

~~SRI DEV SUMAN UNIVERSITY~~
BADSHAHITHAUL
(TEHRI GARHWAL)

Syllabus
Course Structure for
~~M.Sc. (Ag.) AGRONOMY~~
(SEMESTER-WISE)

Under Semester System to come
into
force from
Academic Session 2014-15.

17/01/2015

M.Sc. (Agriculture) – Agronomy

COURSE STRUCTURE – AT A GLANCE

FIRST SEMESTER M.M.: 600

PAPER – 101: MODERN CONCEPTS IN CROP PRODUCTION,

PAPER – 102: PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT,

PAPER – 103 PRINCIPLES AND PRACTICES OF WEED MANAGEMENT,

PAPER – 104 PRINCIPLES AND PRACTICES OF WATER MANAGEMENT,

PAPER – 105 PRACTICAL I,

PAPER – 106 PRACTICAL II,

M.Sc. (Agriculture) – Agronomy

COURSE STRUCTURE – AT A GLANCE

SECOND SEMESTER M.M.: 600

* PAPER – 201 AGROMETEOROLOGY AND CROP WEATHER FORECASTING,

* PAPER – 202 AGRONOMY OF MAJOR CEREALS AND PULSES,

PAPER – 203 AGRONOMY OF OILSEED, FIBRE AND SUGAR CROPS,

PAPER – 204 AGRONOMY OF MEDICINAL, AROMATIC AND UNDER UTILIZED CROPS,

PAPER – 205 PRACTICAL I,

PAPER – 206 PRACTICAL –II,

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M.Sc. (Agriculture) – Agronomy

COURSE STRUCTURE – AT A GLANCE

THIRD SEMESTER M.M.: 600

PAPER – 301 AGRONOMY OF FODDER AND FOR AGE CROPS,

PAPER – 302 CROPPING SYSTEM AND SUSTAINABLE AGRICULTURE,

PAPER – 303 DRYLAND FARMING AND WATERSHED MANAGEMENT

PAPER – 304 PRINCIPLES AND PRACTICES OF ORGANIC FARMING,

PAPER – 305 PRACTICAL- I,

PAPER – 306 PRACTICAL –II,

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M.Sc. (Agriculture) – Agronomy

COURSE STRUCTURE – AT A GLANCE

FOURTH SEMESTER M.M.: 600

PAPER – 401 AGROSTOLOGY AND AGROFORESTRY,

PAPER – 402 ADVANCES IN CROP GROWTH AND PRODUCTIVITY,

PAPER – 403 SEMINAR,

PAPER – 404 THESIS (THESIS & VIVA – VOCE),

PAPER – 405 PRACTICAL,

SRI DEV SUMAN UNIVERSITY BADSHAHITHAUL (TEHRI GARHWAL)

M. Sc. Ag. Examination in Agronomy
PROPOSED REGULATIONS
 Semesters/Papers Title of the papers

SEMESTER I

Sn.No	Subject Name	Subject Code No	Total Marks	Theory Marks	Internal Marks	Mini. Passing marks	Credit
1	MODERN CONCEPTS IN CROP PRODUCTION	Paper 101	100	60	40	40	3
2	PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT	Paper 102	100	60	40	40	3
3	PRINCIPLES AND PRACTICES OF WEED MANAGEMENT	Paper 103	100	60	40	40	3
4	PRINCIPLES AND PRACTICES OF WATER MANAGEMENT	Paper 104	100	60	40	40	3
5	PRACTICAL I	Paper 105	100	60	40	40	2
6	PRACTICAL II	Paper 106	100	60	40	40	2

Total aggregate of First Semester is 45% Max. Marks – 600, Min. Marks – 250

M. Sc. Ag. Examination in Agronomy
PROPOSED REGULATIONS
 Semesters/Papers Title of the papers

SEMESTER II

Sn.No	Subject Name	Subject Code No	Total Marks	Theory Marks	Internal Marks	Mini. Passing marks	Credit
1	AGROMETEOROLOGY AND CROPWEATHER FORECASTING	Paper 201	100	60	40	40	3
2	AGRONOMY OF MAJOR CEREALS AND PULSES	Paper 202	100	60	40	40	3
3	AGRONOMY OF OIL SEED, FIBRE AND SUGAR CROPS	Paper 203	100	60	40	40	3
4	AGRONOMY OF MEDICINAL, AROMATIC AND UNDER-UTILIZED CROPS	Paper 204	100	60	40	40	3
5	PRACTICAL I	Paper 205	100	60	40	40	2
6	PRACTICAL II	Paper 206	100	60	40	40	2

Total aggregate of First Semester is 45% Max. Marks – 600, Min.Marks – 250

M. Sc. Ag. Examination in Agronomy
PROPOSED REGULATIONS
 Semesters/Papers Title of the papers

SEMESTER III

Sn.No	Subject Name	Subject Code No	Total Marks	Theory Marks	Internal Marks	Mini. Passing marks	Credit
1	AGRONOMY OF FODDER AND FORAGE	Paper 301	100	60	40	40	3
2	CROPPING SYSTEM AND SUSTAINABLE AGRICULTURE	Paper 302	100	60	40	40	3
3	DRYLAND FARMING AND WATERSHED MANAGEMENT	Paper 303	100	60	40	40	3
4	PRINCIPLES AND PRACTICES OF ORGANIC FARMING	Paper 304	100	60	40	40	3
5	PRACTICAL I	Paper 305	100	60	40	40	2
6	PRACTICAL II	Paper 306	100	60	40	40	2

Total aggregate of First Semester is 45% Max. Marks – 600, Min.Marks – 250.

M. Sc. Ag. Examination in Agronomy
PROPOSED REGULATIONS
 Semesters/Papers Title of the papers

SEMESTER IV

Sn.No	Subject Name	Subject Code No	Total Marks	Theory Marks	Internal Marks	Mini. Passing marks	Credit
1	AGROSTOLOGY AND AGROFORESTRY	Paper 401	100	60	40	40	3
2	ADVANCES IN CROP GROWTH AND PRODUCTIVITY	Paper 402	100	60	40	40	3
3	SEMINAR	Paper 403	100	60	40	40	3
4	THESIS (THESIS & VIVA - VOCE FARMING)	Paper 404	200	130+50	20		2
5	PRACTICAL	Paper 405	100	60	40	40	2

Total aggregate of First Semester is 45% Max. Marks - 600, Min. Marks - 250

M.Sc. (AGRICULTURE) AGRONOMY
FIRST SEMESTER

COURSE CONTENTS – DETAILED SYLLABUS
PAPER – 101: MODERN CONCEPTS IN CROP PRODUCTION

Objective : -

To teach the basic concepts of soil management and crop production.

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.

Practical

- Measurement of root-shoot relationship in crops at different growth stages.
- Estimation of growth evaluating parameters at different stages of crop.
- Assessment of crop yield on the basis of yield attributing characters.
- Study of crop modeling for different crop yield.
- Estimation of moisture index and aridity index.
- Analysis of productivity trend in un-irrigated areas.
- Tours and visits.

Suggested Readings

- Balasubramanian P & Palaniappan SP, 2001. *Principles and Practices of Agronomy*. Agrobios.
- Fageria NK, 1992. *Maximizing Crop Yields*. Marcel Dekker.
- Havlin JL, Beaton JD, Tisdale SL & Nelson WL, 2006. *Soil Fertility and Fertilizers*, 7th Ed. Prentice Hall.
- Paroda R.S. 2003. *Sustaining our Food Security*. Konark Publ.
- Reddy SR, 2000. *Principles of Crop Production*. Kalyani Publ.
- Sankaran S & Mudaliar TVS, 1997. *Principles of Agronomy*. The Bangalore Printing & Publ.
- Singh SS, 2006. *Principles and Practices of Agronomy*. Kalyani.

M.Sc. (AGRICULTURE) AGRONOMY
FIRST SEMESTER
COURSE CONTENTS – DETAILED SYLLABUS
PAPER – 102:SOIL FERTILITY AND NUTRIENT MANAGEMENT

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.

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 vermin-compost and residue wastes in crops.

PRACTICAL

- Determination of soil pH, ECe, organic C, total N, available N, P, K and S in soils
- Determination of total N, P, K and S in plants
- Interpretation of interaction effects and computation of economic and yield optima

Suggested Readings

- Brady NC & Weil R.R 2002. *The Nature and Properties of Soils*. 13TH Ed. Pearson Edu.
- Fageria NK, Baligar VC & Jones CA. 1991. *Growth and Mineral Nutrition of Field Crops*. Marcel Dekker.
- Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers*. 7th Ed. Prentice Hall.
- Prasad R & Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.
- Yawalkar KS, Agrawal JP & Bokde S. 2000. *Manures and Fertilizers*. Agri-Horti Publ.

M.Sc. (AGRICULTURE) AGRONOMY
FIRST SEMESTER
COURSE CONTENTS – DETAILED SYLLABUS
PAPER – 103: PRINCIPLES AND PRACTICES OF WEED MANAGEMENT

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

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 a weed herbarium
- Weed survey in crops and cropping systems
- Crop-weed competition studies
- 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
- Economics of weed control
- Herbicide resistance analysis in plant and soil
- Bioassay of herbicide resistance
- Calculation of herbicidal requirement

Suggested Readings

- Aldrich RJ & Kramer RJ. 1997. *Principles in Weed Management*. Panima Publ.
- Ashton FM & Crafts AS. 1981. *Mode of Action of Herbicides*. 2 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.

M.Sc. (AGRICULTURE) AGRONOMY

FIRST SEMESTER

COURSE CONTENTS – DETAILED SYLLABUS

PAPER – 104: PRINCIPLES AND PRACTICES OF WATER MANAGEMENT

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

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; micro-irrigation system; fertigation management of water in controlled environments and poly-houses

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 using tensiometer, and pressure plate and membrane apparatus
- Soil-moisture characteristics curves
- Water flow measurements using different devices
- Determination of irrigation requirements
- Calculation of irrigation efficiency
- Determination of infiltration rate
- Determination of saturated/unsaturated hydraulic conductivity

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 S.S. & 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.

THIRD SEMESTER
M.Sc. (AGRICULTURE) AGRONOMY

COURSE CONTENTS – DETAILED SYLLABUS
PAPER – 301: AGRONOMY OF FODDER AND FORAGE CROPS

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

UNIT I

Adaptation, distribution, varietals 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, varietals improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses- lime, 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.

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.

M.Sc. (AGRICULTURE) AGRONOMY

FOURTH SEMESTER

COURSE CONTENTS – DETAILED SYLLABUS

PAPER – 402: ADVANCES IN CROP GROWTH AND PRODUCTIVITY

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

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.

aspects

- Visit to nearby villages for identification of constraints in crop production

Suggested Readings

- Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.
- Hunsigi G & Krishna KR. 1998. *Science of Field Crop Production*. Oxford & IBH.
- Jeswani LM & Baldev B. 1997. *Advances in Pulse Production Technology*. ICAR.
- Khare D & Bhale MS. 2000. *Seed Technology*. Scientific Publ.
- Kumar Ranjeet & Singh NP. 2003. *Maize Production in India: Golden Grain in Transition*. IARI, New Delhi.
- Pal M, Deka J & Rai RK. 1996. *Fundamentals of Cereal Crop Production*. Tata McGraw Hill.
- 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.
- Yadav DS. 1992. *Pulse Crops*. Kalyani.

M.Sc. (AGRICULTURE) AGRONOMY SECOND SEMESTER COURSE CONTENTS – DETAILED SYLLABUS PAPER – 203: AGRONOMY OF OIL SEED, FIBRE AND SUGAR CROPS

Objective:-To teach the crop husbandry of oilseed, fiber and sugar crops. 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 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 sets, 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) aggressively, 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 fiber of different fiber 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*. 2 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.

M.Sc. (AGRICULTURE) AGRONOMY

SECOND SEMESTER

COURSE CONTENTS – DETAILED SYLLABUS

PAPER – 204: AGRONOMY OF MEDICINAL, AROMATIC AND UNDER-UTILIZED CROPS

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

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*, Satavur, 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
- Tour and visit

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.

THIRD SEMESTER
M.Sc. (AGRICULTURE) AGRONOMY

COURSE CONTENTS – DETAILED SYLLABUS
PAPER – 301: AGRONOMY OF FODDER AND FORAGE CROPS

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

UNIT I

Adaptation, distribution, varieties 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, varieties improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses- lime, 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 & Dabodghao 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.

M.Sc. (AGRICULTURE) AGRONOMY
THIRD SEMESTER
COURSE CONTENTS – DETAILED SYLLABUS
PAPER – 302: CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE

Objective: To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.

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; multistoried 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 ideo-types for dry lands; 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.

**M.Sc. (AGRICULTURE) AGRONOMY
THIRD SEMESTER
COURSE CONTENTS – DETAILED SYLLABUS
PAPER – 303: DRYLAND FARMING AND WATERSHED MANAGEMENT**

Objective: To teach the basis concepts and practices of dry land farming and soil moisture Conservation.

Unit - I

Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.

Unit - II

Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.

Unit - III

Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions.

Unit - IV

Tillage, tillth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); anti-transpirants; soil and crop management techniques, seeding and efficient fertilizer use.

Unit - V

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

Practical

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

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.
- Katyal 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.

M.Sc. (AGRICULTURE) AGRONOMY

THIRD SEMESTER

COURSE CONTENTS – DETAILED SYLLABUS

PAPER – 304: PRINCIPLES AND PRACTICES OF ORGANIC FARMING

Objective: To study the principles and practices of organic farming for sustainable crop production.

UNIT I

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects: land and water management - land use, minimum tillage: shelter zones, hedges, pasture management, agro-forestry.

UNIT II

Organic farming and water use efficiency: soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and bio-fertilizers.

UNIT III

Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

UNIT IV

Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides.

UNIT V

Socio-economic impacts: marketing and export potential: inspection, certification, 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. IAO.
- 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: Socioeconomic 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*. PIDBC, Bangalore.
- Subba Rao NS. 2002. *Soil Microbiology*. Oxford & IBH.
- Trivedi RN 1993. *A Text Book of Environmental Sciences*. Anmol Publ.
- Veeresh GF, Shivashankar K & Suiglaachar MA. 1997. *Organic Farming and Sustainable Agriculture*. Association for Promotion of Organic Farming, Bangalore.
- WHO. 1990. *Public Health Impact of Pesticides Used in Agriculture*. WHO.
- Woolmer PL & Swift MJ. 1994. *The Biological Management of Tropical Soil Fertility*. TSBF & Wiley.

FOURTH SEMESTER
M.Sc. (AGRICULTURE) AGRONOMY

COURSE CONTENTS – DETAILED SYLLABUS
PAPER – 40: AGROSTOLOGY AND AGRO-FORESTRY

Objective: To teach crop husbandry of different forage, fodder and agro-forestry crops/trees along with their processing.

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 calorific 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
- Tour & Visits

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 aggressiveness 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 FL, 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.
- Narval SS, Politycka B & Goswami CL, 2007. *Plant Physiology: Research Methods*. Scientific Publishers.

M.Sc. (AGRICULTURE) AGRONOMY
FOURTH SEMESTER
COURSE CONTENTS - DETAILED SYLLABUS
PAPER - 403: SEMINAR

M.Sc. (AGRICULTURE) AGRONOMY
FOURTH SEMESTER
PAPER - 404: THESIS (THESIS & VIVA-VOCE) at least 3 month
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PAPER - 405
PRACTICAL
AGRONOMY

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

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.

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FOURTH SEMESTER

COURSE CONTENTS – DETAILED SYLLABUS

PAPER – 402: ADVANCES IN CROP GROWTH AND PRODUCTIVITY

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

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.