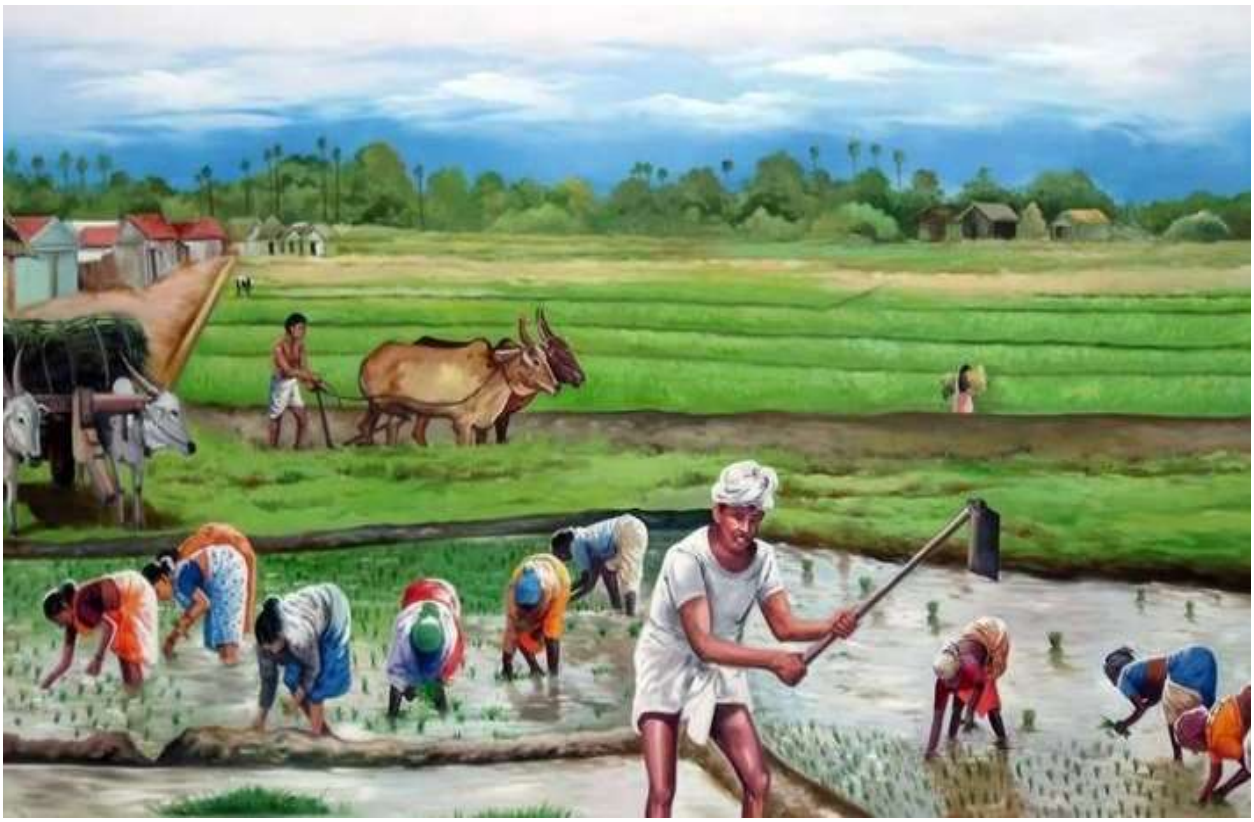
ANNUAL REPORT/NEWSLETTER

FACULTY OF AGRICULTURE



Faculty of Agriculture
Sri Sri University, Bidyadharpur-Arilo, Cuttack 754 006

Dean's Message

On a philosophical note, I had overheard an opinion, which goes 'Agriculture will be the next best profession across the world and the future of humanity is in agriculture as a vocation'. I believe it to be true as most of the agricultural landscapes have assumed advanced stages of degradation of productive elements like soil and water resources.

The industrial agriculture has degraded the integrity of the crop production elements resulting in decline in productive capacity of the agricultural landscapes. Currently, agriculture landscapes are suffering, irrespective of the geographical locations, due to dwindling of water resources, degradation of fertility status of soils, abandoning and migration of farmers to cities and lack of cost neutral technological innovations to assist agricultural practices. It has been one of the reasons to focus on reviving the local or regional scale agricultural systems and management practices. It is more relevant to agriculture sector in the State of Odisha due to small to marginal land holding farmers with minimal technical knowledge on effective farming practices. Hence, regional scale agricultural development requires a strategic approach to provide education and generate skilled manpower.

Admittedly, the conventional education modules have not been evolved over a period to address the changing agricultural landscapes with increasing constraints/limitations in crop management practices

and/or technological interventions. Technological intervention has been suggested to be solution to precisely sustain the key resources with concomitant increase in the productivity per unit area.

The Faculty of Agriculture at the university has vision to build an institution of excellence with a goal to provide pragmatic education, conduct application-oriented research and design an effective outreach programs. The focus will be to develop an inter-disciplinary research programs to foster the innovations. It is imperative that technological interventions in agriculture must be cost effective with larger adoption by the small to marginal farmers.

The envisioned Faculty of Agriculture will be modeled incorporating the inter-disciplinary sciences, breaking the existing model of uni-directional departmental systems as in the SAUs. Likewise, inter-disciplinary departments will be created to address the education and research in a holistic manner to benefit the students and also the stakeholders at large.

Our mission is to build the Faculty of Agriculture at the university as institution of excellence. We have focused approach to achieve the objective goal/s viz.,

1. To build faculty and team of inter-disciplinary expertise to provide quality and comprehensive education in agriculture.
2. To evolve innovation in course curricula and training programs.
3. To design and generate problem solving tools/technologies/innovations relevant to enhance the productivity of agricultural crops and sustenance of ecosystem services.
4. To develop pro-farmer outreach programs– scientist-farmer forums, farmer cooperatives, ICT based user-friendly mobile-based app., forward market linkages and knowledge resource modules, building interactive knowledge base on agricultural practices etc.
5. To build a 'Centre for Conservation Agriculture and Innovations' with inter-disciplinary expertise to promote sustainable agricultural practices and develop technologies to help farmers.

Ancient agricultural heritage recognizes 'Farmer as a logical-wisdom based scientist'. In the modern times, youth can play a critical role in revitalization of farming and farm-based rural livelihood systems. In this direction, creation of informed and skilled human resources assumes prime importance.

In our endeavor to achieve our goals, we wish to collaborate and/or work in association with institutions/organizations to derive mutual benefits. We have taken a step forward now to build an institution

of excellence in agriculture to generate human resources to address issues of relevance to build sustainable agriculture based livelihood systems.

We welcome you to be part of our endeavor to achieve excellence in education and creation of skilled human resources for posterity.

Come join us.

S. Kumaraswamy Ph.D.
Dean and Head, Faculty of Agriculture

Faculty of Agriculture: The beginning

Sri Sri University proudly commenced B.Sc. (Hons.) Agriculture from the academic year 2017. The first batch of students (2017-2021) have already enrolled to the academic program with a strength of 60. The university has vision to provide holistic education with major focus on inculcating pragmatic skills and development of overall professional personality. The course curriculum is similar to the curriculum in the State Agricultural Universities (SAUs) as per Fifth Dean's Committee Report, Indian Council of Agricultural Research (ICAR), New Delhi.

Faculty of Agriculture has a focused vision to achieve academic excellence in grooming the students to generate skilled manpower to assist agricultural development programs, develop a center of excellence to promote sustainable agriculture and innovations, build the repository of agricultural technologies and develop replicable models of crop management to address the drought scenarios and climate resilient agricultural practices. The envisioned research program of the university will focus on thrust thematic areas of local to regional importance. The Faculty of Agriculture will be modeled to initiate collaborative research with agricultural institutions and universities. Besides, faculty of agriculture will act as platform to train the various stakeholders on sustainable agriculture. The Faculty of Agriculture has plans to initiate Masters and Doctoral program in all the discipline with major focus on problem solving research and innovations. In essence, Faculty of Agriculture as part of Sri Sri University has long term goal of building robust interdisciplinary course curricula to generate competent and skilled manpower to support agriculture at local-regional to national level.

The University has vibrant and sprawling campus (185 acres) with vice free environment. The university has adequate infrastructure, student hostels, administrative and facilities to support the academic programs of inter-disciplinary nature.



During the academic year 2017, Faculty of Agriculture was initiated with first batch of enrolled students (60) for the academic year 2017-2021.

B.Sc. (Hons.) Agriculture: Class of 2017-2021

B. Sc. (Hons.) Course curricula booklet was released by Honorable Vice Chancellor Prof. Nand Lal, in the presence of Executive Registrar, Dr. Parasanna David and Sri, Narendra Lamba, Director Operations.

Why agriculture and prospects

Agricultural landscapes have transformed with time adopting industrial farming principles. It has been cause for concern due to eroding inherent capacity of productive landscapes and decline in natural resources. Despite achieving the increase in the productivity of agricultural crops, the gap to achieve potential productivity has widened with passing years. Moreover, natural resources (water and soils) of agricultural landscapes have reached to unsustainable status. It has been a serious constraint to pursue the farmers to continue with the farming activity. The migration of farm dependent community in search of alternative livelihood has increased over the years. In many cases, farmers have completely abandoned the farming as their livelihood. Given the current state of agriculture sector, a plan to revive the agriculture sector at local to regional scale has relevance. In this direction, education and generation of skilled manpower plays a crucial role to revitalize the agriculture sector.

Modern agriculture is projected to have assumed declining trend in terms of productivity per unit area. It is mainly attributed to loss of inherent capacity of agricultural landscapes and degradation of services

providing elements. In this direction, efforts are being made to revive the methods of conservation agriculture and natural farming with minimal use of chemicals viz., fertilizers and plant protection chemicals in the production practices. However, the approaches to revive the sustainable farming activities must consider local and regional scale needs of education to create skilled manpower to address the challenges of agriculture sector.

B.Sc. (Hons.) in Agriculture has been categorized as technical degree program, which integrates agricultural sciences, basic science and humanities and inter-disciplinary allied sciences in a holistic exposure to scientific and technical aspects of agriculture.

The education and experiential learning during the course curriculum (as per the 5th Dean's Committee) enables to acquire scientific knowledge and skills to contribute for the development of tools/technologies and/or processes to increase both the production and productivity of agriculture through efficient utilization and conservation of natural resources of agricultural landscapes.

Agriculture education program administered at the university aims at filling the gap by creating skilled professionals who become progressive and practicing farmers, create agri-based start-up companies to generate technologies and/or provider services to agriculture sector or serve the government at various capacities to promote agriculture. The learning program include rigorous exposure to theoretical concepts and experiential learning at various levels with innovative approaches, faculty-student bonding and agri-industry exposure internship also provides overall personality development while creating skilled human resources to serve agriculture sector. It is a technical program that aims at providing cost-effective education through experiential learning curriculum.

Experiential and skill based learning environment:

- Students undergo experiential learning program (ELP) through placement with the farmers under the RAWE program (Rural Agricultural Work Experience).
- Student Internship program with NGOs involved in the training and building of the rural economy and agricultural technologies development companies under Hands on Training (HOT) and Agro-Industrial Attachment (AIA) program.
- Students will be exposed to state agricultural universities and ICAR governed research institutions and organizations during the educational tours across the country.

Career Avenues:

- Qualify to become agricultural scientists, progressive farmers or agriculture based-entrepreneurs, Service providers and/or creators of agri-technologies. Build small-scale companies that develop technologies to provide services to support agricultural activities.
- Build a career in seed production companies and related industries such as agribusiness, crop production, soil and water conservation engineering, banking, biotechnology industries, farm manager, rural entrepreneur's, agri-produce processing industries etc.
- Pursue career in the State Department of Agriculture/Horticulture – AAO, ADA, Extension officers
- at KVKs, SAUs, ARS.
- Advocacy and policy planners in in NGOs, Research organizations, Consultancy firms.

B.Sc. (Hons.) Agriculture graduates can also pursue higher studies specializing in a Master's program in Agronomy, Entomology, Horticulture, Plant genetics and breeding, Soil and Water Conservation Engineering etc.

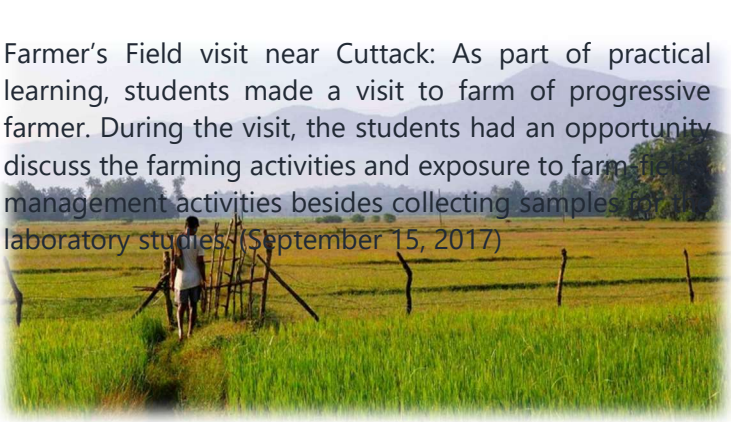
Academic year 1: An overview

Academic year 1 had preparatory activities to build the required infrastructure for teaching and allied educational activities. The beginning was admirably had good response of excellent admission with full capacity of students. Several educational activities were executed during the semester I and II of academic year 2017-18. During the short period, efforts were made to include experiential learning in each course inclusive of field visits, organizing interactive forum in the classroom and class seminars etc. Few of the activities are highlighted below;

Socio-economic survey of households in village, Bidyadharpur

(Aug. 5, 2017)

Farmer's Field visit near Cuttack: As part of practical learning, students made a visit to farm of progressive farmer. During the visit, the students had an opportunity discuss the farming activities and exposure to farm fie management activities besides collecting samples for laboratory studies. (September 15, 2017)



Visit to community based quasi-govt. institution OMFED

Study tour to Satkosia National Park

Study tour to soil and water conservation watershed system at Vishwakahani

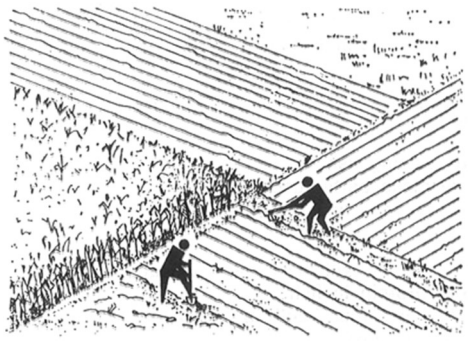
Parent-Student-Teacher Interactive Forum:

As part of holistic owning of responsibilities in education and learning, we organized first-of-its-kind parents-students-teachers interactive meet to understand the deficiencies and limitations of students as perceived by teachers, which is placed before the parents to obtain their feedback on their children. It is an innovative approach to design counseling session with focus to develop interest amongst the students in learning and participate in extra-curricular activities.

The initial response has been encouraging to catalogue the opinions of the parents in shouldering the responsibility to participate in feedback mechanisms to support effective implementation of teaching and student development program.

Collaborations/Guest Lectures/Talks

Initiative to collaborative with Drishtee Foundation for student education and internship.



Guest lectures/Talks

1. Permaculture and its benefits to sustain the food security – Mr. Deepak Suchde, Natueco Farming
2. Making villages self-reliant through innovative agriculture - Mr. Satyan, Director, Drishtee Foundation
3. Communication skills and personality virtues - Mr. Augstine Veliath, formerly with UNICEF
4. Basics of managing an NGOs addressing socially relevant causes - Dr. Sunil Mehra, MAMTA

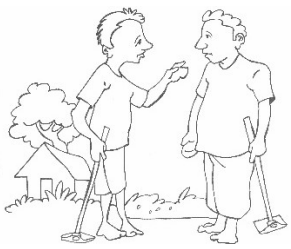
Participation in Conference/Symposium

Prof. S. Kumaraswamy, Faculty of Agriculture delivered an invited talk on February 10, 2018, titled '**Sustainability issues in agro-ecology: Socio-ecological perspective**'. *In:* International Conference on 'Sustainability disruptions: for mitigating global risks organized by Xavier University, Bhubaneswar.

Experiential learning/Extracurricular activities

Students of agriculture have been encouraged to participate in extracurricular activities to imbibe soft skills and overall personality development. Student counselling meetings are conducted to understand the strengths and limitations of students. The extracurricular activities (sports, cultural, classroom seminars, debate etc.) are conducted cohesively to pay attention to each student.

Students made visits to agricultural field site provide exposure and hands-on training. Besides, innovative teaching involves translation of theory into visual model, which explain the concepts in a lucid manner. Students actively participated in developing a model to demonstrate soil and water conservation techniques in agricultural landscapes.



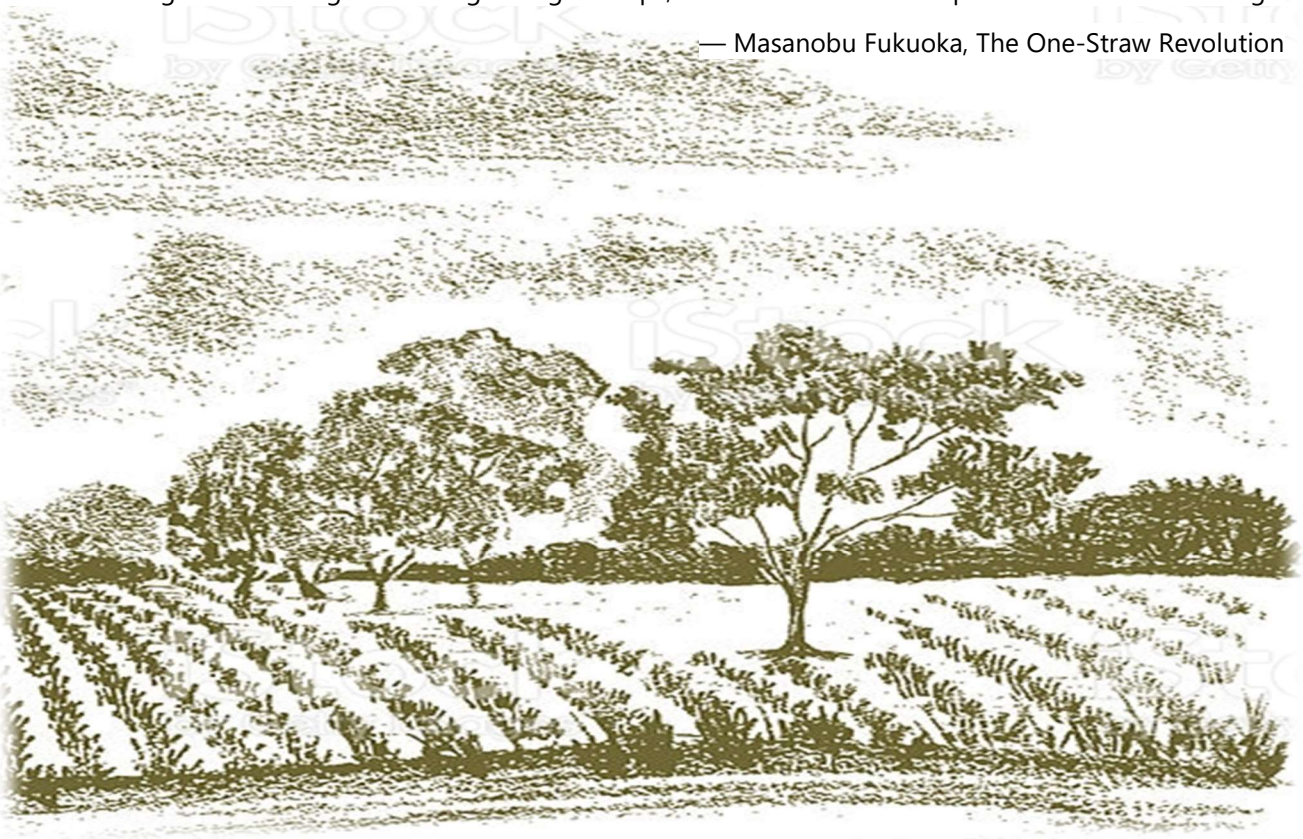
Students participating in academic learning during the institutional visits and field scale practical class

Students of agriculture participated in tree planting activities on several occasion organized by the university. Besides participating in cultural festivities, social relevant programs, conference on health and sports events of the campus.

Mr. Subraneel Sahu participated in a seminar of adult health organized in New Delhi as part of Orient program. Likewise, Ms. Satya Ranjit Singh has been adjudged as one of the winner in the category of poster creation to spread awareness as part of 'Swatchata Pakwada' program. Students of agriculture also participated in tree plantation activity (Sept. 2, 2017) organized to observe the 'Swachta Pakwada campaign in the campus.

The ultimate goal of farming is not the growing of crops, but the cultivation and perfection of human beings.

— Masanobu Fukuoka, The One-Straw Revolution



Soils are temples of agriculture. Sustaining them will revolutionize agriculture and our future is in protecting soils.

— S. Kumaraswamy

Conceptual popular articles

Sustaining modern agricultural landscapes: Prudent socio-ecological approaches

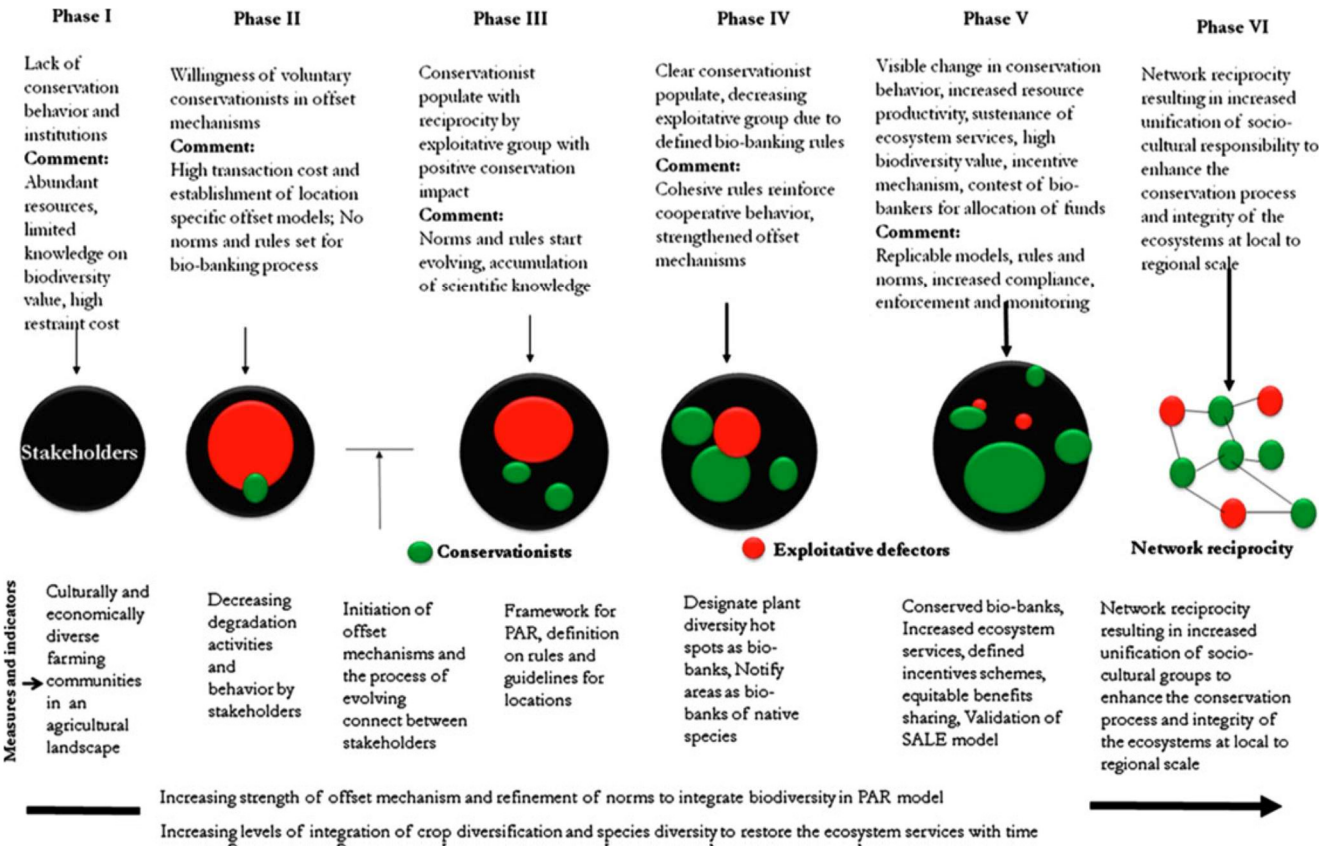
Dr. S. Kumaraswamy, Dean and Head, Faculty of Agriculture

To achieve food security and meet the demands of the ever-growing human populations, farming systems have assumed unsustainable practices to produce more from a finite land area. This has been cause for concern mainly due to the often-irreversible damage done to the otherwise productive agricultural landscapes. Agro-ecology is proclaimed to be deteriorating due to eroding integrity of connected ecological mosaics and vulnerability to climate change. This has contributed to declining species diversity, loss of buffer vegetation, fragmentation of habitats, and loss of natural pollinators or predators, which eventually leads to decline in ecosystem services. Currently, a hierarchy of conservation initiatives is being considered to restore ecological integrity of agricultural landscapes. However, the challenge of identifying a suitable conservation strategy is a daunting task in view of socio-ecological factors that may constrain the choice of available strategies. One way to mitigate this situation and integrate biodiversity with agricultural landscapes is to implement offset mechanisms, which are compensatory and balancing approaches to restore the ecological health and function of an ecosystem. This needs to be tailored to the history of location specific agricultural practices, and the social, ecological and environmental conditions. The offset mechanisms can complement other initiatives through which farmers are insured against landscape-level risks such as droughts, fire and floods. For countries in the developing world with significant biodiversity and extensive agriculture, we

should promote a comprehensive model of sustainable agricultural landscapes and ecosystem services, replicable at landscape to regional scales. Arguably, the model can be a potential option to sustain the integrity of biodiversity mosaic in agricultural landscapes.

What it means to realize that all the ecosystem services have assumed alarmingly declining trend in agricultural landscapes? It is invisibly-visible phenomenon happening at accelerated phase and scale across the agricultural landscapes. The buffer biodiversity which contributed immensely to maintain the integrity of ecosystem functions has vanished from the agricultural landscapes. Soil and water resources productivity has deteriorated due to modern agriculture management practices. Under such scenarios, the skillful integration of concepts and management practices would help restore the ecosystem functions of agricultural landscape. A holistic approach to achieve sustenance of productivity of agricultural landscapes through the participatory action research has immense potential.

A conceptual model of 'Sustainable Agricultural Landscapes and Ecosystem Services' (SALES). This links offset mechanisms to infuse responsible conservation of biodiversity in agricultural landscapes to increase plant species diversity and improve ecosystem services. The model is replicable in agricultural landscapes with various levels of degradation of biodiversity mosaic/induce multiple cropping systems/restore ecosystem services to benefit the contiguous farms; Bio-banks: conserved repositories of plant diversity hotspots in a landscape; Co-evolution: Bilateral sharing of ingenuity to derive mutual benefits from a community activity and/or conservation initiative; Network reciprocity: Mutually agreeable equity-based participation of farming community irrespective of socio-economic status; Offset mechanism: compensatory and counterbalance approaches to restore the original status of an ecosystem; Participatory action research (PAR): a collective research inquiry, voluntary participation and action of collaborative nature with mutual benefits to the stakeholders (researcher and the beneficiary).



The major challenge in the modern agricultural landscapes is to meet the ever-growing demand for agricultural products while simultaneously conserving biodiversity, providing critical ecosystem services and maintaining rural livelihoods. The concept of incentive based offset mechanisms has tremendous potential and it opens up opportunities to restore the diversity of keystone species, build connectivity and develop hotspots of biodiversity repositories to sustain ecosystem services. Offset mechanisms can also be used to bridge the link between complementary conservation initiatives to design local to region-specific and conservation-oriented farming systems. Further, economic and physical environments characteristic of the stakeholders are critical in building consensus-based local or region specific conservation initiatives. However, the development of offset mechanisms linked to economic benefits requires robust quantitative and qualitative data on agro-biodiversity. Generation of such data will facilitate policy reforms to incentivize conservation efforts and suitably amend the crop insurance policy. This can help promote the conservation of biodiversity at all trophic levels and eventually build resilient and productive agricultural landscapes.

Bio-indicators of rain

Dr. Bibudha Parasar, Adjunct Professor

The knowledge and belief about wind, cloud, star, vegetation, animal behaviour with good and bad prospect of crop are transmitted down from generation to generation through words of mouth with rare documentation in the form of literature of ancient periods which are not always available with the present generation. The very proverbs, folktales, common belief and aphorism are the actual carriers of those knowledge which are developed over thousand years of observations and experiences of human beings.

Accordingly, the farming (communities of eastern-ghat high and zone of Odisha (Koraput District) forecasting rain based on their observation about the behaviour of plant, animals, birds and insects. Some of those bio indicators are as follows.

Plant as bio-indicators of rain

Observing the flowering pattern of Satabari (*Asparagus racemous*) plant, the farmers of the zone predict the occurrence of rain. According to them; i) if flowering occurs from base to the tip of the plant, then there will be continuous rain all throughout the rainy season; ii) If flowering occurs in patches from base up to tip in discrete manner, then there will be sporadic rain all throughout the rainy season.

Animal as bio-indicators of rain

i) Frequent coughing of cow is an indicator of quick occurrence of rain.
ii) Instantly comes rain if jackal started crying.
iii) Instantly comes rain, if fishes started jumping over the water surface of ponds.

Bird as bio-indicators of rain

i) While making frequent dips in water, if crow throws water by fluttering this feathers after each successive dip, this behaviour of bird is considered as the forerunner of rain.
ii) When crow produces a chorcorous sound, farmers will go to their respective fields for sowing seeds with a hope to receive a quick shower.

The knowledge on weather and climate held by local and tribal communities can play significant role in developing location package of practices for specially agriculture. Knowledge of weather and climate of local people could be integrated with local planning and strategies in mitigation and adaption.

Commercial cultivation of tissue cultured banana plants

Dr. Damodara Parida, Guest Faculty Member

Bananas are found to be 4th most important food commodity after rice, wheat and milk. Conventionally bananas are propagated by means of suckers and a plant can produce 4-5 suckers per year. Further the rhizomes of the suckers are infected by many pests and pathogens with consequent reduction in productivity. Hence, the farmers face a heavy loss in traditional method of cultivation. Recently using meristem tissue of banana rhizome as explant, millions of tissue cultured banana plants are produced within a short span. Further commercial cultivation of these tissue cultured banana plants provides higher profit to the farming community.

Importance of tissue cultured banana plants;

- Tissue cultured plants are true-to-type and the plants are free from pathogens.
- The plants retain all the qualities of mother plant.
- Small plants in polyethene are suitable for transportation
- The plants grow quickly and flower 1-2 months before the sucker plants.
- All the tissue cultured plants flower at a time. Hence marketing becomes easier for bunches.

Availability of Tissue cultured banana plants in Odisha;

Tissue cultured banana plants of cultivars G-9, Champa, Amritpani and plantain cultivar Gaja Bantal are available at Biotechnology-cum-Tissue Culture Centre, OUAT, Bhubaneswar (near Baramunda Bus Stand), Odisha.

Characteristics of tissue cultured banana varieties;

1. **Grand Nine (G-9)**

    - This is a dwarf type table banana whose ripen fruits are light green to light yellow in colour
    - Suitable for cyclone prone area like Odisha.
    - Bunches are very large with 10-14 hands/bunch and 20-25 fingers/upper hand and 18-20 fingers /lower hand.

2. **Champa**

    - This is a tall table type banana whose ripen fruits are deep yellow in colour
    - Bunches are very large with 13-14 hands/bunch and 27-28 fingers/upper hand and 18-19 fingers/lower hand.
    - The variety is having a very good sugar and acid blend.

3. **Amritpani**

    - It is a tall table type banana whose ripen fruits are light yellow colour and very tasty
    - Bunches are medium to large sized with 11-12 hands/bunch and 20-22 fingers/bunch.

4. **Gaja Bantal**

- This variety is tall and used for curry purpose.
- Plants bear 11 hands/bunch, 20-22 fingers/upper hand and 17-18 fingers/lower hand

Use of GST (Geo Spatial Techniques) in agriculture from Indian perspective

Mr. Tapas Ranjan Sahoo, Visiting Faculty Member, Agronomy

Challenges to agricultural development includes increase in demand for agricultural produce, climate challenge, resource constraint and sustainability challenge. Approaches to agriculture using geo spatial technologies comprises of climate smart agriculture, precision agriculture and conservation agriculture that can address the afore-mentioned challenges.

The objective of GST is to optimizing the use of inputs and resources including water, land, and other inputs – which helps to reduce cost of production, to improve productivity through more precise use of inputs and to minimize agricultural risk due to pests and diseases and climatic variances.

Geo Spatial Technologies are remote sensing, GIS and GPS. Imagery and data collected from space- or airborne camera and sensor platforms (satellites, aerial, UAVs, terrestrial sensor is called remote sensing. A system of integrated computer-based tools for end-to-end processing (capture, storage, retrieval, analysis, display) of data using location on the earth's surface for interrelation in support of operations management, decision making, and science is called GIS (Geographic Information System). GPS (Global Positioning System) is a system which can give precise coordinate locations to civilian and military users with proper receiving equipment.

There are various applications of GST viz., natural resource census, crop intensification and crop insurance, accelerated irrigation benefit program, water availability assessment, mineral exploitation, forest loss location and biodiversity, national urban information system etc. The applications of GST in the agriculture and allied sciences include forest inventory and monitoring, forest fire mapping, forest burnt area assessment, forest fire alerts, crop inventory, crop modeling, hydrological models, agricultural drought monitoring, agricultural drought vulnerability, precision farming, land cover change detection and climate change.

Precision agriculture (PA) is an approach to farm management that uses information technology (IT) to ensure that the crops and soil receive exactly what they need for optimum health and productivity. The approach is also known as satellite agriculture, as-needed farming and site-specific crop management (SSCM). GIS-GPS-RS technologies are used in combination for precision farming/site-specific crop management.

The utilization of space-born multispectral data for crop acreage and production estimation started in seventies with the launching of the Large Area Crop Inventory Experiment (LACIE) jointly by NASA, USDA and NOAA (National Oceanic and Atmospheric Administration) in 1974.

Forecasting Agricultural output using Space, Agro-meteorology and Land based observations (FASAL) was launched in Odisha during September 1997 by ISRO with major objectives to estimate district wise Kharif paddy acreage, to forecast district wise paddy yield using meteorological data and decision making for supply, storage, transport and minimum support price fixation by the central as well as state government. Aerial photographic technique for map making, by soft copy photogrammetric methods for production of large scale geographically accurate data bases can be created. Realizing that Remote Sensing by far only a descriptive tool and not a prescriptive tool, closer linkage with public and low level users in the social fabric be established through Non-Governmental organizational (NGO) in teaching "do-how" rather than "know how". Bringing in effective use of GIS, GPS and geoinformatics in general for developing precision agricultural practices and water harvesting measures in semiarid regions in the country will help to increase agricultural, horticultural and floricultural productivity.

Payment for Environmental Services (PES)

Ms. Upasana Mohapatra, Visiting Faculty Member, Agricultural Economics

Natural ecosystems provide a wide range of environmental services that benefit society as a whole. These services, nevertheless, are often lost because of the lack of financial incentives to preserve them. This problem has been increasingly recognized in recent years, leading to the development of new systems as alternatives to past approaches, which proved ineffective in the preservation of ecosystems. One of the more recent conservation approaches is the one that promotes Payments for Environmental Services (PES).

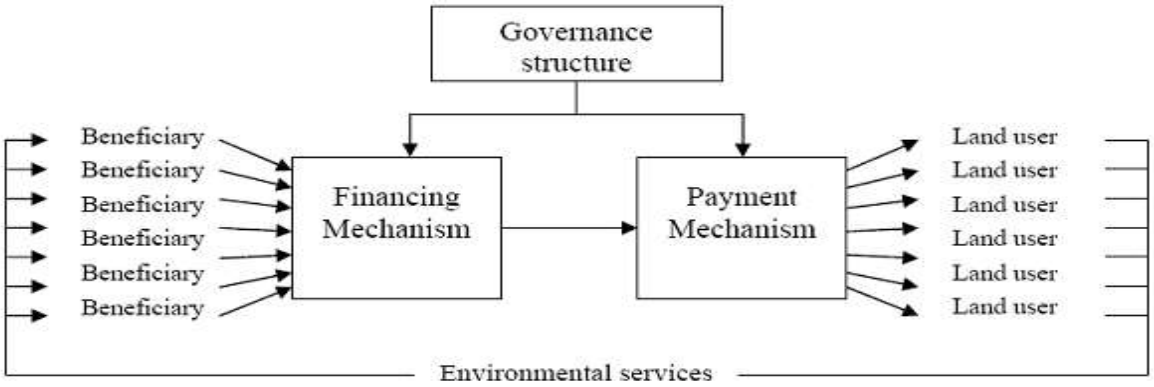
Payment for such environmental services is seen as a source of income to support sustainable management. Payments for environmental services (PES) are relatively new schemes seeking to support positive environmental externalities through the transfer of financial resources from beneficiaries of certain

environmental services to those who provide these services. PES is also a potential means for the poverty alleviation although experience to date has shown this to be an elusive objective. Rewarding resource managers for improved land stewardship could enhance their income. An example might be downstream water users paying upland communities to refrain from land uses that adversely impact the quantity and quality of the stream-flow.

PES schemes focus on those environmental services for which there is an existing market demand, or for which such demand can emerge under appropriate conditions. Over the last decade, the use of PES schemes for four ES has gained popularity.

- Carbon sequestration and storage (e.g. a Northern electricity company paying farmers in the tropics for planting and maintaining additional trees);
- Biodiversity protection (e.g. conservation donors paying local people for setting aside or naturally restoring areas to create a biological corridor);
- Watershed protection (e.g. downstream water users paying upstream farmers for adopting land uses that limit deforestation, soil erosion, flooding risks, etc.);
- Landscape beauty (e.g. a tourism operator paying a local community not to hunt in a forest being used for tourists' wildlife viewing).

Structure of PES Mechanism



Markets for environmental services differ in geographic scope, strength and structure of demand, the competitiveness, nature and price of commodities sold, and the number of transactions. PES schemes have been established for the four types of environmental services identified at the beginning of this section. PES

scheme are likely to be successful only if the nature of markets for the environmental services they are targeting is well understood.

The Clean Development Mechanism (CDM) a market based trading mechanism created by the Kyoto Protocol, functions by delivering a subsidy to the developing world in return for lower emissions of greenhouse gases. It represents the first attempt to address a global atmospheric commons problem using a global market. By means of the CDM, carbon dioxide (CO_2) emission reductions could occur in the developing world that would otherwise have occurred in the developed world at far higher cost.

PES schemes have the potential to become very valuable transfer mechanisms for internalizing positive environmental externalities and generating new revenues for sustainable development. This potential will be gradually fulfilled as markets for environmental services mature over time and as PES schemes become more financially sustainable. In addition, their positive effects on sustainable development will be greatest if their distributional impacts are considered and if concrete efforts are made to build capacities in poor and indigenous communities. Otherwise, there is a significant risk that they will perpetuate or exacerbate existing inequities in resource use and simply continue unsustainable survival patterns in poor communities.

Brighten your apatite with natural food colours
Mr. Shriram Ratan Pradhan, Visiting Faculty Member, Horticulture

The nutritional benefits of fruits and vegetables are known to all. But the chemicals behind those vibrant colours (called phytochemicals) have some unique attributes. The key here is to note that certain colors of food indicate an abundance of specific nutrients. So nutritionists have come up with a brilliant yet simplistic idea to make sure that people eat enough fruit and vegetables each day: 'eat a rainbow'. Red foods like apple, watermelon, red chilli and tomato contain a number of antioxidants, including lycopene (tomatoes) and anthocyanins (red berries). Orange and yellow foods are high in carotenoids, which are responsible for the vibrant orange colour of foods such as pumpkin, sweet potato and carrots. The human body converts beta-carotene into vitamin A. Green vegetables are some of the most nutritionally charged foods around,

packed full of fibre, vitamins and minerals. Anthocyanins are powerful antioxidants that give blue and purple foods (beetroot, radishes and purple cabbage) their colour and may help protect cells from damage and can reduce the risk of cancer, stroke and heart disease. White fruits and vegetables can get their colour from anthoxanthins, which may reduce the risk of cardiovascular disease and arthritis. The fibre in the skins of brown fruit and vegetables (such as potatoes, pears and mushrooms) helps maintain a healthy digestive tract and can reduce the risk of some types of cancer. Eating a plate full of coloured vegetables and fruits is a big plus on the healthy scale. And this can help in preventing disease like the flu, cancers, declining vision etc. Besides, mood will be most likely lifted when plate is full of a variety of visually appealing bright colors versus covered in a dull, white, and plain blandness. So brighten up your plate by adding fruits and vegetables of different colour and thus and you will brighten up your health.

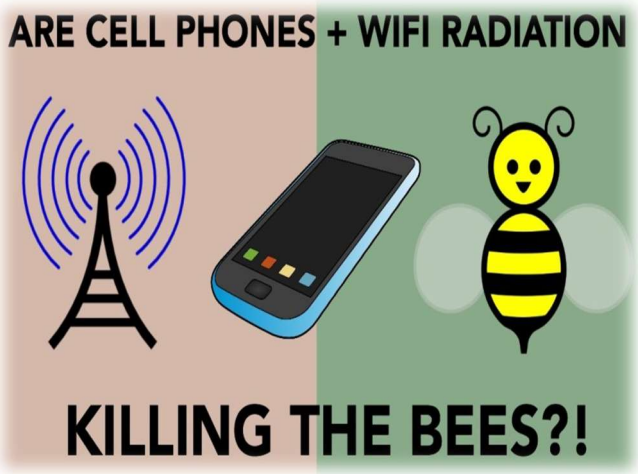
Mobile radiation affects honey bees

Mr. Satya Narayan Satapathy, Visiting Faculty Member, Entomology

In human habitats, dependency on electronics scenarios, the usage of the mobile phones and other electronic gadgets has increased enormously. The mobile phone radiations are the major cause of the electro pollution in the environment. The electromagnetic radiation (EMR) emitted from the cell phones is very harmful to human beings, plants, animals and micro-organisms in the terrestrial ecosystem. Mobile phone uses EMR in the microwave range (450-2100 MHz). In 2011, International Agency for Research on Cancer (IARC) classified mobile phone radiations on Group 2B- possibly carcinogenic.

Albert Einstein has stated that man cannot live for more than four years if honey bees are extinct. Research data suggest that the honey bee's populations are also affected because of the EMR. Many research outcomes support the hypothesis that cell phone radiations are affecting honey bees. Further, data suggest that there is direct relationship between decline in honey bee populations and increased electromagnetic radiations.

A sharp decline has also been noticed in commercial bee population in Kerala posing a serious threat to honey bees, affecting apiculture (the cultivation of bees on a commercial scale for the production of honey) as it has the highest density of mobile towers. When honey bee colonies were exposed to radiation, the honeycomb weight and area were reduced and returning time of honey bees increased compared to similar non-exposed colonies. The massive amount of radiation produced by mobile phones and towers is mis-leading the navigational skills of honey bees and preventing them from returning back to their hives. Evidences also suggest that exposure to radiations lead to low egg laying capacity in honey bee queens or exposure of queen bees to cell phone radiation stimulated production of only drones. EMFs from telecommunication infrastructure interfere with honeybee's biological clocks that disable them to navigate keeping in line with the sun movements as a result of which bee's may fly in the wrong direction when attempting to return to the hive.



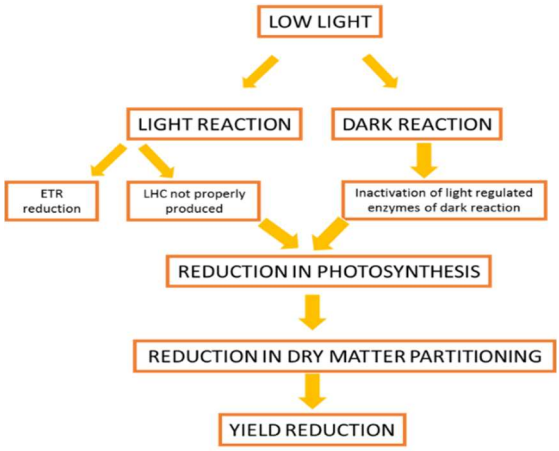
Evidences indicate that the honey bees in their normal state produced sounds at lower frequencies around 450 Hz, and with lower intensity of normalized amplitude. But, when honey bees disturbed by mobile phones are known to produce sounds with higher frequencies that reached 1.5 KHz and with higher intensity reaching 0.7 normalized amplitude which has been attributed to progressive decline in honeybee's populations.

It is clear that the Colony Collapse Disorder (CCD) is mainly attributed to electromagnetic pollution by increasing mobile phone tower radiations. The mobile phones have benefits in spite of several harmful effect and hence complete ban on their usage is not realizable. It is imperative to minimize the usage to conserve the honey bees and their proliferation in the natural systems.

Low light and its impediments in rice productivity

Mr. Prajjal Dey, Visiting Faculty Member, Crop Physiology

Rice is a major staple food crop in India. A number of factors influence the growth and productivity of rice. Light intensity is one among the factors, which affects the growth and performance of rice. Eastern and North Eastern districts of India represents around 60% of aggregate rice-cultivated region. However, it contributes just 48% of the aggregate productivity of rice in the country. Low productivity per unit area is due to low light intensity especially during the grain filling stage, which results in poor yield. Rice plant on a normal day requires around 1500 bright sunshine hours for the period from transplanting to different growth stages. Yet, in Eastern and NEHR of India, just around 800-900 bright sunshine hours of light is gotten amid the long stretches of August to December. This hampers the physiological, agronomical, biochemical and molecular functions of rice ultimately resulting in poor productivity.



Eastern and northeastern India are the major rice-growing regions of the country but rice productivity is the lowest in comparison to other regions of the country. The low incidence of solar radiation coupled with fluctuating light during the wet season is one of the major constraints for realizing the low productivity in eastern and northeastern India. Light being a crucial factor for the plant development, stress experienced by the plants under low irradiance results in increased length of leaves, increased width, increased leaf area, increased time period for growth, decreased differentiation of panicle and reduced yield of grains. Lower rates of photosynthesis (due to low irradiance per unit leaf area) is accompanied by the reduction in the thickness of mesophyll and number of cells/mm^2 in leaves. Evidences suggest that total chlorophyll content will be higher under low light especially chlorophyll-b. It appears, low light stress negatively influences the conductance of stomata. The decreased rubisco activity accompanied by subsequent increase in the intracellular carbon dioxide concentrations is also been observed under low light intensity. Several quality parameters like amylose content of rice plant grown under low light conditions increased while the percentage of chalky kernels decreased. Likewise, the total nitrogen content reduced under low light affecting the total protein content as well. Low light during the grain filling stage has also been reported to decrease the supply of carbohydrates to grains as well as decrease in starch synthesis activity, inhibiting directly the grain filling and accelerating the occurrence of chalky rice.

In order to design rice genotypes with advanced and greater stability under low light stress, a better understanding of the anatomical, physiological, biochemical and molecular basis of low light tolerance is a priority area for research. The best approach to realize yield potential is to breed new cultivars with high tolerance to low light intensity. Genetic diversity is the foundation for crop improvement. Traditional varieties or landraces of rice harbour a large store of valuable genes that can be used to develop new varieties with improved yield potential under low light growth conditions. Allele mining is one of the promising ways to dissect certainly occurring allelic variants of candidate genes with additively beneficial agronomic qualities. These genes can then be systematically studied through a series of expression analysis and association studies to narrow down the candidate genes playing a role in low light intensity tolerance in rice. Such an approach helps in molecular breeding for varieties suitable for low light intensity conditions with improved yield capacity.

Observational notes by the students

Farmer with an ultrasound toy

Mr. R. Anantha Krishnan, Year 1 student, Class of 2017-2021

The superior audio waves with a frequency range of 20 to 20000 Hertz, which is above the hearing range of humans, known as ultrasound can be well exploited in the field of agriculture.

'A farmer with an ultrasound toy is a hypothetical innovative concept, which has potential applications to modify certain characteristics in the course of crop growth. It has been hibernating ideas in the minds of scientists, which has intrigued for a long while. Evidence suggest that ultrasound affects certain or several biochemical reactions. The ultrasound effect can be suitably utilized for increasing growth rates and yield of crops or for enhancing germination rates.

Another potential of ultrasound is the detection power. As it is used in marine field for detecting the depth of a submarine ship, it can be used for detecting the presence of sediments in water reservoirs kept by a farmer for irrigation purposes.

The ability of ultrasound in enhancing chemical reaction rate can also be used in emerging agriculture methods like aquaculture for removing or decomposing chemical substances causing quality issues. May be not, a farmer be able to do all those with a single ultrasound equipment or single handedly, but 'A farmer with an ultrasound toy' simply intents to open up the scope of ultrasound in agriculture in the minds of readers.

Sustainable agriculture

Mr. Akshay Banker, Year 1 student, Class of 2017-2021

In today's scenario, farmers in India as well as across the world are surrounded by intensive agricultural practices. They are adding high input into the soil in terms of chemical fertilizers and using large amount of pesticides for crops to get more yield with increased income. Most of the farmers add fertilizers without soil testing and end's up with adding excessive amount which slowly degrades the soil. Alternatively, adding organic manures and leaving crop harvest residues is simple practice, which will help to build up soil fertility over time period. Likewise, applying pesticide in case it is really needed preferably green mark and non-residual pesticides which will not be that much harmful to human as well as to ecosystem. Sustainable farm practices will result in profitable and healthy environment as well as economic to farmer.

Precision agriculture

Ms. Sonali Misra, Year 1 student, Class of 2017-2021

Precision agriculture is a relatively new and mostly technology driven approach. It is a management approach or philosophy to the cultivation of crops by considering spatially and temporal variation in soils, rainfall and adopting management techniques to reduce environmental pollution. Precision agriculture is also known as precision farming in which in-field variability is taken into account and according to the local circumstances of a given field, seeding, nutrient management, plant protection measures etc. are taken up.

In precision farming, timely collection and analysis of the spatial and temporal variant information of crops, soils and environment is important. This can be done by new emerging information technologies such as global positioning system (GPS), and geographical information system(GIS), remote sensing, yield monitors etc. Thus precision farming which is based on information and knowledge is a new combined technique for the scientific management of modern agriculture.

So in total it is defined as the application of principles and technologies to manage spatial and temporal variability associated with all aspects of agricultural production for the purpose of improving crop performance and environmental quality.

Advantages include: i) Reduction in cost of cultivation; ii) Increase in input efficiency; iii) Reduction in pollution; iv) Reduction in application of nutrients, especially N fertilizers; v) Reduction in runoff and sedimentation of water bodies

Now a day, with the advent of satellites based systems, farmers gained the potential to take account of spatial variability. Though precision agriculture is technology driven, still further development of technology is required. It is information intense and could not be realised without enormous advances in networking and computer processing power.

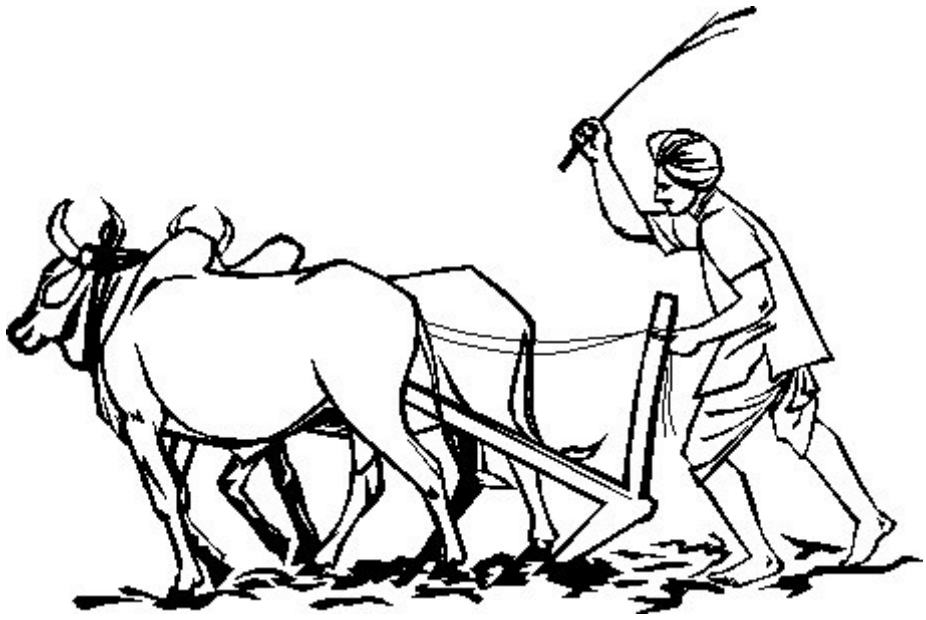
Steamy solution to citrus sickness

Ms. Satya Ranjita Singh, Year 1 student, Class of 2017-2021

The spread of orange and grape fruit disease causing bacterium *Candidatus liberibacter* by Asian psyllid bugs in California and Florida has been a serious problem by producing splotchy leaves. An engineering technology has been developed as a solution using mild heat steam.

The technique involves heating the tree to a constant temperature about 104 degree Fahrenheit for up to 90 second to reduce the bacterial number without harming the fruit and/or tree. However, it is application is limited to a plantation with smaller area. A technology has been revalidated to blast trees with steam at 140 degree Fahrenheit for 30 seconds. The spray is found to be highly effective and keep the tree safe for a year from bacterial infection. Although this method is not the permanent solution for the disease but it can be alternate choice over chemical treatment and less time consuming.

The procedure at field scale involves; i) Enveloping the tree with a translucent trap bag; ii) The machine blasts 140 degree Fahrenheit steam for 30 second. After a while the trap is lifted; and iii) The steamed tree is now protected from bacteria within a small period of time.



Way forward

While building the institution of excellence in agriculture at the university, it is pertinent to pay attention to add faculty members at desired time period to create a robust teaching community. Likewise, build prerequisite infrastructure, laboratories and research facility. In this direction, it is required to create a new building for faculty of agriculture, farm and a technology platform at the university. It is envisioned that the faculty of agriculture will function as institute of agriculture by the end of 5 years of its existence. Master's and doctoral degree programs will be modeled on the basis problem solving research projects besides evolving an adaptable practices/methods/innovations etc.

Development of a faculty requires an independent building, adequate teaching classrooms and laboratory space and supporting infrastructure facilities as a long term goal. A strategic plan is to have an independent building ready by the end of second academic year. It is envisaged to develop the faculty of agriculture to teach/train ~500+ students community in the next 5 years. Over the years the faculty of agriculture will increase the enrolment of students besides initiation of master's and doctoral program. In view of cumulative increase in the student enrolment, the proposed construction of new independent building with adequate classrooms (20), Laboratories (15), Office/s (2), Seminar halls (2), Mini auditorium (1) Committee room (1) Independent faculty rooms (10), Library cum M.Sc./PhD students study hall with independent cabins (to seat 30 students), storage room (1), common room/mini kitchen (1), a room for laboratory technicians/assistants (1), Greenhouse (1), an agricultural engineering workshop (1) and support facilities.

The planned building will be built on the principles of sustainable elements and efficiently harvest rainwater and solar energy to partly meet the demand. It may also be thought to utilize the principle of geo-thermal cooling mechanisms for natural air-conditioning of the building facility. It is a proposal to have such independent building Facility created for the faculty of agriculture.

The envisioned Faculty of Agriculture will be designed as a unique education unit of the university. The university has an advantageous situation to develop a pragmatic education and training programs to meet the increasing demand for skilled manpower to take agriculture as vocation. In the next 10 years' time, we hope to see the Faculty of Agriculture with fully established facilities and adequate faculties engaged in education, research and outreach programs.

Faculty Members and staff: Academic year 1

Faculty Members	
Dr. S. Kumaraswamy	Professor
Dr. Bibudha Parasar	Adjunct Professor
Guest Faculty	
Dr. Damodar Parida	Professor
Dr. Richa Chopra	Director, AQDC
Mr. Manuj Madan	Assistant Professor
Mr. Biswajit Nayak	Assistant Professor
Dr. Rakesh Kumar Tripathy	Assistant Professor
Ms. Anupriya	Assistant Professor
Ms. Rupal Shah	Assistant Professor
Visiting Faculty	
Mr. Tapas Ranjan Sahoo	
Ms. Upasana	
Mr. Debadatta Sethi	
Mr. Prajjal Dey	
Mr. Sataya Nayan Satpathy	
Mr. Sreeram Pradhan	
Ms. Rinny Swain	
Mr. Abhisek Tripathy	
Staff Members	
Ms. Sakshi Garg	Academic Coordinator
Mr. Rasmi Ranjan Patra	Laboratory Assistant

A drawing by one of the student Ms. Satya Ranjita Singh, Class of 2017-2021

We are rooted together to grow and prosper in our endeavor to serve the farming community.

Sri Sri University

Bidyadarpur Arilo, Cuttack 754 006, Odisha