

AGRICULTURE

LIST OF COURSES

Sl. No.	Course Code	Name of the Course	Credits
1	17AG1001	Principles of Agronomy and Agricultural Heritage	3:0:1
2	17AG1002	Agricultural Microbiology	3:0:1
5	17AG1003	Fundamentals of Plant Biochemistry	3:0:1
6	17AG1004	Agricultural Meteorology	3:0:1
7	17AG1005	Irrigation Water Management	3:0:1
8	17AG1006	Crop Physiology	3:0:1
9	17AG1007	Principles of Genetics and Genomics	3:0:1
10	17AG1008	Principles of Agricultural Economics	3:1:0
11	17AG1009	Dimensions of Agricultural Extension	2:0:1
12	17AG1010	Principles of Horticultural Sciences	2:0:1
13	17AG1011	Introduction to Soil Science	3:0:1
14	17AT1001	Introduction to Agriculture	2:0:0
15	17HO1001	Botany of Horticultural Crops	3:0:0
16	17HO1002	Propagation of Horticultural Crops	2:0:1
17	17HO1003	Production Technology of Tropical Fruit Crops	2:0:1
18	17HO1004	Production Technology of Tropical Vegetable Crops	2:0:1

17AG1001 PRINCIPLES OF AGRONOMY AND AGRICULTURAL HERITAGE

Credits: 3:0:1

Course Objectives:

- To have a general understanding on the crops and their classification
- To apprise the student about planting of crops and application of fertilizers
- To familiarize the students with the traditional agricultural practices in the world

Course outcome:

- Basics of crop characteristics and classification understood
- Fundamentals of soil-water-plant relationship studied
- Best traditional practices learned

Description:

Meaning, definition and scope of agronomy. Relationship with other disciplines / divisions of agronomy- Classification of crop / plants based on the intensity of cultivation, uses, life span, growth habit, and climatic response and/or habitat. Agronomic classification of crops. Botanical classification. Category of cultivars - classification of crops based on special purpose. Growth - definition - factors affecting growth - Crop yield contributing characters - harvest index - Seed - definition - characteristics of good quality seed - vegetative propagation in field crops - setts, slips, tubers, and rhizomes - methods of sowing / planting - planting geometry and its effect on growth and yield - Tillage definition - objectives - types of tillage- tillage implements - tillage - characteristics of good tillage - Soil productivity and fertility- Crop nutrition - nutrients - classification - Nutrient sources - organic manures - fertilizers - biofertilizers - Integrated Nutrient Management Agricultural Heritage: history of agriculture in India - Traditional water lifting devices-best traditional water harvesting practices. Ancient irrigation structures in India-Water management during Indus valley civilization period and agriculture in Saptha saindhava.

Practical:

Visit to crop field and identification of crops- Study on field preparation: tillage implements - ploughs, harrows and cultivators - Practice of ploughing; Practice of puddling; Study of seeding equipment. Different methods of sowing crops-direct seeding: broadcasting, dibbling and drilling-transplanting. Identification of manures and fertilizers - organic manures: bulky and concentrated-fertilizers: Straight, complex and mixed fertilizers - Fertilizer recommendation and calculation of doses for rice, coconut, cassava, banana and cowpea. Methods of application of fertilizers broadcasting, placement, foliar application and fertigation - Visit to experimental plots to study design and layout - yield estimation of crops.

References:

1. Vishwakarma, A.K., Gopal Kumar, Brajendra, 2015, Agronomy A to Z, Biotech Books, New Delhi
2. Patil, J.V. et. al., 2015, Key Notes on Agronomy, Daya Publishing House, Delhi
3. Balasubramaniyan, P and Palaniappan, S.P. 2001. Principles and Practices of Agronomy. AgroBios (India) Ltd., Jodhpur
4. Brady, N.C. and Well, R.R. 2002. The Nature and Properties of Soils (13th ed.). Pearson Education, Delhi
5. De, G.C. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co., New Delhi
6. Gupta, O.P. 2000. Weed Management - Principles and Practices. Agrobios (India) Ltd., Jodhpur
7. Havlin, J. L., Beaton, J. D., Tisdale, S.L., and Nelson, W.L. 2006. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (7th ed.). Pearson Education, Delhi
8. KAU [Kerala Agricultural University]. 2016. Package of Practices Recommendations. Kerala Agricultural University, Thrissur
9. Rao, V.S. 2000. Principles of Weed science. Oxford & IBH Publishing Co. New Delhi
10. Reddy.T.Y and Reddy, G.H.S. 1995, Principles of Agronomy, Kalyani Publishers, Ludhiana
11. Reddy.S.R. 1999. Principles of Agronomy, Kalyani Publishers, Ludhiana
12. Sankaran, S. and Subbiah Mudaliar, V.T. 1991. Principles of Agronomy. The Bangalore Printing & Publishing Co., Bangalore
13. Thomas, C.G. and Abraham, C.T. 1998. Common Weeds of Rice Ecosystem and Their Management. Kerala Agricultural University, Thrissur
14. Thomas, C.G. and Abraham, C.T. 2007. Methods in Weed Science. Kerala Agricultural University, Thrissur

17AG1002 AGRICULTURAL MICROBIOLOGY**Credits: 3:0:1****Course Objectives:**

- To learn about germ theory of the diseases
- To have a general understanding on soil microbiology
- To study the beneficial use of micro-organisms

Outcome:

- Germ theory studied
- Action of microbes in soils understood
- Beneficial use of microbes learned

Description:

Introduction to microbial world - history of microbiology – Spontaneous generation theory – prokaryotic and eukaryotic microorganisms – bacterial cell - morphology and structure - germ theory of disease - protection against infections – applied areas of microbiology - metabolism in bacteria - ATP generation - chemoautotrophy, photoautotroph, respiration, fermentation – bacteriophages - structure and properties of bacterial viruses – lytic and lysogenic cycles - viroids, prions. Bacterial genetics – gene expression - genetic recombination - transformation, conjugation and transduction. Genetic engineering: plasmids, episomes - genetically modified organisms. Soil microbiology: microbial groups in soil - microbial transformations of carbon, nitrogen, phosphorus and sulphur - biological nitrogen fixation - microflora of rhizosphere and phyllosphere microflora - microbes in composting - microbiology of water; Microbiology of food: role of microbes in fermentation - microbial spoilage and principles of food preservation. Beneficial microorganisms in agriculture - biofertilizer (bacterial, cyanobacterial and fungal) - microbial insecticides - microbial agents for control of plant disease – biodegradation - biogas production - biodegradable plastics. Plant microbe interactions: beneficial – symbiotic, associative and non-symbiotic – PGPR – plant pathogens. Endomycophytic bacteria

Practical

Familiarization with instruments, materials, glassware etc. in a microbiology laboratory - practice of aseptic methods: I - evaluation of aseptic technique with nutrient broth tubes. II- evaluation of aseptic technique with a nutrient agar plate - methods of sterilization and preparation of media I- preparation of nutrient broth, nutrient agar plates, nutrient agar slant and nutrient agar stab; II- sterilization of glassware by dry heating; III - sterilization of nutrient broth by filtration - plating methods for isolation and purification of bacteria I - isolation of bacteria by streak plate method. II - isolation of aerobic spore forming bacteria by enrichment using streak plate method. III -

checking of purity of a bacterial culture by streak plating method - identification of bacteria by staining methods and biochemical tests: I- morphological examination of bacteria by simple and differential staining. II – different biochemical tests for identification of bacterial culture; enumeration of bacteria: I - enumeration of bacteria by stain slide method. II- enumeration of bacteria by most probable number method. III -enumeration of bacteria by pour plate method and spread plate method.

References

1. Ram Chandra, 2015, Microbial Biodiversity in Sustainable Agriculture, Daya Publishing House, Delhi
2. Lakhman, H. C., 2015, Recent Trends in Microbiology Mycology and Plant Pathology, Daya Publishing House, Delhi
3. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
4. Stanier, R.Y., Ingraham, Wheelis, M.G. and Paintor, P.R. 1986. The Microbiology World. Prentice Hall, New Jersey.
5. Tauro, P., Kapoor, K.K. and Yadav, K.S. 1989. An Introduction to Microbiology. Wiley Publications, New Delhi.
6. Alexander, M. 1985. Introduction to Soil Microbiology. John Wiley & Sons, New York.
7. Subba Rao, N.S. 1999. Biofertilizers in Agricultural and Agroforestry. Oxford & IBH, New Delhi.
8. Deepak Kumar Verma, Balaram Mohapatra, Shikha Srivastava, Sashi kanta Dash, Ajay Veer Singh, Bavita Asthir, Dinesh Narayan Bharadwaj, 2013, Objective Agricultural Microbiology at a Glance, First Edition, Scientific International (Pvt.) Ltd., Delhi

17AG1003 FUNDAMENTALS OF PLANT BIOCHEMISTRY

Credits: 3:0:1

Course Objectives:

- To impart knowledge on plant cells, proteins and biosynthesis
- To educate on the importance of proteins, enzymes and lipids
- To impart knowledge on biosynthesis

Course Outcome:

- Basic understanding imparted on plant cells, proteins, industrial applications and biosynthesis
- The students learnt the importance of plant cells
- Basics of protein enzymes and lipids understood
- Familiarized with the application of bio-molecules in industry

Description:

Biochemistry – introduction and importance. Plant cell, cell wall and its role in livestock, food and paper industries. Bio-molecules – Structure, properties and applications: Amino acids, peptides and proteins –Plant proteins and their quality. Enzymes –Factors affecting the activity, classification, immobilisation and other industrial applications. Lipids –Acyl lipids, their industrial application in soaps, detergents, paints, varnishes, lubricants, adhesives, plastics, nylon, bio-diesel, biodegradable plastics etc. Carbohydrates; Nucleotides and Nucleic acids. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. General reactions of amino acid degradation. Biosynthesis – carbohydrates, lipids, proteins and nucleic acids. Metabolic regulation. Secondary metabolites, Terpenoids, Alkaloids, Phenolics and their applications in food and pharmaceutical industries.

Practical

Amino acid models (atomic); Paper electrophoresis for the separation of plant pigments; Protein denaturation – heat, pH, precipitation of proteins with heavy metals, Protein estimation by Lowry method; Enzyme kinetics, competitive inhibition, enzyme immobilization; Extraction of nucleic acids, column chromatography of RNA hydrolysate; Characterization of lipids by T.L.C.; Extraction of oil from oil seeds; Estimation of fatty acids by G.L.C.; Models of sugars, sucrose and starch; Quantitative determination of sugars; Paper chromatography for the separation of sugars; Determination of phenols.

References

1. Dutcher, Raymond Adams et. al., 2014, Biotech Books, New Delhi

2. Chavan, U. D., Patil, J. V., 2015, Key Notes on Biochemistry and Biotechnology, Daya Publishing House, Delhi
3. Conn, E.E and Stumpf, P.K. 1989. Outline of Biochemistry. Wiley Eastern Ltd., New Delhi.
4. Frank M. Mallette, Paul M. Althouse and Carl O. Glagett. 1960. Biochemistry of Plants and Animals. Published by Wiley Pvt Ltd., New Delhi
5. Jain, J.L. 2001. Fundamentals of Biochemistry. 5th Edn., S.Chand & Company, New Delhi
6. Lehninger, A. 1984. Principles of Biochemistry. Published by CBS Publishers and Distributors, New Delhi
7. Mazur, A and Harrows, B. 1971. Textbook of Biochemistry. W.B. Sanders Publications, New Delhi
8. Metha, S.L, Lodha, M.L and Sane, P.V. 1993. Recent Advances in Plant Biochemistry. ICAR, New Delhi
9. Hans-Walter Heldt ,2005, Plant biochemistry, Academic Press

17AG1004 AGRICULTURAL METEOROLOGY

Credits: 3:0:1

Course Objectives:

- To understand the role of meteorology in plant science
- To learn climatic parameters and their measurements
- To study the fundamentals of global warming and climate change

Course Outcome:

- Agro-climatic factors understood
- Measurement and estimation techniques for climatic parameters learned
- Fundamentals of global warming and climate change studied

Description:

Introduction to meteorology and agricultural meteorology - Scope and importance of agricultural meteorology - Composition of atmosphere - role of greenhouse gases in global cooling and warming - concept of weather and climate - Micro-meso-macro and phyto climates - Electromagnetic spectrum. Nature and properties of solar radiation - shortwave radiation and long wave radiation – Radiation balance - response of plants to solar radiation and photosynthetically active radiation - Thermal structure of atmosphere - vertical profiles - factors affecting surface air temperature - spatial and temporal variations in surface air temperature - soil temperature and its variations. Atmospheric pressure and its variation with height - global distribution of pressure and wind - atmospheric humidity - saturation and actual vapour pressure - relative humidity and dew point temperature. Cloud classification and measurements - cloud seeding - Rainfall and its mechanisms - forms and types of rainfall – Indian monsoons - southwest monsoon - northeast monsoon - monsoon variability across Tamil Nadu and India - Rainfall over India and Tamil Nadu- Importance of weather forecasting in agriculture - weather service to farmers - agricultural seasons - crop weather diagrams and calendars – crop weather relationships. Role of weather on insect pest and diseases - weather and climate related natural disasters, risk and management - Climate change and global warming - weather modification - Introduction to remote sensing.

Practical:

Meteorological and agrometeorological stations - Types of agricultural meteorological stations - Selection of site and layout of agro meteorological stations - Measurement of atmospheric variables - Air temperature and soil temperature - Relative humidity - Determination of vapour pressure - Measurement of wind speed and direction - Measurement of rainfall and open pan evaporation - Installation of soil thermometers and measurement - sunshine recorder and measurement of sunshine duration - Automatic Weather Station - recording of weather data - tabulation - processing and presentation - Preparation of crop weather calendars.

References:

1. Khanna, D R et al, 2013, Climate Change Effects on Agriculture and Economy, Biotech Books, New Delhi
2. Das.P.K. 1968. The Monsoons. NBT, New Delhi
3. Khadekar, S.R. 2001. Meteorology. Agromet Publishers, Nagpur
4. Mavi, H.S. 1986. Introduction to Agrometeorolgy. Oxford & IBH Publishing Co. New Delhi
5. Menon, P.A. and Rajan, C.K. 1989. Climate of Kerala. Classic Publishing House, Kochi
6. Prasada Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Second Edition. Kerala Agricultural University, Thrissur.

7. Sachati, A.K. 1985. Agricultural Meteorology – Instruction-cum-practical manual, NCERT, New Delhi
8. Varshney, M.C. and Balakrishna Pillai, B. 2003. Textbook of Agricultural Meteorology. ICAR, New Delhi.
9. Venketaraman, S. and Krishnan, A. 1992. Crops and Weather. ICAR, New Delhi.
10. Wilsie, P.C. 1961. Crop Adaptation and Distribution. Eurasia Publishing House (P) Ltd., New Delhi

17AG1005 IRRIGATION WATER MANAGEMENT

Credits: 3:0:1

Course Objectives:

- To introduce soil-water-plant relationships in the context of irrigation
- To introduce the concepts of scheduling, water distribution, design and methods of irrigation
- To have practical knowledge on drip and sprinkler irrigation

Course Outcome:

- Students learnt estimation of crop water and irrigation requirements
- Students enabled in implementing irrigation schemes
- Students capacitated in selecting appropriate irrigation methods

Description:

Irrigation: need, importance, impact on development of humanity, development in India; National Water Policy and irrigation. Canal, tank irrigation. Crop water requirement of different crops; infiltration; soil-water-plant relationships; soil quality; Duty of water; supply and demand based water distribution; irrigation scheduling; frequency and interval of irrigation; Warabandhi system. Different irrigation methods: border irrigation, furrow irrigation, basin irrigation, drip and sprinkler irrigation; irrigation methods: consideration of slope, soils and climate, evaluation, wetting pattern and planting techniques, efficiency; case studies.

Practicals

Visit to farm and demonstration of basin, drip and sprinkler irrigation in the field; conducting pumping test; planning, design and estimation related to drip irrigation.

Reference

1. Lamm, Freddie R., et. al., 2013, Microirrigation for Crop Production: Design Operation and Management, Bio-Green Elsevier (Exc)
2. Majumdar D. P., 2005, Irrigation Water Management: Principles and Practices, Prentice Hall of India, New Delhi
3. Dewasish Choudhary, 2008, Irrigation Theory and Practice, Anmol Publications Pvt Ltd
4. Michael A.M., 1999, Irrigation Theory and Practice, Vikas Publishing House, New Delhi
5. Van den Bosch B.E., Hoevenaars J. and Broumer C., 1999, Irrigation Water Management Training Manual, No.1 to 7, FAO, Rome.
6. Asawa G.L., 1996, Irrigation Engineering, New Age International Private Limited, New Delhi.

17AG1006 CROP PHYSIOLOGY

Credit 3:0:1

Course Objectives:

- To introduce the students to seed physiology and biochemical changes during seed development.
- To understand growth and growth characteristics
- To impart knowledge on basic nutriophysiology

Course Outcome:

- Knowledge gained on different aspects of seeds
- Study growth pattern of plants
- Learned nutriophysiology

Description:

Seed physiology, seed structures - morphological, physiological and biochemical changes during seed development - physiological maturity, harvestable maturity, seed viability and vigour. Methods of testing seed viability and vigour, germination, utilization of seed reserves during seed germination. Morphological, physiological and biochemical changes during seed germination. Measurement of growth, growth analysis growth characteristics. Crop water relations. Transpiration - significance. Photosynthesis, energy synthesis, photosynthetic efficiency, photorespiration. Brief account of growth respiration and maintenance respiration, alternate respiration. Physiology of nutrient uptake – functions of plant nutrients – deficiency and toxicity symptoms of plant nutrients – foliar nutrition – hydroponics. Post harvest physiology – Factors influencing seed storage (ISTA standards). Fruit ripening - metamorphic changes – climateric and non-climateric fruits.

Practicals:

Study of plant cells; Preparation of standard solutions; Structure and distribution of stomata, imbibition, osmosis and plasmolysis, measurement of root pressure, rate of transpiration; Separation of photosynthetic pigments through paper chromatography; Estimation of chlorophyll; Rate of transpiration; Photosynthesis, respiration, tissue test for mineral nutrients; Estimation of RWC; Measurement of rate of photosynthesis by IRGA; Estimation of hormone using bioassay.

References

1. Singh, Amrit Lal, Recent Advances in Crop Physiology (Vol.1), 2014, Daya Publishing House, Delhi 2014
2. Devlin R.M. 1979. Plant Physiology, II Edn, Affiliated East West Press, New Delhi
3. Noggle G.R. & Fritz G.J. 1992. Introductory Plant Physiology, II Edn. Prentice Hall of India (P) Ltd., New Delhi
4. Milthroe, F.L. and Marby, J. 1979. An Introduction to Crop Physiology, Cambridge University Press, London
5. Devlin R. M. and Witham F. H. 1983. Plant Physiology, 4th Edn., CBS Publishers and Distributors, New Delhi
6. Gupta .N.K and Sunita Gupta.2002. Plant Physiology. Oxford & IBH Publishing Co.Pvt.Ltd.NewDelhi.
7. Malick, C.P and Srivastava, A.K.. 2000, Text book of Plant Physiology, Kalyani Publishers, New Delhi.
8. Taiz, Land Zeiger, E. 2014. Plant Physiology. Sinauer Associates Publishers Inc., Publishers

17AG1007 PRINCIPLES OF GENETICS AND GENOMICS**Credits 3:0:1****Course Objectives:**

- To impart knowledge on structure of genes and type of genes action
- To make the student understand chromosome, structure, morphology, number and types
- To learn basics of DNA, RNA and fundamentals of transcription, translation, genetic code and outline of protein synthesis

Course Outcome:

- Mendel's laws and types of gene action studied
- Basics of DNA, RNA and fundamentals of transcription, translation, genetic code and protein synthesis learned, as also evolution of different crop species understand
- Chromosomal aberrations and evolutions of different crop species studied

Description:

Mendel's laws of inheritance and exceptions to the laws. Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits and Qualitative traits. Multiple factor hypothesis: cytoplasmic inheritance – important features and difference from chromosomal inheritance. Mutation and its features; Methods of inducing mutations and CIB technique. Fine structure of gene; gene expression regulation and differential gene activation; Ultra structure of cell and cell organelles and their functions. Study of chromosome structure - morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis - their significance and differences. DNA - its structure and function – types of DNA – modes of replication and repair. RNA - its structure, function and types; transcription, translation, genetic code and outline of protein synthesis. Linkage and crossing: types of linkage, over estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like cotton, wheat, tobacco, triticale and brassicas. Structural chromosomal aberrations.

Practicals:

Microscopy-Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identification of various stages of mitosis and meiosis; Monohybrid ratio and its modifications; Dihybrid ratio and its modifications; Trihybrid ratio; Chi-square analysis, Interaction of factors; Epistatic factors, Supplementary factors and duplicate factors; complementary factors; additive factors and inhibitory factors.

References:

1. Singh, Upadhyaya Bisht, 2015, Genetic and Genomic Resources of Grain Legume Improvement, Elsevier-Biogreen
2. Sharma, Ramnivas, 2006, Agricultural Science: Gene Sequencing and Mapping, Biotech Books, New Delhi
3. Acquaah, G. 2007. Principles of Plant Genetics and Breeding, Blackwell Publishing Co., New Delhi
4. Gardner, J., Simmons, M. J. and Snustad, D. P. 2009. Principles of Genetics (8th Ed.). Wiley India Pvt. Ltd., New Delhi.
5. Gupta, P.K. 1999. Cytogenetics. Rastogi Publishers, Meerut.
6. Krebs, J. E., Goldstein, E. S. and Kilpatrick, S. T. 2014. Lewin's Genes.XI . Jones and Bartlett India Pvt. Ltd., New Delhi.
7. Pierce, B. A. 2014. Genetics - A Conceptual Approach, W.H. Freeman & Company, California
8. Singh, B.D. 2000. Fundamentals of Genetics (6th Ed.). Kalyani Publishers, Ludhiana
9. Singh, P. 1995. Elements of Genetics. Kalyani Publishers, Ludhiana.
10. Stansfield, W.D. 1986. Schaum's Outline of Theory and Problems of Genetics. Mc GrawHill Book Co., Singapore.
11. Strickberger, M.W.1996. Genetics (3rd Ed.). Mc Millan Publishing Co., New Delhi.
12. Swanson, C.P., Merz,T. and Young, J. 1975. Cytogenetics. Prentice Hall of India Pvt. Ltd., New Delhi.
13. Winchester, A.M.1967. Genetics (3rd Ed.). Oxford and IBH Publishing Co., New Delhi.

17AG1008 PRINCIPLES OF AGRICULTURAL ECONOMICS**Credits: 2:1:0****Course Objectives:**

- To highlight the importance of agricultural economics
- To familiarize with different theories and laws in economics applicable to agriculture
- To learn the basics of public finance and welfare economics in relation to agriculture

Course Outcome:

- Basics of agricultural economics and fundamentals of welfare economics studied
- Theories and laws applicable to agriculture economics learned
- Gained knowledge on public finance and welfare economics in relation to agriculture

Description:

Economics: Meaning, definition, subject matter. Divisions of economics -importance of economics. Agricultural economics - meaning, definition- Basic concepts -goods, service, utility, value, price, wealth, welfare. Wants - meaning, characteristics, classifications of wants, importance. Theory of consumption; Law of diminishing marginal utility: meaning, definition, assumption, illustration, limitations, law of equimarginal utility-importance. consumer surplus: meaning, definition, importance. Demand: meaning, definition, kinds of demand, demand schedule, demand curve, law of demand, extension and contraction vs increase and decrease in demand. Elasticity of demand: types of elasticity of demand, degrees of price elasticity of demand, methods of measuring elasticity, factors influencing elasticity of demand, importance of elasticity of demand. Supply: meaning, supply function-law of supply - factors influencing Production: meaning, factors of production- land, labour, capital, organization, entrepreneurship.- Distribution: rent, wages, interest, profit. National income: definition and concepts. Public finance: meaning. Public resource: meaning – sources. Taxation types; Public expenditure: meaning, principles, Money: meaning – evolution. Inflation: definition, types of inflation.- Welfare economics: meaning and basic concepts.

References:

1. Sharma, Pawan Kumar, Dwivedi, Sudhakar, Bhat, Anil, 2014, Practicals in Agricultural Economics, Daya Publishing House, Delhi
2. Chavan, U.D. et. al., 2015, Key Notes on Agricultural Economics, Business Management and Statistics (PB), Daya Publishing House, Delhi
3. Dewett, K.K. 2005. Modern Economic Theory. S. Chand, New Delhi.
4. Dewett, K.K., Verma. 2004 Elementary Economic Theory, S.Chand, New Delhi
5. Jhingam, M.L. 2001. Micro Economic Theory. Konark Publishers, New Delhi
6. Kenneth, E.B. 1941. Economic Analysis. Harper and Row, New York.
7. Reddy, S., Raghuram, P., Neelakantan, T.V., Bhavani D. I. 2004. Agricultural Economics, Oxford and IBH Publishers, New Delhi.

17AG1009 DIMENSIONS OF AGRICULTURAL EXTENSION**Credits: 2:0:1****Course Objective:**

- To orient the students with the concept of extension education and its importance in agriculture development
- To expose the students with various rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis
- To make the students learn about the new innovations being brought into the Agricultural Extension in India

Course Outcome:

- Students learned the concepts of agricultural extension and rural development programs
- New innovations in the area of agricultural extension in India understood
- Gained practical knowledge on watershed development and self-help groups

Description:

Education: meaning, definition, types. Formal, Informal and Non-formal education and their characteristics. Extension Education and Agricultural Extension: meaning, definition, concepts, objectives and principles. Rural development: meaning, definition, concepts, objectives, importance and problems in rural development. Developmental programmes of pre-independence era - Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme. Development programmes of post-independence era, Firka Development, Etawah- Pilot project and Nilokheri Experiment. Community Development Programme: meaning, definition, concepts, philosophy, principles, objectives, differences between community development and extension education. National Extension service. Panchayat Raj system: meaning of Democratic Decentralization and Panchayat Raj, Three tiers of Panchayat Raj system: power, functions and organizational setup. Agricultural Development Programmes with reference to year of start, objectives and salient features - Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP), ATMA, ATIC, Social Justice and Poverty alleviation programmes, Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jayanti Gram Swaraj Yojana (SGSY), Prime Minister Employment Yojana (PMEY). New trends in extension, privatization. Women Development programmes Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS) and Mahila Samridhi Yojana (MSY). Reorganized extension system (T & V System)- Salient features, Fort night Meetings, Monthly workshops, Linkages: merits and demerits. Emergence of Broad Based Extension (BBE).

Practicals:

Visits to a village and kisan mandal to study the ongoing development programmes. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayats (GP) and Zilla Praja Parishad (ZPP). Visit and study the District Rural Development Agency (DRDA). Participation in monthly workshops of Training and Visit (T&V) System. Visit to Watershed Development Project area. Visit to a village to study the Self Help Groups (SHGs) of DWCRA. Visit to a voluntary organization to study the developmental activities. Organizing PRA techniques in a village to identify the agricultural problems. Visit to villages.

Reference:

1. Singh, Vir et. al., 2015, Extension for Agriculture and Rural Development, Biotech Press
2. Singh, Ashok K, 2014, Extension Strategies for Agriculture and Rural Development, Daya Publishing House, Delhi
3. Dileep Kumar, Khajan Singh, 2012, Agricultural Extension: Innovations and Dimensions, Satish Serial Publishing House
4. Patel, M.M., Badodya, S. K., Gujpta, Shobhana, 2014, Participatory Approaches for Transfer of Agricultural Technology, Biotech Books, New Delhi
5. Singh A.K. et. al., 2015, Dynamics of Agricultural Extension Approaches, Biotech Books, New Delhi
6. O.P.Dahama & O.P. Bhatanagar, 2014, Education and Communication for Development, Oxford & Ibh Publishing Co Pvt Ltd

17AG1010 PRINCIPLES OF HORTICULTURAL SCIENCES**Credits 3:0:1****Course Objectives:**

- To teach fundamentals of horticulture and horticultural practices
- To impart knowledge on different types of plant propagation and also structures used in farms
- To expose the students to different horticulture vegetables, fruits, species, aromatic and medicinal crops

Course Outcome:

- Fundamentals of horticulture and classification of crops learned
- Different types of plant propagation techniques and structures used in the farm studied
- Gained practical knowledge in plant propagation and pest and disease control

Description:

Horticulture, vegetables, fruits, spices, aromatic and medicinal plants and floriculture, plantation crops, tuber crops, bamboo and mushroom - definition, evolution, art, science, vocation, hobby, etc. Importance, divisions, classification of crops; Commercial orchards, garden and plantations. Selection of site for crops - climate, soil, socio-economic factors; Orchard planning, layout, peg marking, planting systems, spacing, digging pits, age of planting materials, after care, inter cropping, mixed cropping, etc. Tree forms and functions training and pruning in horticultural crops, principles and methods. Techniques of training and pruning – root pruning, girdling, ringing, notching, smudging, and bending, thinning - chemical and mechanical. Phases of growth and development: vegetative / reproductive balance; flowering, bearing habit and its classification; Fruit set - carbon nitrogen relation, structure and process in relation to set and drop, factors affecting and measures to overcome drop; Problems of unfruitfulness - internal factors, external factors – measures to overcome; Seedlessness in horticultural crops - significance and induction; Plant growth regulators in horticulture - natural and synthetic regulators - preparation and methods of application; Plant propagation - definition and basic concepts, types - advantages and disadvantages; Potting and repotting - objectives and uses, containers and potting media/ mixture - kinds, qualities, pre-planting treatments; Propagation by seed - seed qualities, seed testing, seed germination - types of seed dormancy, pre-sowing treatments – factors affecting germination. Asexual propagation - apomixis, polyembryony, plant modifications for vegetative propagation - bud sports, chimeras. Propagation by cuttings - types of cuttings - factors affecting rooting of cuttings. Propagation by layering - advantages and disadvantages -types of layering. Propagation by grafting - advantages and disadvantages, stock - scion relationships, incompatibility; Grafting and budding - methods - advantages and disadvantages - separation and after care; Plant propagating structures - green house/ glass house, hot bed, cold frame, lath house, net house, mist chamber; Nursery - site selection, lay-out, components, progeny orchards, sales unit, display area, management, maintenance, commercial propagation of selected horticultural plants; Micro propagation of horticultural plants - definition, principles, methods, advantages and disadvantages, field of application in horticultural crops.

Practicals

Practice in propagation of plants through seeds. Familiarization with media , implements and containers for plant propagation. Studies on seed testing, certification and storage. Practice in rootstock production, vegetative propagation methods – cutting, budding, grafting layering etc. separation of propagules. Use of growth regulators for plant propagation. Study of propagation through tissue culture. Studies on preparation of designs and estimates for establishment of plant propagation unit, plant growing structures and tissue culture unit. Identification of common pests and diseases in nursery plants and their control. Visit to different types of nurseries, selection of site and

layout– Familiarization with components of nurseries– handling, display and sales of plants – cultural practices – Estimation of production costs for different kinds of planting materials. Practice of potting /bagging, re-potting etc. Packing and transport of nursery materials. Practice in tissue culture laboratory. Registers to be maintained in a commercial nursery. Visit to different nurseries (both government and private).

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13. Leopold, A.C. and Kriedeman, P.E. 1975. Plant Growth and Development. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
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17AG1011 INTRODUCTION TO SOIL SCIENCE

Credits: 3:0:1

Course Objectives:

- To highlight the physical properties of soils
- To understand soil-water interaction and thermal properties of soil
- To study the chemical and biological aspects of soil

Course Outcome:

- Students made familiar with the role of soils in agriculture
- Familiarized with physical, chemical, biological aspects of soil and soil-water-plant interaction
- Learned soil biology including the beneficial and harmful role of soil organism

Description:

Soil-Pedological and edaphological concepts -origin of the earth - earth's crust - composition. Rocks and minerals. Weathering - soil formation - factors and processes - components of soils -soil profile. Soil physical properties - soil texture - textural classes - particle size analysis. Soil structure classification - soil aggregates – significance. Soil consistency - soil crusting. Bulk density and particle density of soils and porosity – their significance and manipulation. Soil compaction - soil colour. Elementary knowledge of soil classification. Soils of India - geological formations – characterization of soils of Tamil Nadu. Soil water - retention and potentials - soil moisture constants - movement of soil water – infiltration – percolation – permeability – drainage - methods of determination of soil moisture. Thermal properties of soils - soil temperature - soil air - gaseous exchange - influence of soil temperature and air on plant growth. Soil colloids – properties – nature - types and significance. Layer silicate clays - their genesis and sources of charges. Adsorption of ions - ion exchange - CEC and AEC - factors influencing ion exchange and its significance. Concept of pH - soil acidity – brief overview of saline, sodic and calcareous soils.

Soil organic matter – composition – decomposability – humus - fractionation of organic matter. Carbon cycle - C: N ratio. Soil biology – biomass - soil organisms and their beneficial and harmful roles.

Practical

Determination of bulk density and particle density - aggregate analysis - soil strength. Soil moisture determination - soil moisture constants – field capacity - infiltration rate - water holding capacity. Soil texture and mechanical analysis. Soil temperature. Analytical chemistry – basic concepts - techniques and calculations. Collection and processing of soil for analysis – organic carbon, pH, EC, - Study of a soil profile – Identification of rocks and minerals. Total elemental analysis of soils. Estimation of CEC.

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17AT1001 INTRODUCTION TO AGRICULTURE

Credit: 2:0:0

Course Objectives:

- To introduce the scope of agriculture to engineering students
- To impart knowledge on soil-water-plant relationship
- To familiarize with plant growth and fertilizer application and irrigation

Course Outcome:

- Basics of agriculture science learned
- Soil-water-plant relationship learned
- Different stages of plant growth and application of fertilizers studied

Description:

Orientation to agriculture and agricultural engineering. Soils: Nature and origin of soil; soil forming rocks and minerals, soil forming processes, important soil physical properties and their importance. Ion exchange in soil and nutrient availability; soil organic matter – its composition and decomposition, effect on soil fertility. Soil reaction – acid, saline and sodic soils. Agronomy: Definition and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tith and its characteristics. Soil water plant relationship and water requirement of crops. Soil fertility and its management, integrated nutrient management. Bio-fertilizers and vermin composting. Weeds and their control, integrated weed management. Crop rotation, cropping systems, relay cropping and mixed cropping. Sustainable agriculture, integrated farming system, precision farming, organic farming and good agricultural practices. Horticulture: Scope of horticultural and vegetable crops. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, criteria for site selection, layout and planting methods, nursery raising, macro and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post-harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds.

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17HO1001 BOTANY OF HORTICULTURAL CROPS

Credits: 3:0:0

Course Objectives:

- To teach the fundamentals of botany of the horticultural crops
- To expose the student to systematic botany
- To learn the basics of morphology and taxonomy of crops

Course Outcome:

- The students learned the basics of botany
- The students familiarized with botanical terms in relation to horticultural crops
- This fundamental course helped students to understand the breeding of horticultural crops

Description:

Systematic botany– terminology, morphological description and classification – root, stem, leaf, inflorescence, flower and fruit – flowering mechanism – modes of pollination asexual/vegetative reproduction – floral biology – fertilization and fruit set. Principles involved in nomenclature, ICBN rules and recommendations with special reference to names of hybrids and names of cultivated plants. Floral biology, pollination, fruit set and economic part in the families; Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin), Musaceae, Moraceae, Vitaceae, Caricaceae, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove), Sapotaceae, Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose). Floral biology, pollination, fruit set and economic part in the families; Solanaceae (tomato, brinjal, chilli, potato), Malvaceae, Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber), Moringaceae, Fabaceae (peas, French beans), Alliaceae (onion, garlic), Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae, Amaranthaceae, Convolvulaceae (sweetpotato), Araceae (elephant foot yam, colocasia), Dioscoreaceae (yam, medicinal dioscorea). Floral biology, pollination, fruit set and economic part in the families; Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (Vanilla, Dendrobium orchid), Apiaceae (Umbelliferae) (coriander), Myristicaceae, Lauraceae, Leguminosae, Caesalpiniaceae, Camelliaceae, Rubiaceae, Arecaceae(Palmae) (coconut, arecanut, palmyrah, oil palm), Sterculiaceae(Cocoa). Floral biology, pollination, fruit set and economic part in the families; Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae, Acanthaceae, Caryophyllaceae, Iridaceae, Apocynaceae, Poaceae (Graminae), (lemongrass, citrononella, palmarosa, vetiver), Geraniaceae, Lamiaceae (Labiatae) (coleus, patchouli, mint, maruvu), Scrophulariaceae.

Practical:

Observations and recordings of the morphology of root, stem, leaf, flower and fruit. Study of taxonomy and morphology of crops in the above families – herbarium (minimum 50 – covering not less than 25 families) - collection of the crops mentioned in theory.

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17HO1002 PROPAGATION OF HORTICULTURAL CROPS

Credits: 2:0:1

Course Objectives:

- To impart skill oriented knowledge on media preparation
- To teach students on propagation methods
- To familiarize with the maintenance and after care of propagated plants

Course Outcome:

- Students benefited with hands-on training in media preparation
- Students learned about mother plant selection and propagation techniques
- Students familiarized with the maintenance and after care of propagated plants

Description:

Basics of plant propagation: Scope and importance - different methods - definitions – sexual propagation - importance, advantages and disadvantages - asexual propagation - importance, advantages and disadvantages - agencies involved in the nursery development - government schemes for development of nurseries - establishment of nursery - site selection - tools and implements - mist chamber - phytotron – humidifiers - greenhouse - glasshouse - polyhouse - shade net - cold frames - hot beds - pit nursery - ball and bur lapped culture - media and containers - soil sterilization - manures and manuring - liquid manures. Sexual propagation: Micro and megasporogenesis - apomixis - mono and polyembryony - seeds - quality - nursery bed - protray culture - sowing - seed viability - longevity - germination - dormancy - types of dormancy - seed treatments - seed invigoration - seedling vigour. Asexual propagation: cutting and layering. Genetic variations - chimeras and types - methods of vegetative propagation identification of plus trees – mother block – raising clonal nursery - types of cuttings – factors influencing rooting of cuttings - use of growth regulators - layering – advantages and disadvantages - methods of layering - anatomical and physiological basis of rooting. Asexual propagation: grafting, budding and propagation through special organs. Grafting and budding; Methods - advantages and disadvantages - rootstocks - scion bank - factors for successful graft union - selection, pre-curing and collection of scion - bud wood selection - bud wood certification - anatomical and physiological basis of graft / bud union - stock-scion relationship - root stock influences - after care and hardening – techniques of propagation through specialized organs - tubers - bulbs - corms - runners - suckers - crown - slips - rhizome - offshoots - top working – quality management and nursery certification –display, packing, transport and marketing. Techniques of micro propagation: Micro propagation – definitions - different methods - protocol of micro propagation - Stage I establishment and sterilization - Stage II shoot multiplication - Stage III root formation - Stage IV acclimatization and hardening – specific protocol for aseptic culture - explants - sterilization techniques - types of media - composition - media preparations - meristem tip culture - micro grafting - in vitro clonal propagation of important horticultural crops - constraints and problems in micro propagation – after care - packing, transport and marketing - infrastructure requirements - establishment of commercial tissue culture units - visit to commercial TC units- status of micro propagation in India.

Practical:

Propagation structures - tools and implements - propagation media - containers - preparation of nursery beds - seed treatment - sowing - plug transplants / seedling production - potting, depotting and repotting of plants - methods of asexual propagation through cuttings, layering, grafting and budding - scion bank – techniques of cuttings - leaf and leaf bud cuttings - stem cuttings - single nodal cuttings and root cuttings - techniques of layering - potting of layers and hardening - grafting methods - separation of grafts - potting and maintenance of grafted plants - budding and maintenance of budded plants - mist chamber - structures - maintenance - use of mist chamber for seed and vegetative propagation - hardening and maintenance – shade structure - nutrition and plant protection - application of growth regulators - standardization of formulations - growth regulators for seed and vegetative propagation - project preparation for commercial nurseries – visit to commercial nurseries and tissue culture units.

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17HO1003 PRODUCTION TECHNOLOGY OF TROPICAL AND ARID ZONE FRUIT CROPS

Credits: 2:0:1

Course Objectives:

- To impart knowledge on the scenario of fruit cultivation in tropical and arid zones
- To impart knowledge on advanced production techniques
- To apprise on production constraints

Course Outcome:

- Practical knowledge on specialized production techniques of tropical and arid zone fruits
- Understanding the production constraints
- Skill management for solving field problems

Description:

Principles and cultivation of tropical fruits: Mango and banana-Scope and importance of tropical fruits cultivation – overview: global, national and regional levels – area, production and export potential– horticultural zones of India and Tamil Nadu with emphasis on tropical fruits- GAP- organic production - composition and uses – origin and distribution – species and cultivars - climate and soil requirements - species and varieties - cropping systems- propagation techniques - planting systems and planting density - after care – training and pruning – water management, macro and micronutrient management, weed management – special horticultural techniques - use of plant growth regulators - production constraints - physiological disorders – post harvest handling - economics of production. Tropical fruits- Papaya, sapota and guava: Composition and uses – origin and distribution – species and cultivars – climate and soil requirements, cropping systems- varieties - propagation techniques – planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management – GAP - organic production - special horticultural techniques – sex forms and pollination - use of plant growth regulators - production constraints - physiological disorders - pre and post-harvest handling - economics of production. Tropical fruits: acid lime, sweet orange and jack fruit: Composition and uses – origin and distribution – species and cultivars – climate and soil requirements, cropping systems- varieties - production constraints - propagation techniques - planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management - GAP - organic production - special horticultural techniques - use of plant growth regulators - physiological disorders - pre and post-harvest handling – economics of production. Arid zone fruits: Aonla, ber, pomegranate and date palm: Dryland horticulture – importance and scope in India and Tamil Nadu- distribution of arid and semi-arid zones in India and Tamil Nadu; Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties - cropping systems and intercropping – crops suitable for dry land system – spacing and planting patterns for rainfed

horticultural crops- in situ grafting and budding techniques – alternative land use systems – mulching - soil and moisture conservation methods – chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering – regulation of cropping – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production. Arid zone fruits - custard apple, jamun, bael, wood apple and manila tamarind: Composition and uses – origin and distribution – species and cultivars – climate and soil requirements – varieties - cropping systems and intercropping – crops suitable for dry land system – spacing and planting patterns for rain fed horticultural crops- in situ grafting and budding techniques – alternative land use systems – mulching – soil and moisture conservation methods – chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering – crop regulation – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production.

Practical:

Description and identification of cultivars/varieties - nursery management - nursery preparation, seed sowing and raising seedlings / rootstocks, practicing propagation techniques of mango, banana, papaya, sapota, guava, acid lime, sweet orange, aonla, ber, pomegranate, date palm, custard apple, jamun, bael, wood apple and manila tamarind. Banana scoring techniques. Selection and pre-treatment of banana suckers - desuckering in banana –planting systems- manures, fertilizers and biofertilizers application in mango, banana, papaya, sapota, guava, acid lime, sweet orange and aonla – application of growth regulators - sex forms in papaya – sibmating and seed production in papaya – latex extraction and preparation of crude papain – training and pruning in mango, sapota, guava, acid lime and sweet orange, aonla, ber, pomegranate and date palm - practising harvesting methods - ripening of fruits - grading and packaging - visit to commercial orchards - project preparation on production economics for fruits.

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17HO1004 PRODUCTION TECHNOLOGY OF TROPICAL VEGETABLE CROPS

Credits: 2:0:1

Course Objectives:

- To teach the students on the scenario of vegetable cultivation
- To impart knowledge on advanced production techniques
- To apprise on production constraints

Course Outcome:

- Hands-on experience of vegetable cultivation
- Knowledge on quality requirement and production techniques
- Skill management for solving field problems

Description:

Overview of vegetable cultivation: Area, production, world scenario, industrial importance, export potential of tropical vegetable crops – institutions involved in vegetable crops research. Classification of vegetable crops - Effect of climate, soil, water and nutrients on vegetable crop production and their management– cropping systems. Vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden – types of vegetable farming and contract farming- rice fallow cultivation, river bed cultivation, rain fed cultivation, organic farming – GAP in vegetable production – export standards of vegetables. Solanaceous vegetables and bhendi: Composition and uses – area and production- climate and soil requirements – season-varieties and hybrids – seed rate- nursery practices-containerized transplant production and transplanting –preparation of field-spacing-

planting systems-planting- water and weed management-nutrient requirement-fertigation-nutrient deficiencies-physiological disorders- use of chemicals and growth regulators-cropping systems-constraints in production-harvest-yield crops. Tomato, brinjal, chilli and bhendi. Bulbous and Cucurbitaceous vegetable crops: Composition and uses- area and production- climate and soil requirements – season - varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting– water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders – sex expression - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield. Onion, ash gourd, pumpkin, bitter gourd, snake gourd, ribbed gourd, bottle gourd, watermelon, musk melon, coccinia, cucumber and gherkin. Fabaceous vegetable crops and greens: Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids - seed rate – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders- use of chemicals and growth regulators - cropping systems – constraints in production harvest – yield. Cluster beans, cowpea, lab-lab, moringa, chekurmanis, palak, basella and amaranth. Tuber crops: Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids - seed rate –preparation of field - nursery practices and transplanting – spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders- use of chemicals and growth regulators - cropping systems – - constraints in production –virus elimination in cassava- harvest – yield. Cassava, sweet potato, colocasia, vegetable coleus, amorphophallus, edible dioscorea, and yam bean.

Practical:

Identification and description of tropical vegetable crops –nursery practices and transplanting for transplanted vegetable crops- preparation of field and sowing /planting for direct sown/ transplanted vegetable crops, kitchen garden- herbicide use in vegetable culture - top dressing of fertilizers and inter-culture – use of growth regulators – identification of nutrient deficiencies - physiological disorders- harvest indices and maturity standards - post harvest handling and storage – marketing – seed extraction- working out cost of cultivation for tropical vegetable crops – project preparation for commercial cultivation. Visit to commercial vegetable growing areas, market and processing centre.

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