

## 27. SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF TEACHING ASSOCIATE IN AGRONOMY

### Unit 1: Crop Ecology and Agrometeorology–

Principles 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; Agro-ecological and agro- climatic regions of India and Rajasthan; Geographical distribution of cereals, legumes, oilseeds, vegetables, fodders and forages, commercial crops, seed spices, medicinal and aromatic plants; Adverse climatic factors and crop productivity; Photosynthesis, respiration, net assimilation, solarenergyconversion efficiencyand relativewatercontent, light intensity, water and CO<sub>2</sub> in relation to photosynthetic rates and efficiency; Physiological stress incrops; Remote sensing: Spectral indices and their application in agriculture, Atmospheric weather variables; Atmospheric pressure, Wind, types of wind, daily and seasonal variationof wind speed, cyclone, anticyclone, land breeze and sea breeze; solar radiation, short wave, long wave and thermal radiation, net radiation, albedo; Atmospheric temperature, Atmospheric humidity, process of condensation, Precipitation, process and types of precipitation ; Artificial rain. Monsoon-importance in Indian agriculture, Weather hazards - Agriculture and weather relations; Weather forecasting-types and theiruses. Climatechange, global warming. Greenhouse effect.

### 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; fate of herbicides, adjuvants, herbicidal resistance, Application methods and equipment; Biological weed control, bio- herbicides: Integrated weed management; Special weeds, parasitic 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 Nutrient Management–

Soil fertility and productivity - factors affecting, history of soil fertility and fertilizer use; Concept of essentiality of plant nutrients, their critical concentrations in plants, nutrient interactions, diagnostic techniques with special emphasis on emerging deficiencies of secondary and micro-nutrients; 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.

### Unit 4: Dryland Farming and Watershed Management–

Concept of dry land farming; dryland farming vs rainfed farming; History, development, significance and constraints of dryland agriculture in India; Climatic classification and delineation of dry land tracts; Characterization of agro-climatic environments of drylands; Rainfall analysis and length of growing season; Typesof drought, drought syndrome, effect on plant growth, drought resistance, drought avoidance, drought management; Mulches, antitranspirants, Crop Planning including contingency, crop diversification, varieties, cropping systems, conservation cropping and mid-season corrections for aberrant weather conditions; Techniques of moisture conservation in-situ to reduce evapotranspiration, 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: Sustainable Land Use Systems–**

Concept of sustainability; Sustainability parameters and indicators; Conservation agriculture; 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, Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, crop diversification, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages.

#### **Unit 6: Agricultural Statistics –**

Frequency distribution, standard error and deviation, correlation and regression analyses, co-efficient of variation; Tests of significance-t, F and chi-square; Data transformation; 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 7: 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 management, quality components, industrial use, economics and post-harvest technology.

#### **Unit 8: Soil Water Relationship–**

Soil and water as vital resources for agricultural production; Occurrence of groundwater, groundwater aquifers, exploration of groundwater; Hydrological cycle; Soil-plant water relationship; Fate of rain water received at the soil surface, run off and infiltration, factors affecting infiltration, means to enhance infiltrability of soil, mechanical and biological means to reduce runoff and soil loss; Cropping patterns, alternate land use and crop diversification in rainfed areas, Soil water relations, 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, Movement of soil water under saturated and unsaturated waterflow; 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 9: Plant Water Relationship-**

Plant water relations: Concept of plant water potential, cell water relations, plant water potential and its components; Significance of osmotic adjustment, leaf diffusive resistance, canopy temperature, Water movement through soil – plant atmosphere systems, 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 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.

#### **Unit 10: Irrigation Water Management-**

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 modelling, crop coefficients, water production functions; Methods of irrigation viz. surface

methods, overhead methods, drip irrigation and air conditioning 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; 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; Socio-economic aspects of on-farm water management; Irrigation water distribution, Irrigation efficiencies; Interaction between irrigation and fertilizers.

**Unit 11: Management of Problematic Soils and Water-**

Problem soils and their distribution in India and Rajasthan; Salt-affected, acidic, water logged soils; Ground water resources, water quality criteria and use of brackish waters in agriculture; Reclamation of problem soils, role of amendments and drainage; Crop production techniques in problem soils-crops, varieties, cropping system and agronomic practices; Excess salt and salt tolerant crops; Drainage for improving water logged soils for crop production; quality of irrigation water, Crop production and alternate use of problematic soils and poor quality water for agricultural production; Amelioration of salt affected soils.

**Unit 12: Organic Farming-**

Natural farming, Zero budget natural farming- concept, components, principle, Organic farming – concept, definition, relevance and future prospects; principles; organics and farming standards; selection and conversion of land, soil and water management - land use; Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures, bio-fertilizers and Farming systems, Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides. inspection, certification, labelling and accreditation procedures; organic farming and national economy.

**Unit 13: Modern Concepts in Crop Production-**

Crop growth and development, growth curves, Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich equation, Baule unit., physiology of grain yield in cereals; plant population and planting geometry in relation to different resources, ideal plant type. Scientific principles of crop production; soil plant relations; yield and environmental stress, use of growth hormones and regulators for better adaptation in stressed condition. modern concept of till age; determining the nutrient needs for yield potentiality of crop plants, precision agriculture. use of GIS, GPS and remote sensing in modern agriculture.

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