Department of Agriculture Development & Farmers' Welfare
Farm Information Bureau

Government of Kerala

JUNE 2022
VOLUME - 9
ISSUE - 12

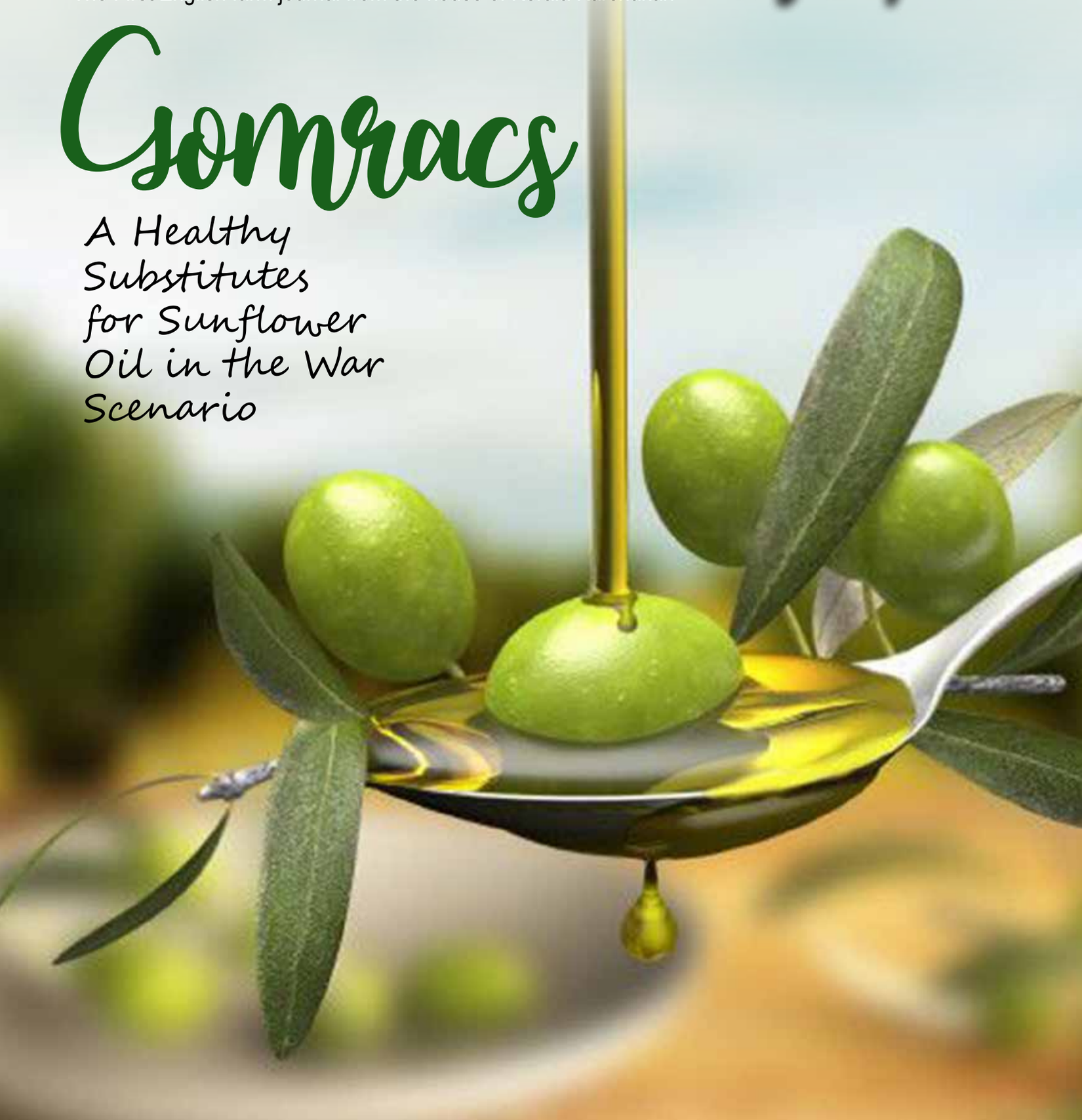
KERALA KARSHAKAN

English journal

The First English farm journal from the house of Kerala Karshakan

Gomracs

A Healthy Substitutes for Sunflower Oil in the War Scenario



INSIDE KERALA KARSHAKAN

English journal

JUNE 2022 Volume - 9 Issue - 12

Mail: editorejournalkkfib@gmail.com Log on to http://www.fibkerala.gov.in
Phone: 0471-2314358

The First English farm journal from the house of Kerala Karshakan

ATTENTION AUTHORS

Articles for Kerala Karshakan e-journal should be certified by head of the institution concerned stating that the article is original and has not been published anywhere. Reference should also be included wherever relevant.

Chief Editor
Sunilkumar R

Editor
Sreekala S

Asst. Editor
Reshmy P K

Editorial Assistant
Anoop R J

Design & Layout
Rajesh V

Articles/ Features appearing in this e-journal are either commissioned or assigned neverthless, other articles of farm relevance are also welcome. A maximum of 750 wordage is appreciated. Such items should be addressed to The Editor, Kerala Karshakan e-journal, Farm Information Bureau, Kowdiar PO, Thiruvananthapuram, Pin: 695003
These may also be mailed to editorejournalkkfib@gmail.com in word format. Responses can be also sent to this mail. Authors are requested to provide the following details along with the articles, for quick processing of the remuneration, after the articles are published: Account Number, Name of Bank, Branch (Place), IFSC Code.

Sushma M.S[1]
Varshini R[2]
[1]M.Sc., student,
Department of Fruit Science
[2]B.Sc., student,
College of Horticulture,
Mysuru University of
Horticultural Sciences,
Bagalkot, Karnataka.

Olive oil

Gomracs

A Healthy Substitutes for Sunflower Oil in the War Scenario

Olive oil

Cooking oil is considered as one of the staple requirements in every kitchen. It is used right from deep fry to stir fry. It is usually subjected to high heat while cooking, hence it should be stable and not turn rancid quickly. Oil help transfer the heat to food, prevent sticking, helps food retain heat, emulsifies or thickens sauces and create a crisp texture. Oils are the main contributors of oleic and linoleic acids that are not synthesised in the human body.

Nutrient content of different cooking oils per table spoon (14 g)

Nutrient Content	Energy (kcal)	MUFA (g)	PUFA (g)	Saturated fat (g)	Vit- E (mg)	Vit- K (µg)	Smoke point (°C)
G: Groundnut	124	6.20	4.30	2.30	2.20	8.13	232
O: Olive	119	9.85	1.42	1.87	1.94	8.10	200
M: Mustard	123	1.62	2.96	1.60	4.76	5.40	250
R: Rice bran	120	5.00	4.80	2.70	4.40	3.30	232
A: Avocado	120	10.00	2.00	2.00	3.50	3.36	271
C: Coconut	121	1.80	6.00	11.20	0.20	0.50	204
S: Soyabean	124	3.10	8.08	2.19	1.30	2.50	230

Indian cooking is among the most intricate, labour-intensive cuisines globally involving a hodgepodge of cooking styles and flavours. The oil needs to be able to handle all the delicate flavours with ease, avoid overwhelming the palate, cope with everything from tempering whole spices; sautéing aromatics like ginger, onions, and garlic or veggies and protein; shallow frying of kebabs, cutlets, toast; deep frying bhajias, samosas, papads; grilling/tandoor of veggies, paneer, breads, and meat. It should also play an integral role in boosting health. Sunflower oil is hands-down among the most powerful and healthiest oil in this regard and is known to produce the best results in Indian recipes. Pressed from the seeds of sunflower, this light amber coloured oil has made its way into Indian kitchens. Since the essence of Indian cooking lies in the diversity of the different foods prepared in the country, it is

Rice bran oil

essential that the oil fits perfectly well in the entire food landscape.

Why substitution is needed?

Around 90 % of the India's sunflower oil imports are from Russia and Ukraine. India consumes around 2.5 million tonnes of sunflower oil annually but it only produces 50,000 tonnes of sunflower oil and imports the rest, according to the data provided by the commerce ministry.

Sunflower oil accounts for 14 % of all edible oil imports. The price of sunflower oil rose from Rs. 98/litre in February 2019 to Rs. 161 in February 2022. An extended war could not only result in increased prices of sunflower oil and disrupt supplies to domestic oil mills but also affect the financial status of India in the global level.

Now comes the question of with what it can be substituted. A perfect alternative should be domestically available in sufficient amount to meet the consumers' demands, should suit better as cooking oil, need ease in processing and has to be healthy enough with acceptable flavour and taste. Key elements to consider oil as cooking oil are Smoke point, fat content, flavour, ideal omega ratio and vitamin content. Here comes the GOMRACS, an approach for sunflower oil substitution. It is not a brand or product name but is just an abbreviation of different alternatives of sunflower oil.

1. Groundnut oil

Peanut kernels contain about 40-50% of fixed oil. The graded and cleaned kernels are crushed and the oil is separated by hot expression method.

- It contains about 32 grams of unsaturated fats which are healthy fatty acid chains that reduce LDL (bad cholesterol).
- It has a high smoke point (around 450°F), that helps to withstand high temperatures without burning while cooking.
- With high levels of vitamin E and monounsaturated and polyunsaturated fats, peanut oil could be good for the

heart.

- Consuming polyunsaturated fats instead of saturated fats aids in improving insulin secretion, which helps keep blood sugar levels low.

2. Olive oil

The ripe fruits are crushed and oil is extracted mechanically. The first quality oil is called 'Virgin oil'. The second extracted oil is edible oil and last quality of oil is technical quality oil.

- Olive oil has strong anti-inflammatory properties
- It helps to prevent strokes
- It is not associated with weight gain and obesity
- It might fight Alzheimer's disease
- It helps to treat Rheumatoid arthritis

3. Mustard seed oil

The oil is made by pressing the seeds or by the process of grinding, whereby it is mixed with water and then further distilled. The black mustard yields a lighter coloured and stronger tasting oil, while the white variety produces yellowish coloured, pungent oil.

- It is a powerful natural stimulant.
- It improves digestion and appetite by stimulating digestive juices and bile in the liver and spleen.
- It contains rich amounts of monounsaturated and polyunsaturated fatty acids (MUFA and PUFA) as well as omega-3 and omega-6 fatty acids. These fats are good as they lower the risk of developing ischemic heart disease.
- Mustard oil also has cancer-fighting properties.
- Pure mustard oil is often applied topically to help optimize hair and skin health.
- Mustard oil contains allyl isothiocyanate, a chemical compound that has been well studied for its effect on pain receptors in the body.

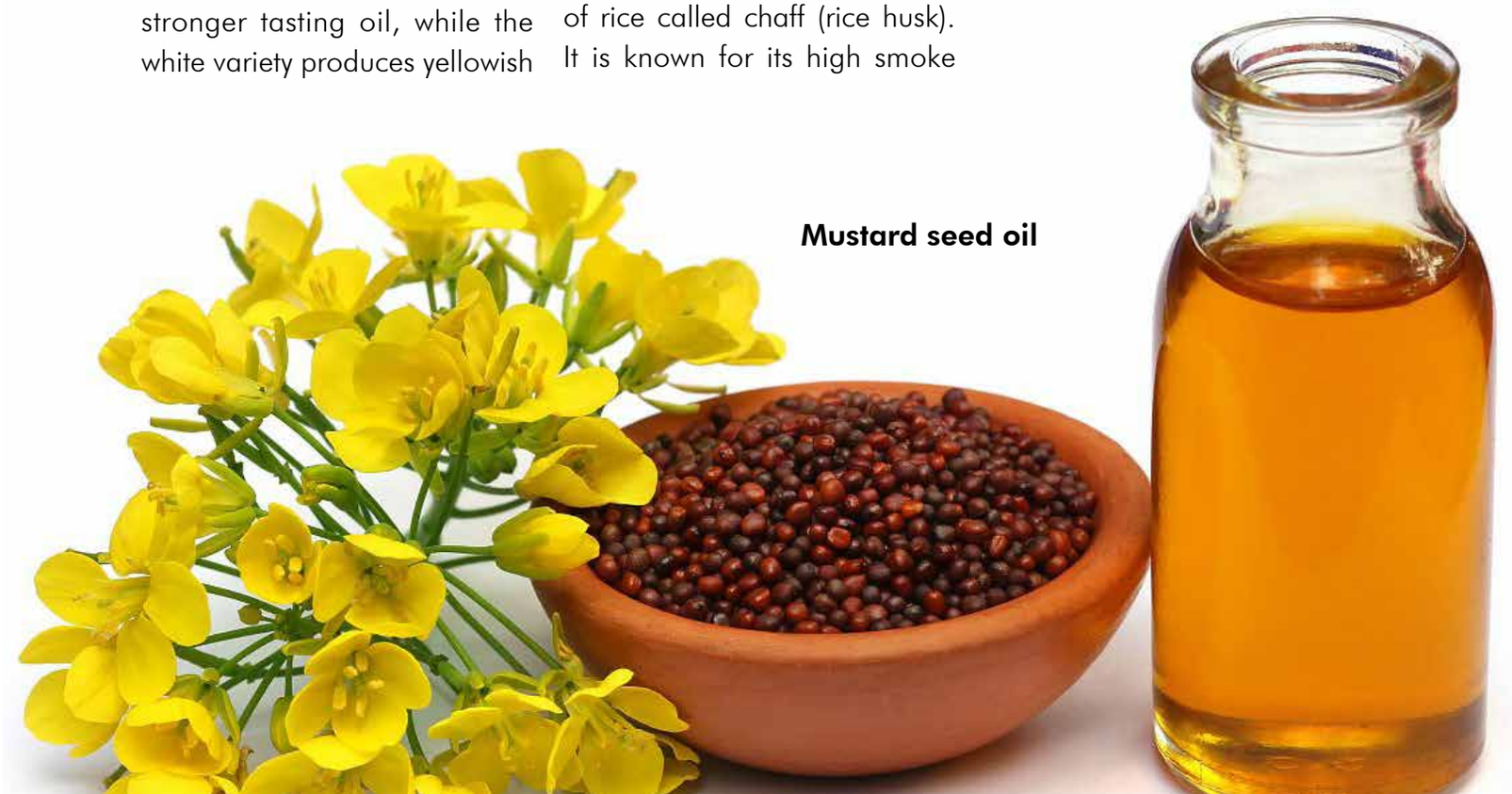
4. Rice bran oil

Rice bran oil is extracted from the hard outer brown layer of rice called chaff (rice husk). It is known for its high smoke pointof 232°C (450°F) and mild flavour, making it suitable for high-temperature cooking methods such as stir frying and deep frying.

- Oryzanol a compound which has been shown to suppress several enzymes that promotes inflammation.
- Tocotrienols from rice bran oil protects human and animal cells exposed to ionizing radiation.
- Tocotrienols, a group of antioxidants in rice bran oil, have anticancer properties.
- Enhance immune health and boost skin health.
- Rice bran oil support healthy blood sugar levels by improving insulin resistance, a risk factor for type 2 diabetes.

5. Avocado oil:

The process for recovering oil from ripe avocados is a mechanical extraction followed by centrifuge to separate oil and other debris.



Mustard seed oil

Coconut oil

- Avocado oil is a good source of monounsaturated fat which has been linked to reducing LDL cholesterol and increasing HDL cholesterol.
- Avocado oil contains both lutein and vitamin E, both of which are important for good eye and skin health.
- Lutein, in particular, is known to protect from age-related macular disease, which can lead to vision impairment and even blindness.
- Avocado oil is known toreduce symptoms of Osteoarthritis.

6. Coconut oil

Extraction of coconut oil from the fresh meat involves either wet-milling or drying the residue, and using a screw press to extract the oil. VCO is extracted from fresh meat by grating and drying it to a moisture content of 10–12%, then using a manual press to extract the oil.

- Coconut oil is a rich source of medium-chain triglycerides (MCTs), a type of saturated fat that encourages fat burning in the body and reduces obesity.
- MCTs provide a rapid energy source that the body can absorb and use faster than other types of saturated fat.
- MCTs may help reduce food intake by decreasing hunger.
- MCTs present in the oil can increase blood ketone concentrations, which may help reduce seizure frequency.
- Rich amount of MCTs in the oil significantly increase blood levels of ketones which may potentially help with symptoms of Alsheimer's disease.
- Coconut oil has antimicrobial and antifungal properties due to its MCT content specifically, lauric acid.

7. Soyabean oil

To produce soybean oil, the soybeans are cracked, adjusted for moisture content, heated to between 60 and 88 °C (140–190 °F), rolled into flakes, and solvent-extracted with hexanes. The oil is then refined, blended for different applications, and sometimes hydrogenated.

- Soybean oil is a highly refined oil rich in omega-6 fats.
- It has a relatively high smoke

Soyabean oil

point of about 450°F (230°C) that suits better for cooking.

- Rich in heart-healthy fats thus reduce cardiovascular issues.
- It is rich in vitamin K, which help maintain bone strength and reduce the risk of fractures.
- It contains omega-3 fatty acids that plays major role in promoting health and preventing chronic disease.
- With rich amount of vitamin E, an antioxidant, it found importance in promoting skin health.

Avocado oil

Muralidhara B.M*
Karthik Nayaka[1]
Siddanna Savadi[2]
Venkataravanappa V[3]
*Scientist, ICAR-Directorate of Cashew Research, Puttur, D.K. Karnataka

The avocado *(Persea americana Mill.)* is one of the important exotic and high value fruit crop belonging to the family of Lauraceae. It is commonly known as butter fruit in India, it is mainly due to the buttery pulp. The other names of avocado are alligator pear, midshipman's butter, vegetable butter, butter pear, cura, cupandra, aguacate, palta, abacate, and avocatier. In present days there is a lot of demand for avocado cultivation due to its various uses and health benefits and for high market value. Hence, a good number of farmers are coming forward to grow this crop and manyhave been growing. But the growers are in the need of basic

AVOCADO

A fascinating fruit in Demand

information related to scope, importance and production aspects of avocado. This article will give an overview of avocado.

Origin and distribution: It was originated in Mexico and Central America (Dreher and Davenport, 2013), possibly from more than one wild species. The early Spanish explorers recorded its cultivation from Mexico to Peru. Later on, it was introduced into Southern

Guacamole

Avocado varieties

Hass

Stewart

Lula

Choquette

Spain in 1601 and to Jamaica in 1650. Thereafter, reported in Zanzibar in 1892, Florida in 1833 and in California in 1856. It was introduced to India by an American missionary, residing in Bangalore between 1906 and 1914 from Royal Botanical Gardens, Ceylon. Later on, it was spread to different parts of the country.

Species in avocado

Avocado consists of approximately 150 species. The three most important horticultural races in avocado are Guatemalan *(Persea americana var. guatemalensis* Williams), Mexican *(Perseaamericana var. drymifolia* Blake) and West Indian *(Persea americana var. americana* Mill) (Bergh and Ellstrand, 1986).

Avocado production in the world

Avocado is grown in more than 60 countries in the world. The total world production of avocado is 5.92 million tonnes (Anonymous, 2018). Mexico is the largest producer and exporter of avocado in the world followed by Dominican Republic, Peru, Indonesia, Colombia, Brazil, Kenya etc., (Anonymous, 2018).

Avocado production in India

In India, avocado is not a commercial fruit crop and the production is very limited. Presently, it is grown on very limited scale and in a scattered way as homestead crop or intercrop in coffee estates. The important regions of avocado cultivation are Tamil Nadu, Kerala, Karnataka and Maharashtra in the South-central India and in the eastern Himalayan state of Sikkim and Northern states like Uttarakhand and Himachal Pradesh. The agro-climatic conditions prevailing in various parts of the country seem to be favorable for bringing more areas under avocado.

Avocado production in Karnataka

In Karnataka avocado is not a commercial solo fruit crop but it is grown as an intercrop in coffee estates or as homestead crop in Coorg district. It is also grown in Chikkamagluru and Dakshina Kannada districts. Due to high demand and good market facility, the area expansion is taking place in and around districts of Bengaluru.

Nutritional value

Avocado is the most nutritive among fruits. The pulp is rich in proteins and fat (up to 30%), but low in carbohydrates. It is also good source of minerals (potassium), vitamins, and other nutrients. Consumption of avocado helps in the absorption of colourful carotenoids necessary for eye health. Improves glucose tolerance in people suffering from type 2 diabetes. Assist in weight management. Avocados are rich in monounsaturated fat, which helps to lower the LDL cholesterol and boost HDL cholesterol, contributing to

Pinkerton

Bacon

Gwen

Mexicola

Fuerte

Ettinger

Reed

Lamb Hass

cardiovascular health. Leaf and seed extracts have been used for a variety of pharmaceutical applications, including treatment of diarrhoea, dysentery, and also as an antibiotic.

Uses

In India, avocado is mainly consumed as fresh fruit by adding sugar to the pulp and also in preparing milkshake. In other countries, It is also used in the preparation of guacamole, sandwich filling, salads, ice creams, avocado burger, avocado pizza, avocado toast etc. Due to the presence of high oil content, it is mainly used in the cosmetic industry for the preparation of shampoo, soap, lipstick, face cream etc. Due to its positive health effects, it is one of the best cooking oil similar to olive oil.

Guacamole

It is one of the most accepted avocado dishes in the world. The preparation method is very simple. The fruit pulp is seasoned with salt, onion, lemon, pepper, and tomato.

Flowering behaviour in Avocado

Generally, avocado seedlings take 5-6 years for flowering, but grafted plants take only 3 years from the date of planting. The panicles were produced on terminal bud and most of them were determinate type. The avocado flower is bisexual but the female part matures first followed by male organ being functional (Protogynous). The peak flowering period ranges from 3 to 4 weeks. The double opening of flower was noticed in avocado.

Flowering season

The avocado trees flower twice in a year, in the months of February-March and September-November. In Karnataka (Coorg) and Kerala (Waynad) more than 80 % plants flower during September-November and remaining will flower from February to March. But in TamilNadu (Lower palni hills and Yercaud) the main flowering season occurs in February to March. In some plants, we can observe flowering in both seasons which leads to less or no crop in next season.

Avocado varieties

More than thousand varieties are available in the world. Some of the internationally popular varieties are Hass, Fuerte, Pinkerton, Stewart, Ettinger, Bacon, Lula, Reed, Gwen, Choquette, Lamb Hass, Puebla, Sharwil, Zutano, Pollock, Shepard, Nabal, Rayan, Mexicola.

In India, only two varieties are released so far i.e., TKD-1 and CHES A-1. The avocado was introduced in India 100 years ago. Due to its cross-pollination and seed propagation nature, a wide variability hasbeen created for fruit shape, size, color and quality traits. Therefore, there is an urgent need to identify good genotypes available in seedling progenies for commercial

cultivation which are having wider adaptability and good quality.

A and B type Varieties in Avocado: Based on flowering behavior the avocado varieties are classified into two types i.e., A and B type.

A-Type varieties: In 'A' type varieties, flowers open in the morning as functional female stage and reopen in the afternoon of the next day as functional male stage. Some of the A-type varieties are Hass, Reed, Wurtz, Pinkerton, Maluma, Gem, Carmen.

B-Type varieties: In the type 'B' varieties, the flowers open in the afternoon as a functional female stage, close in the evening, and reopen on following morning as functional male stage. Some of the A type varieties are Shepard, Fuerte, Sharwil, Edranol, Ettinger, Zutano

Harvesting period

The two main avocado harvesting seasons can be seen. The first harvest starts from April and continue up to June (Sep- Nov flowered plants) and second one starts from August to October (February-March flowered plants). In general, the avocado fruits will be available in Indian markets from April to October.

In Karnataka and Kerala, the main harvesting season is from April to June and in Tamil Nadu, August to October is the main season.

Yield and Farm Price: The grafted plant starts fruiting from the third year of planting and the seedlings will take nearly 5-6 years. The yield will mainly depend on the genotype and age of the plants. From the last two years' growers were selling fruits at Rs. 60-100 / kg depending on the quality of produce from their field (on-farm price) during April to October in Coorg and Waynad regions. The quality of Kodaikanal avocado is better compared to Coorg and Waynad regions, hence they fetch price at Rs.80-120 /per kg.

Puebla

Sharwil

Shepard

Zutano

Nabal

Lalita[1]
Puneet Kumar[2]
[1]ICAR-Central Institute of Agricultural Engineering, Bhopal, MP.
[2] ICAR-Central Institute of Temperate Horticulture, Srinagar, J&K.

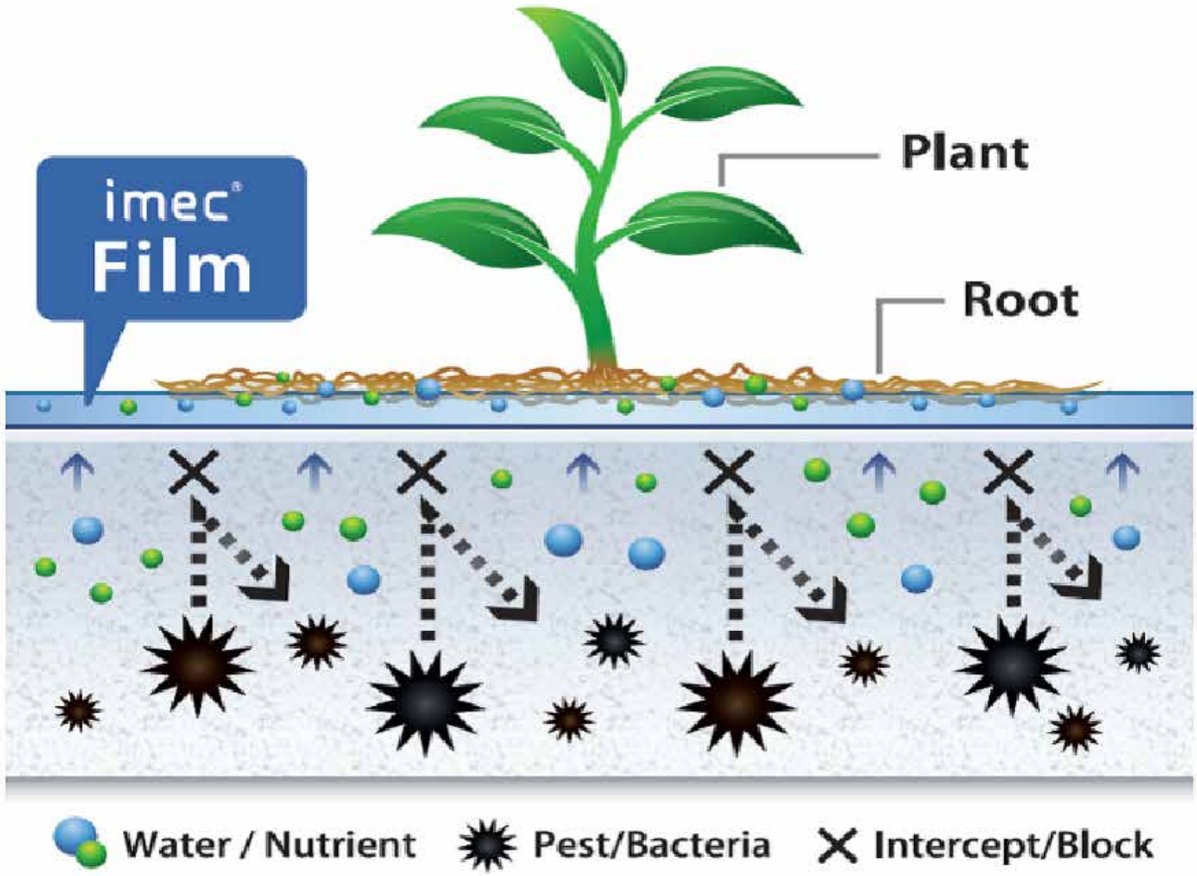
Film Farming

An Innovative Farming

In today's busy world and stressful work culture, people are suffering from several chronic diseases. Some of the chronic diseases like immune dysfunction, cancer, cataract etc. are proof of reducing the consumption of fresh food in our daily diet. This is a consequence of the invasion of industrialization at global scale which leads to the rapid growth of the concrete forest and oppositely limiting the agricultural fields. In concern of limiting agricultural fields and to improve the diet, many cultivation techniques like vertical farming, urban agriculture, kitchen gardening, terrace gardening and, soilless (hydroponic) and waterless farming etc. are emerging. As all these techniques require less area, such farming can be adopted for home. The home-grown food has great benefit in this time of pandemic where isolation and social distancing are major safety measures to control over the spread of COVID-19. Farming at home may lead us to rely less on the market for day-to-day food needed. In the series of these cultivation techniques, soil and water fewer farming techniques are very innovative and thriving with their greater advances. The concept of soil and water less farming means the limited use of water and soil. Film Farming (FF) is newest concept of soil and waterless farming which indicates the farming on the film. This technique was invented during 2009 by the Japanese researchers accompanied with Dubai-based company named "Agricel", founded by Yalman A. Khan and Kunal G. Wadhwani (Agropedia). It was initially adopted by the hospitality sector to serve fresh food with natural aroma, color, appearance etc. unlike the use of chemical additives to improve food taste which is compromising with the health. It can emerge as ready to eat (RTE) food with difference that in RTE food used processed food, whereas in FF raw food replaces the processed food with fresh food and would be entitled with "pluck and eat or cook". Hence Film Farming can be easily adopted at commercial level as well as household level at very little space like balcony, terrace etc. to enriching the meal with fresh food.

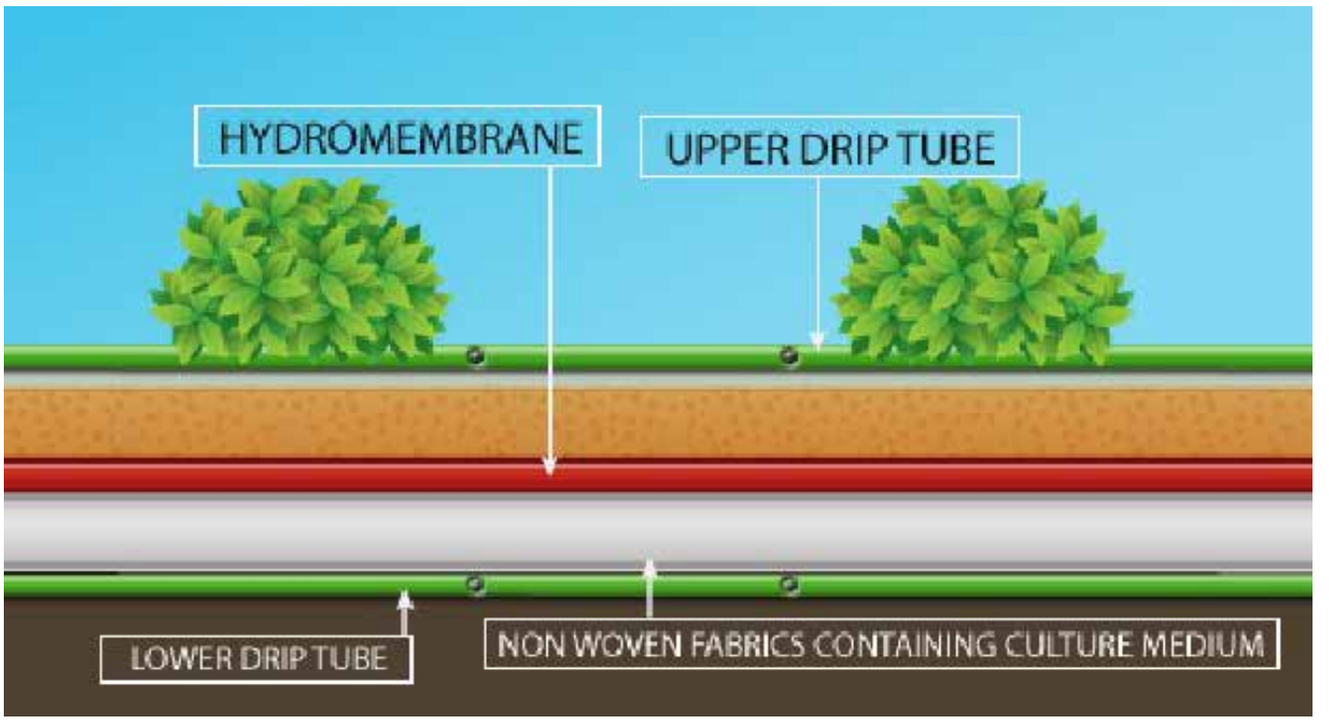
Working mechanism

The film is made up of water soluble hydromembrane. It includes water soluble polymer



and hydrogel based IMEC film. Hydromembrane is hydrophilic booster material having a gel called Skygel which can stagnant up to 1000 times more water than its weight. The hydrophilic booster is enriched with plant nutrition organic chemicals. While the hydrogel based IMEC film is opposite to traditional soil. Because the pore size (one millionth of a millimeter) of film, it is designed in such a way that water and nutrient can only passes through it, whereas the virus and other harmful microorganisms cannot pass through the film. It helps in protecting the plant from the diseases which occurs through the soil unlike in traditional farming, Film Farming helps in boosting the plant immune system. The synergic bond between hydromembrane and IMEC based film act as water and fertilizer source for the plant with disease free environment.

It reduces the water consumption by 90 per cent and also proliferate the yield per plant, and results in higher productivity within the small area. The cost incurred in installation and initial set up of FF is similar to conventional farming. But in



long term it would give more cost benefit than conventional farming as it does not involve the regular irrigation, fertilizer, pesticide, insecticide and the like.

Future aspects of Film Farming

To win the combat against the food scarcity with limited use of natural resources and getting higher productivity, Film Farming would be the answer to this. In India, agriculture is one of the largest sectors in term of man power employed. However, Film Farming is less labor-intensive farming technique unlike the conventional farming. It would not only combat against the food scarcity but also against the natural and manmade disaster which are posing threats to agriculture. Extensive use of fertilizer and pollution have adverse effect on arable land and results in degradation of land in to the barren land. Thus, FF gives hope for blooming in barren as well as abandon land and can come up as a big hub for commercialization.

Last but not the least, in this pandemic where, old people or person who have already chronic diseases are affecting more than youngsters because of huge difference in immune system of the body. The immune boosting herbs could be grown in FF system by some modification or alteration of film propertied and creating the natural growing environment for particular herbs. We anticipate Film Farming could be an answer to various aspect like food security, climate change, cost economic, combat against pandemic, healthy food habits etc.

References:

Mori, Y. (2013). New agro-technology (Imec) by hydrogel membrane. Reactive and Functional Polymers, 73(7), 936-938.

Roba, T. B. (2018). Review on: The effect of mixing organic and inorganic fertilizer on productivity and soil fertility. Open Access Library Journal, 5(06), 1.

Sahin, A. R., Erdogan, A., Agaoglu, P. M., Dineri, Y., Cakirci, A.Y., Senel, M. E., ... & Tasdogan, A. M. (2020). 2019 novel coronavirus (COVID-19) outbreak: a review of the current literature. EJMO, 4(1), 1-7.

AlShrouf, A. (2017). Hydroponics, aeroponic and aquaponic as compared with conventional farming. American Scientific Research Journal for Engineering, Technology, and Sciences (ARSJETS), 27(1), 247-255.v

Sowmya H. M.[*]
Sathish D.[1]
[*]Research Scholar,
Department of genetics and
plant breeding, COH, Bagalkot
[1]Assistant professor,
Department of genetics and
plant breeding, COH, Bagalkot

HYPER RECOMBINANT PLANTS

AN EMERGING FIELD FOR PLANT BREEDING

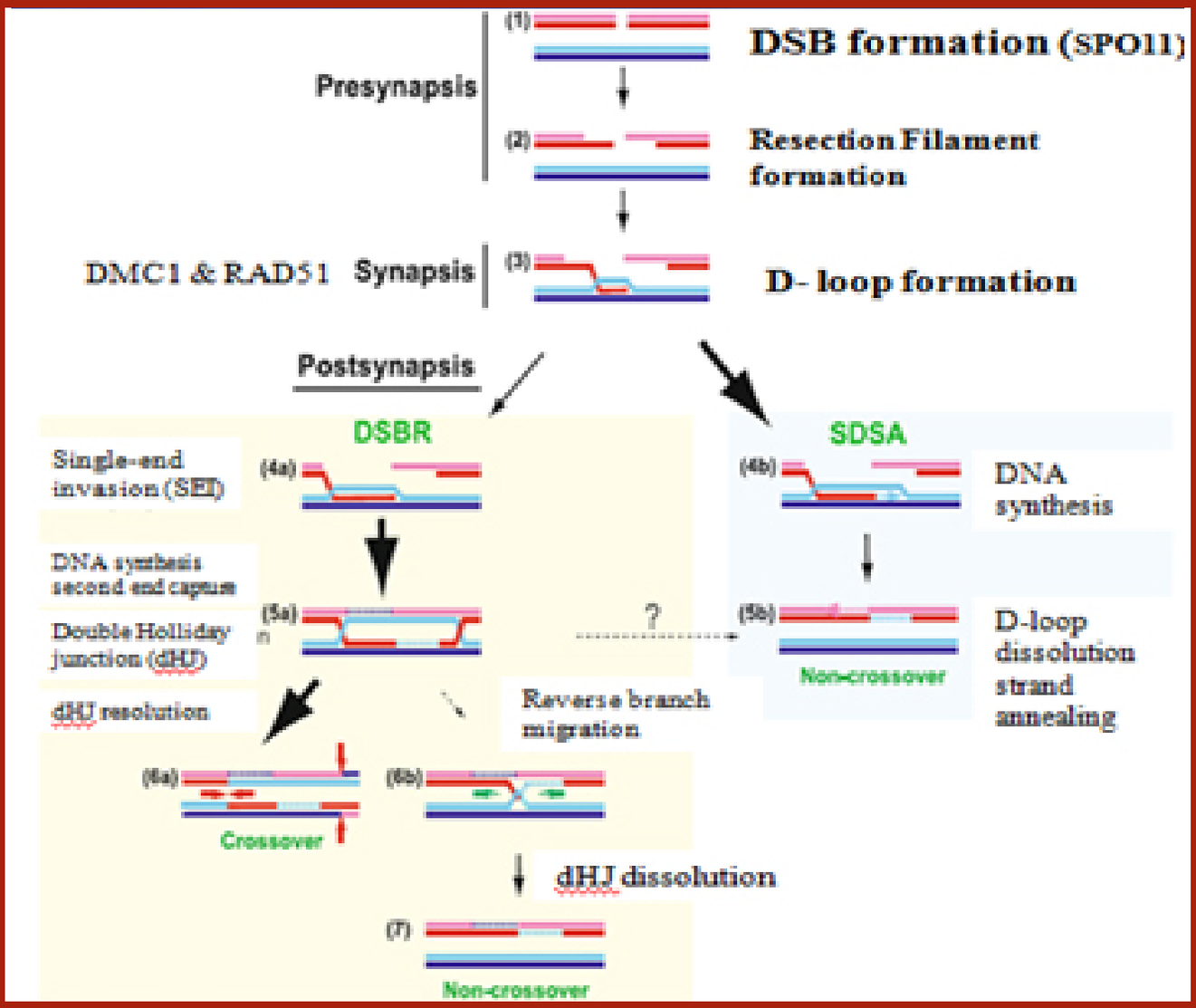
INTRODUCTION

Novelty is the primary requirement and breeding target for plant breeding, which can make a significant contribution to the new cultivar. The key factor for successful breeding is the genetic variation in the progeny, which depends on the degree of genetic material mixing after meiosis (Keeney, 2001). However, meiotic recombination is tightly astricting in plants, resulting in a limited number of crossovers (COs) which is affected by several internal and environmental factors (Yelina et al., 2015). Recently, several anti-CO factors have been identified that limiting the meiotic recombination in plants, and the knock-out mutants displayed a significant increase in recombination frequency. This provides a universal tool to manipulate the meiotic recombination in plants by applying anti-CO genes.

Due to the rapid development of genome sequencing and gene editing technologies, the genomes of more and more plants have been sequenced. In the meanwhile, the efficient gene knockout system has also been established in plants. Thus, it's time to break the shackles of meiotic recombination to create novel cultivars in the biological era of genomics.

Meiotic Recombination Process

Meiotic recombination initiates from the formation of DNA double-strand breaks, which is followed by the resection of 50-ends of the broken DNA strands to generate 30-ends single-stranded DNAs (ssDNAs). The broken DNA strands then invaded into either a homologous chromosome or a sister chromatid to form a stable single-end invasion intermediate. This inter-homolog invading strand extends into the homologous double-stranded DNA (dsDNA) to form a displacement loop (D-loop) structure, which can be further resolved as different joint molecules (JMs) to yield either a CO or an NCO duplex product. In most cases, NCOs are formed through the synthesis-dependent strand annealing (SDSA) pathway via different mechanisms, but it re-mains unclear which



mechanism determines the fate of CO or NCO (Ramakrishnan et al., 2018).

Types of meiotic recombination - At least four types of naturally occurring recombination have been identified in living organisms:

(1) General or homologous recombination

(2) Illegitimate or nonhomologous recombination

(3) Site-specific recombination

Impact of meiotic recombination on genome

- Meiotic recombination breaks down combinations of alleles
- Allowing a more efficient elimination of deleterious mutations
- Generates new combinations of alleles
- Increase the efficiency of selection
- Generating new genes
- Integration of specific DNA element

CONCLUSION

Some of the internal factors like (linkage, genomes, epigenetic factors and annotated genes) and external factors (biotic-pathogens and abiotic factors-nutrients, temperature, antibiotics etc.) are known to affect the frequency of recombination in plants. Hence, knock-out of meiotic recombination suppressors largely increased the recombination frequency and resulted in creation of genetic diversity and production of new alleles.

Therefore, breaking the natural limitation of meiotic recombination will have a revolutionary impact on plant breeding, especially in production of novel variants.

References

Keeney, S., 2001, Mechanism and control of meiotic recombination initiation. Curr. Top. Dev. Biol., 52: 1–53.

Yelina, N. E., Lambing, C., Hardcastle, T. J., Zhao, X., Santos, B. and Henderson, I. R., 2015, DNA methylation epigenetically silences crossover hot spots and controls chromosomal domains of meiotic recombination in Arabidopsis. Genes Dev., 29:

Valorization of Banana Pseudostem Into Bioethanol

Ayeeshya Hasansab Kolhar
S. L. Jagadeesh
University of Horticultural Sciences, Bagalkot-587104

Introduction

The Energy Information Administration (EIA) recently forecasted that global energy consumption is expected to increase almost 50 percent by 2050. Energy consumption is very high in India because of the energy requirements of energy-intensive manufacturing. Due to population and economic growth, energy-related carbon dioxide emissions are expected to increase at an average rate of 0.6 percent per annum. Global energy demand and available energy is progressing in opposite directions. To meet the energy crisis and to combat the environmental pollution, biofuels are environmentally friendly alternatives.

Bioethanol is recently increasingly used as an alternative biofuel for transportation in high and medium income countries. The current increased worldwide ethanol demand in transportation sector will lead to the expansion of fuel ethanol production. In India, sugarcane molasses is the major resource for bioethanol production and inconsistency of raw material supply holds the major hinderance in bioethanol production. Drastic fluctuation in pricing of sugar cane farming and sugar milling resulted in farmers shifting from sugarcane cultivation other crops and the

role of sugarcane in bioethanol is constantly decreasing.

Bioethanol from banana pseudostem

Banana is the most important fruit crop in the world. Global banana cultivation generates about 250 million tons of fresh lignocellulosic biomass residues. Using postharvest wastes like residual banana pseudostem as a feedstock for ethanol production could be an effective alternative. Banana pseudostem are non-food biomass resources and therefore do not compete with human food supply. Cellulosic ethanol has been envisaged to be produced by fermentation of simple sugars from enzymatically hydrolyzed plant biomass. Banana widely is a widely cultivated fruit crop throughout the world. Its pseudostem is a major biowaste which can be volarized to ethanol.

The *Saccharomyces cerevisiae* is the most commonly used fungus of the incipient lignocellulosic biofuel industry due to its robustness, stress-tolerance compared to bacteria and other fermenting microbes. Number of different strains of *Saccharomyces cerevisiae* is available in nature. Selection and use of a potential strain will increase the yield of ethanol.

The utilization of molecular methods enables rapid and precise identification of the *Saccharomyces cerevisiae* strain level. Bioethanol is usually prepared by various methods. Manipulations in the pretreatment, enzymes used and microbe used results in marked increase or decrease in ethanol yield. Pretreatment includes acidification (H2SO4) alkalisation (NaOH) or high temperature. The enzyme used also varies viz., cellulase, amylase or zylase can be used. The efficiency of the pretreatment and enzymes used varies with the chemical nature of the bio-waste. So, an optimised protocol with suitable pretreatment, correct enzyme and microorganism can give maximum.

The pseudostem can be used for ethanol production but still there remains some waste after ethanol production. That waste can further be converted to biofertilizers. As the waste mass has undergone a series of pretreatments for ethanol production, it need be treated well for further degradation.

Conclusion

An optimised protocol will increase the ethanol yield which helps the farmer to get more profit and the biofuel production helps to reduce the energy crisis and environmental pollution.

[A]J.N. Prithiva
BR. Rajesh
Department of Agricultural Entomology, TNAU, Coimbatore
Department of Agricultural Microbiology, TNAU, Coimbatore

REMOTE SENSING TOOL TO STUDY PEST OUTBREAK AND CROP DAMAGE

Introduction:

Agriculture sector is environmentally-sound with increasing implementation of new management epitomes such as Integrated Pest Management and Integrated Crop Management that necessitates ready access to environmental data. Measurements based on Satellite and the Internet provides two key tools for this access.

Remote sensing techniques have been operationally used in many countries to provide basic information on crops, soils, water resources and the impact of drought and flood on agriculture. Integrated studies on soil and water conservation

using remote sensing and GIS have been progressing with a view to raising agricultural production.

Definition:

Remote sensing has been defined as: "The science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area, or phenomenon under investigation."

Characteristics of remote sensing:

- Imagery acquired from aircraft or satellite platforms provides a regional perspective of the earth's surface.
- Sensors can be calibrated to record in spectral regions beyond those to which the human eye is sensitive;
- Data are commonly available in digital format for computer analysis and integration with other digital databases;
- They provide a historical record of conditions for a particular area or region.

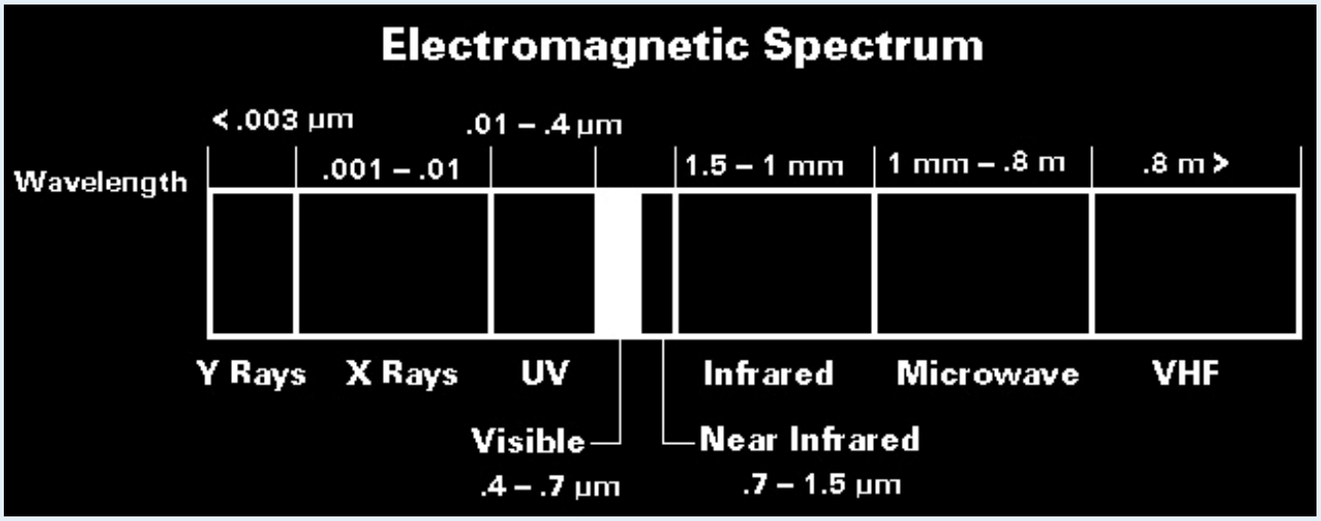
Remote sensing techniques used in entomology:

- Photography and Videography from aircraft
- Satellite – borne photography
- Multispectral scanning
- Thermal imaging
- Ground – based and air borne radar
- Acoustic sounding or Sodar
- Low – light optical methods

Basics:

Remote sensing is the observation and measurement of objects from a distance, i.e. instruments or recorders are not in direct contact with objects under investigation. Remote sensing depends upon measuring some kind of energy that is emitted, transmitted, or reflected from an object in order to determine certain physical properties of the object. One of the most common types of remote sensing is photography, which along with many other techniques is utilized for the images in this Lewis and Clark atlas.

These techniques are based on sensing electromagnetic energy emitted or reflected from the Earth's surface and detected at some altitude above the ground. The electromagnetic spectrum is, thus, the starting point for understanding remote sensing. Passive remote sensing is based on detecting available (background) electromagnetic energy from natural sources, such as sunlight. Active remote sensing, in contrast, depends on an artificial "light" source, such as radar, to illuminate the scene. Sunlight is the main source of energy at the Earth's surface with most energy in the ultraviolet, visible, and short infrared portions of the spectrum. The Earth is a much weaker source of energy at longer wavelengths of thermal infrared and microwaves. All passive remote sensing is based



on these two energy sources.

- Ultraviolet, visible and near-infrared radiations (< 3 μm wavelength) are mainly reflected solar energy.
- Mid-infrared, thermal-infrared, and microwave radiations (> 3 μm wavelength) are mostly emitted from the Earth's surface.

Monitoring Pests and Disease from Satellite:

Various factors such as intensive cultivation, monocropping, changing weather conditions and indiscriminate use of pesticides have resulted in frequent outbreaks of crop pests and diseases causing huge crop losses. Minimising these losses is one way of enhancing grain production and remote sensing tool has been found very useful in monitoring large areas frequently.

The Earth observing systems are useful in monitoring weather and ecological conditions favourable for crop pests and diseases. Weather conditions such as temperature, humidity (moisture), sunshine hours (light) and wind play major influence on the densities of pest population and their natural enemies. Among the weather parameters that can be remotely sensed, type of cloud, extent of cloud cover, cold cloud duration (a surrogate for rainfall) are the most easily retrievable. Such information was used by phytopathologists to study rust diseases of wheat crop.

An aircraft fitted with a camera loaded with color infrared films and flown over Kerala state (India), identified coconut areas severely affected by 'wilt' which could not be easily detected from the ground. This gave a clue to the area that could be viewed from satellite altitude.

Understanding the magnitude of crop losses is necessary to appreciate the importance of plant protection in crop production programmes. Losses can be due to biotic factors such as pests/diseases/weeds and abiotic factors such as drought, floods, cyclones and hailstorms. Damage caused by pests may be quantitative (overall reduction in yield), or qualitative such as change in color and offensive odour. The regional disparities in crop condition assessment, the complex Centre-State relationships in handling relief measures and the introduction of crop insurance scheme, call for an unbiased, objective and timely information system to give early warning, to indicate the intensity of such hazards and to assess the loss.

Desert locust forecasting:

The Desert Locust differs from most other species of locust in that it has no permanent outbreak or breeding area, but lives instead in scattered populations in an arid recession area, which covers some 16 million km^2. In order to breed, populations move downwind between areas of seasonal rainfall (Figure 1). When plagues develop as a result of successful breeding over a number of seasons in a succession of breeding areas, Desert Locust swarms can migrate over a vast invasion area, stretching over 28 million km^2 in 65 countries

(Figure 1). Thus, a high level of intra- and inter-national co-ordination is required to both confine the populations to the recession area and to combat mobile swarms, if they form and escape the seasonal breeding areas.

Control strategies for most major species of locusts involve locating breeding or outbreak areas and preventing the populations in them from forming swarms and escaping to damage crops and pastures.

Uvarov's early work in the 1930s, including mapping field reports on locust life-cycle stages, established the importance of examining both spatial and temporal aspects of migrant pest population developments, particularly in the case of the Desert Locust, Schistocerca gregaria, which has no permanent outbreak area (Uvarov, 1951). For the Desert Locust, *Schistocerca gregaria*, as for many other locust species, the forecasts are part of a strategic preventative control strategy that encompasses:

- Control of populations during upsurges to prevent their spread to agricultural areas; and
- Control of gregarising populations to reduce the amount of pesticides used and the extent of the area *sprayed*.

Desert locust plagues affect about 20 percent of the earth's surface spreading across Africa, the Middle East and south-west Asia. They breed in areas that 354 Satellite-Base Agro-Advisory Service have sufficient soil moisture and vegetation to support the early stages of this insect (viz. egg laying and hopper development). They migrate from west to east along with the passage of troughs moving in the westerlies and northward and southward along with the Inter-tropical Convergence Zone (ITCZ). The main weather systems bringing rainfall favourable for the development of desert locust are western disturbances, depressions over Arabian Sea and a few Depressions developed over land.

Remotely sensed vegetation indices and rainfall estimates based on cold cloud duration and other cloud indexing techniques are the only cost-effective methods to survey the vast stretches of desert locust habitat.

Three types of forecast are usually issued:

- Long-term predictions (<12 months ahead) to help donors, administrators and officials allocate central budgets for staff and equipment;
- Medium-term predictions (1–2 months ahead) to enable campaign managers and pesticide companies to deploy survey and properly equipped control teams; and
- Short-term predictions (1–2 days ahead) to give day-to-day guidance to local field teams and farmers.

Locust information systems:

Since the last major Desert Locust plague in the late 1980s, most research and development work on information systems for Desert Locust forecasting has focused on the use of Geographical Information Systems (GIS) as aids in the management and integration of the diverse data used to prepare forecasts. Computer-based GIS assist in the management and analysis of the large spatially referenced data-sets used to interpret and forecast the changing relationships between environmental processes and pest population dynamics.

The two main GIS-based Deserts Locust management systems are:

A. SWARMS (Schistocerca Warning Management System) – a work station-based GIS to support the administration, mapping and analysis of data for operational forecasting of Desert Locusts across the whole distribution area at FAO's centralized Desert Locust Information Service in Rome (Healey et al., 1996); and

B. RAMSES (Reconnaissance And Management System for the Environment of Schistocerca) – a PC-based system designed to assist national locust units in storing, analyzing and disseminating Desert Locust and related environmental information derived mainly from their own data capturing network.

Both systems contain current information on the pest, weather, rainfall and vegetation status that can be compared to previous locust and environmental data (Figure 2). The resulting analysis and

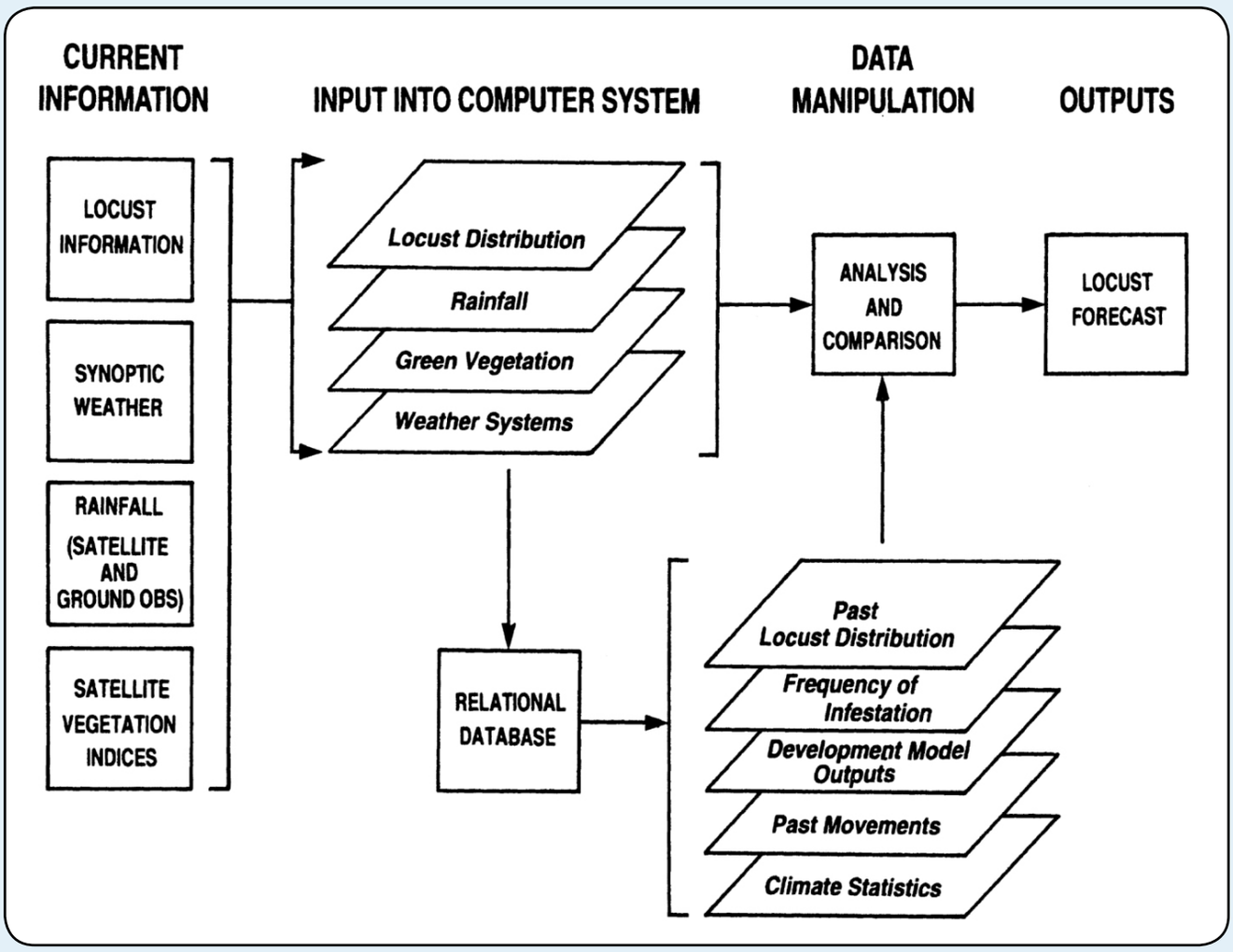


Figure 2. Schematic representation of data input, management and output organization in a Geographic Information System for Desert Locust forecasting (after Magor, 1995).

interpretation form the basis of the forecast. However, the systems differ in scale both spatially and temporally. SWARMS cover the whole Desert Locust distribution area and contains climate statistics and an archive of locust frequency data going back to 1930, thereby enabling long-term forecasts to be developed as well as the routine medium-term forecasts issued by FAO every month (http:__www.fao.org_news_global_locusts_Locuhome.htm) (Cressman, 1997).

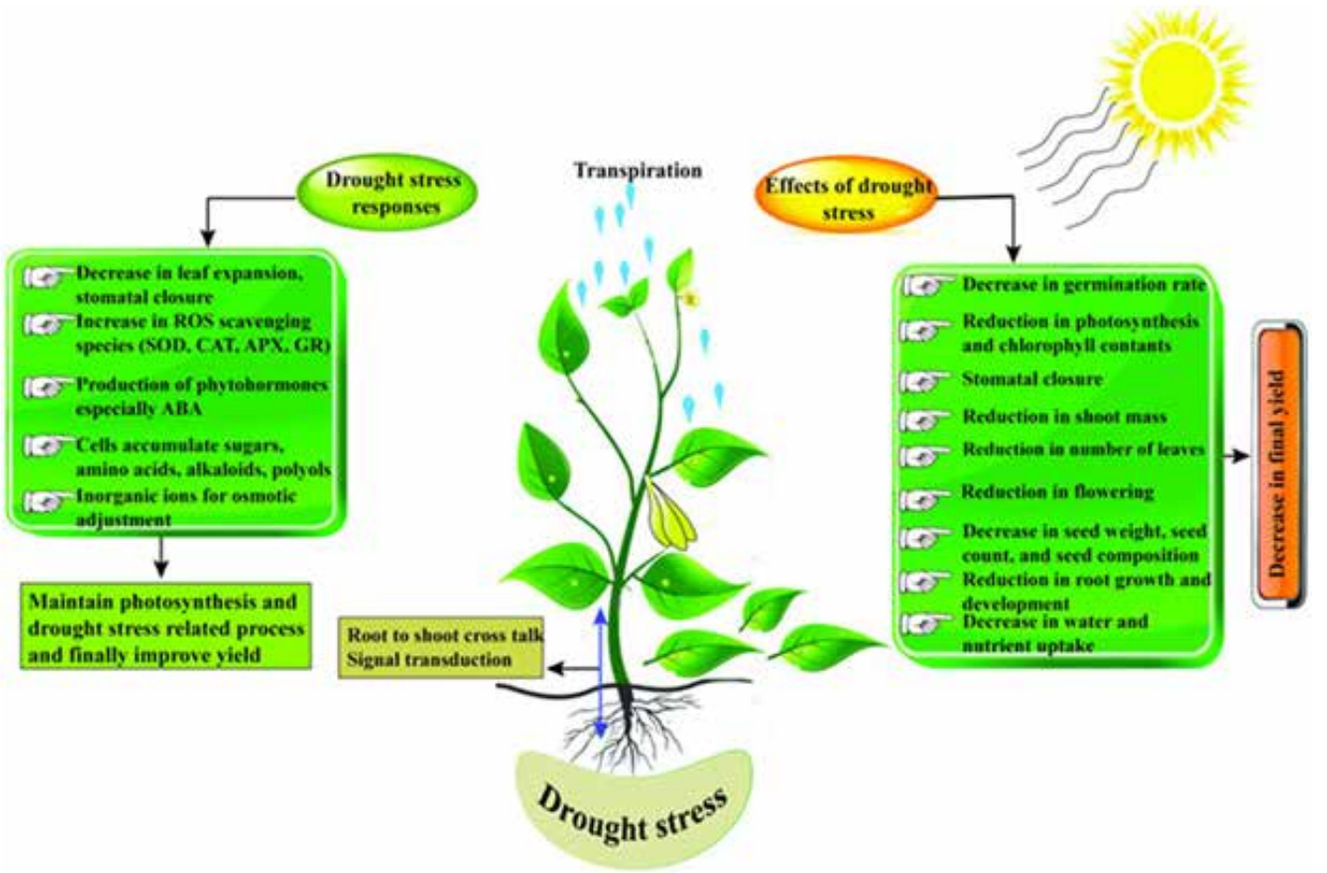
Conclusions:

- The use of satellite based remote sensing has proved itself as a strong and unbiased information system at regular intervals of time.
- Besides, they should integrate the remotely sensed information system with their agricultural information system to derive optimum usage, timely recovery of degraded land and refrain from unsustainable activities by use of other advanced technologies to their benefit and to enable increasing productivity through alternate farming system.
- The geographical extent of pest populations and the ease of monitoring them are of prime importance when organizing and implementing a control strategy.
- Preventative control depends on the presence of experienced survey teams, effective monitoring of environmental conditions and timely interventions by control teams.

References:

1. Riley, J.R., 1989, Remote sensing in entomology, Annual Review of Entomology. 34: 247 – 271

2. Kharuk,V.I., Ranson,K.J., Kuz'michev,V.V., and Im, S.T, 2003, Landsat-based analysis of insect outbreaks in southern Siberia, Canadian Journal of Remote Sensing. 29:286–297.

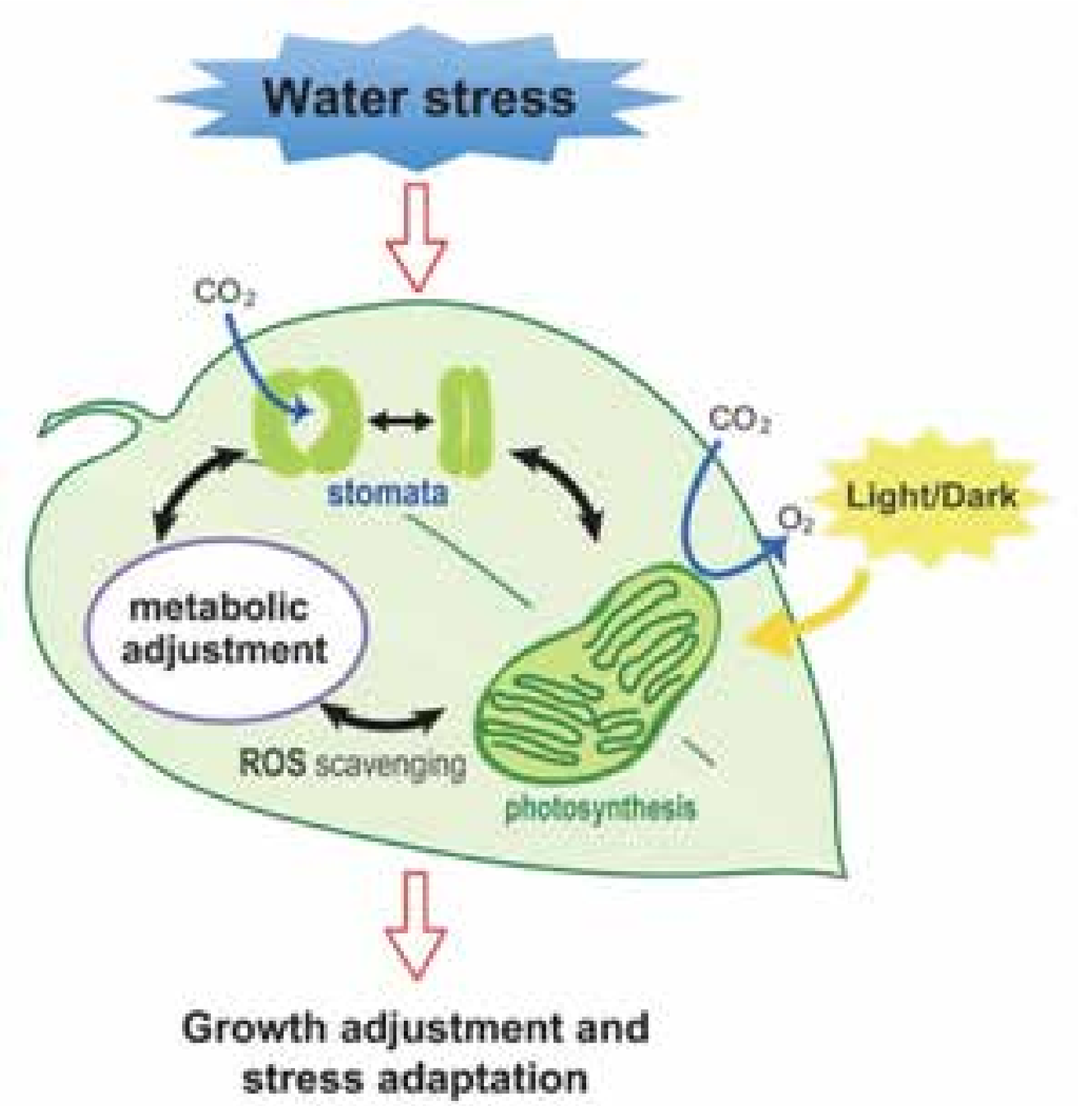


Challenges of Drought stress in Pulses mitagation and management

Ms.D.Beulah Esther
Assistant Professor, Department of Agronomy, Krishna College of Agriculture and Technology (KRISAT), Madurai, Tamil Nadu.

Introduction

Pulses are an important source of protein and vital for global nutritional security. Legumes serve as rich dietary proteins and accounts for 27% of the world crop productivity. Irregular and reduced rainfall, along with temperature rises due to climate change, are making food production more challenging. The abrupt climatic change, particularly the erratic rainfall is one of the major causes for reduction of pulse production in India. Since 80% of



crops are rainfed, it is imperative that we understand how crops react to drought. Occurrence of drought during very early vegetative stage impaired seed germination and plant stand establishment. Moisture stress during reproductive stage is often the most critical phase that influence the yield of crops harvested for grains or seeds.

Materials and methods:

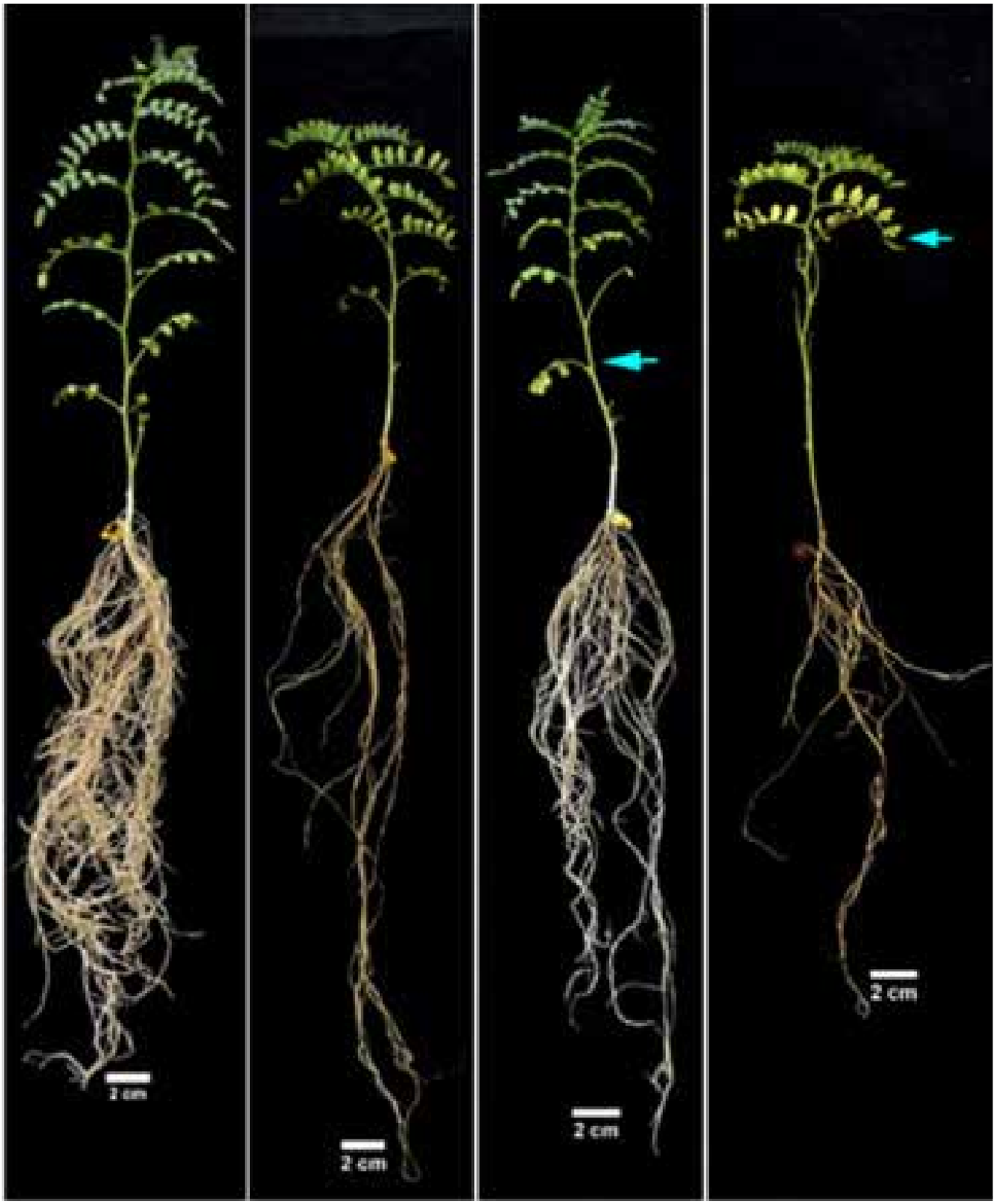
The following plant strategies have been identified to know the challenges facing by drought and mitigation techniques:

- Developing more and deeper roots
- Increasing water use efficiency
- Faster transport of nutrients and carbohydrates
- Maintaining higher relative water content

Results and discussion:

Moisture stress cause captivation i.e. breakage of water column within the plant which means water is taken up from soil up to the tip of the plant, more so in large diameter vessels. Loss of water causes reduction in growth and wilting. Low water stress greatly suppresses cell expansion and cell growth due to the low turgor pressure.

Grain legumes resist the drought by means of i) drought



escape i.e. development of early maturing varieties ii) drought avoidance via efficient stomatal regulation which maintain high leaf water content during mild drought conditions and (iii) drought tolerance via osmotic adjustment which usually allows root growth to proceed under drought condition. Drought tolerance requires less energy demand and less severely affect the productivity than drought avoidance. Legume plants such as common bean, cowpea,

etc are able to maintain high leaf water content and avoid the tissue dehydration during mild drought by controlling their stomatal conductance and closure (Pinheiro et al., 2001; Campos et al.,1999). Stomatal closure, consequently, can lead to a decrease in internal CO_2 concentrations, which eventually limit in the photosynthesis and shoot growth.

Drought Resistant Mechanisms

i) Drought Escape

Drought escape occurs when phenological development is successfully matched with the periods of available soil moisture, where the growing season is shorter and terminal drought stress predominates. Development of short-duration varieties in grain legumes has been found to be an effective strategy for minimizing yield loss from terminal drought, as early maturity helps the crop to avoid the period of stress.

ii) Drought avoidance

Drought avoidance consists of mechanisms that reduce water loss from plants, due to stomatal control of transpiration, and also to maintain water uptake through an extensive and prolific root system (Kavar et al., 2007).

iii) Drought tolerance

Drought tolerance is defined as the ability to grow, flower and display economic yield under suboptimal water supply. Drought tolerant plants can respond and adapt to and survive under drought stress by the induction of various morphological, biochemical and physiological responses.

Drought management strategies

Various strategies are to accomplish the above objective. The two most important strategies may include: (a) selection of the desired plant materials either through traditional breeding methods or through molecular and biotechnological means, including production of genetically modified or transgenic plants and (b) induction of drought tolerance in susceptible plants either through priming or through hormonal application. Drought-tolerant varieties with improved water-use efficiency (WUE) could increase crop productivity in dry areas. Practicing water-efficient methods, such as drip irrigation and mulching are all promising ways to alleviate the dangerous effects of drought.

Conclusion

Different crops respond differently toward different stresses. Pulse is an important crop in all the aspects. Drought stress is a serious issue in pulses and very less work has been done. Hence, the farmers of such areas have to be guided to grow pulses in the proper way to provide the better production in the aforesaid conditions. At present, more than 80% area of pulses is rainfed and therefore, arranging irrigation at critical stage by micro irrigation devices (Sprinkler set and Raingun etc.) may increase production by about 10-15%. Thus, mitigating drought stress is the pavement for the better production.

Reference:

Amede T, Schubert S (2003). Mechanisms of drought resistance in grain legumes: 1. Osmotic adjustment. Ethiopian Journal of Science. 26 (1):37–46.

Farooq M, Wahid A, Kobayashi N, Fujita D, Basra SMA (2009). Plant drought stress: effects, mechanisms and management. Agronomy for Sustainable Development. 29:185–212.

Kavar T., Maras M., Kidric M., Sustar-Vozlic J., Meglic V. (2007) Identification of genes involved in the response of leaves of Phaseolus vulgaris to drought stress, Mol. Breed. 21, 159–172.

Campos PS, Ramalho JC, Lauriano JA, Silva MJ, Matos MDC.(1999) Effects of drought on photosynthetic performance and water relations of four Vigna genotypes Photosynthetica. 36(1–2):79–87

Araus J.L., Slafer G.A., Reynolds M.P., Royo C. (2002) Plant breeding and drought in C3 cereals: what should we breed for? Ann. Bot. 89,925–940.

Pinheiro C, Chaves MM, Ricardo CP. (2001) Alterations in carbon and nitrogen metabolism induced by water deficit in the stems and leaves of Lupinusalbus L. Journal of Experimental Botany 52 (358):1063–70. PMID: 11432922

M Nanda
Senior M.Sc (Vegetable Science) Kittur Rani Channamma College of Horticulture, Arabhavi Karnataka, Ph: 8762160261

"A Bean with Impressive Benefits"

Vegetables are considered as essential for well balanced diets since they supply vitamins, minerals,dietary fibers and phyto-chemicals. Each vegetable group contains a unique combination and amount of phyto-chemicals. Among them chewy and flavorful yardlong bean is the one; it is also known as chinese snake beans specially meant for its immature, tender classic edible pods and have a hint of asparagus like flavor which is widely cultivated and consumed vegetable crop grown throughout the tropical and subtropical countries.

Asparagus bean is a food plant with the potential to improve nutrition, boost food security, foster rural development and support sustainable land-care. The most phenomenal health benefits of yardlong beans in the health word are its role in establishing a healthy heart.

The Nutritional content of Long Beans which are very good to maintain a body health such as,:-

Health Benefits

In a natural food source such as long beans there must be some good effects for the health. The prevention of some kind of dangerous enzymes and stimulating good enzymes for the body can be received from the health benefits of long beans. Here are the details of outstanding health benefits of snake bean:

1.Preventing Diabetes

Long beans can control excess sugar level that prevent the occurrence of diabetes, in addition , they are also low in calories and sugar so it is safe

Nutritional value/100g

Principle	Nutritive value	% of RDA
Energy	47Kcal	2
Carbohydrates	8.35g	6
Protein	2.8g	5
Total Fat	0.40g	2
Cholesterol	0mg	0
Vitamins		
Folate	**62µg**	**15.5**
Niacin	0.410mg	2
Panthothenic acid	0.055mg	1
Pyridoxine	0.024mg	2
Riboflavin	0.110mg	9
Thiamin	0.107mg	9
Vitamin-A	865IU	29
Vitamin-C	18.8mg	31
Elecrolytes		
Sodium	**4mg**	**<1**
Potassium	240mg	5
Minerals		
Calcium	50mg	5
Copper	0.048µg	5
Iron	0.47mg	6
Magnesium	44mg	11
Manganese	0.205mg	9
Phosphorus	59mg	8
Selenium	1.5µg	3
Zinc	0.37mg	2

Source: USDA, National Nutrition Data Base.

for those who have problem with the blood sugar.

2. Cardio-vascular and Heart Health

High vitamin-K content in nutritious long bean can prevent the amplification of the arteries, which is the common factor in coronary artery diseases and heart failure. Recent research shows that one of the vit-K categories i.e vit-K2 combined with vit-D can prevent the calcification of coronary arteries and thereby cardio-vascular diseases.

3. Sources of Antioxidants

Antioxidants are the one which prevents and combat free radicals. Long beans are an important source of rich antioxidants. Besides vit-C and β-Carotene, they also contain Mn minerals that are important for antioxidants. Green Beans contains a wide variety of carotenoids (including lutain, β-carotene, violoxanthin etc) and flavonoids (including quercetin, procyanidins, epicatechins).

4. Preventing Osteoporosis

The high content of vit-K in the yardlong bean is one of the factor that prevent Osteoporosis. The content of vit-K in this vegetable can atleastcomplete more than 20% of daily requirement of vit-K needed by the body.

5. Good for Digestion

The fiber present in beans can facilitate or smoothen the secretions that avoid constipation or more dangerous diseases such as colon cancer.

6. Bone Health

Vit-K and Manganese found in the long beans is very effective to maintain bone health and make it strong until old age.

7. Skin Health

The study shows that those who consume long beans have reduced chances of appearance of wrinkles, skin dryness and slows down the aging process. It is also essential for the ligaments, blood vessels and tendon. It speeds up the healing process.

8. Lowers the risk of Gout

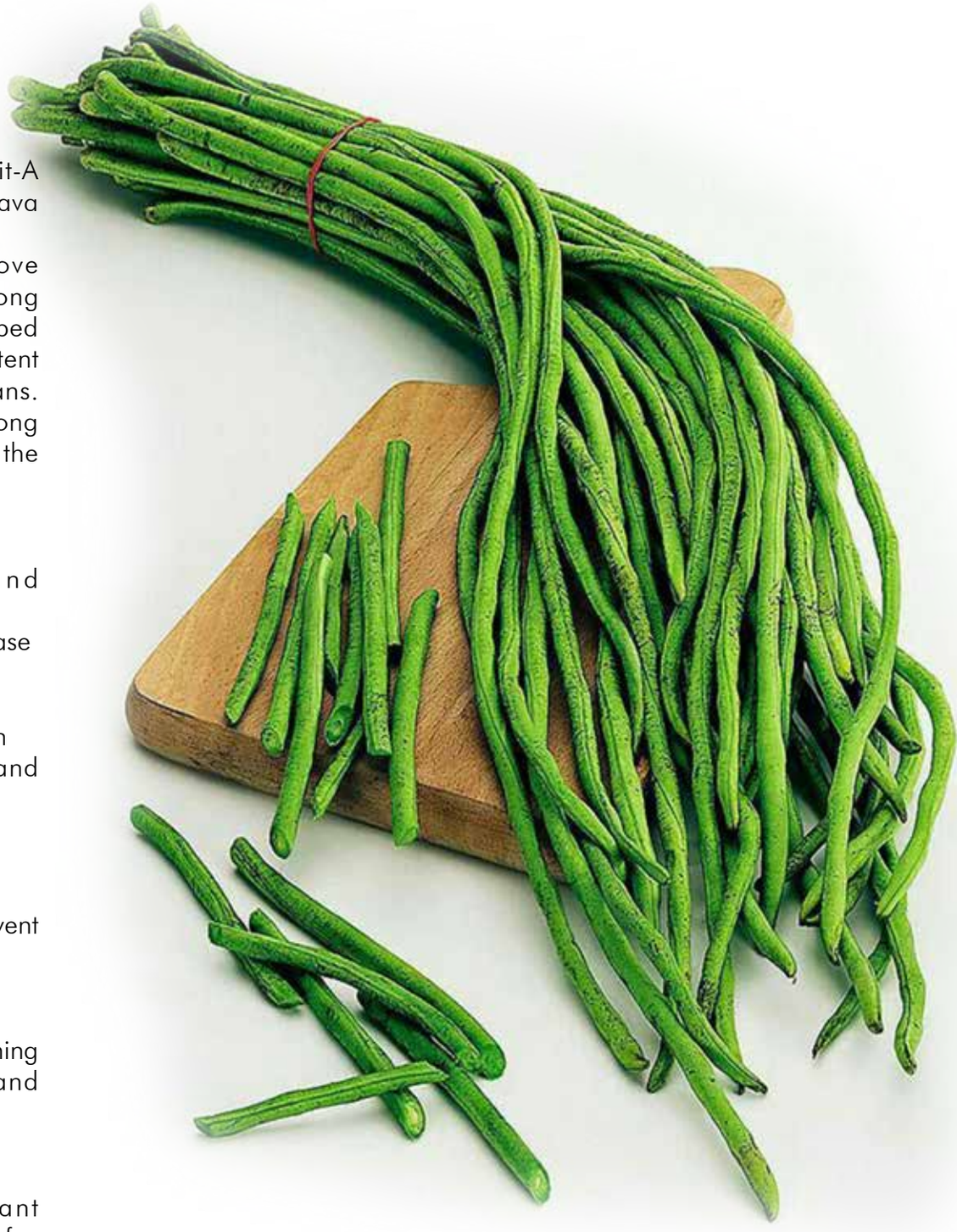
As Yardlong bean are rich in vit-C, it lowers the risk of gout, which is painful condition that afflicts big toe. In those study who consume 1000-1499mg of vit-C, their chances of gout was decreased by 31%.

9. Sound Sleep

Beans provide an adequate amount of Mg which is used to treat sleeping disorders like hyperactivity, anxiety and restlessness.

10. Eye Health

Some research has shown that long beans consist of considerable amount of thiamine and Vitamin-A which can help to defend vision problems such as cataracts and glaucoma.



Long beans have more vit-A compared to lima bean, fava and other green beans.

In addition to above benefits, the efficacy of long beans can also be described based on the nutrient content contained in the long beans. Here are the benefits of long beans in accordance with the nutrients contained in it :

1) Vitamin-K

- Maintain heart health
- Prevent cancers and osteoporosis
- Prevent alzheimer's disease

2) Magnesium

- Maintain healthy skin
- Protection of bone health
- Control blood sugar and prevent free radicals
- Prevent epilepsy

3) Fibers

- Smoothens the digestion
- Maintain weight and prevent stroke

4) Vitamin-C

- Prevent cataract
- Prevent difficulty in breathing
- Prevent heart attack and stroke

5)Folic acid

- Prevent anemia
- Important for pregnant women and provides for nutrition for brain
- Increase the production of red blood cells and cell division

6)Vitamin-B2:

- Prevent migraines and headaches
- Prevent cataract and energy sources

7)Copper:

- Prevent osteoporosis and anemia
- Maintains the health of foetus
- Prevent thyroid abnormalities

8)Vitamin-B1:

- Maintains immune system
- Prevent kidney disorders

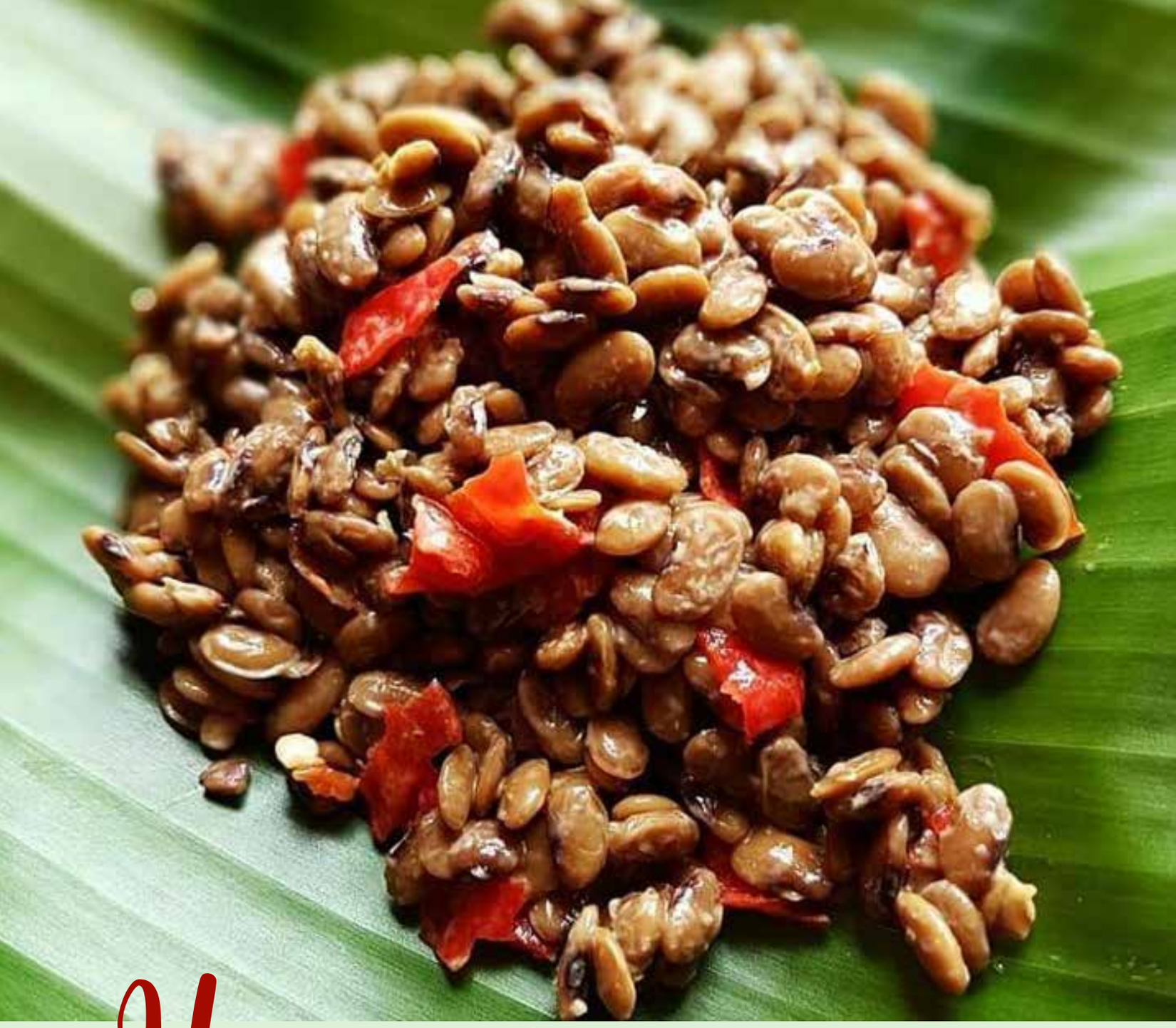
9) Magnesium:

- Maintaining bone health
- Good for diabetes
- Maintain heart health

Vegetable proteins sources such as long beans are more friendly than animal proteins sources for the digestion system, so long beans can be a menu choice for vegetarians for a healthy diet. There are many health benefits of yardlong bean that can be received from consuming them that we already had a glimpse of it. Eat long beans with a variety of tasty menus, not only your tongue will be delighted, but also your body remains healthy with a medical insurance given by in consumption.

Reference-

- Nutrient data by USDA SR-21
- Medical news today
- Herbgarden.co.za(Mountain herb estate)
- Dr HealthBenefits.com
- Antioxidant activity of pod-N I. De Silva



Hawaijar

A traditional fermented food of Manipur, North-East India

Th. Bidyalakshmi Devi[1]*
Khwairakpam Bembem[1]
Surya Tushir[1]
Ritika[2]
[1]Scientist
[2] Senior Research Fellow,
CIPHET, Ludhiana, Punjab

Introduction

Hawaijar is an ethnic fermented soybean product which is prepared by locally in Manipur, India. It is consumed in every households directly or used as an important ingredient in various dishes of Manipur (Premarani&Chhetry, 2011). Hawaijar is rich in almost all the nutrients with characteristics flavor and stickiness. This fermented soybean is widely consumed in north-eastern states of India with different ethnic names such as Kinema in Sikkim, Aakhuni in Nagaland, Tungrymbai in Meghalaya, Peruyaan in Arunachal Pradesh, and Bekangthu in Mizoram (Tamang, 1996). Similar products is also being consumed in different countries like China (Sieng), Japan (natto), Korea (chungkokjang), Thailand (thuanao), Myanmar (Pepok). Bacillus subtilis found predominantly in fermented soy product give rise to high proteolytic activity and markedly increase the free amino acid content (Jeyramet al., 2008 and General et al., 2011).

Fermentation is a crucial step in preparation of Hawaijar, as it allows breakdown of complex compounds through activity of microorganism and enzymatic conversion of food components with better shelf life, safety, nutritional, and therapeutic properties. The micro-organisms identified in fermented soybean includes: *Bacillus amyloliquefaciens, B. cereus, B. culans, B. licheniformis, B. sphaericus, B. subtilis and B. thuringiensis*. However, *B. subtilis* is the dominant functional bacteria in Hawaijar production. The consumption pattern, nature and microorganism involved in naturally fermented soybean products is listed in Table 1. Freshly prepared Hawaijar is cooked and generally eaten as a regular food with vegetables as curry 'Athongba', fried with vegetable shoots'Kangou' and paste with chilli and fresh vegetables 'Ametpa' in Manipur.

Hawaijar is mainly consumed as a regular food in every household of Manipur as a low cost source of high protein. It also plays an economic, social and cultural role in North-East regions of India. Making of fermented soybean provides income to the rural masses in North-East and bears deep attachment with socio cultural lives of the people.

Method of preparation

Traditionally, Hawaijar is prepared with medium and small sized soybean (Glycine max (L.)) seeds. The seeds are cleaned and soaked in water for 12-24 hr and cooked till tender. The excess water is drained off and seeds are washed with normal tap water. The cooked and washed soybean seeds are

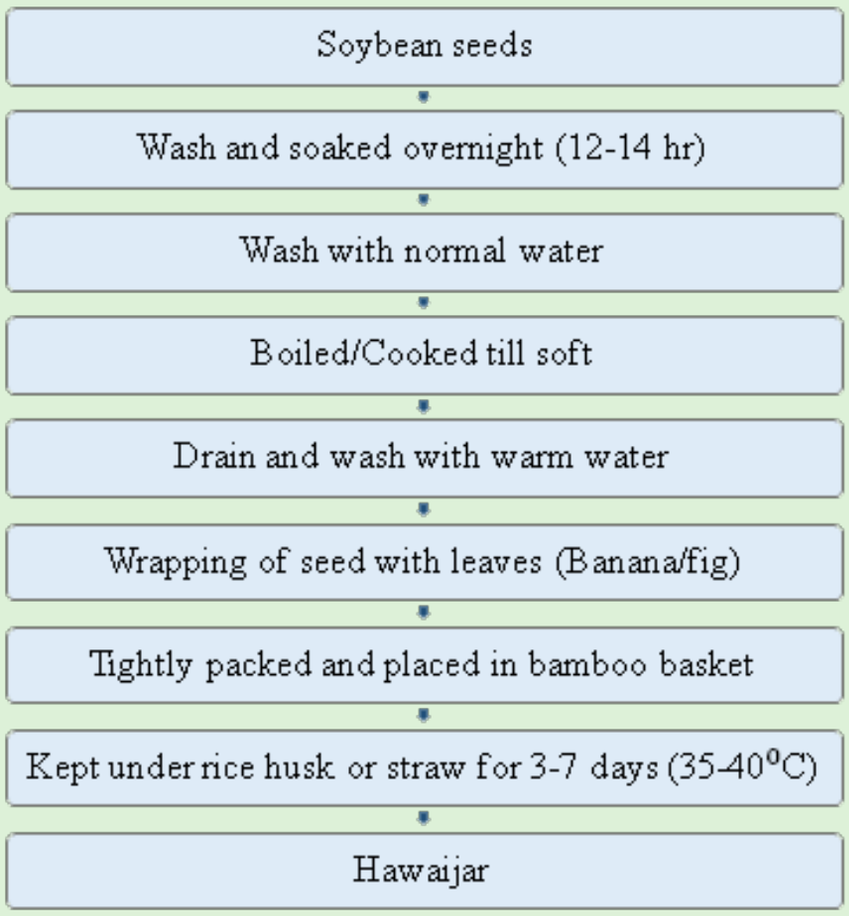
Table 1: Characteristics of fermented soybean products of North-East India

Product	Characteristics and consumption pattern	Microorganisms	States in India
Aakhone	Alkaline, sticky, paste; curry, side dish	*B. subtilis*, *Proteus mirabilis*	Nagaland
Bekang	Alkaline, sticky, paste; curry	*B. licheniformis*, *B. pumilus*, *B. sphaericus* Mizoram	
Hawaijar	Alkaline, sticky, Paste; side dish, curry	*B. subtilis*, *B. licheniformis*, *B. amyloliquefaciens*, *B. cereus*, *Staphylococcus aureus*	Manipur
Kinema	Alkaline, sticky; curry B. subtilis,	*B. licheniformis*, *B. cereus*, *B. circulans*, *B. thuringiensis*, *B. sphaericus*, *Ent. faecium*	Sikkim, Darjeeling hills, Assam
Peruyaan	Alkaline, sticky; side dish	*B. subtilis*, *B. amyloliquefaciens*, *Vagococcuslutrae*	Arunachal Pradesh
Tungrymbai	Alkaline, sticky; curry, soup	*B. subtilis*, *B. licheniformis*, *B. pumilus*	Meghalaya

(Adapted from Tamang, 2015)

wrapped in banana or fig leaves and kept in bamboo basket or jute bags lined with straws for 3-7 days depending on the season. The steps involved in Hawaijar preparation is shown in the Fig.1.

The traditional method of preparation of Hawaijar by natural fermentation leads to quality variation due to use of different methodologies, varying fermentation time and incubation temperature. Often the quality of fermented soybean is unpredictable due to uncontrolled fermentation temperature and the native fermenting microflora. As a result, the shelf life of Hawaijar is very short (2-3 days). Traditional method is still being followed though the demand is increasing.




(a)

Table 2: Nutritional composition of raw soybean and *Hawaijar*

Nutrient/100g	Soybean	Hawaijar
Moisture	8.4	10.3
Carbohydrate	19.6	15.0
Protein	39.8	42.0
Fat	18.5	19.3
Ash	4.8	2.3

(Keishing et al.,2015)

Table 3: Comparison of essential fatty acid (%) composition in soybean and Hawaijar

Sample	Palmitic	Stearic acid	Oleic acid	Linoleic acid	α-linoleic acid
Soybean	10	4	18	55	13
Hawaijar (JS335 +strain H)	12	1.9	20	58	6.7

(Adapted from Devi at al., 2020 and Clemente and Cahoon, 2009)

Fig. 2. (a) Soybean wrapped in banana leaf to be kept for fermentation in bamboo basket (b) Hawaijar

There is a need of scientific investigation of microorganisms to improve production methods and extend shelf life of Hawaijar. The maturity of Hawaijar is identified with the development of brown color on soybean seed, formation of white sticky slimy substance on seeds with ammoniacal smell.

Nutritional composition

The nutritional composition of Hawaijar enhances with fermentation as compared to unfermented soybean (Table 2). During fermentation the enzymes secreted by microbe breakdown the complex substrate into simpler ones. Though raw soybean is primarily rich source of protein, it contains 20% of oil fraction, hence its essential fatty oil fraction is nutritionally equally

important. During fermentation of soybean, the changes in level of fatty acid occur due to lipolysis or degradative/digestive properties of microbial enzyme (Table 3). The anti-diabetic and antioxidant activities of fermented soybean are higher as compared to raw soybean.

Healthbenefits:

Fermentation of soybean releases small peptides and mucilage which is a high potential source for numerous health benefits (Chatterjee et al. 2018). Fermented soybean has a wide range of health benefits like anticancer effects, reduction of menopausal syndrome frequency, osteoporosis protection and coronary heart disease prevention due to anti-atherogenic properties (Keising et al., 2015).The serine protease types of enzyme present in fermented product reduces blood clotting and avoid the onset of thrombosis. Large amount of Vitamin K in fermented soybean is involved in formation of calcium binding groups in protein, which assist in bone formation.It has also been reported that incidence of type 2 diabetes is lower in Asian populations as compared to those in Western countries which may be attributed to the consumption of a traditional Asian diet that includes fermented soybean products among other components (Kwon et al., 2010). According to various reports, Japanese population alone consume about 7.5 billion packets of natto each year while enjoying long lives which is 85 years for women and 78 for men.

Conclusions

The fermented soybean which is mainly being consumed in south-east Asia is well known for its health benefits. Hawaijar isalso one of the fermented soybean product which is traditionally prepared at household level by the women folk of Manipur. Selling of Hawaijar has social and economic role in the society. The traditional method of preparation lacks hygiene practices and has no controlled conditions. This leads to the poor quality of the product and short shelf-life. Therefore it becomes the need of the hour for extensive research for enhancing the shelf life and quality and mechanizing the production of traditional foods in order to supply the demands as well as to generate income for the rural population.

References

Devi, L. S., Kumar, V., Rani, A., Tayalkar, T., Mittal, P., Anshu, A. K., & Singh, T. A. (2020). Fatty Acid Composition, Antinutritional Factors, and Oligosaccharides Concentration of Hawaijar (An Ethnic Fermented Soyfood of India) As Affected by Genotype and Bacillus Subtilis Strain.

Indonesian Food and Nutrition Progress, 17(2), 45-50.

Clemente, T. E., & Cahoon, E. B. (2009). Soybean oil: genetic approaches for modification of functionality and total content. Plant physiology, 151(3), 1030-1040.

Keishing S, Banu T, Umadevi M. (2015). Effect of Fermentation on the Nutrient Content, Antioxidant and Antidiabetic Activities of Hawaijar, an Indigeneous Fermented Soya of Manipur, India. J Hum Nutr Food Sci 3(3): 1066.

Kwon, D. Y., Daily, J. W., Kim, H. J. and Park, S. (2010). Antidiabetic effects of fermentedsoybean products on type 2 diabetes. Nutrition Research, Vol. 30 No. 1, pp. 1–13.

Premarani T, Chhetry GKN. (2011). Nutritional analysis of fermented soyabean (Hawaijar). Assam University J Sci Technol. 7:96–100.

Chatterjee C, Gleddie S, Xiao CW. (2018). Soybean Bioactive peptides and their functional properties. Nutrients 10(9):1211. https://doi.org/10.3390/nu10091211.

General, T., Koijam, K., & KA, A. A. (2011). Process improvement as influenced by inoculum and product preservation in the production of Hawaijar-A traditional fermented Soybean. African Journal of Food Science, 5(2), 63-68.

Jeyaram, K., Singh, W. M., Premarani, T., Devi, A. R., Chanu, K. S., Talukdar, N. C., & Singh, M. R. (2008). Molecular identification of dominant microflora associated with 'Hawaijar'—a traditional fermented soybean (Glycine max (L.)) food of Manipur, India. International Journal of Food Microbiology, 122(3), 259-268.

Tamang, J. P. (2015). Naturally fermented ethnic soybean foods of India. Journal of Ethnic Foods, 2(1), 8-17.

POST-HARVEST MANAGEMENT OF ETHYLENE: MAINTAIN QUALITY OF FRESH PRODUCE AND SHELF LIFE ENHANCEMENT

Bhupendra M Ghodki[a]
Poonam Choudhary[a]
Namrata Pathak[b]
Yogesh B. Kalnar[a]
[a]ICAR-Central Institute of Post-Harvest Engineering and Technology, Ludhiana, India
[b]Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Potsdam, Germany

Introduction and Background

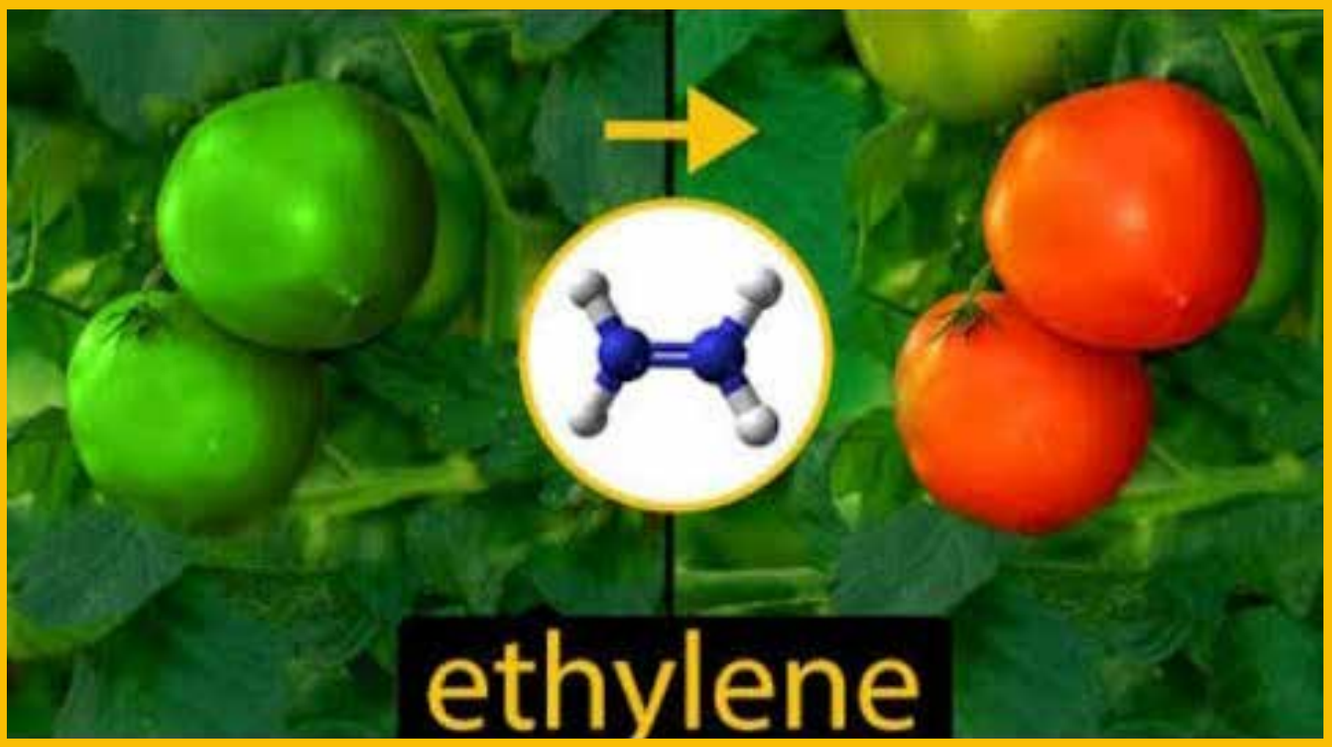
Fruits and vegetables (F & V) occupied a special place in the human diet due to their high nutrient values. However, they are highly perishable commodity which together with roots and tuber reported 40-50% of total food waste globally (Pathak, Caleb, Geyer, et al., 2017). The probable causes of such a bulk amount of wastage and lower export are unscientific post-harvest management practices, poor infrastructure, inadequate ethylene management, weak supply chain, and insufficient food policies as well as traders cartel magnify the problems. Further according to an estimate, 10–30% of fresh produce or F &

V is wasted due to undesirable ethylene exposure (Pathak, Caleb, Rauh, et al., 2017).

Ethylene is a phytohormone or gaseous plant hormone (odorless) that regulates a variety of physiological functions from seed germination to organ senescence. Ethylene exhibits both beneficial and detrimental effects on postharvest quality and storage life of F & V. Beneficial effects include the development of characteristic color, taste, and flavor of F & V. Conversely, it may cause/induce negative effects even at its low concentration such as increased susceptibility to decay leading to discoloration and softening, and promotion of senescence, all of which reduce the storage life. Thus, to slow down the natural process of ripening and senescence, one inherent cause of 1/3rd fruits waste, ethylene management is essential (Blanke, 2014; Pathak, Caleb, Rauh, et al., 2017). The food supply chain, storage chambers, transportation, and residential freezers are endogenous sources of ethylene production while the external source of ethylene includes motor exhausts, pollution, plant, and fungus metabolism.

The fresh produce is categorized into two groups in terms of ethylene production, that is, climacteric and non-climacteric. Climacteric items, such as fruit, create a burst of ethylene as they ripen, as well as an increase in respiration while non-climacteric products do not release ethylene as they ripen. The more obvious technique to determine which class a product belongs to is to observe whether it ripens after harvest. Climacteric products ripen after harvest and often soften, change colour, and become sweeter. Tomatoes, bananas, and mangoes are some examples of climacteric products that ripen after harvest. Some climacteric fruits, such as muskmelon, will soften rather than increase sugar content during ripening. After harvest, non-climacteric fruits do not alter appreciably. As they age, they soften slightly, lose their green colour, and develop rots, but they do not modify their eating features. Leafy vegetables, melons, strawberries and grapes are examples of non-climacteric crops. Non-climacteric fruits will not respond to ripen with ethylene gas. Nevertheless, F & V should be stored separately since fruits release relatively more ethylene than vegetables that can spoil ethylene sensitive vegetables such as cabbage, cauliflower, cucumber, lettuce and others. Even with a minimal change in ethylene concentration in the supply chain of F & V the shelf life and quality affect significantly.

In view of the present global challenge of minimizing post-harvest losses and waste of fresh produce, the significance of ethylene management in the supply chain is paramount. Nevertheless, the quality needs to be maintained for a longer



period/higher postharvest storage life such that it stabilizes the market price along with better economic returns to farmers, processors, consumers and exporters.

Ethylene Management Methods

The traditional ethylene management methods such as controlled atmospheric storage, hypobaric storage, ventilated polybags, high-temperature catalytic oxidation, ethylene absorbers, ethylene adsorbers, ethylene inhibitors, venting by air, and application of biofilters were reported to be effective in maintaining post-harvest quality and enhancing the shelf life of fresh produce. Ethylene adsorbers such as clays, zeolite, activated carbon, etc. and ethylene oxidizers either chemical (potassium permanganate and ozone) or biological (biofilters) are used to remove the excess ethylene from the environment. Inhibition of ethylene by blocking the ethylene receptors using 1-methyl cyclopropene (1-MCP) was proclaimed most effective in maintaining the post-harvest quality of fresh produce. However, such traditional ethylene management methods pose some limitations/ drawbacks such as high energy requirement, high initial capital and operational cost, challenge of waste disposal, require long exposure time and lower effectiveness in ethylene removal (Hussain et al., 2010; Jozwiak, 2003; Pathak, Caleb, Rauh, et al., 2017). Adsorption-desorbing devices and (or) gas processing units may be used to recover excess ethylene; however, the cost involved may be higher than the commercial production of ethylene. Conversely, advanced techniques based on photocatalytic and photochemical oxidation of ethylene offer an alternative approach that could aid in reducing some of these critical drawbacks.

The photocatalytic and photochemical oxidation techniques comprise the use of ultraviolet (UV) radiation with or without a catalyst. In photocatalytic oxidation, a catalyst primarily a semiconductor such as TiO_2, ZnO, ZnS, CdS, Fe_2O_3, and SnO_2 is essential which acts as a photocatalyst on irradiation with UV light (generally 200–380 nm catalyst dependent) and thus facilitates the oxidation of ethylene at its surface (Pathak, Caleb, Rauh, et al., 2017). TiO_2 is the most popular among the catalyst due to its high stability, biological and chemical inertness, high ultraviolet absorption, and low cost (Hussain et al., 2010; Yang et al., 2007). However, in photochemical oxidation, extreme short wave (< 200 nm) vacuum ultraviolet radiation

(VUV) consisting of high-energy photons eliminates ethylene in the gaseous state (Jozwiak, 2003). These methods have been extensively researched for air and water purification (Chang et al., 2013; Pathak, Caleb, Rauh, et al., 2017; Yang et al., 2007). Nevertheless, limited attention has been given to these potential techniques in postharvest storage of F&V (Hussain et al., 2010; Jozwiak, 2003; Pathak, Caleb, Rauh, et al., 2017).

Both photocatalytic and photochemical oxidation possess certain limitations individually such as photocatalytic oxidation suffer from catalyst deactivation and lower efficiency, especially under high humidity conditions. High humidity is essential in the storage of fresh produce to minimize mass loss (Rais & Sheoran, 2015). Although VUV photochemical oxidation is more effective at high RH, O_3 is produced in the process, which could be toxic to plant tissues. Moreover, in the VUV process, only a small part (5–8 %) of the irradiation corresponding to 185 nm is utilized, and the rest is wasted (Pathak, Caleb, Rauh, et al., 2017). In the commercial market, ozone-producing UV lamps (UV254 + 185) with major emissions at 254 nm and minor emissions (~5 %) at 185 nm are available.

The hybrid technique via coupling of VUV photochemical oxidation with UV/TiO_2 photocatalytic oxidation can help in addressing these shortcomings.

The general focus of clubbed photocatalytic and photochemical oxidation studies has been on the removal of air pollutants such as toluene, formaldehyde, and benzene (Cassano et al., 1995; Hussain et al., 2010; Yang et al., 2007). Chang et al., 2013 has reported ethylene and selected organic aerosol removal by this method under atmospheric conditions. However, practical application of clubbed photocatalytic and photochemical oxidation of ethylene considering real-life storage conditions of F&V (temperature and humidity dependent) has not been reported. Nevertheless, limited studies are available on positive results on ethylene removal by both these techniques individually (Cassano et al., 1995; Hussain et al., 2010; Jozwiak, 2003; Pathak, Caleb, Rauh, et al., 2017).

Future Prospective

A combination of traditional and novel ethylene management methods may aid in the development of residual free and environmentally friendly management of ethylene in the fresh produce supply chain. In the future, mathematical and numerical models may be developed as a function of ethylene concentration and ethylene sensitivity of F & V to predict their shelf life and quality in components of the supply chain.

References

Blanke, M. M. (2014). Reducing ethylene levels along the food supply chain: A key to reducing food waste? Journal of the Science of Food and Agriculture, 94(12), 2357–2361.

Cassano, A. E., Martín, C. A., Brandi, R. J., & Alfano, O. M. (1995). Photoreactor Analysis and Design: Fundamentals and Applications. Industrial and Engineering Chemistry Research, 34(7), 2155–2201.

Chang, K. L., Sekiguchi, K., Wang, Q., & Zhao, F. (2013). Removal of ethylene and secondary organic aerosols using UV-C254 + 185 nm with TiO2 catalyst. Aerosol and Air Quality Research, 13(2), 618–626.

Hussain, M., Russo, N., Fino, D., Geobaldo, F., & Saracco, G. (2010). Photocatalytic degradation of ethylene in fruits by new TiO 2 nanoparticles. Materials Science, 2010(Imccre), 29–30.

Jozwiak, Z. B. (2003). Experimental Verification of a Model Describing UV Initiated Decomposition of Ethylene in CA Storage of Apples. 707–710.

Pathak, N., Caleb, O. J., Geyer, M., Herppich, W. B., Rauh, C., & Mahajan, P. V. (2017). Photocatalytic and Photochemical Oxidation of Ethylene: Potential for Storage of Fresh Produce—a Review. Food and Bioprocess Technology, 10(6), 982–1001.

Pathak, N., Caleb, O. J., Rauh, C., & Mahajan, P. V. (2017). Effect of process variables on ethylene removal by vacuum ultraviolet radiation: Application in fresh produce storage. Biosystems Engineering, 159, 33–45.

Forget- me- not

Dr. Niya Celine VJ
Assistant Professor, Plant Physiology,
College of Agriculture, Thrissur.

Do plants have memory? Yes of course, plants do have a sort of memory, an epigenetic memory using modified proteins in nucleus called histone protein. The word epigenetic means the one arising due to non- genetic factors. Epigenetic changes are reversible.DNA is the genetic material in plants and chromosome is a long DNA stretch wound around a protein called histone. The histone proteins are rich in basic proteins namely lysine and arginine which causes it to possess a positive charge and thus attract negatively charged DNA towards it. Histones are helpful in packaging the DNA in the cell. They control chromatin structure and thus favoring gene transcription or repression.

A lot of modification takes place in these kind of proteins like acetylation, methylation, phosphorylation, ubiquitination etc. which helps the cell in performing various activities starting from cell cycle to differentiation and then to gene transcription. For example, DNA methylation, that is the addition of a methyl group to DNA, prevents the genes from being expressed.The histone octamer structure contains H2A, H2B, H3 and H4, where as H1 protein is associated with each nucleosome in maintaining the structure of the chromosome. The histone modifications are directly inherited from parental chromatin. Often epigenetic marks from the maternal environment are retained by the seeds as they grow close to the mother plant.

If somebody hurts a plant, will it remember? Again, it is the epigenetic modification which help plants to remember the environmental cues. Any external change is perceived by the plant cells and communicated to other cells through a type of cell called bundle sheath cell. The signals are transmitted similar to the central nervous system in animals.

In the case of temperate plants, it is highly essential for the plant cell to remember the incidence of cold and then initiate flowering process. Also, this memory should not cause the seeds to cause premature flowering. So,the plants have an excellent mechanism to forget the epigenetic memories in seeds. Researchers found that H3K27me3 gene which got disappeared in pollendue to reason called 'epigenetic resetting'more like erasing and formatting in memory cards.

Apart from all these events, plants remove the unwanted memories by a phenomenon called 'RNA decay', similar to one we used to, while formatting the data in memorycards. For a plant to create a memory, a protein has to be produced through the pathways of central dogma. The RNA decay process can regulate the amount of RNA molecules turning to protein and maintain the genetic material free for future vital functions.

Published by **Sunilkumar R** Principal Information Officer Farm Information Bureau Owned by Department of Agriculture, Government of Kerala and Published at Farm Information Bureau, Kowdiar P.O, Thiruvananthapuram-3. Editor: **Sreekala S.** Mail: editorejournalkkfib@gmail.com Log on to http://www.fibkerala.gov.in Phone: 0471-2314358