ABE 6645C
Computer Simulation of Crop Growth and Management Responses
Summer Semester C, 2022
Instructors: Dr. Gerrit Hoogenboom and Dr. K.J. Boote (University of Florida)
Three Semester Hour Class

BACKGROUND and RATIONALE

Today more than ever, an increase in crop production for food and nutrition security depends on a judicious use of natural resources. In addition, climate change, climate variability, weather extremes, soil carbon sequestration, biofuels, environmental sustainability, and greenhouse gas emissions have become global issues. A systems analysis approach based on dynamic crop simulation models can make a valuable contribution to both furthering our understanding of the processes that determine crop responses and predicting crop performance, resource use and environmental impact for different environmental conditions, management scenarios, and plant genetics. User-oriented computer simulation models can greatly facilitate the task of optimizing crop growth and deriving recommendations concerning crop management. The same models can also be applied to assess the potential impact of climate change on crop production and long-term soil carbon sequestration and provide management scenarios for climate change adaptation for sustainable crop production. The overall goal of this course is to introduce the concept of systems analysis using dynamic crop simulation models. Specific objectives are to learn about the science of Genotype * Environment * Management interactions in a modeling framework and to apply crop simulation models to help solve real-world problems.

COURSE OVERVIEW

The lectures and laboratory sections of this course are provided as part of an International Training Program entitled "Assessing Crop Production, Water and Nutrient Management, Climatic Risk and Environmental Sustainability" held at the University of Georgia – Griffin Campus in Griffin, Georgia from May 16 - 21, 2022. This International Training Program is a 6-day intensive workshop in which lectures and hands-on exercises on modeling and DSSAT are alternated. The DSSAT workshop provides students with the opportunity to interact with many international scientists, participate in discussions, and develop a scientific network. There is a technology fee of $500 to pay for the expenses associated with the workshop and the textbook; the technology fee does **not** include a local hotel and meals that are not provided during the workshop.

Resource material include the book "Understanding Options for Agricultural Production," which will be provided to the students, and the PowerPoint files of the lectures, which will be placed on the workshop website to download. In addition to the lectures and discussions with instructors, students are required to complete homework exercises and submit them for grading. The first six exercises will be submitted within two weeks after the end of the DSSAT workshop, while the remainder will be submitted approximately one month after the workshop. The exercises will count 40% of the final grade. The exercises should be written up in a typed report style that

somewhat mimics a paper, to include what you did for the exercise (the "methods"), the results/outcome (either tables or "cut-and-paste" graphics examples) that answer the questions posed in the exercise, and interpretation by you. Use figures and tables only to support the explanation of your results.

COURSE MATERIALS

The following course material is required:

- DSSAT Version 4.8. This software is free and is available from the DSSAT Foundation (www.DSSAT.net). Students will be provided with the software during the DSSAT course. The DSSAT software is licensed, and you will have a license that will continue after the course.
- A textbook that describes the models and applications, Tsuji et al., *Understanding Options for Agricultural Development*. The book will be provided as part of the registration fee for the DSSAT course, and a copy will be provided to each student.
- Each student is expected to provide his/her own computer, preferably a notebook that can be used during the workshop and be brought to the discussion periods.

FINAL EXAM

We will administer a two-hour exam during late June or early July based on the material covered in the lectures, discussions, and selected chapters of the textbook. The exam will count for 20% of the final grade.

SPECIAL PROJECT

Each student will select a topic for a course project and use the DSSAT software and associated models and tools and programs for analyzing a particular system. This project will count for 40% of your grade. During a class meeting in early June, you will present plans for the project in a 1–2-page submission and obtain feedback from the instructors. Students will present their special projects on an agreed-upon date during late July in-person for on-campus students and zoom for distance and off-campus students. The final written report will be due in late July or early August, approximately one week after the presentation.

GRADING

Assignments	40%
Final Exam	20%
Special project (report and presentation)	40%

INSTRUCTORS

Gerrit Hoogenboom	gerrit@ufl.edu	289 Rogers Hall	Office hours by appointment
Ken Boote	kjboote@ufl.edu	267 Rogers Hall	Office hours by appointment

CLASS SCHEDULE

May 11	Introductory meeting (**Zoom**)
May 16-21	All-day workshop and class meetings @ University of Georgia-Griffin, attend DSSAT course lectures, conduct exercises, begin homework assignments, and participate in group discussions
May 30	First set of six homework exercises are due
May 30	Deadline for 1-page special project description
June?	Meet to discuss first homework exercises and special project (**Room? / zoom**)
June?	Discuss special project; 15-minutes per person (zoom)
June?	Second set of four homework exercises due
June?	Deadline for 2-page special project description - *Please follow instructions for format shown on page 3*
June?	Meet to discuss remainder of homework exercises & review for final exam (**Room? / zoom**)
June?	Final Exam (**Room? / E-mail for remote exam**)
June?	Meet to discuss Special Project (**zoom**)
July?	Draft Special Project Report due - *Please follow instructions for format shown on page 4*
July?	PowerPoint presentations of Special Project (**zoom**) *10-minute presentation & 5 minutes for questions*
August 1	Final submission of Special Project Report - *Please follow instructions for format shown on page 4*
August 5	Classes End
August 8	Final grade due @ noon

Possible Topics for Special Projects: Using crop models to….

1. Use your own data to adapt a model and then apply the model for an analysis (such as a comparison of management options, climate risks, soil nutrients, irrigation, etc.
2. Evaluate physiological traits to improve genetic yield potential or crop adaptation to particular environments.
3. Evaluate crop model response to climatic factors by comparison to published data.
4. Study carbon sequestration relative to crops and management practices.
5. Study benefits of crop rotation to subsequent crops (only N and water effects will work) under particular weather conditions.
6. Evaluate best management practices (BMPs) to minimize nitrate leaching or irrigation water use.

7.   Evaluate crop management (water, N, cultural practices, etc.) to maximize crop yield or net profit.
8.   Evaluate weather risks to production (yield and net profit) for various world sites (soils and weather).
9.   Linkage of crop models with GIS for spatial analysis of yield variability.
10. Use of a model in DSSAT CSM to quantify yield losses to different factors that occur in a particular experiment (yield gap analysis).
11. Modify sections of the CROPGRO or CERES code to accomplish something new or improve crop model performance. Example could be improving prediction of ET, improving root growth algorithms, etc.
12. Using the model in an optimization mode to solve for crop or genetic traits.
13. Compare a DSSAT CSM crop model with another model and real data.
14. Climate change impact, adaptation, and mitigation.

Format of your final report/paper:
The paper should have at least 8-10 pages of text. Additional pages include figures, tables and references. Double-space the lines in your document and use a 12-pitch font and 1-inch margins. Structure the paper like a scientific paper, including a brief introduction with a literature review, statement of the problem and a clear goal and objectives, methods and materials, results and discussion, and references. The instructors will be available and pleased to give feedback on topics, progress in the project, and in the approach using DSSAT and for writing the project paper.

CLASS ATTENDANCE

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with University of Florida policies that can be found at https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies.

ACCOMMODATION FOR DISABILITIES

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability University of Florida Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs as early as possible in the semester.

COURSE EVALUATION

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

UNIVERSITY OF FLORIDA HONESTY POLICY

University of Florida students are bound by The Honor Pledge that 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 (https://sccr.dso.ufl.edu/process/student-conduct-code/) 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 in this class.

COMMITMENT TO A SAFE AND INCLUSIVE LEARNING ENVIRONMENT

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

STUDENT PRIVACY

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html.

CAMPUS RESOURCES

Health and Wellness

U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit umatter.ufl.edu/ to refer or report a concern and a team member will reach out to the student in distress.

Counseling and Wellness Center: Visit counseling.ufl.edu/ or call 352-392-1575 for information on crisis services as well as non-crisis services. Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need or visit shcc.ufl.edu/.

University Police Department: Visit police.ufl.edu/ or call 352-392-1111 (or 9-1-1 for emergencies).

UF Health Shands Emergency Room / Trauma Center: For immediate medical care, call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; ufhealth.org/emergency-room-trauma-center.

Academic Resources

E-learning technical support: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail athelpdesk@ufl.edu.

Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services career.ufl.edu/.

Library Support: cms.uflib.ufl.edu/ask various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352-392-6420. General study skills and tutoring. teachingcenter.ufl.edu/

Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers. writing.ufl.edu/writing-studio/

Student Complaints On-Campus: sccr.dso.ufl.edu/policies/student-honor- code-student-conduct-code/

On-Line Students Complaints: distance.ufl.edu/student-complaint-process/