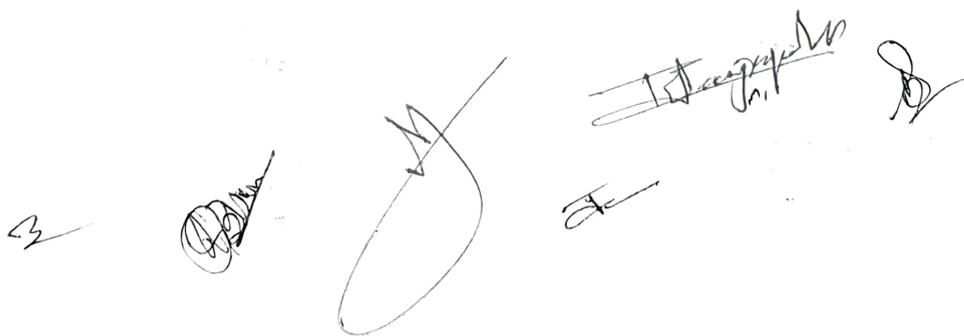


DEPARTMENT OF AGRONOMY
Semesters wise distribution of courses for
M. Sc. Ag. (Agronomy)
Name of the Programme M. Sc. Ag. (Agronomy)

Semester-I			
S. No.	Course Title	Code	Credits
Major Courses			
1.	Modern Concepts in Crop Production	AGRON501	3 (3+0)
2.	Principles and Practices of Soil Fertility and Nutrient Management	AGRON502	3 (2+1)
3.	Dryland Farming	AGRON512	3 (2+1)
Minor Courses			
1.	Principles of Plant Physiology	PP501	4 (3+1)
Supporting Courses			
1.	Statistical Methods for Applied Sciences	STAT511	4 (3+1)
Compulsory Non-Credit Courses			
1.	Library and Information Services	PGS501	1 (0+1)
2.	Technical Writing and Communication Skills	PGS502	1 (0+1)
3.	Intellectual Property and its Management in Agriculture	PGS503	1 (1+0)
4.	Human Values & Professional Ethics	HVE	2(1+1)



PG Course Curriculum

Semester-II			
S. No.	Course Title	Code	Credits
Major Courses			
1.	Principles and Practices of Weed Management	AGRON503	3 (2+1)
2.	Principles and Practices of Water Management	AGRON504	3 (2+1)
3.	Cropping Systems	AGRON511	2 (2+0)
4.	Principles and Practices of Organic Farming	AGRON513	3 (2+1)
Minor Courses			
1.	Soil Biology and Biochemistry	SOILS506	3 (2+1)
2.	Soil, Water and Air Pollution	SOILS509	3 (2+1)
Supporting Courses			
1.	Experimental Designs	STAT512	3 (2+1)
Compulsory Non-Credit Courses			
1.	Basic Concepts in Laboratory Techniques	PGS504	1 (0+1)
2.	Agricultural Research, Research Ethics and Rural Development Programme	PGS505	1 (1+0)
3.	Disaster Management	PGS506	1 (1+0)
Semester-III			
1.	Written Comprehensive Examination (for Major & Minor Courses)	-	-
2.	Seminar	AGRON591	1 (0+1)
3.	Master's Research	AGRON599	10 (0+10)
Semester-IV			
1.	Master's Research	AGRON599	10 (0+10)

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AGR0501 Modern Concepts in Crop Production (3+0)**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 ideotypes plant and crop modelling for desired crop yield.
- UNIT IV** Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and 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.

Suggested Readings

- Balasubramaniyan P. & Palaniappan S.P. 2001. Principles and Practices of Agronomy. Agrobios.
- Fageria N.K. 1992. Maximizing Crop Yields. Marcel Dekker.
- Havlin J.L., Beaton J.D., Tisdale S.L. & Nelson W.L. 2006. Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.
- Paroda R.S. 2003. Sustaining our Food Security. Konark Publ.
- Reddy S.R. 2000. Principles of Crop Production. Kalyani Publ.
- Sankaran S. & Mudaliar T.V.S. 1997. Principles of Agronomy. The Bangalore Printing & Publ.
- Singh S.S. 2006. Principles and Practices of Agronomy. Kalyani.

3

AGR0502 Principles and Practices of Soil Fertility and Nutrient Management (2+1)

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

UNIT 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; 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 and use of farmyard manure, compost, green manures, vermicompost, bio fertilizers and other organic concentrates their composition, availability and crop responses; 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 and physiological methods of increasing fertilizer use efficiency; nutrient interactions.

UNIT V

Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermicompost and residue wastes in crops.

Practical

1. Determination of soil pH, EC, organic C, total N, available N, P, K and S in soils
2. Determination of total N, P, K and S in plants
3. Interpretation of interaction effects and computation of economic and yield optima

Suggested Readings

- Brady N.C. & Weil R.R. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.
- Havlin J.L., Beaton J.D., Tisdale S.L. & Nelson W.L. 2006. Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.
- Prasad R. & Power J.F. 1997. Soil Fertility Management for Sustainable Agriculture. CRC Press.
- Yawalkar K.S., Agrawal J.P. & Bokde S. 2000. Manures and Fertilizers. Agri-Horti Publ.

2

AGRON503 Principles and Practices of Weed Management (2+1)

Objective

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

Theory

UNIT I Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices.

UNIT II Herbicides 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; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allelopathic chemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation.

UNIT IV Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control.

UNIT V Integrated weed management; cost benefit analysis of weed management.

Practical

1. Identification of important weeds of different crops
2. Preparation of weeds herbarium
3. Weed survey in crops and cropping systems
4. Crop-weed competition studies
5. Preparation of spray solutions of herbicides for high and low-volume sprayers
6. Use of various types of spray pumps and nozzles and calculation of swath width
7. Economics of weed control
8. Herbicide resistance analysis in plant and soil
9. Bioassay of herbicide resistance
10. Calculation of herbicidal requirement

Suggested Readings

- Aldrich R.J. & Kramer R.J. 1997. Principles in Weed Management. Panima Publ.
- Ashton F.M. & Crafts A.S. 1981. Mode of Action of Herbicides. 2nd Ed. Wiley Inter Science.
- Gupta O.P. 2007. Weed Management – Principles and Practices. Agrobios.
- Mandal R.C. 1990. Weed, Weedicides and Weed Control - Principles and Practices. Agro-Botanical Publ.

PG Course Curriculum

- Rao V.S. 2000. Principles of Weed Science. Oxford & IBH.
- Subramanian S., Ali A.M.& Kumar R.J. 1997. All about Weed Control. Kalyani.
- Zimdahl R.L. 1999. Fundamentals of Weed Science. 2nd Ed. Academic Press.
- Kewat M.L. and Sharma R.S. (2007). A Practical Manual for Weed Control, College of Agriculture, JNVV, Jabalpur publication

AGRON504 Principles and Practices of Water Management (2+1)

Objective

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

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 condition.

UNIT III Soil, plant and meteorological factors determining water needs of crops; scheduling, depth and methods of irrigation; microirrigation system; fertigation; management of water in controlled environments and polyhouses.

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

1. Measurement of soil water potential by using tensiometer, and pressure plate and membrane apparatus.
2. Soil-moisture characteristics curve.
3. Water flow measurements using different devices.
4. Determination of irrigation requirements.
5. Calculation of irrigation efficiencies.
6. Determination of infiltration characteristics of soil.
7. Determination of saturated/unsaturated hydraulic conductivity.

Suggested Readings

- Lenka D. 1999. Irrigation and Drainage. Kalyani
- Michael A.M. 1978. Irrigation Theory and Practice. Vikas Publ.
- Paliwal K.V. 1972. Irrigation with Saline Water. IARI Monograph, New Delhi.
- Panda S.C. 2003. Principles and Practices of Water Management. Agro bios.
- Parihar S.S. & Sandhu B.S. 1987. Irrigation of Food Crops - Principles and Practices. ICAR.
- Reddy S.R. 2000. Principles of Crop Production. Kalyani.
- Singh Pratap & Maliwal P.L. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ.

AGR0N511 Cropping Systems (2+0)

Objective

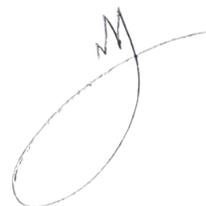
To acquaint the students about prevailing cropping system in the country and practices to improve their productivity

Theory

- UNIT I** Cropping systems definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use.
- UNIT II** Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture, double cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems.
- UNIT III** Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; 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.
- UNIT V** Plant ideotypes for dry lands; plant growth regulators and their role in sustainability.

Suggested Readings

- Palaniappan S.P. & Sivaraman K. 1996. Cropping Systems in the Tropics; Principles and Management. New Age.
- Panda S.C. 2003. Cropping and Farming Systems. Agrobios.
- Reddy S.R. 2000. Principles of Crop Production. Kalyani.
- Raghu J.S., Pahalwan D.K., Sharma T.R. and Anay Rawat 2008 Technologies for productivity improvement.
- Sankaran S. & Mudaliar T.V.S. 1997. Principles of Agronomy. The Bangalore Printing & Publ. Co.
- Singh S.S. 2006. Principles and Practices of Agronomy. Kalyani.
- Tisdale S.L., Nelson W.L., Beaton J.D. & Havlin J.L. 1997. Soil Fertility and Fertilizers. Prentice Hall.



AGR0N512 Dryland Farming (2+1)

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; crop planning for erratic and aberrant weather conditions.
- UNIT III** Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions.
- UNIT IV** Tillage, tillth, 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.
- UNIT V** Concept of watershed resource management, problems, approach and components.

Practical

1. Seed treatment, seed germination and crop establishment in relation to soil moisture contents
2. Moisture stress effects and recovery behaviour of important crops
3. Estimation of moisture index and aridity index
4. Spray of anti-transpirants and their effect on crops
5. Collection and interpretation of data for water balance equations
6. Water use efficiency
7. Preparation of crop plans for different drought conditions
8. Study of field experiments relevant to dryland farming
9. Visit to dryland research stations and watershed projects

Suggested Readings

- Das N.R. 2007. Tillage and Crop Production. Scientific Publishers.
- Dhopte A.M. 2002. Agro technology for Dryland Farming. Scientific Publ.
- Dhruv Narayan V.V. 2002. Soil and Water Conservation Research in India. ICAR.
- Gupta U.S. (Ed.). 1995. Production and Improvements of Crops for Drylands. Oxford & IBH.
- Katyal J.C. & Farrington J. 1995. Research for Rainfed Farming. CRIDA.



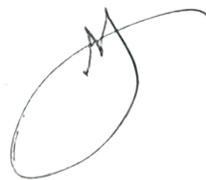
PG Course Curriculum

- Rao S.C.& Ryan J. 2007. Challenges and Strategies of Dryland Agriculture. Scientific Publishers.
- Singh P. & Maliwal P.L. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publishing Company.
- Singh R.P. 1988. Improved Agronomic Practices for Dry land Crops. CRIDA.
- Singh R.P. 2005. Sustainable Development of Dry land Agriculture in India. Scientific Publ.
- Singh S.D. 1998. Arid Land Irrigation and Ecological Management. Scientific Publishers.
- Venkateswarlu J. 2004. Rainfed Agriculture in India. Research and Development Scenario. ICAR.















AGR0N513 Principles and Practices of Organic Farming (2+1)

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; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro-forestry.
- UNIT II** 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 and bio-fertilizers.
- UNIT III** Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.
- UNIT IV** Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides.
- UNIT V** Socio-economic impacts; marketing and export potential inspection, certification, labelling and accreditation procedures; organic farming and national economy.

Practical

1. Aerobic and anaerobic methods of making compost
2. Making of vermicompost
3. Identification and nursery raising of important agro-forestry trees and tress for shelter belts
4. Efficient use of bio-fertilizers, technique of treating legume seeds with Rhizobium cultures, use of Azotobacter, Azospirillum, and PSB cultures in field.
5. Visit to an organic farm
6. Quality standards, inspection, certification and labelling and accreditation procedures for farm produce from organic farms

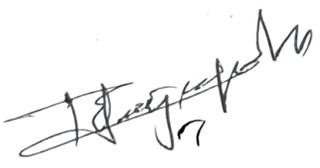
Suggested Readings

- Ananthakrishnan T.N. (Ed.). 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH.
- Gaur A.C. 1982. A Manual of Rural Composting, FAO/UNDP Regional Project Document, FAO.
- Lampin N. 1990. Organic Farming. Press Books, Ipswitch, UK.
- Palaniappan S.P. & Annadurai K. 1999. Organic Farming—Theory and Practice. Scientific Publ.
- Rao B.V., Venkata. 1995. Small Farmer Focused Integrated Rural Development Socioeconomic Environment and Legal Perspective Publ.3, Parisaraprajna Parishtana, Bangalore.

PG Course Curriculum

- Reddy M.V. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH.
- Sharma A. 2002. Hand Book of Organic Farming. Agrobios.
- Singh S.P. (Ed.) 1994. Technology for Production of Natural Enemies. PDDB, Bangalore.
- Subba Rao N.S. 2002. Soil Microbiology. Oxford & IBH.
- Trivedi R.N. 1993. A Text Book of Environmental Sciences, Anmol Publ.
- Veeresh G.K., Shivashankar K. & Suiglachar M.A. 1997. Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore.
- WHO. 1990. Public Health Impact of Pesticides Used in Agriculture. WHO.
- Woolmer P.L. & Swift M.J. 1994. The Biological Management of Tropical Soil Fertility. TSBF & Wiley.

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SOILS506 Soil Biology and Biochemistry (2+1)

Objective

To teach students the basics of soil biology and biochemistry, including biogeochemical cycles, plant growth promoting rhizobacteria, microbial interactions in soil and other soil activities.

Theory

UNIT I Soil biota, soil microbial ecology, types of organisms in different soils; soil microbial biomass; microbial interactions; un-culturable soil biota.

UNIT II Microbiology and biochemistry of root-soil interface; phyllosphere; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora.

UNIT III Microbiology and biochemistry of root-soil interface; phyllosphere; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora.

UNIT IV Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil.

UNIT V Preparation and preservation of farmyard manure, animal manures, rural and urban composts and vermicompost. Bio-fertilizers—definition, classification, specifications, method of production and role in crop production.

Practical

1. Determination of soil microbial population.
2. Soil microbial biomass.
3. Elemental composition, fractionation of organic matter and functional groups
4. Decomposition of organic matter in soil.
5. Soil enzymes.
6. Measurement of important soil microbial processes such as ammonification, nitrification, N_2 fixation, S oxidation, P solubilization and mineralization of other micronutrients.
7. Study of rhizosphere effect.

Suggested Readings

- Alexander M. 1977. *Introduction to Soil Microbiology*. John Wiley & Sons.
- Burges A. & Raw F. 1967. *Soil Biology*. Academic Press.
- McLaren A.D. & Peterson G.H. 1967. *Soil Biochemistry*. Vol. XI. Marcel Dekker.
- Metting F.B. 1993. *Soil Microbial Ecology – Applications in Agricultural and Environmental Management*. Marcel Dekker.
- Paul E.A. & Ladd J.N. 1981. *Soil Biochemistry*. Marcel Dekker.
- Reddy M.V. (Ed.). *Soil Organisms and Litter in the Tropics*. Oxford & IBH.

PG Course Curriculum

- Russel R.S. 1977: *Plant Root System: Their Functions and Interaction with the Soil*. ELBS & McGraw Hill.
- Stotzky G. & Bollag J.M. 1993. *Soil Biochemistry*. Vol. VIII. Marcel Dekker.
- Sylvia D.N. 2005. *Principles and Applications of Soil Microbiology*. Pearson Edu.
- Wild A. 1993. *Soil and the Environment - An Introduction*. Cambridge Univ. Press.

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Stotzky

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SOILS509 Soil, Water and Air Pollution (2+1)

Objective

To make the students aware of the problems of soil, water and air pollution associated with use of soils for crop production.

Theory

UNIT I Soil, water and air pollution problems associated with agriculture, nature and extent.

UNIT II Nature and sources of pollutants—agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants - their CPC standards and effect on plants, animals and human beings.

UNIT III Sewage and industrial effluents—their composition and effect on soil properties / health, and plant growth and human beings; soil as sink for waste disposal.

UNIT IV Pesticides—their classification, behaviour in soil and effect on soil micro-organisms. Toxic elements—their sources, behaviour in soils, effect on nutrients availability, effect on plant and human health.

UNIT V Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases—carbon dioxide, methane and nitrous oxide. Remediation/amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution.

Practical

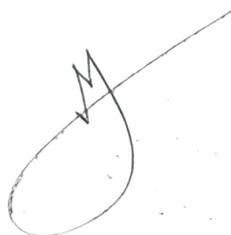
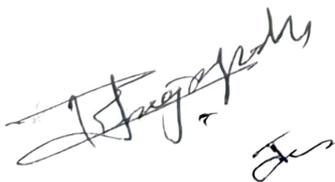
1. Sampling of sewage waters, sewage sludge, solid/liquid industrial wastes, polluted soils and plants.
2. Estimation of dissolved and suspended solids, chemical oxygen demand (COD), biological demand (BOD), nitrate and ammoniacal nitrogen and phosphorus, heavy metal content in effluents.
3. Heavy metals in contaminated soils and plants.
4. Management of contaminants in soil and plants to safeguard food safety.
5. Air sampling and determination of particulate matter and oxides of sulphur.
6. Visit to various industrial sites to study the impact of pollutants on soil and plants.

Suggested Readings

- Lal R., Kimble J., Levine E. & Stewart B.A. 1995. *Soil Management and Green house Effect*. CRC Press.
- Middle brooks E.J. 1979. *Industrial Pollution Control*. Vol. I. *Agro-Industries*. John Wiley Interscience.
- Ross S.M. *Toxic Metals in Soil Plant Systems*. John Wiley & Sons.
- Vesilund P.A. & Pierce 1983. *Environmental Pollution and Control*. Ann Arbor Science Publ.
- Dhruv Narayan V.V. 2002. *Soil and Water Conservation Research in India*.

ICAR.

- Gupta U.S. (Ed.). 1995. *Production and Improvements of Crops for Drylands*. Oxford & IBH. Katyal JC & Farrington J. 1995. *Research for Rainfed Farming*. CRIDA.
- Rao S.C.& Ryan J. 2007. *Challenges and Strategies of Dryland Agriculture*. Scientific Publishers.
- Singh P. & Maliwal P.L. 2005. *Technologies for Food Security and Sustainable Agriculture*.
- Agrotech Publishing Company.
- Singh R.P. 1988. *Improved Agronomic Practices for Dryland Crops*. CRIDA.
- Singh R.P. 2005. *Sustainable Development of Dryland Agriculture in India*. Scientific Publ.
- Singh S.D. 1998. *Arid Land Irrigation and Ecological Management*. Scientific Publishers.
- Venkateswarlu J. 2004. *Rainfed Agriculture in India. Research and Development Scenario*. ICAR.



PP501 Principles of Plant Physiology (3+1)

Objective

To acquaint the students with the basic concepts of plant physiology and their application in agriculture.

Theory

UNIT I

Cell organelles and their physiological functions, structure and physiological functions of cell wall, cell inclusions; cell membrane structure and functions.

UNIT II

Soil and plant water relations, water and its role in plants, properties and functions of water in the cell water relations-cell water terminology, water potential of plant cells.

UNIT III

Mechanism of water uptake by roots-transport in roots, aquaporins, movement of water in plants – Mycorrhizal association on water uptake.

UNIT IV

Water loss from plants-Energy balance-solar energy input-energy dissipation at crop canopy level- evapo-transpiration transpiration –Driving force for transpiration, plant factors influencing transpiration rate.

UNIT V

Stomata structure and function–mechanism of stomatal movement, anti-transpirants.

UNIT VI

Physiology of water stress in plants Influence of water stress at cell, organ, plant and canopy levels. Indices for assessment of drought resistance.

UNIT VII

The role of mineral nutrients in plant metabolism Essential elements, classification based on function of elements in plants.

UNIT VIII

Uptake of mineral elements in plants –Mechanisms of uptake translocation of minerals in plants.

UNIT IX

Physiological and metabolic functions of mineral elements, critical levels, deficiency symptoms, nutrient deficiency and toxicity. Foliar nutrition.

UNIT X

Photosynthesis and its importance in bio productivity. Photochemical process, photochemical reactions, CO₂ reduction in Calvin cycle, supplementary pathway of C fixation in C₄ and CAM plants and its significance.

UNIT XI

Photorespiration and its relevance. Photosynthesis as a diffusive process effect of environmental factors on photosynthetic rates. Synthesis of sucrose, starch, oligo and polysaccharides (composition of cell wall). Translocation of photosynthates and its importance in sink growth.

UNIT XII

Mitochondrial respiration, growth and maintenance respiration, cyanide resistant respiration and its significance.

PP501 Principles of Plant Physiology (3+1)

Objective

To acquaint the students with the basic concepts of plant physiology and their application in agriculture.

Theory

- UNIT I** Cell organelles and their physiological functions, structure and physiological functions of cell wall, cell inclusions; cell membrane structure and functions.
- UNIT II** Soil and plant water relations, water and its role in plants, properties and functions of water in the cell water relations-cell water terminology, water potential of plant cells.
- UNIT III** Mechanism of water uptake by roots-transport in roots, aquaporins, movement of water in plants – Mycorrhizal association on water uptake.
- UNIT IV** Water loss from plants-Energy balance-solar energy input-energy dissipation at crop canopy level- evapo-transpiration transpiration –Driving force for transpiration, plant factors influencing transpiration rate.
- UNIT V** Stomata structure and function–mechanism of stomatal movement, anti-transpirants.
- UNIT VI** Physiology of water stress in plants Influence of water stress at cell, organ, plant and canopy levels. Indices for assessment of drought resistance.
- UNIT VII** The role of mineral nutrients in plant metabolism Essential elements, classification based on function of elements in plants.
- UNIT VIII** Uptake of mineral elements in plants –Mechanisms of uptake translocation of minerals in plants.
- UNIT IX** Physiological and metabolic functions of mineral elements, critical levels, deficiency symptoms, nutrient deficiency and toxicity. Foliar nutrition.
- UNIT X** Photosynthesis and its importance in bio productivity. Photochemical process, photochemical reactions, CO₂ reduction in Calvin cycle, supplementary pathway of C fixation in C₄ and CAM plants and its significance.
- UNIT XI** Photorespiration and its relevance. Photosynthesis as a diffusive process effect of environmental factors on photosynthetic rates. Synthesis of sucrose, starch, oligo and polysaccharides (composition of cell wall). Translocation of photosynthates and its importance in sink growth.
- UNIT XII** Mitochondrial respiration, growth and maintenance respiration, cyanide resistant respiration and its significance.

- UNIT XIII** Nitrogen metabolism Inorganic nitrogen species (N_2 , NO_3 and NH_3) and their reduction to amino acids, protein synthesis and nucleic acids.
- UNIT XIV** Lipid metabolism- Storage, protective and structural lipids. Biosynthesis of fatty acids, diacyl and triacyl glycerol, fatty acids of storage lipids. Secondary metabolites and their significance in plant defence mechanism.
- UNIT XV** Growth and differentiation. Hormonal concept of growth and differentiation, plant growth hormones and their physiological role synthetic growth regulators, growth retardants, Apical dominance, senescence, fruit growth, abscission.
- UNIT XVI** Photo morphogenesis Photo receptors, phytochrome, cryptochrome, physiology of flowering- Photoperiodism and Vernalisation.

Practical

1. Measurement of soil water status Theory and principle of pressure plate apparatus, neutron probe.
2. Measurement of plant water status Relative water content, water saturation deficits Chardakov's test.
3. Theory and principle of pressure bomb, psychrometer and osmometer, Measurement of transpiration rate.
4. Measurement of vapour pressure deficits, theory and principle of porometry, diffusion porometer and Steady state porometer, Stomatal physiology, influence of ABA on stomatal closing.
5. Mineral nutrients Demonstration of energy requirement for ion uptake.
6. Deficiency symptoms of nutrients, Radiant energy measurements, separation and quantification of chlorophylls, O_2 evolution during photosynthesis.
7. Measurement of gas exchange parameters, conductance, photosynthetic rate, photorespiration, Respiration rates, Estimation of reducing sugars, starch.
8. Estimation of NO_3 , free amino acids in the xylem exudates, quantification of soluble proteins.
9. Bioassays for different growth hormones- Auxins, Gibberellins, Cytokinins, ABA and ethylene.
10. Demonstration of photoperiodic response of plants in terms of flowering.

Suggested Readings

- Hopkins W.G. & Huner N.P.A. 2004. Introduction to Plant Physiology. John Wiley & Sons.
- Salisbury F.B. & Ross C. 1992. Plant Physiology. 4th Ed. Wadsworth Publ.
- Taiz L. & Zeiger E. 2006. Plant Physiology. 4th Ed. Sinauer Associates.