PPGA Programa de Pós-Graduação em Agronomia

EA Escola de Agronomia

UFG

TEACHING PLAN

Subject: **Modelling apply to growth simulation**
Workload: 64 hours Theoretical: 32 h Practice: 32 h
Credits: 4 credits
Period: From March 17 to July 16 – Thursday 9-13h (Brasilia time; - 3 GMT)

- **Topics**

- Crop modeling: concepts and applicability (4h);
- Steps of crop model development (4h);
- Components and processes simulated in a crop model (8h);
- Inputs data for crop modeling (4h);
- Concepts related to yield gap (4h);
- DSSAT platform (CSM-CROPGRO-Soybean): estimation of potential and attainable yield (24h);
- Modeling project in applied research in the work area (16h).

- **Objectives**

-To know concepts and stages of development of simulation models;
-To be able to develop models applied to areas of climate, soil, phytopathology and plant production;
-To identify operational data needed for growth simulation models;
-To know the terms and concepts related to the yield gap;
-To quantify potential and attainable yield using CSM-CROPGRO-Soybean from DSSAT platform.

- **Didactic Process:**

The topics of the course program will be presented according to the proposed workload, interspersing the theoretical and practical class period. The interaction with students will be through questions and proposal activities for reflections on the theme during the class period (synchronous and asynchronous). The topics of the course program will be presented via YouTube link, along with a form questionnaire about the class via Google Forms, on the day before the date of the respective class, remaining available for 7 days. Any doubts will be clarified via email (battisti@ufg.br). The synchronous discussion about class topics will be through Google Meeting, following the time on Thursday 9-13h (Brasilia time; - 3 GMT). The students will require a computer with internet access for classes and to run DSSAT free software (https://dssat.net/).

- **Teaching Resources**

Synchronous and asynchronous classes;
Practical activities Synchronous and asynchronous classes;

Read and discussions of manuscripts;
Development of practical projects.

- **Assessment Procedures**

This will be done based on questions form requested in each class, task-related to crop model uses, and the writing and presentation for the modeling project in applied research in the work area. The final points will be converted to the classification:

- A: 9.0 – 10.0;
- B: 7.5 – 8.9;
- C: 6.0 – 7.4;
- D: 5.9 – 0.0 (Not able to receive credits);

- **Class program**

Crop modeling: concepts and applicability: definition, classification and examples of crop model.
Steps of crop model development: model aims, hypotheses, mathematical formulation, code programming, parameterization and model evaluation.
Components and processes simulated in a crop model: phenology, leaf area, dry matter production and partition, water balance, response to water deficit and surplus, and nitrogen balance at plant and soil.
Inputs data for crop modeling: climate data, soil and crop growth and development.
Concepts related to yield gap: potential, attainable and actual yield, and their factors.
DSSAT platform (CSM-CROPGRO-Soybean): installation, run, calibration and data analysis.
Modeling project in applied research in the work area: to use or propose a model to analysis apply to agriculture.

- **Bibliografia Recomendada**

DOORENBOS, J.; KASSAM, A. H. Yield response to water. Rome: FAO, 1979. 193p. (FAO. FAO Irrigation and Drainage Paper, 33).
Hunt, L.A.; Boote, K.J. Data for model operation, calibration, and evaluation. In: Tsuji, G.Y.; Hoogenboom, G.; Thornton, K. Understanding options for agricultural production. Dordrecht: Kluwer Academic, 1998. chap. 2, p. 9-40.
Kassam, A.H. Net biomass production and yield of crops. Rome: FAO, 1977. 29 p.
Soltani, A.; Sinclair, T.R. Modeling Physiology of crop development, growth and yield. CABI, 1st Edition, 340 p., 2012.
Thornthwaite, C.W., Mather, J.R. The water balance. New Jersey: Drexel Institute of Technology, 1955. 104 p. (Publications in Climatology, 1).
Wallach, D.; Makowski, D.; Jones, J.W. Working with dynamic crop models: evaluation,

analysis, parameterization, and application. Amsterdam: Elsevier, 2006. 447 p.
Wallach, D.; Makowski, D.; Jones, J.W.; Brun, F. Working with dynamic crop models: Methods, tools, and examples for agriculture and Environment. Amsterdam: Elsevier, 2014. 487 p.

- **Bibliografia Complementar**

Allen RG, Pereira LS, Raes D, Smith M. Crop evapotranspiration. Guidelines for computing crop water requirements. FAO Irrigation and Drainage Paper 56, 1998. 300p.
Del Ponte, E.M. et al. Predictiong severity of Asian soybean rust epidemics with empirical rainfall models. Phytophthology, v. 96, p. 797-803, 2006.
Justino, L.F. et al. Assessment of economic returns by using a central pivot system to irrigate common beans during the rainfed season in Central Brazil. Agricultural Water Management, v. 224, p. 105749, 2019.
Lobell, D.B. et al. Crop yield gaps: their importance, magnitudes, and causes. Annual review of environment and resources, v. 34, p. 179-204, 2009.
Mavi, H.S.; Tupper, G.J. Agrometeorology: Principles and applications of climate studies in agriculture. CRC Press; 1st editions, 376 p., 2004.
Sentelhas, P.C. et al. The soybean yield gap in Brazil - magnitude, causes and possible solutions for sustainable production. Journal of Agricultural Science, v.153, p. 1-18, 2015.