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Dr. P. Ranjithselvi

Cereals

Cereals are the most important source of plant food to the man. They are considered a gift of Ceres Roman Goddess of Agriculture. All cereals belong to the grass family and their characteristic fruit is caryopsis in which pericarp remains completely fused with seed coat. They are rich in carbohydrates, proteins oils and vitamins. Moisture contents of cereals are very low and as such they can be stored for long periods without deterioration. Some botanically unrelated plants like *Fagopyrum esulentum* (buckwheat), *Chenopodium quinoa* (quincu) and species of *Amaranthus* (Amaranth) are also used as cereals as their chemical constituents are similar to cereals. They are known as pseudocereals.

The pre-historic evidences indicate that all old civilizations of the world were dependent on cereals for food. The ancient civilizations of Mesopotamia (Iraq) Sumerian, Babylonian, Assyrian, and Chaldean - were dependent on wheat and barley, and so also Egyptian, Greek and Roman civilisations. The ancient civilisations of India, China and Japan were dependent on rice, whereas that of western hemisphere on corn. With the advancement of civilisations, way of utilisation of cereal crops has changed. Earlier cereal crops were used for perching and popping, but now they are utilised in numerous ways.

Some Important Cereal Crops

Cereal crops are usually classified into the following two groups:

1. Major cereal crops. These include wheat, rice and maize.

2. Minor cereal crops. These include barley, oats and rye.

WHEAT

Botanical name: *Triticum spp.*

Family: *Poaceae*

Vernacular names: Gehun (Hindi), Giun (Beng.,), Gahung (Mar.), Ghavum (Guj.), Gandhumalu (Tel). Godumai (Tamil), Gendum (Mala.)

Origin and Distribution

Wheat is the principal cereal crop, of the temperate regions of the world. It is a staple food of about half the population of the world. South-west Asia is probably its centre of origin. Two wild species of wheat were cultivated in this region as far back as 6000 B.C., known as emmer wheat. These two species remained under cultivation throughout the world until 300 B.C. when they were replaced by macaroni wheat (*Triticum durum*). Later *T. vulgare* was brought under cultivation and now it is the most widely cultivated species of wheat in the world.

Botanical Characteristics

Wheat is an annual herb with 0.6 - 1.5 m high culms which are differentiated into nodes and internodes. The culms produce tillers at the base Roots formed in the seedling stage are ephemeral and are soon replaced by adventitious fibrous roots arising from the underground nodes of the culm. The inflorescence is a terminal spike which consists of 15 - 20 spikelets arranged in an alternate fashion on a short central axis. The spikelet is enclosed by a pair of glumes and consists of 1 - 5 florets. Each floret has its own lemma and a thin palea, investing two lodicules, three stamens and a single pistil. The grain is a dry, one-seeded, indehiscent fruit, known as caryopsis. The endosperm makes up about 82% of the grain by weight and is delimited by aleurone layer which is rich in proteins, vitamins of the B-group and minerals.


Uses

Wheat is a staple food in most parts of the world. The properties of gluten in the wheat grain makes it suitable for preparing bread from wheat flour. In India, wheat flour is used for making chapaties and a variety of other preparations like loaf-bread, biscuits and breakfast foods such as wheat flakes, puffed wheat and shredded wheat. Wheat is also used in the manufacture of starch, industrial alcohol, malted wheat, and core-binder flour. Low grade flours are utilized in the preparation of pastes for wall papering, plywood adhesives, and in iron foundries as a core binder. Byproducts of wheat milling, bran, germ and middlings, constitute valuable feed for stock. Wheat straw is used as bedding for cattle, for padding in mattresses, for packing fragile foods, for thatching, etc. It is also used in the production of furfuryl alcohol. Straw pulp is utilized in the manufacture of paper, straw board, and building board.

Millets

Small seeded cereals and forage grasses are known as millets. Millets are used for forage and as a food for both man and domestic animals. They are drought resistant and can grow practically in most parts of the world. They are among the most ancient of food grains and have been grown in China since 2700 B.C. They probably originated in Eastern Asia. The following 14 species are generally included in millets:

1. Australian millet - *Echinocloa decompositum*

2. Bajra or Pearl millet - *Pennisetum typhoides*

3. Brown top millet - *Brachiaria ramosa*

4. Italian millet - *Setaria italica*

5. Common millet - *Panicum miliaceum*

6. Little millet - *Panicum miliare*

7. Finger millet or Ragi - *Eleusine corocana*

8. Ditch millet or Kodo - *Eleusine corocana*

9. Japanese barnyard millet - *Echinocloa frumentacea*

10. Shama millet - *Echinocloa colona*

11. Hungry rice - *Digitaria exilis*

12. Job's tears or Adlay - *Coir lachryma-jobi*

13. Teff - *Eragrostis tef*

14. Fonio - *Digitaria iburua*

India occupies the first position in the world both in the area under cultivation and production of millets. Besides India, millets are also widely grown in Africa and Russia.

PEARL MILLET

Botanical name: *Pennisetum typhoides*

Family: Poaceae

Vernacular names: Bajra (Hindi, Beng.,), Kambu (Tamil), Bajri (Mar., Guj.)

Pearl millet is the most important millet crop of India It is grown almost all over the country except Assam for its palatable and nutritious grains. It is mainly grown in Haryana, Rajasthan, western Uttar Pradesh, Gujarat, Madhya Pradesh Maharashtra, Andhra Pradesh. Kamataka and Tamil Nadu. During 2007-08 total area under pearl millet cultivation was 95 million hectare, about one third of the total acreage of the world under pearl millet cultivation. The total produce of pearl millet in India during 2007-08 was approx. 8.4 million tonnes.

It is an annual herb, 1-2.5 m tall, with solid, unbranched stem. The leaves are long, scabrous, linear-lanceolate with wavy margins. The inflorescence is a dense panicle about 8 - 16 cm long and about 2.5 cm in diameter. Each spikelet consists of two florets, the lower usually male and the upper hermaphrodite.

Pearl millet is a quick growing and short duration crop, which matures in about 90 days. It has high tillering and is tolerant to drought and heat. It is grown as a rainy season crop in kharif and as a summer crop under irrigated conditions. The crop can be grown in all types of soils ranging from sandy soils to red and medium-black soils. It thrives best in sandy loam soil. Warm and dry weather with intermittent rains followed by bright sunshine are most suited for its growth. It can withstand drought

and moderately wet conditions, but heavy rains, water-logging, high humidity, prolonged cloudiness and cold weather are detrimental to its growth.

Pearl millet is a staple food grain in many parts of India, especially in Gujarat and Rajasthan. Its nutritive value is comparable to that of rice and wheat. Grains are ground into flour for making breads. It is also used for porridge or eaten after parching. Green ears are roasted and eaten. Grains are also suitable for making malt. It is also grown for green fodder. The straw is utilized as a roughage for livestock, for thatching and as a fuel.


Pulses

Pulses, all belonging to family *Fabaceae*, are an important protein source of vegetarian diet. Besides, they also serve as excellent foliage and cattle feed. They have been cultivated since ancient times. Chinese literature records the cultivation of soybean between 3000 and 2000 B.C. Archaeological remains of Pisum, Vicia and Lens have been discovered form neolithic sites in Greece. Similarly, the occurrence of common bean and lima bean in the deposits of inter-montane Peruvian valley dates back to 6000 B.C. In India, pulses account for about 20% of the total area under food grain crops. Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra and Bihar are the major pulse producing states. During 2008-09 the total area under pulse crop cultivation was about 21.7 million hectare and the yield was 15.19 million tonnes.

BLACK GRAM

Botanical name: *Vigna mungo* syn. *Phaseolus mungo*

Vernacular names: Urd (Hindi), Adad (Guj.), Udid (Mar), Mash-Kalai, Ulundi (Tam.), Minumula (Tel.), Uzhunnu (Mal.).

Black gram is one of the most widely used pulse crop of India. References of black gram are found in ancient Indian literature like Kautilya "Arthasastra' and Charak's 'Charaka Samhita In those days seeds of black gram were used as weights. Carbonised grains of black gram have been recovered from the chalcolithic site, Navdatoli-Maheshwar in India dated back to 1660 1440 B.C. It is believed to be indigenous

to India, though it is now widely cultivated in many tropical and sub-tropical regions of the world including India, Iran, Malaysia, East Africa and many southern European countries. In India, it is grown over nearly 2.5 million hectares of land with a production of about 0.7 million tonnes. It is mainly grown in Madhya Pradesh, Uttar Pradesh, Punjab, Maharashtra, West Bengal, Andhra Pradesh and Karnataka.

Black gram is a fast growing herbaceous annual with procumbent branches and trifoliate leaves. The stem and branches are thickly covered with long reddish brown hairs which give a woolly appearance to the plant. The flowers are small and yellow and are borne in clusters of five to six. The pods are narrow, cylindrical, about 4-6 cm long, and with a short hooked beak at the apex. Each pod contains 4-10 seeds. The seeds are oblong and black and the cotyledons are white.

Black gram is a warm season crop, requiring a well distributed annual rainfall not exceeding 90 cm. The water retentive stiff loamy or heavy soils are most suitable but it also grows on black cotton soils and black alluviums. In India, it is grown both as kharif and rabi crop in the north, where winters are severe, as a kharif crop, in the eastern states, as a rabi crop, and in the south in both the seasons.

Dried seeds of black gram contain 23.4% proteins, 57.3% carbohydrates, 1.0% fats, 3.8% fibre and 4.8% minerals. They are especially rich in phosphoric acid.

Black gram is one of the most highly prized pulses of India where beans are eaten whole of split, boiled or roasted, ground into flour and used to make cakes, breads, and porridge. It is the main ingredient of many south Indian dishes like Idli and Dosa. Fried and salted seeds are eaten as a snack. The pulse is used in rheumatism and nervous and hepatic diseases. It is also useful in dropsy and cephalagia as a diuretic. Besides, it is cooling and astringent and used as diet in fevers and for strengthening the eyes. The pulse is poulticed on to abscesses as a suppurative. The roots of the plant are narcotic and are used for aching bones. Black hypoglycaemic properties and its usage is useful gram possesses in the management of diabetes. Straw and husk are good cattle feed. Urd chuni, a product of seed milling, is used as animal feed ingredient. The plant prevents soil erosion and conserves soil moisture.

Nuts

CASHEW NUT

Botanical name: *Anacardium occidentale*

Family: *Anacardiaceae*

Common name: English-cashew, Tamil: mundri, Bangladesh: kazu badam

Origin : Brazil

It was introduced to India by the Portuguese in the 16th century from Brazil. It was earlier cultivated for soil conservation, then it was continued for its benefits and commercial values. It has proved more profitable with earlier maturity and higher yields.

Botanical characteristics

The cashew tree is a tropical evergreen tree which is up to 12 meters (40 feet) tall, has leathery alternate leaves, and flowers with 5 petals and 5 sepals. Drupe fruit borne on the end of a receptacle (the stem that holds the flower and fruit), which becomes enlarged and fleshy so that it appears as a fruit (with the nut like a comma dangling at its end), and is referred to as a cashew apple. The important cashew growing states of India are Andhra Pradesh, Goa, Karnataka, Kerala, Maharashtra, Orissa and Tamil Nadu. The cashew is a strong plant that is renowned for growing in sandy soils that are generally unsuitable for other fruit trees. For the best production deep, well-drained sandy or sandy-loam soil is recommended. Cashew trees will not grow in poorly-drained soils.

Uses

In a 100-gram serving, raw cashews provide 553 Calories, 67% of the Daily Value (DV) in total fats, 36% DV of protein, 13% DV of dietary fiber and 11% DV of carbohydrates. Cashews are rich sources of dietary minerals, including particularly copper, manganese, phosphorus, magnesium, thiamin, vitamin B6 and vitamin K. Iron, potassium, zinc, and selenium are also present in significant amount. Cashew nuts are used in preparation of various snacks and delicacies. Raw nuts consumed as snack, sweets – Kaju barfi, used in various desserts, cakes. In Brazil cashew fruit juice is popular. In Africa cashew milk (plant milk) is manufactured alternative to diary milk. Cashew oil is a dark yellow oil for cooking or salad dressing pressed from cashew nuts (typically broken chunks created during processing). Discarded cashew nuts unfit for

human consumption, alongside the residues of oil extraction from cashew kernels, can be used to feed livestock. Animals can also eat the leaves of cashew trees. It is used in tropical folk medicine and for antitermite treatment of timber. Cashew is used for stomach and intestinal (gastrointestinal) ailments. Cashew apple is juicy and edible. In Goa, it is fermented into vinegar, as well as an alcoholic drink. Cashew nutshell liquid is a natural resin with a yellowish sheen found in the honeycomb structure of the cashew nutshell and is a byproduct of processing cashew nuts. It is a raw material of multiple uses in developing drugs, antioxidants, fungicides, and biomaterials. Cashew shell oil is a drying oil and is a rich source of phenol. Cashew shell-oil is used in manufacture of varnishes, typewriter rolls, inks, gums, paints, water proof paper, oil cloth, etc. Certain resins and plastics are also prepared from cashew nut shell liquid.

Sugar yielding plant

Sugars are manufactured by all green plants but most of this product is used directly in the metabolism of the plant and very little is accumulated. However, there are plants like sugarcane, sugarbeet and several palms which accumulate sugar to a great extent. Sugar is one of the most necessary foods for man, yet all the great civilizations of the past lived without sugar. It was a rare commodity in Europe until the medieval age and was used only by the aristocratic society. However, now sugar has become a cheap and common food for all the people. The world's major supply of sugar comes from the culms of sugarcane (*Saccharum officinarum*) and sugar beet root (*Beta vulgaris*). A small quantity is also obtained from sugar maple (*Acer saccharum*), sugar palm (*Arenga pinnata*), palmyra palm (*Borassus flabellifer*), toddy palm (*Caryota urens*) and date palm (*Phoenix dactylifera*). Per capita consumption of sugar is the highest in Irish Republic, averaging 60 kg per annum, followed by the Netherlands (54 kg) and the United States (43.5 kg).

SUGARCANE

Botanical name: *Saccharum officinarum*

Family: *Poaceae*

Sugarcane, the chief source of sugar, is known from the prehistoric times and finds reference in earlier writings going back to ancient civilizations before Christian era. The plant is believed to have originated in South Pacific (probably New Guinea) and spread throughout south-east Asia. In India, it is cultivated since pre-historic times. Some authors consider India as the home of sugarcane and from there it was introduced into China around 800 B.C. This view receives support from the fact that sugarcane finds mention in ancient Chinese and Egyptian records, and in the Bible. The Sanskrit word Shakhara, from which sugar has been derived, means a new crop from the east and this provides a linguistic evidence of Indian origin of sugarcane. Grassland Daniels (1974) also consider that sugarcane has evolved in Indo-Burma area of southern Asia. It reached Persia in the beginning of the 6th century A.D. from where it was carried to Egypt (641 A.D.) and Spain (755 A.D.) by Arabs. Later, it was introduced into the New World from the Canary Islands. In the 15th and 16th centuries Portuguese and Spanish explorers and colonizers introduced sugarcane in many parts of the world.

Botanical Characteristics

The plant is a vigorous perennial grass which grows in clumps. The stems (culms) are solid and jointed, attaining a height of 2 - 3 m and diameter of 3 - 6 em. The culms contain about 80% juice which has 12-17% sugar contents. The colour of the culms ranges from almost white through yellow to deep green, purple red or violet. The culm is supported by stilt roots arising from the lower nodes. The leaves are arranged in two rows on either side of the stem at the nodes. The leaf blade is long, thin and flat, 09 - 1.5 m long and 2.5 - 10 cm wide. The stem bears a large terminal inflorescence. The cultivated varieties are mostly heterozygous vegetatively and hence are propagated.

Sugarcane Producing Areas

In India, sugarcane is cultivated in almost all the States. The chief sugarcane growing states are Uttar Pradesh Tamil Nadu, Maharashtra, Andhra Pradesh, Karnataka, Haryana. Punjab, Bihar, Orissa, Gujarat and Rajasthan, In India, the total area under sugarcane cultivation is approximately 3.79 million hectares and it produces more than 340 56 million tonnes of sugarcane. Yield of sugarcane is highest in Konkan region Maharashtra where climate is optimum for 1 growth.

Uses

Cane sugar (sucrose, $C_{12}H_{22}O_{11}$) is a sweet, crystalline substance and is an important source of energy in the human diet. It is widely used in the manufacture of soft drinks, chocolates, confectionery, ice-creams and in canning industry. Sugarcane juice is also used for preparing gur and jaggery, vacuum pan sugar and open pan sugar or khandsari. A good quantity of sugarcane is also used for chewing. Molasses, bagasse and press mud (or filter-cake, filter mud) are byproducts of sugar industry. Bagasse is cane residue left after the extraction of juice and it is used mostly as fuel and in the manufacture of paper and wall board. It finds use as a mulch for plants and as a litter or bedding for poultry and livestock. Molasses is used as food stuff, for candy making and also for cooking. It is also widely used in the manufacture of rum, vinegar, glycerol, lactic acid, industrial alcohol, and monosodium glutamate, etc. Sulphitation filter mud is used as manure. Sugarcane wax, obtained from sulphitation filter mud, is used as a substitute of carnauba wax in the manufacture of carbon paper, wax paper, and shoe and other polishes. Gur is used for direct consumption by human beings and live stock, for sweetening beverages and for making sweets. Leaves of sugarcane can be used as a substitute for diesel to power diesel generators. They also produce char which can be mixed with binder to form an excellent bright fuel for cooking.

Oil crops

Oils and fats are known to man since pre-historic times. The ancient Egyptians and Phoenicians used vegetable oils for food and for anointing their bodies. On the basis of their origin, oils can be classified into vegetable, animal and mineral oils. Vegetable oils are distinguished into volatile or essential and fixed or fatty oils depending on their behaviour on heating.

SUNFLOWER

Family: *Asteraceae*

Botanical name: *Helianth*us *annuus*

Botanical Characteristics

The common sunflower (*H. annuus*) is an annual herb with a rough hairy stem 1–4.5 metres (3–15 feet) high and broad, coarsely toothed, rough leaves 7.5–30 cm (3–12 inches) long arranged in spirals. The attractive heads of flowers are 7.5–15 cm wide in wild specimens and often 30 cm or more in cultivated types. The disk flowers are brown, yellow, or purple, while the petal like ray flowers are yellow. The fruit is a single-seeded achene. Oilseed varieties typically have small black achenes, while those grown for direct seed consumption, known as confection varieties have larger black-and-white achenes that readily separate from the seed within.

Uses

The common sunflower is valuable from an economic as well as from an ornamental point of view. The leaves are used as fodder, the flowers yield a yellow dye, and the seeds contain oil and are used for food. The sweet yellow oil obtained by compression of the seeds is considered equal to olive or almond oil for table use. Sunflower oil cake is used for stock and poultry feeding. The oil is also used in soap and paints and as a lubricant. The seeds may be eaten dried, roasted, or ground into nut butter and are common in birdseed mixes.

Spices

Spices and condiments have a characteristics 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 (LS.O.) defined spices and condiments "such natural plant or vegetable products or mixtures thereof, in whole or ground form, as are used for imparting flavour, aroma piquancy to and for seasoning of foods". Spices and condiments are well known as appetizers and form an essential part of the culinary art. They add a tang and flavour to otherwise insipid foods. They profoundly effect human health as they intensify salivary flow und 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 posses practically no nutritive value.

There are over 70 spices which are cultivated in different parts of the world. The major spices produced by 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 tonnes. It earns over $ 314 million annually by export of spices. Among various spices grown in India, chilli 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 the 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. Although spices are grown in much smaller units as compared to food crops, they contribute to a sizeable share in the international trade. Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra, Orissa, Rajasthan and Bihar are important spice growing states of India.

CARDAMOM

Botanical name: *Elettaria cardamomum*

Family: *Zingiberaceae*

Common name: Choti elachi (Hindi, Beng.), Elchi (Guj.), Veldode (Mar.), Yelakkai (Tam.), Yelakkayalu (Tel.), Yelam (Mal.).

Cardamom of commerce are dried aromatic fruits and seeds of *Elettaria cardamomum*, a native to south India and Sri Lanka. It is the 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. About 90% of the total world acreage under cardamom cultivation falls in India. 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 1,05,000 hectares.

Characteristics

Cardamom plant is a tall herbaceous perennial, attaining a height of 2-4 m. It has a branched 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 rootstock. 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. The seeds are usually reddish brown, angled, about 2-3 mm long, with a thin mucilaginous aril and starchy white perisperm, enclosing endosperm and embryo.

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.

It is propagated vegetatively by rhizomes or by seeds. It comes into bearing in three years after planting but reaches the full bearing at the age of seven or eight years. Sometimes it is cultivated intermixed with tea or rubber plantations.

Cardamom

Uses

Chemical composition of cardamom varies with the variety and age of the product. Cardamom seeds contain moisture 7-10%; volatile oil: 5.5-10.5%, crude fibre: 7-12.8%, crude protein: 7.0-14.0%, starch: 39.0-49.9% and vit. B_1 (thiamine): 0.18, vit. B_2 (riboflavin): 0.23.The characteristic aroma is due to the presence of a volatile oil contained in the seeds. Cincol, terpineol, borneol, terpinene, 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.

Cardamom is one of the most valuable Indian spices, used in the preparation of curry powder, pickles, sausages, cakes and confectionery. Cardamom oil, obtained by distillation of capsules, is used as a condiment and for flavouring beverages. Seeds are used as a condiment in cordials, bitters and other pharmaceutical preparations. Medicinally, they are employed as carminative, aromatic, stimulant and diuretic, and are chiefly used in nausea and vomiting Tinctures of cardamom are used chiefly in medicines for windiness or stomachic. Cardamom seeds are chewed to prevent bad smell in the mouth, indigestion and pyrosis. Gargling with the infusion of cardamom and cinnamom 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.

BEVERAGE PLANTS

Beverages are stimulatory in nature and man feels some pleasure by taking them. Some substances obtained from plants like cocaine, cannabis, opium, etc., use highly stimulant, whereas others like tea, coffee, cocoa, etc. are mild stimulant. Now-a-days, beverages are used in enormous quantity throughout the world and they have become an integral part of the human diet

Beverages may be classified into two groups, viz., alcoholic and non alcoholic beverages. Alcoholic beverages are depressants, lowering the activity of the brain. There are two categories of alcoholic beverages: fermented beverages are those in which alcohol is formed by the fermentation of sugars, and distilled beverages which are obtained by successive distillation of fermented liquors. Wines and beers are the familiar examples of fermented alcoholic beverages, whereas whisky, brandy, rum, gin, etc, are the examples of distilled beverages. Non-alcoholic beverages usually contain alkaloids and are used all over the world for their stimulating and refreshing qualities. Tea, coffee and cocoa fall in this group.

Non-Alcoholic Beverages

The refreshing and stimulating properties of non-alcoholic beverages are due to the presence of caffeine or other related alkaloids. Caffeine, when taken in small quantities, imparts mental animation and wakefulness. It stimulates increased Production of digestive juices and has a marked diuretic action. Tea, coffee and Cocoa are the three major non-alcoholic beverages. The first two have little mutritive value, while cocoa is a good source of energy. Coffee is more stimulating to the brain and cocoa to the kidney, whereas tea occupies an intermediate position between the two, being a mild stimulant to most bodily functions.

COCOA

Botanical name: *Theobroma cacao*

Family: *Sterculiaceae*

Origin and Distribution

Cocoa and chocolate are two major products obtained from roasted kernels of ripe seeds of Theobroma cacao, a native of the low-lying areas of tropical Central and South America. It was cultivated by the Aztecs, Mayas and other tribes of Central and South America and West Indies long before the discovery of the New world. The habit of drinking cocoa was brought to Europe by the Spaniards who found cocoa more palatable when it was sweetened. In 1525, the Spaniards planted cacao trees in Trinidad and later in Venezuela. It was introduced into the Philippine Islands in 1670 and later the Dutch carried it to Ceylon and Indonesia, and to the island of Sao Tome in the gulf of Guinea, off the west coast of Africa. Nearly two thirds of the total world's production of cocoa comes from Africa. The principal cocoa growing countries are Mexico, Guatemala, Salvador, Costa Rica, Colombia, Peru, Ecuador, Brazil. Venezuela, Trinidad, Jamaica, Cuba, Nigeria, Mauritius, Sri Lanka, Java, Sumatra, Fiji. Ghana and Philippines Islands

In India, cacao was introduced from Ceylon. Kerala is the principal cocoa growing state in India, accounting for about 80 per cent of the total area under cultivation about 20,000 ha), followed by Karnataka and Tamil Nadu.

Botanical Characteristics

It is a small, evergreen profusely branched tree attaining a height of up to 12 m in the wild state, but under cultivation its height is limited to 7 m. The leaves are dark green and oblong-oval or elliptic-oblong. It is cauliflorous, the flowers and fruits are borne on older branches and the trunk. The flowers are small, white, yellow or rose coloured and are borne in small clusters. The pods are elliptic-ovoid, 22.5-30 cm long and 10 cm in diameter and yellow, red or maroon in colour. There are about 20-40 seeds embedded in a mucilaginous pulp inside each pod.

Uses

Cocoa is a highly concentrated energy food. The roasted seeds are the source of a beverage, Chocolate and cacao butter prepared from seeds are widely used in confectionery, milk chocolates, cocoa nibs, powdered chocolate, creme de cacao, etc. Fermented sun-dried beans contain appreciable quantity of vitamin D. Cocoa also finds wider application in pharmaceutical ointments and toiletries. Cocoa butter is used in foaming mild washing compositions for human body Suppositories suitable for treatment of anal fissures, thrombophlebitic haemorrhoids and ulcerated haemorrhoids are also made using cocoa butter. Cocoa shells are used as a livestock feed and as an adulterant to cocoa powder and chocolate. The shells are also used as a filler for thermosetting resins in the plastics industry. Cocoa hull is a good source of dietary fibre and can be used to supplement other sources of fibre for food products.

FRESH POD WITH PULP

Timber and pulp yielding plans

RED SANDAL

Botanical name: *Pterocarpus santalinus* Linn.

Vernacular names: Eng. Red sandalwood; Rukhto-chandan, Sanskrit Raktachandana; Hindi and Bengali-Raktachandan, lalchandan, Marathi - Tambada chandana Gujarati-Ratanjali; Telugu-Agarugandhamu, rakta gandhamu, Tamil-Atti, sivappu chandanam; Kannada-Agaru, honne, kempugandha; Malayalam-Patrangam; Oriya Raktachandan; Trade Red Sanders.

A small tree of South India, chiefly found in Cuddapah, North Arcot, and the southern portion of the Karul district. It favours a dry, rather rocky soil, and a hot fairly dry climate, Sapwood is white. Heartwood is purplish-black dark orange-red when fresh cut, extremely hard, the shavings giving a blood red-orange colour. It is used for building and for turning, and is said to be much prized because it is not subject to the attacks of white ants. It is much used for carvings in Andhra Pradesh especially at Tirupati. Wood is highly prized for house posts; also used for agricultural implements, poles, shafts and bent rims

of carts, picture frames, boxes and other joinery work. In Japan, it is used for a musical instrument called Shamisen. Wood is ground and used for dyeing wool, cotton and leather, and staining other woods; santalin is the colouring principle.

EUCALYPTUS

Eucalyptus, (genus *Eucalyptus*), large genus of more than 660 species of shrubs and tall trees of the myrtle family (Myrtaceae), native to Australia, Tasmania, and nearby islands. In Australia the eucalypti are commonly known as gum trees or stringybark trees. Many species are cultivated widely throughout the temperate regions of the world as shade trees or in forestry plantations. Economically, eucalyptus trees constitute one of the most valuable groups within the order Myrtales.

The eucalypti grow rapidly, and many species attain great height. The giant gum tree, or mountain ash (*Eucalyptus regnans*), of Victoria and Tasmania, is one of the largest species and attains a height of about 90 metres (300 feet) and a circumference of 7.5 metres (24.5 feet). Many species continually shed the dead outermost layer of bark in flakes or ribbons, whereas certain other species have thick textured bark. The leaves are leathery and often hang obliquely or vertically; most species are evergreen. The flower petals cohere to form a cap when the flower expands. The capsule fruit is surrounded by a woody cup-shaped receptacle and contains numerous minute seeds. Possibly the largest fruits—from 5 to 6 cm (2 to 2.5 inches) in diameter—are borne by mottlecah, or silverleaf eucalyptus (*E. macrocarpa*).

Major Species and Uses

The leaf glands of many species, especially black peppermint tree (*E. salicifolia*) and Tasmanian bluegum (*E. globulus*), contain a volatile aromatic oil known as eucalyptus oil. Its chief use is medical, and it constitutes an active ingredient in expectorants and inhalants. Tasmanian bluegum, northern gray ironbark (*E. siderophloia*), and other species yield what is known as Botany Bay kino, an astringent dark reddish resin, obtained in a semifluid state from incisions made in the tree trunk.

Eucalyptus wood is extensively used in Australia as fuel, and the timber is commonly used in buildings and fencing. Among the many species of timber-yielding eucalypti are the black peppermint tree; southern mahogany (*E. botryoides*); karri (*E. diversicolor*); Tasmanian bluegum; white ironbark, or yellow gum (*E. leucoxylon*); jarrah (*E. marginata*); messmate stringybark (*E. obliqua*); red mahogany (*E. resinifera*); northern gray ironbark; and others. The bark of many species is used in papermaking and tanning.

Fodder Crop

Fodder crops are cultivated primarily for animal feed. Fodder crops may be classified as either temporary or permanent crops. They contain crude fibre, crude protein and some minerals. The fibre content of most of the fodder crop consists of cellulose, a complex carbohydrate polysaccharide that is indigestible for humans, but which is a good source of energy for animals and particularly ruminants.

FODDER GRASS (*Panicum*)

Binomial Name: *Panicum virgatum*

Family: Poaceae

Local names: switch grass, black well switch grass

Description

Panicum virgatum, commonly called as switch grass is a perennial grass that can grow up to 2.7 m (8ft 10 inch) tall and more or less erect. It forms tufts of leafy culms that are erect to ascending. Leaves are 30 – 90 cm, with a prominent mid rib. Each fertile culm terminates in an inflorescence. Flowers well developed, panicle reaches often up to 60 cm long and it bears a good crop of seed. Seeds are 3 – 6mm

long and up to 1.5 mm thick. The root system is fibrous and rhizomatous. It can penetrate up to 10 ft. into the ground. Reproduction is by seed and through clonal offsets of the rhizomes.

Uses

Switch grass provides excellent feed for livestock and other animals as its quality is high and has good palatability when young. Grazing is allowed only after the switchgrass has reached a height of 12 to 16 inches (30.5 to 40.6 cm). Grazing is stopped when the grass is six inches off the ground and it is allowed to rest for 30 to 60 days before grazing again. It is considered as an environmental benefit due to the abundance of wildlife attracted by this grass. It makes great wildlife habitat, especially for bird species such as pheasant, quail, wild turkey which feed on the abundant seed produced by the grass. It can be used for ethanol production. It is possible to produce up to 380 litres of ethanol per metric ton. This gives it the potential to produce over 400 litres of ethanol per hectare, compared to 270 for sugarcane and 160 for corn. Used in several bio energy conversion processes including cellulosic ethanol production, biogas, and direct combustion for thermal energy applications. Switchgrass is a well-known ornamental grass used in gardens, the inflorescence is also used in bouquets. Varieties such as 'Heavy Metal' and 'Rehbraun' are well known ornamental varieties sold in Europe and are fairly common in gardens and parks. It is often used in soil conservation and stabilization of banks and slopes due to its dense fibrous root system.

Fibre yielding plant

After food plants, fibre plants are the most important in their usefulness to mankind. Since time immemorial man has been using fibres of plant origin for his clothing and many other needs. With the advancement of civilization, their use increased considerably. In recent years, many manmade fibres have replaced the plant fibres, yet plant fibres are used extensively for clothing, ropes, sacks, packing and stuffing and for the manufacture of paper, etc.

JUTE

Botanical name: *Corchorus sp.*
Family: *Tiliaceae*
Vernacular name: Narcha (Hindi, Beng.).

Jute is the most important bast fibre and among natural fibres it is only second to cotton. The fibre is obtained from the stems of two species of Corchorus, *C. capsularis* and *C. olitorius*. Jute was used in India since very ancient times but it became important as sack-cloth in the late sixteenth century, and the first shipment of jute fibre from India to England was made in 1791. There are about 40 species of *Corchorus* distributed throughout the tropics of the world. Eight species of *Corchorus* occur in India, but only two are of commercial importance. *C. capsularis* considered to have its origin in the Indo-Burma region, whereas *C. olitorius* has its primary centre of origin in Africa with a secondary centre in India or Indo-Burma. The major jute producing countries are India, Bangladesh, China, Burma, Nepal, Brazil, Taiwan and Thailand. In India, the major jute growing states are West Bengal, Assam, Bihar and Orissa, and on a small scale jute is also grown in Uttar Pradesh. Tripura and Meghalaya. It is grown in over 0.9 million hectares and during 2007-08 India produced 11.77 million bales (of 180 kg each). About 80% of the total world's production of jute comes from India and Bangladesh. West Bengal has an area of about 4,19,000 ha under jute cultivation and produced 8.8 million bales during 2007-08.

Botanical characteristics

Both the cultivated species of *Corchorus, C. capsularis* and *C. olitorius* are annual woody undershrubs attaining a height of about 2-3 m. The plants branch near the tip of the stem, but under cultivation as they grow in dense clusters and remain unbranched. The leaves are alternate, stipulate, simple and ovate, two spinous appendages are present at the base of the leaf. The flowers are solitary or in 3-4 flowered cymes. They are small, yellow, bracteate, pedicellate and hermaphrodite The sepals and petals are 4 or 5 and the stamens are twice the number of petals. The fruit is a loculicidal capsule which is globular in *C. capsularis* and long cylindrical in *C. olitorius*.

Uses

Jute is an important bagging material and is extensively used for gunny bags and also for coarse cloth, twine, ropes, etc. It also finds wide application in the manufacture of curtains, carpets, blankets, linoleum, oil cloth, etc. The short fibres, known as jute butts are used in paper making. Jute cuttings and sticks (the core portion of jute plant left after extraction of fibre by retting in water) are a good source of cellulose and can be utilised as pulping raw materials for writing and printing papers as well as speciality papers for various uses. They can also be used in making rayon grade pulp. Jute sticks may also be used as a source for sugar production. Jute sticks are burnt as fuel. It has very good scope for utilization in the production of various types of good strength particle boards and composite materials. Such boards are suitable for furniture, false ceiling, partition wall, etc. Jute cloth impregnated with polyethylene can be used to produce plane and corrugated sheets and multiply sandwich boards with corrugated cores. An infusion of leaves is a tonic and febrifuge and is also used as a demulcent in cystitis and dysuria.

Medicinal plant

Cathranthus

Botanical Name : *Catharanthus roseus* (L) G.Don.
Synonyms : *Vinca rosea* L.
Common Name : Baramasi, Sadaphuli, Periwinkle
Plant Family : Apocynaceae

Description

Habit : An erect, everblooming, ornamental herb, with branched tap root system.

Stem : Erect, cylindrical, branched, solid, purple red with milky latex, pubescent.

Leaves : Simple, exstipulate, opposite decussate subsessile or petiolate, ovate or obovate, entire, mucronate, unicostate reticulate.

Inflorescence : Solitary axillary or dichasial cyme.

Flowers : Ebracteate, pedicellate, complete, actinomorphic, bisexual, hypogynous, pentamerous, cyclic, rosy-purple in colour. Calyx made up of 5 sepals, polysepalous, valvate. Corolla made up of 5 petals, gamopetalous, twisted, pink, violet or purple in colour, hypocrateriform, throat of corolla swollen in which are present the stamens. Androecium of 5 stamens, polyandrous, epipetalous, filament short, anthers sagittate, dithecous, dorsifixed, introrse. Gynoecium bicarpellary, syncarpous but sometimes apocarpous, superior, ovary free, ovules many, marginal placentation, style long, stigma modified and capitate. Two green hypogynousnectaries or nectariferous scales are present. Nectaries are anteroposterior to the ovary.

Fruit : Follicle

Uses

Madagascar periwinkle has long been used as a traditional medicine. Tests by pharmaceutical companies in the 1950's showed the presence of a number of medically

active alkaloids, especially the compound vincristine, which has been shown to have activity against leukaemia. The alkaloids, when isolated from the plant, are highly toxic but have also been shown to reduce the numbers of white blood cells, leading to applications which have revolutionized conventional cancer therapy. The plant is cultivated as a source of these alkaloids, a number of which are extracted and used allopathically.

The isolated alkaloids are used to treat and other cancers. The alkaloids vincristine and vinblastine are prescribed in anticancer therapy, particularly in cases of acute leukaemia (especially in children) and Hodgkin's lymphoma. They are usually part of a complex chemotherapy protocol. Used in isolation, they have a number of side-effects, including alopecia, nausea and bone marrow depression.

The dried root is an industrial source of ajmalicine, which increases the blood flow in the brain and peripheral parts of the body. Preparations of ajmalicine are used to treat the psychological and behavioural problems of senility, sensory problems (dizziness, tinnitus), cranial traumas and their neurological complications. Ajmalicine, and another alkaloid serpentine, are prescribed in the treatment of hypertension.

The leaves and aerial parts of the plant have a wide range of traditional uses. Well known as an oral hypoglycaemic agent, the plant is also considered to be depurative, diaphoretic, diuretic, emetic, purgative and vermifuge. A decoction is taken to treat hypertension, asthma, menstrual irregularities, chronic constipation, diarrhoea, indigestion, dyspepsis, malaria, dengue fever, diabetes, cancer and skin diseases. Extracts prepared from the leaves have been applied externally as antiseptic agents for the healing of wounds; to relieve the effects of wasp stings; against haemorrhage, skin rash and as a mouthwash to treat toothache.

An infusion of the flowers is used to treat mild diabetes. A decoction of the roots is taken to treat dysmenorrhea


Horticultural plants

JACK FRUIT

The jackfruit, *Artocarpus heterophyllus* Lam.of the family Moraceae, is also called jak-fruit, jak, jaca, and, in Malaysia and the Philippines, *nangka*; in Thailand, *khanun*; in Cambodia, *khnor*; in Laos, *mak mi* or *may mi*; in Vietnam.

Description

The tree is handsome and stately, 30 to 70 ft (9-21 m) tall, with evergreen, alternate, glossy, somewhat leathery leaves to 9 in (22.5 cm) long, oval on mature wood, sometimes oblong or deeply lobed on young shoots. All parts contain a sticky, white latex. Short, stout flowering twigs emerge from the trunk and large branches, or even from the soil-covered base of very old trees. The tree is monoecious: tiny male flowers are borne in oblong clusters 2 to 4 in (5-10 cm) in length; the female flower clusters are elliptic or rounded. Largest of all tree-borne fruits, the jackfruit may be 8 in to 3 ft (20-90 cm) long and 6 to 20 in (15-50 cm) wide, and the weight ranges from 10 to 60 or even as much as 110 lbs (4.5-20 or 50 kg). The "rind' or exterior of the compound or aggregate fruit is green or yellow when ripe and composed of numerous hard, cone-like points attached to a thick and rubbery, pale yellow or whitish wall. The interior consists of large "bulbs" (fully developed perianths) of yellow, banana-flavored flesh, massed among narrow ribbons of thin, tough undeveloped perianths (or perigones), and a central, pithy core. Each bulb encloses a smooth, oval, light-brown "seed" (endocarp) covered by a thin white membrane (exocarp). The seed is 3/4 to 1 1/2 in (2-4 cm) long and 1/2 to 3/4 in (1.25-2 cm) thick and is white and crisp within. There may be 100 or up to 500 seeds in a single fruit. When fully ripe, the unopened jackfruit emits a strong disagreeable odor, resembling that of decayed onions, while the pulp of the opened fruit smells of pineapple and banana.

Uses

Food: If the jackfruit is allowed to ripen, the bulbs and seeds may be extracted outdoors; or, if indoors, the odorous residue should be removed from the kitchen at once. The bulbs may then be enjoyed raw or cooked (with coconut milk or otherwise); or made into ice cream, chutney, jam, jelly, paste, "leather" or *papad*, or canned in sirup made with sugar or honey with citric acid added. The crisp types of jackfruit are preferred for canning. The canned product is more attractive than the fresh pulp and is sometimes

called "vegetable meat". The ripe bulbs are mechanically pulped to make jackfruit nectar or reduced to concentrate or powder.

Fruit: In some areas, the jackfruit is fed to cattle. The tree is even planted in pastures so that the animals can avail themselves of the fallen fruits. Surplus jackfruit rind is considered a good stock food.

Leaves: Young leaves are readily eaten by cattle and other livestock and are said to be fattening. In India, the leaves are used as food wrappers in cooking, and they are also fastened together for use as plates.

Latex: The latex serves as birdlime, alone or mixed with *Ficus* sap and oil from *Schleichera trijuga* Willd. The heated latex is employed as a household cement for mending chinaware and earthenware, and to caulk boats and holes in buckets. The chemical constituents of the latex have been reported by Tanchico and Magpanlay. It is not a substitue for rubber but contains 82.6 to 86.4% resins which may have value in varnishes. Its bacteriolytic activity is equal to that of papaya latex.

Wood: Jackwood is an important timber in Ceylon and, to a lesser extent, in India; some is exported to Europe. It changes with age from orange or yellow to brown or dark-red; is termite proof, fairly resistant to fungal and bacterial decay, seasons without difficulty, resembles mahogany and is superior to teak for furniture, construction, turnery, masts, oars, implements, brush backs and musical instruments. Palaces were built of jackwood in Bali and Macassar, and the limited supply was once reserved for temples in Indochina. Its strength is 75 to 80% that of teak. Though sharp tools are needed to achieve a smooth surface, it polishes beautifully. Roots of old trees are greatly prized for carving and picture framing. Dried branches are employed to produce fire by friction in religious ceremonies in Malabar.

From the sawdust of jackwood or chips of the heartwood, boiled with alum, there is derived a rich yellow dye commonly used for dyeing silk and the cotton robes of Buddhist priests. In Indonesia, splinters of the wood are put into the bamboo tubes collecting coconut toddy in order to impart a yellow tone to the sugar. Besides the yellow colorant, *morin*, the wood contains the colorless *cyanomaclurin* and a new yellow coloring matter, *artocarpin*, was reported by workers in Bombay in 1955. Six other flavonoids have been isolated at the National Chemical Laboratory, Poona.

Bark: There is only 3.3% tannin in the bark which is occasionally made into cordage or cloth.

Medicinal Uses: The Chinese consider jackfruit pulp and seeds tonic, cooling and nutritious, and to be "useful in overcoming the influence of alcohol on the system." The seed starch is given to relieve biliousness and the roasted seeds are regarded as aphrodisiac. The ash of jackfruit leaves, burned with corn and coconut shells, is used alone or mixed with coconut oil to heal ulcers. The dried latex yields artostenone, convertible to artosterone, a compound with marked androgenic action. Mixed with vinegar, the latex promotes healing of abscesses, snakebite and glandular swellings. The root is a remedy for skin diseases and asthma. An extract of the root is taken in cases of fever and diarrhea. The bark is made into poultices. Heated leaves are placed on wounds.

GERBERA

Scientific name: *Gerbera jamesonii*
Family: *Asteraceae*
Common name: African daisy, Gerbera daisy**,** Barberton daisy

Botanical characteristics

Gerbera jamesonii is a perennial herb with deeply lobed leaves covered with silky hairs arising from a crown. The striking inflorescence is borne on a long stalk and the outermost petals (ray florets) may be cream, red, orange or pink, while the central flowers (disc florets) are cream. Flowering occurs in spring to early summer and in autumn.

Uses

The breeding of *Gerbera* started at the end of the 19th century in Cambridge, England, when Richard Lynch crossed *G.jamesonii* and *G.viridifolia*. Most of the current commercially grown varieties originate from this cross.

This species is grown in gardens throughout the world. It is one of the most popular ornamental flowers in the world, both as a cut flower and as a pot plant, and therefore is of considerable economic importance.


HEDGE PLANT DURANTA

Botanical Name: *Duranta erecta* L.
Family: Verbenaceae
Synonyms: *Duranta repens* L., *Duranta plumieri* Jacq.
Common Name: Damyanti, Golden Dew-drops, Forget-me-Not

Characteristics

Habit: A small shrub with branched tap root system.
Stem: Square, herbaceous but woody below, erect, branched, solid, green.
Leaves: Ramal and cauline, simple, opposite decussate or whorled, petiolate, obovate, ovate or elliptic, entire, with axillary thorns and unicostate reticulate venation.
Inflorescence: Axillary or terminal racemes forming panicles.
Flowers:

Complete, bisexual, bracteates, bracts small at the base of the flowers, pedicellate, hypogynous, zygomorphic, pentamerous, bluish-white in colour. Calyx made up of 5 sepals, gamosepalous, slightly tubular, persistent, valvate, small, teeth 5. Corolla made up of 5 petals, gamopetalous, tubular with unequal lobes, three anterior lobes are larger than two posterior; quincuncial, corolla tube slightly curved, rotate, lilac or light-blue. Stamens 4, polyandrous, epipetalous, didynamous, posterior stamen is absent, sagitate, dithecous, basifixed, introrse. Gynoecium is tetracarpellary, syncarpous, superior, tetralocular, each locule with two ovules; axile placentation; style simple; stigma simple, bifid or 4 lobed.
Fruit: Drupe fleshy with enlarged calyx with four 2-chambered stones, orange.
Seeds: 8, obovate-oblong, smooth, glabrous.
Flowering and Fruiting Time: Throughout the year.

Uses

Commonly cultivated in the gardens and used as a border or hedge plant or wind break. Can be trimmed and maintained in desired shape. Fruit juice is also known to be used against mosquitoes.

Plant for soil conservation

LEMON GRASS

Oil grass, (genus *Cymbopogon*), genus of about 70 species of aromatic oil-containing grasses in the family Poaceae. Oil grasses are native to the tropics and subtropics of Asia, Africa, and Australia and have been introduced to tropical America. Several species have a strong citrus scent and are cultivated for their essential oils.

Most oil grasses are robust densely tufted perennials. The culms (stems) can reach 2 metres (6.6 feet) in height and feature long narrow flexible leaves. The reduced flowers are often reddish and borne in dense or loose clusters known as panicles.

Lemongrass, or sweet rush (*Cymbopogon citratus*), contains citral, obtained by steam distillation of the leaves. The plant is common in Asian cuisine and is also used in scented cosmetics and medicine. Citronella grass (*C. nardus*) contains geraniol (citronella oil), used in cosmetics and insect repellents. It is also used for soil conservation

Lemongrass ~ Cymbopogon citratus