POSTGRADUATE PROGRAM IN AGRICULTURAL SCIENCES (MASTER'S AND DOCTORATE DEGREE)

SUBJECT: AGROECOLOGY
COURSE MENU: Introduction to agroecology. Concepts of natural ecosystems and agroecosystems. Functioning of agroecosystems. Biotic and abiotic factors in agroecosystems. Inter- and intraspecific ecological interactions. Genetic resources in agroecosystems. Diversity and stability of the agroecosystem. Principles of Plant Demography and Population Ecology. Ecological Niches. Diversity and sustainability of agroecological systems.

SUBJECT: INTERNATIONAL ACTIVITY
COURSE MENU: Taxonomic characterization of the main groups of arthropods of economic importance. Description of the biology, ecology, damages caused, hosts, and management of the main groups of arthropods of economic importance.

SUBJECT: INTERNATIONAL ACTIVITY
COURSE MENU: Recognition of merit through activities carried out by the student in foreign institutions during the Course period. The aim is to stimulate the student's internationalization through mobility in foreign institutions. The student interested in this component must submit his/her International Work Plan (PTI), duly approved by his/her Supervisor, before leaving for international mobility. When returning, the student must submit to the Course Collegiate his/her International Activity Report (RAI), the training completion certificate by the foreign supervisor, and the declaration of consent of the Program supervisor, requesting accreditation in this component. For the purpose of the PTI, it will be accepted the work plan or a planning within the scope of the Programs of development agencies, such as CAPES' "Doctorate Sandwich Program" (PDSE) or CNPq's "Support for Participation in Events Abroad" - participation type "Excursions". The following International Activities will be considered: internships and other activities in international academic mobility programs lasting at least one month in English-speaking countries and at least two months in countries with another language; technical excursions directly related to the Course Completion Work, duly endorsed by the Program Supervisor and with a minimum duration of 30 days.

SUBJECT: **CONSERVATION OF PLANT GENETIC RESOURCES**
COURSE MENU: Principles. In situ conservation, ex situ conservation, germplasm banks, procedures and standards related to collection. Processing, analysis, packaging, documentation, and ex situ conservation of accession samples in the short, medium, and long term, with emphasis on genetic resources of cultivated species and other wild species of economic interest or potential use, either directly or for crop improvement. Conservation units. Cryopreservation and *in vitro* conservation. Disorderly exploitation of genetic resources. Policies for preservation, conservation, and use of genetic resources. Farmer in situ genetic conservation. Patenting of organisms.

SUBJECT: AUTHORSHIP CREDITS
COURSE MENU: Recognition of merit by the Program Collegiate through publications under the student's authorship during the Course period.

SUBJECT: RESEARCH DEVELOPMENT
COURSE MENU: Training in research on specific topics in the field of Agrarian Sciences.

SUBJECT: PLANT ECOPHYSIOLOGY

COURSE MENU: Knowledge about the plant cell and its water relations. Plant production factors. Water absorption, transport, and losses. Water deficit and crop yield. Use of solar radiation by plants. Photosynthesis and cellular respiration. Distribution of assimilates and productivity. Photoperiodism. Quantitative growth analysis. Growth physiology. Cultural manipulation.

SUBJECT: INSECT ECOLOGY AND BEHAVIOR
COURSE MENU: Introduction to insect ecology and biodiversity. Abiotic factors and their relationships with insects. Structure and functioning of insect populations and communities. Trophic systems and interactions. Foraging and insect nutrition. Behavioral bases. Communication mechanisms in insects. Reproductive Behavior in Insects. Social Behavior in Insects.

SUBJECT: TEACHING INTERNSHIP
COURSE MENU: The student must participate in the planning of an undergraduate subject, follow theoretical and practical classes in their entirety, and provide 20% to 50% of the course load under the supervision of the professor responsible for the subject, in addition to presenting a report at the end of the semester to be evaluated by the subject professor and by the supervisor.

SUBJECT: EXPERIMENTAL STATISTICS
COURSE MENU: Fundamental Principles of Experimental Planning. Analysis of variance for one and two factors. Procedures for multiple comparisons of means. Basic designs and their analyses. Lost plots. Multifactor experimental plans. Crossed and hierarchical factors. Main effects and interactions. Experiments in subdivided plots. Introduction to multivariate data analysis.

SUBJECT: DOCTORAL EXAMINATION
COURSE MENU: Presentation and defense of the descriptive memorial in the program, and report of the Thesis Project in progress.

SUBJECT: PRODUCTION PHYSIOLOGY
COURSE MENU: Knowledge about the plant cell and its water relations. Water absorption, transport, and losses. Water deficit and crop yield. Use of solar radiation by plants. Distribution of assimilates and productivity. Quantitative growth analysis. Cultural manipulation.

SUBJECT: GENETICS AND EVOLUTION
COURSE MENU: Knowledge of Mendelian inheritance; chromosome structure and cell divisions: mitosis and meiosis; numerical and structural chromosome changes; DNA markers; structure of nucleic acids and the flow of genetic information to the formation of proteins as well as their regulation; qualitative inheritance, mono-, di-, and polyhybridism, allelic and nonallelic interactions, gene expression and genetic mapping; quantitative and extrachromosomal inheritance and sex determination; principles of quantitative genetics; principles of molecular genetics and genetic engineering; principles and mechanisms of evolution of species. GOALS: Understanding the basic fundamentals of Mendelian genetics; cytogenetics; structure and function of the genetic material; introducing the concept of genetic information flow; knowing the mechanisms of gene expression and its regulation as well as the basic aspects of the evolutionary process.

SUBJECT: QUANTITATIVE GENETICS
COURSE MENU: Non-regular subject, taught by visiting professors or in the institution itself, concentrated or not. Discussion of important topics in Quantitative Genetics, of interest for student training, and which have not been addressed in regular subjects.

SUBJECT: INSECT-PLANT INTERACTION
COURSE MENU: Coevolutive interactions between insects and plants. Forms of Herbivory. Definition of resistant plants, types of plant resistance to insects, causes of plant resistance to insects (physical, chemical, and morphological); factors that influence resistance, research on plant resistance. History of insecticidal plants, plant species with effects on pests. Trophobiosis theory.

SUBJECT: BENEFICIAL INTERACTIONS BETWEEN PLANTS AND MICROORGANISMS
COURSE MENU: Soil ecology: main soil organisms and their functions. Rhizosphere: rhizosphere effect on microorganisms and the effect of microorganisms on plant growth, nutrition, and disease biocontrol. Mycorrhizae: contributions of ectomycorrhizae and arbuscular mycorrhizal fungi in agroecosystems. Biological N fixation: main groups of N-fixing bacteria, nitrogenase complex, and N fixation in crops of economic interest. Tolerance to biotic and abiotic stresses: role of microorganisms on plant tolerance to stress.

SUBJECT: PLANT-PATHOGEN INTERACTIONS
COURSE MENU: Introduction to plant-pathogen interactions; Basic concepts; Resistance; Effectors, elicitors, and signaling in plant-pathogen relations; Phytopathogen identification and taxonomy; Models of plant-pathogen interaction: TMV and tobacco, Ralstonia and tomato, Magnaporthe and rice, Ustilago maydis and maize, Phytophthora infestans and potato, Meloidogyne and tomato.

SUBJECT: POLLINATOR MANAGEMENT AND CONSERVATION
COURSE MENU: History of the pollinator service and the decline of pollinators in agricultural areas; floral biology with emphasis on pollination; pollination syndromes; floral visitors and effective pollinators; taxonomic identification of the main groups of pollinators with emphasis on bees (Apoidea); floral visitor survey techniques; techniques for determining pollinator efficiency; nesting biology with emphasis on bees; trophic niche; pollinator-friendly practices; management of colonies of social bees for pollination; and management of artificial nests of solitary bees for pollination.

SUBJECT: MOLECULAR MARKERS APPLIED TO GENETIC BREEDING
COURSE MENU: Concepts and general theory of molecular markers, the main types, their peculiarities and applications as a tool for plant genetic breeding programs.

SUBJECT: DISEASE CONTROL METHODS
COURSE MENU: Knowledge about the methods used to control plant diseases of economic importance. Principles of plant disease control; physical, chemical, biological, and cultural methods, integrated disease management, genetic resistance, and strategies to increase the durability of disease resistance. Notes on phytopathology.

SUBJECT: CHROMATOGRAPHIC METHODS FOR ANALYSIS OF BIOACTIVE COMPONENTS
COURSE MENU: Analytical techniques and procedures for the determination of bioactive metabolites present in environmental, food, and biological samples.

SUBJECT: PLANT BREEDING METHODS
COURSE MENU: Advanced knowledge of plant breeding; identification of appropriate methods and selection criteria for the development of new varieties.

SUBJECT: MORPHOPHYSIOLOGY OF INSECTS

COURSE MENU: External morphology of the class Insecta. Integument; Muscular System and Locomotion; Respiratory System; Digestive System; Circulatory system; Nutrition and Metabolism; Excretion and Osmoregulation; Nervous system; Sense Organs; Endocrine and hormonal system; Reproductive Systems. Development, immature stages, and metamorphosis.

SUBJECT: ORIENTED RESEARCH
COURSE MENU: Research related to the Dissertation project in progress.

SUBJECT: STUDENT ACADEMIC PLANNING (PAD)
COURSE MENU: Compulsory Curricular Activity in which the student must prepare his/her academic planning together with his/her Supervisor, forecasting activities for the entire Course period. Enrollment must be made in the first semester of the Course; this component does not account for credits, and the concept will be “Approved in the Activity” or “Disapproved in the Activity”; the student must submit his/her PAD through a form, with the consent of the Supervisor, at the Program Secretariat until the 8th (eighth) week of the 1st (first) semester; any changes in this component throughout the course must be informed to the Course Collegiate, in the student’s semester report; the Course Collegiate may use the PAD as a tool for evaluating and monitoring the performance of the student in the Program as well as for defining strategies and planning, aiming to improve the Program.

SUBJECT: POLLINATION AND BEE PRODUCTS
COURSE MENU: Highlighting the importance of bees as a supplier of colony products and as a provider of pollination services; emphasizing aspects of honeybee biology and behavior; presenting and discussing cases of crop pollination; characterizing the products of the hive: honey, bee pollen, pot-pollen, propolis, geopropolis, royal jelly, wax, mead, queens and swarms; seminars on topics indicated for literature review.

SUBJECT: PROFICIENCY IN ENGLISH LANGUAGE
COURSE MENU: English proficiency test.

SUBJECT: DISSERTATION PROJECT
COURSE MENU: Elaboration of the Dissertation Project.

SUBJECT: THESIS PROJECT
COURSE MENU: Elaboration of the Thesis Project.

SUBJECT: SEMINAR I
COURSE MENU: Techniques for presentation of seminars and use of audiovisuals; presentation of technical-scientific topics in the field of Agrarian Sciences.

SUBJECT: SEMINAR II
COURSE MENU: Presentation of seminar on the theme of the Dissertation and Thesis Project.

SUBJECT: AGRICULTURAL PRODUCTION SYSTEMS
COURSE MENU: History of agriculture. Concepts related to agricultural production systems. Factors of crop production and cultural manipulation. Conventional production systems. Conservation production systems. Organic and agroecological production systems. Integrated production systems. Intensive production systems. Case studies with emphasis on fruit crops.

SUBJECT: TISSUE CULTURE TECHNIQUES AND APPLICATIONS
COURSE MENU: Plant tissue culture techniques and their applications in agriculture. Basic methods of cellular and molecular biology used in the genetic transformation of plants.

SUBJECT: EXPERIMENTAL TECHNIQUES IN ENTOMOLOGY
COURSE MENU: Providing a theoretical and practical foundation in experimental techniques inherent to Entomology and related sciences for students of the Master's and PhD courses. Techniques for special collection of specific taxonomic groups; laboratory techniques applied to the study of insect trophic niche; techniques for laboratory analysis of insect products; insect breeding techniques in the field and laboratory; techniques for studying the relationships between insects and plants at the field level; techniques for population studies of insects through application of morphometric studies.

SUBJECT: LABORATORY TECHNIQUES IN AGRICULTURAL MICROBIOLOGY
COURSE MENU: Techniques for the isolation, cultivation, identification, and preservation of soil microorganisms, endophytic microorganisms, nitrogen-fixing microorganisms, and food microorganisms. Quantification of microorganisms by the serial dilution method and the most probable number. Measures and rates of microbial growth. Isolation and observation of environmental fungi and phytopathogenic fungi. Pathogenicity tests. Techniques for the extraction and identification of phytonematodes. Techniques for studying food microorganisms. Mycorrhizal fungi: root staining and quantification of root colonization, spore extraction and identification, inoculum production, and inoculation in plants. Preservation of microorganisms. Biochemical, cultural, and morphological tests for the identification of microorganisms.

SUBJECT: ADVANCED TOPICS IN AGRICULTURAL SCIENCES I
COURSE MENU: Special topics in the field of Agricultural Sciences, to be taught by a Visiting Professor in the first academic semester; defined according to the profile of the professor in charge.

SUBJECT: ADVANCED TOPICS IN AGRICULTURAL SCIENCES II
COURSE MENU: Special topics in the area of Agricultural Sciences, to be taught by a Visiting Professor in the second academic semester; defined according to the profile of the professor in charge.

SUBJECT: SPECIAL TOPICS IN PHYTOTECHNY I
COURSE MENU: Special topics in the field of Phytotechny, whose content does not compose the scope of the curriculum matrix. Taught, possibly, by Visiting Professors, Post-Doctoral Students or Guest Professors/Researchers.

SUBJECT: SPECIAL TOPICS IN PHYTOTECHNY II
COURSE MENU: Special topics in the field of Phytotechny, whose content does not compose the scope of the curriculum matrix. Taught, possibly, by Visiting Professors, Post-Doctoral Students or Guest Professors/Researchers.