



Course Title with Credit Load

M.Sc. (Ag) in Organic Farming

Course Code.	Course Title	Credit Hours
OF 501	Concepts and Principles of organic farming	2+0
OF 502	Soil fertility, Crop Nutrition and Nutrients input	3+1
OF 503	Organic Crop Production Systems	2+1
OF 504	Plant Health Management	2+1
OF 505	Post harvest handling of organic produce	1+1
OF 506	Farming systems suitable for organic managements	2+1
OF 507	Organic certification Standards and regulation	2+1
OF 508	Value Chain Management	2+2
OF 509	Marketing	2+0
OF 510	Research Methodology and Biostatistics	2+1
OF 511	Organic Input Management and Production Technologies	2+1
Soil 591	Masters Seminar	1+0
Soil 599	Masters Research/ Thesis	0+30



Course Contents

M.Sc. (Ag) in Organic Farming

- I. Course Title** : Concepts and Principles of Organic Farming
II. Course Code : OF 501
III. Credit Hours : 2+0

IV. Aim of the course

To impart knowledge on the basic concept of organic farming

V. Theory

Unit I: Concepts and principles of organic farming

History and evolution of organic farming in the world and India. Scenario of organic farming in India and world, global market for organic products, IFOAM's Guiding principles of organic farming, conversion to organic agriculture, advantages and limitations.

Unit II: Definitions and types of organic farming

Definitions of organic farming, types of organic farming such as natural farming, zero chemical natural farming, bio dynamic farming, biological farming, compost farming, Natueco culture, integrated farming, homa farming, permaculture etc, traditional farming systems in India and evolving indigenous knowledge systems

Unit III: Conventional vs Organic farming

Philosophy of two farming systems, fundamental differences, productivity issues, management protocols, food quality, nutritional differences and impact of conventional practices on soil fertility, natural resources, environment and overall social perception. Myths and realities about organic farming in addressing nutritional security and food safety need *vis-à-vis* national food security.

Unit IV: Advocacy, Ethics, health and social issues in organic farming

Advocacy for organic farming with sustainability, resource conservation and food safety issues. Advocacy through overall farm productivity under diversified cropping systems. Spirituality values and ethics in organic farming. Socio economic importance of organic farming: concept measurements and issues. Need for ethical practices and values across the organic agriculture value chain including trading and reaching to consumers.

Unit V: Organic farming for sustainability, resource conservation, climate change issues and safe and healthy food

General concerns on sustainability, climate change issues threatening sustainability, potential of organic farming practices in addressing sustainability and climate change. Resource conservation through organic farming, rainwater conservation and preservation of native seeds and germplasm an essential component of organic farming, Consumers concerns on food quality and safety, organic farming for safe and healthy food, ITKs potential and role in sustainability of modern organic farming practices

**Teaching methods/ activities**

Classroom teaching with AV aids, group discussion, assignment and class discussion

Learning outcome

Basic knowledge on organic farming so as to be an organic trainer, promoter and grower.

Suggested Reading

- *Basics of Organic Farming*: by Mamta Bansal. Kindle Edition.
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B.Singh. Published by Jain Brothers
- *Basics of Organic Farming*: Deshpande, WR, 2009, All India Biodynamic and Organic Farming Association, Indore, MP, India P-306.
- Eyhorn, F, Heeb M and Weidmann, Gilles IFOAM *Training Manual for Organic Agriculture in the Tropics*, FiBL and IFOAM.

I. Course Title : Soil Fertility, Crop Nutrition and Nutrient Inputs

II. Course Code : OF 502

III. Credit Hours : 3+1

IV. Aim of the course

To provide knowledge on fertility of soil and also different organic inputs to be used in organic farming

V. Theory**Unit I: Soil – Source of Infinite Life**

Soil as source of life, fundamentals of soil structure and quality, soil fertility, physico-chemical parameters and soil as living entity in organic farming.

Unit II: Soil fertility and productivity

History of soil fertility and plant nutrition. Factors affecting; features of good management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

Unit III: Soil fertility evaluation

Physico-chemical soil testing, biological methods for soil health evaluation, plant and tissue tests; soil quality in relation to sustainable agriculture. Nutrient requirement modeling based on soil health and resources availability.

Unit IV: Soil Conservation and Soil Water Management

Principles of soil and water conservation, general practices for soil and water conservation, soil carbon buildup and biomass recycling.

Unit V: Soil biology and role of microorganisms in soil fertility management

Soil as a habitat for microorganisms, Soil microorganisms, Soil microbial ecology, Soil microbial biomass, Soil enzymes – origin, activity and importance. Microbial management of agricultural, domestic and industrial wastes for potential application in organic farming. Microbiology of composting and bio-methanation. Biodegradation of xenobiotics. Bioremediation – principles and application.

**Unit VI: Nutrient recycling**

Nitrogen, phosphorus and potash cycles, management for nutrient recycling, methods for recycling and reducing nutrient losses.

Unit VII: Management practices

Management practices in organic agriculture (mulching, fallowing, intercropping, manuring, crop rotation, agro-forestry, mixed farming).

Unit VIII: Organic fertilizers and composting technology

Compositing principles and factors affecting composting, dynamics of compositing, methods of composting, different forms of composts with nutrient profiles, Rapid methods of composting, liquid manures, compost enrichment through concentrates, minerals and micronutrients. Field application of compost and their response to crops.

Unit IX: Vermicomposting technology

Earthworm biology, principles of vermicomposting, methods for vermicompost production, nutrient profiling, field application and its response to crop yields

Unit X: Biofertilizers

Different types of biofertilizers, their contribution to soil fertility and nutrient pool, factors affecting their application and response, assessment of biofertilizers application to crop yields.

Unit XI: Addressing nutrient deficiencies and mineral fortification of composts (P, K, S and micro nutrients)

Identification of deficiency, need assessment, identification of mineral resource, fortification of composts and impact assessment on application

Unit XII: Indigenous practices in soil fertility and nutrient management

Indigenous inputs such as liquid manures, Jivamrit, Panchgavya, on-farm protein hydrolysates, plant extracts, dung-urine slurries etc, their production methods and effect of their application on soil fertility and crop productivity.

VI. Practical

- Introduction of analytical instruments and their principles, calibration and applications, Determination of soil pH, electrical conductivity, organic carbon, total and available nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and DTPA extractable micronutrients in soil and their interpretations.
- Biological health assessment through dehydrogenases, soil microbial carbon and soil respiration
- Making of composts through aerobic and anaerobic methods
- Making of vermicompost using earthworms
- Analysis of manures and composts for NPK and heavy metals
- Microbial profiling of Jivamrit/ panchgavya

VII. Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment and class discussion

VIII. Learning outcome

Basic knowledge on soil fertility and management in organic farming



IX. Suggested Reading

- *Basics of Organic Farming*: by Mamta Bansal. Kindle Edition
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B.Singh. Jain Brothers
- *Manufacture of Biofertilizer and Organic Farming*. AB publisher

I. Course Title : **Organic Crop Production systems**

II. Course Code : **OF 503**

III. Credit Hours : **2+1**

IV. Aim of the course

To provide knowledge on organic crop production system

V. Theory

Unit I: Fundamentals of organic farm management and conversion

Salient features of organic farm management, strategies for conversion to organic, step-by-step planning, integration of contamination control measures, planning for on-farm input production and supplementary off-farm inputs, planning for rain water harvesting and water conservation approaches including efficient irrigation systems and moisture preservation techniques, visit to organic farms and study on farmer's best practices for conversion.

Unit II: Management of diversity and cropping systems

Importance of diversity, installation of diversity through plantation of utility trees, nitrogen fixing tree hedges, habitat management for friendly insects and birds and nitrogen fixing crops as intercrops. Importance of cropping systems management with long term planning, crop rotations, intercropping, multi cropping, relay cropping, multi-layered cropping.

Unit III: Nutrient management

Components of nutrient management in organic crop production, assessment of crop nutrient requirements, calculation of nutrient credits from on-farm practices and resources such as intercrops, cover crops, biomass mulching, calculating additional input requirements. Managing nutrient needs through use of organic manures, viz. FYM, compost, Vermicompost, oil cakes, *in-situ* and *ex-situ* green manuring, crop residue management, use of restricted organic nutrient sources, liquid organic manures and dung urine slurries, methods of manuring and biomass application, split application of manures, foliar feeding as replacement of top dressing, ITKs and farmers innovations in nutrient management

Unit IV: Integration of microbial and mineral inputs

Importance of bio fertilizers, types of biofertilizers, nutrient potential, methods of application, enriching manures/ composts with biofertilizers, identifying the need for use of supplementary mineral sources and their integration in nutrient management package.

Unit V: Weed management

Prevention of weeds through cropping systems management, crop geometry, stale seedbed technique, summer ploughing, soil solarisation, cover crops, mulching, flooding, biological weed management, selection of suitable physical and mechanical



approaches and biological and plastic mulches.

Unit VI: Water and Irrigation Management

Soil-water relation, theories of water availability, water use efficiency management, methods of irrigation and automation in irrigation systems, irrigation scheduling in different crops.

Unit VII: Modeling of agronomic practices and nutrient management protocols for some important agricultural and horticultural crops

Identification of compatible associate and intercrops/ companion crops, placing trap crops and insectary plants in cropping geometry, making provisions for nutrient credits from biomass mulching, intercrops and green manures, making provisions for nutrient credits from microbial enrichment with microbial/ liquid manure inputs, balance nutrient requirement modeling and identification of inputs and planning for quantity and time of application.

Unit VIII: Crop growth and yield analysis

Crop growth expressions in plants, growth measurements, important growth indices and forms of growth analysis in field crops. Factors determining yield. Use of growth analysis technique to study variation in yield due to planting season, planting density, fertilizer treatment, other agronomic practices, light, temperature, water, growth substances, varietal differences. Crop response curves. Dynamics of crop growth and modeling.

Unit IX: Success stories of effective crop management with optimum yields of practicing organic farmers (one in irrigated systems and one in rainfed systems)

Field visit, documentation of farming system with inputs and outputs, identification of practices important for organic systems, nutrient management practices, pest management protocols, yields and economics. Salient features for success and for further replication in crop production modeling.

VI. Practical

- Visit to organic farms and study general nutrient management practices, documentation of farming system with inputs and outputs and crop growth analysis using crop growth analysis techniques
- Getting acquainted with different tilling methods and rain water harvesting and water conservation techniques
- Production of liquid manures and dung-urine slurries
- Production of customized composts using FYM/ Compost, mineral nutrients and biofertilizers, assessment of nutrient profiles in enriched composts
- Methods of application for biofertilizers
- Weed management practices, tools and efficacy of different approaches
- Modelling of agronomic practices for a given cropping system with use of available resources.

VII. Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment and class discussion

VIII. Learning outcome

Basic knowledge on organic crop production system



IX. Suggested Reading

- *Basics of Organic Farming*: by Mamta Bansal. Kindle Edition
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B. Singh. Jain Brothers.

I. Course Title : Plant Health Management

II. Course Code : OF 504

III. Credit Hours : 2+1

IV. Aim of the course

To provide knowledge on plant health management for optimization of crop yield due to organic farming

V. Theory

Unit I: Classification of pest organisms

Classification of pests, viz. weeds, bacteria, nematodes, fungi, insects, viruses, vertebrates, *etc.*, identification of pests and beneficial organisms.

Unit II: General principles of plant health management in organic farming

Principles of pest management in organic crop production; Pest surveillance and pest population estimation; concept of economic injury levels (EILs) and economic threshold levels (ETLs), principles of Agro Eco-System Analysis (AESAs) based pest management, estimation of Pest: Defender (P: D) ratio, understanding AESA methodology.

Unit III: Biology of pests and population dynamics

Population dynamics in relation to environment, distribution, identification; Life cycle of key pests of cereals, pulses, vegetables, stored grains, fruit crops and protected cultivation.

Unit IV: Ecological strategies for pest management

Proper sanitation, appropriate fertilization, necessary pruning, timing of planting to escape infection, crop rotation, avoidance of endemic sites, space management for sunlight and air, plant quarantine, *etc.*

Unit V: Cultural and physical control strategies

Importance and use of traps, coloured plates, pheromones, use of insectary plants, trap crops and planning for diversity plant integration as border crops, hedge rows, intercrops, *etc.*

Unit VI: Biological control

Conservation of natural enemies, classical biological control systems, important beneficial insects and their integration and use in different cropping systems.

Unit VII: Biopesticides

Biopesticides, types, mode of action, production, methods of application and impact assessment on crops and pest load.

Unit VIII: Botanical pest management

Using different plants for management of different pests, methods for using such plants and active ingredient extraction methodologies, formulation of usable solutions



and methodologies for application. Integrated strategies, development of crop specific integrated management modules, importance and need for chemical alternatives permitted in organic farming, methods for use and application.

Unit IX: Indigenous practices and their importance in plant protection

Indigenous practices of avoiding pests, managing pests, important plants being used since ages and innovative botanical and fermentation inputs developed by farmers for pest management.

Unit X: Pest control of produce in storage

Physical, mechanical and biological approaches, modified environment, management of hygiene and phyto-sanitary approaches, use of organically acceptable fumigants such as carbon dioxide and nitrogen.

VI. Practical

- Collection and Identification of major/ key pests and plant diseases,
- Estimation of pest population, nature of damage, assessment of crop losses,
- Familiarization with important crop pests & diseases and their biological control agents,
- Demonstration/ familiarization with various tools of insect-pest & disease management,
- Mass rearing techniques of important biological control agents,
- Preparation of organic/ natural formulations for insect-pest & disease management,
- Evaluation of organic formulations for determining their pesticidal properties and field efficacy.
- Preparation and validation of traditional formulations.

VII. Teaching methods/ activities

Classroom teaching with AV aids, group discussion, assignment and class discussion

VIII. Learning outcome

Plant health will be taken care of for optimization of higher crop yield due to organic farming

IX. Suggested Reading

- *Basics of Organic Farming*: by Mamta Bansal. Kindle Edition
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B. Singh. Jain Brothers
- *Principles of Organic Farming*: S.R. Reddy. Kalyani Publisher

I. Course Title : Post Harvest-handling of Organic Produce

II. Course Code : OF 505

III. Credit Hours : 1+1

IV. Aim of the course

To provide knowledge on post harvest handling of organic produce for optimization of crop yield due to organic farming

V. Theory

Unit I: Pre/Postharvest Factors for Post-harvest Losses of Organic Produce

Pre and post-harvest factors responsible for causing organic produce losses.



Principles and practices responsible for losses of organic agricultural produce. Qualitative, quantitative, nutritional and socioeconomic losses. Loss assessment and estimation techniques and their limitations and methods for reducing postharvest losses.

Unit II: Introduction to Value Chain and Handling of Fresh Organic Products for Processing

Management of hygiene and phyto-sanitary measures, measures to reduce field heat, cleaning and washing, control of enzymatic and non-enzymatic changes, transportation, sorting, grading, peeling, sampling and size reduction, packaging, labelling; handling methods for fresh fruits, vegetables and flowers.

Unit III: Organic Food Processing and Preservation

Fundamental principles for food processing in organic farming, acceptable processing techniques, use of preservatives, processing aids, flavouring agents and nutrient supplement in organic food and feed processing.

Unit IV: Food Standards and Residue Analysis/ Toxicology

Fundamental principles of food standards, HACCP system, US and European Export/Import standards for different crops, MRLs, sources of contamination, assessment and management of residues and toxins in food, critical control points, heavy metals and pesticide residue analysis, analytical methods and tools. Interpretation of residue analysis reports, analysis protocols and GMO report analysis.

Unit V: Principles of Packaging

Characteristics of packaging materials for organic food, packaging requirements for fresh and processed organic food for local and international markets, labelling requirements for fresh and processed organic food for local and international markets, labelling requirements and management integrity.

VI. Practicals

- Study of maturity indices for harvest of organic fruits, vegetables, spices and plantation crops.
- Determination of physiological loss in weight and respiration rate in fruits and vegetables.
- Determination of chemical constituents like sugar, starch, pigments, vitamin C, carotenes, acidity during maturation and ripening in fruits/ vegetables.
- Protective skin coating with organic wax emulsion to extend the shelf life of fruits and vegetables.
- Study of effect of precooling on shelf-life and quality of fresh fruits, vegetables and flowers.
- Study of packages-bulk and consumer packs for different fruits, vegetables, flowers and spices.
- Study of construction and working of zero energy cool chamber. Study of storage behaviour of different fruits and vegetables in zero energy cool chamber.
- Preparation and preservation of fruit-based beverages and blended products from fruits and vegetables.
- HACCP analysis, residue analysis in organic products. Visit to packaging centres, local markets, cooperative organisations, super markets dealing with marketing of organic perishables.



VII. Suggested Reading

- *Basics of Organic Farming*: by Mamta Bansal. Kindle Edition
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B. Singh. Jain Brothers.

I. Course Title : Farming Systems Concepts and Practices for Organic Farming

II. Course Code : OF 506

III. Credit Hours : 2+1

IV. Aim of the course

To provide knowledge on practices of organic farming

V. Theory

Unit I: Introduction

Farming systems: Definition, importance, classification and scope, Classification of farming systems according to type of rotation, intensity of rotation, degree of commercialization, water supply, enterprises, Concept of sustainability in farming systems, role of integrated farming systems in agriculture, approaches

Unit II: Agro-ecology

Concepts and practices, Agro-ecology and the design of Sustainable Agro-ecosystems, Ecological processes to optimize in agro-ecosystems, Sustainable Agriculture: Basic Definitions and Concepts, Alternative Sustainable Farming Systems, Low external input sustainable agriculture

Unit III: Enterprises selection and Integration

Natural Farming Systems, Intentional Integrated Farming Systems, Pre-dominant farming systems in various regions, Eco-physiological approaches component selection and integration, Complementary and competitive interaction, Primary, Secondary, Complimentary and Supplementary enterprises for organic farming, livestock based systems, vertical farming, Principles and Practices of organic livestock production, Principles of organic aquaculture, Organic fruit and vegetable production practices, Models of integrated farming systems for irrigated ecosystems and rainfed ecosystems

Unit IV: Modeling of farming systems

Simulation models for intercropping, farming system design using farm design for various resource conditions, Linear programming, Multi-objective criteria decision making, Fuzzy logic analysis, Artificial Neural Network (ANN) based modeling, DSSAT, Infocrop, Cropsyst, Livesim

Unit V: Integrated Organic Farming Systems

Concepts, Principles, Strategies, Diversity plantations, Diversified cropping systems, crop rotations, soil fertility management, Selection of seeds, varieties and planting material, nutrient management, weed and pest management, integration of livestock, breeds and allied activities, *In-situ* recycling of Organic Wastes, Products and processes of composting, Component optimization, Market input chain, family employment generation, case studies, supplementary, Complimentary and substitution effects under dry-land, irrigated, wetland and hill-zone eco systems

**Unit VI: Soil-crop-livestock-human chain**

Bio-nutrition concepts, design of farming systems for nutrition, Household level production of food, feed, fodder, fertilizer, fuel and fibre from farming systems

Unit VII: Secondary Agriculture

Product diversification, Process diversification, processing of marketable surplus produces, packaging, branding and marketing

Unit VIII: Contract Farming

Farming system based cluster formation, production, processing and marketing, legal aspects of contract farming

Unit IX: Specialized farming systems

Protected cultivation, high value crops based systems, water based farming systems, region specific integrated farming systems, medicinal herb based systems

Unit X: Farming System diversification

Existing scenario of farming systems, need for diversification, methods of diversification, horizontal and vertical diversification

Unit XI: Four P Model of organic farming system

4P (Planning, Production, Processing and Promotion) model of organic farming systems

Unit XII: Ecological Engineering

Principles and Practices, Ecological engineering approach of soil fertility and pest management, examples of ecological engineering in traditional farming systems, case studies

VI. Practical

- Agro-ecosystem analysis: Field study of farming systems in the context of production flows, energy flows and pest dynamics using quantitative tools
- Farming System typology analysis and clustering of group of farmers
- Synthesis of organic farming system model for a given region using primary and secondary data
- Estimation of ecological, economic, social and sustainable livelihood indicators for a given farming system
- Design of alternative farming systems using Farm Design and other available modelling tools
- Experiential learning on different enterprises
- Documentation of farming system case studies

VII. Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment and class discussion
Learning outcome: leadership development for an organic entrepreneur

VIII. Suggested Reading

- *Basics of Organic Farming*: by Mamta Bansal. Kindle Edition
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B.Singh. Jain Brothers.
- *Principles of Organic Farming*: S.R. Reddy. Kalyani Publisher.



- I. Course Title** : **Organic Certification, Standards and Regulations**
II. Course Code : **OF 507**
III. Credit Hours : **2+1**

IV. Aim of the course

To provide knowledge Organic Certification, Standards and Regulations

V. Theory

Unit I

National and international regulations on quality assurance and certification

National Programme for Organic Production (NPOP), National Standards for Organic Production (NSOP), USDA NOP Programme and standards, EU Organic standards, Codex Alimentarius, Canada Organic regulation and important differences between NPOP and international standards. FSS Act 2006 for organic food, basic requirements, enforcement, standard operating procedures and verification in value chain

Unit II

ISO systems for quality assurance (ISO 17065, ISO 17011, ISO 19011 etc) and accreditation processes

What is ISO, salient features and functions of ISO, ISO systems for auditing, ISO 17065 for auditing and certification agencies, ISO 19011 Inspection protocols, ISO17011 Accreditation requirements, ISO 17025 Accreditation of quality analysis laboratories. Accreditation procedure and policies under NPOP, Essential requirements and competence for making an organic certification body, Conflict of interest management

Unit III

Types of certification systems (NPOP and PGS), standards and procedures

NPOP - A third party certification systems, Certification bodies operational policies and functions, National standards for crop production, livestock, Aquaculture, Processing and handling and other miscellaneous systems. Tracenet the online data management tool and traceability management

PGS – Participatory Guarantee Systems – Evolution of PGS Systems, Guiding principles, PGS Standards, International scenario on PGS development Procedure for organic guarantee under PGS systems, PGS-India programme, operation of PGS-India programme, institutional structure, PGS-India Data management platform, management of traceability.

Unit IV

On-field management of standard compliance and documentation

Issues for implementation of standards on field such as conversion period, contamination control, fertility management, living condition requirement for livestock, management of integrity in processing and handling, Fundamental policy for inspections, step-by-step inspection protocols, Development of inspection formats and inspection checklists. Documentation requirements such as organic system plan, field operation register, input and cultural practices record, processing record, purchase and sales records and product flow in processing.



Unit V

Individual and grower group certification management

Basic requirements for certification management by (a) Individual producer and (b) Grower/ producer groups. Applicability and types of systems covered

Unit VI

Inspection (under NPOP) and peer review (under PGS) systems

Fundamental principles of inspection, checklists and inspection parameters, general policy frame work

NPOP – Third party inspection procedure, risk assessment, documentation and record keeping review, physical verification of facilities, fields and stables, production facilities, estimated yield/production assessment, tracking the product flow throughout the process, chain of custody. Review of inspection forms and checklists and certification decisions.

PGS-India – Peer review principles, making of peer review committees and peer review checklists, analysis of peer review checklists and certification decisions. Submission of summary sheets to Regional councils and assessment and endorsement of certification decisions.

Unit VII

Certification of crop, livestock, aquaculture and other systems

Standards, their implementation in production systems, measures for contamination control, integrity management, sanitation and hygiene, input evaluation procedures, development of process tracking checklists

Unit VIII

Certification of processing, handling, trading and management of traceability

Standards, their implementation in production/ processing and handling systems, measures for contamination control, integrity management, sanitation and hygiene, packaging and labelling, development of process tracking checklists

Unit IX

Internal control system management in large farmer groups under NPOP

Large farmer groups, essential requirements, internal control systems, development of ICS operating manual, management of ICS, internal inspections, risk assessment, assessment of internal inspections and certification decisions, additional documentation for groups, produce/ output management and sale record management

Unit X

PGS Group development and PGS certification management

Essential requirements for local groups, development of local group operating manuals, requirements of group meetings and trainings, decision making by farmers, operational policies for Regional Councils, developing operating manual for Regional councils, assessment of summary sheets and decisions of local groups, procedure for decision endorsement and certification granting



VI. Practical

- Documentation of certification procedures, acquaintance with record keeping, handling, labeling and preparation of farmers IDs for developing ICS.
- Visit to certification bodies, certified farms, certified processing and handling operations
- Development of organic system plan for specific production system
- Development of inspection format and checklists for specific production system
- Development of operating procedures on specific aspects
- Risk assessment on organic farms and possible mitigating measures
- Running of audit trails in certified operations
- Mock inspections of different production systems
- Exercise on inspection report/ peer evaluation checklist review and certification decision
- Exercise on methods of yield assessment

VII. Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment and class discussion

VIII. Learning outcome

Educating to become a real organic grower

IX. Suggested Reading

- *Basics of Organic Farming*: Mamta Bansal. Kindle Edition
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B.Singh. Jain Brothers.
- *Principles of Organic Farming*: S.R. Reddy. Kalyani Publisher.

I. Course Title : Value Chain Management

II. Course Code : OF 508

III. Credit Hours : 2+2

IV. Aim of the course

To provide knowledge on value chain for optimization of crop yield due to organic farming

V. Theory

Unit I: Introduction

What is value chain? Defining value chain and its finance (Internal value chain finance, External value chain finance, Interest around value chain finance in agriculture, interest in value chain finance in agriculture); Overview of value chain management.

Unit II: Understanding agricultural value chain finance

Context, the concept of agricultural value chain finance, Agricultural value chain finance as an approach, Enabling environment (standards and certification, regulation and enforcement, macro-economic and social context), and Value chains and diversified livelihoods.

Unit III: Value chain business models

Producer-driven value chain models, Buyer-driven value chain models, Facilitated



value chain models, and Integrated value chain models. Case Study 1. On commercial village approach.

Unit IV: Agricultural value chain finance instruments

Product overview, Product financing (trader credit, input supplier credit, marketing company credit, lead firm financing), Receivables financing (Trade receivables finance, factoring and forfeiting), Physical asset collateralization (warehouse receipts, repurchase agreements, financial lease), Risk mitigation products (crop/ weather insurance, forward contracting, futures), Financial enhancements (securitization, loan guarantees, joint ventures). Case Study 2. Producer-driven financing of farm inputs: informal inventory credit; Case Study 3. Integrated financial instruments and value chain services.

Unit V: Innovations

Value chain innovations, Financial innovations, Technological innovations (management systems, networks and exchanges, mobile phones and mobile banking), Infrastructural innovations, Policy and public sector innovations. Case Study 4. Technological innovations; Case Study 5. Avenues for sustainable agricultural development.

Unit VI: Leadership Approaches for Successful Food Value Chains

Values-Based Leadership, Values-Based Leadership in Practice, Leadership in succession.

Unit VII: Organic food value chain management

VI. Practicals

- Collection, aggregation and value addition
- Maintain quality and integrity of the product - practices and procedures, monitoring practices and procedures followed, record keeping systems, management practices and separation measures, handling and processing of organic products
- Pest control - Treatments with pest regulating agents – permitted [physical barriers, sound, ultra-sound, light and UV-light, traps (incl. pheromone traps and static bait traps), temperature control, controlled atmosphere and diatomaceous earth] and prohibited
- Ingredients - approved and prohibited ingredients (microorganisms, minerals, gases)
- Processing methods - permitted and prohibited mechanical, physical and biological
- Packaging - permissible biodegradable, recyclable, reusable systems and eco-friendly packaging
- Labeling - labeling requirements for agricultural commodities and processed food
- Storage and Transport - permitted conditions of storage to maintain product integrity
- Food additives including carriers for use in production of processed organic food
- Processing aids and other products for use for processing of ingredients of agricultural origin from organic production flavouring agents, Preparations of Micro-organisms, Ingredients
- Approved products for packaging of organic foodstuffs incl. Permissible packaging material for aquaculture

VII. Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment and class discussion



VIII. Learning outcome

High value in organic products

IX. Suggested Reading

- *Basics of Organic Farming*: Mamta Bansal. Kindle Edition.
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B. Singh. Jain Brothers.
- *Principles of Organic Farming*: S.R. Reddy. Kalyani Publisher.

I. Course Title : Marketing

II. Course Code : OF 509

III. Credit Hours : 2+0

IV. Aim of the course

To provide knowledge on marketing of organic produce for economic profit of the grower

V. Theory

Unit I: What is Marketing?

Facets of marketing, Facilitating functions of a market, What's special about agricultural markets? Pricing policy and Role of prices.

Unit II: Basics of Supply and Demand–

Demand, Aggregate demand, Supply and Aggregate supply.

Unit III: Food Marketing Channel–

Understanding the food marketing channel, Scenario Analysis.

Unit IV: Market intelligence–

Market research, Production cost assessment, Projecting Revenues, Accounting, Market Selection.

Unit V

Organic production and domestic market size, Institutional context and regulations (such as NPOP, NSOP, APGMC Act, PGS, FSSAI, Jaivik Bharat).

Unit VI: Organic Food Distribution System–

Domestic market structures, and classification framework, urban organic retail models, Organic specialty stores, markets and health food stores. Direct marketing and Community Supported Agriculture.

Unit VII: Market Potential for Organic Foods–

Consumer preferences and perceptions (organic sensitivity, building awareness on organic foods and consumer needs, shopping Behavior, factors influencing purchases of new foods), general trade and organized retail.

Unit VIII: e-Marketing and e-Consumer Perceptions and Behaviour–

Why organic food, source and perception of organic foods, uses of organic food, resistance to use organic products, source of awareness, organic food-is it a fad?, On-line retail and home delivery services, role of advertising and choice of media, understanding the role of quality in marketing, perception of health benefits and assurance/certification.

**Unit IX**

Accessibility of organic foods, premiums and willingness to pay premiums, role of retailer

Unit X

Efficient supply chains and retail channels, sustainability of supply chain.

Unit XI: Consumer purchase Behavior and habits–

Shopping Behavior, role of influencer in decision making, concern over adulteration, chemicals, loss of nutrients and vitamins during processing and manufacturing and its impact on marketing and sale.

Unit XII: Challenges and success stories–

Success stories in organic marketing, organizational models, their advantages, challenges, limitations and legal context.

VI. Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment and class discussion

VII. Learning outcome

Basic knowledge on marketing to get higher prices in organic produces.

VIII. Suggested Reading

- *Basics of Organic Farming*: Mamta Bansal. Kindle Edition
- *The Complete book of Organic farming and products of organic compost*: NPCS Board of consultants and Engineers.
- *ABC of Organic Farming*: Amitava Rakshit and H.B. Singh. Jain Brothers
- *Principles of Organic Farming*: S.R. Reddy. Kalyani Publisher.

I. Course Title : Research Methodology and Biostatistics

II. Course Code : OF 510

III. Credit Hours : 2 + 1

IV. Theory**Unit I**

Experimental techniques: Research design, sampling, data collection, On-station experimentation, On-Farm experimentation, tabulation, Statistical tools and analysis techniques for interpretation of data.

Unit II

Geo-referenced characterization: Questionnaire design principles, Questionnaire design for consumers of organic products, Questionnaire design for farmers and producers of organic products, Questionnaire design for processors/ traders/ exporters, Geo-spatial analysis and mapping of organic farms/ producers/ traders/ consumers.

Unit III

Meta data analysis: Concepts, statistical methods, clustering research results, Holism, Positivism, Objectivism, Reductionism, Constructivism, Subjectivism, data source, Variable coding and analysis, interpretation.

Unit IV

Niche area and crops for organic farming: Parameters for niche area and crop, Different scales of niche area, Tools and steps in Niche area and crop identification,



Parameterization and classification based on macro, regional and micro level.

Unit V

Climate resilience of organic farming: Methodology for identification of climate resilient production systems, GHG's estimation using IPCC, GHG's measurement using instrumentation, Global Warming Potential, Energy & Carbon budgeting.

Unit VI

Breeding for organic production system: Conventional breeding strategies for organic production, participatory plant breeding, Marker aided selection, Stability analysis, Molecular characterization of indigenous organic inputs, Bio-chemical and molecular signature of organic produces.

Unit VII

Commercial Project Formulation on Organic Farming: Internal rate of return, Pay Back period, B: C ratio, Net Present Value, Model project formulation for organic farming, Impact analysis tools and methods.

Unit VIII

Farming System model development: Synthesis of IFS models using primary and secondary data, classification, validation of farming systems.

Unit IX

Notations in statistics: Basics of statistical notation, Algebraic rules, designing a variable, standard notation for statistics.

Unit X

Descriptive statistics: Measures of central tendency, measures of variability, relative scores, measures of relationship, skewness, kurtosis.

Unit XI

Introduction to statistical inference and testing of hypothesis: Statistical model, point estimation, confidence intervals, hypothesis testing, t-test, non-parametric alternative sign test.

V. Practical

- Synthesis of farming system model
- Estimation of GHG emission from IPCC tool
- Meta data analysis using published papers
- Identification and niche area and crops for a district or block
- Identification of Climate resilient production system using long term meteorological data
- Commercial project formulation
- Geo-spatial analysis using GIS platform
- Carbon and energy budgeting of an organic farm

I. Course Title : Organic Input Management and Production Technologies

II. Course Code : OF 511

III. Credit Hours : 2+1

IV. Aim of the course

To provide knowledge on various organic inputs, their production technologies, quality control and commercialization aspects



V. Theory

Unit I: Introduction

Need for on-farm and off-farm (external) organic inputs, types of organic inputs allowed under organic farming, regulatory scenarios and standards. Status of organic and biological input industry in the country.

Unit II: On-farm inputs soil fertility and nutrient management

Types of on-farm inputs for soil fertility and nutrient management, their need assessment under specific cropping systems *vis-à-vis* soil test reports, methodologies for recycling of on-farm biomass and crop residue, innovative traditional inputs such as jivamrit, beejamrit, panchgavya etc. their microbial profiling and nutrient mobilization potential and standardized production methods, Oil cakes and their applications.

Unit III: On-farm inputs, plant health management and pest control

Types of plant protection inputs and intervention approaches, use of biological and ecological approaches, preventive practices, Types of plants used in plant protection and their biological characterization for pest control, basic methodologies for active ingredient extraction and on-farm formulations.

Unit IV: Composts and their value added products

Types of composts, their characters, nutrient potential, composting methodologies (aerobic, anaerobic, NADEP, etc), value added composts, quality control parameters, commercial production methodologies for city waste compost, Phosphate Rich Organic manure (PROM), bio-organic manure, technologies for product formulations such as enrichment and granulations, etc.

Unit V: Biofertilizers

Types of biofertilizers, standards for commercial products, testing methodologies, characterization and efficiency parameters, management of microorganisms in laboratory, production methodologies such as mother culture development, mass production through fermentation and fermentation parameters, mass scale culture techniques, product formulations, carrier-based inoculants, liquid inoculants and lyophilized inoculants.

Unit VI: Microbial Biopesticides

Types of biopesticides, standards for commercial products, testing methodologies, characterization and efficiency parameters, management of microorganisms in laboratory, production methodologies such as mother culture development, mass production through fermentation and fermentation parameters, mass scale culture techniques, product formulations, carrier based inoculants, liquid inoculants and lyophilized inoculants. Types of polyhedrosis and granulosis viruses and their production methodologies.

Unit VII: Mass rearing of beneficial insects

Introduction to beneficial insects such as pest predators and parasites, classification and identification, mass rearing technologies including rearing of host insects, Production of egg cards of beneficial insects and their release in the field.

Unit VIII: Botanical pesticides and other non-chemical pest protectants

Type of non-chemical plant protection options, importance of soaps and oils,



important plants having pesticidal properties, plant parts having pesticidal active ingredient and their extraction methodologies, product formulation and stabilization for increased shelf life, field assessment of efficacy. Regulatory scenario and quality parameters.

VI. Practical

- Getting familiarized with on-farm soil fertility management inputs (such as beejamrit, jivamrit, panchgavyaetc), ingredients needed and production methodology. Preparation and quality assessment
- Application of such inputs in small plots on selected crops and observation on growth
- Production of different composts including vermicompost
- Quality analysis of composts for nutrients and heavy metals
- Biofertilizer organisms, their laboratory characterization, sub-culturing and mother culture development
- Fermentation technology demonstration, production of bacterial broth in pilot scale fermenters
- Biofertilizer product formulations and quality analysis methods
- Study biopesticide organisms, laboratory culturing, mass cultivation using solid state fermentation, liquid fermentation and spore harvesting methods and product formulations
- Visit to beneficial insect rearing laboratory and handling of insects including demonstration on tricho-cards production
- Extraction of neem seed kernel extracts and neem oil. Production of botanical extracts and product formulation using emulsifiers
- Study effect of various botanical extracts on insect pests
- Preparation of Bordeaux mixtures and copper fungicides

VII. Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment and class discussion. Practical in the laboratory, visit to production sites and demonstration of production protocols through industry visits, practical on analysis protocols

VIII. Learning outcome

Basic knowledge on marketing to get higher prices in organic produces.

IX. Suggested Reading

- *The Complete Technology Book on Vermiculture and Vermicompost*, NPCS Board of consultants and Engineers, Asia Pacific Business Press
- *Training material on Composting and Vermicomposting*, Published by Ecosan Services Foundation
- *Biofertilizers and Biopesticides*, A, Channabasava and H.C. Lakshman
- *Handbook of Biofertilizers and Biopesticides*, by AM Deshmukh, RM Khobrgade and PP Dixit
- *Mass Production of Beneficial Organisms*, by J. Morales-Ramos, M. Guadalupe and DS Ilan, Academic Press, 2013.