

AGRIL. AGRONOMY

(Subject Code-95)

Unit 1: Crop Ecology and Geography

Principles and concept of crop ecology; Ecosystem concept and determinants of productivity of ecosystem; Physiological limits of crop yield and variability in relation to ecological optima; Crop adaptation; Climate shift and its ecological implication; Greenhouse effect; Agro-ecological and agro climatic regions of India; Geographical distribution of cereals, legumes, oilseeds, vegetables, fodders and forages, commercial crops, condiments and spices, medicinal and aromatic plants; Adverse climatic factors and crop productivity; Photosynthesis, respiration, net assimilation, solar energy conversion efficiency and relative water content, light intensity, water and CO₂ in relation to photosynthetic rates and efficiency; Physiological stress in crops; Remote sensing: Spectral indices and their application in agriculture, crop water stress indices and crop stress detection. Agro-biology, precision agriculture.

Unit 2: Weed Management

Scope and principles of weed management; Weeds' classification, biology, ecology and allelopathy; Crop weed competition, weed threshold; Herbicides classification, formulations, mode of action, selectivity and resistance; Persistence of herbicides in soils and plants; Application methods and equipment; principle and methods of weed control, Biological weed control, bioherbicides: Integrated weed management; Special weeds, parasitic, perennial and aquatic weeds and their management in cropped and non cropped lands; weed control schedules in field crops, vegetables and plantation crops; Role of GM crops in weed management.

Unit 3: Soil Fertility and Fertilizer Use

History of soil fertility and fertilizer use; Concept of essentiality of plant nutrients, their function, nutrient deficiency symptoms, their critical concentrations in plants, nutrient interactions, relation between nutrient supply and crop growth diagnostic techniques with special emphasis on emerging deficiencies of secondary and micro-nutrients; Soil fertility and productivity and their indicators; Fertilizer materials including liquid fertilizers, their composition, mineralization, availability and reaction products in soils; Water solubility of phosphate fertilizers; Slow release fertilizers, nitrification inhibitors and their use for crop production; Principles and methods of fertilizer application; Integrated nutrient management and bio-fertilizers; Agronomic and physiological efficiency and recovery of applied plant nutrients; Criteria for determining fertilizer schedules for cropping systems direct, residual and cumulative effects; Fertilizer related environmental problems including ground water pollution; Site-specific nutrient management; Contamination of heavy metals in peri-urban soils and their remediation.

Unit 4: Dryland Agronomy

Concept of dryland farming; dryland farming vs rainfed farming; History, development, significance and constraints of dryland agriculture in India; Climatic classification and delineation of dryland tracts; Characterization of agro-climatic environments of drylands; Rainfall analysis and length of growing season; Types of drought, drought syndrome, effect on plant growth, drought resistance, drought avoidance, drought management; Crop Planning including contingency, crop diversification, varieties, cropping systems, conservation cropping and mid-season

corrections for aberrant weather conditions; Techniques of moisture conservation, Type of mulching in-situ to reduce evapo-transpiration, runoff and to increase infiltration; Rain water harvesting and recycling concept, techniques and practices; Timelines and precision key factors for timely sowing, precision in seeding, weed control; Fertilizer placement, top dressing and foliar application, aqua-fertigation; Concept and importance of watershed management in dryland areas.

Unit 5: Management of problematic soils and water problem soils

Problem soils and their distribution in India, acid, saline, waterlogged and mined-soils; Response of crop to acidity, salinity, sodicity, excess water and nutrient imbalances; Reclamation of problem soils, role of amendments and drainage; Crop production techniques in problem soils - crops, varieties, cropping system and agronomic practices; Effects of water table fluctuation on crop growth; Degraded lands and their rehabilitation. Crop and resource management options in rainfed stress prone rice ecosystems, Water quality criteria and use of brackish waters in agriculture; Hydrological imbalances and their corrective measures; Concept of critical water table depths for crop growth; Crop production and alternate use of problematic soils and poor quality water for agricultural and fish production; Amelioration of salt affected soils.

Unit 6: Crop Production

Crop production techniques for cereals, millets, legumes, oilseeds, fiber crops, sugarcane, tobacco, fodder and pasture crops including origin, history, distribution, adaptation, climate, soil, season, modern varieties, fertilizer requirements, intercultural operations, water requirement. weed control, quality components, industrial use, economics and post harvest technology.

Unit 7: Agricultural Statistics

Frequency distribution, standard error and deviation, correlation and regression analyses, co-efficient of variation; Tests of significance-t, F and chi-square (X²); Data transformation and missing plot techniques; Design of experiments and their basic principles, completely randomized, randomized block, split plot, strip-plot, factorial and simple confounding designs; Efficiency of designs; Methods of statistical analysis for cropping systems including intercropping; Pooled analysis.

Unit 8: Sustainable Land Use Systems

Concept of sustainability; Sustainability parameters and indicators; Plant geometry Concept, options and significance of conservation agriculture in context to present agriculture; principles and significance of organic farming in India, Options and component of organic farming, Alternate land use systems; Types, extent and causes of wasteland; Shifting cultivation; Agro forestry systems; Agricultural and agro-industrial residues and its recycling, safe disposal; Allelopathy and biomass production.

Unit 9: Basics of Soil & Water and its Relationship

Soil and water as vital resources for agricultural production; Occurrence of groundwater, groundwater aquifers, exploration of groundwater; Soil-plant water relationship; Fate of rain water received at the soil surface, runoff and infiltration reciprocity, factors affecting infiltration, means to enhance infiltrability of soil, mechanical and biological means to reduce runoff and soil loss; Water harvesting for crop life saving irrigations; watershed management; Soil and water conservation; Analysis of hydrologic data and their use. Soil water relations, available soil moisture, factors affecting available soil moisture, flow of water in to the soil, infiltration, permability, percolation, seepage, capillary movement,

water retention by soil, soil moisture characteristics, field capacity, permanent wilting point, plant available water and extractable water; Soil irrigability, classifications, factors affecting profile water storage; Determination of soil water content, computation of soil water depletion, soil water potential and its components, hydraulic head; Movement of soil water saturated and unsaturated water flow; Field water budget, water gains and water losses from soil, deep percolation beyond root zone, capillary rise; Evapotranspiration (ET), scope for economizing water, measures for reducing direct evaporation from soil and crop canopies; Soil physical properties in relation to plant growth and development; Erodability of soils and their prevention.

Unit 10: Plant Water Relationship & Irrigation Management

Plant water relations: Concept of plant water potential, plant water conservation measures, plant water stress indicator, cell water relations, plant water potential and its components; Significance of osmotic adjustment, leaf diffusive resistance, Water movement through soil - plant atmosphere systems, Water use efficiency and water productivity, uptake and transport of water by roots; Development of crop water deficit, crop adaptation to water deficit, morpho physiological effect of water deficit; Drought tolerance, mechanisms of drought tolerance, potential drought tolerance traits and their measurements. Management and breeding strategies to improve crop productivity under different patterns of drought situations of limited water supplies; Effect of excess water on plant growth and production; Types of droughts, drought indices. Management of irrigation water; History of irrigation in India; Major irrigation projects in India; Water resources development; Crop water requirements; Concepts of irrigation scheduling, Different approaches of irrigation scheduling; Soil water depletion plant indices and climatic parameters; Concept of critical stages of crop growth in relation to water supplies; Crop modeling, crop coefficients, Methods of irrigation *viz.* surface methods, sub surface methods, drip irrigation and sprinkler irrigation, merits and demerits of various methods, design and evaluation of irrigation methods; Measurement of irrigation water, application and distribution efficiencies; Management of water resources (rain, canal and ground water) for agricultural production; Agronomic considerations in tile-design and operation of irrigation projects, Irrigation legislation; Water quality, conjunctive use of water, irrigation strategies under different situation of water availability, optimum crop plans and cropping patterns in canal command areas; Irrigation water distribution, Irrigation efficiencies; Interaction between irrigation and fertilizers.