Annual Report-Newsletter 2020-2021

Faculty of agriculture

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Faculty of Agriculture
Sri Sri University | Sri Sri Vihar | Ward No. 3 |Cuttack 754 006 Odisha

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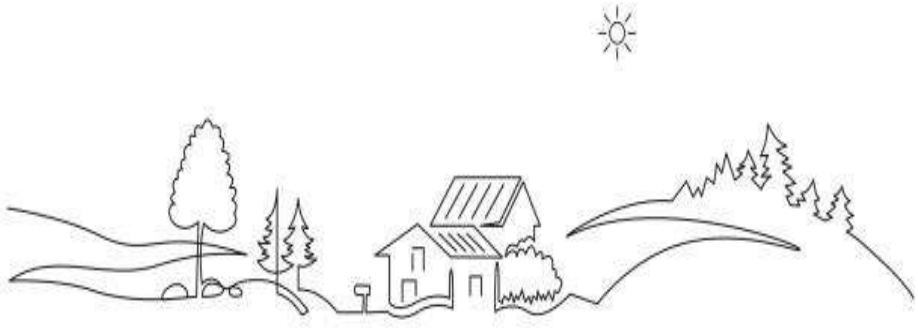

Foreword

Dear all,

It gives me immense pleasure to share the progress made in building the Faculty of Agriculture since its inception in 2017. We are almost completing 6 years of existence with significant progress in achieving the academic excellence in imparting quality education with major focus on experiential learning. We have built adequate human resources in terms of recruiting 45 regular faculty members in all disciplines of agriculture to support the teaching-learning process. Likewise, we have created 13 laboratories with necessary instruments, laboratory logistics etc. to support the practical sessions. The experiential learning is supported by development of approximately 40 acres of farm land to cultivate seasonal crops, flowering plants, horticultural and plantation crops. We are also making an effort to develop an arboretum of economic forest tree species as demonstration plots.

We will be completing soon the accreditation by Indian Council of Agriculture Research (ICAR), New Delhi. We shall begin the PG programs in select disciplines from the academic year 2023.

We promote students to participate in internships, provide adequate exposure to become independent agro-based entrepreneurs, promote internships with agro-industrials and reputed institutions/organization. We counsel students to realize their potential through enabled co-curricular learning and accumulation of knowledge.

We are making progress towards to become institution of excellence in imparting education, research and outreach activities.

We welcome prospective students to enroll with us gain gain knowledge in spiritually enabled learning environment.

We wish all our graduating students best in their future endeavour.

Prof. S. Kumaraswamy Ph.D.
HoD and Dean, Faculty of Agriculture

Faculty of agriculture: Then and Now

Since the inception in 2017, the faculty has grown to build adequate building space, laboratory infrastructure with instrumentation and farm land to support the student education and experiential learning. Likewise, we have recruited 45 regular faculty members at various levels in major disciplines to support excellence building in education, research and outreach programs. We also added sufficient volumes of reference books to the library to benefit the students. As our future, we plan to initiate M.Sc. and Ph.D. programs in select disciplines. We in the pursuit of achieving excellence in efforts build the faculty turning into an institution of excellence.

Department of Soil Science

The Department of Soil Science is aimed to develop the practical experiences to the students studying B.Sc., Agriculture, B.Sc., Horticulture and, B.Sc. Agribusiness. The Educational objectives of the departmental laboratory:

- To familiarize the students with general soil testing equipment like hot air oven, pH meter, weighing balance, centrifuge, hot plate, mechanical shaker etc.
- To acquaint with soil forming process, its properties- physical, chemical and biological, as a plant growth medium.

Faculty members included in the department:

Dr. Bidisha Majumder, Associate Professor
Dr. Rini Labanya, Assistant professor
Dr Purbasha Priyadarshini Padhi, Assistant Professor
Mr. Ambika Misra, Assistant Professor


Flame Photometer 128

Instruments available in the department:

SL No.	Instruments	Quantity
1	Electronic Top pan balance (0.1 g capacity)	2
2	Electronic Top pan balance (1 mg capacity)	2
3	Hot air-oven	1
4	pH Meter	2
5	EC Meter	1
6	Flame Photometer	1
7	Visible Spectrophotometer	1
8	Hot Plate	2
9	Distilled water unit	1
10	Water Bath	1
11	Rotary Shaker	1
12	Binocular Microscope	1
13	BOD Incubator	1
14	Autoclave	1
15	Digestion Block	1
16	Hydrometer	1
17	Nitrogen Analyzer	1
18	Fridge	2

Department of Agronomy

The department of Agronomy has one laboratory under Faculty of Agriculture, 3rd floor, Shruti Building, Room No. 308 for conducting the laboratory based practicals with the following objectives.

To provide the students' knowledge on;

- The several practices involved in field scale crop cultivation and management practices.
- Identify various crop seeds, fertilizers, pesticides, herbicides, etc.
- Practice techniques involved in crop management.

Faculties in the department:

- Mrs. Bidusi Tripathy, Assistant professor, Agronomy

- Dr. Madhab Kumar Dutta, Assistant professor, Agronomy
- Dr. Susmita Das, Assistant professor, Agronomy
- Ms. Rashmirekha Pattnaik, Assistant professor, Agronomy
- Ms. Sayani Bhowmick, Assistant professor, Agrometeorology

Total credit hours under practical's:

Course code	Course Name	Credit Hr.	Theory	Practical
AGR 101	Fundamentals of Agronomy	4 (3+1)	3	1
AGR 102	Introductory Agro-meteorology & Climate Change	2 (1+1)	1	1
AGR 103	Crop Production Technology– I (Kharif Crops)	2 (1+1)	1	1
AGR 104	Crop Production Technology –II (Rabi Crops)	2 (1+1)	1	1
AGR 105	Farming System & Sustainable Agriculture	1 (1+0)	1	0
AGR 106	Practical Crop Production – I (Kharif crops)	2 (0+2)	0	2
AGR 107	Practical Crop Production – II (Rabi crops)	2 (0+2)	0	2
AGR 108	Principles of Organic Farming	2 (1+1)	1	1
AGR 109	Geo-informatics and Nano-technology and Precision Farming	2 (1+1)	1	1
AGR 110	Rainfed Agriculture & Watershed Management	2 (1+1)	1	1
	Total credit	21	10	11

Educational outcome of the practical's conducted;

- After the completion of the courses students will learn the methodology of soil testing, cultivation techniques of different field crops
- Identification of different tools and machines in the laboratory.

Agronomy laboratory

Instruments available in the agronomy laboratory

SL No.	Instruments	Quantity
1.	Hot air oven	1
2.	Electronic Moisture Meter	2
3.	Chlorophyll meter	1
4.	Conductivity meter	1
5.	Digital anemometer	1
6.	Cup Anemometer	1
7.	Pan evaporimeter	1
8.	Rain gauge	2
9.	Self- recording rain gauge	1
10.	Sunshine recorder	1
11.	Thermograph	1
12.	Hygrograph	1
13.	Soil heat flux plate	1
14.	GPS	3
15.	Lysimeter	1
16.	Lux meter	2
17.	Solar pyranometer	1
	Minor instruments/tools	
1.	Bucket Auger	10
2.	Weighing balance small	1

3.	Weighing balance 100kg capacity	1
4.	Spring balance 10kg and 50 kg	2+2
5.	Meter Scale	8
6.	Tape 15 m	3
7.	Moisture box 20gm and 50 gm	30+30
8.	Soil thermometer 5cm, 10cm, 15cm	5+5+5
9.	Top pan balance	1
10.	GPS	1
11.	Shaker	1
12.	Brix meter	1
13.	Tensiometer	1
14.	Double ring infiltrometer	1
15.	Petri plate	38
16.	Sieve	2

Practical conducted by the department:

SL No.	Semester	Course	Practical's
1.	1st	Fundamentals of agronomy	• Identification of seeds, fertilizers, pesticides, and tillage equipment. • Measurement of bulk density and particle density of soil sample • Study on germination percentage of seeds • Yield estimation of crops • Study on the influence of sowing depth on seed viability and vigor.
2.	3rd	Crop production technology-I	• Study on the morphology of different field crops • Numerical exercise on seed rate and fertilizer dose calculations. • Raising of crops in students' demonstration plots.
3.	4th	Introductory agro meteorology and climate change	• Demonstration of meteorological instruments. • Computation of GMT, LMT. • Computation of PET and AET.
4.	3rd	Crop production technology-I	• Study on the morphology of different field crops • Numerical exercise on seed rate and fertilizer dose calculations. • Raising of crops in students' demonstration plots.
5.	5th	Geoinformatics, Nanotechnology	• Introduction to GIS software, spatial data creation • Supervised and unsupervised classification, and acreage estimation

		and precision agriculture	• Fertiliser recommendation based on VRT and STCR techniques Use of GPS for an agricultural survey • Application of nanoparticles in agriculture
6.	5th	Practical crop production- I	Raising of *kharif* field crops in student demonstration plots.
7.	6th	Principles of organic farming	Indigenous Technical Knowledge (ITK) for nutrient, insect, pest disease, and weed management
8.	6th	Practical crop production- II	Raising of *rabi* field crops in student demonstration plots.
9.	8th	Experiential learning programme	ELP activities conducted by students in laboratory

Department of Food Nutrition and Dietetics

The Food Nutrition and Dietetics laboratory is useful to develop the practical experiences to the students studying different food and nutrition courses offered to B.Sc., Food Nutrition and Dietetics, B.Sc., Horticulture, and B.Sc., Agriculture, B.Sc., Agribusiness.

The objectives include;

- To give hands on experience on the processing of agricultural crops.
- To provide the practical knowledge on the nutrition and dietetics related issues.

Faculty members included in the department;

- Dr. Neela Satheesh, Associate professor, Head Department of Food Nutrition and Dietetics
- Dr. Moirangthem Kalpana Devi, Assistant Professor,
- Dr. Krishna Mishra, Assistant Professor
- Mrs. Chinmayee Pattnayak. Assistant Professor
- Ms. Rashmi Mishra, Assistant Professor

A total of 86 credit hours of the Laboratory practical are designed for B.Sc., Food Nutrition and Dietetics students.

Educational outcome of the practical conducted;

- Students get experience on handling of different vegetables crops
- To provide the practical knowledge on the nutrition and dietetics related issues.

Laboratory

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Practical conducted by the department:

Sl. No.	Semester Allotted	Practical's
I	1st sem, Year 2021-25 batch Course: Fundamental of Food Science (FST 101): 3(2+1)	

	1.		Orientation to kitchen equipment and their uses, weighing and measuring food items
	2.		Identification of the food grains
	3.		Identification of condiments and spices
	4.		Introduction to cooking methods
	5.		To study dextrinization of rice starch
	6.		To study gelatinization of rice starch
	7.		To study gluten formation in wheat
	8.		Legumes – Identification and cooking methods
	9.		Nuts and oilseeds – Use in food preparations
	10.		Vegetable cookery – Different preparations with vegetables and effect of heat and alkali on pigments.
II		Nutritional Biochemistry- I NBC 101 3 (2+1)	
11			Practical Handling of equipment and instruments
12			Preparation of samples
13			Handling of the samples and types of the solutions
14			Solutions and buffers
15			Blood constituents: their normal values and their relation to health
16			Estimation of serum protein(Biuret method)
17			Estimation of serum protein (Lowry method),
18			Blood glucose (Folin Wu method)
III		4th sem Year 2020-24 batch Course: Fruits and Vegetables Preparation and Utilization (FVU 104) 2(1+1)	
19			Evaluation of pectin grade
20			Canning of mango/guava/papaya
21			Preparation and quality evaluation of fruit jam with fruits of regional importance
22			Preparation and quality evaluation of fruit jelly with fruits of regional importance
	IV	4th sem Year 2020-24 batch Course: Food Chemistry (FCT 104): 4(3+1)	
23			Basic measurements – Temperature, volume, weight, density and specific gravity
24			Measurement of weight and volume of food stuffs – Flours, sugar, fat, eggs
25			Preparation of standard solutions: Percentage volume by volume, percentage weight by volume, molar, normal
26			Measurement of pH by pH-meter and by indicators acid base and oxidation – reduction titrations and freezing point
V		IVth sem, Year 2020-24 batch	

	Course: NNP 104 Normal Nutrition and Meal Planning, 3 (2+1)	
27		weighing and measuring food items
28		Planning, preparation and nutrient calculation of diets of - preschool children, school going children, adolescents and adults.packed lunches for school children
29		Practice in formal and informal table setting and table manners.
VI	2nd yr IVth sem, Year 2020-24 batch Course: MPU 104 Milk and Milk Products: Preparation and Utilization (2+1)	Preparation of milk products. Paneer, channa, icecream, khoa, burfi, flavoured milk, rasogulla etc. has to be done
30		Processing and quality control of processed milk products to be done
31		Visit to modern milk processing and manufacturing plants to be done after the covid situation stabilizes.
VII	2nd yr 4th sem Agribusiness Year 2020-24 batch Course: FSN-201 Food Safety and Standards	Assessment of personal hygiene
32		Microbiological Examination of different food samples
VIII	IVsem, B.Sc., FNDFood Product Development and Formulations (FPF 104)	
33		Sensory evaluation Methods
34		Training of judges
35		Score card preparation
36		Selection and modification of food products to be developed
37		Formulation and standardization of products
38		Objective and subjective evaluation of the products
39		Evaluation of consumer acceptability
40		Handling and analysis of Sensory data
41		Packaging and sale of products
42		Presentation of developed food products
43		Video shooting of product preparation

Department of Entomology

The Department of Entomology was established with the specific objectives of developing skilled and efficient human resource in the field of entomology and evolving strategies for management of pests of various crops and developing location specific modules for management of insect pests in cereals, pulses, vegetables, fruits, oilseeds. This department offers under graduate program to generate quality human resource. The Department has got one UG laboratory and an Insect Museum which cater to the needs of students for conducting practical and imparting identification skills for the respective programs. The major objective of the departmental laboratory is to maintain an inventory of major insect/vertebrate pests of crops and develop suitable technologies for minimizing the production losses caused by them.

Faculty members

Name	Designation
Dr Snehasish Routray	Assistant Professor
Dr Seema Tripathy,	Assistant Professor
Dr Ipsita Samal	Assistant Professor

Credit hours in total of practical classes conducted by the department: 9

Educational outcome of the practical conducted

Students of various programs can gain a basic knowledge/idea on morphology and physiology of a typical insect body as well as they can acquire skill to identify the insect pests and mites associated with different crops and stored grain products. Apart from gaining idea on harmful insects, they will able to identify various beneficial insects like pollinators, weed killers and scavengers. Students can explore various symptoms of damage, process of collection, identification, preservation, assessment of damage and population of important insect – pests affecting fruits, plantation, medicinal and aromatic crops as well as vegetable, ornamental and spice crops including preparing different formulation of insecticides to manage the pest. They can also have a deeper understanding on pesticide appliances and their maintenance.

Infrastructure and other facilities

- Well-furnished undergraduate Biosystematics Research Laboratory – comprising preserved insects, research microscopes, fluorescence microscope.
- Facility for insect rearing
- Facility for rearing of stored product insects and the fumigation process for safe storage.

Photographs of different herbariums, insect collection boxes, honey bee rearing equipment, student-teacher interaction with Dr. Arun Kumar Sahoo, Minister of Agriculture and Farmers' Empowerment, Fisheries & Animal Resources Development, Higher Education, Prof. Rajita Kulkarni and, Dr. S. Kumaraswami, Dean, FoAG in Entomology Laboratory.

Site of Apiary and colony inspection by ELP Students

B.Sc. (Hons.) Agriculture and B.Sc. (Hons.) Horticulture students under ELP module with team members

Instruments/chemicals available in the laboratory

Sl. No.	Items	No. Of Units/Quantity
	A. Instruments	

1.	Electronic Weighing Balance	1
2.	Soxhlet Extraction Apparatus	1
3.	Solar insect trap	1
	B. Chemicals	
1.	Formalin	1 X 5 Litre
2.	Ethanol	4X 500 ml
3.	Chloroform	4 x 500 ml
4.	Methanol	2 x 500 ml
5.	Benzene	8 x 500 ml
	C. Glassware's	
1.	Petriplate (100 mm)	20 nos.
2.	Beaker 500 ml	4
3.	Beaker 50 ml	12
4.	Beaker 1000ml	4
5.	Slides	1 pkd
6.	Measuring cylinder 500ml	2
7.	Reagent bottle 500ml, 1000ml	5 +1
8.	Conical flask 250 ml	5
9.	Volumetric flask 250ml, 50ml	2 + 10
10.	Specimen bottle	32
	D. Minor Equipment's/ Tools	
1.	Cover slip	1pkd
2.	Squeeze bottle	12
3.	Knapsack sprayer	1
4.	Dustbin (Cover)	1

5.	Plastic tray	8
6.	Scissors	1
7.	Insect collection box	150
8.	Bee hive	50

Practical's conducted by the department:

SL No.	**Course Title: Fundamentals of Entomology (3rd)** **B.Sc. (Hons.) Agriculture and B.Sc. (Hons.) Horticulture**
1	Identification of different insect collection equipment's
2	Identification and differentiation of Hexapoda from Non-hexapoda
3	Studies on morphological structure and functions of insect body parts.
4	Body segmentation. Structure of Head, thorax and abdomen
5	Studies on structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus.
6	Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance.
	Course Title: Pests of Crops and Stored Grain and their Management (5th)
7	General account on nature and type of damage by different arthropods pests
8	Studies on bionomics of crop pests along with their laboratory rearing
9	Studies on major pests and scientific name, order, family, host range, distribution, nature of damage through herbarium preparation
10	Identification of different storage structures and methods of grain storage
	Course Title: Management of Beneficial Insects (6th)
11	Identification of different types and castes of bees
12	Identification of different bee keeping equippments
13	Identification of different natural enemies

Department of Economics

The laboratory for agricultural economics has been made to serve the educational, laboratory and research needs in the field of Agricultural economics. The objective is to make students familiarize with the practical view of marketing tools, business-management models, and production optimization

strategies. The department is currently with four faculties i.e, Dr. Shruti Mohapatra, Dr. R.S. Bhawar, Dr. K. K. Datta and Dr. Devegowda S. R. The practicals undertaken in the laboratory has been explained below which entails numerous outcomes. Students will be familiar with data collection and analysis. They will get practical exposure to the core concepts involved in financial, marketing, production and trading sector as well as the practical application in the real world. Apart from these they will be trained regarding formulation and development of business projects.

Various instruments/chemicals present in the department:

SL No.	Instruments	Quantity
1	Chairs for students	10
2	Chair for teacher	1
3	Tables for students	5
4	Tables for students	1
5	Small cupboard	1
6	Ceiling Fans	7
7	Overhead Projector	1
8	Wall mounted whiteboard	1
9	Wall mounted posters	16
10	Ceiling tube lights	12
11	Wall mounted classroom speakers	2

Various practical conducted by the department:

B.Sc. (Hons) Agriculture

S.N	Course Name	Semester	Practical hour
1	Agricultural Finance and Co-Operation (AEC -102)	3rd	2
2	Agricultural Marketing Trade & Prices (AEC-103)	4th	2
3	Farm Management, Production and Resource Economics (AEC-104)	6th	2

B.Sc. (Hons.) Horticulture

4	Economics and marketing (HEM 101)	1st	2

B.Sc. (Hons.) Food Nutrition and dietetics

5	Economics and marketing (ECM 102)		2

B.Sc. (Hons.) Agribusiness

5	Agricultural and Natural Resource Economics (NRE 101)	1st	2
6	Banking and International Trade (BIT 102)	2nd	2
7	Principles of Economic Theory (PET 203)	3rd	2
8	Agricultural Co-operation, Institutions and Management (ACM 204)	4th	2
9	Dynamics of Indian Agriculture (DIA 305)	5th	2
10	Farm Management and Production Economics (FME 305)	5th	2
11	Financial Management and Insurance in Agribusiness (FMA306)	6th	2
12	Introduction to Agricultural marketing (IAM 102)	2nd	2
13	Marketing Institutions and Organizations (MIO 102)	2nd	2
14	Principles of Marketing Management (PMM 203)	3rd	2
15	Market and Trade Acts (MTA 203)	3rd	2
16	Rural Marketing and Market Infrastructure (RMI 204)	4th	2
17	Input Marketing Management (IMM 204)	4th	2

18	Product Promotion Methods (PPM 305)	5th	2
19	Trading of Agricultural Commodity-I (TAC 305)	5th	2
20	Trading of Agricultural Commodity-II (TAC 306)	6th	2
21	Commodity Markets (CMM 306)	6th	2
22	e-Commerce and Digital Marketing (CDM 604)	6th	2
23	Planning, Formulation and Evaluation of Business Projects (PBP 403)	Elective	4
24	Recent Advances in Banking (RAB 402)	Elective	2

Department of Agribusiness

The practical laboratory infrastructure promotes student centric mentoring and imparting basic concepts and technical knowledge on various disciplines in agriculture, horticulture with balanced exposure in practices of agribusiness management. Besides, yogic sciences, human values and ethics and spiritualism, students are also exposed to rural agriculture work experience and experiential learning and internship in industries. The laboratory for agribusiness has been made to serve the educational, laboratory and research needs in the field of Agribusiness. The objective is to make students familiarize with the practical view of marketing tools, business-management models, and production optimization strategies.

Faculty members included in the department:

- Dr. Shubhaom Panda.
- Prof. Dr. K. K. Datta

Credit hours in total of practical classes are conducted by the department?

A total of 34 credit hours are conducted by the department, including 30 hours of compulsory and 4 hours of elective courses.

Educational outcome of the practical's conducted-

From the practical courses, students will be able to develop innovative business models and skill to become an entrepreneur and create innovative business models or profitable enterprises to market agricultural

produce. Students will have wide array of job opportunities in agricultural sectors, which include; Agri-business companies, Agro-retailing companies, Agri-machinery and equipment companies, Fertilizer/Seed production companies, Food processing companies, Plantation management groups, Practicing progressive agriculturists, Education and research organization, Social enterprise and NGOs. So, they need to gain a lot of practical and technical knowhow in every aspects of agribusiness.

The practical's undertaken in the laboratory has been explained below which entails numerous outcomes. Students will be familiar with data collection and analysis. They will get practical exposure to the core concepts involved in financial, marketing, production and trading sector as well as the practical application in the real world. Apart from these they will be trained regarding formulation and development of business projects.

Practical's conducted by the department;

Sl. No.	Course Details	Semester	Practical Hours
1	ABM 201 Agribusiness Management 3 (2+1)	Elective (4th or 5th or 6th)	4
3	ABM 101 Principles of Agribusiness and Management 2 (1+1)	1	2
4	AIN 102 Agro-based Enterprises and Industrialization 2 (1+1)	2	2
5	AGI 203 Agri. Informatics 2 (1+1)	3	2
6	HRD 203 Human Resource Management and development 3 (2+1)	3	2
7	OPA 204 Office Procedures for Agribusiness 2 (1+1)	4	2
8	OBB 204 Organizational Behaviour for Business Management 2 (0+2)	4	4
9	SBM 305 Strategic Business Management 2 (1+1)	5	2
10	PPC 305 Production Management, Planning and Control 2 (1+1)	5	2
11	IRM 305 Inventory of Risk Management 2 (1+1)	5	2
12	APM 305 Agro-processing Management 2 (1+1)	5	2
13	MAC 306 Managerial Accounting 2 (1+1)	5	2
14	MSP 306 Market Survey and Price Analysis 2 (0+2)	5	4
15	SCM 306 Supply Chain Management 2 (1+1)	5	2

Department of Agricultural Engineering

The Agricultural Engineering Laboratory is equipped with all the implements and machines which are used for various agricultural operations such as tillage, sowing, fertilizer application, weeding, harvesting and threshing. The Agricultural Engineering laboratory helps the students to familiarize with tractor mounted implements as well as self-propelled machines that are widely used in agriculture. The students are able to learn the working principles and objectives of the implements and machines available in the laboratory. As mechanization is the key for obtaining higher productivity in an efficient manner, Farm Machinery and Power course is an integral part of Agricultural Engineering. Upon completion of the course, the students will be able to identify the commonly used implements and machines, learn about their working and also gain analytical skills to analyze the cost of power usage in land preparation.

Implements/machines present in the Agricultural Engineering department:

SL No.	Implements / Machines	Quantity	Purpose
1.	MB Plough	1	Primary Tillage
2.	Disc Plough	1	Primary Tillage

3.	Indigenous Plough	3	Ploughing
4.	Disc Harrow	1	Secondary Tillage
5.	Seed cum Fertilizer Drill	1	Sowing
6.	Reaper (Self-Propelled)	1	Harvesting
7.	Manual Thresher and Power operated Thresher	2	Threshing
8.	Mower (Self-Propelled)	1	Cutting grass
9.	Sprayer	1	Spraying chemicals in liquid form
10.	Duster	1	Spraying chemicals in solid form
11.	Model of Single Cylinder 4 Stroke Petrol Engine	1	Demonstration only

Practical's conducted by the department:

SL No.	Semester Allotted	Practical Conducted
1.	4thSemester B.Sc. (Hons.) Agriculture	Study of cooling system of an engine
2.	4thSemester B.Sc. (Hons.) Agriculture	Study of air cleaning system and fuel system
3.	4thSemester B.Sc. (Hons.) Agriculture	Familiarization with lubrication system
4.	4thSemester B.Sc. (Hons.) Agriculture	Familiarization with power transmission system
5.	4thSemester B.Sc. (Hons.) Agriculture	Familiarization with steering, brake and hydraulic control
6.	4thSemester B.Sc. (Hons.) Agriculture	Familiarization with tillage implements
7.	4thSemester B.Sc. (Hons.) Agriculture	Familiarization with sowing equipment
8.	4thSemester B.Sc. (Hons.) Agriculture	Familiarization with plant protection equipment
9.	2nd Semester B.Sc. (Hons.) Agriculture	Calculation of Rainfall Erosivity
10.	2nd Semester B.Sc. (Hons.) Agriculture	Estimation of Soil Loss
11.	2nd Semester B.Sc. (Hons.) Agriculture	Preparation of Contour Maps
12.	2nd Semester B.Sc. (Hons.) Agriculture	Design of Grassed Waterways
13.	2nd Semester B.Sc. (Hons.) Agriculture	Design of Contour Bunds and Graded Bunds

Department of Crop Physiology and Biochemistry

The Crop Physiology and Biochemistry laboratory aims towards acquainting students with essential laboratory processes, methodological approaches, as well as how to solve agricultural issues via practical's in this laboratory. The courses in the department targets to familiarize the students with the basic theory and concept related to plant physiology. The practical's focuses on establishing an understanding of the fundamental concepts underlying agricultural physiology and metabolism which aims to develop the ability

to apply the principles in production strategies. The emphasis is on functional importance, physiological concepts and their application to various difficulties in agricultural productivity under changing climatic circumstances. At the end of the practical's, Students will be able to identify and solve problems using quantitative Methods with their knowledge on crop growth and metabolism.

Faculty members included in the department:

Name	*Designation*
Dr. Prajjal Dey	Assistant Professor
Dr Udit Nandan Mishra	Assistant Professor

Credit hours in total of practical classes are conducted by the department:

A total of 96 credit hours are conducted by the department including coursed on Crop Physiology and Biochemistry.

Educational outcome of the practical conducted;

From the practical courses, students will be able to understand the different physiological processes of plants and develop skills for selecting superior varieties for cultivation among multidisciplinary science of agriculture. Along with this, Students will be able to accumulate knowledge on different metabolisms found in plants and apply the knowledge for practical oriented studies. Moreover, students will be able to identify and solve problems using quantitative Methods with their knowledge on crop growth.

Instruments present in the department:

SL No.	Instruments	Quantity
1	Electronic Balance	1
2	Chlorophyll meter	1
3	Centrifuge	1
4	Magnetic Stirrer	1
5	Orbital Shaker with Thermostat	1
6	Stereomicroscope	2
7	Thermometer	1
8	Binocular Microscope	2
9	Micropipettes (20-200 µl)	1 unit

Practical's conducted by the department:

SL No.	Semester Allotted	Practical Conducted
1	B.Sc. (Hons.) Agriculture 2nd Semester	• Structure and distribution of stomata • Rate of transpiration • Relative Water Content
2.	B.Sc. (Hons.) Horticulture, 1st Semester	• Basic instrumentation • Common acid and base handling and preparation • Preparation procedure of buffers • Acid base titration
3.	B.Sc. (Hons.) Horticulture, 1st Semester	• Structure and distribution of stomata • Rate of transpiration • Relative Water Content

Department of Environmental Science/Forestry

The Environmental Sciences + Forestry laboratory is well equipped to offer structured undergraduate programs in Agriculture, Horticulture, Agribusiness, and Food Nutrition and Dietetics. Through practical's in this laboratory students get familiarized with the fundamental laboratory procedures, analytical techniques, and tackle stoichiometric problems. The students learn about the sampling techniques, sample processing and analysis of various environmental matrices, and also handle basic equipment/instruments. In addition to this, seeds identification of forest trees, social forestry plantations, forest dynamics, silviculture and management, identification of appropriate species for agro-forestry systems are instilled. Experiments are designed to analyze soil and water samples, understand forest dynamics, and relate them with theoretical information. Dr. Rachna Chandra, Associate Professor and Dr. Sandeep Rout, Assistant Professor work as a team to handle and conduct more than 12 credit hours of practical classes per week in this laboratory.

The laboratory aims to i) provide analytical services, ii) provide social forestry plantation services, iii) develop remedial techniques for mitigating soil and water pollution, iv) restore mined out sites, and v) conserve biodiversity and natural resources.

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SL No.	Instruments	Quantity
1	Centrifuge	01
2	Leaf Area Meter	01
3	Platform Shaker	01
4	Microscope	01
5	BOD Incubator	01
6	Hot Air Oven	01
7	Hot Water Bath	01
8	pH meter	01
9	Electronic Balance	01
10	Desiccator	01
11	Magnetic Stirrer	01
12	Vortex	01

Practical's conducted by the department:

SL No.	Semester Allotted	Practical Conducted
1	BSc. (Hons.) FND Sem I	Determination of moisture content of soil sample
2	BSc. (Hons.) FND Sem I	Determination of soil texture
3	BSc. (Hons.) FND Sem I	Determination of pH in drinking watersample
4	BSc. (Hons.) FND Sem I	Determination of soil organic carbon
5	BSc. (Hons.) FND Sem I	Determination of Alkalinity in the water sample.
6	BSc. (Hons.) FND Sem I	Determination of Dissolved Oxygen (DO) in the water sample
7	BSc. (Hons.) FND Sem I	Determination of Biological Oxygen Demand (BOD) in the water sample
8	BSc. (Hons.) FND Sem I	Determination of Chemical Oxygen Demand (COD) in the water sample
9	BSc. (Hons.) FND Sem I	Determination of residual Chlorine in the water sample
10	BSc. (Hons.) FND Sem I	Determination of Total Dissolved Solids in water/effluent sample
11	BSc. (Hons.) FND Sem I	Vegetation Community Structure of grassland ecosystem
12	BSc. (Hons.) Agribusiness Sem VI	Determination of moisture content of soil sample
13	BSc. (Hons.) Agribusiness Sem VI	Determination of soil texture
14	BSc. (Hons.) Agribusiness Sem VI	Determination of pH and Conductivity in drinking watersample
15	BSc. (Hons.) Agriculture Sem I	Introduction to laboratory, staining techniques, microscope
16	BSc. (Hons.) Agriculture Sem I	Identification of tree-species
17	BSc. (Hons.) Agriculture Sem I	Diameter measurements using calipers and tape
18	BSc. (Hons.) Agriculture Sem I	Diameter measurements of forked, buttressed, fluted and leaning trees
19	BSc. (Hons.) Agriculture Sem I	Height measurement of standing trees by shadow method
20	BSc. (Hons.) Agriculture Sem I	Single pole method and hypsometer
21	BSc. (Hons.) Agriculture Sem I	Volume measurement of logs using various formulae
22	BSc. (Hons.) Agriculture Sem I	Nursery lay out
23	BSc. (Hons.) Agriculture Sem I	Seed sowing
24	BSc. (Hons.) Agriculture Sem I	Vegetative propagation techniques
25	BSc. (Hons.) Agriculture Sem 5	Identification and seeds and seedlings of multipurpose tree species

Department of Horticulture

Educational objectives of the departmental laboratory and other infrastructure

The Department of Horticulture was established with the specific objectives of developing skilled and efficient human resource in the field of horticulture. The Department has got one UG laboratory and two protected structures: one poly house and one green shade net hose which cater to the needs of students for conducting practical and imparting horticultural skills for the respective programs. The major objective of the departmental laboratory is to impart skills of physical, physiological, biochemical

and quality attributes analysis, post-harvest and value addition, freezing, drying, dehydration of different vegetables, flowers or fruits. Protected cultivation of vegetables and flowers, nursery raising/procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing are being done under the poly-house and net-house. This helps in inculcating the entrepreneurship skills among the students and encourages them to start their own business.

Faculty members

Name	Designation
Dr. Suvalaxmi Palei	Assistant Professor
Dr. Suchismita Jena	Assistant Professor
Dr. Kalyani Pradhan	Assistant Professor
Dr. Tanushree Sahoo	Assistant Professor
Dr. Meenakshi Badu	Assistant Professor

Credit hours in total of practical classes conducted by the department: 24

Educational outcome of the practical conducted

Students of various programs can gain a basic knowledge/idea on production technology of flowers, vegetables, fruits, medicinal and aromatic plants. They can able to identify the different horticultural plants. In the protected structures, students can practice nursery raising and their management, they also can practice various techniques followed in plant propagation like grafting, budding, layering, cutting and seed germination of horticultural crops. By using the minor equipment's, they will get trained about various canopy management techniques like training, pruning, top working techniques in well grown fruit trees. They can also have a deeper understanding on fresh flower and dry flower arrangements, preparation of terrarium, bonsai, resin art as well as landscape architecture. Students can also analyze the physico-chemical attributes of fruits and vegetables, canning of fruits and vegetables, preparation of squash, RTS, cordial, syrup, jam, jelly, marmalade, candies, preserves, chutneys, sauces, pickles (hot and sweet). Dehydration of fruits and vegetables, refrigeration and freezing, cut out analysis of processed foods.

Infrastructure and other facilities

- Well-furnished undergraduate horticulture laboratory for physical and quality attributes analysis of different horticultural crops.
- Facility for plant propagation and nursery management.
- Facility for value addition and post-harvest management of fruits, vegetables and flowers.
- Facility for protected cultivation of horticultural crops as well as nursery management in Poly house or Shade net house.

Instruments available in the laboratory

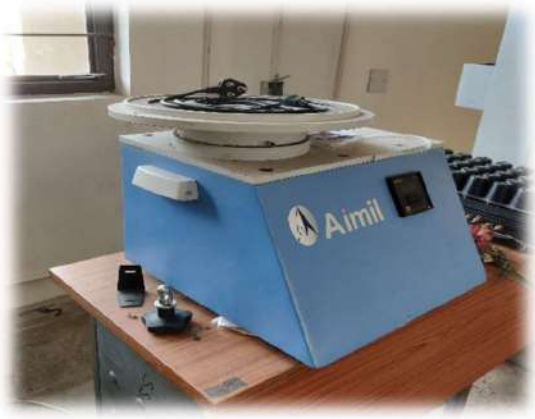
Sl. No.	Items	No. Of Units/Qnty

	A. Instruments	
1.	Electronic Weighing Balance	1
2.	Water bath	1
3.	Seed Germinator	1
4.	Muffle Furnace	1
5.	Dehydrator	1
6.	Microscope(Binocular)	1
7.	Vaccum pump	1
8.	Juice Extractor	1
9.	Mixture Grinder(Sintex)	1
10.	Pressure Cooker (Prestige)	1
11.	Micro oven(Samsung)	1
12.	Poly pouch Sealer	1
13.	Hot Air Oven	1
14.	PH Meter	1
15.	Refractometer	3
16.	Weighing Machine(100 kg capacity)	1
17.	Food Dehydrator	1
18.	Crown Corking Machine	1
19.	Crusher	1
20.	Cap sealer	1
21.	Corking Machine	1
22.	Juice Extractor(wooden)	1
23.	GPS Tracker	1
24.	Hand Juicer	1

	D. Minor Equipment's/ Tools	
1.	Grafting & Budding Knife	23
2.	Secature	10
3.	Sprayer 15lt + 5 lt	2+1=3
4.	Vermilite	3pkt

5.	Burette stand with burette	5
6.	Filter stand	2
7.	Protray	100
8.	Utensil	2set(4each different size)
9.	Squeezer	2
10.	Peeler	4
11.	Spoon	6
12.	Test tube stand	2
13.	Funnel	5
14.	Burette with Stand(50ml)	5
15.	Squeeze bottle	6
16.	Pipette stand	2
17.	Mortal & Pastel	5
18.	Trench(B)	5
19.	Rose cane(10lt)	1
20.	Plastic pot	10
21.	Field display board	5
22.	Secature	5
23.	Knife	3
24.	Plastic bottle	4
25.	Gas Cylinder empty	1
26.	Water Pipe	2
27.	Vermiculite	3 pkts
28.	Mulching	5 roll
29.	Soil rite	2 pkts
30.	Shearer	5
31.	Fruit Penetrometer	2
32.	Hand Caliper	2
33.	Secature	5
34.	Grafting Budding Knife	22
35.	Pep-Cee roller	1 pkt
36.	Black thread	3 bundle

37.	White transparent polythene	1 bundle
38.	Nylon thread	1 bundle
39.	Test tube stand	4
40.	Cotton(Absorbent)	1
41.	Aluminum Foil	2
42.	Forcep	5
43.	Test tube Holder	4
44.	Long Spatula	2
45.	Test tube wash brush	2
46.	Level tag	5 page
47.	Poly bag	400pc
48.	White polythene sheet	1 bundle
49.	Cocopeat	5kg



Poly house and greenhouse facilities

Department of Plant Pathology

Educational objectives of the departmental laboratory

- The Department of Plant Pathology was established with the aim of developing skill and efficient human resources in the field of plant pathology with special emphasis on the basic knowledge about the major groups of organisms that cause plant diseases in crop plants. The Department also aims to develop location specific modules for management of diseases in different field and horticultural crops. The Department has got one UG laboratory which serve to the needs of the undergraduate students for conducting practical and imparting identification skills for the respective programs.

- The major objective of the laboratory is
  - To provide insights on collection and preservation of plant disease specimens.
  - To provide knowledge on basic theory of media preparation and isolation of different plant pathogens responsible to cause disease in plants.
  - To provide knowledge about fungicides, their formulations and methods for application in the disease infected fields.

Name of the faculty members included in the department

- Dr. Chinmayee Mohapatra, Assistant Professor
- Ms. Debanjana Debnath, Assistant Professor
- Dr. Ansuman Khandual, Assistant Professor

How many credit hours in total of practical classes are conducted by the department?

32 hours/ semester

Educational outcome of the practical conducted -What the student will be able to learn from the course?

Students of various programs can gain a basic knowledge on various types of pathogens and microorganisms responsible to cause diseases in crop plants as well as they can acquire skills to identify them and isolate them in artificial medium. Apart from gaining knowledge about the pathogens, they can also learn how to collect and preserve the diseased plant specimens. They can also have a sound knowledge about the symptom, causal organisms, etiology and management of different diseases of both field and horticultural crops. They can also have a deeper understanding of types and formulations of fungicides to be applied for controlling plant diseases.

Pictures of the laboratory.






Mushroom unit

Instruments present in the department:

Sl. No.	Instruments	Quantity
1	Laminar Air flow	1
2	Autoclave	1
3	BOD Incubator	1
4	Hot Air Oven	1
5	Refrigerator	1
6	Microwave Oven	1
7	Electronic Balance	1
8	Binocular Microscope	7
9	Camera Lucida	1
10	Colony Counter	1
11	Centrifuge	1
	Minor tools	
1	Inoculating needle	4
2	Spirit lamp	2
3	Forceps	5
4	Bottle brush	2
5	Painting brush	1 set
6	Mortar and pestle	5
7	Ocular meter	1
8	Stage meter	1
9	Parafilm tape	4
10	Watch glass	5
11	Slide box	4
12	Petriplate rack	2

Practical's conducted by the department:

SL No.	Semester Allotted	Course	Practical Conducted
1	2nd	Fundamentals of Plant Pathology (PLP 101)	Acquaintance with various laboratory equipments
2			Parts of microscope
3			Collection and preservation of disease specimen
4			Preparation of artificial culture media
5			Isolation of fungal and bacterial pathogen
6			Demonstration of Koch's postulates for fungi
7			Demonstration of Koch's postulates for bacteria
8			General study of different vegetative structures of fungi
9			General study of different reproductive structures of fungi
10			Study of symptoms of various plant diseases
11			Study of representative fungal genera
12			Isolation of plant pathogenic bacteria
13			Gram's staining of plant pathogenic bacteria
14			Demonstration of mechanical transmission of plant viruses
15			Study of phanerogamic plant parasites
16			Study of formulations of fungicides
17			Methods of pesticides application

	5th	Diseases of Field and Horticultural Crops and their management I (PLP 102)	
1			Disease sample collection and preservation
2			Symptomatology of different field crops
3			Symptomatology of different horticultural crops
	5th	Principles of Integrated Pest and Disease Management (PLP 104)	
1			Methods of diagnosis and detection of various insect pests and plant diseases
2			Sampling techniques for estimation of insect population and damage
3			Collection of samples for disease diagnosis
4			Assessment of crop yield losses
5			Study of economics of IPM
6			Agro ecosystem analysis and crop dynamics of selected insect pests and diseases
7			Pest monitoring and forecasting
8			Identification of biocontrol agents, different predators and natural enemies
9			Mass multiplication of Trichoderma
10			Mass multiplication of Pseudomonas
11			Mass multiplication of Trichogramma
12			Mass multiplication of NPV
13			Awareness campaign at farmers field

	6th	Diseases of Field and Horticultural Crops and their management II (PLP 103)	
1			Disease sample collection and preservation
2			Symptomatology of different field crops
3			Symptomatology of different horticultural crops

Department of Agricultural Extension

Brief Introduction about the laboratory of the department:

Educational objectives of the departmental laboratory

The Department of Agricultural Extension was established with the specific objectives of developing skilled and efficient human resource in the field of extension, providing training on different aspects of agriculture to the farmers and acquainted the students with farmer's situation by conducting village visit, Rural Agricultural Work Expereience (RAWE). This department offers under graduate programmeto generate quality human resource. he main objective of this department is to transfer the technologies from lab to land. This department is mainly to transfer good agricultural practices and technologies to the farming community. Rural Sociology, Educational Psychology, Panchayati Raj, Social Institutions and Organizations, Developmental Programmes to uplift the Farming Community, Methods involved in teaching farmers, Personality Development, Intelligence and Communication Skills are being taught by the Department of Agricultural Extension and Rural Sociology. Extensive visits to villages, State Department of Agriculture, Government Institutions and Organizations, NGOs are organized for the students to learn their activities. All India Study Tour and Rural Agricultural Work Experience (RAWE) is also being offered to the final year students to expand their knowledge on Indian agricultural scenario.

Faculty members

Name	Designation
Dr. Subhrjyoti Panda	Assistant Professor
Dr. Anupam Dakua	Assistant Professor

Credit hours in total of practical classes conducted by the department: 18

Educational outcome of the practical conducted

Students of various programs can gain a basic knowledge/idea on farmer's field situation, how to prepare training materials like leaflet, folder, poster etc.

Infrastructure and other facilities

- Well-furnished undergraduate Laboratory
  Pictures of the laboratory. Please attach the picture from your collection during Minister visit program.

Instruments/chemicals available in the laboratory

Sl. No.	Items	No. Of Units/Qnty
	A. Instruments	
25.	**Projector**	1

Practical's conducted by the department:

SL No.	**Course Title: Fundamentals Of Agricultural Extension Education (2nd) B.Sc. (Hons.) Agriculture and B.Sc. (Hons.) Horticulture**
1	To get acquainted with university extension system
2	Group discussion- exercise
3	Preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories
4	Visit to NGO and learning from their experience in rural development;
5	Understanding PRA techniques and their application in village development planning
6	Developing script for radio and television
7	Visit to community radio and television studio for understanding the process of Production program.
	Course Title: Communication Skills and Personality Development (5th)
8	Listening and note taking, writing skills, oral presentation skills
9	field diary and lab record
10	Indexing, footnote and bibliographic procedures
11	Reading and comprehension of general and technical articles
12	Precise writing, summarizing,Abstracting
13	Individual and group presentations
	Course Title: Entrepreneurship Development and Business Communication (6th)
11	Assessing entrepreneurial traits
12	Identification and selection of business idea
13	Preparation of business plan and proposal writing




Department of Genetics and Plant Breeding

Brief Introduction about the laboratory of the department: Genetics and Plant Breeding

1. Educational objectives of the departmental laboratory

- ✓ To provide the concept of fundamental biology principles occurring inside the cell and its influence on character expression.
- ✓ Provide insights on basic theory, practices and technology involved in seed production of different crop.
- ✓ Provide insights on basic theory, genetic principles and methods applied for development of variety.
- ✓ Provide insights on basic theory, practices and methods applied for improvement of field crop.

- ✓ Provide insights on basic theory, practices and methods applied for development stress resistance variety.

2. Name of the faculty members included in the department
    - ✓ Prof. Damodara Parida
    - ✓ Dr. Mandakini Kabi
    - ✓ Dr. Anupama Singh
    - ✓ Dr. Mahipal Singh
3. How many credit hours in total of practical classes are conducted by the department?
    - ✓ 20 hrs
4. Educational outcome of the practical's conducted- What the student will be able to learn from the course?

- ✓ Explain inheritance and expression of characters.
- ✓ Explain how variation occurs within living organisms.
- ✓ Acquainted with genetic terminology and its application.
- ✓ Gained the knowledge on the genetic principles behind the development of variety
- ✓ Acquainted with floral biology of crop.
- ✓ Explain about basic principles behind seed production.
- ✓ Know how different classes of seed are produced.
- ✓ Know how certified seed is produced by farmer.
- ✓ Acquired knowledge on different practices and processes for quality seed production.
- ✓ Explain about basic principles of variety development.
- ✓ Know different methods applied in different crop for development of variety.
- ✓ Know about floral biology of different crops.
- ✓ Acquiring knowledge how different breeding method will be applied depending on nature of crop.
- ✓ Know commercial importance of field crop.
- ✓ Able to know Plant Genetic Resources of different crops.
- ✓ Acquired knowledge on how fundamental mechanisms behind resistance and how this resistance transferred from wild to cultivated variety.




Plant Tissue Culture Laboratory


Instruments/chemicals present in the department:

SL No.	Instruments	Quantity
1	BoD Incubator	1
2	Seed Germinator	1

3	Microscope (Binocular)	2
4	Microscope (Stereo)	1
5	Fluorescence Microscope	1
6	Hot Air Oven	1
7	Seed Counter	1
8	Laminar Air Flow	1
9	Refrigerator (Small)	1
10	Centrifuge	1
11	Distillation Assembly Unit	1
12	Autoclave medium	1
13	UV Transilluminator	1

Practical's conducted by the department:

SL No.	Semester Allotted	Practical Conducted
1	Odd semester 2017-2018	**Fundamentals of Genetics (GPB- 101)** • Study of microscope • Study of cell structure. • Mitosis and Meiosis cell division • Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, • Experiments on epistatic interactions including test cross and back cross • Practice on mitotic and meiotic cell division Experiments on probability and Chi-square test. Determination of linkage and cross-over analysis (through two-point test cross and three-point test cross data • Study on sex linked inheritance in Drosophila. Study of models on DNA and RNA structures **Fundamentals of Plant Breeding (GPB-103)**

- Breeder's kit: Description of breeder's kits and its uses in plant breeding
- Floral Biology of Crop Plant: General description of reproductive morphology and floral biology of self and cross pollinated crop plant
- Emasculation and hybridization techniques:
- Study of different artificial selfing and crossing techniques in self and cross pollinated crop plants
- Study of germplasm of various crops: Description about the germplasm of various crops
- Handling of Segregating Generations
- Simple measures of variability and heritability
- Designs used in plant breeding experiment: Different types of Plant Breeding design and analysis of Randomized Block Design
- Inbreeding depression: Consequences of inbreeding on genetic structure of resulting populations
- Study of male sterility system
- Pollination: To work out the mode of pollination in a given crop and extent of natural out crossing
- Double cross hybrid: Prediction of performance of double cross hybrids.

Crop Improvement – I (Kharif)) (GPB-104)

- Floral biology, artificial selfing and crossing technique in Rice
- Hybrid seed development in Rice
- Floral biology, Artificial Selfing and Crossing Techniques in Maize
- Floral Biology, selfing and crossing in Pearl Millet
- Floral biology and emasculation in Sorghum
- Floral biology and emasculation in Pigeonpea
- Floral biology and emasculation in Mungbean
- Floral biology and emasculation in Urdbean

- Floral biology and emasculation of Cowpea
- Floral biology and emasculation in Soybean
- Floral biology and crossing methods in Groundnut
- Floral biology and crossing in Sesame
- Floral biology and crossing in Castor
- Floral biology and emasculation in Cotton
- Floral biology and crossing in Tobacco
- Floral biology and crossing in Brinjal and Okra Handling of segregating generation: Pedigree method
- Handling of segregating generation: Bulk method and Single seed descent method
- Maintenance breeding in self and cross pollinated crops
- Layout of field experiments
- Estimation of heterosis, inbreeding depression and heritability
- Visit to seed production plots and AICRP plots of different crops

Principles of Genetics and Cytogenetics (HGC 101)

- Study of fixatives and stains
- Squash and smear techniques
- Demonstrations of permanent slides and cell division Illustration in plant cells
- Pollen fertility and viability, determination of gametes Solving problems of monohybrid, dihybrid, and test cross ratios using chi-square test
- Gene interactions
- Estimation of linkages using three-point test cross from F2 data and construction of linkage maps
- Genetic variation in pea.

2 Even semester 2017-2018 **Principles of Seed Technology (GPB-102)**

- Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi.
- Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea.
- Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard.
- Seed production in important vegetable crops.
- Seed sampling and testing: Physical purity, germination, viability, etc.
- Seed and seedling vigour test.
- Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report.
- Visit to seed production farms, seed testing laboratories and seed processing plant.

Crop Improvement – II (Rabi) (GPB-105)

- Floral biology, emasculation and hybridization techniques in Wheat
- Floral biology, emasculation and hybridization techniques in Oat
- Floral biology, emasculation and hybridization techniques in Barley
- Floral biology, emasculation and hybridization techniques in chickpea
- Floral biology, emasculation and hybridization techniques in lentil
- Floral biology, emasculation and hybridization techniques in field pea
- Floral biology, emasculation and hybridization techniques in Rajma
- Floral biology, emasculation and hybridization techniques in Horsegram
- Floral biology, emasculation and hybridization techniques in Rapeseed mustard

- Floral biology, emasculation and hybridization techniques in Sunflower, Safflower
- Floral biology, emasculation and hybridization techniques in Potato
- Floral biology, emasculation and hybridization techniques in Berseem
- Floral biology, emasculation and hybridization techniques in Sugarcane
- Floral biology, emasculation and hybridization techniques in tomato, Chilli and Onion
- Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods
- Study of field techniques for seed production and hybrid seeds production in Rabi crops
- Estimation of heterosis, inbreeding depression and heritability;
- Layout of field experiments;
- Study of quality characters
- Study of donor parents for different characters
- Visit to seed production plots;
- Visit to AICRP plots of different field crops

Principles of Plant Breeding (HPB 102)

- Requirements for Plant Tissue Culture Laboratory
- Techniques in Plant Tissue Culture; Media components and preparations;
- Sterilization techniques and Inoculation of various explants
- Aseptic manipulation of various explants
- Callus induction and Plant Regeneration
- Micro propagation of important crops
- Anther, Embryo and Endosperm culture;
- Hardening/Acclimatization of regenerated plants

		• Somatic embryogenesis synthetic seed production Isolation of protoplast; Demonstration of Culturing of protoplast • Demonstration of Isolation of DNA • Demonstration of Gene transfer techniques, direct methods • Demonstration of Gene transfer techniques, indirect methods • Demonstration of Confirmation of Genetic transformation • Demonstration of gel-electrophoresis techniques • Green synthesis of nano particles and their size characterization.
3	Odd semester 2018-2019	Fundamentals of Genetics (GPB- 101) Fundamentals of Plant Breeding (GPB-103) Crop Improvement – I (Kharif)) (GPB-104) Principles of Genetics and Cytogenetics (HGC 101)
4	Even semester 2018-2019	Principles of Seed Technology (GPB-102) Crop Improvement – II (Rabi) (GPB-105) Principles of Plant Breeding (HPB 102)
5	Odd semester 2019-2020	Fundamentals of Genetics (GPB- 101) Fundamentals of Plant Breeding (GPB-103) Crop Improvement – I (Kharif)) (GPB-104)

		Principles of Genetics and Cytogenetics (HGC 101)
6	Even semester 2019-2020	Principles of Seed Technology (GPB-102)
		Crop Improvement – II (Rabi) (GPB-105)
		Principles of Plant Breeding (HPB 102)
		Commercial Plant Breeding (GPB 201)
7	Odd semester 2020-2021	Fundamentals of Genetics (GPB- 101)
		Fundamentals of Plant Breeding (GPB-103)
		Crop Improvement – I (Kharif)) (GPB-104)
		Principles of Genetics and Cytogenetics (HGC 101)
8	Even semester 2020-2021	Principles of Seed Technology (GPB-102)
		Crop Improvement – II (Rabi) (GPB-105)
		Principles of Plant Breeding (HPB 102)
9	Odd semester 2021-2022	Fundamentals of Genetics (GPB- 101)
		Fundamentals of Plant Breeding (GPB-103)
		Crop Improvement – I (Kharif)) (GPB-104)
		Principles of Genetics and Cytogenetics (HGC 101)
10	Even semester 2021-2022	Principles of Seed Technology (GPB-102)
		Crop Improvement – II (Rabi) (GPB-105)

Department of Animal Science


INDOSATI

Overview of Farms

The University has total 40 acres of farm land managed by the Faculty of Agriculture. These farms are used for conducting various field practical and hands on training to the students. Faculty of Agriculture have adequate number of tractors, farm implements, tools and other machinery for providing hands on training to the students. The entire farmland is divided into several Farms based upon their location inside the campus. The details of which is indicated in Table 1.

Table 1: Farm Area within SSU

No.	Area (acres)	Name	Location
1	5.89	Farm 1	Near Kirti building
2	9.58	Farm 2	Near Attreya
3	2	Farm 3	Beside Shivaji Hostel
4	0.67	Farm 4	Opposite Shivaji Hostel
5	22.3	Farm 5	North Side Orchard
Total	40.44		

The land area in Farm 1 is utilised as Student Demonstration unit in which the students are Group wise allotted with plots of area 40 m^2 (8m x 5m). Under Crop Production Technology-I, II and Practical crop production Technology-I, II students grow Kharif and rabi crops under sole cropping and multiple cropping respectively for their practical exposure in field Crop cultivation. Under different courses of horticulture like Fundamentals of Horticulture, Production Technology for Fruits and plantation crops and Production Technology for vegetable crops students cultivate seasonal vegetables and carry out hands on training on propagation techniques of fruit crops and flowering plants. The season wise crop allotment plan of students is indicated in Table 2.

Table 2: Crop allotment in Student Demonstration Unit

Sl. No.	Crop type	Kharif	Rabi	Summer
1.	Field crops	Rice, Green gram, Blackgram, Maize, Arhar, Sesamum, Groundnut, Finger millet, Soybean, Cotton, Sorghum	Wheat, Chickpea, Linseed, Lentil, Frenchbean, Sunflower, Mustard, Garden pea, Sweet corn	Clusterbean, Green gram, Black gram, Sweet corn, Sesamum, Finger millet

2.	Vegetable crops	Ridge gourd, Bottle gourd, Brinjal, Bitter gourd, Ash gourd	Tomato, Cabbbage, Cauliflower, Radish, Fenugreek, Carrot, Potato, Peas, Onion, Garlic, Palak	Water melon, Musk melon, Cucumber, Pumpkin, Cluster bean, Cowpea, Pointed gourd
3.	Flower crops	Gompherna, Balsum, Amaranthus, Cock's comb, Gaillardia	Rose, Dahlia, Jasmine, Marigold, China aster, Gladiolus, Tube rose, Salvia, Portulaca, Chrysanthemum	Zinnia, Gompherna, Coreopsis, Gaillardia, Cosmos

The land area in farm 2 is being utilised for Agroforestry/ farm forestry in which Moringa and Amla based Agroforestry system is developed. In view of this, near about 50 number of Amla and Moringa seedling etc. and some other tree crops in arboretum, live ornamental fencing plants and fruit plants / plantation crops have been planted. Some part of farm land is utilised for raising of vegetables. The area behind Jaydev block is currently planted with 50 number of Sapota seedlings. Rest of the land is being developed by Department of Entomology for creation of an apiary unit and IPM module for student practical purpose. The land area under Farm 3 and 4 are utilised for cultivation of some cucurbits, leafy vegetables and small area is also under mango plantation.

A poly house and a net house has been constructed in Farm 5 in an area of 1000 m^2 which is currently being utilised for the cultivation of red capsicum, green capsicum, indeterminate tomato and papaya nursery for propagation. The rest of the land is developed as an orchard having more than 200 sp. of different fruit trees. The land area below the hill is utilised for cultivation of Rice, Maize and some winter vegetables. The inter row spaces of orchard is used for growing fodder plants during kharif season. Apart from this the entire land area has been planned to be developed department wise for carrying out practical and hands on training under each department. The land use plan is indicated in Table 3.

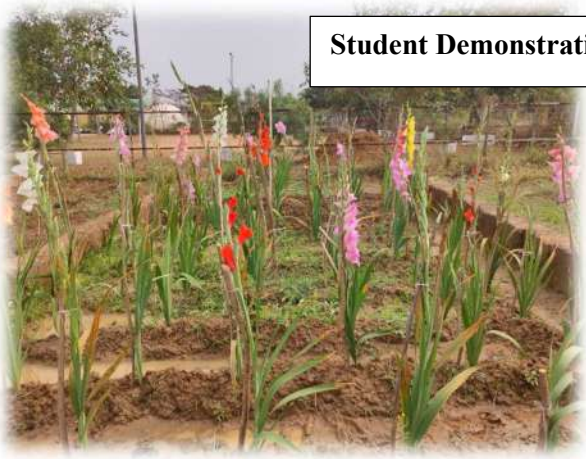
Table 3: Land use plan

Particular of Field Department	**Area in Acre**	**Utilization**
Agronomy + Agrometeorology	8.0	Crop Cafeteria for practical crop production, Crop Husbandry , weed museum, Fodder crops, Organic Field, Agrometeorology Observatory
Environmental Science +Forestry		Agroforestry System,Arboretum, bamboo seatum
Soil Science	1.5	Vermi compost unit, Azolla Unit, Soil nutrient analysis,

Horticulture	9.0	Practicals on fruit and vegetable, Ornamental Crops Production, Medicinal and aromatic plant garden, kitchen garden, Plantation crops.
Genetics and plant Breeding	4.0	Seed Production Plot,Demonstration of Germ plasm, Practical crop improvement
Entomology	0.5	Study of various insect pest of different crops, Apiary, Maintenance of Mulberry stock for sericulture unit, Validation and demonstration of IPM
Plant Pathology	0.5	Cultivation of mushroom, Disease cycle studies, IDM, Bio-control in cucurbits.
Crop Physiology+ Biochemistry	0.5	Cultivation of different crops for abiotic stress condition, Nutrient deficiency condition
Animal Sciences	3.0	Pasture land, Fodder production unit, cattle Shade
Agriculture Engineering	1.0	Demonstration of Agricultural tools and machinery, Agricultural engineering workshop

No.	Area (acres)	Name/Location
1	2.07	Farm 1 / Near Kirti building
2	6.38	Farm 2/ Near Attreya
3	2	Farm 3/ Opposite Shivaji Hostel
4	0.67	Farm 4 / Beside Shivaji Hostel
5	12.8	Farm 5 / North Side Orchard
6	9.5	Farm 6/ Near Gate No.5
7	2.8	Farm 7/Behind Admin Block
8	1.6	Farm 8 (including medicinal garden)/ Opposite Farm 1
9	0.7	Farm 9 (excluding small AFI Theatre)/ Navagraha
10	1.4	Farm 10/ M.P. Hall Backside
11	0.4	Farm 11/Near Airtel Tower
12	0.12	Farm 12/Shruti Building Front Side
Total	40.44	


FACULTY OF AGRICULTURE
FARM - 1



Student Demonstration Plots- Farm-1

Poly house and Net house

Publications

SCOPUS indexed Research/Review Articles

1. Anoop, M., Beevi, C. N. A., & Bhawar, R.S. (2021). Growth, Geographic Concentration and Stability Analysis of Coir Products Export from India. *Indian Journal of Ecology,* 48(1), 210–215.
2. Chandra, R., Sharpanabharathi, N., Prusty, B. A. K., Azeez, P. A., & Kurakalva, R. M. (2021). Organochlorine Pesticide Residues in Plants and their Possible Ecotoxicological and Agri Food Impacts. *Scientific Reports,* 11, 17841.
3. Dash, L., Rout, S., Mishra, U. N., Sahoo, G., & Prusty, A. K. (2021). Insecticidal Genes in Pest Management. *Annals of the Romanian Society for Cell Biology,* 25(6), 5601–5608.

4. Dey, P., Saha, D., Mishra, U. N., Jha, G., Sharma, A. K., & Datta, D. (2021). Thinking Ahead: Agricultural Silver Lining Post Covid- 19 Pandemic Crisis. *Ecology, Environment and Conservation,* 27(S), S281–S286.
5. Dhane, M. M., Kumar, P. K., Rout, S., Packirisamy, S., Haque, S. M., & Kotaiah, B. (2021). Classification and Prediction of Essential Oils Classification and Predication of Essential Oils using Mobile Nets. *Natural Volatiles and Essential Oils,* 8(6), 317–325.
6. Dwivedi, D. K. & Shrivastava, P. K. (2021). Assessment of Roof Water Harvesting Potential of Navsari city of Gujarat State, India by Remote Sensing and Geographic Information System (GIS). *Journal of Natural and Applied Science,* 13(3), 1143–1150.
7. Kabi, M., Baisakh, B., Dash, M., Tripathy, S. K., Sahu, S., & Panigrahi, K. K. (2021). Gene Action and Combining Ability Study in Sesame. *Plant Archives,* 21(1), 1810–1818.
8. Kesawat, M.S., Kherawat, B.S., Singh, A., Dey, P., Kabi, M., Debnath, D., Saha, D., Khandual, A., Rout, S., Manorama, Ali, A., Palem, R. R., Gupta, R., Kadam, A. A. Kim, H., Chung, S., & Kumar M. (2021). Genome-Wide Identification and Characterization of the Brassinazole-Resistant (BZR) Gene Family and Its Expression in the Various Developmental Stage and Stress Conditions in Wheat (*Triticum aestivum L.*). *MDPI-International Journal of Molecular Sciences,* 22(16), 8743.
9. Kumar, A., Singh, S. K., Kant, C., Verma, H., Kumar, D., Singh, P. P., Modi, A., Droby, S., Kesawat, M. S., Alavilli, H., Bhatia, S. K., Saratale, G. D., Saratale, R. G., Chung, S., & Kumar, M. (2021). Microbial Biosurfactant: A New Frontier for Sustainable Agriculture and Pharmaceutical Industries. *MDPI-antioxidants,* 10(9), 1472.
10. Kumar, M., Kherawat, B. S.,Dey, P., Saha, D., Singh, A., Bhatia, S. K., Ghodake, G. S., Kadam, A. A., Kim, H., Manorama, Chung, S., & Kesawat, M. S. (2021). Genome-Wide Identification and Characterization of PIN-FORMED (PIN) Gene Family Reveals Role in Developmental and Various Stress Conditions in *Triticum aestivum* L. *MDPI-International Journal of Molecular Sciences,* 22(14), 7396.
11. Kumar, M., Singh, S. K., Singh, P. P., Singh, V. K., Rai, A. C., Srivastava, A. K., Shukla, L., Kesawat, M. S., Jaiswal, A. K., Chung, S., & Kumar, A. (2021). Potential Anti-Mycobacterium Tuberculosis Activity of Plant Secondary Metabolites: Insight with Molecular Docking Interactions. *MDPI-antioxidants,* 10(12), 1990.
12. Mohapatra, S., & Singh, J. (2021). Co-integration of Major Vegetable Markets in Punjab, India. *Economic Affairs,* 66(2), 181–187.
13. Mohapatra, S., Mishra, R., & Mishra, R. (2021). Impact of COVID-19 on Education Level of Agricultural Farming Community. *International Journal of Agricultural and Statistical Sciences,* 17(S), 915–923.
14. Panigrahi, S., Rout, S., & Sahoo, G. (2021). Ethnobotany: A strategy for conservation of plant. *Annals of the Romanian Society for Cell Biology,* 25(6), 1370–1377.
15. Patra, S. S., Suneetha, P., Rout, S., Panigrahi, S., Sahoo, G., & Dwivedi, D. K. (2021). Estimation of Rice Crop Acreage using Remote Sensing and GIS. *International Journal of Mechanical Engineering,* 6(S), 154–158.
16. Pradhan, K., Rout, S., Tripathy, B., Mishra, U. N., Sahoo, G., Prusty, A. K., & Dash, L. (2021). Role of Biotechnology in Vegetable Breeding. *Turkish Online Journal of Qualitative Inquiry (TOJQI),* 12(3), 5092–5102.
17. Prusty, A. K., Rout, S., Pradhan, K., Sahoo, G., Meena, L. L., & Dash, L. (2021). Technology Adoption of Farmers Regarding System of Rice Intensification (SRI) Method in Puri District of Odisha, India. *Journal of Tianjin University Science and Technology,* 54(7), 394–405.
18. Sahoo, G., Swamy, S. L.,Rout, S.,Wani, A. M., & Mishra, A. (2021). Exploitation of Wild Leafy Vegetables and Under-utilized Fruits: Consequences for Food and Nutritional Security. *Annals of the Romanian Society for Cell Biology,* 25(6), 5656–5668.
19. Sahoo, G., Wani, A. M., Dash, A. C., Rout, S., Tripathy, B., Prusty, A. K., Dash, L. (2021). Impact of Rural Activities on Biodiversity and Ecosystem Services. *Journal of Tianjin University Science and Technology,* 54(7), 373–393.

20. Sahoo, G., Wani, A. M., Rout, S., Mishra, U. N., Pradhan, K., & Prusty, A. K. (2021). Design Innovation and Industrial Utilization of Bamboo: A Prospective Base of Income for Rural Livelihoods. *Journal of Tianjin University Science and Technology,* 54(7), 420–442.
21. Shrivastava, A., Nayak, C. K., Dilip, R., Samal, S. R., Rout, S., & Ashfaque, S. (2021). Automatic Robotic System Design and Development for Vertical Hydroponic Farming using IoT and Big Data Analysis. *Materials Today: Proceedings, In press.*
22. Singhal, R. K., Saha, D., Skalicky, M., Mishra, U. N., Chauhan, J., Behera, L. P., Lenka, D.,Chand, S., Kumar, V., Dey, P., Indu, Pandey, S.,Vachova, P., Gupta, A., Brestic, M., & Sabagh, A. E. (2021). Crucial Cell Signaling Compounds Crosstalk and Integrative Multi-Omics Techniques for Salinity Stress Tolerance in Plants. *Frontiers in Plant Science,* 12, 670369.
23. Sravanthi, A. L., Ratnakumar, P., Reddy, S. N., Eswari, K. B., Pandey, B. B., Manikanta, C., Ramya, K. T., Sonia, E., Mohapatra, S., Gopika, K., Anusha, P. L., & Yadav, P. (2021). Morpho-Physiological, Quality Traits and their Association with Seed Yield in Sesame (*Sesamum indicum* L.) Indigenous Collection under Deficit Moisture Stress. *Plant Physiology Reports,* 27, 132–142.
24. Tripathy, B., Rout, S., Mishra, U. N., Sahoo, G., Pradhan, K., Prusty, A. K., & Dash, L. (2021). Vegetables: A Potential Source of Nutraceuticals. *Annals of the Romanian Society for Cell Biology,* 25(4), 17921–17941.
25. Kumar, P., Kumar, D., Singh, S. & Rout, S. (2021). *Prinsepia Utilis* Royle: Diversified and Indigenous Traditional Uses of Uncultivated Multipurpose Shrub. *International Journal of Mechanical Engineering,* 6(S), 579–590.
26. Mohapatro, S., Rout, S., Singh, T., Pradhan, K., Mane, S. P., Mishra, P. P., & Panda, S. (2021). Intercropping of Maize with Mango and Teak- An Overview. *International Journal of Mechanical Engineering,* 6(S), 575–578.

Web of Science indexed Research/Review Articles

1. Bandyopadhyay, S., Kundu, C. K., Maitra, S., Das, H., Datta, M. K., & Biswas, U. (2021). Influence of Different Tillage Methods and Integrated Weed Management Practices on Soil Microbial Population in Wheat under Lower Gangetic Plains. *International Journal of Botany Studies,* 6(6), 1503–1506.
2. Ramalakshmi, V., Padhy, D., Dash, L., Rout, S., Nihal R., & Nayak, S. (2021). Biorational Approaches for the Management of Rice Weevil *Sitophilus oryzae* (L.) in Cereal Grains. *International Journal of Entomology Research,* 6(4), 96–99.
3. Yadav, M. K., Dash, L., & Rout, S. (2021). Identification and Standardization of Maize Genotype for the Rearing of Maize Spotted Stem Borer, *Chilo partellus* (Swinhoe) on its natural host. *International Journal of Botany Studies,* 6(4), 388–391.
4. Yadav, M. K., Dash, L., & Rout, S. (2021). Evaluation of Host Plant Resistance Traits in Certain Genotypes of Maize (*Zea mays* L.) Against Maize Spotted Stem Borer (*Chilo partellus* Swinhoe, Crambidae). *International Journal of Entomology Research,* 6(4), 64–69.
5. Rout, S., Sahoo, G.,Panigrahi, S., Mishra, U. N., Prusty, A. K., Pradhan, K., Dash, L., & Tripathy, B. (2021). *Moringa oleifera* Lam: A potential Agroforestry Tree Species. *International Journal of Botany Studies*, 6(3), 910–912.

UGC Care Listed Research/Review Articles

1. Debbarma, R., Rout, S., Khare, N., & Panigrahi, S. (2021). Indigenous Species *Homalomena aromatica* Schoott of Tripura, India. *Akshara,* 2(S), 101–102.
2. Hota, A., Barik, N., Pritam, A., Mishra, U. N., & Rout, S. (2021). Haematological alteration in bovine tropical theileriosis in the district of Gajapati, Odisha. *Journal of the Maharaja Sayajirao University of Baroda,* 55(1S), 125.

3. Hota, A., Jambagi, K., Pritam, A., Mishra, U. N., Rout, S., & Barik, N. (2021). Mastitis in cattle-its pathophysiology and mechanism of infection. *Journal of the Maharaja Sayajirao University of Baroda,* 55(1S), 221.
4. Kesherwani, B., Rout, S., Barik, S. R., & Prusty, A. K. (2021). Challenges and Management of Waste Disposal in India. *Akshar Wangmay,* 9(S), 21–29.
5. Meena, L. L., Prusty, A. K., Satapathy, A., Rout, D. S., Rout, S., & Tarania, P. P. (2021). Krishi Vigyan Kendras (KVKs) Training Programmes towards Upliftment of Farmers of Odisha—A Review. *Journal of the Maharaja Sayajirao University of Baroda,* 55(1VI), 1085–1094.
6. Panigrahi, S., Siri, P., Rout, S., & Sahoo, R. K. (2021). Fuel and Fodder Species Used for Agro forestry Practices in Koraput, Odisha. *Akshar Wangmay,* 2(S), 94–100.
7. Satapathy, A., Satapathy, A., & Rout, S. (2021). Dietary Habits and Prevalence of Obesity in O.U.A.T. Girls Hostel, Bhubaneswar, Odisha, India. *Akshar Wangmay,* 2(S), 87–93.

NAAS indexed Research/Review Articles

1. Barik, R., Mohanty, B. K., Prusty, A. K., Rout, S., & Padhy, C. (2021). Impact of Krishi Vigyan Kendra on Adoption of Rice Production Technologies by the Farmers of Keonjhar District of Odisha. *Frontiers in Crop Improvement,* 9(6S), 2434–2436.
2. Dash, L., Rout, S., Ramalakshmi, V., Padhy, D., Nihal, R., & Nayak, S. (2021). Studies on Biology of Red Pumpkin Beetle (*Aulacophora foveicollis* Lucas) under Odisha Condition, India. *Journal of Plant Development Sciences,* 13(6), 381–384.
3. Panigrahi, S., Rout, S., Sahoo, G., Gupta, S., & Kumar, V. S. K. (2021). Finishing Properties of Polyurethane Coating on Bleached and Ammonia Fumigated Mango Wood Surface. *International Journal of Plant & Soil Science,* 33(16), 57–67.
4. Rout, S., Beura, S., Khare, N., & Prusty, A. K. (2021). Role of Different Concentrations Gibberellic Acid (GA3) on Seed Germination and Seedling Quality of *Saraca asoca* (Roxb.) De Wilde. *Frontiers in Crop Improvement,* 9(6S), 2495–2500.
5. Routray, S., & Mishra, H. P. (2021). Evaluation of Developmental and Reproductive Fitness of Laboratory Selected Thiamethoxam Resistance in Black Legume Aphid *Aphis craccivora* Koch. *International Journal of Bioresource and Stress Management,* 12(1), 151–157.
6. Routray, S., Kabi, M., Debnath, D., & Palei, S. (2021). Potential of *Lantana camara* L. Extracts as Biopesticide Against Insect Pests. *Journal of Entomological Research,* 45(3), 461–469.
7. Sahoo, J. P., Behera, L., Praveena, J., Sawant, S., Mishra, A., Sharma, S. S., Ghosh, L., Mishra, A. P., Sahoo, A. R., Pradhan, P., Sahu, S., Moharana, A., Samal, K. C. (2021). The Golden Spice Turmeric (*Curcuma longa*) and its Feasible Benefits in Prospering Human Health—A Review., *American Journal of Plant Sciences,* 12(3), 455–475.
8. Samal, I & Sahu, B. K. (2021). Spider Silk from Silk Worm: An Innovative Venture towards Super Silk. *Biological Forum – An International Journal,* 13(4), 1170–1174.
9. Sarkar, N., Ghosh, S., Rai, U., Panda, S., Das, L., & Mondal, S. (2021). A Study on Different Dimensions of Group Sustainability. *Frontiers in Crop Improvement,* 9(5), 2258–2260.
10. Satapathy, A.,Satapathy, A., Rout, D. S., Prusty, A. K., & Rout, S. (2021). Prevalence of Protein Energy Malnutrition among Under-Five Children in Odisha: A Review. *The Journal of Phytopharmacology,* 10(4), 272–276.
11. Sheera, A., Aftab, N., Rout, S., Mishra, U. N., Sharma, B., & Sivasankar, R. (2021). Assessment of Genetic Variability and Transmissibility Index in Rice Genotypes (*Oryza sativa* L.). *International Journal of Plant & Soil Science,* 33(18), 34–42.
12. Yadav, M. K., Dash, L., & Rout, S. (2021). Evaluation of Various Insecticides as Seed Protectants against Pulse Beetle, *Callosobruchus chinensis* L. Chrysomelidae on Pigeonpea *Cajanus cajan* L. Seed Under Ambient Storage. *Journal of Plant Development Sciences,* 13(7), 491–496.

Peer Reviewed Research/Review Articles

1. Ankith, K. R., Ravindran, D., Sekhar, R., Mamgain, P., Rout, S., & Singh, P. (2021). An Integral Shift in Conventional Extension Approaches towards Agri-Preneurship Development. *Empirical Economics Letters,* 20(2).
2. Krishna, M. K., Borole, Y. D. M., Rout, S., Negi, P., Deivakani, M., & Dilip, R. (2021). Inclusion of Cloud, Blockchain and IoT Based Technologies in Agriculture Sector. *Conference Proceedings, 9th International Conference on Cyber and IT Service Management (CITSM). IEEE,* 44774.
3. Palai, S. K., Ramchandra, & Rout, S. (2021). Evaluation of Organic and Inorganic Fertilizers on Growth and Yield of Onion (*Allium cepa* L.) under Subabul (*Leucaena leucocephala*) based Agroforestry System. *Indian Journal of Pure & Applied Biosciences,* 9(1), 531–541.
4. Rout, S., Sahoo, G., Padhy, D., Mishra, U. N., & Prusty, A. K. (2021). *Embelia ribes* Burm F. (Vai Vidanga)—An Overview. *International Journal of Modern Agriculture,* 10(2), 4588–4594.
5. Sahoo, G., Wani, A. M., Rout, S., Sharma, A., Kar, S., & Prusty, A. K. (2021). Impact and Contribution of Forest in Mitigating Global Climate Change. *Design Engineering,* 2021(4), 667–682.
6. Tomar, V. S., Rout, S., Sahoo, G. & Panigrahi, S. (2021). Clutch Size, Hatching Pattern and Brood Census of Sarus Crane in Faridpur Tehsil in Bareilly District of Uttar Pradesh, India. *Vidyabharati International Interdisciplinary Research Journal,* S, 1246–1255.

Popular Articles

1. Debnath, D., & Jena, S. (2021). Heat: Solution Lies in the Core of a Problem for Quality Maintenance of Fruits. *Agri-India TODAY, Monthly e-Newsletter,* 1(10), 9–12.
2. Debnath, D., & Samal, I., (2021). The Five "F" of Whitefly's Mastery over the Concern of Plant Protectors. *Sabujeema: An International Multidisciplinary e-Magazine,* 1(4), 57–60.
3. Debnath, D., & Labanya, R. (2021). Small Signaling Molecules (SSMs) as an Important Mediator to Establish Beneficial Bacterial—Fungal Interaction in Agricultural Environment. *Biotica Research Today,* 3(11), 961–963.
4. Debnath, D., Labanya, R., & Mohapatra, C. (2021). Plant Growing in your Backyard can turn into a Zombie-A Horror Game Title or a Truth? *Agriblossom: A Monthly Peer Reviewed e-Magazine for Agriculture & Allied Sciences,* 2(5), 25–27.
5. Debnath, D., Mohapatra, S., & Mohapatra, C. (2021). The Trend of Increasing Economic Importance of Sheath Blight of Rice –A Concern., *Agriblossom: A Monthly Peer Reviewed e-Magazine for Agriculture & Allied Sciences,* 1(11), 80–84.
6. Kabi, M., Baisakh, B., Das, T. R., Tripathy, S. K., & Dash, M. (2021). Inheritance Pattern and Validation of RGA Marker for Powdery Mildew Resistance in Sesame. *Indian Journal of Genetics,* 81(2), 331–333.
7. Khandual, A. (2021). Career in Agriculture. *Vigyanpan's Career Guide 2021*, 11(1), 84–85.
8. Labanya, R. (2021). Nematodes as Bioindicator of Soil Ecosystem Health. *Agriculture Letters: Peer Reviewed Monthly Newsletter,* 2(12), 36–40.
9. Mishra, K. (2021). Red Rice: the Natural Drug for our Health. *Sabujeema: An International Multidisciplinary e-Magazine,* 1(6), 61–63.
10. Mishra, R., & Dakua, A. (2021). Prevalence of Malnutrition and Associated Factors among Under Five children in India and World. *Vigyan Varta: An International e-Magazine for Science Enthusiasts,* 2(8), 44621.
11. Mohapatra, S., & Panda, S. (2021). Liberalization of Agriculture through Farm Bill 2020 in India. *Agriculture & Food: E-Newsletter,* 3(5), 188–190.
12. Pandey, B. B., Behura, S., Pasala, R., & Mahapatra, S. (2021). Save Water Earn Money: A Campaign that Turns Lives of Thousand Farmers. *Biotica Research Today,* 3(3), 181–183.
13. Rout, S., Sahoo, G., Mishra, U. N., Sheera, A., & Prusty, A. K. (2021). An Overview of *Acacia catechu. Biotica Research Today,* 3(8), 691–693.
14. Sahoo, J. P., Mishra, A. P., & Samal, K. C. (2021). Antimicrobial Resistance against Zoonotic Microorganisms. *Agriculture Letters: Peer Reviewed Monthly Newsletter,* 2(7), 41944.

15. Sahoo, J. P., Mishra, A. P., & Samal, K. C. (2021). Sustainable Agro-Practices for Augmenting Food Security Prior Affected by Climate Change—Indian Scenario. *Times of Agriculture: A Resonance in Agriculture, a Monthly e-Magazine,* 15, 60–64.
16. Samal, I., & Debnath, D. (2021). Project "i5K": An Initiative to Unravel the Insect Genome. *Biotica Research Today,* 3(10), 849–852.
17. Samal, K. C., Behera, L., Mishra, A. P, & Sahoo, J. P. (2021). Monoclonal Antibody Cocktail—An Exceptional Game Changer for COVID Treatment in India. *Scientific India: By the Scientists, for the People,* 9(3), 28–32.

Books

1. Rout, S. (2021). *Agriculture and Forestry: Current Trends, Perspectives* (Issues-IV). Immortal Publications Prasadampadu, Vijayawada - 521108 Andhra Pradesh, India.
2. Rout, S. (2021). *Agriculture and Forestry: Current Trends, Perspectives* (Issues-III). Immortal Publications Prasadampadu, Vijayawada - 521108 Andhra Pradesh, India.

Edited Books

1. Agarwal, S. K., Nakkella, A. K., & Rout, S. (Eds.). (2021). *Herbal Medicine—A Benign and Conventional Medical System*. Immortal Publications Prasadampadu, Vijayawada - 521108 Andhra Pradesh, India.
2. Beura, S., Rout, S., Nayak, S., Pradhan, K., & Khare, N. (Eds.). (2021). *Recent Trends in Propagation of Forest and Horticultural Crops*. Taran Publication, Haryana, India.
3. Rout, S., Pradhan, K., & Prusty, A. K. (Eds.). (2021). *Food and Agriculture*. ESN Publications, India.

Book Chapters

1. Behera, S., Mohapatra, C., & Singh, J. P. (2021). Pigeon Pea Diseases and their Integrated Disease Management. In S. K. Ghosh, R. K. Rout, & B. Bakshi (Eds.), *Cutting Edge Perspectives in Agricultural and Allied Sciences* (pp. 425–448). Scholars' Press, Dodo Books Indian Ocean Ltd., member of OmniScriptum S.R.L Publishing group.
2. Beura, S., Rout, S., & Jagadev, P. N. (2021). Perpetuation of Ornamental Plants for Indoor Gardening. In S. Beura, S. Rout, S. Nayak, K. Pradhan, & N. Khare (Eds.), *Recent Trends In Propagation of Forest and Horticultural Crops* (pp. 12–18). Taran Publication, Haryana, India.
3. Debanth, D. & Routray, S. (2021). Disease and Pest management of Vegetables seeds after Harvesting. In N. Mishra, K. K. Panigrahi & A. Mani (Eds.), *A Text Book on Vegetable Seed Production* (pp. 511–553). Satish Serial Publishing House, New Delhi.
4. Debnath, D., Chakraborty, S., Golder, S., & Patsa, R. (2021). Hydroponic is Full Proof Protection against Soil Borne Pathogen in the Absence of Soil—Myth or Truth. In S. Rout, K. Pradhan, & A. K. Prusty (Eds.), *Food and Agriculture* (pp. 147–155). ESN Publications, India.
5. Indu, Lal, D., Dadrwal, B. K., Saha, D., Chand, S., Chauhan, J., Dey, P., Kumar, V., Mishra, U. N. Hidangmayum, A., Singh, A., & Singhal, R. K. (2021). Molecular Advances in Plant Root System Architecture Response and Redesigning for Improved Performance under Unfavorable Environments. In T. Aftab, & K. R. Hakeem (Eds.), *Frontiers in Plant Soil Interaction, Molecular Insights into Plant Adaptation* (pp. 49). Academic Press, Elsevier.
6. Meher, D., Panigrahi, S., & Rout, S. (2021). Propagation in Flowering and Ornamental Plants. In S. Beura, S. Rout, S. Nayak, K. Pradhan, & N. Khare (Eds.), *Recent Trends In Propagation of Forest and Horticultural Crops* (pp. 368–373). Taran Publication, Haryana, India.
7. Mishra, S. P., Mohanty, L. K., Padhiary, A. K., & Rout, S. (2021). *Azotobacter*: Nitrogen Fixing Bio-fertilizer for Sustainable Agriculture. In S. Rout (Ed.), *Agriculture and Forestry: Current Trends, Perspectives,*

Issues (Vol.-IV, pp. 96–102). Immortal Publications Prasadampadu, Vijayawada - 521108 Andhra Pradesh, India.
8. Mohapatra, C., & Mohapatra, S. (2021). Red Rust of Guava: An Emerging Threat. In S. Rout, K. Pradhan, & A. K. Prusty (Eds.), *Food and Agriculture* (pp. 489–494). ESN Publications, Tamilnadu.
9. Pattnaik, D., Dash, D., Mishra, A., Padhiary, A. K., Dey, P., & Dash, G. K. (2021). Emerging Roles of Osmoprotectants in Alleviating Abiotic Stress Response under Changing Climatic Conditions. In P. Kumar, R. K. Singh, M. Kumar, M. Rani, & P. Sharma (Eds.), *Climate Impacts on Sustainable Natural Resource Management* (pp. 303–324). John Wiley & Sons Ltd.
10. Pradhan, K., Rout, S., Mishra, U. N., Tripathy, B., & Prusty, A. K. (2021). Propagation of Dioecious Cucurbits. In S. Beura, S. Rout, S. Nayak, K. Pradhan, & N. Khare (Eds.), *Recent Trends In Propagation of Forest and Horticultural Crops* (pp. 388–392). Taran Publication, Haryana, India.
11. Prusty, A. K., Mohapatra, B. P., Rout, S. & Padhy, C. (2021). Mobile Applications in Agriculture. In A. Badon (Ed.), *PLANTA* (Vol.-2, pp. 240–244). Association of Plant Science Researchers (APSR), Plantica Foundation, Madhur Vihar Phase-2, Ajabpur Khurd, Dehradun, Uttarakhand- 248001.
12. Prusty, A. K., Mohapatra, B. P., Rout, S., Senapati, R., & Padhy, C. (2021). Social Media: Boon to Agriculture. In A. Badon (Ed.), *PLANTA* (Vol.-2, pp. 245–250). Association of Plant Science Researchers (APSR), Plantica Foundation, Madhur Vihar Phase-2, Ajabpur Khurd, Dehradun, Uttarakhand- 248001.
13. Rout, D. S., Prusty, A. K., Tarania, P. R., Nandy, A., Rath, S., & Rout, S.(2021). From Job Seekers to Entrepreneurs: Success Stories of Odisha Farmers. In S. Rout, K. Pradhan, & A.K. Prusty (Eds.), *Food and Agriculture* (pp. 127–136). ESN Publications, India.
14. Rout, S., Khare, N., Nayak, S., Beura, S., Pradhan, K., Kar, S., Panigrahi, S., Prusty, A. K., & Tripathy, B. (2021). Vegetative Propagation of *Acacia nilotica* L.—An Overview. In S. Beura, S. Rout, S. Nayak, K. Pradhan, & N. Khare (Eds.), *Recent Trends In Propagation of Forest and Horticultural Crops* (pp. 374–378). Taran Publication, Haryana, India.
15. Sahu, K. K., Kar, S., & Rout, S. (2021). Satellite-Based Soil Erosion Mapping. In S. A. Bandh (Ed.), *Sustainable Agriculture: Technical Progressions and Transitions* (pp. 225–252). Springer Nature Switzerland AG.
16. Tarania, P. R., Prusty, A. K., Pradhan, S., Rout, D. S., & Rout, S. (2021). Rural Empowerment and Development through Agri-preneurship. In S. Rout, K. Pradhan, & A. K. Prusty (Eds.), *Food and Agriculture* (pp. 35–46). ESN Publications, India.

Conference Proceedings

1. Mohapatro, S., Rout, S., Barik, S. R., & Kar, S. (2021). *Emblica officinalis* (Amla): A Multipurpose Medicinal Tree. In Y. Sharma & A. Mathur (Eds.). *Proceedings of 4th International Virtual Conference on "Agricultural & Biological Science Research"* (pp. 67–70). Ideal International e–Publication Pvt. Ltd.
2. Mohapatro, S., Rout, S., Prusty, A. K., & Sharma, Y. (2021). Phytochemical Properties and Biological Importance of Neem (*Azadirachta indica*)—An Overview. In Y. Sharma & A. Mathur (Eds.). *Proceedings of 4th International Virtual Conference on "Agricultural & Biological Science Research"* (pp. 16–20). Ideal International e–Publication Pvt. Ltd.
3. Sheera, A., Rout, S., Aftab, N., Patra, S. S., & Pradhan, K. (2021). Strategies for Waterlogging Tolerance in Wheat Scenario of Climate Change. In Y. Sharma & A. Mathur (Eds.). *Proceedings of 4th International Virtual Conference on "Agricultural & Biological Science Research"* (pp. 71–92). Ideal International e–Publication Pvt. Ltd.

FDPs/Webinars/Guest Lectures

1. Virtual Faculty Development Program On Natural Resource Management for Sustainable Agriculture

2. Date, time, Venue (online) of the event: 19th-20th October 2021; 10 AM-5 PM

The two day's virtual faculty development program (FDP) was started on 19th of October 2021 with Honorable Vice Chancellor Prof. Ajay Kumar Singh, Sri Sri University, Cuttack, Odisha as the chief guest. Prof. Ajay Kumar Singh and Prof. S. Kumaraswamy (Dean, Faculty of Agriculture) were the patron and co-Patron respectively for the FDP Program. The organizing committee consisted of Dr. Sandeep Rout (Convener); Assistant Professor, Dr. Rachna Chandra (Co-Convener); Associate Professor and Dr. Udit Nandan Mishra (Co-Convener); Assistant Professor of Faculty of Agriculture, Sri Sri University, Cuttack, Odisha.

The FDP was started at 09.45 AM, 19/10/2021 with Senior Prof. Dr. Damodara Parida addressing the inaugural session in the absentia of Honorable Vice Chancellor, Prof. Ajay Kumar Singh and Prof. S. Kumaraswamy, Dean, FoAG due to some prior commitments. There were a total of seven sessions chaired by renowned Scientists/Researchers/Professors from different Research institutes and Universities with a total of **60 registered participants** including Researchers/JRF/SRF/faculties/Scientists and government employees of Agriculture and horticulture departments for the FDP.

First session of 19.10.2021 had begun with **Prof. Dr. M.M. Hossain**, Former Professor and Dean, College of Forestry, OUAT, Bhubaneswar, Odisha. He delivered a talk on "Forest food, Ethno-Medicinal and aromatic plants used by tribal's and forest dwellers of Odisha". He emphasized on the booming demand of traditional remedies alongside growing environmental awareness and the desire for the natural healing through natural products.

Second session of 19.10.2021 was chaired by **Dr. Kumud Dubey**, Scientist E, Forest Research centre for Eco rehabilitation (ICFRE), Prayagraj, Uttar Pradesh on "Probiotics and its interventions". She shared her practical experience of how one can exploit the plant and beneficial microbe (probiotcs) interaction for sustainable resource management in Agroforestry.

In the third session of 19.10.2021 **Prof. Dr. Alok Kumar Patra**, Chief Agronomist, All India Coordinated Research Project on Integrated Farming System, OUAT, Bhubaneswar, Odisha had shared a master lecture on "Integrated farming system for Sustainable Agriculture and Livelihood Security". He shared important aspects of *in situ* recycling of organic residues, soil and water productivity, nutritional and environmental security with continuous income and employment

generation. With the third session, the first day of the FDP had come to an end at 3.45 pm on 19.10.2021.

First session of 20.10.2021 was chaired by **Dr. Pragati Misra**, Assistant Professor(S.G.), Department of Molecular & Cellular Engineering, Jacob Institute of Biotechnology and Bioengineering, SHUATS, Prayagraj, Uttar Pradesh. She delivered a lecture on "Sustainable production of banana plantlets through *in vitro* culture methods" where she had addressed many problems and their solutions through the use of modern day tissue culture techniques for successful banana plantation.

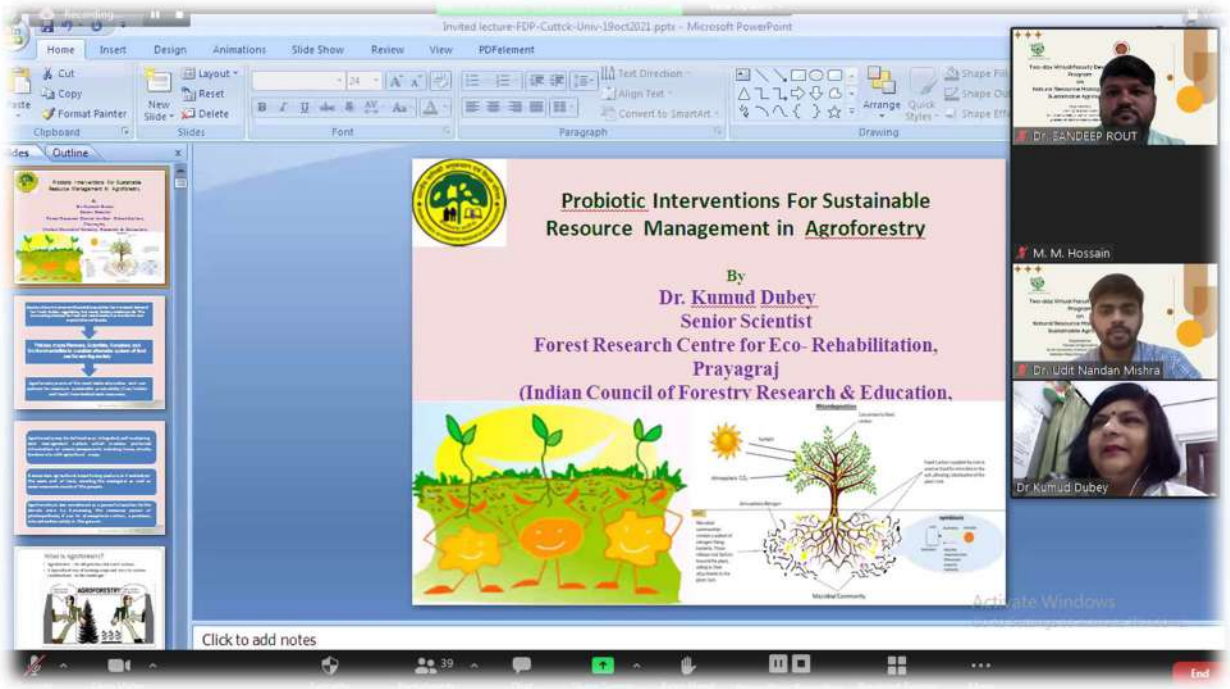
Second session of 20.10.2021 was lectured by **Prof. Dr. Romesh Kumar Salgotra**, Professor & Coordinator, School of Biotechnology, Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu. He shared his vast knowledge on "Genomic Assisted Breeding for Crop Improvement" with practical implications in the era of "Omics". He also segregated his lecture into two portions. One, addressing the downside of traditional breeding approach and the second, with the cutting edge molecular breeding for commercial exploitation of plant genetical information.

In the third session of 20.10.2021, **Dr. B. Anjan Kumar Prusty**, Associate Professor and Head, Department of Natural Resource Management and Geoinformatics, Berhampur University, Odisha presented on "POP Residues in Agri-Ecosystem and their Ecotoxicological and Human Health Impacts". He had presented several aspects of persistent organic pollutants including their transport, deposition, re-evaporation mechanisms and the ways to reduce their usage.

The very last session of the FDP was lectured by **Prof. Dr. Sashikala Beura**, Professor and Head Department of Floriculture and Landscaping and Director Biotechnology cum Tissue Culture Centre, OUAT, Bhubaneswar, Odisha on "Commercial Floriculture". She enlightened the participants with the opportunity of entrepreneurship in the field of floriculture and landscaping with both in-field and protected cultivation system.

There was a virtual group photo session with all the registered participants on ZOOM. The two days FDP had come to an end with vote of thanks by Dr. Rachna Chandra, Associate Professor, Faculty of Agriculture, Sri Sri University at 5.15 pm.

Total number of participants: 61 (National level Participant)
Certificates provided to the participants –Yes


Invited lecture-FDP-Cuttck-Univ-19oct2021.pptx - Microsoft PowerPoint
Probiotic Interventions For Sustainable Resource Management in Agroforestry
By
Dr. Kumud Dubey
Senior Scientist
Forest Research Centre for Eco- Rehabilitation, Prayagraj
(Indian Council of Forestry Research & Education,
Dr. SANDEEP ROUT
M. M. Hossain
Dr. Udit Nandan Mishra
Dr Kumud Dubey
Click to add notes


Dr. SANDEEP ROUT
M. M. Hossain
Dr. Udit Nandan Mishra
Rachna Chandra, FoAG
Sanhita Padhi
Dr Jyoti R Rout
Recording...
Dr Kumud Dubey
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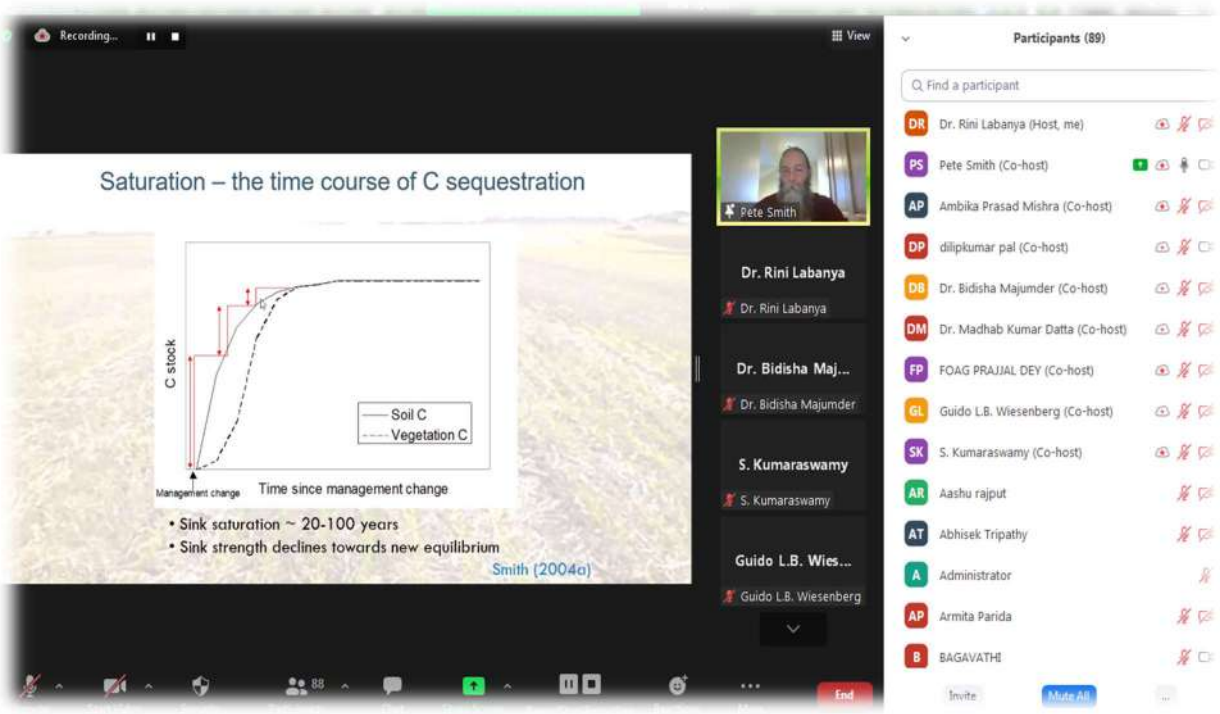
Title of the Guest lectures/ FDPs/Webinars	Name of the speaker(s) with designations:	Date, time, Venue (if online provide the link) of the event	Organized by: FoAG / Farmers club or any other specify	Brief notes about the event	Total number of participants
World Soil Day	Dr. D. K. Pal, Principal Former Scientist and Head, Division of Soil Resource Studies, ICAR-NBSS & LUP, Nagpur	December 5, 10 AM to 12 NOON	FOAG/Farmers club	A discussion on "Soil as Life Supporting System" Both in online and offline mode to celebrate Soil Day	140
International Webinar on CLIMATE CHANGE & SOIL HEALTH	Prof. Biswapati Mandal, Department of Soil Sc. Bidhan Chandra Krishi Viswavidyalay, West Bengal, India Dr. Guido L. B. Wiesenberg, Department of Geography, Soil Science and Biogeochemistry, University of Zurich, Zürich, Switzerland Prof. Peter Smith, Institute of Biological and Environmental Sciences, University of Aberdeen, Scotland, UK	January 18, 2022, (2:00-5:00)PM	Department of Soil Science and Ag Chemistry, FOAG	2:00 -3:00 PM " Organic carbon- the lynch pin of soil health " by Prof. Biswapati Mandal, Department of Soil Sc. Bidhan Chandra Krishi Viswavidyalay, West Bengal, India 3:00 - 4:00 PM "The impact of climate change on soil health" by Dr. Guido L. B. Wiesenberg, Department of Geography, Soil Science and Biogeochemistry, University of Zurich, Zürich, Switzerland 4:00-5:00 PM "How to measure, report and verify soil carbon change" by Prof. Peter Smith, Institute of Biological and Environmental Sciences, University of Aberdeen, Scotland, UK	110



1. **Tasar Sericulture: A Livelihood for Tribal Population of India"**

2. **Name of the speaker(s) with designations:** Mr. Mohammed Muzeruddin Baig, Scientist C, CTRTI, Ranchi
3. **Date, time, Venue (if online provide the link) of the event:** 8th January, 2022 (3.00 PM - 5.00 PM: Online Mode).
4. **Organised by: FoAG/Farmers club or any other specify**
   Department of Entomology, Faculty of Agriculture, Sri Sri University, Cuttack.
5. **Convener of the FDP:**
   Dr. Ipsita Samal, Assistant Professor (Entomology)
   Co-conveners of the FDP:
   Dr. Shruti Mohapatra, Assistant Professor (Economics)
   Dr. Subhrajyoti Panda, Assistant Professor (Agricultural Extension)

6. **Brief notes about the event**

The FDP on " Tasar Sericulture: A Livelihood for Tribal Population of India" was organised on 8th January, 2022 (3.00 PM - 5.00 PM: Online Mode) to inculcate the idea of adopting sericulture by the tribal people in India for their livelihood.

Tribes, live in forest patches with enormous flora and fauna and their basic requirement is fulfilled from the forest produce. The forest areas where in tribes live has dense trees among which Arjun, Asan and sal plants do exist. These arjun, asan and sal plants generally called as tasar silkworm food or host plants. Tasar sericulture is a forest-based tribal oriented industry. It provides income and employment to the rural poor and tribals in different states in India. The government of India has initiated various sericulture development schemes with the support of the Central Silk Board to

improve the socio-economic conditions of the people in general and empowerment of tribals in particular. Hence, through these schemes, these plants can be utilized by tribes in growing or rearing tasar silkworms out of which huge cocoons can be harvested within a very short span, generating man days and money by selling the cocoons. Thus, the money from tasar can fetch bread and butter to tribes. As a result, Tasar sericulture can be proven to be the finest occupation for tribal upliftment. The most significant advantage of tasar culture is that it requires minimal investment and may produce a healthy cocoon crop using simple procedures. Tasar has the potential to become a vital aspect of tribal culture as well as a channel for the transfer of strange wild to economy.

Program Schedule: Dated 08.01.2022

Time	Topic	Speaker
03.00 pm – 03:10 pm	Welcome Address and Introduction to Webinar	Dr. Ipsita Samal Assistant Professor (Entomology)
03:10 pm – 03:20 pm	Key Note Speech	Dr. Shruti Mohapatra Assistant Professor (Economics)
03:20 pm – 4:30 pm	" Tasar Sericulture: A Livelihood for Tribal Population of India"	Mr. Mohammed Muzeruddin Baig Scientist C, CTRTI, Ranchi
04:30 pm – 4:50 pm		Discussion
4:50 pm – 5:00 pm	Vote of Thanks	Dr. Shruti Mohapatra Assistant Professor (Economics)
	Certificate and Appreciation letter preparation	Dr. Subhrajyoti Panda Assistant Professor (Agricultural Extension)

7. **Total number of participants:**
   Total number of registrants – 600
   Total number of participants attended – 300
8. **Certificates provided to the participants (YES)**

GUEST LECTURE (2020-21)

World Forest Day

Date: 21.03.2021

Time: 10:30 am to 11:30 am.,

venue: Virtual forum (Via Zoom)

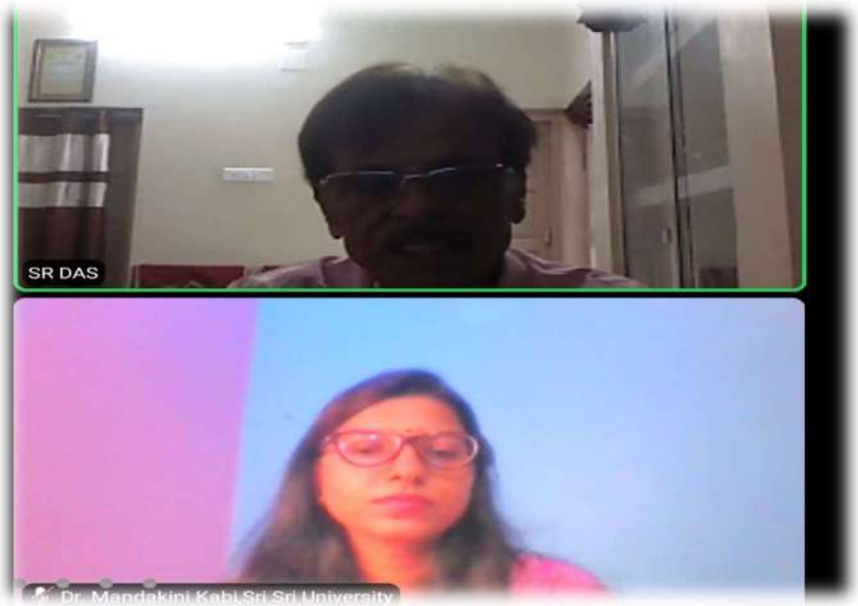
Speaker: Dr Smita Nayak, Ph.D. (Biotechnology)

Topic: Short grain aromatic rice for economic development of rural poor

Date: 24/07/2012

Organized by: Dr. Mandakini Kabi

Speaker: Dr. Satya Ranjan Dash, Honorary Professor, OUAT



2. Algae as a potential candidate

Date: 10/08/2021

Organized by; Rachana Chandra,

Speaker: Dr. Krishna Bala, Associate Professor, IIT, Indore

3. Rain Water Harvesting

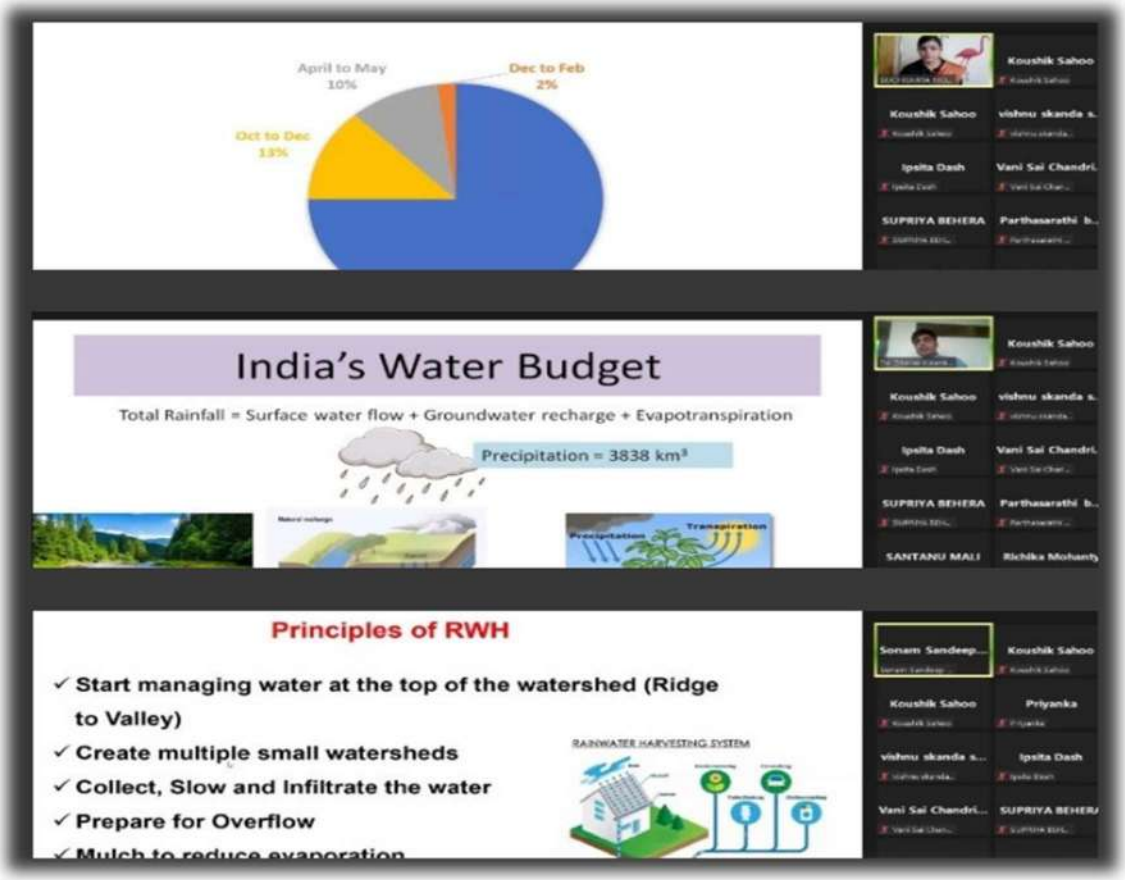
Date: 21/08/2021

Organized by; Farmer's Club and Ek Bharat Shrst Bharat Club

Speaker: 1.Dr. Sonam Sandeep Dash, Assistant professor of School of Agriculture and Bioengineering, Centurion University, Paralakhemundi

2. Ms. Suchismita Mohapatra, Assistant professor of Institute of Agricultural Science, Siksha O' Anusandhan, Bhubaneswar

3. Dr. Dhaval Kirankumar Dwivedi, Assistant professor of Agriculture, Sri Sri University, Cuttack



1. National Webinar On Thyroid Awareness Month

2. Name of the speaker(s) with designations

1. Ms. Rashmi Misra, Assistant Professor, Department of Food Nutrition and Dietetics, Faculty of Agriculture, Sri Sri University

2. Dt. Sudeepta Rath, Dietician and Certified Diabetes Educator Senior Diabetes Educator - Max Healthcare, Department of Endocrinology, Delhi

3. Dt. Fatema Malik, Dietician and Certified Diabetes Educator Senior Diabetes Educator - Max Healthcare, Department of Endocrinology, Delhi

3. Date, time, Venue (if online provide the link) of the event

- ✓ Date: From 27-Jan-2022 to 29-Jan-2022

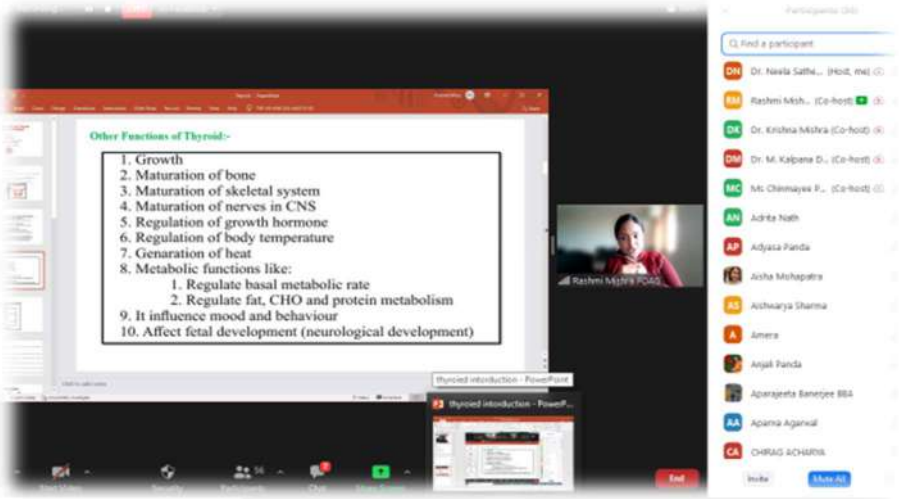
4. Organised by: FoAG/Farmers club or any other specify

- ✓ Department of Food Nutrition and Dietetics, Faculty of Agriculture, Sri Sri University

5. Brief notes about the event

Thyroid disorder is one of the most common lifestyle endocrine disorders nowadays. This may affect seriously an individual's health and often require lifelong monitoring and treatment. In India, one in ten is affected by this disorder. Women have greater chances of suffering from thyroid-related problems when compared to men. Hence, it is essential to be aware of the signs of thyroid problems and spot the symptoms at the earliest. With a proper diagnosis, thyroid dysfunction can be successfully treated.


Participants (55)
Galaxy M31
Nida Sayed
Srishti
Tejaswini Sahani
Vrushali Athavale
Adyasa Panda
Jaytika Joshi
Adrita Nath
Vainavi
piya
Nikita Nandini


Other Functions of Thyroid:-
1. Growth
2. Maturation of bone
3. Maturation of skeletal system
4. Maturation of nerves in CNS
5. Regulation of growth hormone
6. Regulation of body temperature
7. Genaration of heat
8. Metabolic functions like:
1. Regulate basal metabolic rate
2. Regulate fat, CHO and protein metabolism
9. It influence mood and behaviour
10. Affect fetal development (neurological development)


Tejaswini Sahani
Nida Sayed
Participants (41)
Chat
and hence we had some really important questions for the expert
Surely today we will do


THERAPEUTIC DIETARY MANAGEMENT
IN THYROID DISORDER
Participants (41)
Chat
Surely today we will do
yes maam
Tejaswini Sahani


Snehal Patnaik
Dr. Krishna Mish...
Participants (47)
Chat
ok sir
Good evening everyone


Snehal Patnaik
Soumili kar

Report on National Nutrition Week: "National Nutrition Week (NNW) Celebrated from 1st to 7th September, 2021"

2. Name of the speaker(s) with designations

i. Dr. Neela Satheesh, Associate Professor, Head, FND, FOAG

ii. **Prof. (Mrs.) Vijaya Khader,** Former Dean, Faculty of Home Science Acharya N.G. Ranga Agriculture University, (ANGRAU) on the topic

iii. Dr. Champa Dhavan, Sr. Gynecologist

3. Date, time, Venue (if online provide the link) of the event

1st to 7th September, 2022

4. Organised by: FoAG / Farmers club or any other specify

FoAG/ Farmer's club in association with Nutrition and Fitness Club

5. Brief notes about the event

NNW is celebrated worldwide to spread knowledge about Nutrition and Aware about different Nutrients and their Importance for the Human Body. NNW is celebrated from 1st to 7th of September every year. The Food and Nutrition Board under Ministry of Women & Child Development, through its 43 Community Food and Nutrition Extension Units (CFNEUs) located in States/UT. The Following activities undertaken on the occasion of NNW by the organising body:

- ✓ NGOs and organize State/UT Level Workshops
- ✓ Orientation Training of Fields Functionaries
- ✓ Awareness Generation Camps
- ✓ Community meetings during the week on the specified theme.

National Nutrition Week: History

National Nutrition Week was initiated in **March 1973** by the members of the American Dietetic Association (now the **Academy of Nutrition and Dietetics**) with the following objectives:

- ❑ To deliver the nutrition education message to the public

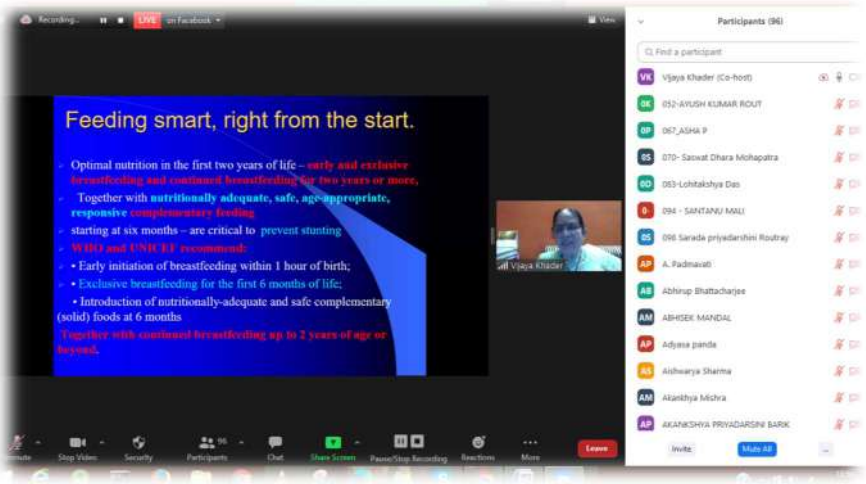
- To promote the profession of dietetics.
-

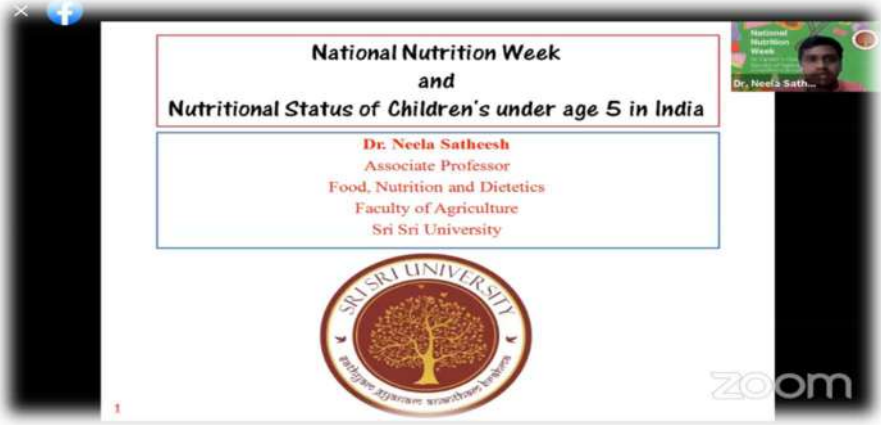
In **1980** the public showed great response towards it and the weeklong celebration expanded to become a month-long observance (in some specific organizations). In the year **1982** National Nutrition week celebration was started by the Central Government in India.

NNW 2021 Theme is: - Feeding smart right from start

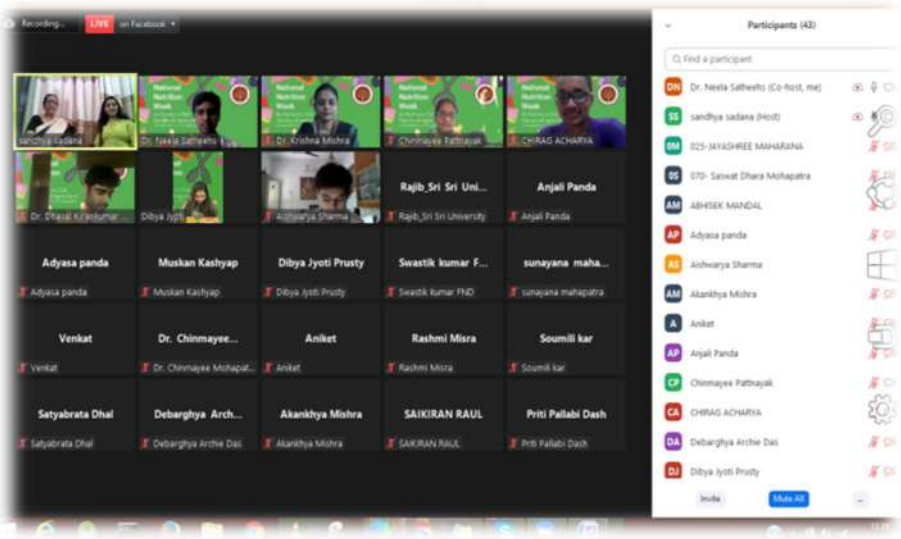
In this Connection, We are organized the 6 days of the programme with different activities. All the activities are reported in following sessions.

6. Total number of participants 200


Feeding smart, right from the start.
Optimal nutrition in the first two years of life – early and exclusive breastfeeding and continued breastfeeding for two years or more,
Together with nutritionally adequate, safe, age-appropriate, responsive complementary feeding
starting at six months – are critical to prevent stunting
WHO and UNICEF recommend:
• Early initiation of breastfeeding within 1 hour of birth;
• Exclusive breastfeeding for the first 6 months of life;
• Introduction of nutritionally-adequate and safe complementary (solid) foods at 6 months
Together with continued breastfeeding up to 2 years of age or beyond.
Participants (96)


National Nutrition Week
and
Nutritional Status of Children's under age 5 in India
Dr. Neela Satheesh
Associate Professor
Food, Nutrition and Dietetics
Faculty of Agriculture
Sri Sri University
SRI SRI UNIVERSITY
zoom


Participants (38)



1. **Title of the Guest lecturers/ FDPs/Webinars:** Guest Lecture on World Bamboo Day
2. **Name of the speaker(s) with designations:** Dr. Kumud Dubey, Scientist-E Forest Research Centre for Eco Rehabilitation (ICFRE), Prayagraj, Uttar Pradesh-211002
3. **Date, time, Venue (online) of the event**: 18/09/2021, 6.30-7.30 PM
4. **Organised by: FoAG and Farmers club**
5. **Brief notes about the event**

World Bamboo Day was celebrated under Farmers club, Faculty of Agriculture (FoAG), SSU, Cuttack on 18th Sept 2021 virtually on zoom platform from 6.30 to 8.00 pm. The event was moderated by Dr. Sandeep Rout, Assistant Professor (Forestry) and Dr. Rachana Chandra, Associate Professor (Environmental Sciences).

The events organized were:

An invited guest lecture by Dr. Kumud Dubey, Scientist-E Forest Research Centre for Eco Rehabilitation (ICFRE), Prayagraj, Uttar Pradesh-211002, on the topic "Ecological role of Bamboo" where she had enlightened the multidimensional role and uses of bamboo for sustainable development.

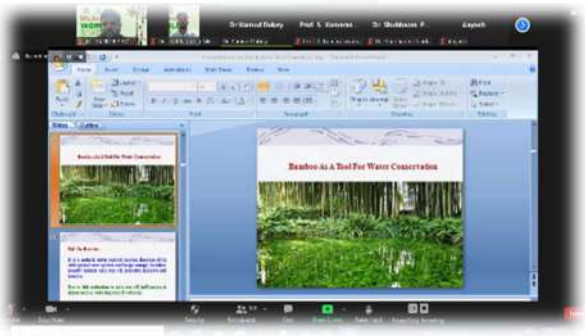
The lecture was followed by a quiz competition for the students of FoAG through Google form arranged and set by Dr. Sandeep Rout, Assistant Professor (Forestry), FoAG.

Question answer session with Dr. Kumud Dubey was fantastic especially the queries from the graduate students were notable.

Prof. (Dr.) S. Kumaraswamy, Dean, FoAG had addressed insights to the guest lecture with his future collaborative ideas with Dr. Kumud Dubey.

Further, the vote of thanks was proposed by Dr. Udit Nandan Mishra and the program was closed at 8.00 pm.

6. Total number of participants: 193 (In-house Participant)



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2. Title of the Guest lecturers/ FDPs/Webinars: Guest Lecture on **Opportunities and Challenges of Mushroom Cultivation in Odisha**

2. Name of the speaker(s) with designations: Prof. Dr. Kailash Behari Mohapatra (Honorary Professor, Dept. of Plant Pathology, GIET, Gunupur, Odisha-765022)

3. Date, time, Venue (online) of the event: 14/11/2021, 10.30-12.30 PM

4. Organised by: FoAG and Farmers club

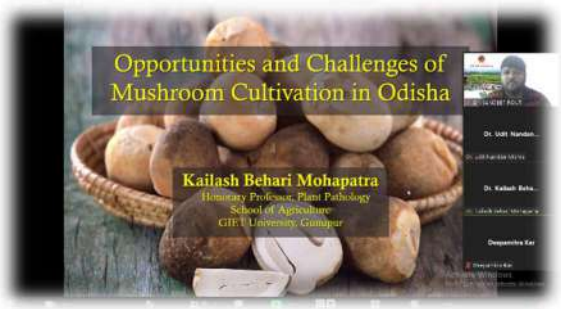
5. Brief notes about the event

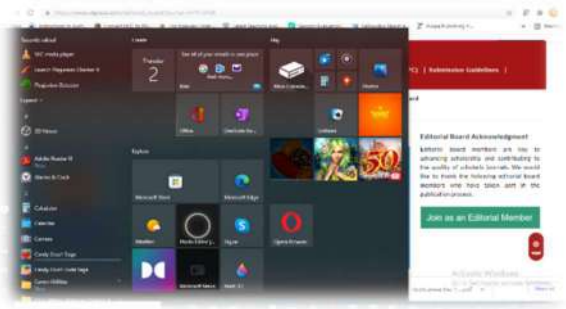
The program started at the scheduled time (10.30 AM) with **Prof. Dr. Kailash Behari Mohapatra** (Honorary Professor, Dept. of Plant Pathology, GIET, Gunupur, Odisha-765022) as the resource person. The organizing committee included Dr. Sandeep Rout (Coordinator), Dr. Udit Nandan Mishra (Co-Coordinator) and Dr. Subhrajyoti Panda (Co-Coordinator). The whole session was moderated by Dr. Udit Nandan Mishra. More than hundred participants including faculties and students had virtually interacted with the invited speaker.

Dr. Mohapatra discussed the different types of mushrooms available for consumption purposes and their biology, where he emphasized the commercial potential of this fungus. He is regarded as the Pioneer of the mushroom revolution in Odisha. He also briefed about his teams' collective research work towards making mushrooms a high value commodity in the state in terms of export opportunities. Dr. Mohapatra had narrated how different projects under his principal investigation changed the socioeconomic status of poor and marginal farmers in Odisha.He also showed how mushroom cultivation can be commercialized with its huge value addition potential.

Students and faculties got the opportunity to interact one to one basis virtually with Dr. Mohapatra and got clarification in several aspects of mushroom business and successful cultivation. The program was ended at 12.25 PM with a vote of thanks to the guest lecture by Dr. Sandeep Rout after which the program was closed officially.

7. **Total number of participants: 160 (In-house Participant)**





A webinar was conducted by Dr. Tuhin Narayan Roy, Professor, Department of Agricultural Economics, Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar on the topic "**NEED AND DEMAND FOR HUMAN RESOURCE IN MODERN AGRICULTURE**" dated 28.12.2021 enclosing 152 participants.

In this session, the expert delivered lecture regarding human resource generation and development, need and status along with scope of human resources in modern Indian agriculture. He has emphasized present scenario and requirement of agricultural human resource with the help of consumption of employment stock, demand-supply model and forecasting models. Partly he has described agricultural education system too and put glimpses of emerging career opportunities in various emerging sectors. He also narrated the updated skill requirement in agriculture sector and how to be ready for that.

It was splendid presentation which exposed students towards rising role of human resource in Agriculture and allied sectors. All the students appreciated and got benefited from his views on the subject.

1. **Title of the Guest lectures/ FDPs/Webinars**
   National webinar on
   Application of Nanotechnology in Crop Protection: Current Status and Future Prospects
2. **Name of the speaker(s) with designations**
   i. Dr. Totan Adak
   Scientist (Agricultural Chemistry)
   Crop Protection Division,
   ICAR-National Rice Research Institute, Cuttack, Odisha, India.

   ii. Dr. Bhaskar Bajaru
   Scientist
   ICAR-NBPGR RS,
   Hyderabad, Telangana, India

3. **Date, time, Venue (if online provide the link) of the event**
   Date: 19th Jan 2022
   Time: 10.00 AM- 12.30 PM; 2.00PM To 04.30 PM
4. **Organized by: FoAG/Farmers club or any other specify**

Department of Entomology
Faculty of Agriculture
Sri Sri University

5. **Brief notes about the event**

The National webinar on 'Application of Nanotechnology in Crop Protection: Current Status and Future Prospects' was organized on 19th Jan 2022. The program was scheduled with the below thematic concept.

The use of nanotechnology in crop protection holds a lot of potential for controlling and targeting the distribution of agrochemicals to insects and pathogens. Insecticides, insect repellents, herbicides, and antifouling agents all use nanoparticles, nanoemulsions, nano suspensions, and nanocapsules. On stored grain insects, crop pests, and other pests, the insecticidal properties have been thoroughly investigated. Nanoencapsulation is the most promising method for protecting host plants from insect pests and other pathogens currently available.

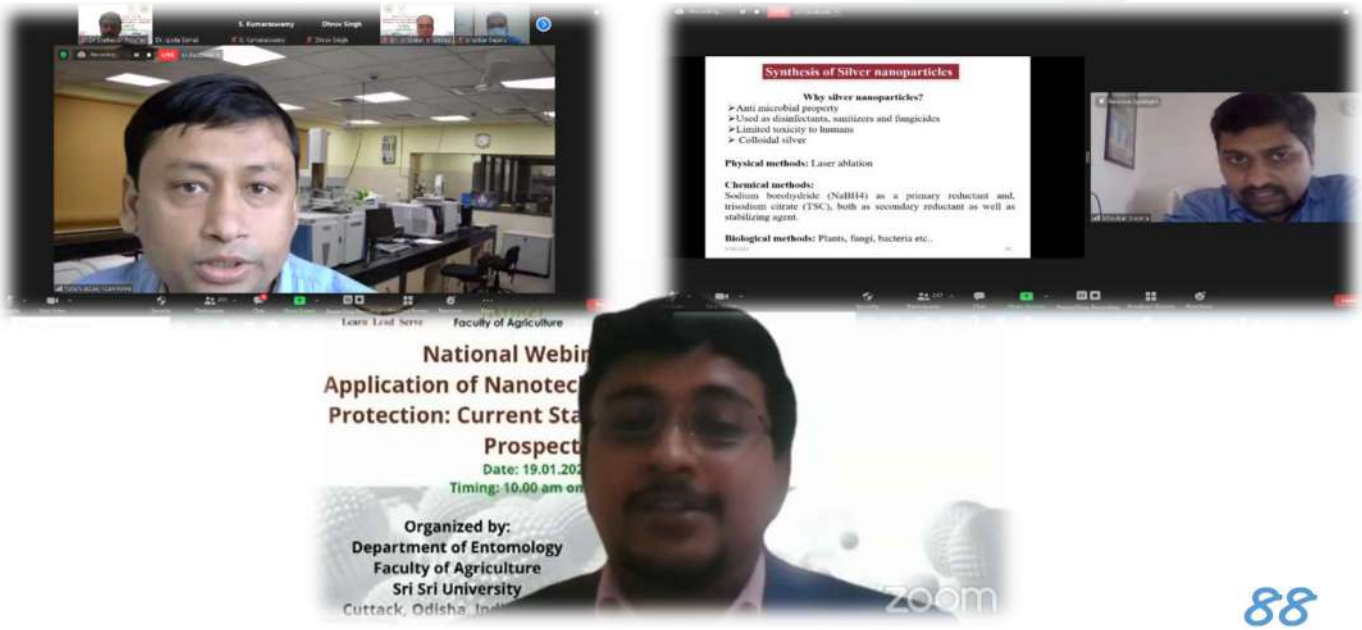
In agriculture, nanoparticles act as 'magic bullets,' holding insecticides, fungicides, herbicides, chemicals, or genes that are delivered to specific plant parts or organisms. Herbicides can be effectively penetrated through cuticles and tissues using nanocapsules, allowing for delayed and consistent release of the active ingredients. They are usually stronger than regular steel, have a higher chemical reactivity, and have a high electrical conductivity. Nanotechnology has a huge range of possible applications and advantages. There is a lot of potential for nanotechnology to be used in pest control research in the near future. There is a need for study into eco-friendly synthesis. Plants and microorganisms, for example, have emerged as cost-effective and efficient possibilities for green production of nanoparticles. They outperform traditional chemical approaches in terms of environmental toxicity. As a result, nanotechnology will change agriculture in the near future, including pest management. In the webinar discussions was carried out regarding the current research trend and challenges with it. There was much queries about the biosafety concern, formulation, environmental impact, biosynthesis etc.

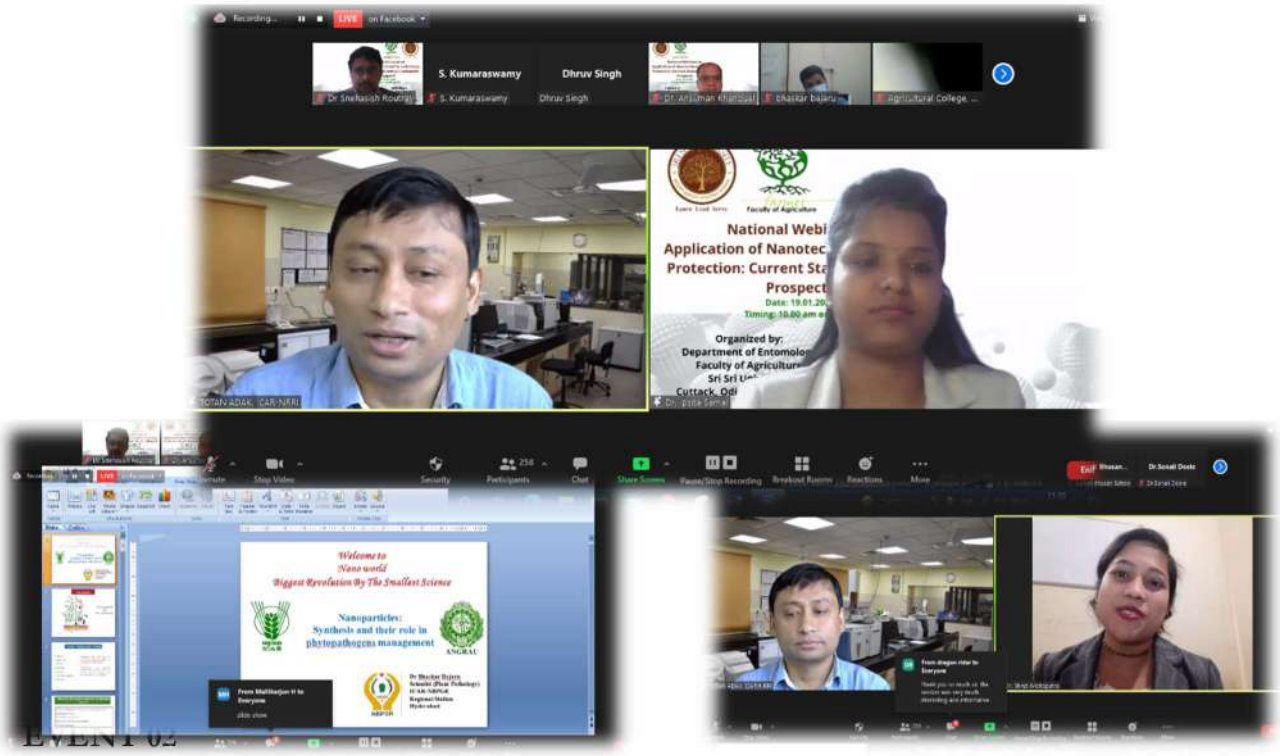
Program Schedule: Dated 19.01.2022

Time	Topic	Speaker
10.00 am – 10:15 am	Welcome Address and Introduction to Webinar	Dr. Snehasish Routray Assistant Professor (Entomology)
10:15 am – 10:30 am	Key Note Speech	Dr. Ipsita Samal

		Assistant Professor (Entomology)
10:30 am – 11:30 am	Application of Nanotechnology in Crop Protection	Dr. Totan Adak Scientist (Agricultural Chemistry) Crop Protection Division, ICAR-National Rice Research Institute, Cuttack, Odisha, India.
11:30 am		Discussion
12.00 pm – 2.30 pm		Break
2.30 pm	Key note speech	Dr. Ansuman Khandual Assistant Professor (Plant Pathology)
2:45 pm-3:45 pm	Nanoparticles: Synthesis and their role in phytopathogens management	Dr. Bhaskar Bajaru Scientist ICAR-NBPGR RS, Hyderabad, Telangana, India
3:45 pm – 4.00 pm		Discussion
4:00 pm – 4.15 pm	Vote of Thanks	Dr. Shruti Mohapatra Assistant Professor (Economics)

6. **Total number of participants**
   Total number of registrants – 610
   Total number of participants attended - 300





1. **Title of the Guest lectures/ FDPs/Webinars:** Guest lecture on 'General and seasonal management of an apiary'.
2. **Name of the speaker(s) with designations**
   Mr. Deepayan Padhi
   Assistant Professor (Entomology)
   M S Swaminathan School of Agriculture - Centurion University, Paralakhemundi, Gajapati, Odisha- 761211
3. **Date, time, Venue (if online provide the link) of the event**
   Date: 10th Jan. 2022. timings: 9.30 am to 11.30 am
4. **Organised by: FoAG / Farmers club or any other specify**
   Department of Entomology
   Faculty of Agriculture
   Sri Sri University
5. **Brief notes about the event**

The guest lecture was organized for B.Sc. (Hons.) Horticulture III year, B.Sc.(Hons.) Agriculture IV year-ELP module students, faculty members and other interested stakeholders regarding the overall

and seasonal management of commercial bee keeping. The speaker had expertise in practical bee keeping which was helpful in clarifying doubts and elevating knowledge of students.

6. **Total number of participants: 60**

1. Title of the Guest lecturers/ FDPs/Webinars: Webinar on Agribusiness
2. Name of the speaker(s) with designations: Dr. Shubhaom Panda, Assistant Professor, FoAG, SSU
3. Date, time, Venue (if online provide the link) of the event
27th December, 2021; 11 am–12.15 pm
4. Organized by: Admission Section, SSU
5. Brief notes about the event:

This event was organized as an online counselling session on career prospects and scope of agribusiness taking perspectives of education, job and entrepreneurial potential in Odisha and Indian context.
6. Total number of participants: 50

1. Title of the Guest lecturers/ FDPs/Webinars: Online Faculty Development Program on Roof Top Farming

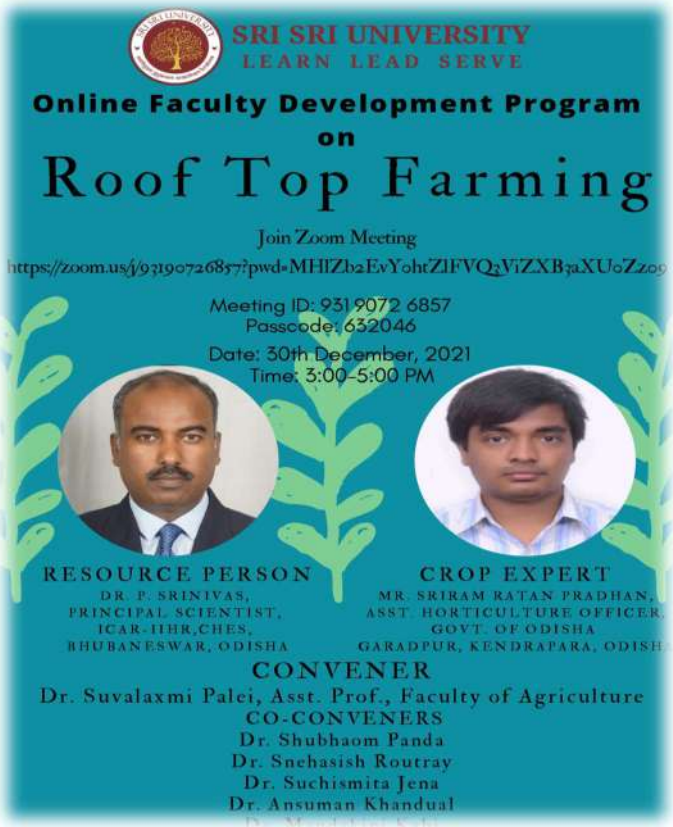
2. Name of the speaker(s) with designations:
Dr. P. Srinivas, Principal Scientist, ICAR-IIHR, CHES, Bhubaneswar, Odisha &
Mr. Sriram Ratan Pradhan, Assistant Horticulture Officer, Government of Odisha
3. Date, time, Venue (if online provide the link) of the event
30th December, 2021; 3.00–5.00 pm

4. Organized by: FoAG

5. Brief notes about the event:

As we know that, world population is growing day by day, and it is going to reach 9 billion by 2050, so the time has come to produce more with limited space. Hence, everybody is deeply interested to know more about Roof Top Farming by which they can implement the concept into reality and produce more agriculture products to feed ever-growing world population. This FDP gave a platform to get a knowhow regarding Rooftop farming to the interested students, faculties, and other stakeholders. In this event experts in the concerned field were invited for delivering the lecture.

7. **Total number of participants:** 60



1. Title of the Guest lectures/ FDPs/Webinars- Virtual workshop for flori-preneurs in India.

2. Name of the speaker(s) with designations- Dr. Alka Singh, Professor and Head, Department of floriculture and landscape architecture, Navsari Agricultural University, Navsari, Gujarat.

Dr. Rajesh A. M., Assistant Professor, Department of floriculture and landscape architecture University of Horticultural Sciences, College of Horticulture, Kolar, Karnataka

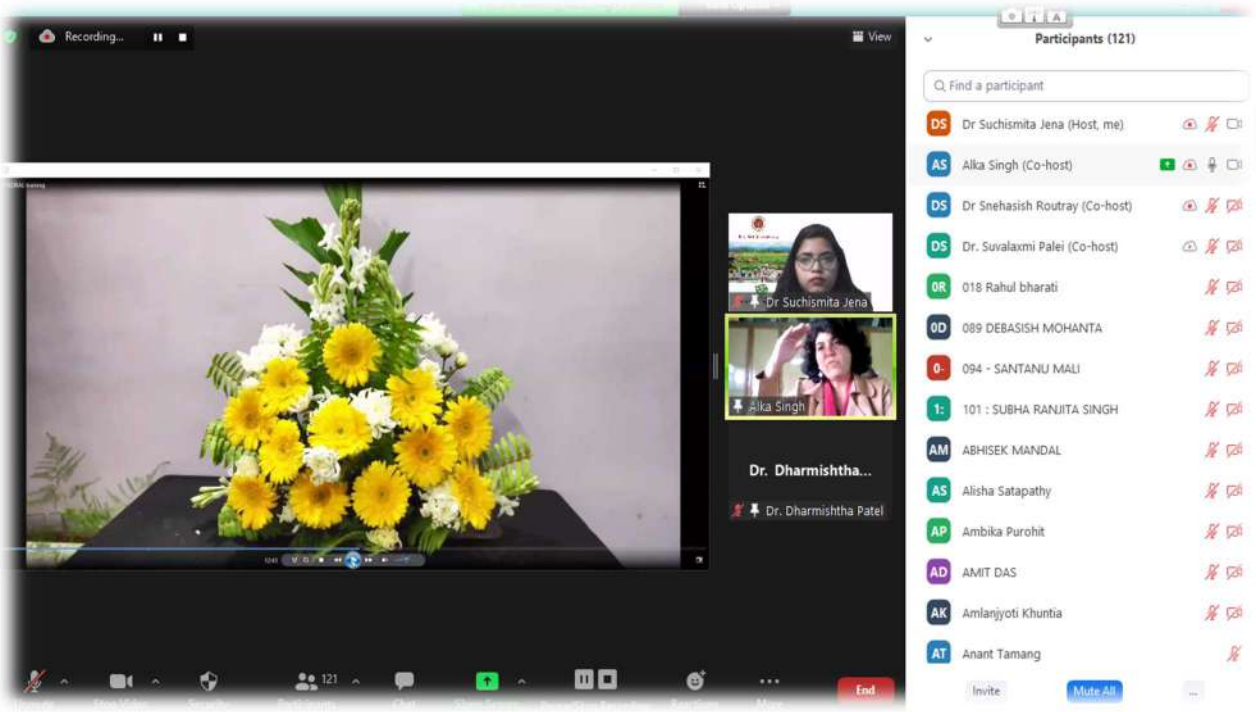
Dr. Yatindra H. A., Assistant Professor, Department of floriculture and landscape architecture University of Horticultural Sciences, College of Horticulture, Mysore, Karnataka

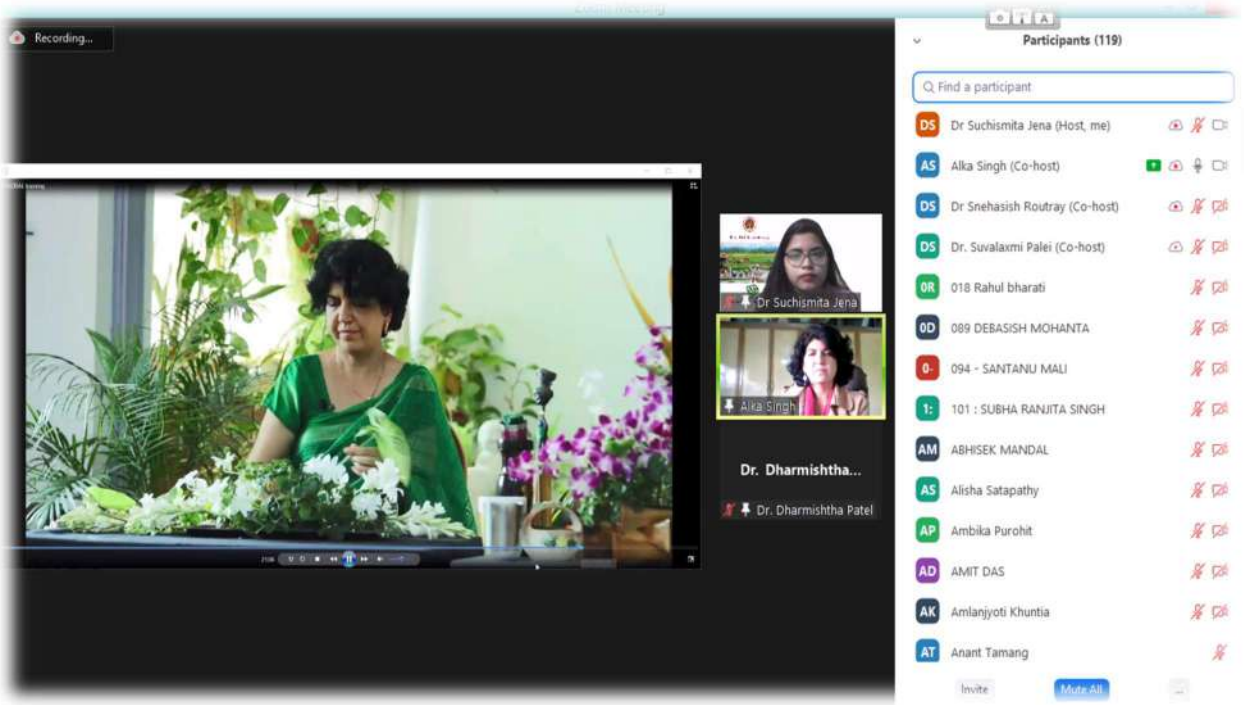
3. Date, time, Venue (if online provide the link) of the event: 12.01.2022 – 10.00 am- 1.00 pm

4. Organised by: FoAG / Farmers club or any other specify: FOAG, Sri Sri University, Cuttack

5. Brief notes about the event: Government of India has identified floriculture as a sunrise industry and accorded it 100% export oriented status. Owing to steady increase in demand of flower floriculture has become one of the important Commercial trades in Agriculture. Looking at its potential we, the Faculty of Agriculture, SSU thought to encourage and inculcate business ideas in our young minds on National Youth Day. So that in future they can be job giver not job seeker. In the virtual workshop the participants got different ideas about fresh and dry flower arrangements, art of making bonsai and terrarium preparation.

6. Total number of participants: 121 (Attended) 234 (Registered)





1. Title of the Guest lectures/ FDPs/Webinars: Guest Lecture on "A talk on experience,vision and mission on organic agriculture"

2. Name of the speaker(s) with designations:
a) Mr. Neeraj Kumar Prajapati (Bi-cycle man of Indian Agriculture)

3. Date, time, Venue (if online provide the link) of the event: 16.12.2021 (04.00-05.00 pm)

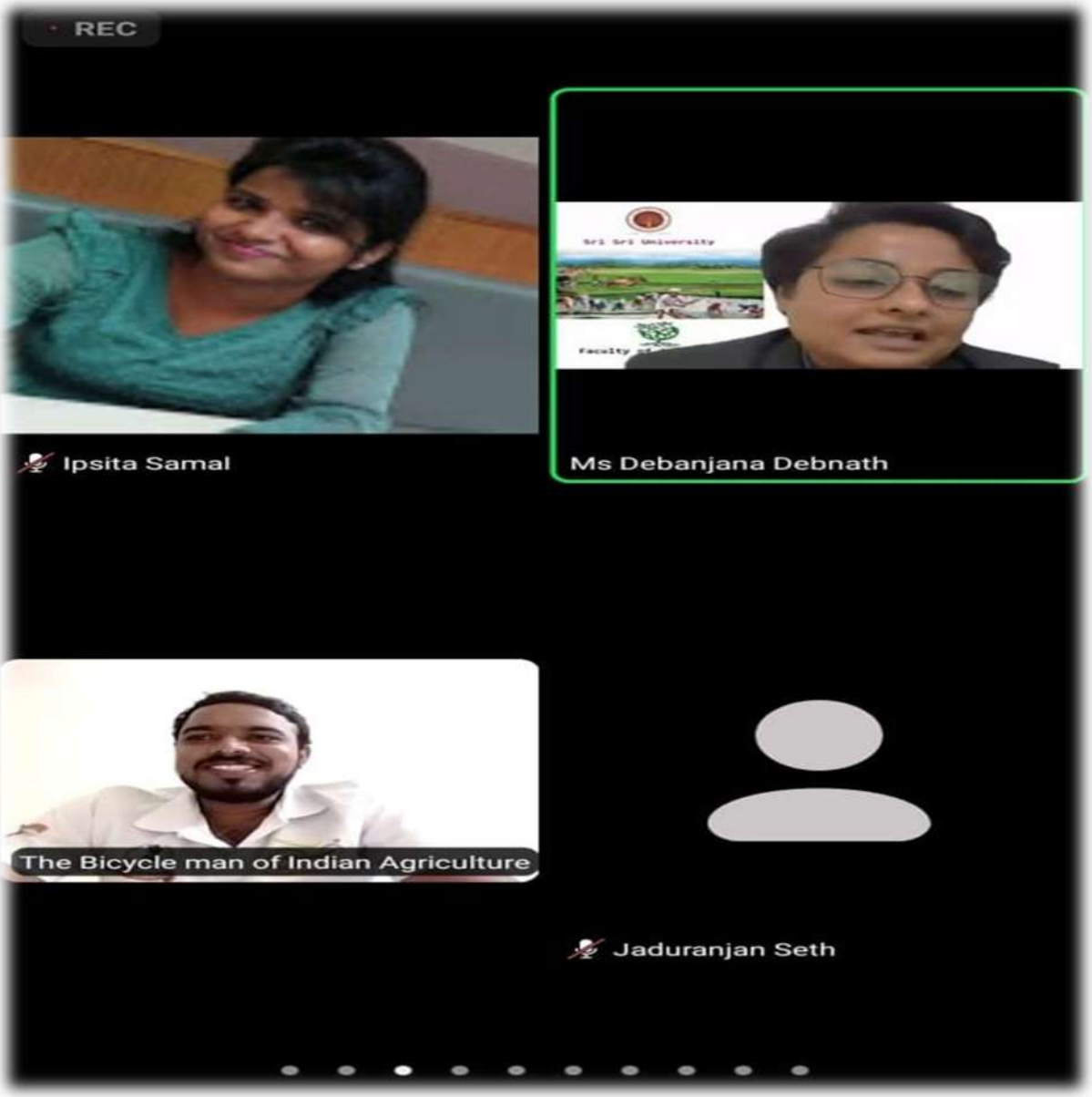
4. Organized by: FoAG

Brief notes about the event:

Mr. Neeraj Kumar Prajapati, well known as Bi-Cycle man of Indian Agriculture has delivered his wide experience on the mission of his spreading awareness for the promoting organic agriculture. In his short speech he has given a broad idea about how he is working as a linkage between the farmers, the scientist and input producers. So that, the sustainability of the agriculture can be established. He has encouraged the youths to take their responsibility to carry this mission forward.

6. Total number of participants: 157


farmer
SRI SRI UNIVERSITY
"A TALK ON EXPERIENCE, VISION AND MISSION ON ORGANIC AGRICULTURE"
MISSION ORGANIC BY FAITH
INDIA
By
THE BICYCLE MAN OF INDIAN AGRICULTURE-
Mr. Neeraj Kumar Prajapati.
Organized by
Faculty of Agriculture
Sri Sri University,
Cuttack,Odisha
Time: Dec 16, 2021 04:00 -05.00 PM India
Join Zoom Meeting
https://zoom.us/j/96613881419?pwd=NVlKcDN0ZGNFUXRuUzN3R3M1VEpCdz09
Meeting ID: 966 1388 1419 Passcode: 366313
Faculty Co-Ordinators
Debanjana Debnath
Assistant Professor
Department of Plant Pathology
Faculty of Agriculture
Sri Sri University,
Cuttack,Odisha
Dr Chinmayee Mohapatra
Assistant Professor
Department of Plant Pathology
Faculty of Agriculture
Sri Sri University, Cuttack,Odisha



Membership in professional societies

SL.NO.	Name	Membership in professional bodies	Types of pofessional bodies(Journal/ Newsletter/Societies)	Types of membership(Annual/Lifetime)	Editor/Reviewer	Membership Id (If any)
1	Dr Suvalaxmi Palei	Society for Promotion in Horticulture	Society	Life time		
2	Dr Snehasish Routray	Entomological Society of India	Professional Society	Life time		
		Plant Protection Association of India				
		Society of Plant Protection and Environment				
		Society of Biotechnology and Bioinformatics				
		Orissa Horticultural Society				
3	Mr Prajjal Dey	Society For Advancement of Agricultural Innovations	Society	Life time		
		American Journal of Plant Biology New York, NY 10020 U.S.A.,	Journal		Editorial member	
		Agrospheresmagazine,	e-Magazine		Editorial member	
		Current Agriculture Trends: e-Newsletter	e-Magazine		Editorial member	

		Plant gene, Gene and Meta gene	Journal		Reviewer	
4	Dr Tanushree Sahoo	Biomolecule Reports- e news letter	e- magazine	Life time		
5	**Dr Chinmayee Mohapatra**	Indian phytopathological society	Society	Annual		
		Agriblossom	E magazine	Annual		
6	Dr Dhaval Kirankumar Dwivedi				Reviewer of Indian Journal of Agricultural Research	
7	Dr Shruti Mohapatra	The Society of Economics and Development	Society	Life Member		
		Agricultural Economics Research Association (India)	Society	Life Member		
		Asian Journal of Economics, Business and Accounting	Journal		Reviewer	
		SABUJEEMA	e-MAGAZINE	Annual	Editorial member	
		AGRIBLOSSOM	e-MAGAZINE	Annual		
		Agriculture and Food-e Newsletter	Magazine(News letter)	annual		
		Current Journal of Applied Science & Technology	Journal	Annual		
8	Mr Ambika Mishra	Oryza, Indian Society of Soil Science	ICAR- Journal	Annual		M/M-172
9	Ms Bidusi Tripathy	Agriculture and food e-Newsletter	Magazine(News letter)	Annual	Editorial member	
10	Dr Sandeep Rout	International Journal of Botany Studies	Journal	Life	Editorial Board Member	

		International Journal of Plant & Soil Science	Journal	Annual	Reviewer
		The Journal of Applied Biology & Biotechnology	Journal	Annual	Reviewer
		Krushi O Paribesh	Magazine	Life	Managing Editor
		Green O2	Magazine	Life	Managing Editor
		Society for Learning Technologies, Andhra Pradesh	Society	Life	Vice President, Odisha Chapter
		Shikshak Kalyan Foundation, New Delhi	Society	Annual	State Convener, Odisha State
		Society for Ecological Sustainability, Odisha	Society	Life	Society Board member
		Krishi Pravahika : e - Samachar Patrika	E-Magazine	Life	Editorial Board Member
		Sunshine Agriculture: e-Newsletter	E-Magazine	Life	Editorial Board Member
		South Asian Journal of Agricultural Sciences	Journal	Annual	Assistant Editor
		Current Agriculture Trends: e-Newsletter	E-Magazine	Life	Editorial Board Member
11	Dr Kalyani Pradhan	Odisha Horticulture Society.	Society	Life	
		Society for Scientific Development in Agriculture and Technology	Society	Life	
		Indian Society of Vegetable Science.	Society	Life	
12	Dr Seema Tripathy	The Society for Plant Protection	society	Life	

		and Environment				
		Journal of Experimental Agriculture International	journal	reviewer		
1	Mr Anupam Dakua	International Journal of Food Science and Nutrition	Journal		Editor	
		International Journal of Agriculture and Food Science	Journal		Editor	
		International Journal of Academic Research and Development	Journal		Editor	
		Journal of Emergeing Technology and Innovative Research	Journal	Life	Reviewer	
		Agriculture and Food-e Newsletter	Magazine(News letter)	Annual	Editor	
		Vigyan Varta	e-Magazine	Monthly	Editor	
15	Dr Udit Nandan Mishra	All India Council For Technical Skill Development	Society			AICTSD/PROFESSOR/21714
		Indian Society of Chemists And Biologists	Society	Annual		Fellow number: AF 1150/2021
		Society for Plant Biochemistry and Biotechnology	Society	Life time		L-938 (2021)
		International Journal of Research and Innovation in Applied Science (IJRIAS)	Journal		Reviewer	
16	Dr. Ipsita Samal	Just Agriculture	Magazine(News letter)	ANNUAL	Member	

		Agriculture Letters	Magazine(News letter)	ANNUAL	Editor
17	Ms Rashmi Misra	Home Science Association of India	Society	Lifetime	
		Nutrition Society of India	Society	Lifetime	
		International Journal of Food Science and Nutrition	Journal		Editor
		International Journal of Agriculture and Food Science	Journal		Editor
		International Journal of Academic Research and Development	Journal		Editor
		Agriculture and Food-e Newsletter	Magazine(News letter)	Annual	Editor
		Journal of Emerging Technology and Innovative Research	Journal	Life Member	Reviewer
18	Dr. Krishna Mishra	Home Science Association of India	Society	Lifetime member	
		Sabujeema	e-Magazine		Editor
19	Ms Chinmayee Pattnayak	Nutrition society of India	Society	Life member	
		Home science Association of India	Society	Life member	
20	Dr Bidisha Majumder	Life member of Association of Institute of Agricultural Science, Calcutta University	Society	Life member	
		Life Member of BayCEER, University of	Society	Life member	

		Bayreuth, Germany		
		Life Member of Indian Science Congress Association	Society	Life member
		Life Member of Alexander von Humboldt Foundation, Germany,	Society	Life member
		Indian Society of Soil Science	Society	Annual member
		Soil Tillage Research	Journal	Reviewer
		Communication of Soil Science and Plant Analysis	Journal	Reviewer
		Environmental Monitoring and Assessment	Journal	Reviewer
21	Dr Subhrajyoti Panda	Indian Society of Extension Education	Society	Life member
		Society for Community mobilization for Sustainable Development	Society	Life member
22	Dr Moirangthem Kalpana Devi	Indian Society of Agricultural Engineers (ISAE)	Journal	Annual member
		Association of Food Scientists & Technologists (INDIA), AFST(I)	Journal	Annual member
		Institute of Food Technologists (IFT), Chicago, Illinious , USA	Journal	Annual member
23	Mr. Devegowda S R	Indian Society of Agricultural Economics	Journal	Annual member

		Association of Agrometeorologists	Journal	Annual member		
24	Debanjana Debnath	Agri blossom e newsletter	E-Newsletter	Annual member	Reviewer	
		Agriculture and food e magazine	E-Newsletter		Editorial Member	
		Society for Advancement in Wheat and Barley Research Institute	Society	Annual member		
		Current Agriculture Research Journal	Journal		Reviewer	
25	Rini Labanya	Indian Society of Soil Sience	Society	Annual membership		M/L/115

Collaborations & MoU

Faculty of Agriculture, Sri Sri University and Central Institute for Freshwater Aquaculture (CIFA-ICAR), Bhubaneswar signed a MoU in 2022 to engage in collaborative activities to share the knowledge, conduct training and workshops.

Popular articles

Microplastics and Nanoplastics are really food safety concern?

Dr. Neela Satheesh, Associate Professor, Food Nutrition and Dietetics

Production and utilization of various types of plastics increased since recent decades around the world. Due to the lower manufacturing cost, versatility, good functional, barrier, and packaging properties,

plastics are extensively used in the packing of different consumer goods. Due to the excess usage and lower degradability, plastics are persistent and accumulated large amounts in the environment. Hence, they are distributed in different environmental conditions like aquatic systems, land surface, inside living bodies, human consumables, and in air.

According to the recent reports, 8.3 billion tonnes of plastic is produced, out of this 6.3 tonnes are turned to plastic waste, only 9% of total production is being recycled, and 12 percent was incinerated and 79% is ended up as landfills or in the environment. Around 8 million tonnes of plastic is deposited in the oceans every year around the world. The riversare carrying the plastic to the oceans and a study projected that if the same trend is continuous in the plastic waste disposal, by 2050 the plastic number will be higher than the fish number in the oceans.

India is one of the highest plastic producing and utilizing counties in the world. Gujarat, Maharashtra, and Madhya Pradesh are the leading plastic utilizing states in the country. The annual utilization of plastics in India is approximately 11 kg per capita and generates 26 million metric tonnes of plastic waste per annum.

Conversion of Plastic Waste to Micro and Nano Plastics:

The researchers are identified these MPs and NPs are generated purposively for different applications (Primarily process) or results of the fragmentation of other types of plastics. Usually, plastic waste material undergoes to weathering and fragmentation (Secondaryprocess) leads to the generation of Microplastics (MPs) and Nanoplastics (NPs). These particles have received attention by many researchers around the world. The NPs are distributed in the size range of 0.1 to 1μm and the MPs are distributed in size less than 5 mm size.

Micro and Nano plastics Distribution:

Still, limited research is reported on the identification of MPs and NPs in different sources. However, scientists are identified MPs and NPs in surface waters, seabed sediments, beaches, freshwaters, wastewater effluents, sea-ice in the Arctic and the Antarctic, several species of living organisms, food products, bottled water, indoor and outdoor air. Similarly, different studies are reported the presence of MPs food products/ ingredients like in sea salt, beer, honey, sugar and water samples collected from different locations. However, the food from marine source is the prime concern recently. The marine animals accumulate MPs in the guts, this leads to the potential for bioaccumulation in different parts of the aquatic animals. However, aquatic animals like shellfish, mollusca, oysters, and crabs are filter feeders so; they accumulate MPs and NPs in their bodies. In addition, the impact of MPs is enhanced due to the adsorption of harmful substances like organic pollutants, heavy metals, pesticides, antibiotics, pathogenic microorganisms on their surface.

Micro and Nano Plastics as food safety concerns:

Consumption of an appropriate amount of safe and nutritious food is essential to promote good health. Usually, the food consumed should be safe and should not cause any illness. Safety of food is effected by harmful contamination of microbes (bacteria, viruses, parasites) and chemical substances that are responsible for more than 200 types of diseases ranging from simple diarrhoea to different types of cancers. Moreover, once in 10 people face food safety issues and fall ill throughout the world due to the contaminated food consumption.
This MPs and NPs are acting as chemical containments and they have a multidimensional approach in food safety concern. The MPs and NPs acts as vehicles for the absorption of different chemicals present in the marine environment and they carry the intentional chemicals added at the time of processing such as styrene, toxic metals, phthalates, bisphenol A, polychlorinated biphynyles and polycyclic aromatic hydrocarbons. The pollutants and additives can be transferred from ingested MPs to animal tissue and cause different cellular dysfunction

In addition to the chemicals, microbes are found on the plastic debris and this is termed as "plastisphere" there are a concern for the spread of different pathogens. These pathogens include microbes like *spp. E. coli, Stenotrophomonasmaltophilia, Bacillus* sp. Hence, this plastic debris may increase the global risk of human and animal diseases via new contamination/infection routes, introduction of pathogens and their vectors into new areas through the environmental spread of MPs or migration of organisms contaminated with pathogens mediated by MPs.

The information available on the presence of MPs and NPs and their additives, associated pollutants, and the effect on human health is still limited. However, scientific studies established the presence of MPs and MPs in different products, their fate and metabolism in the human body is still scientifically not established. Hence, the adverse effects of MPs and NPs effect on human health are still controversial and not understood well. In this context, to establish the facts of NPs and MPs roles, still further elaborative research is required. The presence of MPs and NPs in the environment is studied by only 22.9% countries on the globe. Hence, many countries are not initiating any research in this area.

Conclusions:

Different researchers expressed concern on the MPs and NPs as concerns for food safety. But, food safety regulatory agencies are not considered and not given any limitations or maximum tolerable limits for MPs, NPs in foods. In this regards, to get clarity about this issues wider research should done on the areas like MPs and NPs distribution, bio-accumulation, effect of associated factors (chemical and physical) and health effect in the humans. In addition, it is very important to adopt food safety risk analysis framework to evaluate hazards and risks to consumers by MPs and NPs.

Water is the most abundant compound found in nature and is the most limiting factor in agricultural production. More than 98% of water is lost in the form of transpiration and evaporation. Transpiration is the loss of water from aerial parts of plants in the form of vapour, which is also known as ***'necessary evil'***. It takes place through lenticels, cuticle and stomata. Transpiration is affected by both external and internal factors. Water is a scarce commodity and with the expansion of agriculture, water conservation measures are becoming more important particularly chemical manipulation of transpiration with anti-transpirants. Anti-transpirants are chemicals sprayed on transpiring plant surfaces with an attempt to reduce water use by reducing transpiration.

A wide range of materials have been tried as anti-transpirants. Depending upon their mode of action, they are stomatal closing type, film forming type, reflectance type and growth retardants. Anti-transpirants should have some of the ideal properties like non toxic, cheap, stable, long lasting in their effectiveness and they should have some of the assured benefits. Several researchers reported that anti-transpirants not only reduce the water loss but also they improve the physiological, disease resistance, quality and yield aspects in many vegetable crops.

Within the plants some natural anti-transpirants are synthesized and these includeABA and salicylic acid. ABA regulates the water economy of plant under water stress conditions. Some studies have demonstrated triazoles as anti-transpirants. CO_2 is also shown to act as an anti-transpirant, high concentration of CO_2partially close stomata and increase the rate of photosynthesis.

Effectiveness of anti-transpirants primarily depends on coverage of lower surface of leaves, interaction of anti-transpirant with external environment, surface anatomy of leaf, rate of formation and growth of new leaves.

Although there are number of advantages, still some of the constraints are there like decrease in rate of photosynthesis, being varied greatly with environmental factors, difficult to cover the entire leaf surface, lack of knowledge on the type of nozzles and surfactant to be used, toxicity in leaf etc. limits the use of anti-transpirant.

From the foregoing discussion, it can be concluded that, anti-transpirants not only reduce the transpiration loss but also useful for improving physiological, growth, disease resistance, quality, yield and yield attributing characters in vegetable crops. Continued research is necessary to determine which materials offer the maximum reduction in transpiration with minimum reduction in photosynthesis, as well as optimum concentrations and application methods.

Under-utilized crops: Key to unlock sustainable agriculture

Dr. Mandakini Kabi

Since time, role of agriculture for providing basic needs to human being is indispensible. Major plant species providing food has been evoluted by domestication and gathering of desirable plants species.

Nature has gifted around 75,000 edible plant species, out of which 150 species have been widely used again from this 90% of food demand contributed by 30% of plant species. The alarming increases in population growth which is going to reach 9.7 billion by 2050 have come up with several challenges mostly pertaining to food security and climate change. So, the agriculture sector reeling under intense pressure to meet the food demands for the projected population. Agricultural research, production and policy systems mostly prioritized on very few plant species to fill the food basket and left many potential plant species. These shrinking of food basket is a matter of concern for near future in terms of sustainability. Intense pressure on staple crop for producing sufficient food to meet the demand necessitate to expand the diversity of agricultural crop resources. This diversification can release off burden on major crop and will be significant as part of the progress towards the goal of achieving sustainability in food production. There is also constantly decrease of land for agriculture, due to diversion of land for industrial use, urbanization etc led to more dependence on degraded land to meet the increasing requirements of food, fodder, fiber, firewood and timber. Further, excessive dependency on major/staple crop is unsuitable for long run due to inherent agronomic, ecological, nutritional and economic risks in view of global climate change. Impact of biotic and abiotic stress on agricultural production system increases when cropping pattern relies on very few major crops that may threaten sustainability.

However, diversifying the crop resources in cropping system will builds up spatial and temporal heterogeneity in to the cropping system that act as buffer in agricultural production system. The left-out crops are mostly known as underutilized crop that are more economic importance especially in the developing countries facing natural resource constraints to unlock sustainable agriculture. In the context of nutritional security, underutilized crops are reserviour of micronutrients; particularly iron that can overcome silent hunger. Such micronutrients are in plenty in *Panicum miliaceum* (proso millet), *Paspalums crobiculatum* (kodo millet), *Chenopodium* (chenopod), *Amaranthus* (amaranth), *Fagopyrum* (buckwheat) and so on. Despite their potential for dietary diversification and the provision of micro-nutrients such as vitamins and minerals, they still continue to attract little research and development attention.

Underutilized crops are the crops that have not been categorized under major crops due to lack of attention in terms of their research, production and marketing. These crops have potential to survive in marginal and stress condition that mostly occupies low level of utilization. These crops are restricted

to specialized geographical pockets and mostly cultivated by poor farming communities for their livelihood and sustenance. These crops mostly provide food and nutritional security to about 10percent population inhabiting remote, tribal and backward areas. These crops are good source of diversification in agriculture due to their resistance nature to biotic and abiotic stress. Underutilized crop includes pseudo cereals, minor grain legumes minor fruits, vegetables, oilseed crops and industrial crops. The area under pseudo cereals is low in Indian context and it has high degree of acceptability in the poor farming households. This group of underutilized crops includes amaranth, buckwheat, chenopod and minor millets. Quinoa, Chia Seeds, Wattle seed, Kaniwa) and minor legumes includes hyacinth bean, horse gram, Hausa bean, sword and jack beans, Bambara ground nut, winged bean, faba bean).

These underutilized crops have great potential to be exploited for various purposes. For strengthening of research on underutilized plants, an All India Coordinated Research Project on Underutilized Plants (AICRPUUP) was initiated in1984 with its headquarters at the National Bureau of Plant Genetic Resources (NBPGR), New Delhi. Therefore, research on underutilized crops holds promise to attain sustainability, profitability and diversification in agriculture.

Application of nanotechnology in weed management

Dr. Madhab Kumar Datta

Nanoparticles have abundant utility in various fields and also unleashed huge scope of scientific experimentation in agriculture (Kanjana, 2015). Because of very small size (100 nm or less), they exhibit large surface area: volume ratio which ensures effective applications of chemical inputs that were almost impossible in the past. Nanoactive herbicides control weeds even without use of synthetic chemicals resulting reduction in requirement of the later. The application of nano herbicides can be observed in varying entities.

Herbicide formulations

The application of nanoparticles in herbicide formulations increases its efficiency not only by through better uptake and transportation in the plant but also increased attachment of herbicide in soil. It helps in decreasing loss of herbicide through surface runoff and pollution of water bodies. Nanomaterials also reduce herbicide degradation by the microbes and UV radiation which increase the effectiveness and persistence of herbicides. Commercializations of micro emulsions (ME) which are of 10 to 50 nm in size (Gogos *et al.*, 2012) are a premix of fluroxypyr + clopyralid + MCPA and S-metolachlor + metribuzin.

Nanoparticles as carriers

Nanocarriers are effective for many soil-applied herbicides which are low persistent in soil under aerobic conditions *viz*. S-metolachlor, imazethapyr, flumioxazin, and thiobencarb (Shaner, 2014). They allow slow release of herbicide which is helpful for its longer effectiveness and decrease losses via UV degradation, volatilization, leaching and runoff. Also, compared to conventional formulation increased efficicacy was observed in the top soil when atrazine was applied as nanocapsules as it controlled the sensitive weed species more effectively without causing any injury to corm.

Herbicide Sensors

The nanocrystals are able to penetrate through cell and can work as an efficient tracer of metabolites in plants. This will be helpful for studying entry, movement, and metabolism of herbicides in plants as nanocrystals reach the target site of herbicides. Recently, gold nanorods was used for the first time as for traceing 2,4-D herbicide whereas test plant tobacco (*Nicotiana tabacum* L.) was used (Jia *et al.* 2016).

Conclusion

The innovation and its application of nanoparticles in toward of agrochemicals are in progress. The development of nanotechnology in agribusiness will bring clear economic, social, and ecological benefits. Though in weed management the applications of nanotechnology are quite promising, there are also equal chances of high uncertainties. Still now only a little is known about the effect of nanomaterials on ecosystem and its influence on flora and fauna. Thus, it is an imperative assignment for researchers to investigate more in field and explore the advantages of nanotechnology by minimizing the risks involved if any.

Chekurmanis-21st century vegetable

Dr. Kalyani Pradhan

Sauropus androgynous (Chekurmanis), a less-exploited leafy vegetable from the Phyllanthaceae family, is a small perennial shrub that is widely grown in South and Southeast Asia. It is indigenous to India and the Burma region. The leaves of this plant have the highest levels of -carotene, vitamin E, vitamin C, thiamine, riboflavin, calcium, iron, zinc, and protein. As a result, the underutilised unusual leafy greens with the highest nutrient content are a good source of vitamins, minerals, and proteins.As per reports, the green leaves of this crop contain high levels of antioxidants due to vitamin C and E papaverine.

This alkaloid causes drowsiness and respiratory disorders when consumed in excess. As this plant is readily available, it should be exploited for the development of low-cost nutritious food products.

The plant attains a height of 2-3.5 m having terete and flaccid main stem with thin lateral branches. Oval, alternate, oblong, sessile, and short staked leaves. In nature, the small reddish flowers are monoecious, minute, auxiliary, pedicelled, clustered, and highly cross pollinated (entomophilous). Plant height is usually maintained at 1-1.5m by frequent leaf harvesting.Fruit sessile, white or pinkish -white, 0.2 cm in diameter with a fleshy pericarp. The genus *Sauropus* consist of a several number of species like *S. assimilis*Thw, *S. netroversus* Wight, *S. rigidus*Thw and *S. qudrangularis* M well. The leaves are rich in protein (6.8-7.4% as compared to 3.2% is amaranthus), minerals and vitamins.

The crop can be grown in well in all types of soil. Warm humid climate and sandy loam or semi laterite soil is best suited for growth and high yield. Luxuriant growth is found in a lower elevation at 500m above MSL. Being an underexploited crop, no such distinct varieties are available for this crop.

Seeds and stem cuttings are the methods of multiplication of the leafy vegetable. 6-12 months old herbaceous cuttings with 5-6 number of nodes, 20-30 cm length are dipped in 50ppm IBA/IAA for better rooting and planted in polybags having potting mixture. It takes 25-30 days for rooting. For 1 hectare of area 1 lakhs cuttings are required, which are planted during Apr-May in shallow furrows. Cuttings are planted at a spacing of 60 x 60 cm^2. Pit of $30cm^3$ size is made for planting, where 5kg FYM is incorporated. In addition to that 25 kg each of urea, SSP and MOP is added. Laterals are encouraged by clippings of when the plant attains about 1 m height.

The nutritional profile such as protein, dietary fiber, iron, zinc, niacin, β-carotene, vitamin E and alkaloid content of Chekurmanis leaves. The rich protein content of the leaves did not change as they matured, remaining around 22.0 g/100 g. At various stages of maturity, the total dietary fiber content of the leaves ranged between 34 and 36 percent. When compared to tender leaves, fully matured leaves contained significantly more calcium. These leaves had iron and zinc contents ranging from 3.89 to 4.50 mg/100 g, 1.26 and 1.48 mg/100 g, respectively. Iron and zinc bioaccessibilitywas found to be significantly higher in tender leaves. Niacin levels in Chekurmanis tender and partially mature leaves

were 74 and 69 mg/100 g, respectively. The -carotene and vitamin E content of the leaves ranged from 7400 to 9250 g/100 g and 17.6 to 15.6 mg/100 g, respectively. The leaves contain an alkaloid, with mature leaves having a significantly higher concentration (1740 mg/100 g) than tender leaves (1439 mg/100 g).

Previously, it was discovered that the leaf of Sauropusandrogynus contained high levels of the alkaloid papavarine (580 mg per 100 gm fresh leaf). Excessive consumption of the leaf was said to cause dizziness, drowsiness, constipation, and other symptoms. The ICMR reported that the -carotene content of Chekurmanis leaves was 5700 g/100 g.

The nutritional value of chekurmanis edible part per 100 g has been recorded as follows: water 91.4 g, energy 245 kJ, carbohydrate 11g, fat 1g, protein 4.8g, vitamin A 10370 IU, thiamine (B1) 0.1 mg, vitamin C 239 mg, calcium (204 mg), iron (3mg), phosphorous (98 mg), potassium (457mg), sodium (25mg), zinc (0.94 mg).

Conclusion

The star gooseberry, also known as sweet leaf, is a perennial shrub found in evergreen forests and cultivated up to 1300 meters in elevation. It is grown as a leafy vegetable in tropical regions. Chekurmanis leaves are extremely nutritious; compared to tender leaves, fully matured leaves contained significantly more calcium, a high level of provitamin A carotenoids, especially in freshly picked leaves, as well as high levels of vitamins B and C, protein, and minerals. The more mature the leaves are, the higher their nutrient content. It should be used because it is a good source of micronutrients and protein, especially for vulnerable populations.

Insects: An invertebrate inspiration for artists

Dr. Ipsita Samal

Insects first appeared on Earth around 480 million years ago in the Orodovician period, coinciding with the appearance of terrestrial plants, and coevolution has allowed them to split into diverse

lineages such as Hymenoptera, Lepidoptera, Diptera, and Coleoptera. These orders' insects are regarded as major damaging hexapods, and their cultural values have been ignored. Insects have captivated our attention since time immemorial, from their ability to cause various types of damage to their role in aesthetics. Throughout history and across many civilizations, insects have inspired artists and craftspeople. Insects are well-known pests that wreak havoc on artefacts, museums, monuments, artworks, and other cultural assets. Silk, wax, and lac-like insect products, on the other hand, have a broader use in art as well as other aspects of culture, and insects such as butterflies, honeybees, flies, and stag beetles are important symbols that are frequently represented and focused in paintings, sculptures, monuments, books, or heraldry around the world. Artists have long used insects as a creative force. Some insects leave traces on their surroundings that artists capture, while others collaborate by incorporating their natural behaviours into the art. Insects were first mentioned in an epigram discovered in Ancient Greece around 600 BC, about a young girl and her dying pet bug. After that, there was a lot more documentation of insects in aesthetics. The details of insects, their products use in cultural entomology and aesthetics is mentioned below.

1. Insects and their products:

An engraving of a cricket was cut into a fragment of bison bone around 14,000 years ago and it was considered as one of the oldest instances of insect art. In Egyptian religious art, Scarab beetle images with rolling balls of dung across the ground reflected the habit of god Khepri to roll the sun across the sky each day. Furthermore, according to, Navajo creation myth, cicadas bring mankind out of the earth, thus mimicking the periodic life cycle from underground.Shellac, aresinous secretions of the female lac bug, has wider use in ornate Tibetan armour; Carmine, a scarlet dye derived from cochineal bugs feeding on cactus are utilised by the Aztecs and Mayas painters and textile manufacturers; singing shawls by the Karen people of South-eastern Asia were prepared from insects. While, silk, lustrous thread prepared by silk worm (*Bombyx mori*) has also wider economic value. Apart from, the mulberry silk, (*Bombyx mori*) found on Mulberry leaves, othern on mulberry type silk liketasar silk (*Anthera eapaphia*), erisilk (*Philosa miaricini*), mugasilk (*Antherae aassamensis*) have also significant role in aesthetics. Fire flies (glow worms) belong to Lampyridae combine oxygen with a substance called luciferin to produce bio illuminiscence was widely used in entomotourism. Other than these, ancient Egyptians worship Scarab beetles as powerful symbols of resurrection and eternal life, Jewell Beetle as symbol of rebirth, while honey Bees were thought to have association with sun God Ra- Ra and tear Flies were believed to protect against misfortune and diseases. Fireflies have been used to impart "live jewels" to garments in India, Sri Lanka, and Mexico.

2. Ornamental insects

Several beetles and butterflies, are usually large and colourful, and can be easily prepared and kept as collectibles for lengthy periods of time. Generally, butterflies are known to be the most beautiful insects in the world. Artists, designers, poets and songwriters have been using butterflies as subjects and inspirations in their work. In some cultures, butterflies are often portrayed as symbols of love and peace. Blue Morpho Butterfly, *MorphoFabricius*, Zebra Long tail Butterfly, *Heliconiuscharitonius*, Peacock Butterfly*, Inachis sp.* can be used to attract tourist attention. To enhance this, in India different states have constructed butterfly parks, out of which butterfly Park of Bangalore is India's first of a kind. Moreover, the government of Papua New Guinea, which is home to the interesting genus

Ornithoptera, or bird wings, has promoted butterfly ranching as an income generating source for local farmers, while, active beetle farming communities (Lucanidae, Cetoniidae, and Dynastidae) in Japan and Taiwan have important industrial applications.

3. Singing crickets

Keeping crickets and bush crickets as pets has been practised for ages in Asian cultures and, to a lesser extent, in several Western countries. Around 22000 years ago, singing insects became domestic pets in China.

4. Cricket fighting

Furthermore, cricket fighting was a popular sport in China during the Song Dynasty, which was later stopped during Qing Dynasty. Cricket fighting has resurfaced again in major cities of China in cricket fighting clubs and societies and thus, due to overharvesting, crickets are becoming increasingly scarce in China's urban areas.

5. Crime investigation

Blow flies (*Chrysomyamega cephala*) Blow flies are the first ones to reach the dead bodies. Due to their predictable life cycle, crime scene investigators can use their colonies to help determine a time of death.

6. Medicinal uses

Blister Beetles - beetles secreted a substance known as Cantharidin which act as a pain reliever. Current studies indicated that the blister beetle secretions attack hostile cells – including cancer. thus can be used to battle tumors and in chemotherapy treatments. Furthermore, maggots are used as crime detectors and skin healers in maggot therapy as they eat dead flesh larva This potential was well studied after World War I, but due to development of penicillin and other antibiotics there was limited adaptability. But now a day these treatments have wider usage and acceptance.

7. As bioindicators

Bioindicators are species that can be used for real time monitoring of the health of an environment or ecosystem. Dragonflies and Damselflies (Odonata), Mayflies (Ephemeroptera) and Midges Species of Chironomidae (Diptera) are recognized worldwide for their extreme sensitivity to oxygen depletion in water bodies, while honey bees (Hymenoptera) were observed to act as bio indicator of arial environment either directly through high mortality rates or indirectly via residues in larva, pollen and honey.

Conclusion:

Insects, apart from attacking the crops, can be a profitable source for artists and they have tremendous role in cultural entomology. Apart from this, they can act as an income generating sources for both the rural and urban household. Thus. There is a need to understand the hidden potential of insects in aesthetics for artists and utilize them effectively. Although, though establishment of butterfly garden, some of the aesthetical values of insects have been well exploited, yet there is much scope among

insects in cultural entomology and aesthetics. There is a need to explore the underutilized fauna so that, these can be helpful in income generation either directly/indirectly.

Estimation of Rainfall Erosivity

Dr. Dhaval Kirankumar Dwivedi

The amount of erosion is influenced by the characteristics of rainfall and soil. The capability of precipitation to cause erosion and the susceptibility of soil to get eroded determine the erosion yield. Thus, erosion is a function of the rainfall erosivity as well as the soil erodibility. Erosivity can be considered as the input force that detaches the soil particles while the erodibility is the resisting force against erosivity. Soil erosion occurs when the rainfall erosivity exceeds soil erodibility.

The raindrops fall with a certain amount of kinetic energy which helps in detaching the soil aggregates and then soil particles are carried away by the flowing water. The surface runoff gains kinetic energy as it moves along the sloping land. The kinetic energy that is gained by rain drops as it falls on the land is 256 times more than the kinetic energy of runoff. Terminal velocity is the velocity of a freely falling body when the resistance offered by friction is same as the gravitational force. Kinetic energy of rain drops can be calculated if rain drop size and the terminal velocity are known. Terminal velocity of rain drops is about 4 to 10 m/s.The splash impact of the rainfall seals the soil surface to some extent and allows more runoff. Rainfall erosivity indicates potential of rainfall to erode the soil particles. Erosivity depends on the physical characteristics of rainfall.

Methods

The soil erosion resulting from a single storm was best estimated by using the product of kinetic energy of the rain and 30 minutes maximum intensity as identified by Wischmeier and Smith (1958) based on their analysis of precipitation and soil loss at several fallow plots at Wisconsin, Missouri and Iowa in the United States of America. Runoff, soil loss and the precipitation associated with 8000 plots were analyzed by Wischmeier (1959). It was confirmed the rainfall erosivity factor was suitable at these locations for fallow plots and also for the plots with row crops.

The rainfall erosivity index can be obtained by two methods:

1) EI_{30} index 2) KE>25

1) EI_{30} index

Rainfall erosivity index is the product of the rainfall kinetic energy and the maximum intensity of 30 minutes duration. The mass curve showing the rainfall depth against time is recorded by this rain gauge and it can be used to find the 30 minutes maximum intensity of rainfall. The intensity which is identified from the mass curve may be in cm/hr or inches/hr. It has to converted into mm/hr. Individual storms are chosen for evaluating the EI_{30} values and these values are added for several storms in order to obtain the yearly, monthly or weekly values of erosivity.

EI_{30} index can be computed for individual storms and storm values can be added over periods of time to obtain weekly, monthly or yearly values of erosivity.

Kinetic energy (E) = 0.119 + 0.0873 log I (for I≤76 mm/h)

Kinetic energy (E) = 0.283 (for I > 76 mm/h)

I represent intensity

I_{30} = Maximum amount of rain which fell in 30-minute period and converted to mm/h

EI_{30} = Product of Kinetic Energy (E) and Intensity (I_{30})

Procedure for calculating erosivity index by EI_{30} method

1) Obtain the mass curve (cumulative rainfall vs. time) of the rainfall event from the rain gauge.

2) Prepare a table depicting the rainfall depth at regular time intervals from the mass curve.

3) Compute the rainfall intensity in mm/h or cm/h for each time interval.

4) Calculate the energy per unit rainfall depth using the equations provided by Wischmeier and Smith mentioned in the previous section.

5) The kinetic energy is to be multiplied with the rainfall depth that occurred in the time interval.

6) The total kinetic energy is then obtained by adding all the calculated kinetic energy.

7) Identify the maximum rainfall depth that occurred in any successive 30 minutes of the rainfall event and convert it into intensity (I_{30}).

8) Finally, the rainfall erosivity index (R) which is the product of total kinetic energy (E) and the 30-minute maximum intensity (I_{30}) is obtained.

$$R = E \times I_{30}$$

If unit of the kinetic energy is taken as MJ/ha and rainfall intensity is taken in mm/h, the unit of rainfall erosivity index is $\frac{MJ}{ha}\frac{mm}{h}$.

2) KE > 25 index

The studies related to erosivity have indicated the rainfall which has a low intensity does not significantly contribute to the erosion. Rainfall becomes erosive at a threshold value of its intensity. The experiments suggested that rainfall intensity which is lower than 25 mm/hr i.e. 1 inch/hr will not result in significant erosion. Therefore, only the intensities which are more than 25 mm/h are considered in the calculation of rainfall erosivity using the KE>25 index method. The procedure for

calculating rainfall erosivity using KE>25 method is similar to that of EI30 method except that the rainfall intensities of less than 25 mm/hr are not considered in the calculation of rainfall erosivity. The value of rainfall erosivity obtained by this method is lower than the erosivity calculated using EI_{30} method.

Conclusion

Both EI_{30} as well as KE>25 methods can be used successfully for estimation of rainfall erosivity. The computation of rainfall erosivity is important for estimating the soil loss using the universal soil loss equation. The seasonal variation and yearly variation are accounted by the rainfall erosivity factor which is included in the Universal Soil Loss Equation (USLE) as one of the six factors. The other five factors included in the USLE are soil erodibility, slop length, slope gradient, crop cover management and conservation practices.

Climate Resilient Rice Cultivation in Odisha

Dr. Devegowda S R

The global average surface temperature over the past 50 years has increased at nearly double the rate of the past 100 years. The precipitation pattern has also changed spatially and significantly increased precipitation has been observed in the eastern parts of North and South America, northern Europe, northern and central Asia. Drying has been observed in the Sahel, the Mediterranean, southern Africa, and parts of southern Asia. Heavy precipitation events (above the 95th percentile) have increased in many land regions since about 1950, even where the total precipitation amount has dropped (IPCC 2007). The warming trend in India over the past 100 years (1901 to 2007) was observed to be 0.51°C with accelerated warming of 0.21°C per every 10 years since 1970 (Devegowda *et al.*, 2019). Whereas increasing rainfall trend had observed during the period 1901–1950, while a significant decline in rainfall was detected after 1951 (Praveen *et al.*, 2020). The normal rainfall of the Odisha state is 1451.2 mm, about 75% to 80% of rainfall is received from June to September. Floods, droughts and cyclones occur almost every year varying intensity (Guhathakurta et al., 2020). Climate change has the potential to undermine Odisha's existing economic plan and exacerbate poverty. Climate change is expected to influence sectoral growth, particularly the poor's capacity to participate in agriculture and non-farm sector activities. Extreme climate-related disasters may result in the loss of lives, livelihoods, properties, and infrastructure. All of these factors might stifle the state's economic growth and render macroeconomic policies and pro-poor measures ineffective.

Climate Risks in Odisha

- High variability of rainfall, leaving people with two peak periods of food shortage
- Drought and dry spells at an interval of every two years in Western Odisha with a major drought every 5-6 years

- Flash floods during the rainy season
- Heat waves in summer
- Intense coastal flooding and cyclones

Climate loss in Agriculture of Odisha

Climate change impacts are more pronounced in the agriculture sector in the recent past. The government of India's economic survey (2018) estimated that the annual loss of US$ 9-10 billion was due to the adverse effects of climate change (Rao, Prasad, & Mohapatra, 2019). Rice covers about 69% of the cultivated area and is the major crop, covering about 63% of the total area under food grains (Das, 2012). Rice is highly susceptible to water stress during the reproductive stage, leading to a significant reduction in grain, the delayed rain is a matter of worry. As over 47% of the paddy sown in Odisha is on the upland, the September rains may not help much. The yield-loss magnitude would however depend on the stage of crop growth and duration of rains (Mohanty, 2021a). Western Odisha farmers suffer crop losses of about 30-40% percent and above due to moisture stress in the districts (Mohanty, 2021b). The heatwave also causes loss of up to 8% in Odisha.

Conclusion

Climate change affects adversely crop production in India, with every one-degree increase in temperature rice yield decrease by 8 percent. Odisha is predominantly cultivating rice there is a greater scope in the adoption of flood resilient as well as drought-resilient location-specific rice varieties like Swarna Sub-1, CR 1009 sub-1, etc. for flood and DRR dhan 42, 43 & 44, etc. for drought over local varieties Odisha has greater scope in the adoption of the climate-resilient technologies to minimize the crop loss due to adverse climatic condition.

Biochar-A tool for plant pathogen control in trend

Ms. Debanjana Debnath

Biochar is a carbon dense solid compound produce by the pyrolysis process and basically used as soil conditioner. Pyrolysis is a process where thermochemical conversion of biomass happens in an oxygen-limited condition. The word biochar came from the Greek word “bios” means life and “Char” mean charcoal. It is well popular for its active participation in soil biological process. In a comparison with the biomass burning, biochar production has certain advantages like less emission of carbon di oxide and higher stability of carbon content.

Application of biochar

Biochar has Multiple benefit like soil health improvement by increasing porosity of soil which is helpful for retaining water and water-soluble nutrient. Soil biologist Elaine Ingham(2015) mentioned biochar as good option for habitation by different microorganism. Biochar is also helpful for retaining moisture in this way which helps in proper root growth and strength. In a high pH soil biochar application is extraordinary beneficial to correct the pH. As a overall this wonder material has proved itself repeatedly for increasing soil health, total yield and productivity. (Tenic et al,2020) Biochar has other positive effect on environment by improving water quality, reducing the emission of harmful greenhouse gases from soil, reducing nutrient leaching and indirect effect by reducing irrigation and fertilizer application requirement.

Biochar for controlling plant pathogen

For the positive correlation with the microbial community residing in soil media, biohar help to increase the enzymatic activity in media that has also positive action on nutrient cycle, biochemical defense and pathogen suppression (Lehmann et al. 2011).*Ralstonia solanacearum*, an important soil pathogen causing diseases in solanaceous family has been reported to control with higher efficacy by the application of biochar.(Lu et al,2016,Zhang et al,2017) *Leveillula taurica ,Botrytis cinerea* (Elad et al.,2010), *Fusarium oxysporum f. sp. asparagi* ,*Fusarium proliferatum* (Elmer and Pignatello ,2011)118; *Rhizoctonia solani* (Jaiswal et al., 2014) *Phytophthora cinnamomi* (Zwart and Kim ,2012) has also been reported to be effectively controled by bichar application. This above-mentioned soil invaders and soil inhibitors are difficult to control by the application of soil fungicide whereas biochar showed extraordinary effect through direct and indirect way.

Mechanism of Plant pathogen control

The mechanisms by which biochar may act against plant pathogens are varied. Among them some of are listed below:-

1. They can improve soil physiochemical properties helpful for increasing the rhizosphere bacterial abundance, reduce pathogen motality and increasing the enzyme activity. (Lu et al.,2016,Zhang et al.,2017)

2. Induction of systemic resistance and increase the antagonist population like Pseudomonas. (Elad et al.,2010; Elmer and Pignatello ,2011)
3. Reduction of plants abiotic stress and production of more root exudates. (Zwart and Kim , 2012)

Disadvantages

Although it is known as magic compound for soil and plant itself but disadvantages like lower decomposition rate, high application rate and slower release rate has added some negative point in its list. Proper knowledge of application, benefit and their rate of application are also some points which are questioning its popularity among the farmers.

Conclusion

Biochar application has been shown to have beneficial as antipathogenic compound and a conditioner for soil health Multi directional mode of action is also a strong point in the favour of biochar application. In today's World where everyone is searching for some alternative for chemical fungicide and other, Biochar can effectively emerge as one of the option towards a sustainable agriculture.

Coping with third wave-nutritional and lifestyle aspects

Mrs. Chinmayee Pattnayak

With the wake of Covid pandemic people are more inclined towards the immunity and immunity building foods. During this period social distancing, personal hygiene and healthy foods are basic mantra of all. In all the three waves food is one which is coming under the major commodities. But the handling, packaging, preparing etc. involves the transmission related risks, the reason is any possible chances of contact by an infected person. Above all the body resistance to particular infection is in top most priority, because life does not stop, everyone has to move on and perform their daily-to-daily works, responsibilities and livelihoods. After maximum coverage in vaccination, next important step is to develop immunity in the body to cop up with the virus, other pathogens and the after effect of the covid management. But due to modernization, industrialization, unhealthy life style, faulty food practices, immunity is somewhere compromised.

According to "National Institute of Nutrition" food guidelines, now the slogan, which everybody should follow is "MY FOOD PLATE OF THE DAY". The plate should contain different types of food groups with the variety and diversity in it. Half portion of the plate should be comprised of vegetables, green leafy vegetables, fruits and root veggies followed by cereal, millets, pulses, milk and milk products then egg, fish, meat, nuts and oils of different types.

Nutritional Facts:

Immunity is an integrated system. It is not dependent on single nutrient; all the nutrients play their respective roles having interaction and inter relation with each other.

In micronutrients, vitamin A, D, E, K, Selenium, Zinc, Iron, Copper, in macronutrients amino acids, essential fatty acids (omega 3 fatty acids) are important for optimal immunity of the body.

So here are some of the nutrients and their functions mentioned below with a glance of respective sources and recipes-

SL. NO.	NUTRIENTS	FUNCTION	SOURCES	RECIPES
1.	Proteins	Responsible for body healing and recovery.	soya products, milk and milk products, pulses, legumes, unsalted dry nuts and seeds, lean meats, fish, sea foods, egg, poultry.	Sprouted salads, soups, milk shake, snacks, curry
2.	Omega three fatty acids	Enhance the function of immune cells.	Chia seeds, pumpkin seeds, walnut, watermelon seeds, sunflower seeds, fish like tuna, salmon, Rani fish etc.	Smoothies, chutney, curry, raw or lightly roasted, drinks
3.	Vitamin A	It protects skins, tissues of mouth, stomach, intestine, respiratory system	sweet potato, carrot, papaya, mango, apricot, spinach, milk and milk products.	Salad, juice, pickle, shake Cut fruits, jam, jelly, curry
4.	Vitamin D	The particular vitamin is having anti-microbial effect	Milk and milk products, fatty	Egg, fish preparations, milk shakes etc

			fish, egg, liver and sunlight.	
5.	Vitamin E	Acts as Antioxidant.	Garden cress seeds, almonds, pistachio, flax seeds, sunflower, safflower seeds.	Roasted, soaked seeds, smoothies, salad, drink, chutney
6.	Vitamin B6	Intestinal immuneregulation, reduces inflammation	soyabean, lentil, masoor dal, whole moong, Bael, drumstick leaves, fenugreek leaves, fresh ginger, garlic, methi seed, cumin, whole wheat flour, brown rice, jowar, barley, bajra, maize.	Dal, bhaji, curry Chutney, snacks
7.	Vitamin B9	Helps in antibody production and response to antigen	soya, rajmah, lentil, masoor, black chana, mango, papaya, spinach, fenugreek green, amaranth, beet root, peas, capsicum, drumstick, walnut, pista, ground nut, til, flax seeds	Dal, bhaji, curry
8.	Vitamin B12	Responsible for gut microbiota and T cell production(immunity)	Fish, egg, meat, poultry, milk and milk products.	Egg recipes poach, omelet, scrambled egg, shake,

				smoothies, curries
9.	Vitamin C	It stimulates antibody formation	Green leafy vegetables, citrous fruits	Soup, salad, cut fruits, juice
10.	Pre biotics	special type of fiber stimulates growth of gut microflora	Garlic, onion, banana, barley, oats, apple, flax seed, wheat bran.	Porridge, snacks, roasted seed, chutney
11.	Pro biotics	These are specific strains of live bacteria found in food.	Fermented milk and other products, yoghurt	Curd recipes like kadi, appam
12.	Zinc and Selenium	reduce oxidative stress, resisting viral infection	Whole grain, dal, black til, garden cress seed, watermelon, pumpkin seed, chia seed, tuna salmon	grilled fish, chutney, smoothies
13.	Magnesium	It boosts immunoglobulin.	Ragi, jowar, pulses, legumes, green leafy, almonds, cashew	Porridge, chilla, curry,
14.	Herbs, condiments and spices	Acts in antiviral and anti-microbial activity.	Ginger, tulsi, neem, lemon grass, turmeric, garlic, kalongi, jeera, coriander, cinnamon, black pepper, cloves, ajwain	Tea, chutney, decoctions, mouth freshener, chutney
15.	Hydration	The state maintains the mucous membrane of nose and respiratory tract,	-	Plain water, coconut water, nimbu panni, green tea, herbal

	helps in flushing toxins.	tea, soup, milk, butter milk, un sweetened and unsalted drink,

Dietary guidelines and lifestyle management to keep up with the Immunity:

- ✓ Choosing healthy, locally available foods, cereals, grains, fresh fruits and veggies because storage, processing, transportation these somewhere affect the loss of nutrients and bio availability of particular nutrients.
- ✓ There should be preference of traditional methods and recipes to preserve and concentrate the nutrients.
- ✓ Avoiding over and under eating with good habit of portion control in different food groups.
- ✓ Avoiding consumption of highly processed food, transfats, sugar to suppress undesirable free radical formations in the body.
- ✓ Ensuring the exposure to sun light for availing Vitamin D3 in the body.
- ✓ Moderate yoga, exercise will keep body fit, stress free by maintaining immunity in the body.
- ✓ Body hydration is important for proper physiological functioning, metabolisms and utilization of the nutrients in the body.
- ✓ Smoking and alcohol intake should also in control to avoid the hindrance in immunity.
- ✓ Taking adequate sleep
- ✓ Always be with your family and friends to keep up the happy hormones.
- ✓ Always go for right professional for medical and nutritional advice.

Conclusion:

So, in management practices of covid, emphasis on diet and lifestyle should be in utmost priority. Because this pandemic has not only drawn our attention towards enhancing immunity or body's resistance for a particular communicable disease, but also taught us to keep our body future ready for non-communicable, fatal, degenerative diseases.

Amanita mushroom: A fairy tale mushroom

Dr. Chinmayee Mohapatra

The genus Amanita consists of several hundred species of different mushrooms belonging to the family Amanitaceae (Order Agaricales, Kingdom Fungi). The chief external characteristics of amanitas typically consists white spores, a narrow ring on the stem situated slightly below the cap, a volva which generally tear as the cap expands, and a cup from which the stalk arises.

The destroying angels (*Amanita bisporigera, Amanita ocreata, A. verna,* and *A. virosa*) are the deadliest of all the species of mushrooms present. These mushrooms are generally found in deep forests during wet and damp periods in summer and autumn and have a large white fruiting body. Another species

of Amanita commonly known as "Death cap" (*Amanita phalloides*), are also poisonous, and aregenerally found in woods or their borders in summer or early autumn and have a green or brown cap.

The most common species of Amanita, The fly agaric, or fly amanita (*Amanita muscaria*), is a deadly poisonous mushroom generally found in pastures and fields in summer. *Amanita muscaria* is considered to be one of the most remarkable and beautiful mushrooms. These fungi are very attractive and they generally appear in groups and are very common in all kinds of woodlands. These mushrooms have hallucinogenic properties and was once used as a fly poison to kill the flies.

These mushrooms also have some mythological significance. In ancient mythology, Fly agaric was considered as the home of fairies and magical creatures and have a symbiotic relationship with the trees by helping them by transferring nutrients into their roots, but if they are accidentally consumed can cause high degree of hallucinations and mushroom poisoning, hence they are mostly considered as "Poisonous mushroom".

Amanita muscaria

These attractive and alluring mushrooms are named as "Fly Agaric" as it was a long back tradition of using these mushroom as an insecticide against flies. Some of the European countries crumbled up the caps of *Amanita muscaria* and placed them in saucers of milk to attract the house flies. When the flies drank the milk, containingibotenic acid which not only acts as an attractant for the flies but also poisons and kills them. As the flies drink the milk they become drowsy, collapse and die.

Identification of the fungus:

Fly agaric being very attractive to our eyes generally has a bright red cap with white spots and white gills and can grow upto 20cm across and 30cm tall and has an alluring smell.

Cap:

The cap of the fungus is red in color generally ranging from 10 to 20 cm diameter when they fully mature. Under fully developed conditions, the caps

usually have a broadly convex shape and usually contains white wrat like spots all over the cap.
When damaged, the flesh is found just below the skin of the cap is initially white but when exposed to air turns yellow.

Gills:
The gills are white, free and crowded which latter turn pale yellow towards the maturity of the fruiting bodies.

Stem:
The stems of the mushrooms are usually 10 to 25cm long and 1.5 to 2cm in diameter; white and ragged with a hanging white ring.
The swollen stem base retains the white remains of the sack-like volva, which eventually fragments into rings of scales around the base of mature specimens.

Mushroom poisoning:

In recent years, due to the hallucinogenic properties of the red fly agaric mushroom, their consumption has increased among young peoples. The toxin present in the mushroom are alkaloids: muscarine, ibotenic acid and muscimol. The symptoms of mushroom poisoning usually start 30 minutes to 2 hours after ingestion and the primary effects usually involve the central nervous system, and in severe poisoning, symptoms may manifest with coma and in rare cases lead to death. They symptoms begins as a state of confusion, dizziness, agitation, ataxia, visual and auditory perceptual changes, space distortion and a lack of awareness of time.

Oil palm cultivation- A boon for oil production in India

Mrs. Bidusi Tripathy

Oil palm is a perennial crop in India that produces oil. The tree produces both food and palm kernel oil. The golden palm gets its name from its great oil yield. It produces 4-5 t/ha of CPO and 0.40-0.50 t/ha of PKO from four to thirty years of age Plants. It may easily replace the country's imports of vegetable oil. It yields more per hectare than mustard, groundnut, and soybean. Palm oil is the world's biggest user and importer. Its palm oil consumption is predicted to treble by 2030, but growing imports would transmit its biodiversity concerns to the supplying nations. Oil palm is cultivated roughly 50,000 hectares area under irrigated condition in over 15 Indian states. This is also taken as rainfed crop. The Centrally Sponsored Integrated Scheme of Oilseeds, Pulses, Oil Palm, and Maize supported oil palm cultivation throughout the Tenth and Eleventh Plans (ISOPOM). The biggest oil palm producing states in India are Andhra Pradesh, Karnataka, and Andaman & Nicobar Islands. Without destroying forests, 28 lakh hectares, or approximately one-third of North East India's accessible land, may be utilized for palm oil cultivation. In recognition of the significance of oil palm farming, the DAC&FW initiated the Technology Mission on Oilseeds and Pulses (TMOP) in prospective states in 1991-92. Mini-Mission II (MM II) was started under the 12th Five Year Plan to expand the oil palm acreage and increase production. Arunachal Pradesh and Andhra Pradesh joined the NMOOP MM II on April 1, 2014. The Union Cabinet has authorized the National Mission on Edible Oils-Oil Palm (NMEO-OP) to support Atmanirbhar Bharat. This will help alleviate the country's edible oil shortage and minimize imports.

Advantages of Oil Palm Cultivation:

1. Farmers may intercrop oil palms during the pre-bearing season to augment revenue.

2. There is no chance of theft, and it generates jobs locally.

3.This crops gives constant monthly income and fair market value all the year.

4. High returns will help farmers' financial status.

5. Palm oil saves foreign currency by replacing imported edible oils.

Cultivation practices:

Varieties: India grows three types of oil palm. Dura is pure. The fruit features a thick endocarp (shell) and a thin mesocarp. 30% of the fruit is shell. Pisifera is a sterile cultivar produced for breeding (as a male parent). No endocarps, but thick mesocarps Tenera is a Dura X Pisifera cross. The mesocarp is thicker, and the endocarp is thinner. 10% of the fruit is the shell. The Dura and Tenera varieties are the most widely planted. Tenera variants are grown mainly in India.

Climate: The oil palm is a tropical plant. It grows well in a rainy tropical environment. It thrives at temperatures between 20 and 350°C. The yearly rainfall averages between 100 and 1000 mm, dropping

at least 100 mm each month. It can take 900 mm of rain. It may last two to three months in drought. The ideal environment is hot, humid, and without extended dry spells. It needs more solar hours. Rainfall and sunlight should be frequent. It thrives between 450 and 900 m MSL.

Soil: Oil palm grows well on a variety of soils. It prefers humus-rich, deep loamy soils. Forest soils with loam and clay concentrations are suitable. No lateritic sand or pure clayey soils. Water-saturated soils are inappropriate. Oil palm can tolerate salt up to 5%. These trees need a metre of soil depth. Farmers should avoid very salty, alkaline, coastal sandy, or water-logged soils.

Land preparation: The commencement of the rainy season is when land preparation starts. The soil should be weed-free and ploughed to produce a beautiful tilth. To improve the soil organic matter content, more organic matter should be provided in decomposed crop wastes and FYM. June through December is the optimal period to cultivate oil palm.

Digging and filling of pits: Pits with dimensions of 60x60x60 cm and a spacing of 9 m are dugout during the summer season in a triangular planting system. The pit was filled with topsoil, mixed with manures and fertilizers, and watered to settle.

Propagation and Planting: Oil palm is largely propagated by seeds, removed from fruits using a depericarper. Seeds must be pre-heated for 75 days at 40°C due to their excessive dormancy. The seeds should then be immersed in flowing water for 4 to 5 days and cool. Seeds germinate in 10 to 12 days, and once germinated, sprouts should be transferred to polybags. The seedling and all of the dirt and root system are taken from the polybag. It is feasible to plant during the wet season. The seedling is placed in the polybag's center. The collar section of the plant should not be buried in the soil. It's critical to make sure the collar is level with the ground. There is no deep planting. After planting, it is watered, seedlings are sheltered, and mulching in basins is possible. Manure and fertilizer may be added once the seedling has established itself.

Nutrient application: Because the plant is perennial, it needs frequent fertilizing to maintain its bearing capacity. The kind and grade of fertiliser combination needed is determined by the type of soil in which the palms are planted. Depending on the age of the plant and the kind of soil, FYM at a rate of 25-10 kg/palm should be employed. Between May and June, and September and October, fertiliser should be applied in two equal split dosages. Fertilizer should be forked into the soil in a 2m circle around the base of the palm, or a broadband/trench around the palm under the spread of the leaves may be formed. The treatment is carried out in trenches, which are subsequently covered with dirt and watered promptly. The application rate is shown in the table below.

Age of the plant(yr)	N	P2O5	K2O	Mg	B
	Urea(g/palm/yr)	SSP (g/palm/yr)	MOP (g/palm/yr)	MgSO4 (g/palm/yr)	Borax (g/palm/yr)
1st	870	1250	670	125	25
2nd	1750	2500	1350	250	50
3rdyr onwards	2600	3750	2000	500	100

Irrigation in Oil Palm Cultivation: Oil palm requires appropriate irrigation since it grows quicker and provides a higher yield and biomass. It is not recommended that this crop be grown in regions where enough irrigation is unavailable. Each day, each developing plant needs around 200 liters of water. Older plants demand a bit more water during the hot summer months. Drip irrigation or a micro-sprinkler system may be employed on undulated terrain land if water is a severe limitation. If drip watering is used, each palm will need four dippers at the base. The 160-litre demand per day/palm may be met by four dippers ejecting 32 liters of water each day for five hours. On each side of the palm, micro-sprinklers (180° or 360°) may be put. If you're going to utilise these irrigation systems, be sure to check the drippers or sprinklers regularly to make sure they're working properly. Mulching is an effective method of retaining moisture at the root level. The Basin Method of Irrigation may also be employed when a surplus of irrigation water is available. In this situation, irrigation canals should be created to link the various palms via sub-channel. Water should be provided every 4 to 5 days in most cases. In heavy soils, irrigation intervals would be longer, whereas in lighter soils, frequent irrigation with lesser water quality would be supplied.

Weeding: Weeding can be done manually or chemically regularly in oil palm cultivation. Competition between young developing plants and unwanted plants must be avoided. The basins were kept weed-free. The basins or rings around the palm should be weeded out in young gardens. The entire land is ploughed twice a year in the case of bearing gardens. Herbicides should not be used to control weeds because they are toxic to plants. Chemical weeding, on the other hand, can only be done with approved herbicides. Glyphosate at 700-750 mL/ha/year or 17 mL/basin should be applied for effective weed control.

Pests and Diseases:The following pests and diseases are commonly found in oil palm cultivation: *Pestalotiopsis* leaf spot, *Ganoderma* bud rot, Bacterial bud rot, Oil palm wilt, Rhinoceros beetle, and Mealybugs are all examples of pests. Appropriate control measures for these pests and diseases should be implemented by contacting the nearest agriculture department.

Other intercultural operations:

• Ablation and Flowering-Oil palm trees blossom 14 to 18 months after the crop is planted. Male and female flowers are produced independently on the same palm tree. In the early phases of an oil palm plantation, ablation eliminates male and female blooms. Ablation is required to develop stem girth, vigour, and a robust root system in oil palm farming. Flowers on the oil palm tree should be removed manually or with an approved instrument as soon as inflorescences develop. This procedure might take 2 to 3 years, depending on the tree's vitality and development.

• Pollination—The oil palm is a heavily cross-pollinated crop that benefits from insect and wind pollination. Wind pollination, on the other hand, is inadequate, and insects like "Elaeidobiuskamerunicus" aid in fruit set and pollination. This weevil should be released two and a half years after planting, and three years is advised in the event of a low vigour and girth plantation.

• Leaf trimming is done during the summer when the weather is dry. Pruning is used to get rid of dead, dry, and diseased leaves. It's necessary to get rid of the male inflorescences. It is used to prevent shadow from overloading leaves and to ensure that crown bunches ripen uniformly. It also prevents harvesting obstruction.

• Mulching—Mulching keeps the soil wet and weeds at bay. Dried leaves, coconut husk, male flowers, and empty bunches are all good mulching materials.

• Intercropping—Because oil palms are perennial plants with wide spacing, the interspace may be employed to intercrop over the first three years. After that, shade-loving crops may be planted. Intercrops should be carefully selected to avoid competing for water, light, and nutrients with oil palms. The ideal intercrops include any vegetables, flowers, chilies, banana, tobacco, ginger, turmeric, and pineapple during the first three years. As part of the inter-crop procedure, oil palm fronds should not be clipped or tied near to the stem. Plowing at the palm's base should be avoided since it risks cutting the roots. For best production, the greatest amount of green leaves should be kept.

Cropping: Fruit bunch production begins at the age of 3-6 years, but peak bearing occurs at the age of 8 years. It will continue to bear for at least 40 years. The fertile period can last up to 60 years. The palm can live for up to 100 years.

Harvesting: Fruits harvested after they have reached full ripeness. Harvesting will occur when the fruit colour changes from red to orange and the fruits drop from the bunch. Within 24 hours of harvesting, the bunch is transferred for processing.

Yield: Fresh fruit bunches can be obtained at an average rate of 20-25 t/ha. The oil yield is between 4-6 tonnes. The oil palm produces two different vegetable/edible oils. The oil yield from the fruit's mesocarp is 20%, and the total 46 percent oil it yields.

Double haploid production technique for the crop improvement

Dr. Anupama Singh

Based on the 2015 Revision of World Population Prospects, the world population will reach 9.7 billion in 2050. Feeding the growing population in 2050 is estimated to require increasing overall food production by 70% (http:// www.fao.org/wsfs/forum2050/wsfs-forum/en/). For that, there is need of continued improvement in the performance of crop to increase the yield of major food crops, maize, rice and wheat over the time. But, with the challenges of limited natural resources, land and water, and the global climate change, it is very difficult to achieve this specifically with the conventional plant breeding techniques which take about 10-12 years for the development of the new cultivar. But with the introduction of marker technologies and other innovative breeding approaches, it can be possible to shorten the breeding cycle for the cultivar development and to improve the genetic gain per unit time.

Doubled haploid (DH) technology is one of the example of such technology which is a major breakthrough to speed up cultivar development. By using doubled haploids (DHs), homozygous and homogeneous lines can be produced in two rather than five or more generations. Other advantages include reduced costs to produce cultivars, more precise evaluation of phenotypic traits, effective elimination of undesirable genes, and trait fixation in haploids using marker-assisted selection. As the

success of breeding programs depends on the genetic gain per unit time, the use of DH technology has become routine in the breeding of the major crop species.

The DH technology includes two major steps-

1) Production of haploid plants

2) Genome doubling

1) Production of haploid plants: Three approaches are generally used to develop the haploid plants for the DH production; (a) microspore and anther culture, (b) wide hybridization between different species to induce chromosome elimination, and (c) the use of particular haploid inducer genes within species for the development of haploid embryo.

2) Genome doubling: After the successful development of the haploid plants, there is need to double the genome/chromosome to isolate the fertile double haploid plants for the cultivar development. This can be achieved by two ways-

a) Spontaneous genome doubling: Spontaneous or natural genome doubling has been reported in several species. The frequency of spontaneous genome doubling is 10%–40% in Brassica napus, 70%–90% in barley, 50%–60% in rice, 50%–90% in rye and 25%–70% in bread wheat reported by different scientists.

b) Artificial genome doubling: Artificial genome doubling is the most popular method applied for

doubling the genomes in large-scale DH line production. Colchicine, a chemical, has been widely used and is the most effective genome doubling agent. Colchicine duplicates the genomes by binding to tubulins to inhibit microtubule polymerization and further preventing the spindle fibre formation.

Applications of double haploids in plant breeding and genetic analysis

1) Development of Cytoplasmic Male Sterile (CMS) line - This method can be used to develop any combination of cytoplasmic and nuclear genomes by transferring the male nuclear genome into a heterologous cytoplasm rapidly and conveniently. This facilitates the production of new cytoplasmic male sterile (CMS) lines for F_1 hybrid seed production.

2) Reverse breeding – DH technology also utilized in the reverse breeding technology; a novel plant breeding technology, which can directly generate parental inbred lines from any hybrid. There are three steps required for reverse breeding: (i) inhibition of meiotic crossover in F_1 plants to produce gametes containing combinations of non-recombinant parental chromosomes, (ii) generation of DH lines via in vitro unfertilized ovule or anther culture and (iii) regeneration of the original hybrid through crossing DH lines with complementary sets of parental chromosomes. So, DH production is one of the major steps of this innovative technology of reverse breeding.

3) Gene pyramiding from biparental crosses – Application of doubled haploids significantly reduces the population size required to find desirable genotypes after introgression of several genes through marker assisted backcross breeding.

4) Accelerate plant breeding by MAS and GS - The availability of cheap and abundant molecular markers allows breeders to apply MAS and genomic selection (GS) in crop improvement. The combination of MAS and DHs offers new opportunities for increasing genetic gain and shortens the time required to cultivar breeding. Similarly, for genomic selection also the DH population give superior results over F_2 derived population.

Conclusion - Doubled haploid technology has been successfully used in crop improvement and genetic analysis. Integrating DH technology with MAS and GS offers new insights to minimize breeding cycles and maximize genetic gains. DH technology is also useful in reverse breeding, CMS line production, gene stacking and a variety of other applications.

Although, the DH technology is utilized for various application but the challenges are still present in use of this technology, specifically to understand the mechanisms of haploid induction by various means which is still not clear in different crops.

Concept of Rural Development

Dr. Anupam Dakua

Rural Development (RDD) is nothing but the complete transformation of Rural life. It not only includes Agriculture or Farming but also includes all aspects of rural life. Since Independence, the emphasis has been given to Rural Development. It is a strategy to improve the social and economic life of the rural poor of our country. In general, it can be said that, RD is aiming to improve the standard of living of rural people. It is a dynamic process of development of the rural people through various programs and implementation of different projects to make the target audience self-reliant. This Dynamic process involves numerous organizations and agencies including the co-operation and active participation of the rural people.

Objectives of Rural Development

Every program or process is having some pre decided objectives to achieve the desired goal. Likewise, RD is also having some major objectives which have been given below: -

- To achieve enhanced Production and Productivity.
- To bring about a socio-economic equity among all, i.e., minimize the gap between the rich and poor.
- To bring about equilibrium in social and economic aspect of rural life.
- To improve the ecological environment of the target people.
- To gain broad based community participation in the process of development.
- To provide required goods and services to the needy.
- To create additional employment opportunities in rural or remote areas.
- To make the rural people independent and self-reliant.

Constraints/Drawbacks of Rural Development

Despite the constant effort of every organization, Government and the target audience themselves, there are some constraints or barriers in Rural development process for which sometimes the achievement of target is not fulfilled. Some of the major constraints has stated as follows: -

- Most of the rural people are illiterate and are not aware of different developmental programs.
- Low Adaptive behaviour is another factor which hinders the use of latest technology.
- Inadequate communication channel is one of the major barriers which creates problems in reaching out of the goods and services to the target people.
- Due to Limitation of Funds and trained personnel, the programs are not getting success.
- Shortage of Skilled Field Workers is another barrier for which production from farming and adoption of innovative technologies are less.
- People usually don't want to take the risk unless until they see the result.
- Lack of leadership in rural areas for which people are not getting motivation and encouragement to do something or to try something new.
- Lack of coordination between various developmental institutions.
- The programs are often poor quality so their rate of implementation is also low.
- Many times, the field staffs and the grass root level labours are over burden for which they are unable to perform in a desired way.
- There is a weak linkage between research and extension department.
- Most of the times programs don't reach out to the target people.
- Overlapping or Intermittent programs creates confusion among the rural people.
- Lack of proper supervision, monitoring, evaluation strategies of the implementing organizations or agencies which leads to failure of the programs.

Conclusion

Development of the Rural poor or the Farmers is utmost important because they are the cultivators or the food providers for all. Rural Development is not a short-term plan or program and it's not the duty of a single individual or community rather it is a coordinating and integrating process which needs the support of every individual, organizations or agencies and government. Every Program needs a blue print or layout before carrying out the program, so in case of RD also, a pre structured blue print is required in which every aspect (Identification of the problem, analysis the real rural situation, determining the objective according to the need and goal, development of plan of work and calendar of operation, plan according to the designed plan, evaluation and Reconsideration) would be given utmost importance to mitigate the chances of failure.

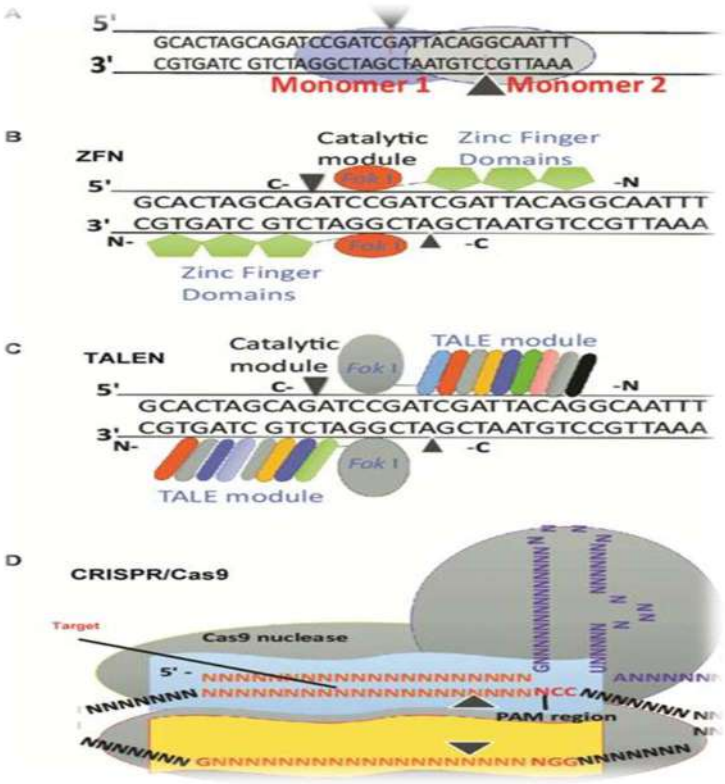
There's no life without food. Different organisms have their own diverse food habits and preferences. Farmers are the one who feed the mankind. But the global population rises at a rapid rate, creating a challenge for the farming community to produce more food. Green revolution was initiated by Norman Ernest Borlaug to mitigate this issue. This revolution started with a purpose to produce bumper yield but the darker side is being realized in the long run. Obviously, there were merits viz., increased productivity and adoption of advanced technologies. Many new practices were adopted such as development and use of semi dwarf varieties, imprudent use of agrochemicals and farm mechanization. This led to monoculture of nitrogen responsive high yielding varieties and decline in use of landraces as well as farm yard manure. In the crop pathology context, new pathogens and diseases emerged. Even new diverse forms of the pathogens came into existence. The changing crop scenario with time forced the minor diseases come to limelight. The impediment to the fitness of pathogens compelled changes at their genetic level. The pathogenic forms varied temporally and spatially. There are also differences in these forms with respect to varieties, environmental conditions and cultural practices. Variation in the same pathogen causing a particular disease leads to shift in the level of severity of symptoms produced. This leads todifficulty in formulating a concrete management strategy. Combatting the losses due to these pathogens requires a critical analysis of the genetic divergence among them and the exact point of change in their genetic makeup. Let us consider a classic example of rice and bacterial blight disease. Introduction of dwarf rice variety Taichung Native 1 led to sudden appearance of the disease. The pathogen is a bacterium with a number of genetic forms called races or pathotypes. These races are able to break the resistance conferred by different genes present singly or combination in several varieties. A race becomes predominant in locations with maximum coverage of a single variety. Several practices are used to curb the losses due to this disease but deployment of resistance is the most efficient of all. But still, identification of the race involved and searching for the resistance source is time consuming and cumbersome. This requires a thorough and continuous screening for race identity and varietal disease resistance. However, a modern and scientific technology with judicious intervention can solve the problem.

An Overview on Genome-editing Tools in Plants

Dr. Mahipal Singh Kesawat

Global warming is becoming a serious warning to food supply owing changes of climate, which affect plant development, eventually yield. The demand for food, vegetables, fruits, meat and other animal products have also been rising sharply. We need to produce more food, fruits, vegetable and meat to feed increasing world population. This is a main challenge for plant biologists to protect the crops from adverse environmental conditions and enhance the agriculture production. Genetically engineered crops have the potential to secure global food security and sustainable agriculture. The introduction of recombinant DNA (rDNA) technology accomplished numerous achievement. Recent advent in the molecular biology have allowed scientist to develop numerous methods of operation

DNA and RNA via formation of different vectors and their mobilization into the plant cell. Genome editing (GE) is a kind of technique in which DNA is modified, replaced, inserted as well as deleted in the genome of any organism. GE is evolving technology that brings revolution in the field of molecular biology. Targeted editing of genomes facilitate to decipher a variety of objectives such as improve quality, productivity and develop the biotic and abiotic stress tolerant crops. Further, it will also permit investigating the fundamental questions of biological sciences. Several genome editing tools were developed in the last decade such as meganucleases, zinc finger nucleases, CRISPR/Cas9 and transcription activator-like effector nucleases (Figure 1). Targeted gene alterations start from the creation of nuclease mediated double-stranded DNA breaks that led to the precise recombination of DNA in plant cells. Nuclease mediated DNA double-stranded breaks could fixed by different mechanisms including homologous and non-homologous recombination resultant in targeted integration or disruption of gene (Figure 1). Therefore, these techniques are efficient and reliable to improve the quality and productivity to feed ever-growing world population.



Different genome editing tools. **(A).** Meganucleases **(B).** ZFNs **(C).** TALENs **(D).** CRISPR/Cas9.

Philosophy of 'Publish or Perish': Rise of Predatory Journals and Academic crisis

Dr. Prajjal Dey

Addressing an issue or problem using scientific approaches requires critical analysis of the issue or problem at hand which defines the term "Research". The purpose of research is to find answers to topics that are on the mind of a researcher and that he or she wants to investigate. The findings of such a study are published in academic journals to be shared with a broader audience and to provide the authors a sense of accomplishment for their part in furthering scientific understanding. Publishing papers appears to be providing feedback to the researcher of how much impact the particular topic has created interest among the scientific community based on the citations received and criteria such as h-index or i-10 index. Research publishing is a must since academic authorities use research papers to analyze and measure a person's creative abilities. It has increased the pressure on academician to publish articles in order to advance their careers, or in other words the precept of "Publish or Perish". In terms of also obtaining a Ph.D. degree, a set minimum number of research publications is a typical prerequisite for receiving a PhD degree across countries. For instance, current University Grants Commission (UGC) requirements demand that a research researcher have at least two publications in a recognised magazine (i.e., one that has an ISSN number) prior to submitting a PhD thesis.Conversely, these well-intentioned restrictions have often been counterproductive since their execution has emphasized quantity before quality.This situation, in which quantity outweighs quality, has been used by a number of unscrupulous publishers in order to establish new 'online open-access' journals.With increased financing for research and an increase in the number of researchers worldwide, many articles are being submitted for publication. It has encouraged commercial entities to enter the arena, where they have assumed control, while traditional academy, society, and university publications have either taken a back seat or voluntarily or involuntarily joined the commercial publishing campaign.The well- operated commercial game of demand and supply has driven journal prices up to the point that individuals and libraries cannot afford them. The 'open-access' model of publishing, in which the author pays the publisher rather than the readers, has gained widespread acceptance as a novel and well-publicized approach.The current structure of costly journal subscription rates and excessive open access/article processing charges ensures that the commercial publishing business is perpetually in a 'heads I win, tails you lose' situation.When financing is enough or the researcher is ready to bear the cost of "Article Processing Charges," the researcher can still publish in reputable journals. But, what happens when the researcher is unable to pay hefty processing fees or is unaware of the "Scopus Index" or "Thomson Reuters Index"? That's where "Predatory Journals" creeps in the picture. Predatory Journals arereferred to journals that lack peer-review and are exclusively concerned with earning from their gullible readers. Their editors and/or editorial boards have little or no established academic reputation. Publishers and administrators profit handsomely while their victim claims academic success scores that have no academic worth in fact. While few authors engage in such publications and conferences on intent, many others, particularly young and inexperienced scientists, are unaware of their predatory aspect.Due to the growing habit of 'citing as you write,' articles of dubious quality are also mentioned in higher-quality journals, so gaining 'legitimacy.' This is academic pollution at its worst.

Conclusion: Though I don't have an answer to the current situation however, at an individual level, the researcher (with enough scientific passion) must scrutinize properly about the journals before submitting articles. Furthermore, our regulatory bodies, such as the UGC and ICAR, must recognize the detrimental consequences of apparently well-intentioned policies that are enacted without adequate quality assurance.

Importance of Risk Management in Agriculture

Dr. R.S. Bhawar

India is an agrarian nation where more than 58 per cent of the population depends on agriculture. Agriculture is a risky enterprise as it is closely associated with different kinds of risk such as climatic, environmental, economic, institutional, personal etc. Majority of this kind of risks are common to secondary and tertiary sector as well but some are very specific to primary sector only. Presence this kind of risk in agriculture mainly effect on planning, production, post-harvest management and marketing of agricultural commodities. This scenario ultimately leads to bring down the overall efficiency in agricultural production system. Further it also leads to fall in the income of farming activities and act as obstacles for socio-economic development of farm families. Hence, it is need of hours to identify and understand the effect of risks in farming system and formulating the strategies to mitigate the risks by adopting suitable techniques.

What is risk and uncertainty

Risk is a particular situation where decision maker has knowledge about all possible outcome for a given management along with their probability. In other word risk is outcomes which could be measurable quantitatively. And risk can be insured. Uncertainty is a situation where decision maker has no idea about future events and is not possible to measure the parameters of probability distribution in empirical manner. And it is not possible to insure the uncertainty.

Importance risk management

Effective management of different kinds of risk in agriculture is a key for improving the productivity and profitability of farm enterprises. In recent time risk management in agriculture is getting major focus of researchers, decision makers and policy makers as risk in farming is main reason for low level of farm income and farm productivity. It was also established fact that degree of risk is always higher in the case of high return enterprises. Therefore, farmers must be equipped to manage the risk in order to realized higher net income from farming by managing the risk in scientific mode. And it is necessary to know the source and degree of risk associated with the different farm activities as it helps in developing and strengthening the risk mitigating strategies in agriculture. Farming is vulnerable different kind of risk such as drought, heavy rainfall, seasonal and regional fluctuations of market price, credit facilities, technology etc. The heterogeneity in the genesis risks in farming requires a variety of instruments to protect the farmers from such risks.

Tools and techniques for reducing risk

Different tools and techniques used to reduce the risk are follows.

1) **Through enterprises diversification:** Managing the more than one activity at same time on farm may minimize the income variability. Example: crop and dairy farming
2) **Selection of suitable enterprises**: Farmers can reduce the risk by selecting the suitable enterprises based on available resources with low yield variability
3) **Insurance policy:** Farmer can minimize his large losses under unavoidable risky situation by availing crop and livestock insurance policy
4) **Contract farming:** Farmers may get quality input and input services and assured price for his farm products.
5) **Warehousing:** By availing the warehousing facilities farmers to overcome the glut in the market. It helps him to spreading sales to manage intra-year and itra-seasonal price variation.
6) **Minimum support price:** Under the MSP government will purchase the notified commodity at pre-announced price through FCI to protect the farmers against fall in price beyond certain level.

Conclusion

Farming is a risky enterprise& often prone to uncertainty situation like spread of diseases, changing the weather, fluctuation in prices, etc. Still majority of farm family are in subsistence nature of farming because of low level of income from farm activities. Risk is considered as a leading cause of low level of investment and income generation in agriculture, Therefore, mitigation and management of risk in agriculture is one of the key concerns. The diversities in the genesis of risks require a different type of tools and techniques for protecting the farmers against such risks. Farmers need to understand nature of risk and scientific risk management strategies for efficient and effective management of risk in farming.

The past of Kolar Gold Fields and scope of gold phyto-mining

Dr. Rachna Chandra

Kolar Gold Fields (KGF) at Kolar district in Karnataka, a known gold hub of India, were once considered world's second deepest gold mine next to AngloGold Ashanti's Mponeng gold mine of Johannesburg in South Africa. The depletion of high-grade ore reserve and increased production costs led to its preclosure during 2001. The mechanised mining for 120 years has left behind 33 million tonnes of mine tailings which still contain nearly 0.72 g/t of gold. Phytomining is thus foreseen as a sustainable solution for the extraction of remaining 24 tonnes of gold in these waste tailings.

The history of gold exploration from KGF links the pre-historical with the modern era. While the rediscovery of KGF after traditional exploration was done during 1820s by Lt. Nicholas, the intensity

of ancient working reflected scant economic returns. However, during 1870s-1880s gold mining boomed in south India and in 1874 'Munday and Linden' set up Oorgaum Gold Mining Company on Ooregum block of KGF. The selected vein just below the ancient mining site gave promising result of over 160 g/t initially and produced 26 tonne of gold with an average of 80 g/t. Subsequently, several companies were set up for gold exploration at KGF. The KGF were systematically exploited by John Taylor & Sons during 1880 at Mysore mine and were handed over to Bharat Gold Mines Ltd. (BGML) during 1972. During operation, BGML produced 800 tonne of gold per 51 million tonne of gold bearing rock. During the mechanised initiation of gold exploration at KGF, all the heavy machineries were brought from west to Arabian sea coast in Goa (per Comm.). About 400 - 500 elephants were engaged to bring these machineries to the site covering 600 km. The first hydroelectric project in South India was built in 1902 to provide electricity to KGF. Later the first Indian railway line was laid from Madras to KGF.

During 1881-1890 the production of gold in KGF was about 47 g/t (Willies, 1991). However, during 1991-1999, the mines returned only 3.0 g/t of gold ore (Chandra *et al*., 2014). Thus, the mines came to a preclosure during 2001 due to subsequent low-quality ore which required deeper extraction protocols. Thus, it increased the mineral excavation cost leading to BGML being declared as a sick company. Since then attempts have been made to revive these mines, with no success.

Ever since the production of gold started systematically, the mine wastes is put in huge piles at different locations of the mine lease area contributing to around 33 million tonne of waste tailings. These tailings/dumps are estimated to contain 0.72 g/t gold and thus are a source for around 24 tonne of gold (Subraman, 2006). Recovery of residual gold from mill tailings is commercially not feasible as it requires higher investments. Conventional mining practices involve drilling, blasting, excavation, crushing, beneficiation, and degrade environmental quality. Thus, sustainable mining is the need of the hour to achieve economic benefit while keeping the environment clean. Uptake of minerals and nutrients from the soil is a natural process for growth and survival of plant and this behaviour of plants is applied to extract metals from substratum. Phytomining is a technique where 'valuable metals' are recovered *via* cropping for monetary returns (Anderson *et al*., 1999a). This is an eco-friendly, sustainable and economically viable technique for extraction of precious metals from ore body and may be achieved naturally or induced chemically. Natural hyperaccumulation mainly depends upon the bioavailability of the specific metal in the soil and driving force of plant to take up the metal. On the contrary, induced hyperaccumulation is achieved by adding suitable chelating agent to the soil-plant environment, where metals become bioavailable and plant forces increase to take up high concentrations of metal from soil.

The technological use of plants to extract commercial levels of gold from soil was first described by Anderson *et al.* (1998). Depending upon the gold concentration in the soil and the effectiveness of the chemical, various chelates/lixiviants may be used to enhance accumulation. Nevertheless, metal chelators are known for their long residence time and thus may pose harm to the environment. Chelates *viz*., cyanide, thiocyanate and thiosulphate are also known to occur naturally and degrade rapidly in an aerobic biological environment (Anderson, 2005).

The geochemistry of the ore substrate or tailing strongly dictates the concentration of gold in the soil and the choice of solubilizing agent to be applied in auriferous soil (Sheoran *et al*., 2013). The mill tailings at KGF also contain significant amount of other elements such as iron, aluminium, calcium, magnesium and >50% silica (Subraman *et al*., 2001). Thus, auriferous mill tailings at KGF can be a source for better growth of gold hyperaccumulaters. While gold is relatively immobile, it may be solubilised from minerals and soils using cyanogenic plants, as cyanogenic plants are known to produce free cyanide by hydrolysis of cyanogenic glycosides within their tissue and leaf litter decomposition which solubilize gold in the soil (Lungwitz, 1900). The application of these kinds of hyperaccumulator plants and use of environment friendly chemicals for induced hyperaccumulation may be a sustainable and eco-friendly approach for gold exploration at KGF.

The above contents are a prelude to the research work being undertaken by the author on chelate assisted metal phytoremediation funded by the Department of Science and Technology (DST), New Delhi. A definite answer in this regard will be given after the trial experiments are completed and statistically analysed.

PCOS (Polycystic Ovarian Syndrome)

Ms. Rashmi Misra

PCOS is a disorder of Hormonal Imbalance (excess Male Androgen levels) which leads to infrequent, irregular or prolonged menstrual periods and other complications. It is a Hormonal disorder in which Normal Ovaries get enlarged with multiple cysts present on the outer edge. It is a multifactorial disease associated with several factors like (Insulin resistance, Obesity, Excessive toxic accumulation in body, low immunity, Inadequate dietary habit etc). PCOS is often associated with Obesity, Insulin resistance, cardiovascular diseases etc. The estimated prevalence in India ranged from ***3.7 to 22.5%***. It affects ***4%–20%***of women of reproductive age worldwide. Infertility, Diabetes Miscarriage or premature birth, fatty infiltration of liver, Abnormal cholesterol or triglyceride levels, Insomnia, Depression, Unusual uterine bleeding, endometrial cancer are some of the complications of PCOS.PCOS can be controlled and maintained by following Healthy Diet, Physical Exercises (Yoga, Pranayam), Medication and Nutrition Supplementation.

Symptoms of PCOS

The following symptoms are seen in a woman who is suffering from PCOS;

- Weight Gain:
- Severe Hairfall
- Acne
- Excess Facial Hair Growth
- Infertility
- Irregular Periods

Complications of PCOS

The following complications generally observed in a woman who is suffering from PCOS;

- Abnormal Cholesterol Level in Blood
- Cardiovascular Problems
- Diabetes
- Insulin Resistance
- Obesity
- Thyroid

Dietary guidelines for PCOS

Though PCOS is a very complicated disorder but one can control this and maintain a healthy lifestyle by following some of the dietary guidelines given below.

- The diet should contain high-fiber complex carbohydrates, Proteins having High Biological value, Neutraceuticals like fruits and green leavy vegetables, Probiotics and Prebiotics etc.
- One should avoid the diet rich in transfat, saturated fatty acids, Simple Carbohydrate and Empty calorie foods (Chocolates, Carbonated drinks, bakery products, sweets) etc.
- Dietary supplements can be included as Complementary to the Diet.

Conclusion

The estimated prevalence rate of PCOS in India ranging from 3.7-22.5%. It affects almost 4-20% women Globally. It is a multifactorial disease leading to many complications. Though it is not completely curable but one can control its severity by followinghealthy balanced diet and regular exercise. Keeping in View of the threatening condition arising by PCOS Globally,Different Awareness Programmes and Public Campaign should be organized by HWCs (Health and Wellness Centers), local, state and Central Govt. to aware the public about PCOS and its prevention measures.

It is a simple way to estimate Nitrogen content in leaves and was developed first time in japan. The intensity of green colour in rice leaves is compared with the bands of LCC and is calibrated to estimate leaf N content.

Guidelines for Using LCC:

- LCC is kept approx. 1cm above the middle part of the upper most fully expanded leaf and the colour band is compared with the leaf colour.
- No destruction or detachment of leaves should be there.
- 8-10 am is the appropriate time to take reading and if taken earlier than that there will be hindrance by dew drops. Leaf should be shielded by our body while taking reading for avoiding reflection effect.
- A particular person at a particular time should take the reading.
- Randomly ten leaves are choosen from each plot and average reading of all the plots are taken starting from 14 DAT for transplanted rice or 21 DAS for direct seeded rice once in a week till first flowering.

Interpretation of LCC Values:

- LCC value varies from 3 to 5 for Nitrogen top dressing. If reading of more than 5 leaves fall below the critical value, then top dressing of 30-45 kg and 20-30 kg of N per ha is need to be done during dry season and wet season respectively.

Conclusion

For using LCC Only colour matching between bands and sample leaf is required hence a comparatively easy to be used by the farmers and also no laboratory analysis needed. Still, it is not a reliable one as the reading values varies from person to person and to know the accuracy of LCC, it is needed to be compared and correlated with the readings of chlorophyll meter. P or K deficiencies may cause darker leaf colour which leads to errors in LCC readings and the values get influenced by diurnal variations of the day, varieties and seasons as well.

Biological Nitrogen Fixation

Dr. Rini Labanya

Biological nitrogen fixation (BNF) is defined as reduction of molecular form of nitrogen (dinitrogen, N_2) up to the level of ammonia by variety of prokaryotes of domains Bacteria and Archaea. The bacteria or archaea that can use dinitrogen as sole source of nitrogen for their growth are called

diazotrophs ('diazo' denotes dinitrogen). Diazotrophs possess an enzyme known as nitrogenase. Diazotrophs are distributed globally including oceans.

Significance of biological nitrogen fixation

BNF is next to photosynthesis in importance to mankind and natural ecosystems, particularly, nitrogen impoverished ecosystems. The nif genes (genes involved in nitrogenase synthesis) are considered to have evolved under the pressure of expanding life on the Earth because combined nitrogen was limited at that time. Even at present nitrogen is often limiting the productivity of plants and microorganisms. All forms life on the earth requires nitrogen as an essential nutrient. Most of the agricultural mineral soils around the world are deficient in plant available form of nitrogen whereas, nitrogen in plant is a major nutrient and is required in sizable amount. Like photosynthesis, in the process of BNF molecular nitrogen (N_2 gas) is brought back from atmosphere and converted in to plant usable form. Ironically huge amount of N (4x109 tons) is estimated to be stored on this planet, yet plants cannot use it for their growth. Plants can use reactive form of nitrogen whereas most of the nitrogen found in atmosphere is in inert gaseous form. Atmospheric air contains about 79% N_2 gas which is non-reactive. To make this gaseous nitrogen reactive and plant usable, its triple bond ($N \equiv N$) needs to be broken which requires energy. In nature some mechanisms like lightening (electric oxidation) and BNF (some N_2 fixing bacteria and archaea) exists which convert non-reactive N_2 to reactive.

Reduction of inert N_2 gas requires large amount of energy. The industrial process of nitrogen fertilizer production (N_2 reduction) (Haber and Bosch process) operates under high pressure (approximately 5.06×107 Pa) and temperature (600 to 800°K) in presence of a catalyst i.e. iron. Biological N_2 fixation also requires energy but it is a renewable energy in the form of ATP and reducing power. Diazotrophs reduce N_2 at ambient temperature and atmospheric pressure in presence of nitrogenase enzyme, ATP and reducing power. Hence nitrogenase is a very important, interesting and vital enzyme nature has provided for the process of BNF. According to an estimate about 65% of fixed nitrogen is contributed globally through BNF. Fertilizer nitrogen when applied to soil is likely to be lost through leaching or volatilization but biologically fixed nitrogen particularly by symbiotic and associative diazotrophs is effectively and efficiently used by host plant. It is estimated that approximately 2 tons of industrially-fixed fertilizer nitrogen is needed to get same crop production as obtained by 1 ton of biologically-

fixed nitrogen by legume crop. Biological nitrogen fixation is found in almost all kinds of ecosystems including marine ecosystem and diazotrophs are also widely distributed among different classes of bacteria and archaea.

Types of biological nitrogen fixation

Only certain bacteria and archaea are known to fix dinitrogen. They have only one thing in common that they all have nitrogenase enzyme. They are found in different ecosystems and have different niches to accomplish the job of dinitrogen fixation. Based on different diazotrophs fixing nitrogen in different ecosystems and association with plants nitrogen fixation is categorized in to three types:

Nonsymbiotic nitrogen fixation

Nitrogen fixation takes place in soil or any other ecosystem without any kind of symbiosis or association with other organism. The diazotrophs involved are *Azotobacter* sp., *Klebsiella pneumonae*, *Clostridium pasteurianum* and phototrophic bacteria. They are free living, non symbiotic or asymbiotic diazotrophs. The heterotrophs depend upon carbon and energy from soil organic matter while photoautotrophs use CO_2 as source of C and light as source of energy. Photoautotrophs are considered more assured of carbon and energy supply under favorable ecosystem.

Associative nitrogen fixation

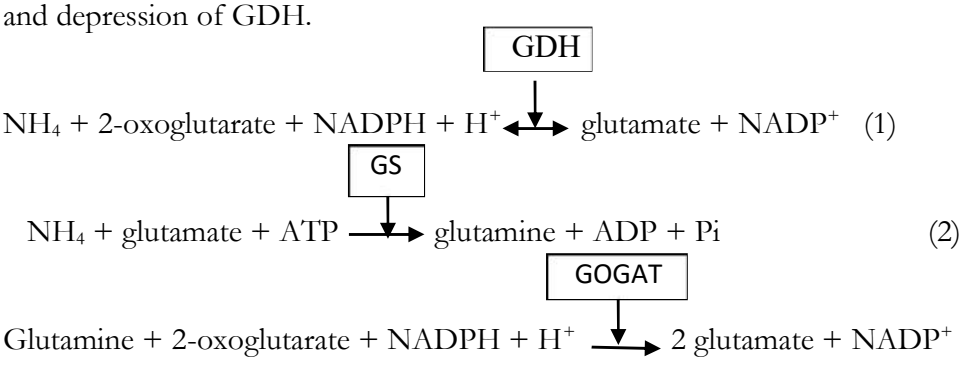
Nitrogen fixation involving diazotrophic bacteria which form loose association with plants and predominantly live in rhizosphere, phyllosphere or root cortex is called associative nitrogen fixation (Associative diazotrophs involved are *Azospirillum, Burkholderia, Herbaspirillum, Pseudomonas* and *Campylobacter*. These diazotrophs derive carbon and energy from root secretions, rhizodeposits and leaf exudates. Some sugarcane varieties were shown to harbor *Gluconacetobacter diazotrophicus* in the internal tissues. The bacterium is assured of the carbon and energy supply without any adversity and fixes good amount of nitrogen.

Symbiotic nitrogen fixation

Symbiotic nitrogen fixation is a unique phenomenon in which N_2 fixing bacteria form mutual association with crops (legume/non-legume) and both partners are benefited by this partnership. In N_2 fixing symbiosis, microsymbiont (diazotrophs) provides nitrogen in usable form while macrosymbiont (crops) shares nutrients including carbon and/or energy source Symbiotic nitrogen fixation is quite ubiquitous in plants and animals of terrestrial as well as marine ecosystems. Some agronomically important symbioses are legume–rhizobia (i.e. Soybean- *Bradyrhizobium*) symbiosis, *Frankia*- non-legume tree (i.e. Casuarina) symbiosis and *Azolla- Anabaena* symbiosis (in rice crop) which fix appreciable quantity of N_2. These diazotrophs are known as symbiotic N_2 fixers. Important diazotrophs involved in symbiotic nitrogen fixation are *Frankia*, *Rhizobium, Azorhizobium,* and *Anabaena azollae.*

Assimilation of biologically fixed nitrogen

Diazotrophs like other bacteria possess both GDH (glutamate dehydrogenase) pathway as well as an alternative pathway of ammonia assimilation called GS-GOGAT pathway. The later pathway involves *glutamine synthetase* (GS) and an NADPH-dependent *glutamine 2-oxoglutarate amidotransferase* (GOGAT) (also called *glutamate synthase*). Role of alternative pathway is that it can use nitrogen (NH_4) even at its low concentration because GS enzyme has high affinity for NH_4. Hence when ammonium concentration is low, synthesis of GS and GOGAT enzymes are derepressed and synthesis of GDH enzyme is repressed. GDH enzyme has relatively low affinity for NH_4 and can only use NH_4 when its concentration is high. However, GDH pathway is the main pathway of nitrogen assimilation when NH_4 concentration is high. High ammonium availability leads to repression and deactivation of GS and depression of GDH.



Both GDH and GS-GOGAT pathways require one mole each of NH_4, 2-oxoglutarate and NADPH to form one mole of glutamate. But the GS-GOGAT pathway also consumes one ATP and is energetically more expensive than the GDH pathway. In nitrogen fixing bacteria GS-GOGAT pathway operates because the product of BNF, that is, NH_4 should be used rapidly as its accumulation in high concentration leads repression of nitrogenase synthesis.

Conclusion

Nitrogen is a critical limiting element (deficiency is quite common) for plant growth and development but plants can't directly use the abundantly available (78%) atmospheric N_2. They depend upon fixed or combined forms of nitrogen (NH_4^+ or NO_3^-). Farmers generally apply nitrogen to crops in the form of chemical fertilizers. Use of these chemical fertilizers for a long time has led to a threat towards a balanced and sustainable environment. Biological nitrogen fixation (BNF), on the other hand, offers a natural source of nitrogen for plants. That's why it is considered a crucial component of many terrestrial, as well as aquatic ecosystems across our biosphere.

Robotics and Automation in Horticulture

Dr. Suchismita Jena

Horticulture sector which covers an array of high-value crops has emerged as a crucial part of agriculture, offering a wide range of choices to farmers for crop diversification and also provides ample opportunities in developing agro-industries which generate sizeable employment opportunities. These high value crops are highly remunerative, hence have a tremendous potential to make quantum leap in farm income which is evident from high BC ratio.

Horticulture, apart from being highly economical, it is aesthetically rewarding. The global population is expanding and expected to reach 9.15 billion by 2050. Therefore, in the next decades, it will be a huge challenge to provide abundant high quality, affordable, safe and nutritious foods, for the increasing population by creating a highly productive agriculture management, whilst preserving the quality of the environment at the same time. India, along with most of the developing countries is facing acute shortage of agricultural labour, as youths in rural areas are shifting towards urban area for better quality of life. There are some operations in horticulture like grafting weeding, harvesting, post harvest grading and packaging which are highly labour intensive. As a result, these operations get delayed due to labour shortage during its peak seasons. Along with this, the labour costs in India, for instance, constitute 30% of the production costs. Studies reveal that there is an urgent need to curtail labour costs and drudgery; there is a need to develop problem specific and location specific mechanization equipments, automation and robotics. Other major problems are water scarcity, rising prices of electricity and fertilizer, combined with regulations limiting irrigation are forcing farmers to

utilize their resources in a more precise fashion. Reducing food waste and spoilage will require both better in-field monitoring and management within the field-to-shelf supply chain.

Status and Scope of Robotics and Automation in Horticulture

Automation is elimination of human effort from the working field. In the last two decades, industrial automation has grown rapidly. But the concept of automation in horticulture in India has not kept pace. Automation includes adoption of precision farming, IoT (Internet of things) and robotics technology. Robots can be used for spraying pesticides, supplying water, plugging, sowing of seeds and harvesting crops. Besides, solar plants can meet the energy requirement of robots. The Horticulture sector can be modernized by opting for automation and investing in robotics.

Precision farming uses modern technologies like remote sensing however in a country like India where average land holding capacity is 1-2 acres only, it is not easy to use aerial remote sensing for gathering details of natural resources, particularly soil. Remote sensing has raised the possibility of applying precision farming methods to smaller areas. Application of satellite based technology to search, identify, analyze and manage the spatial and temporal variability of agronomic parameters (e.g. soil, disease, nutrient water etc.) within field by application of required amount of inputs timely and optimize profitability along with minimum impact on environment.

In horticulture, wireless sensors can be used to monitor soil moisture and temperature, greenhouse temperature and relative humidity, diffused solar radiation, leaf wetness levels and rain levels. Real-time data from these sensors can be used to modify crop maintenance procedures which will help in saving time and money.

Developments of agricultural autonomous vehicles or robots are a recent trend. The application of instrumental robotics is spreading every day to cover further domains, as the opportunity of replacing human operators provides very effective solutions with great return on investment. This is especially required when the duties need be performed, are potentially harmful for the health of the workers or for the safety. Heavy chemicals or drugs dispensers, manure or fertilisers spreaders, etc. are the activities which require deployment of unmanned options. Excellent research has been carried out in Europe, Australia, USA, Canada and Japan and initiated in India for development of agricultural autonomous vehicles for different horticultural activities like grafting, pollination, weeding, irrigation, application of fertilizers, spraying pesticides, harvesting (fruits, vegetable and flowers) by determining their precise maturity indices with the help of accurate sensors, sorting, grading and packaging.

Challenges in Adoption of Automation and Robotics

The challenge is to develop an electronic architecture to integrate the various electronic devices and to develop a physical structure suitable for the agricultural environment. An electronic architecture must be reliable and robust, provide ease and quick maintenance and have flexibility and modularity to allow future expansions and connection of new equipment. In upcoming years, as more autonomous applications for agriculture will be operating, applying robotics in agriculture may be technically difficult compared to industrial robots. Apart from this, Indian farmers would find it tough to invest in this technology. Nevertheless, cooperative farming and provision of subsidy from the government can encourage farmers to adopt hi-tech automation farming.

Multiple aggregate fruit' Breadfruit -A perennial tree vegetable

Dr. Sandeep Rout

Artocarpus altilis (Parkinson) Fosberg is a tree species from Malaysia that belongs to the Moraceae family and has chromosomal number 2n=56. It has 37 genera and 1050 species. This tree species is associated with freshwater habitat and has a self-sustaining growth habit, year-round active growth period, simple broad leaves, yellow flowers, and can grow up to 60 feet in height. It is widely planted in the tropics for the fruit and is also valued as an ornamental and shade tree. It may be found in almost every household garden, along roadsides, and secondary woods.

Breadfruit is a monoecious crop plant closely related to New Guinea's breadnut (*Artocarpus camansi*), the Philippines' Tipolo (*Artocarpus blancoi*), Micronesia's dugdug (*Artocarpus mariannensis*), and jackfruit (*Artocarpus mariannensis*) (*Artocarpus heterophyllus*).

It is a valuable crop, especially in the Pacific Islands, a staple meal. According to Peterson, creating powerful hybrid Breadfruit cultivars 600 to 1200 years ago triggered a "Breadfruit Revolution" that was a key driver of sociocultural transformation in Micronesia.

Description

The evergreen breadfruit tree grows to a height of 28 meters, with a trunk diameter of 2-4 meters before branching, and produces spherical to cylindrical rough-skinned fruits ranging in diameter from 10 to 30 centimeters, weighing 0.25 to 6 kilograms, with a creamy white to yellow pulp containing about 20% starch and a yellow to the green rind. The amount of seeds varies according to the cultivar.

Each seeded fruit is created from an entire inflorescence consisting of many flowers. The numerous aggregate fruit has a greenish conical spinelike protrusion on its surface and a smoothish character honeycombed about 5mm with seedless fruit.

The leaves vary in length from 15 to 90 cm, are dark green, alternately arranged, ovate, glossy leaves with a large apical tip, and are slight to deeply pinnate 7-11 lobed. The bottom leaf surface is lighter and noticeably veined, contrasting the dark green and smooth top leaf surface. The buds are hairy and pointy.

Traditional uses

Breadfruit is a staple cuisine in many tropical locations, and it may be baked, boiled, or steamed. Breadfruit's light, strong wood has been utilized for outriggers, ships, and buildings throughout the tropics, in addition to being a staple meal in many civilizations. The majority of this crop's cultivars yield fruit throughout the year and maybe utilized in cooking. After cooking, unripe fruits are eaten. The flavor of mature breadfruit is described as potato-like or akin to freshly made bread. Each season, one breadfruit tree may yield 200 kg. Male flower clusters are sometimes used to make desserts and preserves. Traditionally culinary applications such as breadfruit pudding mashed with coconut milk

and then cooked or ripe fruits mixed with coconut milk, a raw pudding prepared from fresh. Fermentation is a typical way of preserving fruit during times of excess, and it is widely recorded in various sources.

Breadfruit contains polyphenols that have insect-repelling properties. This tree's wood was the most prized in Samoan architecture for traditional home building. The fruit's leftover pieces may be utilized to feed cattle. Cattle may also graze on the leaves of breadfruit plants.

Propagation

It is mainly spread by seed; however, seedless fruit may also be propagated through suckers that sprout from the tree's surface. Root cuttings of 10 cm thick and 20 cm long are preferable for planting material. They may take up to 5 months to mature and are ready to plant when they reach a height of 60 cm. Root cuttings have a higher success rate (90%) than other methods; hence, many nurseries may employ them commercially.

Nutrient composition

Breadfruit, raw **Nutritional value per 100 g (3.5 oz)**	
Energy	431 kJ (103 kcal)
Carbohydrates	27.12 g
Sugars	11 g
Dietary fiber	4.9 g
Fat	0.23 g
Protein	1.07 g
Vitamins	**Quantity %DV**†
Vitamin A Equiv. lutein zeaxanthin	22 µg
Thiamine (B1)	10% 0.11 mg
Riboflavin (B2)	3% 0.03 mg
Niacin (B3)	6% 0.9 mg
Pantothenic acid (B5)	9% 0.457 mg
Vitamin B6	8% 0.1 mg
Folate (B9)	4% 14 µg
Choline	2% 9.8 mg

Vitamin C	35% 29 mg
Vitamin E	1% 0.1 mg
Vitamin K	0% 0.5 µg
Minerals	**Quantity %DV†**
Calcium	2% 17 mg
Iron	4% 0.54 mg
Magnesium	7% 25 mg
Manganese	3% 0.06 mg
Phosphorus	4% 30 mg
Potassium	10% 490 mg
Sodium	0% 2 mg
Zinc	1% 0.12 mg
Other constituents	**Quantity**
Water	70.65 g

- Units
- µg = micrograms • mg = milligrams

IU = International units

Cropping system

Breadfruit may be grown in various environments, including agroforestry. It's possible to cultivate it as a cocoa shade tree. Intercropping with short-term crops such as ginger and pineapple is used.

Conclusion

The breadfruit tree is a 60-foot-tall tree in tropical locations are attracted by its simple broad leaves, golden blooms, fruit, decorative value, and shade considered to be one of the best candidate plants to distribute to undernourished populations in such locations. It flourishes in gardens, ditches, and secondary forests. It's a big harvest in the Pacific; it began 600-1200 years ago. The evergreen tree produces around to cylindrical fruit with creamy white to yellow flesh and yellow to green skin. Variable seed count: The smooth seedless fruit has a greenish conical spinelike protrusion. However, seedless fruit and suckers may also be employed. 10 cm thick, 20 cm long root cuttings grow to 60 cm in 5 months. Many nurseries utilize root cuttings since they are 90% successful. Being a source of

high-quality protein for food security and novel food production, *Artocarpus altilis* should be considered for future exploitation, which can help in sustainability globally.

A view on Irrigation Water Quality in Odisha

Dr. Sanjeeta Biswas

Irrigation plays a significant role in agricultural intensification. It'san important part within the agricultural production when rain is insufficient, unsure and uneven in a farming state like Odisha. Odisha is endowed with an ample water. It's additionally blessed with an excessive network of rivers and streams. Mahanadi and Subarnarekha square measure major rivers in Odisha. Irrigation facility for under thirty fifth of irrigated cropped space has been created into the states. It's been assessed that even a tenth increase within the gift level of water use potency in irrigation comes will facilitate to crops in massive areas. The farmers of the Odisha using groundwater as a very important supply of water for irrigation. However still it's been ascertained that the most space beneath Odisha bearing poor water quality that influences irrigation. The two most typical water quality factors that influence the conventional infiltration rate square measure the salinity of the water (total amount of salts within the water) and its metallic element content relative to the Ca and Mg content and additionally fluoride rate. As Ground water in the State of Odisha is largely alkaline in nature (range of pH: 6.6-8.7; ave.: 7.9) and also the groundwater, in major cases (91%), is moderately hard, hard to very hard in nature (rage of hardness: 15-2052 mg/L; ave.: 385 mg/L). (*Pattanayak and Mallick,2018*). It has also been observed that around 13%of groundwater in the state of Odisha with Kelley Index (KI)>1 exhibit unsuitability for use as irrigation water. High content of Na+ in irrigation water reduces the soil permeability causing a poor internal drainage in the soil. High sodium content in water leads to soil salinity and development of an alkaline condition.A high salinity water will increase infiltration.

Reasons for poor water quality in Odisha:

- Saline water overlapping fresh water aquifer
- Fresh water overlapping saline water
- Irregular sequence of fresh water and saline water aquifers.
- Leaching of chemical fertilizer.

How to improve irrigation water quality?

- Practice the proper leaching of water while using fertilizers.
- Increase the frequency rate of irrigations applications,
- Avoiding over aerial irrigation application,
- Focus on lesser use of fertilizers which contains chloride or boron, also keep emphasis on right selection of crops, etc (Mourya and Mourya,2018)

- Artificial recharge projects in the higher saline pockets in the inland areas of the state can help in minimizing the salinity effects.
- In the coastal tracts, where groundwater salinity develops owing to sea-water ingress, the salinization can be checked by increasing the sea-ward pressure of freshwater flux by means of minimizing groundwater draft (especially from the shallow aquifer), enhancing recharge through canals running parallel to the coast, restoring ponds, tanks and increasing their numbers, restoring the sand dunes etc.
- Water supply should be undertaken after proper artificial softening of groundwater for reducing hard nature of groundwater.
- More efforts should bekept on extensive irrigation rather than intensive irrigation to such areas where scarcity of water is the main problem.
- Moisture in the soil should be preserved by digging water storing pits in 10% of crop fields.
- In the pockets where elevated concentrations of fluoride in groundwater are observed, alternate sources of water need to be delineated. The option of fluoride free deeper aquifer should be explored. The availability of fresh surface water also should not be ignored

Integrated pest management and its adoption by farming community

Dr Seema Tripathy

Farmers must produce more crops on existing lands to meet the demands of a growing human population for food and fibre. To achieve this increase in production, agricultural technologies must be continually improved in order to reduce crop losses. The problem is to do so while maintaining environmental protection. IPM (Integrated Pest Management) is an important component of the solution.IPMis an environmentally sound, socially acceptable and broad ecological approach for managing pest population below economic threshold level encompassing available methods and techniques of pest management action like physical, mechanical, cultural, biological, chemical etc. in a compatible manner with an ultimate objective of maximizing the crop production with minimum economic, health and environmental risk.

IPM fosters natural pest control mechanisms and emphasizes the growth of a healthy crop with the least amount of interruption to agro-ecosystems. IPM is primarily founded on the notion that it is not required to exterminate all pests, but rather to reduce their population to a level where they do not cause considerable losses.

Merits of IPM

The adoption of IPM methods provides economic benefits due to sustainable development, increased productivity and reduced risk of pest damage. Few of the benefits of an integrated approach are mentioned below:

- Reduced use of pesticide

- Reduced contamination of environment
- Reduced input cost
- Better use of natural resources
- Reduced risk of pesticide resistance, pest resurgence and secondary pest outbreak
- Reduced contamination of crop with chemical residues
- Reduced risk of farmer from contamination of chemicals
- Enhancement of crop quality

Why to follow IPM?

The most effective, efficient and long-term way to manage pests is by using a combination of methods that work better together than separately. Varieties of options are there for pest management but pesticides application always becomes the first line of defense for the farmers. Crop pests, which are considered as the major bottleneck in increasing the crop production, are being controlled by indiscriminate and routine based application of pesticides which resulted in following consequences cited below:

- Resistance development in insects against various insecticides e.g. organophosphate and synthetic pyrethroid resistance in *Helicoverpaarmigera.*
- Due to secondary pest outbreak e.g. emergence of whitefly as major pest when spraying insecticide against *H. armigera*.
- Increased resurgence of target pests e.g. Brown plant hopper population of rice increased when some organophosphate chemicals are applied.
- When rate of application of pesticide increases, profit decreases.
- Environmental contamination and quality reduction.
- Killing of non-target animals and natural enemies.
- Human and animal health hazards.

Extent of adoption of IPM by farmer

Many IPM tactics can only be implemented effectively on a regional basis. This can be accomplished by raising farmer awareness and enacting appropriate legislative actions. IPM must also work in conjunction with other aspects of crop productivity and rural progress. IPM will eventually be employed by farmers, hence it must be transformed from a scientist oriented notion to a farmer oriented approach. Recent developments in information and communication technology have given us a once-in-a-lifetime opportunity to accomplish these goals. Computer-based interaction systems placed at the village level can assist farmers with pest identification, pest population projections, and the range of pest management solutions available, as well as the benefits and drawbacks of each choice.

Most of the IPM tactics can be implemented effectively only on area-wide basis. This can only be made possible through increasing awareness among the farmers and enactment of suitable legislative

act. IPM also should to be mixed with other component of crop production. Ultimately, IPM is to be used at the farmer's level and, therefore it needs to be converted from a scientist-oriented to farmer-oriented concept. The recent technological development on computer based interaction systems can also be a great help to the farmer in identification of pest, pest forecasting, as well as range of option available for pest management with advantages and limitations of each of these options. Despite this progress, a recent study indicated that only about 5% of Indian farmers use IPM programs.

Factors influencing adoption of IPM

- Shortage of training material, curricula and experienced teachers on the principles and practices of IPM.
- The lack of IPM information that could be used by farmers. In a study considering IPM implementation in Haryana, India, it was reported that more than three fourth of the farmers were unaware of the concept of IPM. Even those aware of the concept stated that they lacked the skills required to practise IPM.
- Pesticide industry has created a situation where chemicals are displayed as highly effective and simple to apply.
- Farmers lack confidence and faith in IPM and considered these practices to be risky as compared to chemicals.
- Non-availability of the inputs mostly these biological control agents like NPV, BT etc.
- Difficulty in preparation of some of the IPM components
- Short shelf life of the IPM components
- Lack of timely advice
- Unlike organic produce, IPM-grown food is rarely labelled as such, and so, the product cannot receive a higher market price.

National Mission for Sustainable Agriculture

Dr. Shruti Mohapatra

National Mission for Sustainable Agriculture (NMSA) has been planned for augmenting the productivity section of agriculture specifically focused on rainfed locations targeting on farming in an integrated pattern, proper management of soil health, use efficiency of water synergizing conservation of natural resources. It has specifically formed keeping in to consideration of fulfilling the major objectives of key dimensions through appropriation of sustainable development pathway through adaptation with energy efficient equipment's, natural resource conservation and progressive shifting to ecofriendly technologies. Apart from these, site specific advanced agronomic practices have been

planned to be promoted through astute usages of chemicals, diversification of crops, proper soil health maintenance, stepping towards various beneficial farming systems along with numerous integrated approaches like agro-forestry, crop-sericulture and fish farming etc.

OBJECTIVES

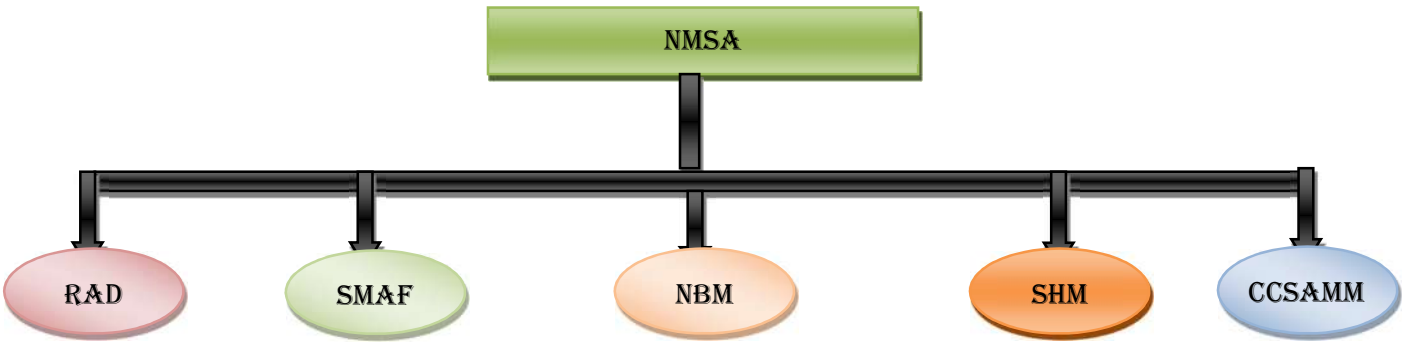
- To give agriculture a progressive look by making it more sustainable, profitable, productive and climate resilient through promotion of site specific composite farming systems
- To encourage the conservation of natural resources through adequate soil and moisture conservation measures.
- To embrace comprehensive soil health management practices depending upon application of macro and micro nutrients according to soil testing, prudent utilization of fertilizers and soil fertility maps etc.
- To amend water resource application through effective water management practices for expanding achievement of 'more crop per drop'.
- To progress the capability of farmers and stakeholders in concomitance with other continuing missions like NICRA (National Initiative for climate resilient Agriculture), NFSM (National Food Security Mission), NICRA (National Mission on Agriculture Extension and Technology) in the domain of climate change adaptation measures.
- To assess the models in selected blocks for boosting the productivity of rainfed based farming augmenting the technologies through NICRA and by supplementing the resources from other missions like MNREGS, IWMP, RKVY etc.
- To organize a successful, inter and intra ministerial/departmental collaboration for achieving the major outputs of NAPCC.

STRATEGY

- Promotion of IFS (Integrated Farming System) enclosing livestock, crops and fishery, pasture and plantation based composite farming for warranting food security, amplifying livelihood opportunities and lessening the crop failure risks through residual production systems.
- Popularization of on farm as well as off farm conservation technologies of resources along with introduction of mitigation supportive practices at the period of peak climatic events or disasters like floods, dry spells etc.
- Advancing the water management practices thereby enhancing the use efficiency through demand as well as supply side management solutions coupled with application of advanced technologies.
- Uplifting the current better agronomic practices for attaining better soil treatment, prudent usage of chemicals, modified soil carbon storage and high level of farm productivity.
- Generating the database on soil related resources through soil analysis on GIS platform, land use survey and soil profile study for facilitating the acquisition of place and soil specific crop management practices and optimizing fertilizer usages.

- Developing crop and location oriented integrated nutrient management (INM) practices for quality assurance of land as well as water resources, crop productivity enhancement and soil health improvement.
- Proficient institutions and skillful professionals should e involved for expanding the mitigation strategies and climate change adaptation for specific agro climatic situations and thereby promoting all of them through appropriate farming systems.
- In selected blocks program interventions according to the land capacity and climate conducive terms should be made guarantying the integrated development through convergence, coordination and leverage investments from related schemes like MGNREGS, IWMP, RKVY, NFSM, MIDH, NMAE&T. For betterment of the farming community with regard to profit and other benefits an noble approach should be evolved taking numerous active stakeholders like SAUs, KVKs, ICAR centres and other professional organizations of state government.
- At state level in case of limited or lack of government infrastructure, reputed NGOs should be called for active involvement for executing the village development plan through transparent selection system, keen supervision and skilful monitoring.
- Setting up a platform to cooperate, coordinate and review the implementation of all sorts of interventions mentioned in the NMSA mission files under sponsorship of national action plan on climate change.

COMPONENTS



1. **Rainfed Area Development (RAD)**
   It has been formulated based on area approach for developing and conserving the natural resources as well as the farming systems. This was mapped out in a 'watershed plus framework' exploring prospective utilization of natural assets made through watershed development and soil conservation practices under NWDPRA, IWMP, NGNREGS, RKVY, RVP&FPR etc.
2. **Sub-Mission on Agroforestry (SMAF)**
   It was started in year 2016-17 for encouraging the tree plantation on farm land with a motto 'Har Medh Par Ped' along with cropping system. It was implemented in states having liberal transit regulations for specific tree species. The implementation can bring incremental farmer

income opportunities along with growth in tree cover leading to higher carbon sequestration thereby complementing the national initiatives upon climate change adaptation.

3. **National Bamboo Mission (NBM)**
   It was formulated for boosting the domestic plantation of qualitative species and granting them to industry thereby upgrading bamboo based livelihoods and employment for blooming the rural economy along with doubling farmer's income.
4. **Soil Health Management (SHM)**
   It has proposed with a aim of encouraging crop and site specific sustainable approaches including organic farming, use of land based on potency, residue management through creation of soil fertility maps and linking with macro-micro nutrient management and minimization o soil degradation.
5. **Climate Change and Sustainable Agriculture: Monitoring, Modeling and Networking (CCSAMMN)**
   In the area of climate smart and sustainable management measures along with local agro climatic condition suited integrated farming system, it will give rise to bidirectional dissemination of information and knowledge related to change in climate through model projects or adaptation pilot measures and research on mitigation. The mission related tasks will be monitored and evaluated within the institution of NMSA through expert group of technical proficient persons thrice a year and regularly updated to the national committee.

The need of Phytiatry in India: A distinct field dedicated to the identification and treatment of plant abnormalities

Dr. Snehasish Routray

Both human and plants share a complex relationship since time immemorial. In many ways, current plant health diagnosis patterns are incorrect. Farmers still rely on nearby pesticide dealers or retailers for immediate advice at the grassroots level. As a result, agrochemicals are applied incorrectly in the agroecosystem, affecting plant health. The necessity of the hour is for accurate diagnosis, recommendations, and follow-up. Agricultural entomologists, plant pathologists, nematologists, weed science experts, and plant physiologists are among the modern plant protectionists. Why not integrate these disciplines into a single discipline that is concerned with plant health in general? The science of medicine and veterinary in humans and animals is well established respectively. They both address the health concerns of their respective entities. Plant health is similarly vital, and a separate field and profession for plant health is sorely needed around the world. As a result, the field of Phytiatry, also known as Phytiatrie, Fitoiatria, Phytomedicin, or Plant Medicine, is gaining traction in universities throughout the world. There is, in fact, a knowledge void in plant health sciences, which has a number of ramifications in India.

The need

a. Human health vs. plant health.

It is more necessary than ever to protect plants from pests and diseases and maintain them healthy in order to provide food for a growing global population of humans and domestic animals. We protect the key components of our meals and the diets of the animals we feed by protecting plants. There is still a lot of work to be done to ensure plant health around the planet. Plant pest and disease outbreaks, which are becoming more common, provide significant difficulties to the global phytosanitary community.

b. Faulty diagnosis at Farmer's level

Farmers in many parts of India still visit neighboring pesticide stores for diagnosis and follow the application of any chemicals prescribed by the sellers for adequate plant protection measures. As a result, farmers face challenges such as incorrect pest management due to faulty identification and improper diagnosis with bogus product application.

c. International year of plant health 2020

In the current situation, the world's top concern is the health of plants. Plant health must be maintained despite a variety of problems such as changing climatic conditions, biotic and abiotic pressures, and the detrimental effects of numerous contaminants. The UNs has celebrated the year of 2020 as the International Year of Plant Health, with a number of goals including increased public awareness on a global, regional, and national level, environmental protection, and economic and trade development, promotion and strengthening of global, regional, and national plant health efforts in light of increased trade, and increased global, regional, and national resources for plant health policies.

d. Climate change, extent of losses and need of correct plant protection measures

According to studies climate change would increase the severity of insect pests in agricultural and forestry ecosystems through alteration of C: N ratio in plants. This would subsequently affect the natural enemies also, particularly in cooler Arctic, temperate, and subtropical regions. Because of the rising temperature amid changing environment, many pests have already expanded their habits, such as fall armyworm (infesting mostly maize, sorghum, millets and other cereals), rugose spiraling whiteflies, Ber fruit flies and others. In recent years the invasion of the desert locust in eastern Africa and North-western India has been detected as the results of changing climate. In this changing climate scenario and growing populations its high time for the farmers to get correct and real time plant disease and pest damage diagnosis and subsequent recommendations. By 2050 we have to feed around 9.9 billion people all over world and around 1.64 billion people in India. With shrinking land resources, we have to prioritize the crop losses both in pre-harvest and post-harvest condition with correct scientific approach at farmer's level.

Development of Phytiatry in different countries

In a number of countries, including Germany, Italy, Greece, and Switzerland, phytiatry, or plant medicine, has been included in university curricula. In Germany, the phrase Phytomedicine has been used for numerous years. Phytomedizine is defined as the study of biotic and abiotic plant diseases, as well as their diagnosis and treatment. It includes all organisms that cause harm to plants, such as insect pests, diseases, and weeds. Fitoiatria is a term that originated in Italy and is now commonly used in the United States (equivalent to Phytiatry). It is characterised as a scientific subject that includes

strategies for plant protection. In France and other European countries, the term Phytiatrie is used, whereas M. Sc. programmes are called Phytiatrie and Phytopharmacie.

Conclusion

In India, a separate profession or field of Phytiatry doctors is currently required for the correct detection and diagnosis of agricultural pests and illnesses. Phytiatry doctors can advise farmers and examine for quarantine and invasive alien pests and pathogens, preventing their admission and spread across regions and countries. Following thorough clinical investigations, they may also be able to provide the finest plant nutrition advice to farmers. They may also be able to assist in the protection of crops and crop produce by teaching farmers how to care for their crops, the environment, and their own health. This will open up new lucrative career opportunities and pathways in the future.

Recent Advances in the Dairy Industry

Dr. Santosh Kumar Sahu

Milk production and processing have come a long way since the days of feudalism. Today's dairy industry is constantly evolving, thanks to new technologies and innovations. Milking machines are now being used to milk cows in large dairy farms. They can milk more cows in a shorter amount of time, which increases production. Robotic milkers are now being used in some dairy farms. They can milk cows automatically, which reduces labor costs and increases efficiency. Here are some of the latest advances in the dairy industry:

1. Milk Components Testing (Milk Analyzer)

Every dairy farmer is affected by milk component testing, which includes fat, protein, lactose, total solids, solid-nonfat, and other solids. Mid-infrared milk analysis is a quick, low-cost secondary testing procedure whose findings are frequently utilized to calculate milk payout to each dairy farmer. Mid Infrared Spectroscopy is employed for all milk composition testing on an individual milch cow for decision making in feeding and management techniques, as well as genetic selection (MIR). It not only speeds up testing but also improves efficiency.

2. Melamine detection by high-performance liquid chromatography (HPLC)

Melamine is the most commonly used adulterant in milk and milk products to increase their protein value. Melamine adulterated milk and milk products are associated with many health hazards like Hypertension, Kidney infection, Haematuria, etc. With the help of high-performance liquid chromatography, we can easily detect melamine in milk and milk products. HPLC is a very fast, accurate, and reliable technique for melamine detection in infants' milk powder, pasteurized milk, cheese, yogurt, etc.

3. Membrane processing

It is one of the most recently used advanced techniques in the dairy industry. It is a non-thermal process and includes many techniques like electrodialysis, Ultra Filtration, Micro-Filtration, etc. This technique retains most of the nutrient values of milk and milk products, while processing.

4. Direct Vat Set (DVS) cultures

These cultures contain microorganisms like *Streptococcus Lactococcus etc.* These are used in the manufacturing of fermented milk products. These cultures are highly beneficial to human health by improving immunity. These DVS cultures are immediately introduced to the processing vat, enhancing output in a shorter period. If we prepare curd at home, it will take around 8 to 10 hrs. But by using Direct Vat Set (DVS) cultures, we can prepare curd within 3 to 4 hrs. This is a significant advancement in the dairy business.

5. Automated CLEAN-IN-PLACE (CIP) System

CIP is a non-disassembly technique of washing the inside surfaces of pipelines, tanks, industrial machinery, filters, and related fittings. CIP has progressed to include fully automated Programmable Logic Controllers, sensors, and valves. The introduction of automated CIP is a blessing to the dairy industry, which requires regular interior cleaning and high levels of cleanliness.

6. Dairy Product Attribute and Composition Testing

The quantity of products generated per hour in large dairy processing plants is extremely high, and controlling has become increasingly important. Inline Mid Infrared (MIR) and Near Infrared (NIR) milk analyzers have been evolved and are widely used in today's modern factories for composition and attribute testing of liquid dairy products (fluid milk) and milk for cheese making.

Conclusion

It must be clear from the foregoing review that a lot has been done to effectively enhance the process technology for manufacturing of different food products from milk by certain strategies like application of advanced technology (microbial, biotechnological), along with modern-day concepts of quality assurance. Our aim is to do the same in the future and take the dairy industry in India to a higher level.

Millets – from staple food to super food

Dr. Susmita Das

Millets are tiny seeded grasses, known as coarse grain cereals which find its roots in Ayurveda as *Trinadhanya* or *Kudhanya* in ancient texts, then during Indus valley civilization that dates back to 3000.

Millets are gluten-free, have a low glycemic index, has higher levels of protein with a more balanced amino acid profile, iron, zinc, and phosphorous and are high in dietary fibre and antioxidants that makes it a traditional food among Asian & African population. Millets are nutritionally superior and often being compared to wheat and rice owing to their higher food value. Millets include sorghum (Jowar), pearl millet (Bajra) as major millet and finger millet (Ragi/Mandua), little millet (Kutki), kodo millet (Kodo), barnyard millet (Sawa/Jhangora), foxtail millet (Kangni/Kakun), proso millet (Cheena) as minor millet. In addition to these eight types, few more like Fonio, Quinoa and BrownTop millet are also presently taken into count.

Sorghum (Jowar)

Apart from being used as grain, livestock, as a sweetener in confectioneries, sorghum also called great millet, egyptian millet, Indian millet, milo, durra, kafir corn, guinea corn, cholam, jonna, shallu, kaoliang is known to have many similarities with millet as both are gluten free and drought resistant grains of hot and humid regions of the world. Compared to other cereal grains like barley or rice, jowar contains a much higher concentration of fibre (single serving = 12 grams fibre), which is almost half the recommended daily intake for fibre. It is high in protein (11 gms/100 gms serving) and good amount of iron, calcium and magnesium, Vitamin B, niacin and Vitamin E.

Pearl millet (Bajra)

Profoundly nutritious and power packed with carbohydrate (61.78 gm), protein (10.96 gm), dietary fibres and fats (11.49 gm& 5.43 gm) respectively, bajra also known as bulrush, cattail, or spiked millet, dukn, cumbu, gero, sanio, kambu are now biofortified with zinc and iron to improve its nutritional status.

Finger millet (Ragi)

Also known as Jhangora, Mandua or Mangal, Kodra, Mandia, Taidalu, Kezhvaragu, finger millet is considered one of the most nutritious cereals. Finger millet contains about 5–8% protein which is quite higher compared to other millets, 65–75% carbohydrates, 15–20% dietary fiber and sufficient minerals. Of all the cereals and millets, finger millet has the highest amount of calcium (344 mg/100 g) and potassium (408 mg/100 g). The cereal has low fat content (1.3%) and contains mainly unsaturated fat which is a very good dietary supplement for people with cardiac diseases. Finger millet consumption is beneficial in conditions of anxiety, depression and insomnia. It is also useful for migraines. Green ragi is additionally counseled to lactating mothers in condition of lack of milk production.

Barnyard Millet

It is a rich source of fibre (8.1% - 16.3%), protein (11.2% - 12.7%), calcium, magnesium, fat, vitamins, and some essential amino acids. Thus, the nutritive value of Barnyard Millet, also known as odalu, swank, kavadapullu is superior to that of other major and minor millets, cereals and protein. It is a rich source of calcium, protein, magnesium, fat, vitamins, and some essential amino acids and extensively used in south India for preparing idli, dosa.

Little millet

Little millet goes by several names such as Moraiyo, Kutki, Gajro, Charna, Shavan, and Sama. It is loaded with B-vitamins and minerals such as magnesium, calcium, iron, zinc, and potassium. It is used in several traditional dishes and often substituted for rice in southern parts of India. Little millet being a good source of phosphorus helps with energy production through fat metabolism, also repair body tissue.

Kodo millet

This is the coarsest known millet. Kodo also known as cow grass, rice grass, ditch millet, Native Paspalum, Indian Crown Grass or some common names used in India as Koden, Kodra, Varagu, Arikelu, Arika, HarkaKoovaragu, Kodo,Kodua. In India, people consume this exceptionally nutritious millet like rice or use its flour to make pudding. Kodo millet is also used to feed pigs, sheep, and goats.

Foxtail millet

Some common names of foxtail millet in India are Thina, Thinai, Navane, Kangni, Rala, Korra, kangam or kaon. Around the world, it is famous as Chinese millet, Foxtail Bristle Grass, Dwarf setaria, Italian millet etc. They are extremely rich in calcium and Vitamin B12. The glycemic index of Foxtail millet is at 50.8 making it an ultimate choice of low-glycemic foods.

Proso millet (Common millet)

Proso millet, also known as white millet, hog millet, kashif millet, Cheena, Panivaragu, Variga and Baragu. Compared to other cereals, proso millet has the lowest water requirement. It comes in various colors, from brownish black through olive brown, orange-red golden and light cream. The bran of

proso millet contains vital nutrients that are essential for a healthy diet and is also an excellent source of fiber. It is gluten-free and has a significant amount of carbohydrates, protein, Niacin and fatty acids.

Hence, mixed millets khichdi is popular in many parts of India while millet cookies, puffs, flakes and laddus are fancied items at high-end organic food stores all over the country. Owing to its immense nutritional benefits and to enrich the nutritional security of the population, states like Karnataka, Odisha and Uttarakhand have already introduced millets in Public Distribution System. Whether through Poshan Atlas under Holistic Nutrition (POSHAN) scheme or "Eat Right India Initiative" under the Food Safety and Standards Authority of India (FSSAI), the government of India is taking every step to create awareness among the masses to considered millets from being poor man's supplementary food to Rich man's status food. Complying these aspects, Government of India has declared 2018 as the "National Year of Millets" and The U.N. General Assembly has declared 2023 as the "International Year of Millets".

Tamarind- a potential minor fruit crop

Dr. Tanushree Sahoo

The name tamarind is derived from the Arabic *Tamar-u'l*-Hind, because the dark pulp of the fruit resembled somewhat to that of dried dates. It was therefore called the *Tamere- hindi* or *the date of India.* Tamarind (*Tamarindus indica* L), is highly drought hardy and can be grown in dry land areas and on degraded wasteland. It is considered to be one of the most exquisite and valuable fruits of the tropics and subtropics. It is the source of timber, fruits, seeds, fodder. It is an excellent tree for social forestry, agroforestry, wasteland development and dryland horticulture. The pulp of ripe fruit has considerable export potential across different parts of the world. In India, the bulk of tamarind production comes from the states like Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Odisha, Madhya Pradesh and to a limited extent from Bihar.

Tamarind grows successfully in wide range of soils starting from gravelly red loam to degraded soils in wasteland situation. But, the best yield is realized, when cultivated on well drained deep loamy or alluvial kind of soil. It can also survive on alkaline and saline soils. It can be grown on sodic soils with 45% ESP without any soil reclamation. However, increased salinity results in stunted and poor growth, the young seedlings being more susceptible to this.

Tamarind is a crop, which is climatically adapted to a wider range i.e. humid to dry hot regions. The tree thrives well in highly warm climate with a maximum temperature of 48^0C. It can also withstand

prolonged drought period. The optimal total rainfall requirement per annum is 750-1900 mm. Though, it can also grow in relatively low rainfall areas also. Young trees are very much susceptible to frost, whereas mature trees are somewhat adapted to it. The onset of dry season and moisture stress trigger leaf shedding. Tamarind has been classified as quantitative long day plant (Broschat and Donselman, 1983).

The genus *Tamarindus* is a monotypic one containing the only species *indica*. Tamarind is highly heterozygous having large genetic diversity in bearing, pod shape and size, fruit quality i.e. sweetness, acidity, flavor, taste, and pulp colour*etc*. Bailey (1947) has clasisified two types of tamarind based on the fruit size and shape.

1. East Indian type: long pods with 6-12 seeds
2. West Indian type: shorter pods with 1-4 seeds

There are varied pod shapes exist in tamarind germplasm, some may have long straight pods, whereas some may have sickle- shaped ones. Seeds also exhibit a wide range of variation in shape, size, colour and ornamentation of the seed coat.

On the basis of organoleptic taste two kinds of tamarind are there.

- Sweet type- the ripe fruit pulp is sweeter with relatively less acidity. These fruits are mainly for dessert purpose (Karale, 1998).
- Sour type- it has highly acidic taste and the pulp is marketed commercially.

Tamarind is a perennial tree and mostly propagated by seeds. But the long juvenility is the major drawback associated with seed propagation. Also, the seedling trees do not produce true-to-type plants. Hence , the vegetative modes of reproduction finds utility in such a commercial crop. Air layering has been successful method followed at a commercial scale for multiplying tamarind plants. It is generally planted at a spacing of 10x10m or 12x12m.

Composition and uses

Composition of tamarind pulp (Anon, 1976)

Composition	Per 100g edible pulp
Moisture	2.9g

Protein	3.1g
Carbohydrates	67.4g
Fibre	5.6g
Fat	0.1g
Total minerals	2.9g
Energy value (Kcal/100g)	230-283

Tamarind is known as the sweetest and the sourest of all fruits owing to its exceptionally high sugar and acid content. Carbohydrates present in tamarind are equal to that of semidry dates, which have a total sugar content of about 61% of fresh weight. Of the invert sugars (30-40%), 70 per cent is glucose and 30 per cent fructose. It is the most acidic of all fruits with a total acidity range varying from 12.2 to 23.8 per cent, whose dominant fraction is tartaric acid. The fruit also contains about 2 per cent of other acids, chiefly malic acid and minor amounts of lactic, oxalic, succinic, quinic and citric acids.

Of the total nitrogen in the pulp, 55 per cent is present as non-protein nitrogen and of this 70 per cent is free amino nitrogen. Tamarind pulp is also unique in its high mineral content. It is the fruit with highest phosphorus and calcium levels. It is a good source of iron. Tamarind is an excellent source of riboflavin, thiamine and niacin, however poor in vitamin A and ascorbic acid. Several pigments have been identified in different parts of the tamarind. Red variety of tamarind fruit contains anthocyanin. Xanthophylls are responsible for yellow colour of the flowers. A red pulp variety of tamarind contains anthocyanin chrisanthemin and a leucoanthocyanidin is present in the brown pulp.

The pulp powder isreported to be rich in calcium, potassium and copper (Manjunath *et al*., 1991). The seeds contain 63% starch, 16% protein and 5.5% oil (Purseglove, 1974). The nutritive value of kernel protein is nearly at par with cereal protein. Tamarind kernel powder (TKP) is widely used for starching of cotton yarns, jute fabrics and woolen. Seed powder has use in manufacture of jam, jelly, fortified bread, biscuits and in confectionary industry.

In India, the pulp is primely used for culinary uses, while in other countries, it is processed into nectar, fruit punch, juice, sauce, concentrates, glaced and crystalized fruit also. It is also often used as a fruit base in the preparation of jams, jellies, ice creams, sherbets, beverages including carbonated drinks. The pulp contains 1.27 % pectin.

The tender flowers are consumed as vegetable. These are also a good source of golden yellow Coloured honey, which is having slight acidic taste.

Leaves are very good fodder due to its 12-15 per cent protein content. These are also rich in calcium. A reddish yellow dye is also commercially extracted from tamarind leaves. Leaves are used as green manure purpose to increase the soil fertility status by incorporating them into soil.

The seed husk or testa contains a colouring agent and water soluble tannins to the extent of 20-40 per cent. This is used in dyeing and leather tanning industry. The utilization of testa as a raw material in making plywood and paper adhesives has also been suggested.

The seed powder is used in manufacture of industrial gums and adhesives. With addition of tamarind seed powder to soil will also improve soil structure, water holding capacity and availability of nitrogen to the plants (Varade and Badhe, 1969).

The oil extracted from tamarind seeds has application in preparation of paints, varnishes, and soap making for burning lamps. It has also use for edible purpose after refining. Oil is also used to give shiny finish to the toys. The fatty oil naturally present in kernel powder plays an important role in giving softness to yarn during weaving and knitting.

Health benefits

- ✓ The sweet acidic pulp is used in Indian medicine as a refrigerant, carminative, antiscorbutic and laxative.
- ✓ It is generally prescribed in febrile diseases and bilious disorders.
- ✓ The beverage prepared from it often used in treatment of diarrhea and constipation.
- ✓ The polyphenols present in pulp have anti-inflammatory properties.
- ✓ It is also rich in antioxidants, which when consumed in ample has the ability to fight against many chronic diseases.
- ✓ The bark is given in diarrhea in lotions and poultices.
- ✓ Bark extracts also reduce mosaic virus infections.

Conclusion

Most of the rural and tribal people in different countries use tamarind products collected from the nearby forests and non-forest areas. However, processing technology at producer level is lacking and

heavy losses are reported. However, tamarind and its by-products have tremendous export potential in export market. It is exported to nearly 60 countries across the globe. Hence we have to focus more in popularization and development of this crop. Collecting the vast amount of indigenous knowledge will be essential to understand its uses in traditional medicinal systems. Availability of marketing information will also be required for the future development of tamarind.

Wild species application in crop sustainability under changing climate

Dr. Udit Nandan Mishra

Climate change has uncertain adverse impact agriculture in the future. Warmer temperatures, longer warm seasons, and adequate rainfall may make temperate zones more appropriate for crop development, whereas extreme climates would have a detrimental impact on the agricultural output. Plant diseases and pests would evolve as a consequence of these climate changes, exposing crops to novel abiotic circumstances as well as increased biotic pressure. There is no doubt that cropping system adaptation (genotypes from wild gene pool) is a critical prerequisite in dealing with climate change.

Crop wild cousins' wide range provides a chance for them to employ breeding to combat expected climatic adversaries. It is conceivable to use wild relatives of cultivated species to speed crop breeding and develop innovative crops or varieties that are resistant to a wide range *in-field* challenges while be able to achieve yield bonus in order to feed the booming population. Researchers are active in conserving crops' wild relatives and landraces. We are now in a position to use wild species and their gene pool for very efficient breeding, because to advancements in both phenotyping and genotyping technology.

Farmers may combat climate change and other threats by strengthening their irrigation system, adding more fertilizer, and spraying more fungicide and pesticide. Traditional approaches like fertilizer, pesticide application, irrigation water quality ensured by farmers are not long-term sustainable alone. Instead, a greater intensive input makes the farming system fragile in terms of risk association. As a result, there is a significant demand for the development of intrinsic stress-resistant traits and climate-friendly crops that can ensure expanding populations' demand while maintaining production stability and causing minimal environmental impact.

Genetic diversity of wild species and limitations

Wild relatives have an array of gene pool that offer a range of environmental and climate adaptations, genetic variety, and crop improvement potential. The wild germplasms are at present are underutilized. Wild germplasm's applicability in plant breeding is hampered by a lack of genetic and phenotypic information. Elite gene introgression is mostly restricted to features linked to prominent genes, such as disease resistance, which is rather straightforward to spot.In staple crops, genomics and

bioinformatics methodologies have improved and become more frequently employed, allowing researchers to gain a better understanding of the genetic mechanisms driving elite features. As a result, molecular mapping and sequencing have been proposed as a way to unleash the genetic potential of wild germplasm. These methodologies have recently been used to disclose genetic information from understudied species, which is useful for wild relatives' breeding. With this knowledge, it will be easier to improve features not just linked to large genes, but also quantitative traits influenced by numerous genes.

Wild trait introgression to cultivars

Adaptive introgression results in beneficial modifications in cultivars. This happened during the developmental phase of major crops. 'Interspecific-' or 'intergeneric-hybridization' is the classic way of resistance introgression. Another viable technique to increase genetic variability and crop vigor is through adaptability. Genotyping-by-sequencing has become possible thanks to the advancement of next-generation sequencing technology, and draught genome assemblies of wild species are rapidly becoming available. Comparative pool-sequencing finds probable genomic areas linked to adaptation to diverse ecological niches and aids in the understanding of enriched genes related to abiotic and biotic stress.

'De novo domestication' is another option for producing climate-friendly crops. A pipeline system is developed for commercializing wild germplasm. Apart from direct plantation of quasi- or non-domesticated plants, the popular wave of genome editing by CRIPSR/Cas9 allows for the accelerated domestication of wild relatives by editing domesticated genes encoding stress proteins and their receptors. These successful domestication gene introgressions show that wild relatives can be used to combat climate change and provide food security.

Conclusion

Modern breeding integrated with molecular techniques can address the issues raised due to global climate fluctuations. Omics coupled with genome editing tools, would speed up stress-resilient breeding that can be fruitful in terms of quality and quantity of the produce. Crop production is becoming increasingly challenging to meet the needs of an expanding population as a result of erratic climate condition. The bottle necks in producing resilient crops can be eradicated with the help of crop wild cousins.

Student achievements

Students participated in Rural Agriculture Work Experience (RAWE) for 45 days as part of Student Ready Program. Students were attached with farmers to learn farming practices, grassroots entrepreneurs and share scientific knowledge through extension principles.

RAWE AND INTERNSHIP DATA FOR ANNUAL REPORT

Rural Agricultural Work Experience

List of Students participated in RAWE, KUS and AIA-2021-22

Agriculture Students

Roll No.	Name
FOA/BAG/2018-22/001	LIPSY PATTANAIK
FOA/BAG/2018-22/002	SMRUTI REKHA SAHOO
FOA/BAG/2018-22/003	RUDRA PRASAD MAHAPATRA
FOA/BAG/2018-22/004	SWETA MISHRA
FOA/BAG/2018-22/005	PALISHREE SAHOO
FOA/BAG/2018-22/006	PUJA NEGI
FOA/BAG/2018-22/007	G DEVDUTT SHARMA
FOA/BAG/2018-22/008	BIDYUT PRAVA MOHAPATRA
FOA/BAG/2018-22/009	NITISH NAVNEET
FOA/BAG/2018-22/010	RICHI REKHA BARIK
FOA/BAG/2018-22/011	PRITAM RATH
FOA/BAG/2018-22/012	SATYAJIT JENA
FOA/BAG/2018-22/013	SUNAYANA MAHALIK
FOA/BAG/2018-22/014	SAI ABINASH SAHOO
FOA/BAG/2018-22/015	BAIBHABI BINDIA NAYAK
FOA/BAG/2018-22/016	SUSHREE SANGITA BEHERA
FOA/BAG/2018-22/017	SATABDI SUBHADARSHINI
FOA/BAG/2018-22/018	RAHUL BHARATI
FOA/BAG/2018-22/019	PRITI PALLABI DASH
FOA/BAG/2018-22/020	SUBHRAJYOSNA
FOA/BAG/2018-22/021	SREERAGI S. KUMAR
FOA/BAG/2018-22/022	SUBHAM GHOSE

FOA/BAG/2018-22/023	BYOMAKESH BARIK
FOA/BAG/2018-22/026	SUDIPA PRIYADARSHINI
FOA/BAG/2018-22/027	LUCKY SAHU
FOA/BAG/2018-22/028	ABHISEK MANDAL
FOA/BAG/2018-22/029	BISHNUPRIYA SINGH
FOA/BAG/2018-22/030	BARSHA MOHAPATRA
FOA/BAG/2018-22/031	M.M. RAJALAKSHMI
FOA/BAG/2018-22/032	MUSKAN SONI
FOA/BAG/2018-22/033	SUDHANSU SEKHAR BARIK
FOA/BAG/2018-22/034	BISMOY MOHANTY
FOA/BAG/2018-22/035	AMLANJYOTI KHUNTIA
FOA/BAG/2018-22/036	PRACHI PRATYASA DEO
FOA/BAG/2018-22/037	SAMPRATI PATRA
FOA/BAG/2018-22/038	ASHUTOSH PRADHAN
FOA/BAG/2018-22/039	RUDRADEV CHATTERJEE
FOA/BAG/2018-22/040	SUBHANGI PANIGRAHI
FOA/BAG/2018-22/041	ABHILIPSHA UPADHYAYA
FOA/BAG/2018-22/042	AMLAN BADU
FOA/BAG/2018-22/043	SUCHISMITA PALAI
FOA/BAG/2018-22/044	PRANAB KU PANIGRAHI
FOA/BAG/2018-22/045	CHANDAN KUMAR SASMAL
FOA/BAG/2018-22/046	KAUSTUV SARDAR
FOA/BAG/2018-22/047	SUNITA SUNDARAY
FOA/BAG/2018-22/048	BIDISHA JENA
FOA/BAG/2018-22/049	SANJEEBANI MOHANTA
FOA/BAG/2018-22/051	BISWA RANJAN SAHOO
FOA/BAG/2018-22/052	NIBEDITA MISHRA
FOA/BAG/2018-22/053	KUNIL KUMAR HATUA
FOA/BAG/2018-22/054	ALEKHIKA PATTANAIK
FOA/BAG/2018-22/055	PRATYUSH MOHANTY
FOA/BAG/2018-22/056	BISWAJEET MISHRA
FOA/BAG/2018-22/057	SIPRA PRIYADARSHINI ROUT
FOA/BAG/2018-23/058	SUSHREE SWAGATIKA BASTIA
FOA/BAG/2018-24/059	DEEPAK KUMAR SAHOO
FOA/BAG/2018-24/060	PRIYANSU SEKHAR MAHAKUDA
FOA/BAG/2018-22/061	PRAGYAN SAHOO
FOA/BAG/2018-22/062	MANALI MISHRA
FOA/BAG/2018-22/063	KSHITIJA N P PRIYADARSHINI
FOA/BAG/2018-22/064	PRADOSH PRAKASH PRADHAN
FOA/BAG/2018-22/065	SARADA PRASAD DAS
FOA/BAG/2018-22/066	AMITAV PAL
FOA/BAG/2018-22/067	ARIJIT SAHOO
FOA/BAG/2018-22/068	SONALI SATPATHY
FOA/BAG/2018-22/069	BIBHU PRASAD JENA
FOA/BAG/2018-22/070	AURO ASHISH PANDA
FOA/BAG/2018-22/071	SASWAT KUMAR BEHERA
FOA/BAG/2018-24/072	SOUMYAJEET SAHU
FOA/BAG/2018-22/073	ROJALIN PRADHAN
FOA/BAG/2018-22/074	PRAGYASINI BEHERA
FOA/BAG/2018-22/075	DURGA PRASAD NATH
FOA/BAG/2018-22/076	AYAN BANERJEE
FOA/BAG/2018-22/077	SWETA PADMA ROUT

FOA/BAG/2018-22/078	SMRUTI PAIK
FOA/BAG/2018-22/079	JINGYASHAJYOTI DAS
FOA/BAG/2018-22/080	BIRAJA PRASAD
FOA/BAG/2018-22/081	PRATYUSH PANDA
FOA/BAG/2018-22/082	DEBIASHRIT MOHANTY
FOA/BAG/2018-22/083	DEVANSH PANDHARKAR
FOA/BAG/2018-22/084	SUBHAM SETHY
FOA/BAG/2018-22/085	SUPRIYA BHARTI
FOA/BAG/2018-22/086	SOUMYA SUBHADARSHINEE
FOA/BAG/2018-22/087	SUMIT CHANDAN JENA
FOA/BAG/2018-22/088	BOKAM SRIRAM
FOA/BAG/2018-22/089	DEBASISH MOHANTA
FOA/BAG/2018-22/090	IPSITA PADHI
FOA/BAG/2018-22/091	SIDDHARTH CHOUDHURY
FOA/BAG/2018-22/092	STYLE SWAIN
FOA/BAG/2018-22/094	ASHUTOSH BARIK
FOA/BAG/2018-22/095	ANKITA SAHOO
FOA/BAG/2018-22/096	TEJASWINI KANOONGO
FOA/BAG/2018-22/097	LUSNA MAHESWARI
FOA/BAG/2018-22/098	ROSALIN DAS
FOA/BAG/2018-22/099	BISWABHUSAN SUPRAMIT MALLIK
FOA/BAG/2018-22/100	UTTARA DATTA
FOA/BAG/2018-22/101	SUBHA RANJITA SINGH
FOA/BAG/2018-22/102	ANKITA SENAPATI
FOA/BAG/2018-22/103	ANANYA PRIYADARSHINEE
FOA/BAG/2018-22/104	HARDIKA RAI
FOA/BAG/2018-22/105	SONIKA ACHARYA
FOA/BAG/2018-22/106	CHIRANJIBI DALAI
FOA/BAG/2018-22/107	JANMEJAY SAHOO
FOA/BAG/2018-22/108	ANSHUMAN DAS
FOA/BAG/2018-22/109	KAUSHIK YAMINENI
FOA/BAG/2018-22/110	SREE LEKSHMI.S
FOA/BAG/2018-22/111	SIDDHESWARI DASH
FOA/BAG/2018-22/112	KIRANMAYEE PRIYADARSHINEE BARIK
FOA/BAG/2018-22/113	NABASMITA SWAIN
FOA/BAG/2018-22/115	PAYAL MISHRA
FOA/BAG/2018-22/116	SHUBHASHREE JENA
FOA/BAG/2018-22/117	RADHARANI SAHU
FOA/BAG/2018-22/119	SOMENDEEP SAHOO
FOA/BAG/2018-22/120	KRISHNA SASTRI
FOA/BAG/2018-22/122	SATABDI BEDANT

Horticulture Students

FOA/BSH/2018-22/002	TAMANNA MAHAPATRA
FOA/BSH/2018-22/003	SHRUTISHRI ACHARYA
FOA/BSH/2018-22/004	PRIYANKA PRIYADARSINI

FOA/BSH/2018-22/005	BINODINI KHAMARI
FOA/BSH/2018-22/006	AYUSH SARAF
FOA/BSH/2018-22/007	SOUMYA SUCHARITA SAHOO
FOA/BSH/2018-22/008	ANITYA MOHANTY
FOA/BSH/2018-22/009	SOURAV RANJAN DASH
FOA/BSH/2018-22/011	ANKITA BISWAL
FOA/BSH/2018-22/012	S. SASWAT SEKHAR
FOA/BSH/2018-22/013	ABHISHEK DAS
FOA/BSH/2018-22/014	RITURAJ MOHANTY
FOA/BSH/2018-22/016	SHRADDHA SUMAN DASH
FOA/BSH/2018-22/017	MANISHA PRADHAN
FOA/BSH/2018-22/018	JYOTIRMAYA MISHRA
FOA/BSH/2018-22/019	PRERNA KANWAR
FOA/BSH/2018-22/020	S. SWADHEEN KUMAR
FOA/BSH/2018-22/021	STITI SHOHALINI
FOA/BSH/2018-22/022	SOUMYA RANJAN NAYAK
FOA/BSH/2018-22/023	SIDHARTHA MOHAPATRA
FOA/BSH/2018-22/024	ABHISHEK RAO
FOA/BSH/2018-22/025	ITISHREE DAS
FOA/BSH/2018-22/026	UPASANA PATNAIK
FOA/BSH/2018-22/027	SUSHREE SUVANKARY SETHI
FOA/BSH/2018-22/028	GEETIKA PATTNAIK
FOA/BSH/2018-22/029	DEBALEENA SATPATHY
FOA/BSH/2018-22/030	LAXMIPRIYA PRIYADARSHEENI SETHY
FOA/BSH/2018-22/031	DEBASHIS MISHRA
FOA/BSH/2018-22/032	SATYAPRAKASH TRIPATHY
FOA/BSH/2018-22/033	SASWATIKA MOHAPATRA
FOA/BSH/2018-22/034	STUTI NIVEDITA MAHANTA
FOA/BSH/2018-22/035	SACHIDANANDA PRADHAN
FOA/BSH/2018-22/036	ALISHA SATAPATHY
FOA/BSH/2018-22/037	SATYAJEET MURMU
FOA/BSH/2018-22/038	DIGANT KUMAR THAPA
FOA/BSH/2018-22/039	AMIT DAS
FOA/BSH/2018-22/040	PINAKI MOHANTY
FOA/BSH/2018-22/041	SHUBHRA NARAYAN MOHANTY
FOA/BSH/2018-22/042	BIPASHA BISWAL
FOA/BSH/2018-22/045	RAJKISHORE RATH
FOA/BSH/2018-22/046	J. N BISWAJIT PANDA
FOA/BSH/2018-22/047	POOJA PANWAR
FOA/BSH/2018-22/048	ANSULA ROUTRAY

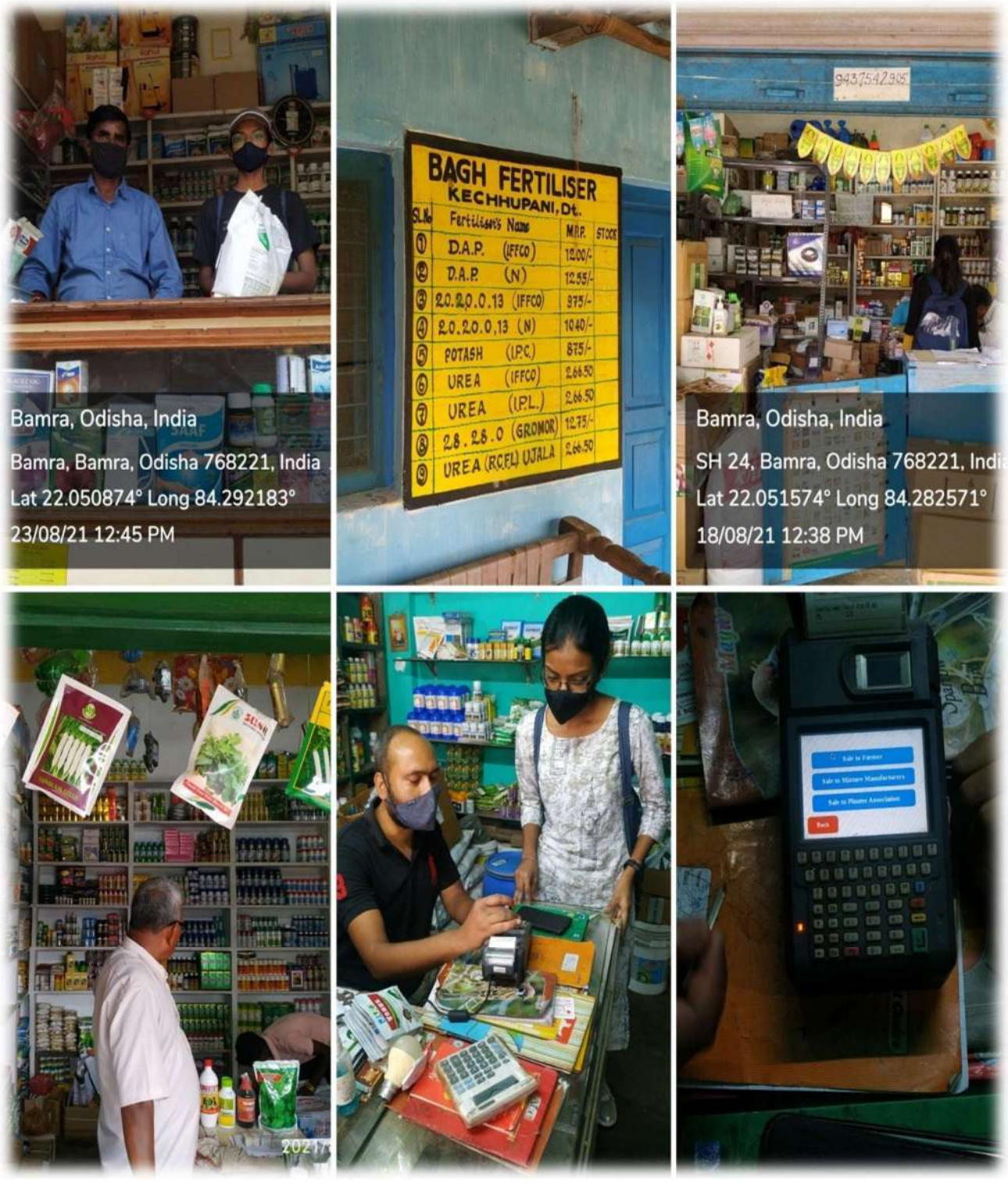
KUS BEST STUDENTS AWARD IN 2022

Sl.. No.	**Name of the Student**
1.	Siddheswari Dash
2.	Sonika Acharya
3.	Pritipallabi Dash
4.	Sanjeebani Mohanta
5.	Sweta Mishra
6.	Sreeragi S. kumar
7.	Lucky Sahu
8.	Nibedita Mishra
9.	Smrutirekha Sahoo

10. Biswajeet Mishra
11. Subham Ghose
12. Bismoy Mohanta
13. Pranab Kumar Panigrahi
14. Bipasha Biswal
15. Kunil kumar Hatua
16. Sushreeswagatika Bastia
17. Siddharth Choudhury
18. Sarda Prasad Das

Krishi Unnat Sahajogi (KUS)

E-Pest Surveillance by the Students



Fertilizer Dealer Survey

RAWE PHOTOS

Zero Energy Cooling Chamber

Interaction with the farmers

Market Survey

Agro-Industry Attachment (AIA)


POCO

Student Internships 2018-22

STUDENT NAME	REGISTRATION NUMBER	TITTLE OF INTERNSHIP	ORGANISATION OF NSTITUTE/ADDRESS, DATE AND PLACE
LIPSY PATTNAYAK	FOA/BAG/2018-22/001	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTDBHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
SMRUTI REKHA SAHOO	FOA/BAG/2018-22/002	BREAD MANUFACTURING PROCERSS	MOREISH FOODS LTDRASULGARH INDUSTRIAL AREA BHUBANESWAR*DATE-18TH NOVEMBER 2021*
RUDRA PRASAD MOHAPATRA	FOA/BAG/2018-22/003	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTDBHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
SHWETA MISHRA	FOA/BAG/2018-22/004	WHEAT PROCESSING	KHAITAN TRADES N COMMRCE,SIRIYABAGICHA,EKTALI, JHARSUGUDA*05TH NOVEMBER 2021*
PALLISHREE SAHOO	FOA/BAG/2018-22/005	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTDBHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
PUJA NEGI	FOA/BAG/2018-22/006	WHEAT PROCESSING	KHAITAN TRADES N COMMRCE,SIRIYABAGICHA,EKTALI, JHARSUGUDA, *05TH NOVEMBER 2021*
G DEVDUTT SHARMA	FOA/BAG/2018-22/007		
BIDYUT PRAVA MOHAPATRA	FOA/BAG/2018-22/008	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOMDANDAMUNDAPURT,PPILI, PURI *DATE-16TH NOVEMBR 2021*
NITISH NAVNEET	FOA/BAG/2018-22/009	RICE MILLING PROCESS	LALGANJ RICE MILLKEOTI,DARBHANGA,BIHAR,INDIA *Date-19th NOVEMBER 2021*
RICHI REKHABARIK	FOA/BAG/2018-22/010	CASHEW PROESSING	JEYPORE,KORAPUTODISHA, *DATE-05TH NOVEMBER 2021*
PRITAM RATH	FOA/BAG/2018-22/011	BISCUITS MANUFACTURING	MUSKAAN FOODS, BAINCHUA,TANGI, CHAUDWAR *DATE-20TH NOVEMBER 2021*
SATYAJIT JEENA	FOA/BAG/2018-22/012	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOM, DANDAMUNDAPURT,PPILI,PURI *DATE-16TH NOVEMBR 2021*
SUNAYANA MAHALIK	FOA/BAG/2018-22/013	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTD, BHIMPUR,PAHALA,BHUBANESWAR, *DATE-21ST NOVEMBER 2021*
SAI ABINASH SAHOO	FOA/BAG/2018-22/014	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTDBHIMPUR,PAHALA,BHUBANESWAR,*DATE-21ST NOVEMBER 2021*
BAIBHABI BINDYA NAYAK	FOA/BAG/2018-22/015	BISCUITS MANUFACTURING	MUSKAAN FOODS BAINCHUA,TANGI CHAUDWAR *DATE-20TH NOVEMBER 2021*

SUSHREE SANGITA BEHERA	FOA/BAG/2018 -22/016	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTD BHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
SATABDI SUBHADARSHINEE	FOA/BAG/2018 -22/017	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTD BHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
RAHUL BHARTY	FOA/BAG/2018 -22/018	BREAD MANUFACTURING PROCERSS	MOREISH FOODS LTD RASULGARH INDUSTRIAL AREA BHUBANESWAR *DATE-18TH NOVEMBER 2021*
PRITI PALLABI DASH	FOA/BAG/2018 -22/019	07 DAYS ONLINE TRAINING ON ORGANIC FARMING	REGIONAL CENTRE OF ORGANIC FARMING BHUBANESWAR ODISHA *DATE-06TH JULY 2020*
SUBHRA JYOSNA	FOA/BAG/2018 -22/020	CASHEW PROCESSING	JAGANNATH FOODS MANGALPUR,DHENKANAL *DATE-5TH NOVEMBER 2021*
SREE RAGI S KUMAR	FOA/BAG/2018 -22/021	WHEAT PROCESSING	KHAITAN TRADES N COMMRCE,SIRIYABAGICHA,EKTALI, JHARSUGUDA *05TH NOVEMBER 2021*
SUBHAM GHOSE	FOA/BAG/2018 -22/022	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTD BHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
BYOMAKESH BARIK	FOA/BAG/2018 -22/023	SEED PROCESSING	NUZIVEEDU SEEDS LIMITED BARGARH,ODISHA *DATE-27TH NOVEMBER 2021*
SUDIPA PRIYADARSHINI	FOA/BAG/2018 -22/026	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTD BHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
LUCKY SAHU	FOA/BAG/2018 -22/027	COTTON PROCESSING	MAA SAMALESWARI COTTO INDUSTRY KHAPRAKHOL,BALANGIR *DATE-05TH NOVEMBER 2021*
ABHISEK MANDAL	FOA/BAG/2018 -22/028	RICE MILLING PROCESS	JAGADAMBA RICE MILL RAIRANGPUR MAYURBHANJ *DATE-20TH NOVEMBER 2021*
BSHNUPRIYA SINGH	FOA/BAG/2018 -22/029	BREAD MANUFACTURING PROCERSS	MOREISH FOODS LTD RASULGARH INDUSTRIAL AREA BHUBANESWAR *DATE-18TH NOVEMBER 2021*
BARSHA MOHAPATRA	FOA/BAG/2018 -22/030	COOKIES MANUFACTURING	M/S COOKIERS PLOT NO-M/31 CHANDAKA INDUSTRIAL ESTATE,BHUBANEASWAR *DATE-19TH NOVEMBER 2021*
M.M. RAJALAKSHMI	FOA/BAG/2018 -22/031	KRISHI BHAVAN (KERALA GOVT)	ERUMAPETTY KRISHI BHAVAN THRISSUR,KERALA *DATE-26TH JULY TO 26TH NOVEMBER 2021*
MUSKAN SONI	FOA/BAG/2018 -22/032	MILK & MILK PRODUCT PROCSSING	SARADA ENERGY & MINERALS LTD VACHAN DAIRY KHRORA-TILDA ROAD RAIPUR, CHATTISGARH *DATE-21ST NOVEMBER 2021*
SUDHANSU SEKHAR BARIK	FOA/BAG/2018 -22/033	RICE MILLING PROCESS	CHANDRIKA_AGRO_FOOD PVT LTD KARANJIA,MAYURBHANJ *21ST NOVEMBER 2021*

BISMOY MOHANTY	FOA/BAG/2018 -22/034	PRODUCTION,PROCESSING & MARKETING OF MILK	OMFED,BHUBANESWAR *DATE 11TH -25TH FEBRUARY 2021*
AMLANJYOTI KHUNTIA	FOA/BAG/2018 -22/035	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOM DANDAMUNDAPURT,PPILI,PURI *DATE-16TH NOVEMBR 2021*
PRACHI PRATYASHA DEO	FOA/BAG/2018 -22/036	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOM DANDAMUNDAPURT,PPILI,PURI *DATE-16TH NOVEMBR 2021*
SAMPRATI PATRA	FOA/BAG/2018 -22/037	PRODUCTION,PROCESSING & MARKETING OF MILK	OMFED,BHUBANESWAR *DATE 11TH -25TH FEBRUARY 2021*
ASHUTOSH PRADHAN	FOA/BAG/2018 -22/038	DIARY FARMING	BBR & BM FARM KHAPURIA,CUTTACK DATE-21ST OCTOBER 2021
RUDRADEV CHATTERJEE	FOA/BAG/2018 -22/039	RICE PROCESSING	ANNADATA AGRO PVT.LTD BARDHAMAN,WB *DATE-16TH NOVEMBER 2021*
SUBHANGI PANIGRAHI	FOA/BAG/2018 -22/040	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTD BHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
ABHILIPSHA UPADHAYA	FOA/BAG/2018 -22/041	BAKERY PROCESSING	BISHNUPRIYA BAKERY BHADRAK,ODISHA *DATE-21ST NOVEMBER 2021*
AMLAN BADU	FOA/BAG/2018 -22/042	BREAD MANUFACTURING PROCERSS	MOREISH FOODS LTD RASULGARH INDUSTRIAL AREA BHUBANESWAR *DATE-18TH NOVEMBER 2021*
SUCHISMITA PALAI	FOA/BAG/2018 -22/043	BISCUITS MANUFACTURING	MUSKAAN FOODS BAINCHUA,TANGI CHAUDWAR *DATE-20TH NOVEMBER 2021*
PRANAB KUMAR PANIGRAHI	FOA/BAG/2018 -22/044	BACKERY PROESSING	JAGGANTH BACKERY BHADRAK,ODISHA *DATE-21ST NOVEMBER 2021*
CHANDAN KUMAR SASMAL	FOA/BAG/2018 -22/045	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOM DANDAMUNDAPURT,PPILI,PURI *DATE-16TH NOVEMBR 2021*
KAUSTUV SARDAR	FOA/BAG/2018 -22/046	MANUFACTURING OF POULTRY FEED	RELIABLE HATCHERIES PVT. LTD JAMALDAHA,COOCHBEHAR *DATE-21ST NOVEMBER 2021*
SUNITA SUDRAY	FOA/BAG/2018 -22/047	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOM DANDAMUNDAPURT,PPILI,PURI *DATE-16TH NOVEMBR 2021*
BIDISHA JENA	FOA/BAG/2018 -22/048	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOM DANDAMUNDAPURT,PPILI,PURI *DATE-16TH NOVEMBR 2021*
SANJEEBANI MOHANTA	FOA/BAG/2018 -22/049	WORKING PRINCIPLE OF FISH HATCHERY UNIT	KAILASH FISHERY & AQUATIC ASTAPUR,BAISINGA MAYURBHANJ *DATE-05TH NOVEMBER 2021*
BISWARANJAN SAHOO	FOA/BAG/2018 -22/051	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTD BHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
NIBEDITA MISHRA	FOA/BAG/2018 -22/052	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOM DANDAMUNDAPURT,PPILI,PURI

			DATE-16TH NOVEMBR 2021
KUNIL KUMAR HATUA	FOA/BAG/2018 -22/053	MUSHROOM SPAWN PRODUCTION PROCESS	KALINGA MUSHROOM DANDAMUNDAPURT,PPILI,PURI *DATE-16TH NOVEMBR 2021*
ALEKHIKA PATTANAIK	FOA/BAG/2018 -22/054	BISCUITS MANUFACTURING	MUSKAAN FOODS BAINCHUA,TANGI CHAUDWAR *DATE-20TH NOVEMBER 2021*
PRATYUSH MOHANTY	FOA/BAG/2018 -22/055	BISCUITS MANUFACTURING	MUSKAAN FOODS BAINCHUA,TANGI CHAUDWAR *DATE-20TH NOVEMBER 2021*
BIWAJEET MISHRA	FOA/BAG/2018 -22/056	DAIRY ENTERPRISE	SHREE DHARA DAIRY & AGROVET PVT.LTD NUASAHI,ODISHA *DATE-30TH NOVEMBER 2021*
SIPRA PRIYADARSHINI ROUT	FOA/BAG/2018 -22/057	BISCUITS MANUFACTURING	MUSKAAN FOODS BAINCHUA,TANGI CHAUDWAR *DATE-20TH NOVEMBER 2021*
SUSHREE SWAGATIKA BASTIA	FOA/BAG/2018 -22/058	MANUFACTURING AD EXPORT OF ORGANIC COTTON BALES	SHRI AMBIKA AGRO PVT.LTD BALANGIR,ODISHA *DATE-05TH NOVEMBER 2021*
DEEPAKI KMAR SAHOO	FOA/BAG/2018 -22/059	TURMERIC PROCESSING	KANDHAMAL TURMERIC PACKAGING & PROCESSING G.UDAYGIRI,KANDHAMAL *DATE-07TH NOVEMBER 2021*
PRIYANSHU SEKHAR MOHAKUD	FOA/BAG/2018 -22/060	PROCESSING OF SPICES AND CONDIMENTS	DIVYA MULTI GRAIN PVT.LTD BHIMPUR,PAHALA,BHUBANESWAR *DATE-21ST NOVEMBER 2021*
MANAL MISHRA	FOA /BAG/2018-22/062	CLIMATE RESILENT AGRICULTURE AND WATER MANAGEMENT	UTKAL UNIVERSITY 23/12/2020- 25/01/2021, SAMBALPU
ASHUTOSH BARIK	FOA.BAG.2018-22.094	ASHUBARIK87631@GMAIL.COM	GREENIIAC 05/11/2021- 25/11/2021, SAMBALPUR
PRAGYAN SAHOO	FOA/BAG/2018 -22/061	KRUSHI UNNNAT SAHYOGI PROGRAMME	DEPARTMENT OF AGRICULTURE AND FARMER'S EMPOWERMENT 2ND AUGUST 2021; ATHAGAD
KSHITIJA N P PRIYADARSHINI	FOA/BAG/2018 -22/063	NURSERY AND POLYHOUSE MANAGEMENT	BAMANDA BIOTEK PRIVATE LIMITED 20/7/21 2. 25/11/2
SOUMYAJEET SAHU.	FOA/BAG/2018 -22/072	1. MARINE INDUSTRY 2. SEED INDUSTRY	1. HARI MARINE, BIRUAN, SERGADH BALASORE. 2. ODISHA STATE SEED CORPORATION, BALASORE 1.20/7/21 2. 25/11/21
SWETA PADMA ROUT	FOA/BAG/2018 -22/077	AIA	BHARAT MASALA (P)LTD CUTTACK, 24-11-2021
JINGYASHA JYOTI DAS	FOA/BAG/2018 -22/079	1. ENTREPRENEURSHIP DEVELOPMENT PROGRAM ON 'SUPPORT SCHEMES FOR AGRIPRENEURS' 2. KRUSHI UNNAT	1. AGRIBUSINESS INCUBATION CENTRE, ICAR-NRRI, BIDYADHARPUR, CUTTACK 2. DEPARTMENT OF AGRICULTURE AND FARMERS EMPOWERMENT, GOVT. OF ODISHA 3. INSTITUTE FOR INDUSTRIAL

		SAHAYOGI 3. HYDROPONICS TRAINING 4. AGRI-INTERNSHIP PROGRAMME 5. INTERNSHIP ON STUDY OF SPICES INDUSTRY	DEVELOPMENT, GOVT. OF INDIA 4. AGRIVISION, ODISHA 5. JAY BHARAT SPICES PVT. LTD. 13TH-15TH DEC 2021, CUTTACK, 2. 26TH JULY 2021- 30TH SEP 2021, BIRIDI, JAGATSINGHPUR, 3. 1ST-6TH JUNE 2021, NEWDELHI, 4. 10TH-11TH JULY 2021, SAMBALPUR, 5. 5TH-20TH NOV 2021, RAMDASPUR, CUTTACK
BIRAJA PRASAD	FOA/BAG/2018-22/080	APPLICATION OF NANOTECHNOLOGY IN CROP PROTECTION: CURRENT STATUS AND FUTURE PROSPECTS	SRI SRI UNIVERSITY
SUBHAM SETHY	FOA/BAG/2018-22/084	INDUSTRIAL ATTACHMENT	SRIRAM FOOD PROCESSING INDUSTRIES, JEYPORE, ODISHA
SUPRIYA BHARTI	FOA/BAG/2018-22/085	AGRICULTURAL INDUSTRIAL ATTACHMENT (AIA)	BHARAT MASALA
SOUMYA SUBHADARSHINEE	FOA/BAG/2018-22/086	PRAWN FARMING AND PROCESSING	HARI MARINE PVT LIMITED, BALASORE
UTTARA DATTA	FOA/BAG/2018-22/100	INDUSTRIAL ATTACHMENT	RICE MILLING INDUSTRY, W.B, DIST-NADIA
SUBHA RANJITA SINGH	FOA/BAG/2018-22/101	AGRO INDUSTRIAL ATTACHMENT	DIVYA MULTIGRAIN PVT . LTD , BHIMPUR , PAHAL , BHUBANESWAR
ANANYA PRIYADARSHINEE	FOA/BAG/2018-22/103	INDUSTRIAL ATTACHMENT	BHARAT MASALA
SONIKA ACHARYA	FOA/BAG/2018-22/105	1.HARI MARINE PVT LTD 2.KRUSHI UNNAT SAHAJOGI 3.MURARKA PVT LTD	1.AT- BIRUAN, PO-SERAGARH, DIST-BALASORE, PIN: 756060 2.DEPARTMENT OF AGRICULTURE AND FARMER EMPOWERMENT GOI, DIST: BALASORE, BLOCK: SIMULIA,756126 3.BAINCHUA, TANGI, CHAUDWAR ODISHA, 754002
JANMEJAY SAHOO	FOA/BAG/2018-22/107	AGRO-INDUSTRIAL ATTACHMENT	HARI MARINE, SERGARH, BALASORE
SIDDHESWARI DASH	FOA/BAG/2018-22/111	1.KRUSHI UNNAT SAHAJOGI 2.HARI MARINE PVT LTD 3.SHREE AMBICA AGRO PVT. LTD 3.AGRI-INTERNSHIP BY AGRI-VISION.	1.DEPARTMENT OF AGRICULTURE AND FARMERS EMPOWERMENT GOV. OF ODISHA 2.AT.BIRUAN PO: SERAGARH , DIST : BALASORE , PIN : 756060 3.INDUSTRIAL ESTATE ZONE-A BALANGIR , ODISHA PIN: 767001 4. AGRI-VISION ,ODISHA
KIRANMAYEE PRIYADARSHINEE BARIK	FOA/BAG/2018-22/112	KRUSHI UNNAT SAHAJOGI HARI MARINE PRIVATE LIMITED AGRI INTERNSHIP BY AGRIVISION	DEPT. OF AGRICULTURE & FARMER EMPOWERMENT, GOVT. OF ODISHA DIRUAN, PO- SERAGARH ,DIST - BALASORE,PIN-754060 SAMBALPUR, ODISHA
SHUBHASHREE JENA	FOA/BAG/2018-22/116	1-MARINE INDUSTRY 2- SEED PROCESSING UNIT	1-HARI MARINE PVT.LTD,BIRUAN,BALASORE,ODISHA

			2-ODIAHA STATE SEED PROCESSING PLANT, SERGARH, BALASORE
SMRUTI PAIK	FOA/BAG/2018 -22/78	1.QUALITY CONTROL AND PRODUCTION OF DAIRY PRODUCTS 2. CAMPUS AMBASSADOR 3. AGRI-INTERNSHIP PROGRAMME 4. AGRICULTURE DEVELOPMENT ASSOCIATE 5. MOVERS AMBASSADOR 6. AGRI-INDUSTRY ATTACHMENT	1.OMFED SAMBALPUR 2.PRAKRITI 202, (DEPARTMENT OF AGRICULTURE AND FOOD ENGINEERING, IIT KGP) 3.AGRIVISION ODISHA 4.KRISHI UNNAT SAHAJOGI 5.MASH PROJECT 6. ORISSA,SEEDS
SIDDHARTH CHOUDHURY	FOA/BAG/2028 -22/091	KRUSHI UNNAT SAHAJOGI	GOVERNMENT OF ODISHA

The team

Sl. No.	Name of the Faculty Member	Designation	Research Interests
1	Prof. Dr. S. Kumaraswamy	Dean & HoD	Microbial Ecology, Biogeochemistry of C and N cycling, Agro-ecology, Climate Change
Agronomy			
2	Ms. Bidudhi Tripathy	Assistant Professor	Nutrient management, Conservation agriculture
3	Dr. Rashmirekha Pattnaik	Assistant Professor	Nutrient management in rice or rice - pulse cropping system
4	Dr. Madhab Kumar Datta	Assistant Professor	Weed management and nutrient management, zero tillage technique, fodder crop
5	Dr. Susmita Das	Assistant Professor	Nutrient Management in Millets, Integrated Farming system approaches
Genetics and Plant Breeding and Biotechnology			
6	Dr. Damodara Parida	Professor	Seed technology
7	Dr. Mandakini Kabi	Assistant Professor	Molecular Breeding, Cytogenetics, Resistance Breeding
8	Dr. Anupama Singh	Assistant Professor	Marker assisted breeding for biotic and abiotic stress resistance
9	Dr. Mahipal Singh	Assistant Professor	Structural and functional genomics; Developmental biology; Abiotic Stress signaling; Hormone signaling; Gene Editing; RNA biology and Epigenetics
Plant Pathology			
10	Dr. Chinmayee Mohapatra	Assistant Professor	Disease detection, molecular plant pathology, Bio informatics
11	Ms. Debanjana Debnath	Assistant Professor	Biochemical defense, chemical alternatives, bio-control agents
12	Dr. Ansuman Khandual	Assistant Professor	Crop diseases, Genetic diversity studies
Entomology			
13	Dr. Snehasish Routray	Assistant Professor	Insect Toxicology, Insect Chemical Ecology
14	Dr. Seema Tripathy	Assistant Professor	Induced resistance, integrated pest management
15	Dr. Ipsita Samal	Assistant Professor	Insect physiology, Host plant resistance
Crop Physiology			
16	Dr. Prajjal Dey	Assistant Professor	Photobiology and Abiotic Stress Mechanisms in Crops
Plant Biochemistry			
17	Dr. Udit Nandan Misra	Assistant Professor	Plant and agricultural biochemistry, Protein Biology, Plant Stress Biology, Interdisciplinary Plant Sciences
Agricultural Economics			
18	Dr. Shruti Mohapatra	Assistant Professor	Policy Research, Supply Chain Management & Natural Resource Management

19	Dr. Revanasiddappa Bhawar	Assistant Professor	Agricultural marketing, Supply chain and value chain management
20	Dr. S.R. Devegowda	Assistant Professor	Climate Resilient Agriculture, Environmental Economics
Agribusiness			
21	Dr. Shubhaom Panda	Assistant Professor	Agri Value Chain, Agricultural Marketing, Rural Marketing
22	Dr. K.K. Datta	Professor	Agribusiness management
Agricultural Engineering			
23	Dr. Dhaval Kiran Dwivedi	Assistant Professor	Hydrology, Remote Sensing and GIS, Irrigation Hydraulics, Water Conservation
Forestry			
24	Dr. Sandeep Rout	Assistant Professor	Forest Products; Plant Tissue Culture, Medicinal and Aromatic Plants
Agricultural Extension			
25	Dr. Vinoda Shankara Naik	Assistant Professor	Information and Communication Technology in Agriculture, Technology gap, etc.
26	Dr. Shubrajyoti Panda	Assistant Professor	Information and Communication Technology in Agriculture, Pluralistic Extension Service, New trends in agricultural extension, Agricultural knowledge information system
27	Dr. Anupama Dakua	Assistant Professor	Farmer Distress, Climate Resilient Agriculture
Horticulture			
28	Dr. Suvalaxmi Palei	Assistant Professor	Morphological, Physiological, Biochemical and biomolecular study in fruit crops and medicinal plants
29	Dr. Tanushree Sahoo	Assistant Professor	Metabolomics study on different fruit crops
30	Ms. Meenakshi Badu	Assistant Professor	Vegetable breeding
31	Dr. Kalyani Pradhan	Assistant Professor	Vegetable Breeding
32	Dr. Suchismita Jena	Assistant Professor	Fruit Breeding, Post-harvest management in Fruit crops
Soil Science and Agricultural Chemistry			
33	Mr. Ambika Prasad Misra	Assistant Professor	Soil chemistry
34	Dr. Purubhasha Priyadarshini Padhi	Assistant Professor	Soil fertility, Soil Chemistry, soil biology, Climate smart Agriculture
35	Dr. Rini Libanya	Assistant Professor	Micronutrients, Microbiology
36	Dr. Bidisha Majumdar	Associate Professor	Carbon sequestration in soil, Soil health
Environmental Science			
37	Dr. Rachana Chandra	Associate Professor	Metal dynamics and Restoration
Statistics			
38	Dr. Sanjeeta Biswas	Assistant Professor	Forecasting and Modelling, Advanced Design of experiment in agriculture, Predictive analysis
Animal Sciences			
39	Dr. Santosh Kumar Sahu	Assistant Professor	Prenatal Development of Heart in sheep, Livestock Management, Poultry Management
Agro-meteorology			
40	Dr. Sayani Bhowmick	Assistant Professor	Climate change, Climate modelling
Food Nutrition and Dietetics			
41	Dr. Neela Satheesh	Associate Professor	Preservation of durable and perishables, Assessment of Post-harvest losses in supply chains, Food quality and safety, Value addition of Agricultural commodities, Food product development, Food Analysis
42	Dr. Krishna Misra	Assistant Professor	Food Science, Product development, Clinical nutrition, Food Analysis
43	Dr. Moirangthem Kalpana Devi	Assistant Professor	Cereal Processing, Drying, Food waste utilization
44	Ms. Rashmi Misra	Assistant Professor	Clinical Nutrition and Dietetics, Food Preservation and Processing
45	Mrs. Chinmayee Pattnayak	Assistant Professor	Community and Clinical Nutrition

Guest Faculty Members (Basic Sciences)*

1	Dr. Surjeet Kaushik	Assistant Professor	Mathematics
2	Dr. Sharda Acharya	Assistant Professor	English
3	Dr. Anjala Devi	Assistant Professor	English
4	Mr. Biswajit Nayak	Assistant Professor	Computer Science
5	Mr. Harikrishnan	Assistant Professor	English

Staff

Sl. No.	Name	Designation
1	Mr. Rasmi Ranjan Patra	Laboratory Manager
2	Ms. Lipsa Mohanty	Academic Assistant
3	Mr. Bijaya Mohanty	Helper