D4.2 – Report on the food quality ontology

Final version

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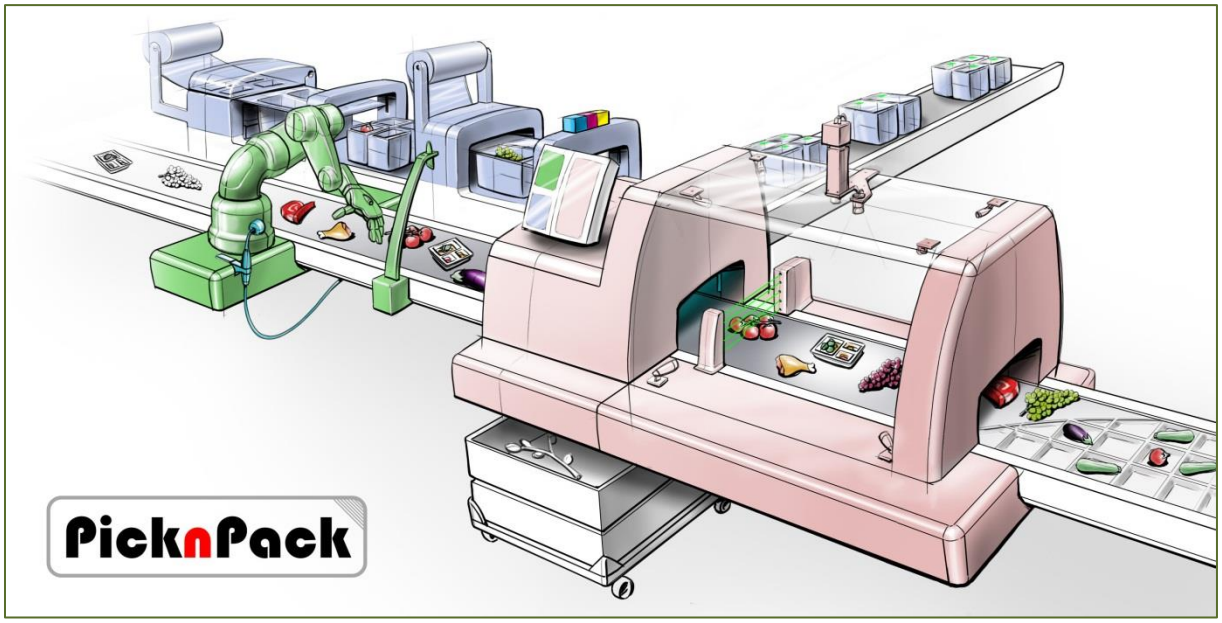

Flexible robotic systems for automated adaptive packaging of fresh and processed food products

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Dissemination level		
PU	Public	X
PR	Restricted to other programme participants (including the EC Services)	
RE	Restricted to a group specified by the consortium (including the EC Services)	
CO	Confidential, only for members of the consortium (including the EC Services)	

Table of Contents

1 Introduction

This document is a description of the food quality ontology. As part of task 4.1 of WP4 the goal of this deliverable is the generation of a structured and standardized semantic vocabulary to allow to producers worldwide to use the same quality aspects in describing food products that have to be packaged. The focus of this deliverable is on the three cases where the PicknPack demonstrator will be working on, namely vine tomatoes, table grapes and ready meals. For each case a mind map is presented where the interdependence between the different quality parameters is shown. Afterwards, each quality parameter is briefly explained.

2 Ontology

2.1 Fresh fruit

2.1.1 Vine tomatoes

2.1.1.1 Mindmap

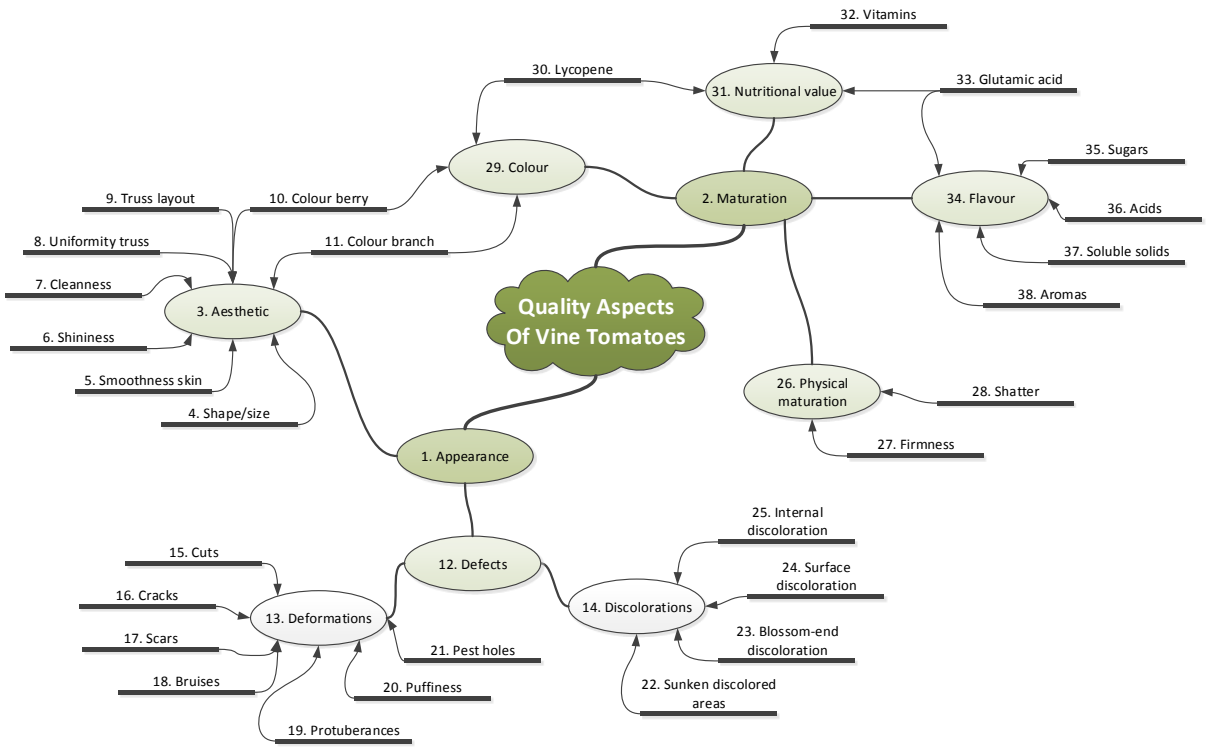

Figure 1: Mindmap of aspects related to the quality of vine tomatoes

A mindmap of the quality aspects related to vine tomatoes is given in Figure 1. We have divided the quality attributes into two categories, related to appearance and related to maturation. Each of the quality aspects is described in more detail below.

2.1.1.2 Explanation of each quality parameter

Table 1: Description of quality attributes of vine tomatoes

Nr	Quality aspect	Belongs to	Description
1	Appearance	Quality aspects	It is a summary of external attributes, which are visually noticeable. The factors related to this term can be divided in **aesthetic parameters**, which consumers perceive as characteristics of that product and in **defects** (**deformations** or **discolorations**) which can make the product not attractive for the consumer.
2	Maturation	Quality aspects	Maturation is the stage of the floral development typically proceeding and signalled by successful pollination. So that maturation encloses not only the ripening of the fruit, known term for process that renders fruit attractive and palatable [1] but also the correct development of the structure of the fruit, meaning that the contents of two or more seed cavities have developed a jellylike consistency and the seeds are well developed [2]. Modifications during maturation include development of desirable **flavour** and **colour**, **physical maturation** involving modification of cell wall ultrastructure and texture (firmness) and changes in the **nutritional value** (vitamins and molecules with antioxidant activity).
3	Aesthetics	Appearance	This aspect comprises a number of features related to consumer's preferences. These features are described below.
4	Shape/size	Aesthetic	**Shape:** The tomato should have a nice regular shape. The shape must be characteristic of the variety (round, ribbed, oblong), see Figure 10. Small deviations in shape are allowed (according to each quality class) and light defects are usually accepted by consumers. Symmetry is a strong aesthetic feature and symmetrical shapes are therefore preferred. **Size:** Size is determined by the maximum diameter of the equatorial section, by weight or by count. The following provisions shall not apply to trusses of tomatoes and are not compulsory for Class II, according to the CODEX (293/2008) standard for tomatoes [3]. These provisions are also optional for cherry and cocktail tomatoes below 40 mm in diameter, according to UNECE standard. According to both, CODEX and UNECE [4] standards: a) Tomatoes may be sized by diameter. In case codes are applied, the codes and ranges in the following table, have to be respected (excluding

<table>
<tr>
<td></td>
<td></td>
<td></td>
<td>not compulsory cases):

<table>
<tr><th>Size code</th><th>Diameter (mm)</th></tr>
<tr><td>0</td><td>≤ 20</td></tr>
<tr><td>1</td><td>> 20 ≤ 25</td></tr>
<tr><td>2</td><td>> 25 ≤ 30</td></tr>
<tr><td>3</td><td>> 30 ≤ 35</td></tr>
<tr><td>4</td><td>> 35 ≤ 40</td></tr>
<tr><td>5</td><td>> 40 ≤ 47</td></tr>
<tr><td>6</td><td>> 47 ≤ 57</td></tr>
<tr><td>7</td><td>> 57 ≤ 67</td></tr>
<tr><td>8</td><td>> 67 ≤ 82</td></tr>
<tr><td>9</td><td>> 82 ≤ 102</td></tr>
<tr><td>10</td><td>> 102</td></tr>
</table>

Tomatoes sized by diameter may also follow specific uniformity provisions, which concern the limits for the maximum difference in diameter between produce in the same packaging (see point Nr 8).

b) Tomatoes may be sized by count, weight or diameter, according to the provisions of the legislation of the importing country.

According to U.S. standards for Fresh Tomatoes [5], the size of tomatoes may be specified by count or weight per container or specified to a minimum and/or maximum diameter.

<table>
<tr><th colspan="3">Inches</th></tr>
<tr><td>Size designations</td><td>Minimum diameter*</td><td>Maximum diameter**</td></tr>
<tr><td>Small</td><td>2-4/32</td><td>2-9/32</td></tr>
<tr><td>Medium</td><td>2-8/32</td><td>2-17/32</td></tr>
<tr><td>Large</td><td>2-16/32</td><td>2-25/32</td></tr>
<tr><td>Extra large</td><td>2-24/32</td><td></td></tr>
</table>
* Will not pass through a round opening of the designated diameter when tomato is placed with the greatest transverse diameter across the opening.
** Will pass through a round opening of the designated diameter in any position.</td>
</tr>
<tr>
<td>5</td>
<td>Smoothness skin</td>
<td>Aesthetic</td>
<td>The skin should be smooth. Consumers don’t appreciate tomato notably ridged or rough. Roughness/shrinking compromising the fresh appearance of tomato is not allowed according to</td>
</tr>
</table>

			international OECD standards [6] (Figure 11). According to U.S. standards for grades of Tomatoes on the Vine [2], U.S. No. 1 and No. 2 are, respectively, free from damage and free from serious damage caused by shrivelling.
6	Shininess	Aesthetic	A shinny surface is preferred.
7	Cleanness	Aesthetic	According to the international standards for tomato, tomatoes must be practically free of soil, dust, chemical residue or other visible foreign matter (Figure 12). Levels of pesticides should be within the margins defined by the EU [7]. Tomatoes must also be practically free of insects and other pests. The presence of pests can detract from the commercial presentation and acceptance [6].
8	Uniformity of truss	Aesthetic	Consumers appreciate uniformity, in terms of shape and size, in the same packaging. The different tomatoes on the truss should therefore be as uniform as possible (shape, colour of berries, symmetry of truss). According to CODEX and UNECE standards [3 and 4], to ensure uniformity in size, the maximum difference in diameter between tomatoes in the same package shall not exceed: ▪ 10 mm, if the diameter of the smallest fruit (as indicated on the package) is under 50 mm; ▪ 15 mm, if the diameter of the smallest fruit (as indicated on the package) is 50 mm and over but under 70 mm; ▪ 20 mm, if the diameter of the smallest fruit (as indicated on the package) is 70 mm and over but under 100 mm; ▪ There is no limitation of difference in diameter for fruit equal or over 100 mm.
9	Truss layout	Aesthetic	According to international standards (CODEX and OECD) [3 and 4], each truss or part of a truss should contain at least 3 (2 if pre-packaged) berries in case of 'normal' vine tomatoes and 6 (4 if pre-packaged) in case of "cherry" tomatoes. The stalks must be fresh, healthy, clean and free of all leaves and any visible foreign matter. For the U.S. standards [2], the term "tomatoes on the vine" means 2 or more tomatoes attached to the same vine.
10	Colour berry	Aesthetic and Colour	The colour of the berry is characteristics of each variety and very indicative of its ripeness. The red colour is related to the degradation of chlorophyll and

			the synthesis of lycopene and other carotenoids, as chloroplasts are converted into chromoplasts [8]. Normally, red is the colour associated to the tomato fruit, although fruit at maturity can be bicolour (mix of red and yellow), pink, various shades of yellow, orange, green or even black. However, red is still the major fruit colour for most of the commonly grown varieties. In general, people like to eat nice red tomatoes. The ripeness of tomatoes from red varieties is determined by colouring. In Europe, the most used colour chart is the '*Kleur-Stadia Tomaten'* from the Dutch Central Bureau for Horticultural Auctions and in Spain the chart of Difrusa Export S.A. is used [9] (Figure 13). The colour of red tomatoes must correspond to at least colouring No. 2 of the OECD colour gauge. In the USDA grading protocol [5], colour is considered the most important quality criteria, with 30 out of 100 points associated to it [10]. The USDA defines a number of colour stages in the ripening process (Figure 14). The categories are defined as: ▪ **Green**. The surface is 100% green. ▪ **Breaker**. A definite break in colour from green to tannish yellow, pink or red on no more than 10% of the surface. ▪ **Turning**. Between 10-30% of the surface shows a definite change in colour from green to tannish yellow, pink or red. ▪ **Pink**. Between 30-60% shows pink or red colour. ▪ **Light red**. Between 60-90% of the surface shows pinkish-red or red colour. ▪ **Red**. More than 90% of the surface shows red colour. In current practice, human sorters use a colour fan. The colour can be objectively measured with, for instance, the Agtron spectrophotometer and the D 52 A from HunterLab. Other colour devices, such us the PCE-TCR 200 colorimeter (PCE Instruments), express colours in numerical terms along the L*, a* and b* axes (from white to black, green to red and blue to yellow, respectively) within the CIELAB colour sphere. See an example of colour changes during the ripening of fresh market tomato fruit in Table 5.
11	Colour branch	Aesthetic and	The branch including the peduncle and sepal (Figure

		Colour	15) should be green. Especially when the peduncle/sepal turns into a more wooden colour and gets corky, the berry is likely to detach, which is an indication that the berry is overripe.
12	Defects	Appearance	This aspect comprises a number of features (**deformations** and **discolorations**) that affect the appearance of the fruit, even leading to safety troubles. See below most common defects.
13	Deformations	Defects	Subclass of defects related to deformations.
14	Discolorations	Defects	Subclass of defects related to discolorations.
15	Cuts	Deformations	Tomatoes must not have any mutilation or injury spoiling the integrity of the produce. Cuts and punctures result from sharp points and edges, such as fruits with stems, fingernails, or rough containers. When non healed cuts are detected, the tomato should be rejected. The damage of the surface will cause water to evaporate and there is a high risk of moulds, which can also infect other berries (Figure 16). U.S. standards [2 and 5] consider specific limits for cuts and broken skin in Tomatoes and Tomatoes on the Vine, which are summarized in Table 7 and Table 8, respectively.
16	Cracks	Deformations	Most commonly, cracks result from extremely rapid fruit growth, called “growth cracks”. Cracks may radiate from the stem end of the fruit or may encircle the fruit. Cracks are often invaded by secondary fungi and bacteria that further rot the fruit. According to the CODEX, OECD and UNECE standards for Tomato [3, 4, and 7] non-healed cracks are not allowed and limit allowed for healed cracks is 3 cm in length (Figure 17). Characteristics by quality grade are presented in Table 6. U.S. standards [2 and 5] point out different limits for growth cracks in Tomatoes and Tomatoes on the Vine, which are summarized in Table 7 and Table 8, respectively.
17	Scars	Deformations	Scars are not due to rapid growth and they have specific scoring guidelines different from those for growth cracks. Scars can be caused by many different things, such as insects, disease, or simply from a limb or leaf rubbing against the fruit or vegetable while

			growing. Scars will range in colour, in texture, and may or may not have depth associated with the injury. A common defect of this type is the presence of a fine elongated blossom scar, a long corky brown scar along the blossom end of the fruit that is probably due to some early injury to the flower, although the exact cause is not known (Figure 19). In OECD and UNECE standards [4 and 7] limits for fine elongated blossom scar are specified only for ribbed tomatoes (Table 6): it is not allowed in Extra Class but allowed in Class II and it is limited to 2/3 of the greatest diameter of the fruit for Class I (Figure 19). U.S. standards [2 and 5] consider different limits for scars in Tomatoes and Tomatoes on the Vine, which are summarized in Table 7 and Table 8, respectively.
18	Bruises	Deformations	Bruises can be caused by impacts against other surfaces or by vibrations during transit. External symptoms include tissue softening, water-soaking, or cracked fruit walls. Often bruise damage is not detected until the fruit is cut and the internal tissue is examined. Water-soaked tissue and whitish to greenish, shrunken and disorganized gel are internal symptoms of damage. Deformation is a localized, permanently flattened area, resulting from pressure on the tomato during transport or storage [11]. According to the international standards (Table 6) different levels of bruises caused by rough handling are allowed provided they cause a not too serious damage to the flesh and are unlikely to develop further (Figure 20).
19	Protuberances / shape deformations	Deformations	Different degrees of deformation in shape are allowed only in Class I and Class II. Catfacing (Figure 32) is a common abnormality that develops on the blossom end and causes the fruit to pucker and have deep crevices. Affected fruit are often somewhat flat with a corky brown scar covering the base of the fruit. Catfaced fruit can have cavities extending deep into the flesh. The cause is thought to be cold weather during blossoming and perhaps high levels of nitrogen. U.S. standards [2 and 5] are the only ones providing specifications and limits, by quality grade, for catfacing in Tomatoes and Tomatoes on the Vine,

			which are summarized in Table 7 and Table 8. Slight elongated tomatoes (Figure 33 and Figure 34) or small and no-suberized umbilicus (Figure 35) are among other usual allowed shape deformations (Table 6).
20	Puffiness	Deformations	Puffiness (Figure 37) refers to the existence of open cavities between the outer walls and the locular contents in one or more locules and is also known as hollowness or boxiness. Puffed fruits are not appreciated by consumers, because they lack gel in the locules and do not ship well, because of their relative softness [12]. Depressions can appear as external sign of puffiness (Figure 37). According to OECD standars [7], slight or not serious hollowness due to insufficient pollination is allowed in Class I and Class II and specific limits are established for each quality grade (Table 6). U.S. standards [2 and 5] provide description and limits, by quality grade, for puffiness of Tomatoes and Tomatoes on the Vine, which are summarized in Table 7 and Table 8.
21	Pest holes	Deformations	Marked holes (Figure 36) usually associated with overripe, rotting or damaged tomatoes. Pests (worm, slug, beetle, etc.) are frequently present. Tomato must be free from pest damage.
22	Sunken discoloured areas	Discolorations	Sunken discoloured areas usually derive from fungus attack. These lesions will later produce the fungal spores, leading to a soft decay and decay is considered a “free from” defect in tomatoes, there is no tolerance for this defect. There are three main looks for such as fungal lesions (Figure 21): ▪ Rough and greasy-looking, with greyish-green or brown to dark brown greasy blotches, which may cover large areas, even whole fruit (known as Late Blight, by *Phytophthora infestans*). Infected tissue is covered with white mycelia in cool wet weather. ▪ Black, sunken lesions (known as anthracnose, by *Colletotrichum coccodes).* Symptoms begin as small, depressed lesions that are circular in shape. Lesions enlarge and become more sunken. As the lesion matures, the centre turns tan and small black fruiting bodies appear. If the

			weather is wet, salmon-coloured spores can be observed on the lesion surface. ▪ Round fuzzy and black spots occurring anywhere on fruit, often on the sides or shoulders (known as Alternaria Rot, by *Alternaria alternata)*
23	Blossom-end discoloration	Discolorations	Most common discolorations specifically developed on the blossom end of tomatoes are Blossom End Rot and suberization of the stigma (Figure 22). Blossom-end rot begins as light tan, water-soaked lesions on the blossom end of the fruit. These lesions enlarge and turn black, sunken and leathery. They are considered as decay and thus not allowed. The cause is thought to be a combination of cold temperatures or excessive heat during blossom set, and fluctuations in water supply. It is also common to find a brown dry scar at the base of the shed stigma. This is known as suberization of the stigma and its limits for ribbed tomato are established in the OECD standard (Table 6).
24	Surface discolouration	Discolorations	Most common surface discolorations are caused by nutrient deficiency, heat and sun injury, viruses, stink bugs, fungus, hail and chilling injury. These are the main looks for surface discoloration: ▪ Greenish or yellowish ring around the stalk cavity being the visible sign of a hard, inedible part of the flesh. Known as greenback or yellowback, it should not extend over the shoulder of the fruit to be allowed. This disorder is usually caused by heat injury and insufficient potassium (Figure 23). ▪ Light brown to white bleached area caused by exposure to direct sunlight. Known as sunscald, the killed tissue gradually collapses forming a slightly sunken area that may wrinkle. The fruit can then be invaded by secondary organisms, causing fruit rot. Slight or reasonably scorching due to sun is allowed in Class I and II (Figure 24). ▪ Yellow rings or spots of different size caused by viruses such as the Tomato Spotted Wilt Virus (TSWV) or the Cucumber Mosaic Virus (CMV). Fruit infected are not allowed (Figure 25). ▪ Dark pinpricks surrounded by a light, discoloured area on green fruit, caused by stink bugs. These areas turn yellow or remain green on ripe fruit. The tissue under the spots is white and spongy

			and remains firm as the fruit ripens (Figure 26). ▪ Faint, pale yellow/white halos (3 to 8 mm in diameter), known as ghost spot and caused by de fungus *Botrytis cinera*. This pathogen is very important on greenhouse tomatoes or hydroponic systems. Halos rarely develop further. Maximum values for Class I (5 spots) and Class II (10 spots) are established[1] (Figure 27). ▪ Spots lighter green than the surrounding tissue. Light hail injury may cause depressed areas of various size and shape on the fruit. If the skin is broken, the surface of the spot becomes greyish-white and paper-like. A few days after the injury, the spot may be surrounded by a greenish-tan halo (Figure 28). ▪ Whitish skin, discoloration affecting practically all the surface of the fruit affected by chilling injury (Figure 29). These skin defects are allowed, either in Class I or Class II, provided the fruit is only slight or reasonably affected.
25	Internal discolouration	Discolorations	There are two kind of internal discolouration to mention: one associated to shrunken water-soaked tissue and other one associated to firm, hard flesh. The first type is whitish to brownish coloured and it is caused by bruising or cold injury (not allowed) (Figure 30). The second type is derived from green/yellowbacks and flesh is green/yellow coloured (allowed in Class I and II if slight) (Figure 31).
26	Physical maturation	Maturation	Changes occurring in the cell wall during maturation affect to the tissue strength and modify the physical resistance or **firmness** of the fruit. Maturation culminates in fruit dehiscence or **shattering**.
27	Firmness	Physical maturation	The firmness is an indication of the tomato's ripeness. It should not be too soft. People in general like to eat firm (but ripe) tomatoes rather than soft ones. However, a study with consumers from 3 countries The Netherlands, France, and Italy identified the overall flavour and firmness as the most important traits for improving tomato fruit quality. It showed

[1] Report following OECD/UNECE quality standards for tomato, 2006. Fred Jacobs, KCB-Quality Inspection Bureau for fruits and vegetables. Source: http://www.unece.org/fileadmin/DAM/trade/agr/meetings/capacity-building/2006_mojmirovce-SK/TomatoesSlowak.pdf)

<table>
<tr><td></td><td></td><td></td><td>that consumer preferences from different European countries are segmented following similar patterns and that diversification of taste and texture is required to satisfy all consumers' expectations as some consumers preferred firm tomatoes, while others preferred melting ones and were more or less demanding in terms of sweetness and flavour intensity [13].

There is not a European standard for this parameter. As reference, in USA, it is used a scale of six grades, based in the compression needed to deform fruit surface by 5 mm, see following table:
<table>
<tr><th>Grade</th><th>Newton for 5 mm compression</th></tr>
<tr><td>Very firm</td><td>30-50</td></tr>
<tr><td>Firm</td><td>20-30</td></tr>
<tr><td>Moderately firm</td><td>15-20</td></tr>
<tr><td>Moderately soft</td><td>10-15</td></tr>
<tr><td>Soft</td><td>10</td></tr>
<tr><td>Very soft</td><td>5</td></tr>
</table>
See an example of textural characteristics of tomatoes, based on subjective and objective tests, in Table 9.

In current practice, the firmness is measured by a human grader through palpation. It can be objectively measured using a penetrometer (destructive), durometer (non-destructive, i.e. Durofel), the acoustic impulse response (AFS/AWETA) [14 and 15]), or low-mass impact (Sinclair iQ).</td></tr>
<tr><td>28</td><td>Shatter</td><td>Physical maturation</td><td>The berries should not detach from the truss. When they fall of spontaneously, it is a sign of overripeness.</td></tr>
<tr><td>29</td><td>Colour</td><td>Maturation and Aesthetic</td><td>Colour is a strong indicator of the level of maturity of the tomato. It shares a few features with the aesthetic aspects, see point 10 and 11.</td></tr>
<tr><td>30</td><td>Lycopene</td><td>Nutritional Value and Colour</td><td>Lycopene has been considered a potential agent for prevention of some types of cancers Tomato is the best source for this antioxidant. However, research on the topic is not conclusive.

Lycopene is a bright red carotene and carotenoid pigment so that it is highly related to colour development on tomato. Lycopene is the majority carotenoid (83%) in ripened fruit. Lycopene content in fresh tomato can vary from 30 to 300ppm [16]
In practice lycopene is not measured in tomato for</td></tr>
</table>

			fresh market but it is measured in tomato for industry. Lycopene is currently offline analysed in laboratory by HPLC method, after extraction with solvents. Some studies show close correlation of lycopene with the ratio of a*/b* [17 and 18]. Chemometric models have been developed for prediction of lycopene concentration in tomato puree from their visible reflectance (500–750 nm) spectra acquired by a fibre optic reflectance probe. The PLS model could predict lycopene concentration with an R^2 of 0.88 [19].
31	Nutritional Value	Maturation	Several molecules with nutritional value and implication in health because of their antioxidant capacity are synthetized and concentrated during tomato ripening. Some of them are described below. There are no marketing standards for these parameters.
32	Vitamins	Nutritional Value	Tomatoes are relatively rich in vitamin C (160-240 mg/kg) [20]. In practice, vitamin C is not measured in tomatoes for the fresh market. Vitamin C can be analysed in laboratory by HPLC method, after extraction with solvents.
33	Glutamic acid	Nutritional Value and Flavour	Glutamic acid is a free amino acid. As a tomato ripens the natural content of glutamate increases and gives the characteristic "umami" flavour[2]. Glutamic acid comprises up to 45% of the total weight of free amino acids in fresh tomato juice and free amino acids form about 2-2.5% of the total dry matter of tomatoes [21]. There are no labelling requirements for naturally-occurring free glutamates. Glutamic acid is determined by high performance liquid chromatography (HPLC), after extraction bay solvents.
34	Flavour	Maturation	Sugars, organic acids, free amino acids and aromas are the main components contributing to tomato flavour. The characteristic sweet-sour taste of tomato is due to a combination of the sugars and organic acids present. It is the sugar/acid ratio which contributes towards

[2] From the site of the International Glutamate Information Service http://www.glutamate.org/

<table>
<tr><td></td><td></td><td></td><td>giving many fruits their characteristic taste and so is an indicator of commercial and organoleptic ripeness. During the ripening process the fruit acids are degraded, the sugar content increases and the sugar/acid ratio achieves a higher value. Overripe fruits have very low levels of fruit acid and therefore lack characteristic flavour. Combinations of both components gives the following taste results: [3]

<table><tr><th>Acidity</th><th>Sugar Content</th><th>Taste</th></tr><tr><td>High</td><td>High</td><td>Good</td></tr><tr><td>High</td><td>Low</td><td>Tart</td></tr><tr><td>Low</td><td>High</td><td>Bland</td></tr><tr><td>Low</td><td>Low</td><td>Tasteless</td></tr></table></td></tr>
<tr><td>35</td><td>Sugars</td><td>Flavour</td><td>The tomato fruit is mostly water with about 5-7% of the fruit being solids. About 50% of the dry matter is composed of sugars, primarily the reducing sugars, glucose and fructose (Table 10).

The total sugar content of ripe tomato is between 1.7 and 4.7% [21].

A strong positive correlation has been observed between trained panel response of sweetness and reducing sugar or total soluble solids content [22].

As the degree Brix (°Brix) is and indicative of soluble solids %, soluble solids are in main part constituted by free sugars and free sugars of tomatoes are predominately reducing sugars, °Brix is typically used to approximately determine sugar content in tomato.

Degrees Brix are usually measured by means of the refractometer. For this, a few sample tomatoes are taken and pulped. The deflection of light is an indication of the sugar or soluble solids content. Recent systems have been developed for online measurement of °Brix (i.e. UNI-BRIX of UNITEC for melons).

Individual and total quantification of sugars can be carried out by chromatographic (HPLC), spectrophotometric and/or enzymatic methods.

There are no marketing international standards for tomato °Brix. However, it may be regulated at local</td></tr>
</table>

[3] http://www.growtomatoes.com/tomato-fruit-characteristics/

			level. For example in Technical Regulation for "Eusko Label" [23] 4,5° is minimum value for tomato °Brix. As reference, normal °Brix value for cherry or grape tomato is 6-10 and for common or round tomato is 3.5-5.5[4].
36	Acids	Flavour	The tomato fruit is mostly water with about 5-7% of the fruit being solids. Organic acids comprise about 15% of the dry content of fresh tomatoes (Table 10). Citric acid is the major organic acid in tomatoes, about 60% of the total organic acids, being the largest contributor to the total acidity and the titratable acidity of the fruit. Two other acids to mention, that contribute to the acidity are malic and glutamic acid. The rise in pH and decrease in titratable acidity indicates that acid concentrations in the fruit are declining with maturity [23]. 'Sourness' closely correlates with titratable acidity and pH [22]. Total acidity is determined by acid-base titration by using a standard counter-active alkali reagent. Individual determination of each acid can be carried out with specific commercial enzymatic tests or by high resolution HPLC with specific columns.
37	Soluble solids	Flavour	See point 35. In current practice, the total content of soluble solids (TSS) in tomato is measured by degrees Brix. Optical spectroscopy in visible (VIS) and near infrared (NIR) spectrum range have been successfully used for many years to determine the optimal harvest date as well as fruit quality development in post-harvest period. The spectral signature of fresh fruit and vegetables shows in the 400 to 1100 nm region two dominant absorption bands. The first one is the absorption band of chlorophyll at about 670 nm and red blush pigments between 500 and 600 nm. The second absorption band is due to water at about 970 nm, close to which, sugar and other carbohydrates contribute to additional light absorption in NIR region High correlation of total soluble solids of tomato concentrate has been found in the wavelength range from 1000 to 1700 nm [24].
38	Aromas	Flavour	Over 400 compounds have been identified in tomato

[4] http://www.yara.us/agriculture/crops/tomato/key-facts/market-requirements/default.aspx

fruit. Of those, only around 30 are present in concentrations over one part per billion (ppb) [25].

Table 2: Classification of the 70 volatile compounds responsible for tomato aroma [26 and 41]

Lipid derivatives		Phenylpropanoids
1-Penten-3-ol	2-Hexanal	Salicylaldehyde
1-Penten-3-one	E-2-Hexenal	Guaiacol
Pentanal	Z-3-Hexanol	Methyl salicylate
2-Ethyl furan	1-Hexenol	Ethyl salicylate
E-2-pentenal	Heptanal	Eugenol
1-Pentenal	Hexenal	
Z-2-Penten-1-ol	E-2-Heptanal	
Z-3-Hexenal	2-n-Pentylfuran	
E,E-2,4-Hexadienal	E,E-2,4-Heptadienal	

Other phenolic volatiles	
Toluene	2-Phenyl-3-butenol
Ethylbenzene	Benzyl alcohol
Styrene	Phenyl-Acetaldehyde
1-Phenylpropane	ρ-Cresol
Benzaldehyde	α- Phenylpropion-aldehyde
Phenol	Phenylethanol
ρ-Methylstyrene	Phenylacetonitrile
Benzonitrile	β- Phenylpropion-aldehyde

Derivatives of Leucine and Isoleucine	Terpenes
3- Methylbutanal	Limonene
2- Methylbutanal	(Z)-Linalool oxide
3- Methylbutanol	(E)-Linalool oxide
2- Methylbutanol	Ocimenol
E-2-Methyl-2-butanol	ρ-Cimen-8-ol
3-Methylbutanoic acid	4-Methyl -Acetophenone
3-Methylbutyl nitrite	α-Terpineol
C5H9NO2	2-Caren-10-al
C5H11NO2	
2-Isobutylthiazole	

Derivatives of carotenoids (open chain)	Derivatives of carotenoids (Cyclic)
6-Methyl-5-hepten-2-one	α-Isophorone
6-Methyl-5-hepten-2-ol	Acetophenone
5-Methyl-3-methylene-5-hexen-2-one	β-Cyclocitral
6-Methyl-3,5-heptadienecitr-2-one	β-Damascenone
β-Citral	β-Ionone
α-Citral	
Geranyl acetone	
Pseudoionone	

Techniques for aroma evaluation are: sensorial

			analysis, gas chromatography coupled to mass spectrometry (GC–MS) and microextraction of solid phase combined with gas chromatography coupled to mass spectrometry (MESP–GC–MS). More recently systems such as e-nose have been successfully applied for aromatic profiles in tomato [26].

2.1.2 Grapes

2.1.2.1 Introduction

The tables grapes (cultivars) that are considered are the ones to be supplied fresh to the consumer; table grapes for industrial processing are excluded from this report. The different varieties could be divided in different types (see Figure 2):

- Seeded or seedless varieties
- Large-berry or small berry varieties
- White, red or black coloured varieties

Figure 2: Different varieties of table grapes[28]

The grapevine cluster is made of a rachis and berries [29]. On the central axis of the rachis we find the peduncle, with the pedicels.

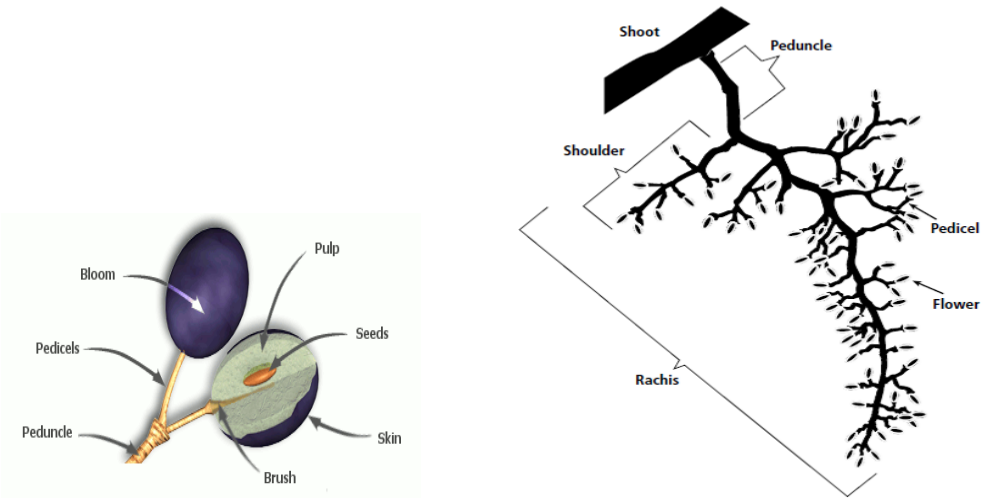

Figure 3: Different parts of table grapes bunch.

- **Cluster:** An entire bunch of grape berries
- **Rachis:** The main stem that runs from the peduncle down through the cluster of grapes.
- **Pedicel:** The stalk of a single flower of an inflorescence or of a berry.
- **Peduncle:** Stalk of an inflorescence or flower head. In grapes, the peduncle is the same as the cluster stem, meaning from the point of attachment to the shoot to the first lateral branch on the cluster
- **Stalk:** A stem or similar structure that supports a plant part such as a flower, flower cluster, or leaf.
- **Skin:** Film or skin that surrounds the fruit containing odorous substances and colouring tannins smoother than the ones from the rachis.
- **Bloom:** The wax dust that covered the film or skin that surrounds the fruit which makes a non-wettable film. It includes yeast involved during the fermentation.
- **Pulp:** A moist, slightly cohering mass, consisting of soft, vegetable matter with juice made of water, sugars and acids.
- **Seeds:** The small hard seedlike fruit of plants such as wheat. There are 1 or 2 per berry, made of tannins and oils (0.5 l of oil for 1 hl of wine).
- **Shatter:** A condition in which individual grape berries become separated from the stem. May be caused pre-harvest by cool, wet weather during early grape development, which tends to prevent the flower caps from falling off. Then, after the berries start to grow, they push against the cap and shatter, significantly reducing yields.
- **Shoot:** New green growth with leaves, tendrils, and often flower clusters, developing from a bud of a cane or spur.

A mindmap of the quality aspects related to table grapes is given in Figure 8. We have divided the quality attributes into two categories, related to appearance and related to maturation. Each of the quality aspects is described in more detail below.

Regarding these quality aspects, table grapes will be commercialized in three different categories, “Extra”, Class I and Class II. The superior quality is the “Extra”, “Class I” are the table grapes with good quality and the lower category but still with a marketable quality is referred as “Class II”. Conditions for each category are explained by the different UNECE, OCEDE and EU standards (see Annexes). An example of a bunch of grapes, “extra” class, “Class I”, “Class II” and out of grade are shown in Figure 4,Figure 5, Figure 6 and Figure 7 respectively [28].

Figure 4: Appearance: Extra class acceptable [30].

Figure 5: Appearance: Class I [30].

Figure 6: Appearance: Class II [30].

Figure 7: Appearance: Out of Grade [30].

UNECE and OECD explains recommendations for quality and marketing attributes, which are contemplated in the European Regulation No 543/2011 [31].

2.1.2.2 Mindmap

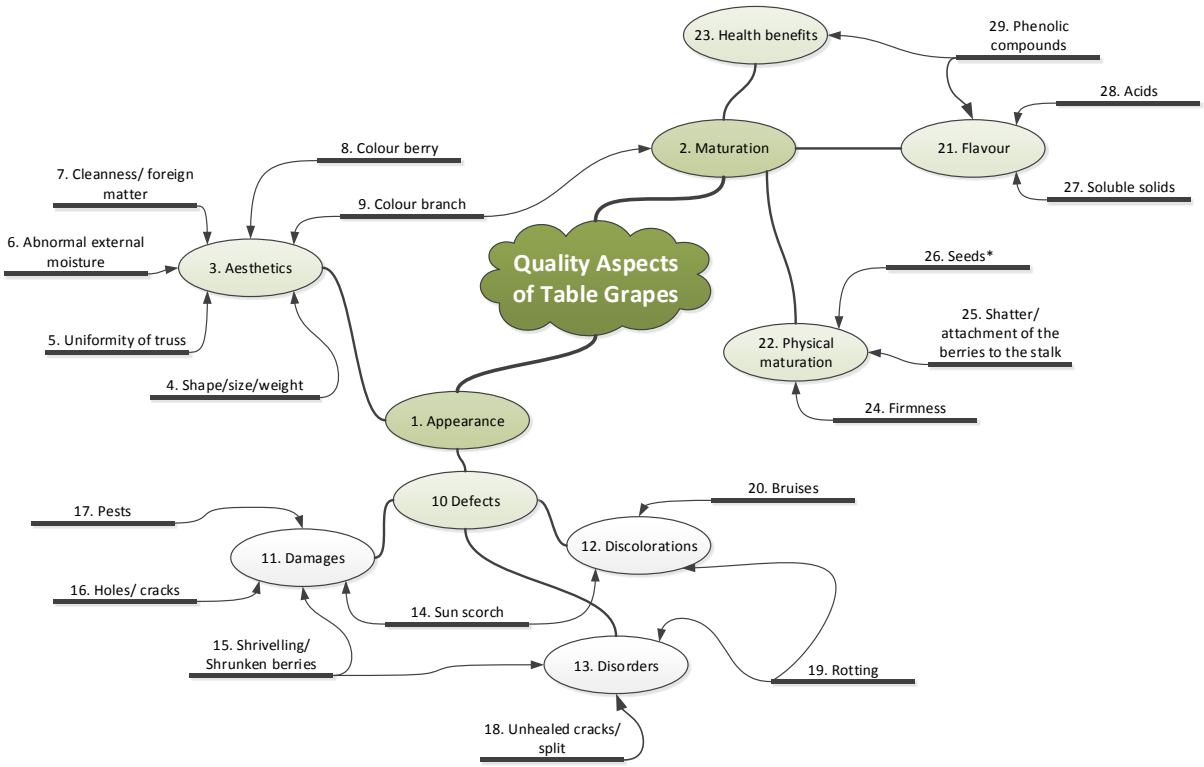

Figure 8: Mindmap of aspects related to the quality of table grapes.

2.1.2.3 Explanation of each quality parameter

Table 3: Description of quality attributes of table grapes

Nr	Quality aspect	Belongs to	Description
1	Appearance	Quality aspects	It is a summary of external attributes, which are visually noticeable. The factors related to this term can be divided in aesthetic parameters, which consumers perceive as characteristics of that product and in defects (disorder, damages discolorations) which can make the product not attractive for the consumer.
2	Maturation	Quality aspects	Grape ripening is a physiological period that starts at the moment of veraison (onset if ripening) and lasts until the fruit is fully ripened. This is a very important period that influences the composition of the grapes and determines varietal characteristics. Grapes undergo many changes during the ripening process which involve a number of physical and biochemical modifications, including weight, volume, rigidity, sugar, acidity, colour and aroma [32]. Table grapes will not ripen further once picked Maturation encloses not only the ripening of the fruit, known term for process that renders fruit attractive and palatable modifications during maturation include development of desirable flavour and colour, physical maturation involving modification of cell wall ultrastructure and texture (firmness) and changes in the nutritional value (vitamins and molecules with antioxidant activity).
3	Aesthetics	Appearance	This aspect comprises a number of features related to consumer's preferences. These features are described below.
4	Shape/size/weight	Aesthetic	Shape: Characteristics of the variety (Extra or Class I) or keeping with minimum requirements (Class II)  Size/weight: Size is determined by the weight of the bunch. Minimum bunch weight-75g [28]. This provision does not apply to packaged intended for single servings. Berry size: In USA specifications: For all varieties, other than seedless varieties, the berries must meet a minimum diameter of 10/16 inch. For all seedless varieties (Flame Seedless, Thompson Seedless, Perlette, Black Seedless, etc.) they must meet a minimum diameter of 9/16 inch.
5	Uniformity of bunch	Aesthetic	Berries must be well formed and normally developed,

			shot berries (underdeveloped berries) are not allowed *(*Figure 38*)* "Unevenly developed "bunches, i.e. "shot" berries resulting from insufficient pollination. The "shot" berries are usual seedless in those varieties that normally develop seeds. They may be entirely greens and hard or mature and colour uniformly with the normal berries. "Thin" (straggly) bunches, i.e. with berries too far apart on the stalk or with too few berries are neither allowed. Bunches with berries of the same size, shape and colour are preferred. Also, the berries should be evenly spaced along the stalk and have their bloom virtually intact, see Figure 47.
6	Abnormal external moisture	Aesthetic	This issue applies to excessive moisture, for example free water lying inside the package. Anyway, it does not include condensation on produce following release from cool storage or refrigerated vehicle.(Figure 39)
7	Cleanness/Foreign matter	Aesthetic	Table grapes should be practically free of visible soil, dust, chemical residue or other foreign matter. However ,as it is not possible to clean the berries of table grapes before eating, chemical residue, soil, dust, sooty mould or pollution by mealy bug secretion is not allowed (Figure 40).
8	Colour berry	Aesthetic and Maturation	The colour of the berry is dependent on the variety. Pigmentation due to sun is not a defect. Berries of white varieties exposed to sun light turn yellow and may shoe pigmentation on the skin only (Figure 41). Characteristic of the variety (Extra) (tonality around yellow, green, red or black) and according to their state of ripeness. Uniformity/discoloration (colour within each berry and of the berry within the vine, to have uniform colouring in the packaging). Slight defects allowed (Class I) and defects allowed (Class II).
9	Colour branch	Aesthetic and Maturation	The branch should be green/yellowish, as that indicates freshness. A branch that is too woody or brown is a sign of overripeness. Berries will be likely to scatter.
10	Defects	Appearance	This aspect comprises a number of features (disorders, damages and discolorations) that affect the appearance of the fruit, even leading to safety troubles. Table grapes must be free from disease or serious deterioration which appreciably affects their appearance, edibility or market value. See below most common defects.
11	Damages	Defects	
12	Discolorations	Defects	

13	Disorders	Defects	
14	Sun scorch	Discolorations	Spots of sun scorch that deteriorate the skin and may affect the flesh are not allowed (see Figure 43*).*
15	Shrivelling/Shrunken	Disorders / Damages	Shrivelling could be the effect of any damage in the berry or internal disorder. Shrivelled berries and wilted rachis (stalk) and pedicels are not allowed (see Figure 42).
16	Holes /Cracks	Damages	Holes and cracks can arise from damages. Mostly they are caused by hail injury or cold injury.
17	Pests	Damages	Pest damage can detract from the general appearance and affect the keeping quality and edibility of the table grapes (Figure 46).
18	Unhealed cracks/split	Damages	Next to the cracks that are present due to damages, they can also arise from disorders. Most commonly, cracks result from extremely rapid fruit growth, called "growth cracks". Cracks may radiate from the stem end of the fruit or may encircle the fruit. Cracks are often invaded by secondary fungi and bacteria that further rot the fruit (see Figure 44).
19	Rotting	Damages	Rotting is a damage of the table grapes. The main reason of rotting of the grapes is the apparition of fungal diseases.
20	Bruises	Disorders / Discolorations	Deterioration or alteration of the skin or pulp caused by fungal diseases, as black rot (*Guignardia bidwellii*), powdery mildew (*Uncinula necator*), anthracnose (*Elsionoe amplelina*) or grey mould (*Botrytis cinerea*). (Figure 45*).*
21	Flavour	Maturation	Grapes contain numerous compounds responsible of their flavour: sugars, organic acids and phenolic compounds. The characteristic sweet-sour taste of grape is due to a combination of the sugars and organic acids present. It is the sugar/acid ratio which contributes towards giving many fruits their characteristic taste and so is an indicator of commercial and organoleptic ripeness. During the maturation, grape accumulates free sugars, and phenolic compounds. During the ripening process, the fruit uses malic acid as its respiratory substrate during maturation to conserve the stored sugars. Therefore, organic acids decrease during berry ripening. Bitterness and astringency of grapes are related to tannin and flavonols content, which are phenolic compounds.

22	Physical maturation	Maturation	Changes occurring in the cell wall during maturation affect to the tissue strength and modify the physical resistance or firmness of the fruit. Maturation culminates in fruit dehiscence or shattering (Shatter refers to the loose berries, those that have detached from the stem.
23	Health benefits	Maturation	Several molecules with implication in health because of their antioxidant capacity are synthetized and concentrated during grave ripening. Some of them are described below. There are no marketing standards for these parameters.
24	Firmness	Physical maturation	According to OECD [34]: Berries must be firm and firmly attached. Berry firmness is a measurable parameter and would therefore allow sorting the table grape cultivars into different firmness ranges or categories [35]. Moreover, characterisation of the texture of grape flesh is important for breeding new cultivars of table grapes [36].
25	Shatter/ attachment of the berries to the stalk	Physical maturation	The berries should not detach from the truss. When they fall of spontaneously, it is a sign of overripeness, (see Figure 48*).*
26	Seeds	Physical maturation	The small hard seedlike fruit that are mostly present in the grape. There are 1 or 2 per berry, made of tannins and oils.
27	Soluble solids	Flavour	Soluble solids content is directly related to ripeness. Sugars are a large portion of soluble solids in grapes, being glucose and fructose the main ones. In unripe berries, glucose is the predominant sugar. At the ripening stage, glucose and fructose are usually present in equal amounts (1: 1 ratio), with some variation among grape variety. In overripe grapes, the concentration of fructose, exceeds that of glucose. In general, as the berry approach full maturity, berry size reaches a maximum and sugar accumulation slows. °Brix is traditionally used to measure the sugar content as well as soluble solid content. As soluble solids are in main part constituted by free sugars. According to CODEX recommendations [33], the fruit must have a refractometric index of at least 16ºbrix. Fruit with a lower refractometric index are accepted provided a specific sugar/acid ratio. According to Regulation EU 543/2011 [31]. The juice of the berries must have a refractometric index of at least: ▪ 12° Brix for the Alphonse Lavallée, Cardinal and Victoria varieties

			▪ 13° Brix for all other seeded varieties ▪ 14° Brix for all seedless varieties. In addition all varieties must have satisfactory sugar/acid ratio levels.
28	Acids	Flavour	Next to sugars, organic acids are the most abundant solids present in grape. They are responsible for the tart taste and have a marked influence on wine stability, colour, and pH. The principal organic acids found in grapes are tartaric, malic, and to a small extent, citric. During the early period of berry growth, concentration of both main acids increases in the fruit. With the onset of ripening, as the sugar accumulates in the fruit, the acid concentration decreases. Generally the reduction in malic acid is greater, and consequently, at maturity, the fruit contains more tartaric acid than malic. Acidity can be measured by the pH value. Titratable acids can be measured through titration with a base. High-performance liquid chromatography (HPLC) can be used analyse the acids According to CODEX the fruit must have a refractometric index of at least 16ºbrix. Fruit with a lower refractometric index accepted provided sugar/acid ratio at least equal to: Sugar/acid ratio (CODEX): If °Brix < 16, fruit are accepted provided the sugar/acid ratio is at least equal to: ▪ 20:1 if the 12.5≤°Brix< 14 ▪ 18:1 if the 14≤°Brix< 16
29	Phenolic compounds	Flavour/ Healthy benefits	Phenolic compounds are responsible for the bitterness and astringency of many foods. Following sugars and acids, they are the most abundant constituents present in grapes. These compounds are primarily located in the seeds and skins of the berry. Among phenolic compounds, main groups related with flavour are tannins and flavonols. Tannins are very complex compounds. They are yellow, brown, and red coloured as well as astringent and bitter. Flavonols are responsible of bitterness too. Analytical determination of these compounds is carried out employing spectrophotometry or chromatographic methods. Among grape phytochemicals, polyphenols are the most important because they possess many biological activities and health-promoting benefits, due to their antioxidant power. The phenolic compounds mainly include anthocyanins, flavanols, flavonols, stilbenes (resveratrol) and phenolic acids. Anthocyanins are

			pigments, and mainly exist in grape skins. Flavonoids are widely distributed in grapes, especially in seeds and stems, and principally contain (+)-catechins, (−)-epicatechin and procyanidin polymers. Anthocyanins are the main polyphenolics in red grapes, while flavan-3-ols are more abundant in white varieties. The reported evidences of beneficial health effects of phenolic compounds include inhibiting some degenerative diseases, such as cardiovascular diseases, and certain types of cancers, reducing plasma oxidation stress and slowing aging. Several methods have been used to monitor and compare the antioxidant activity of foods: DPPH, FRAP, ABTS, ORAC….These methods are based on spectrophotometric or fluorimetric measurements.

2.2 Ready Meals

Apart from a generic description, there appears to be no formal, public domain, detailed definition of a chilled ready meal. Each product type is individually designed and specified jointly by the manufacturer and the retail customer. Each retailer has a set of specifications for each product and a quality check list for inspection and acceptance, but these are confidential to the retailer.

Although, by the help of documents that were presented to us by Marks and Spencer and 2 Sisters Food Group Limited we have built the mind map and table below. We focus on a 3 component ready meal. These ready meals traditionally consist of a piece of meat, some vegetables and an ingredient rich of carbohydrates, like rice or potatoes. In this deliverable we give an overview of quality parameters that are related to 3 component ready meals and focus on the ready meal, chicken in red wine sauce, sold by Marks and Spencer, as an example. This ready meal consists of a chicken fillet in red wine gravy, carrots and peas and mashed potatoes. We assume that the quality of the different ingredients in the ready meal is desirable.

2.2.1 Ready-meals: Chicken in Red Wine Sauce

A mindmap with the general overview of aspects related to the quality of ready meals is given (Figure 9) together with a description of quality parameters related to the ready meals (Table 4).

2.2.1.1 Mindmap

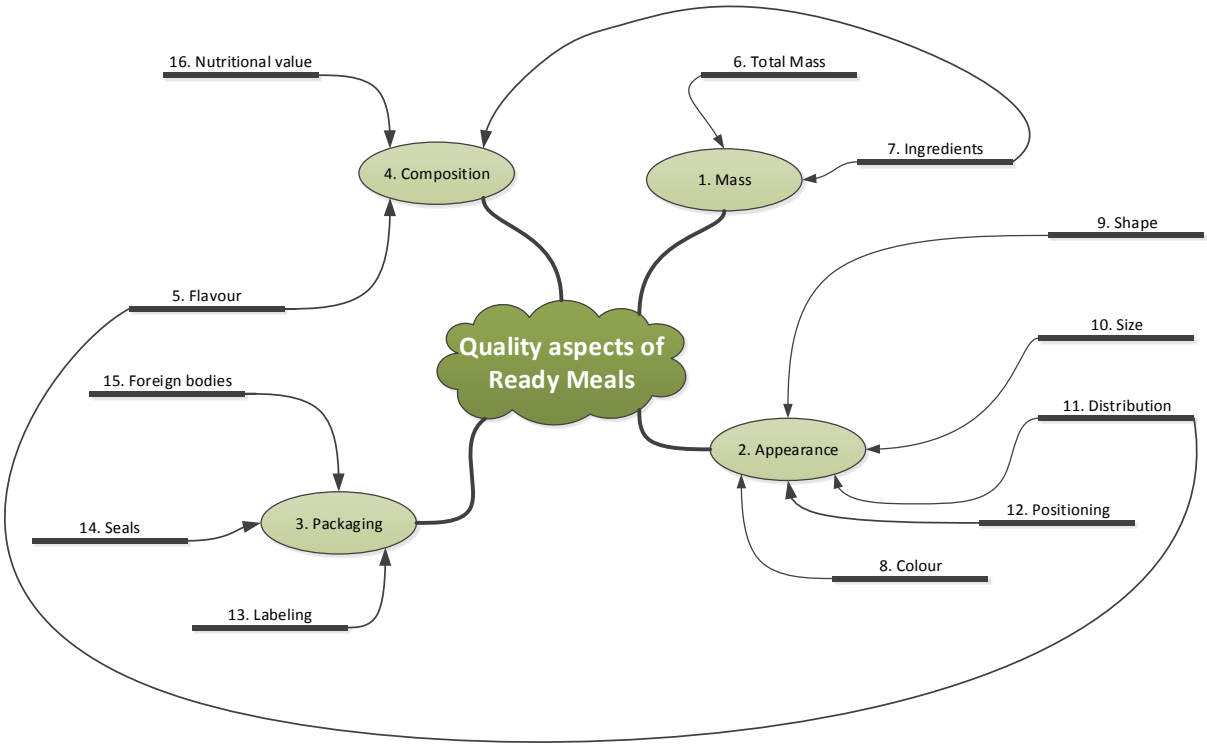

Figure 9: Mindmap of aspects related to the quality of ready meals

2.2.1.2 Explanation of each quality parameter

Table 4: Description of quality attributes of ready meals

Nr	Quality aspect	Belongs to	Description
1	Mass	Quality aspects	It is the quality attribute describing the mass of the complete ready meal and its ingredients.
2	Appearance	Quality aspects	It is a summary of external attributes, that are visually noticeable. It are aesthetic parameters, which consumers perceive as characteristics of the ready meal or its ingredients.
3	Packaging	Quality aspects	Quality parameters that describe the used package.
4	Composition	Quality aspects	The composition of a ready meal is the amount of each ingredient that is used to get the desired pie. The composition is dependent on several parameters, like the price class of the ready meal, the desired taste, …
5	Flavour	Quality aspects	The taste perceived of the ready meal in the mouth [37].
6	Total mass	Mass	The mass of the complete ready meal. The package is not included in this mass.
7	Used ingredients	Mass and Composition	The mass of each ingredient in the ready meal should be between the ranges that are predefined.
8	Colour	Appearance	The colour of each ingredient of the ready meal should be like expected. Colours are defined along the L*, a* and b* axes of the CIELab colour space.
9	Shape	Appearance	The shape is the geometry of the ingredients in the ready.
10	Size	Appearance	The ingredients in the ready meal has to be between certain ranges of size that are defined by the producer.
11	Distribution	Appearance and Flavour	The desired distribution of the different ingredients in the ready meal. The ingredients should cover the right amount of space.
12	Positioning	Appearance	The desired positioning of all the ingredients. They need to be in the correct compartment and in the compartment, they should be in the correct position.
13	Labelling	Packaging	The labels on the package must be correct and legible. The indicated ingredients must be according to the ready meal itself and the date coding must be correct.
14	Seals	Packaging	The packages must be fully sealed. No holes or damages are allowed. No debris is allowed beneath the seal.

15	Foreign bodies	Packaging	The presence of objects that are not wanted in the object is forbidden.
16	Nutritional value	Composition	The nutritional value of the whole ready meal. It is dependent on the nutritional value of the used ingredients.

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4 Annexe 1: Figures

4.1 Tomatoes [34, 38 and 39]

Figure 10: Truss of round, ribbed and oblong tomatoes

Figure 11. Rough tomato. Not fresh in appearance (not allowed)

Figure 12. Soiled tomato (left) and treatment residues (right) (not allowed)

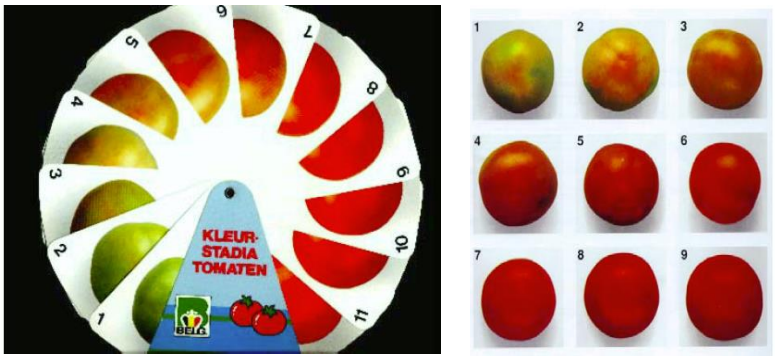


Figure 13. Left: Kleur-Stadia Tomaten *chart from the Dutch Central Bureau for Horticultural Auctions (OECD colour gauge); Rigth: chart of Difrusa Export S.A.(Cartagena, Spain)*

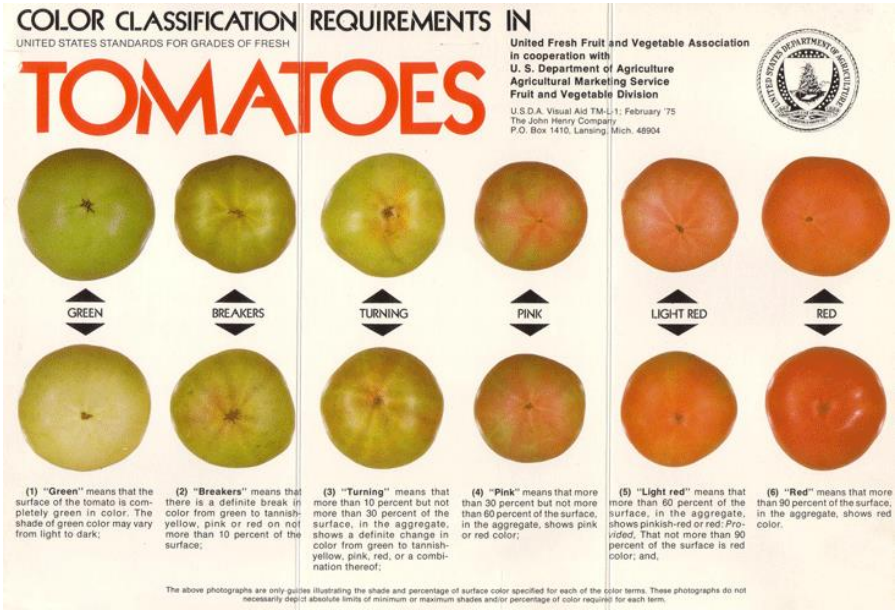


Figure 14. The 6 colour categories defined by the USDA.

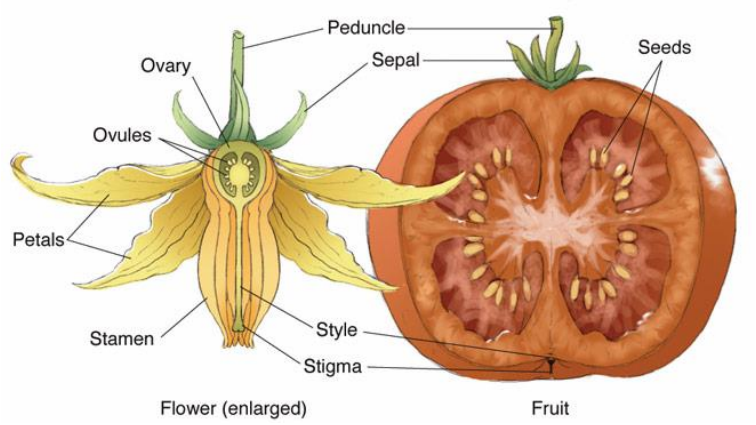
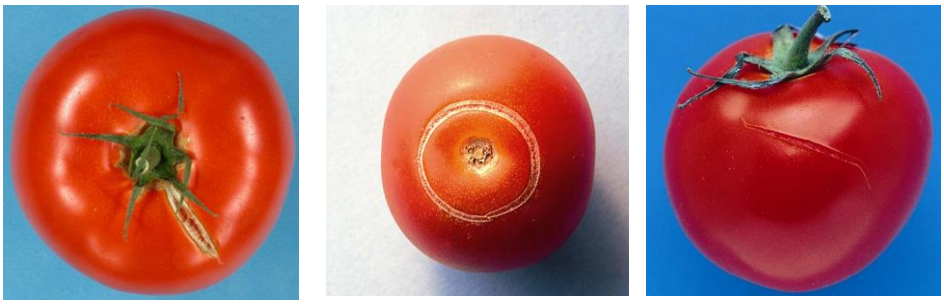


Figure 15. Anatomy of a tomato.

Figure 16. Damaged tomatoes: Slight puncture Class I (left); non-healed puncture out of grade (centre) and infected cut out of grade (right).



1 2 3

Figure 17. 1) Out of grade, non-healed radial crack; 2) Out of grade, non-healed concentric crack; 3) Fresh crack (not allowed).

1 2 3 4

Figure 18. 1) Class I, healed radial growth cracks; 2) Class II, healed radial growth cracks (< 3cm); 3) Class II, healed concentric growth cracks (< 3cm); 3) ; 4) Class II, fine cracking.

Figure 19. Left: linear scars longer than 2/3 of the widest diameter of the fruit (unacceptable); Centre: fine blossom scar, Class I; Right: fine blossom scar, Class II

Figure 20. Market bruising (out of grade). Bruise Class II

Figure 21. Sunken discoloured areas (not allowed). Late Blight (left), anthracnose (centre) and Alternaria rot (right)

Figure 22. Blossom end discoloration. Left: Blossom end rot (not allowed); Centre: suberization of the stigma (Class I); Right: suberization of the stigma (Class II)

Figure 23. Greenback Class II (left) and Yellowback Class II (right)

Figure 24. Marked sunscald (not allowed)

Figure 25. Not allowed discolorations caused by Tomato Spotted Wilt Virus (TSWV) and Cucumber Mosaic Virus (CMV).

Figure 26. Discoloration by stink bug feeding

Figure 27. Botrytis ghost spots. Class I (left); Class II (centre) and Out of grade (right)

Figure 28. White and paper-like unhealed spots caused by hail (not allowed)

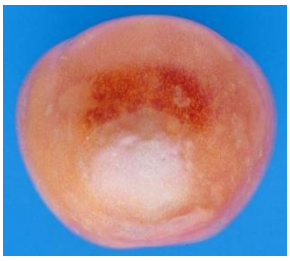


Figure 29. Chilling injury (not allowed)

Figure 30. Internal browning and cold injury (not allowed). External appearance (left) and internal appearance (centre) of browning and external appearance of cold injury (right)

Figure 31. Internal Greenback discolouration Class II (left) and Yellowback Class II (right)

Figure 32. Catfacing

Figure 33. Slight defect in shape for Class I round, ribbed and oblong tomato

Figure 34. Defect in shape for Class II round, ribbed and oblong tomato

Figure 35. Umbilicus Class I (left) and Class II (right)

Figure 36. Pest damage

Figure 37. Puffiness Class I (left) and Class II (centre). External aspect of puffiness (right)

4.2 Grapes [30 and 40]

A B C D

Figure 38: A. Bunch with shot berries, B. Ideal Bunch, C. Some bloom missing (Class I) and D. Poor bloom shape (Class II).

Figure 39: Abnormal external moisture

Figure 40: Not clean. Foreign matters.

A B C D

Figure 41: Colour: A. Out of Grade, B. Extra, C. Class I (Slight defect, colour not ideal for variety) and D. Class II (colour not characteristic of the variety).

Figure 42: Shrunken/shrivelled berries.

Figure 43: Sun scorch.

A B C

Figure 44: A. Unhealed cracks (Out of grade), B. Superficial skin defects allowed (Class I) and C. Class II.

Figure 45: Rotting or deterioration caused by fungal diseases

Figure 46: Affected by pests

A **B** **C**

Figure 47: Firmness: A. Firm cluster, B. Medium firm cluster and C. Soft cluster

Figure 48: Shattering.

5 Annexe 2: Tables

5.1 Tomatoes

Table 5: Example of colour changes during the ripening of fresh market tomato fruit [40]

Stage of Development/Color	USDA Color Chart Stage	L*	a*	b*	chroma	hue
Mature-Green	1	62.7	-16.0	34.4	37.9	115.0
Breaker	2	55.8	-3.5	33.0	33.2	83.9
Pink-Orange	4	49.6	16.6	30.9	35.0	61.8
Orange-Red	5	46.2	24.3	27.0	36.3	48.0
Bright Red; Table-ripe	6	41.8	26.4	23.1	35.1	41.3
Dark Red	6+	39.6	27.5	20.7	34.4	37.0

L* indicates lightness (high value) to darkness (low value); a* changes from green (negative value) to red, b* changes from blue to yellow (high value). Chroma and hue are calculated $[(a^{*2} + b^{*2})^{1/2}$ and $\tan^{-1}(b^*/a^*)]$ and indicate intensity and color, respectively. The lower the hue value, the redder the tomato. Hue is the single most useful color value.

Table 6: Summary of international standards for Tomatoes. The official text of the International Standards for Fruit and Vegetables [6] is in black; the interpretation of OECD standard is in blue and data from other sources is in brown.

	COMPARATIVE SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS		
Requirements	CLASSES		
	Extra	I	II
Market value	Superior quality	Good quality	Marketable quality
I. Definition of produce Commercial types	all varieties (cultivars) of *Licopersicum esculentum Mill*. round ribbed oblong or elongated "cherry" tomatoes (including "cocktail" tomatoes)		
II. ***Minimum requirements***	Intact Sound Clean, practically free of any visible foreign matter Fresh in appearance Practically free from pests and damage caused by pests Free of abnormal external moisture and foreign smell and/or taste The condition must be such as to enable them to withstand transport and handling and to arrive in satisfactory condition at the place of destination Stalks in case of trusses of tomatoes must be fresh, healthy, clean, free form all leaves an free from any visible foreign matter		
III. ***Quality requirements***			
- Appearance	Characteristic of the	Characteristic of the variety	In keep with minimum

	COMPARATIVE SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS		
Requirements	CLASSES		
	Extra	I	II
Market value	Superior quality	Good quality	Marketable quality
	variety		requirements
- Shape	Characteristic of the variety.	Sligth defects allowed	Defects allowed
- Development	Characteristic of the variety. Hollowness not allowed.	Sligth defects allowed. (Slight hollowness due to insufficient pollination is allowed)	Defects allowed. (hollowness due to insufficient pollination is allowed)
- Puffiness (According to the report of Fred Jacobs, KCB-Quality Inspection Bureau for fruits and vegetables, which follows the OECD/UNECE quality standards for tomato, 2006. Source: site of the United Nations Economic Commission for Europe-UNECE)	Not allowed	Max. 50% of the outline and a space of maximum 1/2 cm	space of maximum 1 cm
- Colouring	Very slith superficial defect allowed.	Sligth defects allowed	Defects allowed
- Flesh	Firm (resistant to normal finger pressure, which means that overripe tomatoes are not allowed)	Reasonably firm (a very slight mark may be visible on the fruit after normal finger pressure has been applied)	Reasonably firm but sligthly less firm than in Class I (may be distinguishably marked after normal pressure by the fingers but is not actually damaged)
- Greenbacks	Not allowed	Not allowed if visible	Allowed
- Skin	Very sligth superficial defects allowed.	Sligth defects allowed (such as scorching due to sun or chemical treatment, hail damage or slight damage caused by pests or disease are allowed)	Defects allowed (scorching due to sun or chemical treatment, hail damage or slight damage caused by pests or disease are allowed, provided the fruit is not seriously affected)
- *Botrytis cinera* spots (According to the report of Fred Jacobs, KCB-Quality Inspection Bureau for fruits and vegetables, which follows the OECD/UNECE quality standards for tomato, 2006. Source: site of the United Nations Economic Commission for Europe-UNECE)	Not allowed	Max. 5 spots	Max. 10 spots
- Bruises	Not allowed	Very sligth allowed (caused by rough handling are allowed provided they cause no more than slight damage to the flesh and are unlikely to develop	Allowed provided the fruit is not seriously affected (bruises caused by rough handling are allowed provided they cause a not too serious

	COMPARATIVE SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS		
Requirements	CLASSES		
	Extra	I	II
Market value	Superior quality	Good quality	Marketable quality
		further)	damage to the flesh and are unlikely to develop further)
- Healed cracks	Not allowed	Not allowed (in ribbed tomatoes healed cracks ≤1cm are allowed)	Limit allowed 3 cm in length for round, ribbed or oblong tomatoes
In ribbed tomatoes only: Healed cracks	Not allowed	Limit allowed: 1 cm in length	
Protuberances	Not allowed	Non-excessive protuberances allowed	More pronounced protuberances allowed than under Class I, but without being misshapen
Suberization of stigma	Not allowed	Limit allowed 1 cm^2	Limit allowed 2 cm^2
Fine elongated blossom scar	Not allowed	Limit allowed 2/3 of the greatest diameter of the fruit	Allowed
Umbilicus	Not allowed	Allowed if small, but no suberization	Allowed
Umbilicus (*Color charts prescribed for export tomatoes*. Report from the site of the Department of Agriculture, Forestry and Fisheries of Republic of South Africa[5])	Not allowed	rough marks not deeper than 1.5 mm and a total surface area of 225 mm^2, equivalent to a circle of 15 mm in diameter	corky marks not deeper than 1.5 mm and with a total surface area of 340 mm^2, equivalent to a circle of 20 mm in diameter
IV. ***Sizing*** *(not applicable to cherry tomatoes)*			
Minimum size: - Round and ribbed - Oblong	..... 35 mm .... 30 mm		
Sizing scale (not applicable to trusses of tomatoes)	compulsory	compulsory	
Sizing scale for the USDA Grade Standards[6] for Greenhouse tomatoes (effective March 19, 2007) and Tomatoes on the vine, excludes cherry and grape type tomatoes (effective January 18, 2008)	*Greenhouse tomatoes* sized by count per container, net weight per container, or in accordance with the following designations:		

	Inches	
Size designations	Minimum diameter*	Maximum diameter**
Small	2-4/32 (53mm)	2-9/32 (57mm)
Medium	2-8/32 (56mm)	2-17/32 (63mm)
Large	2-16/32 (62.5mm)	2-25/32 (69mm)

[5] http://www.nda.agric.za/doaDev/sideMenu/foodSafety/doc/Tomatoes%20Colour%20charts.pdf
[6] http://www.unece.org/fileadmin/DAM/trade/agr/meetings/ge.01/2009/INF20.pdf

<table>
<tr><td></td><td colspan="3">COMPARATIVE SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS</td></tr>
<tr><td rowspan="2">Requirements</td><td colspan="3">CLASSES</td></tr>
<tr><td>Extra</td><td>I</td><td>II</td></tr>
<tr><td>Market value</td><td>Superior quality</td><td>Good quality</td><td>Marketable quality</td></tr>
<tr><td></td><td colspan="3">Extra large | 2-24/32 (69mm) |
* Will not pass through a round opening of the designated diameter when tomato is placed with the greatest transverse diameter across the opening.
** Will pass through a round opening of the designated diameter in any position.

However, the most common form of sizing is done by counts with the following ones prevalent - 22’s, 24’s, 28’s, and 32’s, 35’s, 39’s, 45’s, 52’s.

<u>Tomatoes on the vine</u>
The USDA standard for Tomatoes on-the-Vine excludes cherry and grape type tomatoes. The provision of this standard allows for sizing by count or weight per container or top a specified minimum and/or maximum diameter.</td></tr>
<tr><td>Sizing according to CODEX Standars for tomatoes (293/2008)
and
UNECE STANDARD FFV-36 concerning the marketing and commercial quality control of tomatoes
and UE Regulation, No 543/2011</td><td colspan="3">tomatoes are sized with one of the following options:
a) according to the following table:
<table><tr><th>Size code</th><th>Diameter (mm)</th></tr><tr><td>0</td><td>≤ 20</td></tr><tr><td>1</td><td>> 20 ≤ 25</td></tr><tr><td>2</td><td>> 25 ≤ 30</td></tr><tr><td>3</td><td>> 30 ≤ 35</td></tr><tr><td>4</td><td>> 35 ≤ 40</td></tr><tr><td>5</td><td>> 40 ≤ 47</td></tr><tr><td>6</td><td>> 47 ≤ 57</td></tr><tr><td>7</td><td>> 57 ≤ 67</td></tr><tr><td>8</td><td>> 67 ≤ 82</td></tr><tr><td>9</td><td>> 82 ≤ 102</td></tr><tr><td>10</td><td>> 102</td></tr></table>b) according to the maximum difference in diameter between tomatoes in the same package, limited to:
– 10 mm, if the diameter of the smallest fruit (as indicated on the package) is under 50 mm;
– 15 mm, if the diameter of the smallest fruit (as indicated on the package) is 50 mm and over but under 70 mm;
– 20 mm, if the diameter of the smallest fruit (as indicated on the package) is 70 mm and over but under 100 mm;
– There is no limitation of difference in diameter for fruit equal or over 100 mm.

c) by count, diameter or weight, according to the provisions of the legislation of the importing country</td></tr>
<tr><td>V. Tolerances
(by number or weight)

Quality</td><td>5% not satisfying the requirements of the class but meeting those of Class I or, exceptionally, coming within the tolerances of that class</td><td>10% not satisfying the requirements of the class but meeting those of Class II or, exceptionally, coming within the tolerances of that class.</td><td>10% satisfying neither the requirements of the class nor the minimum requirements, with the exception of produce affected by rotting, marked bruising or any other deterioration rendering it unfit for</td></tr>
</table>

	COMPARATIVE SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS		
Requirements	CLASSES		
	Extra	I	II
Market value	Superior quality	Good quality	Marketable quality
			consumption.
- fruit detached from the stalk in the case of tursses of tomato		5%	10%
	To adjust the net weight indicated, individual fruit are allowed in pre-packages of trusses of tomatoes provided the tolerances specified above are met in the relevant lot.		
Size	10%	10%	10%
	Minimum under the scope of size tolerances: 33 mm for round and ribbed tomatoes and 28 mm for oblong tomatoes		
Regulation (EU) No 543/2011	5% by number or weight out of standards, but within Class I. Within this tolerance not more than 0,5% within Class II standards.	10% by number or weight out of standards. Within this tolerance not more than 1% not satisfying Class II or min. requirements. Trusses of tomatoes: 5% by number or weight detached from the stalk	10% by number or weight out of standards, not more than 2% in total may consist of produce affected by decay. Trusses of tomatoes: 10% by number or weight detached from the stalk
VI. Packaging and presentation			
Uniformity	Origin Variety or commercial type Quality Size Ripennes Colouring	Origin Variety or commercial type Quality Size Ripennes Colouring	Origin Variety or commercial type Quality Size (if sized)
	Length of oblong tomoatoes must be sufficiently uniform Visible part of the package must be representative of the entire content		
Uniformity for the USDA Grade Standards for Greenhouse tomatoes (effective March 19, 2007) and Tomatoes on the vine, excludes cherry and grape type tomatoes (effective January 18, 2008)	*Uniformity provisions for both, Greenhouse tomatoes and Tomatoes on the vine*: Fifteen percent (15%) of tomatoes in any lot may vary from the size indicated; however no more than 5% may be less than the size indicated.		
Packaging	– protects produce properly – materials used inside the package new and clean and of a quality to avoid causing external or internal damage – non toxic ink or glue on printing or labelling – free of all foreign matter		
Uniformity for the USDA Grade Standards for Greenhouse tomatoes (effective March 19, 2007)	The Greenhouse tomatoes are packed by size in 8 to 10-lb, single layer cartons, or 20-lb double layers. However, there is no direct correlation between counts uses and weights due to differences in density/mass of tomatoes. It is important to point out that the tomatoes are packed and are marketed either way and other counts and carton sizes are permitted.		

	COMPARATIVE SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS		
Requirements	CLASSES		
	Extra	I	II
Market value	Superior quality	Good quality	Marketable quality
Presentation	– individual tomatoes, with or without calyx and short stalk; – trusses of tomatoes, should comprise at least the following number of tomatoes: • 3 (2 if prepackaged) or • in the case of trusses of cherry tomatoes, 6 (4 if prepackaged)		
VII. Marking	– identification of packer and/or dispatcher – "tomatoes" or "trusses of tomatoes" and the commercial type, if the contents are not visible from outside. These details must always be provided for "cherry" (or "cocktail") tomatoes whether in trusses or not – variety (optional) – country of origin (region optional) – quality class – size expressed as minimum and maximum diameters (if sized), or the word "unsized" where appropriate – official control mark (optional)		

Table 7: United States Standards for Grades of Fresh Tomatoes, 1991.

Factor	**US No. 1**	**US No. 2**	**US No. 3**	**US Combination**
Basic requirements	Similar varietal characteristics; Mature; Not overripe or soft; Clean; Well developed			a combination of U.S. No. 1 and U.S. No. 2 tomatoes: Provided, That at least 60 percent, by count, meet the requirements of U.S. No. 1 grade.
	Fairly well formed	Reasonably well formed	May be misshapen	
	Fairly smooth	Not more than slightly rough	- -	
Decay	Free	Free	Free	
Freezing injury	Free	Free	Free	
Sunscald	Free	Free	Not seriously damaged	
Damages: references to Area, Aggregate Area, Length or Aggregate Length are based on a tomato having a diameter of 2-1/2 inches (64 mm)[7]				
Cuts and broken skins	Not shallow or not well healed, or shallow, well healed cut more than 1/2 inch (12.7 mm) in length, or other shallow, well healed skin breaks aggregating more than a circle 3/8	Not shallow or not well healed, or shallow, well healed cut more than 1/2 inch (12.7 mm) in length, or other shallow, well healed skin breaks aggregating more than a circle 1/2	Fresh or healed and extending through the tomato wall	

[7] Conversion to metric equivalent, make to nearest whole millimeter

Factor	US No. 1	US No. 2	US No. 3	US Combination
	inch (9.5 mm) in diameter	inch (12.7 mm) in diameter		
Puffiness	Open space in 1 or morelocules materially detractsfrom appearance of tomatocut through center at rightangles to a line from stem to blossom end	Open space in 1 or more locules seriously detracts from appearance of tomato cut through center at right angles to a line from stem to blossom end	Open space in 2 or more locules very seriously detracts from appearance of tomato cut through center at right angles to a line from stem to blossom end	
Catfaces	Scars are rough or deep,channels are very deep or wide, channels extend into a locule, or a fairly smooth catface aggregating more than a circle 1/2 inch (12.7mm) in diameter	Scars are rough or deep, channels are very deep or wide, channels extend into a locule, or a fairly smooth catface aggregating more than a circle 3/4 inch (19.1 mm) in diameter	Channels extend into the locule, wall has been weakened to the extent that slight pressure will cause a tomato to leak, or a fairly smooth catface aggregating more than a circle 1 inch (25.4 mm) in diameter	
Scars (other than catfaces)	No depth and aggregatingmore than a circle 3/8 (9.5 mm) in diameter	No depth and aggregating more than a circle 5/8 (15.9 mm) indiameter	No depth and aggregating more than a circle 1 inch (25.4 mm) in diameter	
Growth cracks (radiating from or concentric to stem scar)	Not well healed, more than 1/8 inch (3.2 mm) in depth, individual radial cracks more than 1/2 inch (12.7 mm) in length, aggregate length of all radial cracks more than 1 inch (25.4 mm) measured from edge of stem scar. Any lot of tomatoes which are at least turning may have cracks which are not well healed provided they are not leaking	Not well healed, more than 1/8 inch (3.2 mm) in depth, individual radial cracks more than 3/4 inch (19.1 mm) in length, aggregate length of all radial cracks more than 1-3/4 inch (44.5 mm) measured from edge of stem scar. Any lot of tomatoes which are at least turning may have cracks which are not well healed provided they are not leaking	Not well healed, more than 1/4 inch (6.4 mm) in depth, individual radial cracks more than 1 inch (25.4 mm) in length, aggregate length of all radial cracks more than 2-7/8 inches (73 mm) measured from edge of stem scar. Any lot of tomatoes which are at least turning may have cracks which are not well healed provided they are not leaking, not more than 1/8 inch (3.2 mm) in depth, individual radial cracks are not more than 3/4 inch (19.1 mm) in length	
Hail	Deep, rough, not well healed and corked	Deep, rough, not well healed and corked	Fresh, very deep or fairly smooth, shallow	

Factor	US No. 1	US No. 2	US No. 3	US Combination
	over, or fairly smooth, shallow hail marks aggregating more than acircle 3/8 inch (10 mm) indiameter	over, or fairly smooth, shallow hail marks aggregating more than acircle 5/8 inch (16 mm) in diameter	hail marks aggregating more than a circle 1 inch (25mm) in diameter	
Insect Injury	Materially detracts from the appearance or any insect is present in the fruit	Seriously detracts from the appearance or any insect is present in the fruit	Very seriously detracts from the appearance or any insect is present in the fruit	

Table 8: United States Standards for Grades of Tomatoes on the Vine. 2008.

Source: http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5065701

Factor	US No. 1	US No. 2
Basic requirements	Similar varietal characteristics (except when marked as mixed type or mixed variety); Mature; Not overripe or soft; Clean; Tomatoes shall be attached to stems/vines	
	Fairly well formed	Reasonably well formed
Decay	Free	Free
Freezing injury	Free	Free
Sunscald	Free	Free
Vines	Not be brittle, free from decay and free from damage by mold	Not be brittle, free from decay and free from serious damage by mold
Damages references to Area, Aggregate Area, Length or Aggregate Length are based on a tomato having a diameter of 2-1/2 inches (64 mm)		
Bruises	Not damaged	Not seriously damaged
Sriveling	Not damaged	Not seriously damaged
Disease	Not damaged	Not seriously damaged
Insects	Not damaged	Not seriously damaged
Cuts	not well healed, not shallow, or a cut more than 1/2 inch (12.7 mm) in length	not well healed, not shallow, or a cut more than 1/2 inch (12.7 mm) in length
Puffiness	when the open space in one or more seed cavities materially detracts from the appearance of the tomato when cut through the center at right angles to a line running from the stem to the blossom end	when the open space in one or more seed cavities seriously detracts from the appearance of the tomato when cut through the center at right angles to a line running from the stem to the blossom end
Catfaces	Scars are rough or deep,channels are very deep or wide, channels extend into a	Channels extend into the locule, wall has been weakened to the extent that slight pressure will

Factor	US No. 1	US No. 2
	locule, or a fairly smooth catface aggregating more than a circle 1/2 inch (12.7 mm) in diameter	cause a tomato to leak, or a fairly smooth catface aggregating more than a circle 1 inch (25.4 mm) in diameter
Scars (other than catfaces)	No depth and aggregating more than an area of a circle 3/8 (9.5 mm) in diameter	No depth and aggregating more than a circle 1 inch (25.4 mm) in diameter
Growth cracks (radiating from or concentric to stem scar)	Not well healed, more than 1/8 inch (3 mm) in depth, individual radial cracks more than 1/2 inch (13 mm) in length, aggregate length of all radial cracks more than 1 inch (25 mm) measured from edge of stem scar.	Not well healed, more than 1/8 inch (3 mm) in depth, individual radial cracks more than 3/4 inch (19 mm) in length, aggregate length of all radial cracks more than 1-1/2 inch (38.1 mm) measured from edge of stem scar.

Table 9: Textural characteristics of tomatoes based on subjective and objective tests. One Newton-force = 9.81 kg-force or 4.45 pound-force. [40]

Firmness Class	Description based on hand and finger pressure	Newtons-force
Very Firm	Fruit yields only slight to considerable pressure	>25
Firm	Fruit yields slightly to moderate pressure	18-25
Moderately Firm	Fruit yields moderately to moderate pressure	15-18
Moderately Soft	--	12-15
Soft	Fruit yields readily to slight pressure	8-12
Very Soft	Fruits yields very readily to slight pressure	<8

Measured by compressing fruit at the equator with a 25 mm flat cylindrical probe to a distance of 5 mm on a computerized texture analyzer. 1 Newton force = 9.81 kg-force or 4.45 pound-force.

Table 10: Composition of Dry Matter Content of Tomato [21]

Constituent	Fructose	Glucose	Saccharose	Cirtic acid	Malic acid	Protein	Dicarboxylic amino acid	Pectic substances	Cellulose	Hemicellulose	Minerals	Lipids	Ascorbic acid	Pigments	Other amino acids, vitamins and	volatiles
%	25	22	1	9	4	8	2	7	6	4	8	2	0.5	0.4	1	0.1

5.2 Table grapes

Table 11: Summary of international standards for Table grapes.

	SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS		
Requirements	CLASSES		
	Extra	I	II
Market value	Superior quality	Good quality	Marketable quality
I. Definition of produce Commercial types	This standard applies to table grapes of varieties (cultivars) grown from Vitis vinifera L. of the Vitaceae family,to be supplied fresh to the consumer, table grapes for industrial processing being excluded		
II. ***Minimum requirements*** ***A General***	Sound: free from defects with the exception of very slight superficial defects, produced affected by rotting or deterioration such as to make it unfir for comsumption is excluded. Fresh in appearance Clean: practically free of visibel foregn matter Practically free from pests ad damage caused by pests Free of anormal moisture Free of any foregn smell and/or taste ***Berries***: Intact berries Well formed Normally developed ***Bunches***: The development and condition of the table grapes must be such as to enable them: The condition must be such as to enable them to withstand transport and handling and to arrive in satisfactory condition at the place of destination		
B.Quality requirements **Bunches**: - Appearance - Shape - Colouring	Characteristic of the variety Characteristic of the variety Characteristic of the variety	Characteristic of the variety Sligth defects allowed Sligth defects allowed	In keep with minimum requirements defects allowed defects allowed
- **Berries**: - Appeearence	➢ Firm, ➢ Frimly attached ➢ Evenly spaced along the stalk and have their bloom virtually intact	➢ Firm, ➢ Frimly attached ➢ less evenly spaced along the stalk than in the "Extra" Class and, bloom intact as fas as possible	➢ sufficiently firm ➢ Sufficiently attached ➢ Less evenly spaced along the stalk than in Class I ➢ With bloom where possible ➢
- Defects	Not allowed	sligth defects allowed: very slight sunscorch affecting only the skin	Allowed: Slight sunscorch affecting the skin only Slight bruising Slight skin defects
C.Maturity requirements (EU)	The juice of the fruit shall have a refractometric index of at least: — 12 °Brix for the Alphonse Lavallée, Cardinal and Victoria varieties,		

	SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS		
Requirements	CLASSES		
	Extra	I	II
Market value	Superior quality	Good quality	Marketable quality
543/2011	— 13 °Brix for all other seeded varieties, — 14 °Brix for all seedless varieties. In addition, all varieties must have satisfactory sugar/acid ratio levels..		
III. ***Sizing*** Minimum size: *EU and UNECE Standards [28 and 31]*	-Determined by the weight of the bunch …… 75 g ……		
Minimum sizes: *Recommendations by OECD [40]*:			
• Varieties grown under glass, if indicated	300 g	250 g	150 g
• Open grown varieties Large berry varieties	200 g	150 g	100 g
• Small berry varieties	150 g	100 g	75g
IV. Tolerances			
Quality tolerances Regulation (EU) No 543/2011 UNECE	5% by weight, of bunches not satisfying the requirements of the class, but meeting those for Class I is allowed. Within this tolerance not more than 0,5% in total may consist of produce satisfying the requirements of Class II quality.	10%, by weight, of bunches not satisfying the requirements of the class, but meeting those of Class II is allowed. Within this tolerance not more than 1% in total may consist of produce satisfying neither the requirements of Class II quality nor the minimum requirements, or of produce affected by decay.	10% by weight, of bunches satisfying neither the requirements of the class nor the minimum requirements is allowed. Within this tolerance not more than 2 % in total may consist of produce affected by decay.
Size tolerances In packages not exceeding 1 kg net weight for direct sale to the consumer	10% But no below the minimum size of Class I	10% But not below the minimum size of Class II	10% But not below 75g
	In each sales package, one bunch weighing less than 75 g is allowed to adjust the weight, provided the bunch meets all other requirements of the specified class.		
V. Packaging and presentation			
Uniformity	Origin Variety or commercial type	Origin Variety or commercial type	Origin Variety or commercial type

	SUMMARY TABLE OF REQUIREMENTS LAID DOWN BY STANDARDS		
Requirements	CLASSES		
	Extra	I	II
Market value	Superior quality	Good quality	Marketable quality
	Quality Degree of Ripennes size Uniform in colouring	Quality Degree of Ripennes	Quality Degree of Ripennes
	Uniformoity of variety and origin is not required when packed in small consumer packages not exceding a net weight of one kilogram Bunches of different colours for decorative pruposes are allowed in each package in the case of the variety Chasselas Visible part of contents of the package must be representative of the entire contents		
Packaging	– protect the produce properly – Materials must be clean and not afffect product e.g. visible traces, ink smudges, etc. – Pacakges must be free of foreign matters – Stickers individually affized on the produce being such, that removed, neither leave visible traces of glue, nor lead to skin defects – Free of all foreign matters, although a fragment of vine shoot np more than 5 cm in length is allowed.		
Presentation	– Bunches presented in a single layer	-	-
VI. Marking	– Each package must bear the following particulars in letters grouped on the same side legibly and indelibly marked and previsible from the outside: <u>Identification</u> – identification of packer and/or dispatcher – Name and physical address, of different from the country of origin or a code mark officially recognized by the mnational authority <u>Nature of produce</u> – “table grapes” if contents are nos visible from outside – Name of variety – In case of a misture of table grapes of sistinctly different varieties-names of the different varieties – “underglass” where applicable <u>Origin of produce</u> – Country of origin- optionally district where grown or national regional or local place name – In case of a misture of distincttly different varieties of table grapes of different origins the indication of each countr of origin shall appear next to the name of the variety concernes <u>Commercial specifications</u> – Class – “late harvest grapes” where apllicable. – “Bunches below 75g intended for single servings” <u>Official control mark (optional)</u>		