DEPARTMENT OF AGRICULTURE DEVELOPMENT
& FARMERS' WELFARE, GOVERNMENT OF KERALA

FARM INFORMATION BUREAU

KERALA KARSHAKAN

E-JOURNAL

THE FIRST ENGLISH FARM JOURNAL FROM THE HOUSE OF KERALA KARSHAKAN

AUGUST 2025
VOLUME 13 ISSUE 03

Nurturing Innovations in Dairy Sector

THE YOUTH SAGA

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THE FIRST ENGLISH FARM JOURNAL FROM THE HOUSE OF KERALA KARSHAKAN

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Rooted in Knowledge, Growing with Innovation

As Kerala's agriculture enters a new chapter of transformation, the emphasis is increasingly on blending scientific understanding with traditional wisdom. The August 2025 issue of Kerala Karshakan e-Journal captures this evolving narrative through a collection of insightful contributions that celebrate innovation, sustainability, and indigenous strength.

The cover story features the dynamic efforts of students at the College of Dairy Science and Technology (CDST), Thiruvananthapuram, whose real-world engagement in dairy entrepreneurship reflects a promising future. Through their experiential learning programme, students take the lead in product development, branding, and sales under the brand "K-Lait." Their achievements in making functional dairy products like yogurt, payasam, and probiotic ice cream serve as a model of youth-led agribusiness and practical education.

Complementing this is a thoughtful exploration into the Geographical Indication (GI) tagged coffee varieties of India, including Kerala's Wayanad Robusta. GI tagging not only protects the regional identity and uniqueness of these coffees but also elevates their global recognition and market value. It ensures that farmers benefit from their traditional cultivation methods while reinforcing the distinct character of India's specialty coffees.

A scientific perspective on potassium-solubilizing microorganisms highlights their emerging role in sustainable soil management. These microbial mobilizers help unlock bound potassium in the soil, enhance nutrient uptake, boost plant immunity, and reduce dependence on chemical fertilizers. As potassium is crucial yet often overlooked, these innovations mark an important step toward restoring soil health and building resilient crops.

The issue also presents a compelling case for the use of Brahmi (Centella asiatica) as a live mulch in arecanut gardens. Its creeping habit suppresses weeds, conserves soil moisture, prevents erosion, and improves fertility—all while offering medicinal value. This eco-friendly practice aligns with the principles of low-input, regenerative agriculture and demonstrates how traditional herbs can find new relevance in modern cropping systems.

Further, the detailed article on sustainable yam cultivation underscores the importance of nutrient management, climate adaptation, and crop diversification. With growing consumer awareness around health and traditional food systems, yams—rich in fiber, minerals, and bioactive compounds—emerge as a powerful crop with both nutritional and economic significance. Techniques such as minisett propagation and organic input integration open new doors for inclusive and profitable cultivation.

These articles highlight a broad spectrum of agricultural development, spanning student-led innovation, eco-friendly soil practices, protection of crop heritage, and sustainable productivity enhancement. As editors, we believe these themes reflect the future of farming—not as isolated breakthroughs, but as interconnected pathways to knowledge-based, inclusive growth.

We invite our readers—whether farmers, researchers, or agri-enthusiasts—to explore, engage, and be inspired by the stories in this edition. Let us move forward with a shared vision for a resilient, innovative, and sustainable agricultural ecosystem.

Editor

Nurturing Innovation

The Entrepreneurial Spirit of Dairy Technology Students

The College of Dairy Science and Technology (CDST) at Thiruvananthapuram, Kerala, has become a fertile ground for cultivating not just skilled dairy professionals, but also a new generation of entrepreneurs. The students are increasingly demonstrating a proactive and innovative approach to the dairy sector, moving beyond traditional employment to establish their own ventures.

The college functioning under the Kerala Veterinary and Animal Sciences University was

Students prepared around fifteen products for sale, which inluded

- Yogurt
- Pinni (a traditional Indian sweet)
- Gulab Jamun
- Ghee Cookies
- Sambharam (spiced buttermilk)
- Carrot Halwa
- Payasam (a South Indian dessert)
- Butter Bun
- Paneer
- Energy Bar

established in the year 2015. Initially it was started in the Keltron campus at Karakulam, and currently functions at the building of the BSNL Regional Telecom Training Centre at Kaimanam. Around 130 students have graduated from here with a B.Tech degree in Dairy Technology till 2025. These graduates have secured employment in the Department of Dairy Development, MILMA (Kerala Cooperative Milk Marketing Federation), MNC's, food safety department, private dairies, banks, and various other government and non-government institutions. Some have pursued higher education, while others have obtained jobs abroad.

At present, the college has 22 seats. Admissions are conducted through KEAM (Kerala Engineering Architecture Medical entrance exam). The four-year technical degree course includes three years of classroom learning and one year of training. It comprises a total of eight semesters. CDST's academic programs, which blend dairy science, technology, and management, equip students with a holistic understanding of the industry, from production and processing to marketing and business management. In the seventh semester, students undergo an experiential learning program (ELP), followed by Extension Training Program, Industrial Training at Dairy plants and Farms during the eighth semester. The ELP is designed to equip students with the skills and experience necessary to become entrepreneurs in the dairy sector.

In the Experiential Learning Programme (ELP), students put into practice what they have learned in both theory and practical sessions. During this phase, they are actively involved in the production and marketing of various dairy products. As part of the course, students obtain Food Safety and Standards Authority of India (FSSAI) registration, after which they are divided into two groups and provided with seed money to start a business venture. A faculty member is appointed as the course coordinator to oversee the program. Dedicated faculty members play a crucial role in mentoring students, encouraging them to think innovatively and explore entrepreneurial avenues.

Students propose plans for innovative dairy products, which are then produced under the supervision of the faculty and marketed with attractive packaging and labelling. These products are sold through stalls at various institutions, Government offices, bakeries, and marketing fairs. The students gain hands-on experience in all technical aspects of running a business. They also learn to analyze production costs, profits, and commissions. After repaying the seed money and a 7% of profit share to the college, any remaining profit is distributed among the students.

This product development and marketing initiative of CDST is broadly known by the title "Vaibhavam" with a synonym 'Value addition in benefit of health through valorous avatars of milk'. Currently, the 2021 batch students are carrying out the ELP. Each year, the brand name under Vaibhavam changes. This time, the chosen brand name is "K-Lait" with a tagline "Lite. Bite. Bright"— where "K" stands for Kerala, and "Lait" is the French word for milk.■

Yogurt

The Soul of Dairy, The Science of Tomorrow

ABHIRAMI S P

If you step into a Dairy Product Fermentation Unit, you'll find the gentle hum of incubators, the tangy aroma of fermentation, and rows of gleaming cups—each holding a miracle we often take for granted - Yogurt. As a dairy technology student, I don't just see yogurt as food; I see it as a living product, born from science, nurtured by tradition, and perfected through precision. A product that balances microbiology, nutrition, technology, and a pinch of cultural emotion in every spoon. Behind its simple texture lies a deep process: the harmony of Lactobacillus and Streptococcus, transforming plain milk into a creamy powerhouse of probiotics, proteins, and purity. Yogurt isn't just sustaining bodies—it's shaping industries. As the

demand for functional foods grows, yogurt is evolving as:

- Low-fat, high-protein Greek styles
- Exotic fruit-blended delights and
- Drinkable probiotic shots

As we move towards cleaner eating and sustainable choices, yogurt also ticks the right boxes. It's a low-waste, environmentally conscious food that supports rural economies and small-scale farmers. In a world that's constantly reinventing wellness, yogurt remains refreshingly simple. It doesn't need a fancy label or a celebrity endorsement to prove its worth. It just needs to be tasted, remembered, and respected for the centuries of nourishment it has offered. yogurt isn't just fermented milk. It's memory, medicine, and modern marvel, all in one. As I look ahead to a future in dairy science, I carry a simple truth:

'In every spoon of yogurt, there's a story of science, sustainability, and silent strength'.

Ingredients

Milk - 2 liters

Sugar - 200 g (10%)

Skimmed milk powder - 40g (2%)

Probiotic culture - 0.8 g DVS Culture

Mango flavor - 10 milliliters

Preparation

Set the incubator to 42 degrees. Heat the milk in a thick-bottomed vessel. Monitor the temperature of the milk using a thermometer. When it reaches 60 degrees, add skimmed milk powder and sugar and mix well. Hold this mixture at 90 degrees for 10 minutes. Flame off and when the temperature drops to 600 C add flavour if required. Then cool it to 48 degrees and add the probiotic culture and mix and pack the content of required quantity in the respective packages at 45 to 44o C. Incubate these in a 42-degree incubator for 4 h. After incubation store it in the refrigerated condition. It can be stored for a period of one week.

Cost Component	Amount (Rs.)
Material Cost	145.60
Labour Cost	20
Utility Cost	20
Packaging and Labelling Cost	200
Total Cost	385.60

Quantity produced per batch = 2000g

Quantity per tub = 100 g

Number of tubs made per batch = 20 tubs

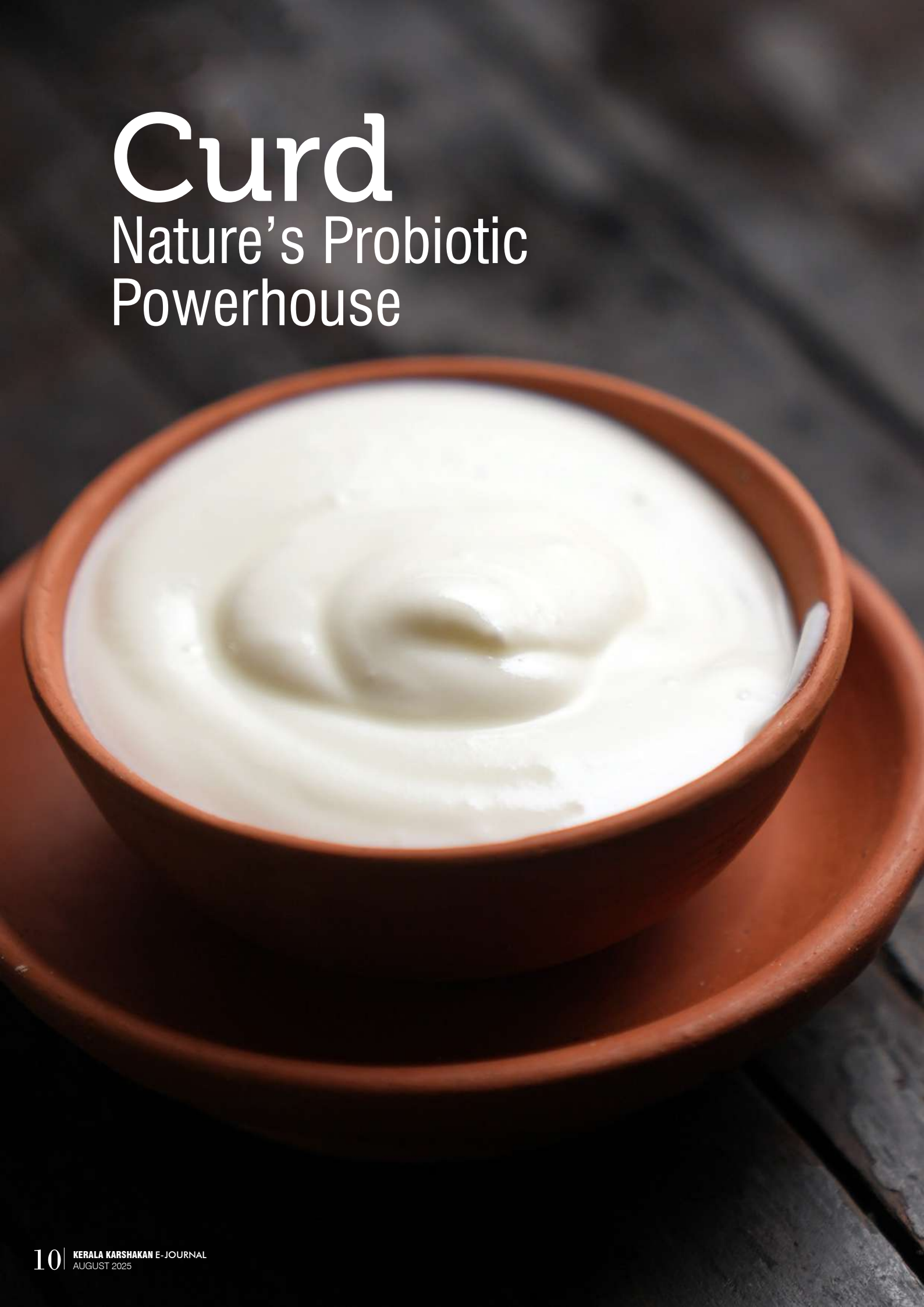
Selling price per tub = 35/-

Total cost of production = 385.60/-

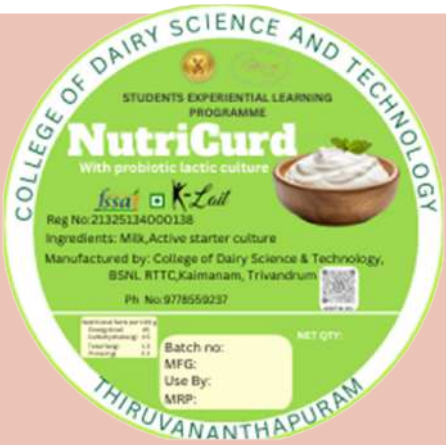
Total Selling Price = 700/-

Profit = 314.40/-

Curd
Nature's Probiotic Powerhouse



ASHNA S KUMAR



Curd, commonly referred to as dahi in India, is a widely consumed dairy product. Beyond its role as a nutritious food, curd carries deep cultural and traditional significance. Prepared through the natural fermentation of milk using beneficial bacteria, it offers a host of health advantages and holds an important place in both culinary practices and religious rituals.

Curd is a highly nutritious dairy product packed with health benefits. It is rich in proteins, calcium, vitamin B12, and probiotics that support digestion and strengthen bones and teeth. The presence of good bacteria in curd helps maintain gut health, boosts immunity, and prevents digestive disorders. Regular consumption of curd can improve skin health, reduce inflammation, and aid in weight management. Its cooling properties also make it a great addition to the diet during hot weather.

Cost Component	Amount (Rs.)
Material Cost	54
Labour Cost	2
Utility Cost	10
Packaging and Labelling Cost	30
Total Cost	96

Ingredients

Milk - 2 liters

Culture – 20ml

Technology of Curd Making

The process involves a few key steps:

1. Milk Selection: Cow or buffalo milk is used. It must be clean and fresh.

2. Heating: Milk is heated to about 85–90°C to kill germs and improve texture.

3. Cooling: The milk is then cooled to around 40–45°C, ideal for fermentation.

4. Adding Starter Culture: A small amount of curd (containing Lactobacillus and Streptococcus bacteria) is added to the milk.

5. Incubation: The mixture is kept undisturbed at a warm temperature for 4–6 hours, allowing the milk to turn into curd.

6. Cooling and Storage: Once set, the curd is cooled and stored in the refrigerator to prevent over-fermentation.

In commercial production, curd is also packaged hygienically for sale.

Quantity produced per batch = 2000g

Quantity per tub = 500g

Number of tubs made per batch = 4 tubs

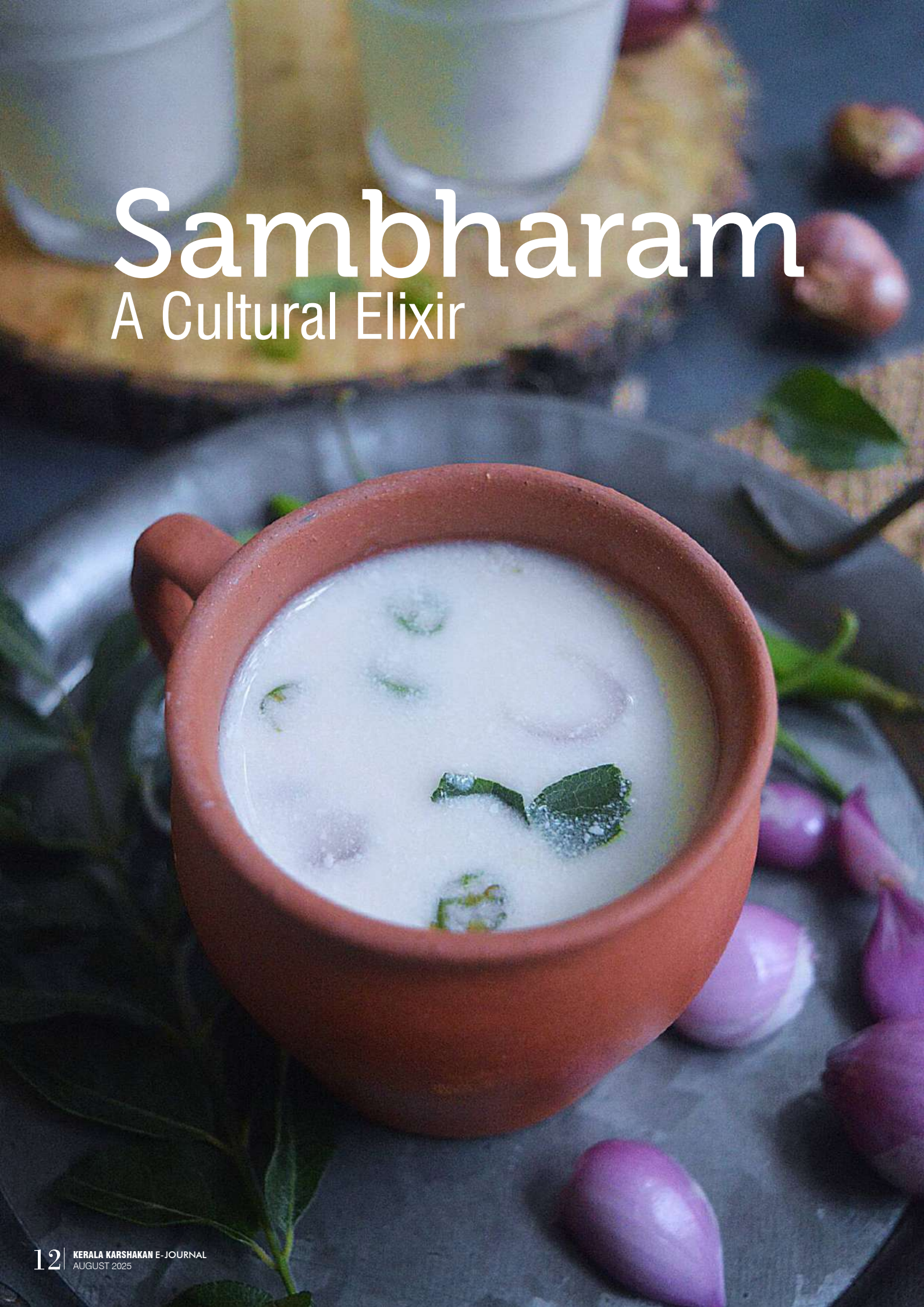
Selling price per tub = 40/-

Total cost of production = 96/-

Total Selling Cost = 160/-

Profit = 64/-

Sambharam
A Cultural Elixir



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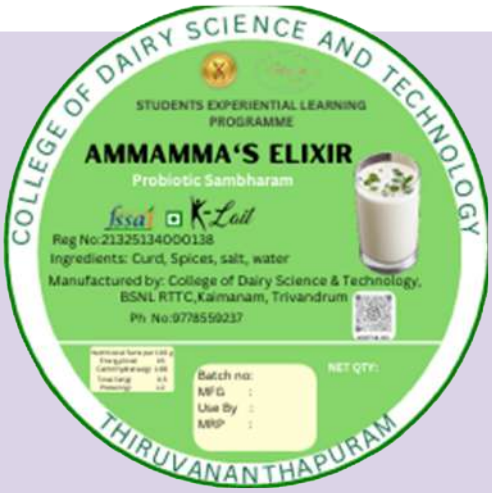


Sambharam, spiced buttermilk drink of Kerala, is more than just a refreshing beverage; it's a cultural icon deeply embedded in the region's culinary traditions and lifestyle. Sambharam is an integral part of the Kerala sadhya, a grand vegetarian feast served during festivals and special occasions. It's traditionally served as the last course, often alongside rice, and is believed to aid digestion after a heavy meal. The spiced buttermilk is also a common sight in homes throughout Kerala, where it's a go-to drink to beat the heat and quench thirst.

The Health Benefits:

Sambharam's popularity isn't solely due to its taste. The drink is naturally fermented, making it a rich source of probiotics, beneficial bacteria that promote gut health. This probiotic content, combined with the cooling effect makes sambharam a healthy and refreshing choice, particularly during the hot and humid Kerala summers. The addition of spices like ginger, curry leaves, and green chilies not only enhances the flavor but also adds to its digestive and medicinal properties.

Ingredients

Curd - 5L

Green chili - 100g

Ginger - 100g

Curry leaves - 10g

Water - 2.5L

Salt -150 g

Cost Component	Amount(Rs.)
Material Cost	250
Labour Cost	5
Utility Cost	10
Packaging and Labelling Cost	111
Total Cost	376

How to prepare

Grind the ginger, green chili, and curry leaves in a mixer. Add it to the curd and mix well. You can add water and salt to this and mix well. It can be stored for 2 to 3 days under refrigerated condition.

Total Cost = 376/-

Number of Packets = 37

Quantity of Product per packet= 200 ml

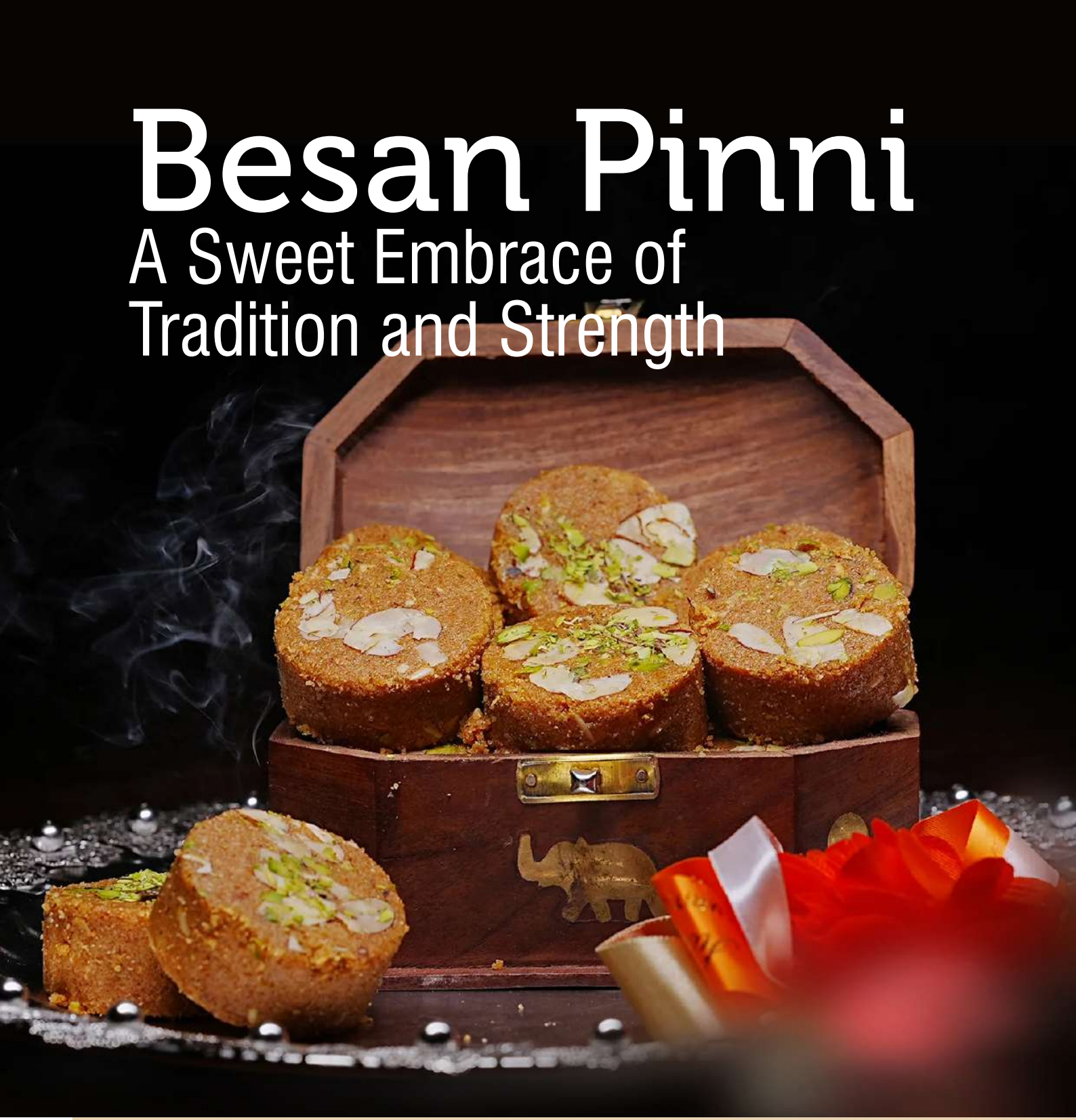
Selling price per packet= 15/-

Total Selling Price=555/-

Profit = 179/-

Besan Pinni

A Sweet Embrace of Tradition and Strength



DEVIKA S JANAKI

In the tapestry of Indian traditional sweets, besan pinni holds a cherished place woven with warmth, nourishment, and centuries of cultural wisdom. Made from roasted gram flour, ghee, and sugar, and often studded with dry fruits, besan pinni is not merely a dessert; it is a celebration of home, heritage, and the subtle art of slow cooking.

Rooted in the culinary traditions of North India, especially Punjab, besan pinni was historically prepared during the winter months for its energy-giving and warming properties. Each bite carries the memory of family kitchens

filled with the aroma of roasted besan and bubbling ghee, often made in large batches to last the season. It was even carried to Indian soldiers during the Second World War as a token of love from their homeland, nourishing both body and spirit. Its rich texture and deep flavors are a testament to the harmonious blend of simple ingredients and thoughtful preparation, with dairy particularly ghee playing a central role in defining its taste, aroma, and longevity. As a Dairy Technology student, exploring besan pinni is not just about savoring its sweetness, but appreciating the silent science and tradition that makes it so enduring.

Ingredients

Besan Pinni is made with a handful of natural ingredients that deliver both taste and energy:

Besan (Gram Flour) – A rich source of protein and dietary fibre.

Wheat Flour (Atta) – Provides carbohydrates and body to the pinni.

Ghee – It lends moisture, richness and digestibility.

Sugar – Provides balanced sweetness households.

Nuts – Almonds or cashews for crunch and added nutrition.

Besan 120g
Wheat flour 240g
Ghee 100g
Sugar 140g
Nuts 20g

Preparation – A Gentle, Skillful Process

1. Roasting the Besan: In a heavy-bottomed pan, besan is first dry roasted on low to medium heat. This step is crucial as it removes rawness and develops a nutty aroma.

2. Adding Wheat Flour: After the besan turns aromatic and slightly golden, wheat flour is added. The two flours are roasted together until a rich brownish hue develops.

3. Incorporating Ghee: Warm ghee is added slowly, and the mixture is stirred continuously.

Cost Component	Amount (Rs.)
Material Cost	124.12
Labour Cost	10
Utility Cost	20
Packaging and Labelling Cost	22.8
Total Cost	176.92

At this stage, stir continuously to break down lumps, giving the mixture a fine, granulated texture.

4. Adding Sugar: Once the flour mixture is evenly roasted and lump-free, sugar is added and stirred to mix thoroughly.

5. Cooling the Mixture: The pan is removed from heat and the mix is allowed to cool to room temperature (around 30°C).

6. Garnishing with Nuts: Chopped nuts are added into the mix.

7. Shaping the Pinni: The cooled mixture is hand-moulded into small balls, with a smooth yet firm texture.

Economical, Healthy & Heart made with ingredients found in every Indian kitchen, Besan Pinni is cost-effective, nutritious, and deeply satisfying. Pinni has a shelf life of 5 days at room temperature.

Why Besan Pinni Matters More Than Ever?

In an age of fast food and artificial sweets, Besan Pinni reconnects us with slow, meaningful eating. It is rich in proteins, free from preservatives, and full of love, each ball a tribute to generations of culinary wisdom. So when you seek sweetness that feeds both body and soul, choose Besan Pinni the sweet that stays true to its roots.

Quantity produced per batch = 600g

Quantity per box = 100 g

Number of tubs made per batch = 6box

Selling price per tub = 45/-

Total cost of production = 176.92/-

Total Selling Cost = 270/-

Profit = 93.08/-

Probiotic Ice Cream

A Healthy Twist to a Frozen Favorite

SAJITH S

Probiotic ice cream is a functional dairy dessert that combines the refreshing taste of traditional ice cream with the health benefits of probiotics. Enriched with live beneficial bacteria such as Lacticaseibacillus casei, Lactobacillus acidophilus or Bifidobacterium spp, this innovative product supports gut health,

Cost Component	Amount (Rs.)
Material Cost	396
Labour Cost	20
Utility Cost	20
Packaging and Labelling Cost	60
Total Cost	496

boosts immunity, and adds nutritional value. It is one of the best carriers of probiotic bacteria and it can ensure gut health at early stage. It offers a delicious way to enjoy wellness, making it especially popular among health-conscious consumers and those seeking digestive support.

Ingredients

Milk - 2 L

Fresh Cream - 500 mL

SMP (Skim Milk Powder) - 175 g

Sugar - 700 g

Stabilizer + Emulsifier mix - 10 g

LA-5 Culture (Probiotic) - 1.5 g

Vanilla Essence - 10 ml

Mode of preparation Ice Cream Mix Preparation

- Boil 2 litres of milk.
- At 45°C, add 500 ml fresh cream and mix thoroughly.
- At 60°C add 175gm SMP slowly while stirring – avoid lumps. Then add 700gm sugar and mix the sugar - SMP mix well.
- At 70°C add 10 gm of stabilizer mix and stir until dissolved.
- Heat the mixture to 85°C and hold for 15 minutes (pasteurization). Then cool quickly to 4°C.

Ageing the Mix

Keep the cooled mix in a refrigerator at 4°C for 12-16 hours. This improves texture and flavor development.

Add Probiotic Culture & Flavor

- After aging, add:
- LA-5 (Lactobacillus acidophilus) probiotic culture (1.5g) at 4°C–6°C. Then add 10 ml vanilla essence and stir gently.

Freezing and Air Incorporation

- Pour the mix into a batch freezer.

•Freeze for 20–30 minutes.

•Air is whipped into the mix (called overrun) to make it light and fluffy.

Final Output

- You get approximately 4 litres of probiotic vanilla ice cream.
- After freezing, pack into containers and store at -18°C or below.

Qty produced per batch = 4 L

Qty per tub = 1000 ml

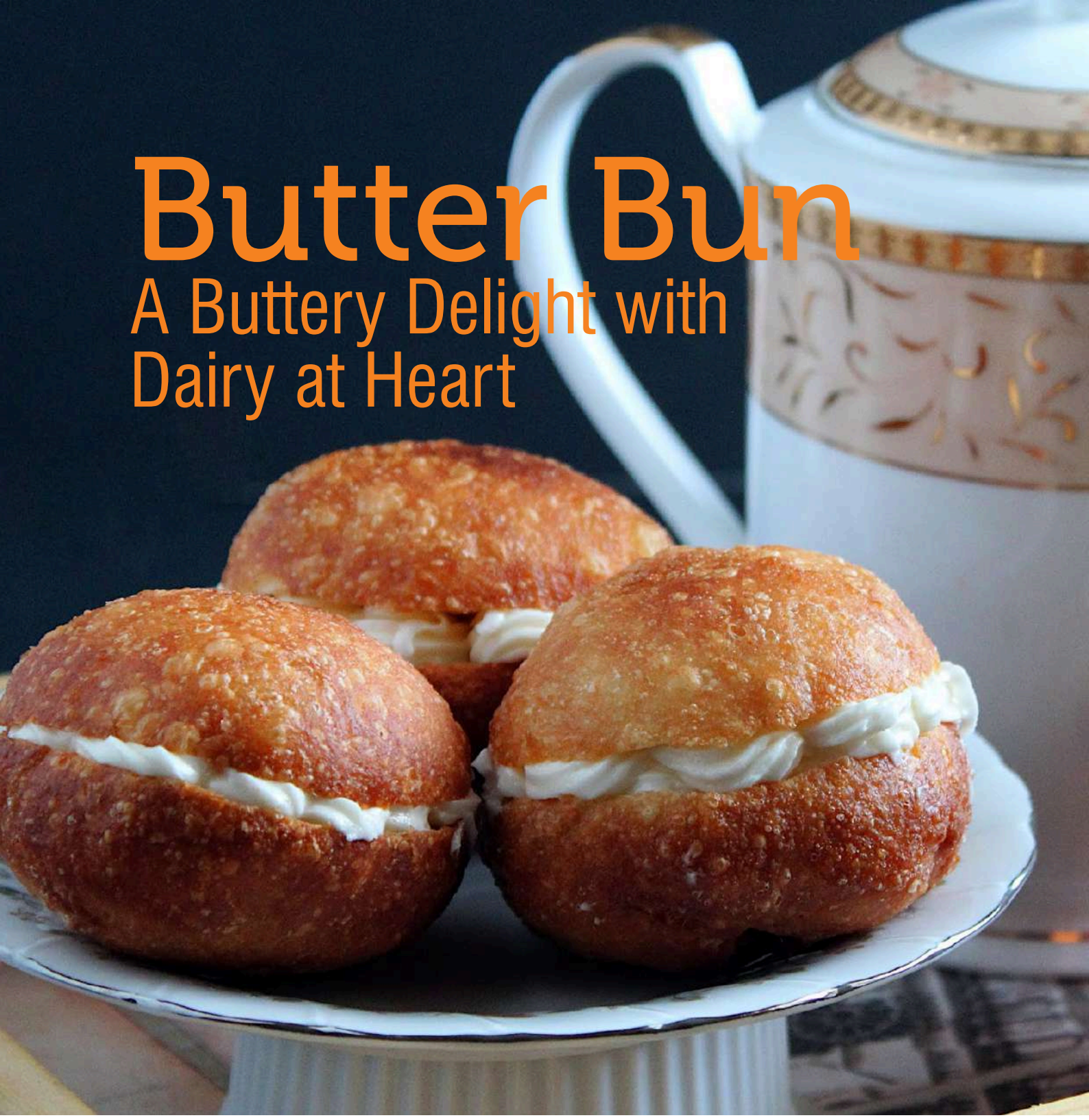
No. Of tubs = 4 tubs

Selling price per tub= 225

Total cost of Production =496

Total selling price = 900

Profit = 404/-



Butter Bun

A Buttery Delight with Dairy at Heart

AKSHITHA V ANTONY

When we think of comfort snacks, few can rival the soft, slightly sweet, and rich flavor of a butter bun. For a Dairy Technology student like me, a butter bun isn't just a tea-time treat—it's a perfect blend of science and tradition, where dairy takes the center stage. This humble bakery product reflects how dairy ingredients, particularly butter, can enhance both texture and taste.

What is a Butter Bun?

A butter bun is a soft bread roll, often enriched with butter, milk, and

Cost component	Amount (Rs)
Material cost	40.50
Utility cost	10
Labour cost	25
Packaging & Labelling cost	20
Total cost	95.50

sugar, making it tender, rich, and flavourful. In many parts of India, it's a popular bakery item, typically enjoyed with a cup of chai or coffee.

The Role of Dairy in Butter Buns

1. Butter – The hero of the bun! Butter not only adds a creamy richness but also contributes to the bun's soft crumb and appealing aroma. It acts as a tenderizer by coating gluten strands and preventing excessive toughness.

2. Milk – Often used in the dough, milk enhances the nutritional value and improves crust colour due to the Maillard reaction during baking. It also helps in softening the texture.

3. Milk Powder (optional) – Adds richness and improves browning, often used in commercial recipes.

Dairy Technology Perspective: From a technical angle, the butter used in buns must be of high-quality—with standardized fat content (80% milk fat) and low moisture. Its consistency at room temperature is vital for uniform mixing. Similarly, pasteurized milk ensures microbial safety and provides consistent results during dough formation.

Ingredients

Maida – 300 g

Sugar – 40 g

Salt – 2.5 g

Whole egg – 30 g (1 No)

Instant yeast – 3g

Milk – 100 ml

Unsalted butter – 65 g

Water – 70 ml(+/-)

Method of Preparation

- Sieve maida, sugar and salt together.
- Add water, milk, egg, yeast and butter into the flour and knead to a smooth dough.
- Proof the dough at room temperature for 60 min, until the dough doubles in size.
- Divide the dough into 12 portions, about 50g for each portions.
- Roll each portions into smooth balls and rest for 15 mins.
- Cut the butter into 12 cubes, about 5g for each portion.
- Make an incision in the centre of each buns and press a cube of butter inside it.
- Second proof the dough at room temperature for 60 mins.
- Egg wash and sprinkle sugar on top of each buns.
- Bake the buns in a preheated oven at 180°C / 350°F for 15-17 minutes

While butter buns are delicious, they are also energy-dense due to the fat and carbohydrate content. Using low-fat dairy alternatives or fortified butter can make it slightly healthier while retaining taste. This has a shelf life of 2 days at room temperature.

The butter bun may seem like a simple snack, but behind its soft layers lies the intricate contribution of dairy science. As a Dairy Technology student, I see it not just as food, but as a representation of how dairy adds value, flavour, and function to our everyday lives. Whether it's your morning chai or an evening craving, the butter bun remains a delicious testament to the wonders of dairy.

No. of buns - 12

No. of packets = 6 pkt

Selling price per packet= 35/-

Total cost of Production – 95.50/-

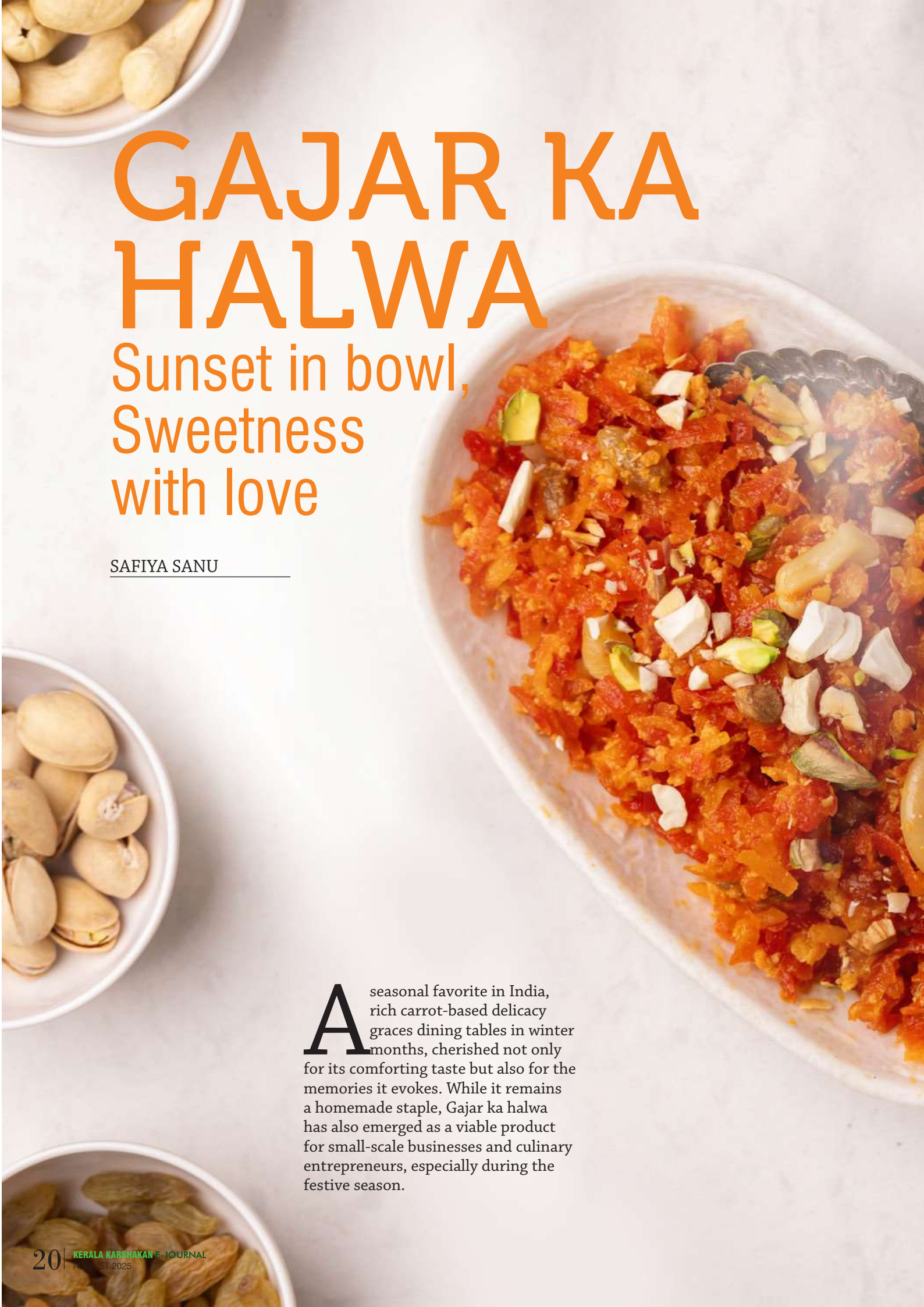
Total selling price = 210/-

Profit =114.50/-

GAJAR KA HALWA

Sunset in bowl, Sweetness with love

SAFIYA SANU



A seasonal favorite in India, rich carrot-based delicacy graces dining tables in winter months, cherished not only for its comforting taste but also for the memories it evokes. While it remains a homemade staple, Gajar ka halwa has also emerged as a viable product for small-scale businesses and culinary entrepreneurs, especially during the festive season.

Gajar ka halwa, also known as Gajorer halwa , gajrela or carrot pudding , is a sweet Indian dessert made with grated carrots, water, milk, sugar, and cardamom and ghee. It is often served with a garnish of almonds and pistachios and generally served hot during winter. It has a medium shelf life, low fat content, vegetarian characteristics, ease of making, and rich taste.

Ingredients

Carrot - 1kg

Milk - 1litre

Sugar - 400g

Ghee - 70g

Condensed milk - 30g

Nuts - 20g

Method of preparation

- Heat ghee in a heavy-bottomed vessel.
- Roast the cashew nuts in it and set aside.
- Then fry the grated carrots in ghee for 10 minutes. Add milk to it, cover and cook for 20 minutes.
- After that, add sugar and condensed milk and stir well until the mixture thickens and comes away from the vessel.
- Then, garnish with the roasted cashew nuts that were set aside earlier.

Cost component	Amount (Rs)
Material cost	222.32
Utility cost	5
Labour cost	5
Packaging & Labelling cost	50
Total cost	282.32

Quantity produced per batch = 1000g

Quantity per box = 100 g

Number of tubs made per batch = 10box

Selling price per tub = 60/-

Total cost of production = 282.32/-

Total Selling Cost = 600/-

Profit = 317.68/-

Gulab Jamun

INDRA S

Gulab jamun is a milk-based sweet popular in India. The traditional method of preparation involves blending of khoa, refined wheat flour and baking powder to a homogeneous mass to obtain a smooth dough along with small amounts of water. The balls of dough are deep-fat fried in ghee or refined vegetable oil to a golden brown colour and subsequently transferred to sugar syrup. The sweet is round or oval in shape and dark brown in colour, and served with or without sugar syrup.

Ingredients

Khoa - 750g

Refined wheat flour - 250g

Baking powder - 5g

For sugar syrup:

Sugar - 2kg

Water - 1litre

Preparation

- For making khoa take 5 litres of milk in a khoa vat, and condense it to a smooth homogenous mass having a moisture of 40 to 45%. 5 litres of milk yields approximately 1 kg of khoa
- The khoa used in the preparation of gulab jamun (Dhap variety) should have a moisture content of 40-45%
- Take 750g of prepared khoa and knead it along with 250g of refined wheat flour and 5g of baking powder to make a smooth dough. Use water if required, for kneading
- Roll the dough into smooth balls of 7g weight. 1kg dough gives approximately 100 gulab jamun balls of 7g
- Deep fry these balls in hot vegetable oil at 140 to a brown colour
- Put these balls in concentrated sugar syrup to get soaked
- Sugar solution can be prepared by boiling 2 kg of sugar in 1 litre of water (For 100 balls). Cardamom can be added in sugar syrup for flavour.
- Pack the gulab jamun balls along with sugar syrup

The shelf life of gulab jamun typically ranges from 5 to 7 days at room temperature in an airtight container and refrigeration can extend this to 10 to 20 days.

Cost component	Amount (Rs)
Material cost	374
Utility cost	20
Labour cost	20
Packaging & Labelling cost	132
Total cost	546

No. of boxes = 33 (each contains 3 balls)

Selling price = 1320/-

Profit = 774/-

CUP CAKE

SANJANA S S

Imagine sinking your teeth into a tender, fluffy cupcake that simply melts in your mouth. The delicate crumbs dissolve effortlessly, releasing a burst of flavour. Vanilla cupcakes offer a delicate sweetness and velvety texture, with a gentle, creamy flavour that coats your palate as it melts. Chocolate cupcakes, on the other hand, are rich and indulgent, with deep, dark chocolate flavour that melts like a warm hug, leaving a satisfying aftertaste. Whether vanilla's subtlety or chocolate's decadence, both are sublime, with a tender crumb that disintegrates in your mouth, leaving you smitten

VANILLA CUPCAKE INGREDIENTS

Maida -95 g

Sugar-65 g

Egg-2 nos.

Vanilla essence-5 ml

COST COMPONENT	AMOUNT[Rs.]
Material cost	44.30
Utility cost	10
Labour cost	5
Packaging and labelling cost	5
Total cost	64.30

Total cost - 64.30/-

No. of cupcakes - 9

Selling price -90/-

Profit – 25.70/-

Vegetable oil-15 ml

Milk-60 ml

Baking powder-3 g

PREPARATION

- Beat the eggs in a large mixing bowl until they're light and fluffy.
- Add vanilla essence to the beaten eggs and mix well.
- Gradually add sugar to the egg mixture and beat well until fully incorporated.
- Add dry ingredients to the mixture and gently mix well with a spatula.
- Add oil and milk to the mixture and mix well until fully incorporated.
- Pour the batter into cupcake moulds or liners.
- Bake in a preheated oven at 180°C for 20 minutes or until a toothpick inserted comes out clean.

Ghee Cookies

A Melt-in-Your-Mouth Legacy

ROSHNY RAMESH

Quantity produced per batch = 600g

Quantity per box = 200 g

Number of box made per batch = 3box

Selling price per box = 120/-

Total cost of production = 178.57/-

Total Selling Cost = 360/-

Profit = 181.43/-

Cost component	Amount (Rs.)
Material cost	108.57/-
Utility cost	20/-
Labour cost	20/-
Packaging & Labelling cost	30/-
Total cost	178.57/-

Ghee biscuits also known as ghee cookies are very popular in the southern part of India. It is light yellow in colour, round in shape, and melts in the mouth easily. It is an alternative to the very popular sweet, Nankhatai. Unlike traditional butter, ghee is lactose and casein-free, making these cookies often more digestible and allowing the pure, caramelized butter notes to truly shine.

Is there any health benefits?

Beyond its unparalleled flavour, pure ghee is a source of essential fat-soluble vitamins (A, D, E, K) vital for overall well-being, and boosts butyrate, a short-chain fatty acid known for supporting gut health. For those with lactose sensitivities, the clarified nature of ghee makes these cookies a more accessible indulgence.

INGREDIENTS

All-purpose flour (Maida) 300 g

Ghee (Melted) 200 ml

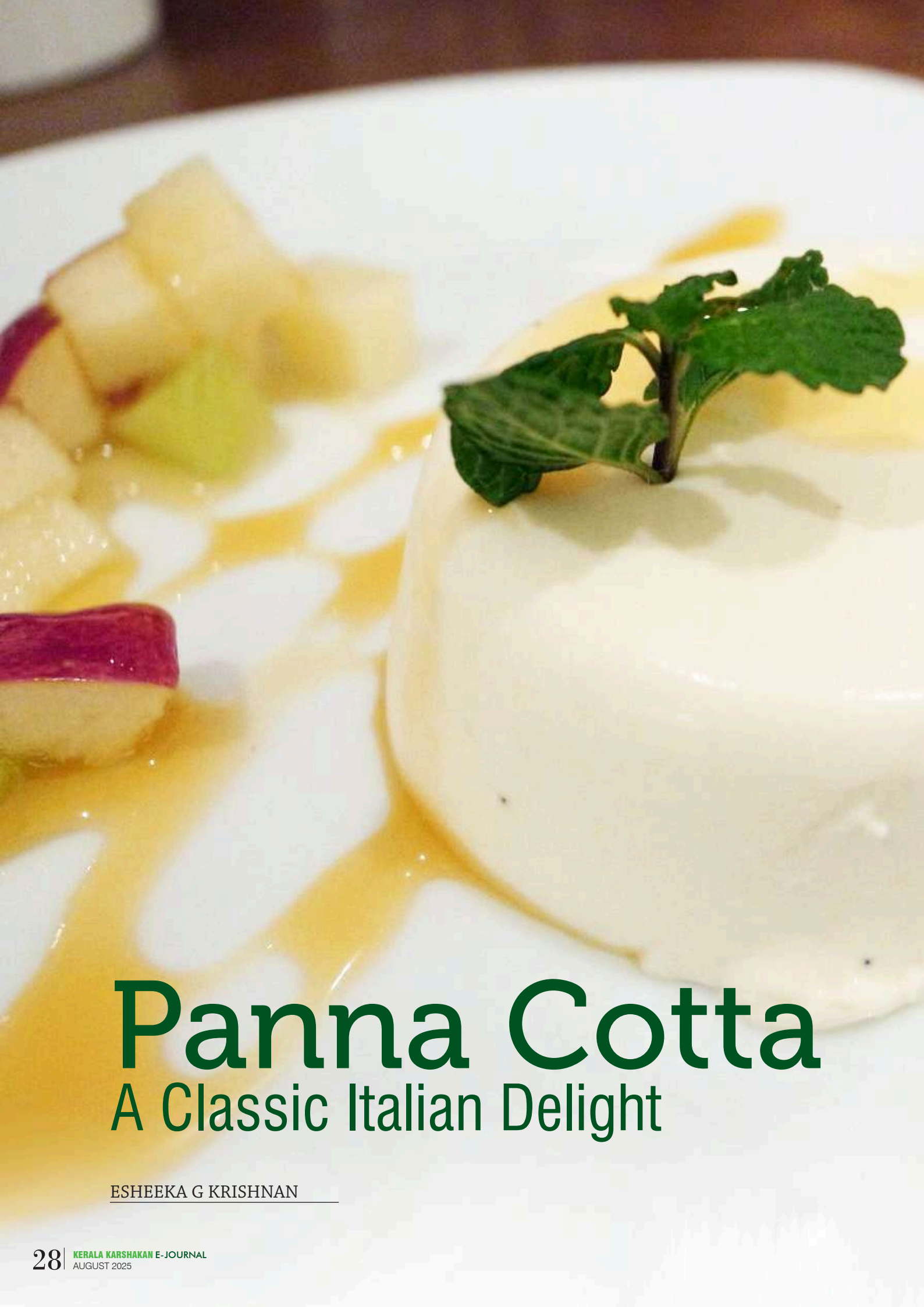
Sugar (Powdered) 180g

PREPARATION

- Preheat oven to approximately 170-180°C (340-350°F). Line a baking tray with parchment paper or a silicone mat.
- Creaming Ghee and Sugar by mixing room-temperature ghee and powdered sugar using a whisk or an electric hand mixer until the mixture becomes light, fluffy, and pale in color.
- Combine the dry ingredient (Maida) to the creamed ghee and sugar mixture
- Forming the Dough by gently mixing and pressing the mixture with your hands.
- Shaping the Cookies by taking small portions of the dough (about 20g each) and gently roll them between your palms into smooth, crack-free balls. Lightly flatten each ball with your palm or by pressing it against the baking tray.
- Bake it for 20 minutes at 150°C.Then cooling and storing at room temperature

Packaging & Storage

Ghee Cookies are packed in a polypropylene box and sachet. Each box contains 10 no.of Ghee Cookies, which contribute to a minimum net weight of 200g and each sachet contains 3 no. of ghee cookies, contributing to a minimum net weight of 60g.



Panna Cotta

A Classic Italian Delight

ESHEEKA G KRISHNAN

Yield & Shelf Life

Number of cups – 16

Servings – 250 ml per cup

Quantity produced per batch – 4 L

Total production cost – 912.30 /-

Selling price – 70/-

Shelf life – 3 to 4 days under refrigerated condition

Delicate, creamy, and effortlessly elegant — Panna Cotta is a classic Italian dessert that has won hearts across the globe. Translating to "cooked cream" in Italian, panna cotta is the embodiment of simplicity and sophistication, requiring just a handful of ingredients to create a dessert that feels luxurious in every bite.

Ingredients

Milk – 2 L

Fresh cream – 2 L

Gelatin– 64 g

Cold Water – 320ml

Sugar – 400 g

Vanilla extract – 20 ml

Preparation of vanilla panna cotta

1. In a bowl whisk gelatin and water. Set aside for 10-15 minutes.

2. In a medium saucepan, heat the heavy cream, milk, and sugar over medium-low heat, until the sugar has dissolved (do not boil).

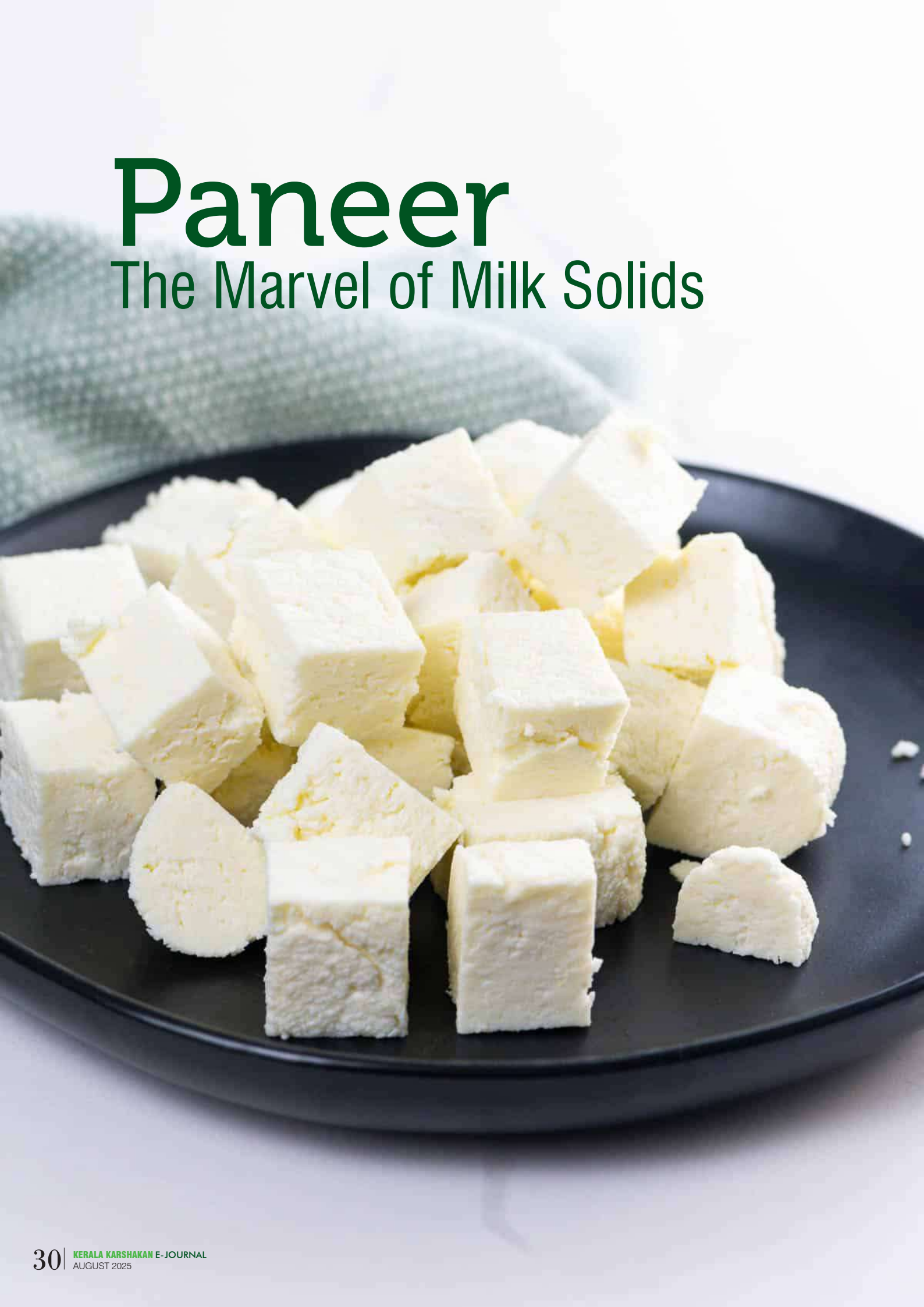
3. Remove from heat, add vanilla extract and stir. Stir in gelatin and immediately whisk until smooth and dissolved.

4. Set the glasses on an angle in a small container or a muffin tin. Pour the mixture. Refrigerate for at least 4 hours.

Raw material cost	Utility cost	Labour cost	Packaging and labeling cost	Total cost	Selling cost	Profit %
818.70	10	10	73.60	912.30	1120	25.4%

Paneer

The Marvel of Milk Solids



VISMAYA RAMESH S R

As a dairy technology student, my world revolves around milk. I see it not just as a beverage, but as a canvas for endless innovation. We talk about pasteurization, homogenization, UHT, and a dozen other processes that transform this humble liquid in to a dizzying array of products. But among them all, there is one that holds a special place in my heart, both for its simplicity and its incredible versatility - Paneer.

Paneer is also called as 'WHITE GOLD'. It is an acid coagulated, non melting, heat set cheese made by curdling milk with an acidic substance like lemon juice, vinegar or even citric acid. Sounds simple, right? The magic however, lies in the science of it all.

When you add an acid to hot milk, you are essentially disrupting the stability of the milk proteins, primarily casein. The casein in micelles, which are usually dispersed throughout the milk, begin to clump together, trapping the milk fat and a bit of the whey. This process of protein denaturation and aggregation is what forms into the soft, spongy paneer we all know and love.

Ingredients

Milk – 1L

Citric acid/ Glucono Delta Lactone – 2 to 3 tbs (1-2% w/v)

Preparation

- Heat milk to 90°C (preferably buffalo milk).
- Cool it down to 70°C and then add citric acid (1–2%, at 70°C) to coagulate
- Once coagulated, filter the curd using a muslin cloth
- Paneer is obtained
- Place the curd with weight on top (pressing) for about 30 minutes.
- After pressing, immerse it in cold water for 30 minutes.
- Then cut into pieces and package.

Shelf life

Paneer is a highly perishable product. It was reported that the freshness of Paneer remains intact only for 3 days at refrigeration temperature. At room temperature paneer does not keep good for more than one day. In order to increase the shelf life of paneer, additives, modification in Paneer manufacturing process, surface treatments and packaging Materials have been recommended.

Yield: A yield of around 21–23% with paneer containing 51–54% moisture can be obtained from buffalo milk, while yield from cow milk is about 17–18%.

Cost component	Amount (Rs)
Material cost	61.20/-
Utility cost	5/-
Labour cost	2/-
Packaging & Labelling cost	10/-
Total cost	78.20/-

1L Milk yields about 220g of paneer.

Quantity produced per batch = 200g

Quantity per packet = 200g

Number of packet made per batch = 1

Selling price per box = 120/-

Total cost of production = 78.20/-

Total Selling Price = 120/-

Profit =33.80/-

WE ARE IN NEWS

Dairy and Animal Husbandry Minister J. Chinchurani visits KVASU Students Stall at 'Ente Keralam' Expo

The "Ente Keralam" Expo was held at Kanakakunnu Palace, Thiruvananthapuram from May 17 to 23, 2025 as part of the State Government's fourth anniversary celebrations. The expo showcased the government's development and welfare initiatives, with various departments offering services to the public. The event also included trade fair stalls and a food fair. The 2021 batch of B. Tech (Dairy Technology) students of the College of Dairy Science and Technology, Thiruvananthapuram opened a stall at the fair as part of their Experiential Learning Programme for selling milk products. Smt. J. Chinchurani, Dairy and Animal Husbandry Minster visited the stall and encouraged the students in their entrepreneurial activity.

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THE HINDU

Making delicacies from milk

Megha Anoop
THIRUVANANTHAPURAM

Ever-tasted the sweet winter delicacy of Punjab called Pinni? Made with roasted wheat flour, sugar, ghee and nuts, the sweet can be sampled at the food stalls run by a bunch of college students in the city.

Other than Pinni, one can also try other value-added products made by the final-year BTech (Dairy Technology) students of the College of Dairy Science and Technology at Kaimanam, near Karamana, at these stalls. The products include yoghurt, curd, gulab jamun, payasam, marble cake, cup-cake, lassi, sambharam, butter buns, kulfi, paneer cutlets, sip-ups, carrot halwa, and ghee cookies.

The college, under Kerala Veterinary and Animal Sciences University (KVASU), encourages students to foster their entrepreneurial skills and apply their classroom learning to real-world production and sales through the university's flagship experiential learning programme, Vaibhavam.

The students learn vital skills needed to launch and run a food business through this programme.

In their seventh semester, the students receive seed funding to design, produce, and market the dairy-based products.

Final-year BTech (Dairy Technology) students of the College of Dairy Science and Technology making dairy-based products.

With guidance from faculty members Rejeesh R., Shyam Suraj S.R., and Rachana C.R., they handle every aspect of the business. The early weeks of the semester focus on product selection, branding, pricing and creating FSSAI (Foods Safety and Standards Authority of India)-compliant labels. With the guidance of their teachers, the students craft a business plan for their venture. The whole operation takes 70 days. After that they open the stalls.

K-LAIT

Every year, a new brand name is coined for the venture. This year, the class of 12 students has named their brand 'K-LAIT', combining K (for Kerala) and the French word for milk.

Pinni is a new addition to their product range and is in high demand.

"Earlier, we used to produce several fat-rich products," says Dr. Rejeesh. "But for the past two years, we are complying with the HFSS (high fat, sugar, and salt) mandate under the FSSAI which encourages reducing such ingredients while enhancing health benefits."

"We also receive pre-orders at the stalls," says Akshitha V. Antony, a student.

The stalls, the students say, are set up at various locations, including government offices, on the museum and zoo premises, and other colleges. A permanent stall is maintained at the BSNL Regional Telecom Training Centre (RTTC) at Kaimanam, where the college campus is located.

The students also participate in expos and events.

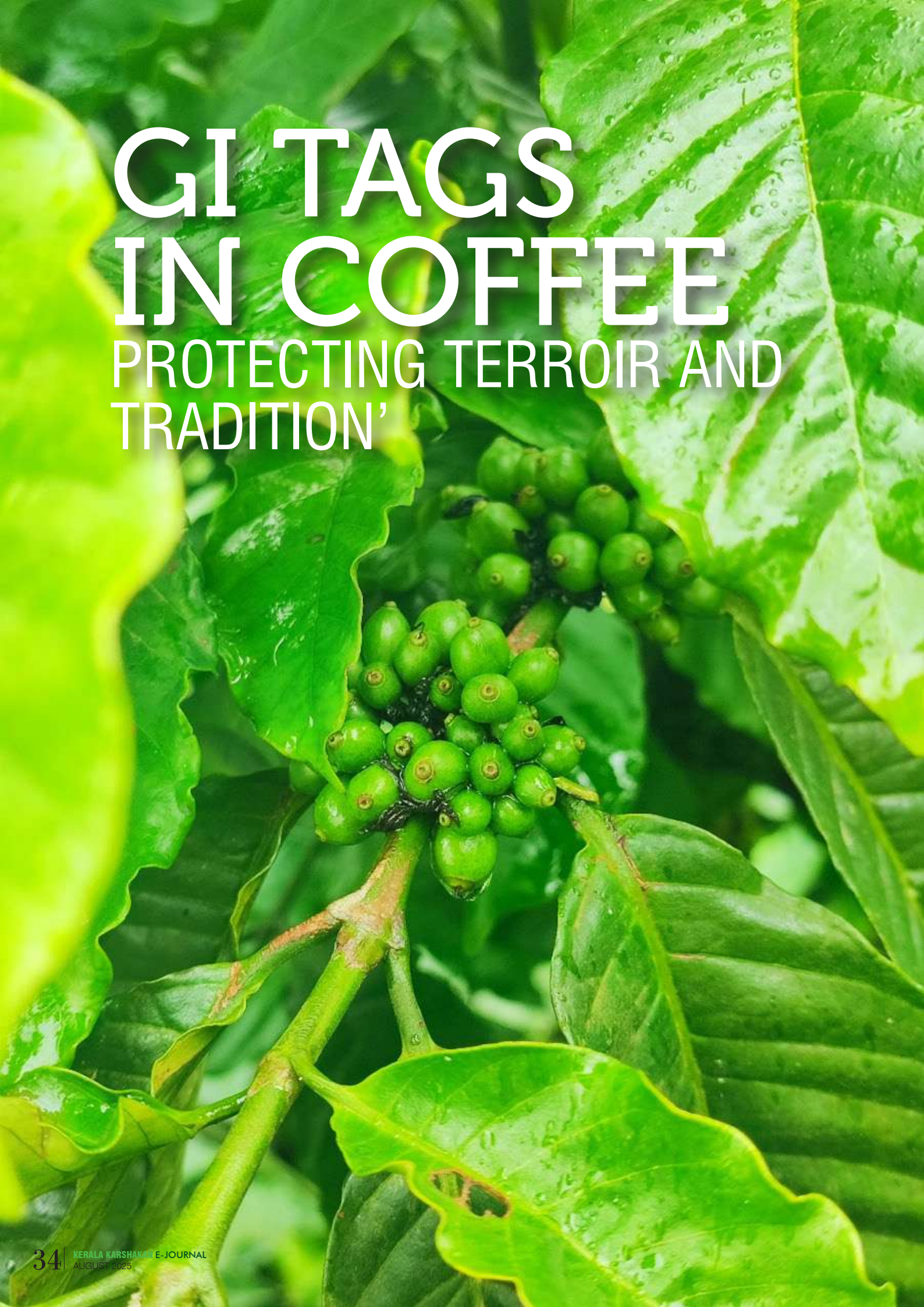
(The writer is an intern at *The Hindu* Bureau in Thiruvananthapuram)

HANDS-ON DAIRY ENTREPRENEURSHIP IN ACTION
2021 BATCH

HANDS ON TRAINING PROGRAM

GI TAGS IN COFFEE

PROTECTING TERROIR AND TRADITION'



RAKHI R, DEEPA S. NAIR, SARADA S

Coffee, also referred to as 'brown gold', occupies a prestigious position among beverage crops. India is the sixth largest producer of coffee in the world and Indian coffee is marketed as premium coffee worldwide. Some of the best coffee, is produced in India especially in the shaded areas of the Western and Eastern Ghats, which are ideal for growing coffee. Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Arunachal Pradesh, Assam, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Sikkim, Tripura, and West Bengal are currently the states that cultivate coffee.

cultivars have a stronger flavour, a grainier texture and more caffeine. India's diverse landscapes and varied topography produce a range of coffee profiles that are distinct in aroma, flavour and quality. Geographical indication tags can be used to preserve these distinctive specialty goods.

Geographical Indications (GI) are unique Intellectual Property Rights and are used on products that have a specific geographical origin and possess qualities, reputation, or characteristics that are essentially attributable to that origin. Geographical Indication tag protects the traditional products from being imitated or misused. The GI tags were granted by the Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Government of India. The Indian Government's GI registration is valid for ten years, after which it must be renewed.

of heritage and quality.GI Tags ensure authenticity of regional coffee varieties and prevent unauthorized use of the product's name by producers outside the region and help farmers get better market prices. Moreover, GI tags help to enhance export value by premium branding. GI-tags also encourage conventional cultivation thereby, preserving traditional farming practices. The coffee kinds with GI tags capture the essence of their individual locations, maintains their distinct identity and quality that is difficult to replicate elsewhere. The GI tag make sure that coffee produced in these specific areas can bear their esteemed names, protecting their authenticity and economic value. This contributes to the outstanding quality of coffees from particular locations being recognized globally.

Geographical Indications (GI) are unique Intellectual Property Rights and are used on products that have a specific geographical origin and possess qualities, reputation, or characteristics that are essentially attributable to that origin.

Coffee is believed to have originated in Ethiopia and coffee was introduced to India in the 17th century by Baba Budan, a Sufi mystic. He brought the coffee seeds from Mocha, a port city in Yemen and raised them in the hills of Chikmangalur. Later, these hills came to be known as Bababudangiri. Two main varieties of coffee grown in India are Arabica (Coffea arabica) and Robusta (Coffea canephora). Arabica variety is sweet, has a delicate flavour, and a well-balanced aroma. Arabica coffee is also called high grown coffee which slowly ripens in the mild climate and thereby the bean acquires a special taste and aroma. Compared to arabica, robusta

In India, the Coffee Board is the nodal agency for research and development of coffee and they have identified and registered 7 unique varieties of coffee with the Geographical Indications registry, Chennai, recognizing their unique terroir, traditional cultivation methods, distinctive flavours and socio-economic significance. GI-Tagged Coffee can be considered as a blend

GI-Tagged Coffees of India

1.Monsooned Malabar Arabica Coffee

Monsooned malabar arabica coffee is the first GI tagged coffee variety of India. It is a specialty coffee derived from arabica coffee beans grown in the Malabar region of South India, specifically from the plantations of Kerala and Karnataka. GI Tag registration process for Monsooned malabar arabica coffee was initiated by

the Coffee Board on April 5, 2007 and GI Tag was granted in 2008. The coffee received its legendary flavour from a process known as 'monsooning'. It is a unique processing method in which beans are exposed to monsoon winds. The monsooning process was discovered accidentally during British colonial rule while transporting coffee beans to Europe by sea. During their travel to Europe. the south west monsoon winds of Kerala made the coffee beans absorb moisture, swell and turn golden yellow. The monsooned coffee beans turned out to be less acidic, developing a unique musty flavour, which was very much appreciated. Today, the process is recreated by exposing beans to monsoon winds for 12 to 16 weeks in specialized open warehouses. The dried beans are cured, sorted and stored in warehouses until the onset of monsoon. The selected beans are exposed to monsoon winds with 90% humidity from June to September. The monsooning process involves careful handling, frequent spreading, raking and periodic turning around at regular intervals. This monsooning process requires precise moisture control since excessive humidity can lead to fungal attack. Because of its mild acidity, it is preferred in espresso coffee blends.

2.The Monsooned Malabar Robusta Coffee

Robusta coffee beans, which are innately more bitter and contain more caffeine are used to make this unique coffee. The monsooned malabar robusta coffee received GI certification in 2008 after being registered on October 12, 2007, by the Coffee Board. Monsooning process of malabar robusta coffee is similar to that of arabica. The monsooning reduces the acidity and bitterness of the robusta beans and enhances their aromatic complexity.

3.Coorg Arabica Coffee

Coorg arabica coffee is grown specifically in the lush green region of Kodagu district in Karnataka which is well known for its distinct climate and soil conditions. This coffee variety is grown at 800 to 1600 meters above mean sea level. This gives Coorg arabica coffee its unique aromatic profile, setting it different from other arabica coffee varieties. Coorg arabica coffee is known for its smooth, well-balanced acidity and is popular in filter coffee preparations in South India. Coorg arabica coffee was registered for geographical indication on 01.01.2018 and obtained GI Tag in 2019.

4.Wayanad Robusta Coffee

Wayanad robusta coffee is grown at higher elevations in the Wayanad district of Kerala. Wayanad robusta is renowned for its strong, robust, chocolaty and nutty flavours. Ideal for South Indian kaapi and espresso blends. The robusta beans produced here stand out for their high quality and resilience, as they are cultivated in rich forest soils under shade trees (GI Tag: 2019)

5.Chikmagalur Arabica Coffee

Chikmagalur Arabica coffee is grown in the high-altitude (around 1035 m above sea level) Malnad region of the Deccan plateau, located in the Chikmagalur district of Karnataka. The cultivation of coffee is ingrained in Chikmagalur's tradition and history. The magic flavour of this GI-tagged arabica cultivar is enhanced by the region's topography, regular rainfall, well drained organic soil and traditional growing practices. The cooler climate in the area is ideal for the slower maturation of coffee beans. This coffee has a delicate flavor with fruity undertones and a slight acidity. Chikmagalur arabica coffee received a GI tag in 2019.

6. Araku Valley Arabica Coffee

Araku valley arabica coffee is one of India's most premium specialty coffees, popular in international markets for its unique profile. The arabica variety of coffee is grown in the hilly tracts of the Visakhapatnam district of Andhra Pradesh and the Odisha region at an elevation of 900-1100 m above mean sea level. The coffee's quality and attributes are linked to its geographical origin in Araku valley and this coffee is primarily cultivated by tribal communities in the valley following an organic protocol. Araku coffee naturally tastes sweet and fruity, with a trace of cocoa. Araku valley arabica coffee was granted the prestigious Geographical Indication (GI) tag by the Indian government in 2019.

7. Bababudangiris Arabica Coffee

Bababudangiris arabica coffee is grown in the Bababudangiri hills of the Chikmagalur district in Karnataka, the birthplace of coffee in India. The distinctive terroir of its hilly area, located in the center part of Chikmagalur district, is reflected in this GI-tagged coffee varietal. The coffee is primarily obtained from Arabica beans, which are hand-picked and undergo natural fermentation process. The coffee has a well-balanced, striking flavour, mild aroma and acidity, with a note of chocolate. Bababudangiris arabica coffee was awarded a Geographical Indication tag in 2019 and it is India's 355th GI tagged product.

On March 29, 2025, the Coffee Board launched premium GI-tagged single-serve coffee drip bags in an effort to boost the nation's domestic consumption of pure coffee. Five GI tagged Arabica coffee varieties viz., Coorg Arabica, Chikmagalur Arabica, Bababudangiri Arabica, Araku Valley Arabica, and the Monsooned Malabar Arabica coffee are included in each drip coffee bag.

Conclusion

India's GI-designated coffees are a balance of terroir, tradition, and flavour. These coffees, which range from the Monsooned malabar coffee to the Bababudangiri arabica coffee, are evidence of India's rich coffee history. India can promote sustainable agriculture and rural livelihoods while solidifying its place in the world coffee market by preserving and advancing these GI types. Global branding, technology use, and strategic strategies can safeguard their future even while issues like climate change and counterfeit goods continue to exist.

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Microbial Mobilizers of Potassium

An Eco-Friendly Approach to Crop Nutrition and Protection

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Potassium (K) is regarded as the third most important plant nutrient, the 7th most abundant element in the earth crust (Etesami et al., 2017). Among essential nutrients, potassium (K) stands out as a key player in regulating enzyme activity and supporting nearly all vital cellular functions that impact disease development. It enhances photosynthesis, aids in the formation of carbohydrates, proteins, and fats, and regulates water absorption and root development. By strengthening plant tissues and boosting enzyme activity, potassium improves resistance to diseases and environmental stresses such as drought, frost, pests, and poor drainage, ultimately leading to better crop quality, increased yields, and longer shelf life of produce. Despite its abundance, only less than 2 to 3% of soil K is available to plants in free soluble form because the rest remains bound to other soil minerals, constituting an estimated 95% of soil potassium.

Most soils around the globe are K-deficient (Dhillon et al., 2019). Potassium deficiency in soils disrupts key physiological and biochemical processes in plants, weakening their growth and natural defense mechanisms. This compromised state reduces the plant's ability to recognize and respond to invading pathogens, making them significantly more vulnerable to pests, infections, and disease-related damage. Adequate potassium availability can enhance the plant's natural resistance to diseases by strengthening cellular functions and improving stress tolerance. Potassium deficiency often goes unnoticed in plants, unlike nitrogen or phosphorus shortages, leading many farmers, especially in the tropics to prioritize only N and P fertilizers. This neglect of potassium, despite its critical role, disrupts plant physiology, lowers crop yields, and increases vulnerability to pests and diseases. The challenge lies in "hidden hunger," where plants suffer yield losses due to potassium deficiency without showing visible symptoms, making it essential to monitor crop nutrient status through regular tissue testing.

Sources of K and it's availability to plant

In soil, potassium exists in four main forms: unavailable (mineral) K, non-exchangeable (fixed) K, exchangeable (ionic) K, and available (soluble) K. The majority of potassium is bound in minerals such as muscovite, biotite, orthoclase, feldspar, illite, and mica, which are not directly

accessible to plants. Additionally, a portion of potassium is associated with organic matter and the microbial community in the soil. The mobility and availability of potassium ions (K^+) in soil depend largely on their form, whether present in the soil solution or bound to exchange sites—and on factors like soil moisture. Soluble potassium, which makes up only about 0.02%–2% of total soil K, is the most mobile and readily available form for plant uptake. In contrast, exchangeable potassium accounts for around 1%–3% and must first be released into the soil solution before plants can absorb it. The majority about 95%–98% exists in mineral forms that are insoluble and unavailable to plants. Potassium uptake varies among plant species and is most critical during early growth stages, often surpassing the demand for nitrogen and phosphorus. Its availability is influenced by soil moisture, temperature, and cultivation practices.

In the pursuit of higher yields, many farmers today rely heavily on chemical fertilizers, often applying them indiscriminately. While chemical potassium fertilizers may offer short-term gains in crop growth, their excessive use disrupts soil microbial balance, diminishes ecological functions, and gradually deteriorates soil health. This practice not only reduces long-term productivity but also leads to groundwater pollution and poses risks to environmental and public health. Moreover, water-soluble chemical fertilizers are costly and may negatively affect food quality. These concerns have driven increased interest in the use of potassium-solubilizing microorganisms (KSMs) as a sustainable alternative. By improving nutrient availability naturally, KSMs offer an eco-friendly and economically viable approach to enhance crop yield and quality, ensuring agricultural sustainability without harming the environment or human health.

Potassium solubilizing micro-organisms

Soil microorganisms are nature's hidden workforce efficient decomposers, nutrient cyclers, and fertility boosters that play a crucial role in making essential nutrients like potassium available to plants. However, the KSMs are most important microorganisms for solubilizing fixed form of K in soil system. KSMs are an indigenous rhizospheric microorganism which show effective interaction between soil-plant systems. Bacteria like Acidothiobacillus ferrooxidans, Aminobacter spp, Arthobacter spp, Bacillus amyloliquefaciens, B. cereus, B. circulans, B. coagulans, B. edaphicus, B. megaterium, B. mucilaginosus, B.subtilis, Burkholderia spp, Cladosporium, Enterobacter hormaechei, Flecobacillus spp, Paenibacillus spp and Pseudomonas spp. Also a few documented fungal strains like Aspergillus niger, A. fumigatus, and A. terreus and yeasts such as Torulaspora globose are implicated in potassium supply in soil for plant use (Olaniyan et al., 2022). These microbes have the remarkable ability to extract potassium locked in insoluble minerals and transform it into a form accessible to plant roots. Inoculation of B. edaphicus in soil enhanced the release of potassium up to 84.8–127.9 % as compared to uninoculated control. In the case of B. mucilaginosus, maximum release of potassium was recorded up to 4.29 mg/L K soil inoculated with muscovite mica (Ahmad et al., 2016). Frateuria aurantia can be used as a bio-inoculant that can solubilize K from almost all types of soils having wide range of pH and temperature. Such bio-inoculants are not only useful for enhancing K availability but are also effective for minimizing the impact of pathogens on plant growth.

Most soils around the globe are K-deficient (Dhillon et al., 2019). Potassium deficiency in soils disrupts key physiological and biochemical processes in plants, weakening their growth and natural defense mechanisms.

Potassium solubilizing micro-organisms in plant protection

Biological control relies on the natural antagonistic interactions among microorganisms, including those that suppress phytopathogens. While KSMs

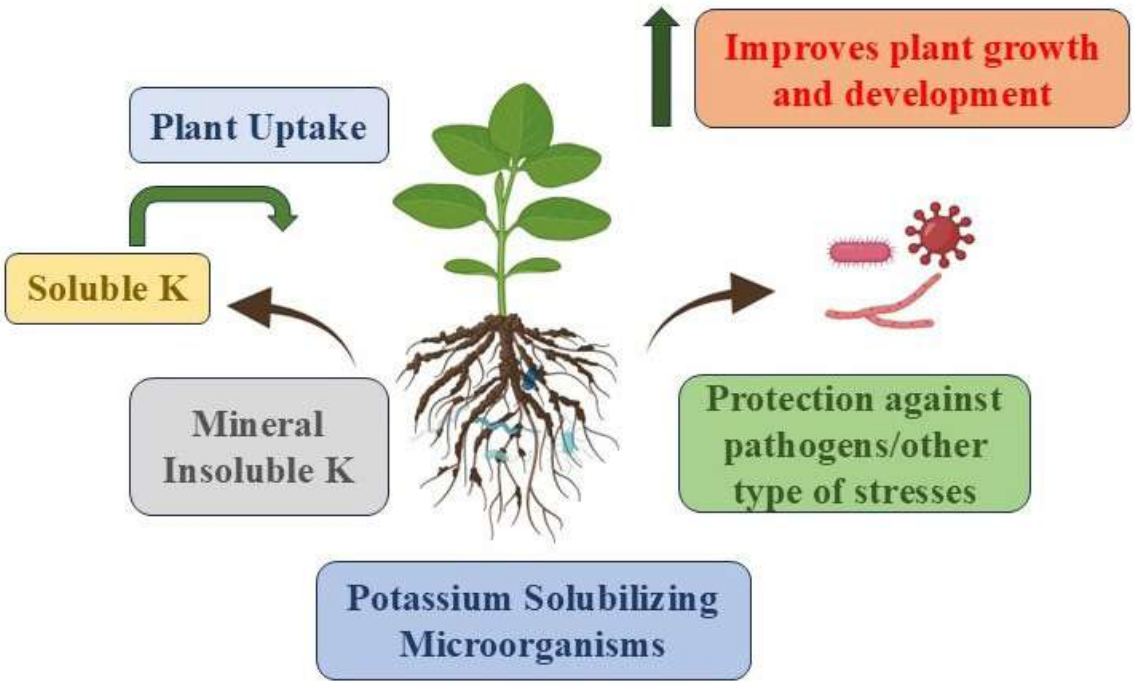

Figure 1: Multifunctional role of potassium solubilizing micro-organisms in sustainable agriculture

are primarily recognized for enhancing plant nutrient uptake, many also possess biocontrol properties. In addition to solubilizing potassium, these microbes contribute to soil health, enhance crop productivity, and help protect plants by producing antibiotics and growth-promoting hormones. Plant pests and diseases remain major constraints to agricultural productivity worldwide. Interestingly, potassium nutrition has been shown to play a significant role in disease suppression. Proper potassium management reduced disease incidence in 66% of cases, with particularly strong effects against bacterial (79%), fungal (68%), and even viral diseases (53%) (Huber and Arny, 1985; Ortel et al., 2024). The variation in disease response to potassium is likely influenced by pathogen type, host–pathogen interactions, and specific soil and environmental conditions. This highlights the multifaceted benefits of KSMs, offering a sustainable approach to both nutrient management and plant protection. Many strains of bacteria have been observed to exhibit antagonistic behavior due their innate ability to produce hydrogen cyanide (HCN), lytic enzymes, antibiotics, phenazines, pyoluteorin, and pyrrolnitrin.

In rice and wheat, K nutrition helps reduce fungal diseases like blast, sheath rot, and leaf blotch. Similarly, bacterial blight in rice and cotton leaf curl virus also decrease with better K supply. However, some diseases like charcoal rot in soybean show no response, and peanut pod rot may worsen with high K. Additionally, K-deficient plants tend to attract more insect vectors like aphids, increasing viral infection risk.

It is suggested that potassium deficiency in plants may increase vulnerability to viral infections due to overlapping disruptions in plant metabolism. Potassium deficiency hampers starch synthesis, and when combined with the metabolic manipulation caused by viral pathogens, the risk of infection may be significantly heightened. However, the deficiency must not be so severe that it leads to plant death, as viruses depend on a living host to complete their life cycle.

Mechanisms of action

Potassium solubilizing microorganisms (KSMs) such as bacteria and fungi can solubilize K from an insoluble form to a soluble form to enhance uptake by plants. Potassium-solubilizing microorganisms (KSMs) play a pivotal role in sustainable agriculture by enhancing potassium availability, promoting plant growth, protection against plant pathogens and other type of stresses as depicted in figure 1.

Solubilization of potassium: These microorganisms solubilize K through the production of organic acids (e.g., tartaric, oxalic, citric acid) that dissolve K-containing minerals, Acidolysis, chelation, ion exchange, and complexolysis, which release K ions from mineral matrices. Polysaccharide secretion and biofilm formation, helps to

create microenvironments around roots, improving solubilization and mineral uptake. They often form biofilms dense microbial communities embedded in extracellular polymeric substances (EPS) on mineral surfaces, creating microenvironments that promote effective solubilization. These biofilms, rich in proteins, lipids, and DNA, aid in mineral breakdown by lowering rhizospheric pH and releasing secondary metabolites, making potassium more accessible to plants.

Multiple plant growth promotion traits of micro-organisms: Beyond potassium solubilization, KSMs often exhibit multi-functional traits that boost plant growth and development like Nitrogen fixation, Phosphorus and micronutrient solubilization, Root colonization and Phytohormone production (e.g., auxins, gibberellins).

Stress tolerance and strengthened plant defense: KSMs exhibit diverse functional traits that support plant growth while also strengthening the plant's defense mechanisms. For example, ACC-deaminase activity, which helps in stress tolerance, Siderophore production, which chelates iron and limits pathogen growth, Chitinase and antibiotic production, offering biocontrol against pathogens. These properties help plants withstand both biotic and abiotic stresses like drought, salinity, and disease, while also promoting root development and nutrient uptake.

Potassium deficiency compromises plant structural and biochemical defenses, resulting in thinner cell walls and diminished enzymatic activity, which increases susceptibility to fungal and bacterial infections. Research has demonstrated a strong link between adequate K nutrition and enhanced disease resistance, such as reduced blast disease incidence in rice. Additionally, potassium plays a critical role in regulating stomatal function, by controlling turgor pressure in guard cells, it governs the opening and closing of stomata. While open stomata are vital for gas exchange and photosynthesis, they can also serve as entry points for pathogens. Potassium-sufficient plants are capable of rapidly closing stomata upon detecting microbial presence, forming an effective defense barrier. However, some parasitic bacteria can override this mechanism by signaling stomatal reopening, thereby facilitating infection, an ability absent in non-parasitic strains. Thus, potassium is vital not only for plant health and productivity but also for immune responses and pathogen resistance.

Conclusion

Low crop yield and productivity can occur when plants with natural immunity or tolerance are exposed to many biotic stresses such as phytopathogens, pests, fungal, and bacterial diseases and abiotic stresses such as drought, salinity, high or low temperature, high light intensity, and nutrient deficiency. The availability of potassium nutrient in the soil was found to greatly enhance plant resistance to different forms of stress. Therefore, potassium solubilizing microbes may be beneficial to plants by improving plant growth and development, resistance to disease and pest attacks, and nutrient uptake. In addition, the inoculation of crop plants with potassium solubilizing microorganisms was also found to significantly enhance plant germination, growth, and yield. Hence, the application of KSMs to agricultural soils will reduce the use of chemical fertilizers and enhance the sustainability of food production.

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Brahmi

A Live Mulch in Arecanut Garden

GOWTHAM K M[1*], SRINIVASULU G B[2], ABHISHEK B[3] AND SIDDANAGOUDA[3]

Brahmi, scientifically known as Centella asiatica, belongs to the Apiaceae/Umbelliferae family and is a revered herb in traditional medicinal systems like Ayurveda and Siddha. This creeping, succulent herb is widely known for its cognitive-enhancing properties and is often used as a natural remedy to improve memory, mental clarity and overall brain function. It is commonly found in humid and warm climates, thriving in damp areas such as marshes, streams and pond borders throughout India and other tropical regions of Asia, Africa, Europe and Australia.

Botanical Features and Habitat

Brahmi is a creeping, succulent herb with an average height of 2-3 feet. The plant grows vigorously, producing multiple branches that root at the nodes, allowing it to spread rapidly over damp and marshy ground. It is most commonly found in tropical and subtropical regions, especially in places that provide a humid, moisture-rich environment such as the border of ponds, streams and marshes. Brahmi thrives in warm, wet conditions, abundant in South and Southeast Asia, including India, Sri Lanka and Thailand. It is also found in Africa, parts of Europe, Australia and North and South

America, where it has adapted to both natural and cultivated habitats.

The leaves of Brahmi are simple, opposite and arranged in a decussate pattern (with pairs of leaves placed one above the other and perpendicular to each other). These succulent, oblong-shaped leaves, typically 1-2 cm long, are sessile (without petioles) and give the plant a distinctive appearance. The flowers of Brahmi are small, pale blue to whitish in color and grow along a single axis, further enhancing the aesthetic charm of this creeping herb. The plant produces tiny, oval-shaped fruits with seeds that are dark brown and about 0.2-0.3 mm in size.

Medicinal Significance and Uses

Brahmi's popularity stems largely from its cognitive-enhancing properties. The herb has long been used as a memory booster and brain tonic in Ayurvedic medicine, where it is considered an essential herb for mental clarity, concentration and intellectual development. The active compounds in Brahmi, particularly saponins, play a pivotal role in enhancing nerve impulse transmission. This action improves communication between brain cells, which is believed to lead to improved memory retention, focus and cognitive function.

Aside from its cognitive benefits, Brahmi is also widely acknowledged for its ability to calm the nervous system. It is classified as a neuropathic sedative and hypotensive agent, meaning it helps reduce stress and anxiety while promoting relaxation. Furthermore, it has anti-inflammatory, antioxidant and antibacterial properties, which contribute to its broader therapeutic uses, such as epilepsy, insomnia and neurodegenerative diseases. In some traditional practices, Brahmi is used as an antidote for snake bites and is also known to assist with conditions like asthma, anemia and tumors.

Brahmi's medicinal application extends beyond the brain and nervous system. In Siddha medicine, it is used to treat joint pain, swelling and peripheral neuritis. It is also valued for its diuretic properties, aiding in the treatment of constipation and burning urination. Its broad spectrum of uses makes it an indispensable herb in natural health systems.

Propagation

Brahmi (Centella asiatica) is primarily propagated through vegetative means by using cuttings. To propagate, healthy Brahmi plants are cut into small divisions, each with 4-6 nodes, which are then soaked in slurry water to promote rooting. These cuttings are transplanted directly into wet soil at a spacing of 20 x 20 cm and irrigated immediately after planting. For mass propagation, approximately 62,500 cuttings are needed for one hectare. The ideal time for planting cuttings is mid-June to early July for optimal growth, though transplanting is also done in the months of March to June. While seed propagation is possible, cuttings are preferred for faster establishment and more reliable results. Regular irrigation is essential for the healthy growth of the plant, and harvesting typically occurs in September.

Spreading habit

Brahmi (Centella asiatica) exhibits a creeping and spreading growth habit. The plant tends to spread horizontally, with its stems growing along the ground. As the plant matures, it sends outside branches that root at the nodes, allowing it to cover a larger area. This rooting at the nodes helps Brahmi form dense mats over the soil, making it an effective ground cover in wet, marshy environments. The plant's spreading habit is facilitated by its ability to grow in humid, moisture-rich conditions and it can rapidly

Benefits of Using Brahmi as Live Mulch in Arecanut Cultivation

- Sustainability: Reduces the reliance on chemical herbicides, fertilizers and synthetic mulches.
- Soil Health: Improves soil structure and fertility over time.
- Water Conservation: Helps retain moisture and reduces irrigation needs.
- Cost-Effective: Reduces labor costs associated with weeding and mulching.
- Biodiversity: Promotes the growth of beneficial insects and microorganisms.
- Additional income generation to farmers

cover areas such as the borders of ponds, streams or moist fields. This growth pattern also aids in its vegetative propagation, as new plants can emerge from rooted nodes along the spreading stems.

Why Brahmi as a Natural Live Mulch?

Arecanut (Betel nut) cultivation is an important agricultural practice in tropical and subtropical regions, particularly in India, Sri Lanka, Southeast Asia and parts of Africa. In arecanut farming, maintaining healthy soil and controlling weeds are crucial for optimal growth and productivity. While chemical mulches and herbicides are commonly used, there is a growing interest in sustainable agricultural practices that minimize the use of synthetic inputs. One such practice is the use of natural live mulches—plants that serve as ground cover and offer a variety of benefits to the ecosystem. Brahmi (Centella asiatica), a creeping herb with numerous medicinal properties, is emerging as an ideal candidate for this role in arecanut plantations.

Brahmi, with its unique growth characteristics and adaptability, makes it an ideal candidate for use as a natural live mulch in arecanut plantations. Here are the Brahmi is well-suited for this role:

1. Creeping and Spreading Habit

Brahmi has a creeping growth habit, which means it spreads along the soil surface, sending out branches that root at the nodes. This allows the plant to form a dense mat of ground cover. In arecanut plantations, this mat of Brahmi can suppress weeds by shading the soil and preventing weed germination. Weeds can be a significant problem in arecanut farming, particularly in the early stages of growth and using Brahmi as a live mulch helps to reduce competition for resources.

2. Soil Moisture Retention

One of the major challenges in arecanut cultivation is ensuring consistent moisture levels in the soil, especially during dry periods. Brahmi's dense foliage helps in moisture conservation by reducing evaporation from the soil. Its root system also helps retain moisture in the soil, which is crucial for the healthy growth of arecanut plants, especially in areas where rainfall is unpredictable or during drought conditions. By using Brahmi as a live mulch, farmers can reduce irrigation costs and improve water-use efficiency.

3. Soil Erosion Control

In arecanut plantations, soil erosion can occur, particularly in areas with sloping terrain or during heavy rainfall. Brahmi's extensive root system helps to bind the soil, reducing erosion and promoting soil stability. The plant's ground-covering nature also prevents the topsoil from being washed away during rainfall, ensuring that the soil remains intact and fertile for arecanut growth.

4. Improved Soil Health

Brahmi, like many other ground-covering plants, contributes to soil health in several ways. As it decomposes, Brahmi adds organic matter to the soil, which enhances the soil structure and promotes the growth of beneficial microorganisms. The organic matter increases the nutrient content of the soil, benefiting not only Brahmi but also the arecanut

plants growing alongside it. Over time, this can lead to improved soil fertility, reducing the need for chemical fertilizers.

5. Reduced Weed Growth

Weed control is a significant challenge in arecanut plantations. Weeds compete with arecanut for nutrients, water and light, leading to reduced crop yields. Brahmi, being a dense ground cover, effectively suppresses weed growth by blocking sunlight and reducing the space available for weeds to establish. This reduces the need for chemical herbicides and manual weeding, which can be labor-intensive and harmful to the environment.

6. Compatibility with Arecanut

Brahmi grows well in the same humid, tropical conditions that arecanut prefers. It thrives in moist, marshy soils, making it an ideal companion plant for arecanut, which also grows best in these conditions. Brahmi does not compete aggressively for nutrients with the arecanut, as it grows low to the ground, forming a ground cover without shading the taller arecanut trees. This makes it a symbiotic partner, providing all the benefits of mulch without negatively affecting the growth of the main crop.

Implementation of Brahmi as a Live Mulch in Arecanut Farms

1. Propagation and Planting

Brahmi can be propagated by vegetative means using cuttings. Whole plants are cut into smaller units, each with 4-6 nodes, which are then soaked in slurry water to encourage rooting. These cuttings can be directly planted into the soil, spaced around 20 x 20 cm apart. Once established, Brahmi grows rapidly, forming a dense mat that covers the ground. The best time for planting Brahmi is during the monsoon season, between June and July.

Farmer field: H. M. Mahalinganna, Hampaiyanamalige, Dyamanahalli post Chitradurga district, Karnataka

2. Maintenance

Once established, Brahmi requires minimal maintenance. It benefits from regular irrigation, especially in dry periods, but it does not need excessive attention. The plant naturally spreads and covers the soil, providing a sustainable live mulch solution. Occasional pruning may be necessary to maintain the desired ground cover and prevent excessive spreading.

Conclusion

Using Brahmi as a natural live mulch in arecanut plantations offers a range of environmental and agricultural benefits. Its creeping habit, moisture retention capabilities, soil erosion control and weed-suppressing properties make it an excellent companion plant for arecanut. By adopting Brahmi as a live mulch, farmers can enhance the sustainability and productivity of their plantations, reduce dependency on chemical inputs and improve the long-term health of the soil. Brahmi's versatility as both a medicinal herb and an agricultural companion plant positions it as a key element in sustainable agroecological practices in tropical farming systems.■

Soil and Crop Health Management for Sustainable Yam Cultivation

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Among the tuber crops, yams belonging to Dioscorea sp. are important crops, next to potato, cassava and sweet potato. The low glycemic index of yam tubers makes them a preferable substitute to potato. They are rich in vitamins and minerals. The significantly higher fibre content in them aids in easy digestion process. Recent research works have shown that yams exhibit numerous health benefits such as blood sugar regulation, weight

management anti inflammatory, anti cancer and anti oxidant properties. The gut health has been found to be favourably influenced by the yam consumption through production of short chain fatty acids. Owing to the increasing health consciousness among the population, the medicinal value of traditional foods as that of yams catches greater attention. They are treated as functional food crops owing to the presence of bio active compounds in them. The most common edible species of yams include the greater yam (Dioscorea alata L.), lesser yam (Dioscorea esculenta L.) and white yam (Dioscorea rotundata L.).

Considering the growing awareness among the general population on the need for following a healthy and balanced diet along with the quality of food rather than its quantity, it is imperative to understand more on the scientific cultivation practices of yams. This article presents the major aspects which are to be considered for ensuring sustainable yam productivity.

Climate

Yams prefer moderate temperature around 25-30oC and cannot tolerate frost, though they are tolerant to dry weather conditions. It prefers a minimum rainfall between 1200-2000 mm for better growth and tuber yield. It can tolerate partial shade though open conditions are preferred.

Soil

For optimum tuber development, yams prefer well drained, fertile, sandy loam soils with a pH of 5.0-7.0 and having adequate organic matter content. They have a preferential requirement of potassium for facilitating tuber growth and bulking.

Land preparation

A fine pulverised seed bed is required for the planting of yams. Land should be ploughed two or three times, levelled and clods should be broken to prevent water logging and impairment of drainage. Uniform application of farmyard manure @ 10 t ha-1 is recommended.

Later, depending on the soil type, mounds or ridges can be prepared for planting. For mound planting, initially pits of size 45 cm3 are taken, and after placing the tubers, it is covered with top soil and formed into a mound. The pits

Considering the growing awareness among the general population on the need for following a healthy and balanced diet along with the quality of food rather than its quantity, it is imperative to understand more on the scientific cultivation practices of yams.

are filled with well decomposed organic matter and top soil before placing the yam tubers. Shallow planting leads to rotting and lesser sprouting. However, lesser yams can be raised in pits of 30 cm3 size which are reformed into mounds.

Planting material

Yams are vegetatively propagated through tubers. Whole tubers are cut into small pieces weighing 200-300 g for planting. Lesser yam can be raised with tuber pieces around 100-150 g. If the tubers are small in size, they can be planted as such. However, the size of the planting material should be uniform so as to ensure the uniform sprouting and establishment in the field. Greater yam and white yam require a seed rate of 2500-3700 kg ha-1, whereas lesser yam requires a seed rate of 1800-2700 kg ha-1.

If there is shortage of the planting material, two node vine cuttings from six month old greater yam plants can be rooted and used for propagation. However, the production of tubers will take more time and tuber yield will be less by this method of propagation. For mass multiplication of desirable clonal materials, this method could be resorted to.

For the rapid multiplication of planting material at reduced costs, minisett technique can be resorted. The tubers are cut into cylindrical pieces and then transversely into 20 g size, each having the intact periderm. These are planted in the nursery at a spacing of 5 cm apart with the cut surface facing upward. After sprouting, the plants can be transplanted to the main field at a spacing of 60x45cm, with proper mulching. Through this technique, the multiplication ratio can be enhanced from 1:6 to 1:40.

For uniform sprouting, ease of handling and transportation, ICAR- CTCRI has further standardised the protocol for the production of portray plants of yams using 20 g minisetts with potting mixture comprising soil: farmyard manure: coco peat in the ratio 1:1:1. The portray raised yam plants are being soil through the sales outlet of ICAR-CTCRI.

Time of planting

Ideally, day length greater than 12 hours at the early stages promotes vine growth whereas short photo period favours tuber production. Hence to tap the advantage of favourable climatic conditions, yams should be planted in the beginning of April and late planting should be avoided to the extent possible. The tubers which are harvested in February can be stored for 2 months and planted in April so that the dormancy can be tide over suitably, as well as climatic requirements can be met. Moreover, yams are mainly raised as rainfed crop and planting with the onset of pre monsoon showers will enable the sprouting and germination.

Yams are vegetatively propagated through tubers. Whole tubers are cut into small pieces weighing 200-300 g for planting.

Spacing

Greater yam and white yam can be planted in ridges or mounds at a spacing of 90 cm between rows and 90 cm between plants in a row. At 90 cm x 90 cm spacing, 12345 plants can be raised in a hectare. Lesser yams can be planted at a closer spacing of 75 cm x 75 cm to accommodate a population of 17,700 per hectare. Minisett plants are raised at a spacing of 60x45cm to accommodate 37,000 plants per hectare

Planting

As the yams cannot tolerate water logging, in heavy clay loam soils, planting of yams should be done in ridges. In laterite and red soils, planting can be done in mounds for facilitating better root proliferation and tuber development. In mild sloppy land, the ridges are prepared across the slope to conserve soil and water.

Mulching

Mulching is an inevitable operation especially under dry spells. For the conservation of soil moisture and to prevent drying of the planting material, the mounds shall be mulched with dried farm waste @ 2 t ha-1 under dry conditions. It also improves the sprouting percentage of the tubers.

Staking

Yams are trailing herbs and require proper staking in wooden/GI poles of 3-4 m height with coir ropes for tuber production. Proper staking exposes the vines to sunlight and promotes photosynthesis. Staking should be done at 15-20 days after sprouting to avoid injury to the developing shoots. Under tree based cropping systems it can be trailed into the trees.

Manures and fertilisers

Farmyard manure @10 t ha-1 is applied at the time of land preparation. The general recommendation of NPK is 80-60-80 kg ha-1 for greater yam and lesser yam. In the case of white yam the recommended dose is 100-50-100 kg ha-1 of NPK. Full dose of P, half N and K should be applied at the time of first weeding at 20 days after sprouting. The second dose of N and K can be given at one month after first application along with the second weeding.

Under organic management, farmyard manure@ 15t ha-1 along with neem cake @1 t ha-1 and biofertilisers such as Azospirullum@ 3kg ha-1, mycorrhizae@ 5 kg ha-1 and phosphobacteria @3 kg ha-1 at the time of planting. Sow cowpea seeds in the inter row spaces @20 kg ha-1 between the mounds and the biomass @ 15-20 t ha-1 can be incorporated at 45-60 days after sowing along with wood ash @ 1.5 t ha-1. Greater yam varieties such as Sree Keerthi and Sree Swathi, which are resistant to anthracnose or tolerant varieties such as Sree Nidhi and Sree Karthika can be selected for organic farming. Application of organic manures improves the physico chemical properties of the soil and enhances the soil carbon sequestration.

The fertiliser requirement of yams can be calculated through a mobile app 'Sree Poshini' developed by ICAR - CTCRI, Thiruvananthapuram. It can be

downloaded from the Google play store which enables the farmers to calculate the quantity of fertilisers to be applied in accordance with the technology of site specific nutrient management.

Apart from the major nutrients, micronutrients also have to be provided for the optimum growth and development of yams. ICAR - CTCRI has developed liquid micronutrient formulations marketed as 'Micronol Yams' containing nutrients such as zinc, copper, boron, iron and manganese. It can be applied as foliar spray @ 5ml/litre thrice at 2nd, 3rd and 4th month after planting. For spraying in 1 acre, 1 litre of the formulation in 200 litre water is required.

Water management

Yams are tolerant to drought, but yield can be enhanced if supplemental irrigation is given. For uniform sprouting irrigate immediately after planting for ensuring uniform sprouting. Through drip irrigation, application of 80 per cent cumulative pan evaporation is recommended. One month before harvesting, irrigation has to be stopped for ensuring the maturity of the tubers as well as drying and withering of the roots. Prior to the day of harvesting irrigation will facilitate easy digging and damage to the tubers.

Yams in cropping systems

For sustained income generation, barring the risks of price fluctuation and climatic vagaries, it is always advisable to follow cropping system approaches. Yams can be planted in an existing tree based system such as coconut (less than eight year and more than 20 years), banana, arecanut, coffee and rubber. In older plantations of over 20 years age, trailing varieties such as Sree Keerthi (greater yam) and Sree Priya (white yam) can be intercropped at a spacing of 90 cm x 90 cm leaving 2 m from the base of the palm accommodating 9000 plants per hectare. In arecanut plantation, about 7000 yams can be accommodated in a hectare at spacing of 90 cm x 90 cm leaving 1meter from the trunk of the palm. While intercropping, care should be taken to manure both the main crop as well as the intercrop. In the case of rubber and coffee, planting can be done during the initial 3-4 years without the yield being affected for both the crops. In one hectare rubber plantation, 6000 plants can be accommodated leaving 1.5 m radius from the base of the tree.

Yams can be planted in the interspaces of banana varieties such as Nendran and Robusta. In between two rows of Nendran variety spaced at 3.6 x 1.8 m (1500 plants/ha), 3 rows of yams can be planted to accommodate 8000 plants/ha. This could reduce the levels of FYM, N and P to the intercrop as well as main crop to half of the recommended dose, though potash has to be applied at full dose for both. Between two rows of the Robusta variety planted at 2.5 x 1.8 m (2300 suckers per ha), 2 rows of yams can be planted to accommodate 6000 plants per ha. In this case, banana should be given the full dose of fertilisers as recommended, while for yams, 2/3rd of the recommended dose is sufficient.

Storage of harvested yams

After harvest, a certain quantity of the tubers will be stored for planting and propagation. Immediately after harvest, spread

Among the diseases, anthracnose and leaf spot are the major ones affecting the cultivation of yams. The symptoms of anthracnose include small brown or black spots or leision on the leaves, petioles and vines.

the tubers under partial shade for a day to prevent rotting, while storage. Storage can be done by placing the tubers separately without being into contact, in racks which are kept in a well ventilated area.

Pests and diseases

The major pest affecting yams is yam scale, which is also a pest of ginger, turmeric, taro and elephant foot yam. The infestation spread though through seed tubers. Owing to sucking and desapping, the plants get dried. The tubers will become shrivelled, which affect the quality, viability and marketability. Shade drying of the tubers after dipping in 1.5% Nanma or neem-soap solution for 10 minutes is recommended to prepare pest free planting material. Dipping the infested tubers in 2% yam bean seed oil extract with 0.01% surfactant for 10 minutes and shade drying is also recommended.

Among the diseases, anthracnose and leaf spot are the major ones affecting the cultivation of yams. The symptoms of anthracnose include small brown or black spots or leision on the leaves, petioles and vines. Lesions develop as yellow halo, which later coalesce and becomes necrotic followed by leaf fall and dieback of vines which presents a scorched appearance.

- For disease management, the crop debris has to be removed from the field.
- Summer ploughing exposes the propagules and prevents their germination.

- Resistant varieties such as Sree Karthika, Sree Keerthi and Sree Roopa can be planted.
- Use symptom free material for planting
- Spray Carbendazim @ 0.05% seven times (spraying after the initiation of symptoms, three times 15 days interval and then monthly interval for four times) in endemic areas.

Cercospora Leaf Spot

Symptoms initiated as small chlorotic spots which enlarges and becomes necrotic and finally present as blackened irregular spots. In severe cases, the leaves will dry and fall off. Normally, the symptom appears in the later stage of the crop during September month after 7 months of planting.

- For disease management, the crop debris has to be removed from the field.
- Summer ploughing immediately after the harvest exposes the propagules and prevents their germination.
- Spray Mancozeb (0.2 %) or Carbendazim 0.05% when symptom initiates and spray for another five months first three at 15 days interval and rest monthly.

Conclusion

Yams are highly adaptable and climate resilient crops suitable to our conditions. Considering their health benefits, medicinal values and the nutrient qualities, yams are inevitable components in the cropping cafeteria in tropics. Adoption of scientific cultivation practices will help to realize an average yield of 30-40 t/ha, improving farm income, crop quality and environmental sustainability making our homesteads as functional food baskets.

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