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KERALA KARSHAKAN

English journal

The First English farm journal from the house of Kerala Karshakan

Dragon Fruit

A promising new fruit crop for Kerala

INSIDE KERALA KARSHAKAN

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FEBRUARY 2025 Volume - 12 Issue - 09

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Navara Rice

Kerala's Medicinal Super food for Holistic Health

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Navara rice, also known as Njavara rice, is a lesser-known variety that originated in Kerala, India. It has been cultivated for over 2,000 years and is particularly prized for its medicinal and healing properties. Unlike more common types like white or brown rice, Navara is a unique variety with significant importance in Ayurveda, where it is used either on its own or in combination with herbs for therapeutic purposes. Due to its remarkable benefits, Navara is often regarded as a medicinal plant.This traditional rice is a key part of South India's agricultural heritage, especially in Kerala. It has a short growing cycle, maturing in just 60 days, earning it the name "Shastika Shali," meaning 60-day rice. The rice is unpolished, reddish-

brown in color, and used both as food and in Ayurvedic medicine. Its nutritional richness makes it one of the region's ancient superfoods, offering benefits for various bodily systems, including skin, bones, muscles, and digestive health.

Navara rice comes in two main types: white-glumed and black-glumed. Navara was granted the geographical indication tag status in 2007-09 for its unique properties. Two varieties of Navara (black glumed and golden yellow glumed Navara) were registered as the GI "Navara Rice" by the Navara Rice Farmers Society, Karukamanikalam, near Chittur (The Hindu, 2008). Both varieties have a naturally sweet taste and are easily digestible, making them suitable for people of all ages. It is often ground into powder, mixed with milk, and served as a cereal. Beyond its health advantages, Navara rice also has spiritual significance and is commonly used in temple rituals.

Courtesy: healthyliving.natureloc.com

Nutritional Profile of Navara Ric

This variety is nutritionally dense, containing 73% carbohydrates, 9.5% protein, 2.5% fat, and 389 calories. It is a rich source

of fiber, antioxidants, and essential minerals like iron, zinc, and calcium. These nutrients contribute to its role as a health-promoting grain.

Health Benefits of Navara Rice

Diabetes Management: Navara rice has a lower glycemic index than white rice, which means it causes a slower release of sugar into the bloodstream. This makes it ideal for people managing diabetes, as it helps maintain stable insulin levels. Its high fiber content also contributes to better overall health.

Bone Health Support: Packed with calcium, magnesium, and phosphorus, Navara rice helps in maintaining strong bones. Regular consumption may reduce the risk of osteoporosis and improve other functions such as blood clotting and muscle contraction.

Skin Benefits: Rich in antioxidants, Navara rice protects the skin from free radicals that contribute to aging. It can help improve skin tone, reduce wrinkles, and promote a youthful appearance. Some people use it topically, mixed with milk or water, to brighten skin and reduce pigmentation.

Muscle and Nerve Function: The magnesium content in Navara rice supports muscle relaxation and healthy nerve function, contributing to overall muscular and neurological well-being.

Heart Health: As a fiber-rich whole grain, Navara rice helps lower cholesterol and prevents plaque buildup in arteries, reducing the risk of heart disease. Immune System Boost: Navara rice is a good source of vitamin C, which strengthens the immune system by aiding in tissue repair and supporting the production of white blood cells.

Digestive Health: Its high fiber content helps prevent constipation by adding bulk to the stool and promoting healthy gut flora, leading to better nutrient absorption and overall digestive wellness.

Suitable for Babies: In Kerala, Navara rice is often used in traditional baby food dishes like "angri," made from Navara flour and dried banana. It offers a natural, healthier alternative to processed cereals and can help underweight infants gain weight. Cancer Prevention:Navara rice contains proanthocyanidins, powerful antioxidants that can help reduce cancer risk by preventing DNA damage and neutralizing harmful free radicals.

Anaemia Prevention: With its high iron content, Navara rice can help prevent anaemia and alleviate related symptoms like fatigue and shortness of breath. Benefits for Pregnant Women: Navara rice provides essential nutrients such as fibre, protein, calcium, and iron, which are particularly beneficial for pregnant women. It helps prevent common pregnancy-related issues like constipation and supports healthy fetal development.

Traditional Uses in Medicine

In Ayurveda, Navara rice is highly valued for its role in treatments like Panchakarma. It is believed to improve the circulatory, respiratory, and digestive systems. The rice is also used in therapies for conditions like arthritis, muscular degeneration, and certain skin disorders. By-products of rice such as rice bran, broken rice, rice hull, and rice straw are the major elementary sources used to manufacture functional food and supplements in the food industry. Rice bran and hull are loaded with dietary fibers that are associated with various health benefits

Challenges in cultivation

Traditional rice varieties are cultivated using organic methods that rely on natural fertilizers and pest control, minimizing harm to the environment. Navara rice is a crop that yields well only during the summer season due to its fragile nature. Only insect repellents are applied, avoiding insecticides that could disrupt beneficial insect populations crucial to ecological balance. Green manure, vermicompost, cow dung, panchagavya can be used instead of chemical fertilizers. It is susceptible to climate change especially strong winds, heavy rains and even dew. It cannot be grown in cooler months as the plant is sensitive and prone to lodging, where the stems bend near the ground, even from light dew. This restricts its production to just one major harvest per year. Navara ricerequires manual harvesting, creating challenges for farmers due to labour shortages and rising labour costs.

Conclusion

Though Navara rice yields less than other varieties, its limited cultivation and remarkable health benefits command a higher market price. This premium pricing, alongside rising consumer demand, has made Navara rice cultivation increasingly profitable. Its rarity and significant medicinal value have earned it the nickname "gold." Adding Navara rice to your diet provides numerous health benefits cherished for generations, while honouring an ancient tradition of wellness and healing.

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Dutch Aquarium Aquascape

Aquascaping

An Aesthetic Amalgam for Recreating Nature's Beauty

Abstract

Climate change profoundly affects the natural and social environment. For instance, agricultural productivity, amount and quality of water resources, and resources derived from land and marine ecosystems are all significantly impacted by variations in the seasonal to interannual climate. One of the most productive ecosystems, wetlands are essential to the hydrological cycle. "Areas of land that are either continuously or seasonally submerged under water are known as wetlands, and they are incredibly diverse in

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terms of their origins, locations, water regimes, and chemistry. Wetlands provide millions of people with both direct and indirect benefits, including storm and flood control, clean water supply, food, fiber, raw materials, as well as scenic beauty, educational opportunities, and recreational advantages.When reinterpreting natural landscapes, aquascaping allows the desired natural landscapes to be transported between locations. The term "Aquascaping" refers to "gardening beneath the water," which produces a new ecosystem in which every living and non-living thing interacts chemically and biologically to establish balance, which enables the plants and any animals to survive. It is the process of enhancing, restoring, or creating freshwater systems by the planting of aquatic and wetland plants.Aquascapes can be of different styles such as Dutch, Japanese, Natural, Rock formation, Jungle, Biotope, or Pardalium. Although creating an aesthetically pleasing aquatic environment is the major goal of aquascaping, technical factors like substrates, water quality, plants, fish, ornaments, and appropriate upkeep must also be taken into consideration.The coexistence of aquatic plants and animals in the house generates a calming ambiance that improves wellbeing and reduces mental tension. The components of these creations are: rocks, different accessories, wood, gravel, sand, plants and fishes. These have been constructed while taking into consideration aesthetic principles like the golden section, chromatic harmonies, and contrasts that are similar to stage scenery or paintings.

Keywords: Aquascaping, Lightning, Golden ratio, Ornamental gardening, Rocks, Stones

Introduction

The earth, which is also known as blue planet, consists 71% of water with natural aquascaping by the nature. It consists of different kind of zoo-plankton, phyto-plankton, wetland plants, pisces, mosses and other living species along with non-living matter such as rocks, stones, sand,

Nature Aquarium Style

shells, caves etc. All these contribute to natural aquascaping. Basically, the term aquascaping refers to 'gardening beneath the water' which creates a new ecosystem where every living and non-living entity contributes for beauty and chemical and biological interaction for creating balance that allows the plants and any animals to sustain.

In this era, as every human being is fascinated by natural landscape but not able to approach, start adopting landscaping at their own levels. Therefore, artificial aquascaping is one of the approaches that involves the indoor or outdoor technique of arranging aquatic plants, rocks, stones, driftwood or other substrates in natural way to create harmony among the elements and gives pleasure to human perception inside a transparent glass body. Aquascaping is a new concept in ornamental gardening which is gaining more importance in the current world. The aim of aquascaping is not always to create a aquarium that appear as natural way instead it can be as per the imagination and requirement of an individual. However, the stimulation is generally drawn from the nature which can come from both underwater as well as terrestrial locations such as forests, mountains, valleys, waterfalls, river lands etc.

Importance and background of Aquascaping

The concept of artificial aquascaping, begins in 1930 in The Netherlands. They began concentrating on water plants and their creative arrangements, which excluded fish. Dutch aquarists initiated their experiment with arranging diverse types of plants with varied size, leaf color, shape and texture etc. However, a book entitled 'The Complete Guide to Freshwater Tropical Fish' published in 1970, edited by 'Raymond Legge' can be considered as one of the first printed references. Later, during 1990's a Japanese photographer and aquarist 'Takashi Amano' introduced the world to his "nature aquarium" style. Amano interestingly made use of the Zen aesthetic practice of plant and rock arrangement to craft nominal, but eye-catching works of living art. With careful use of few plants' species, stones and driftwood, the aquascape of Amano evoked tranquil landscapes in miniature. His three-volume series, Nature Aquarium World, featured magnificent photographs of aquascape designs, ignited a wave of attention in aquarium gardening. Nowadays, aquascaping is getting huge popularity in entire world, especially

Iwagumi: A Japanese Zen Style

Jungle Style

in metro cities, big hotels and restaurants, business firms, industries etc. It gives soothing effects to work place, moreover it has proven therapeutic effects as it reduces stress or anxiety and calm the nervous system. Besides, it helps in developing skills in providing meaningful artwork. Furthermore, it emerges as new business approach and provides employment and income to workers. It also has the potential to conserve some species of aquatic organisms.

Different Styles of Aquascapes

As every art form contains different ways of arranging, styling or beautifying the elements, similarly, aquascaping also suggests, variety of approaches and styles with particular characteristics and unique features.

1. Dutch Aquarium Aquascape

This style is considered as one of the oldest one and was started in 1930s in The Netherland with the accomplishment of the NBAT – the Dutch Society for Aquarists. This style does not emphasize on hardscape materials, instead its major focus is on arrangement and growth of aquatic plants or it can be considered as chaos of plants. Most significant Dutch style is distinguished by high density planting in which more than 70% of the area is covered with varied rich colored plants to give good contrast. Spaces left between plants can be used wisely to create imaginary streets and pathways. Using linear rows of plant sextending from left to right is the fundamental idea behind this style with most common technique of terracing, as it is highly possible when it comes to conveying deepness using plants. Moreover, it is one of the most difficult aquascape to maintain and is also time intensive. The plants suitable for this type of aquascape are:

- Use of low growing plants such as *Lobelia cardinalis* and *Saurus cernuus* for creating

the 'dutch street, or pathways

- Large stem plants such as *Limnophila aquatic* and *Hygrofilia corymbose* which gives a strong visual effect.
- Java moss to cover the space between plant groups, and gives contrast among hardscape.
- Other plants such as *Alternanthera reineckii,* Ammania, Rotala etc.
- Fish such as *Congo tetras* or *Angel fish* or schools are also considered good for this style.

2. Nature Aquarium Style

This style of aquascaping was introduced in 1990's by Japanese photographer, Takashi Amano. It aims to create a very simple asymmetrical natural look appearance with the use of both hardscape as well as softscape for creating balance among the entities. Most common Natural Aquarium Aquascapes portray underwater version of rainforests, green lush, hillsides, mountains, valleys or even beaches inside the aquarium. Natural Aquarium can be made with the use of different themes such as, valleys, cliffs, islands, mountain ranges, hillsides, tropical rainforests and canyons etc. To make it more interesting, contrasts scheme can be used by selecting large and small sized plants, driftwood, stones, pebbles rocks etc., with different color and texture. Generally large objects are placed in front and small at the back. To give rainforest theme to aquascape thin or thick kind of objects can be used. Moreover, as hardscape are incorporated, therefore small

Biotope Style

Taiwanese Style

sized fishes such as Tetras, Rasboras, Barbs, Killifish, Gouramis, Angelfish, Discus, Guppys, Siamese fighting fish etc., are preferred.

However, in Nature Aquarium Style there are three different visual styles:

i. The Concave ShapeStyle: This design creates open space in the centre since, the positioning and height of the plants decreases tocentral low point.

ii. The Convex Shaped Style: In this style the plants aretrimmed lower on either side and higher in the middle, that's why known as island.Moreover, rocks can be used to create a mountain look.

iii. The Triangle Shaped Aquascape: In order to create equilibrium, the plants' height in this style progressively drop from high to low.

3. Iwagumi: A Japanese Zen Style:

This style isinspired from the Japanese garden style and is famous for their beliefs *'Nature in Miniature'* which is based on spirituality, simplicityand beauty. It was first made popular by, Takashi Amano in 1985 with the use of 'Senmigawa stones. The term "Iwagumi" is a Japanese word which means *'rock formation'* therefore it describes a design in which the stone plays the primary role.It uses few objects in conjunction with the stone arrangement to create a cluster of rocks that are similar in colour and texture but differ in shape and contour. Generally, 1 to 3 species of aquatic plants such as *Micranthemum Monte Carlo, dwarf hairgrass*, and *Hemianthus callitrichoides* are used in this style. Fishes used in Zen style are Black Neon tetra (*Hyphessobrycon herbertaxelrodi*), Cardinal tetra (*Paracheirodon axelrodi*), Glowlight tetra (*Hemigrammus erythrozonus*), Harlequin rasbora (*Trigonostigma heteromorpha*)andFirehead tetra (*Hemigrammus bleheri*) etc.

To prevent symmetry, stones in the Zen style are typically used in odd numbers, of 3, 5, 7, 9, and so on and the most common ones among all are Seiryu, Manten, and Ohko Dragon stones. Even though there are many stones, each one has a unique name and a distinct function.

(i) Oyaishi: It is the largest and most important of all stones and is always used to create the

main focal point.

(ii) Fukuishi: It is referred as secondary stone, and has a color and texture similar to Oyaishi. Its aim is to create tension in the aquascape and balance the primary stone.

(iii) Soeishi: It is the third stone, positioned beside the Oyaishi and the Fukuishi, highlighting the first one's strength.

(iv) Suteishi: It is the fourth largest stone known as'sacrificial stone' as it gets covered by plants.

4. Jungle Style

It is a unique, untamed natural style of aquascaping whichaims to portray a chaotic, boundless, and wild appearance. The features are lush, dense vegetation and decor which mimic a forest look. It is considered as a blend of "Dutch and Nature Aquascaping style". The addition of large sized leafy plants with darker substrate gives uniqueness to the Jungle style. It requires constant water maintenance as varieties of plants are incorporated. Moreover, the dense and varied volume of plants can produce a mixture of gases i.e. oxygen and carbon dioxide and their levels need to be constantly monitored to balance the ecosystem. The plants such as Microsorum pteropus, Bolbitis heudelotii, Crinum natans, Crinum calimistratum, Aponogeton boevinianus etc whereas, fishes such as Thayeria boehlkei, Paracheirodon innesi, Coryodoras aeneus, Hyphessobrycon colombianus etc., are generally recommended for Jungle Style aquascape.

5. Biotope Style

The term Biotope generally refers to "habitat", which is a region with uniform environmental conditions for specific assemblage of plants and animals. It can be considered as a miniature replication of a particular aquatic habitat of a particular geographic location. It can be used by the biologists for study purposes.

6. Taiwanese Style

Taiwanese style deals with the use of high terraces, illusions of varying depth, varied planting material or other elements with their little replication to create a sense of life. The goal is to create a realistic version of aquascape, therefore freedom of choice of elements is not so free. Moreover, it is the combination of Dutch and Iwagumi styles which can provide immense scope for creativity.

7. Ryoboku style

This kind of aquascaping involves the use of wood as the chief hardscape material. The word Ryoboku itself means 'driftwood', symbolizing an

Ryoboku style

aquarium with wood. Variety of woods including bogwood,Redmoor roots,drift wood, Manzanita wood in addition with moss and other epiphytic plants can be used. In order to give a natural look to the aquarium, single type of wood is generally preferred. Stones can also be used to cover the space as secondary elements.

Basic principles of Aquascaping

Art and maintenance of aquascape is really a very difficult task and requires practice and skill which can be achieved by getting acquainted with the principles of Aquascaping. There are eight different principles of Aquascaping.

1. Simplicity: As aquascaping is a design beneath water, it should be as simples as possible, otherwise, it would be difficult to maintain the diverse elements. On contrary, it also should not appear monotonous. Hence, selection of elements should be simple, wise and well-organized.

2. Balance: Aquascape contains both aquatic flora and fauna, therefore, it is very important to balance their ecosystem inside a small container. Selected components should be compatible with each other. Moreover, they should not dominate each other, instead they should appeal as healthy balanced well-maintained ecosystem.

3. Proportion: It can be defined as a relationship among the masses of selected components. There are no defining criteria for setting up proportion but it is suitable to have much open space and short foliage plants to give soothing harmony effect.

4.Focal point: It is important to have at least one "centre of attraction" point, where more emphasis is given. It could be a either a piece of driftwood or stone, or any attractive planting material.

5.Symmetry: In order to make aquascape natural, symmetry should be avoided and to make it more asymmetrical, rocks, driftwoods, stones or other focal points can be grouped in odd or uneven numbers.

6.Contrast: Different color or shades of plant or different colors of rock, stones, pebbles or driftwood can be used to make the aquariums more colorful.

7. Rule of Thirds: The rule of thirds describe sexactly how we might employ imaginary rules so that we know how to arrangespecific elements within our landscape so that we are able to manage what the eye of the viewer perceives.

8. Golden Ratio: The Golden Ratio is a number obtained by dividing a line into two parts in such a way that if we divide the larger part by the smaller part the result is equal to the whole part divided by the larger part and which approximately equals to 1.618. The Golden ratio is strictly connected with the creation of a focal point in both art and mathematics as well as in nature. In aquascaping, this is the point where the viewer's attention is initially drawn at a first glance.

Elements of aquascaping

1.Flora: All the planting materials come under flora and it is one of the most important elements, which provides the basic structure to an aquasacaping. Selection of planting material is a very important process. It can be selected on the basis of size, height, color, texture or form of aquatic plants. For example:

(i) Aquarium plants for carpeting: Plants with height in between 1-10cm can be used for making carpet. For example: Java moss (*Vesicularia dubyana*), Dwarf hairgrass (*Eleocharis parvula*), Crystalwort (*Riccia fluitans*) etc.

(ii) Small aquatic plants: The height of plant sranging between 5 to 20 cm can be used such as: Pearl Grass (*Hemianthus micranthenoides*), Brown Wendtii Crypt (*Cryptocoryne wendtii*), Undulated Crypt (*Cryptocoryne undulata*),

Needle Dart Rush (*Eleocharis acicularis*), Whorled Marsh Pennywort (*Hydrocolyle verticillata*), Water cabbage (*Samolus parviflorus*), Baby Gashes (*Micranthemum umbrosum*) etc.

(iii) Medium aquatic plants: Plants height ranging from 15-30 cm can be used as medium one. The plants that falls under this category are Java Fern (*Microsorum Pteropus*),Cyperus (*Cyperus helfen*), Porto Alegre Sword(*Echinodorus portoalegrensis*), Golden Moneywort (*Lysimachi Anummularia'* Aurea'), Broad Leaf Flame Ivy (*Hemigraphis colourata*), Eusteralis (*Eusteralis Stellata*), Brazilian Pennywort (*Hydrocoty leueoeephala*), Dwarf Sagittaria (*Sagittaria Subulata*) etc.

(iv) Large aquatic plants: The plants with height more than 30 cm can be used as tall or large plants. Suitable plants for this purpose are: Red and Blue Water Lily (*Nymphaea stellata*),Orchid Lily (*Barelaya longifolia*), Water Sprite (*Ceratopteris thalietroides*), Eichhornia (*Eiehhomia azurea*), Giant Hygrophila (*Hygrophila Corymbosa*), Water Wisteria (*Hygrophila Difformis*), Ruffled Amazon Sword (*Eehinodorus Martii*), Small Flower Water Lily (*Nymphaea Micrantha*)etc.

(v) Floating aquatic plants: These kinds of plants float on the water surface and creates shady atmosphere such as: Water Lettuce (*Pistia stratiotes*),Eared Watermoss (*Salvinia auriculata*) Duckweed (*Lemna sp.*), Azolla (*Azalia filiculoides*), Asian Watermoss (*Salvinia cueujlata*), Aldrovanda (*Adrovanda vesiculosa*), Floating Watermoss (Salvinia natans), etc.

2. Fauna: It contains all the aquatic animals, including vertebrates and non-vertebrates. Fishes are the key elements and it is always good to have small group of fishes. The size of fishes depends upon the size of container, but selection should be done carefully to avoid competition of survival among them. Therefore, incorporating more species in single container should be avoided. Other small animals such as ornamental snails, crabs, shrimps, turtles and some amphibians can also be added.

3. Hardscape: It involves all the non-living matters to decorate the aquarium which includes-

(i) Lighting: It is one of the most essential and crucial components for plant life, as it is required for photosynthesis. In open condition, plants can absorb light from sun but indoor, it needs artificial sources of light. Therefore, different sources of artificial lights are available now a days, such as: LED lights, Metal Halides and T5 –Fluorescents etc. Moreover, light also makes the aquarium more attractive and can be regarded as "functioning heart of an aquarium."

(ii) Driftwood: Usually wood is lighter than water, therefore, it floats. Hence, driftwood should be chosen wisely. Different kinds of driftwoods such as Malaysian driftwood (dark and linear in shape), Mopani Wood – African driftwood (gnarled branches and light in nature and can lower the pH of water),American driftwood (cheap source but floats), Cherry tree, Oak tree, Pear tree etc., can be used.On the other hand, the wood of cedar tree, Cypress, Grape vine, Horse chestnut, Lilac etc., are not suitable for aquascapingas they may be toxic to fishes and invertebrates.

(iii) Rocks: Rocks are the second-most significant hardscape component found in planted tanks, behind driftwood. They are the ideal items for creating mountain range themes in nature aquarium and aid in laying the groundwork for an aquascape and these rocks are the primary component of Iwagumi designs. The most popular types of rocks found are Seiryu rocks, Ohko or Dragon stone, grey rocks or Elephant skin, Pagoda stones, Manten aqauscaping rocks, Koke stones, Unzan rocks, Frodo stones, Sansui rocks.

4. Layout: One must have a correct layout plan before using the substrate, driftwood, stone, pebble, and rock. There are various forms of composition:the triangular setup and the rectangular setup, the concave setup and the convex setup.

5. Imagination: Aquascaping relies on creativity. One has to prepare their mind with images of the available plants and accessories and try combining them in different ways.

6. Background: There are various methods for selecting a background, including painting it, using self-adhesive greenery, cork, wood, and others.

7. Substrate: Since, aquascape plants can feed through their roots in addition to their leaves, therefore, selecting the right aquascaping substrate is very crucial. Depending on the plants one wants to grow (small foreground, tall background etc.,) the ideal substrate will ensure their appropriate size, development and color.

8. Accessories: Artificial accessories such as different types, colour, shapes and sizes of gravels, sands, soils, gravel cleaners, cameras etc. can be used for preparing aquascape.

Maintenance of an Aquascape

Creation of an Aquascaping is one thing, but maintaining and enhancing its aesthetic appeal is another. It requires regular pruning, trimming, changing of water, have the proper ratio of nutrients, light, and CO_2.

1. Water filters: Water filters are used to get rid aquariums from hazardous chemicals, surplus food, fish waste, and decomposing organic debris.The three basic methods of water filtrationinclude mechanical, biological and chemical, and most of the filters in the market involves a combination of two of them.

2.Carbon Dioxide: Through a process known as photosynthesis, plants employ light, water, and carbon dioxide to produce their sustenance i.e., to prepare their food. Aquatic plants also photosynthesize for growth, but since the CO_2 levels are naturally much lower underwater therefore, increasing the amount of CO_2 in the tank would result in more photosynthesis, thereby leading to better growth of the plants. Although, the CO_2 systems might be little costly, but they are necessary for the plants growth.

3. Fertilizers: There are two kinds of fertilizers one can use to maintain the aquarium's health, depending on its lighting and CO_2 systems. Both of which has to be given at proper time and proper quantity.

i. Macronutrients (Nitrogen, Phosphorous and Potassium) and

ii. Micronutrients (Iron, Boron, Calcium, Chromium, Selenium, Manganese, Magnesium, Zinc, Sodium, Sulphur, etc.)

4. Aquarium Lightning: The health of the fishes and growth of the plants in the aquarium depend on the Lightning being provided. For freshwater plants, the sun is the only source of lightning in nature so to replicate this, extremely bright lighting fixtures are needed. Recently LED lights have become quite popular due to its easily availability and affordable prices. temperature between 6700k and 10,000k should be kept for these bulbs. Metal Halides ranging from 100-400 watts provides very bright light and therefore useful for deep tanks. T5 –Fluorescents is a newer technology which aids in improving the overall health and growth of the plants in all areas of the aquarium.

5. Water Parameters: A successful planted tank requires an understanding of water parameters, particularly if we intend to maintain cattle. These parameters include:

- pH –It indicates how basic or acidic the water is; a pH of 6.5 to 7.5 is generally

appropriate.

- KH - The water's ability to withstand pH changes is measured by its carbonate hardness (lower KH is typically ideal).
- GH –It is the measure of water hardness/ softness (GH of 70-140 ppm is mostly suitable)
- TDS –It is the total dissolved solids in the water (High TDS can be stressful to sensitive livestock, such as certain types of shrimp).

6.Trimming: Trimming of the aquatic plants is important to maintain the health and visual beauty of aquarium. Under ideal circumstances, the aquarium plants can grow rapidly. The type of plant determines the rate of growth. The fastest-growing are stem plants followed by foreground and potted plants, and the slowest-growing are ferns and moss.

Problems faced in Aquascaping

i. One of the main obstacles in aquascaping is algae growth and development which is produced by factors like high water nutrient levels, prolonged exposure to too much light, etc.

ii. Fish overpopulation will restrict their growth and deteriorate the quality of the water. Stocking a single sunfish is one of the biological control techniques.

iii. Aquascaping was the method used to introduce invasive plants. In various regions of the world, *Hydrilla verticillata, Myriophyllum spicatum* and *Egeria densa* have become notorious weeds in many parts of the word.

Conclusion

Aquascaping has the potential to artistically preserve areas facing the threat of destruction and extinction in nature, and is also significant in terms of the biological diversity that is currently at risk. Aquascaping landscape designs not only make it possible to observe nature indoors but also plays an important role in introducing aquatic plants. The presence of aquatic flaura and fauna in the house generates a calming atmosphere that also reduces stress and tension.Therefore, given the rising demand in the domestic market, India's aquascaping sector and other sectors need to be strengthened.

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Black Turmeric

A wild medicinal crop of Meghalaya, North east India

Introduction

Black turmeric (*Curcuma caesia*) is a perennial herbaceous plant belonging to the Zingiberaceae family. It features underground rhizomes that are dark brown to black on the outside and bluish-black on the inside. The plant grows to a height of 1-1.5 meters, with oblong leaves that are green with a reddish tinge along the midrib. The flowers are small, yellow, and arise from dense inflorescences surrounded by bracts.Black turmeric is native to India and is predominantly found in the eastern and northeastern

regions, including Odisha, West Bengal, Meghalaya, Assam, and Arunachal Pradesh. It thrives in tropical and subtropical climates, preferring well-drained sandy loam or clay loam soils with a slightly acidic to neutral pH. The plant typically grows in forested areas and is sometimes cultivated in home gardens.

Medicinal Values: Black turmeric has been valued in traditional medicine for centuries due to its potent therapeutic properties. Key medicinal uses include:

- **Anti-inflammatory property:** Helps reduce inflammation and pain in conditions such as arthritis.
- **Antimicrobial:** Effective against various bacterial and fungal infections.
- **Antioxidant:** Neutralizes free radicals, aiding in the prevention of chronic diseases.
- **Digestive Health:** Used to treat indigestion, diarrhea, and stomach cramps.
- **Respiratory Ailments:** Beneficial in alleviating symptoms of asthma, bronchitis, and colds.
- **Pain Relief:** Used as a remedy for muscle aches and joint pain. It also offers a wide range of cosmetic values due to its antimicrobial and antioxidant properties. The rich phyto-chemical compounds make it a valuable ingredient in skincare and cosmetic products. It is used in formulations to:
- **Brighten and Even Skin Tone:** The *curcumin* and other active compounds help in reducing pigmentation and imparting a natural glow to the skin.
- **Reduce Acne and Blemishes:** Its antimicrobial properties help combat acne-causing bacteria while soothing inflammation.
- **Soothe Irritated Skin:** Black turmeric is effective in calming skin conditions such as eczema, psoriasis, and other rashes due to its anti-inflammatory action.
- **Anti-Aging Benefits:** The antioxidant properties fight free radicals and reduce the

appearance of fine lines, wrinkles, and other signs of aging.

- **Moisturization:** Formulations with black turmeric can enhance hydration and improve skin texture.
- **Hair Care:** Black turmeric is also used in hair care products to strengthen hair roots, reduce dandruff, and promote healthy hair growth.

Chemical Compounds: The rhizomes of black turmeric contain several bioactive compounds, including:

- ***Curcumin:*** Known for its anti-inflammatory, antioxidant, and anticancer properties. It plays a significant role in reducing oxidative stress and modulating cellular pathways linked to chronic diseases.
- ***Camphor:*** Provides antimicrobial and analgesic effects. It is particularly effective in treating skin infections and respiratory issues.
- ***Ar-Turmerone:*** A potent anti-inflammatory compound that has shown promise in neuroprotective and anticancer research.
- ***Zingiberene:*** A sesquiterpene contributing to the anti-inflammatory and aromatic characteristics of black turmeric.
- ***Essential Oils:*** The rhizomes contain a range of essential oils, including borneol, cineole, and linalool, which contribute to its fragrance and therapeutic properties.
- ***Phenolic Compounds:*** These compounds provide additional antioxidant benefits and help in combating cellular damage.
- ***Tannins and Flavonoids:*** These compounds enhance the plant's antimicrobial, antifungal, and antiviral properties.

Propagation: Black turmeric is propagated primarily through rhizomes. Healthy and mature rhizomes are selected and cut into pieces, each containing at least one bud. These are planted in well-prepared soil during the pre-monsoon season (April to May). The spacing between plants is maintained at 30 cm x 25 cm for optimal growth. There is no standard cultivation practices followed in Meghalaya as it is grown as a wild plant in forests.

Harvesting: Black turmeric is typically harvested 8-10 months after planting when the leaves and stems begin to dry and wither. The rhizomes are carefully dug out to avoid damage.

Processing and Drying:

1.Cleaning: Harvested rhizomes are washed thoroughly to remove soil and debris.

2.Boiling: Rhizomes are boiled for 30-40 minutes to deactivate enzymes and improve storage.

3.Drying: The boiled rhizomes are sun-dried or mechanically dried until they reach a moisture content of 8-10%.

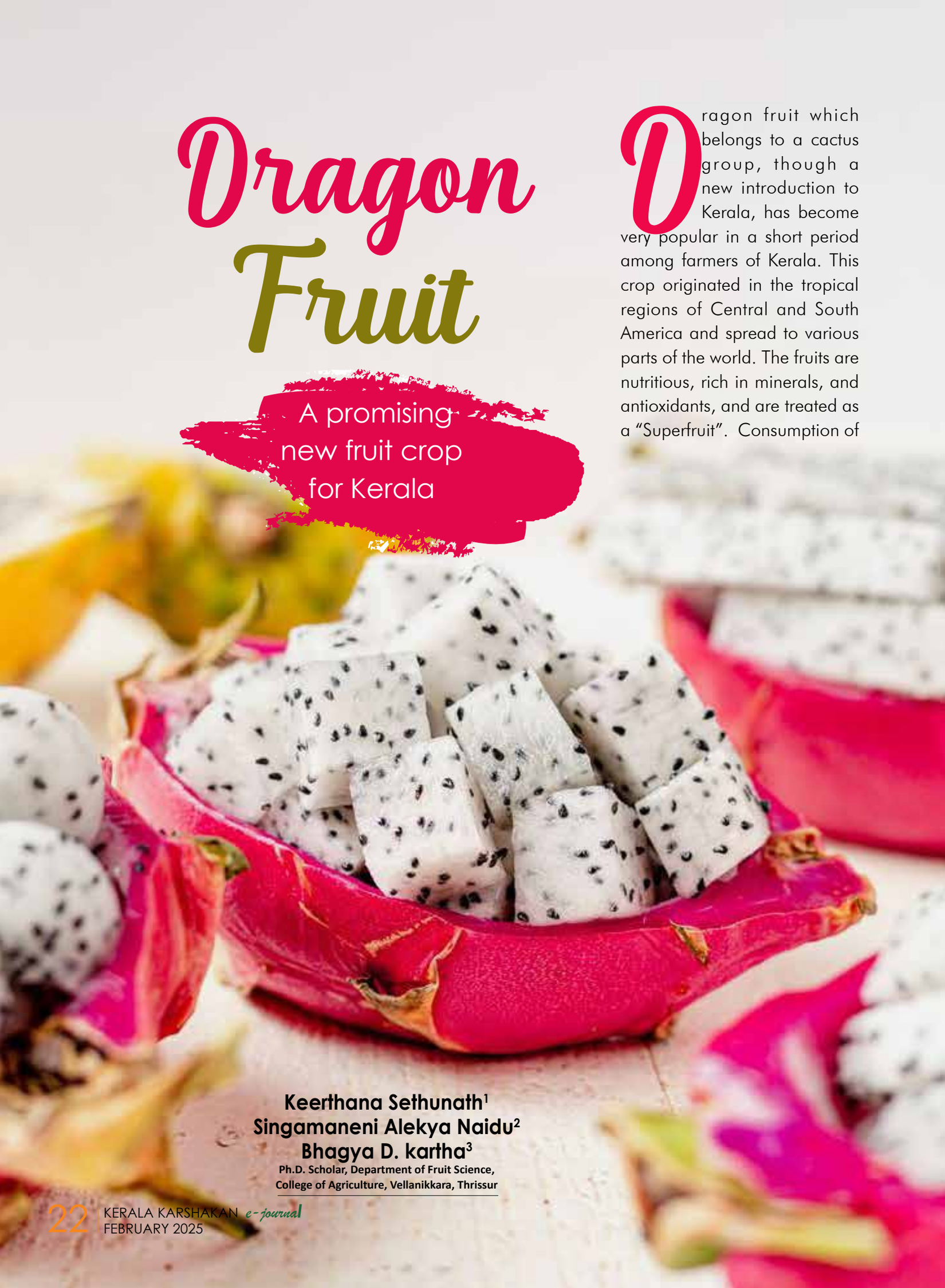
4.Storage: Dried rhizomes are stored in a cool, dry place in airtight containers to prevent spoilage.

Black turmeric is a remarkable plant with extensive medicinal and cosmetic applications. Its cultivation and processing require meticulous care to preserve its valuable properties. With growing interest in natural remedies and cosmetics, black turmeric holds significant potential for future research and commercial development.

Dragon Fruit

A promising new fruit crop for Kerala

Dragon fruit which belongs to a cactus group, though a new introduction to Kerala, has become very popular in a short period among farmers of Kerala. This crop originated in the tropical regions of Central and South America and spread to various parts of the world. The fruits are nutritious, rich in minerals, and antioxidants, and are treated as a "Superfruit". Consumption of



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fruits improves skin, digestion, protection against diseases, and treats diabetics, and cancer. It is also useful to reduce body weight and obesity since it is a low-calorie fruit. Ripe fruits can be used as a desert. Ripe fruits of different colours are used as a natural colouring agent in shakes and ice creams.

Climate

Though dragon fruit is a dry-land crop, it performs effectively in tropical circumstances. It grows well in the climatic conditions of Kerala.Places receiving an annual rainfall of 50-150 cm are ideal for its cultivation. Rainfall during the flowering period adversely affects pollination and fruit set. Receiving rains in February-March is found to induce and improve flowering.

Cultivation

Open areas receiving good sunlight, and soils with good drainage, without any chance for water stagnation, are ideal for the cultivation of dragon fruit. Small pits of about 45-50 cm in size are taken at 2.5- 3.0 metresdistance after preliminary land preparation. The addition of well-composted and matured, dry organic manures like cow dung, poultry manure, composts, bone meal, oil cakes etc. in pits as basal dose helps the vigorous growth of the plants. Spraying *Pseudomonas, Trichoderma* and balanced nutrients will improve tolerance to diseases. Rooted cuttings are ideal for planting. It is recommended to apply

one handful of VAM in the pits at the time of planting. Plants require strong support with a rough surface for satisfactory growth. Concrete or granite pillars of 6-8 feet in height and 4 x4 inches in thickness are ideal for commercial cultivation. The pillars are buried in soil to a depth of 1.5 to 2 feet leaving 5-6 feet above ground level. Wooden posts or pillars and PVC tubes can also be used, but their durability is short. Plants grown on concrete pillars have a longevity of 20-25 years. After fixing the pillars, four plants are planted around each pillar. The growing plants are to be periodically tied to the pillars using jute or coir ropes.

Varieties

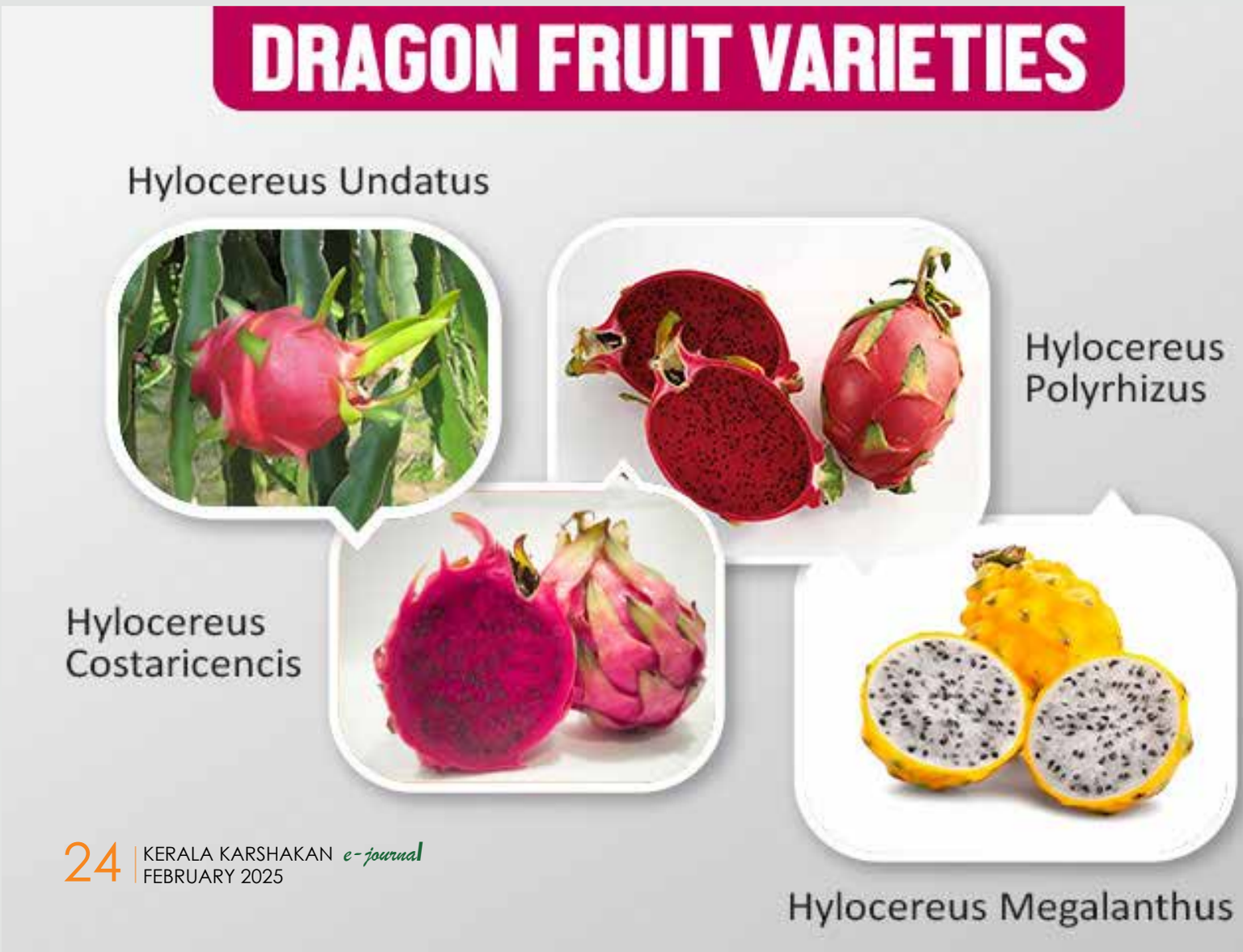
Three types of dragon fruits are popular for commercial cultivation. They are fruits with pink outer skin and white pulp; pink outer skin purple pulp; and fruits with yellow outer skin and white pulp. Fruits with pink skin and purple pulp are preferred in Kerala.

Planting material

Rooted stem cuttings collected from high-yielding healthy mother plants are ideal for planting. Long cuttings of about 90 cm start yield in one year. Smaller cuttings may take 1-2- years for fruiting. Seedlings raised from the ripe can also be used for planting, but they take 2-3 years for fruiting.

Irrigation and manuring

Dragon fruit is a dry land crop and does not require watering. But one or two slight irrigations per week in summer months improve and promote growth. High soil moisture and water stagnation may cause stem rotting and decay at the collar region. Application of organic manures like cow dung. Compost, poultry manure, oilcakes etc. at 3-4



months intervals is ideal to promote growth.

Intercropping

Intercropping of short-duration crops like vegetables, tuber crops, ginger, turmeric etc, in the interspaces during early years can be taken in commercial orchards. Intercropping is not recommended in the yielding stage.

Harvesting

Flower buds open after two weeks of the bud emergence, and fruits are ready for harvest by one month. Fruits are ready for harvesting in 4-5 days once the outer skin colour changes from green to pink or yellow. Delay in harvest results in cracking of fruit tipand subsequent damage by ants and other insects.

THE TINY BUT MIGHTY TRICHO CARD

A GAME- CHANGER FOR RICE FARMERS

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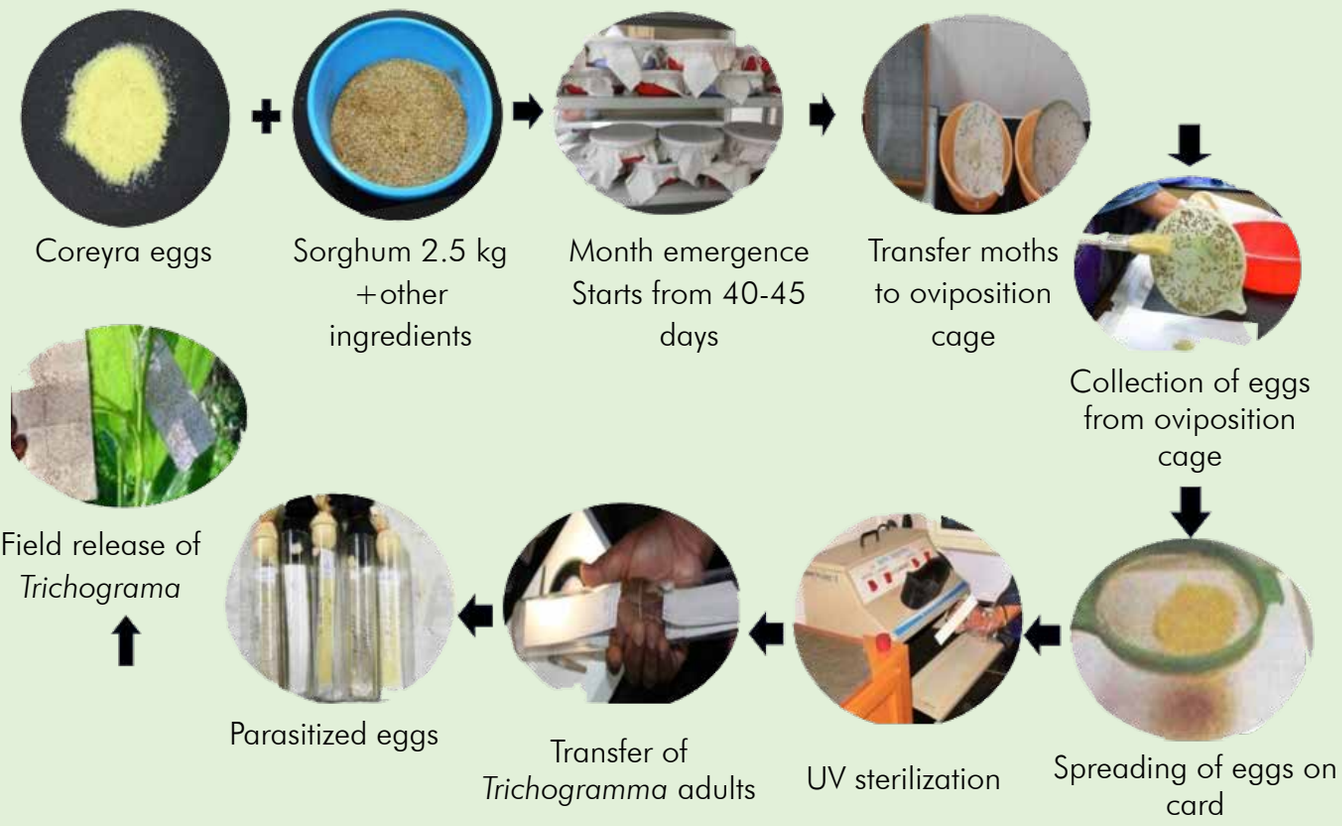
Rice, the staple food for over half of the world's population, is under persistent threat from devastating pests such as stem borers and leaf folders, resulting in significant yield losses and economic hardship for farmers. To combat this challenge, innovative and sustainable solutions are essential. One effective tool in the fight against rice pests is Trichogramma cards, a cutting-edge technology leveraging biological pest control. By harnessing the power of beneficial insects, Trichogramma cards offer a promising solution to protect rice crops, ensure food security, and promote eco-friendly agriculture practices.

WHAT ARE TRICHO CARDS?

Trichogramma cards, also known as Tricho cards, are a biological pest control tool. They contain eggs of tiny parasitic wasps, specifically Trichogramma wasps, which prey on agricultural pests like moth eggs. These wasps lay their eggs inside pest eggs, preventing them from hatching and reducing pest populations. Tricho cards are

On farm mass production of *Trichogramma spp*



small, cardboard or paper cards containing eggs of Trichogramma wasps.When placed in rice fields or other crops, the wasps emerge and target pest eggs, providing an eco-friendly and effective solution for pest management. These cards are strategically placed in agricultural fields, orchards, or greenhouses where they release the Trichogramma wasps to control pest populations

PREPARATION OF HOST:

To prepare the host for Tricho cards, sterilize plastic trays in a hot air oven at 100°C for 1-2 hours. Then, fill each box with 2.5 kg of sterilized crushed maize, sorghum, or rice. Add the following ingredients to each box: 50g of broken groundnut, 5g of yeast, 1g of wettable sulphur, and 0.05g of streptomycin sulphate. Sprinkle 1 cm^3 of Corcyra eggs on top of the culture medium and mix thoroughly. Cover the box with a lid, label the date of inoculation, and maintain favourable conditions (28±2°C temperature and 75%±5% relative humidity). After 45-50 days, collect emerging moths using glass tubes and transfer them to an egg-laying chamber. Provide adult food consisting of cotton soaked in 20% honey and vitamin E solution. Collect eggs daily

PREPARATION OF TRICHO CARDS:

A Tricho card is prepared by uniformly spreading and pasting one cc of Corcyra cephalonica eggs on a 15 cm x 10 cm card with 12 demarcations. Apply gum on the card and sprinkle cleaned eggs through a tea strainer. Remove excess eggs with

Crop/insect	*Trichogramma sp.*	Recommendations
Rice Yellow stem borer	*T. japonicum*	1 Lakh adults / ha
Rice Leaf folder	*T. chilonis*	20/30 DAT at 10 days interval
Cotton bollworm	*Trichogrammatoidea bactrae*	1.0 Lakh adults / ha at 10 days interval
Tomato: H. armigera	*T. prwtiosum*	1.5 Lakh adults / ha at 10 days interval
Cabbage : Diamond back moth	*T. bactrae*	1.0 Lakh ad / ha at 10 days interval
Sugarcane : Chilo sp.	*T. chilonis*	0.5 lakh ad/ha

a shoe brush after air drying. Treat eggs under UV lamp for 30 minutes to kill embryos. Assemble the Tricho card with a Trichogramma nucleus card (6:1 ratio) in a polythene bag, providing 50% honey with vitamin E in a soaked cotton swab. Remove Tricho cards after 24 hours. Parasitization is indicated by Corcyra eggs turning black on the fourth day. Release Tricho cards in fields when there is adult emergence (pharate stage) is observed, cutting them into 12-16 bits and stapling to the lower side of leaves during morning or evening hours. Use a cup for covering the Trichodcards for protecting it from rain. Immediate field release is necessary for trichocard application.

PRECAUTIONS FOR REARING TRICHOGRAMMA

When utilizingTrichogramma cards, ensure the emergence date is clearly specified to guide timely application. To optimize effectiveness, staple cards to the inner side of leaves, avoiding direct sunlight. Application should occur during morning hours, just before emergence, to minimize predation risks. Additionally, refrain from using insecticides in fields where Trichogramma are released, as they can harm these beneficial insects. If insecticide application is necessary, use selective or safer options, ensuring a 15-day gap before or after Trichogramma release. This cautious approach will help maximize the efficacy of Trichogramma in controlling target pests

TRICHOGRAMMA FIELD RELEASES:

ADVANTAGES OF TRICHO CARDS

They are cost-effective, easy to use, and environmentally friendly, causing no harm to the ecosystem. Unlike chemical pesticides, Trichogramma cards do not leave residues on rice grains, ensuring safe consumption. Additionally, they have a long shelf life, allowing for storage and future use

APPLICATION OF TRICHO CARDS

For effective pest management, Trichogramma cards should be applied when rice plants are in their early growth stages. To ensure optimal results, place one card per square meter in the rice field, positioning them in a shaded area to protect the beneficial wasps from direct sunlight. This strategic placement allows the Trichogramma wasps to emerge and target pest eggs efficiently, providing proactive protection for the developing rice crop.

EFFECTIVENESS OF TRICHO CARDS

Trichogramma cards have proven to be a highly effective tool in managing pest populations, with studies demonstrating a significant reduction of up to 90% in pest infestations. To maximize their potential, these cards are most effective when integrated into a comprehensive pest management strategy that incorporates cultural practices such as crop rotation and the use of resistant rice varieties.

FUTURE OF TRICHO CARDS

Trichogramma cards hold immense promise for the future of rice field pest management, with the potential to become a widely adopted and sustainable solution. However, to unlock their full potential, further research is crucial to optimize their use, increase their efficacy, and develop new strains of parasitic wasps that can target a broader range of pests.

LIMITATIONS OF TRICHO CARDS

Notably, they are not effective against all types of pests, and their efficacy is primarily confined to controlling stem borers and leaf folders. Other pests, such as rice bugs, may not be adequately managed by Trichogramma cards. Additionally, to maintain their effectiveness, these cards require proper storage and handling, highlighting the need for careful logistics and user awareness.

Trichogramma cards offer a game-changing solution for rice farmers seeking sustainable and effective pest management. By integrating Trichogramma cards into their pest management strategy, rice farmers can significantly boost yields, enhance crop quality, and ultimately improve their livelihoods. With its potential to transform rice cultivation, Trichogramma cards emerge as a vital tool in the quest for food security, sustainability, and economic prosperity for rice farming communities worldwide.

Entrepreneurship opportunities in TUBER CROPS for enhancing income

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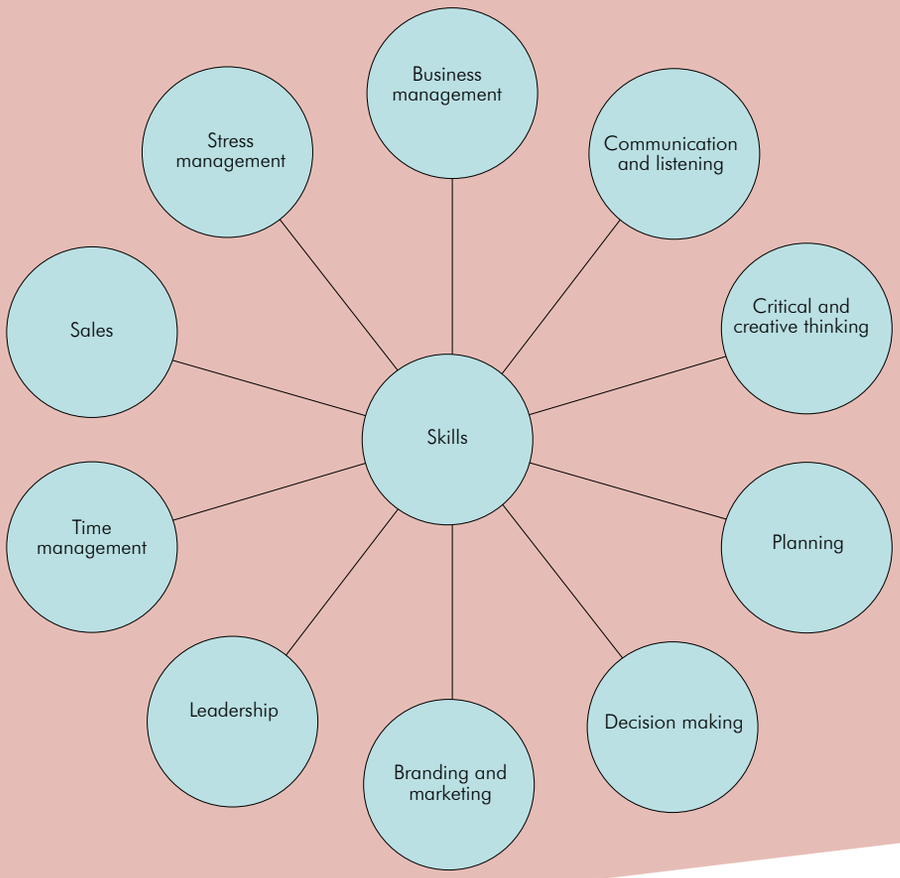
Introduction

Tuber crops are an important livelihood and food security crops which are cultivated in tropical and subtropical countries. Major tuber crops grown in India are cassava, sweet potato, yams and aroids which include elephant foot yam, taro and tannia. These groups of crops can be referred as future food security crops due to its climate resilience and tolerance to erratic climatic conditions. Realizing the potential and their socio economic relevance of tuber crops, ICAR-CTCRI, Thiruvananthapuram was established in July 1963 with its Regional Station at Bhubaneswar, Odisha in September 1976 with a mandate to conduct research on different aspects of tuber crops. In India, cassava is cultivated in nine states with three southern states viz. Kerala, Tamil Nadu, and Andhra Pradesh contributing to about 96% of the total production. Cassava is a secondary staple food in Kerala, while it is an industrial crop in Tamil Nadu and Andhra Pradesh. Cassava is mainly used for edible consumption, industrial applications and animal feed sector in India. About 60% of the total cassava produced in India are used as raw materials

to produce starch, sago and dry chips and it has scope for wider applications in food, paper and textile industries. In recent years, cassava has been globally recognized as a potential candidate for bioethanol production due to its high carbohydrate content and ability to grow under low management conditions.

Farmers in Tamil Nadu, Kerala, Andhra Pradesh, Odisha and North Eastern states depend on these crops for their livelihood, nutrition, food and economic security. It offers business opportunities to multitude of people. Importance of cassava in the socioeconomic development of rural areas has



Minisett technique in cassava

Minisett technique in elephant foot yam

gained recognition during the last few years. It is also a source of income and is used as a raw material in manufacturing of processed food, animal feed and industrial products. Entrepreneurship development is an effective strategy for the growth and development of an economy. It provides employment opportunities for a larger population and equips them with their own strategies to develop their knowledge and skill in the business world. A holistic entrepreneurial ecosystem existing in the country is providing entrepreneurial avenues for the farmers, women and youth especially in the agriculture sector. In addition

Seed villages on tuber crops in Tamilnadu

Seed villages on tuber crops in Kerala

Organic production of tuber crops

to setting up their own income generating enterprises, they can generate jobs for others as well. It provides opportunities for the job seekers to transform themselves into job providers.

Entrepreneurship

Entrepreneurship means an individual or a small group of people who creates new business with a motive to earn profit. They involve themselves in business venture and are ready to undergo greater risks in the business market. If the business returns back profits, they can earn more and become a successful entrepreneur. Agriculture sector provides ample opportunities for business development as it is designated as a sun rise sector. Entrepreneurial pursuits often involve innovation, persistent interest, financial support and risk bearing ability. Agri-entrepreneurship includes agri-business which encompasses cultivating crops, processing and value addition, input production which includes bio-fertilizers, bio-control agents, organic products, farm implements, custom hiring center, planting material production and so on. Skills required for successful entrepreneurship

Business opportunities in tuber crops

Minisett technique in tuber crops

The ICAR-CTCRI has developed a rapid multiplication technique using cassava minisetts in which two- node cuttings are

Micronol for tuber crops

Customised fertiliser

Thippi

Biocapsules

raised in the nursery in shade house (35 per cent shade). The minisetts are planted end to end horizontally, at 5 cm deep leaving 5 cm between the rows. The minisetts are transplanted to the main field 3 to 4 weeks after planting at a spacing of 45 x 45 cm. The stem yield (no.ha-1) in cassava was 24,000 in normal sett planting, while in minisett technique it was 60,000. This method gives an increased yield of 80 t ha-1 for minisett cassava wherein the normal sett planting produced an yield of only 30 t ha-1. Minisetts can be done for elephant foot yam, yams and taro. Entrepreneurs can develop setts by minisett technique and supply to the end users and this can provide them a good business opportunity. The Institute offers training to the persons who are interested to produce minisetts.

Development of seed villages for supply of quality planting materials

Good quality seeds or planting materials are very much important in any crop as they decide the yield. Cassava is a vegetatively propagated crop and the stem cuttings are used as planting materials. The stems are stored in a dry and cool place and used for the next planting season. One of the major constraints reported

Hydroponics system

by the farmers in adopting improved varieties of cassava are lack of access to good quality planting materials of the improved varieties. Since the planting material demand is on the higher side from farmers and industries, it is not possible by the research institutes to cater to the needs of the farmers. If the supply of planting materials demand is met, the cassava cultivation may be extended to non traditional areas of our country. Farm youth, farmers and farm women can make use of this opportunity and can produce their own planting materials in their farms and they can sell it to other farmers who are in need of planting materials. They can get training on quality planting material production from research organizations so as to produce healthy and disease free planting materials. This forms a good avenue of employment and income generation for the rural community.

Production of organic tubers

Organic produce have high demand in the market as they are safe to consume. Cassava plant is very acquiescent to organic farming and it produces higher yield. Organically grown food products receive premium price and have greater acceptability in the market with more consumer preference and it fetches better price for the entrepreneur. In India, organic certification is done by different agencies which regulate organic food in the domestic market and imports. Participatory Guarantee System (PGS) is a process of certifying organic products, which ensures that their production takes place in accordance with the prescribed quality standards. PGS Green is given to chemical free produce under transition to 'organic' which takes three years. It is mainly for domestic purpose.

The National Programme for Organic Production (NPOP) grants organic farming certification through a process of third party certification for export purposes. This provides better business opportunities for farmers, women and other agro based entrepreneurs to earn a living by selling quality organic tubers. Even though area under organic farming is increasing, it is not able to meet the demand of organic produce requisite. So, organic farming has vast scope of business opportunities as the consumer prefers mostly organically grown tubers.

Vertical garden

Bioformulation production unit

Production of micro nutrient mixture 'Micronol'

Micronol is a microfood which is used as foliar micro nutrient spray in tuber crops. The ICAR-CTCRI has developed micronol for cassava, sweet potato, yams, elephant foot yam and Chinese potato. This is widely used by farmers from different parts of the country. With the technical knowhow from the Institute, stakeholders can produce the micronol and sell it in the market. It is a good opportunity for the stakeholders to produce this foliar fertiliser and can earn a good income and they can start a village based production unit as there is vast demand in the market for new generation fertilizers.

Bioformulations

Production of Customised fertiliser

It is a mixture of major nutrients, secondary and micro nutrients specific to crops and soil requirements. Fertilisers namely urea, di ammonium phosphate, muriate of potash, magnesium sulphate etc are mixed and different grades of customised fertilisers are prepared based on plant requirement. This is easy to produce and no drudgery is involved in preparing this product. It can be made in packets and sold in the market. This will save labour cost for the end users and it is more profitable. With the technical help from the Institute entrepreneurs can start

Wax coated cassava tubers

Hand operated

Pedal operated

Motorized

small units and they can produce the customized fertilizers as per the recommendations of the Institute.

Production of thippi from cassava waste

During the manufacture of sago, the tapioca tubers are de-skinned and soaked in water. The tubers are then fed into the crusher adding water for extraction of milk which is passed through a sieve to remove the fibrous materials. This fibrous material in pulp form, when dried is known as tapioca thippi. It is low in protein and fat, but fibre content is 8-9%. In Tamil Nadu, cassava is grown as an industrial crop for the large scale production of sago and starch. There are large-scale starch factories and small sago and starch production units in Tamil Nadu, generating more than 40 tonnes of solid waste per annum. Thippi, the solid waste is one among them. The work conducted at ICAR-CTCRI revealed that thippi compost can be used as an alternative to FYM, green manuring in situ with cowpea, crop residue incorporation, vermicompost and coir pith compost and even fertilizers up to N @ 50 kg ha-1, MgSO4@ 2.5 kg ha-1and ZnSO4@2.5 kg ha-1. Thippi compost application can reduce the bitterness and increase the starch content of cassava tubers. This quality parameter is very advantageous to cassava cultivators as there is market demand for less bitter

cassava tubers. Thippi compost production unit may be set up by the entrepreneurs and focusing on a customer centric approach it can find market throughout the country.

Soilless production of tuber crops by hydroponic formulation

Soilless production methods, such as hydroponics, aeroponics, and aquaponics, offer a sustainable solution for urban farming of vegetables and tuber crops. These systems eliminate the need for soil, allowing precise control over nutrients and conditions, which accelerates growth and increases yield. They also minimize soil-borne diseases and pests, making urban farming more resilient and efficient. ICAR-CTCRI has standardized hydroponic nutrient formulation, which is tested for tuber crops: taro, Chinese potato, sweet potato, greater yam under climate control facility and rain shelter. The yield is higher with no incidence of soil borne diseases, recorded higher palatability score in most of the crops and varieties grown in hydroponics. We will get safe to eat food and the labour involved is less and it helps in resource conservation. Entrepreneurs can adopt this method of cultivation to increase their profit and to sell safe to eat foods in the market.

Mobile starch extraction unit

Biocapsules for growth promotion and disease management

The Institute in collaboration with ICAR-Indian Institute of Spices Research, Kozhikode (ICAR-IISR) jointly developed biocapsules of three growth promoting and disease suppressing microorganisms by utilizing the commercialized encapsulation technology for the smart delivery of agriculturally important microorganisms. The technology involves encapsulation of the microorganisms of interest in a gelatin capsule for delivery to agricultural crops for the enhanced soil nutrient solubilization, enhanced growth, yield and suppression of disease. It can be produced and sold in the market which fetches good revenue to the producer.

Starch and sago production units

The starch content of the fresh cassava root is about 30% and gives the highest yield of starch per unit area of any crop grown. Starch is the most important value added product from cassava. Starch extraction can be done by using different methods. Cassava starch is used in food processing, beverage industry, production of candies, paper industry, textile industry etc. Cassava starch is mainly marketed in Gujarat, Maharashtra, West Bengal and Tamil Nadu. The entrepreneurs can establish starch producing factories which will help them to earn more from production of starch and starch has immense export potential to various countries internationally.

Sago, derived from raw

Noodles

Pasta

tapioca, is in the form of small hard globules with pearl white colour. Sago is manufactured from the wet starch powder crushed from tapioca. Sago and its finished products are used as food, animal feed and as raw material for several industrial products. Sago is almost pure starch, a type of carbohydrate and hence has many health benefits. More than half of the sago produced in the country are marketed in Pune and Nagpur in Maharashtra and Kolkata and Siliguri in West Bengal, Patna in Bihar, Kanpur and Varanasi in Uttar Pradesh, Guwahati in Assam. Demand for sago is generally more during festival seasons and in Sravana month (August) due to more auspicious festivals being held then. Entrepreneurs can establish family owned sago producing units, and thereby do business and earn better income.

Establishment of bioformulation unit extracted from Cassava leaves

Three bioformulations were developed by ICAR-CTCRI namely Nanma, Menma and Shreya from cassava leaf extracts. The apparatus and the process of extraction were also developed by the Institute. The bioformulation is effective against borer pest like pseudostem weevil in banana and red palm weevil in coconut. These technologies were perfected more than a decade ago and proved very effective for the eco-friendly management of a variety of insect pests. The entrepreneurs can create bioformulation production units and they can manufacture bioformulations which have immense market scope and good demand among the farmers.

Small scale unit for waxy coating of Cassava

Cassava can be kept fresh only for a period of two to three days and after that it becomes blackened due to post harvest deterioration. To make them remain fresh and to maintain their weight, wax is coated on the outer surface of the cassava tubers. This wax coating helps cassava to maintain its freshness and helps it to retain moisture and thereby the weight of the tubers may be retained. Entrepreneurs can attempt this technology and they can establish cassava wax coating units so that they can do this as a business and earn income. As the wax coated cassava remains fresh it can be shipped to international markets for export promotion.

Fabrication of machineries for tuber crops

Cassava chipping machine

Cassava chipping machine produces chips of uniform size and shape. There is a great demand for the product in the market. To avoid heavy post-harvest losses, the roots are customarily processed into sundried chips. Cassava chips are used for preparation of flour which is used like rice flour. It also forms a major component in many animal feeds. In industries it is used as raw material for manufacturing starch, dextrin, glucose and ethyl alcohol. Machine chipping becomes more economical, when compared to manual chipping as it reduces labour and minimize the time. The cost of the machine is less and it accommodates tubers irrespective of the size. It is easy to operate and it can produce uniform chips and

adjust the chip thickness too. Manufacturing cassava chipping machines offers a good potential for creating business for different stakeholders who are involved in machinery development.

Mobile starch extraction unit

Mobile starch extraction unit is electrically operated with low cost and is used for starch extraction and it can be transported from one place to other. This unit has the provision to disintegrate the root tissues, wash out the starch from the tissue and separate the starch. It has provisions for easy transportation, to store peeled and sliced tubers, convenient to operate and easy to fabricate and maintain. These machines are suitable for use in villages, adding value to produce and generate additional employment. This can be used to extract starch from cassava, sweet potato and elephant foot yam. This machine can be manufactured and sold in the market for starch extraction as it is a mobile unit which is useful for the clients employed in starch extraction.

Small scale enterprises for value added products from tuber crops

Value-addition is transformation of raw agricultural product into a new and economically more beneficial product through the means of packaging, processing etc. Large proportion of agricultural produce is wasted due to improper storage and warehousing, lack of transportation and food processing facilities. Now-a-days there is a significant shift in consumer food preference towards processed food products. Number of value added products can be prepared from tuber crops.

Cassava based food products: Cassava chips, sago wafers, cassava flour, snack foods, protein enriched pasta, hydrocolloid fortified pasta and rice analogue from cassava based composite flour.

Sweet potato based products: Fried chips (deep fat, vacuum), french fries, crisps, preserves (puree, jam, jelly), starch noodles, gluten-free spaghetti and food bars.

Cassava and sweet potato based functional products: Antioxidant rich functional sago, dietary fibre enriched functional sago, dietary fibre enriched pasta, low glycemic spaghetti. Entrepreneurs can add more value to the developed products with proper management and marketing initiatives. The processed food market opens up a great potential for entrepreneurs be it fast food, packaged food or organic food.

Factors favourable to start a business in tuber crops

- Availability of improved varieties of planting materials for multiplication in the fields
- Technological support from research organizations
- Handholding and capacity building
- Technology licensing for commercialization
- Guidance in preparation of business plan
- Incubation facilities in research organization

Conclusion

Tuber crops are the future crops as they are resilient to climate change and they can be grown in less fertile soil without much cost. Tuber crops offer livelihood options for farmers, farm women and other stakeholders. We need entrepreneurs to start small scale industries to tap these opportunities with the support of funding from Government and other funding agencies. Besides, these business opportunities lead to higher monetary return and better market. Higher export potential for such products augments the income potential of the entrepreneurs.

The Kerala Co-operative Milk Marketing Federation (KCMMF), known as Milma, has become a part of Malayalees' daily lives for the last five decades. KCMMF rules Kerala's dairy market with varieties of market milk and value-added dairy products under its own brand, MILMA.

The Government of Indiaimplemented the Operation Flood Programme to replicate Anand, Gujarat's successful dairy co-operative model. The dairy co-operative societies in Anand were formed under the

The Implementation of Gramscian philosophies in praxis

The Story of milma

Greeshma Greeshmam

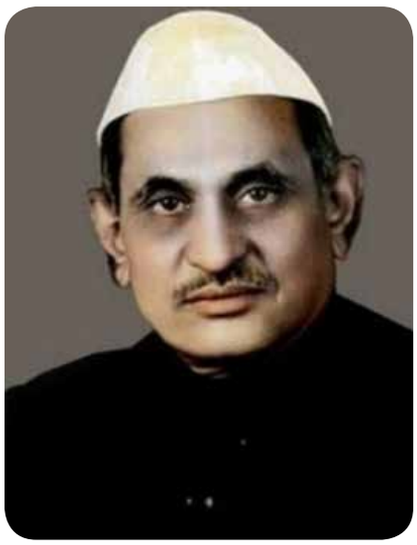
leadership of Tribhuvandas Patel to eliminate intermediaries who profited by exploiting dairy farmers. In 1980, the Anand Pattern Dairy Co-operative Societies (APCOS) were replicated in Kerala as part of the second phase of the white revolution implemented by the National Dairy Development Board (NDDB) headed by Dr Varghese Kurien.

KCMMF is the apex body of APCOS in Kerala and the state adjunct of the Operation Flood Programme. It is a three-tieredorganisation with its headquarters at Thiruvananthapuram. About 3.6 lakh dairy farmers are registered in primary dairy co-operative societies at the Village level. At present, there are 3270 primary dairy co-operative societies across Kerala. These co-operative societies are grouped under the three regional unions - Thiruvananthapuram, Ernakulam and Malabar (TRCMPU, ERCMPU, MRCMPU). The prime motto behind the establishment of KCMMF was to ensure a steady livelihood for the dairy farmers in Kerala by procuring milk from them; later, raw milk and various value-added dairy products were sold in the market under the brand name MILMA. The federation provides regular

Antonio

payments to the farmers every ten days. It also promotes the socio-economic development of dairy farmers in Kerala through milk procurement, processing, and marketing. Despite being a successful co-operative entity under the Government of Kerala,

KCMMF Headquarters, Thiruvananthapuram



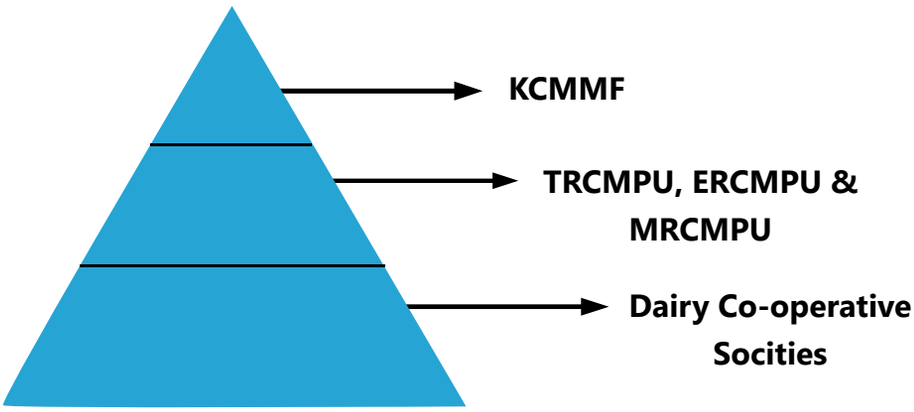
Tribhuvandas Patel

Dr. Varghese Kurien

the philosophical grounds of KCMMF are still unexplored.

The Industrial Revolution of the 18th century ignited the emergence of Marxist and Neo Marxist ideology in Europe. It also facilitated the rise of the Co-operative movement in the 19th century. Antonio Gramsci, one of the founders of the Italian communist party and a pioneering Neo-Marxian idealist, contributed to the further growth and development of Neo-Marxism in Europe.

After World War I, Italy came under the ultra-nationalist and fascist rule of Benito Mussolini.



KCMMF Organisation Chart

Despite Gramci's camaraderie with Mussolini in their early political life, he was imprisoned for 11 years in 1926. However, he used the prison time to turn his pragmatic political experience into principles. He wrote a nearly 3000-page manuscript with about 32 chapters. On April 27, 1937, seven days after his release from prison, Gramsci succumbed to death.

Gramscian philosophy has been put into practice in different institutions and political landscapes across the globe. The Kerala Co-operative Milk Marketing Federation (KCMMF) could be regarded as a successful model of Gramscian philosophy in practice.

One of Gramsci's main arguments revolves around the role of intellectuals in society, which he categorised into two types: Traditional and Organic Intellectuals. Traditional intellectuals hail from the privileged classes and perpetuate the values and culture of the elite, claiming that their traditions are universally beneficial. In contrast, Organic intellectuals

emerge from their communities, often enhancing their status through education, networking, or entrepreneurship, and they focus on sharing knowledge and insights back to their community. The KCMMF comprises both Traditional and Organic intellectuals. The Traditional Intellectuals within the KCMMF are part of the bureaucratic framework of the federation, including the Managing Director (MD), the Director of the Department of Dairy Development, the Principal Secretary (AH&DD), Govt. of Kerala, Joint Secretary, Finance Department, Govt. of Kerala, and Deputy General Manager of NDDB are the Traditional Intellectuals in the Board of Directors in MILMA.

The same set of Traditional Intellectuals is also present in the three regional unions of KCMMF MD of TRCMPU, ERCMPU MD and MD, MRCMPU. Other Traditional intellectuals in Milma include the Senior Managers in the different sections like Procurement and Input, Marketing, Finance, Quality Assurance and Production. The three regional unions also contain senior officials from the Department of Dairy Development as Government Nominees.

Along with the Traditional Intellectuals, the Organic Intellectuals within the federal structure play a vital role in the successful working of KCMMF. The elected representatives of dairy farmers across the state and in KCMMF constitute the Organic Intellectuals. The dairy farmers across the state are members of the dairy co-operative societies. Those members democratically elect the President and other members of the society. The elected presidents of the dairy co-operative societies will elect one among them as the regional union's Chairman. These regional unions also have board members who are democratically elected. The KCMMF and the three regional unions link the dairy farmers and the Department of Dairy Development.

According to Gramsci, the term hegemony means predominance by consent. For him, hegemony is a condition in which a fundamental class exercises a political, intellectual, and moral leadership role within a hegemonic system cemented by a shared worldview. This principle of building the hegemony of working-class members is reinstated in the

MILMA Products

Quality Awareness Program (File Photo)

governing structure of the KCMMF structure. The Federation of KCMMF and the three regional unions are governed by elected Chairpersons and a board of members. There are 3417 registered Anand Pattern Co-operative Societies in the state. Moreover, there are 10,64,400 registered dairy farmers under the Anand Pattern Co-operative Societies in Kerala. Their representations at the three federation levels result in the hegemony of dairy farmers in policy formulation of the dairy sector.

Milma's leadership can also be described as Gramsci's 'Modern Prince'. A modern prince acts as a group or association to realise the needs and desires of the people. Through co-operative societies, MILMA helps dairy farmers enhance both the quality and quantity of their milk while also assisting them in cultivating fodder at lower production costs. Along with reducing the cost of production, Milma advocates different ways to prevent antibiotic residues in milk. It also takes sufficient measures to mitigate the impact of dairy farming on climate change. Additionally, providing subsidies and incentives can offer financial support to dairy farmers throughout the dairy farming process.

According to the theories of Antonio Gramsci,

an organisation is a labour movement if it can influence policies and conquer markets with its growing membership and has a centre of power with a bureaucracy consisting of bureaucrats and technocrats. Similarly, the Kerala Co-operative Milk Marketing Federation is a labour movement. KCMMF can influence policies in the animal welfare and dairy sector by addressing the needs of its member dairy farmers.

Passive Revolution

In a world dominated by neo-liberal socio-political and economic practices, KCMMF and its three-tier dairy co-operative structure could be termed islands, where Gramscian thoughts are put into practice. At a time when balance sheets decide the fate of PSUs in India, KCMMF still distributes its profits among member farmers, only earmarking a minute share for its day-to-day activities.

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