ANNAMALAI UNIVERSITY

Annamalainagar

DEPARTMENT OF AGRONOMY

M.Sc. (Ag.) Agronomy

HAND BOOK

2012 - 2013

ANNAMALAI UNIVERSITY

M.Sc. (Ag.) Agronomy Degree Programme

(Regular and Part – time)

Rules and Regulations with effect from 2012-2013

1. Short title and commencement

1.1. These rules and regulations shall govern the post graduate studies leading to the award of degree of Master of Science (Agriculture/Horticulture) in the Faculty of Agriculture.

1.2 They shall come into force with effect from the academic year 2012 – 2013.

2. Definitions

2.1 An "Academic Year" shall consist of two semesters.

1.2 ."Semester" means an academic term consisting of 110 working days including final theory examinations.

1.3 "Subject" means a unit of instruction to be covered in a semester having specific No., title and credits.

1.4 "Credit hour" means, one hour lecture plus two hours of library or home work or two and half hours of laboratory/field practical per week in a semester.

1.5 "Grade Point of a subject" means the value obtained by dividing the percentage of marks earned in a subject by 10 and the Grade Point is expressed on a 10 point scale.

1.6 "Credit Point" means the grade point multiplied by credit hours.

1.7 "Grade Point Average" (GPA) means the quotient of the total credit points obtained by a student in various subjects at the end of each semester, divided by the total credit hours taken by the student in that semester. The grading is done on a 10 point scale and the GPA has to be corrected to two decimals.

1.8 "Overall Grade Point Average" (OGPA) means the quotient of cumulative credit points obtained by a student in all the subjects taken from the beginning of the first semester of the year divided by the total credit hours of all the subjects which he/she had completed upto the end of a specified semester and determines the overall performance of a student in all subjects during the period covering more than one semester. The OGPA has to be arrived at the second decimal place.

3. Courses offered

The details of various post-graduate degree programmes at Masters' level offered in the Faculty of Agriculture are as follows:

i) Agricultural Economics
ii) Agricultural Entomology
iii) Agricultural Extension
iv) Agricultural Microbiology
v) Agronomy
vi) Genetic and Plant Breeding
vii) Seed Science & technology
viii) Agricultural Bio-technology
ix) Horticulture
    a) Fruit Science
    b) Vegetable Science
    c) Floriculture and Landscape Gardening
    d) Plantation, Spices, Medicinal and Aromatic Crops
xi) Plant Pathology
xii) Soil Science and Agricultural Chemistry
xiii) Microbial Biotechnology

4. Eligibility for admission

Candidates for admission to the M.Sc.(Ag/Hort.) programme should satisfy the following requirements.

4.1. Candidates seeking admission to the M.Sc. (Ag./Hort.) Degreee programme should have completed any one of the following four year degree programmes from Universities recognized by Annamalai University.

B.Sc.(Ag.) / B.Sc.(Hort.) / B.Tech. (Hort.) / B.Sc. (Forestry) / B.Tech. (Agri. Biotech).

4.2. Candidates who have undergone the programme under conventional system should possess not less than a second class Bachelor's degree. The candidates under **4** point grade systems should possess a minimum **OGPA of 2.5 out of 4.00 and 2.75 out of 4.00 in the subject concerned.** For those under **10** point system a minimum **OGPA of 6.00 out of 10.00 and 6.50 out of 10.00 in the subject concerned** is required. **However, this will not apply to SC/ST candidates for whom a pass in the degree concerned is sufficient.**

4.3. An entrance test will be held separately for each Degree programme. Candidates shall be required to be present on the specified date and time for written test and interview at their own expenses.

5.1. Duration of the programme

5.1. A. Full-Time Programme

The duration for Full- time M.Sc. (Ag/Hort) programme will be of Two years with four semesters. A student registered for Full- time M.Sc. (Ag/Hort) programme should complete the course within four years from the date of his admission.

5.1. B. Part-Time Programme

The duration for Part- time M.Sc. (Ag/Hort) programme will be of three years. Part-time students will be permitted to register up to a maximum of 11 credits per semester. The research credits will be offered from third semester. The distribution of research credits for the four semesters (Semester III to VI) will be the same as that of regular students. A student registered for Part- time M.Sc. (Ag/Hort) programme should complete the course within five years from the date of his admission.

5.2. Credit Grade point requirements

A student enrolled for the Master's degree programme to earn eligibility for the degree is required to complete 55 credits as detailed below.

i) Major subjects	20
ii) Minor Subjects	9
ii) Statistical methods and design of experiments	3
iii) Computer application for Agricultural Research	2
iv) Seminar	1
v) Research	20
Total credits	**55**

Minor courses: Minor courses are to be chosen by the students from other discipline in consultation with the Head of the department and the Chairman based on their research specialization.

5.3.Non- credit compulsory courses

S.No.	Name of the Course	Department concerned
1.	Basic Concepts In Laboratory Techniques / Audio visual laboratory techniques* (0+1)	Soil science and Agricultural Chemistry Microbiology Plant breeding and Genetics * Agricultural Extension
2.	Technical writing and communication skills (0+1)	Parent Department and English
3.	Intellectual property and its management in agriculture(1+0) e-course	Agricultural Economics
4.	Library and Information services (0+1)	Library Sciences
5.	Disaster Management(1+0) e-course	Agronomy
6.	Agricultural Research Ethics and Methodology/Agricultural research, research ethics and rural development programmes * (0+1)	Parent department * Agricultural Extension

5.4. Minimum Grade point requirement

A post graduate student should maintain a minimum Grade Point of 6.00 out of 10 to secure a pass in a subject. In the subjects in which a student fails, he/she has to reappear for the examination to get a pass in that subject. Overall Grade Point Average (OGPA) of 6.50 out of 10 is required to secure a degree.

6. Attendance requirement

6.1. "One hundred per cent attendance is expected of each student. A student, who fails to secure a minimum of 75 per cent of attendance in each subject separately for theory and practicals, shall not be permitted to appear for the final examination in that subject and will be required to repeat the subject when ever offered.

In case of new admission, the attendance will be calculated from the date of joining of the student who are permitted to join late due to administrative reasons. However, for genuine reasons, condonation of attendance deficiency may be considered by the Vice-Chancellor on the recommendation of the Head of the Department and Dean, Faculty of Agriculture on payment of condonation fee prescribed by the University.

6.2 Students absenting from the classes with prior permission of the Head of the Department/ Dean, Faculty of Agriculture on official University business shall be given due consideration in computing attendance.

6.3 In respect of the student who had absented for the Mid-Semester Examination (MSE) on University business with prior permission of the Head of the Department /Dean, Faculty of Agriculture, the makeup MSE should be conducted ordinarily within 15 working days from the date of conduct of the Mid-Semester Examinations.

6.4 The students who absent for Mid Semester Examination in a subject on genuine reasons shall be permitted to write the makeup MSE after payment of Rs. 500/- or the amount prescribed by the University.

7. Advisory Committee

7.1. Each post-graduate student shall have an Advisory Committee to guide him/her in carrying out the research programme. The Advisory Committee shall comprise a Major Adviser (Chairman) and two members. Of the two members, one will be from the same Department of Faculty of Agriculture and the other in the related field from the other Departments of Faculty of Agriculture. The Advisory Committee shall be constituted within three weeks from the date of commencement of the first semester.

7.2. **Major Adviser (Chairman)**

Every student shall have a Major Adviser who will be from his/her major field of studies. The appointment of Major Advisers (Chairman) shall be made by the Head of the Department concerned. The chairman in consultation with the Head of the Department will nominate the other two members. In the event of the Major Adviser being away on other duty/leave for a period of more than three months, the member of the Advisory Committee from the same Department will officiate as the Major Adviser.

7.3**. Guidelines on the duties of the Advisory Committee**

i) Guiding students in drawing the outline of research work
ii) Guidance throughout the programme of study of the students.
iii) Evaluation of research and seminar credits.
iv) Correction and finalization of thesis draft.
v) Conduct of final Viva-Voce examination.
vi) The proceedings of the Advisory Committee will be sent to the Head of the Department concerned within 10 working days.

vii) Periodical review of the Advisory Committee proceedings will be made by the Head of the Department concerned.

8. Programme of study:

8.1 The student's plan for the post-graduate work, drawn up by the Advisory Committee, shall be finalized before the end of the first semester.

8.2 The programme shall be planned by the Advisory Committee taking into account his/her previous academic training and interest.

8.3 Programme of research work

The outline of research work of the student, in the prescribed manner and as approved by the Advisory Committee, shall be forwarded by the Chairman to the Head of the Department Concerned by the end of the first semester.

9 . Evaluation of students' performance

9.1 The duration of Mid-Semester Examination (MSE) should be of one hour. The duration of the final theory and final practical examinations shall be three hours each.

9.2. Grading

i) Every teacher handling a subject shall conduct Mid-Semester Examination (MSE) as per the scheme drawn by Head of the Department Concerned, evaluate and send the marks obtained by the students to the Controller of Examinations through the Head of the Department Concerned within seven working days.

ii) There will be final examinations separately for theory and practical which will be conducted by the University.

iii) Each final examination will be evaluated by two examiners (one internal and one external). The practical examination will be conducted and evaluated by two examiners (one internal and one external).

iv) The distribution of marks will be as indicated below.

Test	Courses with Practicals and Theory	Courses without Practical	Courses without Theory
Mid-Semester	20 Theory only	30	30
Final theory	40	70	-
Final practical	40	-	70
Total	**100**	**100**	**100**

The question paper model and distribution of marks for Mid Semester and final theory examinations are as follows.

Mid-Semester

For Subjects with practicals (20 marks)

1. Objective type	10 out of 12	(10 x 0.5)	5 marks
2. Definitions / concepts	5 out of 7	(5 x 1)	5 marks
3. Short notes	2 out of 3	(2 x 2 ½)	5 marks
4. Essay type	1 out of 2	(1 x 5)	5 marks

Final Theory

For subjects with practicals (40 marks)

1. Definitions	5 out of 7	(5x1)	5 marks
2. Short notes	5 out of 7	(5x2)	10 marks
3. Essay type	Either or type	(5x5)	25 arks

v) Each subject shall carry a maximum of 100 marks for purpose of grading. The grading shall be done as grade point, i.e., the percentage of marks earned in a subject is divided by ten. The grade point is expressed on a 10 point scale up to two decimals.

vi) Students who secure marks below 60per cent in a subject will be awarded 'F' grade. The supplementary examinations for the candidates who fail in a subject or subjects will be held in the subsequent semester.

vii) Students who did not have the required minimum attendance of 75 per cent will be awarded 'E' grade and has to repeat the subject.

9.3. Non- Credit Compulsory Subject

For Non–Credit Compulsory subjects the evaluation processes will be as that of the regular subjects, however, the marks obtained will not be taken into account to calculate the OGPA.

10. Credit seminar

Seminar is compulsory for all the students and each student should register and present a seminar of 0+1 credit.

10.1 a. The seminar topic should be only from the major field and should not be related to the area of thesis research.

10.1. b. The seminar topics are to be assigned to the students by the Chairman of the Advisory Committee in consultation with the Head of the Department concerned within 2 weeks after the commencement of the semester.

10.2. Under the guidance and supervision of the Chairman of the Advisory Committee, the student will prepare the seminar paper containing not less than 25 typed/printed pages with a minimum number of 50 references covering the recent 10 years time and present the seminar 2 weeks after completion of Mid-Semester Examination in the presence of the Head of the Department, Advisory Committee, staff members and PG students of the Department concerned.

10.3. The circular on the seminars by the post-graduate students shall be sent to other Departments to enable those interested to attend the same.

10.4. The Chairman will monitor the progress of the preparation of the seminar paper and correct the manuscript. The student will submit 2 copies of the corrected manuscript to the Head of the Department Concerned through the Chairman before presentation.

The student will incorporate suggestions and carry out corrections made during the presentation and resubmit three fair copies to the Head of the Department concerned through the Chairman (one copy each to Dept. Library, Chairman and the student) within 10 days after presentation.

10.5 The performance of the student will be evaluated and Grade Point awarded by the Head of the Department concerned along with Advisory Committee. The Grade Point may be given based on the following norms.

Coverage of literature	40
Presentation	30
Use of audio–visual aids	10
Capacity to participate in the discussion and answer the questions	20
Total	**100**

11. Term paper / Special assignment

This has to be assigned to the student by the teacher in subject with theory and practicals. Term papers should cover a wide range of topics within the subject limits. The topic should be different from that of the credit seminar. Term papers / special assignments will be evaluated during practical examination.

12. Research work

12.1. The topic of thesis research to be carried out by the student will be assigned by the Chairman of the Advisory Committee in consultation with the Head of the Department concerned. After assigning the topic, each student may be instructed to submit a detailed programme of work to be carried out by him/her during the semester in the prescribed proforma. After scrutiny and approval, a copy of the programme may be given to the student for carrying out the work during the semester in the prescribed proforma. The evaluation of research work done by the student should be based on the approved programme.

12.2. The distribution of research credits will be as follows:

I Semester	0+ 2
II Semester	0+ 4
III Semester	0+ 6
IV Semester	0+ 6
	0+ 2 (Thesis Viva-Voce)
Total	**0 + 20**

12.3. The student has to submit his /her research observation note book to the Major Adviser. The Major Adviser will scrutinize the progress and sign the note book with remarks as frequently as possible. This note book will form the basis for evaluation of research progress.

12.4. Before the end of the semester the Advisory Committee should evaluate the work and award Grade Point depending upon the quality and quantity of work done by him/her with reference to the approved programme during the semester.

12.5. Attendance register must be maintained for the research students by the Chairman while monitoring his/her research programme.

12.6. The procedure for evaluation of research under different situations are explained hereunder.

Situation - 1

The student should complete the research work as prescribed by the Advisory Committee.

Grade Point shall be awarded as evaluated by the Advisory Committee.

The student can be permitted to work for fresh research credits in the following semester.

Situation - 2

- The student who does not satisfy the required 75 per cent attendance shall be awarded grade 'E'.
- The student who could not complete grade 'EE'the research work for reasons found satisfactory to the Advisory Committee shall be awarded the
- The student has to reregister the same block of research credits for which 'E / EE' grade was awarded in the following semester.
- The student should not be allowed to register for fresh (first time) research credits.

Situation – 3

The student who fails to complete the research work after repeating the registration for the second time shall be awarded grade 'EE'.

- In the mark sheet the registration for 'second time' should be mentioned.
- For the registration of research credits for the third time permission has to be obtained from the Dean of the Faculty and permission for further registration for the fourth time has to be obtained from the University.
- Re-registration of further research credits shall be decided by the University based on the recommendation of the Advisory Committee, Head of the Department Concerned.

13. Other regulations.

13.1. The valued answer books of each Mid-Semester Examination shall be returned to the student for his/her information and guidance within seven days from the date of examination.

13.2. The various subjects taken by a student along with the credits and the grade obtained shall be shown on his transcript. Based on the total credits admitted, the final Grade Point Average shall be calculated and given.

13.3. At the end of each semester, the student will be given the mark list.

14. Thesis

14.1. The thesis for his/her Master's degree should be of such a nature as to indicate a student's potentialities for conduct of independent research. The thesis shall be on topic falling within the field of the major subject and shall be the result of the student's own work. A certificate to this effect duly endorsed by the Major Adviser (Chairman) shall accompany the thesis.

14.2. Evaluation of thesis

The students completing the thesis work to the satisfaction of the Advisory Committee should submit two copies of the thesis in paper pack within four weeks from the last working day of the semester.

The students who could not submit the thesis in the final form within four weeks will be awarded 'EE' grade and he/she has to re-register in the next semester. The thesis submitted in partial fulfillment of a Master's degree shall be evaluated by an external examiner. The external examiner shall be a specialist in the student's major field of study from outside Annamalai University and shall be appointed by the University in consultation with the Head of the Department. The external examiner will send the evaluation report separately to the Controller of Examinations. If the report is favourable, Viva-Voce will be arranged by the Head of the Department concerned and conducted by the Advisory Committee, Head of the Department concerned and the external examiner who may preferably be the same who evaluated the thesis. The Head of the Department shall send the recommendations of the examining committee to the Controller of Examinations. On the unanimous recommendation of the committee and with the approval of the University, the degree shall be awarded to the candidate.

14.2.1. In case rejection of the thesis by the external examiner, the Controller of Examinations may on the recommendation of the Head of the Department concerned and Advisory Committee refer the thesis for valuation by a second external examiner chosen by the University. If the second external examiner recommend the thesis for acceptance, Viva-Voce will be conducted.

14.2.2. If the revision of the thesis is recommended for repeating experiments, field trial etc., resubmission must be done by the candidate concerned after a minimum of six

months. The revised version should be sent to the examiner who recommended revision.

14.2.3. After the successful completion of thesis Viva-Voce, the student has to submit 4 bound copies of the corrected thesis (one each for Department Library, Faculty Library Chairman and the student), 3 copies of abstract of thesis, 2 copies of the summary of the findings both in Tamil and English (in 10-15 lines) and also in C.D. form.

14.2.4. The student should submit 4 copies of thesis after completion of thesis Viva-Voice within the time as specified by the Head of the Department. In case of failure to submit, the student will be awarded EE grade for final Viva-Voice evaluation credits (0+2).

13.3. Award of Medals

Medal should be awarded only if the student secures at least 8.0 OGPA, clears all courses in first attempt and in the programme having a batch of at least three students.

ANNAMALAI UNIVERSITY
FACULTY OF AGRICULTURE
DEPARTMENT OF AGRONOMY
M.SC.,(AG.) AGRONOMY (2012 – 2013)
Semester-wise Distribution (Full Time)
Semester I

S. No.	Code No.	Courses	Credit Hours
1.	AGR 611	Modern concepts in crop production	2+1
2.	AGR 612	Principles and practices of weed management	2+1
		Total	**4+2=6**
		Supporting courses	
3.	STA 611	Statistical Methods and Design of Experiments	2+1
4.	COM 615	Computer Applications for Agricultural Research	1+1
		Total	**3+2= 5**
5.	AGR 011	Research	**0+2**
		Grand Total	**7+6=13**
		Non- credit compulsory course	
6.	**	Research Ethics and Methodology**	(0+1)
7.	PGS 611**	Basic Concepts In Laboratory Techniques**	(0+1)

Semester II

S. No.	Code No.	Courses	Credit Hours
1.	AGR 621	Principles and practices of water management	2+1
2.	AGR 622	Agronomy of cereals, pulses, fodder and green manure crops	2+1
		Total	**4+2=6**
3.		**Minor course offered by other department**	**2+1=3**
4.	AGR 021	Research	**0+4=4**
		Total	**6+7=13**
		Non- credit compulsory course	
5.	PGS 622**	Technical writing and communication skills**	(0+1)
6.	PGS 623** (e-course)	Intellectual property and its management in agriculture**	(1+0)

***Compulsory course ** Non credit Compulsory course**

Semester III

S. No.	Code No.	Courses	Credit Hours
1.	AGR 711	Agronomy of oil seeds, fibre, sugar and tuber crops	2+1
2.	AGR 712	Cropping and farming systems	1+1
		Major course Total	**3+2=5**
3.		Minor courses 1 **offered by other department**	2+1=3
		Minor course 2 **offered by other department**	2+1=3
		Total	**4+2=6**
4.	AGR 032	Research	**0+6**
5.	AGR 033	Seminar	**0+1**
		Total	**7+11=18**
		Non- credit compulsory course	
6.	PGS 714**	Library and Information services**	(0+1)

Semester IV

S. No.	Code No.	Courses	Credit Hours
1.	AGR 721	Principles and practices of soil fertility & nutrient management	2+1
2.	AGR 044	Research(6+2)	0+8
		Total	**2+9=11**
		Non- credit compulsory course	
3.	PGS 725** (e-course)	Disaster Management**	(0+1)

***Compulsory course**

****** Non credit Compulsory course**

Semesters	Credits
Semester I	7+6=13
Semester II	6+7=13
Semester III	7+11=18
Semester IV	2+9=11
Total	**22+33=55**

Semestre-Wise Distribution
(Part Time)

Semester I (PT)

S. No.	Code No.	Courses	Credit Hours
1.	AGR 611	Modern concepts in crop production	2+1
2.	AGR 612	Principles and practices of weed management	2+1
		Major course Total	**4+2=6**
		Supporting courses	
3.	STA 611	Statistical Methods and Design of Experiments	**2+1=3**
		Grand Total	**6+3=09**
		Non- credit compulsory course	
4.	**	Research Ethics and Methodology**	(0+1)
5.	PGS 611**	Basic Concepts In Laboratory Techniques**	(0+1)

Semester II(PT)

S. No.	Code No.	Courses	Credit Hours
1.	AGR 621	Principles and practices of water management	2+1
2.	AGR 622	Agronomy of cereals, pulses, fodder and green manure crops	2+1
		Major course Total	**4+2=6**
3.		**Minor courses offered by other department**	**2+1=3**
		Total	**6+3=09**
		Non- credit compulsory course	
4.	PGS 622**	Technical writing and communication skills**	(0+1)
5.	PGS 623** (e-course)	Intellectual property and its management in agriculture**	(1+0)

***Compulsory course ** Non credit Compulsory course**

Semester III (PT)

S. No.	Code No.	Courses	Credit Hours
1.	AGR 711	Agronomy of oil seeds, fibre, sugar and tuber crops	**2+1=3**
2.		**Minor course offered by other Department**	**2+1=3**
		Supporting Course	
3.	COM 615	Computer Applications for Agriculture Research	
4.	AGR 011	**Research**	**0+2=2**
5.	AGR 033	**Seminar**	**0+1=1**
		Total	**5+6=11**
		Non- credit compulsory course	
6.	PGS 714**	Library and Information services**	(0+1)

Semester IV (PT)

S. No.	Code No.	Courses	Credit Hours
1.	AGR 721	Principles and practices of soil fertility & nutrient management	2+1=3
2.	AGR 021	Research	0+4
		Total	**2 + 5 = 7**
		Non- credit compulsory course	
3.	PGS 725** (e-course)	Disaster Management**	(0+1)

Semester V (PT)

S. No.	Code No.	Courses	Credit Hours
1.	AGR 712	Cropping and farming systems	1+1
		Minor course offered by other department	**2+1=3**
2.	AGR 033	Research	**0+6=6**
3.			
		Total	**3+8=11**

Semester VI (PT)

S. No.	Code No.	Courses	Credit Hours
1	AGR 044	**Research(6+2)**	**0+8=8**
		Total	**0+8=8**

***Compulsory course** ** Non credit Compulsory course**

Semesters	Credits
Semester I	6+3=09
Semester II	6+3=09
Semester III	5+6=11
Semester IV	2+5=07
Semester V	3+8=11
Semester VI	0+8=8
Total	22+33=55

AGR 611 MODERN CONCEPTS IN PHYSIOLOGY AND PRODUCTIVITY OF CROPS (2+1)

Objective

This course is scheduled to study the advanced concepts of crop production and soil management

UNIT I

Physiological basis for crop yield differences – Mechanisms for carbon assimilation – respiration and photo respiration – plant growth regulators.

UNIT II

Stress physiology – Crop response to biotic and abiotic stress - Application of tissue culture and cloning principles in crop production. Ecological risk assessment for innovations in crop production.

UNIT III

Ever green revolution – GM crops – Eco-restoration – Integrated Natural Resource Management (INRM) – Balanced nutrition - Integrated plant nutrient supply systems (IPNS) – Improved crop nutrition practices - soil health care (SHC) – Efficient post harvest management (EPHM) – organic farming – Crop and land management practices.

UNIT IV

Basic concepts in growth and growth analysis – HYV – stability in yield – yield maximization – crop lodging - concept of ideal plant type and crop modeling for desired crop yield – Interaction of inputs on growth and yield attributes of crops.

UNIT V

Good agriculture practices - Role of sustainable Agriculture - precesion farming – IFS – modern concepts – tillage –Agronomic considerations – Farm mechanization – Agroforestry enrichment – information technology.

Lecture Schedule

Theory

1. Physiological traits & its significance on crop yield
2. Mechanisms for carbon assimilation
3. Mechanisms for carbon respiration & photo respiration
4. Plant growth regulators and retardants
5. Ever green revolution – GM crops – Eco-restoration
6. Integrated Natural Resource Management (INRM) – Integrated plant nutrient supply systems (IPNS)
7. Soil health care (SHC) – Efficient post harvest management (EPHM)
8. Organic farming – concepts, principles.
9. Plant growth – definition, basic concepts, general growth pattern, factors affecting growth and distribution
10. Crop growth analysis in relation to environment
11. Physical and chemical factors affecting crop growth and distribution
12. HYV – stability in yield – yield maximization
13. Hi tech production technologies
14. Source – sink relationship – crop lodging – crop modeling
15. Interaction of inputs on growth and yield attributes of crops.
16. Effect of lodging- major crops- reasons-management
17. Physiology of grain yield in cereals – source sink relationship - yield components – Harvest index
18. Cropping system and nutrient – management – Integration of diverse sources of plant nutrients
19. Optimization of plant population and planting geometry in relation to different resources
20. Concept of ideal plant type and crop modeling for desired crop yield
21. Balanced nutrition – principles of manuring
22. Yield gap analysis
23. Permanent manurial experiments
24. Good agriculture practices - Systems Agriculture

25. Sustainable – precession farming
26. IFS – modern concepts – tillage
27. Agronomic considerations – Agroforestry – enrichment
28. Contingency planting – perquisites – major crops –
29. Information technology in agriculture research and development.
30. Shade net cultivation – green house- Orientation of greenhouse / polyhouse - Design- Environmental factors influencing the greenhouse cultivation
31. Protected agriculture- drip irrigation and fertigation systems in greenhouse cultivation cost estimation
32. Economics of crop production – economic evaluation of crops in a cropping system – monetary advantages
33. Mechanization- operations-sowing- planting- weeding- irrigation- harvesting in field crops
34. Future challenges and opportunities - crop production

Practicals

1. Studies on growth phases of crops
2. Measurement of growth and yield components
3. Mitigation strategies for drought, wind and flood affected crops & their situations.
4. IPNS
5. EPHS
6. Studies on various IFS
7. Yield assessment of various cropping system.
8. Calculation on agronomic efficiency.
9. Studies on yield and yield assessment
10. Studies on agriculture and green house gases.
11. Studies on moisture conservation
12. Crop lodging
13. Crop modeling
14. Comparative studies on conventional farming and modern agriculture
15. Studies on good agricultural practices – low cost and no cost technology.
16. Studies on alternate cropping system under resource constraint condition
17. Studies on the calculation of improved agro inputs.

Suggested Readings

1. Balasubramaniyan P & Palaniappan SP. 2001. *Principles and Practices of Agronomy*. Agrobios.
2. ICAR. 2006. *Hand Book of Agriculture*. ICAR.
3. Palaniappan SP & Annadurai K. 2006. *Organic Farming - Theory and Practice*. Scientific Publ.
4. Panday. S.C 2011. Modern concepts and advance principles of crop production, Agrobios (India). Jodhpur., pp.525.
5. Russel, E.W. 2003. Soil Conditions and Plant Growth. Biotech Books. New Delhi., pp.635.
6. Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani.
7. Tarafdar JC, Tripathi KP & Mahesh Kumar 2007. *Organic Agriculture*. Scientific Publ.

AGR 612 PRINCIPLES AND PRACTICES OF WEED MANAGEMENT (2+1)

Objectives

- To offer an exposure with the concepts and principles of weed management
- To equip the students with scientific advancements in the field of weed science

Unit I: Weed Biology & Ecology

Weeds – definition and concepts – characteristics - losses caused by weeds – economic uses of weeds– classification. Perennation – sexual and vegetative reproduction – dissemination of weed seeds – dormancy and germination. Crop – weed interactions – competition – allelopathy.

Unit II: Weed Control Principles

Methods of weed control – preventive and curative. Mechanical, cultural, biological and chemical control of weeds – Integrated Weed Management - Control of aquatic, parasitic and problematic weeds. Control of weeds in field crops, cropping systems and non-cropped areas; Efficiency indices of weed management techniques. Cost benefit analysis of weed management.

Unit III: Herbicide physiology

Herbicides introduction and history of their development; Classification of herbicides based on application, chemical and physiological - Herbicide structure-activity relationship; factors affecting the efficiency of herbicide; Herbicide formulation - components and adjuvants. herbicide mixtures herbicide rotation; herbicide interaction with other inputs; Mode of action of herbicides – absorption, translocation and mechanism of action of herbicides. Herbicide persistence in soil and plant, Herbicide residue management – Herbicide application techniques – equipments.

Unit IV: Selectivity, safety and compatibility of herbicides

Basis for herbicide selectivity – metabolism of herbicide – carry over effect – residue. Herbicide toxicology and regulatory aspects. Compatability of herbicide with agrochemicals. Decision Support System for weed management.

Unit V: Biotechnology in weed management

Bio control of weeds using plant products, insects and fungi. Herbicide resistance in weeds and crops – Herbicide resistance management. Weed shift and alien invasive species – Weed Risk Assessment(WRA). Bio scavenging of herbicide spills with GMO's.

Practical

Collection and identification of weeds associated in different ecological situations – Weed survey in crops and cropping systems – Preparation of weed herbarium – Weed seed characters – implements used for weed control – Classification, identification and study of characteristics of important herbicides – Herbicide spray equipment – formulation of herbicides - Economics of herbicides application – Herbicides residue determination – Bio-assay – Weed control indices – complimentary weed control – Bioagents and natural products for weed control – Weed research methodology- Phytotoxic injury of herbicides.

Theory – Lecture Schedule

1. Definition – characteristics and classification of weeds
2. Economic uses and losses caused by weeds.
3. Classification of weeds
4. Weed migration, weed seed distribution in different ecosystems.
5. Weed seed dormancy, germination, establishment and perennation of weeds in different ecosystems
6. Crop- weed competition and Allelopathy
7. Preventive , cultural and mechanical weed control
8. Biological method of weed control, bio-herbicides, mycoherbicides and allelo chemicals
9. Mechanical and chemical method of weed control
10. Integrated weed management
11. Weed management in major crops
12. Management of perennial, problematic and parasitic and aquatic weeds
13. Environmental impact and management of aquatic weeds
14. Weed management in non-crop situation and other terrestrial ecosystems
15. Evaluation of efficiency indices cost-benefit analysis of integrated weed management in different ecosystems

16. History and development of herbicides
17. Classification of herbicides
18. Mid-semester examination
19. Characteristics of herbicides and herbicide formulations
20. Herbicides and herbicide mixtures and their compatibility and efficiency
21. Herbicide use efficiency - Adjuvants, herbicide protectants and antidotes
22. Characteristics of herbicides - low dose herbicides and nano herbicides
23. Mode of action of herbicides and their selectivity.
24. Herbicide persistence and degradation in plants and soils
25. Herbicide residues-causes and their management
26. Herbicide rotation and its significance on weed management
27. Herbicide application techniques and equipments
28. Herbicide registration and regulation
29. Decision support system
30. Bio control of weeds – plant products, insects and fungi
31. Herbicide resistant weeds and their impact on weed management
32. Development of transgenic herbicide resistant crops
33. Weed shift and Invasive alien species and WRA
34. Natural products and biotechnology in weed management

Practical Schedule

1. Identification of wetland and aquatic weeds
2. Identification of garden land weeds
3. Identification of dryland weeds and problem weeds
4. Phytosociology survey of weeds & weed mapping
5. Assessment of weed seed bank and seed production potential of weeds
6. Working out herbicides and spray fluid requirements
7. Herbicide application techniques and equipments
8. Study on formulation of herbicides
9. Working out economics of herbicide application
10. Working out weed control efficiencies of different weed management practices
11. Bio-assay of herbicide residues

12. Study on the influence of herbicides on soil microflora
13. Study on complimentary weed control through cultural practices like mulching and intercropping
14. Use of bioagents for weed control viz., azolla, fish, insects and fungi.
15. Use of natural products for weed control
16. Methodology for weed research – competition studies and control
17. Scoring for phyto-toxic injury of herbicides

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1. Das. T.K., 2008. Weed Science Basics and Applications. Jain brothers, New Delhi.

2. Gupta, O.P. 1998. Modern weed management, Agro Botanical Publishers, New Delhi.

3. Hosmani, M.M. 1995. Integrated weed management in field crops, Sarajijakshi M. Hosmani Publishers, Dharwad.

4. Rao, V.S. 2000. Principles of weed science. Second edition - Oxford and IBH Publishing Co. New Delhi.

5. Robert E.L. Naylor, 2002. Weed management hand book. Ninth Edition- Published for the British Crop Protection Council by Black well Science.

6. Saraswat V.N., V.M. Bhan and N.T. Yaduraju. 2003. Weed Management. Directorate of Information and Publications of Agriculture, ICAR, New Delhi.

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AGR 621 - PRINCIPLES AND PRACTICES OF WATER MANAGEMENT (2+1)

Objective

To impart knowledge on principles and practices of weed management practices to enhance the water productivity.

Theory

To equip the students to learn modern trends in weed management

UNIT I – History and Development of Irrigation

History and development of irrigation – importance of irrigation in crop production - Role of water in plants - water resources of India and Tamil Nadu - major irrigation projects - extent of area and crops irrigated in India and different states

UNIT II – Soil water plant relationship

Soil water constants - Soil water movement in soil and plants; Soil-water-plant-atmospheric relationships – evaporation - transpiration - evapo-transpiration water absorption by plants - plant response to water stress - crop plant adaptation to moisture stress condition

UNIT III – Crop water requirement

Crop water requirement - Soil, plant and meteorological factors determining water needs of crops - Irrigation scheduling based on different approaches - merits applicability of each approach – Irrigation scheduling for important crops - Methods of irrigation; Micro irrigation system – fertigation - management of water in controlled environments and polyhouses

UNIT IV – Water use efficiency and water quality

Water management of crops and cropping systems - quality of irrigation water - management of saline water for irrigation - water use efficiency – Factors affecting WUE measures to increase WUE.

UNIT V – Integrated water management

Excess soil water and plant growth - water management in problem soils - drainage requirement of crops - Methods of field drainage – design and layout - Integrated water management in command areas – Farmers participation in command areas.

Practical Schedule

Estimation of soil moisture content by gravimetric and volumetric method - Estimation of soil moisture by neutron probe & other improved devices - Collection of data on soil moisture characteristics and drawing curve - Determination of infiltration rate by ring method - Determination of saturated / un saturated hydraulic conductivity - Determination of soil moisture constants. Field capacity, PWP and soil water equivalent - Assessment of plant water status – RWC by direct method - Computation of crop water requirement using modified penman method - Computing AET and determining ER by direct method - Comparison for water saving and cost of different surface methods - Water flow - measurement using different devices / observation at field level - Determination of irrigation requirement for crops and seasons - Designing and working out cost economics for sprinkler irrigation and drip irrigation - Study of fertigation equipments and practicing fertigation - Study of the quality of irrigation water - Observations on irrigation experiments - Study of water soluble nutrients usage.

Lecture Schedule

Theory

1. Role of water in plants and crop production – need for irrigation and importance of irrigation in India
2. Water resources of India and Tamilnadu - Availability of water resources for different sectors.
3. History of irrigation in India – irrigation projects – major projects – further scope for water resource conservation and storage.
4. Area and crops irrigated in India and Tamil Nadu
5. Soil – water relationship – soil type – soil physical characteristics and water relations – particles – texture, structure, adhesion, cohesion, density, porosity, capillarity.
6. Components of soil - mineral organic matter - water and air – Role of organic matter in soil physical properties and water relations.
7. Soil water movement – Theories and laws relating – application in irrigation management.

8. Soil water and plant relationship – absorption – conductance and loss – soil, plant and atmospheric factors.
9. Loss of water from soil and plant – evaporation and transpiration – transpiration – ET – Factors effecting ET.
10. Plant stress – causes for stress in plants – plant response to stress – indications of stress in plants – crop adaptations – methods to overcome.
11. Water needs of crop – factors affecting the water requirement of crops.
12. Methods of estimating water requirement of crops.
13. Scheduling of irrigation – criteria for scheduling irrigation – criteria based on plant and soil water
14. Scheduling irrigation based on climatological approach – empirical formulae – pan evaporation – crop co-efficient.
15. Methods of irrigation – surface and sub-surface methods – advantages and disadvantages.
16. Overhead and micro-irrigation – sprinkler irrigation – suitability – components – advantages and disadvantages.
17. Drip irrigation – suitability – components – layout – advantages and disadvantages.
18. Special and advanced methods of irrigation – suitability and advantages.
19. Concept of fertigation – fertilizers suitable – methods of applying fertilizer through irrigation water – fertigation tanks – venturies – fertigation under surface methods.
20. Irrigation under controlled environment – glass houses – green house – poly house – netted house – pot watering – sprinkling – pipe irrigations.
21. to 25. Irrigation management for cereals, pulses, oilseeds, fibres, sugar crops and other commercial crops.
26. & 27. Irrigation management for annual and perennial horticultural crops
28. Advanced trends and concepts in scheduling irrigation – modifications in the existing systems.
29. Water management for cropping systems – annuals – perennials - intercropping and – sequential systems.
30. Quality of irrigation water – standards – use of saline water for irrigation.
31. WUE – definition and concept – methods to improve water use efficiency

32. Soil water – excess water – causes for excess water in soil – effect on soil and plants – tolerance of plants for water stagnated environment.
33. Drainage – methods of draining water – surface and subsurface method – layout.
34. Water and irrigation management for problem soils – non drainable, undulating, saline and alkali soils.

Practical

1. Estimation of soil moisture content by gravimetric and volumetric methods.
2. Estimation of soil moisture by neutron probe & other improved devices.
3. Collection of data on soil moisture characteristics and drawing curves.
4. Determination of infiltration rate by ring method
5. Determination of saturated / un saturated hydraulic conductivity
6. Determination of soil moisture constants. Field capacity and PWP
7. Assessment of plant water status – RWC by direct method
8. Computation of crop water requirement using modified penman method
9. Computing AET and determining ER by direct method
10. Comparison for water saving and cost of different surface methods
11. Water flow measurement using different devices / observation at field level
12. Determination of irrigation requirement for crops
13. Designing and working out cost economics for sprinkler irrigation and drip irrigation
14. Study of fertigation equipments and practicing fertigation
15. Study of quality of irrigation water
16. Observations on irrigation experiments
17. Study of water soluble nutrients usage
18. Methods of Drinage

Suggested Readings

1. Gupta. C 1990. Use of saline water in Agriculture, Oxford and IBH, New Delhi
2. Kolay. A.K 2008. Water and Crop growth. Atlantic Publishers and Distributors (P) Ltd., New Delhi.
3. Lenka D. 1999. *Irrigation and Drainage.* Kalyani Publishers, New Delhi
4. Michael AM. 2005. *Irrigation: Theory and Practice.* Vikas Publishers.
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7. Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
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9. Wahab. K and A. Sundari, 1998. Irrigation Management

AGR 622 AGRONOMY OF CEREALS, PULSES, FODDERS AND GREEN MANURE CROPS (2+1)

Objective

To teach the crop husbandry of cereals, pulse crops, fodders and green manure crops.

Theory

Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling, processing, utilization and value addition of cereals and pulses - cropping system.

UNIT I

Cereals – Rice, Maize, Wheat, Barley, Oats, Rye, Triticale

UNIT II

Millets - Sorghum, Cumbu, Finger Millet, Minor millets

UNIT III

Pulses – Chick pea, Lentil, Peas, Horse gram, Rajmash, Pigeon pea, Green gram, Black gram, Cowpea, Soybean, Lathyrus

UNIT IV

Fodders – cereal, legume and tree fodder – Green manures – Daincha, sunhemp, sesbania, glyricidia, pillipesara, cluster bean

UNIT V

Mechanization in cereals and pulse production - anti nutritional quality factors in pulses - present trends and future thrust - low cost and cost effective techniques - problems and prospects of cereals and pulse production-future thrust.

Practical

Laying out observation plots with latest varieties of cereals, millets and pulses - observation on - Phenological studies, intercultural operations at different crop growth stages in cereals - millets - pulses - working out growth indices (LAI, CGR, RGR, NAR, LAD), aggressivity, relative crowding co-efficient, monetary yield advantage and ATER of prominent intercropping systems of different crops - Estimation of quality parameters in cereals and pulse - Planning and layout of field experiments in cereals and pulses - Judging of physiological maturity in cereals, millets and pulses - visit of field experiments on cultural,

fertilizer, weed control and water management aspects in cereals and pulses - visit to nearby village / research stations for identification of constraints in crop production - working out harvest index of major crops in cereals, millets and pulses - determination of cost of cultivation of major crops in cereals and pulses - study of seed production techniques in cereals - pulse crops - Estimation of crop yield on the basis of yield attributes for major cereals and pulses - Observation of growth and yield parameters of green manures/ green leaf manures, area, production and its productivity - Silage and hay making – quality and preservation of fodder - Formulation of cropping schemes for various farm sizes and calculation of cropping intensity.

Lecture Schedule

Theory

1. Rice - Origin and history, area and production, classification, economic importance Rice - Improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition and quality components.
2. Rice- Handling, processing, utilization and value addition in rice – rice based cropping system
3. Maize- Origin and history, area and production, classification, economic importance improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling, processing, utilization and value addition - cropping system.
4. Wheat - Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling, processing, utilization and value addition.
5. Barley - Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling, processing, utilization and value addition.
6. Oats, Rye, Triticale - Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling, processing, utilization and value addition .

7. Sorghum-Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition .
8. Cumbu- Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.
9. Finger millet- Origin and history, area and production, classification, economic importance improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.
10. Minor millets - Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition .
11. Chick pea- Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.
12. Lentil and Peas - Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.
13. Horse gram and Rajmash - Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.
14. Pigeonpea - Origin and history, area and production, classification, Economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.

15. Greengram- Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.
16. Blackgram- Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.
17. Cowpea- Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition.
18. Midterm Examination
19. Soybean and Lathyrus - Origin and history, area and production, classification, economic importance, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing, utilization and value addition .
20. Minor pulses- Rice bean, Moth bean, Lima bean, Sword bean
21. Green manure and green leaf manures – scope and Importance and role of green manures in soil fertility management – agronomic characters of green manures
22. Green manure crop - production package technologies for Daincha, Sesbania, Sunnhemp, Tephrosia and cluster bean and seed production techniques.
23. Forage crops – scope and importance – definition – classification – constraints in forage production
24. Forage cereals – Sorghum, Maize, Oats and Pearl millet – production package technologies.
25. Forage grasses –production package technologies – Perennial grass - Cumbu Napier hybrid grass, Guinea grass, Para grass and Cenchrus – annual grass – Deenanath.
26. Legume forages – production package technologies for Alfalfa, Desmanthus, Stylosanthus, Berseem, Cowpea and minor legume – Pillipesara and Siratro - cutting management, nutritive and quality management – cropping system.

27. Tree – fodders – Agroforestry – Lay farming - quality characters of tree fodder - silvi pastures - Nutritive value and quality aspects of forage crops.
28. Cereal, millet and pulse based cropping system
29. Mechanization in cereal, millet and pulse production
30. Anti nutritional quality factors in cereals, millet and pulses
31. Present trends and future thrust in cereal and pulse production
32. Low cost and cost effective technique in cereal production
33. Problems and prospects of cereal production
34. Problems and prospects of pulse production

Practical

1. Phenological studies, intercultural operations at different crop growth stages in cereals .
2. Phenological studies , intercultural operations at different crop growth stages in millets.
3. Phenological studies , intercultural operations at different crop growth stages in pulses.
4. Working out growth indices (LAI, CGR, RGR, NAR, LAD), aggressivity, relative crowding co-efficient, monetary yield advantage and ATER of prominent intercropping systems of different crops.
5. Estimation of quality parameters in cereals and pulse
6. Planning and layout of field experiments in cereals and pulses
7. Judging of physiological maturity in cereals, millets and pulses
8. Visit of field experiments on cultural, fertilizer, weed control and water management aspects in cereals and pulses.
9. Visit to nearby village / research stations for identification of constraints in crop production
10. Working out harvest index of major crops in cereals, millets and pulses
11. Determination of cost of cultivation of major crops in cereals and pulses
12. Study of seed production techniques in cereal crops
13. Study of seed production techniques in pulse crops
14. Estimation of crop yield on the basis of yield attributes for major cereals and pulses

15. Observation of growth and yield parameters of green manures/ green leaf manures, area,production and its productivity.

16. Silage and hay making – quality and preservation of fodder.

17. Formulation of cropping schemes for various farm sizes and calculation of cropping intensity.

Suggested Readings

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2. Balsubramaniyan, P. and S.P.Palaniappan, 2001. Principles and Practices of Agronomy. Agrobios.Jothpur - 342 002.

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7. Rathore, P.S. 2002. Techniques and Management of Field Crop Production. Agrobios (India)., Jodhpur., pp.525.

8. Singh. S.S. 1997. Crop management under irrigated and rainfed conditions. Kalyani publications.

AGR 711 AGRONOMY OF OILSEEDS, FIBRE, SUGAR AND TUBER CROPS (2+1)

Objective

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

Theory

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

UNIT I

Oilseeds - Groundnut, sesame, rapeseed and mustard, sunflower, safflower, castor, coconut .

UNIT II

Fibre crops - Cotton, jute, sunhemp, mesta and agave

UNIT III

Sugar crops – sugarcane – Sugar beet and sweet sorghum

UNIT – IV

Tuber crops – Tapioca, sweet potato and potato

UNIT – V

By products utilization- low cost and cost effective technology- trends and future thrust farm mechanization- constraint and yield gap analysis - crop rotation.

Practical

1. Planning and layout of field experiments
2. Cutting of sugarcane setts, its treatment and methods of sowing, tying and propping of sugarcane
3. 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
4. Intercultural operations in different crops
5. Cotton seed treatment

6. Working out growth indices (LER, CGR, RGR, NAR, LAD) aggressively, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems
7. Judging of physiological maturity in different crops and working out harvest index
8. Working out cost of cultivation of different crops
9. Estimation of crop yield on the basis of yield attributes
10. Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities
11. Determination of oil content in oilseeds and computation of oil yield
12. Estimation of quality of fibre of different fibre crops
13. Study of seed production techniques in various crops
14. Visit of field experiments on cultural, fertilizer, weed control and water management aspects
15. Visit to nearby villages for identification of constraints in crop production

Lecture Schedule

Theory

1. Oilseeds - Introduction - importance of oilseeds - Area, production, productivity of oilseeds - role of oilseeds in Indian Economy.

2. Groundnut - economic importance - seasonal and soil requirement sowing - planting - nutrient management of groundnut

3. Water management - cultural practices - weed management of groundnut pre and post harvest technologies of groundnut

4. Sesamum - seasonal, soil requirements - cultural practices - post harvest technology

5. Rapeseed and mustard – Economic importance – seasonal and soil requirements – sowing – nutrient - water and weed management and post harvest technologies.

6. Sunflower - seasonal and soil requirements - sowing techniques - nutrient management, Water and weed management - cultural practices - pre and post harvest technology of sunflower

7. Safflower - Economic importance – seasonal and soil requirements, sowing, nutrient, water and weed management and post harvest technologies.

8. Castor - importance - soil and climatic requirements cultural practices, Pre and post harvest technologies of castor.

9. Coconut – economic importance – origin and distribution – soil and climatic requirements – season – varieties – preparation of nursery.

10. Coconut – Planting methods – manures and manuring – weeding – after cultivation – cropping system – harvest and post harvest technology.

11. Jatropha - Economic importance – seasonal and soil requirements, sowing, nutrient, water and weed management and post harvest technologies.

12. Origin, introduction and economic importance and role of cotton, jute and mesta in agricultural growth and economy - Area, production, productivity, - classification - Demand, supply and marketability of cotton, Jute and Mesta.

13. Cotton – improved varieties – adaptability, climate soil, water and cultural requirements

14. Nutrient management, fibre quality parameter

15. Post harvest technology in cotton

16. Jute – Production package technologies – integrated input management- Yield maximization - cost reduction technologies.

17. Jute – Post harvest technologies – Jute processing – quality characters – value added products.

18. Midterm- Test

19. & 20. Scope and importance – production package for Mesta, Agave and Sunhemp – value addition

21. Sugarcane – Introduction – importance of sugarcane in Indian Economy - distribution – area, production and productivity – Demand, supply and marketability.

22. & 23. Sugarcane – production package technologies and sugarcane based cropping system
23. Sugarcane - Ratoon management techniques - Value added products – By product utilization

24. Sugar beet – Introduction – importance of sugar beet – production package technologies

26. Sugar beet – Introduction – importance of sugar beet –package of production technologies

27. Agronomy of sweet sorghum - importance - origin and history - area and distribution – classification - soil and climate - varieties – hybrids - package of practices - pre and Post harvest technologies.

28. Tapioca – economic importance – origin and distribution – area and production – soil and climatic requirements – season – varieties – planting – manures and manuring – weeding – after cultivation – irrigation – cropping systems – harvest and post harvest technology.

29. Potato – economic importance – origin and distribution – area and production – soil and climatic requirements – season – varieties – planting – manures and manuring – weeding – after cultivation – irrigation – cropping systems – harvest and post harvest technology.

30. Sweet potato – economic importance – origin and distribution – area and production – soil and climatic requirements – season – varieties – planting – manures and manuring – weeding after cultivation –irrigation – cropping systems – harvest and post harvest technology

31. By products and value addition in tuber crops

32. Constrains in oil seed production and measures to improve productivity

33. Constrains in cotton production and measures to improve productivity

34. Constrains in Sugarcane production and measures to improve productivity

Practical

1. Planning and layout of field experiments
2. Study of phenology and growth characters in groundnut
3. Study of phenology and growth characters in sunflower
4. Study of phenology and growth characters in sesame
5. Estimation of oil content in oilseed crops
6. Cutting of sugarcane setts, its treatment and methods of sowing, tying and propping of sugarcane

7. Determination of cane maturity calculation on purity percentage, recovery percentage and sucrose content in cane juice, phonological studies at different growth stages of crop
8. Working out growth indices (LER, CGR, RGR, NAR, LAD) aggressivity, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems
9. Judging of physiological maturity in different crops and working out harvest index
10. Working out cost of cultivation of different crops
11. Estimation of crop yield on the basis of yield attributes
12. Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities
13. Determination of oil content in oilseeds and computation of oil yield
14. Estimation of quality of fibre for different fibre crops
15. Study of seed production techniques in various crops
16. Visit to field experiments on cultural, fertilizer, weed control and water management aspects
17. Visit to nearby villages for identification of constraints in crop production

Suggested Readings

1. Chidda Singh, Prem Singh and Rajbir Singh 2003. Modern Techniques of Raising Field Crops. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.
2. Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.
3. Das PC. 1997. *Oilseed Crops of India*. Kalyani.
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   6. Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
7. Singh. S.S. 1988. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.

AGR 712 – CROPPING AND FARMING SYSTEMS (1+1)

Objectives

1. To incorporate the ecological principles of interaction, crop, communities for evolving suitable cropping systems
2. To offer an understanding on cropping and farming system as a tool for enhancing farm productivity.
3. To incorporate scientific principles of sustainability in low input farming

Unit I: Cropping systems – Principles

Cropping system – Definition – scope and importance – in intensive agriculture – principles – ecological interaction among crop communities – competition, annidation and allelopathy – Resource competition and management in intercropping, sequential cropping. Types of multiple cropping – sequential, relay, inter, mixed and multi-storeyed.

Unit II: Assessment and exploitation of biological efficiency

Evaluation indices for biological and economic efficiency of intercropping and sequential cropping – Socio-economic constraints in adoption of systems approach. Resource management and crop planning – alternate land use pattern.

Unit III : Elements of Farming systems

Concept of farming system – scope – factors – influencing choice of elements – requirements & practices for different elements – integrated farming systems – prospects and constraints – component technologies of cropping in systems approach.

Unit IV: Sustainability through systems Approach

Sustainability concepts in cropping and farming systems – Development, management and allocation of resources – low input sustainable agriculture – location specific IFS – models. Crop diversification for sustainability

Unit V: Farming for environmental conservation

Impact of agro inputs – biotechnology – GMO's and invasive alien species on farm productivity. Environmental pollutants abatement and farming – Restoration of degraded and wastelands – WTO and Agroindustries.

Practical

Indices for biological and economic evaluation of cropping system – preparation of cropping system under different resources. Methodology for on farm research. Review of cropping system experiments in India and Tamilnadu. Components of farming system and their contribution. Planning cropping system to suit resource availability for selected intensive cropping system.

Collection of data on resource availability, allocation and use efficiency – Analysis of risks involved and opportunity available – Piggery, sheep and goat – rabbits – Dairy – sericulture – fisheries. Suggestions for development and alternate farming systems.

Theory Lecture Schedule

1. Scope and importance of cropping system, definitions and terminology
2. Plant interaction - Competition and annidation
3. Allelopathy and Interaction among crop communities
4. Multi storeyed cropping & Evaluation of intercropping systems
5. Evaluation of sequential cropping systems & Socio- economic constraints for adoption of cropping systems
6. Resource management and crop planning - Alternate land use systems
7. Scope of Farming systems & Factors influencing the choice of component elements
8. Mid-Semester Examination
9. Integrated Farming Systems - prospects and constraints - Organic recycling and IFS
10. Component technologies in cropping system and farming systems
11. Farming System Management and sustainable agriculture
12. IFS for wetlands, Gardenlands and drylands
13. Environment conservation, GMOs and Farming
14. Threat from invasive alien species

15. Crop diversification for sustainability
16. Farming systems and agro industries, Value addition in farm products
17. Bioremediation and Bioscavenging

Practical Schedule

1. Preparation of cropping scheme for different agro climatic zones.
2. Review of cropping system experiments in India.
3. Review of cropping system experiments in Tamilnadu.
4. Study on Indices for biological evaluation of cropping system
5. Study on Indices for economic evaluation of cropping system
6. Study on Methodology for institutional research
7. Study on Methods in on – farm trials
8. Assessing risks and opportunities with component elements dairy, fishery, poultry, goat rearing, piggery etc.
9. Formulation of Integrated Farming Systems for wetlands
10. Formulation of Integrated Farming Systems for gardenland and drylands
11. Assessment of Organic recycling in Integrated Farming Systems
12. Tracing the role of farming elements in reducing agrochemical use
13. Study on poultry and animal husbandry as component in IFS
14. Study on mushroom culture as a component in IFS
15. Study on agro forestry as a component in IFS
16. Study on sericulture as a component in IFS
17. Practical Examination.

Reference

1. Balasubramanian. P and Palaniappan, SP. 2002. Principles and practices of Agronomy. Agrobios (India). Jodhpur.

2. Jayanthi C, Sakthivel N., Sankaran N and T.M. Thiyagarajan.2002. Integrated farming system. A path to sustainable agriculture.

AGR 721 PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENTS (2+1)

Objective

To impart knowledge of fertilizers and manures as sources of plant nutrients and appraise about the integrated approach of plant nutrition and sustainability of soil fertility

Theory

Unit – I Importance of Soil and Fertility

Soil – origin-formation – dispersion-– factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; soils of India. growth functions. soil fertility- definition importance- and soil productivity-correlation.

Unit – II Essentiality of plant nutrients

Mineral nutrition of plants – elements-Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; nutrient movement and uptake - of major plant nutrients, IPNS-: Soil health, Problem soil and their management, carbon sequestration.

Unit – III Soil fertility

Maintenance of soil fertility- 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. organic farming – basic concepts and definitions

Unit – IV Fertilization for crop production

Commercial fertilizers-soil and liquid; composition, 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, soil moisture and nutrient interaction, fertilizer related environmental and ground water pollution.

Unit – V Latest trends in Crop nutrition

Time and methods of manures and fertilizers application; foliar application and its concept; fertigation- soluble nutrients-chelated nutrients Soil classification–soil survey – types-soil report-correlation –soil conservation-erosion-land degradation..

Practical

1. Determination of soil pH, EC, organic C, total N, available N, P, K and S in soils
2. Determination of total N, P, K and S in plants
3. Interpretation of interaction effects and computation of economic and yield
4. Optima
5. Nutrient budgeting
6. Diagnosis of nutrient deficiencies

Lecture Schedule

Theory

1. Soil fertility- soil productivity –definitions – concepts
2. Factors affecting soil fertility
3. Features of good soil management
4. Problems of supply and availability of nutrients
5. Physico- chemical properties of the soil
6. Relation between nutrient supply and crop growth
7. Growth functions - concepts - importance
8. Criteria of essentiality of nutrients - essential plant nutrients – their functions- Macronutrients –N, P, K, Ca, Mg, S
9. Essential plant nutrients – their functions -Micronutrients
10. Nutrient deficiency symptoms – critical levels
11. Transformation and dynamics of plant nutrients – nitrogen
12. Transformation and dynamics of phosphorus and potassium
13. Methodologies for soil fertility assessment
14. Soil health and its importance; carbon sequestration
15. Problem soils and their management
16. Preparation and use of farm yard manure and compost - composition-availability and crop responses
17. Green manure – green leaf manure - cultivation –incorporation – availability and crop responses
18. Mid semester examination
19. Preparation and use of vermicomost , biofertilizers and other organic concentrates

composition- availability and crop responses

20. Preparation and use of other organic concentrates- composition- availability and crop response
21. Recycling of organic wastes and residue management
22. Organic farming - basic concepts and definitions
23. Commercial fertilizers- solid and liquid composition –relative value and cost
24. Crop response to different nutrients
25. Residual effects and fertilizer use efficiency
26. Fertilizer mixtures and grades – their composition- uses
27. Agronomic, chemical and physiological methods of increasing fertilizer use efficiency
28. Nutrient interaction – soil moisture and nutrient interaction
29. Fertilizer related environmental and ground water pollution
30. Time and methods of manures and fertilizer application
31. Foliar nutrient application and its concept- uses
32. Soil classification–
33. Soil survey – types -
34. Soil report-correlation –
35. Soil conservation-erosion-
36. Land degradation.

Practical

1. Collection of soil sample for analysis
2. Estimation of pH, EC in soils
3. Determination of organic carbon of soil
4. Determination of total N of soil
5. Determination of available N in soil
6. Determination of available P2O5 in soil
7. Determination of available K2O in soil
8. Determination of available sulphur in soil
9. Collection of plant sample for analysis
10. Determination of total N in plants
11. Determination of total P plants

12. Determination of total K plants
13. Determination of total sulphur in plants
14. Interpretation of interaction effects
15. Computation of economic and yield optima
16. Nutrient budgeting
17. Diagnosis of nutrient deficiencies – N, P, K, Ca, Mg, S
18. Diagnosis of nutrient deficiencies – micronutrients

Suggested Readings

1. 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 Nutritionof Field Crops.* Marcel Dekker.
2. Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers.* 7th Ed. Prentice Hall.
3. Prasad R & Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture.* CRC Press.
4. Yawalkar KS, Agrawal JP & Bokde S. 2000. *Manures and Fertilizers*. Agri-Horti Publ.

STA 611 – STATISTICAL METHODS AND DESIGN OF EXPERMENTS (2+1)

Unit I: Concepts in Statistics

Population and sample, parameter and statistic. Concept of Sampling – Simple random Sampling – Concept of Probability distribution – Binominal, Poisson and Normal distributions. F and Chi square distribution. Estimation: Point estimation, interval estimation, Degrees of freedom. Concept of Sampling distribution – Standard Error. Tests of Significance based on t, z, (Mean and equality of Means only). X^2 test for goodness of fit.

Unit II: Correlation and Regression

Definition, types and methods of studying correlation – Properties of correlation coefficient. Regression – Measuring and uses of Regression analysis – Properties. Differences between correlation and regression. Regression co – efficient - simple, linear – multiple linear regression co - efficient – standard error of estimate – test of significance of observed regression co - efficient and co - efficient of determination – Non linear regression. Misuses of correlation and regression in agricultural research.

Unit III: Basic Designs

Agricultural experiments: Concepts – field studies – pot-culture – quantitative and qualitative variables. Errors: Sources of errors and estimate of errors. Basic principles of Design of Experiments – CRD – RBD – LSD layout and their analysis – efficiency.

Unit IV: Mean comparison and Missing data

Comparison of treatments – Least significant Difference method – Duncan's Multiple Range Test (DMRT). Missing plot technique in RBD and LSD (one and two missing). Concept of analysis of Covariance. Data transformation: Logarithmic square root and arc sine.

Unit V: Factorial Experiments

Concept of factorial experiments – 2^n, 3^2 Factorial experiments, Principle of confounding in factorial experiments – confounding in 2^3 Factorial experiments. Split-pot design and strip – plot design.

PRACTICAL

Estimation of samples statistic *viz.,* means, SD, SE and CV. Z-test, t-test and paired t-test.

Comparison of two variances using F-test. Bartlett's test for homogeneity of variances. Chi-square test for test of goodness of fit and homogeneity of ratio test for independence of attributes.Computation of correlation co-efficient and its significance. Fitting of simple linear regression and testing the significance of regression co-efficient. Multiple linear regressions fitting and testing Determination of optimum plot size using uniformity trial. Analysis of CRD, RBD, LSD and DMRT. Analysis of multi-observation data (sampling in RBD) Missing plot technique in RBD with one or two missing values. Analysis of Factorial experiments conducted in RBD Analysis of Split-plot and Split-plot design. Analysis of data with transformations.

Theory schedule:

1. Definition of Population and sample
2. Difference between parameter and statistic
3. Concept of Sampling – Simple random Sampling
4. Concept of Probability distribution – Binominal, Poisson and Normal distributions.
5. F and Chi square distribution
6. Estimation - Point estimation, interval estimation, Degrees of freedom.
7. Concept of Sampling distribution – Standard Error.
8. Tests of Significance based on t, z, (Mean and equality of Means only). X^2 test for goodness of fit.
9. Definition of correlation, significance &types
10. Properties of correlation coefficient
11. Definition of regression – Measuring and uses of Regression analysis – Properties.
12. Differences between correlation and regression.
13. Regression co – efficient - simple, linear –
14. Multiple linear regression co - efficient – standard error of estimate
15. Test of significance of observed regression co -efficient and co - efficient of determination –

16. Non linear regression. Misuses of correlation and regression in agricultural research.
17. Mid semester examinations
18. Characteristics of Agricultural experiments: Concepts – field studies –
19. Characteristics of Agricultural experiments -pot-culture – quantitative and qualitative variables.
20. Sources of errors and estimate of errors
21. Design of Experiments– Basic principles of CRD
22. Design of Experiments– Basic principles of RBD
23. Design of Experiments– Basic principles of LSD
24. Efficiency of designs -layout and their analysis
25. Comparison of treatments – Least significant Difference method
26. Duncan's Multiple Range Test (DMRT).
27. Missing plot technique in RBD and LSD (one and two missing).
28. Concept of analysis of Covariance
29. Data transformation: Logarithmic square root and arc sine.
30. Concept of factorial experiments
31. 2^n, 3^2 Factorial experiments,
32. Principle of confounding in factorial experiments
33. Confounding in 2^3 Factorial experiments.
34. Split-pot design and strip – plot design.

Practical schedule:

1. Estimation of samples statistic *viz.,* means, SD, SE and CV.
2. Z-test, t-test and paired t-test.
3. Comparison of two variances using F-test
4. Bartlett's test for homogeneity of variances.
5. Chi-square test for test of goodness of fit and homogeneity of ratio test for independence of attributes.
6. Computation of correlation co-efficient and it's significance.
7. Fitting of simple linear regression and testing the significance of regression co-efficient.
8. Multiple linear regressions fitting and testing

9. Determination of optimum plot size using uniformity trial.
10. Analysis of CRD.
11. Analysis of RBD
12. Computation of LSD and DMRT
13. Analysis of multi-observation data (sampling in RBD)
14. Missing plot technique in RBD with one or two missing values.
15. Analysis of Factorial experiments conducted in RBD
16. Analysis of Split-plot and Split-plot design.
17. Analysis of data with transformations.

Reference Books

1. Bhattacharyya, G.K. and Johnson, R.A. 1997. Statistical concepts and methods, John Wiley and Sons, New York.
2. Crozon, F.E. and Cowden, D.J. 1986. Applied General Statistics, Prentice Hall of India, New Delhi.
3. Gomez, K.A. and Gomez, A.A. 1984. Statistical procedure for Agricultural Research, John Wiley and Sons, New York.
4. Panse, V.G. and Sukhatme, P.V. 1961. Statistical methods for Agricultural Workers, ICAR, New Delhi.
5. Ramaswamy, R, 1995. A text book of Agricultural Statistics, Wiley Limited, New Delhi.

COM 615 COMPUTER APPLICATIONS FOR AGRICULTURAL RESEARCH (1+1)

Objectives

To understand the basic concepts of computer and their peripherals, to get the knowledge in office automation tools like MS Word, MS Excel, and MS Access. And to get exposed to the current trends in the internet and their usages. And also to make them acquire sound knowledge in various Agricultural statistical software and their analysis.

THEORY

Unit – I: Introduction to Computer

Overview of computers - basic principle of operation - devices of a computer and their functions - current trends in hardware and software. Computer applications - Operating systems - DOS - Windows - feature of windows - version of windows.

Unit – II: Word Processor

MS Word - Creation, Editing and Printing of a document - using the features of word like page setting, underlining, bold, italics, spell check, grammar check etc.-creation of tables in word, inserting graphics.

Unit-III: Data Processing & Database

MS Excel - creation of excel sheet - statistical analysis using the features in excel. MS Access - creation of database and retrieval - Query - Applications to Agricultures.

Unit-IV: Agricultural Statistical Software

SAS, MSTAT, IRRISTAT, AGRES, AGRISTAT, STATISTICA- MANOVA AND MANCOVA.

Unit-V: Internet

Internet Definition - getting the connectivity - service providers - web – sites – home page – email – retrieval of information from internet.

Theory Schedule

1) Introduction to computers, input, output devices and their operation.
2) Components of computers (hardware and software) and their applications.
3) Booting sequences of operating system (DOS, WINDOWS) and their features.
4) Introduction to word processor and their special features.
5) Creating, editing printing of a document, Formatting features (underline, bold, italic etc) and operation of table.
6) Introduction to data processing and creation of excel sheets, Working with different built-in-function.
7) Creating different types of graphs and working procedures of various statistical functions.
8) Importing and exporting objects among different application (MS-word, MS-excel, MS-access).
9) Mid semester Examination.
10) Database and MS- access- Creation, storing and retrieval of data from database.
11) Working of various statistical function (mean, variance, sd, T test etc).
12) SAS, MSTAT, IRRISTAT.
13) AGRES, AGRISTAT.
14) STATISTICA-MANOVA AND MANCOVA.
15) Introduction to internet, Features of internet.
16) Need for Internet service provider, creation and working principle of E-mail.
17) Information retrieval from various web pages of internet.

Practical Schedule

1) Introduction to hardware, software and operating systems.
2) Study of various DOS commands.
3) Creating and Editing of a word Document.
4) Study of various features in MS-WORD (spelling and grammar check, protection of a document).
5) Operation of tables and Mail-merge.
6) Working with different statistical packages in MS-EXCEL.

7) Drawing of different graphs for the given data.
8) Various string operations (Concatenation, count, left string, right string, type conversion etc.).
9) Table creation using wizards.
10) Forms and reports.
11) Retrieval of data from the database using queries.
12) Correlation and multiple regression analysis.
13) T test and Chi-square test, Creation of data file systat and importing a data file from other packages.
14) SAS, MSTAT, IRRISTAT.
15) AGRES, AGRISTAT, STATISTICA.
16) Creating E-Mail account (sending and receiving mails), Information retrieval from Internet.
17) Model Practical Examinations

References

1. Kapoor V.K. 2004. Introduction to computers and Information systems. New Delhi: Sultan Chand and sons.
2. Karthy Jacobs. 2007 "Microsoft office Excel", The Express Line to Learning, Willey Chand & Sons, New Delhi.
3. Peter Norton's 2001, "Introduction to Computer (4^{th} edition)", Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. TNAU 2004, "Advanced Quantitative Techniques and Data Analysis" Training Manual-Argl. Engineering College and Research Institute, Coimbatore.
5. Http: //en.wikipedia.org/wiki/Internet.

NON CREDIT COMPULSORY SUBJECTS

RESEARCH ETHICS AND METHODOLOGY (0+1)

Objective

To enlighten the students about the agricultural research systems at national and international levels, Research ethics, and Research methodologies adopted to carry out agricultural research.

Practical

Research Ethics

Global agricultural research system - need, scope, opportunities, role in food security, poverty reduction and environmental protection; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC)-International fellowships for scientific mobility.Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics-Good Laboratory Practices – Plagiarism and Copy right rules.

Research – Fundamental vs. applied research – research prioritization and selection of research problem – Research planning - review of literature – setting of objectives and hypothesis – research design and techniques – data collection – analysis – formulation of tables – interpretation of results and thesis writing – writing of research articles - Type and choice of experiment - Designing research programme for experimentation – Formulation and preparation of research / Scheme proposal.

Layout of field experiment - Designing - sampling techniques - Use of experimental tools and equipments for recording observation and analysis – Growth Recording biometric observations - data analysis - Computer software - Tabulation and presentation - Guidelines for thesis and technical paper writing – Appraisal of published research articles - Collection of details on research periodicals - Guidelines for oral / poster presentations – Internet in scientific research.

Research Methodology.

Practical schedule

1. Global agricultural research system: need, scope, opportunities, role in food security, poverty reduction and environmental protection
2. National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR)
3. International Agricultural Research Centres (IARC)-International fellowships for scientific mobility.
4. Research ethics: research integrity, research safety in laboratories and Welfare of animals used in research
5. Computer ethics,Standards and problems in research ethics
6. Good Laboratory Practices – Plagiarism and Copy right rules
7. Research prioritization and selection of research problem
8. Designing research programme for field experimentation & research planning
9. Mid-semester
10. Preparation of research projects/schemes proposal
11. Selection of experimental sites and laying out field experiments
12. Recording growth parameters & growth analysis
13. Recording of yield parameters and yield - Tabulation, analysis and interpretation of results
14. Use of instruments for recording observations
15. Evaluation of research articles; National and International
16. Review of literature and writing bibliography
17. Practice on writing materials and methods
18. Practice on writing results and discussion of thesis.

Reference Books

1. Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publication.
2. Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
3. Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. John Willey and Sons, New York
4. Panse, U.G. and P.V. Sukhatme, 1995. Statistical Methods for Agricultural Workers: ICAR, New Delhi.
5. Rangaswamy, R. 1995. A Text Book of Agricultural Statistics. Willey Eastern Limited, New age International Limited Publishers, New Delhi.
6. Sekar, K. 2004. Research Methodology for Agricultural Sciences, Velan Pathipagam, Chidambaram.

PGS 611 **BASIC CONCEPTS IN LABORATORY TECHNIQUES (0+1)

Objective: To acquaint the students about the basics of commonly used techniques in laboratory

Practical

Unit I Safety measures and common laboratory equipments

Safety measures while in labs; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, seperatory funnel, condensers and micropipettes. Washing, drying and sterilization of glassware; Drying of solvents /chemicals

Unit II Preparation of standard solutions

Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparations of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values

Unit III Use and handling of laboratory equipments

Use and handling of vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath and water bath.

Unit IV Microscopy and media preparation

Use and handling of microscope and laminar flow - Preparation of media – differential, selective and enriched media. Methods of sterilization – physical methods- dry and moist heat,cold, filtration and radiation, chemical methods and disinfectants.

Unit V In-vitro culture Techniques

Description of flowering plants in botanical terms in relation to taxonomy – seed viability test – pollen fertility test – tissue culture media – composition of media – media preparation – instant media – Aseptic manipulations – Autoclaving, flame sterilization – filter sterilization – Hot water sterilization – procedure for in vitro culture of explants – leaf bit – stem bit – anthers – pollen – microspores – ovule and embryo

Practical Schedule:

1. Safety measures in labs and handling of chemical substances
2. Common Laboratory equipments
3. Calibration and cleanliness of volumetric glass wares
4. Methods of expressing strength of solutions
5. Preparation of primary standard solutions and buffer solutions

6. Preparation of standard solutions for nutrient analysis of soil, plant and water.
7. Preparation of different agro-chemical doses for field experiments
8. Preparation of buffer solutions
9. Mid- Semester
10. Handling of Instruments- Vaccum pumps, thermometers, magnetic stirrer
11. Handling of instruments - Ovens, sand bath and water bath.
11. Handling and uses of microscopes and laminar flow
12. Sterilization by physical methods
13. Sterilization by chemical methods
14. Preparation of different media for culturing the micro organisms.
15. Description of flowering plants – seed viability test and pollen fertility test
16. Aseptic manipulations and media
17. Invitro culture of different explants

Reference Books:

1. Furr, A.K. 2000. CRC Handbook of Laboratory safety. CRC press.
2. Jackson,M.L.1997. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi.
3. Prescott.L.M., P.Harley and A.Klein. 2003. Microbiology,5th Edition, Mc.Graw Hill, USA.
4. Gupta, P.K. 1997. Elements of Bio technology, Rastogi Publications. Meerut.
5. Singh, B.D. 2005. Bio technology, Expanding Horizons , Kalyani Publications, New Delhi.

PGS 622 **TECHNICAL WRITING AND COMMUNICATION SKILLS (0+1)

Objective

To equip the students with skills *Viz.,* writing of dissertations, research papers, etc. and to communicate and articulate in English

Practical

Grammar - Tenses, parts of speech, clauses, punctuation marks; Error analysis - Common errors; Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers. Proof reading.

Technical Writing **-** Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Structure of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Practical schedule

1. Grammar (Tenses, parts of speech)
2. Grammar (clauses, punctuation marks)
3. Error analysis (Common errors); Concord; Collocation;
4. Phonetic symbols and transcription;
5. Accentual pattern: Weak forms in connected speech
6. Participation in group discussion
7. Facing an interview; presentation of scientific papers.
8. Technical Writing- Various forms of scientific writings- theses, technical papers
9. Mid -semester
10. Technical Writing- reviews, manuals
11. Structure of thesis and research communications
12. Writing of abstracts, summaries, précis, citations etc
13. Commonly used abbreviations in the theses and research communications

14. Illustrations, photographs and drawings with suitable captions
15. Pagination, numbering of tables and illustration, numbers and dates in scientific write-ups
16. Editing and proof-reading
17. Writing of a review article.

Suggested Readings

1. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
2. Mohan K. 2005. Speaking English Effectively. MacMillan India.
3. Richard WS. 1969. Technical Writing. Barnes & Noble.
4. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek.
5. Wren PC & Martin H. 2006. High School English Grammar and Composition. S.Chand & Co.

PGS 623 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (1+0) (E-course)

Objective

The Course Objective of the course is to create awareness about intellectual property rights in agriculture. The course deals with management of patents, trademark, geographical indications, copy rights, designs, plant variety protection and biodiversity protection. The students will be taught on the Marketing and Commercialization of Intellectual Properties.

Theory

Unit - I:

World Trade Organization- Agreement on Agriculture (AoA) and Intellectual Property Rights (IPR) - Importance of Intellectual Property Management - IPR and Economic growth- IPR and Bio diversity -Major areas of concern in Intellectual Property Management -Technology Transfer and Commercialization-Forms of different Intellectual Properties generated by gricultural research.

Unit - II:

Discovery *versus* Invention - Patentability of Biological Inventions - Method of Agriculture and Horticulture- procedure for patent protection: Preparatory work.Record keeping, writing a patent document, filing the patent document -Types of patent application-patent application under the Patent cooperation treaty (PCT).

Unit - III:

Plant genetic resources -Importance and conservation - Sui Generic System –Plant Varieties Protection and Farmers Rights Act- Registration of Extant varieties -Registration and protection of New Varieties / Hybrids / Essentially DerivedVarieties - Dispute prevention and settlement -Farmers' Rights.

Unit - IV:

Trademark- Geographical Indications of Goods and Commodities – Copy rights-Designs – Biodiversity Protection.

Unit - V

Procedures for commercialization of technology - Valuation, Costs and Pricing of Technology- Licensing and implementation of Intellectual Properties- Procedures for commercialization – Exclusive and non exclusive marketing rights-Research Exemption and benefit sharing .

Theory Schedule

1. World Trade Organization - Agreement on Agriculture (AoA) and Intellectual Property Rights (IPR)
2. Importance of Intellectual Property Management - IPR and Economic growth-IPR and Bio diversity
3. Major areas of concern in Intellectual Property Management -Technology Transfer and Commercialization
4. Forms of different Intellectual Properties generated by agricultural research.
5. Discovery *versus* Invention Patentability of Biological Inventions –
6. Method of Agriculture and Horticulture- procedure for patent protection:
7. Preparatory work.Record keeping, writing a patent document, filing the patent document
8. Types of patent application-patent application under the Patent cooperation treaty (PCT). Plant genetic resources
9. **Mid Semester Examination**
10. Importance and conservation
11. Sui Generic System –Plant Varieties Protection and Farmers Rights Act-Registration of Extant varieties
12. Registration and protection of New Varieties / Hybrids / Essentially Derived Varieties - Dispute prevention and settlement
13. Farmers' Rights.Trade mark-Geographical Indications of Goods and Commodities – Copy rights- Designs
14. Biodiversity Protection.
15. Procedures for commercialization of technology - Valuation, Costs and Pricing of Technology
16. Licensing and implementation of Intellectual Properties- Procedures for commercialization
17. Exclusive and non exclusive marketing rights-Research Exemption and benefit sharing.

Suggested Readings

1. Ganguli, P. 2001. *Intellectual Property Rights –Unleashing the Knowledge Economy*. Tata McGraw Hill, New Delhi.
2. Gupta, A.K., 2003. *Rewarding Conservation of Biological and Genetic Resources and Associated Traditional Knowledge and Contemporary Grass Roots Creativity*, Indian Institute of Management, Ahmedabad.
3. Khan S.A ., and Mashelkar R. 2004. *Intellectual Property and Competitive Strategies in the 21st Century*. Kluwer Law International, The Hague.

PGS 714 ** LIBRARY AND INFORMATION SERVICES 0+1

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary -Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services - (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing - information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized - library services; Use of Internet including search engines and its resources; e-resources access methods.

Practical Schedule

1. Introduction to library and its services
2. Role of libraries in education, research and technology transfer;
3. Classification systems and organization of library
4. Sources of information- Primary –Sources
5. Sources of information -Secondary Sources and Tertiary Sources
6. Intricacies of abstracting and indexing services
7. Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.);
8. Tracing - information from reference sources; Literature survey
9. Mid- Semester
10. Citation techniques/Preparation of bibliography;
11. Use of CD-ROM Databases,
12. Online Public Access Catalogue and other computerized - library services
13. Online Public Access Catalogue and other computerized - library services
14. Use of Internet including search engines and its resources
15. Use of Internet including search engines and its resources
16. e-resources access methods.
17. e-resources access methods.

PGS 725 ** DISASTER MANAGEMENT (1+0)
(e-Course)

Objectives

To introduce learners to the key concepts and practices of mitigation for natural disasters and calamities and to equip them to conduct thorough assessment of hazards, risks vulnerability and capacity building strategies.

Theory

UNIT I

Natural Disasters - Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves.

UNIT II

Climatic change: Global warming, Sea level rise, Ozone depletion,Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters.

UNIT III

Building fire, coal fire, forest fire. oil fire, air pollution, water pollution, deforestation, Industrial waste water pollution, Disaster Management- Efforts to mitigate natural disasters at national and global levels.– India's Key Hazards, Vulnerabilities and Disaster Response Mechanisms in India-

Unit IV

Concept of disaster management, national disaster management framework; financial arrangements, role of NGOs, Community-based organizations, and media-Central, state, district and local administration. Dissemination of Disaster Warning, Response to natural disasters, national, state, district level, relief – food & nutrition – water – health – mental health services.

Unit V

Rehabilitation – tolerant and resistant crops- Resilient farming concepts – Bioshields Livelihood options – insurance and compensation-Clothing & utensils & fuel – shelter – relief camp – Sanitation and Hygiene. Preparedness – Emergency Operations Centres (EOCS).

Lessons

1. Natural Disasters Meaning and nature of natural disasters, their types and effects –
2. Floods, drought, cyclone, earthquakes Landslides, avalanches, volcanic eruptions, Heat and cold waves.
3. Climatic change- Global warming, Sea level rise, Ozone depletion
4. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters
5. Building fire, coal fire, forest fire. oil fire,
6. Air pollution, water pollution, deforestation, Industrial wastewater pollution
7. Disaster Management- Efforts to mitigate natural disasters at national and global levels.
8. Mid-Semester
9. India's Key Hazards, Vulnerabilities and Disaster Response Mechanism in India
10. Concept of disaster management, national disaster management framework
11. Financial arrangements, role of NGOs, Community-based organizations, and media-
12. Central, state, district and local administration
13. Dissemination of Disaster Warning - Response to natural disasters, national, state, district level
14. Relief – food & nutrition – water – health – mental health services
15. Rehabilitation – tolerant and resistant crops- Resilient farming concepts – Bioshields Livelihood options – insurance and compensation-
16. Clothing & utensils & fuel – shelter – relief camp – Sanitation and Hygiene.
17. Preparedness – Emergency Operations Centres (EOCS).

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2. Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
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