Plant Resources and Utilization: Including brief description of plant /plant parts used:

Cereals: A cereal plant, or cereal crop, is any plant of the grass family (Poaceae) that is cultivated for its edible starchy seeds, known as grains. These grains are a major source of food for humans and animals worldwide, providing essential nutrients and energy, and are considered staple crops for many cultures. Common examples of cereal plants include wheat, rice, maize (corn), barley, and oats.

Key characteristics of cereal plants:

- **Grass family:** They belong to the graminaceous family, Poaceae.
- **Edible seeds:** They are grown for their starchy, edible seeds, or grains.
- **Staple food:** They are a primary source of food and energy for humans and animals.
- **Nutritional value:** The whole grains are rich in carbohydrates, vitamins, minerals, and fiber.
- **Industrial uses:** Beyond food, cereal grains are used for animal feed, seed production, and industrial purposes like making biofuels and spirits.

Wheat:

Botanical name: *Triticum aestivam*

Family : Poaceae

Useful part: Seed (Furite)

A wheat plant is an annual grass of the Triticum genus, cultivated for its cereal grains which are a global staple food. It grows in well-drained soil with plenty of sunlight, featuring slender leaves and stems, with a life cycle including germination, tillering, floral development, and grain filling before harvest.

An annual grass, the wheat plant grows one stem and narrow leaves, typically reaching up to four feet in height. The plant features long, slender leaves and stems that are often hollow. Two types of roots support the plant: seminal roots emerge from the seed to support early growth, while nodal (or adventitious) roots develop later, supporting tillering. The flowers are small and grouped into spikelets, which house the two or three grains that develop after pollination.

Chemical contain :

Wheat is composed primarily of carbohydrates 70–75% (amylose and amylopectin-starch), protein 12–17% (glutenins and gliadins), and water (about 12%), with smaller amounts of lipids 2% (nonpolar lipids, phospholipids, and glycolipids), minerals (1.8–3%), and dietary fiber. Key macronutrients include starch and storage proteins like gliadins and glutenins, while micronutrients encompass B vitamins (B1, B2, B6, folic acid), vitamin E, and minerals like iron, zinc, magnesium, and phosphorus

Uses and Significance:

- **Staple Food:**
  Wheat grains are a primary global food source, particularly common wheat (Triticum aestivum).
- **Food Products:**
  The processed grain is used to make a variety of foods, including bread, pasta, pizza, and pastries.
- **Animal Feed:**
  Wheat bran and other parts of the plant are valuable components in cattle, poultry, and livestock feed.

  Industrial & Other Applications
- **Biofuels:** Wheat can be used in the production of bioethanol, a type of fuel.

- **Plastics & Materials:** Some strains of wheat are used in the manufacture of biodegradable plastics.
- **Paper & Building Materials:** Wheat straw pulp is used in making paper, strawboard, and building board.
- **Adhesives & Binders:** Low-grade flours can be used to prepare pastes for wallpapers and as a core binder in iron foundries.
- **Alcoholic Beverages:** Wheat is a base ingredient for popular alcoholic drinks like beer, vodka, and whiskey.
- **Specialty Uses:** Starch from wheat is used in the textile industry, and some wheat is grown for use in pet foods and cosmetics.

Rice:

Botanical name: Oryza sativa

Family : Poaceae

Useful part: Seed (Furite)

Rice is a globally important cereal grain and a primary staple food for over half the world's population, particularly in Asia and Africa. It is the seed of the annual grass species Oryza sativa (Asian rice) or Oryza glaberrima (African rice). Rice cultivation, including China, India, and the civilizations of Southeast Asia. However, the earliest archaeological evidence comes from central and eastern China and dates to 7000–5000 BCE. More than 90 percent of the world's rice is grown in Asia, principally in China, India, Indonesia, and Bangladesh, with smaller amounts grown in Japan, Pakistan, and various Southeast Asian nations. Rice is also cultivated in parts of Europe, in North and South America, and in Australia.

Rice plants are semi-aquatic, typically growing 1 to 2 meters tall, and are cultivated in warm regions worldwide. The grain's nutritional value comes from its bran layer, which contains fiber, vitamins, and minerals, though much of this is removed in polished white rice.

ChemicL composition: Rice's chemical composition primarily consists of carbohydrates, mainly starch (amylose and amylopectin), along with moisture, protein (glutelin), fiber s(cellulose, hemicellulose, and pentosans),fat, and ash. It also contains essential minerals like potassium, magnesium, calcium, zinc, and various vitamins like thiamine, riboflavin, and niacin (though often reduced in polished rice).

Uses : It is a major source of carbohydrates for energy, is safe for those with celiac disease as it is a gluten-free food, supports digestive health, plays a role in reducing the risk of heart disease, and is also the fiber in rice promotes digestion and is beneficial for intestinal health. Rice water is used to hydrate the skin, reduce wrinkles, remove blackheads, and tighten the skin. And It brightens the skin and can help reduce blemishes.

Jowar: (Sorghum)

Botanical name: Sorghum valgare

Family : Poaceae

Useful part: Seed (Furite) and stem, leaves also

Sorghum (jowar) is a resilient, drought-tolerant grain crop that is a staple food in many semi-arid regions, particularly in Africa and India. Sweet Sorghum; Known for its high sugar content, used for syrups, brewing, and biofuel production. Sorghum morphology includes a fibrous root system spread out to absorb water, an erect, waxy stem (culm) The stem is solid and can be very strong and tall, sometimes growing up to 4 meters in height. The central part of the stalk, or pith, is often juicy and can be sweet in some types, similar to sugarcane. Leaves and long, narrow leaves with a parallel-veined blade and a sheath that wraps the stem. At the top of the plant, sorghum produces a large, bushy flowerhead called a panicle or inflorescenc. which produces numerous tiny flowers that develop into small, dense clusters of

grains. Sorghum is a tall grass that can be annual or perennial. The grains can vary in color, including white, red, or brown, depending on the specific variety.

Chemical composition: Sorghum is a rich source of carbohydrates (starch) providing calories and energy. and also contains protein, fat, fiber, and various minerals and vitamins. On a dry weight basis, its average composition can range from approximately 8–18% protein, 70–80% carbohydrates, 2–7.6% fat, and 1–3.4% crude fiber. Key minerals, include potassium, phosphorus, and magnesium, while beneficial B-complex vitamins and antioxidants like phenolics and carotenoids are also present.

Uses: Sorghum is a nutrient-dense, gluten-free grain used in food, animal feed, and biofuel production, offering benefits such as improved digestion, stable blood sugar levels, heart health support, and increased energy from its high fiber in sorghum helps to stabilize blood sugar levels, making it a beneficial grain for people with diabetes. magnesium, iron, and phosphorus, vitamin B-complex content also present. As a versatile ingredient, it serves as a healthy alternative for those with gluten intolerance and contributes to overall bone and immune system strength. The grain is also used as a component in animal feed. Biofuel Production due to its high sugar content, sorghum is a valuable crop for producing ethanol, a renewable energy source.

Bajra: (Pearl millet)

Botanical name: Pennisetum typhoides.

Family : Poaceae

Useful part: Seed (Furite) and stem, leaves also

Pearl millet is an upright bunch grass that typically grows 1.2–3.5 meters tall from the base and has an extensive root system that provides drought tolerance. Stems are stout, herbaceous, and cylindrical

1/2–1 inch diameter. It is a leafy plant with leaf blades that are 8–40 inches long and 1/2–3 inches wide, and a prominent terminal spike (ear) that bears the seeds. It is a robust crop known for its climate resilience and ability to thrive in hot, dry conditions where other crops fail, thanks to its deep root system and high photosynthetic efficiency. The plant is a source of nutritious grains rich in protein, fiber, and minerals and is also grown for forage for livestock.

Chemical composition : Pearl millet is primarily composed of carbohydrates in the form of starch (58–70%) and dietary fiber (2.6–4.0%), along with protein (8.5–15.1%), fat (2.7–7.1%), vitamins B3 (niacin), and minerals like iron, zinc, and magnesium. It also contains antioxidants and phytic acid, a compound that can reduce the absorption of certain minerals. It is a rich source of minerals such as iron (up to 85 ppm), zinc (up to 50 p pm), magnesium, potassium, and calcium.

Uses: Pearl millet, or bajra, is a versatile whole grain used to make food like flat breads, porridge, roti, bhakri, and thali peet. It offers health benefits like improved digestion, stronger bones, better heart health, and skin & hair support. As a gluten-free grain with a low glycemic index, It is used to make breakfast dishes similar to poha or upma. pearl millet aids digestion, promotes gut health, and can help relieve constipation. It helps in reducing LDL (bad) cholesterol and can prevent arterial blockages. Nutrients like protein, iron, zinc, and folate found in pearl millet strengthen hair follicles and improve skin health.

Legumes: Legumes come from the family Leguminosae, and a trait all legumes share is that they grow in a type of pod. A bowl of pea soup is full of legumes, and so is a bag of peanuts. Lentils, soy, and clover are all legumes.

Green gram: (Moong)

Botanical name: Vigna radiate.

Family : Leguminosea/Fabaceae.

Useful part: Seed (Fruit)

Green gram, also known as mung bean or moong, is a short-duration pulse crop in the legume family (Vigna radiata) primarily grown for its protein-rich seeds. It is cultivated across India during the Kharif, Rabi, and Summer seasons and is used in various foods and as green manure to improve soil fertility. Major Indian producing states include Rajasthan, Karnataka, and Maharashtra.

Green gram is a short-statured, herbaceous annual legume with trifoliate leaves and yellow, papilionaceous flowers borne in axillary racemes. It produces cylindrical, hairy pods containing small, globose seeds that are typically green but can vary in color. The plant is known for its well-developed root system, capable of nitrogen fixation, and its self-pollinating flowers.

The plant is typically an erect or semi-erect herbaceous annual, growing 30-100 cm tall, with some varieties exhibiting a tendency to twine at the tips. The leaves are trifoliate (composed of three leaflets) and attached to long petioles. The leaflets are large, oval, and entire, and both stems and leaves are covered in short hairs.The root system is extensive and features numerous lateral roots with nodules, where nitrogen-fixing bacteria reside. Yellow flowers are borne in clusters (racemes) in the leaf axils, with each inflorescence containing 10-20 flowers on long stalks. Seeds are small and globose, with a thin, tough coat that reveals two yellow cotyledons when peeled. The seeds are most commonly green but can also be yellow-brown or purple-brown.

Chemical composition: Green gram (mung bean) is rich in carbohydrates (around 55-60%), protein (20-32%), dietary fiber (14.5-24.5%), and a variety of minerals like potassium, calcium, magnesium, and iron, along with vitamins such as folate, thiamine, and riboflavin. It also contains beneficial phytochemicals like flavonoids, phenolic acids, and bioactive peptides, which have antioxidant and anti-inflammatory properties. However, green gram also contains antinutrients such as phytic acid, tannins, and trypsin inhibitors.

Uses : Green gram, or moong dal, is a nutritious legume rich in protein, fiber, vitamins like C and E, along with antioxidants and minerals like zinc, it helps protect against infections and supports the body's natural defenses, offering benefits such as improved digestion, heart health, weight management, and a stronger immune system due to its antioxidant properties. Its abundant antioxidants protect the body from damage caused by harmful free radicals, potentially reducing the risk of chronic diseases. It can also help regulate blood sugar and blood pressure, reduce inflammation, and is a valuable plant-based protein source for vegetarians. Its versatility makes it easy to incorporate into a balanced diet, and its benefits extend to promoting healthy skin and acting as a natural detoxifier. Green gram can help control blood sugar levels, making it beneficial for those managing diabetes. .

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Chickpea: (garbanzo bean):

Botanical name: Cicer arietinum/ Cicer album

Family : Leguminosea/Fabaceae.

Useful part: Seed

The chickpea plant is a bushy, annual legume, typically 20-60 cm tall, taproot with an extensive lateral root system, nodules formed by nitrogen-fixing bacteria, with feathery, pinnate leaves with 11-15 leaflets that give the foliage a fern-like appearance. Small, papilionaceous, and typically white, pink, or purple, fading to blue. Its angular, ribbed, and covered in glandular and non-glandular hairy stem and pods are covered in glandular hairs that secrete a defense-acting acid. The characteristic pods contain one to four seeds, which vary in size and color depending on the variety (Desi or Kabuli).

Chemical composition: Chickpeas are composed of carbohydrates about 40-60% (including fiber and starch), protein 18 types of amino acids, with 8 being essential for humans., and fats, along with essential minerals (like iron, zinc, and manganese), vitamins B9 (such as folate) such as thiamine (B1) and vitamin B6, and various bioactive compounds like flavonoids and isoflavones. Their composition varies by cultivar, and they are a rich source of dietary fiber and

plant-based protein, making them a nutrient-dense food. Chickpeas have a high fiber content, more than twice that of cereals or oilseed beans

Uses: Chickpeas are used in a wide range of foods, including Mediterranean and Middle Eastern dishes like hummus and falafel, Indian curries such as chana masala, and various global dishes like soups, stews, salads, and roasted snacks. They are also used to make chickpea flour for flatbreads (like socca), such as vegan tuna salad and chickpea-based baked goods.Chickpeas have a symbiotic relationship with nitrogen-fixing bacteria and can improve soil conditions when rotated with other crops.

Cashew :

Botanical name: Anacardium occidentale.

Family : Anacardiaceae.

Useful part: Seed.

The cashew plant is a fast-growing, evergreen tree in the mango family (Anacardiaceae) that grows 12-14 meters tall and features a short, irregular trunk and deep taproot. Its leaves are simple, leathery, and spiral-shaped, while its flowers grow in terminal panicles and are a mix of bisexual and staminate. The tree produces a distinct, kidney-shaped, edible "nut" (a true fruit) at the end of a fleshy, juicy, pear-shaped cashew apple (a false fruit or pseudocarp).

Chemical content:

Cashew nuts are primarily composed of fats, with a high proportion of monounsaturated fats, which are healthy fats. (about 44-47%), protein (about 18-21%), and carbohydrates (about 22-30%), with a small amount of water and dietary fiber. They are also rich in beneficial unsaturated fatty acids, minerals like magnesium, phosphorus, potassium, zinc, copper and iron, and vitamins, including some B vitamins and vitamin K. Contain compounds like carotenoids, which have antioxidant properties.

Uses: Cashew nuts are versatile and nutrient-dense, supporting heart health unsaturated fats, fiber, and antioxidants that help lower bad cholesterol and reduce the risk of cardiovascular diseases. managing blood sugar them beneficial for people with diabetes, strengthening bones, improving brain function, and promoting healthy skin and hair due to their content of healthy fats, protein, fiber, magnesium, zinc, and antioxidants. They can be eaten raw, roasted, or incorporated into desserts, stir-fries, and salads. However, moderation is key due to their calorie density, the magnesium and unsaturated fats support cognitive function and brain health. The zinc content in cashews plays a vital role in boosting and maintaining a healthy immune system.

Sugarcane:

Botanical name: Saccharum officinarum.

Family : Poaceae

Useful part: Stem

The sugarcane plant (Saccharum officinarum) is a tall, perennial grass with fibrous, jointed stalks rich in sucrose, primarily grown for sugar production, fresh juice, jaggery, and ethanol. Thriving in warm, humid climates, it requires plenty of sunlight and water, with growth stunted below 70°F. The plant is cultivated globally, with uses extending to fuel, animal feed, paper, and medicine. Native to tropical and subtropical regions of Asia and New Guinea, these plants have jointed stems with nodes and internodes, and long, sword-shaped leaves. The stalks are primarily used to extract sugar and can also be processed into ethanol (for fuel), bagasse (a fibrous residue), molasses, paper, and various chemicals.

Sugarcane has a fibrous root system. Each joint is called a node, and the areas between them are called internodes. Nodes bear buds and leaves, while the solid, fibrous internodes are filled with sweet sap.

Long, narrow leaves grow from the nodes, each with a sheath wrapping around the stalk. At the top of the stalk, a feathery inflorescence or panicle appears, featuring tiny flowers.
Chemical composition: Sugarcane is primarily composed of water (about 70-75%), sucrose (13-15%), and fiber (10-15%). The fiber, also known as lignocellulose, consists of cellulose, hemicellulose, and lignin. Other significant components include glucose and fructose present in smaller amounts, minerals, proteins, waxes, and organic acids.
Uses: Sugarcane is used to produce sugar, jaggery, and ethanol for fuel and beverages like rum. Its fibrous by-product, bagasse, can generate electricity, produce paper, and make particleboard, while the liquid by-product, molasses, is fermented for various industrial chemicals. Additionally, sugarcane is a source of carbohydrates, minerals, and antioxidants for human and animal consumption, with its juice offering health benefits and the residue (press mud) and the entire plant, when decomposed, serve as valuable fertilizer for crops. The leaves and tops of the sugarcane plant are used as fodder for livestock
A biofuel produced by fermenting sugarcane sugars, used as a fuel additive or a standalone fuel.
Industrial and Other Uses: Sugarcane residue, bagasse, is a combustible material that can be used to generate electricity and heat. Molasses is fermented to produce industrial chemicals such as furfural, acetic acid, and yeast. Bagasse, the fibrous residue, can be processed into paper products and particleboard.
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