



**IFTM**  
**UNIVERSITY**  
**M O R A D A B A D**

**NAAC ACCREDITED**

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**(Effective from 2018-19)**

**Programme: M.Sc. Ag. (Agronomy)**

**Programme Outcomes (POs):**

**Students completing this course will be able to:**

1. Apply the theoretical and conceptual knowledge obtained at graduation level in the real field conditions.
2. Deeply elaborate various fundamental concepts learned at graduation level.
3. Learn the advanced production techniques of various agronomic crops as well as their commercial utilization including import and export scenario.
4. Apply the concepts of crop rotation, inter cropping and multi cropping to select the best possible crop and other enterprise combination.
5. Understand the effect of various biotic and abiotic factors on crop production and the remedies associated with it.
6. Understand the basic principles of experimental design and learn the basics of field data collection, it's analysis and interpretation to draw valid results and conclusions.
7. Understand the importance of integration of different possible ways of nutrient management, weed management and pest management to maximize the profit as well as to maintain ecological balance.

**School of Agricultural Sciences & Engineering**  
**IFTM UNIVERSITY, MORADABAD**  
STUDY & EVALUATION SCHEME  
**M. Sc. Ag. (Agronomy)**

**YEAR - I, SEMESTER – I**

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits
			L	T	P	Mid Term Exam			External Exam		
						CT	AS +AT	Total			
<b>Theory</b>											
1.	MAS 101	Agronomy of Kharif Crops	3	0	0	20	10	30	70	100	3
2.	MAS 102	Principles and Practices of Soil Fertility and Nutrient Management	3	0	0	20	10	30	70	100	3
3.	MAS 103A	Elective I	3	0	0	20	10	30	70	100	3
4.	MAS104	Principles of Plant Physiology	3	0	0	20	10	30	70	100	3
<b>Practical / Project</b>											
5.	MAS 151	Soil Fertility and Nutrient Management Lab	0	0	2	20	10	30	70	100	1
6.	MAS 154	Plant Physiology Lab	0	0	2	20	10	30	70	100	1
<b>Total</b>			<b>12</b>	<b>0</b>	<b>4</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>600</b>	<b>14</b>

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STUDY & EVALUATION SCHEME  
**M. Sc. Ag. (Agronomy)**

**YEAR – I, SEMESTER – II**

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits
			L	T	P	Mid Term Exam			External Exam		
						CT	AS +AT	Total			
<b>Theory</b>											
1.	MAS 201	Principles and Practices of Water Management	3	0	0	20	10	30	70	100	3
2.	MAS 202	Agronomy of Rabi Crops	3	0	0	20	10	30	70	100	3
3.	MAS 203 B	Elective II	3	0	0	20	10	30	70	100	3
4.	MMAG204	Agricultural Statistics and Experimental Design	3	0	0	20	10	30	70	100	3
<b>Practical / Project</b>											
5.	MAS 251	Water Management Lab	0	0	2	20	10	30	70	100	1
6.	MMAG254	Agricultural Statistics and Experimental Design Lab	0	0	2	20	10	30	70	100	1
<b>Total</b>			<b>12</b>	<b>0</b>	<b>4</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>600</b>	<b>14</b>

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**YEAR - II, SEMESTER – III**

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits
			L	T	P	Mid Term Exam			External Exam		
						CT	AS +AT	Total			
<b>Theory</b>											
1.	MAS 301	Principles and Practices of Weed Management	3	0	0	20	10	30	70	100	3
2.	MAS 302	Modern Concepts in Crop Production	3	0	0	20	10	30	70	100	3
3.	MAS 303C	Elective III	3	0	0	20	10	30	70	100	3
<b>Practical / Project</b>											
4.	MAS 351	Weed Management Lab	0	0	2	20	10	30	70	100	1
5.	MAS 352	Seminar	0	0	2	-	-	100	-	100	1
6.	MAS 354	Pre- Dissertation	0	0	2	-	-	30	70	100	1
<b>Total</b>			<b>9</b>	<b>0</b>	<b>6</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>600</b>	<b>12</b>

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**M. Sc. Ag. (Agronomy)**

**YEAR - II, SEMESTER – IV**

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
<b>Theory</b>											
-	-	-	-	-	-	-	-	-	-	-	-
<b>Practical's / Project</b>											
1.	MAS 451	Dissertation Work	0	0	40	-	-	300	300	600	20
<b>Total</b>			-	-	<b>40</b>	-	-	-	-	<b>600</b>	<b>20</b>

**School of Agricultural Sciences & Engineering**  
**IFTM UNIVERSITY, MORADABAD**  
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**List of Electives**

**Group - A**

**Elective I**

<b>S.N.</b>	<b>CODE</b>	<b>Name of Elective</b>
1.	MAS 103 I	Cropping Systems & Sustainable Agriculture
2.	MAS 103 II	Fodder and Forage Crops

**Group - B**

**Elective II**

<b>S.N.</b>	<b>CODE</b>	<b>Name of Elective</b>
1.	MAS 203 I	Principles and Practices Organic Farming
2.	MAS 203 II	Medicinal, Aromatic & Under Utilized Crops

**Group - C**

**Elective III**

<b>S.N.</b>	<b>CODE</b>	<b>Name of Elective</b>
1.	MAS 303 I	Dryland Farming & Watershed Management
2.	MAS 303 II	Soil Conservation & Watershed Management

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MAS 101

Agronomy of Kharif Crops

L:T:P 3:0:0

**Objective:** Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of all Kharif Crops given below

### Unit I

Cereals: Rice, Maize, Millets

Maize:

1. Study of the plant morphology

Millets: Sorghum.

1. Study of the plant morphology

### Unit II

Pulses: Pigeonpea, Urdbean and Mungbean

### Unit III

Oilseeds: Groundnut, Castor, Sesamum, Sunflower and soybean

### Unit IV

Forage crops: Maize, Sorghum, Guar, Cowpea, Bajra, etc.

### Unit V

Fibre crops: Cotton, Jute and Sun hemp.

### Course Outcomes:

After completing this course, the students will acquaint about the package of practices and processing of different kharif crops.

### References:

1. Das, N.R. 2007. Introduction to Crops in India. Scientific Publication.
2. Das, P.C. 1997. Oilseed Crops of India. Kalyani Publication.
3. Prasad, Rajendra, 2002. Text Book of Field Crop Production. ICAR.
4. Singh, C., Singh, P. & Singh, R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.
5. Singh, S.S. 1998. Crop Management. Kalyani Publication.

**Website Sources:**

- <http://www.agrimoon.com>
- <http://agricoop.nic.in>
- <https://www.researchgate.net>
- <http://eagri.org>
- <https://ecourses.icar.gov.in>
- <http://www.agriglance.com>
- <https://agrimoon.com/field-crop-kharif-pdf-book/>
- [https://www.pau.edu/content/pf/pp\\_kharif.pdf](https://www.pau.edu/content/pf/pp_kharif.pdf)
- <https://www.pdfdrive.com/agronomy-kharif-crops-e48671113.html>
- [https://14.139.51.37/centrallibrary/admin/book/b38dbbaccfPractical\\_ma-kharif-2.pdf](https://14.139.51.37/centrallibrary/admin/book/b38dbbaccfPractical_ma-kharif-2.pdf)
- <https://ecourses.icar.gov.in/>
- <https://eagri.org/>



**Objective:** To impart the 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, deficiency and toxicity symptoms of major and micro nutrients and remedial measure; transformation and dynamics of major plant nutrients

### **Unit III**

Kinds of fertilizers-straight, complex and bulk blended; methods of fertilizer application; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades

### **Unit IV**

Fertilizer application in cropping systems direct, residual and cumulative effects; integrated nutrient management; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interactions

### **Unit V**

Organic manures, compost, green manures, vermi-compost, bio-fertilizers and fertilizers application; foliar application and its concept

### **Course Outcomes:**

- Understand the role of soil fertility in plant growth.
- Gained knowledge about essential nutrients and their functions in plant.
- Imparts knowledge on types of fertilizers.
- Gained knowledge about how to increase nutrient use efficiency.
- Knowledge about the organic manures and bio- fertilizers.

**References:**

1. Brady, N.C. & Weil, R.R. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.
2. Fageria, N.K., Baligar. V.C. & Jones, C.A. 1991. Growth and Mineral Nutrition of Field Crops. Marcel Dekker.
3. Havlin, J.L., Beaton, J.D., Tisdale, S.L. & Nelson. W.L. 2006. Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.
4. Prasad, R. & Power, J.F. 1997. Soil Fertility Management for Sustainable Agriculture. CRC Press.
5. Yawalkar, K.S., Agrawal, J.P. & Bokde, S. 2000. Manures and Fertilizers. Agri-Horti Publ.

**Website sources:**

- <http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-502/502-Soil-Fertility-and-Nutrient-Management-SSR.pdf>
- <http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-502/502-Soil-Fertility-and-Nutrient-Management-SSR.pdf>
- <http://ecoursesonline.iasri.res.in/course/view.php?id=135>
- <https://bit.ly/3mQEddk>

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**MAS 104**

**Principles of Plant Physiology**

**L:T:P 3:0:0**

**Objective:** To make the students aware about various physiological processes in plants so that they can have better understanding of reasons behind various agronomic operations in crops.

### **Unit I**

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

### **Unit II**

Soil and plant water relations, water and its role in plants, properties and functions of water in the cell water relations-cell water terminology, water potential of plant cells; Mechanism of water uptake by roots-transport in roots, aquaporins.

### **Unit III**

Movement of water in plants – Mycorrhizal association on water uptake; Water loss from plants-Energy balance-Solar energy input-energy dissipation at crop canopy level-evapotranspiration transpiration –Driving force for transpiration, plant factors influencing transpiration rate

### **Unit IV**

Stomata structure and function – mechanism of stomatal movement, anti-transparent. Physiology of water stress in plants: Influence of water stress at cell, organ, plant and canopy levels. Indices for assessment of drought resistance

### **Unit V**

The role of mineral nutrients in plant metabolism; Essential elements, classification based on function of elements in plants; Physiological and metabolic functions of mineral elements, critical levels, deficiency symptoms, nutrient deficiency and toxicity; Foliar nutrition, Uptake of mineral elements in plants –Mechanisms of uptake-translocation of minerals in plants

### **Course Outcomes:**

Students completing this course will be able to:

- Define plant cell and its physiological functions.
- Understand plant water relations and various process associated with it such as osmosis, diffusion etc.

- Understand the physiological roles and commercial use of Plant Growth Regulators in agriculture.
- Understand the stomatal physiology in detail and mechanism of water and nutrient movement inside the plants.
- Effect of water stress on different plants and adaptation of plants towards it.
- Role of minerals and nutrients in the growth and development of plants.
- Apply the knowledge of plant physiology to have better understanding science behind agronomic practices in different crops.

**References:**

1. Hopkins, W.G. &Huner, N.P.A. 2004. Introduction to Plant Physiology. John Wiley & Sons.
2. Salisbury, F.B. & Ross, C. 1992. Plant Physiology. 4th Ed. Wadsworth Publ.
3. Taiz, L. & Zeiger, E. 2006. Plant Physiology. 4th Ed. Sinauer Associates.
4. Gardner FP, Pearce RB & Mitchell RL. 1988. Physiology of Crop Plants. Scientific Publ.
5. Pessarakli M. Handbook of Plant and Crop Physiology. CRC Press. Selected reviews and articles from Periodicals and Journals.

**Website Sources:**

- <https://www.rku.ac.in>
- <https://uu-img.s3.ap-south-1.amazonaws.com>
- <http://du.ac.in/du/uploads/Revi>
- <https://agrimoon.com>
- <http://agcollegejagtial.weebly.com/>
- <https://iasri.icar.gov.in/>
- <https://tnau.ac.in/>
- <http://ecoursesonline.iasri.res.in/>

**Objective:**

- To teach the basic principles of water management and practices to enhance water productivity.
- To learn how to analyze and comprehend basic principle of water resources and its planning and management.
- Introduce the concepts of system approach to Irrigation scheduling.

**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

**Course Outcomes:**

After successful completion of course, student will:

- Be able to discuss the water resources, major and minor irrigation projects in India.
- Professionally developed for irrigation water estimation under various conditions of data availability, scales and proper methodologies and master the skills for their

applications.

- Technically understand, design of irrigation structures including for drainage management and comment on irrigation project evaluation.
- Technically understand the different irrigation methods and their efficiencies.

**References:**

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

**Website Sources:**

1. <http://www.ecourses.icar.gov.in/>
2. <http://www.agrimoon.com/>
3. <http://www.ekrishishiksha/>
4. <http://www.ecoursesonline.iasri.res.in/>
5. <http://www.iaritoppers.com/>
6. <http://www.agriglance.com/>
7. <http://www.agritech.tnau.ac.in/>

**Objective:** Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of all Rabi Crops given below

### Unit I

Cereals: Wheat and Barley.

1. Growth and development studies in wheat.

### Unit II

Pluses: Chickpea, Lentil and Peas.

1. Study of yield contributing characters and estimation of yield

### Unit III

Oil Seeds: Rape seed-mustard, Linseed, Safflower.

### Unit IV

Sugar crops Sugarcane and Sugarbeet

### Unit V

Forage crops: Oat, Barley and Berseem.

### Course Outcomes:

After completing this course, the students will acquaint about the package of practices and processing of different *rabi* crops.

### References:

1. Chatterjee, B.N. 1989. Forage Crop Production – Principles and Practices. Oxford & IBH.
2. Das, N.R. 2007. Introduction to Crops of India. Scientific Publication.
3. Das, N.R. 2007. Introduction to Crops of India. Scientific Publication.
4. Hunsigi, G. & Krishna, K.R. 1998. Science of Field Crop Production. Oxford & IBH.
5. Narayanan, T.R. & Dabadghao, P.M. 1972. Forage Crops of India. ICAR.

6. Singh, P. & Srivastava, A.K.1990. Forage Production Technology. IGFRI, Jhansi.
7. Prasad, Rajendra, 2002. Text Book of Field Crop Production. ICAR.
8. Singh, C., Singh, P. & Singh, R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.

**Website Sources:**

- <https://agrimoon.com/field-crop-rabi-pdf-book/>
- <https://www.pdfdrive.com/agronomy-rabi-crops-e48671113.html>
- [https://14.139.51.37/centrallibrary/admin/book/b38dbbaccfPractical\\_ma-rabi-2.pdf](https://14.139.51.37/centrallibrary/admin/book/b38dbbaccfPractical_ma-rabi-2.pdf)
- <https://ecourses.icar.gov.in/>
- <https://eagri.org/>
- [https://www.pau.edu/content/pf/pp\\_rabi.pdf](https://www.pau.edu/content/pf/pp_rabi.pdf)
- <http://agrimoon.com/field-crops-rabi-with-multiple-choice-questions-pdf-book/>



**Objective:** The main aims of this course are to provide comprehensive knowledge of the basic information of agriculture statistics and experimental design.

### Unit I

Presentation of Data: Frequency distributions; graphical presentation of data by histogram, frequency polygon, frequency curve and cumulative frequency curves Measures of Locations and Dispersion: Mean, median, mode and their simple properties (with-out derivation) and calculations of median by graphs; range, mean deviation, standard deviation, standard error, coefficient of variation.

### Unit II

Probability and Distributions: Random distributions; events exhaustive, mutually exclusive and equally likely; definition of probability (with simple exercises); definitions of binomial, Poisson's and normal distributions; and simple properties of the above distributions (without derivation)

### Unit III

Correlation and Regression: Bivariate data-simple correlation and regression coefficients and their relation; Spearman rank correlation; limits of correlation coefficient; effect of change of origin and scale on correlation coefficient; linear regression and equations of line of regression; association and independence of attributes.

### Unit IV

Sampling: Concept of population and sample; random samples; methods of taking a simple random sample. Tests of significance: sampling distribution of mean and standard error; z and t-test (equality of means; paired and unpaired t-test); t-test for comparison of means when variances of two populations differ; Chi- square test for goodness of fit; independence of attributes, and homogeneity of samples; interrelation between t-test and F-Test.

### Unit V

Experimental Designs: Principles of experimental designs; completely randomized, randomized complete block design (missing plot value in RBD); latin square designs; augmented block design; simple factorial experiments including split and strip plot design (mathematical derivations not required); analysis of variance (ANOVA) and its use including estimation of LSD (CD).

**Course Outcomes:**

The student is able to

- Understand basic theoretical and applied principles of agricultural statistics needed to enter in agriculture.
- Demonstrate an understanding of the basic concepts of probability and random variables.
- Understand and interpret the concepts of descriptive statistics from the obtained data.
- Utilize and apply regression and other statistical methods to analyze commodity markets and economic data.
- Gain proficiency in using statistical software for data analysis.

**References:**

1. J, Medhi: Statistical Methods, New age International (P) Ltd.
2. J.K. Goyal & J.N. Sharma, Mathematical Statistics.
3. J.K. Ghosh, Mathematical Statistics, John Wiley & Sons, New York.
4. S.C. Gupta & V.K. Kapoor .Advanced Statistics, S. Chand.
5. M. Ray, Mathematical Statistics, R.P & Sons, Agra.
6. Goulden, C.H. (1952). Methods of Statistical Analysis, 2/e, John Wiley, New York
7. Kempton RA and Fox PN (1997). Statistical Methods for Plant Variety Evaluation.
8. Chapman and Hall.
9. Panse, V.C. and Sukhatme, P.V. (1967). Statistical Methods for Agricultural Workers,
10. I.C.A.R., New Delhi.

**Website Sources:**

- [www.pdfdrive.com](http://www.pdfdrive.com)
- [www.dmi.gov.in](http://www.dmi.gov.in)
- [www.yourarticlelibrary.com](http://www.yourarticlelibrary.com)
- [www.onlinecourses.nptel.ac.in](http://www.onlinecourses.nptel.ac.in)
- [www.en.wikipedia.org](http://www.en.wikipedia.org)

**Objective:**

- To study about the weed habitat, types of weeds, weed dissemination, weed management, IWM, different herbicides and their mode of action.
- Be able to define a weed and its stages of development, differences between weeds, cultural weed controls, advantages and disadvantages of the various methods of herbicide applications, herbicide carryover and how to prevent it.
- Know about the herbicide adjuvants.
- Know about the chemical, biological and myco-herbicides their application methods, mode of action and persistence.
- To familiarize the students about the weed management in different crops and cropping systems.
- 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.

### Course Outcomes:

- Students will be able to differentiate the crop and weed plants.
- Students will be able to identify the origin, distribution, propagation, dispersal and management method of weed.
- Understand the herbicides uses and their mode of action.
- Understand about the herbicide resistance and how to minimize risk of it.
- Understand the benefits of integrated weed management.

### References:

1. Aldrich RJ & Kramer RJ. 1997. *Principles in Weed Management*. Panima Publ.
2. Ashton FM & Crafts AS. 1981. *Mode of Action of Herbicides*. 2nd Ed. Wiley Inter-Science.
3. Gupta OP. 2007. *Weed Management – Principles and Practices*. Agrobios.
4. Mandal RC. 1990. *Weed, Weedicides and Weed Control - Principles and Practices*. Agro-Botanical Publ.
5. Rao VS. 2000. *Principles of Weed Science*. Oxford & IBH.
6. Subramanian S, Ali AM & Kumar RJ. 1997. *All about Weed Control*. Kalyani.
7. Zimdahl RL. 1999. *Fundamentals of Weed Science*. 2nd Ed. Academic Press

### Website Sources:

- <http://www.agrimoon.com>
- <http://agricoop.nic.in>
- <https://www.researchgate.net>
- <http://eagri.org>
- <https://ecourses.icar.gov.in>
- <http://www.agrilance.com>

**Objective:**

- To teach the basic concepts of soil and crop management along with quantitative agro biological principles and crop growth analysis.
- To teach the principles of crop production, integrated farming systems and organic farming.
- 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.

**Course Outcomes:**

- Understanding Principles involved in ecology, growth and factors affecting crop production.
- Gain knowledge on Plant physiology and its application in crop production.
- Overview of the management of Soil health and plant nutrient status.

- To impart knowledge on basic concepts of crop growth, responses to growth factors, ideal plant type, crop production of recent time and yield gap analysis.
- Gain the knowledge about the concept of balance nutrition and integrated nutrient management; precision agriculture.

**References:**

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

**Website Sources:**

- <http://www.agrimoon.com>
- <http://agricoop.nic.in>
- <https://www.researchgate.net>
- <http://eagri.org>
- <https://ecourses.icar.gov.in>
- <http://www.agriglance.com>

**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; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture

### **Unit IV**

Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system

### **Unit V**

Plant ideotypes for drylands; plant growth regulators and their role in sustainability

### **Course Outcomes:**

- Understanding Principles involved Cropping systems .
- Gain knowledge of concept of sustainability in cropping systems and farming systems.
- To impart knowledge on basic Crop diversification for sustainability.
- Gain the knowledge about the Plant Ideotypes for drylands.

**References:**

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

**Website Sources**

- <http://www.jnkvv.org/PDF/13042020134922Unit%20II.pdf>
- <https://bit.ly/3qNGDMk>
- <http://eagri.org/eagri50/AGRO101/lec15.pdf>
- <http://www.agrimoon.com>
- <https://ecourses.icar.gov.in>



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

- The goal of the subject is to acquire knowledge, skills and competencies in the area of forage crops cultivation and production in India.
- Students will learn about management of temporary mixtures of grasses and legumes and annual forage crops, including harvest technology and their preservation.
- Students get acquainted with qualitative parameters of forage.
- 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, etc.

### **Unit II**

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

### **Unit III**

Year-round fodder production and management, preservation and utilization of forage and pasture crops; Canopy measurement, yield and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc; of various fodders 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

### **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

### **Course Outcomes:**

- Understating of forage crop production and classification of forage crops.
- Studying of anti- nutritional factors in forage crops and principles and methods of hay and silage making.
- Role of fodder and forage crops in Indian agriculture.
- Advances agro techniques for augmenting productivity of Fodder and forage crops.

### **References:**

1. Chatterjee, B.N. 1989. Forage Crop Production - Principles and Practices. Oxford & IBH.
2. Das, N.R. 2007. Introduction to Crops of India. Scientific Publ.
3. Narayanan, T.R. & Dabadghao, P.M. 1972. Forage Crops of India. ICAR.
4. Singh, P. & Srivastava, A.K. 1990. Forage Production Technology. IGFRI, Jhansi.
5. Singh, C., Singh, P. & Singh, R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.
6. Tejwani, K.G. 1994. Agroforestry in India. Oxford & IBH.

### **Website Sources:**

- <http://www.agrimoon.com>
- <http://agricoop.nic.in>
- <https://www.researchgate.net>
- <http://eagri.org>
- <https://ecourses.icar.gov.in>
- <http://www.agriglance.com>

**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.

### **Unit II**

Soil and Water management, tillage systems, Making of vermin-compost, 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**

Quality standards, inspection, certification and labelling and accreditation procedures for farm produce from organic farms; marketing and export potential: inspection.

### **Course Outcomes:**

Students completing this course will be able to:

- Understand the concepts of organic farming and its relevance in present context.
- Preparation and use of different organic manures and compost such as vermicompost, FYM etc.
- Understand farming system, crop rotations and various multi cropping systems.
- Culture and use of biofertilizers.
- Inspection, certification and labeling of organic products.
- Scope of organic crop production.

**References:**

1. Ananthakrishnan, T.N. (Ed.). 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH.
2. Gaur, A.C. 1982. A Manual of Rural Composting, FAO/UNDP Regional Project Document, FAO.
3. Lampin, N. 1990. Organic Farming. Press Books, Ipswich, UK.
4. Palaniappan, S.P. & Anandurai, K. 1999. Organic Farming–Theory and Practice. Scientific Publ.
5. Reddy, M.V. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH.
6. Sharma, A. 2002. Hand Book of Organic Farming. Agrobios.
7. Singh, S.P. (Ed.) 1994. Technology for Production of Natural Enemies. PDBC, Bangalore.
8. Subba Rao, N.S. 2002. Soil Microbiology. Oxford & IBH.
9. Veeresh, G.K., Shivashankar, K. & Suiglachar, M.A. 1997. Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore.
10. WHO. 1990. Public Health Impact of Pesticides Used in Agriculture. WHO.

**Website sources:**

- [www.iifsr.res.in](http://www.iifsr.res.in)
- <https://ncof.dacnet.nic.in/>
- [www.agrimoon.com](http://www.agrimoon.com)
- <https://ecourses.icar.gov.in/>

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**MAS 203 II                      Medicinal, Aromatic and Under-Utilized Crops                      L:T:P : 3:0:0**

**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.

**Unit II**

Classification of medicinal and aromatic plants according to botanical characteristics and uses; Quality characters in medicinal and aromatic plants.

**Unit III**

Climate and soil requirements; cultural practices; yield and important constituents of medicinal plants (Isabgol, Rauwolfia, Poppy, *Aloe-vera*, Satavar, Stevia, Safed Musli, Kalmegh, Asaphoetida, *Nux vomica*, Rosadle etc)

**Unit IV**

Climate and soil requirements; cultural practices; yield and important constituents of aromatic plants (Citronella, Palmarosa, Mentha, Basil, Lemon grass, Rose, Patchouli, Geranium etc)

**Unit V**

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)

**Course Outcomes:**

Students completing this course will be able to:

- Understand the importance of medicinal and aromatic plants in human health, national economy and related industries.
- Understand the classification of medicinal and aromatic plants according to botanical characteristics and uses.
- Understand the package of practices of different medicinal and aromatic and under-utilized crops.

## References

1. Chadha, K.L. & Gupta, R. 1995. Advances in Horticulture. Vol. II. Medicinal and Aromatic Plants. Malhotra Publ.
2. Das, N.R. 2007. Introduction to Crops of India. Scientific Publ.
3. Handa, S.S. 1984. Cultivation and Utilization of Medicinal Plants. RRL, CSIR, Jammu.
4. Hussain, A. 1984. Essential Oil Plants and their Cultivation. CIMAP, Lucknow.
5. Hussain, A. 1993. Medicinal Plants and their Cultivation. CIMAP, Lucknow.
6. ICAR 2006. Hand Book of Agriculture. ICAR, New Delhi.
7. Kumar, N., Khader, Md. Abdul, Rangaswami, J.B.M. & Irulappan 1997. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford & IBH.
8. Prajapati, N.D., Purohit, S.S., Sharma, A.K. & Kumar, T. 2003. A Hand Book of Medicinal Plants: A Complete Source Book. Agrobios.

## Website Sources:

- <https://bit.ly/3mQEddk>
- <http://jnkvv.org/PDF/AERC/Study-93.pdf>
- <https://bit.ly/39R895B>
- <http://www.fao.org/organicag/oa-portal/orca-database/list/en/?links=11466>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3349165/>

**Objective:** To teach the basic 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; midcontingent 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

#### **Course Outcomes:**

Students completing this course will be able to:

- Understand the difference between dry, dry land and rainfed farming system.
- Understand the significance of dry land farming in Indian agriculture.
- Understand the drought adaptation mechanism in plants.
- Drought management strategies in different plants and preparation of contingency plan for aberrant weather conditions.

- Soil and moisture conservation strategies under different abnormal weather conditions.

**References:**

1. Das NR. 2007. Tillage and Crop Production. Scientific Publishers.
2. Dhopte AM. 2002. Agrotechnology for Dryland Farming. Scientific Publ.
3. Dhruv Narayan VV. 2002. Soil and Water Conservation Research in India. ICAR.

**Website sources:**

- [www.iifsr.res.in](http://www.iifsr.res.in)
- <https://ncof.dacnet.nic.in/>
- [www.agrimoon.com](http://www.agrimoon.com)
- <https://ecourses.icar.gov.in/>



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

### Unit I

Soil erosion: Definition, nature and extent of erosion, types of erosion, mechanism of water and wind erosion, effects of soil erosion and factors affecting soil erosion.

### Unit II

Soil Conservation: Definition, methods of soil conservation, agronomic measures-contour farming, strip farming, cover cropping, lay farming, alley cropping, mixed cropping, vegetative barriers, mulching and residue management, improved dry farming practices; mechanical measures - bunding, land leveling, contour trenching, terracing, and gully control. Role of grasses and pastures in soil conservation. Wind breaks and shelter belts.

### Unit III

Water shed Management: Definition, objectives, concepts, principles, components, problems, steps in implementation of watershed, development of cropping systems for watershed area.

### Unit IV

Land use capabilities, classification, alternative land use systems, agro forestry – Jhum management –basic concepts, socio- ethic aspects, rehabilitation of abandoned Jhum lands.

### Unit V

Drainage considerations and agronomic management.

### Course Outcomes:

#### The student will be able to-

- Know about the causes about water scarcity and their solution to fight against the damage effects through soil and water conservation technologies.
- Recognize different types of erosion, rainfall and runoff.
- Apply the knowledge on engineering for design of SWC structures in watersheds
- Develop rainfall-runoff relationship for a watershed for prediction purpose
- Apply the knowledge on hydrology for planning watershed management projects

### References:

1. Arakeri HR & Roy D. 1984. Principles of Soil Conservation and Water Management. Oxford & IBH.

2. Dhruvanarayana VV. 1993. Soil and Water Conservation Research in India. ICAR.
3. FAO. 2004. Soil and Water Conservation in Semi-Arid Areas. Soils Bull., Paper57.
4. Frederick RT, Hobbs J, Arthur D & Roy L. 1999. Soil and Water Conservation: Productivity and Environment Protection. 3rd Ed. PrenticeHall.
5. Gurmel Singh, Venkataraman CG, Sastry B & Joshi P. 1990. Manual of Soil and Water Conservation Practices. Oxford &IBH.
6. Murthy VVN. 1995. Land and Water Management Engineering. Kalyani.
7. Tripathi RP & Singh HP. 1993. Soil Erosion and Conservation. Wiley Eastern.
8. Yellamanda Reddy T & Sankara Reddy GH. 1992. Principles of Agronomy. Kalyani.

**Website Source:**

- [onlinecourses.nptel.ac.in](http://onlinecourses.nptel.ac.in)
- [grimoon.com](http://grimoon.com)
- <http://ecoursesonline.iasri.res.in>

**List of Experiments:**

1. To study determination of soil pH, EC, Organic Carbon, Total N, Available N, P, K and S in soils.
2. To study determination of Total N, P, K and S in plants.
3. To study interpretation of interaction effects and computation of economic and yield optima.

**List of Experiments:**

1. To study measurement of soil water status: Theory and principle of pressure plate apparatus, neutron probe, Measurement of plant water status: Relative water content, water saturation deficits Chardakov's test.
2. To study theory and principle of pressure bomb, psychrometer and osmometer, Measurement of transpiration rate.
3. To study measurement of vapour pressure deficits, theory and principle of porometry, diffusion prometer.
4. To study steady state porometer, Stomatal physiology, influence of ABA on stomatal closing.
5. To study mineral nutrients: Demonstration of energy requirement for ion uptake, deficiency symptoms of nutrients.

**List of Experiments:**

1. To study measurement of soil water potential by using Tensiometer.
2. To study soil-moisture characteristics curve.
3. To study water flow measurements using different devices.
4. To study determination of irrigation requirements.
5. To study calculation of irrigation efficiency.
6. To study determination of infiltration rate.
7. To study determination of saturated/unsaturated hydraulic conductivity.

**List of Experiments:**

1. Measurement of central tendency and dispersion
2. Standard deviation and standard error
3. Principle uses of  $\chi^2$ , F and T- test.
4. Correlation Coefficient, Regression coefficient and Regression equation.
5. Analysis of data generated from completely randomized design, randomized block design.
6. Analysis of data generated from Latin square design, factorial experiments in  $2^2$ ,  $2^3$  Split plot designs
7. Missing plot techniques.
8. Analysis of covariance.
9. Sampling in field experiments.
10. Analysis of variance (ANOVA).

**List of Experiments:**

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