

AGRONOMY
Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
AGRON 501*	MODERN CONCEPTS IN CROP PRODUCTION	3+0
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
AGRON 505	AGROMETEOROLOGY AND CROP WEATHER FORECASTING	2+1
AGRON 506*	AGRONOMY OF MAJOR CEREALS AND PULSES	2+1
AGRON 507*	AGRONOMY OF OILSEED, FIBRE AND SUGAR CROPS	2+1
AGRON 508	AGRONOMY OF MEDICINAL, AROMATIC AND UNDER UTILIZED CROPS	2+1
AGRON 509	AGRONOMY OF FODDER AND FORAGE CROPS	2+1
AGRON 510	AGROSTOLOGY AND AGROFORESTRY	2+1
AGRON 511	CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE	2+0
AGRON 512*	DRYLAND FARMING AND WATERSHED MANAGEMENT	2+1
AGRON 513	PRINCIPLES AND PRACTICES OF ORGANIC FARMING	2+1
AGRON 591	MASTER'S SEMINAR	1+0
AGRON 599	MASTER'S RESEARCH	20
AGRON 601	CURRENT TRENDS IN AGRONOMY	3+0
AGRON 602	CROP ECOLOGY	2+0
AGRON 603	CROP PRODUCTION AND SYSTEM MODELING	2+1
AGRON 604	ADVANCES IN CROP GROWTH AND PRODUCTIVITY	2+1
AGRON 605	IRRIGATION MANAGEMENT	2+1
AGRON 606	ADVANCES IN WEED MANAGEMENT	2+0
AGRON 607	INTEGRATED FARMING SYSTEMS FOR SUSTAINABLE AGRICULTURE	2+0
AGRON 608	SOIL CONSERVATION AND WATERSHED MANAGEMENT	2+1
AGRON 609	STRESS CROP PRODUCTION	2+1
AGRON 691	DOCTORAL SEMINAR I	1+0
AGRON 692	DOCTORAL SEMINAR II	1+0
AGRON 699	DOCTORAL RESEARCH	45

*Compulsory for Master's programme

Minor Departments **9**

Soil Science

Plant Physiology

Supporting Departments **5**

Soil Science

Plant Physiology

Statistics and Mathematics

Non credit compulsory courses

CODE	COURSE TITLE	CREDITS
PGS 501	Library information services	0+1
PGS 501	LIBRARY AND INFORMATION SERVICES	0+1
PGS 502	TECHNICAL WRITING AND COMMUNICATION SKILLS	0+1
PGS 503 (e-course)	INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE	1+0
PGS 504	BASIC CONCEPTS IN LABORATORY TECHNIQUES	0+1
PGS 505 (e-course)	AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES	1+0
PGS 506 (e-course)	DISASTER MANAGEMENT	1+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 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.

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 (India), Jodhpur, India.
- Fageria, N.K. 1992. *Maximizing Crop Yields*. Marcel Dekker Inc., New York.
- Havlin, J.L., Beaton, J.D., Tisdale, S.L. & Nelson, W.L. 2006. *Soil Fertility and Fertilizers*. 7th Ed., Pearson/Prentice Hall, Upper Saddle River, New Jersey.
- Paroda, R.S. 2003. *Sustaining our Food Security*, Konark Publishers Pvt. Ltd., A-149, Main Vikas Marg, New Delhi.
- Reddy, S.R. 2000. *Principles of Crop Production*. Kalyani Publishers, New Delhi.
- Sankaran, S. & Mudaliar, T.V.S. 1997. *Principles of Agronomy*. The Bangalore Printing & Publishers, Bangalore.
- Singh, S.S. 2006. *Principles and Practices of Agronomy*. Kalyani Publishers, New Delhi.
- Yellamanda Reddy, T. & Sankara Reddi, G.H. 2002. *Principles of Agronomy*, Kalyani Publishers, New Delhi.

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, biofertilizers 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 vermincompost and residue wastes in crops.

Practical

Determination of soil pH, Determination of EC, Determination of organic Carbon, Determination of total N and available N in soils, Determination of P in soils, Determination of K in soils, Determination of S in soils, Determination of total N in plants, Determination of total P in plants, Determination of total K in plants, Determination of total S in plants, Interpretation of interaction effects, Computation of economic and yield optima

Suggested Readingss

Brady, N.C. & Weil, R.R 2002. The Nature and Properties of Soils. 13th Ed, Prentice Hall, Upper Saddle River, New Jersey.

Havlin, J.L., Tisdale, S.L., Beaton, J.D., & Nelson, W.L. 2006. Soil Fertility and Fertilizers. 7th Ed., Pearson/Prentice Hall, Upper Saddle River, New Jersey.

Prasad, R. & Power J.F. 1997. Soil Fertility Management for Sustainable Agriculture. CRC Press-Lewis, Boca Raton, Florida.

Reddy S.R. 2006. Principles of Crop Production, Kalyani Publishers, New Delhi.

Reedy T.Y. and Reddi, G.H.S. 2002. Principles of Agronomy, Kalyani Publishers, New Delhi, India.

Tandon, H.L.S. 1992. Management of nutrient interactions in Agriculture. FDCO, New Delhi.

Tandon, H.L.S. 1994. Fertilizers, Organic manures, Recyclable wastes and Biofertilizers – Components of Integrated Plant Nutrition. FDCO, New Delhi.

Fageria, N.K., Baligar, V.C. & Jones, C.A. 1991. Growth and Mineral Nutrition of Field Crops. Marcel Dekker Inc., New York

Yawalkar, K.S., Agarwal, J.P. & Bokde, S. 2000. Manures and Fertilizers. Agri-Horti Publishers, Nagpur.

AGRON 503 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 allelochemicals; 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

Identification of important weeds of different crops, Preparation of weed herbarium, Weed survey in crops and cropping systems, Study of crop weed competition in on-going research experiments, Preparation of spray solutions of herbicides for high and low volume sprayers , Use of various types of spray pumps and nozzles and calculation of swath width, Economic analysis of weed management practices in different crops and cropping systems, Calculation of herbicide dose requirement, Study of herbicide residue analysis in plants and soils , Bio-assay of herbicide residues

Suggested Readings

Aldrich RJ & Kramer RJ. 1997. *Principles in Weed Management*. Panima Publ.

Ashton FM & Crafts AS. 1981. *Mode of Action of Herbicides*. 2nd Ed. Wiley Inter-Science.

Gupta OP. 2007. *Weed Management – Principles and Practices*. Agrobios.

Mandal RC. 1990. *Weed, Weedicides and Weed Control - Principles and Practices*. Agro-Botanical Publ.

Rao VS. 2000. *Principles of Weed Science*. Oxford & IBH.

Subramanian S, Ali AM & Kumar RJ. 1997. *All About Weed Control*. Kalyani.

Zimdahl RL. 1999. *Fundamentals of Weed Science*. 2nd Ed. Academic Press.

AGRON 504 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

Measurement of soil water potential by Tensiometer, Measurement of soil water potential by pressure plate & pressure membrane apparatus, Construction of soil moisture characteristic curves for soils representative to the region, Determination of infiltration rate by double ring infiltrometer method, Determination of saturated and unsaturated hydraulic conductivity, Determination of reference crop evapotranspiration by Modified Penman, Penman Monteith & Pan evaporation method, Construction of crop coefficient curves for important crops of the region, Determination of crop evapotranspiration, effective rainfall, leaching requirements and irrigation requirements, Measurement of irrigation water by 90 V-notch, Parshall flume and water meter, Calculation of irrigation efficiency parameters, Study of sprinkler & drip irrigation system components, Determination of design emission uniformity in drip irrigation, Study of on-going irrigation experiments

Suggested Readings

Lenka D. 1999. *Irrigation and Drainage*. Kalyani

- Michael AM. 1978. *Irrigation: Theory and Practice*. Vikas Publ.
- Paliwal KV. 1972. *Irrigation with Saline Water*. IARI Monograph, New Delhi.
- Panda SC. 2003. *Principles and Practices of Water Management*. Agrobios.
- Prihar SS & Sandhu BS. 1987. *Irrigation of Food Crops - Principles and Practices*. ICAR.
- Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
- Singh Pratap & Maliwal PL. 2005. *Technologies for Food Security and Sustainable Agriculture*. Agrotech Publ.

AGRON 505 AGROMETEOROLOGY AND CROP WEATHER FORECASTING 2+1

Objective

To impart knowledge about agro-meteorology and crop weather forecasting to meet the challenges of aberrant weather conditions.

Theory

UNIT I

Agro meteorology - aim, scope and development in relation to crop environment; composition of atmosphere, distribution of atmospheric pressure and wind.

UNIT II

Characteristics of solar radiation; energy balance of atmosphere system; radiation distribution in plant canopies, radiation utilization by field crops; photosynthesis and efficiency of radiation utilization by field crops; energy budget of plant canopies; environmental temperature: soil, air and canopy temperature.

UNIT III

Temperature profile in air, soil, crop canopies; soil and air temperature effects on plant processes; environmental moisture and evaporation: measures of atmospheric temperature and relative humidity vapor pressure and their relationships; evapo-transpiration and meteorological factors determining evapotranspiration.

UNIT IV

Modification of plant environment: artificial rain making, heat transfer, controlling heat load, heat trapping and shading; protection from cold, sensible and latent heat flux, controlling soil moisture; monsoon and their origin, characteristics of monsoon; onset, progress and withdrawal of monsoon; weather hazards, drought monitoring and planning for mitigation.

UNIT V

Weather forecasting in India – short, medium and long range; aerospace science and weather forecasting; benefits of weather services to agriculture, remote sensing; application in agriculture and its present status in India; atmospheric pollution and its effect on climate and crop production; climate change and its impact on agriculture.

- Visit to agro-meteorological observatory and to record sun-shine hours, wind velocity, wind direction, relative humidity, soil and air temperature, evaporation, precipitation and atmospheric pressure
- Measurement of solar radiation outside and within plant canopy
- Measurement/estimation of evapo-transpiration by various methods
- Measurement/estimation of soil water balance
- Rainfall variability analysis
- Determination of heat-unit requirement for different crops
- Measurement of crop canopy temperature
- Measurement of soil temperatures at different depths
- Remote sensing and familiarization with agro-advisory service bulletins
- Study of synoptic charts and weather reports, working principle of automatic weather station
- Visit to solar observatory

Suggested Readings

- Chang Jan Hu 1968. *Climate and Agriculture on Ecological Survey*. Aldine Publ.
- Critchfield HJ.1995. *General Climatology*. Prentice Hall of India.
- Das PK.1968. *The Monsoons*. National Book Trust Publ.
- Lal DS.1998. *Climatology*. Sharda Pustak Bhawan.
- Lenka D.1998. *Climate, Weather and Crops in India*. Kalyani.
- Mavi H.S.1994. *Introduction to Agro-meteorology*. Oxford & IBH.
- Mavi HS & Tupper GJ. 2004. *Agrometeorology: Principles and Application of Climate Studies in Agriculture*. Haworth Press.
- Menon PA.1991. *Our Weather*. National Book Trust Publ.
- Sahu DD. *Agrometeorology and Remote Sensing: Principles and Practices*. Agrobios.
- Variraju R & Krishnamurty 1995. *Practical Manual on Agricultural Meteorology*. Kalyani.
- Varshneya MC & Balakrishana Pillai P. 2003. *Textbook of Agricultural Meteorology*. ICAR.

AGRON 506

AGRONOMY OF MAJOR CEREALS AND PULSES

2+1

Objective

To teach the crop husbandry of cereals and pulse crops.

Theory

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of

UNIT I

Rabi cereals.

UNIT II

Kharif cereals.

UNIT III

Rabi pulses.

UNIT IV

Kharif pulses

Practical

Planning, seed bed preparation and layout of field experiments, Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities, Intercultural operations in different crops. Phenological studies at different growth stages of crops. Working out growth indices (CGR, RGR, NAR and LAD), LER, aggressivity, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems of different crops. Judging of physiological maturity in different crops. Estimation of crop yield on the basis of yield attributes. Estimation of protein content in pulses. Working out harvest index of various crops. Determination of cost of cultivation of different crops. Study of seed production techniques in various crops. Visit of field experiments on cultural, fertilizer, weed control and water management aspects. Visit to nearby villages for identification of constraints in crop production.

Suggested Readings

- Das, N.R. 2007. Introduction to Crops of India. Scientific publishers, Jodhpur, India.
- Rajendra Prasad. 2004. Text Book of Field Crop Production. Technical Editor, ICAR, New Delhi.
- Reddy, S.R. 2004. Agronomy of Field Crops. Kalyani Publishers, New Delhi.
- De Datta, S.K. 1981. Principles and Practices Rice Production., John Willey & Sons, New York.
- Jeswani, L.M. & Baldev, B. 1997. Advances in Pulse Production Technology. ICAR, New Delhi.
- Yadav D S. 1992. Pulse Crops. Kalyani Publishers, New Delhi.
- Gururaj Hunsigi & Krishna, K. R. 1998. Science of Field Crop Production. Oxford & IBH publishing Co., Pvt., Ltd., New Delhi.
- Mahendra Pal, Jayanta, D. & Rai, R.K. 1996. Fundamentals of Cereal Crop Production.. Tata McGraw Hill Publishing Co., New Delhi.
- Singh, C., Singh, P. & Singh, R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH Publishing Co., Pvt., Ltd., New Delhi.

AGRON 507

AGRONOMY OF OILSEED, FIBRE AND SUGAR CROPS

2+1

Objective

To teach the crop husbandry of oilseed, fiber and sugar crops.

Theory

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of :

UNIT I

Rabi oilseeds – Rapeseed and mustard, linseed, etc.

UNIT II

Kharif oilseeds - Groundnut, sesame, castor, sunflower, soybean etc.

UNIT III

Fiber crops - Cotton, jute, sunhemp etc.

UNIT IV

Sugar crops – Sugar-beet and sugarcane.

Practical

Planning and layout of field experiments, Cutting of sugarcane setts, its treatment and methods of sowing, tying and propping of sugarcane, Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice phenological studies at different growth stages of crop, Intercultural operations in different crops, Cotton seed treatment, Working out growth indices (LER, CGR, RGR, NAR, LAD) aggressivity, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems, Judging of physiological maturity in different crops and working out harvest index, Working out cost of cultivation of different crops, Estimation of crop yield on the basis of yield attributes, Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities, Determination of oil content in oilseeds and computation of oil yield, Estimation of quality of fibre of different fibre crops, Study of seed production techniques in various crops, Visit of field experiments on cultural, fertilizer, weed control and water management aspects, Visit to nearby villages for identification of constraints in crop production

Suggested Readings

Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.

Das PC. 1997. *Oilseed Crops of India*. Kalyani.

Lakshmikantam N. 1983. *Technology in Sugarcane Growing*. 2nd Ed. Oxford & IBH.

Prasad, Rajendra. 2002. *Text Book of Field Crop Production*. ICAR.

Singh C, Singh P & Singh R. 2003. *Modern Techniques of Raising Field Crops*. Oxford & IBH.

Singh SS. 1998. *Crop Management*. Kalyani.

AGRON 508

**AGRONOMY OF MEDICINAL, AROMATIC AND
UNDER-UTILIZED CROPS**

2+1

Objective

To acquaint students about different medicinal, aromatic and underutilized field crops, their package of practices and processing.

Theory

UNIT I

Importance of medicinal and aromatic plants in human health, national economy and related industries, classification of medicinal and aromatic plants according to botanical characteristics and uses.

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, Lemon grass, Rose, Patchouli, Geranium etc.).

UNIT IV

Climate and soil requirements; cultural practices; yield of under-utilized crops (Rice bean, Lathyrus, Sesbania, Clusterbean, French bean, Fenugreek, Grain Amaranth, Coffee, Tea and Tobacco).

Practical

Identification of crops based on morphological and seed characteristics, Raising of herbarium of medicinal, aromatic and under-utilized plants, Quality characters in medicinal and aromatic plants, Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants

Suggested Readings

- Chadha KL & Gupta R. 1995. *Advances in Horticulture*. Vol. II. *Medicinal and Aromatic Plants*. Malhotra Publ.
- Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.
- Handa SS. 1984. *Cultivation and Utilization of Medicinal Plants*. RRL, CSIR, Jammu.
- Hussain A. 1984. *Essential Oil Plants and their Cultivation*. CIMAP, Lucknow.
- Hussain A. 1993. *Medicinal Plants and their Cultivation*. CIMAP, Lucknow.
- ICAR 2006. *Hand Book of Agriculture*. ICAR, New Delhi.
- Kumar N, Khader Md. Abdul, Rangaswami JBM & Irulappan 1997. *Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants*. Oxford & IBH.
- Prajapati ND, Purohit SS, Sharma AK & Kumar T. 2003. *A Hand Book of Medicinal Plants: A Complete Source Book*. Agrobios.
- Sharma R. 2004. *Agro-Techniques of Medicinal Plants*. Daya Publ. House.

AGRON 509

AGRONOMY OF FODDER AND FORAGE CROPS

2+1

Objective

To teach the crop husbandry of different forage and fodder crops along with their processing.

Theory

UNIT I

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like maize, *bajra*, *guar*, cowpea, oats, barley, berseem, *senji*, lucerne etc.

UNIT II

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasseslime, napier grass, *Panicum*, *Lasiurus*, *Cenchrus* etc.

UNIT III

Year-round fodder production and management, preservation and utilization of forage and pasture crops.

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.

UNIT V

Economics of forage cultivation uses and seed production techniques.

Practical

Practical raining of farm operations in raising fodder crops; Canopy measurement, yield and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops, Anti-quality components like HCN in sorghum and such factors in other crops, Hay and silage making and economics of their preparation

Suggested Readings

Chatterjee BN. 1989. *Forage Crop Production - Principles and Practices*.

Oxford & IBH.

Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.

Narayanan TR & Dabadghao PM. 1972. *Forage Crops of India*. ICAR.

Singh P & Srivastava AK. 1990. *Forage Production Technology*. IGFRI, Jhansi.

Singh C, Singh P & Singh R. 2003. *Modern Techniques of Raising Field Crops*. Oxford & IBH.

Tejwani KG. 1994. *Agroforestry in India*. Oxford & IBH.

AGRON 510

AGROSTOLOGY AND AGRO-FORESTRY

2+1

Objective

To teach crop husbandry of different forage, fodder and agroforestry crops/trees along with their processing.

Theory

UNIT I

Agrostology: definition and importance; principles of grassland ecology: grassland ecology – community, climax, dominant species, succession, biotype, ecological status of grasslands in India, grass cover of India; problems and management of grasslands.

UNIT II

Importance, classification (various criteria), scope, status and research needs of pastures; pasture establishment, their improvement and renovation-natural pastures, cultivated pastures; common pasture grasses.

UNIT III

Agroforestry: definition and importance; agroforestry systems, agrisilviculture, silvipasture, agrisilvipasture, agrihorticulture, aquasilviculture, alley cropping and energy plantation.

UNIT IV

Crop production technology in agro-forestry and agrostology system; silvipastoral system: meaning and importance for wasteland development; selection of species, planting methods and problems of seed germination in agro-forestry systems; irrigation and manuring in agro-forestry systems, associative influence in relation to above ground 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 pastures and agro-forestry systems, 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 silvipastoral system, Fertilizer application in strip and silvipastoral systems, After-care of plantation, Estimation of protein content in loppings of important fodder trees, Estimation of calorie value of wood of important fuel trees, Estimation of total biomass and fuel wood, Economics of agro-forestry, Visit to important agro-forestry research stations

Suggested Readings

Chatterjee BN & Das PK. 1989. *Forage Crop Production. Principles and Practices*. Oxford & IBH.

Dabadghao PM & Shankaranarayan KA. 1973. *The Grass Cover in India*. ICAR.

Dwivedi AP. 1992. *Agroforestry- Principles and Practices*. Oxford & IBH.

Indian Society of Agronomy. 1989. *Agroforestry System in India. Research and Development*, New Delhi.

Narayan TR & Dabadghao PM. 1972. *Forage Crop of India*. ICAR, New Delhi.

Pathak PS & Roy MM. 1994. *Agroforestry System for Degraded Lands*.
Oxford & IBH.

Sen NL, Dadheech RC, Dashora LK & Rawat TS. 2004. *Manual of Agroforestry and Social Forestry*. Agrotech Publ.

Shah SA. 1988. *Forestry for People*. ICAR.

Singh Panjab, Pathak PS & Roy MM. 1994. *Agroforestry System for Sustainable Use*. Oxford & IBH.

Singh SP. 1994. *Handbook of Agroforestry*. Agrotech Publ.

Solanki KR. 2000. *Multipurpose Tree Species: Research, Retrospect and Prospects*. Agrobios.

Tejwani KG. 1994. *Agroforestry in India*. Oxford & IBH.

AGRON 511 CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE 2+0

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, 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 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 drylands; plant growth regulators and their role in sustainability.

Suggested Readings

- Palaniappan SP & Sivaraman K. 1996. *Cropping Systems in the Tropics; Principles and Management*. New Age.
- Panda SC. 2003. *Cropping and Farming Systems*. Agrobios.
- Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
- Sankaran S & Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing & Publ. Co.
- Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani.
- Tisdale SL, Nelson WL, Beaton JD & Havlin JL. 1997. *Soil Fertility and Fertilizers*. Prentice Hall.

AGRON 512 DRYLAND FARMING AND WATERSHED MANAGEMENT 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, tillage, 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); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use.

UNIT V

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

Practical

Seed treatment, Seed germination and crop establishment in relation to soil moisture contents
Study of moisture stress effects and recovery behaviour of important crops, Estimation of moisture index and aridity index, Spraying of antitranspirants and their effect on crops, Collection and interpretation of data for water balance equations, Study of water use efficiency in different crops, Preparation of crop plans for different drought conditions, Study of field experiments relevant to dryland farming, Visit to dryland research stations and watershed projects

Suggested Readings

Das NR. 2007. *Tillage and Crop Production*. Scientific Publishers.

Dhopte AM. 2002. *Agrotechnology for Dryland Farming*. Scientific Publ.

Dhruv Narayan VV. 2002. *Soil and Water Conservation Research in India*. ICAR.

Gupta US. (Ed.). 1995. *Production and Improvements of Crops for Drylands*. Oxford & IBH.

Katyaj JC & Farrington J. 1995. *Research for Rainfed Farming*. CRIDA.

Rao SC & Ryan J. 2007. *Challenges and Strategies of Dryland Agriculture*.

Scientific Publishers.

Singh P & Maliwal PL. 2005. *Technologies for Food Security and Sustainable Agriculture*. Agrotech Publishing Company.

Singh RP. 1988. *Improved Agronomic Practices for Dryland Crops*. CRIDA.

Singh RP. 2005. *Sustainable Development of Dryland Agriculture in India*.

Scientific Publ.

Singh SD. 1998. *Arid Land Irrigation and Ecological Management*. Scientific Publishers.

Venkateshwarlu J. 2004. *Rainfed Agriculture in India. Research and Development Scenario*. ICAR.

AGRON 513 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 biofertilizers.

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, biopesticides.

UNIT V

Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

Practical

Aerobic and anaerobic methods of making compost, Making of vermicompost, Identification and nursery raising of important agro-forestry trees and trees for shelter belts, Efficient use of biofertilizers, Technique of treating legume seeds with *Rhizobium* cultures, Use of *Azotobacter*, *Azospirillum*, and PSB cultures in field, Visit to an organic farm, Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms

Suggested Readings

Ananthakrishnan TN. (Ed.). 1992. *Emerging Trends in Biological Control of Phytophagous Insects*. Oxford & IBH.

Gaur AC. 1982. *A Manual of Rural Composting*, FAO/UNDP Regional Project Document, FAO.

Lampin N. 1990. *Organic Farming*. Press Books, Ipswich, UK.

Palaniappan SP & Anandurai K. 1999. *Organic Farming – Theory and Practice*. Scientific Publ.

Rao BV Venkata. 1995. *Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective*.

- Publ.3, Parisaraprajna Parishtana, Bangalore.
- Reddy MV. (Ed.). 1995. *Soil Organisms and Litter Decomposition in the Tropics*. Oxford & IBH.
- Sharma A. 2002. *Hand Book of Organic Farming*. Agrobios.
- Singh SP. (Ed.) 1994. *Technology for Production of Natural Enemies*. PDBC, Bangalore.
- Subba Rao NS. 2002. *Soil Microbiology*. Oxford & IBH.
- Trivedi RN.1993. *A Text Book of Environmental Sciences*, Anmol Publ.
- Veeresh GK, Shivashankar K & Suiglachar MA. 1997. *Organic Farming and Sustainable Agriculture*. Association for Promotion of Organic Farming, Bangalore.
- WHO. 1990. *Public Health Impact of Pesticides Used in Agriculture*.
- Woolmer PL & Swift MJ. 1994. *The Biological Management of Tropical Soil Fertility*. TSBF & Wiley.

AGRON 601

CURRENT TRENDS IN AGRONOMY

3+0

Objective

To acquaint the students about recent advances in agricultural production.

Theory

UNIT I

Agro-physiological basis of variation in yield, recent advances in soilplant- water relationship.

UNIT II

Globalization of agriculture and WTO, precision agriculture, contract farming, organic farming, marketing and export potential of organic products, certification, labeling and accreditation procedures.

UNIT III

Crop residue management in multiple cropping systems; latest developments in plant management, weed management, cropping systems, grassland management, agro-forestry, allelopathy.

UNIT IV

GIS, GPS and remote sensing for crop management, global warming, GM crops, seed production technology; seed certification, seed multiplication, hybrid seed production etc.

UNIT V

Concepts of system agriculture; holistic approach of farming systems, dryland farming, sustainable agriculture and research methodology in Agronomy.

Suggested Readings

- Agarwal RL. 1995. *Seed Technology*. Oxford & IBH.
- Dahiya BS & Rai KN. 1997. *Seed Technology*. Kalyani.

Govardhan V. 2000. *Remote Sensing and Water Management in Command Areas: Agroecological Prospectives*. IBDC.

ICAR. 2006. *Hand Book of Agriculture*. ICAR.

Narasaiah ML. 2004. *World Trade Organization and Agriculture*. Sonali Publ.

Palaniappan SP & Annadurai K. 2006. *Organic Farming - Theory and Practice*. Scientific Publ.

Sen S & Ghosh N. 1999. *Seed Science and Technology*. Kalyani.

Tarafdar JC, Tripathi KP & Mahesh Kumar 2007. *Organic Agriculture*.

Scientific Publ.

AGRON 602

CROP ECOLOGY

2+0

Objective

To acquaint the students about the agricultural systems, agro-ecological regions, and adaptation of crops to different agro-climatic conditions.

Theory

UNIT I

Concept of crop ecology, agricultural systems, ecology of cropping systems, principles of plant distribution and adaptation, crop and world food supply.

UNIT II

Ecosystem characteristics, types and functions, terrestrial ecology, flow of energy in ecosystem, ecosystem productivity, biomass, succession and climax concept.

UNIT III

Physiological response of crop plants to light, temperature, CO₂, moisture and solar radiation; influence of climate on photosynthesis and productivity of crops; effect of global climate change on crop production.

UNIT IV

Exploitation of solar energy in crops; vertical distribution of temperature; efficiency in crop production.

UNIT V

Competition in crop plants; environmental pollution, ecological basis of environmental management and environment manipulation through agronomic practices; improvement of unproductive lands through crop selection and management.

Suggested Readings

Ambasht RS. 1986. *A Text Book of Plant Ecology*. 9th Ed. Students' Friends & Co.

Chadha KL & Swaminathan MS. 2006. *Environment and Agriculture*.

Malhotra Publ. House.

Dwivedi P, Dwivedi SK & Kalita MC. 2007. *Biodiversity and Environmental Biotechnology*. Scientific Publ.

Hemantarajan A. 2007. *Environmental Physiology*. Scientific Publ.

- Kumar HD. 1992. *Modern Concepts of Ecology*. 7th Ed. Vikas.Publ.
- Lenka D. 1998. *Climate, Weather and Crops in India*. Kalyani.
- Misra KC. 1989. *Manual of Plant Ecology*. 3rd Ed. Oxford & IBH.
- Pandey SN & Sinha BK. 1995. *Plant Physiology*. Vikas Publ.
- Sharma PD. 1998. *Ecology and Environment*. Rastogi Publ.
- Singh J & Dhillon SS. 1984. *Agricultural Geography*. Tata McGraw Hill.
- Taiz L & Zeiger E. 1992. *Plant Physiology*. Benjamin/Cummings Publ.

AGRON 603

CROP PRODUCTION AND SYSTEM MODELING

2+1

Objective

To familiarize the students about systems approach and to simulate yields and growth of several crops under varied soil and weather conditions with different management practices and their optimization.

Theory

UNIT I

Systems classification; flow charts, modeling techniques and methods of integration - state, rates and driving variables, feedbacks and relational diagrams.

UNIT II

Elementary models for crop growth based on basic methods of classical growth analysis.

UNIT III

Crop modeling methods for crop-weather interaction, climate change and variability components.

UNIT IV

Potential production: leaf and canopy CO₂ assimilation, respiration, dry matter accumulation, crop phenology and dry matter distribution and development in different crops.

UNIT V

Production by moisture availability, potential evapotranspiration, water balance of the soil, and production with nutrient and moisture limitations.

Practical

Simulation of elementary models for crop growth, Simulation of potential production, Simulation with limitations of water and nutrient management options, Sensitivity analysis using different climatic years and crop management practices

Suggested Readings

- Gordan G. 1992. *System Simulation*. 2nd Ed. Prentice Hall.
- Kropff MJ & Vann Laar HH. (Ed.). 1993. *Modelling Crop Weed Interactions*. ISBN.
- Mathews RB, Kropff MJ, Bachelet D & Vaan Laar HH. (Eds.). 1993.
- Modelling the Impact of Climate Change on Rice Production in *Asia*. CABI.

- Penning de Vries FWT & Van Laar HH. (Eds.). 1982. *Simulation of Plant Growth and Crop Production*. Wageningen Centre for Agricultural Publications and Documentation, Netherlands.
- Ritchie JT & Hanks J. 1991. *Modelling Plant and Soil Systems*. American Society of Agronomy, Madison.
- Zeigler BP. 1976. *Theory of Modeling and Simulation*. John Wiley & Sons.

AGRON 604 ADVANCES IN CROP GROWTH AND PRODUCTIVITY 2+1

Objective

To study the physiology of vegetative and reproductive growth in relation to productivity of different crops in various environments.

Theory

UNIT I

Plant density and crop productivity; plant and environmental factors, yield, plant distribution, strategies for maximizing solar energy utilization; leaf area; interception of solar radiation and crop growth; photosynthesis: the photosynthetic apparatus, factors essential for photosynthesis; difference in photosynthetic rates among and within species; physiological limitations to crop yield; solar radiation concept and agro-techniques for harvesting solar radiation.

UNIT II

Growth analysis: concept, CGR, RGR, NAR, LAI, LAD, LAR; validity and Limitations in interpreting crop growth and development; growth curves: sigmoid, polynomial and asymptotic; root systems; root-shoot relationship; principles involved in inter and mixed cropping systems under rainfed and irrigated conditions; concept and differentiation of inter and mixed cropping; criteria in assessing the yield advantages.

UNIT III

Competitive relationship and competition functions; biological and agronomic basis of yield advantage under intercropping; physiological principles of dry land crop production, constraints and remedial measures; heat unit concept of crop maturity: concept and types of heat units.

UNIT IV

Concept of plant ideotypes: crop physiological and new ideotypes; characteristics of ideotype for wheat, rice, maize, etc.; concept and types of growth hormones; their role in field crop production; efficient use of resources.

Practical

Field measurement of root-shoot relationship in crops at different growth stages, Estimation of growth evaluating parameters like CGR, RGR, NAR, LAI etc., at different stages of crop growth, Computation of harvest index of various crops, Assessment of crop yield on the basis of yield attributing characters, Construction of crop growth curves based on growth analysis data, Computation of competition functions, viz. LER, IER aggressivity competition index etc in intercropping, Senescence and abscission indices, Analysis of productivity trend in un-irrigated areas, Analysis of productivity trend in irrigated areas

Suggested Readings

- Chopra VL & Paroda RS. 1984. *Approaches for Incorporation of Drought and Salinity Resistance in Crop Plants*. Oxford and IBH.
- Delvin RM & Vitham FH. 1986. *Plant Physiology*. CBS Publ.
- Evans LT. 1975. *Crop Physiology*. Cambridge Univ. Press.
- Evans LT. 1996. *Crop Evolution, Adaptation and Yield*. Cambridge Univ. Press.
- Gupta US. (Ed.). 1995. *Production and Improvement of Crops for Drylands*. Oxford & IBH.
- Gupta US. 1988. *Progress in Crop Physiology*. Oxford and IBH.
- Kramer PJ & Boyer JS. 1995. *Water Relations of Plant and Soils*. Academic Press.
- Mukherjee S & Ghosh AK. 1996. *Plant Physiology*. Tata McGraw Hill.
- Narwal SS, Politycka B & Goswami CL. 2007. *Plant Physiology: Research Methods*. Scientific Publishers.

AGRON 605

IRRIGATION MANAGEMENT

2+1

Objective

To teach students about optimization of irrigation in different crops under variable agroclimatic conditions.

Theory

UNIT I

Water resources of India, irrigation projects; irrigation needs, atmospheric, soil, agronomic, plant and water factors affecting irrigation need; water deficits and crop growth.

UNIT II

Soil-plant-water relationships, transpiration and evapotranspiration, significance of transpiration, energy utilization in transpiration, physiological processes and crop productivity.

UNIT III

Infiltration; water movement under saturated and unsaturated conditions; management practices for improving water use efficiency of crops.

UNIT IV

Application of irrigation water, conveyance and distribution system, irrigation efficiency; agronomic considerations in the design and operation of irrigation projects; characteristics of irrigation and farming systems affecting irrigation management.

UNIT V

Strategies of using limited water supply; factors affecting ET, control of ET by mulching and use of anti-transpirants; fertilizer use in relation to irrigation; optimizing the use of given irrigation supplies.

UNIT VI

Land suitability for irrigation, land irrigability classification; integrated water management in command areas, institution of water management in commands, farmer's participation in command areas; irrigation legislation.

Practical

Determination of water infiltration characteristics and water holding capacity of soil profiles, Moisture extraction pattern of crops, Consumptive use, Water requirement of a given cropping pattern for optimum/variable productivity, Crop planning at the farm and project level, Agronomic evaluation of irrigation projects, Case studies

Suggested Readings

FAO. 1984. *Irrigation Practice and Water Management*. Oxford & IBH.

Michael AM. 1978. *Irrigation: Theory and Practice*. Vikas Publ.

Mishra RR & Ahmad M. 1987. *Manual on Irrigation and Agronomy*. Oxford & IBH.

Panda SC. 2003. *Principles and Practices of Water Management*. Agrobios.

Reddy SR. 2000. *Principles of Crop Production*. Kalyani.

Sankara Reddy GH & Yellamananda Reddy 1995. Efficient Use of Irrigation Water. In: Gupta US. (Ed.). *Production and Improvement of Crops for Drylands*. Oxford & IBH.

Singh SS. 2006. Principles and Practices of Agronomy. In: Gupta US.

(Ed.). *Production and Improvement of Crops for Drylands*. Oxford & IBH.

AGRON 606

ADVANCES IN WEED MANAGEMENT

2+0

Objective

To teach about the changing weed flora, new herbicides, their resistance, toxicity, antidotes and residue management under different cropping systems.

Theory

UNIT I

Crop-weed competition in different cropping situations; changes in weed flora, various causes and affects.

UNIT II

Physiological and biological aspects of herbicides, their absorption, translocation, metabolism and mode of action; selectivity of herbicides and factors affecting them.

UNIT III

Climatic factors and phytotoxicity of herbicides; fate of herbicides in soil and factors affecting them, residue management of herbicides, adjuvants.

UNIT IV

Advances in herbicide application techniques; herbicide resistance; antidotes and crop protection compatibility of herbicides of different groups; compatibility of herbicides with other pesticides.

UNIT V

Development of transgenic herbicide resistant crops; herbicide development, registration procedures.

UNIT VI

Relationship of herbicides with tillage, fertilizer and irrigation; bioherbicides, allelochemical herbicide bioassays.

Suggested Readings

- Aldrich RJ & Kramer R.J. 1997. *Principles in Weed Management*. Panama Publ.
- Ashton FM & Crafts AS. 1981. *Mode of Action of Herbicides*. 2nd Ed. Wiley-Inter Science.
- Gupta OP. 2000. *Weed Management – Principles and Practices*. Agrobios.
- Mandal RC. 1990. *Weed, Weedicides and Weed Control - Principles and Practices*. Agro-Botanical Publ.
- Rao VS. 2007. *Principles of Weed Science*. Oxford & IBH.
- Ross MA & Carola Lembi A. 1999. *Applied Weed Science*. 2nd Ed. Prentice Hall.
- Subramanian SAM & Kumar R.J. 1997. *All About Weed Control*. Kalyani.
- Zimdahl RL. 1999. *Fundamentals of Weed Science*. 2nd Ed. Academic Press.

AGRON 607

INTEGRATED FARMING SYSTEMS FOR SUSTAINABLE AGRICULTURE

2+0

Objective

To apprise about different enterprises suitable for different agroclimatic conditions for sustainable agriculture.

Theory

UNIT I

Farming systems: definition and importance; classification of farming systems according to type of rotation, intensity of rotation, degree of commercialization, water supply, enterprises.

UNIT II

Concept of sustainability in farming systems; efficient farming systems; natural resources - identification and management.

UNIT III

Production potential of different components of farming systems; interaction and mechanism of different production factors; stability in different systems through research; eco-physiological approaches to intercropping.

UNIT IV

Simulation models for intercropping; soil nutrient in intercropping; preparation of different farming system models; evaluation of different farming systems.

UNIT V

New concepts and approaches of farming systems and cropping systems and organic farming; case studies on different farming systems.

Suggested Readings

- Ananthakrishnan TN. (Ed.) 1992. *Emerging Trends in Biological Control of Phytophagous Insects*. Oxford & IBH.
- Balasubramanian P & Palaniappan SP 2006. *Principles and Practices of Agronomy*. Agrobios.
- Joshi M & Parbhakarasetty TK. 2005. *Sustainability through Organic Farming*. Kalyani.
- Lampin N. 1990. *Organic Farming*. Farming Press Books.
- Palaniappan SP & Anandurai K. 1999. *Organic Farming - Theory and Practice*. Scientific Publ.
- Panda SC. 2004. *Cropping systems and Farming Systems*. Agribios.
- Reddy MV. (Ed.). 1995. *Soil Organisms and Litter Decomposition in the Tropics*. Oxford & IBH.
- Sharma AK. 2001. *A Hand Book of Organic Farming*. Agrobios.
- Singh SP. (Ed) 1994. *Technology for Production of Natural Enemies*. PDBC, Bangalore.
- Trivedi RN. 1993. *A Text Book of Environmental Sciences*. Anmol Publ.
- Veeresh GK, Shivashankar K & Suiglachar MA. 1997. *Organic Farming and Sustainable Agriculture*. Association for Promotion of Organic Farming, Bangalore.
- Venkata Rao BV. 1995. *Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective*. Publ. 3. Parisaraprajna Parishtana, Bangalore.

AGRON 608

SOIL CONSERVATION AND WATERSHED MANAGEMENT

2+1

Objective

To teach about different soil moisture conservation technologies for enhancing the agricultural productivity through holistic approach watershed management.

Theory

UNIT I

Soil erosion: definition, nature and extent of erosion; types of erosion, factors affecting erosion.

UNIT II

Soil conservation: definition, methods of soil conservation; agronomic measures - contour cultivation, strip cropping, cover crops; vegetative barriers; improved dry farming practices; mechanical measures - bunding, gully control, bench terracing; role of grasses and pastures in soil conservation; wind breaks and shelter belts.

UNIT III

Watershed management: definition, objectives, concepts, approach, components, steps in implementation of watershed; development of cropping systems for watershed areas.

UNIT IV

Land use capability classification, alternate land use systems; agro-forestry; ley farming; *jhum* management - basic concepts, socio-ethnic aspects, its layout.

UNIT V

Drainage considerations and agronomic management; rehabilitation of abandoned *jhum* lands and measures to prevent soil erosion.

Practical

Study of different types of erosion, Field studies of different soil conservation measures, Run-off and soil loss measurements, Laying out run-off plot and deciding treatments, Identification of different grasses and trees for soil conservation, Visit to a soil conservation research centre, demonstration and training centre

Suggested Readings

- Arakeri HR & Roy D. 1984. *Principles of Soil Conservation and Water Management*. Oxford & IBH.
- Dhruvanarayana VV. 1993. *Soil and Water Conservation Research in India*. ICAR.
- FAO. 2004. *Soil and Water Conservation in Semi-Arid Areas*. *Soils Bull.*, Paper 57.
- Frederick RT, Hobbs J, Arthur D & Roy L. 1999. *Soil and Water Conservation: Productivity and Environment Protection*. 3rd Ed. Prentice Hall.
- Gurmel Singh, Venkataraman CG, Sastry B & Joshi P. 1990. *Manual of Soil and Water Conservation Practices*. Oxford & IBH.
- Murthy VVN. 1995. *Land and Water Management Engineering*. Kalyani.
- Tripathi RP & Singh HP. 1993. *Soil Erosion and Conservation*. Wiley Eastern.
- Yellamanda Reddy T & Sankara Reddy GH. 1992. *Principles of Agronomy*. Kalyani.

AGRON 609

STRESS CROP PRODUCTION

2+1

Objective

To study various types of stresses in crop production and strategies to overcome them.

Theory

UNIT I

Stress and strain terminology; nature and stress injury and resistance; causes of stress.

UNIT II

Low temperature stress: freezing injury and resistance in plants, measurement of freezing tolerance, chilling injury and resistance in plants, practical ways to overcome the effect of low temperature stress through, soil and crop manipulations.

UNIT II

High temperature or heat stress: meaning of heat stress, heat injury and resistance in plants, practical ways to overcome the effect of heat stress through soil and crop manipulations.

UNIT III

Water deficit stress: meaning of plant water deficient stress and its effect on growth and development, water deficit injury and resistance, practical ways to overcome effect of water deficit stress through soil and crop, manipulations.

UNIT IV

Excess water or flooding stress: meaning of excess water stress, its kinds and effects on crop plants, excess water stress injury and resistance, practical ways to overcome excess water stress through soil and crop manipulations.

UNIT V

Salt stress: meaning of salt stress and its effect on crop growth, salt stress injury and resistance in plants, practical ways to overcome the effect of salt stress through soil and crop manipulations.

UNIT VI

Mechanical impedance of soil and its impact on plant growth; measures to overcome soil mechanical impedance.

UNIT VII

Environmental pollution: air, soil and water pollution, and their effect on crop growth and quality of produce; ways and means to prevent environmental pollution.

Practical

Determination of electrical conductivity of plant cell sap, Determination of osmotic potential and tissue water potential, Measurement of transpiration rate, Measurement of stomatal frequency, Growing of plants in sand culture under salt stress for biochemical and physiological studies, Studies on effect of osmotic and ionic stress on seed germination and seedling growth, Measurement of low temperature injury under field conditions

Suggested Readings

Baker FWG.1989. *Drought Resistance in Cereals*. Oxon, UK.

Gupta U.S. (Ed.). 1988. *Physiological Aspects of Dryland Farming*. Oxford & IBH.

Kramer PJ.1983. *Water Relations of Plants*. Academic Press.

Levitt J. 1980. *Response of Plants to Environmental Stresses*. Vols. I, II. Academic Press.

Mavi HS.1978. *Introduction to Agro-meteorology*. Oxford & IBH.

Michael AM & Ojha TP.1981. *Principles of Agricultural Engineering*. Vol II. Jain Bros.

Nilsen ET & Orcut DM. 1996. *Physiology of Plants under Stress - Abiotic Factors*. John Wiley & Sons.

Singh K. 2000. *Plant Productivity under Environmental Stress*. Agribios.

Singh KN & Singh RP. 1990. *Agronomic Research Towards Sustainable Agriculture*. Indian Society of Agronomy, New Delhi.

Somani LL & Totawat KL. 1992. *Management of Salt-affected Soils and Waters*. Agrotech Publ.

Virmani SM, Katyal JC, Eswaran H & Abrol IP.1994. *Stressed Ecosystem and Sustainable Agriculture*. Oxford & IBH.

List of Journals

Advances in Agronomy
Agriculture, Ecosystems and Environment
Agricultural Systems
Agricultural Water Management
Agronomy Journal
Annual Review of Plant Physiology
Applied Ecology and Environment

Research

Australian Journal of Agricultural Research
Australian Journal of Experimental

Agriculture

Crop Protection
Environment and Ecology
European Journal of Agronomy
Fertilizer Research
Field Crops Research
Indian Journal of Agricultural Sciences
Indian Journal of Agronomy
Indian Journal of Ecology
Indian Journal of Weed Science
Irrigation Science
Japanese Journal of Crop Science
Journal of Agronomy
Journal of Applied Ecology
Journal of Experimental Botany
Journal of Farming Systems Research
Journal of Range Management
Journal of Agricultural Science

Cambridge

Journal of Sustainable Agriculture
Netherlands Journal of Agricultural

Sciences

Nutrient Cycling in Agroecosystems
Pesticide Biochemistry and Physiology

Plant and Soil

Plant Production Science

Soil and Tillage Research

Swedish Journal of Agricultural

Research

Tropical Agriculture

Weed Research

Suggested Broad Topics for Master's and Doctoral Research

Crop diversification under different agricultural situations

Development of farming systems for marginal, small and other farmers

Agricultural information at door step/click of mouse

Farm-specific nutrient management

Weed management in different cropping/farming systems

Nutrient studies in different cropping/farming systems

Biodiversity of farming systems for conservation

Organic farming systems for different regions

Modeling for different crop situations

Conservation agriculture for yield sustainability

Role of edaphic factors on weeds proliferation and management

Implications of global warming on weed growth and herbicide behaviour

Ecological implications of using thresholds for weed management

Effect of cultivation practices and herbicides on weed flora shift

GM crops and weed management strategies

Weed management under reduced moisture regime in major summer/*kharif* crops

Avoidance of herbicide resistance using IWM