Graduate level

# AGR 5266C Field Plot Techniques (Section 0877)

Graduate Level – 3 credit hours
Fall 2016

**Instructor:** Dr. Patricio R. Munoz
2005 SW 23rd Street Building 350 Off. 5
352-392-6180
p.munoz@ufl.edu
Office Hours TBA

**Teaching Assistant:** Lin Xing (TA)
2005 SW 23rd Street Building 350 Off. 2
lxing@ufl.edu
Office hours TBA

**Location and time:** Monday periods 2nd-3rd (8:30-10:25), McCarty B 3096
Wednesday 5th period (11:45-12:35), McCarty B 3096

**Prerequisite**
Graduates: STA6166 or ALS5932 or equivalent required.

**Course Description**
This course provides an introduction to techniques and procedures used in planning, designing and analysis of field plot, greenhouse, and laboratory research experiments with special focus on application of research methodology, analysis and interpretation of research results.

**Intended Audience**
The course is designed for graduate students implementing experiments in plant science related disciplines (e.g. agronomy, horticulture and forestry).

**Course Objectives**
To familiarize students with fundamental elements of field experimentation: factors to consider, basic experimental designs and their implementation, and analysis of data from field, greenhouse and lab experiments. At the end of the course, students are expected to be able to discuss the advantages and disadvantages of major experimental designs, design their own experiments, calculate required sample size, and analyze their own data.

**Evaluation**
30 points – Homeworks, at least 1 per calendar month
20 points – Quizzes, at least 7
12.5 points – Project Part 1 (see details below)
12.5 points – Project Part 2 (see details below)
12.5 points – Project Part 3 (see details below)
12.5 points – Poster Presentation (see details below)

A >90 B+ 85 to 89 B 80 to 84 C+ 75 to 79 C 70 to 74 D+ 65 to 69 D 60 to 64 E < 60

UF grading policies: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

**Homework**
Homework will be due **one week after it is handed out and should be turned in before the class starts**. Homework should be emailed to the TA in PDF format. You are expected to understand the analysis process, results, and conclusions from the homework as you may be ask to explain it to the class (part of the homework score). Late homework will be penalized at a rate of 10% per day.

**Quizzes**
Quizzes will happen in the **first 5 minutes** of the class. There will be no notice of when quizzes are happening and there is no make up of quizzes, so be on time for class.

**Final Project**
Each student will have to develop an experimental design project through the semester. It is expected to contain a rationale for the question or hypothesis being investigated, justification of the experimental design chosen over the alternatives, plan to execute the design in the field or greenhouse, field and equipment considerations for implementation of experiment, R script for analysis, expected result and data behavior. The final project will be due on Thursday Nov 17 by 5:00 PM (EST). Project should be emailed to the TA in PDF format. Late projects will be penalized at a rate of 20% per day. Each project section will be peer reviewed by other students taken the class. Final score will be an average of all reviews plus instructor evaluation. Peer review counts for 2.5 points of your grade for each project section.

This project will be divided in three sections:

**Part 1.** Due on Thursday Sep 14 by 5 PM (EST). It should contain the introduction, rationale, objectives/hypothesis and material sections.

**Part 2.** Due on Wednesday Oct 19 by 5 PM (EST). It should include the improved version of part 1 and the methods. **Methods:** Emphasis should be given to the experimental design, the field or greenhouse consideration to establish and measure the experiment, the statistical model for the analysis (including assumptions), justification of the experimental design chosen and layout of the experiment.

**Part 3.** Due on Thursday Nov 17 by 5 PM (EST). It should include all the information above (included revisions provided by TA) plus analysis, results, discussion and conclusions.

**Poster Presentation of Final Project**
Each student will develop a poster based on his/her final project. The printed poster will be presented during one class period to the whole class and its format should follow the final project sections. Amount of time to present each poster will depend on the number of students enrolled in the class and will be informed later on the semester.

**Laboratory/Field**
The weekly laboratory and/or field work is mandatory. Laboratory topics include, but are not limited to, basics of statistical package R, design of experiments, analysis of data, invited speakers and paper discussions. Field topics include, but are not limited to, field survey, factors affecting experimental design, implementation of research experiments, research equipment, planting, labeling, data collecting, reporting results and dealing with unexpected events. We will plan two trips to the Plant Science Research and Education Unit near Citra, FL to view equipment and experiments. Transportation will be provided.

**Software**
**You will need to bring your own laptop.** The main software used will be the statistical software R which can be downloaded from www.r-project.org. and R-studio http://www.rstudio.com/. It is your responsibility to make sure that your computer has the latest version of R. Prior to the first day of class, please make sure you have removed all old versions of R, and have the most recent version installed.

**Required and Recommended Literature**
Clewer, A.G. & D.H. Scarisbrick (2001). Practical Statistics and Experimental Design for Plant and Crop Science. John Wiley & Sons, Ltd. (**REQUIRED**)
Pearce, S.C., G.M. Clarke, G.V. Dyke, R.E. Kempson (1988). A Manual of Crop Experimentation. Oxford University Press.
Lenth, R.V. (2001). Some practical guidelines for effective sample size determination. *The American Statistician*, *55*(3), 187-193.
Casella, G. (2008). Statistical Design. Springer Science + Business Media, LLC.

There are numerous online resources available for R; however, if you would like a traditional textbook, The R Book, is widely available and comprehensive.

Crawley, M. J. (2012). The R book. John Wiley & Sons.

**Course Schedule and Topics (Tentative). Chapters refer to book Clewer et al. 2001.**

| Topic | Description |
|---|---|
| Wk 1 | Basic Concepts of Experimentation (Chapter 1, 2, 3)<br>a. **Reading assignment on Friday 19**<br>b. Introductions, reviewing syllabus, and basic concepts of experimentation – Monday Aug 22<br>c. Basic concepts of experimentation (continue) – Wednesday Aug 24<br>**d. Assign Homework #1: How my scientific peers do experiments?** |
| Wk 2 | Basic Statistics, Review (Chapter 4, 5, 7)<br>a. Review of Basic Statistics – Monday Aug 29<br>b. Fundamentals of Experimental Design – Wednesday Aug 31<br>c. Group discussion of HW 1, compilation of results and turn in (**Lab #1)** |
| Wk 3 | Fundamentals of Experimental Design (Reading TBA)<br>a. No class – Monday Sept 05<br>b. Fundamentals of Experimental Design – Wednesday Sept 07<br>c. Introduction to R software (**Lab #2)** |
| Wk 4 | Field Visit – Site Survey, soil sampling, equipment – Monday Sept 12 9:30 – 12:30 PM<br>Plan:<br>9:30 Leave from McCarty<br>10:10 arrive to Citra (Jim and Dr. Quesenberry)<br>Welcome from Jim<br>Check equipment and Questions<br>10:50 Field Survey (Dr. Munoz)<br>Stop 1: Seasonally flood<br>Stop 2: Alfalfa and Bermudagrass<br>11:30 Soil sampling<br>12:00 Return to Gainesville<br>a. No class Wednesday Sept 14<br>**a. Final Project First Portion Due Sept 14 by 5 PM.** |
| Wk 5 | Experiments with Single Factor (Chapter 9, 10)<br>a. Experiment with single factor – Monday Sept 19<br>b. Design of experiment with single factor – Wednesday Sept 21<br>d. Design of single factor experiments using different strategies (**Lab #3)**<br>**e. Assign Homework #2: Design of single factor experiments.** |
| Wk 6 | Experiments with Single Factor (Chapter 9, 10)<br>a. Analysis of experiment with single factor – Tuesday Sept 26<br>b. Analysis and interpretation of experiment with single factor – Wednesday Sept 28<br>c. Analysis and interpretation of single factor exp. (**Lab #4)**<br>d. **Assign Homework #3: Analysis of single factor exp.** |
| Wk 7 | Field Visit – Single factor experiments – Monday Oct 03 9:30 – 12:30 PM<br>Plan:<br>9:30 Leave from McCarty<br>10:10 Arrive to Citra<br>10:20 Horticultural experiments – TBA<br>10:50 Row-crop Experiments – TBA<br>11:30 Ornamental Experiments – TBA<br>a. No class Wednesday Oct 05 |
| Wk 8 | Designing experiments with Two Factor (Chapter 12, 16)<br>a. Designing experiment with factorial arrangement – Monday Oct 10<br>b. Designing Split-plot experiments – Wednesday Oct 12<br>c. Design of two-factor exp. (**Lab #5)**<br>d. **Assign Homework #4: Design two factor exp with R.** |

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| Wk 9 | Analyzing experiments with Two Factor (Chapter 12, 16)<br>a. Analysis and interpretation of factorial experiment – Monday Oct 17<br>b. Analysis and interpretation of split-plot experiments – Wednesday Oct 19<br>c. Analysis of Two factor experiments with R. (**Lab #6)**<br>d. **Final Project Second Portion Due Wed Oct 19 by 5 PM.** |
| Wk 10 | Multiple Comparisons and Sample size (Chapter 13)<br>a. Multiple Comparisons – Monday Oct 24<br>b. Multiple comparisons and calculation of # of reps – Wednesday Oct 26<br>c. Multiple comparisons. (**Lab #7)**<br>d. **Assign Homework #5: Multiple comparison interpretation.** |
| Wk 11 | Dealing with Assumptions Departure and Introduction to more complex Designs (Chapter 14)<br>a. Dealing with assumption departures – Monday Oct 31<br>b. Survey of more complex designs – Wednesday Nov 02<br>c. Examples of assumption departures and complex designs. (**Lab #8)** |
| Wk 12 | **NO CLASS Nov 07 and 09. CROP SCIENCE MEETING** |
| Wk 13 | Field Visit – Two factor experiments greenhouse and laboratory – Bldg 350. Nov 14 8:30 – 10:25 AM<br>Plan:<br>08:30 Meet in Building 345<br>08:40 Design and implementation of experiments in the lab - TBA<br>09:10 Design and implementation of experiments in the lab – Dr. Munoz<br>09:40 Design and implementation of experiments in the Greenhouse - Dr. Erickson<br>10:10 Design and implementation of experiments in the Greenhouse - Dr. Kenworthy<br>11:30 Back to McCarty<br>b. Questions about final project – Wednesday Nov 16<br>**c. Final Project Third Portion Due (complete project) Thursday Nov 17 by 5 PM.** |
| Wk 14 | Advanced experimental designs (reading TBA)<br>a. Introduction to Linear Mixed Models (**Dr. Salvador Gezan**) – Monday Nov 21<br>b. No class, thanksgiving – Wednesday Nov 23 |
| Wk 15 | Advanced Designs and Project Presentation (reading TBA)<br>a. More in advanced experimental designs and analysis – Monday Nov 28<br>b. Poster project presentation – Wednesday Nov 30 |
| Wk 16 | Project Poster Presentations<br>a. Poster project presentation – Monday Dec 05<br>b. Project Poster Presentation – Wednesday Dec 07<br>c. Wrap up |

**Attendance and Make-Up Work**
"Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx."

**Online Course Evaluation Process**
"Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/."

**Academic Honesty**
"UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (http://www.dso.ufl.edu/sccr/process/student-conduct-honorcode/) specifies a

number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class."

**Software Use:**
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

**Services for Students with Disabilities**
"Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester."

**Campus Helping Resources**
Health and Wellness:

U Matter, We Care: If you or a friend is in distress, please contact umatter@ufl.edu or 352 392- 1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS) Student Health Care Center, 392-1161. University Police Department, 392-1111 (or 9-1-1 for emergencies). http://www.police.ufl.edu/