

PLNT*6170
STATISTICS IN PLANT AGRICULTURE

WINTER SEMESTER 2009

INSTRUCTOR Stephen R. Bowley Crop Sci Bldg., Room 408, Ext. 58704 sbowley@uoguelph.ca

CLASS TIMES & LOCATION Lectures Mondays 3:00-6:00 Rm 227 MacKinnon Bldg.
Project help sessions Thursdays 2:00-3:00 Rm 121 Crop Sci. Bldg.

COURSE OBJECTIVES

The objective of this course is to provide you with hands-on experience in applying statistical techniques to research in plant agriculture. You will be introduced to a number of statistical procedures and be required to apply them to data from laboratory and field experiments. SAS (Win ver Statistical Analysis System, Cary, NC) will be the software used to perform data analyses. Emphasis will be placed on basic statistical principles, the design of experiments, the testing of hypotheses, and communication of findings to other scientists.

PRESENTATION METHOD

The material will be presented and discussed in weekly lecture-assigned project format. Lectures will be a discussion of the relevant methodologies. The assigned projects will provide experience in application of these methodologies. Experimental data for analysis in order to complete the assignments will be distributed via email.

TEXT

The required text for the course is:

Bowley, S.R. 2008. A hitchhiker's guide to statistics in plant biology. Second Edition. Any Old Subject Books, Guelph ON. ISBN 978-0-9685500-3-8

The SAS macros & additional resources are found at <http://www.plant.uoguelph.ca/research/homepages/sbowley/>

List price, including GST, is \$68. Students registered in the course can obtain a copy from the instructor for \$60.

COURSE CONSTRAINTS

It is anticipated that you likely will work on the weekly projects in study groups, however, the assignments and reports you submit for grading must be independent and document only your work. Furthermore, there is a ban on the use of writing services and statistical analysis services for all reports submitted in this course. Please review the University's General Regulations regarding Academic Misconduct for a detailed summary, the process, and penalties involved for offences against the academic integrity of the learning environment (www.uoguelph.ca/academics/calendars.shtml See: Graduate Calendar, II. General Regulations) .

GRADING

Analysis reports	70%	1@25 – Week 6 analysis report; 3@15 – Weeks 3, 5, & 8 analysis reports)
Manuscript critique	20%	
Thesis Project	10%	

All assignments are to be typed and any appended information provided must be legible to the instructor. The Manuscript critique will be graded by the instructor and one other student enrolled in the course.

COMPLETION DATES

The specific analysis reports are due Mondays at 3:00 pm. Manuscript critique: A copy of the paper you propose to critique must be submitted by 2 Feb. and the critique per se is due 16 March. You will receive a classmate's manuscript critique for blind review on 23 March. Your evaluation of this critique as well as your thesis project is due 30 March.

PLNT 6170 SEMESTER OUTLINE

Date	Lecture topic.	Chapter	Assignment Due dates
6 Jan	Pre-course module: Win-SAS Navigating the system; program, log & output windows; import/export; data manipulation; graphical display; data exploration, etc.		
5 Jan	Week1: Distributions, hypotheses tests.	1,2	
12 Jan	Week2: Goodness of fit.	3	
19 Jan	Week3: Variance analyses, Randomized complete block.	4	
26 Jan	Week4: Regression.	5	▣▣▣Report on Week 3 Project -Two tables & Appendix A & B.
2 Feb	Week5: Regression in anova; Segmented regression, non-linear regression.	6	▣▣▣Hand in copy of manuscript selected to critique.
9 Feb	Week6: Tests of assumptions, presentation of statistics.	7	▣▣▣Report on Week 5 Project - One Figure & one Table & Appendix A & B.
16 Feb	<i>No classes this week -Family day & winter break.</i>		
23 Feb	Week7: Error control, improving experimental design.	8	▣▣▣Report on Week 6 Project -Methods, Results, & Appendix A & B
2 Mar	Week8: Factorial, EMS, Split-plot, split-block, combined analyses.	9	
9 Mar	Week9: Response surface designs & analysis.	10	▣▣▣Report on Week 8 Project - Two tables & Appendix A &B.
16 Mar	Week10: Multiple regression.	11	▣▣▣Manuscript critique due.
23 Mar	Week11: Multivariate analyses.	12	▣▣▣Receive copy of classmate's critique.
30 Mar	<i>Hordeum vulgare</i> and its industrial applications.		▣▣▣Thesis project. ▣▣▣Evaluation of classmate's critique due.

I. PROJECT REPORTS

All four reports are to be submitted on paper and include the following two appendixes:

- A) The SAS statements that you used for the analysis.
- B) A copy of the SAS output.

Figures & tables are to be suitable for submission to a scientific journal. The figures and tables must “stand alone”, that is, one should not require additional information in order to interpret what is being presented. Titles need to be brief but sufficiently detailed to explain the data and statistical analysis.

For the Week 6 project, the report is to be: A short scientific summary, typed, double spaced, minimum 10 point font, no more than 3 pages, composed of **Statistical methods** (including a description of the experimental arrangement and statistical procedures), the **Results** (including Figures and/or Tables), and the **Conclusions** drawn. For this report you are limited to a maximum of *two* illustrations (either 2 figures, or 2 tables, or one of each); tables and figures and references will not be included as part of the ‘page count’.

The hypotheses under test, the Type I error rate used, and the statistical decisions must be clearly presented.

*You are **not** to do a literature review.*

Assignments will be given a numerical grade out of 10 based on adherence to the requested format and limitations, grammar, logic, clarity, completeness, accuracy, and application of statistical principles and methodologies presented in the course. *A penalty of one mark (out of 10) will be imposed for each day that the assignment is late.*

The DO NOT list: Don't include a literature review; don't put on a fancy cover, don't use colours.

II. Manuscript critique

The purpose of this project is to allow you the opportunity to conduct a critical review of the design, analysis, explanation, and presentation of results of an experiment. This exercise should aid you, not only for evaluation of other unpublished/published research, but also with your own dissertation and subsequent research.

You are required to select a journal article published within the last year and critique the use of statistics for the experiments presented in the article. *The article must be relevant to Plant Science, must not have been published by the American Society of Agronomy (ie. Crop Sci., Agron. J., etc.), and must be pre-approved by the course instructor.*

The following checklist, adapted from Maindonald and Cox (1984 N.Z.J. Agr. Res. 27:597-610), is provided to assist you with your manuscript critique:

1. Is the purpose (objective) of the study and the hypotheses tested sufficiently described?
2. Is the experimental design adequate in: a) its description; b) information relevant to analyzing the results; and c) the assignment of treatments and choice of sample?
3. Does the experiment seem adequate in sample size and was the design appropriate?
4. Are the statistical procedures a) described and referenced; b) appropriate; and c) consistently applied?
5. Is the presentation of statistical material clear and appropriate in the text, tables, and figures?
6. From the statistical viewpoint, is the information provided and presentation of the results of this experiment of acceptable standard to be published? What needs to be done to strengthen it?
7. Comment on any statistical issues not covered by the above questions.

The critique must be typed. *Two copies of the critique AND Two copies of the journal article must be submitted, one copy with a cover page providing your name, the other copy missing a cover page and any other information which would reveal that you are the author.* One copy will be graded by the instructor, the other copy will be graded by a classmate. The critique will be assessed as outlined above for the thesis project. *A penalty of 2 marks (out of 20) will be imposed for each day the critique is late.*

III. Thesis project

This is a 3-5 page typed (double spaced) report detailing an experiment you are proposing to conduct, or are in the process of conducting, as part of your thesis research. The purpose of the project is to provide you an opportunity to practice the three major principles that the late Gertrude Cox (North Carolina State) emphasized for conducting experiments:

1. The experimenter should clearly set forth his or her objectives before proceeding with the experiment.
2. The experiment should be described in detail.
3. An outline of the analysis should be drawn up before the experiment is started.

The report must be written in scientific format and must: 1) introduce the problem and the background information motivating the experiment under consideration; 2) define the hypotheses and objectives of the experiment; 3) detail the experimental design and the layout of the experiment; 4) outline the statistical analysis and list the SAS statements needed to obtain the analyses; and 5) list the assumptions required to make the analysis valid.

It is acceptable to include one or two figures and one or two tables as part of the report. Tables, figures, the SAS statements, and cover pages will not be included as part of the 'page-count'.

Grades will be assessed using the criteria listed for the assignments. *Note that a penalty of two marks (out of 10) will be imposed for each page over 5 pages of text. Also, a penalty of 1 mark (out of 10) will be imposed for each day that the project is late.*

ACADEMIC MISCONDUCT

The Dean's Office has requested that we remind all students about Academic Misconduct. Based on past experience, I request that you pay close attention to example number 4 in the following list.

The University Policy on Academic misconduct will be adhered to (see www.uoguelph.ca/academics/calendars.shtml Graduate Calendar, II. General Regulations). Of particular importance is plagiarism - which is the act of misrepresenting the work of others as one's own. It is easy to avoid the problem by writing the information and ideas in your own words and referencing the source of the information.

For example, if Bowley in 1999 wrote: "Perennial forages are of major importance to the farm economy" you could write: Forage crops such as alfalfa and timothy make a significant contribution to farm income (Bowley 1999).

Students charged with academic misconduct often cite ignorance of what constitutes academic misconduct. Here are some illustrations of academic misconduct:

1. No Quotation and references. Plagiarism has occurred if the author does not place quotation marks around word-for-word copying of print or electronic format source material even if the source is correctly cited. As a suggestion, place all quotations in italics to highlight the fact it is a direct quotation.
2. Degree of fidelity to source. Plagiarism has occurred if the author's writing is clearly recognizable as essentially derived from the original source. Inverting words and substituting synonyms is still plagiarism. Authors should summarize and synthesize ideas and concepts rather than interchange words.
3. Group projects. Teams working on group projects should practice group dynamics (such as meetings of the whole group, review of each other's work and discussion of academic misconduct) that will discourage individuals from contributing plagiarized material. Groups may bear collective responsibility for the academic integrity of their project.
4. Copying, reproducing, or paraphrasing someone else's work and representing these as one's own work. Plagiarism will be strongly suspected if two or more students submit individual projects that have identical or substantially identical components. Tables, figures, paragraphs in reports should reflect your own efforts, not be copies or essential derivatives of work performed by someone else.