



## Unit I - Topic 1

### **Exposure To Commercially Important Fruits and Vegetables, Their Regions, Season, Morphology, Texture and Composition.**

India is the 2nd largest producer of Fruits & vegetables in the World.

According to APEDA data, India is the largest producer of vegetables such as **ginger and okra** and second largest producer of vegetables such as **potatoes, onions, cauliflowers, brinjal, and cabbages**. While it is the largest producers of fruits such as **Bananas, Papayas, and Mangoes**.

There is a huge opportunity in harnessing the potential of fruits and vegetables processing in **India in the form of frozen (IQF)**, canned, pulp, puree, paste, sauces, snacks, dressings, flakes, dices, dehydration, pickles, juices, slices, chips, jams and jelly.

Andhra Pradesh, Maharashtra, Uttar Pradesh, Madhya Pradesh, Gujarat and Karnataka are the major Fruits producing States, whereas Uttar Pradesh, West Bengal, Madhya Pradesh, Bihar, Gujarat, Maharashtra and Odisha are the major Vegetables producing States of the country

Fruit and vegetables have many similarities with respect to their compositions, methods of cultivation and harvesting, storage properties and processing. In fact, many vegetables may be considered fruit in the true botanical sense. Botanically, fruits are sweet and fleshy products of plant or tree that contains seed and the vegetables are plant or derived from various parts of plant. Therefore such items as tomatoes, cucumbers, eggplant, peppers, and others would be classified as fruits on this basis.

Vegetables and fruits are a foodstuff category, which is noticed by its unique content, as compared to other food sources, in vegetal fibers, mineral elements, vitamins and trophines (nutrients).



**Fruit:** A fruit is the seed-bearing structure in flowering plants (also known as angiosperms) formed from the ovary after flowering. In common language usage, "fruit" normally means the fleshy seed-associated structures of a plant that are sweet or sour, and edible in the raw state, such as apples, bananas, grapes, lemons, oranges, and strawberries.

**Vegetable:** A vegetable is any part of a plant such as the stems and stalk (celery), root (carrot), tuber (potato), bulb (onion), leaves (spinach, lettuce), flower (globe artichoke), fruit (apple, cucumber, pumpkin, strawberries, tomato) or seeds (beans, peas) that is consumed by humans as food as part of a savory meal. The term vegetable is somewhat arbitrary, and largely defined through culinary and cultural tradition.

### **Morphology:**

In reference to fruits and vegetables, the characteristics that impart distinctive quality may be described by four different attributes –

- 1) color and appearance,
- 2) flavor (taste and aroma),
- 3) texture and
- 4) nutritional value.

As consumers, these four attributes typically affect us in the order specified above, for example we evaluate the visual appearance and color first, followed by the taste, aroma, and texture. The shape, size, gloss, and vibrant color of a fruit or vegetable attract us and entice us into picking it up by hand or fork. There are some associations between textural attributes, especially juiciness and flavor and between the color and nutritional composition of fruits and vegetables.

**a) Color:** Color is derived from the natural pigments in fruits and vegetables, many of which



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change as the plant proceeds through maturation and ripening. The primary pigments imparting color quality are the fat soluble chlorophylls (green) and carotenoids (yellow, orange, and red) and the water soluble anthocyanins (red, blue), flavonoids (yellow), and betalains (red). Appearance is determined by physical factors including the size, the shape, the wholeness, the presence of defects (blemishes, bruises, spots, etc.), finish or gloss, and consistency. Size and shape may be influenced by cultivar, maturity, production inputs, and the growing environment.

**b) Flavor(Aroma and taste):** Flavor has been defined as: A mingled but unitary experience which includes sensations of taste, smell, and pressure, and often cutaneous sensations such as warmth, color, or mild pain. Aroma compounds are volatile—they are perceived primarily with the nose, while taste receptors exist in the mouth and are impacted when the food is chewed. Taste has been divided into five primary tastes—sweet, sour, salty, bitter, and umami.

**c) Texture:** Textural parameters of fruits and vegetables are perceived with the sense of touch, either when the product is picked up by hand or placed in the mouth and chewed. In contrast to flavor attributes, these characteristics are fairly easily measured using instrumental methods. The texture of fruits and vegetables is derived from their turgor pressure, and the composition of individual plant cell walls and the middle lamella “glue” that holds individual cells together. The term texture is used primarily with reference to solid or semi-solid foods; however, most fruits and vegetables are viscoelastic, implying that they exhibit combined properties of ideal liquids, which demonstrate only viscosity (flow), and ideal solids, which exhibit only elasticity (deformation).

### **Nutritional value of Fruits and Vegetables:**

Nutrients or trophines (food) are the substances from foods assuring a normal deployment of the biological processes from the human body and participate into the metabolic processes. To maintain a good health we need 50 nutrients that fall into six basic groups: glucides, protides, lipids, vitamins, minerals and water. The most important nutrients are proteins with the



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necessary essential amino acids, lipids with the corresponding essential fatty acids, useful mineral salts, vegetal fibers and vitamins.

Fruit in general is acidic and sugary. They commonly are grouped into several major divisions, depending principally upon botanical structure, chemical composition and climatic requirements. Most fresh vegetables and fruit are high in water content, low in protein, and low in fat. In these cases water contents will generally be greater than 70% and frequently greater than 85%.

Compositions of vegetables and fruit not only vary for a given kind in according to botanical variety, cultivation practices, and weather, but change with the degree of maturity prior to harvest, and the condition of ripeness, which is progressive after harvest and is further influenced by storage conditions. Vegetables and fruit are important sources of both digestible and indigestible carbohydrates. The digestible carbohydrates are present largely in the form of sugars and starches while indigestible cellulose provides roughage which is important to normal digestion. Fruit and vegetables are also important sources of minerals and certain vitamins, especially vitamins A and C.

### **Chemical composition:**

Fruit and vegetables are important sources of minerals and certain vitamins, especially vitamins A and C.

**1) Water:** Vegetal cells contain important quantities of water. It has effects on the storage period length and on the consumption of tissue reserve substances. Vegetables contain generally 90-96% water while for fruit normal water content is between 80 and 90%.

**2) Mineral substances** Mineral substances are present as salts of organic or inorganic acids or as complex organic combinations (chlorophyll, lecithin, etc.); they are in many cases dissolved in cellular juice. Vegetables are richer in mineral substances as compared with fruits. The mineral substance content is normally between 0.60 and 1.80% and more than 60 elements are present; the major elements are: K, Na, Ca, Mg, Fe, Mn, Al, P, Cl, S. Among the



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vegetables which are especially rich in mineral substances are: spinach, carrots, cabbage and tomatoes. Mineral rich fruit includes: strawberries, cherries, peaches and raspberries. Important quantities of potassium (K) and absence of sodium chloride (NaCl) give a high dietetic value to fruit and to their processed products. Phosphorus is supplied mainly by vegetables.

**3) Carbohydrates** Carbohydrates are the main component of fruit and vegetables and represent more than 90% of their dry matter. From an energy point of view carbohydrates represent the most valuable of the food components; daily adult intake should contain about 500 g carbohydrates. They are produced by the process of photosynthesis in green plants. They may serve as structural components as in the case of cellulose; they may be stored as energy reserves as in the case of starch in plants; they may function as essential components of nucleic acids as in the case of ribose; and as components of vitamins such as ribose and riboflavin. Carbohydrates can be oxidised to furnish energy, and glucose in the blood is a ready source of energy for the human body.

**4) Fats** Generally fruit and vegetables contain very low level of fats, below 0.5%. However, significant quantities are found in nuts (55%), apricot kernel (40%), grapes seeds (16%), apple seeds (20%) and tomato seeds (18%).

**5) Organic acids** Fruit contains natural acids, such as citric acid in oranges and lemons, malic acid of apples, and tartaric acid of grapes. These acids give the fruits tartness and slow down bacterial spoilage. Organic acids influence the colour of foods since many plant pigments are natural pH indicators. With respect to bacterial spoilage, a most important contribution of organic acids is in lowering a food's pH.

**6) Nitrogen-containing substances** These substances are found in plants as different combinations: proteins, amino acids, amides, amines, nitrates, etc. Vegetables contain between 1.0 and 5.5 % while in fruit nitrogen-containing substances are less than 1% in most cases. From a biological point of view vegetal proteins are less valuable than animal ones because in their composition all essential amino-acids are not present.



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**7) Vitamins** Vitamins are defined as organic materials which must be supplied to the human body in small amounts apart from the essential amino-acids or fatty acids. The vitamins are conveniently divided into two major groups, those that are fatsoluble and those that are water-soluble. Fat-soluble vitamins are A, D, E and K. Their absorption by the body depends upon the normal absorption of fat from the diet. Water-soluble vitamins include vitamin C and several members of the vitamin B complex.

Enzymes are biological catalysts that promote most of the biochemical reactions which occur in vegetable cells. Enzymes have an optimal temperature - around +50°C where their activity is at maximum. Heating beyond this optimal temperature deactivates the enzyme. Activity of each enzyme is also characterised by an optimal pH. In fruit and vegetable storage and processing the most important roles are played by the enzymes classes of hydrolases (lipase, invertase, tannase, chlorophylase, amylase, cellulase) and oxidoreductases (peroxidase, tyrosinase, catalase, ascorbinase, polyphenoloxidase).

- **RED Fruits and Vegetables:** The phytochemicals in red foods are carotenoids and anthocyanins. One of the most abundant carotenoids is lycopene. Lycopene helps reduce damage from free radicals in your body and it also prevents heart disease, cancer, prostate problems, and reduces the skin damage from the sun. These red foods help memory function, urinary tract health, and makes your heart healthy. Like as Apple, Cherries, Cranberries, Red Grapes, Pomegranate, Strawberries, Watermelon, Tomato, Red Pepper etc.
- **ORANGE Fruits and Vegetables:** Carotenoids are the powerful phytochemical in orange foods, and they are what give the foods their color. Carotenoids repair DNA and help prevent cancer and heart disease, as well as strengthening our vision. These orange foods also give us the right amount of potassium and vitamin A, which keeps our eyes and skin healthy, and protects against infections. Like as Orange, Mango, Apricots,



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Papaya, Pumpkin, carrots etc.

- **YELLOW Fruits and Vegetables:** Yellow foods are high in antioxidants like vitamin C. Vitamin C keeps our teeth and gums healthy, helps to heal cuts, improves the mucus membranes (like when we have colds), helps to absorb iron, prevents inflammation, improves circulation, and therefore prevents heart disease. Like as Lemons, Kiwi, Pineapple, Yellow Peppers, Ginger, Corn etc.
- **GREEN Fruits and Vegetables:** These foods have the phytochemicals sulforaphane and indoles, which both prevent cancer. They are also good for the circulatory system and have good vitamin B and minerals. Like as Avocado, Green Apples, Green Grapes, Limes, Broccoli, Cucumber, Cabbage and all green fruits and vegetables.
- **GREENISH/WHITE Fruits and Vegetables:** The strong phytochemical in these whitish/greenish vegetable is called allicin an allium, which create an anti-bacterial, antifungal and anti-viral chemical environment in your body Some white foods prevent cancer and heart disease, and lower cholesterol levels. Like as Banana, Garlic, Mushrooms, Onions, Potatoes, Ginger etc.
- **BLUE/INDIGO/VIOLET Fruits and Vegetables:** The blue, indigo, and violet list of fruits and vegetables are great for their anti-aging properties. These foods have tons of antioxidants, specifically anthocyanins and phenolics. Some blue and purple fruits and vegetables are also really high in vitamin C. They are also known to help memory function and urinary tract health and to reduce free radical damage. An especially healthful fruit in the blue group is the blueberry. Like as Blueberries, Blackberries, Black Currants, Figs, Brengle, Purple Grapes etc.

### **1. Apples:**

- Regions: United States, China, Poland.
- Season: Fall (September to November).
- Morphology: Round or oblong shape, various colors.
- Texture: Crisp or soft, depending on the variety.



- Composition: Rich in fiber, vitamin C, and various antioxidants.

## **2. Bananas:**

- Regions: Ecuador, Philippines, Costa Rica.
- Season: Year-round.
- Morphology: Long and curved with a peel.
- Texture: Soft and creamy.
- Composition: High in potassium, vitamin B6, and energy.

## **3. Strawberries:**

- Regions: United States, Spain, Mexico.
- Season: Spring to early summer.
- Morphology: Small, red, and heart-shaped.
- Texture: Juicy and tender.
- Composition: Rich in vitamin C, manganese, and antioxidants.

## **4. Potatoes:**

- Regions: China, India, Russia.
- Season: Year-round.
- Morphology: Variable shapes, usually with a brown skin.
- Texture: Starchy when cooked.
- Composition: Good source of carbohydrates, vitamin C, and potassium.

## **5. Tomatoes:**

- Regions: United States, China, India.
- Season: Summer.
- Morphology: Round, red, yellow, or green.
- Texture: Juicy and fleshy.
- Composition: Rich in vitamin C, potassium, and antioxidants like lycopene.

## **6. Grapes:**

- Regions: Italy, China, United States.





- Season: Late summer to early fall.
- Morphology: Small, round, and often in clusters.
- Texture: Juicy, with a thin skin.
- Composition: High in natural sugars, antioxidants, and vitamins.

#### **7. Carrots:**

- Regions: China, Russia, United States.
- Season: Year-round.
- Morphology: Long, slender, orange root.
- Texture: Crunchy and firm.
- Composition: Excellent source of beta-carotene, fiber, and vitamin K.

#### **8. Oranges:**

- Regions: Brazil, United States, China.
- Season: Winter to early spring.
- Morphology: Round, orange citrus fruit.
- Texture: Juicy and pulpy.
- Composition: High in vitamin C, potassium, and dietary fiber.



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