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Krishi Parasar

Department, School of Agriculture and Allied Sciences

Volume 2nd issued 2nd, **2022**

Forewords

The global community experienced the most significant disruption during the last two years due to COVID-19 pandemic situation. This brought unimaginable changes in all sectors in general and in the social, economic and health sectors in particular. The situation imposed changes in education, business, supply chains and virtual systems that had to be adopted in coping up with the situation. The same situation was occurred is past also and the human civilization explored the opportunities in building up more sustainable and resilient socio-ecological systems, particularly in bringing the health and food security. As agriculture the backbone of food security and it calls for having sustainability in the agriculture sectors even if any other pandemic situation occurred again.

It has been observed that one of the most critical characteristics of the successful organizations is their capacity to evolve, adapt, innovate and create value. The virtual systems have explored this opportunity through the adoption of Internet Communication Technology (ICT). The ICT is also plying a big role in meeting the sustainable development goal. Worldwide sustainable sourcing program have been adopted by many international organizations for supplying agricultural items like food grains, vegetables and spices. This assisted the producers in the implementation of best practices for in-farm biodiversity enhancement, contributing to the conservation of natural ecosystems and the services they provide to agricultural landscapes. The programs also supported and assisted the producers in the implementation of innovative techniques and approaches for crop and pest management that contribute to reducing production costs, as well as harvest losses and environmental pollution through the Intelligence Hub (iHub) which further developed as an information management solution to simplify decision making and implement best practices in livestock production in various parts of the globe.

The past pandemic situation and the ongoing climate crisis have become triggers for systemic transformational change, where sustainable agriculture is one of the most important parts of the solution, supported by social innovations, circular economy and agro-ecological principles that improve, soil, water, plant, animal and human health, as they all are interlinked. This is an opportunity for our academic community to integrate with the supply chain partners to continue working together to buildup up a global collaborative network for successful agricultural transformation.

I hope that our School of Agriculture and Allied Science is looking after all of the above aspects in developing our students such that they can be familiar with the total situation in sustaining themselves and this will be reflected in the forthcoming issue of e-journal ‘Krishi Parasar’. In addition to this the present volume of Krishi Prasar will also address on the integration of ICT with sustainable agriculture in improving our ecology, economy and empowerment of 70% of our population those are living in rural areas and nurturing the agriculture sector in bringing our food security.

Prof. (Dr.) Biswajit Ghosh

Vice Chancellor

The Neotia University

Dean's Message

I am extremely happy to know that the School of Agriculture & Allied Science is coming out with the 2022 / 2nd issue of the e-magazine "Krishi Parasar" on the eve Durga Puja, a most important festival of West Bengal. The festival marks the victory of goodness over evil forces. In agriculture prevalence of evil forces in in the form of pest and disease infestations, flooding, drought, cyclone & storms, etc. is common leading to poor crop yield, uncertainty over crop production, food & nutrition security, and the sufferings of small and marginal farmers due to low income that affects their livelihood. Parallel to these evil appearances, forces of goodness operate providing several solutions to outstanding problems enabling mankind to overcome the issues. Recent research and development in the 2-areas namely, climate resilient agriculture and application of information and communication technologies (ICT) in agriculture is significant in helping us to resolve many of the outstanding issues faced by our farmers. The theme of this e-magazine has therefore been decided considering the flavour of the festive occasion. The use of ICT in decision-making, precision farming, smart farming, crop monitoring, value addition, marketing and logistics are the key new areas to focus on the near term. I am told that the theme of this issue of e-magazine is kept in alignment of areas of present-day significance and smart way of growing crops. This will help the farming community in general beside promoting creativity amongst students. It's a platform to showcase achievements of the school and academic excellence. I am sure this will generate lots of interaction among students, teachers, researchers, and the farming community.

I am told that the e-magazine would have 7-segments (scientific article, agri-vision, photography / image gallery, animation & drawing, students' corner, field activities & interviews, events). Students and faculty members participation was overwhelming across all the 7-segments. The biannual publication of the e-magazine is providing our students opportunity on a continuous basis to think on the new emerging areas of research as a whole / topic of their choice and apply their creative mind in developing / expressing it. I congratulate our agriculture faculty members, mentors, digital initiative team and TNU management for encouraging young minds and providing them this opportunity to present their ideas on e- platform. I wish a grand success of this e-magazine.

Prof. (Dr.) Sushil Kumar Kothari
Dean
School of Agriculture and Allied Sciences
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Content

Editorial Board

Convenor and Chief Editor:

Prof. (Dr.) Sushil Kumar Kothari

Associate Editors:

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Assistant Professor and Editor

Department School of Agriculture and Allied Sciences

The Neotia University

During the pandemic induced lockdown, while everyone was isolated and stuck in their homes and people were looking for an outlet for their creative energy, an idea of engaging students and faculties of the School of Agriculture and Allied Sciences of the Neotia University into an ingenious endeavour took shape in the form of an e-magazine. We named it **"Krishi Parasar."**

Now, with immense pleasure and gratitude, I along with the entire editorial board and a passionate dynamic group of student coordinators and contributors bring you the **2nd volume 2nd issue of "Krishi Parasar"**. It is indeed a pleasure to see that small bud of hope blossom into such an important and integral platform for sharing the vision, opinions, scientific knowledge, latest trends and developments in the field of agriculture for students and faculty alike. Our e-magazine has now become a manifestation of literary and artistic expression.

It is my sincere hope that the diverse array of content in this issue of our e-magazine inculcates divergent thinking, which moves away from the traditional, convergent thinking and is nonlinear and spontaneous. Rather than following a single set path, our students explore multiple options and innovative approaches in dealing with the burning issues that are going to confront the future of agriculture, food and humanity.

Dr. Sarita Pandey
Assistant Professor and Editor

Department School of Agriculture and Allied Sciences

The Neotia University

Welcome to **Krishi Parasar,** a new twice-yearly magazine about the life of the School of Agriculture and Allied Sciences at The Neotia University.

When I first started working at The Neotia University, one of the first things I noticed about our new community, was how eager students were to share their learning experiences at the School of Agriculture and Allied Sciences. Whether it was the lifelong friendships they made or the faculty members that truly influenced their careers and lives, the huge impact TNU has had and continues to have is evident.

Students' eagerness to share their stories like these is what inspired the foundation for this 2nd edition of **Krishi Parasar** Magzine. In this issue, you can read examples of the agricultural innovation that impact our lives. The art and drawing part gives a glimpse of natural beauty of our campus. I hope that reading this magazine will have an impact on you and encourage you to be a part of this magazine. We may never know how much our words or actions influence the lives of those around us. But through this magazine, we can choose to be a positive influence on others in a way that could change the rest of their lives, even if it's just within the walls of our university.

I congratulate all the students whose articles, photo and drawings are published in this issue of **Krishi Parasar** and express my sincere thanks to their mentors. I hope you enjoy each and every part of this magazine. We welcome your feedback and will see you again in the summer with a new issue.

Editorial Board

Convenor and Chief Editor:

Prof. (Dr.) Sushil Kumar Kothari

Associate Editors:

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Assistant Professor and Editor

Department School of Agriculture and Allied Sciences

The Neotia University

In its **2nd volume 2nd issue** of our e-Magazine "Krishi Parasar" authors tackle tough issues head-on. We grapple with climate resilient agriculture and information and communication technology in agriculture. The **"Krishi Parasar"** is a content rich bi-annual e-Magazine initiated for the purpose of providing information about recent innovations and technologies in agriculture and allied sectors also revealing the creative mind of our young brilliant students. It was started at 2021 by The Neotia University agriculture students and faculties who wanted to benefit the society in agriculture and related fields. This e-Magazine gives a platform to dignitaries like scientists, researchers, scholars, students and innovative farmers to share their views and vivid ideas about agriculture. The second issue of 2nd volume of the E-magazine **"Krishi Parasar"** will be published on the eve of celebrating the arrival of the Goddess Durga.

Finally, I would like to thanks our all collaborators, co-editors, specially our students, who are the backbone of this magazine.

Mr. Subhadip Pal
Assistant Professor (Adhoc.) and Editor

Department School of Agriculture and Allied Sciences

The Neotia University

Agriculture is the primary source of livelihood for about 58% of India's population. Indian agricultural sector has shown a growth rate of 3.9% in the financial year of 2021-22 and estimated to grow up to US $ 24 billion by 2025. In the financial year of 2021-22 India has achieved highest ever food grain production of 314.5 million tonnes and gross value added by agriculture and allied sector was 18.8% of India's GDP in this year. India's foodgrain production has grown enormously of 36% whereas area under foodgrain production has grown only by 1% effecting productivity growth rate of 28% during last 6 decades. Although India's agriculture and allied sector has grown 9 folds after the independence, the total foodgrain demand will increase from 201 million tonnes in 2000 to about 291 and 377 million tonnes by 2025 and 2050, respectively. To achieve this mountainous task India needs to engage all types of resources in agricultural production system and need to use its huge human knowledge base, for what different types of printed media, audio and visual aids become very important. Publication of **"KRISHI-PARASAR"** is a small step to achieve a platform for awareness as well as advocacy. As a member of Editorial Board member, I wanted to create the platform not as a subject matter expert, but as an engaged and curious global citizen, dedicated to exploring the issues, gathering the stories, interviews, and content to be able to present on a regular basis.

I and my fellow board members sincerely hope that this small undertaking of ours, blossom into a vibrant creative space for our dear students, without whose active participation such an endeavour would not have been possible.

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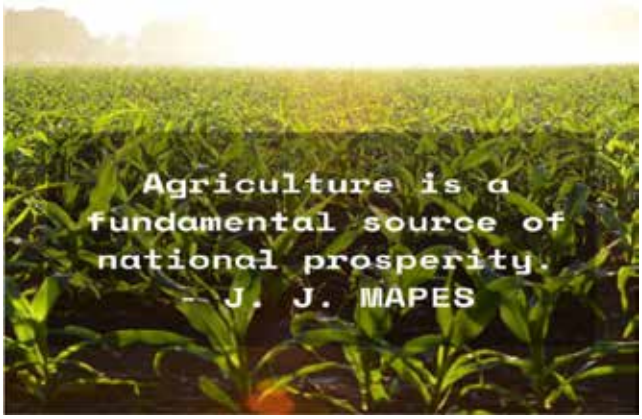
Agri vision

AN INSIGHT IN FUTURE CAREER PROSPECT IN AGRICULTURE

Mr. Siddhartha Hazra
Assistant Academic Officer, SAAS

Introduction:

Agriculture is one of the vastly profitable areas of the Indian economy. Other industries may face downsizing but agriculture can never fall prey because "food" is the basic necessity for life. Feeding the world will never face a recession or a slowdown. In fact, the development in technology, research, and innovation has multiplied the scope of agriculture in a big way. As an outcome, many students are eager to seek a degree in this field. B.Sc. (Agriculture) Hons. graduates will have plenty of career opportunities in a range of industries, including government, private, and public organizations, research institutions, agribusiness firms, and other areas. This article highlights various careers available after obtaining a BSc (Agriculture) Hons., both in the public and commercial sectors.



Future Career scope:

- Government Research Institutes - Subject Matter Specialist in different Krishi Vigyan Kendras (KVKs), Agricultural Research Scientist (ARS) etc.
- Farm Manager, Assistant Plantation Manager.
- Assistant Professor in State Agricultural Universities (SAUs) and Private Agriculture Universities.
- State-level exams for positions such as Assistant Director Agriculture (ADA), Agriculture Officer, Seed Officer, Extension Officer, Officer in Quality Assurance in Related Fields (Food safety officer)
- Seed, Agro-chemical, Fertilizer companies – both National and Multi-National like Bayer, Syngenta, FMC, UPL, Nagarjuna, Indorama, Yara, East-West Seed, Pioneer seed, Seminis etc.: Positions-Sales & Marketing Manager, Product Development Manager, R&D Manager, Production Manager, Plant Breeder etc.
- Development Management Trainee – Agronomist, Programme Manager etc. positions in State Level and National Level NGOs (Non-Government Organizations).
- Chief Executive Officer (CEO), Marketing Executive, Project Officer etc. in Farmer Producer Organisations (FPOs)
- Food Processing Companies
- Banks – Nationalized and Private
- Fertilizer Manufacturing Firms
- Food Processing Units
- Central & State Government Departments
- Farm Machinery Industries
- This course equips you with the knowledge and skills needed to handle Agri-preneurship, agriculture businesses, food production. You can start your own business as an entrepreneur.

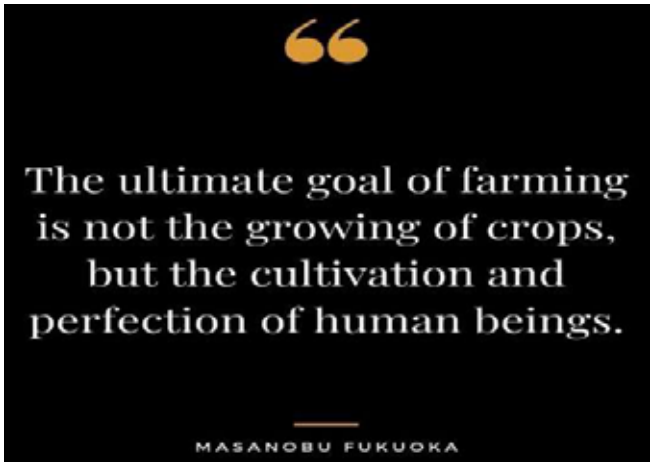
Future Career Scope after B.Sc. (Agriculture) Hons.:

As per the recent trend, after the B.Sc. (Agriculture) Hons. starting salary in private organisation will starts from 1.5 – 2.0 lakh per annum (LPA). But after the M.Sc. career scope will become broaden by many folds and salary starts from 3.5 – 4.0 lack per annum (LPA).

- State-level exams for positions such as Assistant Director Agriculture (ADA), Agriculture Officer, Seed Officer, Extension Officer, Officer in Quality Assurance in Related Fields (Food safety officer)
- Seed, Agro-chemical, Fertilizer companies – both National and Multi-National: Positions- Field trainee, Field Officer, Crop Doctor, Graduate trainee, Field Sales & Marketing executive, Product Development Executive, Extension Executive etc.
- Development Management Trainee – Agronomist, Programme Manager etc. position in State Level and National Level NGOs (Non-Government Organizations).
- Chief Executive Officer (CEO), Marketing Executive, Project Officer etc. in Farmer Producer Organisation (FPO)
- Banks – Nationalized and Private
- Farm Machinery Industries
- This course equips you with the knowledge and skills needed to handle Agri-preneurship, agriculture businesses, food production. You can start your own business as an entrepreneur.

Academic Pursuits after BSc Agriculture – Scope & Opportunities

After pursuing B.Sc., those who want to study further can opt for an M.Sc. programme from various government and private universities that offer scope of research, teaching or pursuing a PhD. Students can appear in agriculture entrance exams like ICAR AIEEA (PG) and others to pursue a Master's in Agriculture. It's possible to pursue a postgraduate degree programme in agriculture related subject which will broaden the scope such as specializing in agronomy, soil sciences, horticulture, plant breeding and genetics, entomology, plant pathology, animal sciences, extension education, plant biochemistry, agriculture economics, biotechnology etc.



Competitive Exams After BSc Agriculture:

1. State-level exams for positions such as Assistant Director Agriculture (ADA), Agriculture Officer, Seed Officer, Extension Officer, Officer in Quality Assurance in Related Fields (Food safety officer)
2. The Institute of Banking Personnel Selection (IBPS); Bank Exam:
   a. Specialist officer (Agricultural Field Officer)
   b. Rural Development Officer
   c. Probationary Officer
   d. Bank Clerk
3. NABARD Grade-A Exam
4. UPSC- IFS (Indian Forest Services)
5. Food Corporation of India (FCI)
   a. You can apply for technical or non-technicalroles by taking the FCI online exam.
   b. Technical Managers, Technical Officers, Assistant Officers, and other similar positions are frequently advertised.
6. Exam to pursue MBA – Gen / MBA – Agri-Business: CAT, MT, XAT, CMAT etc.
7. International exams for pursuing Higher studies from Foreign Universities: GRE, GMAT, IELTS, TOEFL etc.

Conclusion: Top Market Trends in Agriculture – The Future

The agriculture sector is becoming more modern, scientific and technology-oriented. Shifting farm structures, changing demographics in the food production system, evolving biotechnology strategies, resource management strategies, are playing a major role in the food production and management systems. Specialization in agriculture opens up a world of possibilities for students who have chosen to pursue education in this field.

FAQs – How to Prepare for University Placement

When should I start preparing for placement?

– Placements generally are conducted in or before the final year commences. But for best performance one start preparation from 3rd year onward and should be sincere, serious and attentive throughout the course duration.

What are the skills required for campus placement?

– Depending on the kind of company that one goes to for interviews, various skills like language, aptitude, communication, observation, problem-solving etc are required. For professional jobs, one might need robust subject knowledge based on the position they are applying for.

What is the minimum CGPA required for placements?

– An average and decent CGPA score stand to 8.0 to apply for a well-reputed company (this CGPA is widely accepted and welcomed by many companies). But overall 60% or OGPA 6.0 is the cut off to sit for an interview and good attendance.

How do you prepare for an off-campus placement?

– Off-campus placements are much similar to that of on-campus. The only difference is you go in search of the right company for you in the former one. The key is to work on your resume and make it professional, brush up your skills and stay confident throughout the process. And most importantly, not to lose hope.

How do you crack an interview placement?

– We will recommend that the best way to crack an interview is to be sharp and confident. Having the right amount of subject knowledge is extremely important to find your seat. Good body language and researching about the company can also give you a better edge over other candidates.

What is the key to crack the campus placements?

– The key to crack a campus interview is to stand strong and confident. Update yourself with current trends. Define your goal and reason to get into the company you are applying for. Talk to your seniors/ faculty/T & P Manager and focus on subject related or aptitude based on what the company is expecting. Prepare well and stay calm.

How to prepare for Agriculture and Allied Sciences Campus Placements?

– We will say that, preparing for placements is all about planning and a proper schedule. The best way is to consider various rounds of interviews that you will be going through right from a group discussion to panel discussions to HR interviews. Brush your skill set and prepare well, face the interviewer with confidence. Stay calm and poised.

Regards and Best of Luck,

Mr. Siddhartha Hazra
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SPONTANEOUS GENERATION OF LIFE AND LOUIS PASTEUR

Prof. Bharat Chandra Saha
Professor, SAAS

Spontaneous generation or the hypothetical process by which, it was thought, that living organisms develop from nonliving matter or the archaic theory that utilized the process to explain the origin of life and thereafter, the discoveries of Louis Pasteur, has been the topic of this article. The Greek philosopher Aristotle (384–322 BC) was one of the earliest recorded scholars to articulate this theory of spontaneous generation, the notion which states that, life can arise from nonliving matter. Aristotle proposed and subsequently added that life can arise from nonliving material if the material contains pneuma ("spirit" or "breath"). As evidence, he noted several instances of appearances of animals from environments previously devoid of such animals, such as the seemingly sudden appearance of fish in a new puddle of water. The proponents of the theory cited how frogs simply seem to appear along the muddy banks of the River Nile in Egypt during the annual flooding. Others observed that mice simply appeared in the heaps of grains when stored in barns with thatched roofs. When the roof leaked and the grain molded, mice appeared.

Jan Baptista van Helmont, a 17th century Flemish scientist, proposed that mice could arise from rags and wheat kernels are left in an open container for 3 weeks. In England, John Needham also supported the idea of spontaneous generation. He performed experiments on spontaneous generation in mutton broth and hay infusions, to see, if organisms came from outside or generated from the broth or hay infusions. He heated the flasks of broth/hay infusions and then corked them tightly. After sometime when the broth/hay infusions were cooled, he found the appearance of micro-organisms in the flasks. This took him also, as the supportive evidence of spontaneous generation. He then published his observations and interpretations in 1748 in a work entitled, "Observations upon the generation, composition and decomposition of animal and vegetable substances".

Later, an Italian biologist, Lazzaro Spallanzani (1729-1799) and a French biologist, astronomer and mathematician Pierre-Lois Moreau de Maupertuis (1698-1759) refuted the theory of spontaneous generation. Maupertuis and Spallanzani conducted similar experiments where they boiled the broth completely and, thereby, completely eliminating all the living micro-organisms initially present in the flask (Fig.1). Maupertuis observations were published in 1751, as Systemede la nature. Finally, Louis Pasteur (1861), solved the ambiguity of the spontaneous generation by using a simple experimental procedure. He showed that beef broth could be sterilized by boiling in a "swan-neck" flask, which had a long bending neck that traps dust particles and other contaminants

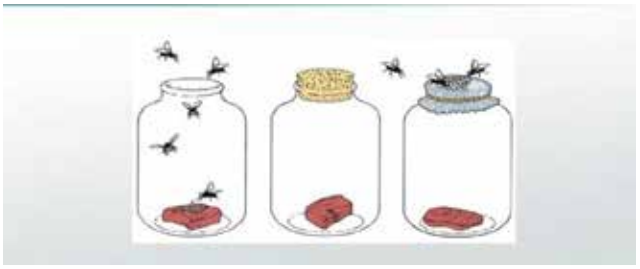
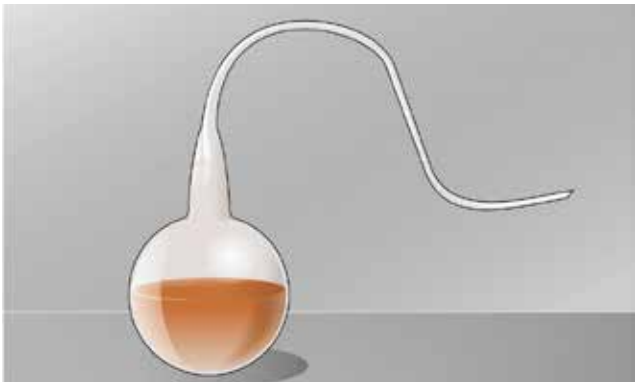


Fig.1.Experiment of Maupertuis and Spallanzani

before they reach the body of the flask. He designed a procedure to test whether sterile nutrient broth could spontaneously generate microbial life. To do this, he set up two experiments, in one flask; Pasteur added nutrient broth where the necks of the flasks were bent. In the other experiment, the neck of of the flask was not bent (otherwise the normal flask. Then he boiled the broths of both the flasks, to kill all the existing microbes. He observed both the flasks for some weeks and found that microbes appeared only in the normal flask (whose neck was not bent) and not in the bent flasks. Thus, his experiment showed that microbes cannot arise from nonliving materials under the conditions that existed on Earth. But his experiment did not prove that spontaneous generation never occurred. After the discovery of Louis Pasteur,



Swan Neck Flask of Louis Pasteur

Scientists at that focused their attention to search the origin of life, but till now no concrete proof has been put forward to solve the mystery of origin of life.

Dragon Fruit Farming Technology

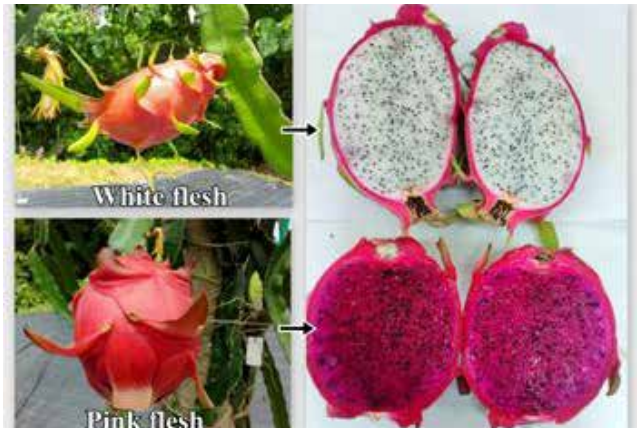
Prof.(Dr.) Ananda Kumar Mandal
Professor (Visiting), SAAS

Introduction:-

The dragon fruit (Hylocereus sp.), a new introduction in India, is a high value fruit crops for its reported neutraceutical properties. It is a climbing vine cactus species with most beautiful fruit in the family Cactaceae . It blooms beautiful flowers for one night only and is nicknamed as 'Noble woman' or 'Queen of the Night'. The juicy flesh of the fruit is delicious in taste. It is a high value fruit crop for diversification of Indian Horticulture. Pitaya or pitahaya is known as dragon fruit under cactus species indigenous to the South Americas. Pitaya usually refers to fruit of the genus Stenocereus, while pitahaya provides all these nutrients- per 100gms.- viz.,energy 268 calories, protein 3.57 gm, vitamin 9.2 mg, calcium 107 mg ,dietary fibre 1.8 gm

Major types are –

1. Red White Dragon Fruit Variety- Pink colour upper epicarp, the edible part is pink colour with black seeds –Hylocereus undatus
2. Pink Dragon Fruit Variety – upper epicarp and edible part is pink colour with black seeds- H. costaricensis
3. Yellow Dragon Fruit Variety- upper epicarp is yellow colour but edible part is white with black seeds.- H. megalanthus.



Vietnam is the largest producer and exporter of dragon fruit around the Globe. Most of the cultivated states in India by rank are Karnataka, Kerala, Tamil Nadu, Maharastra, Gujrat , Orissa, Andhra Pradesh and Andaman &Nicobar Island . West Bengal is a new Indian state to this exotic fruit .

Some of the interesting facts of Dragon farming are as follows

1. Dragon fruit tastes best when it is eaten chilled.
2. Flower buds of the fruit are also edible
3. Taste is a little combination of a kiwi and pear
4. Dragon fruit seeds consists of protein as well as omega 3 & 6 fatty acids
5. Eating dragon fruit keeps your hair healthy and smooth
6. It has many antifungal & antibacterial property
7. There are more than hundred varieties are available in the farmers fields of West Bengal

I have visited and seen very recently, five different collections of dragon fruit which have been collected and established at the experimental farm of Central Island Agricultural Research Institute(CIARI) which I have witnessed during my visit to CIARI in 2021-a covid pandemic period. . As dragon fruit is climbing cacti, support is essential for the growth of the vines,which is as long as 20 ft/year. The concrete pillars are supported by a square structure in the top to train the vine for bearing purpose. Since the island is high rainfall zone, soil erosion is the common problem and hence scientists have made concrete square structures as base for maintaining the media that supports the growth of the vine.

Alternatively our scientists initiated cost effective structures using iron poles and used tyres as base structure. The structures are made at a spacing of 3 m ×3 m. The media consisted of the soil enriched with organic inputs like farmyard manure, coir compost and vermin-compost along with biofertilizers. The rooted

cuttings of dragon fruit accessions were generally planted in June, 4 cuttings around each concrete pillar. The growth of dragon fruit vines was so fast that an average growth rate of 8.2 cm was observed per week. The reported rainfall requirement of dragon fruit is 1,145- 2,540 mm/year. Since the rainfall is distributed for eight months in the Island, irrigation is not required but in the dry season, the growing media is kept moist by irrigation through drip system on

Dragon Plantation at ICAR-CIARI, A&N

alternate days. Weed control is an important operation in dragon fruit cultivation and the use of weed mat efficiently reduced the weeds growth and also aids in soil moisture conservation. In about 8 months after planting the dragon fruit forms a thick dense mass of vines on top of the trellis which lies drooping to the ground.

The flowering was initiated in the red fleshed and white fleshed dragon fruits in the month of March, (nine months after planting). Dragon fruits become ready for harvesting in 25-35 days after flowering. The maturity index of the fruit is colour breaking stage from bright green colour to red colour. Exact time of harvesting is 3 to 4 days after colour change for local market. But in case of long distance transport/export, the fruits are to be harvested when the colour break is noticed.

The initial establishment cost is little high in the dragon fruit especially for the construction of trellis but once the plants are established, the fruits can be harvested continuously upto 20 years. After establishment of the crop, only minimum expenses are required for maintenance of the dragon fruit plantation. This dragon fruit is packed with excellent health benefits and has good demand in local as well as international markets. In the Islands too, the fruits have good demand and imported fruits are marketed presently at the rate of Rs 200 to 250 / kg. Dragon fruit cultivation in the islands could be a viable option for farmers and entrepreneurs of medium to large scale plantations. It is a fast return potential fruit crop with production in the second year of planting.The on farm demonstration of dragon fruit has drawn the interest of farmers and entrepreneurs. The visiting farmers relished the dragon fruits organically produced at the Institute and learnt the growth and development of the crop. The farmers were highly fascinated by the new fruit crop and showed lots of enthusiasm for learning the technical know-how of this fruit crop.

Method & Procedure for Dragon Fruit Growing Condition

Dragon fruit is a tropical fruit that has become very popular in recent years. Many farmers cultivate dragon fruit in a big way because of dragon fruit taste, medicinal value and demand in the fruit market. Those in urban localities, who lack sufficient space, can take up cultivation on the roof. For example, a house built in 30×40 square feet can grow 30 plants on the terrace. Within two years, a person can produce and earn up to Rs 30,000 a year from dragon fruit farming, depending on the price in the market.

For the dragon fruit farming process, farmers must know all the procedures related to dragon fruit agriculture which is honestly reliable for those who want to earn money from Indian dragon fruit. Such Dragon fruit plant for sale are available in the Indian market.

The dragon fruit plant is a climbing, large cactus dragon fruit plant that grows tall, succulent-like branches, thickens and also produces bright red or yellow fruit. The fruit of the dragon fruit plant (called dragon fruit, papaya, strawberry pear pitahaya or cactus fruit) is dense, juicy, and sweet—noble.

Dragon fruit flower also produces some of the largest flowers in the world, often referred to as “night-blooming cereus,” which bloom as gorgeous white flowers for only one night. And fill the air with a unique tropical.

Dragon Fruit Farming Techniques And Process

1. Climate Requirement for Dragon Fruit in India

A key feature of these crops is that they can grow in extremes of temperature. Dragons grow well in poor soils but are best suited to tropical climates with 40–60 cm rainfall for growth. The temperature between 20°C to 30°C is considered best for growing dragon fruit crops. If your climate outside is too cold or too hot for dragon fruit, you can also successfully grow a potted dragon fruit plant.

Although dragon fruit is in the cactus family, it is not like the cacti you typically see in the desert. Dragon fruit is a subtropical cactus native to Central America and South America, which means it thrives in mild, humid environments.

2. How to Grow Dragon Fruit Plant From Seeds?

Dragon Fruit Farming is an easy way to grow your dragon fruit cactus. Be aware, however, that if you grow a dragon fruit plant from seed, it can take several years (sometimes up to five) to bear fruit.

Prepare the Soil Bed:- Dragon fruit tree requires full sun. So that plant chooses a sunny area in your garden or a sunny window that gets at least six hours of sunlight a day. For soil, choose well-draining soil. Dragon fruit is sensitive to “wet feet” or constantly wet roots and is rich in organic matter. Don’t use cactus soil – As tropical plants, dragon fruit prefers more water than other cactus and wants something that will retain moisture a bit better.

Prepare the Seeds:- Cut a ripe dragon fruit in half and remove the black seeds. Wash the fruit pulp and pulp from the seeds and place the seeds on a damp paper towel for at least twelve hours.

Plant the seeds:- Sprinkle dragon fruit seeds over the soil’s surface and cover them with a thin layer of soil. It’s okay if it barely covers the seeds—they don’t need to be planted deeply.

Water:- Most the soil bed consistently, keeping it evenly moist. Cover the soil bed with plastic wrap to hold moisture in until the seeds germinate if your soil dries out.

Thin and transplant:- As your dragon fruit shoots continue to grow, thin them to give each new plant room. If you are growing them indoors, transplant them into larger pots. Mature dragon fruit will eventually need at least twenty inches wide pot for optimum health.

3. How to Plant Cuttings for Dragon Fruit Cultivation in India?

Cuttings:- Cut the dragon fruit cuttings into three to five pieces. Each of these pieces can propagate to a new dragon fruit plant. Make sure you keep track of the “up” direction for each cutting – when you plant them, you’ll need to plant them upright to allow them to develop properly. Generally, 1 foot size rooted cutting is good for planting.

Planting of the cuttings:- Plant each cutting by placing the base an inch or two below the soil and pressing down on the soil around it to keep it secure and upright. Make sure you plant the cuttings in the same direction as the original branch was growing – the end closest to the base of the original dragon fruit plant should be the end planted in the soil, and the end closer to the tip of the original branch. It is simply can be grown in the pot or even in a unused bucket with compost and garden soil.

4. How to Care for a Dragon Fruit Plant ?

Pruning:- To keep your plant disease-free and growing properly on its support system, prune back any dead, dying, diseased, or overcrowded branches.

Fertilization:- During the dragon fruit season, fertilize your dragon fruit plant once a month to give it the nutrients it needs. Actually 10-12 kg FYM is required which will have to be increased 2kg extra /year . In vegetative stage , Urea 70 gm, SSP 90gm and MOP 40 gm re required per plant but in reproductive phase low nitrogen and high K is recommended. After harvesting of fruits Urea 70 gm/plant , SSP 50 gm and MOP 100 gm/ plant and increase 220 gm /year basis reaching maximum 15 kg.

Pollination:- Dragon plants rely on nocturnal pollinators such as moths and bats to help them produce fruit. Indoor cultivation needs artificial-pollination on the blooms: Run a clean cotton swab or paintbrush in the middle of the flower to collect the pollen, then blow the pollen off the flower. Some varieties of dragon fruits are self-pollinated and others are cross polinated. Artificial LED light induces off-season flowering and fruiting in dragon fruit.(ICAR).

Temperature:- Dragon fruit plants don't get hardy in cold or hot climates, so make sure you keep your plant between 25-40 0. C temperature.

5. How to Harvest Dragon Fruit?

After maturity harvesting is done simply by turning the whole fruit as in the picture .

Once your dragon fruit tree begins to bear fruit, harvesting is easy. Look for brightly coloured fruits whose "wings" (the flaps of the skin on the outside of the fruit) are beginning to wither. Turn the fruit over gently – if it is ripe, it will easily come off the stem. Don't wait for the fruit to drop off the stem on its own.

6. Estimated cost of cultivation of Dragon Fruit (Hylocereus sp.) for 1 Acre

Sl. No.	Item of Works in detail	Amount in Rs.
1.	Cost of saplings , 2000 plants (@ 4 per trellis) @Rs 30/-each	60,000/-
2.	Cost of land or rental value for one Acre @1.5 lk	1,50,000/-
3.	Cost of 550 trellis with 2ft x2ft pit and 3.5m pole with upper round structure.	2,00000/-
4.	Cost of labour @ Rs 5000/- per month	60,000/-
5.	Costs of pesticides for one year	10,000/-
6.	Intercultural operations (weeding, spraying, manuring etc.)	15,000/-
7.	Miscellaneous costs	15,000/
	Total cost for 1 Acre of land	5,10,000/-

- If we deduct cost of commercial farming (Land lease , Labour and trellis) i.e. 5,10,000- 4,10,000 = 1,00000/- for 1st year/Acre for homestead gardening.
- Yield per Acre for 1 st year @1ton @ Rs 150/- per kg = 1,50,000/-
- Profit : 1,50,000/-- 1,00,000/-= 50,000/-
- Yield will increase @70 % extra /year for 20 years resulting increased income.

Dragon Fruit Species/types/ varieties

You can find three species of dragon fruit in the genus Hylocereus and one species in the genus *Selenicereus.* Varieties of *Hylocereus guatemalensis, Hylocereus polyrhizus, Hylocereus undatus,* and hybrids of these three varieties are grown commercially worldwide.

Types of Dragon Fruits

Different types of dragon fruit are available in India. Below we have described dragon fruit types:-

1. Red Dragon Fruits

Red dragon fruit grows on slender, tall, creeping cactus that often grow on fences, trees or walls. From the outside, red dragon fruits look almost identical to the white-fleshed variety. The brightly coloured oblong fruits are about 10 cm in length and also can weigh up to a pound. They have pink to magenta coloured skin in which succulent, fleshy scales are visible overlapping. The skin is an average thickness of only 3 millimetres, so the ratio of flesh to peel is high. As a result, red dragon fruit benefits from a higher amount of antioxidants than a white one.

2. Green Dragon Fruit

The dragon fruits produced by Bruni Green Dragon Fruit are green. The green tips are edible and sweet, with white, flavorful flesh. Bruni Green is a wonderfully high yielding, self-pollinating variety, with a small size that weighs 0.3 – 0.7 pounds on average.

3. White Dragon Fruit

This dragon fruit is a tropical fruit cultivated in Central America, Southeast Asia, Mexico, Australia. The skin is soft and pinkish with scales, while the flesh is white with small, black edible seeds. It has a mildly sweet flavour and a texture between the fruit of a kiwi and a pear.

4. Yellow Dragon Fruit

Yellow dragon fruit is oblong in shape and slightly smaller in size than the more common red varieties. The fruits are about 10 cm long and 7 cm wide. Their size depends on climatic conditions, and they are often classified into three different size groups. Yellow dragon fruit trees are grown in Ecuador and also in Colombia.

5. Pink Dragon Fruit

The benefits of pink dragon fruit are not only sweet, but it is also low in calories and rich in antioxidants. According to an abstract published in the World Journal of Pharmacy and Pharmaceutical Sciences, one of the best health benefits of dragon fruit is its ability to prevent inflammatory diseases such as arthritis and gout.

6. Blue Dragon Fruit

Blue dragon fruit plant in India is harvested from April to the end of October of the lunar calendar. Harvesting blue dragon fruit. We are classifying blue dragon fruit with red flesh before selling it. This is because blue dragon fruit with red flesh is rich in vitamins and nutrition.

7. Purple Dragon Fruit

Purple dragon fruit is one of the most beautiful and delicious fruits in the world. With bright purple flesh, still little known in the West, it will captivate you. Dragon fruit flesh can vary from white (with pink or yellow skin) to hot pink or dark red with tiny black seeds. Taste is associated with the colour of the flesh. The white dragon fruit flavour is often mild, while the darker, red flesh can be sweet and juicy.

8. Black Dragon Fruit

It is difficult to describe Black Dragon Fruit in the taste of Dragon Fruit. Its taste is mildly sweet, delicate on the tongue and similar to that of a raw pear. The texture of the fruit is firm,creamy, crisp to bite and juicy. Unlike many tropical fruit substitutes, dragon fruit is rarely scented.

More About Dragon Fruit

Dragon fruit or "Pitahaya" is basically a tropical fruit known for its vibrant red skin and sweet, seed-speckled pulp. Nowadays, this fruit is more prevalent in India. When asked what dragon fruit is, we can simply reply that everyone should eat it because it is a delicious fruit.

Its unique look and acclaimed superfood powers have made it popular among foodies and the health-conscious people.

Origin of Dragon Fruit

Dragon fruit grows on the Hylocereus cactus, also known as the Honolulu Queen, whose flowers open only at night. The plant is native to Central America and southern Mexico. However, today farmers grow it all over the world. As a result, it is known by many names, including papaya, pitahaya and strawberry pear.

How to cut Dragon Fruit?

Although the exterior looks tough with its rough raised leaves, it is easy to cut. The surface of the skin is thin and smooth like that of a mango. It is a thick, soft, waxy and flexible rind that separates easily from the pulp.

How to eat Dragon Fruit?

Generally a sharp knife is used to cut the dragon fruit in half lengthwise because it is too hardy.

After it, Scoop out it with a spoon or cut it into cubes by cutting vertical and horizontal lines across the pulp without cutting off the peel.

To enjoy, add it to salads, smoothies and also yoghurt, or simply snack on it on its own.

Health Benefits of Dragon Fruit:

There are many uses of dragon fruit that we must focus on, because dragon fruit is most beneficial in health care.

Along with this, dragon fruit uses in the skin glow, Helps soothe sunburnt skin and may prevent free radical damage; these are the dragon fruit benefits for the skin.

Dragon fruit as a source of calorie and fibre

The fruit has antioxidants, vitamin C, is rich in fibre and low in calories. But, of course, it would help if you also took the dragon fruit juice. So these are the advantages of dragon fruit thats why dragon fruit farming is most popular.

Dragon fruit is rich in vitamin C and other antioxidants, which are good for your immune system. In addition, it can increase your iron levels. Iron is important for moving oxygen through your body and giving you energy, and dragon fruit contains iron. These are the benefits of eating dragon fruit.

The vitamin C in dragon fruit helps your body take in and use iron. Dragon fruit tastes like a sweet little cross between a kiwi and a pear.

Prevents cancer- Antioxidants present in dragon fruit can help in preventing cancer caused by free radicals. The crotene present in the fruits is loaded with anti-carcinogenic qualities that help in reducing the risk of tumours.

Dragon Fruit Nutrition:-

1. Calories: 60,Protein: 1.2 grams,Fat: 0 grams,Carbohydrates: 13 grams, Fibre: 3 grams, Vitamin C: 3% of the RDI, Iron: 4% of the RDI, Magnesium: 10% of the RDI
2. Dragon Fruit Side Effects:-There are some disadvantages of dragon fruit: Consumption of dragon fruit can cause diarrhoea. However, there do not appear to be any serious side effects or health risks associated with eating dragon fruit. Still, if you eat dragon fruit and develop symptoms of an allergic reaction, stop eating the fruit immediately.

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মাশরুমের উপকারিতা, ব্যবহারএবংপার্শ্বপ্রতিক্রিয়া

ডঃ. সোলাঙ্কি সরকার
সহকারী অধ্যাপিকা, উদ্ভিদ রোগতত্ত্ব বিভাগ
দি নেওটিয়া ইউনিভার্সিটি

প্রকৃতি আমাদের বিভিন্ন উদ্ভিদের আকারে বিভিন্ন খাদ্যসামগ্রী সরবরাহ করে। এরকম একটি উপাদান হল মাশরুম। সারা বিশ্বে অনেক ধরনের মাশরুম রয়েছে। আপনি হয়তো জানেন না যে এই ছোট গাছটি পুষ্টি গুণে ভরপুর। শুধু তাই নয়, এই পুষ্টি উপাদানটি আমাদের সুস্বাস্থ্য গঠনে গুরুত্বপূর্ণ ভূমিকা পালন করে। এই নিবন্ধে আমরা মাশরুমের বৈশিষ্ট্য এবং একাধিক স্বাস্থ্য উপকারিতা নিয়ে আলোচনা করব। এটা জানা যায় যে মাশরুম শুধুমাত্র আমাদের শরীরকে সুস্থ রাখতে সাহায্য করে না বরং বিভিন্ন রকম রোগ নিরাময়েও গুরুত্ব পূর্ণভূমিকা পালন করে.

মাশরুমেরপ্রকারভেদ

গোটা বিশ্বজুড়ে অনেক প্রজাতির মাশরুম রয়েছে। কিন্তু আমি এখানে মাত্র কয়েক ধরনের মাশরুমের নাম উল্লেখকরব।তারাযথাক্রমে-

১। বোতাম মাশরুম
২। ঝিনুক মাশরুম
৩। মিল্কি মাশরুম এবং
৪। পোয়াল মাশরুম

মাশরুমের উপকারিতা

দৈনন্দিন জীবনে খাদ্য হিসেবে মাশরুমের গুরুত্ব অপরিসীম। গোটা পৃথিবীতে অনেক ধরনের মাশরুম দীর্ঘদিন ধরে খাদ্য ও ওষুধ হিসেবে ব্যবহৃত হয়ে আসছে। NCBI (ন্যাশনাল সেন্টার ফর বায়োটেকনোলজি ইনফরমেশন) দ্বারা প্রকাশিত গবেষণায় দেখা গেছে যে মাশরুমে বিভিন্ন ধরনের পলিফেনল, পলিস্যাকারাইড, ভিটামিন এবং অনেক খনিজ রয়েছে। এছাড়াও বিভিন্ন বায়োঅ্যাকটিভ যৌগ রয়েছে।মাশরুমের অ্যান্টিঅক্সিডেন্ট, অ্যান্টি-ইনফ্লেমেটরি, অ্যান্টি-ক্যান্সার, ইমিউনোমোডুলেটরি, অ্যান্টিমাইক্রোবিয়াল, হেপাটোপ্রোটেকটিভ এবং অ্যান্টিডায়াবেটিক বৈশিষ্ট্যের কারণে এটি ক্যান্সার, হৃদরোগ, ডায়াবেটিস এবং নিউরোডিজেনারেটিভ রোগের মতো রোগ প্রতিরোধে সাহায্য করতে পারে।

১। কোলেস্টেরলের মাত্রা কমায় –

NCBI ওয়েব সাইটে প্রকাশিত একটি পরীক্ষা অনুসারে, ৪৬ বছর বয়সী কিছু লোককে ২৪ দিনের জন্য সবার থেকে আলাদা করে রেখে, তাদের ডায়েটে ঝিনুক মাশরুম অন্তর্ভুক্ত করা হয়েছিল, এবং গবেষণার শেষে, উল্লেখযোগ্য ভাবে এটি দেখা যায় যে ওই লোকগুলোর কোলেস্টেরল এবং ট্রাইগ্লিসারাইডের মাত্রা আনেক খানি কমে গেছে ।তাই কোলেস্টেরল নিয়ন্ত্রণে বিনা দ্বিধায় মাশরুম খাওয়া যেতে পারে। যাই হোক, মাশরুম যে কোলেস্টেরলের মাত্রা কমায় তা এখনও গবেষণাধীন।

২। স্তন ও প্রোস্টেট ক্যান্সার প্রতিরোধ করে –

বিজ্ঞানীরা সংশ্লিষ্ট বিষয়ে বেশ কিছু গবেষণা করেছেন।গবেষণাটি পরবর্তীকালে NCBI ওয়েবসাইটে একটি গবেষণাপত্র হিসাবে প্রকাশিত হয়েছিল। এই গবেষণা দেখায় যে মাশরুম স্তন এবং প্রোস্টেট ক্যান্সার প্রতিরোধক হিসাবে গুরুত্বপূর্ণ একটি ভূমিকা গ্রহণ করে। মাশরুমে অ্যান্টি-টিউমার, ইমিউনোমোডুলেশন এবংঅ্যান্টি-ক্যান্সার বৈশিষ্ট্য রয়েছে। মাশরুমের এই বৈশিষ্ট্যগুলি ছাড়াও এতে ফেনোলিক যৌগ রয়েছে যা স্তন ক্যান্সার এবং প্রোস্টেট ক্যান্সারের সমস্ত সম্ভাবনা প্রতিরোধে সহায়তা করে। উপরন্তু, মাশরুম ক্যান্সার- প্রচারকারী সমস্ত কোষের বৃদ্ধিকে বাধা দেয়। কিন্তু পাঠককে স্পষ্ট জানিয়ে দেওয়া হচ্ছে ক্যান্সার একটি মারণ রোগ। যদি কেউ ইতিমধ্যেই এই রোগে ভুগছেন তবে ডাক্তারের পরামর্শ ছাড়া মাশরুম খাওয়া একেবারেই উচিত নয়। আর একজন ক্যান্সার রোগীর ডাক্তারের পরামর্শ অনুযায়ী সঠিক চিকিৎসা প্রয়োজন।

৩। মধুমেহ অসুখের জন্য সুষম আহার –

মধুমেহ রোগের জন্য মাশরুমকে সবচেয়ে গুরুত্ব পূর্ণ খাবার হিসেবে বিবেচনা করা হয়। NCBI প্রকাশিত একটি গবেষণা পত্র থেকে এই তথ্যের প্রমাণ পাওয়া যায়।গবেষণা পত্রটি আরও প্রকাশ করেছে যে বিভিন্ন ধরণের মাশরুম রয়েছে যেগুলিতে মধুমেহ রোগ প্রতিরোধকারী বৈশিষ্ট্য রয়েছে। এইধরনের মাশরুম রক্তে শর্করার মাত্রা কমিয়ে মধুমেহ নিয়ন্ত্রণ করে। এছাড়াও, মধুমেহ রোগ নিয়ন্ত্রণের ওষুধের সাথে আক্রান্ত ব্যক্তি কে দেওয়া হলে মাশরুম শরীরে ইনসুলিনের মাত্রা বজায় রাখতে পারে। তবে এটাও মাথায় রাখতে হবে যে কেউ যদি আগে থেকেই মধুমেহ রোগে ভুগে থাকেন তা হলে তাকে অবশ্যই বিশেষজ্ঞ চিকিৎসকের পরামর্শ অনুযায়ী নির্দিষ্ট কিছু ওষুধ খেতে হবে।

৪। আমাদের রোগ প্রতিরোধ ক্ষমতা বাড়ায় –

কেউ যদি সারাক্ষণ দুর্বলও অসুস্থবোধ করে তাহলে তার কারণ হিসেবে দায়ী করা হয় রোগ প্রতিরোধ ক্ষমতার অভাব বা দুর্বল প্রতিরোধ ব্যবস্থা। NCBI দ্বারা প্রকাশিত গবেষণা দেখায় যে খাদ্য হিসাবে মাশরুম খাওয়া আমাদের রোগ প্রতিরোধ ক্ষমতা বাড়ায়। মাশরুম পলিস্যাকারাইড মানব

দেহের ইমিউনসিস্টেমকে শক্তিশালী করে এবং শরীরে প্রয়োজনীয় পুষ্টি সরবরাহ করে। এছাড়াও, মাশরুমে পর্যাপ্ত পরিমাণে ভিটামিন ডি এর উপস্থিতি সুস্থ হাড় গঠনের জন্য উপকারী বলে মনে করা হয়।

৫। ওজন কমাতে সহায়ক –

হঠাৎ ওজন বেড়ে যাওয়া স্বাভাবিকভাবেই সবার জন্য উদ্বেগের বিষয় হয়ে দাঁড়ায়।মাশরুম ওজন নিয়ন্ত্রণ এবং চর্বি কমানোর জন্য সবচেয়ে গুরুত্বপূর্ণ প্রাকৃতিক বিকল্পগুলির মধ্যে একটি হিসাবে পরিচিত। একটি চীনা গবেষণা প্রতিষ্ঠানের মতে, মাশরুমে ফাইবার সহ পলিস্যাকারাইড, টারপেনস, পলিফেনল, ফ্ল্যাভোনয়েডের মতো বেশ কিছু জৈব সক্রিয় যৌগ রয়েছে, যা স্থূলতার কারণে সৃষ্ট কার্ডিওভাসকুলার সমস্যা কমাতে সাহায্য করতে পারে। এছাড়াও, মাশরুমের অ্যান্টি-ওবেসিটি বৈশিষ্ট্য ওজন কমাতে সাহায্য করে। কম চর্বি, উচ্চ ফাইবার এবং উচ্চ মানের প্রোটিন সমৃদ্ধ, মাশরুম একটি সুষম খাদ্য হিসাবে বিবেচিত হয়। তবে মাশরুম গ্রহণই চর্বি কমানোর একমাত্র উপায় নয়। একটি সুষম খাদ্য, নিয়মিত স্বাস্থ্য অনুশীলন এবং জীবনধারা পরিবর্তন ওগুরুত্বপূর্ণ।

৬। হৃৎপিণ্ড ভালো রাখে –

খাদ্য তালিকায় মাশরুমের উপস্থিতি হৃৎপিণ্ডের স্বাস্থ্য ভালো রাখে। **NCBI** ওয়েবসাইটে প্রকাশিত একটি গবেষণায় জানা গেছে যে মাশরুমে উচ্চ ফাইবার, অসম্পৃক্ত ফ্যাটি অ্যাসিড, সোডিয়াম এবং এরিথেডিন, ফেনোলিক যৌগ এবং স্টেরল রয়েছে। মাশরুমের এইউপাদানগুলো কোলেস্টেরলের মাত্রা নিয়ন্ত্রণ করে এবং ক্ষতিকর কোলেস্টেরল কমায়। এই উপাদানগুলির রক্তচাপ, অক্সিডেটিভস্ট্রেস এবং প্রদাহনিয়ন্ত্রণে ইতিবাচক প্রভাব ও দেখায়।মাশরুমের এই বৈশিষ্ট্যগুলি ভাল হৃৎপিণ্ড বজায় রাখে এবং শরীরকে বিভিন্ন রোগের সম্ভাবনা থেকে রক্ষা করে।

৭। মানব দেহের বিপাকীয় হার বৃদ্ধি করে –

একটি দুর্বল বিপাক হার বা দুর্বল বিপাক অনেক শারীরিক সমস্যার কারণ হতে পারে, যেমন হৃদরোগ, স্থূলতা, ক্যান্সার এবং ডায়াবেটিস। খাদ্য হিসেবে মাশরুম সহজেই এসব শারীরিক সমস্যা থেকে মুক্তি পেতে পারে।এছাড়াও মাশরুমে বেশ কিছুপুষ্টি উপাদান রয়েছে যা অ্যান্টিঅক্সিডেন্ট এবং অ্যান্টি-ইনফ্লেমেটরি হিসেবে কাজ করে।

৮। পেটের সমস্যা নাশক –

বিশ্বাস করতে মুশকিল হলেও একথা ঠিক যে খাদ্য হিসেবে মাশরুমের গ্রহণ করলে আলসার নিরাময় করা সহজ হয়। মাশরুমের নির্যাস আলসার নিরাময়ে গুরুত্বপূর্ণ ভূমিকা পালন করে। এনসিবিআই এর ওয়েবসাইটে প্রকাশিত একটি গবেষণাপত্রে এই সম্পর্কে বিস্তারিত আলোচনা করা হয়েছে।

ইঁদুরের ওপর একটি গবেষণা করে মাশরুমের আলসার প্রতিরোধক বৈশিষ্ট্যের সম্পর্কে ধারণা পাওয়া গেছে। এছাড়াও অন্য একটি গবেষণা থেকে জানা যায় মাশরুমে রয়েছে পর্যাপ্ত পরিমানে ফাইবার যা কোষ্ঠ্যকাঠিণ্যের সমস্যার অনায়াস সমাধান করতে পারে। একইসাথে বৈজ্ঞানিক গবেষণা থেকে আরোও জানা গেছে যে কোষ্ঠ্যকাঠিণ্যের সমস্যায় খাদ্য হিসেবে মাশরুমের ব্যবহার উপকার ছাড়া অপকার করেনা।

৯। নানাবিধ ভিটামিন সমৃদ্ধ –

শুনলে হয়ত অবাক লাগবে কিন্তু একথা সত্যি যে মাশরুম পর্যাপ্ত পরিমান ভিটামিনের আধার। এনসিবিআই ওয়েবসাইটে প্রকাশিত একটি গবেষণা অনুসারে জানা যায় যে এতে রয়েছে ভিটামিন বি ১, বি ২, বি ৯, বি ১২, ভিটামিন সি এবং ভিটামিন ডি ২। এই সব ভিটামিন গুলি নানাভাবেই আমাদের সুস্বাস্থ্য গঠনের ক্ষেত্রে উপযোগী ভূমিকা পালন করে। যেমন রক্তাল্পতা দূর করে, গর্ভবতী মহিলা এবং গর্ভস্থ শিশু সুজনের জন্যই উপকারী হিসেবে মনে করা হয়, কোলেস্টেরল নিয়ন্ত্রন করে, ত্বকের পরিচর্যা করে ইত্যাদি।

১০। মানব দেহের ত্বকের পরিচর্যায়ক –

ত্বকের পরিচর্যার ক্ষেত্রে মাশরুমের গুরুত্ব অপরিসীম। ত্বকের স্বাস্থ্যোন্নতির ক্ষেত্রে মাশরুম এক গুরুত্বপূর্ণ ভূমিকা পালন করে। খাদ্য হিসেবে মাশরুম গ্রহণ করলে ত্বকের আর্দ্রতা বজায় থাকে, নানা রকম ভাইরাসঘটিত সংক্রমন থেকে ত্বক সুরক্ষিত রাখে। মাশরুম অ্যান্টিএজিং বৈশিষ্ট্যযুক্ত হওয়ার জন্য ত্বকের বলিরেখা দূর করে। প্রাকৃতিক উপায়ে ত্বক উজ্জ্বল করে রাখে। জীবানু ঘটিত বিভিন্ন সংক্রমন থেকে ত্বক নিরাপদে থাকে।

১১। চুলের সুস্বাস্থ্য বজায় রাখে –

অন্যান্য শারীরিক উপযোগীতার পাশাপাশি মাশরুম সেবন চুলের সুস্বাস্থ্য বজ্য রাখার ক্ষেত্রে সহায়তা করে। খাদ্য হিসেবে মাশরুম গ্রহণ করলে চুল পড়া কমে যায়, চুলের স্বাভাবিক দৈর্ঘ্য দ্রুত বৃদ্ধি করে। শুধু তাই নয় মাশরুমে উপস্থিত সেলেনিয়াম চুল পড়া হ্রাস করে চুলের ঘনত্ব বৃদ্ধি করে।

মাশরুম ব্যবহারের পদ্ধতি

মাশরুম নানারকম ভাবেই ব্যবহার করা যেতে পারে। এখানে কতগুলি সহজ উপায় সম্পর্কে আলোচনা করা হল।

- খাবারের বিভিন্ন পদে বিভিন্ন ধরণের মাশরুম ব্যবহার করা যেতে পারে।
- পিৎজা তৈরীর সময় মাশরুমকে টপিংস হিসেবে ব্যাবহার করা যেতে পারে।
- মাশরুম, পণির এবং অন্যান্য সব্জির সাথে মিশিয়ে ব্যবহার করা যেতে পারে।
- মাশরুমের ব্রথ, স্যুপে ব্যবহার করা যেতে পারে।
- মাশরুম মাখন সহযোগে গ্রিল করে খাওয়া যেতে পারে।
- মাশরুম পাওডার বিভিন্ন প্রকার স্যুপ তৈরীর ক্ষেত্রে বা সস তৈরীর ক্ষেত্রে ব্যবহার করা যায়।

- মাশরুম স্যাণ্ডুইচ তৈরীর সময় পাঁউরুটির স্বাদ বৃদ্ধি করে সুস্বাদু করে তোলে।
- আঁচার তৈরিতে আনেক সময় মাশরুম ব্যাবহার করা হয়।

পরিমান –

প্রতিদিন ১০০ -১৫০ গ্রাম মাশরুম খাদ্য হিসেবে গ্রহণ করা যেতে পারে। তবে আপনার স্বাস্থ্য অনুপাতে সঠিক পরিমাণ মাশরুম গ্রহণের ধারণা পেতে হলে একজন পুষ্টিবিদের পরামর্শ গ্রহণ করা অবশ্যই দরকার। একমাত্র তিনিই এই বিষয়ে সঠিক তথ্য পরিবেশন করতে পারবেন।

মাশরুমের পার্শ্ব প্রতিক্রিয়া –

যতক্ষণ অবধি মাশরুম পরিমিত পরিমাণে গ্রহণ করা যায়, এর উপযোগীতা পাওয়া যায়। তবে প্রয়োজনের অতিরিক্ত পরিমান মাশরুম গ্রহণের ফলে বেশকিছু পার্শ্ব প্রতিক্রিয়া পরিলক্ষিত হয়। মাশরুমের পার্শ্ব প্রতিক্রিয়া গুলি হলো নিম্নরূপ –

১। কিছু ব্যক্তি মাশরুম খাওয়ার পরে ক্লান্তি, অস্বস্তি এবং অশক্তিহীন বোধ করতে পারেন। তাদেরকে আবশ্যই দৈনন্দিন খাবার রুটিনে মাশরুমটাকে এড়িয়ে যাওয়া উচিত।

২। মাশরুমের কিছু পার্শ্ব প্রতিক্রিয়াও অনেকের পেটের সমস্যা তৈরি করে। কিছু লোকের মধ্যে, মাশরুম খাওয়ার পর ডায়রিয়া সমস্যা, বমি এবং ক্র্যাম্পিং হয়। সেই সমস্ত লোকদের আবশ্যই খাবার হিসাবে মাশরুমটিকে এড়িয়ে চলা উচিত।

মাশরুম খাওয়ার আরেকটি সাধারণ পার্শ্বপ্রতিক্রিয়া হল বমিবমি ভাব। এটি সাইলোসাইবিন নামে একটি রাসায়নিক দ্বারা সৃষ্ট হয়, যেটি শিরভাগ মাশরুমের প্রজাতিতে উপস্থিত থাকে। সাইলোসাইবিনের হ্যালুসিনোজেনিক বৈশিষ্ট্য রয়েছে এবং এটি ব্যবহারকারীদের মধ্যে উচ্ছ্বাসের অব্যক্ত অনুভূতি লক্ষ্য করা যায়।

৩। যদি কোন ব্যাক্তি না জেনে বন্য মাশরুম খেয়ে ফেলে তাহলে, কিছুসময়ের মধ্যে তার হ্যালুসিনেশন ঘটতে শুরু করবে। এই হ্যালুসিনেশন প্রভাবগুলি এত ভয়ঙ্কর হয় যে, সেইগুলিকে **LSD** ওষুধ দ্বারা সৃষ্ট প্রভাবের সাথে তুলনা করা হয়। বন্য মাশরুম খাওয়ার ঠিক বিশ মিনিটের মধ্যে এই প্রভাবটি অনুভব করে। আধা ঘন্টা থেকে চল্লিশ মিনিটের পরে, প্রভাব সর্বোচ্চ পর্যায়ে পৌঁছে যায়। কেউকেউ তাদের পেটে স্বাভাবিকের চেয়ে বেশি জোরে শব্দ শুনতে পারে।

৪। মাশরুম রোগ প্রতিরোধ ক্ষমতা শক্তিশালী করতে পরিচিত। কিছু কিছু লোকের মাশরুমের আহারের ফলে ত্বকে ফুসকুড়ি এবং ত্বকের জ্বালা হয়। কেউ কেউ অতিরিক্ত পরিমাণে গ্রহণ করলে নাক থেকে রক্তপাত, শুকনো নাক এবং শুকনো গলা এবং অন্যান্য সমস্যাও দেখা দিতে পারে।

৫। যদি আপনি ভুল করে বন্য মাশরুম খেয়ে ফেলেন, তাহলে তা খাওয়ার ২০ থেকে ৩০ মিনিটের পরে, খুশি এবং উত্তেজিত বোধ করবেন। তারপরে, উত্তেজিত হওয়ার অনুভূতির সাথে সাথে তাদের পুরো শরীরে একটি ঝাঁকুনি সংবেদনও অনুভব হবে। কিছু সময়ের পর আপনি বিষণ্নতা অনুভব করবেন।

৬। কিছু কিছু ডাক্তার মহিলাদেরকে বুকের দুধ খাওয়ানো এবং গর্ভাবস্থায় মাশরুম খাওয়া এড়াতে পরামর্শ দেন। যদিও তার কোন গুরুতর পার্শ্বপ্রতিক্রিয়া এখনও পর্যন্ত রিপোর্ট হয় নি, তবে সেগুলি এড়িয়ে নিরাপদ দিকে থাকাই ভাল।

- বেশ কিছু প্রকার মাশরুমে কিছু বিষাক্ত উপাদান রয়েছে, যা অনেক সময়ই প্রাণঘাতী হতে পারে।
- ফাংগাস ধরে যাওয়া মাশরুম খাদ্য হিসেবে গ্রহণ করা কখনই উচিৎ নয়। তা স্বাস্থ্যের পক্ষে ক্ষতিকর প্রমাণিত হয়।
- বেশ কিছুদিনের পুরোনো মাশরুম খাদ্য হিসেবে গ্রহণ করা আকদমই উচিৎ নয়। কারণ একটা নির্দিষ্ট সময়ের পর মাশরুমে পোকা এবং ফাংগাসের বাসস্থান হয়ে ওঠে।

উপরিক্ত প্রবন্ধ থেকে মাশরুমের ব্যবহার, স্বাস্থ্যোপযোগীতা, পুষ্টিগুণ এবং পার্শ্ব প্রতিক্রিয়া সম্পর্কে সম্যক ধারণা পাওয়া গেলো। এটি শরীরের জন্য উপযোগী হলেও বেশ কিছু সময় মাশরুমের সুফলের পাশাপাশি কুফলের পরিচয়ও পাওয়া যায়।তাই, আপনি যদি আপনার খাদ্যতালিকায় মাশরুম অন্তর্ভুক্ত করার কথা চিন্তা করেন, তাহলে এই বিষয়ে চিকিৎসকের পরামর্শ অবশ্যই গ্রহণ করা জরুরী।

MYCOTHERAPY - AN EMMERGING TREATMENT FOR CANCER PATIENTS

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There is a global resurgence of interest in the use of natural product (s) to treat almost all diseases including the difficult to treat cancer! Therefore, searching of new potent drugs against cancer is immense important. Biotherapy is now coming in cancer therapy (Plácido et al. 2022). Mycotherapy is one biotherapy where fungi or mushroom or their products are used to treat cancer as alternative to current cancer therapies (Chemotherapy, radiation and surgery). The mushrooms belong to the kingdom Fungi and later is regarded as one of the most diverse group of organisms and a recent estimate even suggested that there may be over 5.1 million species (Blackwell 2011). Mushrooms alone are represented by about 14,000 species, of which approximately 850 species are recorded from India (Monoharachary et al 2005). Recently, it has been discovered that many mushroom species are miniature pharmaceutical factories producing hundreds of novel constituents with miraculous biological properties (Shin et al 2010).

Lucas et al (1957) got the first credit for demonstrating the anti-cancer activity of mushrooms (Boletus edulis and other mushrooms) against implanted Sarcoma 180 line in mice. Fifty nine years passed after Lucas's research, how many attempts have been made to bring mushroom or mushroom products to bed side of cancer patients are the main features in this discussion. Shitake (Lentinus edodes) contains a glucan called AHCC and is used in treatment of cancer in Japan due to its immune-enhancing function. AHCC also is sold in the U.S. under the brand name ImmPower TM (American BioSciences, Inc., Blauvelt, NY 10913). Lentinan, a compound found in Shitake, is used as an intravenous anti-cancer drug with antitumor properties. Clinical studies have associated lentinan (i.e. 0.5-1.0 mg lentinan per day, intravenous), especially in Japan and China, with a higher survival rate, higher quality of life and lower recurrence of cancer patients with stomach cancer, colon cancer and other carcinomas in comparison to patients who had chemotherapy alone (Parris 2000). Cell cycle analysis demonstrated that L. edodes extract induced a transient G1 arrest. PSK from Coriolus versicolor, is a polysaccharide consist of sugars associated with a small fragment of protein. It is marketed as Krestin (Jong 1999). Once in 1987, it was a top selling anticancer agent in Japan and annual sale total 358 million dollars and accounted for 25.2% of country's total sale of anticancer drugs (Chang 1993). Till now it is prescribed against colon, stomach and esophagus cancer in Japan and China. Ganoderma lucidum, Reishi contains diverse biological compounds, including polysaccharides [(1→3) and/or β-(1→6)-D-glucans] that stimulate the immune system, triterpenoids (ganoderic acids, lucidimol-A, -B, ganodermanondiol, ganoderiol F and ganodermanontrio) and triterpenes (triterpene aldehydes, including lucialdehydes A, B, and C) that demonstrate cytotoxicity against cancer cells. The anticancer activity of Reishi is attributed to the inhibition of signaling pathways involved with cell adhesion, proliferation, survival, invasion and degradation of the extracellular matrix (Plácido et al. 2022). The inhibition of tumor invasion and metastasis by ganoderic acid T, a lanostane triterpenoid or other bioactive of G. lucidum in human prostate cancer, cervical and breast cancer cell lines. In 1998, the Food and Drug Administration (FDA) granted Maitake (Grifola frondosa) products, as an investigational new drug application, to conduct a phase II pilot study using D –fraction on patients with advanced breast and prostate cancers. The broth of Agaricus blazei induced LDH leakage in three cancer cell lines, whereas the activities of caspase 3 and the DNA fragmentation were enhanced the most in androgen independent PC3 cells (Prostate cancer). The protein expressions of apoptosis-related molecules were elevated by the broth of A. blazei in PC3 cells (Yu et al. 2009). Decreased quality of sleep is frequently reported by cancer patients and contributes to an increased risk of depression (Weng et al. 2021; Otte et al., 2015; Ravasco, 2019). One study reported that the nutritional status of patients was improved by treatment with Agaricus sylvaticus combined with chemotherapy (Valadares et al. 2011). Moreover, the consumption of A. brazei and Coriolus versicolor extracts combined with chemotherapy decreased

vomiting and diarrhea in patients with gynecological (Ahn et al. 2004) or hepatocellular cancer (Chay et al. 2017), respectively. Regarding adverse effects, although the majority of studies reported that the use of mushrooms can reduce the adverse effects of conventional therapy, only one study (Chay et al. 2017) out of a total of five studies (Zhao et al. 2012; Chay et al. 2017; Tsai et al. 2016; Valadares et al. 2011 Yamaguchi et al. 2011) that assessed adverse effects achieved significant values. The immunomodulatory effects of medicinal mushrooms are well reported by in vitro studies and can potentially be used to minimize chemotherapeutic myelosuppression. Irofulven is one clinical successfully anticancer drugs marketed by MGIPHARMA, Inc., Bloomington, MN. It is chemically 6-hydroxymethylacylfulvene- an alkylating agent isolated from Mushroom- Omphalotus illudens. Its mechanism of action is to inhibit DNA synthesis and to induce apoptosis. Its clinical trial success is in phase I and Phase II trials of human cancer (ovarian carcinoma and advanced renal cell). Recently, it is widely accepted that cancer is formed by many pathways but dysregulation of mainly two pathways such as MAPK (Dhillon et al 2007) and NF-κB pathways (DiDonato et al 2013) are very important. NF - κB is increasingly recognized as a crucial player in many steps of cancer initiation and progression. During these later processes NF - κB cooperates with multiple other signaling molecules and pathways. Prominent nodes of crosstalk are mediated by other transcription factors either directly interact with NF- κB subunits or affect NF- κB target genes. Crosstalk can also occur through different kinases, such as GSK3- β, p38, or PI3K, which modulate NF- κB transcriptional activity or affect upstream signaling pathways (Hoesel et al 2013). Prof. Ananda Mohan Chakrabarty, Illinois University, Chicago, USA, made an attempt to evaluate different edible and medicinal mushrooms from West Bengal as anticancer agents against cervical, breast, lung and pancreatic cancer. The inhibitory and cytotoxic effects of Calocybe indica have been tested based on MTT assay, on human Ewing's sarcoma MHH →ES→1 and breast cancer MCF-7 cell lines. The IC50 values of WE and ME in MHH→ES→1 cell line were 55.25±1.201mg / ml and 46.56±0.134 mg/ml respectively while these values of MCF7 cell line were 52.12±0.15mg/ml and 47.94±0.09 mg/ml respectively. Treated cancer cells were studied by PI and DAPI staining under inverted fluorescence microscope. It indicates that both WE and ME of this mushroom has anticancer activity (Ghosh, 2015). The fruit bodies of other mushrooms (Lenzites sp, Schizophyllum commune, Asterius hygometrica, Ganoderma spp etc) are potent antioxidant and effective for inhibition of many cancer cell lines as tested in several experiments. The fractions of ME and EE of C. indica cause up regulation of p53, P21 and caspase3 genes in MCF7 and PAN1 cell lines as observed through Western Blotting. Up regulations of these genes indicate the apoptosis of cancer cells. Recently cancer stem cells (CSCs) research opens a new treatment of cancer by targeting CSCs The polysaccharopeptide (PSP) extracted from Coriolus versicolor targets prostate CSCs in vitro and suppresses tumor formation in vivo. There is more need to assay their bioactive metabolites that can be used as possible remedies for cancer treatments. It is expected that mycotherapy may increase immunity of patients, kill the target specific cancer cells and increase the normal life span of cancer patients.

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CONVERSION OF RICE-FALLOWS TOWARDS PRODUCTIVE AGRICULTURE IN COASTAL BENGAL: CHALLENGES AND OPPORTUNITIES

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1. Introduction

Agriculture in the coastal saline zone (CSZ) of West Bengal is predominantly rainfed and almost rice-based monocropped, while only 4% of the cultivated area is under irrigation with available non-saline water (Banerjee et al. 2018). Coastal lands spread over an area of approximately 1.14 million hectares of which about 0.35 million hectares are under cultivation. The region covers a cultivated area of 4.2 lakh ha in the wet season; while in the remaining 6 to 7 months the lands generally remain fallow **(Figure 1)**. The existence of large fallow land during winter season is accorded to lower rainfall, lack of irrigation facilities, late harvesting of long duration kharif rice, soil moisture stress at the time of sowing due to early withdrawal of monsoon, water logging (medium deep, 25–50 cm for most of the season), and lack of appropriate varieties of winter crops for late planting. Moreover, saline soil, flash flood (complete submergence for 1–2 weeks), the uncertainty of rainfall along with aggravated climate change, lack of technological interventions have made the farming activities difficult in the coastal zone of West Bengal. Therefore, introducing the second crop in rice–fallows in coastal zone is a great challenge as post-rainy season often confronts a series of abiotic and biotic stresses. However, there is an enormous opportunity of growing low water requiring short duration winter season crops like pulses and oilseeds having good market demand. This intervention, besides improving cropping intensity, could also ensure improved nutritional security for the small holder households of this resource poor region.

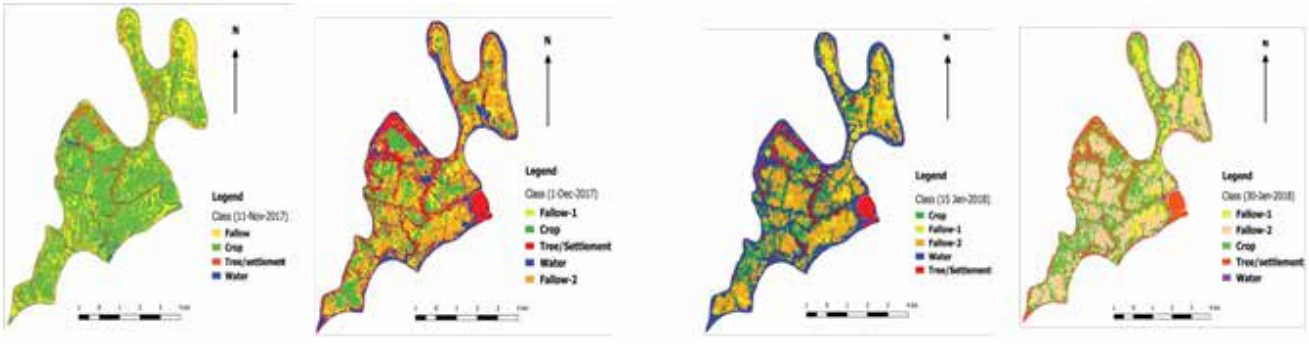

Figure 1: Land use map in coastal zone from November-February

2. Challenges in coastal rice-fallow areas

2.1 Climatic variability

The coastal zones are extremely vulnerable to climate change induced fast and slow onset of disasters. The climate in the coastal zone has shown a general warming trend in the last 40 years, equivalent to 0.04°C per year (Yu et al. 2019). Every year, loss of life and property in the coastal areas are increasing due to high intensity cyclones, floods, change in rainfall pattern, cloud burst, saline water ingression and coastal erosion due to accelerated sea level rise. From few years it has been shown the dry season receives heavy rainfall and its timing determines the riskiness of dry season cropping in coastal zone (Bell et al. 2019). Additionally, the increased population pressure and economic activity in coastal zones are magnifying the extent of coastal disasters.

2.2 Lack of fresh water and poor soil physical condition

During the monsoon periods a fresh water layer is created on the top of saline groundwater but in the post-monsoon dry season when rainfall becomes low, the fresh water layers becomes contaminated by the the salt reaches from the saline groundwater and dominant clay complex to the soil surface through capillary rise and makes the soil saline and unproductive for agriculture. In coastal areas of Bengal, transplanted rice is grown during rainy season under puddled condition that creates crack at the end of season, leading to unavailability of soil moistures for support the winter crops.

2.3 Soil moisture stress and lack of irrigation facility

Coastal Bengal receives enough rainfall during kharif season, but due to poor physical condition of soil most of rain water is lost through infiltration and deep percolation. Moreover, lack of irrigation facilities and poor soil moisture are limiting factor for production of pulses/ oilseed in rice–fallows. In fact, poor water–retention capacities are directly associated with lowers soil organic carbon.

2.4 Greater area coverage under long duration traditional rice varieties

Farmers of coastal Bengal grow mostly low yielding traditional rainfed or long duration rice varieties (145–150 days) during wet season. This causes delayed sowing of subsequent of pulses/oilseeds, resulting in poor yields due to terminal drought.

2.5 Lack of superior cultivars and quality seeds

Lack of suitable quality seeds of short-duration varieties of pulses/oilseeds for rice–fallows is also one of the main bottlenecks in coastal Bengal. Lower seed replacement ratio (Table 1) of pulses and oilseeds in comparison with major cereals is another lacuna for improving the rice-fallow system in coastal Bengal.

Table 1: Seed replacement ratio in West Bengal

Crop	Seed replacement ratio (MT)
Lentil	554.72
Chick Pea	313.75
Pigeon Pea	9.68
Green gram	105.60
Black gram	0
Mustard	929.10
Sesame	402.13

2.6 Negligence of farmers

Farmers consider the winter crops as a bonus economic return after harvesting of kharif rice. But most of cases they are very careless about the proper crop management practices in terms of selection of suitable cultivars, seed treatment with Rhizobial culture, seeding rate, crop protection, foliar feeding of nutrition and farm mechanization. Huge labour migration in search of quality life is another reason behind this rice-fallow.

2.7 Socio-economic constrains

The extremely fragmented land (per capita land availability 0.15 ha) in costal zone hampers implementation of mechanized farming in this region (Kumar et al. 2016). Lack of credit accessibility (57% of household do not have credit accessibility) and marketing infrastructure creates barrier to adopt high value agriculture practices.

3. Opportunities in coastal rice fallows

To introduce the second crop in rice fallows in coastal region of Ganges delta, a numbers of technological interventions should be adopted. Pulses/oilseeds might be considered as main crop for strengthening of coastal fallow areas because of their short growing period, resilient and low-input requiring in nature, can able to use of residual soil moistures optimally. Beside these, strategic crop and water management, use of suitable varieties, soil management, farm mechanization and climate resilient contingency measures should be work out to intensify the cropping system in coastal area.

3.1 Water harvesting and storage

Although there is no shortage of available water during rainy season but moisture become foremost restrictive factors during post-monsoon dry season. Therefore, construction of farm pond, in-situ rain water harvesting and community water reservoir is urgent necessity to provide at least life saving/ supplemental irrigation at the critical stages of crop growth in dry season.

3.2 Early harvesting of wet season rice

The farmers of coastal saline zone are habituated with the cultivation of long duration (145-150 days), tall stature types rice varieties which delaying the harvesting. To mitigate this problem a high yielding promising varieties (cv. Pratikshya, Swarna masuri) has been introduced recently which also mature 15 to 20 days earlier than traditional cultivars (Sarangi et al. 2019). Some indigenous and aromatic varieties such as Dudheswar, Kerala sundari, Radhatilak and Gobindabhog are promising in respect to salinity tolerant, early maturing and water logging tolerant. Direct seeded rice matures early as compared to traditional transplanting and tolerates water-logging situation that might be an option.

3.3 Uses of superior crop varieties

After harvesting of early or medium duration wet season rice, enough residual moisture is present in soil to cultivate short duration pulses/oilseeds in fallow lands. Therefore, community based seed multiplication unit with suitable dispensation and storage facilities should be available in this coastal belt. In this region short duration pulses like lentil, lathyrus, green gram, black gram and oilseeds like mustard, sunflower and groundnut with appropriate varieties enable the crops to avoid terminal heat stress and climatic hazards in fallow land. Promising cultivars for coastal saline zone in different land situation are listed in **Table 2.**

Table 2. Promising varieties identified for the coastal region of Gangetic deltas

Crop	Identified varieties	Season	Land situation
Chemical aspects of water quality	B-9, Pusa Bold, Varuna, Kranti, TM 143 and TM 204	Winter (late sown)	Medium
Lathyrus	Nirmal, Ratan, Bidhan Khesari -1	Winter (pyra cropping)	Medium and medium-low
Lentil	Moitrayee	Winter (pyra cropping)	Medium and medium-low
Sunflower	KBSH 44, KBSH 53, Aditya	Winter / spring	Medium
Mungbean	PM 05, IPM 99-125, IPM 2-3 Samrat, Bireswar, Sukumar	Summer	Medium and medium-low
Blackgram	Sarada, Pant U31	Summer	Medium and medium-low
Maize	P3396, Yuvraj Gold, PAC 740	Winter (late sown)	Medium
Potato	Kufri Pukhraj, Kufri Jyoti	Winter (late sown)	Medium

3.4 Use of resource conservation technologies (RCTs)

Resource conservation technology (RCT) which deals with soil moisture conservation, organic matter build-up and improvement in soil structure and microbial population could be an appropriate approach to address the problems in rice fallows. Therefore, the retaining of rice residue on soil surface (mulching) with appropriate tillage practices such as conservation tillage (CT)/zero tillage (ZT) has been found very important in sustaining the farming. Zero tillage (ZT) potato cultivation in post-harvest paddy field is another innovative technology in coastal region for cropping system intensification in the rainfed low lands in coastal saline region, with limited use of irrigation water, less labour input and higher yield.

3.5 Adoption of diversified cropping systems

In order to efficient utilization of soil moistures and maximize the land and system productivity in resource scarce condition in coastal zone, a wide range of field crops and vegetable crops which are feasible and profitable should be adopted for rice-fallow cropping system intensification. Rice-pulse or rice-oilseeds under relay/utera cropping may be best suitable cropping system because it has emerge potential to utilize residual soil moisture, also decreases cost of production.

3.6 Ensure well–timed accessibility of crucial inputs, credits facility and marketing infrastructure

In the resource scare situation of coastal saline zone well-timed accessibility of required crucial inputs, proper implementation of agricultural schemes and its utilization, accessibility of rural credits, government subsidy on farm inputs and marketing feasibility could motivate the farmers to take the second crop in rice fallow areas. Creating awareness about seed village concept, region-specific varieties, using of farm machinery by co-operatives and capacity building of farmers might be important extension approaches towards mounting the cropping intensity and overall development of coastal region.

4. Conclusion

In costal saline areas rice fallow offer a great opportunity to enhance the cropping intensity and year round income generation for marginal farm families with proper utilization of natural resources. Rain water harvesting, residual soil moisture conservation, proper drainage facility, and soil management to keep salinity in safe limit, and climate resilient strategies are required for successful trapping of rice–fallows. These areas also have a huge potential to maximize the vicinity and productivity of pulses and oilseeds that gives the nutritional security also. Improved agro-techniques such as sifting towards the use of early duration varieties, crop establishment methods, resource conservation and plant protection measures

also should be given emphasized. Marketing and credit facility, availability of crucial inputs, proper extension approaches with appropriate crop planning can be eradicate the fallow land in post rainy season with a great rid of the poverty and malnutrition in coastal saline zone to a great extend.

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NANOTECHNOLOGY IN AGRICULTURE: A POSSIBLE SUSTAINABLE WAY FOR CROP PRODUCTION

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Agriculture is practiced for food production via the cultivation of varied crops and the raising of livestock. It is considered the backbone economy for most developing countries as a vital role in progress and development. The agricultural sector is dealing with enormous challenges such as rapid climatic changes, a decrease in soil fertility, macro and micronutrient deficiency, overuse of chemical fertilizers and pesticides, and heavy metal presence in the soil. The universal challenge on our planet is the question of establishing food security for a rapidly increasing population in the world. The rising population in the world results in high demand for more food supply, and scientists and engineers are now searching for new ways to improve agricultural products. Over the last several years' farmers throughout the world were focussing on new innovations and technologies for enhancing crop productivity by overcoming different challenges and reducing agriculture and environmental sustainability issues. Nanotechnology refers to the science and engineering of tiny objects between one and 100 nanometers (a nanometer is one billionth of a meter). Nanotechnology can be applied to renovate agricultural divisions; it helps in learning the biochemical pathways of crops via modifying the conservative methods for evaluating environmental issues and their application to crop production improvements. The small size of nanomaterials offers a toolset that works at just the right scale to provide efficient, targeted delivery to living cells. The prospective use of nanoscale agrochemicals or environmentally friendly nanotechnologies such as nano-fertilizers, nano-pesticides, nano-sensors, and nano formulations in agriculture has transformed traditional agro-practices, making them more sustainable and efficient. There are several other utilization of nanotechnology such as wastewater treatment, reducing the quality of polluted soil, enhance the productivity of crops via security in terms of sensors to detect pathogens. The application of nanopore-bearing zeolite for slow discharge and improved efficacy of enrichers, nanosensors for measuring soil quality, and smooth supply mechanisms for herbicides are among the positive impact of nanotechnology in agriculture (Chinnamuthu and Boopathi, 2009). Several nanoparticles used for monitoring plant diseases are nano-forms of carbon, silica, silver, and alumino-silicates. The use of nanomaterials for agriculture can minimize nutrient wastage during applying fertilizer and promote the harvests by enhancing water and ingredient management (Gogos et al., 2012). Utilization of nanotechnologies for various agricultural aspects such as nano-pesticides delivery, slow and controlled release of nanoparticles containing bio-fertilizers, transport of genetic materials for crop development, and application of nano-biosensors for rapid detection of phytopathogen and other biotic and abiotic stresses. For enhancing agricultural crop production commonly used nanoparticles are polymeric nanoparticles, silver nanoparticles, nano-alumino-silicates, titanium dioxide nanoparticles, carbon nanomaterials, zinc oxide, copper oxide nanoparticles, and magnetic nanoparticles.

Fig 1. Application of nano urea in paddy field
(Credit: AgriculturePost.com)

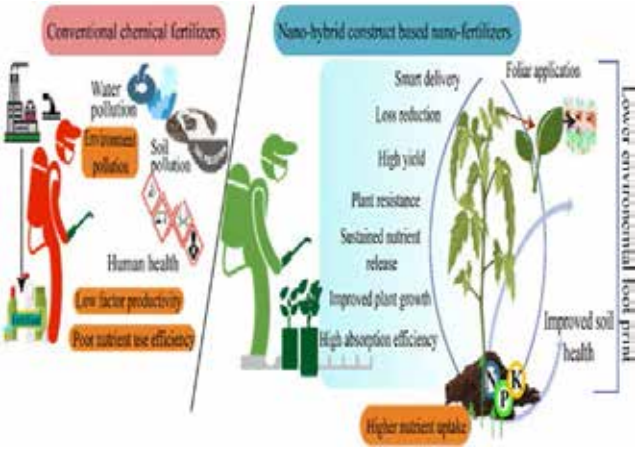

Fig 2. Shows benefits of nano fertilisers over conventional fertilizers (Credit: Babu S et al., 2021)

The application of nano-herbicides and nano-pesticides for the management of weed and pests have significantly increased crop productivity. Different types of nanoparticles such as polymeric nanoparticles and inorganic nanoparticles are utilized for the nano-herbicide formulations. Nanotechnology has a smart delivery system that would release nutrients in a slow and controlled manner to the targeted site to tackle nutrient deficiency in plants and improve crop productivity by enhancing the availability of essential nutrients to the plant. It has been observed that carbon nanotubes can enter the hard seed coat of tomatoes and significantly improve the germination index and plant growth. Nano biosensors convert biological responses to electrical responses via a microprocessor, are highly sensitive, and offer real-time signals to detect direct or indirect detection of pathogenic microorganisms, antibiotic resistance, pesticides, toxin, and heavy metal contaminants. Nano biosensors can also be used to monitor crop stress, soil health, plant growth, nutrient content, and food quality. In conclusion, we can understand that the use of nanotechnology in agriculture provides great opportunities to improve plant nutrition and stress tolerance to achieve higher yields but not all nanomaterials will be equally safe for all applications. The risks of nano-fertilizers/nano-chemical compounds should be carefully examined before use, and further biotechnological advances are required for a correct and safe application of nanomaterials in agriculture.

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PRESICION AGRICULTURE: FUTURISTIC TECHNOLOGY FOR IMPROVING LIVELIHOOD OF FARMERS

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Introduction:-

Agriculture is the backbone of the national economy and environmental sustainability. The population explosion is also increasing the food demand for human survival around the globe. Meeting such food requirement of the planet is currently one of the major issues of concern. Proper farming techniques can ensure a lot of quality food grain production which can solve hunger and malnutrition problems. But Indian agriculture is currently in a crisis situation. Most of the farmers want to sell their land and want to come out of farming due to requirement of hard work, non-remunerative, less availability of labours and lack of technology disseminations among them. But we need to understand that we need food for survival and we can't survive based on software or technologies.

The actual wealth and security of a country generally comes from its land and natural resource utilization techniques. Hence, we need such improved technologies which can ensure sustainable and highly productive agriculture with less labour requirement. Precision agriculture can be an effective solution to solve such issues. Precision Agriculture is generally defined as information and technology based farm management system to identify and manage variability within fields for optimum profitability, sustainability and protection of the land resource (Banu, 2015). Precision Agriculture (PA) highlights the improved efficiency which can be realized by dealing with the natural variability found within a field. PA involves the acquisition and processing of a large amount of data related to crop health. PA includes recouping real data about the conditions of soil, crops and weather from different sensors placed in the crop fields. Thus, based on these results, the productivity can be increased without having any kind of adverse effect by maximizing the resource input efficiency in the farm.

Importance of Precision Agriculture:-

Any crop production system is an outcome of complex interaction of seed material, water, organic or inorganic nutrients through fertilizers and pesticides also. So, careful management of such input materials is necessary to maintain the complex system and obtain proper output from it. It is also very much certain that there will be shortage of labour in maintaining agricultural operations in near future. Now, time has arrived when scientists need to rethink about bringing information technology and agriculture science together in such a way which can ensure not only environmentally sustainable crop production but also improve the livelihood of the farmers. The prospective of precision farming for economical and sustainable benefits could be visualized through lessened use of water, fertilizers, herbicides and pesticides besides the farm equipments (Banu, 2015). Farmers usually are conscious that their cultivated fields have variable yields across the landscape. These variations can be traced to management practices, soil properties and/or environmental characteristics with the help of precision farming techniques. So, as a whole the advantages of precision agriculture are pointed below:

- Precision farming approach recognizes site-specific differences within fields and adjusts cultural management actions accordingly (Singh, 2004).
- PA offers the capability to automate and simplify the collection and analysis of information (Banu, 2015).
- Different management decisions to be made quickly on small areas within larger fields through PA is also an important advantage.

- PA involves the accretion and processing of a huge amount of data related to crop health.
- Farmers can use PA to know precisely what parameters, where and in what amount, are needed for a healthy crop. All collected information related to soil nutrients, presence of weeds and pests, weather conditions need to be analysed to produce agronomic recommendations (Shafi et al. 2019).
- PA for small farms can help in subsurface drip irrigation for precise water and fertilizer application in crop fields and robots can be utilized for weed control, cultural operations and harvesting.

Tools and Equipments of Precision Agriculture:-

PA is the combination of different kind of technologies. The concepts and technologies developed in the framework of precision agriculture, including automation and robotics, make it possible to produce with a minimal environmental impact and at the same time all treatments and handling are recorded and can be uploaded in the different data bases. The different tools and equipments of precision farming are briefly discussed below:

1. Global Positioning System (GPS):

It is a set of 24 satellites in the earth orbit. It sends radio signals that are processed by ground receivers to determine the geographic position on earth. Having precise location information at any time allows soil and crop measurements to be mapped. GPS receivers, either carried to the field or mounted on implements allow users to return to specific locations to sample or treat those areas (Banu, 2015). Yield monitors when linked with a GPS receiver can provide data necessary for yield maps. Yield measurements are essential for making any kind of crop management decisions.

2. Geographic Information System (GIS):

It is a kind of software that exports, imports and processes spatially and geographically distributed data. An important function of an agricultural GIS is to store layers of information, such as yields, soil survey maps, remotely sensed data, crop scouting reports and soil nutrient levels.

3. Yield monitor:

This generally include several sensors and other components, including a data storage device, user interface (display and key pad), and a task computer located in the combine cab, which controls the integration and interaction of these components. The sensors measure the mass or the volume of grain flow (grain flow sensors), separator speed etc.

4. Grid soil sampling and variable rate technology (VRT) fertilizer application:

This generally include several sensors and other components, including a data storage device, user interface (display and key pad), and a task computer located in the combine cab, which controls the integration and interaction of these components. The sensors measure the mass or the volume of grain flow (grain flow sensors), separator speed etc.

5. Remote Sensors:

Remote sensing is collection of data from a distance. The remote sensors are categorically aerial or satellite sensors. Remotely-sensed data provide a tool for evaluating crop health. Change in colour of the field indication is one of the important features of the remote sensors. Arial and satellite imagery can be processed to provide vegetative indices that reflects the plant health.

6. Proximate sensors:

For measuring soil parameters like N status, soil pH these type of sensors can be used.

7. Precision irrigation system:

Recently, technologies are developed for sprinkler irrigation by controlling the irrigation machines motion with GPS based controllers for achieving higher water efficiency.

8. Precision farming on arable land:

PA techniques on arable land is the most widely used and most advanced among the farmers. Controlled traffic farming is a whole farm approach that aims at avoiding unnecessary crop damage and soil compaction by heavy machinery, reducing costs imposed by standard methods.

Challenges for Precision Agriculture:-

Adoption of PA by farmers is still not achieved yet in larger scale owing to some particular challenges in it. The major challenges are mentioned below:

1. Hardware cost:

PA system depends mostly on hardware such as sensors, drones, wireless nodes, spectral imaging sensors etc., which are used to assess multiple parameters in crop. These sensors have various limitations including high development, maintenance and deployment cost. These kind of huge amount is not manageable for the poor and marginal farmers in most cases.

2. Variable weather conditions:

Various weather parameters like rain, wind, and other environmental variations can affect sensor nodes placed in the field. The satellite, air borne and drone platforms are also sensitive to weather variations. Images acquired by these platforms is affected by contamination of clouds and other natural aerosols.

3. Literacy rate:

Literacy is an important factor which influences the adoption ratio in PA. In developing countries like India where the illiteracy rate is high, farmers grow crops based on their experience. They don't want to adopt new technologies which in turn results in poor production of the field crops. Since resources and education are limited in underdeveloped areas with low literacy rates, PA is not very common.

4. Interoperability:

Digital standards are a major barrier to interoperability in PA. Interoperability is not only hindering the adoption of new IoT technologies but also inhibits the gain of production efficiency through smart agriculture applications.

Conclusion and the way forward:

PA in many developing countries has numerous kind of opportunities for farmers to identify better high yielding location specific crops. Thus a farmer can be a breeder himself by producing specific crops for particular locations based on site specific management. The objective of PA is to provide decision support systems based on multiple parameters of crops, i.e., soil nutrients, water level of the soil, wind speed, intensity of sunlight, temperature, humidity, chlorophyll content, etc. It can address both economic and environmental issues which are effecting present agriculture today. PA can provide a platform for industrial and social activities by helping rural families to improve their livelihood through high tech farming. Government can also provide facilities of subsidy or soft loans to the farmers for adoption of PA to reduce crop loss and maintaining ecological sustainability. In the end, precision agriculture's success depends heavily on finding the knowledge needed to guide new technologies quickly and effectively.

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HIGH DENSITY PLANTING (HDP) AND FRUIT PRODUCTION

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Now a day, accommodating maximum number of plants per unit area is a very popular and effective trend in terms of higher yield with quality production. Most of the fruit producing country follow high density planting (HDP) by manipulating the spacing between trees. It was practiced first in temperate fruit crops in Europe at the end of 1960. India is the second largest producer of fruits in the world. However, the average productivity and per capita availability of fruits in our country is much lower as compared to many other fruit growing countries.

Old and senile orchards, wider spacing, low yielding varieties, poor orchard management and inadequate technological up-gradation and adoption by the growers are the main reason behind the low productivity. Beside low productivity decline in the availability of cultivable land and increased demand of fruit and fruit products, have given thrust to the concept of high density planting (HDP) in fruit crops.

High density planting gives earlier production and higher return per unit area, shortens juvenility, eco-friendly, provides efficient land use and better use of resources like light, water and fertilizers, efficient pesticides application, besides, in this system the harvesting becomes easy. The growth and shape of the trees are managed shorter by ensuring proper canopy management suitable pruning method. Earlier, HDP was commercially followed in most of the temperate tree and nut crops all over the world for its higher proximity of suitable and compatible dwarf rootstock. But day by day HDP got more attraction among the fruit grower for its higher economic return. The basic principle of practicing HDP in fruit crops is to the maximum utilization of land and solar radiations to obtained higher productivity. In HDP the orchard receives well distributed light throughout the canopy and a very good balance between vegetative growth and cropping is maintained which results high yield with quality fruit.

The amount of photo-synthetically active radiation (PAR) intercepted is the ultimate limit on productivity. The HDP orchards should be maintained based on average light interception over the life of the planting. A tree should have a large portion of its volume devoted to bearing than one with most of its volume devoted to tree support, middles or other functions for getting much potential for productivity (Mitra et al, 2008). Tree canopy management, especially size control has become a priority for reducing production cost and increasing fruit yield and quality. The objective of canopy management is to optimize the plant model in such a way so that it may intercept maximum light by tree training, pruning, branch and tree orientation.

Pesticides have a very important role in commercial fruit cultivation because it has a vital role in protection of fruit crops from disease and pest. In 1985, Bukovac stated about some trends in spray application technology of fruit production. Orchard designs with shorter height plant by the use of dwarf variety of cultural practice like- training and pruning is much easier to spray as well as maintaining other cultural practice. As a result, it reduces the labour cost and clearly pays extra dividends for the grower.

In fruit production, cost for harvesting is up to 30% of total production cost; especially for mechanical harvesting. Taller trees are more prone to fruit damage due to harvesting. Commercial orchard should be raised up with dwarf canopy by following HDP to reduce harvesting cost as well as time.

Fig: High density planting in Papaya

Fig: High density planting in Banana

Fig: High density planting in Guava

Methods of HDP:

1. Control the tree size:

   Tree size is largely controlled by the combination of the following four variables.

   - Genetically dwarf variety.
   - Dwarf root stock.
   - Training and Pruning.
   - Growth retardants.

2. Regulate the planting systems:

   Here closer spacing is followed as compare to conventional planting system.

   To fulfill the increased demand of fruits with quality and quantity because of its nutritional security for the burgeoning population it is the urgent need to accommodate ten times more plant per unit area (Srivastava, 2007). It varies with growing region, climatic condition, species, variety, rootstock, agro-techniques adopted for a particular crop. In India, HDP has been successfully followed not only in temperate fruit crops but also in so many tropical and subtropical fruit crops like- mango, citrus, pineapple, banana, guava, litchi, papaya etc.

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CLOUDBURST, ITS CAUSES AND ITS IMPACT ON ENVIRONMENT-A REVIEW

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Very recently a cloudburst triggered roaring flood took place on Friday, 8th July, 2022 at the holy cave area of Amarnath, Jammu and Kashmir. The automatic weather station inside the cave reported around 133 mm of rainfall starting from 4:30 pm to 6:30 pm on that day. Therefore the base camps near the caves were flooded damaging 25 tents and three community kitchens of the pilgrims. The cloudburst dumped heavy rain and thick stream of sludge and mud rolled down from mountain to valley. At least 16 people died and over 60 were injured in the flash flood when water swept away the camps pitched at the base camp at Baltal.

What is cloudburst?

Cloudburst is heavy precipitation event over a small area within short time spell. According to India Meteorological Department (IMD), cloudburst is unexpected rainfall phenomena when the rainfall amount exceeds 100 mm per hour over a geographical area of 20-30 square km (Das, 2015). Cloudburst result in sudden intensive rainfall and formed when warm mass come in contact with the cold air mass. Cloudburst is considered as extreme weather event or sometimes referred to as weather hazard (Figure 1).

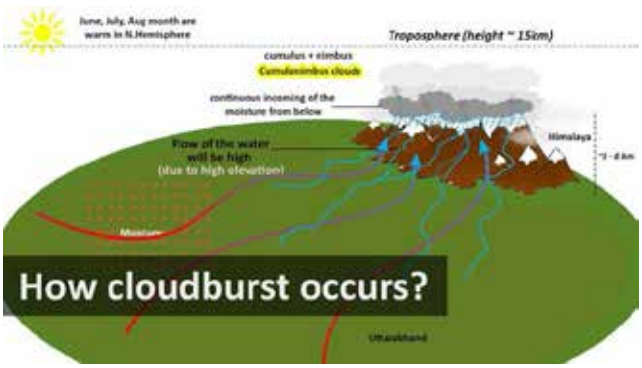

Figure 1: Formation of cloudburst

Figure 2: Flash flood

Causes of cloudburst

When warm monsoon air interacts with the cold air, there is formation of huge amount of cloud. This type of cloud formation intensifies in the mountainous region due to orographic factors. The cloudburst strikes at random with a lightning speed, and normally lasts for a short span of time leaving behind a trail of devastation (Anbalagan, 1996). Cloudburst generally occurs along the isolated slope facing towards west and south direction and it occurs during the late hours of the day (Asthana and Asthana, 2014). It can be identified on the basis of inundation occurred mostly along the first

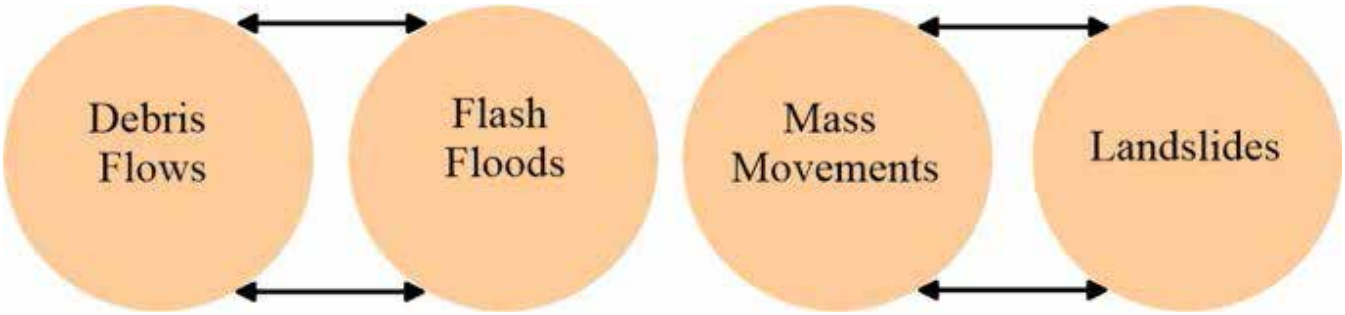

Figure 3: Cloudburst-triggered hazards

and second order drainages in hilly terrain during monsoonal rainfall and associated debris flows have caused severe damage to settlement and infrastructure (Khanduri, 2018a). Cloudburst events occur at meso-scale (2-20 km) and may be difficult to distinguish from thunderstorm (Orlanski, 1975). Cloudbursts occur during the monsoon season in the Himalaya and trigger debris flows, flash floods, landslides, and mass movements (Figure 2). Fragile landscape, rough and rugged terrain, and precipitous slope accentuate the magnitude of such geo-hydrological hazards to occur more frequently. Cloudburst-triggered hazards like debris flows, flash floods, landslides, and mass movement have caused large-scale destruction of people, land, and property (Wang et al., 2016; Mayowa et al., 2015; Malla et al., 2020; Sim et al., 2022). Recently due to fast warming up of the ocean surface, the huge moisture laden air reaches to Himalayas and produce cloudburst.

Why does not the system alert before the occurrence?

In January, 2021, IMD with the help of state government installed one radar in Kumaon in Mukteshwar to predict extreme rainfall and cloudbursts of that region. Doppler radar is ideal for real-time tracking of potential cloudbursts that allows it to track the air pressure and moisture.

Economic and environmental impact of cloudburst and associated flash flood

The Uttarakhand Himalaya has many eco sensitive zones which are vulnerable to eco-hydrological hazards like cloudburst and flash flood. The most devastating cloudburst triggered flash flood event of this century took place on 16th to 17th June, 2013 in the Kedarnath in which more than 10,000 people were killed and the whole Mandakini-Alakananda valley were devastated (Upadhyay,2014). Several studies have been carried out on cloudburst-triggered debris flows and flash floods in the Himalaya (Shugar et al., 2021; Byers et al., 2018; Cook et al., 2018; Asthana and Sah, 2007) (Figure 3).These studies were conducted covering the entire Himalaya. Critical analysis of those reports discloses the environmental impact of cloudbursts in terms of forest and fruit trees dislocation, land degradation, and arable soil erosion etc (Figure 4). It also evaluates the human and economic losses like the killing of people, loss of existing crops, and damage of houses and cowsheds, respectively.

Figure 4: Land slide after flash flood

Conclusion

Cloudburst-triggered flash floods and mud flow are natural calamities in the Himalayan regions. They occur naturally and cannot be stopped and the associated environmental and economic losses are also huge. However, the severity of these natural calamities can be minimized by establishing dense rain gauge network and hourly rain data to document all cloud burst and mini cloudburst events.

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ENVIRONMENTAL STRESS AND RHIZOBIUM RESPONSE

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Rhizobium: A quick explanation

Enormous population pressure and a lack of available arable land are currently two major concerns of agriculture. In certain areas, the need for daily food has already prompted the adoption of destructive agricultural practises and the utilisation of marginal land for crop cultivation. The situation is particularly dire in tropical areas because of the fragile soil structure, erosion, insufficient soil organic matter, and improper farming. One of the many frequent effects of poor soil management is the depletion of nutrients, an unjust N balance, and soil acidification. Thus, since this nutrient typically restricts crop productivity, adequate N management is required. In this context, for sustainable land management, Biological Nitrogen Fixation is a vital and key process which is inextricably depends upon Rhizobium, a group of small, rod-shaped, gram-negative bacteria that collectively have the ability to produce nodules on the roots of leguminous plants and fix atmospheric N in those nodules.

What is Stress Response?

It's critical to understand how each species develops and reacts to specific environmental factors when researching any living thing. To understand how bacteria live, develop, and survive, one must ascertain criteria is how they react to environmental cues or stressful situations. Every bacterium has ideal settings that make this process simpler, but the ability to adapt is necessary for the bacteria to survive in a changing environment or under other types of stress. This adaptation is a reaction to stress. The bacterial stress response enables microorganisms to endure unfavourable and varying environmental conditions. Different bacterial processes identify various environmental changes and mount the proper response. A bacterial cell can react simultaneously to a wide variety of stresses and the various stress response systems interact with each other by a complex of global regulatory networks.

Examples of Stress Response in Rhizobium

1. Water Stress:

Rhizobial survival rate, soil growth and population structure, nodule formation and longevity, leghaemoglobin synthesis, and nodule function are all significantly impacted by water or moisture stress, making it one of the most important environmental factors. Furthermore, severe stress may lead to irreversible cessation of N2 fixation. Research has shown that nitrogenase activity decreases under drought conditions. Decrease in nodule cortical permeability, enforcing a primary limitation in oxygen supply to the bacteroid zone, restricting respiration and resulting in a simultaneous decrease in nitrogenase activity and Rhizobium population. Dry and hot conditions, sandy soils or uncovered soils more adversely affect rhizobial survival and growth, and can be crucial for effective nodulation when rains are delayed after planting.

2. Temperature Stress:

In arid and semiarid regions of the tropics, the soil temperatures near the surface can be very high. The soil temperature decreases rapidly with depth, reaching moderate 35°C, at 15 cm. It appears that rhizobia are more resistant to high temperatures in soil than in laboratory conditions. The flow of chemical signals between rhizobia and their host is greatly influenced by temperature, which reduces nodulation. In tropical soils, high temperatures reduce rhizobial survival and establishment. Root zone temperature affects rhizobia survival in soil and the exchange of chemical signals between the two symbiotic partners even before nodule development. The optimum temperature for rhizobia growth is 25-30 C.

3. pH Stress:

The ideal pH for the growth of Rhizobium is considered to be between 6.0 and 7.0. The rhizobia strains vary widely in their acidity tolerance. Some mutants of R. leguminosarum have been reported to be able to grow at a pH as low as 4.5, R. meliloti is viable only when the pH is down to 5.5, but B. japonicum cannot grow at the extremes of the range that is below 4.5 or above. Alkaline or acidic agricultural soil has a great influence on the survival or multiplication of rhizobia and can affect both symbiosis partners. Stress regarding soil reaction can also retard Rhizobium from growing, leg-haemoglobin production, infection process, including the exchange of molecular signals between symbiotic partners, attachment to the roots, and subsequent establishment of a viable nitrogen fixing symbiosis with a legume host.

4. Salt Stress:

Degradation of land and Salinity are the major factors that threatening agriculture in arid and semi-arid tropics. Biological N fixation by legumes may constitute a sustainable alternative to chemical fertilization in salinity affected areas, when adapted cultivars and inoculants are available. The legume-Rhizobium symbioses and nodule formation on legumes are more sensitive to salt or osmotic stress than the rhizobia. Salt stress inhibits the initial steps of Rhizobium-legume symbioses by reduction in respiration of the nodules, reduction in cytosolic protein production, specifically leghemoglobin, by nodules. The salt injury on the symbiotic interaction not only inhibits the formation of the nodules, but also thereby leads to the inhibition in nitrogenase activity and reduction of the growth of the host plant, formation of non-functional nodules with abnormal structure, and degradation of peribacteroid membrane.

5. Oxidative Stress:

Oxygen not only has the prominent role in the critical function of energy generation but also has the ability in the generation of oxidative stress. The oxygen sensitive assimilatory process of nitrogen fixation in rhizobia-legume symbiosis but the need for oxygen in order for cells to respire is an example of the balance that must be carefully controlled (Fischer, 1994). The root nodules formed as part of symbiosis between bacteria and plant, provide the ideal and essential micro aerobic environment for the nitrogen fixing bacteria. Lack of suitable level of oxygen in the soil limits the Rhizobium growth, function, and multiplication by restricting the bacterial cell respiration which in turn affects the nod gene and leghaemoglobin production as well as reduce nitrogenase activity and N-fixation.

6. Nutrition Stress:

The organic matter percentage and nutrient content differs from soil to soil according to fertility status of each soil. Some of which having around 5 percent while other does not exceed 0.5 percent such as in arid and semi-arid soils. In fact, organic matter is the sink of soil nutrients. Most of the N-fixing micro-organisms require a good supply of organic carbon as an energy source. The effect of organic matter on soil microbial activity depends upon type of materials, its nutrients content and initial fertility of soil. When in their natural environment, rhizobia are rarely in conditions with a constant nutrient supply. During growing at sub-optimal levels of nutrients bacteria express appropriate cellular responses. Rhizobium have therefore developed a number of mechanisms that allow them to survive even long-term nutrient starvation and then to resume growth once conditions are favourable again. Due to organic matter and nutrient starvation, especially the lack of adequate nitrogen and phosphorous levels hamper the Rhizobium activity in soil and in host plant. The most important one is that cell metabolism slows to an almost halt for Rhizobium. Osmotic stress and soil acidity can also lead to nutrient-limited conditions, as the demands for calcium and phosphorus increase under these conditions.

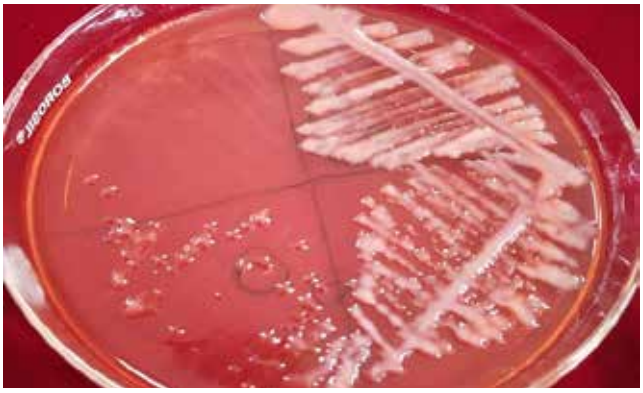

Fig 1. Rhizobium growth in YEMA media

Fig 2. Liquid Rhizobium culture

This in turn can lead to Rhizobium being unable to attach to root hairs during the nodulation process as the calcium-dependent cell surface components cannot function properly.

Conclusion

Tropical soils are often deficient in nitrogen; therefore, biological nitrogen fixation is a key process to agricultural sustainability. Rhizobium activity may be restricted as a result of environmental stress factors such high temperatures, drought, acidic soil, lack of soil moisture, presence of heavy metals, inappropriate oxygen and nutritional status in soil, etc., which may also affect nitrogen fixation. As a result, slow environmental circumstances have a significant impact on how legume-rhizobia interactions are regulated because they can stop rhizobia from growing, multiplying, and surviving in the soil rhizosphere. The stages of the legume-Rhizobium symbiosis, such as molecular signalling, the infection process, nodule formation, and function, are also negatively impacted by stress conditions, which lowers crop production and nitrogen fixation. Therefore, Selection of proper nitrogen fixing Rhizobium strain that is tolerant to a broad range of environmental stresses is important for agriculture system and besides that good agronomic as well as soil management practices, genetic modifications, and monitoring of adaptive mechanisms of Rhizobium against stress management strategies are needed for sustainable production system.

HYDROPONIC: THE UPCOMING SYSTEM FOR CROP PRODUCTION

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Conventional crop cultivation or "open field agriculture," is becoming challenging since it requires a lot of land space, labor-intensive work, and water. Moreover, in some areas, such as metropolitan areas, there is an acute shortage of soil suitable for crop cultivation. In some areas, there aren't enough fertile cultivable arable lands due to poor topographical or geographical characteristics. But till date, the most readily accessible growing medium for crops is typically soil because it helps plants to flourish successfully by offering anchoring, nutrients, air, and water. Besides the scarcity of agricultural land due to a huge increase in population, soil can occasionally impose significant restrictions on plant development because in so many cases soil act as a home for nematodes and disease-causing organisms. Inappropriate soil reactivity, unfavorable soil compaction, poor drainage and a variety of factors that have a detrimental effect on the health and growth of plants are presented to them when they are grown in gardens and fields. Under such circumstances, soilless culture can be a successful alternative in near future. In so many types of soilless culture, Hydroponics is the most established and promising one.

Fig 1: Hydroponic Chamber

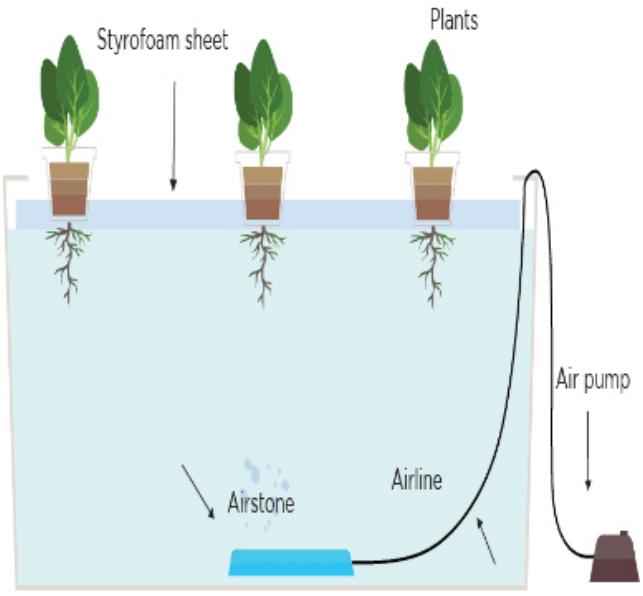

Fig 2: Hydroponic System

Fig 3: Vertical farming

The word "hydroponic" comes from the Greek words "hydro" which means "water" and "ponos" means "labour." Hydroponics is a part of Horticulture in which plants grow without soil by utilizing nutrient-enriched water. Sometimes it is also called as aquaculture, nutriculture, soilless culture or tank farming. Hydroponics can be practiced with or without the mechanical support of an inert medium such as sand, gravel or perlite.

In this system of farming, there is fine control over environmental factors like temperature and pH balance and maximizing exposure to nutrients and water. The fundamental of hydroponics is to provide plants with exactly what they require at the right time. To meet the specific needs of the plant being cultivated, hydroponics provides complete control over how much and how long the plants are exposed to light. It is possible to monitor and modify pH levels. Plant development is accelerated in an environment that is highly tailored and controlled. Mainly different types of vegetables and floricultural crops can be grown satisfactorily in hydroponic. Like-

lettuces, spinach, kale, tomatoes, peppers, cucumbers, basils, mints, gerbera, carnations cucumbers, green beans, strawberries, blueberries and cannabis.

Benefits of Hydroponics:

The major benefits of hydroponics are as follow.

1. Maximizes space
2. Conserves water
3. Facilitates micro-climate
4. Produces higher yield
5. Require less labor
6. Needs no soil
7. Produces higher quality food
8. Reduces supply chain
9. Suitable for off-season cultivation
10. Crops grow faster

Types of Hydroponic:

1. Wick:

In this type, an absorbent "wick" pulls nutrient-rich water up from a water reservoir to the root zone of crops and plant roots grow down through the medium. The growth medium also enables air (oxygen) to reach the roots.

2. Air-Gap:

The upper portion of a plant's root system is exposed to air while the roots are partially submerged in water that is rich in nutrients and oxygen.

3. Raft:

The roots of the crops are suspended in nutrient-rich water while they are situated on a floating surface. The oxygen is added to the water by an aquarium-style pump.

4. Ebb and Flow:

Plant roots spread out through the medium. Pumps are frequently used to deliver nutrient-rich water to the root zone area and let it drain back into a water reservoir after a certain period. (e.g., every 30 minutes).

5. Top Feeder:

Plant roots penetrate a surface. The growth medium enables air (oxygen) to reach the roots. A water reservoir is filled with nutrient-rich water that is pumped to the surface of the medium, allowed to percolate down to the root zone, and then drained.

6. Nutrient Film Technique (NFT):

Plants are arranged on a floating platform suspended in a trough with a small slope. The root system of the plant hangs with the upper portion exposed to the air (oxygen). The lower portions of the roots are exposed to nutrient-rich water that is pushed into the top (higher) end of the trough. Other root systems are bypassed (down) as the water returns to a reservoir.

Conclusion:

In recent years, hydroponics has gained popularity as a potential method for raising various crops. Hydroponics can make a significant contribution in locations with limited soil and water resources as well as for the impoverished and landless people, just as it is possible to grow short-duration crops like vegetables year-round in extremely small spaces with cheap labour. In India, the hydroponic industry is anticipated to expand rapidly in the next few years. To encourage commercial hydroponic farms, it is important to develop low-cost hydroponic technologies that decrease reliance on human labour and minimize total startup and operational expenses.

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ORGANIC FARMING FOR HEALTH AND FOOD SECURITY ORGANIC FARMING FOR HEALTH AND FOOD SECURITY

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There is an old proverb 'Health is wealth,' and this is the main region behind the increasing demand of organic product to sky-high day by day. Practicing organic systems over a long period of time also able to provide equal yields or even more the conventional methods. For India it is like to some extent 'Old wine in a new bottle.' Here it is a traditional method of farming without the use of chemical fertilizers and pesticides with an eco-friendly and socially responsible approach.

Actually organic farming is practicing agriculture, rearing of animals and allied industry without any chemical inputs. According to IFOAM, 2008 "Organic farming is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic farming combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved." Sir Albert Howard is widely considered to be the "father of organic farming". It relies on ecologically balanced agricultural principles like crop rotation, green manure, organic waste, biological pest control, mineral and rock additives. Organic farming makes use of pesticides and fertilizers if they are considered natural and avoids the use of various petrochemical fertilizers and pesticides.

Benefits of Organic Farming:

1. Helps to maintain environment health by reducing the level of pollution due to chemical fertilizer and pesticides.
2. Reduces human and animal health hazards by minimizing the level of chemical residues in the product.
3. Helps in keeping agricultural production at a sustainable level.
4. Reduces the production cost of agriculture as well as improves the soil health.
5. Ensures optimum utilization of natural resources for short-term benefit and helps in conserving them for future generation.
6. Saves energy for both animal and machine.
7. Reduces risk of crop failure.
8. Improves the soil physical properties such as granulation, good tilth and aeration which helps easy root penetration and improves water-holding capacity.
9. Reduces soil erosion.
10. To prevent antibiotics, drugs, and hormones in animal products.
11. Organically produced foods are natural and having better taste as compare to conventional agriculture.

Organic manures commonly in use in organic farming:

- Farm Yard Manure
- Green manure
- Vermi-compost
- Crop residues
- Bio-fertilizers

Weed control:

- Prevention
- Cultural Practices
- Mechanical Practices
- Competitive plant species
- Stale seed bed technique

- Biological weed management
- Bio-herbicides.

Disease and management:

- Conservation of natural enemies of pests
- Resistant varieties
- Crop rotations

Conclusion:

An environmentally sustainable system of agriculture like organic farming will be able to maintain a stable resource balance, avoid over exploitation of renewable resource, conserving inherent soil nutritional quality and soil health, and biodiversity. It will lead us to sustainable agriculture and create a sustainable lifestyle for generations to come.

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Scientific Articles

INDIA'S SMART AGRICULTURE STRATEGIES

Avinandan Jana
BSC Ag_3rd Year

An overview of Indian Agriculture

The history of agriculture in India dates back to the neolothic. India ranks second worldwide in farm outputs. Agriculture employed more than 50% of the Indian work force and contributed 17-18% to country's GDP.

What is Smart Agriculture ?

Smart Agriculture is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology-including big data, the cloud and the Internet of things(IoT)-for tracking, monitoring, automating and analysing operations.

Is Smart Agriculture the future of Agriculture?

Smart Agriculture has a real potential to deliver a more productive and sustainable form of Agricultural production, based on a more precise and resource-efficient approach. New farms will finally realize the eternal dream of mankind . It will feed our population , which may explode to 9.6 billion by 2050.

Is Smart Farming in India really Possible?

India is embraced technology in every field of activity. It is adopting smart agriculture method through technology and innovation in the agriculture sector and this may prove to be a game changer in days to come by sustainability raising farmers income

How is this method beneficial?

Smart farming involves the application of sensors and automated irrigation practices. It can help monitor agricultural land, temperature and soil moisture. This would enable farmers to monitor crops from anywhere. Moreover, smart farming can help integrate digital and physical infrastructure, which would benefit small farmers. Agri-based , tech driven startups have been very innovative in assisting farmers and revolutionising farming techniques. They have also addressed one of the most powerful headwinds through climate-smart farming.

Smart Agriculture strategies in India-

- Technology Integrated Agriculture- Precision agriculture and smart farming involves the integration of modern technologies(like the IoT, Machine Learning) into agricultural practices, it upgrades traditional agricultural practices to accelerate processes, increase efficiency, production and quality of agriculture.
- Automation and Robotic Labour- Farmers can delegate these labour-intensive tasks to robotics and automated based solution. Such solution have the capability to perform tasks that range from seeding and watering to harvesting and sorting.
- Irrigation and Crop Management- Farmers can use irrigation for crops when farms have inadequate rainfall or for maintaining landscapes they can balance the right amount of water with the help of automatic irrigation.
- Drones and sensors- Drones can travel at certain altitude and visually check the crops condition.

Government Partnership-

- In 2018, NITI Ayog partnered with IBM for developing a crop yield prediction model using AI.
- The Indian government has partnered with Microsoft foe empowering small-holder farmers in India.

- The government has launched a project Sensor-based Smart Agriculture(SENSAGRI) involving six institutes. In this project, drones could be used for smooth scouting over land fields, for collecting precious information and transforming the dat to farmers on a real time basis.

Impact of Budget 2022-

Budget 2022 focuses on smart and modern agricultural practices. According to Prime Ministers of India, agricultural loans have surged 2.5 times over the past seven years. This loan will help to modernise agriculture significantly and enhance natural farming with the prime focus on Agri-Waste management.

Drawbacks of Smart Agriculture-

- The smart agriculture based equipments require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries.
- The smart agriculture needs availability of Internet continuously. Rural part of most of the developing counties like India do not fulfil this requirement. Moreover internet conection is slower

IMPORTANCE OF HORTICULTURE CROPS

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The importance of horticulture crops can be enunciated by studying the following points;

1. Horticulture crops contributes to the national income:

The main contribution of horticulture crops is to increase the national income. It also increases foreign exchange earning achieved through the export of produce.

2. High production per unit area:

A horticulture crops give very high production per unit area as compared to cereals and pulses crops. In horticulture crops inter-crops are also taken during initial years of cultivation. For example agronomic crops like Rice gives 4.3 t/ha yield, Jowar give 4-5 t/ha yield. Whereas horticulture crops like Mango gives 18-19 t/ha, Banana gives 30-35 t/ha and Tomato gives 50-60 t/ha

3. Fruit and vegetables are "protective foods":

Fruit and vegetables have good source of vitamins and minerals, proteins and other substances which are needed for human body. viz,. Minerals like calcium, iron, phosphorus, etc. and vitamin such as A, B complex, C are in adequate quantity.

4. Source of income throughout the year:

In vegetable crops, some of the vegetables are annual crops. Some vegetables give yield within month of planting/sowing, while crops like coconut give income throughout the year.

5. Best utilization of undulating and barren land:

The horticulture fruit crops such as Cashewnut, Aonla, Ber, Mango, Tamarind, Jamun, Karonda, can be grown on undulating, barren/wastelands where agronomic crops cannot be grown on such land.

6. Utilization of dry land areas for fruit crops

like ber, custard Apple, drumstick, aonla, jamun etc., can be utilized under low water availability.

7. No recurring expenditure:

In the case of fruit crops, there is no recurring expenditure like layout of orchards every year encountered in the case of agronomic crops. There is no need to search planting material every year.

8. Industrial use:

The Horticulture crops are used in various industries such as Coconut in Coir and toys industries, aonala, turmeric, alovera, clove in Medicinal industries, turmeric, alovera in Cosmetic industry, flower like jasmine, rose in perfumery industry and kokum juice, ginger, turmeric, mango Pulp, aonala, candy in Preservation industry:

9. Saving money:

10. Horticultural crops, especially the fruit crop

reduce environment pollution and reduce soil erosion and help in increasing precipitation.

11. Fodder to cattle:

During famine, leaves of some of the crops such as Tamarind, Aonala, Ber etc. are used as fodder.

12. Social Importance:

a) Use in religious functions: eg. Coconut, Turmaric, Arecanut, Flowers of various kinds, Betalvine etc.

b) Symbol of love affection and friendship: Flowers are used for express affection and decorating halls and welcoming function.

Why is horticulture important

Horticulture enriches diets:

Horticulture — specifically, growing fruits and vegetables — provides critical nutrients for a balanced diet. Diets low in fruits and vegetables contribute significantly to some of the world's most widespread and debilitating nutrient-related disorders.

Horticulture increases incomes:

Farmers growing high-value crops, such as fruits, vegetables, flowers or herbs, consistently earn more than those growing other commodities. Horticulture can be an engine for agricultural and economic diversification

Improving livelihoods — by increasing farmer profits and diversifying nutrient-rich diets — are major goals of the Horticulture Innovation Lab's research efforts around the world. The program is guided by the Global Horticulture Assessment , an in-depth, collaborative, global analysis that also identified these challenges for horticulture development:

- **Gender equity:** Vegetables, fruits and cut flowers are often grown and marketed by women, but women often have less access to markets, land, inputs and education. Addressing these constraints places women growers on the path to increasing productivity and expanding horticultural markets.
- **Technological innovation:** Given the complexity of horticulture, innovative "leapfrog" technologies can reduce constraints and input costs that limit the ability of smallholder farmers to achieve maximum profitability.
- **Access to information and research capacity:** Commercial success in horticulture depends on locally adapted research on tools such as improved cultivars, management tools, market knowledge and effective postharvest practices. Sustained horticultural growth requires access to reliable information, a well trained workforce and local capacity to conduct both original and adaptive research.

  These three themes of gender equity, technological innovation, and information access are critical themes in all projects of the Horticulture Innovation Lab.

  Working across the horticulture value chain

  The Horticulture Innovation Lab's research spans the horticultural value chain, from issues related to seed systems through produce marketing. Information resources created by the program are organized on this website in relation to the various stages of an agricultural value chain, including:

1. Seed systems and germplasm

How can farmers access higher quality seed and improved crop varieties? How can local seed saving practices be improved?

Fruit and vegetable production

What agronomic practices can improve horticultural crop production? How can production be more profitable for farmers

2. Soil and irrigation:

What tools and practices can help vegetable farmers improve soil health and access improved irrigation?

3. Pest management:

How can farmers improve pest management in their fruit and vegetable crops? What tools and practices can manage pests safely? How can horticulture farmers in developing countries use integrated pest management tools?

4. Postharvest practices

After harvest, how can fresh fruits and vegetables best be handled to maintain quality? How can fresh produce be handled, cooled, packed and transported to reduce postharvest losses? What tools make postharvest practices more successful? What training makes adopting improved postharvest practices a viable option for farmers, traders and others?

5. Food safety

How can critical food safety practices be better shared with farmers who handle fresh produce? What are challenges and solutions on small-scale farms in developing countries that may raise livestock and grow vegetables for fresh markets? How can scientific capacity to conduct food safety and microbial science in developing countries be expanded?

6. Nutrition

How can more consumers access nutritious fruits and vegetables? What agronomic practices support improved nutrition? What horticultural practices increase dietary diversification among farmer households?

7. Gender considerations

How can horticulture provide a pathway for women to improve their household's nutrition or income? How can training better serve the needs of women farmers, who often grow vegetable crops?

8. Training and extension

What methods improve agricultural extension of horticulture-related information? How can researchers learn skills that advance innovation and design appropriate solutions? What tools and practices make new technologies more available and likely to be adopted by farmers?

Research

Research in vegetables and fruits has been conducted for a long time in Kenya since the creation of the national Pyrethrum and Horticultural Research Station in Molo and the National Horticultural Research Centre in Thika in the late 1950s. Temperate fruit research was initially begun in Molo, while vegetable and tropical fruit research was carried out in Thika. Emphasis was placed on fruits and vegetables for local consumption and small quantities for export.

The Kenya Agricultural Research Institute (KARI), universities and non-governmental organizations (KENGO) currently conduct research in the area of vegetables and fruits. The latter carries out research on indigenous vegetables. This paper discusses vegetable and fruit research carried out by the Kenya Agricultural Research Institute.

The Kenya Agricultural Research Institute (KARI) was established in 1979 by an Act of Parliament. It is a semi-autonomous parastatal under the Ministry of Research Science and Technology. KARI has 15 National Research Centres, six Regional Research Centres and a number of sub-centres.

The mandate of the National Research Centres is to conduct research in order to generate and test improved technologies for improving agricultural productivity using multidisciplinary teams. The mandate of the Regional Research Centres is to carry out adaptive research to improve agricultural production systems in their mandate districts.

The following research Centres are involved in technology generation and testing to improve both fruit and vegetable production:

- The National Horticultural Research Centre, Thika
- The National Pyrethrum and Horticulture Centre, Molo
- The Regional Research Centres Mtwapa, Kakamega, Garissa and Kisii
- The National Plant Breeding Research Centre, Njoro
- The National Agricultural Research Centre, Kitale

Conclusion

Horticultural research has a major role to play in the improvement of the horticultural industry in Kenya. For the farmers to produce good quality fruits and vegetables for the export market, research should focus on the identification of high-yielding varieties adapted to different agroecological zones; availability of good quality planting material of the selected varieties and development of production and post-harvest technologies. Emphasis should be placed on maturity indices, post-harvest physiology, pathology and sea shipment. There is a need to diversify exports, train producers and conduct market studies. This could be done by KARI, HCDA and the Ministry of Agriculture.

MITIGATION STRATEGY IN AGRICULTURE

Samaj Mukherjee
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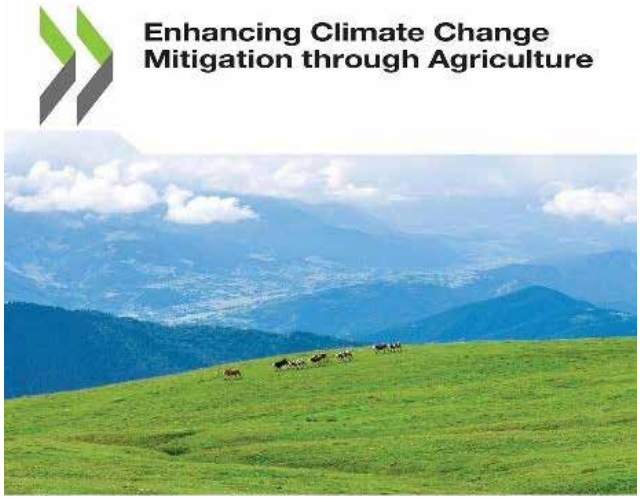
Introduction of Mitigation in Agriculture:

Mitigation means making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere. Mitigation is achieved either by reducing the sources of these gases — e.g., by increasing the share of renewable energies, or establishing a cleaner mobility system — or by enhancing the storage of these gases — e.g., by increasing the size of forests. In short,



mitigation is a human intervention that reduces the sources of GHG emissions and/or enhances the sinks. (Source: oecd.org)

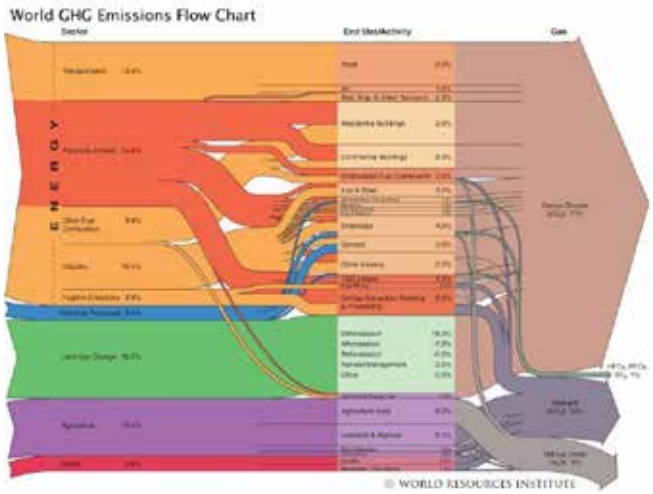
Why Mitigation in Agriculture?

1. SIGNIFICANT:

- 10% – 12% of Global Emissions.
- Agriculture contributes on average 35% of developing countries 'total emissions.

2. NECESSARY:

Reductions in other sectors will not be enough to achieve 2ºC and 1.5ºC targets.



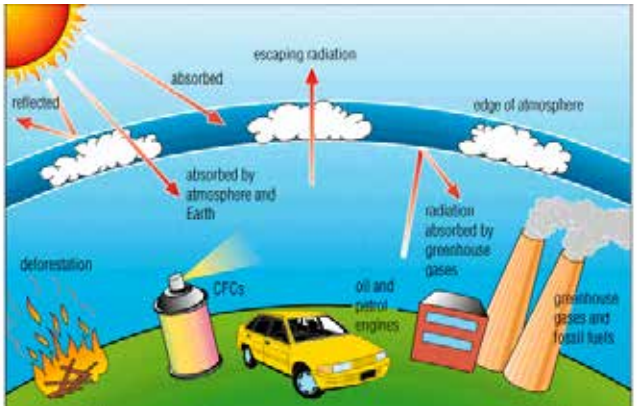
3. POSSIBLE:

Many practices are compatible with SDGs [Sustainable Development Goals], hence the possibility of "low emissions development". (Source: researchgate.net)

Agriculture Emits 3 Key Greenhouse Gases [Ghgs]

- METHANE (CH4) □ NITROUS OXIDE (N□O) □ CARBON DIOXIDE (CO2)

  AND CAN STORE CARBONIL IN PLANTS AND SOIL
- ORGANIC CARBON –



- Above – ground and below- ground biomass.
- Grassland.
- Soil organic carbon.

GLOBAL NET CO2e IS WHAT MATTERS TO THE CLIMATE

GLOBAL WARMING POTENTIAL OVER 100 YEARS

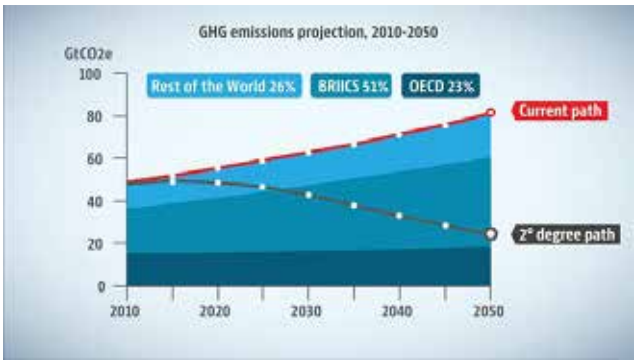
• (CO2): 1 • (CH4): 25x • (N□O): 298x

Units: tons CO2 Equivalent/yr.

One ton of carbon equals 3.67 tons of carbon dioxide (Source: slideshare.net)

Mitigation is a Reduction in Emission

Reductions are measured relative to the previous land use or supply chain emissions. The Reference can be a base year or baseline. A baseline is a projection into the future showing business-as-usual (BAU) emissions. (Source: slideshare.net)



Existing Mitigation Options in Agriculture

- PADDY RICE – alternate wetting and drying (AWD)
- LIVESTOCK SYSTEM – improving feeding, animal and herd management, pasture management.
- CEREAL CROPS – building soil organic matter, e.g., through integrated soil fertility management; nutrient efficiency through technologies such as urea deep placement; BNI (Biological Nitrification Inhibition Technology) in crops used to improve crop productivity.
- PERENNIAL CROPS – transitioning from annual crops or degraded land to agroforestry, forestry or grassland.
- Avoided conversion of high carbon landscapes (forests, peatlands, mangroves, grasslands)
- Reduced food loss and waste – storage packaging waste recycling
- Supply chain energy use – fertilizer production, cooling, transportation
- Dietary shifts – shift to low emissions food product, e.g., beef, chicken

Water Management in Paddy Rice Alternate Wetting and Drying

- Reduce (CH4) emissions up to 38%. Also reduce fossil fuel use, lodging and pests.
- Issues: required farmer control over irrigation, uneven incentives for water-level management, increased weeding, (N□O), difficult to verify.

Livestock Intensification

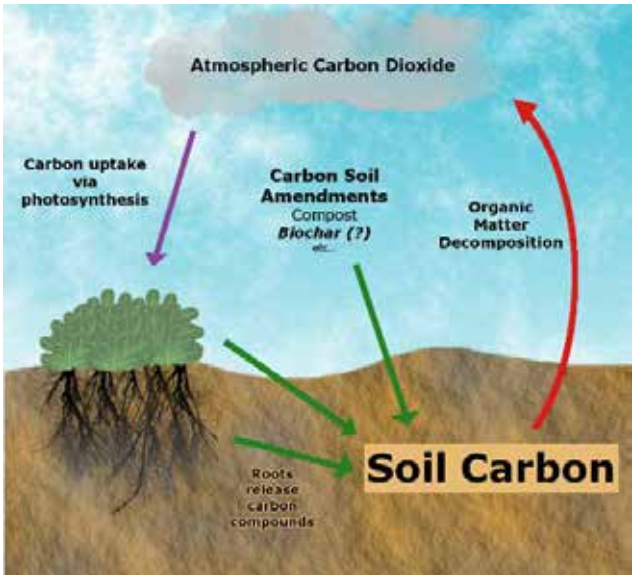
- Livestock intensification reduce emissions intensity up to 20X for beef, 300X for dairy.
- Improve digestibility of feed and reduce numbers of animals.
- Issues: absolute emissions increase, cost of improve feed, cultural barriers, emissions for land use change and feed productions, other environmental impacts.
- Resource: tackling climate change through livestock.

Efficient Use of Nitrogen Fertilizers

- Increasing NUE from 19 to 75%, decreases emissions intensity by 56% (12.7 to 7.1g N2O-N/Kg N uptake)
- Increase efficiency of N fertilizer uptake by plants, e.g., timing, rates, deep placement, micro dosing.
- Issues: most smallholder farmers only use small amounts of N, so absolute emissions will increase.
- Resources: Site-specific nutrient management.

Soil Carbon Sequenstration

- Agriculture is the major driver of soil carbon loss
- But soil C can be managed; e.g., reduced burning, legume intercropping, agroforestry, compost, manure, deep-rooted plants.
- Issues – finite, reversible, ambitious potentials, competition for biomass inputs, insufficient other nutrients, MRV costs and detectable changes only after – 20 years.



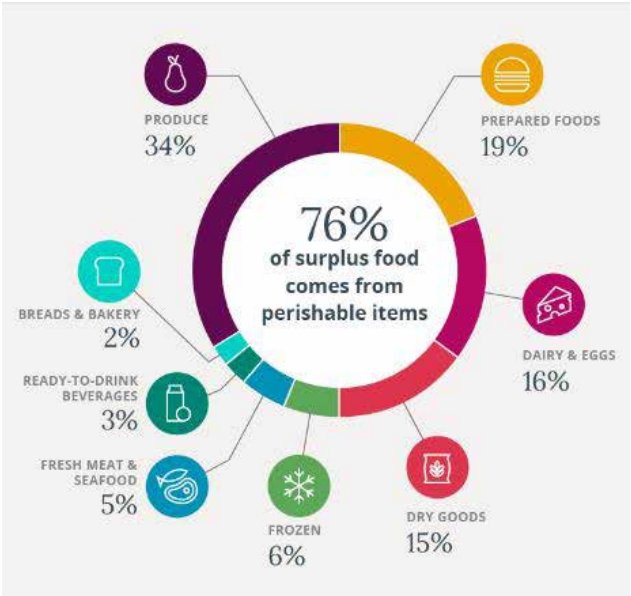
Agroforestry

- Global review shows maximum carbon increases in – 1) plant biomass in improved fallows: 11 tC/ha/yr. and 2) soil C in silvipastoral systems: 4 tC/ha/yr
- Issues: finite, reversible, can conflict with crops, classifications as forestry or agriculture, trees on farms often not counted due to scale.

Reduce Food Loss and Waste in Supply Chain

- 10-20% reduction of emissions based on assessment of Feed the Future projects in Asia.
- Issues: reduces emissions intensity, but not necessarily total emissions; lack of available data.

(Source: slideshare.net)



THE EFFECT OF HIGH-YIELDING VARIETY ON RICE YIELD, FARM INCOME

Silpa Chakraborty
Bsc Ag_3rd Year

Introduction

High-yielding varieties developed in the 1960s and 1970s at the International Rice Research Institute (IRRI) and elsewhere benefited farmers and the public, ultimately increasing yields and reducing the cost of rice to consumers.HYVs become popular in the 1960s and play an important role in the Green Revolution.

Rice production and productivity increase are important for ensuring food security, reducing hunger and important for economic growth.A number of technologies have been identified as potential for increasing rice yield including high-yielding rice varieties, efficient agronomic management techniques, enhancing nutrient and water availabilit. Among these technologies improved or HYVs is a particularly successful intervention used to increase yields.

Poor farmers directly benefit from adopting new agricultural technologies through increases in farm household income, and indirectly, through reduced unemployment, and higher wage rates of landless labourer.

Characteristics

Rice varieties should have:-

- Good grain quality (especially, color, shape, taste and aroma.
- Optimum yield potential and stability over seasons
- Maximum tillering capacity for weed competition
- Resistance or tolerance to major diseases, insects, and other stresses (i.e. drought and flood) of the areas

Indoor Plants don't need direct sunlight but they can't compromise on water, except succulents. So, here are 5 scientific methods to water indoor plants when you're away from home. These methods are really simple to install. Also, you hardly have to spend a few pennies, plus most of the required materials are available at home. So, let's check them out.

Objectives

By using High yielding varieties we can get suffecient yield within a short duration. Moreover,they are resistantce to disease and insects and responds well to fertilizers.Therefore, the tendency of spraying insecticide and pesticides also decreases. The cost of production will also be less and environment friendly to some extent.Hence, marketable value of the produce will be high.Our objective is to expand the production which results in getting maximum yield, and if we can increase the yield simultaneously farmer will be able to sell more produce in the market thereby increasing their income.

How is HYV Seeds Benefits The Farmers?

- High Yielding Variety Seeds (HYV) has shorter lifecycle and thereby enables the farmers to go for multiple cropping. For example, new seeds of rice complete their lifecycles in 110 and 120 days respecively. The traditional varieties of rice on the other hand, take about 130 and 150 days respectively to harvest. Thus, enable the farmers to economize on land.
- HYV Seeds needs a lot of water for better yields. If it is considered in terms of water required per quintal of wheat or rice, the new seeds require less water as compared to that of the traditional varieties. HYV thus economize on water and farmers do not have to wait for monsoon.
- (HYV) under optimal conditions requires more labour per unit area, and thus help in generating more employment.
- The adoption of HYV does not require any special skill and farmers of various socioeconomic and cultural backgrounds can adopt the new seeds easily.
- Yield growth can also contribute to the nutritional outcome of families by increasing food available to households for own consumption or increasing income available to households.
- Higher crop yield per area (hectare)

Conclusion

New varieties that aim to replace the old varieties must offer a clear advantage, such as higher yield. Additionally, the farmers with small land holdings can also get the advantage.So that farmers will have a suitable market value for their produce from these new varieties.

By adopting this ,Farmers are expected to rapidly adopt new varieties that are superior to the older varieties being planted. It can also be grown to the non traditional areas (areas prone to drought and famines).HYV Seeds has shorter lifecycle and thereby enables the farmers to go for multiple cropping, which helps in increasing farm income.

IMPACT OF GLOBAL CLIMATE CHANGE ON AGRICULTURE

Ashish Chowdhury
2nd year, Bsc Hon's Agri.

Abstract:

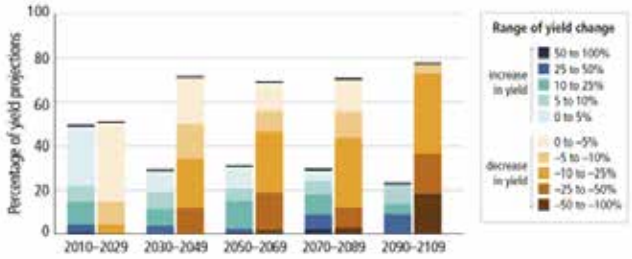
Climate change is a long-term shift in global or regional climate pattern. It is a alteration of temperature and typical weather patterns of a place. Climate change may cause weather conditions to be less predictable. From different types of research these unexpected weather conditions can make it more difficult to maintain and grow crops in regions that rely on farming because of expected temperature and rainfall levels can no longer be relied on. Also Physical effects of climate change make an impact on livestock yields and economic consequences of these potential yield changes.

Introduction:

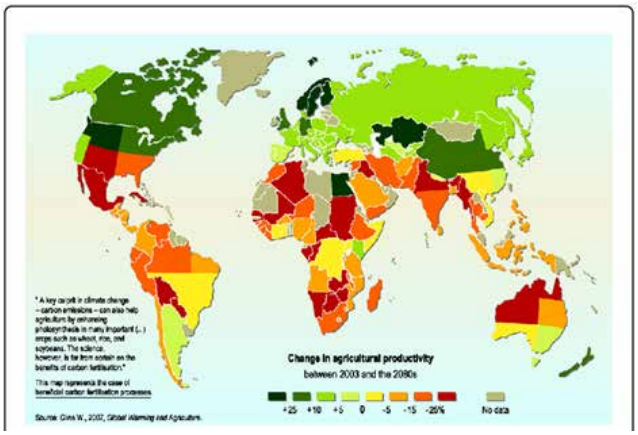
Climate change and Agriculture are correlative to each other, both of a part of global scale. The basic role of agriculture in human properity, concern has been expressed by many institution and others regarding the dynamic effects of climate change on agriculture productivity. Global warning is prominent to a important impacts on condition affecting agriculture, including increase of temperature, glacial run-off, Carbon dioxide and the interacts of air elements.

Effects on worldwide agriculture:

Africa is one of the part of the world that is the most vulnerable to the impacts of climate change(IPCC 2014). In addition to climate change, land degradation is also expected to affect African countries(Hummel 2015). IPCC is the substantial climate changes has already occurred since 1950s, that it's likely the global average surface air temperature will increase by 0.4 to 2.6 degree C in the second highest of this century. Crop production is projected to decrease in many areas during this 21st century as the climate changes. Below figure which summarize average crop yields projection across all regions with or without adaption by farmers, showing a scenario of increasing trend towards to widespread yield decreases.

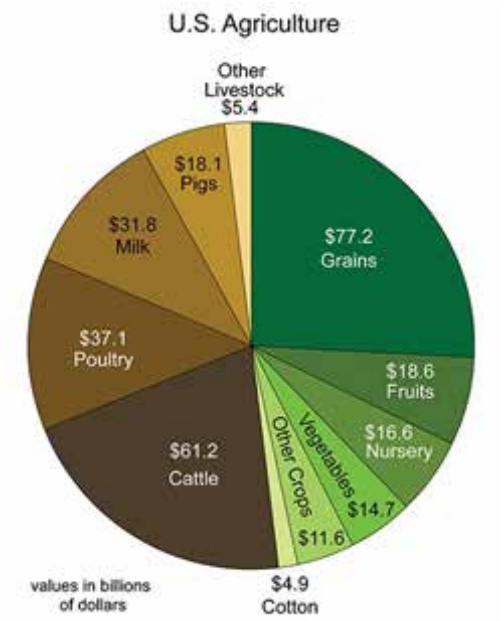


Due to global warming, the highlands of the tropics have become more important for planting fruit trees. The climate at high altitudes is mainly characterized by decreased temperatures and increased solar radiation. The first world climate conference takes place in 1979 in Geneva.



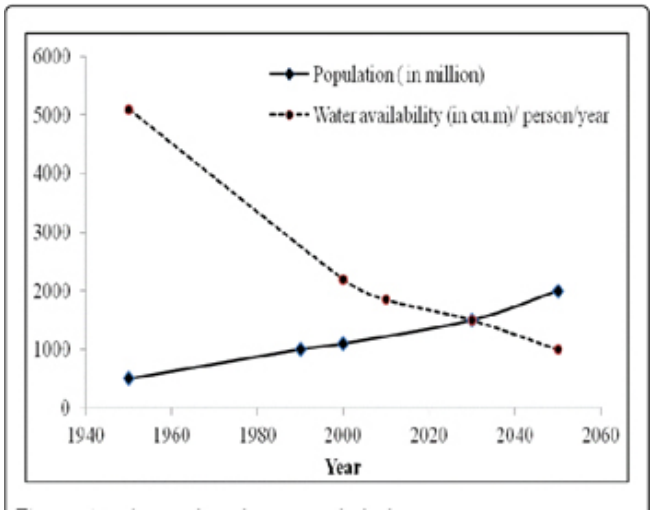
Impact of climate change on agricultural yields in different lattitude

By mid-century, when temperature increases are projected to be b/w 1.8°F and 5.4°F and precipitation excessives are further intensified, yields of major U.S. crops and farm profits are expected to decline. Over time, climate change is expected to increase the annual variation in crop and livestock production because of its effects on weather patterns and because of increases in some types of extreme weather events.



Impact of climate changes on crop productivity in India:

Rainfall in India has a direct relationship with the monsoons which originate from the Indian and Arabian Seas. Warm air holds more moisture and it will result in an increase in evaporation of surface moisture. In arid regions of Rajasthan state an increase of 14.8 per cent in total evapo-transpiration due to increase in temperature, global warming would have a larger impact on the water resources of arid zone biodiversity of Rajasthan. Several recent analysis have concluded that the higher temperatures expected in coming years will disproportionately affect agriculture in the planet's lower latitudes where most of the world's poor live. India has made a National Action Plan on Climate Change which was unveiled in 2008. There are eight national missions that would form the core of the national plan. These include national missions for solar energy, enhanced energy efficiency, sustainable habitat, conserving water, sustaining the Himalayan eco-system, a "Green India", sustainable agriculture and strategic knowledge platform for climate change. n. It has been found that yield and income can be increased by 50 to 100 per cent in most of the crops by using water saving technologies. Additional yield of 1 ton per hectare can be realized through supplemental irrigation.



Conclusion:

Global climate change is not a new phenomenon. The effect of climate change poses many threats; one of the important consequences is bringing about changes in the quality and quantity water resources and crop productivity. A number of mitigation and adaptation strategies have been developed to offset the deleterious impact of climate change on agricultural sustainability. These technologies include water-smart practices, weather-smart activities, carbon-smart activities and knowledge-smart activities. These technologies significantly reduce the effects of climate change on crops, and make them more suited to the climate by minimizing the unfavorable impacts. Agriculture sector is the most prone sector as it will have a direct bearing on the living of 1.2 billion people. India has set a target of halving greenhouse gas emissions by 2050. There is an urgent need for coordinated efforts to strong the research to assess the impact of climate change on agriculture, forests, animal husbandry, aquatic life and other living beings.

References & Further Details:

1. Data for each timeframe sum to 100%. **© IPCC, 2014, 5th assessment**
2. **https://www.researchgate.net/figure/Projected-impact-of-climate-change-on-agricultural-yield-in-different-latitude_fig1_304207131**
3. **https://nca2014.globalchange.gov/report/sectors/agriculture**
4. **https://www.semanticscholar.org/paper/Climate-Change-and-its-Impact-on-Agricultural-in-Kumar-Gautam/28552b59e8b81f68640d8fe2ca96f19bdf5da7d**

HOME MADE FERTILIZER FOR INDOOR PLANTS

Souvik Barman
BSC Ag_2nd Year

Natural fertilizers are materials containing nutrients that are minimally processed, so the nutrients remain in their natural forms. Fertilizing your houseplants naturally can be as simple as using kitchen and household waste to feed your plants. Whilst you can purchase excellent natural fertilizers, they tend to be more expensive than synthetic fertilizers.

Eggshells

Eggshells have:

- Calcium
- Micro nutrients

You can also follow the same steps using Pasta, Potato and any boiled vegetables wastewater.

Instructions

- Boil 3 eggs.
- Take the water out and let it cool down.
- Use this water for watering your plants.

Banana Pills

Banana peels are high in

- Potassium
- Phosphorus

Instructions

- Cut the banana peels into small pieces and put them in a bowl.
- Add water to the bowl and let it dry in a shade for 3 days.
- On the third day, the colour of the water will be brown.
- Strain the peels from the water and use the water.
- Use 50% of this fertilizer water, with 50% of normal water.
- Try to use this fertilizer mixed with your water, once every week.

Rice Water Rice Water Have

- Nitrogen
- Phosphorus.
- Potassium
- Microelements

Instructions

- Put some rice in water and let it sit for a few hours.
- Drain the water from the rice.
- Use this water for watering your plants.

Ashes

Soil has the following nutrients:

- Iron
- Phosphorous
- Potassium
- Manganese
- Zinc
- Calcium

Benefits

- Raise the pH
- Lower the acid

Aquarium Water

Fish water is high in Nutrients from the fish poop.

Worm

Worm are a great way to turn kitchen scraps into natural fertiliser for your plants.

Instructions:

Place your fruit and vegetable scraps in the top of the worm farm and the worms will break it down to create a nutritious liquid tea for your plants.

Green tea

green tea is best for plants that like acidic soil.

Instructions:

If you drink green tea you can save the used tea bags and use them to create an easy and inexpensive homemade houseplant food. Empty the tea leaves from the bag and place them on the soil to create a nutritious liquid fertilizer for your indoor plants.

CYCLONE: DEVIL OF COASTAL AGRICULTURE

Suvendu Maji
B.Sc Ag_3rd Year

Agriculture is the essential sector in any type of economy. Agriculture not only helps the people to get their food but also keeps the sustainability of the environment. Coastal areas provide excellent soil and climatic conditions for agriculture. They play an important role in the economy, providing food and raw material for industry. However, coastal agriculture faces several challenges due to temporal sea activities producing saline air and water and the inundation of erosion of coastal land.

Effects of Cyclone:

The agricultural sector includes field crops, horticultural cops, agro-forestry plants, livestock and fisheries. Cyclones in coastal areas severely affect all these components of agriculture sector through direct damage by high speed wind, torrential rain and extensive flooding. High tide may bring in saline water and sand mass making the fields unsuitable for agriculture. The effects of cyclones are:

- Due to storm surge, sea-water levels rise and the coastal areas are exposed to floods.
- Strong winds cause uproots trees.
- Cyclones also reduce the fertility of the soil. Continuous heavy rainfall may further worsen the flood situation.
- The rise in sea-water level also erodes beaches and embankments that impacts in agriculture.

Changing climate in micro and macro level attribute to influence and bring changes in productivity and production trend of every industry including agriculture and its ecosystem. The influence of climate change and its environmental impact on coastal ecosystem greatly influence the life and livelihood of agrarian communities and people involved in allied industries.

- Severe cyclonic storms resulting in floods can damage vegetation and livestock.
- Cyclones harm the ecosystem of the surrounding region.

Cyclonic storms result in loss of human, plant and animal lives and affect the country's economy.

Recent Cyclone in India:

India witnesses cyclones in the north Indian Ocean Cyclone season usually between April and November. In Indian history, there have been various cyclones that made headlines due to their effect on the country. The most recent cyclone in the West Bengal is:

Cyclone Amphan – 2020:

- It was a super tropical that affected Indian states of West Bengal and Odisha and Bangladesh.
- It originated in the Bay of Bengal in May 2020.
- The coastal districts of West Bengal recorded estimated gusts of 180 km/h.
- Within India, the cyclone caused a damage of approximately USD 14 billion.
- Amphan produced extremely high winds that ripped roofs off houses, uprooted trees and damaged on vegetables and other crops.

How We Can Protect Agriculture From Cyclone:

Direct and indirect effects of cyclone disaster adversely affect the economic backbone of the affected farmers. Government support is required for revival of agriculture. The managements are:

- We know that, a large amount of betelvine is grown in the coastal areas of West Bengal. We can grow betelvine in protected structure to protect from cyclones.
- To protect from cyclone, we can grow wind-resistant plants.
- **Flood Management:** As the cyclonic storms lead to heavy rainfall that further lead to flooding. The drainage systems should be well-designed to mitigate flooding.
- **Vegetation Cover Improvement:** To increase the water infiltration capacity, improving vegetation cover is of high importance. Planting trees in rows, coastal shelterbelt plantations, mangrove shelterbelt plantations etc can help break the wind force and mitigate the severe losses. mangrove shelterbelt plantations etc can help break the wind force and mitigate the severe losses.
- **Mangrove Plantation:** The ecologically efficient mangroves should be planted more. The root systems of mangroves help in mitigating soil erosion.
- **Saline Embankment:** Among the coast, saline embankments help protect habitation, agricultural crops and other installations.

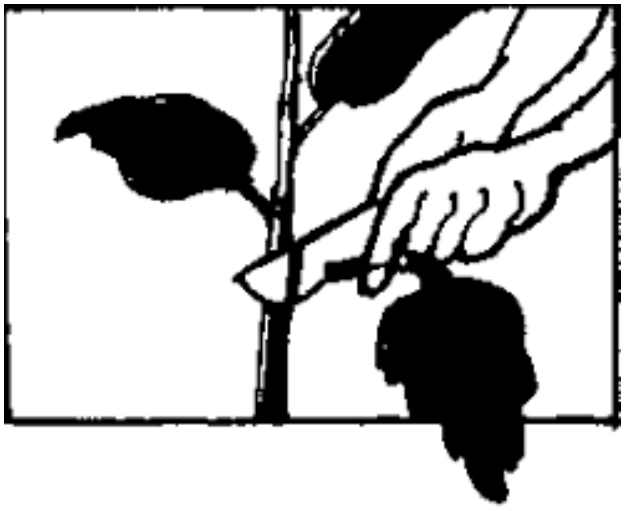
However, temporal sea activities and competition for natural resources and interactions with many sectors are on the rise, producing future challenges for coastal agriculture. Therefore, to meet these challenges an effective management and development plan for coastal areas needs to be developed integrating sustainable agriculture. Integrated coastal agriculture management planning would require information on resources, effects of sea activities and identification the ways to control the harmful effects etc.

NEEDFUL CULTURAL METHODS TO GROW DISEASE FREE CROPS

Swagato Bhattacharya
B.Sc Ag_3rd Year

Farming is the foundation of Indian economy. It is because it provides employment to roughly half of India's workforce and contributes to 17% of India's GDP. During the last 50 years the technologies generated by National Agricultural Research System (NARS) in India, backed by government policies, have significantly contributed to the transformation of Indian agriculture and achieved phenomenal success ensuring self-sufficiency in food production ushering in rainbow (Green, White, Golden, Brown, Blue) revolution in food grain, milk, oilseeds, pulses, horticulture and fisheries sectors. However, increasing population, rising demand for food, feed, fodder, decreasing land availability, natural resource degradation, climate change, and new global trade regulations have put up new challenges threatening food, nutritional and livelihood security. Crop yield losses in India due to pests range from 15-25%, which in monetary terms is 0.9-1.4 lakh crore/ trillion rupees or 15-23 billion US $. The farmers of our country grow many crops as well as their different varieties. But due lack of proper maintenance knowledge or technological gap, majority of them don't want to adopt recent methods of improved technologies in disease management of crop plants. The main feature of this discussion is to highlight some **'PRECAUTIONS'** or cultural methods for plant disease management to get profitable yield of crops.

Plant diseases are occurred generally by means of fungus, bacteria, virus, nematodes etc. Most of the diseases are due to fungal (85%), bacterial and viral infection which also affect the yield. Some of the bacterial disease are devastating in nature, like **bacterial wilt of solanaceous crop** *(Ralstonia solanacearum)*. Bacteria gets entry into the plant by hydathode, stomata, incidental wounds and reproduce inside them by affecting physiology and growth of the plant. Other side, most of the viral diseases **(mosaic, leaf curl, vein clearing)** are transferred to healthy plant by means of different insect vectors like aphid, leaf hopper, whitefly or by means of sap, seed, grafting materials or even lower group of fungi and nematodes. The main important fungal diseases of plant are seed borne **(loose smut of wheat)**, soil borne *(Rhizoctonia sp., Sclerotinia sp., Sclerotium sp.)* or wind borne (rust, smut) in nature. They also spread by the irrigation water, like *Phytopthora infestans* (a water loving pathogen which causes late blight of potato).



Most of the farmers don't know how to control the diseases. They are just dependent on the fungicides, pesticides, herbicides and the other chemicals. But there are also some treatments which are acceptable by the farmers from all the sides, like the cultural methods, mechanical methods, biological methods which can be of low cost or can also be of 'no cost'. For example, majority of the crops, if we remove the

collateral weeds (weeds are of same family of crop) and alternate weeds (weeds are of different family), then the pathogen has no way to stay in the weed hosts and affect the main crops in time. Secondly, after ploughing if we remove the stubbles from the plot, then maximum disease causing pathogen will be removed, as because we know that the soil and seeds borne pathogen can be controlled if management is taken in perfect time, for ex: *Phytopthora sp., Fusarium oxysporum, Pyricularia oryzae*. But for controlling wind spread diseases of many vegetable crops (like alternaria leaf spot of cabbage and cauliflower) we may adopt protected cultivation technology in green or glass house by choosing disease resistant varieties at proper time.

Formerly we have got a brief concept of the disease causing organism. If we are going to manage diseases, then we should not be dependent on chemicals only. Yes, it is required obviously but before that we must have to know the tricks also. For example, the plant viral diseases may not be controlled by applying chemicals only.

First of all, there are some basic cultural methods which we must do in our field:

1. We have to remove the weeds which are the host of the pathogen, from the field as well as from the nearby areas or from the bunds.
2. Stubbles or crop debris must have to be removed from the field after ploughing.
3. The exact amount of NPK fertilizer or mainly the nitrogen should be applied in perfect amount.
4. Always have to do crop rotation with the leguminous crops or cereal ones which are much more effective.
5. Trap cropping and intercropping must be adopted.
6. For the fruit crops, regular pruning is important to get less insect infestation as well as disease.
7. If the pathogen is transferred by water than method, amount, schedule of irrigation should be modified.
8. When, using any mechanical tools, we have to clean it properly by applying any sterilants.
9. Proper plant spacing, depth of sowing, seed rate should be maintained.
10. Sometimes raised seed bed technique is helpful for good drainage.
11. If there are any plants seen to be affected, then it must be removed from the field.
12. If possible than go for certified seed or disease resistant variety.
13. Seed treatment with biocontrol agents (Trichoderma, Bacillus, Pseudomonas sp.) or hot water treatment is recommended for minimizing any seed borne fungal/ bacteria or viral infection.

Several cultural practices give good control when adopted at community level. It serves as a baseline procedure that is compatible and can be integrated with many disease management tactics. Cultural practices are often disease, crop and region specific. Care should be exercised in transferring tactic to a region with markedly different agro-ecological conditions.

MSP ACTUALLY MARKET DISTORTING

Swapnashis Baidya
BSC Ag_3rd Year

Introduction:

Agriculture is the primary source of livelihood for about 58% of India's population. Consumer spending in India will return growth in 2021 in post-pandemic –led condition, expending by as much as 6.6%. the Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. The Indian food processing industry accounts for 32% of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth.

Market Size:

According to Inc42, the Indian Agricultural sector is predicted to increase to US$ 24billion by 2025. Indian food and grocery market is the world's 6th largest with retail contributing 70% of the sales. As per the second advance estimates, food grain production in India is estimated to be 316.06 MT ijn FY 2021-22.

What is MSP?

MSP stands for Minimum Support Price. MSP is a form of market intervention by the Government of India to insure agricultural producers against in any sharp fall in farm Price.

How is MSP helpful to the Farmers?

An MSP provides a powerful signal to the farmer to exercise the choice of sowing a particular crop because the farmer can back-calculate the expected margin. On the other hand, we can stretch the market argument to the limit, we can argue that we do not even need a tokrn MSP.

Which crops come under MSP?

AS of now, CACP recommends MSPs of 23 commodities, which comprises of 7 cereals(Paddy, Wheat, Maize, Sorghum, Pearl-millet, Barley and Ragi) 5 Pulses(Gram, Tur, Moong, Urad, Lentil) 7 oilseeds(Groundnut, Rapeseed- mustard, Soybean, Sesame , Sunflower, Safflower, nigerseed) & 4 commercial crop(Copra, Sugarcane, Cotton, Raw Jute)

What is Market distortion?

Market distortion is the lack of free and open competition in a market, whether through intentional actions or prevailing market conditions. Further distortion occurs when governing bodies step into regulate the market for example by setting price floors or ceilings or offerings tax subsidies.

Why MSP is not a solution?

- Legal MSP can not work if not supported by demand and supply side factors. At best it can work only when trade pays lower prices to farmers as compared to competitive market price. Thus, legal MSP can work if the level of MSP is close to the open market price or market clearance price.

- As the name suggests MSP is the minimum price a farmer must be paid for their food grains as guaranteed by the government. The big problem with the MSP system, however has been that it was never backed by a parliament act and therefore, could never be legally enforced across India.
- India has had MSPs for several crops for several decades now, but that has not resolved the problem of agrarian distress.
- It simply doesn't have the capacity to put in place something like this, all across the country. Hence the issue is not about the ability of the government to spend money , it's more about its ability to put in place a system which they can use to spend money, procure crops and gurantee an MSP.
- MSPs are short –term palliatives; they are not a sustainable for all of Indian agriculture. Moreover, merely announcing MSPs not enough. The government also has to procure goods at the said MSPs.

Why MSP is not a solution?

- NITI AAyog member Ramesh chand has proposed **deficiency price payments (DDP) system** has an alternative to the existing practice of procuring food grain at minimum support prices (MSP) for the public distribution system.
- Subsequently a price deficiency scheme (largely for Oilseeds) formed part of the

  Pradhan Mantri Annadata Aay Sankrakshan Abhiyan (PM-AASHA)

GRAFTING: AN APPROACH TO IMPROVE ABIOTIC AND BIOTIC STRESS TOLERANCES IN VEGETABLE CROPS

Trishita Bera
B.Sc. Ag_3rd Year

Due to limited availability of arable land and the high market demand for vegetables around the world, cucurbit and solanaceous crops are frequently cultivated under unfavorable soil and environmental conditions. These include thermal stress, drought, soil salinity-alkalinity, flooding and contamination by persistent organic pollutants. For these stresses they exhibit physiological and pathological disorders which leads to stunted growth and severe reduction of both fruit quality and quantity.

Thus, one way to avoid or to reduce such losses in vegetable and fruit production would be to graft them into rootstocks capable of reducing the effect of external stresses on the shoot. When these grafted plants are grown under adverse soil or climatic conditions, they proved to outstand the abiotic stresses and exhibited greater growth and yield, better nutritional status, good tolerance to disease. Some of the improved traits of grafted plants are:

1. More vigorous root system
2. Improved water and nutrient uptake
3. Increased photosynthetic efficiency

These mechanisms influence both root and shoot functioning, and the interconnection of the factors (rootstock, scion and environment) implicated the contribution towards the phenotypic adaptation.

Assuming that root is the first tissue sensing stressful soil conditions, potential rootstocks have to be selected based on the traits inherent to the root itself. The advantageous root system of the selected root stocks enables better performance against soil borne pathogens and other abiotic stresses, through improved uptake of both macro and micro nutrients. Scion- rootstock combination may manipulate the root microbiome. Microbial communities in the rhizosphere of the rootstock can influence the composition of root exudates and the uptake of micronutrients, they can also generate hormone that induces tolerance to abiotic stresses and also suppress soilborne and foliar pathogen and pests. Tolerant rootstocks against biotic and abiotic stresses can also be enhanced by activating antioxidant enzymes and also by regulation of hormonal synthesis.

Many such grafting experiments were done on Solanaceous plants and success rate in some cases is also high at field level. It has been observed that when tomato ***(Solanum lycopersicum L.)*** grafted onto commercial rootstock and subjected to infection with ***Verticillium dahliae,*** the grafted plant exhibited resistance to the verticillium wilt disease. Grafting of chilli peppers ***(Capsicum annum L.)*** is a recent practice where ***C. annum*** scions are grafted onto C. annum rootstocks that have soil borne disease and nematode resistance.

It is also observed that grafting of eggplants onto wild eggplants exhibited improved yield and fruit quality under drought conditions. By this way grafting tomato on ***S. torvum*** rootstocks improved the flood tolerance and yield significantly. So, grafting can influence a lot both on the improvement of biotic and abiotic stresses by making them disease tolerant, insect tolerant, temperature tolerant, flood tolerant, salinity tolerant and drought tolerant.

But to make it successful in large scale, mass awareness is required. Arrangements for awareness and training programmes for farmers by state government and SAU's would be a good way to popularise it among the farmers. Initial subsidies can be provided to the farmers for shifting from non-grafted cultivation to grafted seedling cultivation and helping them to set up small production unit for producing grafted seedlings will encourage quick adoption of the technique. Farmers have to be kept updated from time to time regarding grafting techniques, this will keep them encouraged and motivated.

Thus, if some part of the cultivated land can be converted into grafted plant cultivation for vegetables

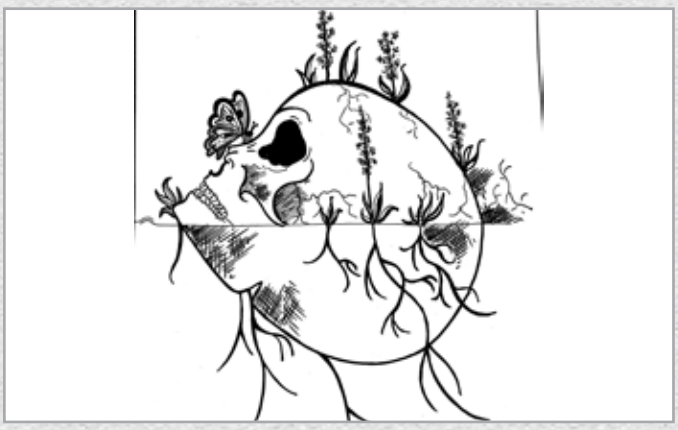
and fruits, a huge expenditure of money made on chemical fungicides, insecticides and other pesticides can be reduced which not only becomes environment friendly but also the amount of money saved can be spent by the farmer on raising their standard of living.

Abiotic Stress Tolerance of Grafted Plants to that of Non-Grafted Plants

Commercial Grafting of crop plants

Tube grafting in a Solanaceous Crop

Drawing and Animation



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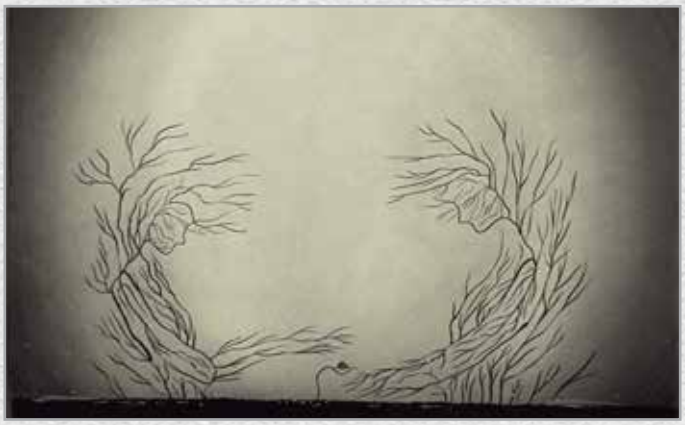

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Students Corner

শহর

শহর, তুমি আজ বড্ড একা শান্ত নীরব স্থির,
শত শত পদধ্বনি, রেষারেষি-কোথায় সেসব ভিড়?
শহর, তোমার ল্যাম্পপোস্টটা কেমন যেন একা,
হারিয়ে যাওয়া শালিক দুটি পেয়েছিল কি দেখা?
শহর তুমি শপিং-মলে বিলাসিতার খোঁজে -
তোমার পাড়ার মুদি-ই আজ লাগলো সবার কাজে।
শহর, তোমার অটো রিকশা, কোথায় তোমার 'ওলা'?
আজ তোমার বুকেই চলছে কেমন সেই পুরাতন ঠ্যালা।
আচ্ছা শহর, শুনতে পাচ্ছো গভীর রাতের কান্না?
জ্যোতিষও আজ হার মেনেছে, বৃথা চুনী পান্না।
শহর তোমার এ কি রূপ ! নিষ্ঠুরতা একাকিত্ব ভরা,
দোহাই তোমায়, মুছে ফেল এই মৃত্যুরূপী খরা ।।

[প্রেক্ষাপটঃ- লকডাউন এবং করোনা মহামারী]

- সৌমি গোস্বামী
(Saumi Goswami)
Assistant Professor (Ad hoc),
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Students Corner

আনন্দের ব্যাতিক্রম

'আমরা চাষ করি আনন্দে...'

বিশ্বকবি-র কণ্ঠে ধ্বনিত হলেও, বর্তমান ক্যানভাস ফুটে ওঠে নানান ব্যাতিক্রম।

একবিংশ শতাব্দীর দোরগোড়ায় দাঁড়িয়ে থাকা নিম্নবিত্ত কোন এক গ্র্যাজুয়েট,

ঘুস না দেওয়ার অক্ষমতাই ভাগ্যে জোটাতে দেয়নি একখানা চাকরি!

অভাবকে সঙ্গী করে, পরিবারের ভার মাথায় নিয়ে ধরতে হয় চাষবাসের হাল।

চারিদিকে ধ্বনিত নগ্ন সমাজের কুরুচিকর মন্তব্য তার কাছে যেন এক হতাশার দিশারী!

সেই মুহূর্তে ওই ব্যক্তির কখনো কি মনে হবে-'আমরা চাষ করি আনন্দে'?

চাষের ক্ষেতে পরিপুষ্ট ফসলের আশায় যখন আগাছা নির্মূল চলতে থাকে,

সমাজ দর্পণে প্রতিফলিত হতে থাকে আগাছারুপী নিজ প্রতিবিম্ব।

দীর্ঘ রুদ্ধশ্বাস ছেড়ে শান্তির প্রাণবায়ু নিতে গেলেও যেন এক ব্যর্থ প্রচেষ্টা!

সেই মুহূর্তে ওই ব্যক্তির কখনো কি মনে হবে -'আমরা চাষ করি আনন্দে'?

দীপ্ত কাস্তে হাতে প্রখর রৌদ্রে, মাথার ঘাম পায়ে ফেলে

শস্য ফলিয়ে অর্থ উপার্জনের তীব্র বাসনা জ্বলন্ত কর্পূরের মত উবে যায়।

লাভের প্রদীপ নিভে গিয়ে ক্ষতির আগুন দ্বিগুণ শিখায় জ্বলে!

সেই মুহূর্তে ওই ব্যক্তির কখনো কি মনে হবে-' আমরা চাষ করি আনন্দে'?

Name- Aditi Maji

UID- TNU2021032100126

Semester -3rd

Students Corner

-: WORLD WITHOUT FARMERS :-

India is a developing country with an agrarian economy with 70% of the population residing in villages. According to the World Bank data, 42% of the Indian workforce engages in agriculture. It is an economy that is heavily dependent on agriculture where farmers have a critical task to carry out. Indian farmer is one of the most important members of the society as he is the producer and giver of the food for whole country. Farmers ensure that food production does not become stagnant in India and food availability for all.

The farmers led a very simple lifestyle and have a very busy, hardworking schedule as they wake up early in the morning and go to their respective fields for cultivation without bothering about the fact whether it is blazing hot summer day or chilling cold winter day. Farmers produce crops, pulses and vegetables which are needed by everyone. They work extremely hard so we can have food on our table every day. Thus we should thank them whenever we have a meal. Farming is not an easy process. The farmer has to take care a lot, well maintain and should follow preventive measures or precautions to make the cultivation successful just like a father raising his own child to become a good human being successfully. For feeding us, they cultivate different crops and begins the cultivation process firstly by tilling and ploughing the fields. Earlier farmers used to plough the fields by the help of oxen, but nowadays they are using tractors and advanced machineries. Farmers plough the field, they sow the seeds, give water in the field timely so that grains could grow and then reap the grains after ripening. Farmers sprinkle fertilizers, manures, compost in the field and for protecting the crops from insects and pests they use insecticides and pesticides. Previously, most of the farmers where illiterate and did not know about latest farming methods but nowadays farmers have become literate and other technological methods. By maintaining this way, finally after waiting for some more days, the hard work of an farmer pays off and thus this is the reason why we are having a meal today. So the question arise here is "Will we able to survive without food if there are no farmers paying so much hard work for us?" and "Is the economy possible without farmers?". So the answer will probably be "A big No". Therefore farmers are the one who are not just farmers but the real formers of the economy of our nation.

Farmers of India are the largest producer of pulses, rice, wheat, spices and spice products. They are also involved in other small businesses such as dairy, meat, poultry, fisheries, food grains etc. India has also emerged as the second

Students Corner

largest producer of fruits and vegetables in the world. But there is a dark side also beyond some happy faces of the farmers that is the life and condition of big farmers are quite good but the condition of small and marginal farmers needs improvement. This small farmers take loans which they are unable to repay due to loss in agriculture and commit suicide due to increasing pressure from banks. The crops of the farmers either get damaged due to bad weather or they get very less amount of the crops due to mischievous middlemen. But still some of the farmers accept their fate and try to overcome such situation and again starts working hard for the next time.

Thus an farmer should be respected by everyone. It is he who produces grains and vegetables for the citizens of the country. Throughout the year, the Indian farmer remains busy in tilling the fields, sowing seeds and reaping the crops. Indeed, he has a very busy and hard life, he gets up early in the morning. Then, he takes his bulls and plough or tractor and goes to his fields. In the fields, he ploughs the land for hours together. A farmer is the very soul of a nation. Our late prime minister, Lal Bahadur Shastri, gave a slogan, "Jai Jawan, Jai Kisan." He realized that an Indian farmer feeds the nation. Upon him depends the agricultural production, hence he must be provided with all the latest implements of farming. Better seeds, fertilizers, manures, implements and chemicals for agriculture can enable them to grow more.

"They are not labourers but lovers who loves the nature and can transform the loose soil in such a way that it can turn out to yield huge treasures like gold."

Written by,

Ankita Sen (3rd Semester, 2nd Year, Section:- C)

UID Number:- TNU2021032200153.

Students Corner

মাটির গান ----

মাটির ওপর জন্ম আমার,আমি মাটির কন্যা,
যার বুক দিয়ে বয়ে চলে যায় সহাগ ও ভালবাসার বন্যা।
মাঠের ওপর বহু ফসল ফলিয়ে যায় মা-এর ধন
যার ভূমিকা আমদের কাছে যেন মাত্ দুগ্ধে ভরা স্তন।

দেশের প্রাচীণ সভ্যতা মোরা হারিয়ে ফেলেছি আজ,
তাই জন্যে এসেছে এখন দারিদ্র্যের মহারণ মুর্তির সাজ।

কৃষি কার্যে চলতো তখন মোদের অর্থনীতি,
এভাবেই এগিয়ে চলা ছিল মোদের রীতি।

বহু কাল পরে আজকে আবার সেই প্রাচীন কৃষি সভ্যতাকে খুঁজে পাওয়া,
নবীন বৈজ্ঞানিক প্রজুক্তির দারা সেই প্রাচীন সভ্যতার উন্নতি করার চেষ্টা করে যাং
আজকে নতুন আর পুরনো মেলান বয়ে চলেছে অবাক করা এক হওয়া।

সকলে মিলে একত্রে আনন্দে চাষ করার গান গওয়া।

Arnobi Roy
B.Sc. (Agriculture), 2nd Year

Students Corner

সপ্নের চাবিকঠি

– Ayan Mukherjee

ছোটো বেলার প্যান্ট পড়া হোক, বা কলেজে এর জিন্স আর জুতো পড়া ছেলে।

সত্যি বলতে ছুটছে সবাই সপ্নের দিকে,

সপ্নের আকারে নই ,বরং বিচার হয় তার শক্তিতে।

ছোটো বেলার সপ্ন শুধুই বড়ো হওয়ার,

আর তারপর ডাক্তার বা ইঞ্জিনিয়ার হওয়া,

কিন্তু বড়ো হতে হতে বুঝলাম সপ্নের চাবিকঠি,

খুঁজে নিলেই হবে ভালো।

এখন বড়ো হয়েছি কিন্তু বেশি বড়ো স্বপ্ন দেখতে লাগে ভয়,

যদি পড়ে গিয়া লাগে জোরে যেমন লাগে ,আপন মনে উড়তে থাকা পাখি পড়ে যায়।

এখন কথায় কথায় দায়িত্ব নেয়ার আর সহবত শেখার, কিন্তু সত্যি কি আর দরকার আছ্ছা তার

যখন জানি সপ্ন এমন যাতে সমাজের কাছে দাড়াতে পারবো কিনা।

এখন চাকরি পেলেই আপনি সপ্নের চাবিকাঠি পেলেন , কারণ চাকরি ছাড়া আপনি বাঁচবেন না আর আপনার কোনো প্রয়োজন নেই।

কিন্তু কি বা যাবে করা?

যে হারতে জানে সে জেতার মূল মন্ত্র জানে,

কারণ হারার মধ্যে তা লুকিয়ে থাকে।

তাই সপ্নের চাবি কাঠি চাকরি পাওয়া নয় বা ছোটো বড়ো সপ্ন দেখা নই, শুধু হলো সব হেরে যাওয়া থেকে শিখে যাওয়া।

Ayan Mukherjee
B.Sc. (Agriculture), 2nd Year

Students Corner

দুরন্ত স্বপ্ন

আজি এই ঘন বর্ষণমুখরিত দিনে,

তারই কথা মনে পড়ে শুধু খনে খনে ।

স্মৃতিপটে আঁকা তার আবছায়া মুখটার,

মায়াজাল জড়িয়েছে দু'চোখ আমার ।

মেঘগুলো দ্রুত পায়ে,

ছুটে চলে ধরা দায়,

বর্ষার ঘনঘটা মন ছুঁয়ে যায় ।

মাথা রেখে ভেবে চলি

খোলা জানলায়,

তারও কি আবার মনে পড়েছে আমায়?

-বনানী হালদার

Banani Harder
B.Sc. (Agriculture), 3rd Sem

Students Corner

||প্রত্যুত্তর||

বড়মানুষে কয়, চাষবাস! সেতো ছোটলোকের কাজ,

মাঠে ঘাটে বেড়ায় চষে নেইকো কোনো লাজ|

ইশ: কি নোংরা ওরা! হাতে কাদা, পায়ে কাদা,

গায়ের রং বেজায় কালো,একটুও নয় সাদা|

শিক্ষা নেই,দীক্ষা নেই, মুখের ভাষার নেই লাগাম,

এই তো জীবন, আছে কিই বা দাম?

ছোটলোকে শুধায় তখন, ওও বড়মানুষের দল তুদের অন্ন জুটায় কে?

এই ছোটলোকে মাঠে নামে,কাদা মাখে,তাই তুদের অন্ন ওঠে মুখে|

আর শরীরটো সাদা হয়ে হবেকটা কি! যদি মনটাই হয় ময়লা,

তুদের থেকে সাদা বুঝি কয়লাখনির কয়লা|

রইলো বাকি শিক্ষা, মুদের ছিলে পিলাও পড়ে,একদিন উরাও কামাবে ডোলার|

মিয়েটা মোর কৃষিবিজ্ঞানে স্নাতকোত্তর, ফাস্টো কেলাস ফাস্ট, রিসাচ কলার|

বড়মানুষের দল এইবার তুদের ফেলে ইগবো আমরা, মনের সুখে করব চাষের কাজ,

সর্বদা হাত পেতে পছন্দের খাবারটো লিবি তুরা, আর মোদের ঘুচবে লাজ||

Dipika Mondal
B.Sc. (Agriculture), 3rd Year

Students Corner

মাটি

- মধুরিমা চক্রবর্তী

গ্রাম বাংলায় ভোরের আলো প্রস্ফুটিত হওয়ার সাথে সাথেই শোনা যায় পাখ-পাখালির কিচিমিচি রব। আর সেই রবেই ঘুম ভাঙে আব্দুলের। পশ্চিমবাংলার এক প্রত্যন্ত গ্রামে বাস আব্দুলের। গ্রামের পূব দিক দিয়ে বয়ে চলেছে রূপনারায়ণ নদী। বর্ষায় ফুলে উঠে আর শীতে দেখা যায় চর।

আব্দুলের বয়স আনুমানিক ৪২ বছর।ময়লা গায়ের রং, মাঝারি উচ্চতা বিশিষ্ট মাথা ভর্তি চুল। শীর্ণ চেহারা দেখলে অনুমান করা যায় সে একজন কৃষক সম্প্রদায়ের মানুষ। পরিবার বলতে স্ত্রী ও এক সন্তানকে নিয়ে তার সংসার। বছর পাঁচ ছয় হবে সে বিয়ে করেছে। ছেলের বয়স তিন সাড়ে তিন বছর। দশ বারো বছর আগে এক প্রাকৃতিক দুর্ঘটনায় সে তার বাবা ও ভাইকে হারায়। আব্দুলের বয়স যখন দুই বছর তখন তার মা মারা যায় কোনো এক দুরারোগ্য ব্যাধি তে।

গ্রামের আর পাঁচ জন কৃষক দের থেকে আব্দুলের জমির প্রতি টান টা একটু বেশি।তার জমি তার কাছে মাতৃসম। জমির মাটির গন্ধে সে যেন মায়ের গন্ধ খুঁজে পায়। জমিটা নদীর পাশে নিচু জলা জায়গায় হওয়ায় চাষের পক্ষে

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সুবিধাই হয়। রোজ সকালে ঘুম থেকে উঠে বাড়ির কাজ সম্পন্ন করে দু এক মুঠো আহার মুখে গুঁজে লাঙ্গল কোদাল নিয়ে বেরিয়ে পড়ে চাষের উদ্দেশ্যে। দুপুরের খাবারও বেঁধে নিয়ে যায় সাথেই। কাজের ফাঁকে নদীতে স্নান সেরে দুপুরের খাবার খেয়ে ক্ষেতের আলের খেজুর গাছটার ছায়ায় খানিকক্ষণ জিরিয়ে ফের লেগে পড়ে কাজে।সূর্য পশ্চিমে পুরোপুরি হেলে গেলে পড়ন্ত রোদের সোনালী আভায় নিজের জমির বিচিত্র রূপ দেখে বাড়ি ফিরে আসে সন্ধ্যা নামার আগেই।

শ্রাবনের দ্বিতীয় পক্ষেই আব্দুল লাগিয়ে দেয় আমন ধানের চারা।শ্রাবন শেষে চারাগুলির বর্ণ গাঢ় সবুজ হলে সে তার দীর্ঘ অভিজ্ঞতায় ঠাওর করতে পারে চারাগুলি বেশ ভালোভাবেই গজে উঠেছে। এরপর চলে নিয়মিত পরিচর্যা, যেমন নিড়ানি করা, আল বাঁধা, জৈব সার প্রয়োগ, আগাছা দমন,কীটনাশক প্রয়োগ ইত্যাদি। এসব করতে করতে প্রায় সারাদিনটাই কেটে যায়। তাছাড়া জমির প্রতি তার ভালোবাসা অশেষ। সে টানেই সময় কাটাতে পারলে আব্দুল আর কিছুই চায় না।

ভাদ্র মাসের এক মেঘাচ্ছন্ন দিন। বর্ষা যে সম্প্রতি বিদায় নিয়েছে, সেটা নদীর গর্জনশীল প্রবাহ সবুজ-শ্যামল গাছপালা, খালে-বিলে-পুকুরে ভরে থাকা টলটলে জল,কর্দমাক্ত রাস্তাঘাট, তার জানান দিয়ে দিচ্ছে।দিন টা বেশ মেঘলাই কাটছিলো, মাঝে মধ্যে যে দু এক পশলা বৃষ্টিও হচ্ছিলো না, এমনও নয়। প্রতিদিনের ন্যায় আব্দুল সেদিনও গেলো জমিতে। দুপুর পড়ে বিকাল গড়াতে না গড়াতেই আকাশটাকে ঘিরে ধরলো ঘন কালো মেঘে। মেঘের এরূপ চেহারা দেখে তার সব সামগ্রী গুটিয়ে রওনা

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দিলো বাড়ির উদ্দেশ্যে। অর্ধেক রাস্তা অতিক্রম করতেই নামলো প্রবল বেগে বৃষ্টি। কয়েক সেকেন্ড ছাড়া ছাড়া বিদ্যুৎ চমকাতে থাকলো। বাড়ি অব্দি যেতে হলে সে পুরোপুরি ভিজে যাবে, আর ভিজলেই তাকে যদি আবার অসুখ বিসুখে পেয়ে বসে। তাছাড়া প্রকৃতিদেবের এমন উগ্রচন্ডা নাচন কোদনের মধ্যে তার কোথাও আশ্রয় নেওয়াটাই বুদ্ধিমানের কাজ হবে। সেসব ভেবে সে ঠিক করলো গ্রামের প্রধান রাস্তার বাম দিকের বট গাছটার নিচে নারানের চায়ের দোকানে সে একটু দাঁড়াবে, বৃষ্টি থামলে ফের রওনা দেবে বাড়ির উদ্দেশ্যে।

নারানের চায়ের দোকানে প্রত্যহ বসে চায়ের আড্ডা। গ্রামের জমিদার, মোড়ল ও কিছু কিছু মধ্যবিত্ত মানুষেরা বসে চায়ের আসরে। রেডিও তে খবর শোনে। বিভিন্ন বিষয় নিয়ে চলে আলোচনা, তর্ক-বিতর্ক ইত্যাদি। আব্দুল দাঁড়িয়ে দাঁড়িয়ে সেসবেই শুনছিলো। এমন সময় হটাৎ রেডিও থেকে একটা খবর এলো, বঙ্গপোসাগরে নিম্নচাপ উঠেছে। আগামী তিনদিন ভারী থেকে অতিভারী বৃষ্টি হওয়ার সম্ভাবনা রয়েছে। সমুদ্র উপকূলবর্তী ও নদী তিরবর্তী এলাকাগুলি তে লাল সতর্কতা জারি করেছে রাজ্য আবহাওয়া দপ্তর। এই খবর শুনে তার সারা শরীরে যেন শিহরণ খেলে যায়। নানারকম চিন্তা ভাবনা আসতে থাকে।

ঘন্টাখানেক পর বৃষ্টির তেজ একটু কমলেই সে বাড়ির পথ ধরে।এরপর সময় যত বাড়তে থাকে বৃষ্টির তেজ ও ততো বাড়তে থাকে আর বাড়তে থাকে তার দুশ্চিন্তা। স্ত্রী ও পুত্রের নিরীহ মুখ দেখে সে যেন নিজেকে আটকে রাখতে পারেনা আর।তিনদিন বৃষ্টি হলে তার যে বড় বিপদ। জমিতে অধিকমাত্রায় জল দাঁড়ালে সব চারাগাছ মরে

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যাবে। তাতেই যে তার এক বছরের সম্পদ। তার উপর ভর করেই তার সংসার। সেদিন রাত্রে কিছু না খেয়েই ঘুমিয়ে পড়ে আব্দুল। স্ত্রী খাবার কথা জানতে চাইলে সে জানায় তার শরীর ভালো নেই।

পরদিন সকালে ঘুম ভাঙলে সে আন্দাজ করতে পারে তখনো ঝড় সহ প্রবল বৃষ্টি হচ্ছে। যেন প্রকৃতির অভিশাপ আছড়ে পড়ছে পৃথিবীর বুকে। একবার করে ভাবে, যে একবার গিয়ে দেখে আসবে কিন্তু প্রকৃতির তেজের কাছে সে হার স্বীকার করতে বাধ্য হয়। এভাবেই ক্রমশ তিন দিন কেটে যায়।

তিনদিন পর, আকাশে মেঘের চাদর হালকা হলে বৃষ্টিও থেমে যায়। আব্দুল বেরিয়ে পড়ে ছুটতে থাকে জমির রাস্তা ধরে। অনেকেই তাকে বাধা দিয়ে বলে "ওদিকে যাসনা আব্দুল। নদীর বাঁধ ভেঙেছে, সব ভাসিয়ে নিয়ে চলে গেছে।" কিন্তু আব্দুল যেন কারোর কথা শুনতেই পায়না।

গ্রাম যেখানে শেষ, সেখান থেকে কিছুদূর বিস্তৃত একটা উঁচু জায়গা। আর উঁচু জায়গা যেখানে শেষ, তার নিচ থেকে শুরু হচ্ছে গ্রামের সব চাষীদের জমি। তার পাশে নদী। সেই উঁচু জায়গায় গিয়ে আব্দুল দাঁড়িয়ে পড়ে। শরীরের ভেতর একটা ঠান্ডা স্রোত নিচ থেকে উপরে উঠে যায়। পাথরের মত দাঁড়িয়ে দেখতে থাকে নদীর বিধ্বংসী রূপ। চোখের সামনে শুধু জল আর জল,জমি তার নিচে। বাঁধ ভেঙে সব ভাসিয়ে দিয়েছে। একটা বুকফাটা চাপা আর্তনাদ যেন ঠিকরে বেরিয়ে আসতে চায় তার ভেতর থেকে, কিন্তু পারেনা। উঁচু জায়গা টা থেকে একটা সরু পথ চলে গেছে নদীর পাড়ের দিকে। আচমকা সেই পথ ধরে

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দিকবিদিক জ্ঞান শুন্য হয়ে দৌড়াতে থাকে নদীর পাড়ের দিকে। পাড়ে গিয়ে দাঁড়ায়। চোখের কোন ঝাপসা হয়ে আসে। চিন্তা করে তার ছেলের কথা, তার স্ত্রীর কথা, তারা কি খাবে? মুদির দোকানের ধার কিভাবে শোধ করবে? আর বাড়ির চালাটা,ওটা ঠিক করাও যে খুব দরকার। মনে পড়ে সেই দশ বারো বছর আগে তার বাবা ও ভাইয়ের এই নদীর কবলে পড়ে মৃত্যুর কথা।

শেষ সম্বল ওই জমি। সেটাও আর নেই।এমন নানান চিন্তা গ্রাস করতে থাকে তার হৃদয় ও অন্তর আত্মা কে। চোখ বন্ধ করে আব্দুল। ভাবতে থাকে, এক লাফে নিজের দেহকে সমর্পন করে দেবে বিদ্যুৎবেগে ছুটে চলা নদীর প্রবাহে। হয়ত তার দেহ উঠবে রূপনারায়নের ই কোনো এক কূলে, আর হতভাগা জীবনের প্রাণটা বয়ে যাবে স্রোতের সাথে।

কি অদ্ভুত এই মাটির প্রতি টান, তাইনা? মাটি আঁকড়ে বাঁচাও যায়, আর মাটির জন্যে প্রাণ ও দেওয়া যায়।

Madhurima Chakroborty
B.Sc. (Agriculture), 2nd Year

Students Corner

Steps to grow crops

When the time is right for the crops to grow,
Collect some seed, search for a land, a spade and a hoe,

Dig the soil, till it well.
until the clods break, and is friable.
Then cheer out loud, for the farmers friend;
that is to be added as FYM.

Mix the soil and leave it Idle for days.
for the very next, take time to gaze.
And one fine morning, when the weather is nice.
Sow the seeds, give a drip, followed by daily watering twice.

Now count for days, for the bean to emerge,
with two little leaves, and the seedling to surge.
Thanks for the hardwork, brought smile to the face.
Next pull off the weeds which puts the crop in a race.

Again, stand the time for the seedling to raise,
when it's height, put amount of nutrient as topdress.
Don't forget watering and enjoying the beauty.
see it grow, for the crop becoming fruity.

And once, it fruits, let it enlarge.
save it from the birds and pests who barge.
when it's ripe, it's time to harvest.
share it all, have a great fest.

Moulami Das
B.Sc. (Agriculture), 3rd Year

Students Corner

কৃষক

কৃষক হল এমন একজন ব্যক্তি যিনি কৃষিকাজে নিয়োজিত, খাদ্য বা কাঁচামালের জন্য ফসল উৎপাদন করেন। দুর্ভাগ্যবশত, আমাদের দেশের অধিকাংশ কৃষক দরিদ্র এবং তাদের নিজস্ব কোন জমি নেই। তাই তাদের অন্যের জমিতেই চাষ করতে হয়। তার এবং তার পরিবারের বেঁচে থাকা নির্ভর করে জমির ফসলের উপর এবং অনেকটা প্রকৃতির উপর। বীজ রোপণের ক্ষেত্রে জমি প্রস্তুত করার জন্য তিনি খুব পরিশ্রম করেন। তিনি খুব সকালে উঠে চাষের জমিতে কাজ করতে যান। কৃষকদের কঠোর পরিশ্রমের কারণেই আমরা খাদ্য পাই। তারা আমাদের অর্থনৈতিক স্থিতিশীলতা বজায় রাখতেও গুরুত্বপূর্ণ ভূমিকা পালন করে। আমাদের অর্থনীতি মূলত কৃষির উপর নির্ভরশীল কারণ ভারতবর্ষ একটি কৃষিপ্রধান দেশ। বিপুল সংখ্যক মানুষ প্রত্যক্ষ বা পরোক্ষভাবে কৃষিতে নিয়োজিত। দেশের জাতীয় আয় ও অর্থনীতিতে কৃষি যে ভূমিকা পালন করে এর সাথে প্রত্যক্ষভাবে জড়িত এদেশের কৃষক। প্রয়োজনীয় খাদ্যের জোগান দিয়ে কৃষকরা আমাদের অস্তিত্ব টিকিয়ে রেখেছে। শস্য উৎপাদনে ভারতবর্ষের কৃষককুল যদি সক্রিয় ভূমিকা পালন না করত তাহলে নিত্য দুর্ভিক্ষের মধ্য দিয়ে বিপন্ন হয়ে যেত। পুষ্টিহীনতা আমাদের দেশের একটি জাতীয় সমস্যা। এ সমস্যা দূরীকরণে কৃষকরা প্রাণপণ চেষ্টা অব্যাহত রেখেছে। তাদের উৎপাদিত কৃষিপণ্য শাকসবজি ও ফলমূল থেকে ভিটামিনের চাহিদা পূরণ করা হয়ে থাকে, যা অত্যন্ত গুরুত্বপূর্ণ বিষয়। কৃষকরা যদি তাদের উৎপাদন বন্ধ করে দিত শুধু জনস্বাস্থ্যই হুমকির মুখে পড়ত না গভীর খাদ্যসংকটে বিনা আহারে প্রাণপাত হতো মানুষের। মূলত কৃষিপ্রধান ভারতবর্ষে কৃষিই বেঁচে থাকার ভরসা এবং আমাদের আশা-আকাঙ্ক্ষার মূল কেন্দ্রবিন্দু। ভারতবর্ষের কৃষক সমাজ তাদের জীবন ও জীবিকা ধারণের ক্ষেত্রে প্রতিমুহূর্তে অসংখ্য ছোট-বড় সমস্যার সম্মুখীন হয়। এই সকল সমস্যাবলী কৃষকদের জীবন ধারণ, জাতীয় উৎপাদন প্রক্রিয়া এবং সর্বোপরি সমগ্র জাতির অগ্রগতিকে বাধা দান করে। এ প্রসঙ্গে সর্বপ্রথম উল্লেখ করতে হয় নিজের রক্ত জল করে কৃষকের উৎপাদিত ফসলের ন্যায্যমূল্য না পাওয়ার ঘটনাকে।

ন্যায্যমূল্যের অভাবে প্রতিবছর ভারতবর্ষের অসংখ্য কৃষকের জীবন দুর্বিষহ হয়ে ওঠে। এছাড়া উল্লেখ করতে হয় কৃষিক্ষেত্রে সুদের কারবারের কথা। সরকারের তরফ থেকে কাঙ্খিত সাহায্য না পেয়ে বহু কৃষক বিভিন্ন ব্যাঙ্ক থেকে ঋণ নিতে বাধ্য হয়।

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তারপর সেই ঋণ শোধ করতে না পেরে দেনার দায়ে ডুবে আত্মহত্যা করা ছাড়া নিরীহ কৃষকের কাছে আর কোন পথ খোলা থাকেনা। এছাড়া বিভিন্ন অঞ্চলে প্রয়োজনীয় সেচের জল না পাওয়া, ন্যায্যমূল্যে ফসলের বীজ কিনতে না পারা, ব্যবসায়িক ক্ষেত্রে বিভিন্ন প্রক্রিয়াগত বাধা ইত্যাদি কৃষক সমাজের জ্বলন্ত সমস্যা। ভারতবর্ষের কৃষি খাতকে উন্নয়নশীল কৃষি খাতে পরিণত করতে হলে কৃষিতে বেশি বেশি প্রণোদনা বাড়ানো দরকার। কৃষকদের বেশি করে ঋণের ব্যবস্থা করতে হবে; যাতে কৃষকরা চাষাবাদের উপর বেশি মনোনিবেশ করতে পারে। এতে করে কৃষির উৎপাদন ক্ষমতা বাড়বে। কৃষকরা কৃষি কাজে আরও মনযোগী হবেন। সরকারি পৃষ্ঠপোষকতা ছাড়া কোনোভাবেই কৃষিখাতে উন্নয়ন সম্ভব নয়। সুতরাং, জাতীয় অর্থনীতির উন্নতির জন্য, কৃষকদের বৈজ্ঞানিক পদ্ধতিতে ফসল উৎপাদন করার পদ্ধতি শেখানো উচিত। কৃষকদের জীবনের উন্নতি ঘটাতে সরকারের উচিত সহজ শর্তে ভর্তুকি এবং ঋণ প্রদান করা।

ভারতবর্ষের সবচেয়ে বড় সম্পদ কৃষি। কৃষি ভারতবর্ষের কৃষকদের প্রাণ, ভারতবাসীর মুখের হাসি। কৃষি মিশে আছে ভারতবাসীর কৃসকদের রক্তে। দেশের ৬০শতাংশ লোক কৃষির ওপর নির্ভশীল। তাই উন্নয়নের সবচেয়ে বড় হাতিয়ার হবে কৃষি। আমাদের মাটি কৃষির মাটি।এদেশের মাটিতে সোনা ফলে।তাই কৃষিকে বাঁচাতে হবে, কৃষককে বাঁচাতে হবে। অল্পদামে কিংবা বিনামূল্যে সার, কীটনাশক, বীজ ও কৃষি যন্ত্রপাতি বিতরণ করতে হবে।

কৃষকের ভাগ্যের সাথে এই দেশের বেশিরভাগ মানুষের ভাগ্য নির্ভর করে। আমাদের দেশের অর্থনীতির মেরুদন্ড হলো কৃষি। এই মেরুদন্ডকে সোজা রাখতে হলে অর্থাৎ এদেশের উন্নতির করতে হলে তাই সর্বপ্রথম কৃষি ও কৃষকের উন্নয়ন করতে হবে। নয়তো দেশের সার্বিক উন্নতি ও পরিকল্পনা ব্যাহত হবে। এই গুরুদায়িত্ব কারো একার পক্ষে নেয়া সম্ভব নয়। এই দায়িত্ব আমাদের সবার তথা দেশের সকল জনগণের। তাই সরকারের পাশাপাশি আমাদেরকেও কৃষি ও কৃষকের উন্নয়নে এগিয়ে আসতে হবে।

Rahul Paul
B.Sc. (Agriculture), 2nd Year

Students Corner

বুড়ো চাচার প্রশ্ন

-সাহেব গড়াই

মুরা নাকি দ্যাশটোর ভবিষ্যৎ
মুদের জন্য নাকি লুকে খাবার পায়।
খালে বাবু মুদের উপর এমন অন্যায়টো ক্যানে?
রেশন দুকানে কদ্দিন এভাবে দাড়াবো বলতো।
মুদের ফসল হামাদিকেই কিনতে হবে দু'টাকায়।

সারাটোদিন ওই রোদে পুড়ে চাষ কইরছি,
গায়ের রং কালো তো হবেই;
তাবলে উমনভাবে অবহিলা করবি?
হাসপাতালে গিলে "পায়ে কাদা" বলে ডুকতে দেয়না,
জামাকাপড় কিনতে গেলে লুঙ্গি ছেড়ে প্যান্ট দিখায় না।

ওই "কেসিসি" তে নাকি মিলা টাকা;
সেই কবে ধান দিলুম, টাকা আসলোক লাই;
করিমের তো আবার ধান দিবার ডেটটোই এলু না।
তাবলি উমন "কেসিসি" কি হবে শুনি?

ছোড়াটো নাকি গাছের ডাক্তার,
এসেছিল বটে; কদিন ধরে মাপল-দেখল
সে কী বিশাল আয়োজন।
শেষদিনে কীসব বলে গেলো,

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কিন্তু ঔষুধ দিলেক লাই।
তাবলি ডাক্তার হইছিস কীসের লিগ্যা?

"জিরো টিলেজ" এ চাষ করলে নাকি উনেক লাভ পাবো;
করলুম; কিন্তু মিশেনের ভাড়াতে তো ভিখারি করে দিলো।
যেটো করলি সেটোর আগে খরচা ভাবলি লাই?

সিবারে মিলা আয়োজন করে রঞ্জনবাবুকে সিরা চাষির সম্মানটো দিলি,
কিন্তু তারই ফসলগুলা তো হাটে বিক্রি হল লাই!
বলি বাজারের দামটো কবে ঠিক করবি?

পিয়াজের দাম দেখে সিবারে সব ফেলে পিয়াজ লাগালাম;
পরের বারে আলুর দামটো বাড়ায় দিলি।
বলি হাতে-ভাতে সব জায়গাতেই মারবি?

বেগুনে নাকি পুকা ডুকাবি!
বলি পাগল হলে যাহয়;
বেগুনে কম পুকা হয় নাকি?
যাই করে লে, বেগুন তো বে-গুণই হবে।

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অমুক-তমুক কতোই তো করলি;

কাজ হলো তো লবডঙ্কা।

বলি এই বুড়ো চাচার কথাটো শুন,

পারলে আবার আগের মতো করে করে দে চাষবাসকে;

ছেলে-মেয়েগুলা খেয়ে-পড়ে বাঁচুক,

ক্ষেত-খামার ভরা ধান-গম দেখে চোখ জুরোতে দে।

Saheb Garain
B.Sc. (Agriculture), 3rd Year

Students Corner

RAIN

Rain Rain, O! beautiful rain,
Why don't you bring relief to my pain?
Don't touch those marigolds and lilacs in my grove,
Their frail petals would fall off then,
They are the only ones with whom I share my miseries,
They are the only ones who have seen me become insane;
Rain Rain, O! beautiful rain,
Why don't you bring relief to my pain?

I can't feel your pleasant rhythms,
I can't sleep at night,
All that I can do is to try to hold your drops tight;
I have found for bliss everywhere,
I try to laugh but all in vain;
O! Rain Rain, can't you heal my wound
And bring solace to my pain?

I am tried of this darkness all around,
Tell those restless clouds to go;
I need a day with the sun above,
A morning with the blazing rainbow...

But neither the dream would ever come true,

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Nor you can wash my sorrow;

I have to cherish your cold drops on my palm,

And the solitude from someone I did borrow;

Whoever could get me out of these bitter thoughts,

Will never come to again,

Rain Rain, O! beautiful rain,

You can't bring relief to my pain....

Samaj Mukherjee
B.Sc. (Agriculture), 2nd Year

Students Corner

Stay forever

Swinging through the air
I thought it was fair.
To love the air
Rather than your sweet glare
The aroma makes me strong
But I was clearly wrong
The sugary taste of yours
Can kill thousands of girls
You don't feel my presence
But I have lots of patience
The bees around you
Makes me feel jealous about you
Unluckily, that's the fate
Which I have to accept
With my hearts being free
Just Stay forever my mango tree

2022-09-13
From vivo Notes

Saptadwipa Mudi
B.Sc. (Agriculture), 2nd Year

Students Corner

RACHEL CARSON AND HER "SILENT SPRING"

We all know many scientists and authors. Today we come to know about a finest nature writer of the twentieth century, Rachel Carson (1907-1964) is remembered more today as the woman who challenged the notion that humans could obtain mastery over nature by chemicals, bombs and space travel than for her studies of ocean life.

Rachel Carson, writer, scientist, and ecologist, grew up simply in the rural river town of Springdale, Pennsylvania. Her mother bequeathed to her a life-long love of nature and the living world that Rachel expressed first as a writer and later as a student of marine biology. Carson graduated from Pennsylvania College for Women (now Chatham University) in 1929, studied at the Woods Hole Marine Biological Laboratory, and received her MA in zoology from Johns Hopkins University in 1932.

She was hired by the U.S. Bureau of Fisheries to write radio scripts during the Depression and supplemented her income writing feature articles on natural history for the Baltimore Sun. She began a fifteen-year career in the federal service as a scientist and editor in 1936 and rose to become Editor-in-Chief of all publications for the U. S. Fish and Wildlife Service.

She wrote pamphlets on conservation and natural resources and edited scientific articles, but in her free time turned her government research into lyric prose, first as an article "Undersea" (1937, for the Atlantic Monthly), and then in a book, Under the Sea-Wind (1941). In 1952 she published her prize-winning study of the ocean, The Sea Around Us, which was followed by The Edge of the Sea in 1955. These books constituted a biography of the ocean and made Carson famous as a naturalist and science writer for the public. Carson resigned from government service in 1952 to devote herself to her writing.

She wrote several other articles designed to teach people about the wonder and beauty of the living world, including "Help Your Child to Wonder," (1956) and "Our Ever-Changing Shore" (1957), and planned another book on the ecology of life. Embedded within all of Carson's writing was the view that human beings were but one part of nature distinguished primarily by their power to alter it, in some cases irreversibly.

DDT, the most powerful pesticide the world had ever known, exposed nature's vulnerability. Unlike most pesticides, whose effectiveness is limited to destroying one or two types of insects, DDT was capable of killing hundreds of different kinds at once. Developed in 1939, it first distinguished itself during World War II, clearing South Pacific islands of malaria-causing insects for U.S. troops while being used as an effective delousing powder in Europe. Its inventor was awarded the Nobel Prize.

When DDT became available for civilian use in 1945, there were only a few people who expressed second thoughts about this new miracle compound. One was nature writer Edwin Way Teale, who warned, "A spray as indiscriminate as DDT can upset the economy of nature as much as a revolution upsets social economy. Ninety percent of all insects are good, and if they are killed, things go out of kilter right away." Another was Carson, who wrote to Reader's Digest to propose an article about a series of tests on DDT being conducted not far from where she lived in Maryland. The magazine rejected the idea.

Thirteen years later, in 1958, Carson's interest in writing about the dangers of DDT was rekindled when she received a letter from a friend in Massachusetts bemoaning the large bird kills that had occurred on Cape Cod as the result of DDT sprayings. The use of the pesticide had proliferated greatly since 1945, and Carson again tried, unsuccessfully, to interest a magazine in assigning her the story of its less desirable effects. By

Students Corner

1958, Carson was a best-selling author, and the fact that she could not obtain an assignment to write about DDT is indicative of how heretical and controversial her views on the subject must have seemed. Having already amassed a large quantity of research on the subject, however, Carson decided to go ahead and tackle the issue in a book.

Silent Spring took Carson four years to complete. It meticulously described how DDT entered the food chain and accumulated in the fatty tissues of animals, including human beings, and caused cancer and genetic damage. A single application on a crop, she wrote, killed insects for weeks and months—not only the targeted insects but countless more—and remained toxic in the environment even after it was diluted by rainwater. Carson concluded that DDT and other pesticides had irrevocably harmed animals and had contaminated the world's food supply. The book's most haunting and famous chapter, "A Fable for Tomorrow," depicted a nameless American town where all life—from fish to birds to apple blossoms to human children—had been "silenced" by the insidious effects of DDT.

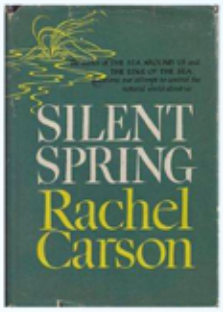
First serialized in The New Yorker in June 1962, the book alarmed readers across America and, not surprisingly, brought a howl of indignation from the chemical industry. "If man were to faithfully follow the teachings of Miss Carson," complained an executive of the American Cyanamid Company, "we would return to the Dark Ages, and the insects and diseases and vermin would once again inherit the earth." Monsanto published and distributed 5,000 copies of a brochure parodying Silent Spring entitled "The Desolate Year," relating the devastation and inconvenience of a world where famine, disease, and insects ran amok because chemical pesticides had been banned. Some of the attacks were more personal, questioning Carson's integrity and even her sanity.

Her careful preparation, however, had paid off. Anticipating the reaction of the chemical industry, she had compiled Silent Spring as one would a lawyer's brief, with no fewer than 55 pages of notes and a list of experts who had read and approved the manuscript. Many eminent scientists rose to her defense, and when President John F. Kennedy ordered the President's Science Advisory Committee to examine the issues the book raised, its report thoroughly vindicated both Silent Spring and its author. As a result, DDT came under much closer government supervision and was eventually banned. The public debate moved quickly from whether pesticides were dangerous to which ones were dangerous, and the burden of proof shifted from the opponents of unrestrained pesticide use to the manufacturers.

The most important legacy of Silent Spring, though, was a new public awareness that nature was vulnerable to human intervention. Carson had made a radical proposal: that, at times, technological progress is so fundamentally at odds with natural processes that it must be curtailed. Conservation had never raised much broad public interest, for few people really worried about the disappearance of wilderness. But the threats Carson had outlined—the contamination of the food chain, cancer, genetic damage, the deaths of entire species—were too frightening to ignore. For the first time, the need to regulate industry in order to protect the environment became widely accepted, and environmentalism was born.

Students Corner

Carson was well aware of the larger implications of her work. Appearing on a CBS documentary about Silent Spring shortly before her death from breast cancer in 1964, she remarked, "Man's attitude toward nature is today critically important simply because we have now acquired a fateful power to alter and destroy nature. But man is a part of nature, and his war against nature is inevitably a war against himself? [We are] challenged as mankind has never been challenged before to prove our maturity and our mastery, not of nature, but of ourselves."



One of the landmark books of the 20th century, Silent Spring's message resonates loudly today, even several decades after its publication. And equally inspiring is the example of Rachel Carson herself. Against overwhelming difficulties and adversity, but motivated by her unabashed love of nature, she rose like a gladiator in its defense.

Name – Shankhashubhra Sahoo

B.Sc Agriculture(Hons.), 2nd year

UID – TNU2021032100152

Sec- C

Students Corner

"ভেজাল জীবন"

জমিটাতে জীবনটা দিচ্ছে দিয়ে
পাচ্ছেনা তাও ভালো ফলন,
ভেজাল সার দিচ্ছে তাদের
বড়ো বাবুদের বড়ো খোকন।

গরীবের লুটে খাচ্ছে তারা
অগাধ দামে সস্তা মালে,
গ্রামের মানুষ ভোলা যত
পড়ছে বাবুদের কাটা খালে।

লাভের হার নেমেছে তলায়
ভেজাল ওষুধে চাষীর ক্ষয়,
শরীর তাদের যাচ্ছে ঢলে
তাদেরও বুকে জমছে ভয়।

মাথার ওপর ঋণের ধাক্কা
এবার সব শেষ করার পালা,
বিষের শিশিটা কি পারবে মেটাতে
যন্ত্রণাকাতর চাষীর বুকের জ্বালা!

-শুভদীপ মাহাতো

Students Corner

"আড়াই বিঘার দাম"

কথা-তথা বলে লাভ নেই ভাই,jcb টা দাও সোজা চালিয়ে;
আড়াই বিঘা জমির মালিক,সে আটকাবে আমাদের কাজ!
জানেনা ওরা সরকারের হাতে সময় নেয়! সামনেই ভোট
যে কোনো ভাবেই হোক রাস্তাটা চওড়া করতেই হবে আজ।

চাষ করে দু-পয়সা পাবে খুব জোর, মরবে না খেতে পেয়ে;
সরকার বলেছে মাসে অন্তত পাঁচ হাজার করে ভাতা দেবে।
খুশী মনে রাজী হলেই হয়,বোকা চাষী লাভ বোঝেই না কিছু;
হ্যাঁ কিন্তু শর্ত একটাই ভাতাটা পাঁচ বছর এর জন্যই পাবে।

তারপর,
তারপর সরকার ঘুরেও তাকাবে মানুষটা খেতে পাচ্ছে নাকি!
চাষ করে তো ভালোই বেচেঁ ছিল,দিব্যি কাটছিল দিন গুলো।
হ্যাঁ সাদা কালো ছিলো,সবার তো জীবন মানেই জি বাংলা নয়;
তাই বলে জীবন সমান জমিটাই কেড়ে রাস্তা বানাতে হলো!

একদিন শুধু রাস্তাই থাকবে,থাকবেনা ওই বোকা মানুষ গুলো,
আর একদিন,ওই রাস্তা দিয়েই অন্য রাজ্য থেকে আসবে চাল;
বেশি দাম দিয়ে কিনবে,বাড়াবে কর,আবার মরবে সেই চাষীটা,
যুগ পরেও তারা নুন মেখেই ভাত খাবে,জুটবে কি পাতে ডাল!

-শুভদীপ মাহাতো

Students Corner

কৃষকের প্রাণ:- 4 টাকা প্রতি কেজি

সেদিন নিজের বাড়ির ড্রয়িং রুমে খবরের কাগজ পড়তে পড়তে বিনয় বাবুর চোখে পড়ল শেষপাতার কোনায় থাকা একখান টুকরো খবরের উপর। মানে, পাতা ভরানোর জন্য যেটুকু না দিলে না হয় ততটুকু আর কি...!। কিন্তু খবরটা কী? "লোনের টাকা না দিয়ে আত্মঘাতি কৃষক, বর্তমান অবস্থা আশঙ্কাজনক"

বিনয় বাবুর কথায়, আচ্ছা সরকার তো ওদের এত টাকা দিচ্ছে, তা কোথায় যাচ্ছে?। সবই লোন না দেওয়ার ধান্দা...!। বাজারে যা জিনিসপত্রের দাম তা-কি কৃষকরা পাচ্ছে না?। তাছাড়া ওদের তো আর বিনয় বাবুর মত ট্যাক্স দিতে হয় না।ওহ বলে রাখি, বিনয় বাবু একখান বেসরকারি মাল্টিন্যাশনাল কোম্পানির সিনিয়র কর্মচারী। যার মাসিক বেতন বলে আর লজ্জা দেওয়া ঠিক হবে না। কৃষকরা দেশের কী কাজে লাগবে শুনি? ওদের কারণে দেশটা আজ এত পিছিয়ে...। না হলে কবেই দেশটা আমেরিকা হয়ে যেত। আচ্ছা চাষিরা যদি নাই থাকে তবে কি এমন হয়ে যাবে?। অনেক তো দেশ আছে তারা খাবার জিনিস বাইরে থেকে ইমপোর্ট করে, তা বলে তো তারা আর গরিব নয়...।

আচ্ছা বিনয় বাবু, প্রতিটা কৃষক যদি ওই একই কথা ভাবতো তাহলে সত্যি হয়তো তাদের অবস্থা এমন হতো না। কিন্তু ওই যে যারা মা-মাটির সাথে থাকে তারা আর যাই হোক স্বার্থপর হতে শেখেনি। কৃষক যদি প্রয়োজন মেপে চাষ করত তাহলে কি বিনয় বাবুর মত মানসিকতা তৈরি হতো?। না! কোনদিনই হতো না!।

এই সমাজ আজ ও বুঝে উঠতে পারল না ওরা কোন যন্ত্র নয়, ওরাও মানুষ। নিজের বুকের রক্তে গড়া সোনা কেজি দরে বিক্রি করতে হয়তো শুধুমাত্র কৃষকরাই পারে।

এই যে বিনয় বাবু , ওদের প্রাণের দাম কত টাকা কেজি হিসাবে ইমপোর্ট করতে পারবেন বলে মনে হয়...!।

বি:দ্র- লেখার সাথে বাস্তবের কোন চরিত্রের মিল থাকলে তা সম্পূর্ণ অনিচ্ছাকৃত ও কাকতালীয়

Name- suman manna

UID-TNU2021032100128

3rd sem

Students Corner

हर जिव के लिए जैसे यह भगवान है,

इनके बिना मच सकता त्राहीमाम है,

हमारे भुख मिटाने को खुद भुखे काम करते,

ऐसे हमारे किसान महान है।

Translation:- Hindi to English

For every living being as it is God,

Without them, there can be a tragedy,

To satisfy our hunger, he himself use to work hungry,

Our farmers are great like this.

_Sutapa Sarkar

Photography and Image Gallery

Arijit Pati
B.Sc. (Agriculture), 2nd Year

Arijit Pati
B.Sc. (Agriculture), 2nd Year

Arijit Pati
B.Sc. (Agriculture), 2nd Year

Arijit Pati
B.Sc. (Agriculture), 2nd Year

Arijit Pati
B.Sc. (Agriculture), 2nd Year

Arnab Sannigrahi
B.Sc. (Agriculture)

Arnab Sannigrahi
B.Sc. (Agriculture)

Arnab Sannigrahi
B.Sc. (Agriculture)

Arnab Sannigrahi
B.Sc. (Agriculture)

Photography and Image Gallery

Avinandan Jana
B.Sc. (Agriculture), 5th Sem

Dibyendu Panda
B.Sc. (Agriculture)

Dibyendu Panda
B.Sc. (Agriculture)

Dibyendu Panda
B.Sc. (Agriculture)

Dibyendu Panda
B.Sc. (Agriculture)

Keya Ghosh
B.Sc. (Agriculture), 3rd Year

Keya Ghosh
B.Sc. (Agriculture), 3rd Year

Keya Ghosh
B.Sc. (Agriculture), 3rd Year

Keya Ghosh
B.Sc. (Agriculture), 3rd Year

Photography and Image Gallery

Keya Ghosh
B.Sc. (Agriculture), 3rd Year

Keya Ghosh
B.Sc. (Agriculture), 3rd Year

Keya Ghosh
B.Sc. (Agriculture), 3rd Year

Keya Ghosh
B.Sc. (Agriculture), 3rd Year

Antima Roy
B.Sc. (Agriculture), 2nd Year

Antima Roy
B.Sc. (Agriculture), 2nd Year

Antima Roy
B.Sc. (Agriculture), 2nd Year

Antima Roy
B.Sc. (Agriculture), 2nd Year

Apurba Dutta
B.Sc. (Agriculture), 2nd Year

Photography and Image Gallery

Apurba Dutta
B.Sc. (Agriculture), 2nd Year

Apurba Dutta
B.Sc. (Agriculture), 2nd Year

Apurba Dutta
B.Sc. (Agriculture), 2nd Year

Apurba Dutta
B.Sc. (Agriculture), 2nd Year

Apurba Dutta
B.Sc. (Agriculture), 2nd Year

Kaushal Panda
B.Sc. (Agriculture), 2nd Year

Kaushal Panda
B.Sc. (Agriculture), 2nd Year

Kaushal Panda
B.Sc. (Agriculture), 2nd Year

Kaushal Panda
B.Sc. (Agriculture), 2nd Year

Photography and Image Gallery

Kaushal Panda
B.Sc. (Agriculture), 2nd Year

Kaushal Panda
B.Sc. (Agriculture), 2nd Year

Rima Chandra
B.Sc. (Agriculture), 2nd Year

Rima Chandra
B.Sc. (Agriculture), 2nd Year

Rima Chandra
B.Sc. (Agriculture), 2nd Year

Rima Chandra
B.Sc. (Agriculture), 2nd Year

Rima Chandra
B.Sc. (Agriculture), 2nd Year

Rima Chandra
B.Sc. (Agriculture), 2nd Year

Sukanta Hazra
B.Sc. (Agriculture), 3rd Year

Photography and Image Gallery

Sukanta Hazra
B.Sc. (Agriculture), 3rd Year

Sukanta Hazra
B.Sc. (Agriculture), 3rd Year

Sukanta Hazra
B.Sc. (Agriculture), 3rd Year

Sukanta Hazra
B.Sc. (Agriculture), 3rd Year

Sukanta Hazra
B.Sc. (Agriculture), 3rd Year

Sukanta Hazra
B.Sc. (Agriculture), 3rd Year

Sayan Das
B.Sc. (Agriculture), 3rd Year

Sayan Das
B.Sc. (Agriculture), 3rd Year

Sayan Das
B.Sc. (Agriculture), 3rd Year

Photography and Image Gallery

Puspendu Bera
B.Sc. (Agriculture), 2nd Year

Puspendu Bera
B.Sc. (Agriculture), 2nd Year

Puspendu Bera
B.Sc. (Agriculture), 2nd Year

Ritabrata Mukhopadhyay
B.Sc. (Agriculture), 2nd Year

Ritabrata Mukhopadhyay
B.Sc. (Agriculture), 2nd Year

Ritabrata Mukhopadhyay
B.Sc. (Agriculture), 2nd Year

Ritabrata Mukhopadhyay
B.Sc. (Agriculture), 2nd Year

Ritabrata Mukhopadhyay
B.Sc. (Agriculture), 2nd Year

Rupsha Chakraborty
B.Sc. (Agriculture), 4th Year

Photography and Image Gallery

Rupsha Chakraborty
B.Sc. (Agriculture), 4th Year

Rupsha Chakraborty
B.Sc. (Agriculture), 4th Year

Rupsha Chakraborty
B.Sc. (Agriculture), 4th Year

Rupsha Chakraborty
B.Sc. (Agriculture), 4th Year

Rupsha Chakraborty
B.Sc. (Agriculture), 4th Year

Sarfaraj Ikbal
B.Sc. (Agriculture), 2nd Year

Sarfaraj Ikbal
B.Sc. (Agriculture), 2nd Year

Sarfaraj Ikbal
B.Sc. (Agriculture), 2nd Year

Shreetama Giri
B.Sc. (Agriculture), 3rd Year

Photography and Image Gallery

Soham Chatterjee
B.Sc. (Agriculture), 2nd Year

Soham Chatterjee
B.Sc. (Agriculture), 2nd Year

Soham Chatterjee
B.Sc. (Agriculture), 2nd Year

Soham Chatterjee
B.Sc. (Agriculture), 2nd Year

Soham Chatterjee
B.Sc. (Agriculture), 2nd Year

Srijeet Bhakta
B.Sc. (Agriculture), 4th Year

Srijeet Bhakta
B.Sc. (Agriculture), 4th Year

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Photography and Image Gallery

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Sumit Biswas
B.Sc. (Agriculture), 4thYear

Sumit Biswas
B.Sc. (Agriculture), 4thYear

Sumit Biswas
B.Sc. (Agriculture), 4thYear

Photography and Image Gallery

Sumit Biswas
B.Sc. (Agriculture), 4thYear

Sumit Biswas
B.Sc. (Agriculture), 4thYear

Sumit Biswas
B.Sc. (Agriculture), 4thYear

Sumit Biswas
B.Sc. (Agriculture), 4thYear

Sayan Hazra
B.Sc. (Agriculture), 4th Year

Sayan Hazra
B.Sc. (Agriculture), 4th Year

Sayan Hazra
B.Sc. (Agriculture), 4th Year

Sayan Hazra
B.Sc. (Agriculture), 4th Year

Sayan Hazra
B.Sc. (Agriculture), 4th Year

Photography and Image Gallery

Sayan Hazra
B.Sc. (Agriculture), 4th Year

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B.Sc. (Agriculture), 4th Year

Sayan Hazra
B.Sc. (Agriculture), 4th Year

Sayan Hazra
B.Sc. (Agriculture), 4th Year

Field Activities and Interviews

Conversation between Saheb Garain and farm assistant of the Neotia University

Saheb: Good afternoon sir, what is your name?

Sir: Sukritiranjan Bauri.

Saheb: Sir, where do you live?

Sir: South 24 paraganas, mothurapur, 2no block, kharapara gram.

Saheb: sir, please tell me about your studies.

Assiatant: I just only passed my HS exam from arts.

Saheb: sir then how do you connected with agriculture?

Sir: my family was an agricultural family and I was doing clubbing after my HS. Then suddenly one 6 month course was announced from Nimpith Ramkrishna Mission and I registered on it. The subjects of the training were agronomy, horticulture, animal husbandry, fishery etc. During that training teachers taught us very carefully about the subjects and after that training I got chances to participates in such type of trainings. And that's how I came to agriculture field.

Saheb: where you started your first job career sir?

Tell us something about your career please.

Sir: Nilpith Mission surveyed a project on my village where I participate actively and after the grand result of the project they called me for the job.

Here I used to monitor the fields of villages firstly and then shift to the work of observing the farm of the Ramkrishna Mission.

Field Activities and Interviews

Saheb: Sir please tell us about your first project.

Sir: My first project was coordinated by Dr. Kanailal Bandhopadhay. This project is developed and accepted by the farmers of the villages very much. In the lowland areas like Sundarbans where 6 months are flooded with salt water and another 6 months were left dried, one farmer can dug a pond on 5/6th portion of the land and can utilize the Dugged-soil to fill up the 1/6th land for cultivation .Thus the cultivation of high yielding paddy varieties started in spite of the traditional varieties on the raised bed and vegetables were cultivated on the furrows of the field and fruit plants are cultivated on the bunds of the ponds. As well as farmers can cultivate 3-4 crops on the same piece of land by using the stored pond water and fishery on that pond became their additional income. It was largely accepted on the rural areas of south 24 parganas' like Patharpratima, Namkhana, Kakdwip, Sagar, Mothurapur, Joynando. They raised their level economically by cultivating on this way on this project farmers got the full support of the farmers until and unless they can stand on their own lands.

Saheb: Sir what type of fruit or vegetable we can cultivate?

Sir: On south 24 parganas, after the monsoon we can cultivate tomato, chilli and cucurbits like cucumber, jingle, corolla etc vegetables and fruits like guava, papaya, plum etc.

Saheb: what are the other works done by you sir?

Sir: I do different type of works, in that I concentrate on where to plant trees, prepare land, maintaining land, plot selection, selection of crop for cultivation, practicing mulching cultivation.

- Three norms of farming: -
  - Trial
  - Demonstration
  - Extension

Saheb: Sir, any new method introduced in farming there?

Sir: Drip irrigation system- this type of irrigation has many benefits, like it protects excessive weed growth.

Field Activities and Interviews

Saheb: In your 39yr of working experience have what type of practices you do participated.

Sir: I have practiced grafting and also instructed other workers in practicing grafting and in majority we received success.

Saheb: what is the cause of your grand success in grafting?

Sir: The much you practice according to that success rate will increase. Using sharp knife and different tools are not the actual key behind success, you have to know the thing and have the practice knowledge after that the successes rate will increase drastically. Once I met with a person, the success rate was 97 out of 100, and his key of success was practice.

E.g.: - a simple batsman knows the to hit sixer but he can't because he does not have, the practice knowledge. Same everyone knows how to do grafting by watching YouTube, teachers, farmers but if the practice is not there then successes rate will be low or null.

Saheb: In which plant you have tried grafting?

Sir: I have done grafting in sapota and apple tree and budding in guava and star fruit.

Saheb: When did you join the campus, sir?

Sir: In 2020 I joined the institute.

Saheb: What labs and area of cultivable land is there in our campus?

Sir: 25 acre or 75 bighas of cultivable land and specific land for goatry and fisheries, and at present there are sufficient infrastructure for students.

There is mushroom cultivation lab, azolo pinata cultivation area and dairy cultivation area are made.

Saheb: At present what cultivation are going on in our campus?

Field Activities and Interviews

Sir: Horticultural crops and agronomic crops are in cultivation vegetables and orchard cultivation are there (coconut, sapota, banana, guava).

Coffee seedlings are sown which are in trial process of cultivation. And next attempt is for apple plant.

Saheb: What crop are being cultivated on agronomy plot?

Sir: All type of agronomic crops like rice, maize, ground nut, pea, sorghum, sugarcane.

Saheb: In low land with rice what type of plantation are being cultivated?

Sir: In low land hip method is followed to cultivate fruit. Hip to hip distance 7m, hip diameter 3m, plant height 1.5m. Ridge and furrow method is also used for fruit cultivation. In ridge fruits are planted and from furrow water is transported. We cultivate vegetable also. Paddy cum fish culture can also be done is also being practiced. Trench system and pit system are practiced.

Saheb: What is trench system and pit system?

Sir: In the trench system trench/ bund is formed around a fields and fish is cultivated. In pit system small pit is formed where rice and fish are cultivated together. When water level decreases in the pit then fish are sold out in market.

Saheb: What crops are being cultivated in poly house.

Sir: High value crops like off season spinach, tomato, gerbera etc. When I was in Nimpit Ramkrisna Misson we provided free polyhouse to 85 farmers but they cannot able to maintain.

Saheb: What type of fertilizers we should use from your point of view.

Field Activities and Interviews

Sir: Now a days we use chemical fertilizer but one day we will return to organic manure. Land in which organic manure is used from first are giving good yield even if we don't use fertilizer for one year, but in land where we us chemical fertilizer we can see yield loss in disturbance in fertilizer. Using chemical fertilizer is people mentality. The land doesn't need chemical fertilizer in that land also people give chemical fertilizer. Once a farmer came to me and asked that in my land I cannot cultivate any crop, after doing soil test I came to a result and to farmer that apply bio fertilizer till 1 year then start cultivation and the land will be perfect.

Saheb: What is the future planning of agriculture in our campus?

Sir: In floriculture, orchard, agro forestry, and in fruits huge amount of investment has been done.

Saheb: Any suggestion for we agriculture student from your side.

Sir: You all need confidence and mentality to study agriculture. Without focused mind set for agriculture you cannot do any thing in proper way. You have to do field work from your heart just not for you have to do that.

Saheb: Thank you sir I am really grateful near you for giving me your valuable time as well such precious information from your experience.

CREDIT: -

Sukritiranjan Bauri (Farm assistant), south 24 parganas', mothurapur, 2no block, kharapara gram.

Information collected by – Saheb Garain

Video made by – Malay kr Doluy

Edited by – Sourav Goldar

Field Activities and Interviews

Link-

https://web.microsoftstream.com/video/23f5939b-79bb-4e26-8ffe-afde67242431

Saheb Garain
B.Sc. (Agriculture), 3rd Year

Field Activities and Interviews

Conversation between Sourav Bag And a Farmer of Sehalampur village

Sourav :-Uncle, What is your name?
Farmer:- Barun Mondal.

Sourav:-Where do you live?
Farmer:- Sehalampur, Diamond Harbour-II.

Sourav:-How much land you have?
Farmer:- I have Total 15 bigha land in which I cultivated the kharif rice in 11 bigha land and vegetables within 4 bigha land.

Sourav:- Can you tell me the name of Cultivated Kharif Rice variety in your field ?
Farmer:- Super Shyamoli, Dudheshwar, Santoshi

Sourav:-Well, Which Variety among them have you considered better for cultivating in your field ?
Farmer:-For High Rainfall Super Shamoli is best but in case of Medium Rainfall Dudheshwar, Santoshi are better than Super Shyamoli.

Sourav:- Which type of Nursery Bed have you followed for rice Cultivation?
Farmer:-Wet bed Nursery

Sourav:- How Much Rice Seeds are required for 1 bigha Transplanting For each variety?
Farmer:- Super Shyamoli:-8 kg, Dudheshwar:-5 kg, Santoshi:-7 kg

Sourav:-Have you Followed Any Seed Treatment?
Farmer:-Yes

Field Activities and Interviews

Sourav:-Have you applied Cowdung or FYM for your Rice Cultivation as a Basal Dose ?
Farmer:- Yes, 800 kg cowdung for 1 bigha .

Sourav:-How much quantity of inorganic fertilizer have you applied in your main field ?
Farmer:-Urea:-18 kg ,DAP:-12 kg, MOP:-12 kg for 1 bigha.

Sourav:-Have you followed top dressing?
Farmer:- yes.

Sourav:-Which method of irrigation have you followed in your rice field ?
Farmer:- Canal irrigation.

Sourav:- Any ITK Technology have you followed?
Farmer:- I had applied leaf manure of jute leaf in main field. But now a days I don't follow the practice as because the cost of cultivation become high.

Sourav:-What type of pest have you observed in your field?
Farmer:-Yellow stem borer, Brown plant hopper, Green Leaf Hopper.

Sourav:-What type of Insecticides have you applied to get rid off from pest infestation ?
Farmer:-
For Yellow Stem Borer:- Zygant Insecticides , Flubendiamide 0.7 % Gr @ 5 kg / Acer
For Brown and Green Plant Hopper:- Hunk Insecticides Acephate 95 % SG @ 1 gm / liter of water
For Cattepillar:- Koranda 505 insecticides, Chloropyriphos 50 % + Cypermethrin 5 % @ 2 ml / Liter

Sourav:- What type of Disease have you observed in your Rice field ?
Farmer:- Rice Blast and Sheath Blight

Field Activities and Interviews

Sourav :- What type of Fungicides have you applied to get rid off from Disease infestation ?
Farmer:-
Rice Blast :-- Fujione Insecticides , Isoprothiolane 40 % EC @ 2 ml / Liter
Sheath Blight :-Contaf Plus , Hexaconazole 5 % SC @ 2 ml / Liter

Sourav:-Have you followed the Border Cultivation in the bund around the Rice Field?
Farmer:-Yes

Sourav :-Well, Which Crop have you Sown at bund ?
Farmer:- Vegetables

Sourav:-Okay. But why you have practiced this Vegetable Cultivation at Bund ?
Farmer:- I have cultivated the vegetables at bund due to Utilization of extra palces of the bund besides of that I also used the vegetables as a side business for income generation as well for my own home consumption .

Sourav:- How Much Yield have you got from Rice Cultivation?
Farmer:- Rice 800 kg /bigha

Sourav:-Do You Think to practiced of Integrated farming in your field ?
Farmer:- No

Sourav:-Did the ADO office organized any Training Program?
Farmer:- Yes

Field Activities and Interviews

Sourav:-Thank you uncle, I am really grateful near you for giving me your valuable time as well as such precious Information about your Strategies of Rice Cultivation.

Barun Mondal, Farmer, Sehalampur, Diamond Harbour-II
Information Collected by Sourav Bag, 4th year, B.Sc Agriculture
Photographer:- Bastab Bose, 2nd year, B.Sc Agriculture
Video Edited by Subhadeep Mahato, 2nd year, B.Sc Agriculture

https://drive.google.com/file/d/1iuOySQqZUnrK5L_toCRC3kIUd0Voakwr/view

Sourav Bag
B.Sc. (Agriculture), 4th Year

Field Activities and Interviews

Puspendu Bera
B.Sc. (Agriculture), 2nd Year

Samrat Maity
B.Sc. (Agriculture), 2nd Year

Sayan Kumar Naskar
B.Sc. (Agriculture), 3rd Year

Sayan Kumar Naskar
B.Sc. (Agriculture), 3rd Year

Shreetama Giri
B.Sc. (Agriculture), 3rd Year

Shreetama Giri
B.Sc. (Agriculture), 3rd Year

Field Activities and Interviews

Subhadeep Mahato
B.Sc. (Agriculture), 2nd Year

Surajit das
B.Sc. (Agriculture), 3rd Year

Swarnendu Bhowmick
B.Sc. (Agriculture), 3rd Year

Taniya Pal
B.Sc. (Agriculture), 3rd Year

FARMERS' AWARENESS AND OUTREACH PROGRAMMES: PLANNED AND ORGANISED BY THE DEPARTMENT OF AGRICULTURAL EXTENSION

Dr. Abhishek Ghosh

Farmers' awareness and outreach programmes are intended to reach the rural community to provide them with the access to knowledge and information they need to increase productivity and sustainability of their production process and enhance their quality of life and livelihoods. Latest developments in agricultural policies and practices need to reach the farmers and other stakeholders associated with the agriculture sector. The reason being there are certain important issues including the necessity to respond to the specific problems and challenges faced by the farmers that vary from one agro-ecological zone to other. The Neotia University is located in the coastal saline region of West Bengal and the farming community of this particular region face some unique issues related to soil salinity, low lying lands, water stagnation and increasingly unpredictable weather events. As a result, there is a need for localized solutions suited for this particular environmental and local conditions.

All the programmes were planned based on the idea of creating awareness about modern crop management practices, providing information to the farmer's community as well as exploring new income opportunities for the rural community. Through these programmes the School of Agriculture and Allied Sciences got directly engaged with the farming community, Farmer-producer Company (FPC) and Self Help Group (SHG) who played a pivotal role in the successful completion of the Rural Agricultural Work Experience Programme (RAWE) for our 7th Semester B.Sc. Agriculture students.

Two Farmers' Awareness cum Demonstration Programmes on Vermicompost Production were conducted at Ashotosh Mukherjee Block (SB-2) in The Neotia University campus. Farmers (both including male and females) from Sahelampur and Darikrishnagar village attended these programmes. The farmers were shown the process of vermicomposting and its application by the students under supervision of subject matter expert Dr. Tanuj Kumar Mondal, Dr Shraddha Bhattacharjee and Dr Abhishek Ghosh. The farmers were also given a guided tour of the vermicompost production unit and Dr. Mandal shared valuable information's about pit construction with farmers. Students also showed the farmers other structures present on campus (net house, poly house, etc.) as well as the aromatic and medicinal plants (vetiver, brahmi, mint etc.) growing in farm.

Another Farmers' Awareness Programme on Vetiver was organised at the premises of Pallymangal Agro-farmers Producers Company Ltd. under the supervision of Dr. Sarthak Bhattacharya (subject matter expert), Dr. Shraddha Bhattacharjee and Dr. Agniswar Jha Chakraborty. The various aspects of Vetiver cultivation including varietal selection, crop management practices, harvesting techniques, processing and economic feasibility were discussed. The chairman and the farmer members of the FPC participated in the programme.

Another Farmers' Awareness cum Demonstration Programme was conducted on Integrated Pest & Disease Management under the supervision of Dr. Koushik Sen (subject matter expert), Dr. Arghya Banerjee (subject matter expert), Dr. Shraddha Bhattacharjee and Dr Abhishek Ghosh. This particular program was attended by the farmers from Lakshmanpur village. The focus here was on Integrated Pest & Disease Management with symptoms and control measures of certain important insect pests and diseases prevalent in this region. The farmers were shown herbarium of insects and disease samples by Mr. Tanmoy satpati after a presentation by the students. Thereafter a guided tour of the Soil Science laboratory was organised for the visiting farmers under the supervision of Mr. Sourav Mullick (subject matter expert).

Mushroom is not only an affordable source of nutrition, it also has excellent potential of becoming a viable income source for rural women. The women of a SHG from Jhaodari village attended a Farmers' Awareness cum Demonstration Programme on Oyster mushroom production technique. The students of 7th Semester B.Sc. Agriculture actively participated in this programme and assisted Dr. Solanki Sarkar (subject matter expert) in demonstrating the culture media preparation and production techniques to the visiting SHG members. The women from Jhaodari were extremely enthusiastic about taking up mushroom production in the future. Dr. Sarkar also made them aware of the various processing techniques of mushroom which can help the women prepare value added food items from their future produce.

INSTITUTIONAL AND EDUCATIONAL VISITS

1. Visit to Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith, South 24 Parganas

On 07.06.2022, the students of 6th semester of B.Sc. Agriculture (2019 Batch) visited to Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith, South 24 for the completion of a practical lesson on Beekeeping in the course Management of Beneficial Insects. After reaching the KVK campus, the KVK authorities welcomed the students and the faculties and made their sitting arrangement in the Conference Hall where they were communicated by the respective KVK personnel. Dr. Prabir Kumar Mandal, SMS and In charge of AICRP- Beekeeping had introduced himself. He briefly discussed about the KVK, its mandate, objective, and functions to the students.

On practical aspects of beekeeping, he highlighted the topic related to beekeeping such as castes and species of honeybees, their importance in pollination, importance of honey and bee products, history of beekeeping, production of honey, biology of honeybees, methods of beekeeping, beehives and equipment's as well as care and management of honeybees. After that, the students were practically viewed the apiary site where they examined the beehives, how to identify queens and drones, how to handle the queens, how to extracts honey, different beekeeping appliances etc. All these technical details were vividly discussed by Dr. Prabir Kumar Mandal in front of the students and the students learned and responds very well. In the afternoon, students were taken their meal and returned to university campus.

2. Visit to State Warehouse Corporation – to study function and organization

This year, we organized one visit for the 4th Semester students under the practical of Agricultural Marketing Trade and Price. In this tour, students visited the SWC (RIDF Diamond Harbour) to understand the organization and function of these great organizations.

The RIDF, Diamond Harbour is situated in Chaora, Jhinga, (Near Diamond Harbour Women's University), Diamond Harbour, South 24 PGS. The visit was conducted in four batches the first batch of 47 students visited on 10/05/2022, the second batch of 46 students on 12/05/2022, the third batch of 47 students on 13/05/2022, the fourth batch of 44 students visit done 23/05/2022. During this total visit, the superintendent of RIDF, Diamond Harbour, Mr. Saibal Kanti Misra, cooperated a lot and explained about the organization and its functions to students.

3. Visit to The Bose Institute (Falta Branch) for Mushroom Production

B.Sc.(Ag) Final Year Students of Department of Agriculture, The Neotia University,Visited to The Bose Institute (Falta Branch), under the ELP course,Mushroom cultivation technology on 1st June 2022. Our students have visited the spawn production and incubation room where they have

demonstrated the process of media formulation, culture inoculation and growth patterns. Afterwards, they saw the mushroom cultivation and harvesting facility. Finally, they have prepared milky mushroom cultivation bags by themselves as a practical experience practice.

4. Visit to Sasya Shyamala Krishi Vigyan Kendra, Arapanch, Sonarpur , RKMVERI

The final year students of B.Sc.(Hons.)Agriculture-Soil Science and Seed Production Technology group, visited the Sasya Shyamala Krishi Vigyan Kendra, Arapanch,Sonarpur,RamaKrishna Mission Vivekananda Educational and Research Institute on 27.04.2022 by University bus. The students, guided by course reached the Sasya Shyamala Krishi Vigyan Kendra, Arapanch,Sonarpur, at quarter to one in the afternoon (12.45 p.m.). Dr. Narayan K.Sahoo, the Principal Scientist and Head of Sasya Shyamala Krishi Vigyan Kendra greeted the students and demonstrated the system .

5. Visit to PAN seed unit in Fatehpur

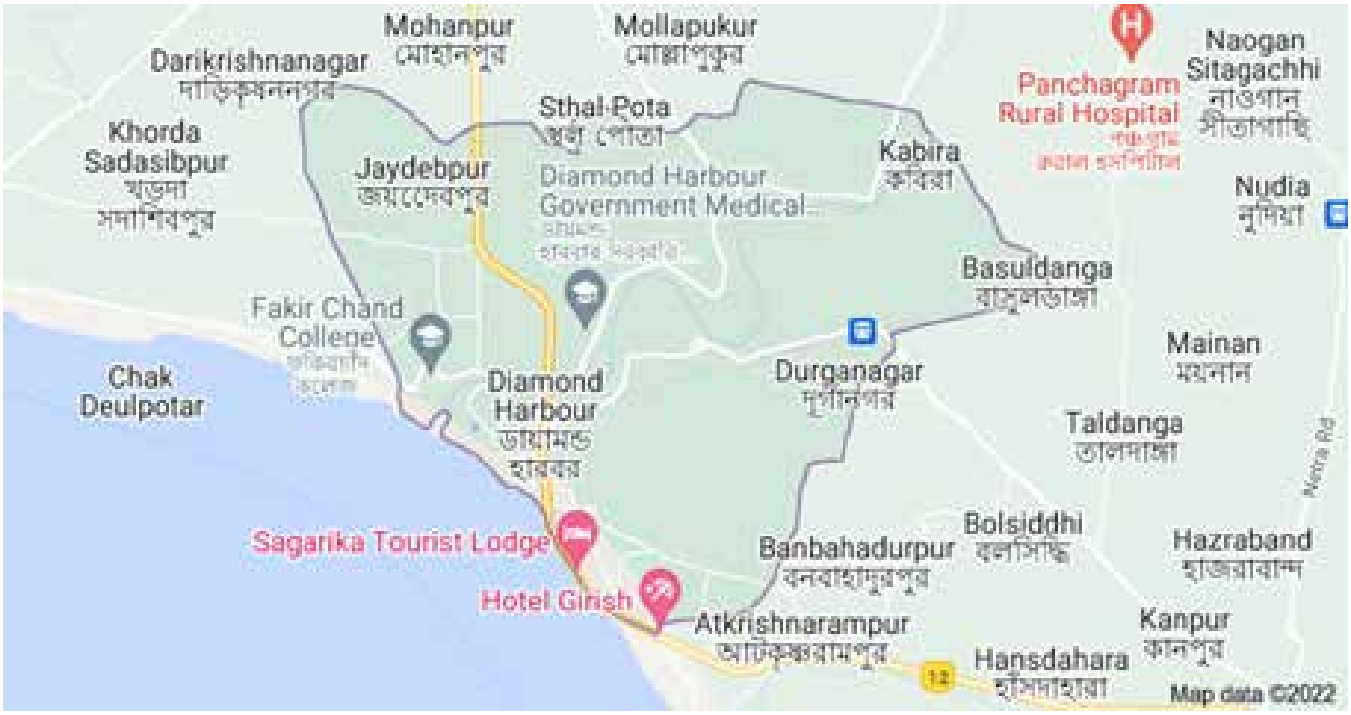
The final year students, of B.Sc.(Hons.). Agriculture-Soil Science and Seed Production Technology group visited PAN Seeds Unit, Fatehpur, on 29.04.2022 by University bus. As desired, by the local PAN seeds unit, the total number of students was divided in two batches for easy movement of the students in the unit.

OUTREACH PROGRAMME- FARMERS' FIELD VISIT AND SURVEY

Village attachment programme is an outreach programme by periodically conducted by SAAS, TNU. This outreach programme is conducted by Mr. Rohan Bhaduri, on behalf of Dept. of Agriculture Extension directed by Dean, SAAS, TNU. By this activity we helped numerous farmers of the nearby villages solving their issues regarding farm activities. SAAS gathered almost 150 samples of farmers with their land holding, crop rotation practices, land condition etc. Along with these SAAS, by this outreach programme got attached with almost 11 villages that will help the students to conduct their various practical based activities in that villages. The concerned Agriculture Extension dept. deals with the data collection and rapport building segment of the farmers of the nearby villages that include Darikrishnagar, Jhinga, Kalagachi, Jobrali, Cheora, Kalitala, Mohanpur, Rajarampur, Sukhdevpur, Amira, Kopertkhan and so on…

The purpose of this sampling was to study the-

Land holding, Crop rotation, Land condition (Upland/ lowland), Problem faced by the farmers during agriculture agricultural activities andCollecting contact numbers for future reference



STUDENTS' ORIENTATION PROGRAMME

1. RICE Education Seminar, School of Agriculture & Allied Sciences, TNU

The School of Agriculture & Allied Sciences, TNU , The Neotia University organised A seminar on the prospects of Government Jobs, "Explore the Career Opportunities in Govt. Sector & Unlock the Potentials in You" from RICE Education where educators from RICE gave lecture onavailable career opportunity after the graduation in B.Sc. Agriculture and also suggested to focused on available Govt. jobs after the graduation.

2. Orientation programme - Seed to Harvest Solutions by Rallis India Ltd

We have successfully conducted an orientation programme - Seed to Harvest Solutions by Rallis India Ltd. This programme was organised by Agriculture Unit, School of Agriculture & Allied Sciences, The Neotia University and Conducted by Rallis India Limited.Prof. Sushil K. Kothari, Dean, School of Agriculture & Allied Sciences, TNU and Officers from Rallis India Limited had inaugurated the programme by Lightning the Lamp. The dignitaries of Rallis India Ltd. were Mr. Srikanta Pal - Manager NGP and Arup Kumar Batabyal - Business Development Manager and Dr. Rakesh Pasi - Regional R&D Head. Around 70 students from B.Sc. Agriculture final year batch were attended the programme.

EXPERIENTIAL LEARNING PROGRAMMES(ELPS)

VI. Experiential Learning Programmes (ELP)

course curricula of the University keeping parity with the Indian Council of Agricultural Research (ICAR) formulated UG syllabus having a set objective of – "Earn While You Learn". Experiential denotes interactive involvement based personally determined experience that would turn into innovation finally leading to the development of an entrepreneur resulting the generation of job provider rather than job seeker. The aim of the scheme is to involve student for learning in the environment of experimental farms, model plants and engineering workshops. It inspires greater confidence, competitiveness and competence among students to meet needs of private sector and to undertake self-employment in vocations of their choice. In 2021-22 SIX (6) Experiential Learning Programme units started their operation at The Neotia University in different establishments namely –

Sl. No.	Subject	Credit	Year of Sanction
1.	Production Technology for Bioagents and Biofertilizer	0+10	2021-22
2.	Seed Production and Technology	0+10	2021-22
3.	Mushroom Cultivation Technology	0+10	2021-22
4.	Soil, Plant, Water and Seed Testing	0+10	2021-22
5.	Food Processing	0+10	2021-22
6.	Organic Production Technology	0+10	2021-22

1. Production Technology for Bioagents and Biofertilizer-

Considering the important contribution of Arbuscular Mycorrhizal Fungi (AMF) altogether 11 students of 8th semester have submitted their Daily Project Report on Vessicular Arbuscular Mycorrhiza (VAM) production and Marketing . All of them have also presented their experiential learning programme before the external examiner . Everybody present in the seminar room highly appreciated the performances of the students. Atleast they have learnt all the details of the project stating from project description, Technical details including economic analysis of the business after their field practical classes. At least before leaving the campus of the University they have with them one bankable Detail Project to start-up business on VAM Production and marketing.

2. Seed Production and Technology

The Experiential Learning Programme was undertaken for the final semester (8 thSemester) students for promoting professional skills and knowledge through hands on training experience. 28 students of 8th semester choose Seed production as ELP course. The seed production field experiments were done in 6plots inside The Neotia University campus. 'Shreya', 'Vina' and 'Mukta' varieties of Rice were sown.

1. Mushroom Cultivation Technology

A total of 71 students had chosen Mushroom cultivation technology in their 8th semester ELP course. All the students take part in the production of mushroom spawn and fresh mushroom. Students did all the activity from production of spawn by using isolated pure culture of mushroom fruiting body to harvesting of fresh mushroom by using that mushroom spawn including marketing of the produce. All the students take part in production of different by-products from fresh mushroom. They prepared mushroom pickle and mushroom powder by using fresh mushrooms.

2. Soil, Plant, Water and Seed Testing

The main objectives of this course are:

- To promote professional skills, entrepreneurship, knowledge and marketing skills through meaningful hands on experience and working in project mode.
- To build confidence through end to end approach in product development.
- To acquire enterprise management capabilities including skills for project development and execution, accountancy, national/international marketing, etc.

A total of 68 students had chosen Soil, plant, water and Seed testing in ELP. All students took part all the activities like soil sampling, processing, analysis, result interpretation and map creation and learned a lot through hands on training.

3. Food Processing Technology

A total of 71 students had chosen food processing technology in experiential learning program. Each student has participated in processing and production of different food products like flavoured soymilk, soya flour-based cookies,mushroom-based protein enriched chocolate, mushroom pickle, grape based ready to drink beverage and ready to eat processed food products. The students

have also performed different physicochemical and microbial analysis for characterization of shelf life and nutritional properties of the processed food products. Sensory evaluation was also done by the students to evaluate the overall acceptability of the food products among the consumers processed by them in the food science and technology laboratory.

Flavoured soya Milk

Precooked canned fish

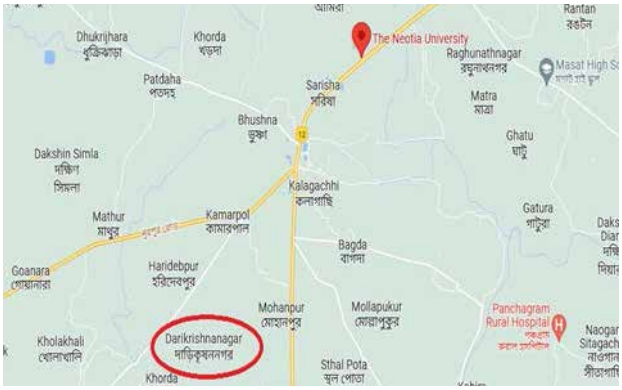
Mushroom Flavoured Choclate

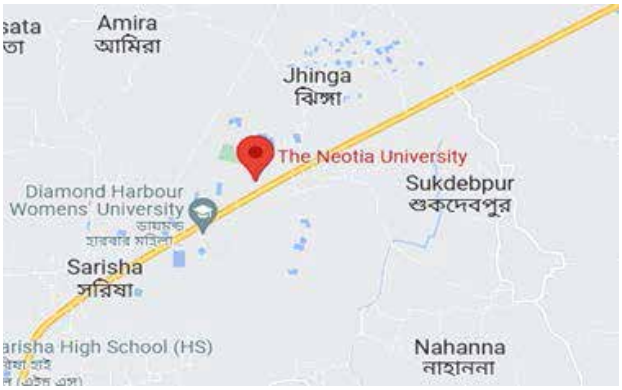
6. Organic Production Technology

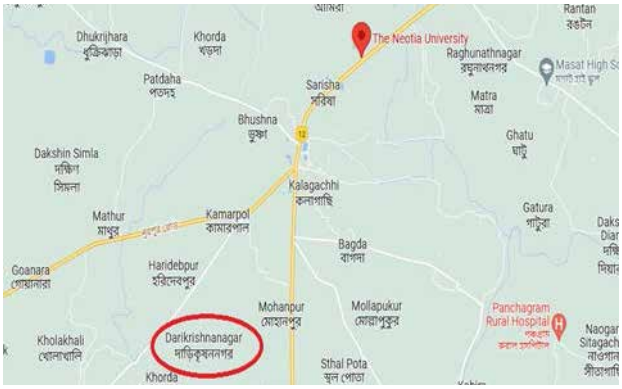
A total of 72 students had chosen organic production technology in ELP. Each student got 1 plot (5×4 m) for growing crops. All the students take part in organic crop production. Students did all the activities from seed sowing up to harvesting including marketing of the produce. The students prepared and used amritpani, panchagavya, ginger-garlic-green chili extract in the field. The students also used bio fertilizers, neem seed karnel extract, solar light trap for growing crops. All the students take part in vermicompost production and NADEP compost production from raw material collection to harvesting. The quality parameters of the vermicompost (Moisture content, pH, EC, Organic carbon, availableP2O5 and K2O) were also tested in laboratory.

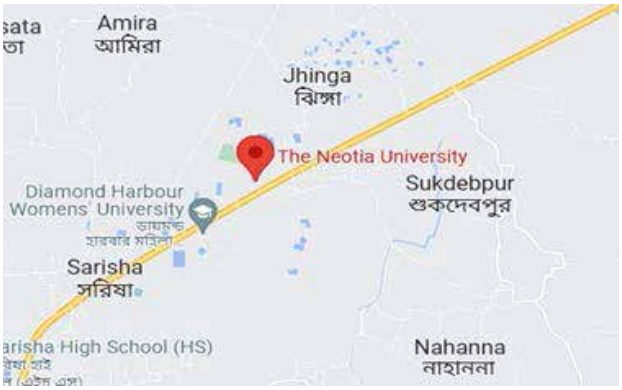
7. Agro-meteorological Advisory Service (AAS) SAAS, TNU

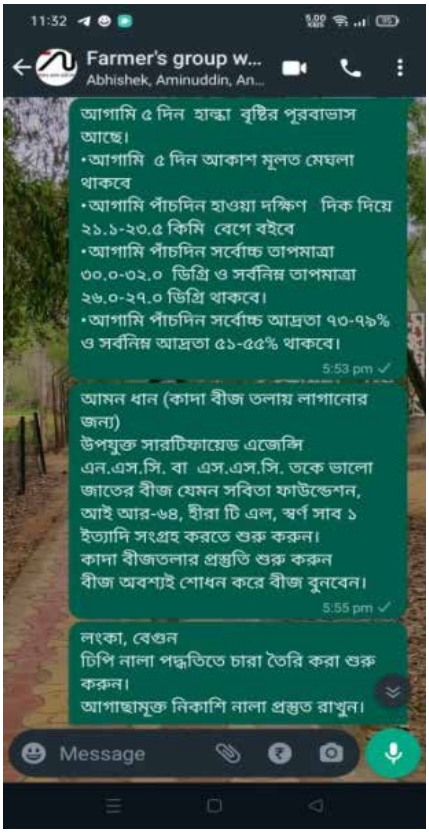
Weather and climate information plays a vital role in agriculture management and production. In order to cater the weather information needed for the farming community, India Meteorological Department (IMD) initiated Farmers Weather Bulletin in the year 1945. AAS provide a very special kind of inputs to the farmer as advisories that can make a tremendous difference to the agriculture production by taking the advantage of benevolent weather and minimize the adverse impact of malevolent weather. It emerged that prime need of the farmer is location specific weather forecast in quantitative terms. In this regard, SAAS, TNU has also started to issue weather information along with crop specific agro- advisory to its adjoining villages like Darikrishnagar, Jhinga, Kalagachi, Jobrali, Cheora, Kalitala from June, 2022. Presently we have collected the whatsapp numbers of the progressive farmers and the whole agro advisory is being circulated through the whatsapp group on every Tuesday and Friday. The whole process is done after getting the weather forecasting and agro advisory from the Regional Meteorological Center, Kolkata. Here in our TNU campus, we also have our Agrometeorological observatory for recording the day to day weather observations.











8. Farmers' Counselling-'KRISHI BANDHU' at SAAS, TNU

Krishi Bandhu is an initiative by the Dept. of Agriculture, SAAS, TNU. This is a consultation centre meant to facilitate the farmers with solutions of the problems, they face regarding agriculture practices.

Objectives:

- Facilitating farmers with consultancy services regarding solving issues related to agriculture farm practices.
- This centre will also keep all the records related to problems faced by the farmers.
- This is a customized consultancy service centre by which a farmer will be directed to the SMS with his respective issues.
- This consultancy service centre will also facilitate the students to get attach with the concerned faculty members getting pre bound time slot to clarify their doubts on one on one basis.

SEMINARS AND SYMPOSIUMS

1. **International Sun Day Celebration (Theme: Food and Energy Security from Zero Land & Zero Water Systems)**

   Across the globe, reductions in precipitation and rising air temperatures are increasing vulnerabilities in both the agricultural and energy sectors. Water scarcity concerns are shaping conversations and driving action in the agricultural sector while extreme weather events are impacting energy systems worldwide, reducing the reliability of energy generation. As such, the resilience of the global energy system is of growing importance. Drought-proof technologies such as wind and solar photovoltaics can satisfy both resilience and sustainability concerns. Keeping in mind the huge impact of photovoltaic system in present day agriculture, The Neotia University commemorated the International Sun Day on May 05, 2022 (Thursday). The day is being celebrated for successive years with utmost enthusiasm and diligence. The day began with a pure and serene chorus song of Rabindranath Tagore presented by the B.Sc Agriculture students.

   Theinauguration of '**Agrivoltaic Park**' in the field opposite to SB II Buildings was done by Mr Samrat Mukherjee, Deputy General Manager,NABARD. Mr Samujjal Ganguly, from Vikram Solar, one of the largest production house of solar panel in India provided a magnificent insight into the production process of solar panels, as well as the company. The program was chaired by another eminent personality of the scientific fraternity, Dr Priyobrata Santra from CAZRI, ICAR. Dr Santra presented wonderful insights on the possibilities and potential of Agrivoltaic system. He presented a detailed overview on the design aspects of the solar photovoltaics and performance of agriculture under a photovoltaic panel.

2. Orientation Program on 'Seed Production Technology'

Realizing the importance of seed, School of Agriculture and Allied Sciences, The Neotia University conducted an orientation Program on Seed Production Technology on May 10th 2022. The School of Agriculture & Allied Sciences, The Neotia University commemorated the 1 st Orientation Program on 'Seed Production Technology' on Tuesday, May 10th , 2022. The chief speakers of the auspicious occasion were Sri **Bidhan Chakraborty, Managing Director,West Bengal State Seed Production Limited and Dr. Nirmalendu Samanta, Technical Director, Hall Mark Seed Company**. The program began with lightning lamp by our honorable guests with Vice Chancellor Sir - Prof. Biswajit Ghosh, Registrar - Mr. Manish and our respected Dean of the School of Agriculture and Allied Sciences - Prof. Sushil K. Kothari.by Rallis India Limited.Prof. Sushil K. Kothari, Dean, School of Agriculture & Allied Sciences, TNU and Officers from Rallis India Limited had inaugurated the programme by Lightning the Lamp.The dignitaries of Rallis India Ltd. were Mr. Srikanta Pal - Manager NGP and Arup Kumar Batabyal - Business Development Manager and Dr. Rakesh Pasi - Regional R&D Head. Around 70 students from B.Sc. Agriculture final year batch were attended the programme.

3. World No Tobacco Day (Theme: Tobacco – Threat to our environment)

The Neotia University observed World No Tobacco Day on 30.05.2022 with a mission to evoke awareness on harmful and deleterious effect of tobacco use on everybody and on any time-frame of human life. This year the theme of the day was Tobacco: Threat to our environment, by keeping the theme on mind the event was covered under the umbrella of green initiatives taken by the University to build a pollution free green and clean campus for our students. This day was organised by a committee involving several schools and all the students of the university were invited to participate in the programme.

4. National Seminar on "Agrochemicals for Upkeeping Crop and Environmental Health"

jointly organized by Society for Fertilizers and Environment and School of Agriculture and Allied Sciences, The Neotia University in Hybrid Mode on 13th September 2022 (Tuesday) The President of the Society Dr. Himadri Sen, Ex-Director of ICAR-CRIJAF, Dr. Subhendu Bhadraray Ex- GM (R and D), Tata Rallies Crop Nutrition Division and Dr. Pradip De, Principal Scientist, ICAR-ISSS, Bhopal and National Coordinator, Soil Testing and Crop Response Project delivered lectures online while Prof. Biswapati Mandal, Secretary SFE and Ex-Pro Vice Chancellor, BCKV, Dr. F.H. Rahman, Jt. Secretary, SFE and Principal Scientist , ICAR-ATARI Zone-V. Dr. Dipankar Gorai , SMS, Bud Bud, KVK, CRIJAF, Mr. Partha Bhattacharya, Ex State Marketing Manager, IFFCO delivered lectures on different topics. Students and faculties of TNU participated in the programme.

A poster competition on Fertilizers and Environment was organized in which 9 groups of students presented 9 posters. 1st and 2nd poster presented were awarded. Dr. S. K. Kothari, Dean of School of Agriculture and Allied Sciences, TNU chaired the technical session.

Finally, the programme successfully ended with a vote of thanks by Dr. N.C. Sahu to all the dignitaries present in both the online and offline mode and to the Society for Fertilizers and Environment and School of Agriculture and Allied Sciences, The Neotia University.


Agrochemicals for Upkeeping Crop and Environmental Health
Venue: Seminar Hall,
SB III Building,
The Neotia University


13th September, 2022, 10.30 AM
Venue: Seminar Hall,
SB III Building,
The Neotia University
Organised By


THE NEOTIA UNIVERSITY
Agrochemicals for Upkeeping Crop and Environmental Health

COCONUT PLANTATION PROGRAM

Coconut Plantation Program at The School of Agriculture and Allied Sciences- The Neotia University

"The true meaning of life is to plant trees, under whose shade you do not expect to sit."- Nelson Henderson

The School of Agriculture and Allied Sciences, in collaboration with Non-Profit Organisation BHOR and Mithrimitti planted over 150 coconut saplings in an ambitious move to counter the effects of deforestation and climate change. The school launched a coconut planting campaign led by Dr Sarita Pandey, Assistant Professor, School of Agriculture and Allied Sciences to support the Green Kolkata Initiative of NGO BHOR and MITHRIMITTI. Dr Sushil Kumar Kothari, Dean of School of Agriculture and Allied Sciences congratulated the NGOs for not only providing more than 200 saplings of different tress but also for its collective Green Kolkata initiative. The tree planting event started at 11:00 am on Sunday, 18th September 2022 at The Neotia University farm and attended by Dr. Sushil Kumar Kothari, Dean, Dr. Sarthak Bhattacharya, Dr Agniswer Jha Chakraborty, Mr Abhishek Anand students of the school and representative of NGO whose support for this ambitious action was crucial. The initiative aims to tackle the effects of deforestation and climate change in the Kolkata and nearby areas. The school estimates that south 24 paraganas tree coverage has declined drastically after the cyclone Amphan. Afforestation is the most effective climate change solution to date and with this initiative by SAAS and NGO, other universities should also move with speed and challenge the status quo," said Dr Kothari. He further added that the Coconut Plantation project will empower farmers with sustainable practices to better manage their farms and increase their yields. Eventually, this will boost livelihood opportunities and enhance the socio-economic conditions of the rural poor through the promotion of sustainable livelihoods.

Trees provide many ecosystem services and environmental benefits for the planet as a whole. As they grow, they absorb and store carbon dioxide—a major driver of global heating. Ms. Sneha, co-founder of BHOR emphasized the importance of tree restoration as it is among the most effective strategies for climate change mitigation. Mr. Sanjay from Mithrimitti said that planting trees is therefore considered the biggest and cheapest way to tackle the climate change. This is crucial in honouring school's commitments to mitigate climate change and improve

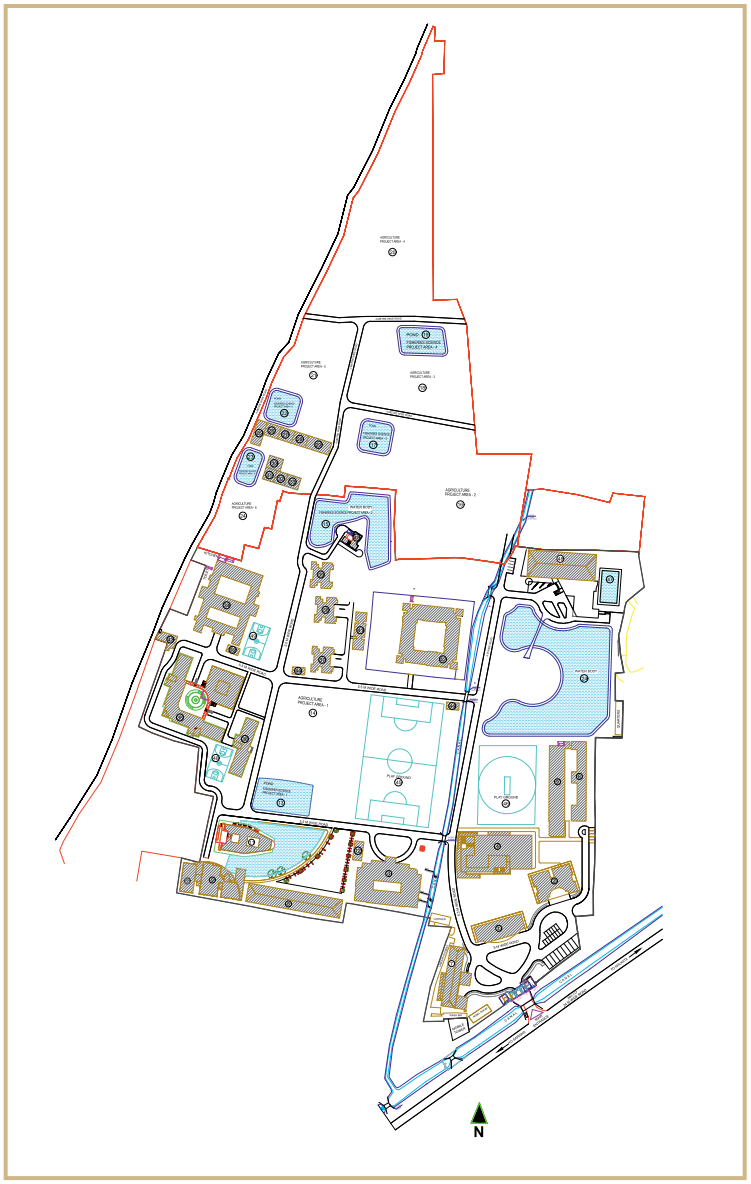
Fig. 1. NGO BHOR with planting material and volunteers at The Neotia University

the livelihood of rural farmers in South 24 Praganas, West Bengal. Dr Kothari thanked all the guests and staff for their support for this noble cause. The event ended at 3:30 PM.

"Until you dig a hole, you plant a tree, you water it and make it survive, you haven't done a thing. You are just talking."- Wangari Maathai

Fig. 2. Dr Kothari with the guests and faculty at the coconut planting site

Fig. 3. A coconut sapling being planted at The Neotia University Farm



LEGEND- BUILDING

A. ADMINISTRATIVE BLOCK

1. ADMINISTRATIVE BUILDING (G + V)

B. ACADEMICS BLOCK

2. SCHOLASTIC BUILDING - 1 (G + III)
3. SCHOLASTIC BUILDING - 2 (G + II)
4. SCHOLASTIC BUILDING - 3 (G + III)
5. SCHOLASTIC BUILDING - 4 (G + III)
6. SCHOLASTIC BUILDING - 5 (G + III)
7. WORKSHOP BUILDING
8. NEW WORKSHOP BUILDING
9. NEW PHARMACY BUILDING (G + III)
10. PHARMACY BUILDING (G + III)
11. SHIP IN CAMPUS (G + III)

C. AGRICULTURE & FISHERY SCIENCE BLOCK

12. POLY HOUSE & NET HOUSE
13. FISHERY SCIENCE PROJECT AREA - 1
14. AGRICULTURE PROJECT AREA - 1
15. FISHERY SCIENCE PROJECT AREA - 2
16. AGRICULTURE PROJECT AREA - 2
17. FISHERY SCIENCE PROJECT AREA - 3
18. AGRICULTURE PROJECT AREA - 3
19. FISHERY SCIENCE PROJECT AREA - 4
20. AGRICULTURE PROJECT AREA - 4
21. AGRICULTURE PROJECT AREA - 5
22. FISHERY SCIENCE PROJECT AREA - 5
23. FISHERY SCIENCE PROJECT AREA - 6
24. AGRICULTURE PROJECT AREA - 6
25. MUSHROOM UNIT
26. FIELD LAB
27. STORE HOUSE
28. SERICULTURE UNIT
29. THRESHING FLOOR
30. BIO GAS PLANT
31. CATTLE SHED
32. VERMI COMPOST PIT
33. BIO FERTILIZER PLANT

D. RESIDENTIAL BLOCK

34. BOY'S HOSTEL - 1 & 2 (G + III)
35. BOY'S HOSTEL - 1 & 2 (G + III)
36. BOY'S HOSTEL - 1 & 2 (G + III)
37. OLD STAFF QUARTERS (G + III)
38. NEW STAFF QUARTERS (G + III)
39. NEW STAFF QUARTERS (G + III)
40. DIRECTOR'S RESIDENCE (G + I)
41. OLD STAFF QUARTERS (G + III)
42. GIRL'S HOSTEL - 3 (G + II)

E. UTILITY & SERVICES BLOCK

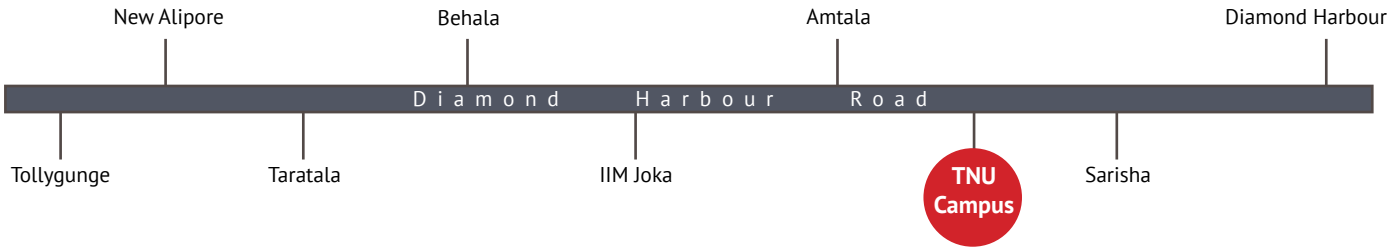
43. ELECTRICAL ROOM
44. PUMP ROOM

F. RECREATIONAL BLOCK

45. FOOTBALL GROUND
46. CRICKET GROUND
47. SWIMMING POOL
48. MULTI PURPOSE HALL
49. BASKETBALL COURT (3 NOS.)

G. HEALTH BLOCK

50. MEDICAL UNIT



AmbujaNeotia

THE NEOTIA UNIVERSITY
ज्ञानम् आत्म प्रदीपाय
UGC Enlisted & Recognised

NEOTIA INSTITUTE OF TECHNOLOGY MANAGEMENT AND SCIENCE
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