

Maturity and Quality Standards




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QUALITY

- **Quality** is defined as “...degree of excellence, relative nature, attribute, trait, or faculty” (Oxford Dictionary)
- **Grade standards** for perishable products provide objective criteria for marketing fruits & vegetables
 - They provide a common language for the marketing chain, allowing accurate reporting of prices and supplies and assisting in the settlement of claims

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Components of Quality



- Quality attributes of perishable commodities:
 - Appearance
 - Kinesthetic (feel)
 - Flavor (taste and aroma)
 - Nutritional
 - Safety



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Components of Quality

- **Appearance** quality
 - Size: dimensions, weight, volume
 - Shape: diameter, length, compactness, uniformity
 - Color: hue, intensity, uniformity
 - Gloss: wax of cuticle, “bloom”
 - Defects: external, internal

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Components of Quality


- **Defects:** May have little or nothing to do with eating quality
- In a competitive marketplace, however, premium prices are reserved for produce that is free from blemishes




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Components of Quality

- **Defects: External**
 - **Morphological**
 - Sprouting
 - Rooting
 - Elongation
 - Curvature
 - Seed germination in fruits
 - Doubles, split pits
 - Floret opening



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Components of Quality


- Defects: External
 - Physical
 - Shriveling and wilting
 - Internal drying
 - Mechanical damage:
 - punctures, cuts and deep scratches, splits and crushing, skin abrasions, scuffing, deformation (compression), bruising
 - Growth cracks: radial, concentric



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Components of Quality


- Defects: External
 - Physiological
 - Temperature-related disorders: freezing, chilling, sunburn, sunscald
 - Puffiness
 - Nutrition-related disorders, blossom-end rot, bitter pit, cork spot, tipburn, internal breakdown, water core, black heart
 - Pathological
 - Decay caused by fungi and bacteria
 - Virus and mycoplasma-related disorders, blemishes, irregular ripening, and other disorders



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Components of Quality

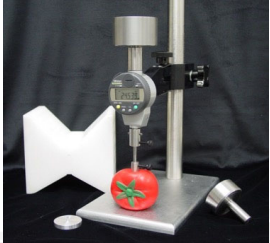
- Defects: External
 - Other defects
 - Insect damage
 - Hail damage
 - Bird damage
 - Chemical injury
 - Scars, scabs and other blemishes (russetting, staining, etc.)



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Components of Quality

- Kinesthetic quality (feel)
 - External smoothness or roughness
 - Internal texture
 - Firmness, fibrousness, toughness, succulence/juiciness, grittiness, woodiness, mealiness, etc.
 - Instruments: "pressure" testers & penetrometers, deformation testers, Instron machine



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Components of Quality

- Flavor quality (taste and aroma)
 - Sweetness, sourness, saltiness, bitterness, astringency
 - Aroma (volatiles); also off flavors and aromas




Thomas Wright, IFAS Comm. Serv.

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Components of Quality

- Nutritional quality
 - Includes concentrations of nutrients as well as their availability
- Safety quality
 - Absence of human pathogens (i.e., food poisoning microbes), toxins, allergens, and chemical or physical contaminants



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■ ■ ■ Perspectives on Quality & Value

- **From the standpoint of:**
 - **Grower:** yield, intended market, packout
 - **Packer/shipper:** uniformity, lack of defects, shelf life
 - **Retailer:** uniformity, proper maturity, shelf life
 - **Consumer:** appearance, flavor, social responsibility
 - Consumer segments: regional, ethnic, age
 - **Government:** public safety, market transparency

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■ ■ ■ Maturation and Maturity Indices

- Maturity is the number one determinant of the potential quality of fruits and vegetables
 - Optimal maturity generally coincides with optimal eating quality of **nonclimacteric** crops (quality does not improve postharvest).
 - There are exceptions, *e.g.*, cured sweetpotatoes.

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■ ■ ■ Maturation and Maturity Indices

- The relationship between maturity and quality is more complicated for **climacteric** fruits
 - Eating quality at maturity may be far from optimal
 - Quality mature fruit should be acceptable after postharvest ripening, but...
 - Best quality corresponds to ripening on the plant (*i.e.*, tree-ripe or vine-ripe)


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■ ■ ■ Maturity Indices

- The need is due to the sometime conflicting priorities of growers, merchants, and regulatory authorities to know whether or not a commodity is mature
 - Maturity and quality standards
 - Consumer interests
 - Planning harvest operations





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■ ■ ■ Maturity Indices

- The search for objective maturity indices...
 1. **Simple:** (can be performed in the field with inexpensive equipment)
 2. **Objective:** (measured, not subjective)
 3. **Relates to quality:** regardless of grower, district or year
 4. **Predictive:** a progressive change with maturation






Audrey Wynne, IFAS Comm. Serv.

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■ ■ ■ Maturity Indices

- **Fruits:** Quality vs. storage life
 - Tree-ripe = higher eating quality
 - Mature-green = longer storage life
- **Vegetables:** Size vs. quality
 - Yield increases with greater maturity, but...
 - Texture and flavor quality decline

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Maturity Indices for Selected Fruits and Vegetables

| Index | Examples |
|---|--|
| Elapsed days from full bloom to harvest | Apples, pears |
| Mean heat units during development | Peas, apples, corn |
| Development of abscission layer | Cantaloupe, many tree fruits |
| Surface morphology and structure | Cuticle formation on grapes and tomatoes netting of cantaloupes; gloss of some fruit (wax development) |
| Size | All fruits and vegetables |
| Specific gravity | Cherries, watermelons, potatoes |
| Shape | Angularity of banana fingers and full cheeks of mangos; compactness of broccoli and cauliflower |

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Maturity Indices for Selected Fruits and Vegetables

| Index | Examples |
|-----------------------------------|---|
| Solidity | Lettuce, cabbage, Brussels sprouts |
| Textural properties | |
| Firmness | Apples, pears, stone fruits |
| Tenderness/toughness | Peas, asparagus |
| Color | |
| External | All fruits and vegetables |
| Internal | Tomatoes, mangoes, stone fruits |
| Compositional factors | |
| Starch content | Apples, pears |
| Sugar content | Apples, pears, stone fruits, grapes |
| Acid content and sugar:acid ratio | Pomegranates, citrus, papaya, melons, kiwifruit |
| Juice content | Citrus fruits |
| Oil content | Avocados |
| Astringency (tannin content) | Persimmons, dates |

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Grade Standards and Inspection

- There are >150 federal grade standards covering 85 crops in the U.S.
- <http://www.ams.usda.gov/standards/>
- Federally licensed inspectors work in fields as crops are harvested, in packinghouses, and at terminal markets
 - Shipping point and destination provisions sometimes differ

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Why Grade Standards?

- Grade standards provide a common “language” for buying and selling.
- Grading is based on standards, and standards are based on measurable attributes that describe the value and quality of the product
 - e.g., regular shape, netting on cantaloupes, freedom from defects, damage and decay, etc.

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Why Grade Standards?


- Grade standards ensure that contract specifications have been met:
 - The buyer receives the product in the condition and quality described by the terms of the contract



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Quality and Grade Standards

- Quality and grade standards can hardly be separated from:
 - Phytosanitary (quarantine) requirements
 - Food safety (sanitary hygiene) requirements

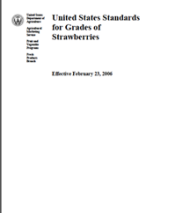


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https://www.ams.usda.gov/sites/default/files/media/Strawberry_Standard%igB%igD.pdf

Grade Standards

- **Voluntary**
 - Federal grade standards have been developed by the industries involved
 - Buyers and sellers may use them or not
- **Required**
 - Marketing orders can require grade standards (the standards then apply to all sales, including imports)
 - State regulations (California has minimum, required standards for sales outside state)



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Marketing Orders


- **Marketing Orders:** producers organize to work at solving marketing problems.
 - Marketing Orders are legal instruments that have the force of law in the U.S.
 - Marketing Order rules apply to both domestic and imported products sold in the U.S.
 - May require certain quality/grade standards
 - May require standard packages or containers
 - Authorize collection of fees for advertising, research, and market development

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Mill Pulnam, IFAS Comm. Serv.

Inspections

- **Requested by shipper** (for protection)
 - Inspections may be required by a Marketing Order
- **Requested by receiver** (to settle a dispute)
 - If the grade is not the grade agreed upon, the receiver is not bound to buy
- **Inspectors** have guides, visual aides, and standard sampling procedures to use to ensure uniformity of inspections
- **Standard schedule of fees**



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Quality Factors Found in Some Grade Standards

| Commodity | Quality factors |
|--------------------|---|
| Avocados (Florida) | Maturity; shape; texture; skin and flesh color; and freedom from decay, anthracnose, freezing injury, bruises, russeting, scars, sunburn, mechanical damage and other defects |
| Broccoli | Color; maturity; stalk diameter and length; compactness; base cut; and freedom from defects and decay |
| Watermelons | Maturity and ripeness (optional internal quality criteria - %SSC >10% = VG, >8% = G); shape; uniformity of size (weight); and freedom from anthracnose, decay, sunscald, whiteheart, etc. |

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Strawberry Grade Standards

- **Grades:** U.S. No. 1, U.S. Combination, and U.S. No. 2
- **Application of Tolerances:** what (and how much of it) is allowed within each grade
- **Definitions:** Overripe, Undeveloped, Damage, Serious damage, Diameter

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U.S. No. 1 Strawberry Grade

- Firm, not overripe or undeveloped, free from mold or decay, free from damage, at least 3/4 red, and not less than 3/4-inch diameter
- Not more than 10% total defects (5% serious; 5% undersized; 2% decay)
- No individual basket with more than 20% total defects (10% serious; 4% decay; but one defective and one off-size fruit allowed)
 - Provided, the average for the entire lot is within the tolerances




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Classification of Some Grapefruit Defects

§51.784 Classification of defects. Table 1

(Partial table)

| Factor | Injury | Damage | Serious Damage | Very Serious Damage |
|----------------------------|---|---|--|--|
| Ammoniation | | Not occurring in light speck type. | Scars are cracked or dark and aggregating more than a circle 1 inch (25.4 mm) in diameter. | Aggregating more than 25 percent of the surface. |
| Brises | Segment walls are collapsed, or ring is ruptured and juice sacs are ruptured. | Segment walls are collapsed, or ring is ruptured and juice sacs are ruptured. | Segment walls are collapsed, or ring is ruptured and juice sacs are ruptured. | Fruit is split open, stem is badly water-soaked, or ring is ruptured and juice sacs are ruptured causing a moldy condition affecting all segments more than 3/4 inch (19.1 mm) at brised area or the equivalent of this amount, by volume, when affecting more than one area on the fruit. |
| Buckskin | | Aggregating more than a circle 1 1/2 inches (38 mm) in diameter. | Aggregating more than 25 percent of the surface. | Aggregating more than 50 percent of the surface. |
| Cakal moldiness | | Aggregating more than a circle 3/4 inch (19.1 mm) in diameter. | Aggregating more than a circle 1 inch (25.4 mm) in diameter. | Aggregating more than 25 percent of the surface. |
| Dryness or mushy condition | | Affecting all segments more than 1/4 inch (6.4 mm) at stem end, or the equivalent of this amount, by volume, when occurring in other portions of the fruit. | Affecting all segments more than 1/2 inch (12.7 mm) at stem end, or the equivalent of this amount, by volume, when occurring in other portions of the fruit. | Affecting all segments more than 3/4 inch (19.1 mm) at stem end, or the equivalent of this amount, by volume, when occurring in other portions of the fruit. |

https://www.ams.usda.gov/sites/default/files/media/Grapefruit_%288FT%29_Standard%28B%29%28D.pdf

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- ### Worldwide Grade Standards
- **European Union:**
 - Directorate-General for Agriculture and Rural Development (http://ec.europa.eu/dgs/agriculture/index_en.htm) Fruit and Vegetable Common Market Organisation (CMO)
 - DG for Health and Food Safety (https://ec.europa.eu/info/departments/health-and-food-safety_en) is responsible for food safety and nutrition labeling
 - The main requirements of E.U. marketing standards relate to:
 - **Quality classification**
 - **Information labelling:** identification, origin, safety, nutrition, etc.

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- ### Worldwide Grade Standards
- **Codex Alimentarius Commission (Codex)** <http://www.codexalimentarius.org/>
 - An FAO Commission – more than 160 member countries
 - **Purpose:** develop international food standards, related codes of practice, and guidelines to protect consumer health and ensure fair practices in the food trade
 - More than 200 standards

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