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Quality Control System for the Tomato Release Process produced in Greenhouse

Sistema de Control de Calidad para el Proceso de Liberación de Jitomate producido en Invernadero

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Abstract

Quality control is considered a primary feature to determine the commercial value of the tomato (*Lycopersicon escultelum*) and the acceptability of the product by the customer, this based on standards and parameters that guarantee a high level of quality of the tomato accepted in the process of releasing it and affirm customer confidence. This project was carried out in an agro-producing and marketing company of tomato produced in a greenhouse in the Region of Tehuacán, Puebla, Mexico, and proposes a quality control system in the tomato release process through an analysis and study of the physical and chemical attributes of the fruit that is entered into the company, to subsequently assign a quality according to the behavior of the fruit, The quality of the tomato is based mainly on the uniformity of the shape and the absence of growth and handling defects present in the fruit. Size, although not a factor that defines the degree of quality, usually has an important influence on the expectations of its commercial quality.

Tomato, Greenhouse, Quality Control

Resumen

El control de la calidad se considera una característica primordial para determinar el valor comercial del jitomate o tomate (*Lycopersicon escultelum*) y la aceptabilidad del producto por parte del cliente, esto basado en estándares y parámetros que garanticen un alto nivel de calidad del jitomate aceptado en el proceso de liberación del mismo y afirme la confianza del cliente. El presente proyecto se realizó en una empresa agroproductora y comercializadora de jitomate producido en invernadero de la Región de Tehuacán, Puebla, México, y propone un sistema de control de la calidad en el proceso de liberación del jitomate mediante un análisis y estudio de los atributos físicos y químicos del fruto que es ingresado en la empresa, para posteriormente asignarle una calidad de acuerdo al comportamiento de la fruta, La calidad del tomate se basa principalmente en la uniformidad de la forma y en la ausencia de defectos de crecimiento y de manejo presentes en la fruta. El tamaño, aunque no es un factor que defina el grado de calidad, suele influir de manera importante en las expectativas de su calidad comercial.

Jitomate, Invernadero, Control de Calidad

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Introduction

The tomato (*Lycopersicon escultelum*) is a fruit belonging to the Solanaceae family, its origin dates back to the Low Andes, however, it was cultivated and domesticated by the Aztecs in Mexico.

The tomato (red tomato) has a thick, pubescent, long stem. It has a deep, pivoting root system with little branching. The main stem is formed by secondary stems composed of epidermis with glandular hairs, bark, vascular cylinder and medullary tissue, so the plant is not self-supporting and the use of tutors is necessary for its support. The flowers are grouped in racemose inflorescence or racemose cymes (SADER, 2023).

Fruits such as Saladette tomatoes are physiologically defined as climacteric fruits due to the presence of increased respiration and ethylene synthesis at the onset of eating maturity. As part of their natural ripening process, climacteric fruits continue to ripen after harvesting.

Tomato is one of the most consumed vegetables worldwide, of which there are many types of varieties, each of which satisfies a particular demand. Among the varieties we can find the following:

– **Saladette or Roma type tomato**

It is characterised by its oval shape and abundant pulp. It can be cultivated in the open air and under protected conditions, in the open air varieties with determinate growth are cultivated, while under protected conditions indeterminate varieties are chosen.

– **Ball or Round Tomato**

It is a large, round tomato with a lot of pulp. It reaches diameters between 5.4 and 9 cm. Internationally, it is a tomato in high demand. It can be presented in bunches of four or five fruits, although the latter is more complex to produce.

– **Cherri or Cherry tomato**

It is characterised by a high sugar content and the fruit diameters fluctuate between 2 to 3.5 cm. It is generally harvested one by one and in clusters (TOV Cherry). The fruits are red or yellow in colour.

– **Cocktail tomato**

It is a variety considered gourmet and its main destination is salads. It is characterised by being round or pear-shaped, with a diameter between 3,5 and 4,5 cm.

– **Grape tomato or Uvalina**

The grape tomato has the shape and size of a large grape. The taste is similar to that of the cherry tomato, but with its own unique nuances. It is usually harvested in bunches and is approximately 1" long by 3/4" wide. The grape tomato is a hybrid, with a good leaf cover and a sweet flavour.

– **Heirloom Tomato**

Also known as "Heirloom Tomato". It is an ancestral variety characterised by its vine-like appearance and diversity of colours and sizes. It is very sensitive to diseases and has a short life once harvested. In Spain there is a subtype of this variety known as Raf tomato. Its fruit is multilocular, fleshy, ribbed and small-seeded, with a marked green neck that distinguishes it, very fleshy and with a high dry matter percentage (it does not release liquid when cut) (I. Agrónomo 2022).

Main quality parameters for tomatoes

The environmental efficiency of agricultural production and the relationship between the type of management and the monetary value of achieving environmental efficiency are important parameters for assessing the competitiveness of farms (Turkten, H. and Ceyhan, Van, 2023) as is the case in greenhouse tomato production.

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With regard to fruit quality, one should not only think of fruit with a homogeneous appearance, without damage, with a long shelf life, one should look for the quality that consumers demand in fruit, i.e. those quality factors that they perceive through their senses, those that make up the organoleptic quality such as flavour (sugar content, acid content), firmness, colour (external and internal) and aroma (FAO, 2023).

Tomato cultivation in greenhouse structures is becoming increasingly common as a crop production system. However, environmental conditions inside a greenhouse favour the development of microbial diseases (Ally, N.M., Neetoo, H., Ranghoo-Sanmukhiya, V.M., and Coutinho T. A., 2023) so good cultivation practices should prevail.

The quality level of tomato is evaluated by external aspects and technical factors, in which the ripening stage of the fruit is paramount to achieve good fruit quality.

– **Tomato colour**

Colour is a sensory attribute that can be appreciated through the physical sense of sight. The shade of the tomato influences the customer's perception of quality, because customers associate a nice and bright intense colour with a high quality tomato, showing a preference for those fruits in which the appearance is attractive. Lycopene is a carotenoid with a simple structure with an aliphatic chain consisting of forty carbon atoms, lycopene is the pigment that gives tomatoes their characteristic colour. Colour is particularly important for tomatoes destined for industry, and the red must be a deep, uniform red free of defects such as cracks or bumps. Colour measurement serves as a quality control tool, as it determines maturity and post-harvest life, and is the determining factor in terms of customer acceptability (FAO, 2023).

– **Firmness**

Firmness is one of the physicochemical parameters that best relates to the degree of ripeness of the fruit, it is a parameter indicative of the quality of tomatoes that is related to the structure of the cell wall and the state of maturity, its determination is essential for storage and acceptability.

The firmness is the perception of the fruit to the touch, it depends on the turgidity, cohesion, shape and size of the cells that form the cell wall, the ripeness stage, the type and variety of tomato classified from Very Firm (fruits that do not yield to considerable pressure), Firm (fruits that yield only gently to considerable pressure), Soft (fruits that yield to moderate pressure), up to Very Soft (fruits that yield very easily to gentle pressure).

The fruit loses firmness due to physical and chemical changes that are associated with the degradation of the cell wall and the solubilisation of pectins by the enzymes pectinase, polygalacturonase and pectalolyses. The softening or loss of firmness of the fruit is caused by the cumulative effect of a series of modifications that occur in the polymer networks that constitute the primary cell wall. Fruit softening is a complex process that involves three subsequent steps: 1) cell wall relaxation mediated by expansins; 2) depolymerisation of hemicelluloses; and 3) depolymerisation of polyuronides by polygalacturonase or other enzymes; this is why there is a loss of firmness and changes in texture quality (Díaz F.R, Juárez L., Ruiz K. 2014).

Modifications in cell wall polymers during softening are complicated and are considered to involve a coordinated and interdependent action of a range of cell wall modifying enzymes and proteins such as polygalacturonase, pectinmethylesterase, β-galactosidase, xyloglucan endotransglycosylase and expansins (Díaz F.R., Juárez L., Ruiz K. 2014).

Firmness changes as fruits ripen and become softer, its measurement is used as a sensory quality parameter to measure texture. Regarding the measurement of fruit strength, there are different measurement techniques, based on mechanical properties such as penetration, compression, puncture, deformation, controlled impact, etc. (Grupo SPE3, S.L. 2022).

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– **Size/weight**

Although size is not a factor that defines the quality grade of fruits, it can have an important influence on the expectations of their commercial quality. This is due to the fact that depending on the weight of the fruit, the size or calibre of the fruit determines the different qualities: excellent fruit, medium quality fruit, low quality fruit. The size of the tomato varies and according to the weight, the size of the fruit is determined (FAO, 2023).

– **Proper development and maturity**

During development, the fruit incorporates photoassimilates, minerals and water. The most important factor determining the final size of the fruit is the incorporation of water. There is a gain of different nutrients over time, but the most significant gain for fruit size is the gain in water. Water content marks the difference in size between different fruits of the same plant (Lobos M. and Fierro M., 2019).

– **Absence of defects**

Good appearance is the most important component for customer acceptance. Shape is one of the most easily perceptible subcomponents. In some cases, shape is an indicator of maturity and therefore of taste. This parameter is essential to determine a good quality in fruits because defects are often rejected as a consequence of customer perception, which relates a good appearance with an optimal quality, showing preference for those fruits in which the appearance is good (FAO, 2023).

– **TSS or Brix content**

The sweetness of the fruit is the result of the content of Total Soluble Sugars (TSS) such as sucrose, sorbitol, glucose and fructose. More than one type of sugar may be present in the fruit. TSS content is an important quality parameter, as sweetness has an impact on taste and therefore on the consumer's purchasing decision. It is used as a quality parameter for all fruits, climacteric and non-climacteric. In climacteric fruits, starch is converted into sugars during ripening due to ethylene (C_2H_4). In this case, TSS indicate maturity.

TSS are used as maturity indicators for non-climacteric fruits that do not ripen further after harvest. In these fruits there is no starch reserve; sugars accumulate as a result of ripening and are the major component of DM. In stone fruits such as plums, peaches and nectarines, DM and TSS are closely correlated. In these cases, DM can be used as an index of maturity. TSS is measured as °Brix, where 1°Brix is equal to 1 g sucrose equivalents per 100 g solution.

After harvest, TSS is also used as a quality parameter for fruit grading and pricing. The TSS content allows to monitor the quality of stored fruit for sales decisions.

The conventional method for measuring TSS uses a refractometer and is destructive, laborious and time-consuming. Non-destructive measurement with near infrared spectroscopy (NIRS) instruments allows for the repeated estimates needed in precision horticulture (Grupo SPE3, S.L. 2022).

– **pH**

The most subjective method to determine the degree of ripeness of the fruit is its pH, a numerical index used to express the degree of acidity or alkalinity of a solution. The determination of the pH is determined by taking samples of the tomato juice and is measured using a previously calibrated potentiometer capable of reproducing pH values. For a perfectly ripe tomato the optimum pH is approximately below 4.6, the pH in a tomato should be between 4.0 and 4.5. Tomatoes tend to become less acidic as they ripen, so they are harvested until they are slightly ripe, in order to reach the right maturity (Díaz F.R, Juárez L., Ruiz K. 2014).

– **Defects**

Defects in tomatoes are one of the main causes of a decrease in the quality level of tomatoes. They are an alteration caused by factors inherent to the development of the fruit, they can be mechanical, climatic or by external agents, which compromise the appearance or quality of the tomato.

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– **Damage due to manipulation**

This type of defect is caused when tomatoes are not harvested on the plant with a smooth rotary movement, and due to inadequate handling can cause defects or a decrease in the quality level of the tomato (Clarifruit, 2021).

– **Dehydration**

When the tomato plant receives insufficient or too much irrigation, it may develop yellow leaves or have a wilted appearance. This can cause damage to the fruit, such as wrinkled skin caused by dehydration, or cracked skin caused by overwatering (Clarifruit, 2021).

– **Pests**

Due to infestation by various insects and worms, which can cause damage to tomato plants, damage can occur from the roots to the fruit (Clarifruit, 2021).

– **Skin defects**

Tomatoes can show a multitude of skin defects, such as cracks, scars, healed wounds, pale colour, green edges, brown spot, green shoulder, etc. These types of defects affect the appearance of the tomato and therefore affect the quality of the fruit (Clarifruit, 2021).

– **Bruising**

Bruising can occur from harvesting to post-harvest handling, however, during the highest stage of ripening the fruit is more susceptible to this type of defects, because the riper the fruit is, the lower the quality decreases due to the loss of its qualities (Clarifruit, 2021).

– **Open wounds**

This type of defect may occur during the growing process or due to improper handling of the fruit, which may cause cracks or wounds in the fruit causing water loss or black mould (Clarifruit 2021).

– **Rot**

Rot can come from various sources, such as lack of calcium balance in the tomato tissue causing a certain area of the tomato to turn dark brown or leathery leading to mould (Clarifruit 2021).

The applicable standard for the handling of tomatoes for marketing is NMX-FF-031-1997SCFI NON-INDUSTRIALISED FOODSTUFFS FOR HUMAN CONSUMPTION-FRESH VEGETABLES-TOMATO. This standard establishes the minimum quality specifications to be met by tomatoes of the Solanaceae family, in all their varieties, to be consumed fresh and marketed after preparation and packaging.

Quality control is crucial to ensure that finished products meet the requirements and standards specified in a manufacturing or production context. A key area where quality control is essential is sorting and separating goods on a conveyor belt (Kamanli, A.F., 2023), such as that used in the tomato release process.

This paper presents a proposal for a quality control system in the tomato release process for a primary vegetable production unit in the Tehuacán region dedicated to the cultivation and marketing of tomatoes in greenhouses. Given that tomato is a fruit susceptible to changes in its morphology due to different factors, after a good harvest management, it is necessary to continue with a correct handling of the fruits to avoid physical damage due to impact, compression, cuts, bruises, storage temperature, among others, This affects the acceptance of the product and its positioning in the marketing chain, for which the quality control in the process of releasing the tomato takes special relevance, where it is assigned according to the characteristics and behaviour of the fruit, the final quality of the product with which it will be marketed.

Methodology

The research is of type Applied Technological for having the purpose of generating a proposal that improves its System of Quality Control in its current process of liberation of the Tomato, for which the following methodology was applied:

- Study of the release process applied in the company
- Selection of the main tomato producers that participate in the company to apply the evaluation of the Quality Control System for the process of releasing the fruit.
- Selection of the predominant tomato varieties of the selected producers.
- Identification of the parameters to determine the quality of the tomato used in the company.
- Development of the Quality Control System proposal for the tomato release process.

Analysis of results

The company under study is a producer and marketer of tomato produced in greenhouses that works with 21 producers in the region, of which the 3 producers with the greatest impact on the marketer were selected by the volume of product entered. Vibranio and Pai Pai were identified as the main varieties marketed.

The tomato quality parameters used in the company to assign the quality are the determination of firmness, the maturity index (by determining the colour), the presence of defects. It is important for the company under study to have a method that allows them to standardize the evaluation and allocation of the quality of the fruit to be marketed regardless of the different producers involved in the marketing section of the fruit, for which it is required to monitor the behaviour of the fruit by studying control samples at entry, at 8 days and 15 days, evaluating the types of defects and the predominant sizes that each producer presents.

Identification of defects

Among the main defects identified in the fruit entering the marketing and that are most likely to affect the quality of tomatoes throughout the supply chain are those described in Table 1.

Nomenclature to identify the main defects of tomatoes			
CS	**DC**	**DH**	**GS**
Dry Chalice	Damage in Coronilla	Frost damage	Sun Stroke
GO O MA	**IH**	**MC**	**LL**
Knock or Bruising	Incidence of fungus	Brown Stain	Sore
PA	**PD**	**VE**	**MV**
Clowning	Damaged Tip	Green	Greenish Spot
PG	**RT**	**MO**	**PC**
Grey Wall	Russeting minimal (cracking)	Dark Spot	Brown spots

Table 1 Nomenclature of the main defects in tomatoes

Quality Control System for the Tomato Release Process

In order to develop the proposal for a Quality Control System for the tomato release process, we started from what was initially used successfully in the company, making some modifications to complement the evaluation method.

- **Raw material evaluation**

The evaluation of the raw material begins with a series of primary inspections carried out on the fruit when it enters the marketing company, where the physical characteristics of the fruit are evaluated and the defects, sizes and significant shades of the producers are identified in order to later evaluate the yield and percentage of defects.

The tomato evaluation method is based on the standard NMX-FF-031-1997-SCFI Non-Industrialised Food Products for Human Consumption - Fresh Vegetables - Tomato - (lycopersicun esculentum mill.) - Specifications, as well as on the internal knowledge that is managed in the company.

ISSN-On line: 2414-4819

For the identification and classification of tomato shades, Table 2 is used

Tone image:							
Description:	Green	Broken	Striped	Salmon	Orange	Red Orange	Red
Criteria	100% green tomato, which may vary from light to dark	Green to light yellow, pink or red tipped by more than 10%.	Light yellow green, pink, red or a combination of 10-30 %.	Between 30%-60% of the surface shows light pink colour	Higher concentration of red tones	Between 60-90% appears pink or red	More than 90% of the tomato surface with pink/red colours

Table 2 Shades for Saladette

– **Firmness**

For the determination of the firmness, the perception of the fruit to the touch is used, i.e. according to the touch, the firmness level of the fruit is classified according to table 3.

number	Observation
1	Very firm
2	Firm
3	Soft
4	Very gentle

Table 3 Classification of firmness levels

– **Weight and sizes**

The size of the tomato varies in direct relation to its weight, for its determination the weight/size ratio shown in Table 4 is used.

Sizes of the Saladette		
Size	**Key**	**Weight grams**
Marble	C	20-40
Third	T	45-70
Small	S	70-85
Medium	M	85-96
Long	L	96-120
Extra long	XL	120-145
Jumbo	J	140-200

Table 4 Sizes of the Saladette

Figure 1 Sizes of Saladette Tomatoes

– **Quality traffic light**

This system allows to classify and assign the quality for which each product that enters the company is destined, thus facilitating the release of raw material and determining the packaging process that each producer's fruit must have. It is updated every week, which allows to have a record of the history of the behaviour of the fruit. An example of the use of the quality traffic light is shown in Table 5.

Quality traffic light							
High presentations							
Excelnt	Producer	Variety	Zone	Specification	All Destinations	Destination MP1	Destination MP2
	Producer A	Vibranium	1	Packing in Tone 1.5	X		
	Producer B		2				
Media	Medium-sized presentations						
	Producer C	Vibranio	3	Packing in Tone 2		X	X
	Producer D		4				
National	Rescued						
	Producer E	Vibranio	5	Clowning closure from 5 to 7			
	Producer F		6				
Signature	General changes						

Table 5 Quality traffic light

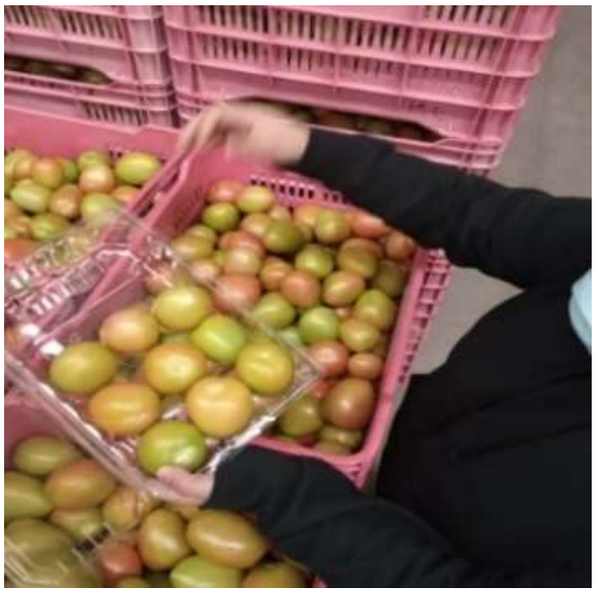

Figure 1 Collection of control samples from the producer under study

The control samples taken from the producer's batch are placed in trays, which are labelled for identification, and the samples are then identified by separating the defects from the good samples. Figures 1 and 2 show an example of taking a control sample from a producer under study and its identification, respectively.

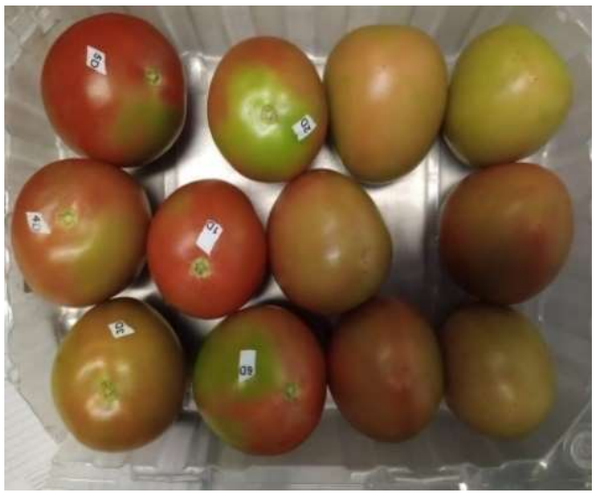

Figure 2 Identification of control sample

Complementary evaluations

– **Determination of the length of the tomato in the control samples.**

For the determination of this parameter, a vernier was used to measure the length and width of the fruit, taking into consideration the defects and the good tomatoes, which were measured twice, on the day of entry and on day 8, to evaluate the differences that exist between one day and the other.

– **Determination of pH**

For the determination of pH, two pH readings are taken, the first corresponds to the initial reading, for which a representative homogenised sample of 6 fruits is prepared, for which the skin of the tomato is removed and the placenta (where the seed is located) is removed. Subsequently, 10 g of tomato pulp is weighed and liquefied with the pulp with 20 mL of distilled water and the mixture obtained is filtered with filter paper or sky blanket. Once the filtrate has been obtained, the pH reading is taken with measuring strips or a potentiometer. The second measurement corresponds to the evaluation of the pH of the fruit after 8 days of its entry.

– **Determination of the Brix degrees**

To determine the Brix degrees, two readings are made, the first corresponds to the initial reading, in which 6 random samples taken directly from the producer's lots are selected, the Brix degrees are determined to the samples, then after 8 days after their entry, the second reading is taken to the control samples that were taken for study and observation.

Conclusions

Within the Mexican agricultural sector, tomato cultivation has an important place among the vegetables grown under greenhouse conditions, which offer advantages of control against adverse weather conditions and the presence of pests and/or diseases that limit their production and productivity compared to open-air growing conditions.

The investment in greenhouses is justified by the increase in yields, the obtaining of higher quality fruit and the possibility of obtaining several harvests per year.

For marketing, a key step is the Quality Control System for the release process of tomatoes produced in greenhouses, which allows evaluating the characteristics of Shades, Firmness, Size/Weight, Development and Maturity, Absence of Defects (dry calyx, crown damage, frost damage, etc.), damage to crown, frost damage, sun damage, bruising, fungus incidence, brown spot, sores, clowning, tip damage, green, green spot, greenish spot, grey wall, cracking, dark spot and brown spots), TSS or Brix content and pH.

Having a good organisation and Quality Control in the Agro-production and Marketing Company of tomatoes produced in greenhouses in the region of Tehuacán, Puebla, allows the product to be released with quality standards for export and national markets. The company must continue with its good agricultural practices and food safety and security programmes, which contribute to the final quality of the fruit.

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References

Ally, N.M., Neetoo, H., Ranghoo-Sanmukhiya, V.M., y Coutinho T. A., (2023) Greenhouse-Grown Tomatoes: Microbial Diseases and their Control, International Journal of Phytopathology ISSN: 2312-9344 (Online), 2313-1241 (Print), Esciencepress, https://esciencepress.net/journals/phytopath

Clarifruit (2021) La importancia del control y las pruebas de calidad del tomate https://www.clarifruit.com/es/knowledge-base/categorias-de-productos-frescos/tomates/

Díaz F.R, Juárez L., Ruiz K. (2014) Estudio de la vida de anaquel y calidad del jitomate (lycopersicon esculentum) REVISTA NO.4 (ittehuacan.edu.mx)

NMX-FF-031-1997-SCFI (1997). DOF. PRODUCTOS ALIMENTICIOS NO INDUSTRIALIZADOS PARA CONSUMO HUMANO - HORTALIZAS FRESCAS - TOMATE - (Lycopersicun esculentum Mill.) – ESPECIFICACIONES https://www.dof.gob.mx/nota_detalle.php?codigo=4863116&fecha=07/01/1998#gsc.tab=0

FAO (2023) Capitulo 5. La calidad en frutas y hortalizas (s.f) https://www.fao.org/3/y4893s/y4893s08.htm

Grupo SPE3, S.L. (2022) Los cinco parámetros más importantes en el control de calidad de las frutas y hortalizas https://poscosecha.com/felix-instruments/los-cinco-parametros-mas-importantes-en-el-control-de-calidad-de-las-frutas-y-hortalizas%20

I. Agrónomo (2022) Variedades y tipos de Tomate (Jitomate) https://infoagronomo.net/Variedades y tipos de Tomate (Jitomate) - InfoAgronomo

Kamanli, A.F. (2023) Real-Time Deep Learning based Tomato Fruit Quality Control in Conveyor Belt, International Journal of Advanced Natural Sciences and engineering Researches, E- ISSN-2980-0811, Vol. 7 No. 2, Ed. Ijanser

Lobos M. y Fierro M. (2019) Fisiología del crecimiento y maduración de frutos https://www.ruralprimicias.com.ar/sitio/quienes-somos/

SADER (2023). Secretaria de Agricultura y Desarrollo Rural. ¿Qué es la poscosecha y por qué es importante? https://www.gob.mx/agricultura/es/articulos/que-es-la-poscosecha-y-por-que-es-importante

Türkten, H. y Ceyhan, V. (2023) Environmental efficiency in greenhouse tomato production using soilless farming technology. Journal of Cleaner Production, Vol 398, 136482, Elsevier