

**COURSES RELATED TO AGRONOMY
FOR
UNDER GRADUATE AND POST GRADUATE
DEGREE PROGRAMME**

**B. Sc. (Hons.) Agriculture
B. Sc. (Hons.) Horticulture
B. Tech. in Agricultural Engineering**

M. Sc. (Ag.) in Agronomy

Ph. D. (Ag.) in Agronomy



**Department of Agronomy
Faculty of Agriculture
Bidhan Chandra Krishi Viswavidyalaya
Mohanpur, Nadia, West Bengal**

COURSES RELATED TO AGRONOMY FOR UNDER GRADUATE AND POST GRADUATE DEGREE PROGRAMME

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M. Sc. (Ag.) in Agronomy

Course No.	Course Title	Credit(s)
1st Semester		
AGRON 501*	Modern Concepts in Crop Production	2+1
AGRON 502*	Soil Fertility and Nutrient Management	2+1
AGRON 503*	Principles and Practices of Weed Management	2+1
AGRON 504*	Principles and Practices of Water Management	2+1
2nd Semester		
AGRON 551	Agronomy of <i>Kharif</i> Cereals and Pulse Crops	2+1
AGRON 552	Agronomy of Fibre and <i>Kharif</i> Oilseed Crops	2+1
AGRON 553	Agronomy of Medicinal, Aromatic and Narcotic Crops	2+1
AGRON 554	Agronomy of Fodder and Forage Crops	2+1
AGRON 555	Seed Production of Major Field Crops	2+1
AGRON 556	Cropping System and Sustainable Agriculture	2+1
3rd Semester		
AGRON 601	Agronomy of <i>Rabi</i> Cereals and Pulse Crops	2+1
AGRON 602	Agronomy of Sugar and <i>Rabi</i> Oilseed Crops	2+1
AGRON 603	Agronomy of Tuber and Under-utilized Crops	2+1
AGRON 604	Organic Farming	2+1
AGRON 605	Rainfed Farming and Watershed Management	2+1
AGRON 649	Seminar I (Masters' Seminar)	1+0
4th Semester		
AGRON 651	Agrostology and Agro-forestry	2+1
AGRON 652	Dryland Farming	2+1
AGRON 699	Seminar II (Masters' Research)	1+0

*Core course

AGRON 501: Modern Concepts in Crop Production (2+1)

[1st Semester]

Theory

Unit I: Geo-ecological zones of India; Crop growth analysis in relation to environment;

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

Unit III: Physiology of grain yield in different crops; optimization of plant population and planting geometry in relation to different resources; Effect of lodging in cereals; Concept of ideal plant type and crop modeling for desired crop yield;

Unit IV: Scientific principles of crop production; Crop response production functions; Concept of soil-plant relations; Yield and environmental stress; Crop insurance: concept, scope, methodology and applications;

Unit V: Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; Nutrient needs for yield potentiality of crop plants; Energy requirement in cultivation; Precision and sustainable agriculture.

Practical

Field demonstration of different types of tillage methods; Study on sowing / planting pattern and determination of planting density; Working out growth indices (LAI, CGR, NAR, RGR, LAD, etc.), aggressiveness, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems of different crops; Working important intercultural operations in different crop fields; Use of leaf colour chart, leaf area meter, lux meter, line quantum sensor, etc. in crop fields and interpretation of data; Judging of synchronous, non-synchronous maturity and harvesting of different crops; Estimation of yield and working out harvest index of various crops; Determination of cost of cultivation, net return and B:C ratio of different crops; Calculation of energy requirement in crop production; Making the lists of traditional and modern farm implements / equipments with specifications and uses; Preparation of map for geo-ecological zones of India; Collection of literature on a specific topic of crop production and preparation of Term Paper.

AGRON 502: Soil Fertility and Nutrient Management (2+1)

[1st Semester]

Theory

Unit I: Factors affecting soil fertility and productivity; Features of good soil management; Problems of availability of nutrients; Relation between nutrient supply and crop growth; Organic farming - basic concepts and definitions;

Unit II: Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; Transformation and dynamics of major plant nutrients;

Unit III: Preparation, composition, availability and use of farmyard manure, compost, green manures, vermicompost, bio-fertilizers and other organic concentrates; Nutrient availability from manures and crop residues; Recycling of organic wastes and residue management;

Unit IV: Commercial fertilizers; composition, relative fertilizer value and cost; Crop response to different nutrients, residual effects and fertilizer use efficiency; Fertilizer mixtures and grades; Agronomic, chemical, physiological and biological methods of increasing fertilizer use efficiency, slow release fertilizers; nutrient interactions;

Unit V: Time and methods of manures and fertilizers application; Foliar applications and purposes; Relative performance of organic and inorganic manures; Integrated nutrient management; Site-specific nutrient management; Economics of manure and fertilizer use.

Practical

Determination of soil pH, EC, organic C, total N, available N, P, K and S in soils; Determination of total N, P and K in plants; Interpretation of interaction effects, and computation of economic and yield optima; Calculation on nutrient uptake by crops and nutrient balance in soil; Field demonstration on various methods and combinations in application of fertilizers and manures in crop fields; Isolation of beneficial micro-organisms for fertility-building; Calculation on fertilizer use efficiency, N- use efficiency, etc.

AGRON 503: Principles and Practices of Weed Management (2+1)

[1st Semester]

Theory

Unit I: Weed biology and ecology, crop-weed competition including allelopathy; Principles and methods of weed control; Weed indices;

Unit II: Herbicides: introduction and history of development; Classification based on chemical, Physiological application and selectivity; Mode and mechanism of action of herbicides;

Unit III: Herbicides: classification, structure, activity and factors affecting efficiency, formulations, mixtures; Degradation and persistence of herbicides in soil and plants; Herbicide resistance in weeds and crops; Herbicide rotation; Weed control through bio-herbicides, myco-herbicides and allelo-chemicals;

Unit III: Weed management in major crops and cropping systems; parasitic weeds; weed flora shifts in cropping systems; aquatic and perennial weed control;

Unit IV: Integrated weed management; Benefit: cost analysis of weed management.

Practical

Identification of important weeds including invasive ones in different crops fields; Weed survey in crop field and cropping systems in the region; Preparation of a weed herbarium; Study on crop-weed competition; Weed count study in different crop fields; Calculation on weed density and weed control efficiency; Calculation of herbicidal requirement; Use of various types of spray pumps and nozzles and calculation of swath width; Preparation of spray solutions of herbicides for high and low-volume sprayers and application in fields; Economics of weed control; Herbicide resistance analysis in plant and soil; Bioassay of herbicide resistance; Making a list of weed management related equipments including specifications and uses; Visit to nearby villages for understanding various methods of weed management.

AGRON 504: Principles and Practices of Water Management (2+1)

[1st Semester]

Theory

Unit I: Water and its role in plants; Water resources of India; Major irrigation projects; Extent of area and crops irrigated in India and different states;

Unit II: Soil 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 conditions;

Unit III: Soil, plant and meteorological factors determining water needs of crops; Scheduling, depth and methods of irrigation; Micro-irrigation system; Fertigation; Management of water in controlled environments and poly-houses;

Unit IV: Water management of the crops and cropping systems; Quality of irrigation water and management of saline water for irrigation; Water use efficiency;

Unit V: Excess of soil water and plant growth; Water management in problem soils; Drainage requirement of crops and methods of field drainage, their layout and spacing.

Practical

Determination of soil moisture and study on soil-moisture characteristics curves; Measurement of soil water potential by using tensiometer, pressure plate and membrane apparatus; Determination of irrigation requirements for different crops; Water flow measurements using different devices (V- notch, parshall flume, etc.); Calculation of irrigation efficiency and economics of water management; Determination of infiltration rate and hydraulic conductivity; Field study on micro-irrigation methods (drip, sprinkler, etc.); Field study on different drainage systems; Determination of water balance in soil for different crops and seasons; Analysis of pH, EC, SAR and other parameters of irrigation water; Making a list of equipments/devices related to irrigation; Visit to Central Library for books, journals, e-books etc. related to water management Visit to field experiments for crop-water relationships in farm/research station; Visit to nearby villages for understanding various types of irrigation methods in different crops.

AGRON 551: Agronomy of *Kharif* Cereals and Pulse Crops (2+1)

[2nd Semester]

Theory

Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:

Unit I: *Kharif* cereals: Rice, Maize, Sorghum, Pearl Millet and Minor millets

Unit II: *Kharif* pulses: Mungbean, Urdbean, Pigeonpea and Cowpea

Practical

Sowing/ transplanting and important intercultural operations in different crops; Study on morphological characteristics and phenophases of different crops; Working out growth indices at different stages and nutrient use efficiency; Judging of synchronous and non-synchronous maturity in different crops; Estimation of crop yield and working out of harvest index; Determination of cost of cultivation, net return and B:C ratio of different crops; Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities; Determination of quality characteristics of rice; Estimation of protein content in pulses; Making an abstract based on research findings of a specific crop; Visit of field experiments for varietal differences and agronomic management practices of different crops in farm and research station; Visit to Paddy Processing Centre/ Rice Mill and preparation of flow-chart for milling of paddy; Visit to nearby villages for cultivation aspects and identification of constraints in crop production.

AGRON 552: Agronomy of Fibre and *Kharif* Oilseed crops (2+1)

[2nd Semester]

Theory

Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:

Unit I: *Kharif* oilseeds: Groundnut, Sesame, Soybean, Castor, etc.

Unit II: Fibre crops: Jute, Cotton, Mesta, Sunhemp, Ramie, Sisal, Flax, etc.

Practical

Sowing and agronomic management of different crops in field; Morphological and phenological studies at various growth stages of crop; Working out growth indices of different crops; Judging of physiological

maturity and estimation of duration of different crops and varieties; Estimation of yield (groundnut, jute, cotton, etc.) and working out harvest index; Harvesting, retting and extraction of jute fibre including modern methods; Grading of quality of jute fibre; Formulation of cropping schemes for various farm sizes and calculation on cropping and rotational intensities; Determination of economics of cultivation of different crops; Determination of oil content in oilseeds and computation of oil yield; Visit of field experiments on cultural, fertilizer, weed control and water management aspects; Visit to nearby villages for identification of constraints in production of fibre and *khariif* oilseeds and preparation of suggestive measures.

AGRON 553: Agronomy of Medicinal, Aromatic and Narcotic Crops (2+1) [2nd Semester]

Theory

Unit I: Importance of medicinal and aromatic plants in national economy and related industries; Classification of medicinal and aromatic plants according to botanical characteristics and uses; Types of narcotic crops and their effects on human health;

Unit II: Climate and soil requirements, cultural practices, yield and important constituents of medicinal plants: Isabgol, Rauwolfia, Poppy, *Aloe vera*, Satavar, Stevia, Safed Musli, Kalmegh, Asaphoetida, *Nux vomica*, Rosadle, etc.;

Unit III: Climate and soil requirements, cultural practices, yield and important constituents of aromatic plants: Citronella, Palmarosa, Mentha, Basil, Lemongrass, Rose, Patchouli, Geranium, etc.;

Unit IV: Climate and soil requirements, cultural practices, yield and important constituents of Narcotic crops: Tobacco, Arecanut, Betelvine, Poppy, *Cannabis*, etc.

Practical

Identification of crops based on morphological and seed characteristics; Preparation of herbarium of medicinal, aromatic and narcotic crops; Sowing and cultural practices in medicinal, aromatic and narcotic crops Estimation on yield of economic produce of different crops; Curing of tobacco including a flow-chart; Analysis of essential oil and other important chemicals in medicinal and aromatic plants; Making a list of products made from medicinal and aromatic plants and their uses; Preparation on a Term Paper on a specific crop; Field visit to experimental plots of medicinal, aromatic and narcotic crops in farm/ research station; Visit to nearby villages to understand cultivation aspects, market-linkage, etc.

AGRON 554: Agronomy of Fodder and Forage Crops (2+1) [2nd Semester]

Theory

Unit I: Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops: Maize, Sorghum, Bajra, Guar, Cowpea, Oats, Barley, Berseem, Ricebean, Lucern, etc.;

Unit II: Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses: Stylo, Guineagrass, Paragrass, Setaria, Humidicola, Napier × Bajra-hybrid, *Panicum*, *Lasiurus*, *Cenchrus*, etc.;

Unit III: Year-round fodder production and management, preservation and utilization of forage and pasture crops; Economics of forage cultivation uses and seed production techniques;

Unit IV: Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder.

Practical

Sowing and agronomic management of fodder and forage crops in field; Study on growth, development and canopy measurement of different fodder and forage crops; Harvesting of green foliage through single and multi-cuts; Estimation of green forage yield and economics of cultivation; Estimation of quality parameters (crude protein, NDF, ADF, lignin, silica, cellulose, etc.) in green and dry forage, Making of hay and silage and economics of their preparation; Preparation of plan for inclusion of fodder or forage crop in crop sequence under different agro-ecological conditions; Visit of field experiments on fodder and forage crops in farm/ research station ; Visit to nearby village for identification of constraints in production of fodder and forage crops and preparation of suggestive measures.

AGRON 555: Seed Production of Major Field Crops (2+1)

[2nd Semester]

Theory

Unit I: Classes of seed; Seed Act regulations; Seed certification and testing;

Unit II: Seed production and processing of principal crops: Cereals (Rice, Hybrid rice, Wheat, Maize, Hybrid maize), Pulses (Chickpea, Lentil, Greengram, Blackgram, Lathyrus), Oilseeds (Mustard and Rapeseed, Groundnut, Sunflower, Sesame), Tuber crops (Potato), Fibre crops (Jute), Fodder crops (Ricebean, Cowpea).

Practical

Selection of land and study on specific cultivation practices (isolation distance, seed treatment, sowing / planting pattern, rouging, harvesting, etc.) in seed production plots; Varietal identification at different growth stages in seed production fields; Study on parental lines in hybrid seed production; Methodology of seed testing for physical purity, moisture content, viability, germination, vigour index, etc.; Calculation on seed production methods, economics and testing procedures; Visit to seed production plots of hybrid rice, greengram, rapeseed-mustard groundnut, sesame, jute, etc.; Understanding of seed certification process; Visit to Seed Processing Plant for post-harvest processing and storage; Visit to Seed Testing Laboratory and making a report.

AGRON 556: Cropping System and Sustainable Agriculture (2+1)

[2nd Semester]

Theory

Unit I: Cropping systems: definition, types, indices and importance; Physical resources and their effective utilization, agronomic management in cropping systems; Assessment of land use; Cropping schemes;

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, intercropping and multi-storied cropping; Effect of weather aberrations on cropping programme; Mechanism of yield advantage in intercropping systems; Above and below ground interactions and allelopathic effects; Competition relations;

Unit III: Crop diversification for sustainability; Plant ideotypes for drylands; Role of organic matter in maintenance of soil fertility; Crop residue management; Fertilizer use efficiency and concept of fertilizer use in intensive cropping system; Plant growth regulators and their role in sustainability;

Unit IV: Study on various types of crop sequences under different land situations in agro-climatic zones of West Bengal; Role of non-monetary inputs and low cost technologies; Difference between modern and sustainable agriculture; Goal, advantages and limitations of sustainable agriculture; Research need for sustainable agriculture.

Practical

Sowing and agronomic management of crops under mixed, intercropping and relay systems; Assessment of yield advantages under different cropping systems; Calculation on sustainability/ stability index (relative production efficiency, system water use efficiency, land use efficiency, mandays generation, energy use efficiency, etc.); Evaluation on crop sequences under both irrigated and rainfed conditions; Relay crop production under various cropping systems; Study on scope of multiple cropping under monocropped rainfed situation; Preparation of suitable crop sequences for different agro-climatic zones of West Bengal; Visit of field experiments on mixed, inter, relay and multi-tier cropping in farm/ research station; Visit to nearby village to study on different cropping systems and making a report.

AGRON 601: Agronomy of *Rabi* Cereals and Pulse Crops (2+1)

[3rd Semester]

Theory

Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:

Unit I: *Rabi* cereals: Wheat and Barley

Unit II: *Rabi* pulses: Chickpea, Lentil, Peas, Lathyrus and Rajmah

Practical

Sowing and important intercultural operations of different *rabi* cereals and pulse crops; Morphological and phenological studies of different crops in field; Seed inoculation with *Rhizobium* culture; Working out growth indices and nodulation at different stages; Judging of synchronous and non-synchronous maturity and harvesting of crops; Estimation of crop yield and working out harvest index of various crops; Estimation of protein content in pulses; Determination of economics of cultivation of different crops; Formulation of cropping schemes for different agro-climatic zones of West Bengal; Preparation of Term Paper on specific aspect of *rabi* cereals and pulse crops; Visit of field experiments for varietal differences and agronomic management practices in farm / research station; Visit to Dal Mill and preparation of flow-chart for processing of pulses; Visit to nearby villages for cultivation aspects and identification of constraints in crop production.

AGRON 602: Agronomy of Sugar and *Rabi* Oilseed Crops (2+1)

[3rd Semester]

Theory

Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:

Unit I: *Rabi* oilseeds: Rapeseed and Mustard, Sunflower, Safflower, Linseed, Niger, etc.

Unit II: Sugar crops: Sugarcane and Sugar beet

Practical

Sowing and important intercultural operations (thinning, weeding, wrapping and propping, supplementary pollination, etc.) in sugar and *rabi* oilseeds crops; Morphological and phenological studies at different crop growth stages; Working out growth indices of different crops; Judging of physiological maturity in different crops and cane maturity in sugarcane; Estimation of crop yield and working out harvest index of various crops; Calculation on economics of cultivation of different crops; Formulation of cropping schemes and calculation of cropping and rotational intensities; Determination of oil content in oilseeds and computation of oil yield; Determination of sugar content in cane juice; Visit of field experiments on

cultivation aspects of crops in farm and research stations; Visit to Oil Mill and preparation of a flow-chart on oil extraction process; Visit to nearby villages for cultivation methods, post-harvest processing and identification of constraints in crop production.

AGRON 603: Agronomy of Tuber and Under-utilized Crops (2+1)

[3rd Semester]

Theory

Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:

Unit I: Tuber crops: Potato, Sweet potato, Yams, Yambean, Cassava, etc.

Unit II: Underutilized crops: Colocasia, Water chestnut, Makhana, Amorphophallus, etc.

Practical

Calculation of seed rate/ planting materials of tubers and underutilized crops; Sowing and agronomic management of crops in fields; Morphological and phenological studies of different tubers and underutilized crops; Working out growth parameters at different stages; Harvesting and estimation of yield of different tubers and underutilized crops; Grading of potato tubers; Assessment of quality parameters of various tuber and under-utilized crops; Calculation on economics of cultivation of different crops; Formulation of crop sequences including tubers and underutilized crops in different situations; Visit to field experimental plots and wetlands in farm and research stations; Visit to nearby villages/ areas to study the cultivation methods of different crops including wetland crops; Visit to cold storage to understand the principles and methodology of long-term storage.

AGRON 604: Organic Farming (2+1)

[3rd Semester]

Theory

Unit I: Organic farming: concept and definition, its relevance to India and global agriculture and future prospects;

Unit II: Choice of crop and varieties, suitable crop sequences and rotations; Farm enterprises and their relationships; Ecological aspects and economics of organic farming;

Unit III: Soil fertility, nutrient recycling, soil biota and decomposition of organic residues, organic manures, composting, earthworms and vermicompost, green manures and biofertilizers; Permissible nutrient management inputs under NPOP;

Unit IV: Physical, cultural, mechanical and biological methods of weed and insect-disease management; Potential bio-pesticides, botanical pesticides, bio-herbicides, etc.; Permissible pest management inputs under NPOP; Water management in organic farming system;

Unit V: Organic certification standards: National and International; Accreditation and certification procedures under NPOP; Inspection, certification and labelling with organic logo; PGS: cluster formation, certification procedures and logos; Organic farming and national economy; Socio-economic impacts.

Practical

Making of compost by aerobic and anaerobic methods; Making of vermicompost, uses in agriculture and economics of production; Preparation of liquid manures and their application in fields; Efficient use of bio-fertilizers (*Azotobacter*, *Azospirillum*, *Azolla* and PSB) in cereals and pulse crops; Growing and incorporation of green manures *in-situ* and use of green leaf manures in fields; Preparation of botanical pesticides and their applications in fields; Making a list of permissible organic inputs under NPOP; Preparation of stale seedbed for management of weeds; Soil solarization for pest management; Preparation

of diagrammatic sketch of organic farm including production potential of enterprises and use of resources and wastes; Visit to a certified organic farm to understand production, inspection, certification, labelling, accreditation procedures and quality standards of farm produces; Making a list of organic standard logos used in the world.

AGRON 605: Rainfed Farming and Watershed Management (2+1)

[3rd Semester]

Theory

Unit I: Rainfed area: Global and Indian scenario; Classification of rainfed ecology of India; Problems and prospects of rainfed farming in India; Socio-economic scenario of rain-fed areas;

Unit II: Soil properties of rainfed areas and land use pattern; Climate characteristics relevant to rainfall pattern and potential evapo-transpiration; Rainwater harvesting: methods, structures, and management;

Unit III: Cropping pattern in rainfed areas; Soil and nutrient management in rainfed farming; agronomic management of crops for improving water use efficiency; Contingent crop planning for aberrant weather conditions;

Unit IV: Watershed management: concept, objectives, principles and components; Selection criteria and procedure for watershed; Factors affecting watershed management; Development of cropping systems in watershed areas; Case studies of some important watersheds and their management in different agro-climatic regions.

Practical

Study on rainfall analysis in rainfed areas; Study on cropping pattern of different rainfed areas in the state and country; Calculation on supplemental irrigation based on evapo-transpiration data; Field study on mulching, planting density, depth of sowing, nutrient management for mitigating moisture stress; Study on characterization and delineation of watershed models; Field demonstration of soil and moisture conservation techniques; Study on rain-water harvesting, structures and conservation; Visit to field experiments relating to rainfed farming technology in research station; Benefit / impact analysis of watershed development activities; Visit to watershed project areas in the district / region / state.

AGRON 649: Seminar I (Masters' Seminar) (1+0)

[3rd Semester]

AGRON 651: Agrostology and Agro-forestry (2+1)

[4th Semester]

Theory

Unit I: Agrostology: definition and importance; Grassland ecology: principle, community, climax, dominant species, succession, biotypes; Ecological status of grasslands and grass cover in India; Problems and management of grasslands;

Unit II: Pasture: importance, classification, scope, status and research needs; Pasture establishment, their improvement and renovation; Natural pastures, cultivated pastures and common pasture grasses; Grazing management;

Unit III: Agroforestry: definition and importance; agroforestry systems, agri-silviculture, silvipasture, agrisilvipasture, agri-horticulture, aqua-silviculture, alley-cropping and energy plantation;

Unit IV: Crop production technology in agro-forestry, silvi-pastoral and agrostology system; Meaning and importance for wasteland development; Selection of species, planting methods, problems of seed germination, manuring and irrigation in agro-forestry systems; Associative influence in relation to aboveground and underground interferences; Lopping and coppicing in agro-forestry systems; Social acceptability and economic viability, Nutritive value of trees; Tender operation; Desirable tree characteristics.

Practical

Preparation of charts and maps of India showing different types of agro-forestry systems and pastures; Identification of seeds and plants of common grasses, legumes and trees of economic importance with reference to agro-forestry; Seed treatment for better germination of farm vegetation; Methods of propagation/planting of grasses and trees in silvi-pastoral system; Fertilizer application in strip and silvi-pastoral systems; After-care of plantation in agroforestry system; Estimation of total biomass and fuel wood; Estimation of protein content in loppings of important fodder trees; Estimation of calorie value of wood of important fuel trees; Economics of agro-forestry systems; Calculation on number and size of paddock; Preparation of a Term Paper on status and research on agro-forestry in a particular state / region; Visit to important agro-forestry systems in farm/ research stations.

AGRON 652: Dryland Farming (2+1)

[4th Semester]

Theory

Unit I: Definition, concept and characteristics of dryland farming; Dryland versus rainfed farming; Significance and dimensions of dryland farming in Indian agriculture; Recent advances in dryland agriculture;

Unit II: Soil and climatic parameters with special emphasis on rainfall characteristics; Constraints limiting crop production in dryland areas; Aridity and drought; Drought: types, causes and indices;

Unit III: Stress physiology and resistance to drought, adaptation of crop plants to drought; Crop planning for dryland areas; Contingent plan for short, mid and terminal droughts; Alternate land use systems;

Unit IV: Tillage, tillage, frequency and depth of cultivation, compaction in soil tillage; Concept of conservation tillage with relation to weed control and moisture conservation; Nutrient management strategies in dryland areas and efficient fertilizer use; Techniques of soil moisture conservation and methods of economic use of water; Mulches: kinds, effectiveness, uses and economics; Anti-transpirants; types, methods of application and effectiveness.

Practical

Field study on seed treatment, germination and crop establishment in dryland situations; Study on moisture stress effects and recovery behaviour of important crops; Spray of anti-transpirants and their effects on crops; Estimation of moisture index and aridity index; Collection and interpretation of data for seasonal ET losses; Calculation on irrigation scheduling and water balance equations; Calculation on water use efficiency and economics of water use; Preparation of a map showing dryland areas in India; Formulation of cropping schemes in different dryland situations; Preparation of contingent crop plans for various drought conditions; Visit to field experiments on dryland farming in farm/ research station; Visit to dryland research stations.

AGRON 699: Seminar II (Masters' Research) (1+0)

[4th Semester]