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Editorial Board

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RECIRCULATORY AQUACULTURE SYSTEM (RAS)

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Introduction

Recirculatory Aquaculture System (RAS) is a technology where water is recycled and reused after mechanical and biological filtration and removal of suspended matter and metabolites. This method is used for high- density culture of various species of fish, utilizing minimum land area and water. In this system fish are typically reared in indoor/outdoor tanks in a controlled environment. Recirculating systems filter and clean the water by recycling it back to fish culture tanks. The technology is based on the use of mechanical and biological filters and the method can be used for any species grown in aquaculture. New water is added to the tanks only to make up for splash out, evaporation and that used to flush out waste materials. The reconditioned water circulates through the system and not more than 10% of the total water volume of the system is replaced daily. In order to compete economically and to efficiently use the substantial capital investment in the recirculation system, the fish farmer needs to grow as much fish as possible in the inbuilt capacity. The management of recirculating systems relies heavily on the quantity and quality of feed and the type of filtration. Numerous filter designs are used in recirculating systems, but the overall goal of all filtration is to remove metabolic wastes, excess nutrients, and solids from the water and provide good water quality for the aquatic organisms. It is important to consider all factors when designing and investing in aquaculture systems.

Advantage of RAS

- Extended durability of tanks and equipment
- Reduced dependency on antibiotics and therapeutants hence, advantage of getting high quality fish
- Reduction of direct operational costs associated with feed, predator control and parasites
- Potentially eliminate release of parasites to recipient waters
- Risk reduction due to climatic factors, disease and parasite impacts
- RAS production can promote flexibility in terms of location for farming, proximity to market
- Enable production of a broad range of species irrespective of temperature requirements
- Feed management is considerably enhanced in RAS when feeding can be closely monitored for 24 hours
- Exposure of stock to stress on RAS can be reduced for some factors such as adverse weather, unfavourable temperature conditions, external pollution and predation
- Enable secure production of non-endemic species
- Judicial use of water and land areas

Disadvantage of RAS

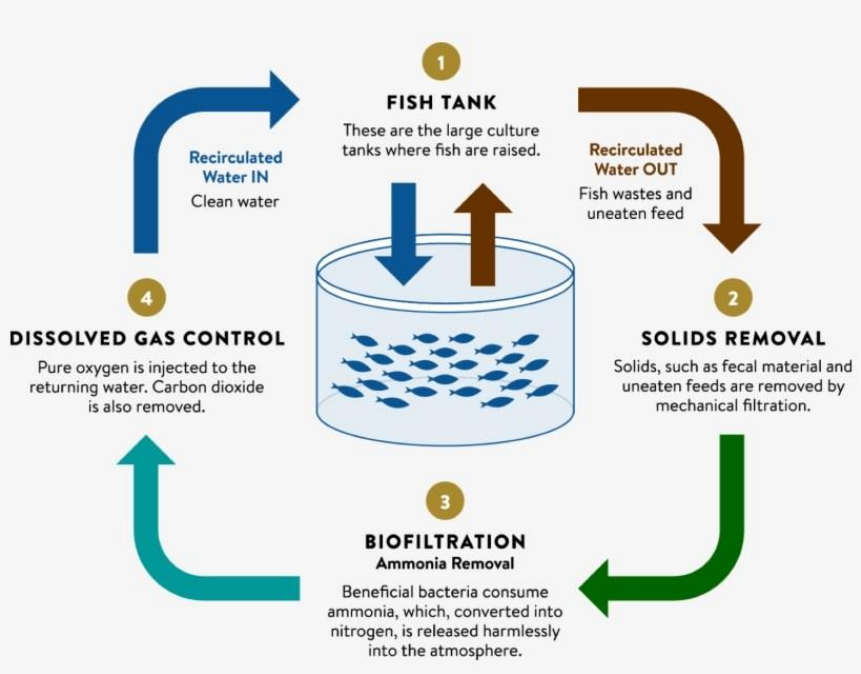
- Constant uninterrupted power supply is required if electric power fails than backup of electricity is required
- Capital cost of starting a recirculating aquaculture system is high as compared to ponds and raceways

Species suitable for RAS

- Baramundi/ Asian Seabass/Bhetki (*Lates calcarifer*)
- Cobia *(Rachycentron canadum)*
- Silver/Indian Pompano *(Trichinotus Blochii/ Trichinotus mookalee)*
- Tilapia *(Oreochromis niloticus)*
- Pearl spot/Karimeen *(Etroplus suratensis)*
- Pangasius *(Pangasianodon hypophthalmus)*
- Rainbow Trout *(Oncorhynchus mykiss)*, especially in Hilly/cold water Region

Components of RAS

- Insulated shed/ Building
- Store cum office for feed and accessories
- Pump house
- Grow out tanks: Circular cement tanks/ FRP tanks, including inlet, outlet central drainage
- Settling tanks for sludge
- Water Storage (sump) tanks
- Overhead tanks
- Mechanical (Hydraulic) filters, Drum filter, Glass wool/ muslin cloth filter
- Pumps and motors
- Power generator
- Sludge collector, settable/ dissolved solid collectors
- Biofilters, UV units
- Electrification
- Automatic feeder (wherever required)
- Aeration system (air/ oxygen), Carbon dioxide trapper system (degasser)
- Water testing kit
- Water supply system, bore well etc. (wherever required)
- Inputs such as Seed, Feed, additives and supplements, electricity/ Diesel, man power etc.



How does a Recirculatory Aquaculture System (RAS) work ?

Feed

- A high protein feed, containing all the essential minerals and vitamins
- Species specific feed
- Feeding can be done @ 3-5 % of the body weight of the fish depending on the quality and protein content of feed
- More frequent feedings (several times per day) shall result in better growth rates and thus improved feed conversion ratio

Model Technical Specification for GIFT Tilapia culture in RAS

S.No.	Title	Description
1	Name of Species	Nile Tilapia (GIFT)
2	Tank size	6.7mX 6.7m X 2m
3	Total volume	90 m^3
4	Stocking size	Fingerling
5	Stocking density/tank	6000
6	Survival rate	90%
7	FCR	1:1.3
8	Culture period/crop duration	6 months
9	Cost of Seed	Rs.4/pc
10	Cost of feed	Rs.30/kg
11	Total feed required	3.51 MT
12	Size at the time of Harvest	500g
13	Expected total Biomass	2.7 MT
14	Sale price	Rs.140/kg

Cost estimates for GIFT Tilapia culture in RAS

Sl. No.	Components	Amount (Rs. in lakh)
A	**Capital Cost**	
1	Fish Tank Construction	1.50
2	Procurement & installation of pumps, filters, aerators, pipes, valves, etc.	4.50
	Sub-Total (A)	**6.00**
B	**Input Cost**	
1	Seed (4500 fingerlings @ Rs.4/each)	0.18
2	Feed (28-30% protein; floating pellets)	0.77
3	Probiotics	0.05
4	Electricity	0.40
5	Miscellaneous	0.10
	Sub-Total (B)	**1.50**
	Total Cost (A+B)	**7.50**

Economic feasibility for 1-year production

S.No.	Particulars	Amount (in lakhs
1	Capital cost	6.00
2	Operational cost	1.50
3	Total project cost	7.50
4	Gross income from 1st crop	3.78

S.No.	Particulars	Amount (in lakhs
5	Gross income at the end of 1st crop after deducting the recurring cost for the 2nd crop	2.28
6	Gross income from 2nd crop	3.78
7	Gross income at the end of 2nd crop	6.06
8	Depreciation cost @15% of capital cost	0.90
9	Interest @ 12% of TPC	0.90
10	Repayment @1/7th of TPC	1.07
11	Recurring cost for next year	1.50
12	**Net profit = (6.06)- (0.9+0.9+1.07+1.5) 6.06-4.37**	**1.69**

Cost Breakup for Large RAS (with 8 tanks of minimum 90 m3 /tank capacity) model

S.No.	Particulars	Total amount (in Rs. lakhs)
A. Capital Cost		
1	Construction of tank including the pump, aerator, biofilter, Net, water quality testing kits and accessories @Rs.4.5 lakh/unit	36.00
B. Input Cost		
1	Seed cost @ Rs.4/pc for 48000	1.90
2	Feed cost	8.00
3	Electricity charges	3.00
4	Manpower	0.96
5	Miscellaneous	0.14
	Sub total	14.00
Total		**50.00**

Conclusion

Aquaculture holds an immense potential, especially for the marginal farmers, to improve their financial condition. RAS system which has less area requirement at the same time higher monetary can be a good fantastic option for future fish farming.

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IMPORTANCE OF NUTRITIONAL EDUCATION FOR WOMEN EMPOWERMENT

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Abstract

"***Just as a bird cannot fly with one wing only, a nation would not march further if women are left behind." (*Singh 2008).** Women are the base for all round development venture. No nation can develop without the development of women. Women, the reservoir of productive human resource constitutes almost half of the country's total population. Women perform a multiplicity of roles to make critical contribution to family, health and sustainable development in our country. As a mother, she shapes the personality and character of her children and thereby the character of the nation. As a house wife, she maintains the productivity of the human capital with in her household through proper home management. She is pivotal in society's social, cultural, educational and economic programmes. By catering to physical, emotional and moral needs of the members, women gives meaning to life, provides a suitable environment for the growth of personality and refines the life of citizens. In India, women are the central figure of family life. Present paper aim is to disscuss the role of nutritional education for women empowerment.

Key words : Nutritional Education, women

Introduction

Women have strong potential role in many aspects of economic development in relation to their family responsibilities as well as their agricultural production activities. According to **Chakravarti (1975)** the work done by women in home and farm contributes as much as half of the economic development of the country. The labour force participation rate of women is 22.7 per cent, less than half of the men's rate of 51.6 per cent. In rural India, agriculture and allied industrial sectors employ as much as 89.5 per cent of the total female labour. **(Sustainable Development Department, Food and Agriculture Organization of United Nation, 2009).**

Importance of Education

The women in rural area are deprived of minimum facilities of enlightenment and education. Women's education in India plays a very important role in the overall development of the country. It not only helps in the development of half of the human resources, but in improving the quality of life at home and outside. The literacy rate in women is very low. According to Census 2001, female literacy rate is 54.16 per cent and the female illiteracy rate is 62 per cent whereas, male illiteracy rate is 42 per cent. There is a proverb saying ***"Educate a man, you will educate but one, educate a women, you will educate a nation."*** It is to remember developmental trilogy Nutrition, Health and Education depend on Women to a large extent.

Nutritional status of women

Maternal Mortality Rate (MMR) was 301 per 1000,000 live births during 2001-03 mainly among pregnant women and under nourished, malnourished women **(Patel 2008).** Frequent pregnancies, coupled with poor diets result in anaemia and women fall ill more frequently than men, but avail of medical facilities more infrequently. All these result in a reduced life span of women. The most vulnerable groups who suffered from these nutrient deficiencies and their consequences were

preschool children, pregnant and lactating women especially in rural area **(Rao 2007).** Pregnancy is crucial stage in women's life from the nutrition point of view **(Saibaba 1985)**. During pregnancy a woman is responsible to provide good nutrition for two individuals. The growing baby gets all its nourishment from its mother through the umbilical cord, so diet is very important. If the mother is lacking in any vitamin and nutrients, her baby might be mentally retarded. Women who consume minimal amounts over the eight week period have a higher mortality or disorder rate concerning their offspring than women who eate regularly, because children born to well-fed mothers had less restriction within the womb. According to **World Bank (1993)** about one third of the total disease burden in developing country of women between 15-45 years of age is linked to health problems related to pregnancy, child birth, abortion and reproduction tract infection. Not only are physical disorders been linked with poor nutrition before and during pregnancy, but neurological disorders and handicaps are a risk that is run by mothers, who are mal-nourished, a condition which can also lead to the child becoming more susceptible to later degenerative diseases. Poor nutrition that continues into pregnancy and lactation leads to Low Birth Weight (LBW) babies, infant's death, and progressive growth retardation of children. According to the diet survey, there is a shortage of the nourished diet in the women of rural area. In reference of Indian Council of Medical Research the comparison of the figure of pregnant women is very low and irrelevant nutritive rate is very high, which results to a delivery of unhealthy and low weight baby **(Kavita 2003).** Consequences of anaemia during pregnancy include increased risk of maternal and infant death, premature delivery and LBW. There is a higher risk for both mother and child if the mother has little education, a poor household and rural residence. Impact of various micronutrient deficiencies in India has second rank for low birth weight baby. Low birth weight baby include infants born prematurely or with intrauterine growth retardation. Maternal illiteracy and low socio economic status have been shown to be major risk factors for intrauterine growth retardation **(Muthayya and Kurpad 2007).** Maternal weight, Maternal undernutrition, Maternal Body Mass Index are associated with high number of Low Birth Weight, LBW is associated with poor growth during infancy and childhood and high non communicable disease in adult life **(Ramachandran 2007).**

Role of media in Nutritional Education

Eapen (2000) stressed that the traits of traditional media are important for bringing about social change in developing nations. These media are comparatively cheap. They do not have to be imported and therefore involve no foreign exchange. **Kumar *et. al.* (2000**) produced video film on prevention and control of vitamin A deficiency. The film was used for nutritional education among middle school children of Bhimtal; India. There was 45.37 per cent gain in knowledge. **Kaur and Verma (2000)** conducted a study in Hissar district where the media combination selected for the study included charts, flip charts, flash charts and leaflets with the combination of method demonstration. It was found that demonstration plus flip charts was the most effective media combination and demonstration plus leaflets was found least effective. It was concluded that all the media were not equally effective for imparting knowledge regarding energy saving technology. **Pandey and Khanna (2000)** discovered that out of the three modes selected i.e. discussion, interview and informal dialogue; the discussion mode was better both in terms of gain and retention and was better than groups exposed to informal dialogue. **Retnowati (2000)** reported that poster is one of communication media useful for information dissemination of conservation farm. The research intended to find out the combination pattern effect of picture and poster text on the increasing of farmer's knowledge of conservation farm. Picture and text combination pattern poster using combination of photograph and dominant picture is quite effective in increasing knowledge of conservation farm in Imogiri sub district Bantul regency. **Agrawal and Kumar (2001)** concluded that video cassette is highly effective in imparting nutritional education to adolescent

girls on prevention and control of anaemia, a nutritional problem of great concern in India. Video Film may also be useful for imparting nutritional education to the entire community on matters related to prevention and control of iron deficiency anaemia. Video film is becoming popular among increasing population everywhere including hill areas. **Begum (2001)** reported that print media is one of the most effective channels for imparting health and nutritional information. The developed booklet and three folders were found as most effective because they contain pictures with short printed message through printed words. **Haque and Kumar (2001)** reported that training method with chart/poster was much more understandable and it was also more effective in increasing knowledge, resulting in adoption of practices for high yielding rice cultivators. **Yahaya (2001)** used a multimedia communication strategy with combination of various media recognized the religious, cultural and socio economic diversity of the target audience. Findings showed that it resulted in increase in knowledge of the people in the intervention communities especially on meaning and methods of the spread of AIDS (Acquired Immuno Deficiency Syndrome), as well as ability to identify various methods of birth control. Television, outreach programmes, radio and drama series are considered as the most appropriate or influential and effective multimedia channels. **Bhati (2002)** found that the visual perception of the flip book was good and comprehension was poor in pretest. In post test, visual perception was very good and comprehension was found to be excellent. **Atwal and Bellorkar (2005)** concluded that the lecture plus demonstration was found to be more effective media followed by electronic media and the print media respectively used in the intervention programme on post natal care. **Shehrawat *et. al.* (2005)** concluded that farmers gained maximum knowledge when the improved sugarcane farm technology was communicated through visual plus discussion and gained minimum knowledge through lecture plus discussion. The researcher further reported that the visual plus discussion mode of presentation for dissemination of sugarcane technology to the farmers was found to be most effective followed by printed material plus discussion, group meeting plus discussion and lecture plus discussion method was found least effective. Therefore, the farmers should update through these extension teaching methods rather than simply delivering the lecture and lecture should be short and followed by group discussion and more emphasis should be on audio-visual aids. The training regarding preparation and use of improved quality audio-visual aids should be imparted to extension field functionaries so that they can use gained skill in transfer of the latest technology to the farmers. **Srivastava *et. al.* (2005)** reported that mean scores increased greatly at post exposure stage when compared to the pre exposure scores. The gain in knowledge of experiment group was 64.37 per cent as against 0.31 per cent of the control group. The actual gain in knowledge in the experimental group was 64 per cent. When the paired t- test was used, it was found that the difference between the pre and post exposure knowledge level of experimental group was significant ('t' cal was 36.21). **Bishnoi and Ahmed (2006)** found that there was significant difference in the pre and post test score of overall knowledge of the respondents as calculated value't' was highly significant. Women had poor initial knowledge level about importance of family welfare as indicated by low scores in pretest. Maximum gain was found in the component prevention from communicable disease (36.99 per cent) and child care (34.83 per cent) in rest of the components gain was less than 30 per cent. There was significant gain in overall and component wise knowledge of the respondents. **Srivastava (2006)** carried on a project on hill women of *Kumaon* region for promoting utilization of small millets among hill women. Under this project audio visual kit for imparting hill women was developed. It consisted of a set of chart, posters, recipe booklet and video cassette was developed. There was a considerable gain in knowledge among women on different nutritional aspects. **Bist and Raghuvanshi (2007)** reported that gain in knowledge in terms of knowledge scores of experimental groups was found to be 47 per cent through comic book and 34.13 per cent through audio cassette. Thus, comic book

and audio cassette both can bring about significant changes in nutrition related knowledge of children and can be used as effective media for imparting nutrition education to similar population groups. **Singh and Yadav (2007)** concluded that media combination face to Face Interaction (FFI) + Slide (S) + Method Demonstration (MT) had maximum impact (69.1, 69.51 and 78.66 per cent) in Urea treatment for improving the quality of dry fodder, budding on local *ber* root stocks and gum production from a *senegal* respectively. It is suggested that skill teaching communication method demonstration alone or in combination with other media was most effective in skill perfection and dissemination of technology among farm youth. **Woodall *et. al.* (2007)** reported that messages sent by email appeared to promote a modest short-lived increase in use of a disease prevention website by some adults. Those who responded to the messages by logging on to the website may have been influenced to improve their diet. **Verma (2007)** reported that there was significant gain in knowledge after exposure on developed Video programme. The initial knowledge of the respondents was poor (22.71 per cent). Significant improvement in the knowledge of the respondents was found as a result of exposure to video programme as the pre test score increased from 22.71 to 61.96 per cent with the gain in knowledge of about 39.25 per cent. **Kharde (2008)** observed that among the various electronic and print media and their combinations used, the combination of video cassette plus folder was found to be more effective method followed by audio cassette plus folder in terms of gain and retention of knowledge by farm women. Thus, the study focused on the proper selection and combination of media in communicating message. Hence, the extension workers should use printed material with visual and audio aids; so, maximum emphasis should be given on the use of printed material along with audio and audio visual media for imparting knowledge to literate farm women. He further reported that there was a significant difference in the mean knowledge score before treatment and immediately after in all selected extension teaching methods that is audio cassette, folder, video cassette, audiocassette plus folder and video cassette plus folder. **Singh (2008)** used communication techniques consisting of lecture cum discussion method, T.V. film (slide story) and cooking demonstration on few low cost nutrition recipes. There is considerable improvement on the knowledge of mothers about increased diet during pregnancy that is 38 per cent (pre) to 60 per cent (post). Again there is significant improvement in Breast feeding (colostrums feeding) practice from 0.3 per cent (pre) to 100 per cent (post). **Snyder *et. al.* (2009)** organized five Day Campaign as components of heart disease, obesity or diabetes prevention efforts. The purpose of this research was to review the effectiveness of nutrition campaigns that use the media to change nutrition behaviour. The interventions/campaigns included in the study utilized a wide range of channels to deliver their messages including television, radio, workplace e-mail, CD-ROM and newspaper. Studies were also categorized by the population targeted, age of participants, gender of participants, location of intervention, tailoring of intervention, theoretical underpinnings and length of campaign. The results indicate a small positive effect on behaviour, similar to effect sizes found in media campaigns on other health topics (Snyder 2001). Thus, nutritional campaigns using the media contribute positively to advancing public health. The findings should help practitioners to design more effective and efficient nutrition campaigns and interventions.

Conclusion

Thus, on the basis of reviews we can say that nutritional education play an important role in empowerment of rural women.

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AN OVERVIEW ON REMOTE SENSING: PRINCIPLE AND APPLICATIONS

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Abstract
Remote sensing is a technique that uses different sensors and resolutions to measure the amount of electromagnetic radiation (EMR) exiting a body or geographic area at a far distance and then collecting information from the data using mathematical and statistical tools or algorithms or models. Geographic information systems (GIS) tools are used to analysed the data and the utilized for applications in different fields. The different kinds of interaction between the incident energy and the targeted material are the principle behind remote sensing and this reflected energy is being collected and interpret for different applications. Large amount of data can be collected rapidly for large area non- destructively using remote sensing. Various applications of remote sensing used over a wide range of disciplines (Jensen, 2007).

Keywords : Remote Sensing, Agriculture, Geology, Satellite

Introduction
Remote sensing is a method for acquiring information about different objects on the surface without any physical contact with it. The exercise of gathering of data in the ultraviolet (UV) to radio wave regions of electromagnetic radiation (EMR) spectrum. The collection of information can be related to any discipline, environment or field and its measurements of EMR or its energy characteristics without any physical contact with the target. Remote sensing offers the capability to observe and collect data for large areas relatively rapidly, and is a non-destructive and important source of information can be used for further analysis and interpretation in various disciplines (Campbell et al. 2011).

The principle behind the remote sensing is the interactions between the incident energy or EMR and the targeted material that take place at the surface of that substance or medium and it is a surface phenomenon and penetration of EMR below the surface of a substance or medium results in the interaction which is called volume phenomena. The surface and volume interactions with medium can produce a sum of characteristic changes in the incident EMR or the energy. There may be some primary changes in magnitude, direction, wavelength, polarization and phase when the incident energy interacts with any targeted surface. Remote sensing detects and records these representative changes and produce subsequent images and these data are then interpreted to recognize remotely the characteristics of the targeted material that produced the changes in the recorded EMR (Curran, 1985).

The following interactions may occur in which radiation may be **reflected**. If radiated energy is come back unchanged from the surface of a medium with the angle equal and opposite to the angle of incidence, then it is called specular reflectance (e.g., like in a mirror). If radiated energy is reflected equally in all directions, it is called diffuse reflectance. Radiation or the energy may be **transmitted** or passed through the substance or phase. The velocity of EMR changes when it is transmitted from one medium like air into other substances or phase or medium. Radiation may be **absorbed** by a medium and give away as heat energy to heat the medium or phase. Radiation energy may be **emitted** or released by a substance in form of different EMR. Radiation may be **scattered** or dispersed, and the energy is deflected in any direction and lost into the atmosphere.

Types of Remote Sensing

1. Based on Source of Energy**: Passive remote sensing** uses natural energy source radiated or reflected from an object. An **active remote sensing** has its own source of energy, which is focused on the target to collect data of the reflected energy. When compared, flashlight photography at night is active remote sensing but daylight photography uses sun's light is passive remote sensing. Radio wave Detection and Ranging (RADAR) is a good example of active Remote Sensing which uses its own source of EMR.

2. **Based on platform used:**
   i. **Satellite based remote sensing :** It is a stable platform but need to wait a time for certain event and have fixed spatial resolution. Three types of Satellites are found, they are:
      - Low Earth Orbits/Satellites: Usually used in Military purposes
      - Sun-synchronous Orbits/Satellites: Most of the earth resources satellites are sun-synchronous orbit. (E.g., LANDSAT TM Satellites)
      - Geostationary Orbits/Satellites: At a height of around 36,000 km, which view the same portion of the Earth's surface all the time. For metrological observations

   ii. **Aerial surveying :** Collect data at any time with variable spatial resolution due to changing flight altitude and camera focal length. But it has high geometric errors and requires sophisticated geometric correction model and costly for small areas or specific purpose.

   iii. **Ground based remote sensing :** Scientific experiment purposes like crop canopy studies, soil physico-chemical studies, soil pollution, etc. Hand held Spectroradiometer is a good example of ground-based platform.

Advantages of Remote Sensing

1. Remote sensing can cover and identify very large areas in less time.
2. Remote sensing is an inexpensive and constructive method for creating maps
3. Remote sensing makes easy date collection over a variety of scales and resolutions.
4. There is no limitation on the amount of data that can be collected from a single remotely sensed image.
5. Remotely sensed data can be processed and analysed using GIS tools and that data can be utilized for various application.
6. Passive remote sensing does not disturb or affect the targeted object.
7. Large data can be collected through remote sensing which minimizes the field work.
8. Remote sensing can repeat coverage over course of time.
9. It is easier to monitor floods or forest fire using remote sensing.

Limitations of remote sensing

1. Remote sensing is expensive for smaller or specific areas.
2. Remote sensing needs special trained personnel to use this technology.
3. Powerful EMR used in active remote sensing systems may affect the target.
4. The image may be sometimes be affected by other phenomena and introduce error to the result.
5. It is easier to introduce human error during data collection and calibration.
6. Different models need to be prepared regularly to gain precision and preparation of models is sometimes time consuming.
7. The information provided by remote sensing data may not be complete and may be temporary and need to be corrected regularly.

Applications of Remote Sensing

1. Agriculture: Agriculture plays an important source of income and livelihood in almost every country. Use of satellites and airborne images are used to map, classify the crops and soil, examining and monitoring their healthiness. Agricultural applications include crop classification, crop yield estimation, mapping of soil characteristics and soil management practices, monitoring of the crops and soils, and irrigation scheduling in standing crops (Jones and Vaughan, 2010).
2. Forestry: Forests are a valuable resource provider and it balance the various important earth systems. Various applications in Forestry include collection of forest data and monitoring the forest cover, vegetation types, density, and their measurement, and mapping of forests.
3. Geological applications of remote sensing include structural mapping, sand and gravel aggregate exploration, mineral exploration, geo-botanical mapping, sedimentation and geo-hazard mapping and their monitoring.
4. Hydrological and Sea Ice applications include river and delta change, flood, and lake ice mapping and their monitoring, drainage basin mapping and watershed modelling, wetland mapping and monitoring, snow pack, ice and its thickness measurement and their monitoring, iceberg and glacier dynamics detection and monitoring, meteorological / global climate change research and pollution monitoring in hydrosphere (Navalgund et al. 2007).
5. Land Cover & Land Use applications of remote sensing include natural resource and land use classification and management, wildlife habitat monitoring and protection, urban data collection, expansion, planning and mapping, natural resource extraction activities and its identification.
6. Oceans & Coastal Monitoring includes ocean current pattern, regional circulation identification and monitoring, Storm forecasting, ocean water temperature, gases, and pressure monitoring, phytoplankton and corals diversity and concentration, fisheries surveillance, marine diversity assessment, oil spills and its prediction in extent and effects, Shipping navigation, routing, and traffic monitoring, coastal vegetation mapping (Sabins Jr. 1987).

Conclusion

Remote sensing can cover large areas rapidly and is an inexpensive method to create maps. Remotely sensed data can be processed and analysed using GIS tools and that data can be utilized for mapping, monitoring, measurement, and management in across disciplines. Large amount of data can be collected along with repetitive coverage can be done through remote sensing which minimizes the field work. It is easier to monitor the change in weather, floods or forest fire using remote sensing. The main limitation is that it is expensive to cover and study smaller areas and it requires special training to utilize this technology.

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WATERLOGGED SOIL APPRAISAL AND MANAGEMENT

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Waterlogging is excess water in the root zone accompanied by anaerobic conditions. The excess water inhibits gaseous exchange with the atmosphere, and biological activity uses up available oxygen in the soil air and water – also called anaerobiosis, anoxia or oxygen deficiency. India has approximately 11.6 M ha i.e. 8.3% of its net sown area under waterlogged condition (Planning Commission 2011) out of which more than 20 % falls in the eastern region where surface waterlogging is a major cause rendering the area unproductive. **Waterlogging** is defined as turning the soil unproductive and infertile due to excess moisture and creation of anaerobic condition called as waterlogged soils.

The soil is intermittently saturated with water, oxidation of organic matter is slow and it accumulates in the in "A" horizon. In the second horizon Fe and Mn are deposited as rusty mantels or streaks if the diffusion is rapid they are deposited as concretions. In submerged soils due to diffusion of oxygen in the water, the organic form nitrogen undergoes mineralization to form NH_4 to NO_2 and NO_2 to NO_3 takes place in the aerobic layer. But in an anaerobic layer the absence of oxygen inhibits the activity of the nitrosomonas microorganisms that oxidizes NH_4 and nitrogen mineralization stops at the Ammonical form. The accumulation of NH_4 on submerged soils take placed the NH_4 diffuse aerobic volatilization and nitrification the NO_3 nitrogen in aerobic layer diffuses into reduced zone undergoes denitrification to form N_2. The availability of N drops on submerged conditions due to denitrification, volatilizations of ammonia, ammonium ions fixation by clay minerals leaching and runoff NO_3 and NH_3.

These conditions affect agricultural plants in several ways:

- nutrient deficiencies or toxicities
- root death
- Reduced growth or death of the plant.

A. Different type of water logging in the field

1. Riverine flood waterlogging: In the rainy season, flood may come to the adjacent land from the river having surplus floodwater.

2. Seasonal water-logging : Run off water accumulates in the low lands and depression in the rainy season.

3. Perennial water-logging : Deep water, swamp etc, get rain water runoff water and seepage water from canal causing perennial water-logging.

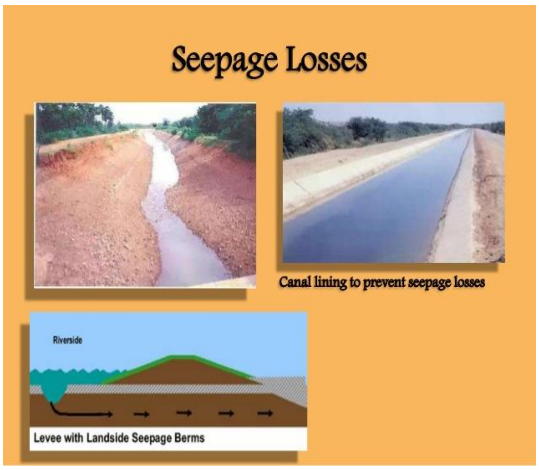
4. Sub soil water-logging : High water table in the rainy season is normally unsuitable for root growth.

5. Oceanic floodwater logging : Sea water spreads in the adjacent land cause waterlogging.

1. Riverine flood waterlogging

2. Oceanic floodwater logging

3. Sub soil water-logging



4. Perennial water-logging

5. Seasonal water-logging

B. Factors affecting formation of water-logging

1. **Climatological factor:** due to high rainfall water accumulates on the soil surface.
2. **Flood:** Flood water is usually causing water-logged situation in the field.
3. **Seepage from canal**: Ground water levels are closer to the surface due to seepage from canal
4. **Land shape:** Saucer-shaped land gets water from high-lands which results into water-logging
5. **Uncontrolled and unwanted irrigation:** Excess irrigation may cause accumulation of water on the soil surface
6. **Drainage:** Poor drainage system is responsible for water-logging in the field.

C. Problems of water-logged soils as follows

1. Water depth : Low land areas are usually flooded to depths of about 50 cm and the limitations to crop production associated with extensively low reduction potentials and partly because of low phosphorus availability. In the 'deep-water' (flooding to depths of 50 to 100 cm) and 'very deep-water' or 'floating' (water depth more than 100 cm) areas, the principal problem of rice production is the tendency for the rice crop to be submerged for periods of up to 10 days or more.

2. Poor aeration : Due to water-logging, a part of the soil air moves out into the atmosphere as it is displaced by the incoming water. Inadequate supply of oxygen either retards or ceases plant growth as the accumulated carbon dioxide hampers the growth of the plant roots. Poor aeration results in the development of toxin and other injurious substances. Only rice plants can survive poor aeration due to water-logging.

3. Soil structure : Continuous water stagnation destroys the soil structure and makes the soil compact

4. Soil temperature : Water-logging lowers down the soil temperature. Moist soils have a higher specific heat than dry soils. Consequently, a moist soil has lower temperature than dry soil. Low temperature affects the microorganism activity which consequently lowered the rate of nitrogen-fixation.

5. Soil pH : There are reversible pH change of the flooded soil, pH tends to increase in acidic soils and decrease in alkaline soil, undoubtedly pH is alter towards normal.

6. Availability of nutrients : Nitrogen- nitrogen deficiency is extremely common in water-logged soil. Due to lesser temperature and reduced condition, mineralization of organics is affected.

a. Phosphorus : The inorganic form of P are usually present at higher levels in flooded soils then in upland soils.

b. Potassium : K response is apparent in many lowland soils. Flooding and puddling of the soils during lowland preparation might considerably increase the soil solution concentration of K because of displacement of exchangeable K by the large amounts of Fe and Mn in the soil solution.

c. Sulphur : Sulphur deficiency has been reported from many lowland area. The reduction of SO_4 in flooded soils has three implications for rice culture: the S supply may become insufficient, Zn and Cu may be immobilized, and H_2S toxicity may arise particularly in soils low in Fe.

d. Zinc : Widespread deficiency of Zn to rice crop in wetland conditions is reported. Zinc is most frequently deficient in alkaline soils.

e. Iron and Manganese: Fe^{++} and Mn^{++} an available in excess causing toxicity to the plant.

7. Salinity : Salinity is an important constraint to rice production in many coastal lowlands as well as in some poorly drained in land areas.

8. Effect on crops : Under water-logged condition all field crops cannot survive due to poor aeration and unavailability of nutrients to the plant. Only rice is an exception.

D. Various Ways of Preventing Waterlogging

1. Control the Loss of Water : The seepage loss from the canals can be reduced by a number of measures. First, is by lowering the full supply level (FSL) of the canals to a sufficient extent. Secondly, is by lining the canal section by providing the lining with the seepage loss, which makes the canal section fairly watertight. Thirdly, is by introducing intercepting drains, which are constructed parallel to the canal.

2. Augmenting Outflow and Preventing Inflows : Artificial open and underground drainage grids can be introduced. The same can also be achieved by improving the flow conditions of existing natural drainages.

3. Disposing of the Rainwater : Rainwater should be quickly removed from the soil's surface, thereby preventing a rise in the level of the water table and subsequent waterlogging.

4. Preventing the Loss of Water : The loss of percolation can be eliminated by using water more economically. It can also be achieved by keeping the intensity of irrigation low. Only a small portion of the irrigable land becomes flooded and the only loss in percolation happens in the limited area. This also keeps the water table sufficiently low.

5. Not Using Alkaline Water : Alkaline water used in irrigation affects the soil and makes it more susceptible to waterlogging in the future. For this reason, alkaline water should not be used for irrigation purposes. The mineral Alkali salts can accumulate on top of the soil creating a crust on the surface that prevents the surface water to drain as required.

6. Raise the Beds : If you are working on a small garden which is becoming waterlogged, you might consider raising it and growing your plants on raised beds. You can also slightly slant the bed so that the excess water goes down the bed. It is a tiresome affair, but it keeps your plant roots from sitting in the water.

7. Install Proper Drainage Systems : Draining the water means both the surface and sub-surface waters. It removes the water in a controlled manner and in a quick manner. Before and when draining the water, be sure not to adversely affect the environment or neighboring lands which might also be affected by the waterlogging.

8. Mulching : It is not a preventative measure but a treatment measure that can help a plant grow even in waterlogged soil. Mulching involves the addition of either organic or inorganic materials that are spread on top of the soil. The mulch covers the affected land by covering the soil and helping reduce evaporation losses. Crops can continue to grow even in the waterlogged area, while at the time, working with the aforementioned preventative measures to fix the problem.

E. State the electrochemical changes occur in water logged soil.

1. Change in pH : On flooding, an increase in pH is observed in an acid soil which may be due to reduction of ferric and manganic compounds and release of OH ions, the production of ammonia and CO_2. The decrease in pH is observed in calcareous soils (alkaline). The pH of a submerged soil tends to be buffered around, regardless of initial pH value and other soil properties; by substances produced as a result of submergence, e.g. ferrous carbonate and ferrous hydroxide. Flooding causes the pH of both acid and alkaline soils to converge to a value at which the availability of P and release of nutrients by microbial activity is highest.

2. Change in redox potential (Eh) : The electrochemical property that differentiates a submerged soil from an upland soil is its redox potential. The aerobic soils are characterized by high positive potentials in the range of +500 to +700 millivolts. After flooding there is a sharp drop in the potentials as low as -300 to -400 millivolts depending upon the type of soil organic matter, Fe and Mn content, pH and temperature, i.e. presence of poisoning system and bacterial potential.

3. Change in specific conductance : The specific conductance of a solution is a measure of its ionic content. On flooding the specific conductance of soil increases as Ca^{++} and Mg^{++} are mobilized by CO_2, organic acids and cation exchange, Fe^{++} and Mn^{++} also go into soil solution following the reduction of their insoluble oxidized counterparts and accumulation of NH_4^+.

F. Management of Water -Logged Soils

1. **Levelling of land** : Leveling of land in many wetlands eradicates water by run off.

2. **Drainage** : Drainage removes extra water from the root zone that is injurious for plant growth. Land can be drained by surface drainage, sub-surface drainage and drainage well methods.
3. **Controlled irrigation** : Excess use of water in the irrigation results in waterlogged area
4. **To check the seepage in the canals and irrigation channels** : Due to seepage, land becomes water-logging
5. **Flood control measures** : Construction of bunds may check water flow from the rivers to the cultivable lands.
6. **Plantation of tree having high transpiration rate :** Transpiration rate in certain tree like Eucalyptus, acacia, zyzyphus is very high. In transpiration process the underground water is consumed by trees, thus, lowering the ground water table.
7. **Selection of crops and their proper varieties :** Certain crops like rice waternut, jute and sesbania can tolerate water-logging upto same extent. In rice crop submergence tolerance varies from one variety to another. Generally, lowland and deepwater varieties.

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RAMBUTAN (*ADI* LITCHI/ JUNGLE LITCHI) -AN UNDEREXPLOITED FRUIT CROP IN ARUNACHAL PRADESH

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Abstract
Survey from East Siang district of Arunachal Pradesh revealed that two morphotypes of rambutan locally known as *Adi* Jungle litchi have observed one having sweet taste (dull red colour fruit) and another having acidic taste (red colour fruit). Flowering period is observed during the month of Feb-Mar and the fruits ripe during April-May before the available of litchi in the market. The fruits are attractive and have a good demand in the market. However, till now this fruit is grown in wild in the forest area as underexploited fruit crop and which need standardization its propagation and its cultivation aspects for commercial cultivation for the future.

Introduction
Rambutan or hairy litchi (*Nephelium lappaceum*) is a medium sized evergreen tree with an open structure growing 12-15m high, is a native of the Malaysian-Indonesian region. In *Adi* language, the tribe which is inhabited in East Siang district of Arunachal Pradesh locally called it as *Adi* litchi or Jungle litchi. It belongs to the family Sapindaceae which includes fruit tree of about 37 genera and 72 species, but a few species are important. It produces ellipsoidal fruits in clusters of 15-20 fruits. Fruits weigh 40-50g each and resemble litchi but because of long, thick, soft hairs or spines on the surface these are known as rambutan in common language. It word is derived from Malay 'rambut' stands for hair. The hairy outgrowth has eye-catching red and yellow colours and it imparts a distinctive exotic appearance to its fruits (Chadha, 2006). It is strictly a tropical fruit requiring a moist warm climate with a well distributed annual rainfall of at least 200cm. The plants can grow at 10-500m above mean sea level, but areas with dry winds are harmful for the trees growth, which leads to browning of leaf margins. They are grown mainly for fruits in which the juicy, white, translucent, subacid – sweet flavoured sarcotesta (aril) is the edible flesh. The sweet fruits are consumed fresh whereas the sour ones are eaten stewed in other countries. However, in Arunachal Pradesh they are use for the fresh consumption for desert purpose. The aril of rambutan is very nutritive and rich is sugar, vitamin and mineral content. Due to difference in latitudes, sugar and vitamin C content of fruits and due to growing environment, the composition of quality in terms flavour and taste is affected. However, till now this fruit remain as underexploited fruit crop and found in the forest areas only which need domestication and standardization its cultivation aspect due to its good demand in the market.

Composition of fruit and its nutrition value

Table 1: Composition of rambutan fruits per 100 g edible portion

Constituent	Content (g)	Constituent	Content (g)
Water	82.1	Niacin	0.5
Protein	0.9	Carotene	0
Fat	0.3	Phosphorus	0
Ash	0.3	Calcium	15
Glucose	2.8	Iron	0.1-2.5
Fructose	3.0	Vitamin C	70
Sucrose	9.9	Riboflavin	0.7
Starch	2.8	potassium	140
Dietary fibre	0.05	Sodium	2
Malic acid	0.31	Magnesium	10
Citric acid	297KJ	Thiamine	0.01
Energy			

(Source: Bose et al., 2002)

Fig 1: Mature and ripe stage of rambutan (*Adi* litchi)

Distribution in East Siang district of Arunachal Pradesh

Rambutan is indigenous to the Malay Archipelago and has spread and grown in the tropical region of south East Asia, central America and Africa where the temperature and humidity are high enough the year round. From Malaysia, the center of production, it spread westward to the countries, such as Thailand, Myanmar, Sri Lanka, India and eastward to Vietnam, Philippines, Indonesia and Hawaii. In Arunachal Pradesh, they are grown in few pockets having the mild-subtropical climatic condition. In East Siang district, it is confined mostly in Ruksin, Ayeng , Balak and Sillay vallages. It is mostly found in the forest area and prefer shade for its luxurious growth. Type of rambutan found in Arunachal Pradesh is unique and different from the commercial variety like Arka Croog Arun and Arka Croog Patib which are sweet in taste and ripen during September-October as compared to *Adi* litchi which are sour in taste in ripen during April-May and prefer hillock having shade condition as favourable site for its growing.

Morphotype of rambutan in Arunachal Pradesh

Rambutan being a cross-pollinated crop, large genetic variation has occurred in nature over generations and numerous varieties have been identified but their nomenclature is confused. Most of them can be distinguished by spine length, fruit wall colour, aril thickness, aroma, adherence of aril to the seed, vitamin C content and fruit set. In East Siang district of Arunachal Pradesh, two types of morphotype are found viz. sweet and sour type. Sweet type is smaller in size both in fruit in seed size and dull red colour when it is fully ripe whereas sour type is bigger in size both seed and fruit and have bright red colour when it is in fully ripe stage (Singh et al.,2017). Sweet type are rarely found mostly sour type are common which need selection and conservation of superior genotype for the future.

Fig 2. Sour type

Fig 3. Sweet type

Table 2. Morphological characteristics features of acid and sweet types of Rambutan (*N. lappaceum* L.) of Arunachal Pradesh

Characters	Acid type	Sweet type
Fruit shape	Elongated and larger size	Round and smaller size
Fruit colour	Dark red colour	Dull red colour
Flesh attachment	Tightly attached to seed	Same
Seed colour	Pinkish colour	Yellowish colour
Fruit length (cm)	6.2[a]	6.0[a]
Fruit breadth (cm)	3.5[a]	3.2[a]
Fruit weight (g)	47.3[a]	45.8[a]
Peel weight (g)	6.5[a]	10.1[a]
Peel thickness (g)	0.6[a]	0.5[a]
Spine length (cm)	0.5[a]	0.7[a]
Seed length (cm)	2.5[a]	2[a]
Seed breadth (cm)	2.5[a]	2[a]
Pulp weight (g)	10.1[a]	6.5[a]

[a] All data of this column represents average value
(Source Singh et al., 2017)

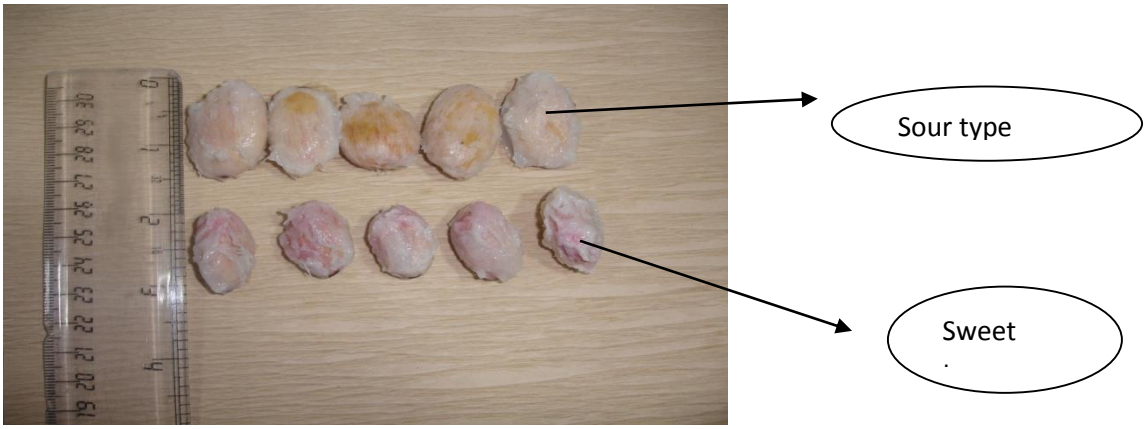

Fig 4. Variability of seed size and seed colour

Major problem for cultivation of rambutan cultivation in Arunachal Pradesh

1. Lack of superior planting materials and no superior variety is not identified till now
2. There is lacking of scientific way of cultivation
3. Since the fruit have low shelf life under ambient room temperature (3-4 days only), marketing is a major problem during the harvesting period
4. There is lacking of knowledge about the different process products from this fruit
5. Rambutan species found in Arunachal Pradesh prefer partial shade in young stage of the plant and sensitive to open field condition

Conclusion

Rambutan is an attractive fruit having spiny and aesthetic tree in nature. In East Siang district of Arunachal Pradesh, there is variability of rambutan viz. sweet and sour morphotype found in the forest region as an underexploited fruit crop. So, selection of superior genotype having sweet in taste and standardization of its propagation as well as its cultivation aspects is necessary due to its good demand in the market.

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INTEGRATED MULTI-TROPHIC AQUACULTURE

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Population around the world face question of food security today on a scale that has not been seen in recent human history. The evolution of how we feed our population and the technologies we use to do it have created a unique set of circumstances that bring with them unique challenges, and despite significant advances in food production and our knowledge of food nutrition and food safety, hunger continuous to million of people around the world. It is thought that over a billion people in the world are currently undernourished (World Food Programme, 2010). At present the world's greatest challenges – how to feed more than 9 billion people by 2050 in a context of climate change, economic and financial uncertainty, and growing competition for natural resources. Global fish production is estimated to have reached about 179 million tones in 2018 with a total first sale value estimated at USD 401 billion. Aquaculture accounted for 46 percent of the total production. Shrimp aquaculture feed represents about 60% of operating cost and the major ingredient of formulated feeds has been fish meal derived from the smaller pelagic fisheries. Further, it was reported that more than 50% of formulated feed remain unused and thus the profitability of monoculture and sustainability are directly linked. Brackish water aquaculture in India is nearly synonymous with monoculture of shrimp and this system is more vulnerable to volatility both in production and prices. Further, the more a system is managed to take maximum yield, it would become less resilient and more vulnerable to abiotic and biotic shock. Therefore, diversification of systems and species used for culture are considered to be the key elements to strengthen the resilience to food production system and its sustainability. The Integrated multi-trophic aquaculture (IMTA) involving fed species with organic extractive species and Inorganic extractive species that utilize wastes from aquaculture for their growth. IMTA systems can be land-based or open-water systems such as marine or freshwater systems, and may comprise several species combinations. Some IMTA systems have included such combinations as shellfish/shrimp, fish/seaweed/shellfish, fish/shrimp and sea-weed/ shrimp. IMTA is considered more sustainable than the common monoculture systems – that is a system of aquaculture where only one species is cultured in that fed monocultures tend to have an impact on their local environments due to their dependence of supplementation with an exogenous source of food and energy without mitigation. Integration of different species in one culture unit can reduce these impacts because the culture of the species that do not require exogenous feeding may balance the system outputs through energy conversion, whereby the waste of one species becomes the food for another.

The importance of IMTA as a management option for sustainable ecosystem functions along with economic benefits has been recognized recently. Brackish water aquaculture has not developed in many states on the west coast (Kerala, Karnataka, Goa, Maharashtra and Gujarat) as in the case of east coast of India, even though aquaculture potential in these states is high. Maharashtra has ~80000 ha of brackish water area of which ~12445 ha are suitable for aquaculture with an annual production of only ~7000 tone of shrimp.

Definition

IMTA is the farming of aquaculture species from different trophic levels and with complementary ecosystem functions, in a way that allows one species uneaten feed and wastes, nutrients and by-

products to be recaptured and converted into fertilizer, feed and energy for the other crops, and to take advantage of synergistic interactions between species. This system is entirely different from the 'Polyculture.' To the aims of IMTA is "To ecologically engineer system for environmental sustainability, economic sustainability and societal sustainability. Recent study about IMTA by Barrington (2009) is the practice which combines the cultivation of fed aquaculture species (e.g. shellfish/herbivorous fish) and inorganic extractive aquaculture species (e.g. seaweed) too create balanced system for environmental sustainability (bio-mitigation) economic stability (product diversification and risk reduction) and social acceptability (better management practices). In the Polyculture system fish share the same bio and chemical process which could eventually lead to shift in ecosystem.

Principal of IMTA

IMTA is based on principle "The solution to nitrification is not dilution but extraction and conversion through diversification." IMTA promotes economic and environmental sustainability by converting byproducts and uneaten feed from fed organisms into harvestable crops, thereby reducing eutrophication, and increasing economic diversification.

System Design for IMTA

An IMTA operation needed the selection and placement of various types of components or species. The system design should be engineered to optimize the recapture of waste products. As larger organic particles, such as uneaten feed and faces settle down the cage system, they are eaten by deposit feeders, like sea cucumbers and sea urchins. At the same time, the fine suspended particles are filtered out of the water column by filter-feeding animals like mussels, oysters and scallops. The seaweeds are placed a little farther away from the site in the direction of water flow so they can remove some of the inorganic dissolved nutrient from the water, like nitrogen and phosphorus. In simple meaning of this system the main component is fed aquaculture species is eat some type of food after that release some gases and this some gases used by inorganic extractive aquaculture species, this system is IMTA system. IMTA species should be economically viable as aquaculture products, and densities that optimize the uptake and use of waste material throughout the production cycle.

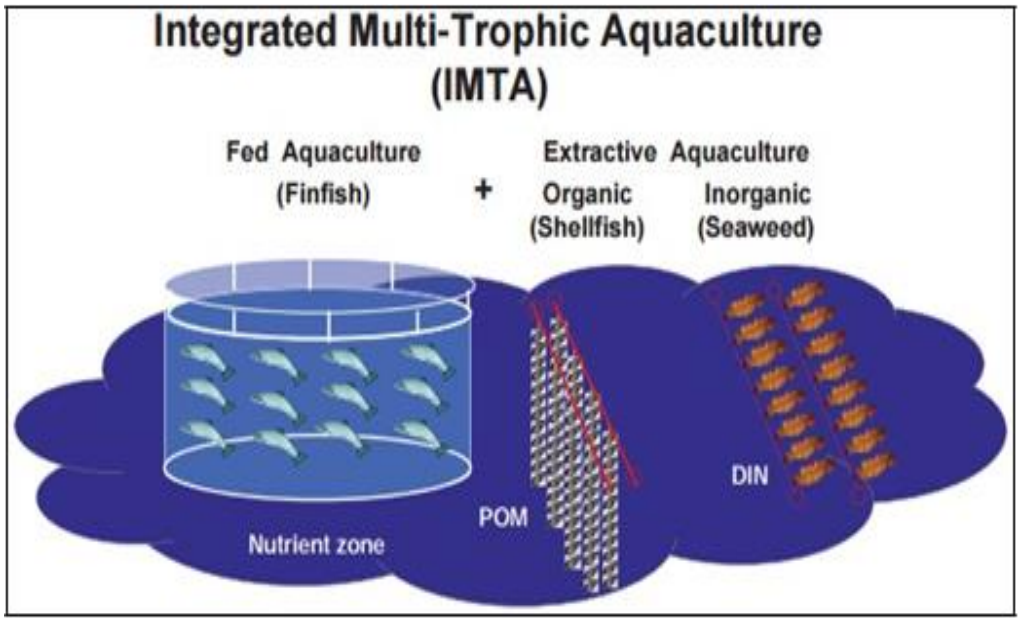

Fig.- Conceptual diagram of an integrated multi-trophic aquaculture (IMTA) operation combining fed aquaculture (finfish) with organic extractive aquaculture (shellfish), taking advantage of the

enrichment in particulate organic matter (POM), and inorganic extractive aquaculture (seaweeds), taking advantage of the enrichment in dissolved inorganic nutrients (DIN).

Criteria for selection of fish :

The following important criteria for selection of fish in IMTA system:-

1) Adaptation to tropical environment.
2) Acceptance to all types of feed like natural and artificial feed.
3) Amiability to live together.
4) Compatibility.
5) High Market demand.
6) High market prices.

Appropriate steps should be taken in the IMTA. They are as follows:

- Establishing the economic and environmental value of IMTA systems and their co-products.
- Selecting the right species, appropriate to the habitat, available technologies, and the environmental and oceanographic conditions, complementary in their ecosystem functions, growing to a significant biomass for efficient bio-mitigation, and for which the commercialization will not generate insurmountable regulatory hurdles.
- Promoting effective government legislation/regulations and incentives to facilitate the development of IMTA practices and the commercialization of IMTA products.
- Recognizing the benefits of IMTA and educating stakeholders about this practice.
- Establishing the R&D&C continuum for IMTA.

Taking all these factors into account, IMTA can be used as a valuable tool towards building a sustainable aquaculture industry. IMTA systems can be environmentally responsible, profitable and sources of employment in coastal regions for any country that develops them properly, especially when government, industry, academia, communities and environmental non-governmental organizations work in consultation with each other.

Fish Feed

Fish are largely respond well to natural and commercial fish feed. Their diets need to be well balanced in terms of amino acids, proteins, fats, vitamins, minerals and carbohydrates etc. in order to achieve good growth and survivability.

Advantages of IMTA

- Effluent bio-mitigation:- The mitigation of effluents through the use of bio-filters (e.g. seaweeds and invertebrates), which are suited to the ecological niche of the farm.
- Disease control:- Prevention or reduction of disease among farmed fish can be provided by certain seaweeds due to their antibacterial activity against fish pathogenic bacteria or by shellfish reducing the virulence of ISAV (Infectious salmon anaemia virus).
- Increased profits through diversification:- Increased overall economic value of an operation from the commercial by-products that are cultivated and sold.
- Increased profits through obtaining premium prices:- Potential for differentiation of the IMTA products through eco-labeling or organic certification programs.
- Improving local economy:- Economic growth through employment (both direct and indirect) and product processing and distribution.
- Form of ‘natural’ crop insurance:- Product diversification may offer financial protection and decrease economic risks when price fluctuations occur, or if one of the crops is lost to disease or inclement weather.

Disadvantages of IMTA

- Lower productivity than fed monocultures.
- Food safety concerns (coliforms and parasites).
- Public perception issues.
- Species limitations (especially in New Zealand).
- Requires good management to balance inputs and nutrient flows.

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AN OVERVIEW ON NUTRITIONAL AND MEDICINAL VALUE OF MUSHROOM

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Abstract
Nowadays, mushrooms are popular foods because of their nutritional and medicinal value. Mushrooms contain high protein, fibers, vitamins, minerals contents, low fat level and all the necessary amino acids also with different bioactive compounds. Mushrooms degrade complex lignin rich compounds and thus by it decomposed all lignin rich organic waste materials from surrounding leading to clean environmental conditions. Agricultural wastes (straw, leaves, etc) and waste from forest and industry can be gainfully used as substrates for the cultivation of mushrooms and after harvesting of mushrooms these substrates can be reused as manures in agriculture and floriculture. This also constitutes an excellent means of recycling many of the farm wastes.

Keywords : Mushroom, nutritional value, proteins, carbohydrates.

Introduction
Mushrooms are known as healthy foods throughout the world with proteins, vitamins, minerals, chitin, essential amino acids as well as low fat and calories. Mushrooms are defined as "a macro fungi with a distinctive fruiting body" and are traditionally used worldwide as nutritious food and as medicinal sources including antioxidant activity (Kumari *et al*., 2011; Kumari and Atri, 2014.). Further, mushrooms are great recyclers and decomposers and therefore play a significant role in the ecosystem. Mushrooms are frequently mentioned as alternative sources for food. Modern mushroom culture produces more proteins per unit area of land than by any other form of agriculture. Mushrooms have been considered one of the world's greatest natural resources since they have the ability to transform required input into nutritional substance and high protein food. In the event of large increase in population resulting in scarcity of nutritious food, the mushrooms offer a good source of nutrition due to being rich in minerals and vitamins.

Area and Production
In India, mushrooms are raised as a seasonal crop on a commercial scale round the year under the controlled environmental conditions. Himachal Pradesh, Jammu & Kashmir, Haryana, Uttarakhand, Uttar Pradesh and Punjab are the major mushroom growing states of India. Mushroom industry in India had its humble beginning in late 1960's when a few progressive growers in Himachal Pradesh and Kashmir started growing button mushroom on commercial scale. The annual world production of all types of mushrooms is estimated to be over 25 million tones. At present, the total mushroom production in India is approximately 0.13 million tons. From 2010-2017, the mushroom industry in India has registered an average growth rate of 4.3% per annum. Out of the total mushroom produced, white button mushroom share is 73% followed by oyster mushroom (16%), paddy straw mushroom (7%) and milky mushroom (3%) (Sharma VP *et al*., 2017).

Major growing mushroom in India

Mushrooms grown indoors, no additional land is required for their culture, cultivation is labour intensive and can offer self-employment to unemployed both educated and illiterate persons. Mushrooms can be produced in large quantities within a short time. The efficiency with which mushrooms convert carbohydrates into proteins is about 65 per cent in comparison to about 20 per cent for pork, 15 per cent for poultry and 45 per cent for beef. Mushrooms degrade complex lignin rich compounds and thus by it decomposed and produce nutritious fruiting bodies of mushroom (Dehariya and Vyas, 2013.).

Himachal Pradesh has congenial atmosphere to grow mushrooms throughout the year without incurring much expenditure on maintaining temperature & humidity. Mushrooms promote immune function; boost health; lower the risk of cancer; inhibit tumor growth; help balancing blood sugar; ward off viruses, bacteria, and fungi; reduce inflammation; and support the body's detoxification mechanisms. Mushrooms enhance the chances of improving the economy of the local villagers, farmers as well as the entire state and to maintain the health of forests. It nvolved in the formation of ectomycorrhizal associations with the rootlets of the trees. Mushroom cultivation recycles agricultural wastes into an easily digestible protein source that enriches the human diet (Gupta *et al*., 2016).

Nutritional Values of mushroom

Mushrooms, which serve as a good source of food for human beings for centuries, have high nutritional value due to the vitamins and minerals they contain. Mushrooms have been included in the human diet for centuries because of their specific taste and flavour.

Nutritional Values of edible mushroom	
Water	88-90%
Protein	Most mushrooms have a high protein content, usually around 20-30% by dry weight (3-8%).
Fiber	Helps lower cholesterol and is important for the diagestive system

Vitamin D	Essential for the absorption of calcium.
Copper	Aids in helping the body absorb oxygen and create red blood cells.
Selenium	An antioxidant that helps neutralize free radicals, thus preventing cell damage and reducing the risk of cancer and other diseases. Mushrooms contain more selenium than any other form of produce
Potassium	An extremely important mineral that regulates blood pressure and keeps cells functioning properly
Other important minerals	Phosphorous, zinc, and magnesium
Low levels	Fat (0-3%), calories, and sodium
No	Cholesterol

Mushrooms are also rich in vitamin C and vitamin D. Mushroom contain 5-10 times more vitamin B3 than vegetable and calcium, phosphorus, iron, copper, chlorine, sodium, zinc, manganese and bromine in trace amounts; B vitamins A and B complex vitamins B1 (Thiamin), B2 (Rhiboflavin), B3 (pantetonic acid), B5 (Nicotinic acid), vitamins also found. It is also a food ingredient recommended for those who do not eat cholesterol because the fat content of mushroom is low. The richness of vitamins is known to have a calming and softening effect on the nervous system of humans. They have been considered nutritionally healthy foods due to the high contents in carbohydrates, proteins, minerals and vitamins, and low fat levels (Kalac, 2009; Thatoi and Singdevsachan, 2014). Nowadays, they attract attention because of their bioactive compounds, beneficial effects and possible use in the prevention or treatment of diseases, being classified as functional foods and sources of nutraceuticals (Kumari and Atri, 2014).

Some of the mushrooms bioactive properties are related with their antioxidant activity and antioxidant compounds (Ferreira et al., 2009). In fact, antioxidants are in constant activity in living organisms, being required to be in sufficient amounts to neutralize the toxic effects of reactive oxygenspecies (ROS), reactive nitrogen species (RNS) and reactive sulphur species (RSS) that are produced continuously (Carocho and Ferreira, 2013). They are well recognized as supplementary food due to their high nutritional values and medicinal importance, which includes their antioxidant and antimicrobial activities (Cai *et al*., 2015; Chowdhury *et al.*, 2015), immune enhancer and to be effective for the treatment of diabetic and few types of cancers as well.

Summary

Today, increasing population is a big challenge from the limited land resource for our country. In addition to this, malnutrition and associated diseases are more common among the economically poor population. This compels us to search for cheap alternative quality nutritional sources for our huge population. Non green revolution otherwise referred as mushroom farming ways to meet this challenge because mushroom grow on wastes without requiring additional land besides its exceptional nutritional and medicinal properties.

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REMOTE SENSING, GIS AND GPS TECHNOLOGY IN PRECISION FARMING

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Remote Sensing

Remote sensing is the art and science of making measurements of the earth using sensors on airplanes or satellites. It is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance (typically from satellite or aircraft). Special cameras collect remotely sensed images, which help researchers "sense" things about the Earth.

- Cameras on satellites and airplanes take images of large areas on the Earth's surface, allowing us to see much more than we can see when standing on the ground.
- Sonar systems on ships can be used to create images of the ocean floor without needing to travel to the bottom of the ocean.
- Cameras on satellites can be used to make images of temperature changes in the oceans.

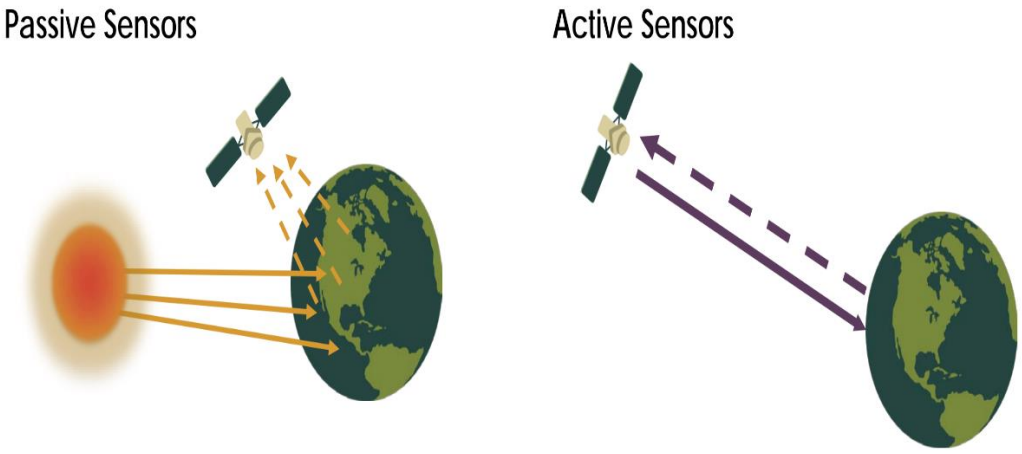
Types

Active Sensing : Active sensors, provide their own source of energy to illuminate the objects they observe. An active sensor emits radiation in the direction of the target to be investigated. The sensor then detects and measures the radiation that is reflected or backscattered from the target.

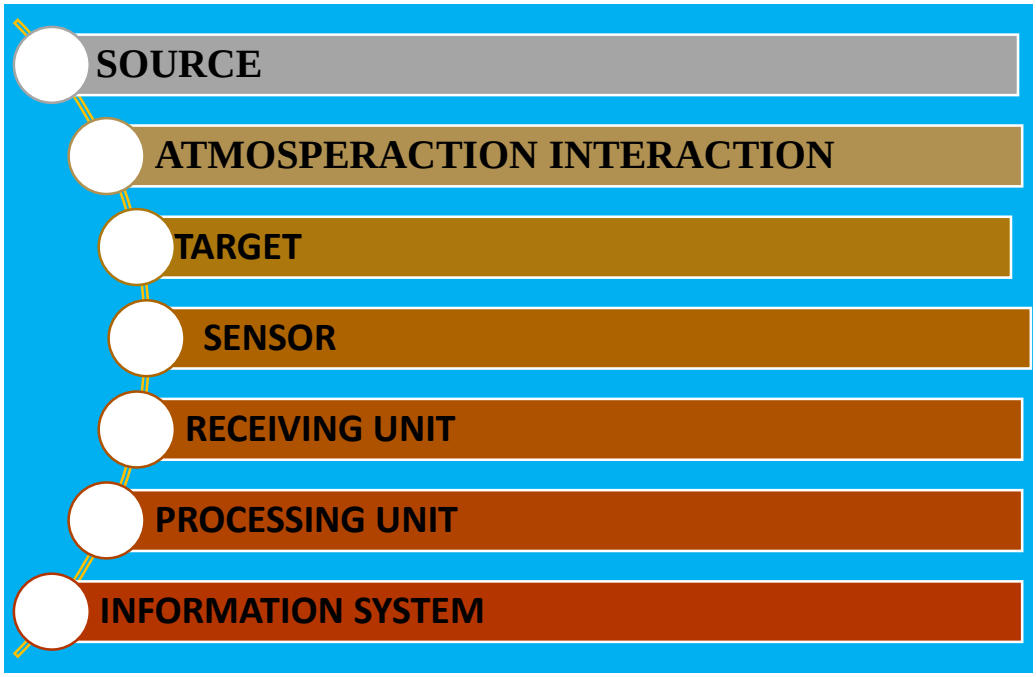
The sensor embodies within itself the source of illumination like a satellite equipped with a RADAR sensor. Active sensors throw their own energy to scan the object. RADAR and LiDAR are examples of active remote sensing which measure the time delay between emission and return.

Passive Sensing : Passive sensors, on the other hand, detect natural energy (radiation) that is emitted or reflected by the object or scene being observed. Reflected sunlight is the most common source of radiation measured by passive sensors.

The sensors gather radiation that is emitted or reflected by the object or surrounding areas. Sunlight reflection is the most common source of radiation measured by passive sensors. Examples of passive remote sensors are photography, infrared, and radiometers. Passive sensors are more used because it provides great quality satellite imagery. The passive sensor is superior within the field of technical observation of the planet, such as Multispectral and Hyperspectral technology.



Steps in Remote Sensing



Remote Sensing Major Applications Area

- **Weather**
- **Forestry**
- **Agriculture**
- **Surface changes**
- **Biodiversity**

GIS

A geographic information system (GIS) is a computer-based tool for mapping and analyzing feature events on earth. GIS technology integrates common database operations, such as query and statistical analysis, with maps. GIS manages location-based information and provides tools for

display and analysis of various statistics, including population characteristics, economic development opportunities, and vegetation types. GIS allows you to link databases and maps to create dynamic displays. Additionally, it provides tools to visualize, query, and overlay those databases in ways not possible with traditional spreadsheets. These abilities distinguish GIS from other information systems, and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

GIS is an invaluable tool in a planning and monitoring of natural resources like soil, land use etc. at a regional or national level. It can be used as decision making tool in agriculture. It can take into account of soil fertility, gradient of lands, annual rainfall, availability of rural labour and access to the markets.

GPS

GPS is being used to achieve precision farming and enables farm planning, field mapping, soil sampling, crop scouting, and yield mapping. GPS also allows farmers to work during low visibility field conditions such as rain, dust, fog, and darkness. GPS is being used to correlate production techniques and crop yields with land variability. The correlation enables the farmers to develop the most effective soil/plant treatment strategies, hence enabling higher farm production. Today, farmers in developed countries use GPS mapping for more precise application of pesticides, herbicides, and fertilizers; better control and dispersion of these chemicals are possible through precision agriculture, thus reducing expenses, producing a higher yield, and creating a more environmentally friendly farm.

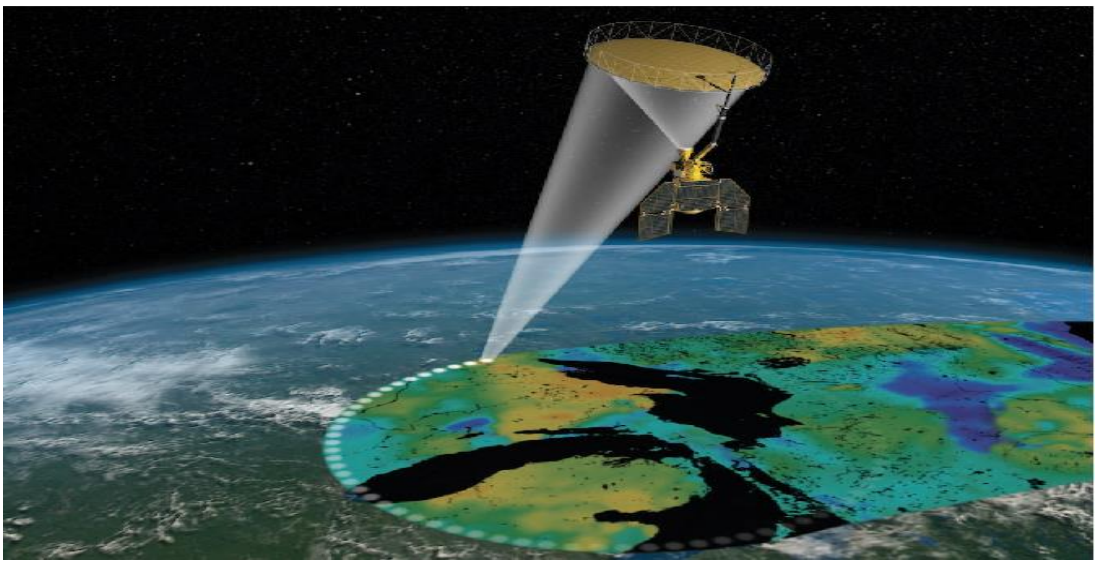
Application of remote sensing in agriculture?

1. **Identifying crop conditions :** Satellite imagery and normalized difference vegetation index(NDVI) technologies are used in order to monitor global food supplies. Healthy crops area reflect green where other areas reflect red or blue.
2. **Determining the soil moisture content :** Active and passive sensors of a satellite in space are used in order to determine soil moisture content. Many earth sciences such as water cycle, flood, and drought are based on the content of soil moisture.
3. **Crop production forecasting :** Remote Sensing is used to predicting crop production and yield over a given field and determine how much of the crop will be harvested under the specific conditions. The researcher can predict the crop quantity that will be produced in given farmland over a given period of time

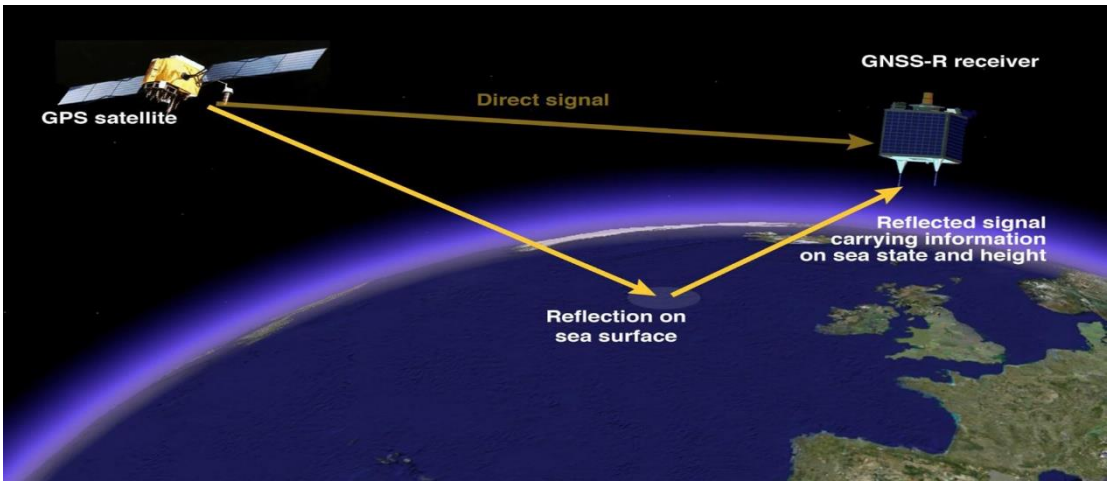
4. **Determining crop damage and crop progress :** In the event of crop damage or crop progress, remote sensing technology can be used to penetrate the farmland and determine exactly how much of a given crop has been damaged or under stress and the progress of the remaining crop in the farm.
5. **Crop condition analysis and stress detection :** Remote sensing technology plays an important role in the assessment of the crop health condition and the extent to which the crop has withstood stress. This data can be then used to determine the quality of the crop.
6. **Drought Monitoring :** Remote sensing technology is used to monitor the weather patterns including the drought patterns over a given area. The information is used to forecast the rainfall patterns of an area and also tell the time difference between the current and the next rainfall which can be helpful to keep track of the drought.
7. **Water content determination of the field crop :** Apart from determining the soil moisture content, remote sensing also plays an important role in the estimation of the water content in the field crops.
8. **Crop health analysis :** Health analysis of a crop can be also determined which helps in determining the overall crop yield.
9. **Disaster Management and Mitigation :** Today a well-developed GIS systems are used to protect the environment. It has become an integrated, well developed and successful tool in disaster management and mitigation. GIS can help with risk management and analysis by displaying which areas are likely to be prone to natural or man-made disasters.
10. **Surveying :** Land survey is measuring the distance and angles between different points on the earth surface. An increasing number of national and governments and regional

organizations are using GNSS measurements. GNSS is used for topographic surveys where a centimeter level accuracy is provided. These data can be incorporated in the GIS system. GIS tools can be used to estimate area and also, digital maps can prepared.

11. **GIS for Fisheries and Ocean Industries :** GIS tools add value and the capability to ocean data. ArcGis is used to determine the spatial data for a fisheries assessment and management system. It is extensively used in the ocean industry area and we get accurate information regarding various commercial activities. To enhance minimizing cost for the fishing industry. Also it can determine the location of illegal fishing operations.



12. **Pest Control and Management:** Pest control helps in the agricultural production. Increasing in the rate of pest and weeds can lead to decrease in the crop production. Therefore GIS plays an important role to map out infested areas. This leads in the development of weed and pest management plan.



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DRAGON FRUIT A NEW INTRODUCTION IN THE INDIAN MARKET

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Introduction

Dragon fruit a recently introduced super fruit in India, is considered to be a promising, remunerative fruit crop. Fruit has very attractive colour and mellow mouth melting pulp with black colour edible seed embeded in the pulp along with tremendous nutritive property which attract the growers from different part of India to cultivate this fruit crop which is originated in Mexico and Central and South America. It is a long day plant with beautiful night blooming flower that is nicknamed as “Noble Woman” or “Queen of the Night”. The fruit is also known as Strawberry Pear, Dragon fruit, Pithaya, Night blooming Cereus, Belle of the night, Conderella plant and Jesus in the Cradle. Fruit is named as pitaya because of the bracts or scales on the fruit skin and hence the name of pitaya meaning ‘‘the scaly fruit’’. It has ornamental value due to the beauty of their large flowers (25 cm) that bloom at night; they are creamy white in color. It is considered as a fruit crop for future. The fruit comes in three types, all with leathery, slightly leafy skin: Hylocereus undatus white flesh with pink skin, Hylocereus polyrhizus red flesh with pink skin, Hylocereus costaricencis with violet red flesh and pink skin and Hylocereus (Selenicerus) megalanthus white flesh with yellow skin.

The biggest advantage of this crop is that once planted, it will grow for about 20 years, and 1 hectare could accommodate about 800 dragon fruit plant. It is being grown commercially in Israel, Vietnam, Taiwan, Nicaragua, Australia and the United states. It produces fruit in the second year after planting and attain in full production within five years. This article concentrates mainly on how to cultivate dragon fruit based on the literature available and research work done in Bidhan Chandra Krishi Viswavidyalaya with the genus Hylocereus and species costaricensis. Hylocereus comprises 16 species, which are endemic to Latin America and they are not very well known among the growers and researchers and have only recently been the subject of studies. Very few research works have been done on this fruit crop in India. Specific topics associated with the difficulties met by countries that have introduced the new species. So, the research thrust must be given in the following areas; floral biology and ecophysiology. The aims of this article were to draw up a list of literature currently available on Hylocereus, grouping the references which covers importance, botany, vegetative and reproductive biology, cultivation, manuring, pollination, harvesting, pest & disease. So that everyone become familiar with dragon fruit.

Cultivation

One of the major merits of this crop is that it can grow in the extremes of temperatures up to 40 degree °C and best suited for the tropical climate with a good annual rainfall. Care should be taken during summers when temperatures go beyond 42 degree °C. Growing intercrops like castor, drumstick will help to reduce the effect of heat during summer. It can be grown on almost all soils which have good drainage capacity. There are two methods of growing dragon fruit, the first is the use of seeds and the second is using a cutting from the plant sampling. Seeds take a time of three years before the plant is large enough to be used so farmers generally opt for the cutting method. The length of the sapling should be 20 cm and it should be cut from the mother plant and left in the shade for 5-7 days before being planted in the field. Many farmers who are cultivating the crop have started selling saplings at a cost of Rs 50 per sapling. Poles are used to train the plants on them and are allowed branch at the top of the poles with the help of a circular ring. These poles should be of 7 foot length and 2 feet is allowed into pits. Poles are erected at a distance of 10 feet between the rows and 8-10 feet between poles in the rows. With 450 – 500 poles can be erected in one acre land. Four plants are planted at each pole on four sides of it, which amounts to 1600-2000 plants per acre. Planting should be done during monsoon.

Management

Cultivation of dragon fruit demand very less management. This crops attracts very less pests and diseases and hence cost of management is very minimal. Supplying farm yard manure twice year and 50-100 gm. of urea is very much sufficient. Farmers cultivate this crop in organic manner to fetch good returns. Two litres of water per day is sufficient for each plant and irrigating through drip system is highly preferable.

Pruning

The Dragon fruit plants are fast growing vines and produce more thick dense of branches during the initial stage. The lateral buds and branches should be pruned to grow towards stands. Once vines reach up to the top of the stands the branches are then allowed to grow. The removal of tip of main stem is done to allow growth of new shoots to grow laterally and climb at the ring to form an umbrella like structure of vines where flowers will emanate and develop into fruits which would induce lateral branching. This pruning referred as structural pruning or making a structure on the trellis. The well grown vine may produce 30 to 50 branches in one year and may be more than 100 branches in-four years.

Harvesting

The plant start yielding after 10-12 months from the date of planting and the fruit maturity could be optimized with the change of fruit epicarp color from green to red. Proper time of harvesting was found after seven days of color transition. The plants yield the fruits in the months between June to September, and harvest could be done three to four times in a month. The fruit weight ranges between 250 – 500 grams, and the average yield from the single post is realized about 30 to 35 kgs from the three years old planting. Present farm gate price is around Rs 200 per kg.

Expenditure and Yield

Cultivating dragon fruit per acre may go up to Rs 5 Lakh (Including pole setup, plants, labour, drip and other management expenses). Though it may look expensive but crop can give yielding up to 25-30 years. Though crop starts to give fruits after one year, remunerative yields start from third year onwards with 4-6 tonnes per acre with proper management and yields goes on increasing as it attains umbrella shape at the top of the pole. Farmers can cover entire expenditure in first 2-3 harvestings and rest harvestings up to 25 years can be considered as profits.

Marketing

Though the fruits are less common in rural areas and small towns, it has a very good market in big towns and cities considering its nutritional values. The current farm gate price is around Rs 170-210 and in the retail market it is fetching around Rs 270-300. The price of this fruit may come down a bit, if more farmers grow it. As per the experience of farmer who is growing it, confidently say that even Rs 55 – 65 per kg would be a remunerative price.

Conclusion

Dragon fruit consumption in India is increasing day by day, especially among the urban elite. Many farmers are very interested in growing the crop and capture the existing demand. Though the per kg price of the fruit bit high and chances of price dip in the coming future is very obvious as many farmers started cultivating it.

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