SKILL MANUAL

HERBAL HERITAGE

TURMERIC & GINGER

GRADE-VIII

केन्द्रीय माध्यमिक शिक्षा बोर्ड
भारत
असतो मा सद्गमय

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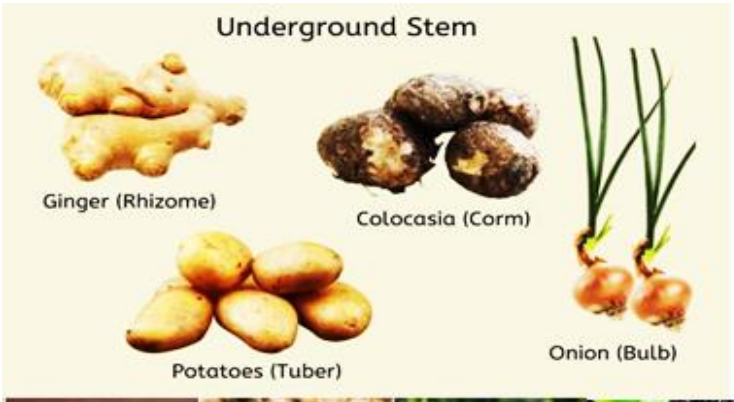

Underground Stem
Ginger (Rhizome)
Colocasia (Corm)
Potatoes (Tuber)
Onion (Bulb)


Aerial stem
Passiflora (Tendril)
Dioscorea (Bulbil)
Opuntia (Phylloclade


Turmeric
Curcuma


(a)
(b)


Infected plants and rhizome


HARVESTING


Dry Ginger (Sonth)


Raw Ginger
Cleaning & Sorting
Peeling & Chopping
Soaking
Drying
Essential Oil Extraction
Oleoresin Extraction
Packing
Pulverizing

FOREWORD

The future belongs to those who learn more skills and combine them in creative ways."
— Robert Greene

The new National Curriculum Framework (NCF) in line with the National Education Policy 2020 (NEP) focuses on making learning a joyful experience and remove stress from students, to develop a sense of self-reliance and dignity of the individual which would form the basis of social relationship and would develop a sense of nonviolence and oneness across the society. A child centered approach is the need of the hour to promote universal enrollment and retention as there is an emergence of new avenues and an entirely new set of demands are required.
It is the time to reform our pedagogies by effecting a shift from learning by rote to improving knowledge retention by advocating practical application as stated in NEP 2020. We must endeavor to effect a decisive shift from education for all to quality education for all.
As it is precisely the time to bring reforms in education, everyone must make concerted efforts to redesign curriculum and be more open to work and embrace intuitive teaching techniques that increase student involvement in the learning process. The new learning and teaching practices must excite students and ignite their imagination.

The 'Herbal Heritage' is one such effort to make learning fun-filled and enable students know about our spices that have a range of health benefits. The students will strive to gain sufficient knowledge of concepts, language and have the will to innovate! Constructive learning has to be part of the curriculum. Situations and opportunities have to be created for students to provide students with challenges, encourage creativity and encourage their active participation.

I congratulate the Management, Principal, teachers and students of Delhi Public School Kamptee Road, Nagpur who successfully shouldered this responsibility and came up with this brilliant work which will give the student fraternity an opportunity to have fun-filled learning. I am also grateful to Princess Diya Kumari Foundation who mentored the facilitators for producing this phenomenal and astounding work. I would like to advise the students to continue to study and learn new skills and be persistent in their pursuit for expansion.

INDEX

CLASSIFICATION OF STEM MODIFICATION

Learning objective-Students will learn about modification of stem.
Learning outcome- Children will be able to identify and name the plant according to the category it belongs to.

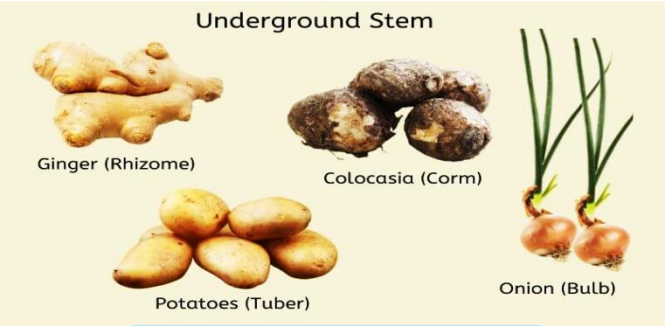
The stem helps in providing structure and support to the plant. It is modified into three important types:

1. **Underground stem**
2. **Aerial stem**
3. **Sub- aerial stem**

1. UNDERGROUND STEM

The stem that grows inside the soil is known as the underground stem. It produces aerial shoots annually.

Storage of food and perennation (to live over from one growing season to another) are the main functions of underground stems. These stems are also capable of vegetative propagation.



Picture Credit: https://www.quora.com/

They are of different types as follows:

Rhizome: is a non-green underground stem with distinct nodes and internodes and dry, scaly leaves at the nodes. It grows horizontally or obliquely. Rhizomes store plant nutrition in the form of proteins and starches. Example: Ginger, Turmeric

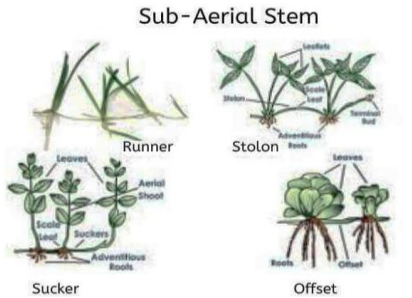
Tuber: is a short and thickened underground stem that grows horizontally below the ground. It stores plant nutrition in the form of starch. Example: Potatoes.

Bulb: is a short underground stem with internal buds surrounded by fleshy leaves or leafbases that help the plants to survive adverse environmental conditions. Example: Onion.

Corm: is a short, vertical, swollen underground stem of a plant-covered by thin sheathing leaf bases of dead leaves called scales. These dry leaf bases help protect the stem of the corm from harsh weather conditions and lack of moisture.Corm serves the functions of food storage, vegetative propagation, and perennation. e.g. Crocus, Gladiolus

2. SUB-AERIAL STEM

The stem, which partially remains below the ground and partially above the ground (i.e., in the air), is known as the sub-aerial stem. These stems are useful in the vegetative propagation of plants. E.g. Cynodon



Picture Credit: https://www.inspiritvr.com/

They are further divided into the following types:

Runner: It is a creeper that runs horizontally along the surface of the soil. Runners have long internodes. The nodes have scaly leaves, adventitious roots, and auxiliary buds. An underground runner is known as sobole. Example: Grass, Cynodon, Oxalis.

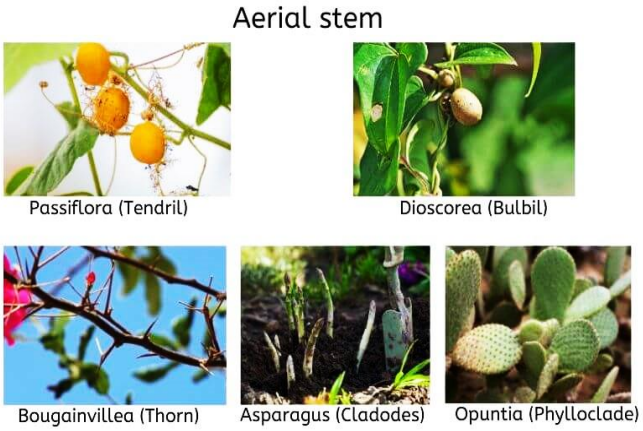
Offset: These are shorter and thicker than the runner with a single internode. It originates from the leaf axis and grows horizontally. Offsets are often found in aquatic plants like water lettuce, water hyacinth, etc.

Stolon: It grows above ground for some time and then bends towards the ground until it touches the ground. Stolon arises from the lower part of the main axis. Example: Jasmine, colocasia, etc.

Sucker: The sucker stem is very similar to the stolon, but it grows obliquely upwards and gives rise to a new plant. Example: Garden chrysanthemum, strawberry, pineapple, mentha, etc.

3. AERIAL STEM

These stems are found above the ground and perform various functions like food storage, vegetative propagation, protection, climbing, etc.



Picture Credit: https://smartclass4kids.com/

The aerial stem is further divided into the following types:

Tendril: These types of stems are slender, spirally coiled, which help a plant to climb. Example: Passiflora, Grapevine etc.

Bulbil: These are modified axillary buds which become fleshy and swollen due to storage of food. They help in vegetative propagation to form a new plant. Example: Dioscorea.

Thorn: These are hard, woody and pointed structures that protect plants from grazing animals. It originates from the axillary or terminal bud. Example: roses, citrus, bougainvillea, duranta etc.

Cladodes: These are non-fleshy and cylindrical that contain only one internode. Example: Asparagus, butcher's broom.

Phylloclade: These are green, fleshy, and flattened or cylindrical branches containing chlorophyll and carry out photosynthesis. This modification is found in xerophytic plants and stores water. Example: Opuntia, Casuarina, etc.

SELF REFLECTION

WHAT?	HOW?	WHY?

TURMERIC

Picture Credit: https://mobicred.co.za/

CHAPTER 1: INTRODUCTION THROUGH STORY-TURMERIC

Learning objective-Children will be introduced to the rhizome Turmeric.

Learning outcome-Children will understand the spice and cuisines where they are used.

It is that time of the year when the temperatures are soaring high. Every one complains about the heat as they go about their daily chores. But there are some who love this time, who wait for this time the whole year round. Any guesses. Yes, school students! It's time for summer holidays. It's the time when many of us visit our grandparents in their beautiful rustic villages.

I remember spending memorable times in my village in Kerala as a child. I would enjoy the unconditional love, care and pampering of my grandparents. Grandma would make lip smacking delicacies each day and grandpa would regale us with interesting stories from their times. Climbing trees, swimming in the pond and helping in the fields was such a unique experience. Through all this there was a spice spreading its golden goodness in our lives. Whether it was the delicious curries they prepared or when grandmother poured in the hot, haldi milk in a mug to soothe my feverish disposition or to help in healing when I scraped my knee rather badly while playing? Turmeric, the sunny spice, has been an integral part of my growing years.

GLOSSARY

1. aerial- growing above ground
2. partially- only in part, to a limited extent
3. obliquely- slantwise direction
4. terminal-borne at the end of a stem or branch
5. nodes - the points on a stem where the buds, leaves, and branching twigs originate
6. internode-an interval or part between two nodes (as of a stem)
7. originates- have a specified beginning
8. adverse- harmful, unfavourable
9. delicacy-something pleasing to eat that is considered rare or luxurious
10. chores -a routine task, especially a household one
11. regale -entertain or amuse (someone) with talk
12. disposition -a person's inherent qualities of mind and character
13. integral -necessary to make a whole complete; essential or fundamental

LET US RECALL

1. **Choose the most appropriate answer.**

   a) Which of the following is not a type of underground stem?
   - i) Rhizome
   - ii) Runner
   - iii) Tuber
   - iv) Corm

   b) The type of stem that is slender and spirally coiled is called …….
   - i) Thorn
   - ii) Cladode
   - iii) Sucker
   - iv) Tendril

2. **Categorise the following on the basis of stem modification.**

   Potato, Onion, Ginger, Opuntia, Rose, Jasmine, Water Hyacinth, Menthe

3. **Fill in the blanks using the words given in the help box.**

Corm	offset	potato	aerial	stolon

   a) _____ is a type of tuber that stores nutrition in the form of starch.
   b) Stem is modified as _____ in Crocus and Gladiolus.
   c) _____ stems are found above the ground and perform the function of storage and climbing etc.
   d) Water lettuce has modified stem called _____

4. **True / False**

   a) Cladodes are non-fleshy and cylindrical that contain only one internode. _____

   b) Onion is an example of a rhizome. _____

5. **Visit a vegetable market near your home. Identify some examples of stems that we use in our daily life as food. Draw the diagram and identify the type of stem modification.**

SELF-REFLECTION

WHAT?	HOW?	WHY?

CHAPTER 2: INTRODUCTION TO TURMERIC

Learning objective-Students learn and understand about turmeric, its name and origin.

Learning outcomes-Children will know the name, origin and importance of turmeric.

Picture Credit: https://www.24mantra.com/

Plant name (Latin): *Curcuma longa*
Plant family: Zingiberaceae (grass family)
Native region: South East Asia and Indian Subcontinent
Growing habit: Erect, herbaceous perennial plant reaching to height of 60-100cm
Parts used: Underground rhizome, leaves
Essential oil extraction method: Steam distillation

DISCOVERY

Let's begin and know how Turmeric was discovered. Turmeric as an aromatic medicinal plant was known to Indians since ancient times. Many scientists and historians argue that South Asia is the original home of turmeric and from there it might have spread to countries in the South East Asia and Pacific islands where turmeric is cultivated. It was recorded that turmeric was grown wildly in the forest regions of Java, Indonesia as early as 5th century AD. There are Sanskrit texts belonging to 5th and 6th centuries AD which describe the usages of turmeric. Marco Polo mentions the usages of turmeric in China. Turmeric is widely cultivated mainly in India, China, Taiwan, Indonesia, Sri Lanka, Java, Brazil, Peru, many parts of Africa and Australia.

ORIGIN

Turmeric comes from the root of the Curcuma Longa plant which is a perennial plant that is a part of the ginger family. This plant is native to India and requires warm, tropical climate and lots of rain to grow and thrive. The plant has a tough brown skin and a very rich orange pulp. Some plants that we get to see in same climatic conditions are banana plants, ferns and orchids.

How are perennial plants different from annual plants?

Perennial plants regrow every spring, while annual plants live for only one growing season and then die.

Can you name some more plants that are perennial?

Wonderful!!

Can you name some dishes you had this week which used turmeric to give an attractive yellow colour?

Yes you all are correct.

Rhizome is a new term you have learnt. Can you recollect what it means?

Horizontal underground plant stem capable of producing the shoot and root systems of a new plant.

The rhizomes are the most widely used part of the plant as cooking ingredient, medicine and colour dye though the leaves and the stems are used for many purposes mainly cooking and medicinal use.

NAMES (BOTANICAL AND COMMON NAMES)

We have already learnt some interesting facts about turmeric, now let us know more about its scientific names and common names.

Scientificname

Curcuma longa

Common names

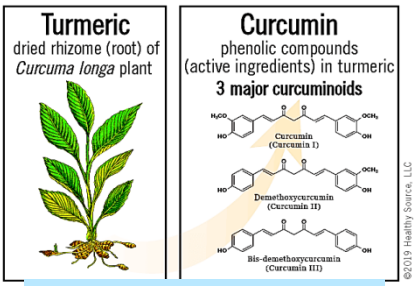
Haldi, Manjal, Turmeric Root, Yu Jin, Safran Bourbon, Indian Saffron, Pian Jiang Huang

Picture Credit:
https://divinitynutra.com/

You can now surely give some examples of Chemical components of Turmeric.

I am sure you would like to know the chemical composition of turmeric.

Turmeric powder is about 60–70% carbohydrates, 6–13% water, 6–8% protein, 5–10% fat, 3–7% dietary minerals, 3–7% essential oils, 2–7% dietary fiber, and 1–6% curcuminoids.



Picture Credit:
https://www.curcumin-turmeric.net/

Phytochemical components of turmeric include diarylheptanoids, a class including numerous curcuminoids, such as curcumin, demethoxycurcumin, and bisdemethoxycurcumin.

EXTRACTION OF ESSENTIAL OIL FROM TURMERIC

Let us recall, we mentioned that turmeric yields essential oil.
You must be wondering what is essential oil? The answer to this lies in the question itself. Take a guess children.

An essential oil gets its name from the plant from which it is derived. This oil was given the name “essential,” because it was believed to capture a plant's essence, that is its odour and flavour. Essential oil that we obtain is actually an aromatic oil.

Do you know what is aromatic oil?

It simply means volatile liquid that is capable of changing from a solid/liquid form to a vapour form.

volatile liquids.

Yes, Perfumes. We all love the smell; it makes us feel so fresh just by smelling.

Picture Credit:
https://www.doterra.com/

In order to extract turmeric oil, researchers have used steam distillation, hydro-distillation, and extraction using hexane. Hexane was combined with the oils after curcumin extraction and heated to 60 °C three times for one hour. The solvent was removed, which resulted in successful turmeric oil extraction.

GLOSSARY

1. aromatic: having a pleasant and distinctive smell
2. perennial: lasting or existing for a long or apparently infinite time; enduring or continually recurring
3. native: a local inhabitant
4. thrive: prosper; flourish
5. solvent: able to dissolve other substances
6. extraction: the action of removing something

LET US RECALL

1. **Choose the most appropriate option.**
   a) The country where turmeric is not commonly grown is
      i) India iii) America
      ii) Sri Lanka iv) China
   b) Which one of the following is not a common name of turmeric?
      i) Indian Saffron iii) Manjal
      ii) Haldi iv) Cinnamon

2. **Fill in the blanks using the words given in the help box.**

vapour	steam distillation	native	annual	Curcuma longa

   a) The scientific name of turmeric is _____.
   b) A volatile liquid is capable of changing from a solid/liquid form to a _____ form.
   c) The method of extracting essential oil from turmeric is known as _____.
   d) The plants which live only for one season are called _____ plants.

3. **True/ false**
   a) Ginger contains the chemical called curcumin. _____
   b) Turmeric is an erect, herbaceous, perennial plant. _____

4. **Share an incident where you have used herb or spice to enhance your health during the pandemic.**

SELF-REFLECTION

WHAT?	HOW?	WHY?

CHAPTER 3: USES AND IMPORTANCE OF TURMERIC

Learning objective-Children will understand the importance and uses of turmeric.

Learning outcome-Children will include turmeric in different recipes.

HEALTH BENEFITS OF TURMERIC

Picture Credit: https://www.lybrate.com/

1. It's anti-inflammatory

Now that's a new word, isn't it? Let's learn what it means. Anti-inflammatory properties help people to reduce redness, swelling and pain in the body. Use of turmeric as an anti-inflammatory, dates back to centuries in Ayurvedic medicine.

I hope that explains why your grandma applied turmeric paste on your wound.

2. It aids in digestion

I always suggest turmeric to my father when he complains of uneasiness in his stomach. Wondering why?

Turmeric's health benefits are known to be supportive of digestion. The compound is especially beneficial in helping with digestive disorders such as gas, bloating and inflammatory bowel disease, due to its anti-inflammatory properties.

3. It helps control blood sugar levels and improves heart health

Curcumin, the highly active ingredient in turmeric, has been shown to help lower blood sugar and improve cholesterol and blood pressure thus improving heart health.

4. It has anti-oxidant properties

Anti-inflammatory food like turmeric can reduce circulating levels of free radicals in the body.

Do you know what are anti-oxidants?

Anti-oxidants are substances that prevent or slow down the damage caused to cells by free radicals which are normally found in cigarette and air pollution as well.

5. It may help prevent Alzheimer's disease

Have you heard of Alzheimer's disease?

It is a progressive disease that destroys memory and other important mental functions**.**

Here is an interesting fact: India has a relatively low rate of occurrence of Alzheimer's disease, something that may be connected to Indian citizens' average daily intake of 125 mg curcumin per day.

6. It eases symptoms of arthritis

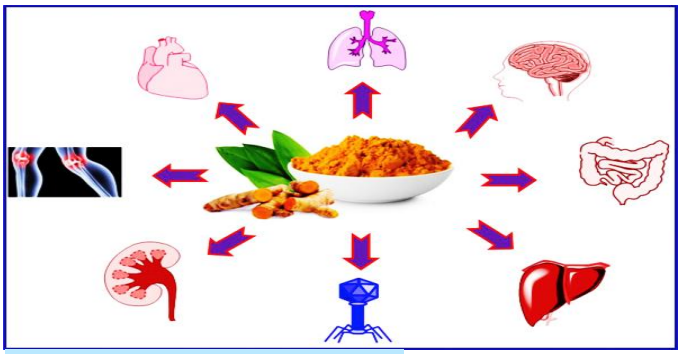
You may have heard your grandparents complaining of joint pain. It may be caused due to arthritis.

Turmeric's anti-inflammatory properties have been demonstrated to help rheumatoid arthritis, joint pain, and osteoarthritis.

7. It can help with depression

Some studies show that curicumin may increase serotonin and dopamine—two brain chemicals that affect your mood. It may also help you respond better to unexpected stress.

So you know the secret to stay stress free and happy: a glass of turmeric milk everyday will enhance your mental health.



Picture Credit: https://www.lybrate.com/

Wow isn't turmeric a magic spice. Now you know that turmeric has multiple health benefits, hence why not introduce it in your diet every day. I have shared two simple recipes. You may make it and serve it to your parents.

RECIPES

Super food Latte

An anti-inflammatory Ayurvedic healing cuppa.

- ½ teaspoon of turmeric (fresh grated or powder)
- ½ teaspoon of fresh grated ginger
- 2-3 peppercorns
- 2 cups of milk
- Spices (optional) cardamom, nutmeg, cinnamon,
- Honey to taste

Picture Credit: https://www.pixtastock.com/

Combine all ingredients except the honey in a pot. Simmer for 2-3 minutes. Strain it. Add the honey once the mixture has cooled a little.

'Golden Milk' or 'Haldi ka Doodh' is used in Indian natural medicine as a winter drink to heal coughs and sore throats. Trendy cafes worldwide are now offering an espresso or golden latte with a similar recipe.

Picture Credit:
https://www.indoindians.com/

Anti-inflammatory drink

Juice full of vitamin C, antioxidants, and proven antiviral qualities. This quick drink can help soothe sore throats, cure upset stomach and will become your favourite daily tonic.
Ginger and turmeric are spices known for their anti-inflammatory and cancer-preventing properties and when combined with orange juice is super easy to prepare.

- 1/2 cup of freshly squeezed orange juice
- 12 mm piece of fresh ginger, grated
- 12 mm piece of fresh turmeric, grated
- Mix the ingredients and enjoy the healthy drink.

POTENTIAL RISK AND SIDE EFFECTS

Excess of anything is not good. So, keep in mind to take turmeric in moderation. At the higher doses used in some experimental treatments (1,500 to 2,000 milligrams a day), it has the potential to cause issues in some people, including:

- **Clotting problems-** Turmeric may slow blood clotting, which can create problems post-surgery or major injury. This effect also means that people taking prescribed blood thinners should avoid high doses of turmeric.
- **Iron deficiency-** In susceptible patients, high doses interfered with iron metabolism.
- **Low blood sugar-** Curcumin in excess can lower blood sugar level called hypoglycemia.
- **Kidney stones-** Turmeric naturally contains oxalates, organic acids that increase the risk of kidney stones formation in people who are prone to them.

GLOSSARY

1. inflammatory: a localized physical condition in which part of the body becomes reddened, swollen, hot, and often painful, especially as a reaction to injury or infection
2. bowel: the part of the alimentary canal below the stomach; the intestine
3. arthritis: a disease causing painful inflammation and stiffness of the joints
4. clotting: form or cause to form clots (thick mass of blood)
5. susceptible: likely to be influenced or harmed by a particular thing
6. potential: having or showing the capacity to develop into something in the future

LET US RECALL

1. **Choose the most appropriate option:**
   a) Which of the following is not a health benefit of consuming turmeric?
   i) Prevents Alzheimer's iii) Is anti-inflammatory
   ii) Increases sugar level iv) Aids in digestion

   b) Arthritis is a disease that affects the
   i) Heart iii) Joints
   ii) Teeth iv) Kidney

2. **Fill in the blanks using the words given in the help box.**

anti-oxidant	bowel	Curcumin	clotting	cough

   a) _____ may increase serotonin and dopamine—two brain chemicals that affect your mood.

   b) Golden Milk or haldi ka doodh is used in Indian natural medicine as a winter drink to heal _____ and sore throats.

   c) Turmeric is an _____ as it can reduce circulating levels of free radicals in the body.
   d) Excess of turmeric in the diet can affect blood _____.

3. **True / False**
   a) Arthritis is progressive disease that destroys memory and other important mental functions. _____

   b) Anti-inflammatory properties of turmeric help to reduce redness, swelling and pain in the body.
   _____

4. **Share a recipe which includes the use of turmeric. Mention its health benefits.**

SELF-REFLECTION

WHAT?	HOW?	WHY?

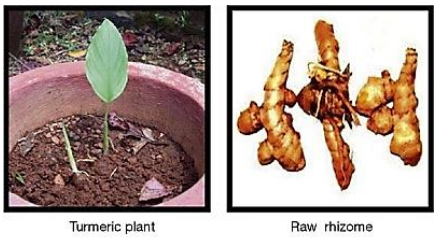
CHAPTER 4: LET US GROW TURMERIC

Learning objective- Children will learn the meaning of the term propagation and steps to propagate turmeric.

Learning outcome- Children will grow turmeric using the rhizome.

Let's start propagating turmeric with the steps given below.
But wait!
What is propagation?
The process of increasing the number of plants to get the desired products.

PROPAGATION



Picture Credit: https://www.sciencedirect.com/

How to Grow Turmeric from Rhizome

Growing turmeric is easy as long as you can consistently monitor and water your rhizome. Also, most of the growing process can take place indoors and doesn't require sunlight. For growing turmeric, buy some turmeric rhizomes, plant them in smaller pots or planters, and then transfer them outside after 6-10 months before harvesting them. The easiest way to find them is to search for fresh turmeric rhizome in organic food stores. Searching online will be another alternative. Turmeric grows from the rhizomes just like ginger. The best season to plant turmeric is spring or summer when the temperature starts to stay above 12° C, preferred temperature is 25-30°C.

STEPS FOR INDOOR TURMERIC CULTIVATION:

Picture Credit: https://www.urbangardengal.com/

1. Select a large pot because this spice herb can easily exceed the height of 1 m. The pot should be at least 12 inches deep and 12-18 inches wide so that the plant can spread its tubers freely. It is advisable to plant 1 or 2 rhizomes in one pot.
2. Cut the large rhizome into small pieces, and ensure that each one should have at least two or three buds. Fill a pot with rich organic soil that is moist and well-drained. The rhizomes should be then placed about 2 inches (5 cm) below the soil surface, with the buds facing up. Keep watering the pot thoroughly.
3. The application of manure or compost is also helpful in the growing season. Feed the plant with an all-purpose liquid fertilizer once in 3-4 weeks during the growing phase. The application of compost tea, manure, or worm casting is also beneficial.

Picture Credit: https://www.etsy.com/market/

4. Tip: If growing in the garden, you can use beans, peas, or ginger as companion plants for turmeric, as they enrich the soil with nitrogen that turmeric plants love the most.
5. Remove dried leaves from time to time.
6. The soil should be kept moist throughout the growing season and one should make sure to moisten the foliage in dry weather so as to increase the humidity level around the plant. The position must be sheltered from the wind. One should grow turmeric in a well-drained soil otherwise, the plant growth will suffer.

7. The turmeric plant normally takes around 8 to 10 months to mature and harvesting is done once the leaves become yellow and stem begins to dry up. Simply dig up the plant entirely, including the roots and then cut the required amount. After this replant the remaining part again to get a new plant growing.

Picture Credit: https://www.dreamstime.com/

8. The following steps are involved after the rhizome is cut – First boil the rhizomes and then remove the skin from rhizomes carefully. Place the bare rhizomes in a tray and dry them by exposing to sunlight. When the rhizomes are dry, grind them to turn into turmeric powder and finally store the homemade fresh powder in airtight containers, ready for household use.

TURMERIC PLANT CARE

Sunlight

In the tropical climate of India, the plant does well in full to partial light. But, it requires shelter during the scorching afternoons. Choose a spot where it can get a morning sun and protection from harsh sunlight.

Soil

The plant performs well in well-draining and aerated soil. Go for any sandy-loamy soil with a pH of around 5-7. Make sure to enrich it with organic matter like aged compost or well-rotted manure. Using a mix of 70% regular soil and 30% compost would be a great start.

Water

Keep the soil moist but do not over-water the plant. Keep a close eye on the topsoil and water the plant when it feels dry to touch. You may have to water the plant more frequently in the hot summer months of India.

Climate

Turmeric plant responds well to a warm and humid tropical climate. It grows best when the temperature is between 20-35^{o}C. Ensure that the temperature does not drop below 15^{o}C, as it will result in poor rhizome growth.

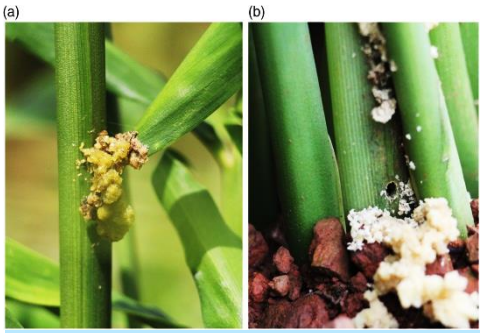
Pot Size

Since the plant produces tubers, so it requires plenty of room to grow. Hence, consider using at least 12-16 inches deep and wide pot. Make sure the container is breathable, like terracotta or ceramic, as it allows better aeration.

Protecting the Crop from Pests and Diseases

Be careful about Slugs and Snails. Make sure the plant is well ventilated. You can take care of the pests using a neem oil solution or an insecticidal soap solution.
The plant is also prone to tuber rotting due to waterlogged conditions. Hence, do not keep the soil soggy for long.

PESTS



Picture Credit: https://onlinelibrary.wiley.com/

1. Shoot borer (Conogethespunctiferalis)

Symptoms - It is the most important and serious pest of turmeric. The larvae bore into stems and feed on the growing shoot resulting in yellowing and drying of infested shoots. The larvae also bores into the rhizome. Larva pupates inside the affected stem in a thin silk cocoon.
Control: Removal and destruction of alternate hosts in the immediate vicinity. Pruning or cutting of infested stem during July-August at fortnightly intervals.

2. Leaf roller (Udaspesfolus)


Picture Credit: https://en.m.wikipedia.org/

It is a specific and serious pest of turmeric. The butterfly is black and white; the larvae feeds inside the leaf folds and pupate inside a thick mass of waxy stuff.
Control: Collection and destruction of larvae and pupae of leaf roller mechanically can reduce infestation. 2-3 foliar spray of garlic-chilly extract with 2.5% neem oil with soft soap starting from the appearance of pest at an interval of 10-15 days is quite effective.

DISEASES

1. Rhizome rot (Pythium aphanidermatum, P. graminicolum)


Picture Credit: http://eagri.org/

Symptoms - The disease is characterized by drying ofleaves starting from the margin of the lower leaves. There is rotting of rhizomes as well as roots. The infected rhizomes emit obnoxious smell. Varying degrees of brown shade can also be noticed on the infected rhizome in contrast to the bright yellow colour of the healthy rhizome.
Control- Selection of healthy rhizome for planting, good drainage facility, crop rotation, removal and burning of the infected plants.

2. Leaf blight [Rhizoctonia solani (Thanatephoruscucumeris)


Picture Credit: https://agritech.tnau.ac.in/

Symptoms - The disease manifests as water soaked spots of varying sizes and shapes on the lower leaves and lightening of leaves. In moist weather fungal growth appears on the under surface of the infected portion of the leaf. At the end, the infected plant dies.

Control - Selection of seed material from disease free areas. The infected and dried leaves should be collected and burnt in order to reduce the spread of disease in the field. Crop rotation should be followed whenever possible.

HARVESTING AND STORAGE

Picture Credit: https://greencountrylk.com/

The turmeric may take up to 8-10 months to get ready for harvest. Check if its stems are dry and the leaves have turned yellow or droopy. They are the tell-tale signs that the plant is ready for harvest.

- For harvesting, dig the whole plant out of the soil using a garden fork.
- Snip off the tuber from the plant using a sanitized shear.
- Discard the excess soil.
- Wash the tubers and boil them for a couple of minutes. After boiling, peel off the outer skin.
- Place them on tissue paper, and dry them in the full sunlight.
- Once the tubers become completely dry, grind them.
- You can store the powder in an air-tight container for later use.

Picture Credit: https://www.mofpi.gov.in/

GLOSSARY

1. water logged: saturate with water
2. ventilated: cause air to enter and circulate freely in (a room, building, etc.)
3. vicinity: the area near or surrounding a particular place
4. obnoxious: extremely unpleasant
5. droopy: hanging down limply

LET US RECALL

1. Choose the most appropriate option.

a) Turmeric grows best in the temperature range of

i) 20-35^{o}C iii) 15- 20^{o}C

ii) 35-40^{o} C iv) 10-15^{o} C

b) Rotting of rhizomes as well as roots with the infected rhizomes emitting obnoxious smell is observed in

i) Leaf blight iii) Rhizome rot

ii) Leaf roller iv) Shoot borer

2. Fill in the blanks using the words given in the help box.

sandy-loamy	shoot borer	droopy	nitrogen	propagation

i) The process of increasing the number of plants to get the desired product is called _____

ii) Turmeric grows best in _____ soil.

iii) The larvae of the pest _____, bore into stems and feed on the growing shoot resulting in yellowing and drying of infested shoots.

iv) We can use beans, peas, or ginger as companion plants for turmeric, as they enrich the soil with _____ and aid in the growth of turmeric plants.

3. True / False

i) Turmeric is said to be ready for harvest when the leaves are green in colour. _____

ii) The best season to grow turmeric is in winters. _____

Activity: Grow turmeric in a pot.

Record your observation by listing the following:

- Date of sowing the bud
- Type of soil used
- Temperature and sunlight duration
- Irrigation practices
- Care taken
- Manure and fertilizers applied-date and quantity.
- Harvesting

SELF-REFLECTION

WHAT?	HOW?	WHY?

CHAPTER 5: ADULTERATION OF TURMERIC

Learning objective-Students will learn how to check for adulteration of turmeric at home and learn the value of honesty.

Learning outcome-Students will be able to test for adulteration of turmeric at home.

TURMERIC ADULTERATION

. Adulteration of turmeric powder poses a significant risk. Turmeric powder is commonly adulterated:

- To increase the amount of turmeric powder, ingredients that have little nutritional value, such as saw dust, rice flour, chalk powder, or starch, are added.
- Along with the fillers, synthetic colour dyes, which include chemicals like metanil, yellow colour and lead chromate are added to make turmeric powder appear brilliant and yellow.

Given its regular usage and the importance of turmeric to our health, it is critical that you choose the highest quality turmeric available. It may be difficult to tell the difference between real and fake turmeric just by looking at it. If you're not sure, do these turmeric adulteration tests to see if the turmeric you're currently using is impure and polished with adulterants.

HOW TO CHECK FOR TURMERIC POWDER ADULTERATION AT HOME?

- **Palm Test**
- **Water Test**
- **Metanil Test**
- **Lead Chromate Test**
- **Chalk Powder Test**

.

Picture Credit: https://www.slideshare.net/

Palm Test: Put a pinch of turmeric powder on your palm and massage it with the thumb of your other hand for 15-20 seconds. Pure turmeric powder will adhere to your palm, creating a strong yellow stain.

Much of the turmeric powder will adhere to your palm if you turn it upside down. However, if a large amount of turmeric powder falls, it indicates that it has been adulterated.

Water Test: You may perform this turmeric adulteration test at home. Take a glass flask of warm water and add a teaspoon of turmeric powder to it; let it sit for around 10-15 minutes. If the turmeric powder settles down, it is pure, if it does not settle down and leaves a dark yellow colour, it is adulterated.

Picture Credit: https://www.indiatimes.com/

Metanil Test: To test for the presence of metanil yellow, place a pinch of turmeric powder in a test tube, add few drops of strong hydrochloric acid, and violently shake it. If the solution becomes pink, this indicates the existence of metanil. Consuming turmeric powder that is high in metanil will make you feel nauseated, create stomach problems, and cause food poisoning.

Lead Chromate Test: To test the presence of lead chromate in turmeric powder, mix a teaspoon of turmeric powder with water. It will instantly leach streaks of water-soluble colour into the solution, indicating the presence of lead chromate.

Chalk Powder Test: To test for the presence of chalk powder in turmeric powder, place a teaspoon of turmeric powder in a test tube and fill it with few drops of water and hydrochloric acid.
The presence of chalk powder is indicated by the formation of bubbles in the solution. It might induce indigestion if consumed in excess.

Caution: Be very careful while handling acids. This test should be only done under adult supervision.

GLOSSARY

1. adulteration: the action of making something poorer in quality by the addition of another substance
2. adhere: stick fast to (a surface or substance)
3. critical: having a decisive or crucial importance in the success, failure, or existence of something
4. nauseated: a feeling of sickness with an inclination to vomit
5. indigestion: pain or discomfort in the stomach associated with difficulty in digesting food
6. consumed: eat, drink, or ingest (food or drink)

LET US RECALL

1. Choose the most appropriate option.

a) Which one of the following test to check for adulteration in turmeric involves the use of hydrochloric acid?
   i) Palm test
   ii) Water test
   iii) Chalk powder test
   iv) Lead chromate test

b) If turmeric is adulterated with metanil yellow, on addition of hydrochloric acid it will turn
   i) Red
   ii) Green
   iii) pink
   iv) brown

2. Fill in the blanks using the words given in the help box.

Chalk	adheres	adulterated	pure	metanil	adulteration

i) Addition of unwanted substance to food which spoils the food quality is called _____.
ii) While performing the water test, if the turmeric powder settles down, it is _____, if it does not settle down and leaves a dark yellow colour, it is _____.
iii) Rub a pinch of turmeric on your palm, if it _____ to the palm it is pure.
iv) Consuming turmeric powder that is high in _____will make you feel nauseated, create stomach problems, and cause food poisoning.

3. True or false

i) A person who adulterates food items is an honest person. _____
ii) On adding hydrochloric acid to a solution of turmeric powder, the presence of chalk powder is indicated by the formation of bubbles in the solution. _____

Here is a fun activity. You have to use turmeric solution to make the yellow sheet. You are aware that turmeric is a natural indicator for base like soap solution. Create your palm print by smearing your palm with soap solution. Write the following sentence on the sheet and complete it.

"I would like to leave a mark on this world by……"
Enjoy the activity. Let your creative skills flow.

SELF-REFLECTION

WHAT?	HOW?	WHY?

GINGER

Picture Credit: https://tinyurl.com/

CHAPTER 1: INTRODUCTION THROUGH STORY – GINGER

Learning objective- Children will be introduced to an Asian herb Ginger.
Learning outcomes- Children will understand the herb and cuisines where they are used.

"A cup of tea shared with a friend is happiness tasted and time well spent!" – Anonymous.

When I remember my best times at home, tea with the family was one of those. That one cup of ginger tea made by my mom was magical. And now, when I am at the hostel, I have a new family, a bunch of friends who love to share the essence of home with a cup of tea. But the magic of my mom's ginger tea which she used to serve us in the chilly winters of Delhi is unforgettable.

I was introduced to tea pretty late as compared to my friends, as my mother was strictly against tea due to the presence of caffeine in it.

But the irony over here is that she herself introduced tea in my life. It so happened that I suffered from a very bad cold and flu, a week prior to my pre board exams and after looking at my pathetic running nose she gave me a cup of ginger tea. I still cherish that first sip of ginger tea, its aroma that attracted my attention, the flavour that bursted in my mouth with each sip was something I couldn't forget for my lifetime. The best part of it, I got rid of my puffy nose and its partner; headache. Thanks to my mom and her magical concoction of ginger tea.

This amazing property of ginger compelled me to look for its details on Google. I learned that Ginger is a Southeast Asian herb and it's among the healthiest and most delicious spices on the planet. It is known for its traditional medicinal value.

It's been used to aid digestion, reduce nausea, and help fight the flu and common cold, it has powerful anti-inflammatory and antioxidant effects, that help to reduce stress and morning sickness.

GLOSSARY

1. Essence- the basic or most important quality of something
2. Caffeine- the substance found in coffee and tea that makes you feel more awake and fuller of energy
3. Pathetic- causing you to feel pity or sad
4. Cherish- To keep a thought, feeling, etc. in your mind and think about it often
5. Concoction- a mixture of various ingredients or elements
6. Nausea- a feeling of sickness with an inclination to vomit
7. Anti-inflammatory- A drug or substance that reduces inflammation (redness, swelling, and pain) in the body
8. Reaping- receive (something, especially something beneficial) as a consequence of one's own or another's actions

LET US RECALL

1. Choose the most appropriate answer:

a) Which one is the favourite memory of the author's parents' home?

i) Sitting in the park. ii) Watching the movie

iii) Tea with the family iv) Going on vacation

b) Identify the herb used by the author's mother in making the tea.

i) Tulsi ii) Turmeric iii) Clove iv) Ginger

2. Fill in the blanks using the help box.

Asthma	South east	anti-histamine	flu	North east	internship	anti-inflammatory	hostel	anti-histamine

a) Ginger is the _____ Asian herb.
b) Ginger helps to fight cold and _____
c) The _____ property of ginger helps to reduce stress.
d) The author learned about ginger cultivation during his _____ days.

3. State whether the following statements are true or false.

a) Ginger is known for its traditional and cultural heritage in Egypt. _____
b) A person suffering from indigestion should consume ginger. _____

4. Suggest some recipes where ginger is used to enhance the flavour of the food.

5. Go to the nearby vegetable market and find out the price of 1 kg of ginger.

SELF-REFLECTION

WHAT?	HOW?	WHY?

CHAPTER 2: INTRODUCTION OF GINGER

Learning objectives- Students learn and understand about Ginger, its name and origin.

Learning outcomes- Children will know the name, origin and importance of Ginger.

Plant name (Latin): ***Zingiber officinale***
Plant family: Zingiberaceae
Native region: South East Asia, India and China
Growing habit: A perennial seed-like plant with annual leafy stems, about a metre (3 to 4 feet) tall.
Parts used: Underground stem
Essential oil extraction method: Hydro distillation

DISCOVERY

Ginger first appeared in the southern parts of the ancient China. From there, it spread to India, Maluku Islands (so-called Spice Islands), rest of the Asia and West Africa. Europe saw ginger for the first time in the 1st century when the ancient Romans traded with India.

ORIGIN

Ginger is a type of flowering plant whose rhizome (subterranean stem of a plant) we use as a spice, as food, or as a medicine.

Rhizome is defined as an underground stem that grows horizontally under the ground and it has nodes.

Can you name some more plants that fall in the category of rhizome?

Poison ivy, bamboo, Bermuda grass, rhubarb, and hops. Yes, that's absolutely correct.

So how exactly does this Ginger plant look like?

Ginger (*Zingiber officinale*) is a flowering plant whose rhizome, **ginger root** or ginger, is widely used as a spice and a folk medicine. It is a herbaceous perennial which grows annual pseudo stems (false stems made of the rolled bases of leaves) about one metre tall bearing narrow leaf blades. **The inflorescences bear flowers having pale yellow petals with purple edges, and arise directly from the rhizome on separate shoots.**

Observe the ginger stem carefully.

Did you observe the nodes on the stem? It is fleshy and juicy. It also grows horizontally to the ground.

POPULAR FORMS OF COMMERCIAL GINGER

Dry ginger- It is one of the most popular forms of ginger commercially exported, this ginger must undergo drying and preparation to reach the goal product. Ginger rhizomes that are to be converted into dry ginger must be harvested at full maturity (8–10 months), then they are soaked overnight and rubbed well for cleaning. After being removed from water the outer skin is very delicately scraped off with a bamboo splinter or wooden knife and this process must be done by hand as it is too delicate a process to be done by machinery.

Fresh ginger- It is another very popular form of exported ginger. It is not required to undergo further processing after being harvested, and can be harvested much sooner than dry ginger.

NUTRITIONAL INFORMATION

Picture Credit: https://tinyurl.com/

Raw ginger comprises:
Water- 79%
Carbohydrates- 18%
Protein – 2%
Fat- 1%

In 100 grams (a standard amount used to compare with other foods), raw ginger supplies 333 kilojoules (80 kilocalories) of food energy and contains moderate amounts of vitamin B6 (12% of the Daily Value, DV) and the dietary minerals, magnesium (12% DV) and manganese (11% DV), but otherwise is low in micronutrient content.

When used as a spice powder in a common serving amount of one US tablespoon (5 grams), ground dried ginger (9% water) provides negligible content of essential nutrients, with the exception of manganese (70% DV).

CHEMICAL COMPONENTS OF GINGER

Let's recall, we studied that ginger yields essential oil.

Ginger oil is extracted from the ginger rhizome after a distillation process. Like other essential oils, it's very concentrated.

Ginger oil has a distinct aroma that can be described as strong, warm, or spicy. As such, it's often used for aromatherapy. Ginger oil can also be used in a variety of applications in the skin and hair.

Ginger contains many phenolic compounds such as gingerol, shogaol and paradol that exhibit antioxidant, anti-tumor and anti-inflammatory properties. The role ofginger and its constituents in ameliorating diseases has been the focus of study in the past two decades by many researchers, who provide strong scientific evidence of its health benefit.

Ginger and ginger oil have also been used to help ease the following conditions:

Picture Credit: https://tinyurl.com/

- Nausea, Arthritis,Digestive upset, Colds, Migraines
- The main chemical constituents of Ginger Oil are **Camphene, B-Phellandrene, α-Pinene, Geranial, Zingiberene, β-Bisabolene, β-Sesquiphellandrene, and Curcumene**. Camphene is known to exhibit anti-oxidant and anti-inflammatory properties.

GLOSSARY

1. perennial- a plant living for several years
2. inflorescence- the arrangement of the flowers on a plant
3. aroma- a distinctive, typically pleasant smell
4. yields- produce or provide (a natural, agricultural, or industrial product)
5. micronutrient- a chemical element or substance required in trace amounts for the normal growth and development of living organisms
6. ameliorate- make (something bad or unsatisfactory) better
7. negligible- so small or unimportant as to be not worth considering; insignificant
8. aromatherapy- the use of aromatic plant extracts and essential oils for healing and cosmetic purposes

LET US RECALL

1. Choose the most appropriate answer.

a) Sam's grandfather is suffering from arthritis. His friend suggested him to use the essential oil of a herb that would give him relief from the pain. Identify the essential oil suggested by Sam's friend.

i) Gingerol ii) Lemon grass oil iii) Eucalyptus oil iv) Ginger oil

b) Name the phenolic compound present in the ginger that has got anti-inflammatory properties and is beneficial for our health.

i) Gingerol ii) Shogaol iii) Paradol iv) All of these

2. Fill in the blanks with the help box.

70	red	southern parts	yellow	
northern parts		79	rhizome	tuber

a) Raw ginger has _____ % water.

b) The petals of ginger flower are pale _____ with purple edges.

c) Ginger was first originated in the _____ of ancient China.

d) Poison ivy and bamboo grass fall in the category of _____.

3. State whether the statements are true or false.

a) Ginger oil is extracted from ginger by hydro distillation. _____

b) Ginger is a non-flowering plant. _____

c) Ginger oil has a distinct strong, warm and spicy aroma. _____

d) Dry ginger is one of the most popular forms of commercial ginger. _____

4. Name the three phenolic compounds present in ginger that exhibit medicinal properties.

5. Which health problems can be cured by ginger and ginger oil?

6 Search the recipe of ginger candies on YouTube and prepare it at home. Enjoy the candies with your family and friends.

SELF-REFLECTION

WHAT?	HOW?	WHY?

CHAPTER 3: USES AND IMPORTANCE OF GINGER

Learning objective- Children will understand the importance and uses of Ginger.

Learning outcome-Children will include ginger in different recipes.

PARTS OF HERB USED:

Besides yielding aromatic oil, what else do we get from ginger?

Any guesses! Are all parts of ginger edible?

The rhizome (underground part of the stem) is the part commonly used as a spice. It's often called ginger root or, simply, ginger.

Ginger can be used fresh, dried, powdered, or as an oil or juice. It's a very common ingredient in recipes. It's sometimes added to processed foods and cosmetics.

TRADITIONAL USES& HEALTH BENEFITS OF GINGER:

Traditionally, Ginger has been used for thousands of years for the treatment of numerous ailments, such as colds, nausea, arthritis, migraine, and hypertension.

Picture Credit: https://tinyurl.com/

1. Contains gingerol, which has powerful medicinal properties

Ginger has a very long history of use in various forms of traditional and alternative medicine. It's been used to aid digestion, reduce nausea, and help fight the flu and common cold, to name a few of its purposes.

The unique fragrance and flavour of ginger comes from its natural oils, the most important of which is gingerol. According to research, gingerol has powerful anti-inflammatory and antioxidant effects.

2. Can treat many forms of nausea, especially morning sickness

Ginger appears to be highly effective against nausea. It may help relieve nausea and vomiting for people undergoing certain types of surgery.

3. Can help with Osteoarthritis

Osteoarthritis (OA) is a common health problem. It involves degeneration of the joints in the body, leading to symptoms such as joint pain and stiffness. There are some studies showing ginger to be effective at reducing symptoms of osteoarthritis, especially osteoarthritis of the knee.

4. May drastically lower blood sugar and improve heart disease risk factors

Ginger has been shown to lower blood sugar levels and improve various heart disease risk factors in people with type 2 diabetes.

5. Can help fight infections

Gingerol can help lower the risk of infections. In fact, ginger extract can inhibit the growth of many different types of bacteria.

6. May Help Lower the Cholesterol

According to experts, ginger is also linked to lower level of Low-Density Lipoproteins (or bad cholesterol), which leads to increased risk of heart diseases. Adding ginger to your daily diet may help in lowering the bad cholesterol.

7. Eases Joint Pains

The high anti-inflammatory properties present in ginger can help easing joint pain to a great extent. It can be used in food, as medicine, dry powder or fresh root slices.

Ginger is often called a "superfood"— and for good reason. It contains a very high nutritional density per portion.

Besides being a delicious spice for cooking, ginger has powerful health benefits, such as anti-inflammatory, antibacterial, and antiviral properties.

Picture Credit: https://tinyurl.com/

Adding ginger to your diet

If you want to add ginger to your diet, you can do so through what you eat and drink. Here are a few chicken and beverage recipes to try:

- Chicken with ginger
- Garlic-ginger chicken with cilantro and mint
- Spicy orange-ginger chicken
- Lemon-ginger chicken
- Fresh ginger tea
- Ginger Bread
- Ginger Cookies
- Ginger coffee
- Ginger smoothies
- Ginger is loaded with nutrients and bioactive compounds that have powerful benefits for your body and brain.
- It's one of the very few superfoods actually worthy of that term.

GLOSSARY

1. ailments- an illness, typically a minor one

2. symptoms- a physical or mental feature which is regarded as indicating a condition of disease, particularly such a feature that is apparent to the patient

3. inhibit- hinder, restrain, or prevent (an action or process)

4. antioxidant- a substance that protects cells from the damage caused by free radicals (unstable molecules made by the process of oxidation during normal metabolism)

5. beverage- chiefly in commercial use a drink other than water

LET US RECALL

1. Choose the most appropriate answer:

a) Rhizome is an underground stem that grows horizontally and has nodes on it. Choose the rhizome from the following options.

i) Turmeric ii) Potato iii) Onion iv) Garlic

b) Identify the health problem that involves the degeneration of the joints in our body.

i) Nausea ii) Hypertension iii) Osteoarthritis iv) Scurvy

2. Fill in the blanks using the help box.

Superhero	anti-inflammatory	ginger tea	bad cholesterol	
superfood	bad carbohydrates	superfood	ginger cookies	anti-viral

a) Ginger is often called as the _____ because of its high nutritional value.

b) The high _____ properties of ginger, help to reduce joint pains.

c) _____ and _____ are my favourite delicacies prepared with ginger.

d) Ginger has the property of reducing the level of bad _____ which causes heart ailments.

3. State whether the statements are true or false.

a) Ginger appears to be highly effective against nausea. _____

b) The unique fragrance and flavour of ginger come from its natural oils, the most important of which is Shogerol. _____

c) Ginger has medicinal properties such as anti-inflammatory-, antibacterial-, and antiviral properties. _____

4. Make a power point presentation to explain the medicinal properties of ginger.

SELF-REFLECTION

WHAT?	HOW?	WHY?

CHAPTER 4: LET US GROW GINGER

Learning objective- Children will learn what is propagation and step to propagate Ginger.

Learning outcome- Children will grow Ginger.

Let's start propagating Ginger with the steps given below.

But wait!

What is propagation?

The process of increasing the number of plants to gets the desired products.

PROPAGATION

Ginger can grow from the vegetative buds present on the rhizome.

Infected plants and rhizome

Picture Credit: https://tinyurl.com/

The ginger plant (Zingiber officinale) is grown for its aromatic, pungent, and spicy rhizomes, which are often referred to as ginger roots.

The texture of ginger rhizomes is firm, knotty, rough, and striated (banded). Depending on the variety, the flesh may be yellow, white, or red. The skin is cream-coloured to light brown and may be thick or thin, depending on the plant's maturity at harvest.

Picture Credit: https://tinyurl.com/

Ginger flesh can be red, white, or yellow

SITE SELECTION

Ginger thrives best in warm, humid climates. Ginger thrives in partial shade with only about two to five hours of sun a day. Ideal spots are also protected from strong winds.

SOIL PREPARATION

The best soil for ginger is loose, loamy, and rich in organic matter. Loamy soils allow water to drain freely, which will help prevent the rhizomes from becoming waterlogged. Thick mulch can also provide nutrients, retain water, and help control weeds. Ginger plants require mildly acidic soils for healthy growth and rhizome production. Ensure that your soil pH is between 5.5 and 6.5. If the soil pH is too high, it is too alkaline; if it is too low, it is too acidic, and will interfere with ginger growth. Lower the soil pH by applying composted manure, or increase the pH with calcium carbonate or dolomite to achieve optimal pH.

PLANTING

Before planting, cut the ginger rhizome into 1- to 1½-inch pieces, and set them aside for a few days to allow the cut surface area to heal and form a callus. Plant parts of the underground rhizomes in early spring. Each piece should be plump with well-developed growth buds, or eyes. A good source for planting ginger are fresh rhizomes.

Plant the rhizomes 6 to 8 inches apart, 2 to 4 inches deep, and with the growth buds pointing upward. They can be planted whole or in smaller pieces with a couple of growing buds each. Ginger plants will grow to about 2 to 3 feet tall.

FERTILIZING

If the soil is less than ideal, add a slow-release organic fertilizer while planting. Afterwards, liquid fertilizer may be applied every few weeks.

These soil amendments are especially needed in regions of heavy rainfall, where rain can leach essential nutrients from the soil. You can also add compost, which will supply nutrients as well as retain water in the soil. Ginger roots benefit from fertilizer containing high levels of phosphorus (P).

WATERING

To obtain good yields in ginger 1320 to 1520mm rainfall is required. Planted in April-May, depending on the moisture of the soil water it 2-4 times a week. Do not allow the plants to dry out while they are actively growing. As the weather cools, reduce watering. This will encourage the plants to form underground rhizomes. In dry areas, mist or spray the plants regularly. Always avoid overwatering.

WEED MANAGEMENT

Weed management is carried out twice during the cultivation of ginger. The weeds must be removed at intervals of 45-60 days, depending on the amount of weed. When we remove the weed, the plant needs to be taken care of without affecting stem and root.

Picture Credit: https://tinyurl.com/

CROP ROTATION

Ginger absorbs the large amount of nutrients from the soil. So, ginger should not be cultivated on the same land continuously. It should be cultivated with rotation of tapioca, beans, chow-chow and other vegetables. Ginger can be cultivated as a single crop or intercrop with coffee, orange, banana etc.

PLANT PROTECTION

Pests and Diseases Management in Ginger

DISEASES OF GINGER

Bacterial wilt or Prem Rog: Ralstonia solanacearum

Symptoms: It is the most serious disease and the symptoms can be noticed form July-August. The leaf margins of the affected plant turn bronze and curl backward. The whole plant wilts and dies. The base of the infected pseudostem and the rhizome emit foul smell.

Management: Seed contamination is the major source of infection. Hence, procure only healthy rhizome from disease free area. Treat the seed with Streptocyclin (20g/100 litre water).

Soft rot or Paheli: Pythium aphanidrematum

Symptoms: It is a serious seed as well as soil borne disease and the symptoms can be seen from July. Yellowing of leaves appear first on the lower leaves and proceeds to upper leaves. Roots arising from the affected rhizome become rotten and show brown discoloration of the rhizome tissue. Sometimes the pseudo stem comes off easily with a gentle pull. The rotten parts attract other fungi, bacteria and insects particularly the rhizome fly.

Management: Avoid water logging. At the time of sowing, treat the rhizome with Bordeaux mixture (1%) and again with Trichoderma (8-10-gm/litre) water.

Dry rot: Fusarium and Pratylenchus complex

Symptoms: It is a fungus-nematode complex disease. In contrast to rhizome rot, dry rot appears in field in small patches and spreads slowly. The affected plants appear stunted and exhibit varying degree of foliar yellowing. Older leaves dry up first followed by younger ones.
Management: Soil application of mustard oil cake at the rate of 40 kg/ha before sowing in furrows can check the nematode problem. Hot water treatment (51^0C for 10 min) followed by seed treatment with Bordeaux mixture (1%) effectively checks the problem.

INSECT PESTS OF GINGER

White Grub or Khumlay : Holotrichia spp.

It is a sporadic pest, sometimes causes serious damage. The grub feeds on the roots and newly formed rhizomes. The infestation is generally more during August-September. The entomophagous fungus Metarrhiziumanisophilae can be mixed with fine cow dung and then applied in the field to control the grubs.

Shoot borer: Conogethespunctiferalis

The larvae bore the tender pseudostem and reach the central portion by feeding on the internal tissues, thus resulting in yellowing and drying of shoots. Infestation may occur from June to October. Spray Nimbicidine (2-5ml/l) or Beauveria bassiana@ 2-5ml/l

Integrated Pest and Disease Management for Ginger

- Field hygiene is more important to manage the pests and diseases. Avoid water stagnation, provide adequate drainage, remove weeds periodically, apply only well-rotted FYM compost and thoroughly incorporate it in the soil, apply dolomite @ 2 t/ha before sowing to increase soil pH, sow ginger in raised beds of at least 25-30 cm height and provide mulching with leaves and twigs and follow crop rotation of 2 to 4 years depending on the incidence and severity of the diseases.
- Use good quality rhizome for sowing. Procure disease free seeds from disease free area.
- Before sowing, treat the rhizome in hot water (51^oC for 10 min) and again in solution of Bordeaux mixture 1% for 15 min. Add Streptocyclin (20g/ 100 l water) if bacterial wilt too is a problem. Dry the rhizome in shade and then sow. If cut rhizomes are to be planted, they should be treated after cutting.
- Treat rhizome with bio-inoculant Pseudomonas fluorescens and Trichoderma harzianum followed by soil application 60 days after planting to reduce rhizome rot.

GLOSSARY

1) propagation – the breeding of specimens of a plant or animal by natural processes from the parent stock
2) pungent – having a sharply strong taste or smell
3) pseudostem – a false stem made of the rolled bases of leaves
4) weed – a wild plant growing where it is not wanted and in competition with cultivated plants.
5) amendments- a minor change or addition designed to improve a text, piece of legislation
6) exudates – a substance secreted by a plant or insect
7) infestation – the presence of an unusually large number of insects or animals in a place, typically so as to cause damage or disease
8) bio inoculant - bioinoculants are agricultural amendments that use beneficial rhizosphericic or endophytic microbes to promote plant health

LET US RECALL

1. Choose the most appropriate answer:

a) What kind of climate is best suited for the cultivation of ginger plant?
i) Warm & dry ii) Cold & dry iii) Monsoon iv) Warm & humid
b) What kind of soil the farmer should prefer for cultivating ginger in his farm?
i) Clayey soil ii) Loamy soil iii) Sandy soil iv) Silt

2. Fill in the blanks using the help box.

Rhizomes	magnesium	1320 to 1520mm	Grapes	450-950 mm
phosphorus		bulb	coffee	

a) We should take fresh _____ for cultivating ginger in the farm.
b) Ginger roots benefit from fertilizer containing high levels of _____
c) To obtain good yields in ginger _____ rainfall is required.
d) . Ginger can be cultivated as a single crop or intercrop with _____

3 State whether the statements are true or false.

a) The leaf margins of the ginger plant turn bronze and curl backward in the bacterial wilt disease. _____
b) The soft rot is a serious seed as well as soil borne disease. _____
c) Ginger plants require mildly basic soils for healthy growth and rhizome production. _____

4. Briefly explain the various steps involved in the cultivation of ginger.

5. Grow a ginger plant in your garden and observe its growth by maintaining a record of it.

SELF-REFLECTION

WHAT?	HOW?	WHY?

CHAPTER 5: HARVESTING AND POST-HARVESTING

Harvest ginger by digging up the entire plant.

Picture Credit: https://tinyurl.com/

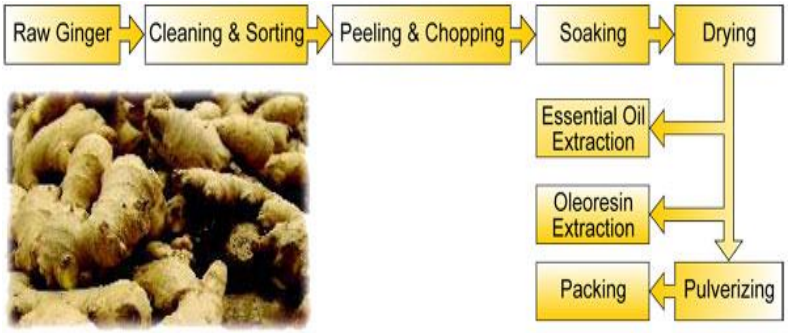
HARVESTING

Picture Credit: https://tinyurl.com/

Ginger attains full maturity in 210-240 days i.e., eight months after planting. Harvesting of ginger for vegetable purpose starts after 180 days based on the demand. However, for making dry ginger, the matured rhizomes are harvested at full maturity i.e., when the leaves turn yellow and start drying. Irrigation is stopped one month before harvest and the rhizome clumps are lifted carefully with a spade or digging fork. In large scale cultivations, tractor or power tiller drawn harvesters are also used. The dry leaves, roots and soil adhering on the rhizomes are manually separated. Late harvest is also practised, as the crop does not deteriorate by leaving it underground for some months. In India, domestic market prefers fresh green ginger for culinary use while two types of dried ginger i.e., bleached and unbleached are produced for export purpose. The most important criteria in assessing the suitability of ginger rhizomes for particular processing purposes is the fibre content, volatile-oil content and the pungency level. The relative abundance of these three components in the fresh rhizome is governed by its state of maturity at harvest. After harvest, choose rhizomes for replanting and replant them promptly.

PROCESSING OF GINGER

Processing of ginger to produce dry ginger basically involves two stages- peeling of the ginger rhizomes to remove the outer skin and sun drying to a safe moisture level.



Picture Credit: https://tinyurl.com/

Peeling

Peeling serves to remove the scaly epidermis and facilitate drying. Peeling of fully matured rhizomes is done by scrapping the outer skin with bamboo splits having pointed ends and this accelerates the drying process. Deep scraping with knives should be avoided to prevent the damage of oil-bearing cells which are present just below the outer skin. Excessive peeling will result in the reduction of essential oil content of the dried produce. The peeled rhizomes are washed before drying. The dry ginger so obtained is valued for its aroma, flavour and pungency. Indian dried gingers are usually rough peeled when compared to Jamaican gingers, which are clean peeled. The rhizomes are peeled only on the flat sides and much of the skin in between the fingers remains intact. The dry ginger so produced is known as the rough peeled or unbleached ginger and bulk of the ginger produced in Kerala is of this quality.

Drying

Dry Ginger (Sonth)

Picture Credit:
https://tinyurl.com/

The moisture content of fresh ginger at harvest is about 80-82 per cent which is brought down up to 10 per cent for its safe storage. Generally, ginger is sun dried in a single layer in open yard which takes about 8 to 10 days for complete drying. The sun-dried ginger is brown in colour with irregular wrinkled surface. The yield of dry ginger is about 19-25 per cent of fresh ginger depending on the variety and climatic zone.

Polishing, cleaning and grading

Polishing of dried ginger is done to remove the dry skin and the wrinkles developed on the surface during drying process. It is generally done by rubbing against hard surface. Cleaning of dry ginger is done manually to remove the extraneous matter and the light pieces.

Storage

Dry ginger, packed in gunny bags is highly susceptible to infestation by insects like Lasiodermaserricone (cigarette beetle) during storage. Fully dried rhizomes can be stored in airtight containers such as high-density polyethylene or similar packaging materials. Long term storage for more than two years would result in deterioration of its aroma, flavour and pungency.

Bleached ginger

Bleached ginger is produced by dipping scrapped fresh ginger in a slurry of slaked lime, $Ca(OH)^2$, (1 kg of slaked lime/120 kg of water) followed by sun drying. As the water adhering to the rhizomes dry, the ginger is again dipped in the slurry. This process is repeated until the rhizomes become uniformly white in colour. Dry ginger can also be bleached by the similar process. Liming gives ginger a better appearance and less susceptibility to the attack of insect pests during storage and shipping.

Extraction of essential oil from Ginger.

There are a lot of methods to extract essential oil from ginger, one of which is **hydro distillation**. Hydro distillation provides essential oils in low yields containing several by-products of the distillation process; this method is most frequently used for essential oil extraction from raw plant materials.

It can cause mild side effects including **heartburn, diarrhoea, burping, and general stomach discomfort**. Taking higher doses of 5 grams daily increases the risk for side effects. When applied to the skin, ginger is possibly safe when used short-term. It might cause skin irritation for some people.

GLOSSARY

1. harvest –the process or period of gathering crops
2. adhering – stick fast to (a surface or substance)
3.heartburn- a form of indigestion felt as a burning sensation in the chest, caused by acid regurgitation into the oesophagus
4.manually – using the hands
5. susceptibility –likely or liable to be influenced or harmed by a particular thing
6. abundance – a very large quantity of something

LET US RECALL

1. Choose the most appropriate answer:

a) Ginger attains maturation after how many days of plantation?
i) 100-150 days ii) 150-200 days iii) 210-240 days iv) 320-400 days
b) How many days before harvesting, do the farmers stop irrigating the field?
i) 10 days ii) 30 days iii) 20 days iv) 60 days

2. Fill in the blanks using the help box.

Steam distillation	remove	70, 82	essential oil	aroma
Hydro distillation	add			

a) _____ method is most frequently used for essential oil extraction from raw plant materials.
b) Peeling is done to _____ the scaly epidermis and facilitate drying.
c) The moisture content of fresh ginger at harvest is about _____ percent.
d) Excessive peeling will result in the reduction of _____ content of the dried ginger

3. State whether the statements are true or false.

a) Fully dried rhizomes can be stored in airtight containers. _____
b) Peeled ginger is produced by dipping scrapped fresh ginger in a slurry of slaked lime.
_____
c) Taking higher doses of essential oil is harmful for our health. _____

4. Briefly explain the points to be kept in mind while harvesting.

SELF-REFLECTION

WHAT?	HOW?	WHY?

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