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The First English farm journal from the house of Kerala Karshakan

SPECIALTY COFFEE

A CUP THAT CHEERS



The First English farm journal from the house of Kerala Karshakan

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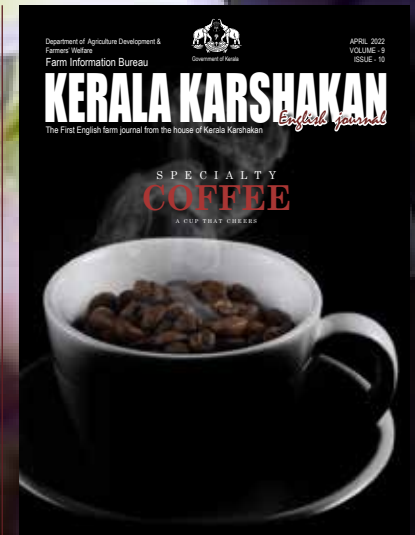


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SPECIALTY COFFEE

A CUP THAT CHEERS



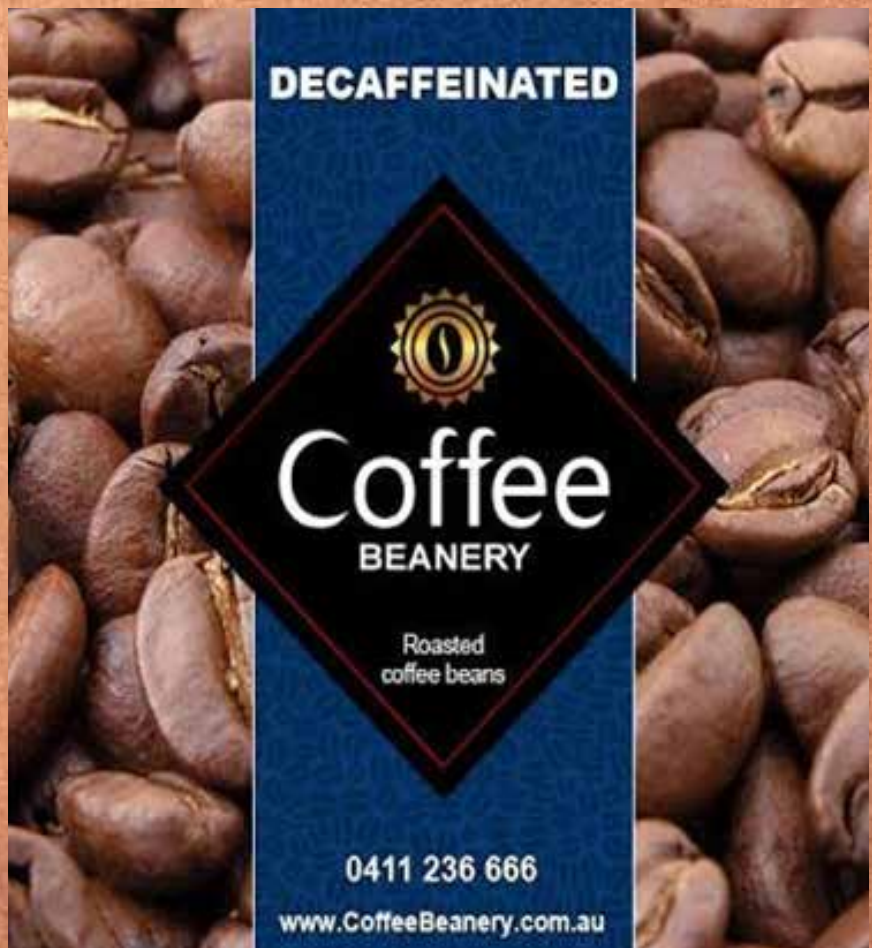
Introduction: Coffee has been for decades the most commercialized food product and therefore the most widely consumed beverage in the world. Since the opening of the first coffee house in Mecca at the end of the 15th century, coffee consumption has greatly increased all around the world. The reasons for this increase in coffee consumption include improvement in cup quality through selection of varieties and breeding; improvements in agricultural practices; creation of specialty shops; and change in coffee image through the dissemination of information on the health benefits of long-term coffee consumption. Today, coffee is considered by many as a functional food mainly owing to its high content of bioactive compounds with anti-oxidant and other beneficial biological properties. The characteristic flavour and richness of coffee aroma also make it a unique beverage, with almost a thousand volatile compounds being identified in roasted coffee. The worldwide shift in the consumer market for artisanal products, services, handcrafted and specialized beverages has led to the recent trends evident amongst consumers. Consumers have become more knowledgeable about products and have a better appreciation of products quality, affecting the international hospitality industry. Following the trend something called specialty coffee has grown in consumption and become a phenomenon in recent years globally, to become a popular social activity. With



this background a detailed description about the specialty coffee has been tracked below.

Specialty coffee: It is a term for the highest grade of coffee available, typically relating to the entire supply chain, using single origin or single estate coffee. The term was first used in 1974 by Erna Knutsen who used the term specialty coffee to describe beans of the best flavor which are produced in special micro-climates. Specialty coffee, according to Specialty Coffee Association of America (SCAA) standards, is coffee which has been standardized from the coffee plantation process until its delivery to the consumer, in compliance with all quality standards, to highlight the

characteristics of the beverage. In a broad sense, Specialty coffee is a term used to refer to coffee that has scored over 80 points on a 100 point scale by the SCAA (Specialty Coffee Association of America). Specialty coffees are markedly different from regular coffees in the sense that they are grown at higher elevations, are traceable and processed carefully once harvested. Every step from growing to brewing is monitored and understood to improve the quality every day. Coffee growing countries are now focusing on improving their quality at the farm level in an effort to improve their cup scorings. Specialty coffee mainly focuses on fruity, floral, sweet and acidic notes in coffee,



which are opposite to phenolic compound aroma characteristics during roasting process.

The specialty coffee segment is gaining attraction all over the world. In the developed countries like US, daily consumption of specialty coffee has grown from 9% to 34% in the span of a decade and the UK specialty coffee market is expected to grow by 13% every year. Asia is projected to soon represent the world's largest consumer of specialty coffee, with over US\$3.7 billion in new value growth projecting since 2016 till date. Countries like Kenya, Ethiopia and Columbia looked upon Mecca for specialty coffee, but there are also smaller countries like India and Japan who are avidly picking up on the trend. Considering the Indian scenario, even this country is not an exception as India's demand for specialty coffee is increasing because of the introduction of new micro roasters and better coffee education. Chikamagalur, in Karnataka, is home to some of the best arabicas in India. Information on few designated coffees renowned as specialty coffee is furnished below:

Decaffeinated (decaf) coffee: It is coffee from coffee beans that have had at least 97% of their caffeine removed. There are many ways to remove caffeine from coffee beans. Most of them include water, organic solvents, or carbon dioxide. Coffee beans are washed in the solvent until the caffeine has been extracted from it, then the solvent is removed. Caffeine

can also be removed using carbon dioxide or a charcoal filter — a method known as the Swiss Water Process. The beans are decaffeinated before they're roasted and ground. The nutritional value of decaf coffee should be almost identical to regular coffee, apart from the caffeine content. However, the taste and smell may become a little milder, and the color may change, depending on the method used. This can make decaf coffee more pleasing to those who are sensitive to the bitter taste and smell of regular coffee. There's a lot of individual variability when it comes to tolerance for caffeine. For some people, one cup of coffee can be excessive, while others may feel fine with more. Under such instances decaf coffee would do well.

Organic coffee: There are no synthetic fertilizers or chemicals used in growing or production, which means cleaner beans, air, land, and water. The coffee is grown with only organic fertilizers, like coffee pulp, chicken manure, or compost. Organic farms also combat climate change by emitting less carbon than chemical farms, while also sequestering significant amounts of carbon. As a bonus, organic coffee beans are richer in healthful antioxidants, and many people can even taste the difference. Our health, and the health of the planet, both get a boost.

High grown coffee: Growing coffee under higher elevation is what makes high grown coffee



a special one. However they are subcategorized as Strictly high grown where in coffee is grown 4,400 feet above sea level, while coffee grown at elevations 3,900 to 4,400 feet above sea level is grouped under high grown and Central standard is the one grown below 3,900 feet above sea level. The ideology behind this is when coffee beans are grown at higher elevations, they develop slowly. This means more nutrients are delivered to the beans, allowing for a high nutrient concentration. While

the high quality often means a more expensive product, it also results in a healthier and more flavorful coffee thus they get endowed with the name high grown coffee.

Estate coffees: These are a specific type of single-origin coffee. They are generally grown on one massive farm, which might range in size from a few acres to large plantations occupying many square miles, or a collection of farms which all process their coffee at the same mill.

Variety Coffee: Some of the varieties are known to possess good inherent quality due to the genetic makeup of the plant. Fruits from such varieties can be harvested and processed separately to retain the unique quality. Some of the Indian selections like Kents, Agaro, Cioccie, CxR are unique in their cup quality. Separate processing of these varieties help in retaining their intrinsic quality.

Black ivory coffee: Black Ivory Coffee is created through a process whereby coffee cherries are naturally refined by Thai elephants in the remote rural province of Surin, Thailand. It begins with selecting the best 100% Thai Arabica cherries that have been picked from an altitude as high as 1500 metres. Then the cherries are fed to elephant by mixing the cherries with the elephant's favorite food like rice, banana and tamarind. This combination helps to ensure that the elephant enjoys the snack and that there is additional nutritional benefit. Once elephants ingest it, the digestive process will begin and this can take between 12 to 72 hours depending on the amount of food already in the stomach of the elephant. Once deposited by the elephants, the individual cherries are hand-picked by the elephant care-givers. The picked cherries are washed, raked and sun dried. Once dried to a certain percentage of moisture the cherries are then hulled and sorted by machine for density and by hand for physical defects and size. Only the largest

sizes are chosen to ensure an even roast. Next, the beans are roasted, packed in a one-way valve bag to ensure freshness and shipped out. Approximately 33 kilograms of coffee cherries are required to produce just one kilogram of Black Ivory Coffee. The result is a very distinctive cup with notes of chocolate/cacao, spice, (tobacco and leather), a hint of grass and red cherry. Black Ivory Coffee lacks bitterness and is delicate, almost tea-like in its complexity. While taste is subjective, this is the most distinctive cup that have been ever tasted.

Monsooned coffee: Monsooned coffee is a specialty coffee of India, which undergoes a natural process of curing dry green arabica and robusta coffee beans by exposing them to moist monsoon winds prevailing in the west coast of southern India (Malabar coast), especially in the regions of Mangalore and Tellichery. The history of monsooned coffee is quite curious. In the days of sailing ships, the cherry coffee sent to Europe used to take 6 months to arrive in their destination. The high relative humidity of the seas and the monsoon winds caused the beans to swell in size, change colour to light yellow and acquire an intensely mellow but aggressive, musty flavour. With the opening of the Suez Canal and speedy transport on steam ships, complaints were received from Europe that the coffee did not have the flavour it had earlier. It was only then that the coffee exporters in Mangalore





devised a process known as 'monsooning coffee'. Today, Monsooned coffee beans are exported from India to Europe, Asia, Africa and North America. Monsooned coffee is known to have good body, mild (reduced) acidity and pleasant aroma and flavour in the cup. For preparing monsooned coffees only dry processed arabica and robusta beans are used. This coffee is mainly used in blends to mellow and impart richness to rougher, more acidic coffees.

However there are indeed limitless possibilities when it comes to creating specialty coffee drinks that tailor the taste buds. Various popular choices can be made in preparing coffee using various equipments making them special. Few of

them are:

Espresso: It is made by forcing very hot water under high pressure through finely ground, compacted coffee.

Cafe Americano: A style of coffee prepared by adding hot water to espresso, giving a similar strength but different flavour from regular drip coffee.

Caffè latte: It is the Italian name for coffee with milk. It is a coffee beverage consisting of strong coffee mixed with scalded milk in 1:1 ratio.

Cafe mocha: It is a variant of a cafe latte. A portion of chocolate is added, typically in the form of chocolate syrup.

Frappe: A big favourite in parts of Europe and Latin America, especially during the summer months. Originally a cold

espresso, it has more recently been prepared putting 1-2 teaspoons of instant coffee with sugar, water and ice.

Cappuccino: It is a coffee-based drink prepared with espresso, hot milk, and steamed milk foam.

Irish coffee: It is a cocktail consisting of hot coffee, Irish whiskey, and brown sugar, stirred, and topped with thick cream.

Turkish coffee: It is a method of preparing coffee where finely powdered roast coffee beans are boiled in a pot with added sugar, before being served into a cup where the grounds settle.

Macchiato: Macchiato, means 'stained', is an Espresso with a dash of foamed milk. At first sight it resembles a small Cappuccino.

Oliang: Commonly known as Thai iced coffee, is an iced coffee drink which blends the coffee together with soybeans, corn, sesame seeds, and other additives.

A flat white: It has its origin from Australia and New Zealand. It is prepared by pouring micro foam (steamed milk from the bottom of a pitcher) over a single shot or double shot of espresso.

Cafe Breva: A cappuccino made with half milk (equal parts whole milk and light cream), instead of whole milk.

Indian (Madras) filter coffee: It is made by mixing frothed and boiled milk with the decoction obtained by brewing finely ground coffee powder in a traditional Indian filter.

Cafe Latte Freddo: It is a type of cold coffee. It is an espresso

mixed with cold milk in similar proportions as a Cafe Latte that is usually shaken well with ice in a cocktail shaker

Vienna coffee: It is a popular traditional cream based coffee beverage. It is made by preparing two shots of strong black espresso in a standard sized coffee cup and infusing the coffee with whipped cream until the cup is full.

Liqueur coffee: A liqueur coffee is a coffee drink with a shot of liqueur. It is usually served in a special liqueur coffee glass, often with whipped cream and sugar.

Café Bombon: Popular in Valencia, Spain, it is an espresso served with sweetened condensed milk in a 1:1 ratio.

Conclusion: As consumers are more demanding and as the speciality coffee public grow, the quality and differentiation among the various coffee brands will tend to increase, along with specific label information such as types of blends, roasting degree, sensorial attributes, etc. Additionally, a massive research effort is being made with the intent of combining the peculiar flavor of coffee with its biological properties and a series of new coffee based 'functional' beverages and products are being created. With increasing coffee consumption, more attention is focused not only on the flavor and texture of the drink, but also on the impact of coffee on health. Thus specialty coffees can offer a rejuvenating and satisfying sense of feeling with their modified properties.



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CHANGALIKODAN NENDRAN

THE SECRET BEHIND GRANTING GEOGRAPHICAL INDICATION TAG TO THE MOST BEAUTIFUL AND PREMIUM BANANA BUNCHES

Geographical Indication for Changalikodan Nendran

Changalikodan Nendran Banana or famously known as Changalikodan is a banana variety originated and cultivated in Chengazhikodu village of Thrissur District in Kerala state of India. It got Geographical indication registration from the Geographical Indications Registry, Chennai in 2015. The very basis of Geographical indication (GI) is the existence of a given quality, reputation or any other character of a product that could be attributed to its origin, which gives rise to its uniqueness. It is an intellectual property which provides the producer community with the right to claim the uniqueness of



the product. The Changalikodan Banana Growers' Association, Erumapetty, was given the registration. It is now cultivated on the banks of the Bharathapuzha river, also grown in Erumapetty, Wadakkancherry, Munderoor, Kaiparambu, Desamangalam and Thayyur of Thrissur District.

Since GIs have association with specific territories and links to specific local resources, they can act as a strong tool for rural development in the hands of the community with proper benefit sharing mechanism. Its uniqueness are due to the size, characteristic taste, bunch shape and fruit colour. The sugar contents of this product are 26-30% and shelf life of 7-9 days with 21-25 cm fruit size. This product is having very high demand on festive occasions in Kerala and offered to divine Kazhchakula at temples across Kerala state. The average bunch (10-15 kg) bears 20 to 25 fruits per hand with golden coloured bananas and have a long inflorescence pendants.

A bunch of Changalikodan banana worth Rs. 1,000- 2,500. It is the kaazhchakula to the presiding deity of the temple and also presented as gifts. Perhaps, this is the only agricultural produce fetching this fancy price during the festive season of onam. The price of the plantain is not in tune with the quantity, but it is directly proportional to the appearance and quality of the plantain. The more showy and colourful the bunch, its demand increases and fetches more price.

History of Changalikodan

Chengazhikode was a near by princely state of Thalappilly. Chengazhi Nambiar people were ruling the state. The specialty of the banana cultivated in the place was widely known. With this, the Changalikodan banana became the offering given to SreePadmanabha Swamy temple. The name Changalikodan is derived from the place name Chengazhikode.

Cultivation

The cultivation of Changalikodan demands special care and individual attention. The cultivation of this banana variety is mainly found in Talappilly taluk of Thrissur-in Kaiparambu, Velloor, Puthoor and Vadakkanchery.

The Changalikodan is planted in the month of October and are grown organically which gives its unusual yellow colour and texture. Individual attention, special care and monitoring of every stage are needed for this banana variety. Green leaf manure, ash and cow dung are used to supplement the growth. Overdose of organic fertilizers affects the appearance of bunches.

Traditional farmers involved in the cultivation are well-versed with the requirement of the plant for producing good quality bunches. The state of art-technology in the final makeover is the covering of bunches with old banana leaves so that it can get the colour. Bunches are covered 20-25 days after emergence. This practice requires special skill. Even the spacing between

banana fingers and hands are adjusted by placing the leaves during the 'bunch covering' process.

Only few farmers are involved in this cultivation due to the laborious process involved and they too plant only 100-150 plants. No other variety of banana can be a substitute for the Changalikodan in taste and appearance. This makes it the star of the onam season and this is the reason behind it has received GI.

A bunch of plantain weighs approximately 10-15 kg. Uncut long inflorescence is one of the attractive feature. The fruits can be harvested 10 months after planting. Offering kazhchakula at Guruvayoor temple is a special ritual during onam. This plantain variety has a unique taste and this makes it an exceptional choice for making pazhamnurukku and sharkkaravaratti.

Geographical peculiarity

A study conducted by the District Department of Soil Survey and Soil Conservation concluded that the Changalikodan banana, which is native to Thalappilly taluk received its characteristics due to the specialty of the soil. The features like beauty of the bunch of banana, intense sweetness of fruits, unique shape of fruits, and golden colour of bananas resulted from the soil contents.

Changalikodan turned out to be a unique variety of banana due to the presence of alluvial soil flowing from the Machad hills. This soil is rich in



plant nutrients. The soil never gets washed away from Thalappilly. The organic farming method and local weather conditions also help the banana grow with special features. It also obtained geographical indication due to this specialty.

The soil samples were collected from Varavoor, Mulloorkkara and Erumapetty panchayats. Instead of digging holes, the Changanalikodan banana is planted by making groove on the soil. Also the soil is heated before planting. These practices have influenced the banana plant.

However, it has been found that the unscientific use of fertilizers has started affecting the soil. Acidity of soil has increased

and the presence of iron, manganese and phosphorus also is high. The study also pointed out that this will affect absorption of other nutrients and gradually affect the natural growth of Changanalikodan.

Conclusion

The prime economic function of GI protection is to maintain the goodwill and reputation of the product in the market and thus expanding the access to the market for better revenues. Experts and lawyers specializing in GI are of the opinion that the scope of GI has not been exploited to the fullest extent here, unlike in other countries, and there are no proper mechanisms to monitor what happens after a product

is given this tag. GI registration has increased the fame and demand of course, but there are still more avenues to be opened for the farmers in this regard. Exploring and investing in market potential along with Govt. to facilitate registration and post registration measures has to be triggered to tap the market potential. Development of strong models ensuring fair benefit sharing among communities has to be formulated. Decentralized mechanism for GIs with uniform statutory framework has to be materialized. Let us hope that this GI tagging can take this beautiful and premium banana bunches to the world market, adequately rewarding the traditional farmers.

THE NEXT BIG WHAT IN AGRICULTURE HIGH THROUGH PUT PHENOTYPING

Drones, automated harvesters, autonomous tractors, automated seeding and weeding techniques etc. are very much common nowadays. We are often familiar with these major farm technologies. Farm automation technology addresses major issues like farm labour shortages, a rising global population etc. India, being an agrarian country, whose population is growing

tremendously has to highlight its further research in this regard. High throughput Phenotyping techniques is the best answer for the hour. Phenotype is a word derived from the Greek words 'phainen' meaning to show and 'tupos' meaning type and thus, phenotypes represent the organism's nature and nurture. It refers to an individual's collection of measurable characteristics resulting from the genotype's

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interaction with the environment. Increasing the size of breeding system offers high levelled accuracy of the experiment. Plant phenotyping is a leading factor in detecting the intensity of selection, precision of selection, and new genetic variation.

Automated image-based plant phenotyping with high-



throughput techniques, has emerged as a cutting-edge technology in breeding and management of crops i.e., precision agriculture. It works with non-destructive image analysis, data management, and modelling. Plant characters were quantified by analyzing images collected at regular intervals and with accuracy. The widely used Organ phenotyping, (e.g., leaves, roots, fruits) structural phenotyping (number of fruits, leaf area, leaf shape, leaf color, shoot elongation, plant architecture, etc.) and functional phenotyping (e.g., leaf gas exchange, volatile organic compounds, etc.) help us to study both model species and crops.

Satellite monitoring of the crops allows tracking of the positive and negative changes in the crop development using high resolution satellite images. A vegetation index is then generated, and alterations in that data indicate disproportions enabling one to figure out required

agricultural measures that need to be taken on a particular field. Such monitoring technology lets farmers monitor crops in different areas, fields, regions, and countries. The resultant map from this technology can be read and interpreted by a variety of people. Phenotyping of plants with ground-based vehicles and sensors is known as proximal phenotyping. Proximal phenotyping is an emerging science that associates genomics with agronomy and plant ecophysiology.

Unmanned aerial vehicles (UAVs) are rapidly evolving in the field of agriculture, replacing satellites and other aircraft. When UAVs were first developed, they were widely used for military purposes and surveillance. UAVs can obtain high-quality images at low prices, whereas satellites and aircraft require high altitudes, cloud penetration, and other capabilities to enable clear photography. UAVs, on the other hand, fly at lower altitudes, allowing them to acquire

clear images with ease. Thus, the number of UAVs used in agriculture is rapidly increasing. Unmanned aerial vehicles combine information and communication technologies, robots, artificial intelligence, big data, and the internet of things. Agricultural UAVs are highly capable, and their use has expanded across all areas of agriculture, including pesticide and fertilizer spraying, seed sowing, and growth assessment and mapping. UAVs are not only less expensive than most other agricultural machines, but also they are easily operated

Natural field phenotyping

Commonly used vehicles in natural field phenotyping are high clearance tractor or tall tractor, crane or linear move, cable robot, aerostat etc. Parachute, Blimps, Rotocopter, Fixed wing etc, are also widely used vehicles for natural field phenotyping. The comparison between these vehicles can be clearly seen in the table below. Different sensors like



Visible light imaging camera, Fluorescence imaging camera, Thermal imaging camera, Bioluminescence imaging camera, Near infrared imaging & multispectral line scanning camera, Hyperspectral reflectance imaging camera, Stereo camera, Light detection and ranging and laser triangulation sensor, NIR and Fourier transform infrared spectroscopy are widely used in these vehicles. Large number of genotypes can be evaluated in this technique. Phenotyping is done in conditions near to the farmer's field. But natural field phenotyping has got few disadvantages also. Field and environmental variability results in requirement of multilocation and multi-year experiments to obtain reliable results. Under

Criteria	High-Clearance tractor	Crane or linear move	Cable robot	Helicopter	Aerostat
Maximum payload	200 kg	Over 500 kg	100 kg	400 kg	10 kg
Portable	Yes	Limited	No	Yes	Limited
All Weather Operation	No	Yes	Yes	No	No
Potential for damage to plants, soil compaction, or transmission of pathogens	Yes	No	No	No	No
Type of operator required	Driver	Technician	Technician	pilot plus assistant	Technician
Power supply	One-board	On-board or cable	Battery or cable	Battery	Battery or cable
Random access to field positions, with start /stop	No	Yes	Yes	Yes	Yes
Potential for high-frequency vibration	Yes	No	No	Yes	No
Minimum sensor distance to canopy	10cm	10cm	10cm	160cm	1m
Maximum vertical clearance	2m	5m	5m	>100m	>10m
Can support sensors spaced for multiple rows	Yes	Yes	Weight limited	No	weight limited
Based on well - established engineering	Yes	Yes	No	Yes	Yes
Base cost (exclusive of fuel, operators, maintenance, etc)	\$1.00,000	?	?\$	1,000per 1h flight	\$ 3,000

Type	Payload (kg)	Flight time (min)	Benefits	Limitations	Examples
parachute	1.5	10-30	<ul style="list-style-type: none"> • Simple operation 	<ul style="list-style-type: none"> • Not operable in windy conditions. • Have limited payload 	HawkEye
Blimps	>3.0	~600	<ul style="list-style-type: none"> • Simple operation 	<ul style="list-style-type: none"> • Not operable in windy conditions Have limited payload 	AB1100, cameron fabric Engineering
Rotocopter	0.8-8.0	8-120	<ul style="list-style-type: none"> • Applicable with waypoint navigation • Hovering capabilities • Can hold range of sensors from thermal, multispectral to hyperspectral Cameras 	Payload may limit battery usage and flight time	DJI Inspire , Mikrocopterer ARK
Fixed wing	1.0-10	30-240	<ul style="list-style-type: none"> • Applicable with Waypoint navigation • Better flight time Multiple sensors Can be mounted 	<p>Limited hovering capacity</p> <p>Lower speeds are required for i mage stitching</p>	Landcaster precision sensefly eBee



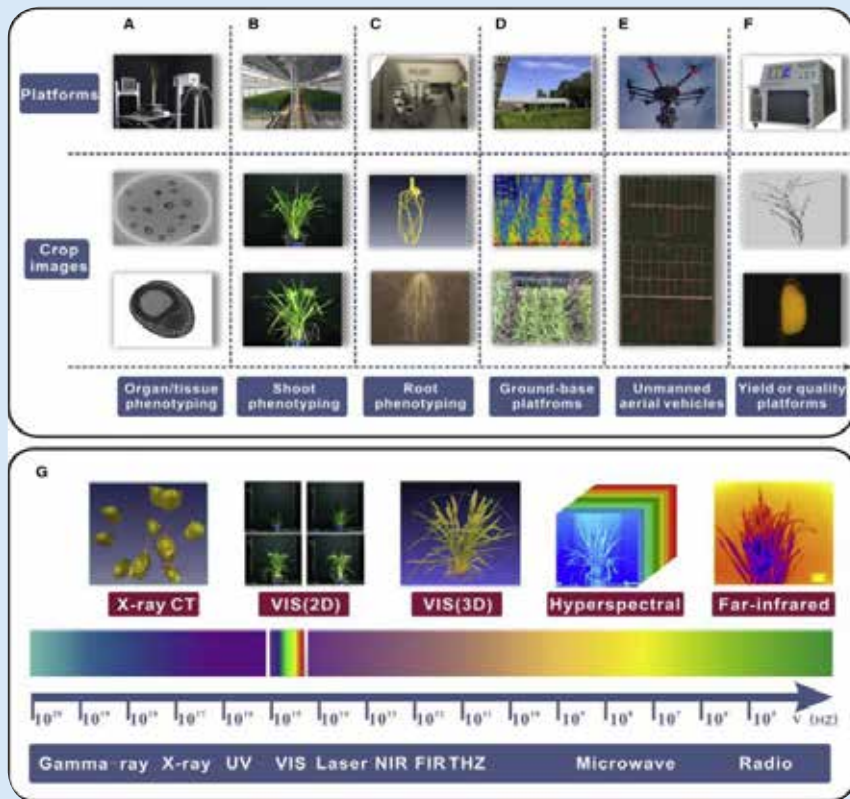
Rotocopter



Fixed wing



Unmanned helicopter



Schematic Overview of Phenotyping Platforms and across Different Scales

field conditions the inability to obtain standardized and consistent drought stress/nutrient deficiency contributes to a loss in heritability and presents a challenge for both selection and mapping experiments. Not possible to impose similar levels of stress at defined phenological stages for a mapping population and germplasm lines.

Phenotyping under Controlled Environment

Phenotypic data on whole-plant during its entire life cycle can be acquired in a controlled environment. Non-invasive sensors capture phenome of the plants are based on the principle of radiation reflectance, transmittance and emissivity. These physical

parameters depend upon chemical composition, physiological state and structure of plants. Robotized delivery of plants to the imaging sensors is commonly used in controlled environment phenomics platform. Stresses (water, nutrient, temperature, salinity, etc.) can be imposed at equal stress levels and phenological stages for a germplasm and mapping population.

Phenotyping for mapping genes/QTLs for stress tolerance and resource use efficiency in crops is addressed. As the environmental variation is minimized, heritability of traits is high. Hence gene/QTL mapping is accurate. High precision is possible in critical measurements

such as input use. Maximum amount of information may be obtained from a minimum of replicates. Decreases the experimental cost through automation and standardization. Uniform quality of images can be obtained as the light conditions required for specific images are maintained when automated non-destructive phenotyping is performed. Off-season phenotyping is also possible in this technique. Limited greenhouse space or chamber volumes often limits the number of genotypes to be phenotyped. Maintaining environmental conditions (temperature, RH, light) in sinusoidal fashion similar to that of natural environment is often found difficult. The soil volume that is provided for plants in controlled environments usually is far less than that available to plants in the field. In greenhouses and chambers, solar radiation, wind speed and evaporation rates typically are lower than under open-air conditions.

Even if these techniques are available, the popularity of the same has to be enhanced. Now scientists are moving from phenotyping to phenomics era which unlocks the hidden genetic variation which reveals the keys to stress tolerance and break yield barriers. Complementary use of phenotyping and phenomics data can assist fundamental research and analytical crop breeding programs.



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Powdery mildew (Diseases of Mango)

PHYSIOLOGICAL AND BIOCHEMICAL BASIS FOR DISEASE RESISTANCE IN MAJOR TROPICAL FRUIT CROPS

Mango, banana, papaya, sapota, and pineapple are all major tropical fruit crops and these fruits are important components of natural ecosystems. A limited number of the thousands of species that exists are important to humans. Diseases are often the most important constraint in the production of tropical fruits. They indirectly reduce yields by debilitating the plant, and directly reduce the yield or quality of the fruits before and after they are harvested. The use



Anthracnose (Diseases of Mango)

Why disease resistance required?

Crop	Diseases	% of yield loss	Reference
Mango	Powdery mildew	80 - 90 %	Nelson.,2008
	Anthracnose	10-20%	Nelson.,2008
	Malformation	80%	Chakrabarti., 2011
	Bacterial canker	10-85%	Haggag,2010
Papaya	PRSV	40-90%	Singh et al., 2010
Banana	Fusarium wilt	30-40%	Venkatesh et al., 2013



Malformation (Diseases of Mango)





PRSV (Diseases of papaya)

of pesticides or agrochemicals has many attendant side effects over the environment as well as fruit plants. Physiological and biochemical components induce disease resistance in fruit plants. The physiological basis like stomatal number, pore size, transpiration etc., and number of biochemical compounds including mangiferin, total phenolics and their metabolizing enzymes, antioxidants, alkaloids and phytoalexins have been implicated to play a crucial role in the tolerance/resistance towards diseases.

Many of the fruit crops have considerable yield loss because of incidence of many diseases as described in the above table.

What is disease resistance?

Plant disease resistance is the inherent ability of a

plant to prevent or restrict the establishment and subsequent activities of a potential pathogen.

Plant disease resistance

The plant disease resistance through Physiological and biochemical basis,

Physiological basis for disease resistance

1. Stomatal Number
2. Transpiration rate
3. Thickness of cuticle
4. Stomatal conductance and spore size

Stomatal Number and transpiration rate: -

For example mango malformation.

Higher rate of transpiration that was recorded in susceptible cultivar (Singh 2006,) may be due to presence of higher number of stomata as has been reported in other

crop (Zeiger, 1983). Lower leaf temperature and higher relative humidity in susceptible cultivars were also obtained by Varma et al., (1971) where it was monitored that the fungus *F. mangiferae* (pv. *moniliforme* var. *subglutinans*), the casual organism of mango malformation, grows well at lower temperature and higher relative humidity and maximum number of stomata was noticed in susceptible cultivars.

Thickness of cuticle: -

A thick cuticle may increase resistance to infection in diseases in which the pathogen enters its host only through direct penetration. Cuticle thickness, however, is not always correlated with resistance, and many plant varieties with cuticles of considerable thickness are invaded easily by directly penetrating pathogens. The

thickness and toughness of the outer wall of epidermal cells are apparently important factors in their resistance of some plants to certain pathogens. Thick, tough walls of epidermal cells make direct penetration by fungal pathogens difficult or impossible. Plants with such walls are often resistant, although if the pathogen is introduced beyond the epidermis of the same plants by means of a wound, the inner tissues of the plant are invaded easily by the pathogen.

Stomatal conductance and pore size: -

Stomatal conductance means opening and closing of stomata. Many pathogenic fungi and bacteria enter plants only through stomata. Although the majority of pathogens can force their way through closed stomata, some, like the stem rust of wheat, can enter only when stomata are open. Thus, some wheat varieties, in which the stomata open late in the day, are resistant because the germ tubes of spores germinating in the night dew desiccate due to evaporation of the dew before the stomata begin to open. If the pore size is large the pathogen easily enters its host and if pore size is less the pathogen entry is difficult. So the pore size also influences the disease resistance in plants.

Biochemical basis for disease resistance: -

Presence of phenolics and phytoalexins helps in providing resistance in host. Here the mechanism involved is when the pathogen come in contact with the host there will be signal transaction between host and pathogen. When the signal is sent by the pathogen,



Fusarium wilt (Diseases of Banana)

in the resistant plant there will be stimulation to produce the phenolic compounds. These phenolics and phytoalexins will act on the fungal hyphae and rupture the pathogen cell membrane and cause death of pathogen, there by induces resistance in plant host to rust.

Biochemical defense through two ways they are

1. Pre- existing biochemical defense

2. Biochemical defense induced by the pathogen (active biochemical defense)

1. Pre- existing biochemical defense

Although structural characteristics may provide a plant with various degrees of defense against attacking pathogens, it is clear that the resistance of a plant against

pathogen attacks depends not so much on its structural barriers as on the substances produced in its cells before or after infection. This is apparent from the fact that a particular pathogen will not infect certain plant varieties even though no structural barriers of any kind seem to be present or to form in these varieties. Similarly, in resistant varieties, the rate of disease development soon slows down, and finally, in the absence of structural defenses, the disease is completely checked. Moreover, many pathogens that enter non host plants naturally or that are introduced into non host plants artificially, fail to cause infection, although no apparent visible host structures inhibit them from doing so. These examples suggest that defense mechanisms of a chemical rather

than a structural nature are responsible for the resistance to infection exhibited by plants against certain pathogens.

a) Inhibitors released by the plant in its environment.

Plants exude a variety of substances through the surface of their aboveground parts as well as through the surface of their roots. Some of the compounds released by certain kinds of plants, however, seem to have an inhibitory action against certain pathogens. Fungi toxic exudates on the leaves of some plants, e.g., tomato and sugar beet, seem to be present in sufficient concentrations to inhibit the germination of spores of fungi *Botrytis* and *Cercospora*, respectively that may be present in dew or rain droplets on these leaves.

b) Defense through lack of essential factors.

1, Lack of recognition between host and pathogen.

Plants of a species or variety may not become infected by a pathogen if their surface cells lack specific recognition factors (specific molecules or structures) that can be recognized by the pathogen. If the pathogen does not recognize the plant as one of its host plants, it may not become attached to the plant or may not produce infection substances, such as enzymes, or structures, such as appressoria, penetration pegs, and haustoria, necessary for the establishment of infection. It is not known what types of molecules or structures are involved in the recognition of plants and

pathogens, but it is thought that they probably include various types of oligosaccharides and polysaccharides, and proteins or glycoprotein's. Also, it is not known to what extent these recognition phenomena are responsible for the success or failure of initiation of infection in any particular host-pathogen combination.

2, Lack of host receptors and sensitive sites for toxins.

In host-pathogen combinations in which the pathogen (usually a fungus) produces a host-specific toxin, the toxin, which is responsible for the symptoms, is thought to attach to and react with specific receptors or sensitive sites in the cell. Only plants that have such sensitive receptors or sites become diseased. Plants of other varieties or species that lack such receptors or sites remain resistant to the toxin and develop no symptoms.

3, Lack of essential nutrients for the pathogen.

Species or varieties of plants that for some reason do not produce one of the substances essential for the survival of an obligate parasite, or for development of infection by any parasite, would be resistant to the pathogen that requires it. Thus, for *Rhizoctonia* to infect a plant it needs to obtain from the plant a substance necessary for formation of a hyphal cushion from which the fungus sends into the plant its penetration hyphae. In plants in which this substance is apparently lacking, cushions do not form, infection does not occur, and the plants

are resistant.

c) Inhibitors present in plant cell before infection.

It is becoming increasingly apparent that some plants are resistant to diseases caused by certain pathogens because of one or more inhibitory antimicrobial compounds, known as phytoanticipins, which are present in the cell before infection. Several phenolic compounds, tannins, and some fatty acid-like compounds such as dienes, which are present in high concentrations in cells of young fruits, leaves, or seeds, have been proposed as responsible for the resistance of young tissues to pathogenic microorganisms such as *Botrytis*. For example, Strawberry leaves naturally contain (+)-catechin, which inhibits infection by *Alternaria alternata* by blocking the formation of infection hyphae from haustoria although it allows both spore germination and appressoria formation.

2. Biochemical defense induced by the pathogen (active biochemical defense)

(a) Defense through increased levels of common phenolic compounds and phytoalexins.

Certain common phenolic compounds that are toxic to pathogens are produced and accumulate at a faster rate after infection, especially in a resistant variety of plant relative to a susceptible variety. Chlorogenic acid, caffeic acid, and ferulic acid are examples of such phenolic compounds. In peach, chlorogenic acid is present in quite high

crop	Biochemical component	Disease resistance	References
Mango	Mangiferin	Malformation	V.K. Singh,2006
	TPC	Anthraco nose	Jinhe Lin et al.,2011
papaya	PAL, POD, TPC	Anthraco nose	Jingying Shi et al.,2011
Papaya	PPO, Peroxidase	PRSV	Jayavalli,2010
Banana	Total phenols	Fusarium wilt	Venkatesh et al.,2013

TPC- Total phenolic content, PAL-Phenylalanine ammonia-lyase, PPO-Poly phenoloxidase, and POD- Peroxidase.

concentration both in immature fruit and in fruit of varieties resistant to the brown rot disease caused by the fungus *Monilinia fructicola*. The fruit is resistant in both cases, not because of the toxicity of the acid to the causal fungus, but rather because it inhibits the production of fungal enzymes that cause degradation of host tissue.

(b) Hypersensitive reaction.

The hypersensitive response, often referred to as HR, is a localized induced cell defense in the host plant at the site of infection by a pathogen. HR is the result of quick mobilization of a cascade of defense responses by the affected and surrounding cells and the subsequent release of toxic compounds that often kill both the invaded and surrounding cells and, also, the pathogen.

The hypersensitive response is often thought to be responsible for limiting the growth of the pathogen and, in that way, is capable of providing resistance to the host plant against the pathogen.

(c) Toxic phenolics released from nontoxic phenolic Glycosides.

Many plants contain nontoxic glycosides, i.e., compounds consisting of a sugar (such as glucose) joined

to another, often phenolic, molecule. Several fungi and bacteria are known to produce or to liberate from plant tissues the enzyme glycosidase that can hydrolyze such complex molecules and release the phenolic compound from the complex. Some of the released phenolics are quite toxic to the pathogen, especially after further oxidation, and appear to play a role in the defense of the plant against infection.

(d) Phenol- oxidising enzymes (phenoloxidases).

The activity of many phenol-oxidizing enzymes (polyphenol oxidases) is generally higher in the infected tissue of resistant varieties than in infected susceptible ones or in uninfected healthy plants. The importance of polyphenol oxidase activity in disease resistance probably stems from its property to oxidize phenolic compounds to quinones, which are often more toxic to microorganisms than the original phenols. It is reasonable to assume that an increased activity of polyphenol oxidases will result in higher concentrations of toxic products of oxidation and therefore in greater degrees of resistance to infection.

(e) Induced synthesis of enzymes.

Synthesis of phenols by phenol-oxidizing enzymes in plants it induce the disease resistance.

(f) Detoxification of pathogen toxins.

Whatever pathogen produced toxin it can be detoxified by plants which results in disease resistance in plants. e.g., HC toxin and pyricularin, produced by the fungi *Cochliobolus carbonum* and *Magnaporthe grisea*, respectively, is known to occur in plants and may play a role in disease resistance. Some of these toxins appear to be metabolized more rapidly by resistant varieties or are combined with other substances and form less toxic or nontoxic compounds. The amount of the nontoxic compound formed is often proportional to the disease resistance of the variety.

The above table shows biochemical components are important to induce the disease resistance in plants.

Thus understanding physiological and biochemical means helps to overcome the disease incidence and sustain the growth and yield parameters. It also helps to avoid the cost incurred towards plant protection chemicals, thereby increased yield and production can be realized.

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Lily

“An emerging cut flower for maximum profits”



Lily (*Lilium* spp.) belongs to the family Liliaceae and is native to the Northern Hemisphere.

The east coast of Asia, the west coast of North America & the Mediterranean region are the three most richly garnished places. Lilies are among the top 10 flowers of the world traded for high value flowers with attractive colours, excellent vase life and in some cases with exhilarating fragrance.

Uses / Nutrient values: -

Apart from growing as cut flowers, lilies can also be grown in the border, beds, and pots. Certain species of *Lilium* are edible also. Flowers of *Lilium candidum* contain an alkaloid lilaline. The mucilaginous substance coming out from the bulbs is used as an ointment for softening corns & healing scalds

and burns.

Botanical description: -

Lily bulbs have a solid basal plate that produces series of fleshy, overlapping scale of varying width from its top. Most lilies produce a single unbranched stem bearing linear leaves. Flowers are in the terminal raceme on umbel. Flowers are perfect & contain 6 tepals with a honey bearing gland at the base, 6 stamens, vestibule anthers, ovary superior. Fruit is a 3 celled capsule with numerous seeds.

Production technology

Climatic requirement: -

Lilies prefer mild climatic conditions. It needs partial shade (40-50%) during growing season and can be grown successfully under protected conditions. Outdoor cultivation is possible only in regions where the climate

remains favourable during the cultivation period. The risks involved in outdoor cultivation are strong winds, hail, periods of frost and botrytis. The climatic conditions of low, mid and high hilly areas are suitable for growing lilies to supply the flowers round the year in the market. In the plains favourable climatic conditions prevail only during winter season to produce quality flowers. Lilies need 2000-3000 foot candles of light for quality flower production. The optimum day and night temperature for obtaining higher yield and quality of *Lilium* is 20-25°C and 8-12°C during day and night. Optimum humidity inside the greenhouse must be around 60 to 70 per cent.

Soil:-

Lilium can be grown under wide range of soils but the



ideal soil should be well drained with good humus content. Most lilies prefer soil with pH 5.5-6.5.

Preparation of field: -

Soil sterilization should be done with 2% formaldehyde or methane sodium @ 25/acre at least one month prior to bulb planting. About 30-40 cm deep soil is dug out from the beds and the bottom soil is drenched with formaldehyde solution quickly and the trench is filled and levelled with the removed soil. The bed is then quickly covered with polyethylene sheets for at least 15 days. After sterilization process, the polyethylene sheets are removed and the soil is dug again and irrigated thoroughly before planting.

Classification: -

Asiatic cultivars: -

The Asiatic hybrid lilies are derived from seven Asiatic species. These are between 30 to 150 cm tall. Individual blooms are 15 to 20 cm in diameter, facing upright and are frequently streaked with purple or any other colour. Early flowering (10-12 weeks), easy to propagate and resistance to insects and pests make its cultivation more attractive. The vase-life of flowers is relatively short (7-14 days).

Varieties – Connecticut King, Enchantment, Monte Rosa, Elite, Jollanda, Snow Star, Salmon Beauty, Alaska, Dreamland, Roma.

Oriental cultivars: -

Oriental hybrids are

elegant large flowered lilies with fragrance. These are 60-180 cm tall, late flowering (14-16 weeks), having large saucer shaped flowers with long vase life (10-15 days).

Varieties – Casa Blanca, Mona Lisa, Everest, Stargazer, Marco Polo.

LA hybrids: -

Cultivars of *Lilium longi florum* are crossed with Asiatic hybrid lilies to develop the LA hybrids. These hybrids have the characteristics like Asiatic hybrid lilies but are dwarf and sturdy.

Varieties – Brindisi, Pavia, Casa Rosa, Evening Star, Royal Dream.

Propagation: -

Lilies are commonly propagated by a bulb. The flower quality of the crop depends mainly upon the size of the planted bulb. A large size bulb produces tall and stronger plants with more uniform and heavier flowers as compared to small sized bulb. In Asiatic hybrid and LA lily commercial size bulb circumference ranges from 12-18 cm but in case of Oriental hybrid lily it varies from 14-22 cm. Bulb do not sprout if sown immediately after harvest due to its dormancy. Dormancy can be broken by storing the bulbs in cold storage. Asiatic hybrid, LA and Oriental lilies require a cold treatment for a minimum of 10-14 weeks at 2 to 4°C before planting for rapid shoot emergence and flowering. Defrosting of bulbs is done at

7-13°C for 1 to 3 days.

Planting time and method: -

The planting time for lily is usually during October-November in the plains whereas in the hilly areas it is usually planted during April-May. The flowering time is Jan- Feb and July-August in the plains and hilly areas respectively. It can be planted in flat beds, raised beds and ridges. In light soils such as sandy and sandy loam, it is advisable to plant them in ridges or 1m wide raised beds. In the hilly regions having high rainfall during crop season planting should be done in raised beds and ridges to facilitate excess water to drain and hold the plant intact in the field.

Spacing:-

Plant spacing of 15 cm X 15 cm row to row and bulb to bulb has to be maintained. Accordingly, 40-50 bulbs are planted in per square meter. The depth of planting should be at 15 cm.

Nutrient Management: -

FYM, phosphorus in the form of single super phosphate (SSP), and muriate of potash (MoP) are incorporated into the soil before planting. Three weeks after planting, calcium ammonium nitrate (CAN) @1 kg/100 m³ should be applied. When the plants are in active vegetative growth, the second dose of CAN should be applied @1 kg/100 m³. Fertilizer application is stopped once the

flower buds show colour.

Irrigation or Water Management: -

Watering of the field should be done few days prior to planting, in such a way that bulbs can be planted when the soil is moist but not extensively wet. Drip irrigation system is suitable for this type of crop as this would avoid wetting the foliage thereby, reducing the chance of disease. Average water requirement is 8-10 l/m³ during the dry period.

Plant support: -

It is always necessary to support the lilies with wire or supporting net during their active growth period and it can be extended during the growing period parallel to the growth of the plants till flower stems are harvested.

It is advisable to place a few layer (3-4) of net over the beds at the time of planting the bulbs and then slowly raise the net above the ground as the plants gain height.

Harvesting and storage

Flowers are harvested 15-20 cm above the ground level when they just start showing colour and become loose. The remaining lower portion of the plants are allowed to grow so that development of the bulbs continues in the soil.

Freshly cut flowers which are pretreated with pulsing solution (10%) can be stored dry in tightly sealed moisture retentive polythene foil at 2 to 5°C for 2-3 weeks.

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THE SEEDS OF OUR FUTURE

Svalbard Global Seed Vault

The Seed Vault represents the world's largest collection of crop diversity. Deep inside a mountain on a remote island in the Svalbard archipelago, halfway between mainland Norway and the North Pole, lies the Global Seed Vault. It is a facility located on a remote Norwegian island in the Arctic Ocean and it houses the world's largest collection of seeds. It is a long-term seed storage facility, built to stand the test of time and the challenge of natural or man-made disasters. It is therefore also referred to as the doomsday vault. The storage rooms are kept at -18°C (-0.4°F). The low temperature and limited access to oxygen will ensure low metabolic activity and delay seed aging. The samples stored in the genebanks are accessible in accordance with the terms and conditions of the International Treaty on Plant Genetic Resources for Food and Agriculture, approved by 118 countries or parties.

Construction

The entrance leads to a small tunnel like

room filled with the loud whirring noise of electricity and cooling systems required to keep the temperature within the vault consistent. Through one door is a wide concrete tunnel illuminated by strip lighting leading 430 ft. down into the mountain. At the end of this corridor is a chamber, an added layer of security to protect the vaults containing the seeds.

There are three vaults leading off from the chamber, but only one is currently in use, and its door is covered in a thick layer of ice, hinting at the subzero temperatures inside. In here, the seeds are stored in vacuum packed silver packets and test tubes in large boxes that are neatly stacked on floor

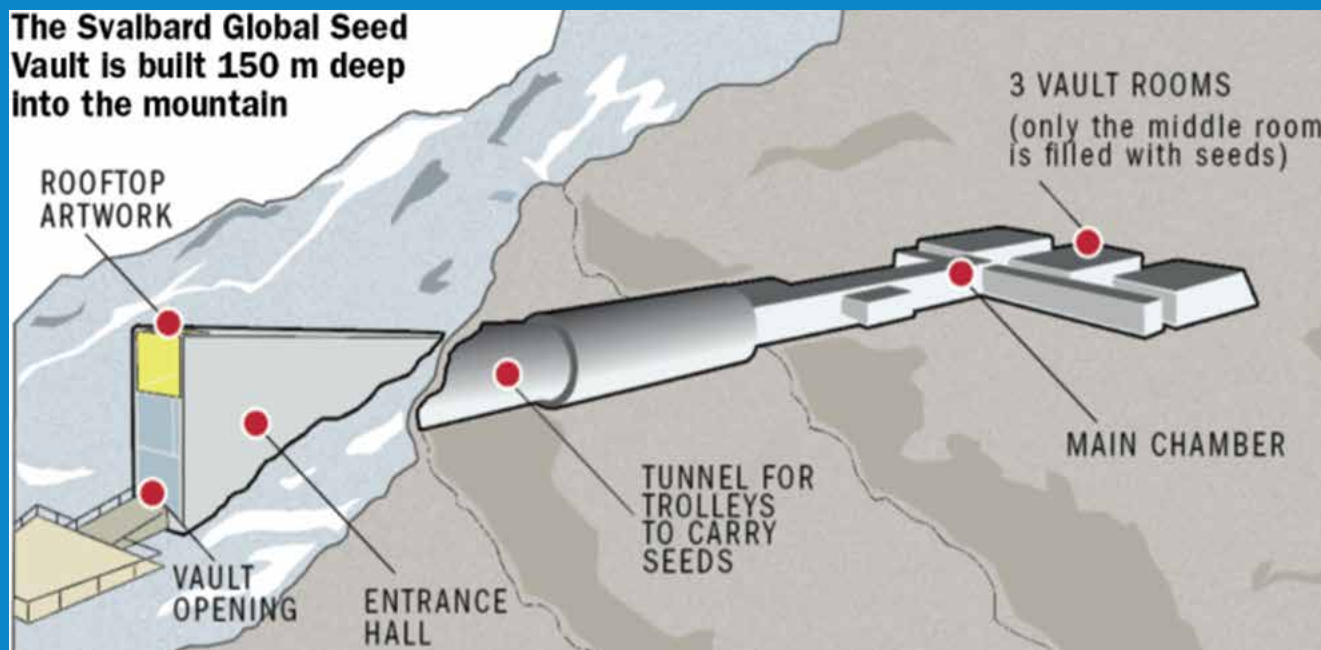
to ceiling shelves. They have very little monetary value, but the boxes potentially hold the keys to the future of global food security.

The seeds lying in the deep freeze of the vault include wild and old varieties. But the genetic diversity contained in the vault could provide the DNA traits needed to develop new strains for whatever challenges the world or a particular region will face in the future. One of the 200,000 varieties of rice within the vault could have the trait needed to adapt rice to higher temperatures. There are as many as 1,700 versions of the vault, called gene banks, all over the world. This global network collects, preserves and shares

seeds to further agricultural research and develop new varieties. The Svalbard vault was opened in 2008, effectively as a backup storage unit for all those hundreds of thousands of varieties.

It was the recognition of the vulnerability of the world's genebanks that sparked the idea of establishing a global seed vault to serve as a backup storage facility. The purpose of the Vault is to store duplicates (backups) of seed samples from the world's crop collections. Permafrost and thick rock ensure that the seed samples will remain frozen even without power. The Vault is the ultimate insurance policy for the world's food supply, offering options for future generations





to overcome the challenges of climate change and population growth. It will secure millions of seeds representing every important crop variety available in the world.

The Seed Vault has the capacity to store 4.5 million varieties of crops. Each variety will contain on average 500 seeds, so a maximum of 2.5 billion seeds may be stored in the Vault. Currently, the Vault holds more than 1,000,000 samples, originating from almost every country in the world. A temperature of -18°C is required for optimal storage of the seeds, which are stored and sealed in custom made three-ply foil packages. The packages are sealed inside boxes and stored on shelves inside the vault. The low temperature and moisture levels inside the Vault ensure low metabolic activity, keeping the seeds viable for long periods of time.

The focus of the Vault is to safeguard as much of the world's unique crop genetic material as possible, while also avoiding

unnecessary duplication. It will take some years to assemble because some genebanks need to multiply stocks of seed first, and other seeds need regenerating before they can be shipped to Svalbard.

Black box system

The depositors who will deposit material will do so consistently with relevant national and international law. The Seed Vault will only agree to receive seeds that are shared under the Multilateral System or under Article 15 of the International Treaty on seeds that have originated in the country of the depositor. Each country or institution will still own and control access to the seeds they have deposited. The Black Box System entails that the depositor is the only one that can withdraw the seeds and open the boxes.

Salient Features

- The Svalbard Global Seed Vault was commissioned in 2008.
- It is capable enough to withstand manmade and natural disasters.

- Seeds at this vault are locked in airtight boxes at minus 18 degrees Celsius.
- Millions of seeds of crop varieties from Indian rice to Uzbek corn.
- It is theoretically protected against conventional bombs, and sits out of reach of rising sea levels.
- Nearly 9 crore seeds of Indian origin have been sent to Svalbard.
- It also has its National Genebank, which is one of the world's most modern Genebank with capacity to store up to 1.25 million samples.

Svalbard seed bank vault is very important for conserving seeds for the future. In 2015, when the Syrian conflict had made it difficult to access seeds of drought and heat resistant local wheat; this seed bank was accessed to meet the domestic demand. Therefore, Norway government, with the help of other government is taking the measures to provide additional security to the seed vault.



NEW AGE BEVERAGES

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Introduction:

The notion of “functional foods” is frequently stated as being new. But this concept, however is not new having been recorded in ancient Vedic scriptures from India and being a fundamental part of Chinese traditional medicine. The goal of developing functional foods is inspired by the oriental philosophy that “medicine and food have a common root.” In Japan, a recent emphasis on the production of foods with added advantages arose in the 1980s for food items fortified with elements that had positive health benefits. The phrase “functional food” was first used in the publication Nature in 1993, under the headline “Japan explores the boundary between food and medicine.” The basic idea behind functional foods is that food may have a purpose other than gastronomic pleasure or energy and nutritional provision [1]. This rising interest



in functional foods is being driven by advancing scientific research to find positive health qualities and prospective uses of nutraceutical compounds, as well as growing public awareness in the role of food in wellbeing.

Among the functional foods, beverages are one of the most suitable forms of functional foods due to the reasons such as

1. Comfort and likelihood to meet the client's requirements for the required container contents, size, shape and appearance
2. Improved distribution and ease of cold storage
3. Channel to provide essential nutrients and bioactive substances

Antioxidant, anticancer, anti-inflammatory, and anti-aging activities of phenolic compounds which are present in high concentration in fruits and vegetables, adequately supports the consumption of functional beverages.

Fruits, Vegetable and Leafy Vegetable Based Beverages

In 2003, the World Health Organization issued a study report recommending a daily intake of 400g of either fruit or vegetables (excluding potatoes and starchy tubers) for the prevention of probable chronic illnesses and micronutrient deficiencies [2]. Individuals who wish to boost their immune system and lower their blood pressure and cholesterol levels should consume beverages prepared from beets, carrots, celery, currants, spinach, grapes,



Table: Some of the beverages from fruits and vegetables having functional properties

Product	Active compound
Fortified-strawberry beverage	Polyphenols from rose petals
Fermented carrot juice beverage	Prebiotics: inulin and fructo- oligosaccharides
Fiber-fortified dairy beverage	Fibers (soybean)
Grape-based fermented beverage with potential anti-hypertensive effect	Polyphenols (grape must); γ -amino butyric acid (<i>L. plantarum</i> DSM19463)
Olive leaf extract-enriched fruit beverage	Polyphenols (olive leaf extract)
Antioxidant red-coloured beverage	Polyphenols (red-fleshed apples)
Fruit-based beverage with hypolipidaemic effects	Ginger, amino acids, vitamins and minerals

Source: Corbo et al., 2014



cherries, or watermelons daily, supplemented with garlic and ginger. According to research, functional drinks made from fruits and vegetables can influence cardiovascular risk factors by decreasing blood pressure through antioxidant effects and improving the cardiovascular system. Beverages from melon, apricots, peaches, or broccoli are effective in treating potassium, magnesium, or calcium deficiency.

I. Fruit Based Beverages

1. Mango: Mango is known as king of fruits because of its rich flavour and taste. Mango beverage is the most preferred beverage among other fruit beverages. Even though mango is providing a very good amount of bioactive compounds especially carotenoids, still there is scope to improve its nutritional quality. Whey protein and flaxseed oil were used to develop a mango beverage which showed high nutrient content including omega 3, minerals, vitamins and unique proteins, besides digestible carbohydrates [3]

2. Apple: Apples are not only temperate fruits, but they are also among the healthiest. They are high in antioxidants, such as quercetin, catechins, phlorizin, and chlorogenic acids, which guard against the development of breast cancer and colon cancer, as well as aid to avoid kidney stones and control cholesterol. According to research, eating at least two apples each week can lower the chance of getting asthma





and type 2 diabetes while also improving lung function. Other researchers found that apple polyphenols can alter glucose absorption in the small intestine by suppressing the function of glucose transporters [4].

3. Oranges: Oranges are categorized as winter fruits and may be bought in grocery stores from December through April. A medium sized orange fruit contains 3.5 g of fibre (soluble and insoluble); 11% of the necessary everyday dose of vitamin B1 and folic acid; and 107% of the suggested regular consumption of vitamin C. A functional orange juice fortified with vitamin D helps in strengthening the bone.

4. Pineapple: Pineapple is a tropical fruit with high concentration of vitamins, enzymes, and antioxidants. Pineapple contains anti-inflammatory properties and may help prevent colon cancer, macular degeneration, and arthritis. A fermented probiotic beverage using whey from curds and pineapple juice had probiotic population of $4.20 \text{ Log}_{10} \text{ CFU mL}^{-1}$ even after 56 days of storage at low temperature. It shows that this probiotic drink may have good functional and nutritional qualities for human consumption.

II. Vegetable Based Beverages

1. Carrot: Carrot contains high beta carotene (which has a function in immune response) and is shown to be effective in the therapy of liver illnesses

such as viral hepatitis, chronic hepatitis, and hepatobiliary insufficiency. Carrot juice is the more therapeutically effective form of carrot.

2. Cabbage: Cabbage juice is regarded as one of the most efficient treatments for vitamin C insufficiency. Cabbage juice drinks are abundant in vitamins, and minerals. It is a potent blood purifier, advised for ulcers, constipation, and skin eruptions, eczema, colitis, and headache, purifies the digestive tract.

3. Pepper/Capsicum: Green, yellow, or red pepper adds colour and flavour to our cuisine. This vegetable's flavour ranges from somewhat hot to highly spicy to soothing and slightly sweet. Peppers are a good resource of vitamin C. (100 g of hot pepper contains 140 mg of vitamin C). Hot pepper has high beta carotene (vitamin A) content, reaching up to 1300 g, whereas sweet pepper has somewhat lower amounts. The combination of vitamin C and beta carotene may be beneficial in the prevention of cataracts as well as cardiovascular disorders.

III. Leafy Vegetable Beverages:

1. Spinach: Spinach is a very nutritional leafy vegetable. Spinach contains vitamin K and carotenoids, which are beneficial to bone and heart health, as well as eye illnesses such as cataracts and macular degeneration (occurring with age). Furthermore, it protects the brain from oxidative stress and lowers the unfavourable features

of ageing that lead to brain function reduction[5]. A study showed that intake of beetroot juice, and spinach beverage effectively increases plasma nitrate and nitrite concentrations and lowers blood pressure to a greater extent in adults [6]

2. Parsley: is an annual herb having good amount of vitamins and essential minerals. Its supplementation at sufficient levels can promote the levels of the vitamins and essential minerals in the human body. Supplementation of diets with fresh parsley leaf can decrease oxidative stress in humans

Conclusion:

Rising consumer health consciousness has contributed significantly to the development of healthy fruit and vegetable beverages. Consumption of functional fruit and vegetable beverages having health promoting attributes is rising globally. Functional and medicinal beverages represent a business potential for the industry as well as for consumer health. The future of these beverages will be determined by unequivocal proof of their usefulness in improving health, common worldwide marketing standards, and effective flavour enhancement tactics.

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Santol

“Summer’s
Wondrous
Edible Cotton
Fruit”

The Santol or Cotton fruit, is a unique exotic tropical fruit native to Southeast Asia known scientifically as *Sandoricum koetjape*. The plant goes by several other common names including Kechapi, Lolly Fruit, Sentol, Wild Mangosteen, Red santol, Cotton fruit, Sentul, Sayai and Visayan. It is only one of the two edible fruits found in the Meliaceae, or Mahogany family. The fleshy fruits are known for their sweet and sour flavour and are widely cultivated throughout tropical lowlands in Southeast Asia, sold in fresh markets as a raw snack.

The Santol tree grows at lower altitudes, are elegant-looking and fast-growing. It usually grows between 15 and 40 meters in height. Its leaves are evergreen (or briefly deciduous), have a spiral shape, and grow between 4 and 10 inches long. The flowers come in three colours; greenish, yellowish and pinkish and are about 1 cm long and grow on the young branchlets in stalked panicles.

The Santol fruit looks

like a giant hazelnut inside an orange or pear (depending on the colour) with round shape and having size of an apple. Inside the fruit, there's a white juicy tissue with 3-4 brown seeds and wrinkles that extend from the base and downy rind with thin cotton like consistency. It's tissue is sour, even when the fruit is ripe depending on the variety and when the fruit ripens, it transforms into a sweet, vinous fruit. The sweetest santol fruits have a candy like taste with mild peach and apple notes, while in the sour varieties, strong umami after taste may linger on the palate.

Varietal wealth

There are two main varieties of santol fruit-red (*S. koetjape*) and yellow (*S. nervosum*) with the former one being considered as more prevalent at farmer's markets. The main differences between the two varieties lie in the leaflets, the peel, and the taste of the tissue.

Yellow santols usually have leaflets that are up to 15 cm long and turn yellow as they

grow old while red santols have leaflets that grow up to 30 cm long and turn red as they grow older. The yellow variety has a thin peel and a sweet tissue while the red variety has a thicker peel and a tissue that has a slightly sour flavour.

Health benefits

1. Primitive cancer preventer

Because the santol fruit is high in antioxidants, it can prevent cancer cell proliferation. Two bioactive chemicals extracted from the fruit, secotriterpene and koetjapic acid, were discovered to have cytotoxic effect against cancer cells. They can lower the number and size of mammary tumours in rats, and also kills human leukaemia cells.

2. Help to smile with healthy teeth

By stimulating the salivary glands to generate more saliva, santol fruits help to reduce dental caries by reducing the quantity of germs in the mouth. Hence, help to maintain healthy teeth.

3. Lowers low density lipoprotein (LDL)

Pectin, is a soluble fibre found in santol fruit. Pectin and HDL binds with LDL to prevent lipids from being absorbed into the circulatory system. Hypertension, stroke and heart diseases are all linked to high levels of LDL. As a result, santol fruit find its way in preventing cardiovascular disease.

4. Body weight controller

Obesity is linked to a variety of health issues, including cardiomyopathy, stroke, hypertension, diabetes, hormonal disturbances and sleep difficulties. Santol fruits

Overview of the nutrition values per 100 grams

Component	Yellow type	Red type
Protein	0.118 g	0.89 %
Fat	0.10 g	1.43 %
Fibre	0.1 g	2.30 %
Iron	0.42 mg	0.002 %
Calcium	4.3 mg	0.01 %
Phosphorous	17.4 mg	0.03 %
Thiamine	0.045 mg	0.037 mg
Niacin	0.741 mg	0.016 mg
Ascorbic acid	86.0 mg	0.78 mg
Pectin	14.9 mg	17.1 mg
Ash	0.31 g	0.65-0.88 %
Moisture	87.0 g	85.0 %



which contain both soluble and insoluble fibres, help in reducing food cravings thereby controls body weight and improves the general health.

5. Immunity enhancer

Santol fruits contain quercetin, an antioxidant that helps to strengthen the immune system by avoiding cell damage and promoting normal cell growth. Santol's fibre stimulates probiotic microorganisms, which strengthens the immune system. In addition to this, vitamin C which is abundant in fruits also acts as a powerful factor for increasing the stamina.

6. Reduce the risk of Anaemia and Alzheimer's

Anaemia is a condition in which there aren't enough healthy red blood cells in the body. The presence of iron (a mineral that help to move oxygen in the blood) and vitamin C (helps the intestine to absorb iron effectively) in santol fruits helps

to alleviate anaemia. On the other hand, abundance of antioxidants present in the fruit combat brain ageing and help to minimise the risk of Alzheimer's disease.

7. Potential evil of Haemorrhoids

Haemorrhoids are vascular structures in the anal canal that aid in the management of bowel movements. Thromboses haemorrhoids are caused by constant straining during defecation process. When the pressure in the belly rises during the defecation process, blood cannot circulate correctly around the lower abdomen, causing thromboses. Vitamin C present in santol fruit aids in the maintenance of healthy endothelium in blood vessels whereas, fibre aids in the defecation process.

8. Regulator of blood sugar level

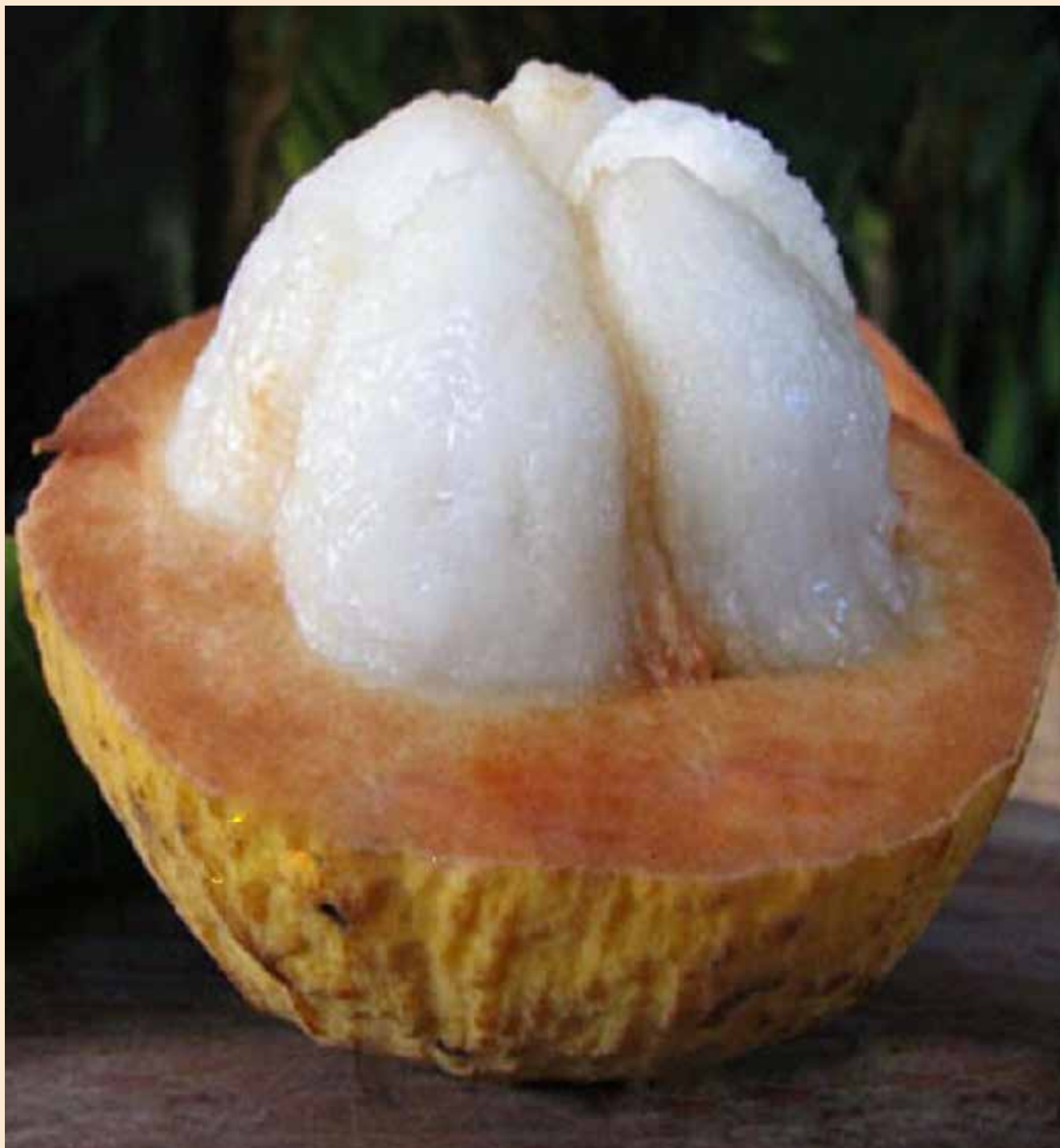
Low glycaemic index of santol

fruit help in slow increase in glucose by lowering sugar absorption into the bloodstream thereby regulating blood sugar level.

9. Potent source for healthy skin

Vitamin C, which is found in santol fruits, aids in the creation of collagen, a crucial component of the skin's connective tissues. The presence of sandorinic acid and bryonoticacid in santol fruits has been claimed to help prevent and treat allergies.

Rashes, psoriasis, and other skin problems can be treated using the fruit's natural steroidal sapogenin and alkaloids, which are a natural precursor to cortisone. Santol leaves can be mashed and applied to sensitive skin to soothe it. Sapogenin, a mildly poisonous alkaloid, is found in the bark of the santol tree. Sapogenin is a natural steroid that can be used to treat ringworm and other



fungal infections on the skin. The bark is ground into a powder and applied on the skin.

10. Leucorrhoea and Other Vaginal Infections

Apart from fruit, santol bark that has been boiled can be used to treat vaginal infections and leucorrhoea. The bark is boiled for vaginal infection, and the

water is then used to wash the vulva and vagina on a daily basis.

Post-harvest products:

Som tam: A delicious spicy salad with shredded santol fruits is prepared in Thai cuisine, which is used in several different prawn curries, and is the main ingredient in santol pork.

Sinatolan: In Filipino cuisine, the fruit is the main ingredient of sinatolan, an appetizer made of grated santol fruit rinds.

It is also used as a souring agent in many sour broth and milkfish dishes. The partly ripe sour fruits are also used as a souring agent in sour broth dishes like sinigang.



Priya Prakashan and her team with Kerala Agricultural University Dean, near the mobile veterinary clinic and petsalon.

AGRI CLINICS & AGRI BUSINESS CENTER (ACABC)

Priya Prakashan is a veterinary nurse by profession. But she realised that many owners hesitate to reach out to vet hospitals for their pets, as they are located in remote areas. She envisioned the business model of “Sredha” mobile veterinary clinic and grabbed the opportunity to have one as a start-up investing 1 crore rupees, without any second thoughts back in 2019. Besides her, almost 15 trained kudumbasree members and experienced vet doctors

constitute the team, offering services including animal birth control (ABC) in Thrissur & Ernakulam districts.

Bindya Balakrishnan from Irinjalakkuda, Thrissur started a tissue culture unit supplying tissue culture planting materials of banana varieties Nendran and Kadali. Recently she expanded it with the sales of ornamental plants. Bindya is an M. tech graduate. With her grit and perseverance she’s now offering employment opportunities to 5 more people who support herlab, investing 1 crore rupees

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as an agri start-up. Please see the link below for details.

<https://www.onmanorama.com/lifestyle/women/2018/03/30/bindhyathrissur-tissue-culture-lab.html>.

Agri start-ups are gaining a fillip in the country since the ministry of Agriculture & Farmer's Welfare launched the Agriclincs & Agri business center (ACABC) programme in early 2000s. Above mentioned women entrepreneurs are inspiring instances of successful ACABC units in Kerala.

What is ACABC ?

This scheme aims at motivating agri graduates to explore their underutilised professional potential in offering accurate and timely technical assistance to farmers. An agribusiness centre can act as an authentic information source for input facilitation, market analysis, price trends, crop selection as per season, best farm practices, crop insurance, post harvest value addition, risk mitigation or even credit facility as a paid service.

NABARD (National Bank for Agriculture and Rural Development) is channelising financial support as bank loans, for the unemployed talented graduates interested in starting up agripreneurship ventures.

Who is eligible to apply?

Qualified candidates in the age group from 18 to 60 years can be an agripreneur by this scheme. Graduates in agriculture and allied subjects like horticulture, veterinary

sciences, sericulture, forestry, fisheries, dairy sciences, biotechnology and food sciences are all welcome in attending the training and there after loans will be made available for economically feasible start-up project ventures. Recently applicants having graduation in environmental sciences, botany, chemistry or even diploma holders in a griculture are also being considered but all should have a minimum of 55% aggregate marks.

Online application and training

Interested graduates can fill in the online application form by visiting the website <http://www.agriclincs.net>. The successful online applicants have a 45 days training programme, organised conjointly by SFAC (Small Farmers Agri Business Consortium) and Hyderabad based centre of excellence MANAGE (National Institute of Agricultural Extension Management).

The training for the participants on developing business strategy and entrepreneurial skills are conducted via nodal training institutes (NTI). In Kerala there are two NTI's one at College of Agriculture, Vellayani, Thiruvananthapuram and the other at Regional Agricultural Research Station, Mele pattambi, Palakkad.

The curriculum of the training includes detailed project report (DPR) preparation, field and industrial visits of successful entrepreneurs, exposure visits to national agricultural technology

institutes for getting a hands-on experience of the innovations, accounts & finance along with entrepreneurial marketing. There will be practical sessions as well on agri and allied sector business models. Beyond the training session, hand holding support is assured for establishing the venture and getting incentive for upto a period of one year and theme based refresher courses will be intimated to the interested.

Financial aid

NABARD has certain norms on the available subsidy amount, which is 36% for general category and 44% for women, SC/ST categories and those from North East and hilly regions of India. Credit support for an amount of 20 lakhs or a maximum upto 25 lakhs for exemplary projects will be availed as bank loans. Back ended subsidy amount will be made available to the entrepreneur after 3 years. There payment period is from 5-10 years.

Advances so far

MANAGE is monitoring the progress of each venture from initial phase of hand holding until an established phase through the 144 nodal training institutes located in 31 states covering a total of 31234 ACABC ventures all over India.

According to the progress report from the website of MANAGE, from 2002 to 2021, out of the 240 training candidates, 51 ventures have been successfully established in Kerala.

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