early harvest be done after the water droplets on the surface evaporates. In all cases, the shorter the normal shelf life of a product, the greater the benefit of the harvest early in the day. Higher temperatures will also speed up the ripening process.

Sunshine, high temperatures and wind will increase water losses and speed up the ageing of products. Products should therefore be taken to a storehouse as soon as possible using a means of transport that minimizes damage and maintains the quality of the products in the best possible way.

While still in the field, products need to be protected from sun, wind, rain, dust and any other factors affecting their quality by, for example, being placed in covered containers or under a tree or in a shed. Humid weather makes fruit more water saturated (high turgor pressure), and this in turn

makes fruit bruise more easily. For many fruits, harvesting in humid weather conditions should be avoided if possible.

## 1.6 Ensure rapid cooling

The single most important factor for retaining product quality after harvest is temperature. Suboptimal cool or cold chain processes and management account for much food loss. The higher the temperature at harvest and the more sensitive the products, the greater the benefit from cooling<sup>3</sup>.

There is thus much to gain from rapid and efficient cooling of products after harvest. If cooling is available, products should be cooled to the recommended temperature as quickly as possible without harming the product. Products should be cooled before transport, with the exception of short transports to a storage facility or packhouse. The cooling equipment of transport vehicles does not have the power to lower product temperature, just maintain it.

When pre-cooling facilities are not available it is even more important to harvest at the coolest time of the day (i.e., early harvest) and to transfer the produce to a shadowed area as soon as possible.

Products that contain much air – for example, leafy vegetables – take a long time to cool. Certain cooling techniques such as forced air and vacuum cooling speed up the cooling process and reduce the risk that the interior of pallets remains uncooled after harvest cooling. To avoid dehydration they must be combined with high humidity.

Products with a large surface-to-volume ratio – for example, leafy vegetables and broccoli – easily lose water during harvest cooling. Most products, but these in particular, benefit from high air humidity during cooling to prevent them from rapidly losing water.

Subtropical and tropical products develop chilling injuries when kept at lower, though non-freezing, temperatures. Attention should therefore be paid to ensuring appropriate storage temperatures so that products sensitive to chilling are not subjected to temperatures below those that may cause chilling injury (See annex II for recommended lowest storage temperatures).

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<sup>3</sup> Annex X sets out optimal temperatures for the most important fruits and vegetables.

## 1.7 Store products appropriately

When products are stored prior to dispatch, they should be stored at their appropriate, product-specific temperature to retain the visible quality, keeping quality and to reduce food loss and waste. The longer the storage period the greater the gain in storing products as close to their optimum storage temperature as possible. A low temperature will reduce the aging of products and reduce the growth of plant pathogens.

When products have reached their optimum storage temperature, air circulation should be reduced to a minimum, just ensuring removal of respiration heat and gas exchange around products as air circulation will cause dehydration and loss of freshness.

Frequent changes in temperature also reduce produce shelf life. Taking products from cool storage and back should therefore be avoided.

The use of Controlled atmosphere technology<sup>4</sup> during long-term storage can extend the life of products extensively and reduce losses. However conditions, i.e. level of oxygen and carbon dioxide, need to be closely monitored for different crops and even varieties.

When refrigerated storage is not available, products should be kept at the best possible conditions and protected from sun, rain, wind, and dust. If kept outside a clean tarpaulin can provide some protection.

Humidity is another important factor to consider as freshness is an important quality parameter in most products. Leafy vegetables and other products with a large surface to volume ratio (f.ex.broccoli), will quickly lose water in dry conditions, especially in combination with high speed air circulation or wind. Lowering the temperature will increase relative humidity in the air, but may damage the produce due to dehydration if the water vapor content remains too low.

High speed air circulation is important during cooling after harvest as it speeds up the cooling process, but must then be combined with high moisture. After products have reached their optimum temperature, air circulation should be low, but allowing for the removal of respiration heat.

Relative humidity can be controlled by the temperature of the storing facility and/or controlling the moisture in the air of the facility (e.g., mists, spraying water and/or leaving water tins inside the storage facility are practical alternatives).

In addition, products producing ethylene (climacteric fruits, see annex ?) and products that are sensitive to ethylene (see annex ?) should not be transported together but in separate vehicles, trailers, containers or compartments to avoid damages or shortening the shelf-life of the ethylene sensitive products.

## 1.8 Choose appropriate packaging

Appropriate packaging need to be chosen to protect products during transport and distribution. The cost and quantity of packaging material should be balanced against sufficient protection and buyer requirements.

Packaging is often chosen as the result of a dialogue between seller and buyer. The wish to fill packages and thereby use space in storage and transportation efficiently should be weighed against the risk of causing damage to the products when packages are put on top of each other in a pallet.

Packages must be of a quality, strength and characteristic to protect the produce during transport and handling and maximize air circulation for effective cooling. Clean materials should be used to protect the produce from foreign matter such as leaves, sand or soil, which could negatively affect the produce and its presentation. A visible lack of cleanliness in several packages could result in the goods being rejected. Bruising caused by vibration during

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<sup>4</sup> In Controlled atmosphere the level of oxygen in the storage room is reduced and the level of carbon dioxide is increased compared to normal air. As a result, product respiration and ethylene production decreases which reduces aging and loss of nutrients in the stored products.

the transport and distribution can be minimized by using appropriate packaging as well as properly inflated vehicle tyres.

For products that bruise easily, the use of trays should be considered. For many products, modified atmosphere may extend shelf life and reduce waste.

Durable reusable crates which could be cleaned in a proper way, could be used between actors with a long-term relationship and if an exchange of full and empty crates is feasible. This would ensure the continuous use of suitable packaging.

## **1.9 Stack boxes and crates appropriately**

Produce particularly in cartons/cardboard boxes and crates should not be stacked too high on pallets exceeding the individual container stacking strength. The stacking strength is built (into their sidewalls and sometimes printed on the carton) to resist crushing when stacked correctly. Handling staff should adhere to the maximum height of unbroken pallet loads received from the wholesaler or exporter. Proper stacking includes following the lengthwise and crosswise method that aligns the carton vent holes in the correct direction to allow air circulation throughout the stacked containers.

The most common height for wholesale units is seven to eight layers high, whereas single layer boxes containing retail units can be stacked higher. Often products with large individual sizes such as melons, pumpkins and other such gourds are packed in pallet bins; while tubercule vegetables such as carrots, turnips, beets and onions are packed in mesh bags or loose in boxes. Irrespective of the container there is an appropriate stacking method applied.

All pallets can be both under stacked and over-stacked in storage. Both practices have cost implications for the trader and retailer.

Under-stacking of pallets may result in:

- Less efficient use of the refrigerated storage/holding space
- An increased risk of placing containers of other produce atop the stack and mixing non-compatible produce.
- Giving an incomplete tally of number of cartons/containers available (if only the number of pallets is counted) that can lead to inappropriate volumes being ordered.

Over-stacking of pallets may result in:

- Crushing of the packages at the lowest level and damaging the produce.
- Restricting efficient cold air circulation within the stack.
- Rougher handling by staff (manually and with equipment such as pallet jacks and forklifts).
- Posing direct threats to the safety of the workers who may have problems reaching the top layers and buy forklift operators to see around them.
- Inability to re-use cardboard boxes and plastic crates due to being damaged.
- Placing packages on pallets and not directly on the floor in storage:
  - enables the ease of handling through the use of machinery for loading and unloading,
  - facilitates circulation of cool air throughout every produce container in the stack,
  - contributes to sanitary conditions in storage and helps address consumer food safety concerns.

## **1.10 Post-harvest treatments may be considered**

Post-harvest treatments to increase shelf life and reduce losses and waste are available for both organic and non-organic production of fruit and vegetables. When used, they must be authorized by the producing country and the country of destination.

Post-harvest treatments may have several positive effects, such as:

- Reducing water loss, and thereby delaying weight loss and loss of freshness
- Limiting the exchange of oxygen and carbon dioxide between the product and the surrounding air (creation of a modified atmosphere), which delays ripening and senescence and may delay loss of the nutritional value of products.
- Restricting the presence and access of insects and other pests as much as possible in order to avoid immediate losses and losses occurring at a later point in time.

### **1.11 Ensure quick deliveries**

Products that are not fit for long storage should be delivered as soon after harvest as possible. Delivering harvested products without delay to warehouses or cooling facilities decreases waste throughout the distribution chain.

Harvested products that are normally not fit for long-term storage have a limited shelf life. The length of the shelf life depends on the climatic conditions in which they are harvested, transported, graded, packed, distributed, stored and displayed. Temperature has the greatest effect, but humidity and air circulation may also play a role.

The “age” of a product is largely determined by temperature and time. The shorter the time from harvest to retailer, the better the quality and the longer the shelf life.

Although a large share of food waste takes place at consumer level, part of this waste is caused by too short a shelf life remaining when products reach the consumer.

### **1.12 Record quality affecting parameters**

Parameters that affect quality such as temperature, humidity, harvest time, etc. at harvest/ transport to packing house/ grading/ packaging / storage should be monitored and recorded for easier traceability and implementation of corrective measures. They should be recorded per handling stage and for every shipment.

### **1.13 Report outbound quality**

Reducing waste in the global food chain starts by supplying the appropriate quality into the system. It is recommended that producers create “outbound quality control reports”, that mirror the quality reports of their clients i.e. know what critical quality parameters the client monitors and check the same (with photographs) when product is ready for sendoff. This allows for corrective measures to be taken prior to departure, or warning client to know what to expect and avoid rejections.

### **1.14 Find alternative outlets**

#### *Oversupply products*

Weather conditions may cause more products to be ready for harvest at the same time than was planned. These products meet buyer quality requirements but face a saturated market. Producers should therefore have in place alternative outlets and uses for products that cannot be placed on the intended market and/or sold to the intended buyer. However, accessing the alternative markets may require an adjustment of price]

[The following alternatives are examples that might be considered:

- Find alternative outlets, new markets or destinations, e.g. in the HORECA sector. To facilitate these alternatives, electronic marketplaces for unsold/ surplus products are being developed in some countries.
- Change presentation to address new market segments

- Find buyers that can process (industrial) for food purposes
- Find buyers that can process into fresh-cut fruits and vegetables or other novelty products
- Process products on-site, e.g. drying, fermentation etc. to make them durable and to address new market segments
- Donate to charity, respecting applicable guidelines <sup>5</sup>
- Use surpluses for non-food economic uses, such as animal feed, energy generation, fertilizers, etc.

If no alternative outlet can be found, products should be treated in a way that limits the negative effects on the environment. [make sure wording is in line w/FAO vocabulary ‘food loss/food waste’. Felicitas to look at.]

#### *Products not meeting buyer specifications*

I all production, part of the crop will not meet the requirements specified by the buyers that the products are normally sold to.

A good communication with buyers is therefore important in order to know clearly what the buyer expects but also to increase the buyer’s knowledge and understanding regarding certain defects. It can raise an interest in the buyer for selling products with exterior defects as for example “rescued produce” in order to contribute to reducing losses and waste. If products are sold in quality categories, a lower category will often accommodate most of the products with exterior defects thanks to the higher tolerances in lower categories.

If products cannot be sold to the “normal” buyer in a lower category or as “rescued produce” or equivalent, the alternatives under 1.12 above can also be considered.

### **1.15 Measure the losses**

Producers that are aware of their food loss volume and that understand the causes and have the means to measure it, should have a greater capacity to reduce the loss than those that do not. This implies that the producers identify problem areas and manage the food losses through targeted interventions. This enables them to start a learning process that serves as an important tool for finding remedial measures that lead to reduced loss. [DL]

Such results can be used, not only for future planning but also for the implementation of measures related to handling, temperatures, transport, logistics etc. Apart from the aspect of reducing losses there are strong business incentives to implement this Code of Good Practice because money spent on reducing loss and waste is reported to give up to an estimated 14-fold <sup>6</sup> return on the money spent. (For further details, see the UNECE measuring methodology in Annex III.)

Primary producers and actors in food production that understand the causes of food waste and measure it have a greater capacity to reduce waste at the source. This implies that most actors acknowledge there is a problem, measure the loss, identify hotspots and manage the food losses through targeted interventions. Actors that regularly measure waste can identify more easily the hotspots for this waste (where it happens) and review the results to start a learning process. This is an important tool for finding measures that lead to reduced waste.

The results can be used not only for future planning but also for the implementation of measures related to cultivation, handling, temperatures, transport, logistics etc. Apart from the aspect of reducing waste, there is a strong business incentive to carry out this work since money spent on reducing waste is reported to give an estimated 14-fold return on the money spent.<sup>5</sup>

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<sup>5</sup> One example is the EU recommendations on food donations (link)  
<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2017:361:FULL&from=EN>



## 1.16 Local government interaction

Submit/ communicate waste data to the local government or the agricultural office. This information opens opportunities for public measures (e.g. redistribution of surpluses into shortage areas). The UNECE digital food loss management system named FeedUP@UN allows the collection of data and may facilitate redistribution of products.

## 2. Traders

**Traders – buyers, wholesalers and sales departments of retail chains – adhering to the Code of Good Practice undertake to do the following:**

This heading covers quite a wide range of actors along the value chain of fresh fruits and vegetables. It may be a cooperative or producer organization collecting and marketing their members' production and also storing, sorting and packing their produce. It can also be a private company buying products and selling them to buyers locally or far away as exporting actors. Furthermore it can be wholesalers connected to retailer chains, supplying their retail stores. Many of these actors see and handle large volumes of products. Small changes in their handling practices can therefore make major contributions to reducing losses and also waste at the following retail level.

### 2.1 Ensure proper training of staff

Warehouse and Quality control staff working with fresh fruit and vegetables should be trained in how to handle the products and have a good knowledge of the consequences of shortcomings in handling and storing products. They should understand the impact of poor handling and storing practices on quality, shelf life and waste, and on loss of profit.

Traders are encouraged to provide training on proper product handling and to understand the consequences on environment, climate and profitability of not adhering to the recommendations. Handling guides per product developed taking into account the level of education and the high-labour force turnover may be a useful tool for this. The guides should highlight appropriate practices and key parameters affecting quality. Special attention must be paid to sorting and grading as this affects food losses and waste throughout the chain .]

In addition sales personnel need to be trained on the urgency of selling products within shelf-life limits so as to avoid food losses and waste,

(Note: Look at CODEX *code of good hygiene practice* wording).

### 2.2 Plan ordered volumes to demand

Planning and adjusting ordered volumes to market demand via careful product planning is necessary to ensure that products ordered can be delivered to retailers without unnecessary delay and thus with minimal losses. Careful product planning also includes harvesting at market maturity and having logistical arrangements that facilitate product arrival at retail stage with a longer shelf life remaining, i.e. fresher and better quality leading to reduced loss and waste at both retail and at consumer levels. Products delivered to clients must meet quality specifications, including maturity, so as to avoid rejections or disputes that can lead to waste of these at client or consumer level.

Fresh fruit and vegetable demand varies depending on weather, season, holidays and celebrations. For some products, demand periods are well established, whereas for others they are less predictable, thereby making planning more difficult. Procurement staff are required to speculate less and employ demand planning strategies and tools, to minimize as much uncertainty as possible.

An efficient chain from harvest to retailer requires market knowledge and careful planning as well as implementing the plan. Planning involves pre-guaranteeing sales volumes of

different products, but also for example trade types, varieties, sizes, quality classes/ grades, colour requirements and maturity level/stage of ripeness. Good communication with both clients and suppliers is very important to coordinate market supply and demand. [Give example(s)]

### **2.3 Ensure efficient logistics**

An efficient logistics chain that reduces the time from producer or packer to retailer is important for ensuring an appropriate shelf-life of perishable products for retail and consumer stages. Such efficiency reduces quality losses and waste along the chain.

An efficient logistics chain has no more stops and reloading points than necessary. Stops should be short and reloading conducted effectively and efficiently. Strict first-in, first-out principle must be followed, as long as the quality of the produce is also aligned. In the case that a later delivery has more sensitive products (shorter shelf-life), these must be prioritized. Quality control staff are encouraged to frequently monitor the quality of the products in the warehouse. In the absence of automatic systems, environmental conditions should also be monitored.

### **2.4 Place and change orders in timely manner**

Orders should be placed in a timely manner that gives the producers enough time to harvest products at the appropriate time of day, cool products to the appropriate temperature, sort/ grade and pack according to specifications given. If orders are placed or changed shortly before time of dispatch producers may have to send products that are not properly cooled. This will reduce the shelf life of the products and increase food loss and waste. It may also lead to sorting and packing having to be done too quickly to allow for careful handling and for quality assurance to be carried out properly. In cases where orders are placed in foreign countries requiring several days or weeks of sea travel last minute orders is often not feasible.

### **2.5 Avoid late cancellations<sup>7</sup>**

Orders of perishable products that are cancelled at short notice close to dispatch makes finding a new buyer difficult, often leading to food loss. This problem is more severe when the product is packed in specific branded packaging of the retailer which cannot be sold to another retailer without costly repackaging and additional risk of damages by handling.

In cases of orders placed in foreign countries requiring several days or weeks of sea travel to destination markets, order cancellations may not be feasible, or can result in high rates of food loss in producing countries; particularly if the product is not part of the country's diet.

The frequent cause of late cancellations is often that market demand for a product, at a given time, is lower than when the buyer originally placed the order. In some cases when it is impossible to change the order (product is located at the shipping port, or already loaded on the means of transport), the products may therefore still be wasted upon arrival at the destination market. In these cases, the buyer should consider measures to promote the sale of these products.

The negative impact of a late cancellation will be particularly severe if an order is cancelled for example after a producer has opened a cold store or a Controlled Atmosphere (CA) store and removed the products from the storage room. Once a CA store has been opened, the fruit must be moved into the distribution chain.

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<sup>7</sup> Some countries or regions have adopted legislation addressing this problem. One example is the EU that has adopted a regulation directive on Unfair Trading Practices which includes a section on cancellation of orders (EU /2019/633).

## 2.6 Define clear specifications

Retailers' specifications, including quality requirements, correct maturity for the intended purpose and labelling should be clearly defined in advance and in dialogue and/ or purchase agreements with producers, in order to avoid causing unnecessary loss/ waste (alt. such a way that unnecessary waste is avoided).

Retailers' specifications on quality should, as far as possible, be identical to the marketing standards<sup>8</sup> developed for trading fresh fruits and vegetables. Additional quality requirements, added to the requirements in the trade standards, should be kept at a minimum in order to reduce transaction costs, losses and waste. An increased acceptance and therefore sale of products with exterior defects not affecting the eating quality will reduce losses at primary production.

Trading parties should be mindful of specifications that might require grading, sorting or trimming of produce that might lead to avoidable food waste (examples: trimming to the same size or length to fit into a specific package, refusing specific sizes or varieties as not being part of the goods accounting. Trading parties should also take note that some products such as tropical root crops (for ex. yams and ginger) must be trimmed during harvest. This knowledge is very important to avoid food wastage.

Fruit and vegetables needs to have reached an appropriate stage or degree of development when harvested to have sufficient shelf life and appropriate quality for the intended purpose. This stage is called horticultural maturity<sup>9</sup>. Horticultural maturity is thus any stage from a seedling (sprouts), a tender spring carrot, a shoot (asparagus), undeveloped flowers (broccoli) and all the way to ripe and fully developed fruits (apples, peaches etc.) Climacteric fruit such as apples, pears and peaches must attain an appropriate degree of development to ensure proper completion of the ripening process and develop the expected taste, aroma and texture i.e. physiological maturity<sup>10</sup>.

The correct maturity is also important for products to be able to withstand transportation and handling and have a sufficient shelf-life for retail and at consumer level.

It is of utmost importance that trading parties understand and have the same interpretation of the terms "maturity" (in fruits<sup>11</sup>) and "sufficiently developed" (in vegetables and root crops).

Consumers may be very eager to buy early season products at a premium price. However, if these early season products are marketed before they have reached the appropriate maturity they may not be able to ripen properly and reach the desired quality. Consumers may then throw these products away and avoid buying such products again, either in the near future or permanently – even when better qualities are available. This will have a negative impact on price and demand of such products for an extended period of time, as well as the reputation of the supplier/producer.

It is important that the trader knows that the different varieties from the same region or country, of many fruits, for example apples and pears, mature and ripen at different times. As such they should be also marketed at different times. Each variety should be placed on the market at the correct time to avoid low eating quality and eventually the products being wasted. One of the best ways to avoid this is to have good communication with producers, and seek and respect their advice.

The best way to avoid losses and waste connected to maturity is to follow the guidelines as set out in the OECD brochures for fresh fruit and vegetables and to have a good adherence among producers and traders in respect to the international standards in regard to the maturity requirements and to seriously respect the advice given by producers and traders. The OECD brochures are acknowledged worldwide as a prime reference to interpret international

<sup>8</sup> International marketing standards developed by UNECE or CODEX.

<sup>9</sup> Horticultural Maturity: The stage of development when a plant part possesses the necessary characteristics for use by consumers

<sup>10</sup> Physiological maturity: The stage of development when a plant part will continue development even if detached;

<sup>11</sup> Including fruit vegetables such as tomatoes, cucumbers, aubergines, zucchini.

standards. Their adoption should be agreed on between producers and buyers (wholesalers and importers) and between seller (wholesalers and importers) and retailer. (link to OECD and ECE brochures in a footnote).

## 2.7 Control ordered products at arrival

The buyer (wholesaler or importer) should inform the supplier of the inspection protocol that produce undergo upon arrival. This is important because in many cases produce undergo food safety and plant health inspections before quality/conformity assessment. Additionally, it is prudent for both parties to:

- Apply an agreed inspection procedure
- Set up a control protocol specifying the defects and the percentage of non-conforming products
- Communicating complaints/claims to the supplier in preferably a written report format such as the inspection report and within a timely manner after the products are inspected and/or have arrived at the buyer's premises
- Establish, if possible, the likely reason for the non-conformity and possible actions that can be undertaken to reduce food loss and waste (reconditioning, downgrading, processing, feed).

Rejection of products at wholesale level due to products not fulfilling the requirements of a quality standard or the requirements that have been agreed by buyer and supplier constitutes a major cause of waste.

An added difficulty is that buyers and suppliers do not always agree on whether products are in conformity. However, when the complaint is fair, and is justified by photos and additional supporting evidence, common agreement is facilitated.

When evidence in the case is clear, for example if all products are dirty or overripe, non-conformity is easy to establish. Applying an agreed control method may then not be necessary. Instead, photographs may sufficiently communicate the extent of non-conformity to the seller.

Products may also be judged by the buyer as not to be in conformity because the tolerances set out in the standards have been exceeded. However at times when such non-conformity is not excessive and the complaint is less visible from photographs, a common control method that is applied will give a replicable and objective control result. With an agreed control method, the buyer can establish the percentage of products with different defects and communicate the result to the supplier. The communication of non-conformity is difficult without having an agreement to use international standards and control methods for conformity assessment. Having a commonly agreed control/inspection method can also avoid products being rejected erroneously.

One example of Quality inspection guidelines for fruit and vegetables are those developed by the OECD<sup>12</sup>. The OECD inspection method defines the number of boxes in the primary sample – depending on the size of the lot – that should be taken randomly and inspected. It also defines the method of inspection for products in consumer packages and for products in different sizes of consumer packages and for products loose in the package.

The perishable nature of fresh fruits and vegetables demand that quality control results are communicated to the supplier within a reasonable time depending on the sensitivity of the products, thus allowing for consideration of alternative actions, including price adjustments, if necessary. This also help the actors involved to take measures to avoid this problem in the future. If, for example, products show symptoms of chilling injury and there has been known deviation from the appropriate temperature during transport, this is an important information to those involved. The buyer, in agreement with the supplier, should always try to find ways to avoid returning or rejecting products.

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<sup>12</sup> Link to OECD quality control guidelines

The control protocol should preferably specify the percentage of products with different defects as found in the control that has been made. Depending on the sensitivity of the products and how they are kept and handled after arriving at the buyer's premises, their quality may diminish quickly.

Control results are therefore only a valid judgement of the quality of delivered products at a point in time immediately after the arrival of these products at the buyer's premises. What is judged to be "a reasonable time" will vary according to the product and how it is stored, transported and handled after arrival.

Areas considered high risk and likely to cause problems should be defined in the contracts in advance or otherwise by a common agreement between buyer and seller.

When products do not meet specifications, this should be communicated to the dispatcher immediately and the reason for the non-conformity should be sought. This will help the actors involved to take measures to avoid this problem in the future. If, for example, products show symptoms of chilling injury and there has been a known deviation from the appropriate temperature during transport, this is important information to those involved. The buyer, in agreement with the seller, should always try to find ways to avoid returning the respective product.

## **2.8 Choose appropriate packaging**

If products are packed by the trader it should be noted that appropriate packaging need to be chosen to protect products during transport and distribution. The cost and quantity of packaging material should be balanced against sufficient protection and buyer requirements.

Packaging is often chosen as the result of a dialogue between seller and buyer. The wish to fill packages and thereby use space in storage and transportation efficiently should be weighed against the risk of causing damage to the products when packages are put on top of each other in a pallet.

Packages must be of a quality, strength and characteristic to protect the produce during transport and handling and maximize air circulation for effective cooling. Clean materials should be used to protect the produce from foreign matter such as leaves, sand or soil, which could negatively affect the produce and its presentation. A visible lack of cleanliness in several packages could result in the goods being rejected. Bruising caused by vibration during the transport and distribution can be minimized by using appropriate packaging as well as properly inflated vehicle tyres.

For products that bruise easily, the use of trays should be considered. For many products, modified atmosphere may extend shelf life and reduce waste.

Durable reusable crates which could be cleaned in a proper way, could be used between actors with a long-term relationship and if an exchange of full and empty crates is feasible. This would ensure the continuous use of suitable packaging.

## **2.9 Stack boxes and crates appropriately**

Produce particularly in cartons/cardboard boxes and crates should not be stacked too high on pallets exceeding the individual container stacking strength. The stacking strength is built (into their sidewalls and sometimes printed on the carton) to resist crushing when stacked correctly. Handling staff should adhere to the maximum height of unbroken pallet loads received from the wholesaler or exporter. Proper stacking includes following the lengthwise and crosswise method that aligns the carton vent holes in the correct direction to allow air circulation throughout the stacked containers.

The most common height for wholesale units is seven to eight layers high, whereas single layer boxes containing retail units can be stacked higher. Often products with large individual sizes such as melons, pumpkins and other such gourds are packed in pallet bins; while tubercule vegetables such as carrots, turnips, beets and onions are packed in mesh bags or loose in boxes. Irrespective of the container there is an appropriate stacking method applied.

All pallets can be both under stacked and over-stacked in storage. Both practices have cost implications for the trader and retailer.

Under-stacking of pallets may result in:

- Less efficient use of the refrigerated storage/holding space
- An increased risk of placing containers of other produce atop the stack and mixing non-compatible produce.
- Giving an incomplete tally of number of cartons/containers available (if only the number of pallets is counted) that can lead to inappropriate volumes being ordered.

Over-stacking of pallets may result in:

- Crushing of the packages at the lowest level and damaging the produce.
- Restricting efficient cold air circulation within the stack.
- Rougher handling by staff (manually and with equipment such as pallet jacks and forklifts).
- Posing direct threats to the safety of the workers who may have problems reaching the top layers and buy forklift operators to see around them.
- Inability to re-use cardboard boxes and plastic crates due to being damaged.
- Placing packages on pallets and not directly on the floor in storage:
  - enables the ease of handling through the use of machinery for loading and unloading,
  - facilitates circulation of cool air throughout every produce container in the stack,
  - contributes to sanitary conditions in storage and helps address consumer food safety concerns.

## **2.10 Store products appropriately**

Temperature is a vital factor in retaining product quality during distribution. It increases shelf life by affecting respiration rate and thereby reduce the ageing of the fruit and vegetables. Shelf life is highly influenced by deviations in temperature during storage. As a result, inadequate cool-chain processes and management cause a considerable share of food losses and waste.

During distribution, products should be stored at their appropriate, product-specific temperature to retain the visible quality, keeping quality and to reduce food loss and waste. Therefore if products are kept at incorrect temperatures, at any time along the chain, the money and resources spent on all activities at every previous stage including production, harvest and post-harvest is quickly lost and/ or wasted. For example, lettuce has an estimated shelf life of up to 12 days at zero degrees Celsius but only 2 days at 20 degrees; leek and cauliflower may be stored over 20 days at zero degrees but only 2 days at 20 degrees. This, however, only refers to products that are not sensitive to chilling (see annex II).]

Frequent changes in temperature also reduce produce shelf life. Taking products from cool storage and back should therefore be avoided. The resources invested into pre-cooling and cooling products to the appropriate temperature is quickly lost if these products are kept at inappropriate temperatures later in the chain. Collaboration and discussions along the value chain should be conducted to establish an unbroken cool chain.

Subtropical and tropical products develop chilling injuries when kept at low temperatures. Attention should therefore be paid to ensuring that chilling-sensitive products are not subjected to temperatures below those that may cause chilling injury. (See Annex II). When possible, there should be different temperature zones in the storage facilities to accommodate the different temperature requirements of products.

In addition to temperature, traders should take into consideration all other aspects that are important to retain the quality (visible quality, keeping quality, taste, smell, appearance and touch) and that would reduce waste, such as humidity and ethylene.

Relative humidity can be controlled by the temperature of the storing facility: setting the dew point and/or controlling the moisture in the air of the facility (e.g., mists, spraying water and/or leaving water tins inside the storage facility are practical alternatives). Products that easily loose water should not be placed next to a fan or air outlet. Products producing ethylene (climacteric fruits, see annex ?) and products that are sensitive to ethylene (see annex ?) should be stored separately.

## 2.11 Record quality affecting parameters

Parameters affecting quality such as temperature or humidity should be monitored throughout the distribution chain and recorded for easier identification of points for the implementation of corrective measures.

## 2.12 Outbound Quality reporting

Reducing loss and waste in the global food chain starts by supplying the appropriate quality into the system. It is recommended that producers create “outbound quality control reports”. These should mirror the quality reports from the buyers arrival control to convey what critical quality parameters the client monitors and check these parameters when product is ready for sendoff from the supplier. This allows for the supplier to take corrective measures before sendoff and informing the client of the quality of the consignment in order to avoid rejections. (link to OECD procedures [add a link from Andre] Andre, Milza, Kristina to look at.)

## 2.13 Find alternative outlets

Even with the most careful planning, there will invariably be products that cannot be sold to the intended buyer. Actors in the fruit and vegetable trade should therefore have in place alternative outlets and uses for products that cannot be placed on the intended market and/or sold to the intended buyer. However, accessing the alternative markets may require an adjustment of price]

[The following alternatives are examples that might be considered:

- Find alternative outlets, new markets or destinations, e.g. in the HORECA sector. To facilitate these alternatives, electronic marketplaces for unsold/ surplus products are being developed in some countries.
- Change presentation to address new market segments
- Find buyers that can process (industrial) for food purposes
- Find buyers that can process into fresh-cut fruits and vegetables or other novelty products
- Donate to charity, respecting applicable guidelines <sup>13</sup>
- Use surpluses for non-food economic uses, such as animal feed, energy generation, fertilizers, etc.

If no alternative outlet can be found, products should be treated in a way that limits the negative effects on the environment. [make sure wording is in line w/FAO vocabulary ‘food loss/food waste’. Felicitas to look at.]

## 2.14 Measure the losses

Traders that are aware of their food loss volume and that understand the causes and have the means to measure it, should have a greater capacity to reduce the loss than those that do not. This implies that retailers identify hotspots and manage the food waste through targeted

<sup>13</sup> One example is the EU recommendations on food donations (link) <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2017:361:FULL&from=EN>

interventions. This enables them to start a learning process that serves as an important tool for finding remedial measures that lead to reduced waste. [DL]

Such results can be used, not only for future planning but also for the implementation of measures related to handling, temperatures, transport, logistics etc. Apart from the aspect of reducing waste there are strong business incentives to implement this Code of Good Practice because money spent on reducing loss and waste is reported to give up to an estimated 14-fold<sup>14</sup> return on the money spent. (For further details, see the UNECE measuring methodology in Annex III.)

### **2.15 Local government interaction**

Submit/communicate waste data to the local government or the agricultural office.

This information opens opportunities for public measures (e.g. redistribution of surpluses into shortage areas). The UNECE digital food loss management system named FeedUP@UN allows the collection of data and may facilitate redistribution of products.

## **3. Transporters**

**Transporters – adhering to the Code of Good Practice undertake to do the following:**

Transportation services are essential in the produce industry at every stage from harvest through the distribution channel and eventually to the retailer or, in modern e-commerce, directly to consumer. Therefore, considering the type of product, its age and the duration of the transport, transporters must determine the most appropriate means of transport (ground, sea or air) and transport package (refrigerated containers, rail carloads, break bulk, palletized, and bulk). The means of transport chosen should be cost effective and protect and deliver the produce to its destination in marketable condition with the least possible impact on its quality and shelf life.

As road transport is the most common means of transport, this chapter mainly focuses on this but it is applicable also to other means of transport.

Transporters that in addition to providing transport also are service providers that will provide storage facilities for fresh fruit and vegetables should in addition to this chapter also adhere to the recommendations given in chapter two for traders.

### **3.1 Ensure proper training of staff**

Transportation staff need to be knowledgeable on the storage, handling and distribution of perishable products as well as the impact of careless/ poor handling on safety quality and shelf life, that results in losses and waste and reduced profitability. Transporters are encouraged to provide training for truck drivers, dock workers as well as workers at other re/unloading points to ensure that handling and transportation of fresh fruit and vegetables are done carefully, thereby providing the best conditions for products during transport. In this regard transporters are encouraged to train and give their staff basic knowledge on the different temperature requirements of products. Training should also include the importance of transporting ethylene producing and ethylene sensitive products separately. It is recommended that detailed information on products, including quick referencing literature, such as individual product optimum temperature charts and container product mixture charts for storage and transportation purposes be available for the staff.

### **3.2. Ensure proper planning of transports**

Transport should be planned to minimize time and optimize conditions.



The longer the transportation period, the more important it is to provide optimal climatic conditions for the transported perishable products and its packing material in the vehicle.

If products will be unloaded at more than one point, products should be loaded on to the vehicle/ container in reverse unloading order, to avoid unnecessary loading and reloading. In cold climates, measures should be taken to avoid products from getting freezing damage.

In vehicles and/or containers with regulated temperatures, careful planning is required/ must be executed/ to ensure that products that have similar temperature requirements are stored in the same compartment/ container. Careful planning should also avoid putting products emitting ethylene in the same space as products that are sensitive to ethylene (see annex ?).

### **3.3 Ensure optimum conditions during transport**

Transporters should provide the best possible conditions in terms of temperature, humidity, compatibility between products, and protection against direct sun, rain, wind and dust, etc. If cooling is available, products should be cooled to the recommended temperature as quickly as possible without harming the product. Products should be cooled before transport, with the exception of short transports to a storage facility or packhouse. The cooling equipment of transport vehicles does not have the power to lower product temperature, just maintain it.

Humidity is another important factor to consider as freshness is an important quality parameter in most products. Leafy vegetables and other products with a large surface to volume ratio (f.ex.broccoli), will quickly lose water in dry conditions, especially in combination with high speed air circulation or wind. Lowering the temperature will increase relative humidity in the air, but may damage the produce due to dehydration if the water vapor content remains too low. [Product water loss during transport may be reduced by packed ice in the cargo, plastic, and/or pre-cooling the cargo. [ML]

[Annex from COLEACP or UC Davis @ which produce can be transported together.]

In addition, products producing ethylene (climacteric fruits, see annex ?) and products that are sensitive to ethylene (see annex ?) should not be transported together but in separate vehicles, trailers, containers or compartments to avoid damages or shortening the shelf-life of the ethylene sensitive products.

#### **3.3.1. Non-refrigerated transport**

Products transported in non-refrigerated vehicles should be loaded in the shade. In open vehicles, the products should be completely and adequately covered for example with a tarpaulin or any other suitable material to protect it against direct sunlight, the elements, dirt and temperature variations. Tarpaulins must be clean and undamaged with sufficient measures in place so as to ensure that they are adequately secured. Thermal insulation tarpaulin may provide some protection against heat.

Proper ventilation should be provided with care to avoid dehydration of the produce.

Stops and reloading should be kept at a minimum. Care must be taken during loading and unloading to avoid temperature abuse and physical injuries.

#### **3.3.2. Refrigerated transport**

Shelf-life of perishable products is highly influenced by temperature deviations during transport, handling and storage. Optimum product temperature is one of the most important factors for retaining product quality and condition during the storage, handling and distribution in the value chain. Products exposed to inappropriately high temperatures get a reduced shelf life due to increased respiration rates and thereby enhancing the ripening process, ageing and loss of turgidity of the perishable product. Inappropriately low temperatures on the other hand causes chilling injuries and therefore shortens shelf-life and increases losses and waste in all the following stages including at consumer level.

There is much to gain from keeping an unbroken cool chain at the optimum product temperature. For example, lettuce has an estimated shelf life of up to 12 days at zero degrees

Celsius but only 2 days at 20 degrees; leek and cauliflower may be stored over e.g. 20 days at zero degrees but only 2 days at 20 degrees. This only refers to products that are not chilling sensitive (see annex II).

Subtropical and tropical products quickly develop chilling injuries when kept at temperatures below ambient/ inappropriately low, though non-freezing, temperatures. Therefore, attention must be paid to appropriate storage and transport temperatures to ensure that chilling sensitive products are not subjected to temperatures below those that may cause chilling injury (see annex II).

Frequent changes in temperature as well as shipping and/or storing fresh fruit and vegetables with different optimum product temperature in the same shipping container or cold storage also reduces shelf life. Having good communication and collaborations along the value chain should therefore include discussions on how to establish and maintain an uninterrupted cool chain.

If possible, products should be transported with regulated and monitored temperature vehicles and/or containers. Uniform temperature should be maintained through distribution. Small deviations may be tolerated by some of the less perishable products, but typically temperatures should be maintained within small deviations of the targeted temperature to avoid loss of quality.

### **3.3.3 Monitor temperatures during transport**

Keeping track of the temperature in the vehicle during the entire duration of the transport will raise awareness of the importance of proper temperature management. Therefore, transporters are reminded to use the temperature chart on shipping containers and/ or ground transportation vehicles. These charts are very useful in recording the transportation temperature history and help identify the possible route course/ when and where the temperature chain was broken or failed/ if product quality at the destination point is not of an appropriate standard.

## **3.4 Use proper vehicles, packaging and unitizing**

Vehicles should have a good suspension system to avoid excessive shocks, or alternatively, a good means of cushioning products during ground transportation.

Proper temperature management demands proper air circulation through airflow management, proper packaging and unitization and cargo space management.

Proper packaging and unitization is necessary to avoid physical injuries due to compression and vibration of the cargo. Packaging material should be suitable and fit for the transport and its conditions. Usage of low quality packing material (e.g. boxes) might lead, especially when transport takes place under humid transport conditions, to collapsing of boxes and damage of the products in the packaging material. Therefore, transporters should inform the sender of potential risks when inappropriate packaging for the transport is identified.

## **3.5. Stack boxes and crates appropriately**

Produce particularly in cartons/cardboard boxes and crates should not be stacked too high on pallets exceeding the individual container stacking strength. The stacking strength is built (into their sidewalls and sometimes printed on the carton) to resist crushing when stacked correctly. Handling staff should adhere to the maximum height of unbroken pallet loads received from the wholesaler or exporter. Proper stacking includes following the lengthwise and crosswise method that aligns the carton vent holes in the correct direction to allow air circulation throughout the stacked containers.

The most common height for wholesale units is seven to eight layers high, whereas single layer boxes containing retail units can be stacked higher. Often products with large individual sizes such as melons, pumpkins and other such gourds are packed in pallet bins; while

tubercule vegetables such as carrots, turnips, beets and onions are packed in mesh bags or loose in boxes. Irrespective of the container there is an appropriate stacking method applied.

All pallets can be both under stacked and over-stacked in storage. Both practices have cost implications for the trader and retailer.

Under-stacking of pallets may result in:

- Less efficient use of the refrigerated storage/holding space
- An increased risk of placing containers of other produce atop the stack and mixing non-compatible produce.
- Giving an incomplete tally of number of cartons/containers available (if only the number of pallets is counted) that can lead to inappropriate volumes being ordered.

Over-stacking of pallets may result in:

- Crushing of the packages at the lowest level and damaging the produce.
- Restricting efficient cold air circulation within the stack.
- Rougher handling by staff (manually and with equipment such as pallet jacks and forklifts).
- Posing direct threats to the safety of the workers who may have problems reaching the top layers and buy forklift operators to see around them.
- Inability to re-use cardboard boxes and plastic crates due to being damaged.
- Placing packages on pallets and not directly on the floor in vehicles:
- enables the ease of handling through the use of machinery for loading and unloading,
- facilitates circulation of cool air throughout every produce container in the stack,
- contributes to sanitary conditions in the vehicle and helps address consumer food safety concerns.

### **3.6 Ensure clean transports**

Vehicles and containers should be kept clean to ensure proper air circulation around the load, to reduce produce contamination by plant pathogens, food borne pathogens, chemicals, dirt and dust, as well as strong smells and chemical contamination. The container should be free of any evidence, including taint, of previous cargo. The substances for cleaning should be appropriate in connection to food.

### **3.7 Clarify responsibility of damages**

Products may be damaged during loading, unloading and transportation. Therefore the responsibility of each party or service provider at each point and stage must be clear. Such clarity leads to improvement in handling, transportation and storage which improves or maintains quality, reduces damage and decreases economic losses.

## **4. Retailers**

[DN add something regarding produce labels are clear/helpful for consumers]

**Retailers and retailer chains adhering to the Code of Good Practice undertake to do the following:**

In this final stage of the value chain all measures taken to produce high quality products, cool them to preserve quality and nutritional value, sort, grade and pack them for nice presentation and transport and distribute them to the store, will be seen in the performance of products on display for the consumer. The result will determine the price consumers are willing to pay for the produce, the share of products wasted and in end the profitability of the store.

It is therefore important that all the measures invested in production and along the value chain are properly taken care of at this last stage. Products should be carefully handled and stored and then displayed in appropriate conditions.

#### **4.1 Ensure proper training of staff**

Retail staff need to know fresh produce storage, handling, product placement and display practices and to understand the impact of poor handling on safety and quality, shelf life and waste, consumer purchases and eventually the retailer's profitability. They also need to know the urgency of selling products within their shelf-life limits and therefore the importance of applying "first in first out. Therefore, staff should be trained in fresh fruit and vegetables best practices enabling them to a good knowledge of the consequences of inappropriate handling and storing the products including their continued employment. [

Handling guides per product, with guidance on appropriate temperatures, ethylene sensitivity, mixture charts and common problems may be a useful tool for this. The guides should highlight quality affecting key parameters and appropriate practices.

#### **4.2 Ensure ordered volumes match demand**

The best retailer practice is to adjust your produce volumes ordered to demand. In this way products will not be required to be kept in storage or on display longer than necessary, thereby retaining their quality/marketability and reducing food loss and waste. A "first in first out" approach to stocking/ storage also significantly contributes to minimizing food loss and waste and economic losses unless the condition of received consignments of products motivate a change in order.

Demand for products vary due to the weather, i.e. seasons, holidays and celebrations. Some high-demand periods are easily predictable, whereas others are less. To ensure a steady flow of the appropriate products based on consumer demands the retailer shop needs good market knowledge and a marketing/ sales and supply plan is essential. Procurement staff are required to speculate less and employ demand planning strategies and tools, to minimize as much uncertainty as possible.

Plan carefully in order to avoid oversupply. Planning involves more than estimates of only sales volume of the various products but also types, varieties, sizes, quality categories and colour categories and also the stage of ripeness. Promotion campaigns promoting the sale of one product may also influence the sales volumes of other, similar products. Therefore, good communication with the supplier or distribution centre should help coordinate supplies to meet market demand.

#### **4.3 Define clear specifications**

Retailers' specifications, including quality requirements, correct maturity for the intended purpose and labelling should be clearly defined in advance and in dialogue and/ or purchase agreements with producers, in order to avoid causing unnecessary loss/ waste (alt. such a way that unnecessary waste is avoided).

Retailers' specifications on quality should, as far as possible, be identical to the marketing standards<sup>15</sup> developed for trading fresh fruits and vegetables. Additional quality requirements, added to the requirements in the trade standards, should be kept at a minimum in order to reduce transaction costs, losses and waste. An increased acceptance and therefore sale of products with exterior defects not affecting the eating quality will reduce losses at primary production.

Trading parties should be mindful of specifications that might require grading, sorting or trimming of produce that might lead to avoidable food waste (examples: trimming to the

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<sup>15</sup> International marketing standards developed by UNECE or CODEX.

same size or length to fit into a specific package, refusing specific sizes or varieties as not being part of the goods accounting. Trading parties should also take note that some products such as tropical root crops (for ex. yams and ginger) must be trimmed during harvest. This knowledge is very important to avoid food wastage.

Fruit and vegetables needs to have reached an appropriate stage or degree of development when harvested to have sufficient shelf life and appropriate quality for the intended purpose. This stage is called horticultural maturity<sup>16</sup>. Horticultural maturity is thus any stage from a seedling (sprouts), a tender spring carrot, a shoot (asparagus), undeveloped flowers (broccoli) and all the way to ripe and fully developed fruits (apples, peaches etc.) Climacteric fruit such as apples, pears and peaches must attain an appropriate degree of development to ensure proper completion of the ripening process and develop the expected taste, aroma and texture i.e. physiological maturity<sup>17</sup>.

The correct maturity is also important for products to be able to withstand transportation and handling and have a sufficient shelf-life for retail and at consumer level.

It is of utmost importance that trading parties understand and have the same interpretation of the terms “maturity” (in fruits<sup>18</sup>) and “sufficiently developed” (in vegetables and root crops).

Consumers may be very eager to buy early season products at a premium price. However, if these early season products are marketed before they have reached the appropriate maturity they may not be able to ripen properly and reach the desired quality. Consumers may then throw these products away and avoid buying such products again, either in the near future or permanently – even when better qualities are available. This will have a negative impact on price and demand of such products for an extended period of time, as well as the reputation of the supplier/producer.

It is important that the retailer knows that the different varieties from the same region or country, of many fruits, for example apples and pears, mature and ripen at different times. As such they should be also marketed at different times. Each variety should be placed on the market at the correct time to avoid low eating quality and eventually the products being wasted. One of the best ways to avoid this is to have good communication with producers, and seek and respect their advice.

#### 4.4 Control ordered products at arrival

Buyer and seller should have a common agreement on criteria and method for ensuring conformity with agreed quality requirements and the process for handling non-conformities. Non-conformity of buyers’ specifications, as well as non-valid claims are major causes of food loss and waste. However, areas considered high risk and likely to cause problems should be defined clearly in contracts in advance or otherwise by a common agreement between buyer and seller. Effective communication between buyer and seller is the best way to address the problem and reduce losses and waste.

It is very difficult when buyers and sellers do not agree on whether products are in conformity with agreed quality standards. In cases of dirty or overripe products – non-conformity is easily established; photographs usually suffice to communicate the extent of non-conformity to the seller. However, in less obvious cases, a more thorough quality inspection of the product is required. However, when a poor quality complaint is supported by a legal inspection report (based on transparent sampling, tolerances, photos and additional supporting evidence), common agreement is facilitated.

A precondition for the acceptance of a complaint is a prompt incoming inspection and a prompt feed back to the seller /supplier. The quality inspections should be carried out directly after arrival of the produce in order to clearly reflect the condition at arrival. The results (non-

<sup>16</sup> Horticultural Maturity: The stage of development when a plant part possesses the necessary characteristics for use by consumers (referera till US Davis)

<sup>17</sup> Physiological maturity: The stage of development when a plant part will continue development even if detached; will continue development even if detached; mature fruits mature fruits

<sup>18</sup> Including fruit vegetables such as tomatoes, cucumbers, aubergines, zucchini.

conformities) should be communicated to the seller as quickly as possible in order to avoid the impression that the defects might have developed due to unfavourable conditions at the buyer's premises. The results of the quality inspection are therefore only a valid judgement of the quality of delivered products if made in connection with the arrival of these products at the buyer's premises. Depending on how sensitive products are and how they are kept and handled after arriving at the buyer's premises, they may quickly deteriorate in quality.

If possible, the reasons for non-conformities must be identified. This communication will assist those involved to take necessary measures to avoid this problem in the future. If, for example, products show symptoms of chilling injury and there has been a known deviation from the optimum temperature during transport, this deviation is important information for those involved.

The buyer, in agreement with the seller, should always try to find ways to avoid returning the product. Possible remedies are: accepting the legal tolerances, downgrading the produce, correct the labelling.

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When products are stored prior to display, they should be stored at their appropriate, product-specific temperature to retain the visible quality, keeping quality and to reduce food loss and waste. Therefore, if products are kept at incorrect temperatures, at any time along the chain, the money and resources spent on all activities at every previous stage including production, harvest and post-harvest is quickly lost and/ or wasted. For example, lettuce has an estimated shelf life of up to 12 days at zero degrees Celsius but only 2 days at 20 degrees; leek and cauliflower may be stored over 20 days at zero degrees but only 2 days at 20 degrees. This, however, only refers to products that are not sensitive to chilling (see annex II).]

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In addition to temperature, retailers should take into consideration all other aspects of produce presentation that are important to retain the quality (visible quality, keeping quality, taste, smell, appearance and touch) and that would reduce waste, such as humidity and ethylene.

Relative humidity can be controlled by the temperature of the storing facility: setting the dew point and/or controlling the moisture in the air of the facility (e.g., mists, spraying water and/or leaving water tins inside the storage facility are practical alternatives). Products that easily loose water should not be placed next to a fan or air outlet. Products producing ethylene (climacteric fruits, see annex ?) and products that are sensitive to ethylene (see annex ?) should be stored separately.

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received from the wholesaler or exporter. Proper stacking includes following the lengthwise and crosswise method that aligns the carton vent holes in the correct direction to allow air circulation throughout the stacked containers.

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- Less efficient use of the refrigerated storage/holding space
- An increased risk of placing containers of other produce atop the stack and mixing non-compatible produce.
- Giving an incomplete tally of number of cartons/containers available (if only the number of pallets is counted) that can lead to inappropriate volumes being ordered.

Over-stacking of pallets may result in:

- Crushing of the packages at the lowest level and damaging the produce.
- Restricting efficient cold air circulation within the stack.
- Rougher handling by staff (manually and with equipment such as pallet jacks and forklifts).
- Posing direct threats to the safety of the workers who may have problems reaching the top layers and buy forklift operators to see around them.
- Inability to re-use cardboard boxes and plastic crates due to being damaged.
- Placing packages on pallets and not directly on the floor in storage:
- enable the ease of handling through the use of machinery for loading and unloading,
- facilitate circulation of cool air throughout every produce container in the stack,
- contributes to sanitary conditions in storage and helps address consumer food safety concerns.

(Put this text in other sections with appropriate adjustments related to section topic?)[DL to supply text for producer, wholesaler, transporter]

#### **4.7 Handle products carefully**

Poor handling is manifested by bruising and other damages. Damages reduce quality and can lead to rot resulting in products being wasted. Products may be damaged not only when being transferred from boxes into display areas but also by consumers who handle and squeeze them.

Products that are packed individually on trays in the packages (boxes) will be less damaged if displayed for sale in these boxes.

Products should be handled as carefully as possible when being transferred to retailer displays. As such, retail staff should be well trained and fully understand the consequences of improper handling of products. Any wasted produce reduces the profit of the retailer, has an impact on sustainability and disregards all efforts of producers and other partners along the chain.

Retailers should consider taking measures that limit the damage of products caused by improper consumer handling. Possible measures include, restricting the volume displayed at any given time and thereby the number of times each product is scrutinized by a consumer until finally chosen and providing point of sale information. For products that are easily

damaged such as peaches, apricots, ripe pears and ripe avocados, sale in pre-packages can reduce waste but this measure has to be weighed against the increased use of packaging material.

#### **4.8 Display products appropriately**

Products should be displayed appropriately, taking into consideration their specific characteristics and the facilities available. In addition to temperature, take into consideration any other aspects of the presentation of the produce that are important to retain the visible quality, the keeping quality, the nutritional quality and that would reduce waste. The appropriate temperature should be kept all the way to the point of display as frequent changes in temperature at retail points reduces produce shelf life.

Good communication [KM to check document for use of “dialogue.”] along the distribution chain on how to establish an unbroken cold chain, product placement in retail outlet (near doors, other frozen type foods – cheese, butter, frozen meat and fish), retail method (pallet bins, smaller retail containers of only one fruit variety or mixture of different fruits) is essential.

To avoid shortening shelf-life the quantity on display should be adjusted to possible sales in order to limit the volume of products displayed at inappropriate temperatures. This is particularly important in open air markets.

When products are offered for sale in the open, measures should be taken to protect them from direct sunshine, wind, dust, dirt and contamination by other sources. Products that dehydrate easily, such as leafy vegetables, may be sprayed with potable water. Small retailers with no cooling facilities may prolong shelf life by covering their fresh produce overnight with cloth, tissue or any other suitable material dipped in or moistened with potable water.

Products should be presented in such a way as to minimize a negative impact of fruit with high ethylene production with ethylene sensitive products (see annex?)[reference from Andre]

- [regularly check quality also of product on display]

#### **4.9 Choose responsible promotional campaigns**

Promotional campaigns such as “Buy one get one free” and other enticements to large volume purchases encourage consumers to buy more products than they, or their household, may be able to consume. Such purchases often result in food waste. Although there may be good intentions behind many promotion campaigns – such as increasing consumption of produce for health reasons or providing economic help to domestic producers to sell an unexpected overproduction due to favourable weather conditions – it may however, from a waste perspective, be better to decrease the price instead.

It is important to consider the side effects of promotional campaigns. For instance, when consumers are encouraged to buy more of a targeted product, they may likely buy less of other similar products, i.e. a campaign to promote pears may lead to decreased sales of apples, thus leading to possible waste of apples. Therefore, in the long run, a stable volume and price decreases losses and waste.

#### **4.10 Find solutions for unsold products**

Even with the most careful planning, there will invariably be products that cannot be sold to the intended buyer. Therefore, retailers should have alternative solutions for selling or disposing of the products to reduce food waste. However, accessing the alternative markets may require an adjustment of price.

The following alternatives are examples that might be considered:

- Sell as



- lower category produce (if applicable)
- “for home processing” (if applicable)
- “for immediate consumption”
- Promote interesting recipes or new preparations to increase interest of consumers (at point of sale), including tastings
- Process to juices, jams, smoothies, etc.
- Donate to charity respecting applicable guidelines<sup>19</sup>
- Include saved products

If no alternative outlet can be found, products should be treated in a way that limits the negative effects on the environment. [make sure wording is in line w/FAO vocabulary ‘food loss/food waste’. Felicitas to look at.]

#### 4.11 Measure waste

Retailers that are aware of their food waste volume and that understand the causes and have the means to measure it, should have a greater capacity to reduce the waste than those that do not. This implies that retailers identify hotspots and manage the food waste through targeted interventions. This enables them to start a learning process that serves as an important tool for finding remedial measures that lead to reduced waste. [DL]

Such results can be used, not only for future planning but also for the implementation of measures related to handling, temperatures, transport, logistics etc. Apart from the aspect of reducing waste there are strong business incentives to implement this Code of Good Practice because money spent on reducing loss and waste is reported to give up to an estimated 14-fold<sup>20</sup> return on the money spent. (For further details, see the UNECE measuring methodology in Annex III.)

**Retailers buying directly from producers should also undertake the following:**

#### 4.12 Improve logistics

As fresh fruit and vegetables have a limited shelf life, the time that elapses from harvest to retail, or for long-term stored products from packing to retail, should be as short as possible.

An efficient logistics chain that reduces the time from producer or packer to retailer is therefore important for ensuring an appropriate shelf-life of perishable products for retail and consumer stages. Such efficiency reduces quality losses and waste along the chain.

An efficient logistics chain has no more stops and reloading points than necessary. Stops should be short and reloading conducted effectively and efficiently. Strict first-in, first-out principle must be followed, as long as the quality of the produce is also aligned. In the case that a later delivery has more sensitive products (shorter shelf-life), these must be prioritized.

#### 4.13 Ensure unbroken cool chains

Products should be kept at an appropriate temperature from harvest to retail. The investments (money and effort) put into production, post-harvest handling and cooling products to the appropriate temperature is quickly lost if products are exposed to inappropriate and/or fluctuating temperatures later in the value/ distribution chain. Therefore, good communication among all participants along the distribution chain shall include discussions on how to establish an unbroken cool chain. The cool chain should be established and maintained from harvest to retail stage – which includes point of sale display.

<sup>19</sup> One example is the EU recommendations on food donations (link)  
<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2017:361:FULL&from=EN>

#### 4.14 Place and change orders in timely manner

Orders should be placed in a timely manner that gives the producers enough time to harvest products at the appropriate time of day, cool products to the appropriate temperature, sort/grade and pack according to specifications given. If orders are placed or changed shortly before time of dispatch producers may have to send products that are not properly cooled. This will reduce the shelf life of the products and increase food loss and waste. It may also lead to sorting and packing having to be done too quickly to allow for careful handling and for quality assurance to be carried out properly. In cases where orders are placed in foreign countries requiring several days or weeks of sea travel last minute orders is often not feasible.

#### 4.15 Avoid late cancellations

Orders of perishable products that are cancelled at short notice close to dispatch makes finding a new buyer difficult, often leading to food loss. This problem is more severe when the product is packed in specific branded packaging of the retailer which cannot be sold to another retailer without costly repackaging and additional risk of damages by handling.

In cases of orders placed in foreign countries requiring several days or weeks of sea travel to destination markets, order cancellations may not be feasible, or can result in high rates of food loss in producing countries; particularly if the product is not part of the country's diet.

The frequent cause of late cancellations is often that market demand for a product, at a given time, is lower than when the buyer originally placed the order. In some cases when it is impossible to change the order (product is located at the shipping port, or already loaded on the means of transport), the products may therefore still be wasted upon arrival at the destination market. In these cases, the buyer should consider measures to promote the sale of these products.

The negative impact of a late cancellation will be particularly severe if an order is cancelled for example after a producer has opened a cold store or a Controlled Atmosphere (CA) store and removed the products from the storage room. Once a CA store has been opened, the fruit must be moved into the distribution chain.

#### Further reading

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