**Unit- I Utilization of Plants**

* 1. Food plants: Origin of wheat, maize and rice and their cultivation in India.
  2. Fibres: Cultivation and processing of cotton and jute.
  3. Non-alcoholic beverages: Botany and processing of tea and coffee.
  4. Spices and Condiments: Botany and utility of asafoetida, cumin, fennel, coriander, cloves, cinnamon, ginger, turmeric and cardamom.

1.1

Origin and cultivation of wheat in India

Origin: -

* A cereal grain crop from ***Lavant range* (***Mountain ranges of middle east countries which include modern* ***Jordan, Syria, Iraq and Lebanon*)**, where cultivation is reported ***9600*** years back.
* Egyptian monuments / Pyramids in ***Dashur***, show wheat grains in bricks.
* Chinese grow it ***2700 B.C***. and considered it as Direct gift from Heaven.
* **A*.P. de Candolle*** (‘‘Origin of cultivated plants’’) written that original home of wheat is ***Mesopotamia*.**
* Strong evidences shows that***India*** might be home of some form of wheat (***Indus valley civilization***).
* According to **N.I. Vavilov** multiple origin Centre’s of wheat.

**Source and Distribution: -**

Wheat is an annual herb. It is the second major crop of India. The major wheat growing countries are USA, China, Russia and India. The main wheat growing states of India are U.P, Punjab, M.P., Bihar and Maharashtra. Wheat is a rabi crop.

**Botany of Wheat: -**

**Botanical name** : ***Triticum sps.***

**Family : *Poaceae***

**Edible part : *Endosperm***

**Common name : *Gehun***

Wheat belongs to genus ***Triticum*** which includes some 18 species. On the basis of chromosome number these species are divided into 3 categories:

* Diploid species (2n = 14) – *Triticum monococcum*
* Tetraploid species (2n = 28) *– T. durum*
* Hexaploid species (2n = 42) – T. aestivum (Bread wheat).

Out of the total 18 species 5 of them are grown in India also

***T. aestivum*** is common in north India, ***T. durum*** in central India and ***T. dicoccum*** in south India. But comparatively wheat production in South India is low as compared to North and Central India. In India total wheat grown is 3.5% of the total wheat production in the world. Out of the total cereal crops grown in India wheat accounts for nearly 10% of the total production. According to data available during 2015-16 wheat is the second most cultivable cereal crop after maize and second after rice to be used as food crop in the whole world.

**Cultivation: -**

* Wheat is a temperate crop however it may be grown in tropical regions but originally wheat is a temperate crop. In India it is a rabi crop normally grown during October and November.
* **Temperature**: 100C for flowering period 15-200C for fruit formation and 20-250C during ripening period.
* **Soil**: Loam soil is best suited for wheat cultivation.
* **Irrigation**: 4-5 irrigations are required during entire season.
* **Fertilizers**: Common fertilizers required for wheat are Nitrogen, Phosphorus and Potash.
* **Harvesting**: Harvesting period particularly in Northern India is between march and April and the whole crop get ready within 120-180 days.
* **Improved varieties**: Sonalika, Sharbati Sonara, Kalyan Sona, Janak, Pratap, Arjun etc.

Origin and cultivation of Rice in India

Origin: -

* About **130** million years ago in super continent **Gondwana,** which later drifted to become ***Asia***, ***Africa***, ***Australia*** and ***Antarctica.***
* First domesticated about **12000** years ago in **Yangtze River Valley** in **China**.
* Around **3 B.C**. Rice spread to **India,** **Nepal,** and other Asian countries.
* In India first time cultivation started about **3000** years ago in **Indus River Valley**.

**Source and Distribution: -**

This is the most valuable food in India. It is mostly grown in West Bengal, U.P., Uttarakhand, Punjab, Bihar, Orissa and Maharashtra etc. China Australia, USA and India produce maximum rice in the world.

**Botany of Rice: -**

**Botanical name : *Oryza*** ***sps.***

**Family : *Poaceae / Gramineae***

**Edible part : *Endosperm***

**Common name :  *Rice /Paddy /Chawal /Dhan***

Rice belonged to genus *Oryza* which includes 02 cultivated 21 wild species. The two cultivated species are:

* ***Oryza sativa***– Asian Rice – originated from – *O. rufipogon* (About 90-95% cultivation in Asia).
* ***Oryza glaberima*** – African Rice
* ***Oryza sativa*** has 3 subspecies– **Indica, Japonica, Javanica** with 40,000 varieties.

**Cultivation: -**

* **Tropical crop** of moist heavy rained areas. It is a kharif crop in India.
* **Temperature** – 20-250C with bright sunshine.
* **Average Rainfall** – 120-150 cm.
* **Soil** – Alluvial, Loam, Clay. River delta regions are best for cultivation.
* **Sowing** – May – June or July – August
* **Maturity Period** – 90 – 120 days / 140 – 170 days.
* **Harvesting** – September – October or November – December.
* **Transporting Crop** – Seedling 9-10 cm long are transported to main field and remain under 15-20 cm of water for 60-90 days.
* **Varieties** – **Jasmine** Rice – Thailand, **Koshihikari** – Japan, **Corn** Rice – Vietnam and **Basmati** – India. In India about 1100 varieties of Rice is found and about 300 improved varieties are also developed in India. Central Rice Research Institute Cuttack also developed some improved varieties such as **Jaya**, **Padma,** **Krishna**, **Kaveri**, **Basmati – 307**. International Rice Research Institute (IRRI) Manila (Philippines) – **IR – 64**.

Origin and cultivation of Maize in India

Origin: -

* Mexico / South America. Mexico is known as center of domestication around 9000 years ago in the lower reaches of **Balsas River Valley,** whereas South America is known as center of origin.
* Originated from fodder maize **Teosinte** (***Euchliana mexicana***).
* Maize was first introduced into Europe by **Columbus**, and into Asia by the earlier **Portuguese** explorers. Maize had acclimatized wherever the climate permitted, and has now spread all over the world.
* In India maize was first introduced by **Portuguese** in the 16th century following the discovery of trade - routes by **Vasco da Gama** in 1498.
* Maize is commonly known as ‘‘***Queen of cereals’’***.

**Source and Distribution: -**

The major maize producing countries include USA (57%) China (4.4 per cent), the Russia (3.3 per cent), Manchuria (2.9 per cent), Yugoslavia (2.4 per cent) and Mexico (2.3 per cent). India accounts for about 1.4 per cent of the total world production. Maize is mainly grown as ‘kharif crop’. Although it is grown throughout India, the chief concentration is in the north-eastern parts. The crop is of special importance in the hilly and submontane regions where it makes the staple food of people. It is grown as a food crop mainly in Uttar Pradesh, Punjab, Madhya Pradesh, Bihar, Andhra Pradesh, Jammu and Kashmir.

**Chemical Composition: -**

Maize grain contains,

* Protein – 10%
* Carbohydrate – 70%
* Oil – 4%
* Albuminoids 10.4%
* Crude fibre – 2.3%

**Botany of Maize: -**

**Botanical name : *Zea*** ***mays***

**Family : *Poaceae / Gramineae***

**Edible part : *Seeds***

**Common name :  *Makka, Corn***

**Kipps** in **1959** divided into 7 subspecies as:

1. **Flint Corn** (***Zea mays indurate***) – Indian corn – most cultivated in India.
2. **Dent Corn (*Zea mays indendata*) –** most common in USA.
3. **Pop Corn (*Zea mays everta*) –** when they are heated the pressure built up within the kernel suddenly result in an explosion and the grain is turned inside out
4. **Sweet Corn (*Zea mays saccharata*) –** Sweeter than other because it contains more sugar than starch.
5. **Soft Corn /Flour Corn (*Zea mays amylacea*) –** used in flour.
6. **Pod Corn (*Zea mays tunicata***) – each grain is covered by a separate husk / pod.
7. **Waxy Corn (*Zea mays ceratinakulesh*) –** contains waxy endosperm and is used in adhesives.

**Cultivation: -**

* Maize is a summer annual. It thrives best in fertile, well irrigated, medium, heavy loamy soil. It is also commonly grown in the coarse gravel soils of hilly tracts. In India the crop is generally sown in June-July and harvested in September-October. The maize stems are cut close to the ground with the help of com knife or sickle.
* The stalks are stacked to allow the grain to ripe further. After a month of this curing process, the ears (cobs) are husked by hand or by machine. Maize must be stored in well ventilated bins so that the excess of moisture is evaporated.

**Uses of Maize: -**

* The chief use is as a food for man and livestock. The grain is very nutritious, with a high percentage of carbohydrates, fats and proteins. Not only is the grain valuable as a stock feed, but the plant as a whole is an important fodder crop. The immature cobs are largely eaten after roasting.
* The grains are also used in making com starch and industrial alcohol. The glucose is also manufactured from the grain. The com oil is prepared which is used for soap making, lubrication and as salad oil. Com flakes make a good breakfast food.
* The fibres in the stalks are utilized for making paper and yarn. **Zein**, the protein which occurs in maize grain, is utilized for making artificial fibres with good tensile strength and wool-like qualities.
* It is of special importance in the hilly and sub-montane regions of the country where it forms the staple diet of the people, particularly in the winter months. In the northern parts, it is also extensively grown as a fodder.
  1. Fibres: Cultivation and processing of cotton and jute.

**Fibres: -**

Fibre or fibre (from Latin: fibra) is a natural or man-made substance that is significantly longer than it is wide. Fibers are often used in the manufacture of other materials. Fibres may be **Natural** fibres or **Synthetic** fibres. Natural fibres may again be of two types – **Plant fibres (**e.g., *Cotton, Jute, Coir, Sun Hemp, Hemp etc.***)** and **Animal Fibres (**e.g., *Silk, Wool etc*.**).** Whereas **Synthetic fibres** include – *Nylon, Polyester* etc. Plant fibres (Sclerenchyma) are mainly composed of – Cellulose + Lignin + Pectin. Some Important Fibre Yielding plants are:

1. **Cotton (*Kapas*)**

**Botanical Name – *Gossypium arboreum / G. barbadense***

**Family – *Malvaceae***

**Part Used – *Seeds***

* Source of cotton fibres are epidermal hairs from seed surface. Since they are obtained from seed surface they are also known as **Seed fibres** or **Surface fibres**.
* Chemically composed of 94% of cellulose.
* They are flat, tubular, twisted, white fibres – some are short known as **Fuzz**, while some are long known as **Lint.**
* Most important economic importance is that they form the base of **Textile Industry** / **Paper Industry**.

1. **Jute (*Patsan*)**

**Botanical Name – *Corchorus capsularis***

**Family – *Tiliaceae***

**Part Used – Secondary *phloem of Stem***

* Source of Jute fibre is secondary phloem of stem (**Bast fibre**). Those fibres which are obtained from secondary phloem or tissues out side phloem such as pericycle, endodermis etc. are known as bast fibres whereas, fibres obtained from Xylem tissue is known as **wood fibre** or **Xylary fibre.**
* 90% of the world’s jute production comes from Bangladesh and India. Bangladesh alone accounts for 80% of the total production.
* West Bengal and Assam are chief jute producing states in India.
* Used in the preparation of **Bags, Carpets and Paper**.

1. **Sun - Hemp (San, *Sanai*)**

**Botanical Name – *Crotolaria juncea***

**Family – *Papilionaceae***

**Part Used – *Secondary Phloem of Stem***

* Source of this fibre is also secondary phloem of stem i.e.; it is also a bast fibre.
* This fibre is thick, strong and durable.
* Used in making **Fishing Net, Cigarette Paper, Tissue Paper** etc.

1. **Coir (*Coconut fibre*)**

**Botanical Name – *Cocos nucifera***

**Family – Arecaceae */ Palmae***

**Part Used – *Fruit***

* Source of coconut fibre is mesocarp of fruit
* Such fibres are stiff, reddish brown, strong, water proof and elastic.
* One of the strongest fibres, often used in marine cables.
* Commonly used in **brush, cord and mats**.

1. **Hemp (Bhang)**

**Botanical Name – *Cannabis sativa***

**Family – *Cannabinaceae***

**Part Used – *Secondary Phloem of Stem***

* These fibres are obtained from secondary phloem of stem hence, they are also bast fibres.
* Fibres are long and strong but lack elasticity.
* Most commonly used in **ropes, mats and nets** etc.

**Cotton**

Cotton is the most important fibre crop not only of India but of the entire world. It provides the basic raw material (cotton fibre) to cotton textile industry. Its seed (*binola*) is used in vanaspati industry and can also be used as part of fodder for milch cattle to get better milk.

**Types of Cotton:**

Three broad types of cotton are generally recognized on the basis of the length, strength and structure of its fibre.

**1. Long staple cotton:**

It has the longest fibre whose length varies from 24 to 27 mm. The fibre is long, fine and shining. It is used for making fine and superior quality cloth. Obviously, it fetches the best price. There has been rapid progress in the production of long staple cotton since Independence. About **half** of the total cotton produced in India is long staple. It is largely grown in ***Punjab, Haryana, Maharashtra, Tamil Nadu, Madhya Pradesh, Gujarat and Andhra Pradesh.***

**2. Medium staple cotton:**

The length of its fibre is between 20 mm and 24 mm. About **44** per cent of the total cotton production in India is of medium staple. ***Rajasthan, Punjab, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, Karnataka and Maharashtra are its main producers***.

#### 3. Short staple cotton:

This is inferior cotton with fibre less than 20 mm long. It is used for manufacturing inferior cloth and fetches less price. About **6** per cent of the total production is of short staple cotton. ***U.P., Andhra Pradesh, Rajasthan, Haryana and Punjab*** are its main producers.

**Cultivation**

Cotton is the crop of tropical and sub-tropical areas and requires uniformly high temperature varying between 21°C and 30°C. The growth of cotton is retarded when the temperature falls below 20°C**. Frost** is enemy number one of the cotton plant and it is grown in areas having at least **210 frost** free days in a year.

The modest requirement of water can be met by an average annual rainfall of 50- 100 cm. However, it is successfully grown in areas of lesser rainfall with the help of irrigation. About one-third of the total area under cotton cultivation is irrigated. In the year 1988-89 an area of 24 77 lakh hectares out of a total of 73.43 lakh hectares i.e., 33.73 per cent of the total area under cotton was irrigated.

About **80 per cent** of the total irrigated area under cotton is in Punjab, Haryana, Gujarat and Rajasthan. Moist weather and heavy rainfall at the time of boll-opening and picking are detrimental to cotton as the plant becomes vulnerable to pests and diseases. High amount of rainfall in beginning and sunny and dry weather at ripening time are very useful for a good crop.

Cotton is a **kharif** crop which requires **6 to 8 months** to mature. Its time of sowing and harvesting differs in different parts of the country depending upon the climatic conditions. In **Punjab and Haryana,** it is sown in April-May and is harvested in December-January that is before the winter frost can damage the crop.

In the **peninsular** part of India, it is sown up to October and harvested between January and May because there is no danger of winter frost in these areas. In **Tamil Nadu**, it is grown both as a kharif and as a rabi crop.

Here the rainfall occurs after September and cotton is sown in October. The irrigated crop is sown in January-February. Most of the crop is grown mixed with other kharif crops such as maize, jowar, ragi, sesamum, castor, groundnut and some vegetables.

Cotton cultivation is closely related to deep black soils (regur) of the Deccan and the Malwa Plateaus and those of Gujarat. It also grows well in alluvial soils of the Satluj-Ganga Plain and red and laterite soils of the peninsular regions. Cotton quickly exhausts the fertility of soil. Therefore, regular application of manures and fertilizers to the soils is very necessary.

Picking is a crucial period from the labour point of view. Since picking of cotton is not yet mechanized, a lot of cheap and efficient labour is required at this time. Normally the picking season is spread over a period of about three months.

**Processing**

Processing of cotton involves following steps:

1. **Ginning**
2. **Bailing**
3. **Picking**
4. **Carding**
5. **Combing**
6. **Drawing**
7. **Ginning: -** Capsule walls and soil are removed from cotton bolls with the help of **roller gin / saw type gin**; cleaning with roller gin is slow process than saw gin; less injurious to long fibres; roller gin is suitable for Egyptian and Sea-Island cotton; saw type gin for ***G. hirsutum, G. arboreum, G. herbaceum.***
8. **Bailing: -** Cotton obtained from gin is packed into bales with help of hydraulic press; each bale weighs approx. 226 kg., and these bales are transported to mills.
9. **Picking:** - In mills, bales are beaten, fluffed to remove foreign matter from fibres through a scutcher, cotton is condensed in sheet form called as ‘**Lap’.**
10. **Carding: -** Remaining lumps of fibres separated into individual fibres in carding machines; immature fibres and impurities are removed.
11. **Combing:** - Short fibres are separated.
12. **Drawing:** - Fibres are straightened.

Cotton in form of thin sheets is obtained with the help of specialized funnels; strips drawn out are wound on spools; in spinning its further drawn and twisted.

**Jute: Cultivation and Processing**

Jute is one of the important natural fibers after cotton in terms of cultivation and usage. Cultivation is dependent on the climate, season and soil. Almost 85% of the world’s jute cultivation is concentrated in the Ganges Delta.

This fertile geographic region is shared by both Bangladesh and India (Mainly west Bengal). China also has a dominating place in jute cultivation. On a smaller scale, Thailand, Myanmar (Burma), Pakistan, Nepal and Bhutan also cultivate jute.

Jute is also called ‘**golden fibre’** for its color and high cash value.

**Climate and Soil: -**

* Tropical and Humid climate.
* Temperature – 24-350c.
* Rainfall – 150-250 cm.
* Humidity – 70-90%.
* Soil – Alluvial soil.
* p H of soil – 6 - 7.5.

**Cultivation: -**

The cultivation of jute involves following steps.

1. **Sowing: -** Sowing ofSeed is done after pre-monsoon mainly in April or May. Sowing is mainly done by two methods i.e., ***Broadcasting*** and ***Dibbling.***
2. **Thinning: -** After seed germination thinning is done and ***4-6 inches*** of distance is maintained between two plants.
3. **Weeding:** - Weeding is also done at least 2-3 times during the whole period.
4. **Harvesting:** - Harvesting is done after 3-4 months at **flowering stage.** After that the plants are cut from the base and the bundles are stacked in the field for 2-3 days so that their leaves become dry and fall out.

**Processing /Extraction: -**

The jute plants fibres lie beneath the bark and surround the central woody part of the stem (secondary phloem). The various steps in the extraction / processing of jute fibres include:

1. **Retting: -** Retting is the process in which fibres get loosened and separated from the woody stalk.

* The bundles are immersed in water in at least 60-100 cm depth.
* Due to microbial activity stem pectin, gum and other mucilage substances start dissolving.
* Retting process takes near about 10-30 days.
* Retting process depends upon – maturity of crop, depth of water, and temperature.
* Two important bacterial species – ***Clostridium pectinovorum*** & ***Clostridium pelsineum*** play important role in retting.

1. **Stripping: -** Stripping is the process of removing fibres from the stalk after the completion of retting.
2. **Washing and Drying:** - Extracted fibres are washed in clean water, after squeezing excess water the fibres are hang on bamboo railing for sun drying for 2-3 days.
3. **Bailing and Packing:** - After drying the extracted fibres are pressed into bales and finally packed. After packing the fibres are then transported to mills.

**1.4. Spices and Condiments**

Spices and condiments have a characteristic aroma and taste and they are widely used to season and flavour various food preparations, and in medicine, pharmaceuticals, perfumery, cosmetics and several other industries. International Organization for Standardization (I.S.O) defined spices and condiments as ‘‘***such natural plant or vegetable products or mixtures thereof, in whole or ground form, as are used for imparting flavour, aroma and piquancy to and for seasoning of foods’’.***

Spices and condiments are well known as appetizers and form an essential part of culinary art. They add a tang and flavour to otherwise insipid foods. They profoundly effect human health as they intensify salivary flow, and secretion of amylase, neuraminic acid and hexosamines. They show strong anti-microbial and antibiotic activities. They increase the rate of perspiration, thus having a cooling effect on the body. They possess practically no nutritive value.

Cultivation and use of spices goes back to pre-historic times. India is known as ‘‘**The Home of Spices’’.** Spices were among the first items to be traded between the east and the west. The Persians were perhaps the first traders, who transported these commodities from India and the neighbouring Molucca Islands and sold them to the Phoenicians. Until the **8th** century A.D., the monopoly of this trade was in the hands of Indians and Greeks. Later several nations of western Europe – Portugal, Spain, France, Holland and Great Britain fought for the control of spice trade. In **1605**, The Dutch captured the Moluccas Islands, destroying the Portuguese monopoly. Later Britishers controlled the trade, establishing the **East India Company.** In the early part of the 18th century, spices introduced to many other countries of the world, especially the West Indies, Zanibar, Madagascar, Malaysia and Sri Lanka.At present there is no scarcity or monopoly of the spices, but the vast majority of spices are still obtained from the wetter parts of the tropics, chiefly Asia. The United States is by far the largest importer of spices and Russia, Australia, Great Britain, Canada and some European countries also import spices to a considerable extent.

There are over 70 spices which are cultivated in different parts of the world. The major spices produced in India are **pepper**, **cardamom**, **ginger**, **turmeric** and **chillies.** India is the largest producer, consumer and exporter of spices and spice products. During 2007-08 the total area under spice cultivation was 2.56 million hectares yielding approximately 4.3 million metric tons.Among various spices grown in India, **Chilly** is the most widely grown spice with a share of 33.7% in the total production whereas **turmeric** has a share of 21.6% in the total spice production. Pepper is the most important spice known as ‘**King of Spices**’ or ‘**Black Gold of India**’, earning alone foreign exchange to the tune of Rs. 1,700 millions. Cardamom, called the ‘**Queen of Spices**’ comes next with an export of over Rs. 500 millions. Kerala, Karnataka, Tamil Naidu, Andhra Pradesh, Maharashtra, Orissa, Rajasthan and Bihar are important spice growing states of India.

Some important spices are described as follows.

1. **Coriander**

**Botanical Name :** *Coriandrum sativum*

**Family :** Apiaceae

**Vernacular Name : Dhania**

Coriander of commerce are the dried ripe fruits of *Coriandrum sativum.* It is probably one of the first spices to be used by mankind, having been known as early as 5000 B.C. The plant is indigenous to the Mediterranean region. It is extensively cultivated in India, Morocco, Russia, Hungary, Poland, Rumania, Czechoslovakia, Guatemala, Mexico, Turkey, Argentina and U.S.A. It is grown practically in all parts of India and constitutes an important subsidiary crop in the black cotton soils of Deccan and South India. Andhra Pradesh, Maharashtra, Tamil Naidu, Punjab, Uttar Pradesh, Himachal Pradesh, Assam and Madhya Pradesh are the chief states where coriander is cultivated.

Coriander is a small aromatic annual herb, attaining a height of **0.3 – 1 m**. The lower leaves are broad with crenately – lobed margins and the upper are finely cut with linear lobes. The flowers are white or pinkish, arranged in compound terminal umbels. The fruit a nearly globular, yellowish brown schizocarp. Coriander requires a fairly mild climate and is cultivated as a cold weather crop in northern India.

The chemical composition of coriander seeds varies, depending upon the country of its origin, agro-climatic condition, harvesting and storage conditions. On an average, the seeds contain: moisture – 6.3%; proteins – 1.3%; fats – 19.6%; carbohydrates – 24%; mineral matter – 5.3%; crude fibre – 31.5% and vitamins. The seeds also contain volatile and fixed oils, tannins, cellulose, pentosans and pigments.

The pleasant delicate aroma and taste of coriander fruits is due to the presence of an essential oil, the contents of which vary from 0.1 – 1.7% depending upon the variety and agro-climatic conditions. Coriander oil is a colorless, pale yellow liquid with a characteristic odour and taste. It is made up of hydrocarbons and oxygenated compounds.

Coriander plant is pleasantly aromatic and is used as a pot herb. The leaves are used for garnishing meat preparations and sausages, for making chutneys, and for flavouring curries and soups. The seeds are extensively used as condiment in the preparation of curry powder, pickling spices, sausages and seasonings. They are also used for flavouring pastries, cookies, buns, cakes, tobacco products and liquors, particularly gin. The seeds are carminative, diuretic, tonic, stomachic, antibilious, refrigerant and aphrodisiac. A poultice of the seeds is applied to chronic ulcers and carbuncles and an infusion in combination with cardamom and caraway seeds is useful in flatulence, indigestion, vomiting and intestinal disorders. Coriander oil is used as a flavouring agent for liquors and perfumes, in cocoa and chocolate industries. An oleoresin extracted from coriander seeds is used for flavouring beverages, pickles, sweets and other delicacies.

1. **Cumin**

**Botanical Name : *Cuminum cyminum***

**Family : Apiaceae**

**Vernacular Name : Jira**

Cumin is the dried ripe fruit of an annual herb, ***Cuminum cyminum.*** It is a native of Egypt, Syria, Turkestan and the Eastern Mediterranean region. It is one of the oldest spices, known since Biblical times. It now cultivated extensively in Iran, India, Morocco, China, Indonesia, Japan, Turkey, southern parts of Russia, The Mediterranean Islands, Syria, Egypt and Argentina. In India, it is mostly grown in **Uttar Pradesh, Punjab, Rajasthan, Gujrat and Tamil Naidu.**

The plant is a low – growing annual herb with a much-branched angular stem and decompound leaves. The flowers are small and white and are borne in terminal compound umbels. The fruit is an ovoid- elongated, laterally compressed and greyish or yellowish-brown schizocarp. It requires a fairly mild climate and is grown as a cold weather crop in India.

Cumin seeds contain: moisture – 6.2%; proteins – 17.7%; fats – 23.8%; Carbohydrates – 35.5%; mineral matter – 7.7%; crude fibre – 9.1%; and vitamins.

Cumin seeds are used as a condiment in curry powders and for flavouring dishes. They are **carminative, stomachic** and **astringent,** useful in **dyspepsia and diarrhoea**. The seeds have been credited with **aphrodisiac properties**. They are chiefly used in **veterinary medicines**. The oil of cumin is used for flavouring **liquors and cordials**, and in **perfumery.**

1. **Fennel**

**Botanical Name : *Foeniculum vulgare syn.***

***F. officinale***

**Family : Apiaceae**

**Vernacular Name : Saunf**

Fennel of commerce is dried, ripe fruits of cultivated varieties of *Foeniculum vulgare*. It is a native of southern Europe and the Mediterranean region where it has been grown since ancient times. It is now extensively grown in India, Russia, Romania, Hungary, Italy, Germany, France, Japan, Argentina and the United States. It is mostly grown as a garden or home yard crop throughout India at altitudes up to 1825m specially in **Maharashtra, Gujarat, Karnataka, Uttar Pradesh, Punjab, Haryana and Rajasthan**. Gujarat contributes about 90% of the total production. India produces about 20,000 tonnes of fennel seed.

Fennel plant is a stout, aromatic, perennial herb with decompound leaves and small yellow flowers borne in compound terminal umbels. The fruit is a small, oblong, ellipsoidal or cylindrical, straight or slightly curved cremocarp, greenish – yellow in colour. It requires a fairly mild climate and is cultivated as a cold weather crop in Northern India.

The fennel seeds contain: moisture – 6.3%; proteins – 9.5%; fats – 10%; carbohydrates – 42.3%; mineral matter – 13.4%; crude fibres – 18.5% and vitamins.

Fennel plant is pleasantly aromatic and is used as a pot herb. Its dried fruits which have fragrant odour and a pleasant aromatic taste are used for flavouring **soups, meat dishes, sauces, bread rolls, pasteries, confectionary and liquors,** and it is also used in the manufacture of **pickles.** The **aromatic, stimulant**, and **carminative** fruits are useful in diseases of chest and kidney. Fruits are also used in **flatulence, fever, intestinal colic, burning sensation and constipation** and made into **gripe water** for babies. Its extract is used in oral compositions such as toothpaste, for prevention of dental caries, and periodontal diseases. Compresses of an infusion of leaves and fruits relieve **sore eyes and eyelids**, while a lotion strengthens the eyes. A hot infusion of fruit is useful in **amenorrhoea.** The fennel oil is used as a flavouring agent in **culinary preparations, confectionary, cordials and liqueurs.** It is stimulant and carminative and useful in infantile colic and flatulence and is used as a good vermicide against hookworm.

1. **Cloves**

**Botanical Name : *Syzygium aromaticum***

**Family : Myrtaceae**

**Vernacular Name : Laung**

Clove of commerce is the dried unopened floral buds of an evergreen tree, *Syzygium aromaticum.* It is one of the most ancient and valuable spices of the Orient, known as for back as the first century B.C. Clove trees are indigenous to small volcanic islands of Moluccas. French introduced it into Mauritius in 1770, from where it reached Zanzibar. It was introduced to Sri Lanka in 1796 and to India in 1800 A.D. by the East India Company. Today, Zanzibar, Pemba islands, Madagascar and Indonesia are the largest clove producing regions of the world. Zanzibar and the nearby Pemba islands alone contribute to 80% of the total world’s production. Clove is also grown to a small extent in Sri Lanka, India, Malaysia and Haiti. In India, it is mainly grown in **Nilgiris, Tanbasi hills** and **Kanyakumari district** in Tamil Nadu and **Kottayam and Quilon** districts in Kerala.

It is a small evergreen tree, 12 – 15 m in height, with a large number of branches spreading from near the base in an upward direction. The leaves are opposite, glabrous and dotted with oil glands. The crimson flowers are borne in terminal paniculate cymes. The ripened fruit is a purple drupe. Clove thrives best in tropical maritime climate with warm humid conditions. It grows best in deep, volcanic loamy soils. It requires an annual rainfall of 150 – 250 cm and a mean temperature of 16 - 380 C.

On an average, cloves contain: moisture – 5.4%; proteins – 6.3% ; volatile oils – 13.2% ; fats – 15.5% ; crude fibres – 11.1% ; carbohydrates – 57.7% ; mineral matter – 5% and vitamins.

Cloves are very aromatic, possess a fine flavour and impart warming qualities. They are esteemed as a flavouring material and as a spice. They are **aromatic, stimulant and carminative** used for **dyspepsia** and **gastric irritation**. Clove is an ingredient of an Ayurvedic preparation **Vimusti Vatis** which exhibits **antifertility activity** but has teratogenic properties. Cloves form an ingredient of a pharmaceutical powder used in the treatment of **gastronomic disorders** and preventing **hangovers**. Cloves are a good preservative and antioxidant and can replace synthetic preservatives and antioxidants used in processed foods. Tonic drug for improving body functions, **antiageing, skin conditioners, toothpaste for dental caries and periodontal diseases**, therapeutic compositions for **dandruff** and **pruritis** have also been prepared from clove.

Clove oil is extensively used for flavouring food products and fermented beverages. It is an ingredient of **dentifrices, gargles** and **chewing gums** and also used for scenting soaps, in perfumery and as a clearing agent in histological work. It is used externally as a **rubefacient** and counter-irritant, and internally as a **carminative** and **antispasmodic**. Clove oil is also used in tropical formulations for use in cryotherapy for treating circulatory diseases such as post **traumatic oedema**.

**5.Cardamom**

**Botanical Name : *Elettaria cardamomum***

**Family : Zingiberaceae**

**Vernacular Name : Chhoti Elaichi**

Cardamom of commerce are dried aromatic fruits and seeds of *Elettaria cardamomum*, a native to South India and Sri Lanka. It is a second most important “national spice” of India and is considered as the “**queen of spices**”. It is one of the most valued spices of the world. **India, Sri Lanka, Guatemala** and **Thailand** are the major producers of cardamom in the world, and **Laos, Vietnam, Costa Rica, El Salvador and Tanzania** also produce it on a small scale. **India** is the largest exporter of cardamom, supplying 90 – 95% of the world market. It is widely cultivated in **Kerala, Karnataka and Tamil Nadu**. Kerala alone contributes to about 62% of total production of India. The total area under the crop is estimated to be 1,00,000 hectares.

Cardamom plant is a tall herbaceous perennial, attaining a height of 2 – 4 m. It has a branches underground rhizome which gives off several erect leafy shoots. The leaves are distichous, dark green, lanceolate with sheathing leaf bases. The flowers are borne on long panicles emerging directly from the root stock. The fruit is a creamy white, oblong – ovoid, three-sided capsule with a fibrous, papery and longitudinally wrinkled pericarp. There are about 10 – 15 seeds in each capsule. It is essentially a tropical crop, and grows best in the natural canopy of evergreen forests at an altitude between 600 and 1500 m. It requires a warm humid climate with an annual rainfall of 250 – 300 cm and well drained humus rich loamy soils.

Chemical composition of cardamom varies with the variety and age of product. Cardamom seeds contain moisture - 7 -10%; volatile oils – 5.5 – 10.5%; total ash – 3.8 – 6.9%; crude fibre – 6.7 – 12.8%; crude protein -7.0 – 14.0%; starch – 39 – 49.9%; and vitamins. The characteristic aroma is due to the presence of volatile oils contained in the seeds. Cineol, turpineol, borneol, turpinene, sabinene and limonene are the chief components of this essential oil.

Cardamom is one of the most valuable Indian spices used in the preparation of **curry powder, pickles, sausages, cakes** and **confectionary.** Cardamom oil, obtained by distillation of capsules is used as a condiment and for **flavouring beverages**. Medicinally, they are employed as **carminative, aromatic, stimulant** and **diuretic**, and are chiefly used in **Nausea** and **vomiting.** The tinctures of cardamom are used chiefly in medicines for **windiness or stomachic**. Cardamom seeds are chewed to prevent bad smell to the mouth**, indigestion, pyrosis**. Gargling with the infusion of cardamom and cinnamon cures **pharyngitis,** **sore throat** and **hoarseness** during the infective stage of flu.

Cardamom is one of the ingredients of the Unani drug ***Majoon – e – Azaraqui*** which is used as a general nervine tonic. It also possesses anti – inflammatory, analgesic and cardiotonic properties. Cardamom also forms one of the ingredients of ayurvedic drug ***Kanchnar Guggulu***, used in the management of various glandular swellings.

**6.Cinnamon**

**Botanical Name : *Cinnamomum verum***

***(= C. zeylanicum)***

**Family : Lauraceae**

**Vernacular Name : Dalchini**

Cinnamon of commerce is the dried inner bark of mankind. It was known to Egyptians since 2000 B.C. For centuries, it has been used as a breath – sweetener and has been employed in oriental temples to counteract the strong unpleasant odour of burning flesh. The plant is a native to Sri Lanka and South India, but is now widely cultivated in Seychelles, China, Malaysia, Indonesia, Kenya, Tanzania, West Indies and South America. At present, Sri Lanka alone contributes to nearly 60% of the world’s production of cinnamon. In India, cinnamon is widely cultivated in Kerala and Western Ghats.

Cinnamon plant is a small evergreen tree attaining a height of 9 – 15 m. The leaves are leathery, dark glossy green and highly aromatic. The small yellow flowers are borne in lax axillary and terminal panicles at the ends of twigs. The fruit is black, ovoid, one – seeded fleshy berry. Plants prefer a hot and moist climate and grows best at low altitudes on poor white sands. It prefers an average temperature of 270 C and 200 – 250 cm of annual rainfall. Cinnamon is usually propagated by seeds, but plants can also raise by cuttings of young shoots, by layering of shoots or by divisions of old root stocks.

On an average, cinnamon contains moisture – 9.9%; protein – 4.6%; fats – 2.2%; fibres – 20.3%; carbohydrates – 59.5%; total ash – 3.5%; calcium – 1.6%; phosphorous -0.05%; iron – 0.004%; sodium – 0.01%; potassium – 0.4% and vitamins. Its calorific value is about 355 calories per 100 gm. The principal aromatic substance of cinnamon bark is cinnamic aldehyde, besides eugenol and other substances.

Cinnamon is extensively used as a **spice or condiment**. It is **astringent, stimulant** and **carminative**. Powdered cinnamon is used in **chocolates**, **dentrifrices**, **incenses** and **perfumes**. It possesses the property of checking **nausea** and **vomiting**. Cinnamon bark oil is used for flavouring confectionery, liqueurs, pharmaceuticals and soaps. Medicinally, it is useful in **gastrodynia, flatulence, colic and gastric debility**.

The bark forms one of the components of the Unani drug, **Majoon – e – Flasfa** which invigorates the muscular function of human body and acts as an aphrodisiac. The drug is also useful in Anorexia and disorders such as Arthritis, Gout, lumbago and other rheumatic pains. Cinnamon leaf oil is used in perfume and flavouring industries. It is also used as an embrocation in rheumatism.

1. **Ginger**

**Botanical Name : *Zingiber Officinale***

**Family : Zingiberaceae**

**Vernacular Name : Adrak**

Ginger is the underground stem (rhizome) of a perennial herb, *Zingiber officinale,* a native to south eastern Asia. It has been used since ancient times by Indians and Chinese. It was introduced to Germany and France in the ninth century and to England in the tenth century. It is now cultivated in several parts of the world, which include India, Jamaica, Nigeria, Southern China, Japan, Taiwan and Australia. India is the largest producer and exporter of ginger in the world, contributing to about 50% of the total world production. Of the total Indian production about 70% comes from Kerala alone. The other states where ginger is grown in India are West Bengal, Orissa, Karnataka, Madhya Pradesh, Himachal Pradesh ang Gujrat.

Plant is perennial herb, with robust branched rhizome, covered with small scale leaves and fine fibrous roots. The pale-yellow flowers are borne at the tip of the stem in a dense spike. Plant requires a warm and humid climate, brilliant sunshine and heavy rainfall, and prefers a sandy loam soil. The crop is propagated vegetatively by portions of rhizomes, each with at least one viable bud. Harvesting is done after 9 – 10 months of planting when leaves begin to turn yellow. The rhizomes are pale yellow in colour with a greenish yellow inside.

On an average, dry ginger contains: moisture – 6.9%; protein – 8.6%; fat – 6.4%; fibre – 5.9%; carbohydrates – 66.5%; ash – 5.7%; calcium – 0.1%; phosphorus – 0.15%; iron – 0.011%; sodium – 0.03%; potassium – 1.4%; and vitamins. Its calorific value is about 380 calories / 100gm.

Rhizomes of ginger are highly esteemed as a spice due to their characteristic odour and warm pungent taste. Dried ginger is widely used for flavouring foods, for extraction of oleo-resins and preparation of extracts and for the production of an essential oil called **oil of ginger**. Green ginger is used in culinary preparations, pickles and ginger cocktails. It is also used extensively in flavouring baked foods, soft drinks, liqueurs and processed meat. It is digestive, stimulant and is extensively used in several pharmaceutical preparations. It is prescribed as an adjunct to many tonics and stimulating remedies due to its aphrodisiac values. It is also used as one of the ingredients in Unani drug preparations, and several Ayurvedic drugs. Ginger is also used in several Japanese and Sino-Japanese medicines, used to treat **chronic hepatitis, anti-inflammatory, immunomodulatory and anti-atherosclerotic problems.**

The homeopathic drug ***Zingiber officinale*** is used for treating asthma.Oral administration of fresh ginger or its extracts is prescribed for treating various types of **gastric ulcers**. Ginger taken as fresh, dried powder, or as tincture is found to enhance the integrity of the capillary cells and stimulate peripheral blood flow in rheumatoid arthritis patients. Ginger is also used in distilleries for the preparation of **ginger beer, ginger ale** and **ginger wine**.

1. **Turmeric**

**Botanical Name : *Curcuma domestica***

**(*syn. C. longa*)**

**Family : Zingiberaceae**

**Vernacular Name : Haldi**

Turmeric is the dried, boiled, cleaned and polished rhizomes of ***Curcuma domestica***. A native to south eastern Asia, it has been highly esteemed as a condiment, dyestuff and medicine since time immemorial. Early Sanskrit writings of the 4th and 5th centuries A.D. find mention of turmeric. It is one of the most important and ancient spices of India. It is now a commercial crop of the tropics, mainly cultivated in India, Sri Lanka, Indonesia, Taiwan, parts of China and Indo-China. Turmeric is one of the five major spices of India and ranks high in its export earnings, being next only to black pepper and cardamom. India has a prime position in the world production of turmeric. It is estimated that 80% of the world production is coming from India, although nearly 95% of the Indian produce is consumed within the country. It is cultivated throughout the country. However, large – scale cultivation is largely confined to southern and eastern India. Andhra Pradesh, Tamil Nadu, Orissa, Karnataka and West Bengal contribute about 90% of the production. Andhra Pradesh is the leading producer of turmeric followed by Tamil Nadu and Karnataka.

Plant is a robust perennial herb, 60-90 cm high, with a short-thickened rhizome bearing a tuft of large, broad, lanceolate leaves. The pale-yellow flowers are borne in dense spikes terminating the stem. The flowers remain covered by pink bracts.

Turmeric is grown in warm and moist regions and it thrives best on well – drained loamy or alluvial fertile soils. In India, it is usually grown in rotation with rice or sugarcane and often in mixed cultivation with vegetable crops. It is propagated by fingers of rhizomes with one or two buds, planted 5 – 7.5 cm deep on ridges. Leaves appear above ground in about 30 days and the crop is ready for harvesting within 270-300 days.

Cured and finished turmeric is deep yellow to orange yellow in colour and has a distinctive pungent flavour. Dry turmeric rhizomes contain: moisture – 5.8%; protein – 8.6%; fats – 8.9%; carbohydrates – 63.0%; fibre – 6.9%; mineral matter – 6.8%; calcium – 0.2%; phosphorous – 0.26%; iron – 0.05%; sodium – 0.01%; potassium – 2.5% and vitamins. The calorific value of turmeric is 390 calories per 100gm.

Turmeric is valued for its distinctive colour, flavour and aroma. In India, it is an auspicious article in all religious observances in Hindu households. Turmeric is used as a condiment and a colouring agent It is stimulant, tonic, stomachic and depurative. The attractive yellow colour and delicate flavour have been most preferred as an essential ingredient of curry powders. It is used to flavour and colour butter, cheese, pickles and other food stuffs.

It is widely used for dyeing silk, leather, fibre, paper and many other articles. In an Indian system of medicine, turmeric occupies an important place as an ingredient of medicinal oils, ointments and poultice. It is used to aid digestion, as a tonic and as a blood purifier and vermicide. Boiled with warm milk and taken internally, it relieves sore throat and common cold. Burnt turmeric used as tooth powder relieves dental troubles.

Various turmeric preparations, like **‘Kumkum’** and ‘**parani**’ are indigenous beauty aids. Smearing turmeric paste on the face and limbs clear the skin and beautify the face. It also checks the growth of unwanted hairs on the feminine skin. Turmeric oil is used as a flavouring and seasoning agent in confectionery and aerated drinks, and also in perfumery.