Master of Science Program in Bioscience for Sustainable Agriculture
(International Program/ Revision 2020)
Faculty of Animal Sciences and Agricultural Technology

Program title

Thai	หลักสูตรวิทยาศาสตรมหาบัณฑิต สาขาวิชาชีววิทยาศาสตร์เพื่อเกษตรกรรมที่ยั่งยืน (หลักสูตรนานาชาติ)
English	Master of Science Program in Bioscience for Sustainable Agriculture (International Program)

Degree title and field of study

Thai	วิทยาศาสตรมหาบัณฑิต (ชีววิทยาศาสตร์เพื่อเกษตรกรรมที่ยั่งยืน) วท.ม. (ชีววิทยาศาสตร์เพื่อเกษตรกรรมที่ยั่งยืน)
English	Master of Science (Bioscience for Sustainable Agriculture) M.Sc. (Bioscience for Sustainable Agriculture)

Place of instruction

Faculty of Animal Sciences and Agricultural Technology, Silpakorn University, Phetchaburi IT Campus, Phetchaburi

Objectives of the program

1. To train the graduates to possess the knowledge in bioscience for agricultural sustainability, regards to the principles of science, biology, and factors relating to agricultural technology and patterns.
2. To ingrain the graduates with virtue, responsibility, critical thinking, and skill for communication with scholars, farmers, and communities.
3. To equip the graduates with the capacity to conduct a research in bioscience for agricultural sustainability.
4. To develop human resources as required by public and private sectors in both national and international levels for the development of sustainable agriculture.

Student qualifications

1. **Plan A1 (Thesis)**

Graduates of Bachelor degree in science or a related field with an equivalent GPA of 2.75 or higher or with consent of the curricular academic committee

2. **Plan A2 (Thesis and course works)**

Graduates of Bachelor degree in science or a related field with an equivalent GPA of 2.50 or higher

3. Eligible candidates under Clause 1 and 2 must have all the qualifications specified in the Silpakorn University's Regulation on Graduate Study B.E. 2561 (2018). and/or subsequent changes.

Curriculum structure

Plan A 1 equivalent to 36 credits

Seminar (non-credit)	2	credits
Required course (non-credit)	7	credits
Thesis (equivalent to)	36	credits

Plan A2 not less than 36 credits

Required courses	15	credits
Elective courses not less than	9	credits
Thesis (equivalent to)	12	credits

Note: All students enrolled in both plans are required to pass the comprehensive examination.

Curriculum courses

1. Plan A1

1.1 Seminar (non-credit) 2 credits

(Course in which no credit will be given as part of the curriculum and its assessment will be given as S or U)

715 505	Seminar in Bioscience for Sustainable Agriculture I	1*(1-0-2)
715 506	Seminar in Bioscience for Sustainable Agriculture II	1*(1-0-2)

1.2 Required course (non-credit) 7 credit

(Course in which no credit will be given as part of the curriculum and its assessment will be given as S or U)

715 503	Research Methodology for Agricultural Sustainability	3* (3-0-6)
715 504	Selected Skills for Research in Bioscience for Sustainable Agriculture	1*(1-0-2)
715 507	Integrative Research in Bioscience for Sustainable Agriculture	3* (2-3-4)

1.3 Thesis (equivalent to) 36 credits

715 591	Thesis	(equivalent to) 36 credits

2. Plan A2

2.1 Required courses 15 credits

715 501	Cell Science and Molecular Biology	3(3-0-6)
715 502	Bioscience for Agricultural and Environmental Sustainability	3(3-0-6)
715 503	Research Methodology for Agricultural Sustainability	3(3-0-6)
715 504	Selected Skills for Research in Bioscience for Sustainable Agriculture	1(1-0-2)
715 505	Seminar in Bioscience for Sustainable Agriculture I	1(1-0-2)
715 506	Seminar in Bioscience for Sustainable Agriculture II	1(1-0-2)
715 507	Integrative Research in Bioscience for Sustainable Agriculture	3(2-3-4)

Note: * means non-credit subjects.

2.2 Elective courses not less than 9 credits

The elective courses can be chosen from the following list or can be chosen from the post-graduate courses provided by the Faculty of Animal Sciences and Agriculture Technology with the decision and content of the curricular academic committee.

(1) Animal Production

715 521	Organic Livestock Production for Sustainability	3(3-0-6)
715 522	Animal Genetic Improvement and Conservation	3(3-0-6)
715 523	Animal Farming Management Technology	3(3-0-6)
715 524	Hygiene in Dairy Production	3(3-0-6)
715 525	Animal Pathobiology	3(3-0-6)
715 526	Diagnosis of Aquatic Animal Diseases	3(2-3-4)

(2) Plant Production

715 527	Genetic Improvement for Crop Production	3(3-0-6)
715 528	Plant Genetic Resource and Application	3(3-0-6)
715 529	Seed Technology	3(2-3-4)
715 530	Plant Pathology	3(2-3-4)
715 531	Postharvest Physiology and Technology	3(2-3-4)
715 532	Integrated Pest Management	3(2-3-4)

(3) Multidisciplinary

715 533	Principle of King Rama IX Wisdom for Agricultural Sustainability	3(3-0-6)
715 534	Natural Resources and Environmental Management	3(3-0-6)
715 535	Ecology and Management of Aquatic Resources	3(3-0-6)
715 536	Soil Fertility and Protection for Sustainable Agriculture	3(2-3-4)
715 537	Microbial Diversity and Agricultural Application	3(2-3-4)
715 538	Food Safety Standard and International Policy	3(3-0-6)
715 539	Agribusiness and Entrepreneurship	3(3-0-6)
715 540	Modern Technology for Smart Farming Agriculture	3(3-0-6)
715 541	Molecular Biology Techniques and Bioinformatics	3(3-0-6)
715 542	Research in Agricultural Areas	3(3-0-6)
715 543	Enzyme Technology	3(3-0-6)
715 544	Selected Topics in Bioscience for Sustainable Agriculture	3(3-0-6)

2.3 Thesis (equivalent to) 12 credits

715 592	Thesis	(equivalent to) 12 credits

Course description

715 501 Cell Science and Molecular Biology 3(3-0-6)

Cell structure and function, structure of genetic materials, DNA replication, cell cycle, cell division, gene expression, gene regulation, cell differentiation, mutation, cell-cell communication, energy flow in biological system, techniques in molecular biology.

715 502 Bioscience for Agricultural and Environmental Sustainability **3(3-0-6)**

Integration of bioscience with King Rama IX wisdom, sufficiency economy philosophy, and local wisdom in sustainable farming models, good agricultural practices, organic farming, green production, smart farming, zero waste agricultural practices, integrated agricultural farming system, agricultural product processing and marketing, relationship and impact of farming on the natural resources and environment, and knowledge transferring techniques.

715 503 Research Methodology for Agricultural Sustainability **3(3-0-6)**

Research and research questions for agricultural sustainability, errors in research, research designs, research methods, research tools, population and sampling, statistical analysis techniques, and research presentation.

715 504 Selected Skills for Research in Bioscience for Sustainable Agriculture **1(1-0-2)**

Criteria: Assessment will be given as S or U.

The virtues of researchers, research ethics in human and animals, intellectual property rights, self-safety and environmental safety in conducting research such as biological safety, chemical safety, radiation and electricity safety, techniques for reading and writing scientific works, including research projects, thesis, research articles and review articles for publication.

715 505 Seminar in Bioscience for Sustainable Agriculture I **1(1-0-2)**

Criteria: Assessment will be given as S or U.

Reading on recent agricultural bioscience research literature, improving ability on critical thinking process, discussion and presentation of research work under advisory of seminar instructors.

715 506 Seminar in Bioscience for Sustainable Agriculture II **1(1-0-2)**

Pre-requisite: 715 505 Seminar in Bioscience for Sustainable Agriculture I

Criteria: Assessment will be given as S or U.

Compiling the information of scientific research, discussion and presentation of research in bioscience for sustainable agriculture.

715 507 Integrative Research in Bioscience for Sustainable Agriculture **3(2-3-4)**

Analysis of the situation and agriculture problems from the farmers, agricultural operation agencies or agricultural entrepreneurs, concepts and impacts of integrative research to agriculture, environment, and health, presenting research guidelines for solving agricultural problems by applying the knowledge of bioscience or with other academic fields appropriately.

715 521 Organic Livestock Production for Sustainability 3(3-0-6)

Principle of organic livestock, animal welfare, productivity in organic livestock production, food security and sustainability in organic livestock, Thai and International laws, regulations, and product certification systems of organic livestock.

715 522 Animal Genetic Improvement and Conservation 3(3-0-6)

Biodiversity, animal genetic resources, domestic animal diversity, loss of genetic diversity in domestic animals, reasons and criteria for breed selection and conservation, methods for conservation of animal genetic diversity, status of breeds, concepts and principles in genetic improvement of livestock.

715 523 Animal Farming Management Technology 3(3-0-6)

Modern technology in animal housing, hygiene and sanitary control, farm waste and environmental management, resource management system, public relations and marketing quality control, evaluation system including product accreditation underlying animal welfare.

715 524 Hygiene in Dairy Production 3(3-0-6)

Factors affecting milk quality, milking parlor design and management, milking systems and analysis, milking machine, mastitis and milk quality management, waste management from dairy farms.

715 525 Animal Pathobiology 3(3-0-6)

Principles of pathology and pathogenesis, inflammation and wound healing, cellular adaptation after injury, genetic abnormalities and hemodynamic disorders, metabolic disorders of carbohydrates, proteins, lipids, minerals and colorants, abnormal cell growth and cancer.

715 526 Diagnosis of Aquatic Animal Diseases 3(2-3-4)

Aquatic animal diseases caused by parasitic, bacteria, fungal and viral, diagnosis of aquatic animal diseases, prevention and treatment of aquatic animal diseases, experimental methodology in aquatic animal diseases.

715 527 Genetic Improvement for Crop Production 3(3-0-6)

Genetic theory, conventional breeding and gene manipulation methods for genetic improvement in plants, utilization of genetic resources for qualitative and quantitative improvement, socio-economic aspect in adopting genetically modified crops.

715 528 Plant Genetic Resource and Application 3(3-0-6)

Genetic diversity of plant in the agro-ecosystem in Thailand, methods in determining genetic diversity of plants, preservation of plant genetic diversity in agro-ecosystem, identification of indigenous plant species with potential for conservation and commercial utilization.

715 529 Seed Technology 3(2-3-4)

Seed morphology and physiology of seeds under storage and germination, process of seed production, methods in determining seed quality, seed pathology and insect pests of seeds, techniques used in seed storage.

715 530 Plant Pathology 3(2-3-4)

Definition of plant diseases, history of plant disease outbreak of important economic crop, types of microorganisms causing diseases in plant, mechanisms of plant defense, important diseases of economic plants, principles of plant disease management and tactics for plant disease control, biotechnology in plant pathology, appropriate technology for controlling plant diseases in sustainable crop production.

715 531 Postharvest Physiology and Technology 3(2-3-4)

Causes of loss in post-harvest products, physiology of maturity, ripening, and senescence, genetic control of maturity and senescence, post-harvest loss, prevention of post-harvest loss, insect pests and diseases of post-harvest products.

715 532 Integrated Pest Management 3(2-3-4)

Definition of pests, key historical events in pest outbreak, effect of pest outbreak to agriculture, pest control tactics, biological control of insect pests, integrated pest management (IPM) concept, components and steps of IPM, sampling techniques and decision tools for IPM, examples of IPM in current practices.

715 533 Principle of King Rama IX Wisdom for Agricultural Sustainability 3(3-0-6)

Principles of King Rama IX wisdom relating to agricultural development, production system and farm resources management follow the footsteps of sufficiency economy, agricultural land management in accordance with royal works, principles of "new theory" in agriculture and rural development, transfer of agricultural innovation theory of preventing soil degradation and erosion by vetiver grass, and the theory of teasing the ground due to the royal initiative.

715 534 Natural Resources and Environmental Management 3(3-0-6)

Approaches in natural resource management, stakeholder analysis for natural resource management, Geographic Information Systems (GIS), auditing systems for natural resource management, biodiversity, and environmental conservation

715 535 Ecology and Management of Aquatic Resources 3(3-0-6)

Ecology of aquatic ecosystems, methods for aquatic ecology study, water resource, examination and solving of water resource problems, and management of aquatic resources.

715 536 Soil Fertility and Protection for Sustainable Agriculture 3(2-3-4)

Nutrient recycling in soil, soil fertility analysis, plant-soil-microbe interaction, methods of enhancing soil fertility for crop production, and soil protection method and application for sustainable agriculture.

715 537 Microbial Diversity and Agricultural Application 3(2-3-4)

Habitat of microbes, host-microbe association, isolation and identification of microbes, detection and utilization of potential microbes for agricultural application, product formulation, and commercialization of beneficial microbe.

715 538 Food Safety Standard and International Policy 3(3-0-6)

Physical, chemical and biological hazards in food processing and production, standard and good manufacturing practices in food safety, hazard analysis and critical control point, maximum residue limiting value related to food safety, and international food safety policy.

715 539 Agribusiness and Entrepreneurship 3(3-0-6)

Concepts of agribusiness management, principles of agribusiness organization management, principles of marketing, principles of business initiation analysis and preparation of business plan.

715 540 Modern Technology for Smart Farming Agriculture 3(3-0-6)

Principle of smart farming, electronic and information technologies for smart farming, application of GIS and meteorology in weather forecast for smart farming system, digital image processing, and smart sensing system for site-specific farming management.

715 541 Molecular Biology Techniques and Bioinformatics 3(3-0-6)

DNA and RNA extraction, Polymerase Chain Reaction, gel electrophoresis, cloning, sequencing, molecular hybridization, DNA microarray, immunofluorescence staining technique, bioinformatics database utilization, nucleic acid analysis and sequence alignment, bioinformatics for gene cloning and expression, phylogenetic analysis, protein bioinformatics database, analysis of protein structure and function, prediction of post-translational modification of proteins and protein modeling, proteomics, metabolomics and transcriptomics.

715 542 Research in Agricultural Areas 3(3-0-6)

The concept and importance of research in agricultural areas, communication and working with farmers, application of theoretical knowledge and practice in agricultural areas.

715 543 Enzyme Technology 3(3-0-6)

Introduction to enzymes, mechanisms of enzyme catalysis, enzyme structure specificity and stability, natural and recombinant enzyme production and purification, industrial enzymes, methods in improvement of enzyme activity using genetic engineering, and application of enzymes in agricultural approaches.

715 544 Selected Topics in Bioscience for Sustainable agriculture 3(3-0-6)

Topics of current interest in Bioscience for Sustainable agriculture.

715 591 Thesis (equivalent to) 36 credits

Original research dissertation related to bioscience for sustainable agriculture under the guidance of advisory committee.

715 592 Thesis (equivalent to) 12 credits

Original research dissertation related to bioscience for sustainable agriculture under the guidance of advisory committee.