Department of Agronomy and Agro-meteorology
(Semester-wise Course List)

		AGRONOMY	
S. No	**Semester**	**Course Title**	**Credit Hours**
1	I	Fundamentals of Agronomy	3(2+1)
2	I	Farming based livelihood systems	3(2+1)
3	III	Crop Production Technology-I (Kharif Crops)	3(2+1)
4	III	Principles and Practices of Natural Farming	2(1+1)
4	IV	Crop Production Technology-II (Rabi Crops)	3(2+1)
5	IV	Water Management	2(1+1)
6	V	Weed Management	2(1+1)
7	V	Introductory Agroforestry	2(1+1)
8	VI	Dryland Agriculture/Rainfed Agriculture and Watershed Management	2(1+1)
		Elective courses	
9	VII	Climate Resilient Agriculture	4(3+1)
10	VII	Geoinformatics and Remote Sensing, Precision Farming	4(3+1)
11	VII	Principles and Practices of Organic Farming/Conservation Agriculture	4(3+1)
12	VIII	Organic Production Technology	2(0+2)
		Agricultural Meteorology	
13	II	Environmental Studies and Disaster management	3(2+1)
14	V	Introduction to Agro-meteorology	2(1+1)

Syllabus: Agronomy Courses

Semester : I

Course No. : MDC-111

Credit Hrs. : 3(2+1)

Course Title : Farming-based Livelihood Systems

Objectives

To make the students aware about farming-based livelihood systems in Agriculture.

To disseminate the knowledge and skills that how farming-based systems can be a source of livelihood.

Theory

Status of Agriculture in India and different States, Income of farmers and rural people in India, Livelihood-Definition, Concept and livelihood pattern in urban and rural areas, Different indicators to study livelihood systems. Agricultural Livelihood Systems (ALS): Meaning, approach, approaches and framework, Definition of farming systems and farming-based livelihood systems, Prevalent Farming systems in India contributing to livelihood.

Types of traditional and modern farming systems. Components of farming system/ farming-based livelihood systems: Crops and cropping systems, Livestock (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agroforestry systems, Aquaculture, Duck/Poultry-cum-Fish, Dairy-cum-Fish, Piggery-cum-Fish etc. Small, medium and large enterprises including value chains and secondary enterprises as livelihood components for farmers, Factors affecting integration of various enterprises of farming for livelihood.

Feasibility of different farming systems for different agro-climatic zones, Commercial farming-based livelihood models by NABARD, ICAR and other organizations across the

country; Case studies on different livelihood enterprises associated with the farming. Risk and success factors in farming-based livelihood systems, Schemes and programs by Central and State Governments; Public and Private organizations involved in promotion of farming-based livelihood opportunities.
Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing life style.

Practical

Survey of farming systems and agriculture-based livelihood enterprises, Study of components of important farming-based livelihood models/systems in different agro-climatic zones, Study of production and profitability of crop based, livestock based, processing-based and integrated farming-based livelihood models. Field Visit of innovative farming system models. Visit of Agri-based enterprises and their functional aspects for integration of production, processing and distribution sectors and Study of agri-enterprises involved in industry and service sectors (Value Chain Models). Learning about concept of project formulation on farming-based livelihood systems along with cost and profit analysis, Case study of Start-Ups in agri-sectors.

Semester : II

Environmental Studies and Disaster Management

Credits Hours : 3 (2+1)

Objective: To expose and acquire knowledge on the environment and to gain the state-of-the-art - skill and expertise on management of disasters

Theory

Introduction to Environment - Environmental studies - Definition, scope and importance – Multidisciplinary nature of environmental studies - Segments of Environment - Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere. Natural Resources: Classification - Forest resources. Water resources. Mineral resources Food resources. Energy resources. Land resources. Soil resources. Ecosystems -

Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of ecosystem. Biodiversity and its conservation: Introduction, definition, types. Biogeographical classification of India. Importance and Value of biodiversity. Biodiversity hot spots. Threats and Conservation of biodiversity Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution h. light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes. Social Issues and the Environment: Urban problems related to energy. Water conservation, rain water harvesting, watershed

management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Disaster management - Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community- based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management.

Practical

Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units. Biodiversity assessment

in farming system. Floral and faunal diversity assessment in polluted and un polluted system. Visit to local polluted site - Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of E. coli in water sample. Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem – Visit to pond/river/hills. Visit to areas affected by natural disaster

Semester : III

Course No. : AGRO-232 Credit Hrs. : 3(1+2)

Course Title : Crop Production Technology-I (Kharif crops)

SYLLABUS

Objectives

kharif crop production,

(ii) To impart knowledge and skill on scientific crop production and management.

Theory

Origin, Geographical distribution, Economic importance, Soil and climatic requirements, Varieties, Cultural practices and Yield of Kharif crops. Cereals- Rice, Maize, Sorghum, Pearl

millet, Finger millet and Other Minor millets (Foxtail millet, Proso millet, Barnyard millet);

Pulses- Pigeon pea, Mungbean, Urdbean and Horse gram; Oilseeds-Groundnut, Soybean, Sesame, Niger and Castor; Fibre crops- Cotton and Jute; Forage crops- Sorghum, Cowpea, Cluster bean, Maize, Guinea and Napier.

Practical

Rice- Nursery preparation and transplanting; Sowing of Soybean, Pigeon pea and Mungbean, Maize, Groundnut and Cotton; Effect of seed size on germination and seedling vigour of Kharif crops; Effect of sowing depth on germination of Kharif crops; Identification of weeds in Kharif crops; Top dressing and foliar feeding of nutrients; Study of yield contributing characters and yield calculation of Kharif crops; Study of crop varieties and important agronomic experiments at experiential farm; Recording biometric observations; Study of forage experiments; Morphological description of Kharif crops; Visit to research centres of related crops. Allotment of 2 R area to each student for undertaking various cultural operations as part.

Practical

carried-out concurrently with the above-mentioned practical sessions.

Course No. : AGRO-233 Credit Hrs. : 2(1+1)

Course Title : Principles and Practices of Natural Farming

SYLLABUS

Objectives

natural farming.

(ii) To teach students the concept, need and principles of native ecology-based production under natural farming.

(iii) To impart practical knowledge of natural farming and related agricultural practices in Indian and global environmental and economic perspectives.

Theory

Indian Heritage of Ancient Agriculture, History of Natural Farming, Importance of natural farming in view of climate change, soil health, water use carbon sequestration, biodiversity conservation, food security and nutritional security, and sustainable development goals (SDGs), Concept of natural farming; Definition of natural farming; Objective of natural farming, Essential characteristics and Principles of natural farming; Scope and importance of natural farming. Main Pillars of natural farming; Methods/

types/schools of natural farming. Characteristics and design of a natural farm, Concept of ecological balance, ecological engineering and community responsibility in natural versus other farming systems, Introduction to concept of ecological, water, carbon and nitrogen foot prints, Concept and evaluation of ecosystem services, integration of crops, trees and animals, cropping system approaches, Biodiversity, indigenous seed production, farm waste recycling, water conservation and renewable energy use approaches on a natural farm,

Rearing practices for animals under natural farming, Nutrient management in natural farming and their sources, Insect, pest, disease and weed management under natural farming; Mechanization in natural farming, Certification and standards in natural farming, marketing and export potential of natural farming produce and products. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of natural farming and chemical free agriculture, Entrepreneurship opportunities in natural farming.

Practical

Visit of Natural farm and Chemical-free Traditional Farms to study the various components and operations of Natural Farming principles at the farm; Indigenous Technical Knowledge (ITKs) for seed, tillage, water, nutrient, insect-pest, disease and weed management; On-farm inputs preparation methods and protocols, Studies in green manuring in-situ and green leaf manuring, Studies on different types of botanicals and animal urine and dung based non-aerated and aerated inputs for plant growth, nutrient, insect and pest and disease management; Weed management practices in natural farming; Techniques of Indigenous seed production- storage and marketing, Partial and complete nutrient and financial budgeting in natural farming; farming; Evaluation of ecosystem services in natural farming (Crop, Field and System). Case studies and Success stories in natural farming and chemical-free traditional farming

Semester : IV

Course Title : Crop Production Technology-II (Rabi Crops)

Credits Hours : 3(1+2)

Objectives

ii) To impart knowledge and skill on scientific crop production and management. .

Theory

cultural practices and yield of Rabi crops; cereals- wheat and barley, pulses- chickpea, lentil, peas , oilseed- rapeseed, mustard and sunflower; sugar crops-sugarcane; medicinal and aromatic crops- mentha, lemon grass and citronella ,Forage crops –berseem, lucerne and oat.

Practical

morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of rabi crops at experimental

farms. Study of rabi forage experiments, oil extraction of medicinal crops, visit to research stations of related

crops.

Course Title : Water Management

Credits Hours : 2(1+1)

Objectives

requirement for optimum growth and development

ii) To study different methods of irrigation and water management practices of both field and horticultural

crops and drainage.

iii) To study the soil moisture conservation practices including management of rain water,

watershed and command areas

Theory

Irrigation: definition and objectives, Importance function of water for plant growth, water resources and irrigation development for different crops in India; Soil plant water relationships; Available and unavailable soil moisture – distribution of soil moisture – water budgeting – rooting characteristics – moisture extraction

pattern, effect of moisture stress on crop growth.. Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, different approaches of scheduling of irrigation; Methods of irrigation: surface and sub-surface, pressurized methods viz., sprinkler and drip irrigation, their suitability,

merits and limitations, fertigation, economic use of irrigation water; Layout of different irrigation systems, Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); Agricultural drainage. Water management problem, soils quality of irrigation water, irrigation management practices for different soils and crops., drip, sprinkler. Layout of underground pipeline system.

Practical

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water by using water measuring

devices viz., flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; layout for different methods of irrigation, Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and

calculation of emitter discharge variability; Determination of EC, pH, carbonates, bio-carbonates, Ca++ and Mg++ in irrigation water (quality parameters).

Semester : V

Course Title : Introduction to Agro-meteorology

Credits Hours : 2(1+1)

Objectives

1. To introduce the students to the concept of weather and climate and the underlying physical processes occurring in relation to plant and atmosphere
2. To impart the theoretical and practical knowledge of instruments/equipments used for measurement of different weather variables in an agrometeorological observatory
3. To study the meteorological aspects of climate change in agriculture and allied activities

Theory

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation,

process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture; Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave; Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop andlivestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic

variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording, Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law, Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS; Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis,

Measurement of soil temperature and computation of soil heat flux, Determination of vapor pressure and relative humidity, Determination of dew point temperature, Measurement of atmospheric pressure and analysis of atmospheric conditions, Measurement of wind speed and wind direction, preparation of windrose, Measurement, tabulation and analysis of rain, Measurement of open pan evaporation and evapotranspiration, Computation of PET and AET.

Semester : VI

Course Title : Dryland agriculture/ Rainfed agriculture and watershed management

Credits Hours : 2 (1+1)

Objectives

1. To learn about characteristics and conditions of dryland/rainfed agriculture
2. To gain knowledge about drought and its mitigation
3. To impart knowledge on water harvesting and watershed management

Theory

Problems and prospects of dry land/rainfed agriculture in India ; Soil and climatic conditions prevalent in dry land/rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Crop adaptation and mitigation to drought; Water harvesting: importance, its

techniques, Efficient utilization of water through soil and crop management practices, Crops and cropping systems in dry land/rainfed areas; Management of crops in dry land/rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, history, objective, principles and components of watershed management, factors affecting watershed management.

Practical

onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country. Effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure. Soil moisture determination under different land situations, Importance of seed priming to mitigate drought. Assessment of meteorological drought. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

Semester : VI

Elective courses

Course Title : Climate Resilient Agriculture

Credits Hours : 3(2+1)

Objectives

1. To impart the concept of climate resilient agriculture under the present context of climate change
2. To study the integrated role of different sectors in building resilience to climate change in agriculture

Theory

Climate change and impacts of climate change on agriculture and food security; crop productivity under different climate change scenarios including extreme events such as drought, flood, pest and disease outbreak etc. Basics of adaption and mitigation in the agricultural sectors; analyzing and assessing climate vulnerability to identify vulnerable sectors and possible adaptation options in agriculture; assessing biophysical and socio-economic impacts on agricultural sector; risk assessment strategies, preparedness for weather and climate risks in agriculture; application of geospatial tools and techniques for sustainable agriculture. Climate resilient agriculture (CRA) – concept, scope and importance with special reference to India, climate resilient technologies for enhancing crop productivity and sustainability – role of weather & climatic information, agro-advisories, ICTs and simulation models; climate resilient agronomic practices – crop/cultivar selection, crop diversification/ crop mixtures; water management practices – rain water harvesting, micro-irrigation, deficit irrigation and drainage management, organic/natural farming, integrated farming systems (IFS); site specific nutrient management (SSNM), conservation agriculture technologies to build soil organic carbon, harnessing microbial biodiversity, biomass recycling; use of renewable sources of energy; climate resilient pest-disease management strategies. Breeding strategies for development of climate change resilient crops and varieties, development of biotic and abiotic stress tolerant/resistant cultivars under changed climatic scenarios including extreme weather events.

Practical

Acquaintance with meteorological instruments including AWS, Statistical techniques to study trend of climatic parameters, Analysis of extreme weather events using non-parametric tests, Building climate change scenarios under different futuristic emission of GHGs, Designing strategies to mitigate the effect of climate change using climate resilient crops/cultivars, climate resilient technologies and manipulation of cropping patterns,

Acquaintance with ICTs for effective dissemination of local weather information and agroadvisories, Analysing carbon sequestration potential of different agro-ecosystems; Designing 'climate smart village'

model considering the availability of resources. Awareness programme on climate change and climate resilient agriculture among farming community.

Course Title :Geoinformatics and Remote Sensing, precision farming

Credits Hours : 4(3+1)

General Objectives: Enabling students acquire knowledge on basics of remote sensing technique for precision farming applications

Specific Objectives: To provide a comprehensive knowledge of remote sensing, precision farming and its benefits in improving crop production and soil health management

Theory

Introduction and history of remote sensing; sources, Principles of remote sensing, propagation of radiations in atmosphere; Interaction with matter, Application of remote sensing techniques land use soil surveys, crop stress and yield forecasting, Advantages and disadvantages of remote sensing,

Remote sensing institutes in India, Basic Concepts about geoinformatics.

What is artificial intelligence; History of artificial intelligence, Fundamentals of big data & machine learning(ML), Use of artificial intelligence in autonomous systems: agricultural robots and drone monitoring systems, driverless tractors, automated sprinklers and self-harvesting machines etc.; Use of AI in crop analysis: monitoring soil quality, promoting organic crops, monitoring weeds, precision agriculture, using drones for crop analysis; Role of AI for sustainability and climate change, yield and demand forecasting, food tech/wider

value chain including impact of blockchain, AI use for in the emerging markets; Technology deployment like sensors, AI and agricultural technologies and How to scale AI for agricultural technologies applications, Responsible AI in agriculture, Data sharing; Expert System: Introduction to expert system, Characteristics and features of expert system, Applications of Expert System, Importance of Expert system, Rule based system architecture; Software Agents.

Practical

Familiarization with different remote sensing equipments and data products, Interpretation of aerial

photographs and satellite data for mapping of land resources, Global positioning system (GPS), Basics of

Geographic Information System (GIS), Georeferencing of toposheets,

Live examples and case study of AI use in Agriculture, Search and Control strategies: Blind search, Breadth -first search, Depth First search, Hill climbing method, Best First search, Branch and Bound search, Programming in Prolog Syntax and meaning of Prolog Programs. Using Data Structures. Controlling Back-tracking. Input and Output. Built-in Predicates, Using Prolog Grammar Rules. Higher level assignments/exercises for implementation using Prolog.

Course Title : Principles and Practices of Organic Farming and Conservation Agriculture

Credits Hours : 2 (1+1)

Objectives

1. To teach students the principles of crop production under organic and conservation agriculture situation

2. To impart practical knowledge of organic and conservation agriculture practices

Theory

farming; Nutrient management in organic farming and their sources, Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and crop standards of organic farming; Processing, labelling, economic considerations and viability, marketing and export potential of organic products. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture. Conservation agriculture: definition, origin, principles,

advantages, challenges,primary practices in conservation agriculture: minimum soil disturbance, crop residue retention, and crop diversification, complementary practices, conservation agriculture vis a vis Climate smart Agriculture, .

Practical

compost, vermicompost and their quality analysis; Method of application of bio-fertilizers; Indigenous technology knowledge (ITK) for nutrient, insect-pest and disease management; Studies in green manuring in- situ and green leaf manuring, Studies on different type of botanicals for insect-pest management; Weed management in organic farming; Cost of organic production system; Practices of conservation agriculture

M. Sc. (Agri.) Course Syllabus

Department- AGRONOMY

Seme-ster	Course No.	Credits	Course Title	Course Teacher
I	AGRON-501	3+0=3	Modern concepts in crop production	Dr. P. R. Patil
	AGRON-503	2+1=3	Principles and practices of weed management	Dr. G. B. Shendage
	AGRON-513	2+1=3	Principles and practices of organic farming	Prof. A. H. Karpe
II	AGRON-502	2+1=3	Principles and practices of soil fertility and nutrient management	Dr. P. R. Patil
	AGRON-504	2+1=3	Principles and practices of water management	Dr. G. B. Shendage
	AGRON-505	1+1=2	Conservation Agriculture	Prof. A. H. Karpe
III	AGRON-511	2+0=2	Cropping System and Sustainable Agriculture	Dr. G. B. Shendage
	AGRON-512	2+1=3	Dry land Farming and Watershed Management	Prof. P. P. Sarawale
	AGRON-591	1+0=1	Master's Seminar	Dr. P. R. Patil

IV	AGRON-599	0+30= 30	Research Work	Research Guide

AGRON 501

Credit Hour: 3+0

Course title: MODERN CONCEPTS IN CROP PRODUCTION

OBJECTIVE: To teach the basic concepts of soil management and crop production.

Theory

UNIT-I:

Crop growth analysis in relation to environment; agro-ecological zones of India.

UNIT-II:

Quantitative agro-biological principles and inverse yield nitrogen law;
Mitscherlich yield equation, its interpretation and applicability; Baule unit.

UNIT-III:

Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modelling for desired crop yield, Define; causes; factors and remedies of lodging.

UNIT-IV:

Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress, use of growth hormones and regulators for better adaptation in stressed condition; Remedies to mitigate environmental stress.

UNIT-V:

Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition

and integrated nutrient management; precision agriculture. Modern crop production concepts: soil less cultivation, Aeroponics, Hydroponics, Robotics and terrace farming. use of GIS, GPS and remote sensing in modern agriculture and protected agriculture, use of Drone technology in modern agriculture; Vertical farming.

AGRON 502

Credit hour: 2+1

Course Title: PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT

Objective: To impart knowledge of fertilizers and manures as sources of plant nutrients and apprise about the integrated approach of plant nutrition and sustainability of soil fertility.**Theory**

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I

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; Integrated Nutrient Management.

UNIT II

Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients, Micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; Nutrient sources.

UNIT III

Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Soil less cultivation, Enrichment of FYM and compost, recycling of urban waste and garbage

UNIT IV

Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency; agronomic, chemical and physiological, fertilizer mixtures and grades; nano-fertilizer materials and application; methods of increasing fertilizer use efficiency; nutrient interactions; precision nutrient management; Forms of fertilizers (Conventional and Water soluble fertilizers), Nano fertilizers, Customized slow fertilizers.

UNIT V

Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic nutrients; economics of fertilizer use; integrated nutrient management; use of vermin-compost and vermi-wash and residue wastes in crops, STCR technique.

Practical

1. Determination of soil pH and soil EC,
2. Determination of soil organic C,
3. Determination of available N, P, K and S of soil and DTPA extractable micronutrients in soil.

4. Determination of total N, P, K and S of soil,
5. Determination of total N, P, K, S in plant,
6. Computation of optimum and economic yield
7. Nutrient requirement as per soil test,
8. Use of sensors and Apps in soil fertility estimation

AGRON 503

Credit hour: 2+1

Course Title: PRINCIPLES AND PRACTICES OF WEED MANAGEMENT

Objective: To familiarize the students about the weeds, herbicides and methods of weed control.

Theory:

UNIT I

Weed biology, and ecology and classification, crop-weed competition including allelopathy; principles and methods of weed control and management; weed indices, weed shift in different eco-systems, weed dispersal; weed uses.

UNIT II

Herbicide's introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides.

UNIT III

Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures, sequential application of herbicides, rotation; weed control through use of nano-herbicides and bio-herbicides, myco-herbicides bio- agents, and allele chemicals; movement / fate of herbicides in soil and plant, Degradation of herbicides in soil and plants; herbicide resistance, residue, persistence and management; development of herbicide resistance in weeds and crops and their management, herbicide combination and rotation**.**

UNIT IV

Weed management in major crops and cropping systems; alien, invasive and parasitic weeds and their management; weed shifts in cropping systems; aquatic and perennial weed control; weed control in non-crop area.

UNIT V

Integrated weed management; recent development in weed management-robotics, use of drones and aero planes, etc., cost: benefit analysis of weed management.

Practical

1. Identification of important weeds of different crops,
2. Preparation of a weed herbarium,
3. Weed survey in crops and cropping systems,
4. Crop-weed competition studies,
5. Weed indices calculation and interpretation with data,
6. Preparation of spray solutions of herbicides for high and low-volume sprayers,
7. Use of various types of spray pumps and nozzles and calculation of swath width,
8. Economics of weed control,
9. Herbicide resistance analysis in plant and soil,
10. Bioassay of herbicide resistance residues,
11. Calculation of herbicide requirement,
12. Effect of herbicides on soil micro flora,
13. Use of drone for herbicide application.

AGRON 504

Credit hour: 2+1

Course Title: PRINCIPLES AND PRACTICES OF WATER MANAGEMENT

Objective: To teach the principles of water management and practices to enhance the water productivity

UNIT I

Water and its role in plants; Irrigation: Definition and objectives, water resources and irrigation development in India and concerned state, major irrigation projects, extent of area and crops irrigated in India and in different states.

UNIT II

Field water cycle, water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition. Water availability and its relationship with nutrient availability and losses, Soil water potentials; Kinds of water**.**

UNIT III

Soil, plant and meteorological factors determining water needs of crops, consumptive use of water; scheduling, depth and methods of irrigation; micro irrigation systems; automated irrigation system; deficit irrigation; fertigation; management of water in controlled environments, polyhouses and Hydroponics.

UNIT IV

Water management of crop and cropping system; crop water requirement; estimation of ET and effective rainfall; irrigation efficiency and water use efficiency', Water management of the major crops under climate change scenario, Virtual Water.

UNIT V

Excess of soil water and plant growth;, drainage requirement of crops and methods of field drainage, their layout and spacing;

UNIT VI

Quality of irrigation water and management of saline water for irrigation, water management in problem soils

UNIT VII

Soil moisture conservation, conjunctive water uses; water harvesting; roof-water harvesting; rain water management and its utilization for crop production.

Practical

1. Determination of Field capacity by field method
2. Determination of Permanent Wilting Point by sunflower pot culture technique
3. Determination of Field capacity and Permanent Wilting Point by Pressure Plate Apparatus
4. Determination of Hygroscopic Coefficient
5. Determination of maximum water holding capacity of soil
6. Measurement of matric potential using gauge and mercury type tensiometer
7. Determination of soil-moisture characteristics curves
8. Determination of saturated hydraulic conductivity by constant and falling head method
9. Determination of hydraulic conductivity of saturated soil below the water table by auger hole method
10. Measurement of soil water diffusivity

11. Estimation of unsaturated hydraulic conductivity

12. Estimation of upward flux of water using tensiometer and from depth ground water table

13. Determination of irrigation requirement of crops (calculations)

14. Determination of effective rainfall (calculations)

15. Determination of ET of crops by soil moisture depletion method

16. Determination of water requirements of crops

17. Measurement of irrigation water by volume and velocity-area method

18. Measurement of irrigation water by measuring devices and calculation of Irrigation efficiency

19. Determination of infiltration rate by double ring in filtrometer

20. Use of different apps for irrigation and fertigation scheduling

21. Estimation of Potential ET by Thornthwaite method

22. Estimation of uniformity coefficient of pressurized irrigation system.

23. Artificial intelligence and machine learning in irrigation management

24. Estimation of Reference ET by Penman Monteith Method

AGRON 505

Credit Hour: 1+1

Course Title: Conservation Agriculture

Objective: To impart knowledge of conservation of agriculture for economic development.

Theory:

UNIT I

Conservation agriculture (CA), definition, scope, principles, prospects and importance, advantages and disadvantages; conventional and conservation agriculture systems, sustainability concerns; conservation agriculture – concept, historical background, global experiences, present status in India; similarity/dissimilarity between resource conservation technology (RCT) and CA; similarity/dissimilarity between conservation tillage and CA; modern concept of tillage and its management through conservation agriculture.

UNIT II

Crop establishment and varietal response; nutrient management; water management; weed dynamics and management; energy use, resource-and input-use efficiency; insect-pest and disease dynamics and management; farm machinery, crop residue management; constraints in crop residue management; cover crop management in CA; cropping pattern in CA, role of farm mechanization in CA

UNIT III

Climate change adaptation and mitigation potential of CA and potential benefits; C- sequestration; soil health management: physical, chemical and biological properties of soil under CA.

UNIT IV

CA in agroforestry systems, rainfed / dryland regions

UNIT V

Economic considerations in adoption of CA, constraints and future of agriculture under CA, Policy issues

Practical:

1. Study of long-term experiments on CA,
2. Evaluation of soil health parameters,
3. Estimation of C-sequestration,
4. Machinery calibration for sowing different crops,
5. Weed seedbank estimation under CA,
6. Energy requirements in CA,
7. Economic analysis of CA.

AGRON 511

Credit hour: 2+0

Course Title: CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE

Objective: To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.**Theory UNIT-I**:

Cropping systems: definition, indices and its importance; physical resources, resources capture and use efficiency; major cropping systems of irrigated; rainfed / dry land and semi- arid / arid environments and their approximate acreage in India; soil and water management in cropping systems; assessment of land use; principles involved in inter and mixed cropping systems under rainfed and irrigated conditions.

UNIT-II:

Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, criteria in assessing the yield advantages; mechanism of yield advantage in intercropping systems, biological and agronomic basis of yield advantage under intercropping..

UNIT-III:

Cropping systems: above and below ground interactions and allelopathic effects; competitive relationship and competition functions; cropping patterns; alternate land use and crop diversification in rainfed and irrigated conditions; multi-storied cropping and yield stability in intercropping, role of non- monetary inputs and low cost technologies; categorization of cropping systems for soil health, family nutrition, livestock nutrition and income enhancement; research need on sustainable agriculture.

UNIT-IV:

Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Advanced nutritional tools for big data analysis and interpretation.

UNIT-V:

Plant ideotypes for drylands; plant growth regulators and their role in sustainability.

Unit VI:

Artificial Intelligence- Concept and application.

AGRON 512

Credit hour: 2+1

Course Title: DRYLAND FARMING AND WATERSHED MANAGEMENT

Objective: To teach the basic concepts and practices of dry land farming and soil moisture conservation. **Theory UNIT-I:**

Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.

UNIT-II:

Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability.

UNIT-III:

Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; management and breeding strategies to improve crop productivity under different patterns of drought situation under limited water supplies preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions; abiotic stress management in dry land agriculture

UNIT-IV:

Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); anti-transpirants; soil and crop management techniques, seeding and efficient fertilizer use; good agricultural

practices in dry land; farm pond technology; tools and implements in dry land agriculture.

UNIT-V:

Concept of watershed resource management, problems, approach and components.

Practical

1. Method of Seed Priming

2. Determination of moisture content of germination of important dryland crops
3. Determination of Relative Water Content and Saturation Deficit of Leaf

4. Moisture stress effects and recovery behaviour of important crops

5. Estimation of Potential ET by Thornthwaite method

6. Estimation of Reference ET by Penman Monteith Method

7. Classification of climate by Thornthwaite method (based on moisture

index, humidity index and aridity index)

8. Classification of climate by Koppen Method

9. Estimation of water balance by Thornthwaite method

10. Estimation of water balance by FAO method

11. Assessment of drought

12. Estimation of length of growing period

13. Estimation of probability of rain and crop planning for different drought condition

14. Spray of anti-transpirants and their effect on crops

15. Estimation of water use efficiency

16. Visit to dryland research stations and watershed projects

17. Drought indices in dryland Crops and Cropping pattern in dry land to mitigate drought condition

18. Study of green seeker and leaf colour chart techniques in precision nutrient

AGRON 513

Credit hour: 2+1

Course Title: PRINCIPLES AND PRACTICES OF ORGANIC FARMING

Objective: To study the principles and practices of organic farming for sustainable crop production.**Theory UNIT I:**

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; principles of organic agriculture; organic farming and sustainable agriculture; selection and conversion of land, soil and water management - land use, conservation tillage; shelter zones, hedges, pasture management, agro-forestry.

UNIT II:

Organic farming and water use efficiency; soil fertility, nutrient recycling; organic manures, composting; soil biota and decomposition of organic residues; earthworms and vermicompost; green manures, bio-fertilizers and biogas technology; biodynamic compost, enrichment of organic manures; organic formulations and bio fertigation

UNIT III

Farming systems, selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity; maintenance of soil fertility, concept of IOFS; mixed cropping; cover crops; smoother crops.

UNIT IV

Pest management through biological agents and pheromones; bio-pesticides, Management of weeds; pests and diseases; Botanicals; Trap crops; Insect traps; ITKs, Bio herbicides; use of plant extract in weed management; Allelopathic effect.

UNIT V

Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy; types of certifications; certification agencies; branding and packaging; Farmer Participatory Organization in organic farming.

Practical

1. Compost preparation by method by aerobic and anaerobic methods

2. Methods of vermi composting

3. Identification and nursery raising of important agro-forestry tress and tress for shelter belts

4. Efficient use of biofertilizers, technique of treating legume seeds with Rhizobium cultures, use of Azotobacter, Azospirillum, and PSB cultures in field

5. Visit to a biogas plant

6. Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms

7. Preparation of different organic formulations

8. Preparation of seed album of local/ deshi germplasm

9. Visit to an organic farming research and training centre

10. 

11. Dr. Pranavsingh Patil

12. Assistant Professor of Agronomy
Dr. Sharadchandra Pawar College of Agriculture, Baramati
Affiliated to Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra

13. Academic Background

14. - Doctoral Degree (Ph.D.) in Agronomy from MPKV, Rahuri with First Class and Distinction
15. - Master of science in Agronomy from University of Agricultural sciences, Dharwad.
- Qualified ICAR-ASRB NET (2014 & 2023)
- ICAR JRF Rank 40, ICAR SRF Rank 20, 2nd Rank in MH CET Ph.D. Entrance Exam 2019

16. Awards & Recognition

17. - Recipient of ‘‘Krushi Bhushan Excellence Award’ for Best Contribution in Agricultural Education and Extension by Krushibhushan Mahafpo Start-up Federation, Maharashtra
18. - Academic Gold Medalist with two medals in Agronomy from UAS, Dharwad, Karnataka

19. Professional Experience

20. - Over 14 years of teaching, research, and extension experience in Agronomy and allied sciences
- Guided 4 M.Sc. Agronomy students successfully for their postgraduate research programs
- Published 15 research papers in reputed national and international journals
21. - Conducted several training programs for faculty members on student centered learning, experiential learning, Brain-based learning.
22. - Worked as Marketing Executive in Mangalore Chemicals and Fertilizers for 6 months.

23. Research & Outreach

24. - Research interests include crop production, natural farming, water management, and sustainable agriculture practices
    - Actively participated in several national and international seminars, workshops, training programs, and conferences
25. - Authored 13 popular articles for agricultural magazines and farmer-focused publications
26. - Delivered 6 radio talks on agriculture for farmers
    - Author of a book Farming based livelihood systems
27. - Conducted several farmers training programs on Sugarcane trash management, Sugarcane ratoon management, Organic farming
28. - Conducted training programs for Agri-entrepreneur on Weed management, water management in rainfed area, Agro-met advisory
29. - Conducted training programs for 600 school teachers of Baramati region on global teaching techniques

Prof. Ashwini Karpe

Assistant Professor of Agronomy

Dr. Sharadchandra Pawar College of Agriculture, Baramati

Affiliated to Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra

Academic Background

- Post Graduation (M.Sc.) in Agronomy from Dr. BSKKV, Dapoli with First Class

- Qualified ICAR-ASRB NET (2021)

- ICAR JRF Rank 92

Awards & Recognition

- Awarded ASPEE Fellowship for research work by ASPEE Foundation

Professional Experience

- 14 years of teaching, research, and extension experience in Agronomy and allied sciences

- Guided 2 M.Sc. Agronomy student successfully for their postgraduate research program

- Published 13 research papers and 7 abstracts in reputed national and international journals

- Authored 22 popular articles in agricultural magazines and farmer-focused publications

Research & Outreach

- Actively participated in several national and international seminars, workshops, training programs, and conferences

- Delivered 5 radio talks on agriculture subjects for farmers

Name of Professor: Dr. G. B. Shendage

Department: Agronomy

Qualification: M. Sc. Agri., Ph.D. Agronomy

Dr. Ganesh Balaso Shendage is working as an Asst. Professor of Agronomy in Dr. SPCOA, Baramati affiliated to MPKV, Rahuri, Maharashtra. He has completed post-graduation and Ph. D. in Agronomy department from Dr. BSKKV, Dapoli with first class with distinction. He was awarded 'Young Scientist Award' for Ph.D. Agri. research. He was also awarded 'Research Excellence Award' from Institute of Scholar, Hyderabad. He has experience of 08 years in teaching, research and extension. He has published about 20 research papers in international journals and 08 research papers in national journals, 10 technical papers. He delivered 16 radio talks on agriculture subject for farmers. He has published about 18 popular articles. He has participated in several national and international seminar, training programme, workshop and conference.