

PH.D PROGRAM SPECIFICATION

Program title: Crop science
Program code: 62 62 01 11
Type of Program: Full-time/ Part-time

*(Promulgated in Decision No: 4234 of President of Vietnam National University of
Agriculture, 29th December 2015)*

1. Program Objectives and Expected Learning Outcomes

1.1. Program Objectives

- Provide advanced knowledge in various aspects of crop science: Crop physiology and ecology, principles of crop production, cultivation and environment, farming system, hi-tech crop production and information technology applying in crop production
- Possess ability to update, discover and propose the research problems in specialist field.
- Understand thoroughly research methodology, propose suitable solutions, and organise research program.

1.2. Expected Learning Outcomes

Knowledge

- Apply basic knowledge of crop science in evaluating real situations, from that proposing scientific theories and research questions, conducting experiments, analysing and summarising research results in order to find out new scientific and practical discoveries.
- Apply professional, advanced and comprehensive knowledge of crop science in:
 - o Analysing and summarizing knowledge of relationships between environment conditions and crop growth, development, yield and quality, adaptation mechanism of crop with adverse conditions in building intergated crop production techniques.
 - o Evaluating the effects of climate change on crop growth, adaptability and productivity; Applying knowledge and research results of farming system, cultivation method, tropical cultivation technology in cropping system arrangement and building cultivation models coping with climate change, ensuring biological diversity conservation, developing sustainable agriculture.
- Possess new thinking to organise work and research to resolve the different problems arising from crop production practically and scientifically. Develop the principles and theory of physiology and ecology relating to crop growth and development.

- Apply knowledge of policy, organisation and management, environment protection in research and production of crop, producing high quality seeds and nursery plants according to national standards.

Skills

- Create new knowledge contributing to develop principles, theory of crop science.
- Discover and evaluate complex issues in specialist field and propose creative solutions to resolve problems
- Apply knowledge and skill in real conditions and making plans and carrying out the duties in the field of crop science
- Analyse the principles and application of software in simulating the impacts of surrounding on crop growth, development and yield; forecasting crop yield in climate change condition.
- Establish and participate international and national cooperation network through building, organising and operating research projects in the field of crop science.
- Achieve B2 level in English or equivalent.
- Write and evaluate professional report and paper in the field of crop science and genetic and plant breeding; Communicate effectively, explain ideas clearly and protect own opinions and review professional issue in the field of crop science and genetic and plant breeding.

Ethics and Attitudes

- Be creative in working and possess ability to discover, resolve problems and summarise and conclude the principle, rules based on own experiences in the field of crop science.
- Summarise and evaluate effectively situation and development trend of agriculture production in the world and Vietnam. Pro-active in research direction. Be adaptable to various working environments and specific conditions. Possess ability to intergrate into global research network in the field of crop science.
- Pro-active in decision making of working plan, manage research activities and put new proposal, knowledge development, new ideas and new production process in the field of crop science
- Pro-active in continuous study, knowledge and experience accumulation to improve professional knowledge and skills in the field of crop science.

2. Education duration

Duration of education is 3 years for Master's degree holding candidates and 4 years for non- Master's degree holding candidates.

3. Course load

No.	Knowledge blocks	Credit
1	General compulsory knowledge	6
2	Elective knowledge	8
3	Review essay	2
4	Serminar	4

5	Dissertation	70
	Total	90

- Non-Master's degree holding candidates must complete more 30 credits of Master's degree program of Crop Science, not including Philosophy course.
- If candidates hold near Master's degree program or Master's degree of crop science but graduated for a long time or Master's degree of other education institute, depend on specific circumstance candidate will must take required course of Bachelor' and Master' degree according to the requirements of program.

4. Enrollment

4.1. Relevant field

Crop Science, Genetic and plant breeding, Agronomy, Cultivation

4.2. Near field

Crop protection, Biotechnology, Bachelor of Agriculture, Horticulture

5. Educational process and graduation requirements

The educational process and the graduation conditions follow the regulations of Ministry of Education and Training and university of PhD degree program.

6. Grading system

Grade according to 10-point scale grading system.

7. Curriculum

No.	Course code	Course name	Credits	Theory	Practice	Compulsory	Elective
Compulsory and Elective knowledge							
1	NH0819	Advanced Crop Physiology and ecology	2	2	0	x	
2	NH0820	Plant and Climate changes	2	2	0	x	
3	NH0826	Management of Organic Agriculture	2	2	0	x	
4	NH0821	High technology in plant cultivation	2	2	0		x
5	NH0822	Farming system in the tropics	2	2	0		x
6	NH0815	Genetics and breeding for resistance to abiotic stresses	2	2	0		x
7	NH0824	Conservation Agriculture	2	2	0		x

No.	Course code	Course name	Credits	Theory	Practice	Compulsory	Elective
8	NH0825	Modelling & Prediction in Crop Science	2	1,5	0,5		x
9	NH0813	Management and utilization of plant germplasm in breeding	2	2	0		x
10	NH 802	Advances in plant pest management	2	2	0		x
11	KTNN 802	Agricultural development and integration	2	2	0		x
Review and essay							
11	TLTQ	Review essay	2			x	
1	CD	Plant physiology (yield, abiotic and biotic stress tolerance, adaption)	2				x
2	CD	Biotechnology in crop production	2				x
3	CD	Agricultural Systems	2				x
4	CD	Crop nutrition	2				x
5	CD	crop ecology	2				x
6	CD	Crop and water	2				x
7	CD	Soil and water	2				x
8	CD	Climate change and crop production	2				x
9	CD	Scientific bases for development of cultivation practices of crop groups (grain, root, stem and leafy crops)	2				x
10	CD	Indigenous crops and conservation of plant germplasms)	2				x
11	CD	Postharvest Physiology and preservation of crops	2				x
12	CD	Weeds	2				x
13	CD	High tech farming	2				x
14	CD	Crop production and hygiene and food safety	2				x
15	CD	Role of varieties in crop production	2				x
16	CD	Intergrated crop management	2				x
Thesis			70			x	

8. Study plan

Semester	No	Course name	Course code	Credits	Theory	Practice	Compulsory/Elective
1-6.	1	Advanced crop Physiology and ecology	NH0819	2	2	0	Compulsory
1-6.	2	Platns and Climate changes	NH0820	2	2	0	Compulsory
1-6	3	Management of Organic Agriculture					Compulsory
1-8	4	Doctor Thesis		70		70	Compulsory
1-6.	5	Management and utilization of plant germplasm in breeding	NH0813	2	2	0	Elective
1-6.	6	Modelling & Prediction in Crop Science	NH0825	2	1,5	0,5	Elective
1-6.	7	Genetics and breeding for resistance to abiotic stresses	NH0815	2	2	0	Elective
1-6.	8	Tropical cultivation systems	NH0822	2	2	0	Elective
1-6.	9	conservation Agriculture	NH0824	2	2	0	Elective
1-6.	10	Agricultural development and integration	KT0802	2	2	0	Elective
1-6.	11	High technology in plant cultivation	NH0821	2	2	0	Elective
1-6.	12	Advances in plant pest management	NH0802	2	2	0	Elective
Review essay (2 credits)				2	2	0	Compulsory
Seminar Essay (2 credits/essay, choose 2 topics and choose crop relevant to own thesis)				4			Compulsory
4-7.	1	Plant physiology (yeld, abiotic and biotic stress tolerance, adaption)		2			
4-7.	2	Biotechnology in crop production		2			
4-7.	3	Agricultural Systems		2			

4-7.	4	Crop nutrition		2			
4-7.	5	crop ecology		2			
4-7.	6	Crop and water		2			
4-7.	7	Soil and water		2			
4-7.	8	Climate change and crop production		2			
4-7.	9	Scientific bases for development of cultivation practices of crop groups (grain, root, stem and leafy crops)		2			
4-7.	10	Indigenous crops and conservation of plant germplasms)		2			
4-7.	11	Postharvest Physiology and preservation of crops		2			
4-7.	12	Weeds		2			
4-7.	13	High tech farming		2			
4-7.	14	Crop production and hygiene and food safety		2			
4-7.	15	Role of varieties in crop production		2			
4-7.	16	Intergrated crop management		2			

9. Course content and work load

9.1. Course description

1. NH0819: Advanced Crop Physiology and ecology (2: 2-0-4): Analyze the physiological processes in relation to plant growth and development; Energy balance and water use efficiency; Photosynthesis, respiration and source - sink relationships. Stress and responses of plant to environmental stress; molecular mechanisms underlying stress responses and adaptation.

2. NH0820: Plant and climate change (2: 2.0-0-4): Definition of climate change; Phenomena and trends in climate change; The risks and impacts of climate change on plants; Characteristics and resistance of crops to the phenomena of climate change; Scientific basis for designing crop system to respond to climate change; The correlation between biodiversity and climate change.

3. NH0813: Management and utilization of plant germplasm in breeding (2: 2-0- 4): New knowledge of In-situ conservation; Evaluation of genetic resources based on phenotypes and molecular markers; Exploitation of genetic resources in plant breeding; Identification of the gene source carrying the target genes. Improvement of genetic resources through hybridizing among gene pools. Genetic improvement through outcrossing and transgenic methods.

4. NH0815: Genetics and breeding for resistance to abiotic stresses (2: 2-0-4,0): Abiotic stress: Definition and classifications. Gene-environment interaction; Genetic resistance; Selection of varieties for drought-tolerance (rice, corn, and soybean); salt and waterlogging-tolerance (rice, maize, and tomato); and heat-tolerance (tomato and cowpea).

5. NH0821: High technology in plant cultivation (2: 2- 0 - 4,0): Introduction to high technology in agriculture; The research and application of high technology in agricultural production, current situation of high technology in agriculture; High-tech cropping system in a net house; Hydroponic and substrate cultures. Economic and environmental issues of high-tech agriculture.

6. NH0822: Farming system in the tropics (2: 2-0-4): Tropical climate, potential and problems of tropical farming system; Farming system in the tropics: characteristics, principles of crop cultivation; problems and improvements for each farming system; Research methodology and development of farming systems.

7. NH0824: Conservation Agriculture (2: 2-0-4): The Concepts and characteristics of Conservation Agriculture; The scientific basis and principles of agro-ecological establishment under Conservation Agriculture; Contents of Conservation Agriculture Conservation Agriculture techniques; Establishment of agro-ecosystems according to Conservation Agriculture techniques.

8 NH0825: Modelling & Prediction in Crop Science (2: 1.5 – 0.5- 4): The concepts for modelling, simulation, classification of simulation, history of modelling and simulation in agricultural and resource management; Basis steps of modelling method; Introduction to digital methods and applications to computers; Modeling of crop accumulation, transport and metabolism processes in crops; Software for simulation of plant growth and

development; Data models and software in database management, especially data in large capacity with spatial and temporal characteristics.

9. KT 802: Agricultural Development and Integration (2: 2-0-4): The course enhances knowledge about agricultural development contexts, food safety and security, industrialization, agricultural and rural modernization, resource usage and sustainable issues; international economic integration and agricultural development; the experience lessons and agricultural developing trends.

10. NH 802: Advances in plant pest management (2-0-4): New perspectives in pest management; The achievements of biotechnology in pest management; Nanotechnology and its application in pest management; Juvenile Hormone Enzymes agents in pest management; The new generation pesticides; The new advanced technologies for managing several insect pests on different crops.

11. NH0826: Management of Organic Agriculture (2- 0-4): The concepts and principles of Organic agricultural production; The scientific basis of main factors in Organic agricultural production including soil, water, nutrient, pest management; preservation and organic product market; The general concepts of organic agriculture management; The scientific basis for organic agriculture management; Establishment of price and market for organic products; Opportunities and challenges for organic agriculture.

9.2. Review essay

a) Requirement

Review essay, equivalent to two credits, is presented to research situation and related issues of the dissertation. The PhD candidate not only shows analysis and evaluation abilities through the related international research but also points out existing problems that the dissertation focuses on. The essay must not exceed 15 pages of A4 size; 1,5 line spacing; a 20-minute power-point presentation.

b) Evaluation Criteria

Evaluation criteria of the review essay (10 points)

- Quality of the specialization information: 5pts
- Quality of the presentation: 2pts
- Answering questions of the academic committee: 3pts

9.3. Specialization topics

a) Requirement

The doctoral specialization topics require the PhD candidate to update knowledge directly relevant to the dissertation, improve research capabilities, and help the candidate to address some contents of dissertation.

The PhD candidate must write topics (each topic does not exceed 15 pages of A4 size, 1.5 line spacing) and present with power-point presentations (no more than 20 minutes) in front of the academic committee for the topic evaluation.

b) Evaluation Criteria

Evaluation criteria of the review essay (10 points)

- Quality of the specialization information: 5pts
- Quality of the presentation: 2pts
- Answering questions of the academic committee: 3pts

c) Possible Specialization Topics

- 1. Plant physiology:** Plant production physiology (Grain and tuber crop); The issues related to photosynthesis, respiration, abiotic stress tolerance, water exchange, mineral nutrition, plant growth regulators, regulation of plant organ growth.
- 2. Biotechnology in Agriculture:** Topics focus on plant tissue culture (in plant breeding and multiplication); DNA engineering: gene detection and multiplication; molecular diagnostics, transgene, DNA screening, bioinformatics, genomics, proteomics.
- 3. Agricultural System:** System theory and its application in agricultural systems research and rural development; Household system; Farming systems in the world and Vietnam; Organic and sustainable farming and industry development.
- 4. Plant nutrition:** Absorption and mineralization of nutrients in plant; Fertilizer demand by crops; The effects of fertilizer application on the quality of agricultural products and the consumer Product Safety; Economic efficiency and environmental protection in fertilizer application.
- 5. Crop ecology:** The ecological factors (including temperature, light, and water) in the relation to growth and yield of crops; Ecological zones and cropping season in farming system.
- 6. Water and crop:** Water use and water use efficiency in crops; Tolerance and adaptation in plants to drought stress; Irrigation and water saving irrigation in crop production.
- 7. Soil and crop:** Nutrient requirements and soil adaptability of crops; The relationship and interaction among soil components and crops; Scientific basis to design crop system in line with natural and socio-economic conditions and achieve high economic efficiency, protection and improvement of environmental resources.
- 8. Climate change and crop production:** Phenomena and trends in climate change; The risks and impacts of climate change on plants; Characteristics and resistance of crops to the phenomena of climate change; Crop system responses to climate change; Biodiversity and climate change.
- 9. Principles of cultivation techniques for each crop group:** Major crop groups in the world and Vietnam (Grain, oil, root and tuber and industrial crops); Importance of each crop groups in agricultural sector; ecological and nutrient requirements of major crops in Vietnam; Cultivation techniques; Advanced technology in major crop production in Vietnam.

- 10. Native plants and gene conservation:** The concepts of native plants, cultural and economic values of native plants; Methods in managing and conserving genetic resources of native plants; The difficulties and challenges in conserving genetic resources of native plants; Researches for using and conserving genetic resources of native plants in Vietnam and the world.
- 11. Postharvest physiology and storage of agricultural products:** The physiological functional changes in agricultural products after harvesting and during post-harvest storage; The effects of pre-harvest cultivation techniques on the physiological changes and post-harvest biochemical composition; Pre-harvest and post-harvest treatments for prolonged storage; Techniques for controlling the physiological activities of agricultural products during storage process, the changes in the quality of agricultural products after harvesting.
- 12. Weed science:** Weed diversity; Damages caused by weeds; The biology of weeds; Weed management.
- 13. High technology in Crop production:** The techniques for crop production in controlled polyhouse; agricultural production on an industrial scale, Programmed crop production; Organization and commercialization of high-tech agricultural products.
- 14. Crop production, food hygiene and safety:** The concepts of food hygiene and safety (FHS); Benefit and effects of FHS to human life and ecological environment; Environmental, human and social factors affecting FSH; Crop production in FHS. Approach, methods and techniques for managing crops in the direction of FHS; Quality assurance system; Evaluation on FSH conformity of products; The role of the state management in food safety. Introduction to crop management models for the standards of food safety.
- 15. Importance of crop varieties in farming system:** Concepts of crop varieties; history of plant breeding; Importance of varieties in crop production; New advanced technology of plant breeding in Vietnam and the world; scientific basis of heterosis, heterosis in breeding, and cultivation techniques.
- 16. Integrated crop management (ICM):** Topics focus on crop production and product consumption; soil and crop management, integrated pest management (IPM).

10. Scientific research and Dissertation

10.1. Scientific research

Conducting scientific research is a particular and compulsory stage while working on the doctoral dissertation. Each PhD candidate should submit his/her dissertation as results of research, investigations, or experiments to complement required data. Therefore, the candidate gains higher level of expertise or comes up with new ideas for research problems. This is the most important step for the students to write doctoral dissertations.

The PhD candidate must take responsibilities for honesty, accuracy and novelty of the scientific research results, following regulations on the intellectual property in both Vietnam and the world.

10.2. Journal papers

The PhD candidate has to publish at least two journal papers which are relevant to the dissertation. The paper publishers must be on the list of journals approved by the State Council for Professor (based on publication year) or with the name on the below list. Of the paper, there is at least one paper published on Science and Development Journal of Vietnam National University of Agriculture. Besides, there is at least one published paper in which the PhD candidate is the first author.

No.	Name of Journal	Publishers
1	International scientific journals of national and international organizations written in one of the following languages: English, Russian, French, German, Chinese, Spanish.	
2	Other international scientific journals certified by the State Council for Professor (including the author's work, no more than 1 point)	
3	Reviewed Scientific reports at national and international scientific conferences	
4	Science and Technology Journal of Agriculture & Rural Development	Ministry of Agriculture and rural development
5	Journal of Plant Protection	Plant Protection Department
6	Journal of soil science	Vietnam Society of Soil science
7	University Journal of Science	Can Tho University
8	Journal of Agriculture and Development	Nong Lam University
9	Vietnam Journal of Agricultural Science	Vietnam National University of Agriculture
10	Journal of sciences VNU	Vietnam National University, Hanoi
11	Hue University Journal of Science	Hue University
12	Journal of Science and Technology	Vietnam Academy of Science and Technology
13	Thai Nguyen University Journal of Science and Technology	Thai Nguyen University
14	Vietnam Journal of Forest Science	Vietnamese Academy of Forest Sciences
15	Journal of Biology	Vietnam Academy of Science and Technology
16	Journal of Vietnam Agricultural Science and Technology	Vietnam Academy of Agricultural Science and Technology

17	Journal of Biotechnology	Vietnam Academy of Science and Technology
18	Journal of Applied genetics	Vietnam society of genetics

10.3. Scientific conferences

All PhD students are required to present their dissertation-related contents at least in two national academic conferences (encouraging in international conferences).

10.4. Dissertation

A doctoral dissertation must be an independence and creative work of the Ph.D. candidate. The dissertation should make contributions in terms of theory and reality in development economics or bring about new measures for development, enrich scientific knowledge, be able to solve problems creatively in science or in reality of socio-economic development.

The dissertation must have new academic contributions, be presented by academic language, and apply the fundamental scientific theories in order to analyze, argue results of previous research work related to the dissertation. Based on those requirements, new problems and hypothesis are proposed, and proved by new evidences. The dissertation author must have assured with honor for the scientific work. The author is encouraged to write and submit the dissertation in English.

The dissertation should be covered within 150 pages of A4 size, excluding contents. Of which, at least half of the dissertation is dedicated to research results and arguments of the candidate.

Format and style of the dissertation must be presented under regulation of Vietnam National University of Agriculture. The dissertation must be assessed at two level, the department and university.

11. Lecturers

No.	Course	Department	Lecturers		
			Name of Lecturers	Date of birth	Academic degree
1	Advanced Crop Physiology and ecology	Plant Physiology	Vu Quang Sang Nguyen Van Phu	1954 1962	Assoc.Prof. PhD
2	Plant and climate change	Food crops Science	Pham Van Cuong Doan Van Diem Nguyen Dinh Vinh	1971 1954 1955	Assoc.Prof. Assoc.Prof. PhD
3	Management of Organic Agriculture	Experimental Methods and	Pham Tien Dung Nguyen Thi Ai Nghia	1954 1981	GS PhD

		Biostatistics			
4	High technology in plant cultivation	Cultivation Science	Ha Thi Thanh Binh Nguyen Tat Canh Nguyen Quang Thach Tran Thi Minh Hang	1954 1958 1954 1971	Assoc.Prof. Assoc.Prof. Prof. Assoc.Prof.
5	Faming system in the tropics	Cultivation Science	Ha Thi Thanh Binh Nguyen Tat Canh Nguyen The Hung	1954 1958 1954	Assoc.Prof. Assoc.Prof. Assoc.Prof.
6	Conservation Agriculture	Industrial and Medicinal Crops Science	Nguyễn Đình Vinh Lê Quốc Doanh Nguyễn Thanh Lâm	1955 1955 1968	PhD Assoc.Prof. PhD
7	Modelling & Prediction in Crop Science	Experimental Methods and Biostatistics	Pham Tien Dung Nguyen Duy Binh Tran Duc Quynh	1954	Prof. Assoc.Prof. PhD
8	Management and utilization of plant germplasm in breeding	Plant Genetics and Breeding	Vu Van Liet Tran Van Quang Vu Thi Thu Hien Nguyen Van Cuong	1954 1973 1975 1959	Prof. Assoc.Prof. Assoc.Prof. Assoc.Prof.
9	Advances in plant pest management	Entomology	Ho Thi Thu Giang Nguyen Van Dinh Le Ngoc Anh Nguyen Duc Tung	1967 1953 1977 1980	Assoc.Prof. Prof. PhD PhD
10	Agricultural development and integration	Agricultural Economics and Policies	Pham Bao Duong Nguyen Phuong Le Do Kim Chung	1973 1973 1953	Assoc.Prof. Assoc.Prof. Prof.
11	Genetics and breeding for resistance to abiotic stresses	Plant Genetics and Breeding	Vu Van Liet Tran Van Quang Vu Thi Thu Hien Nguyen Van Cuong	1954 1973 1975 1959	Prof. Assoc.Prof. Assoc.Prof. Assoc.Prof.

12. Facilities

12.1. Laboratories and important equipment systems: Faculty of Agronomy, Vietnam National University has ten departmental laboratories and one crop science laboratory having modern machineries and equipments to serve all students for research and study.

12.2. Library: A total of 738 books including textbooks and references is kept in Faculty library to serve learning, teaching and researching activities. Of these, 138 English books are used in crop science advanced educational program.

12.3. Textbooks

Code	Course	Textbooks	Authors	Publishing	Published year
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KT 802	Agricultural development and integration	Economics of Agricultural Development	George W. Norton (Ed)	Virginia University Press	2006
NH0819	Advanced Crop Physiology and ecology	Plant physiology	Hoang Minh Tan (Ed)	Hanoi University of Agriculture Press	2006
NH0820	Plant and climate change	Climate Change	Nguyen Duc Ngu (Ed)	Science and Techniques Press	2007
NH0826	Management of Organic Agriculture	Organic Agriculture	Pham Tien Dung (Ed)	-	2017
NH0821	High technology in plant cultivation	Lectures	Nguyen Quang Thach (Ed)	-	
NH0822	Farming system in the tropics	Intensified Systems of Farming in the Tropics and Subtropics	J A N Wallis	World Bank ISBN: 0-8213-3944-3	1997
NH0824	Conservation Agriculture	Lecture	Nguyen Dinh Vinh (Ed)	Hanoi University of Agriculture Press	
NH0825	Modelling & Prediction in Crop Science	Lectures	Nguyen Duy Binh (Ed)	-	
NH0813	Management and utilization of plant germplasm in breeding	Principles of Plant breeding	Vu Van Liet (Ed)	Hanoi University of Agriculture Press	2013
NH 802	Advances in plant pest management	Lectures	Ho Thi Thu Giang (Ed)		
NH0815	Genetics and breeding for resistance to abiotic stresses	Lectures: Genetics and breeding for resistance to abiotic stresses	Vu Van Liet (Ed)		2013

13. Program Implementation Guidelines

- Related departments write the detail syllabus, lectures and textbooks of course listed in brief description.

-The specialization Faculty coordinates with Office of Training Management to develop training plan for each course to ensure knowledge distribution, logic and prerequisite of modules.

14. Detail syllabus (Attached)

PRESIDENT