

PLANT SCIENCES

[The Regulations for the Degree of Philosophiae Doctor \(PhD\) at the Norwegian University of Life Sciences](#) apply for the PhD education. The regulations concern the objectives of, responsibility for, admission to, and implementation and completion of the PhD education, including collaboration on PhD education with another degree-conferring institution. For all references in the text, these Regulations apply.

PROGRAMME OF STUDY

The PhD programme in Plant Sciences, at the Department of Plant Sciences.

MAIN OBJECTIVES

The PhD programme in Plant Sciences shall qualify students for research of international standard and for other work in society where there are high demands on scientific insight and analytical thinking, in accordance with recognised principles of academic and research ethics. The objective of the PhD education is to give candidates knowledge, skills and expertise in line with the Norwegian qualifications framework.

PLACE IN THE NORWEGIAN QUALIFICATIONS FRAMEWORK

Level 8, philosophiae doctor (PhD)

DEGREE ON COMPLETION OF THE PROGRAMME OF STUDY

PhD

SCOPE

The PhD programme has a nominal duration of three years' full-time study, divided into a minimum of 30 credits for the PhD education and at least 2.5 years for the research work.

OWNER AND CONTACT DETAILS

Department of Plant Sciences (IPV)

Research committee secretary/PhD contact person: Ingrid Heggelund, ingrid.heggelund@nmbu.no, tel. +4767232791

Research committee chair: Morten Lillemo, morten.lillemo@nmbu.no, tel. +4767232775

COLLABORATION WITH OTHER INSTITUTIONS

The PhD programme in Plant Sciences is a doctoral programme that will educate independent researchers of international calibre in conjunction with national and international research communities. There is a high level of national and international collaboration among the research communities at IPV. PhD students are brought into such networks and collaboration along the same lines as other academic staff. Supervisors are responsible for ensuring that candidates are invited to relevant meetings and networks, and collaborate with research groups outside the department and NMBU.

SOCIETAL RELEVANCE

The PhD programme in Plant Sciences shall qualify students for research work and for other work that require a high level of scientific insight regarding plants. The PhD programme seeks to fulfil the current and future needs for competence to conduct research, development and dissemination at universities, other public and private institutions, enterprises and organisations. The PhD programme will educate competent and reflective

candidates who will not only receive specialisation in the subject area, but will also gain the ability to reflect on the major global challenges regarding the environment, food production and sustainable development, and whose specialist knowledge will make them attractive contributors to the national and global society.

ADMISSION REQUIREMENTS AND FUNDING

See sections 5 and 6.

Admission as a PhD student is contingent on the applicant having a relevant education corresponding to a five-year Norwegian programme of study, where 120 credits are at master's degree level. The applicant must have achieved learning outcomes corresponding to the descriptions given in the Norwegian qualifications framework's second cycle. The applicant must have a strong academic background from previous studies. Admission is granted on a rolling basis. The department has formal authority to admit candidates. An application for admission shall be submitted to the department on the standard form, and it must be processed at the latest three months after the start date

An application for admission must contain:

- Documentation of the education on which admission will be based
- Documentation of written and oral English skills
- A simplified project description (as an appendix)
- A description of the necessary infrastructure
- A request to use a language other than English or Norwegian in the thesis, if relevant
- A proposal for a principal supervisor and co-supervisor(s)
- A list of sources of funding

Admission decisions are based on an overall assessment of the application. A prerequisite for admission is that the applicant's academic background fulfils the criteria in section 5.1 of the Regulations. The admission letter will specify the supervisors appointed, and the duration of the contract will be stipulated with a start date and an end date.

Admission may be made conditional upon:

- Funding, admission capacity, supplementary education and satisfaction of infrastructure requirements
- Agreement being reached on any intellectual property rights issues when the contract is signed (see section 6.1)

NMBU's regulations regarding admission to the PhD programme shall apply (see section 5). The applicant must have completed a relevant master's degree or the equivalent, and have grades from among the best half of his/her student population. Foreign applicants must document approved competence in written and oral English (see section 5.2). For admission to the PhD programme, the applicant and/or supervisor must document full funding or salary for at least three years, and necessary funds to run the project in accordance with the project budget and for the educational component.

LEARNING OUTCOMES

KNOWLEDGE

On completion of the PhD programme in Plant Sciences, new doctors are expected to:

- Have in-depth knowledge within their subject area in plant sciences, and to be at the forefront of knowledge within their specific area of research.
- Have in-depth knowledge about scientific theories and methods associated with the field.
- Be able to assess and analyse different theories, methods and processes in research and academic development projects – also from an international perspective.
- Contribute to the development of new knowledge, new theories and methods in the field.

SKILLS

On completion of the PhD programme in Plant Sciences, new doctors are expected to:

- Be able to formulate issues, and plan and conduct research and academic development work at a high international level within their field.
- Know how to use the scientific equipment, instruments and analysis tools of their field of specialisation, and be familiar with equipment normally used by researchers.
- Master relevant statistical methods and be able to assess the utility and limitations of different statistical methods.
- Have conducted original research that has led to new knowledge that can be published in international peer-reviewed journals.
- Be able to handle complexity, create an overview, and synthesise scientific information.
- Be able to perform critical assessments and give constructive criticism on scientific work in their field.
- Be able to disseminate research results in writing and orally, in both scientific and popular scientific forums.

GENERAL COMPETENCE

On completion of the PhD programme in Plant Sciences, new doctors are expected to:

- Be able to conduct their research with professional and ethical integrity, and be able to identify and evaluate relevant environmental and ethical issues.
- Be able to disseminate research and development work through recognised national and international channels, and participate in scientific debates in international forums.
- Be able to disseminate the results of their research work to the business sector, the authorities and public administration, and to the general public through contact with the media.
- Have some experience with teaching students within their subject area or area of specialisation.
- Be able to place own research in larger academic and societal contexts.
- Be able to assess the need for and, if required, stimulate innovation in the field.

LEARNING ACTIVITIES

MEANS OF ACQUIRING THE KNOWLEDGE

- The required coursework of at least 30 academic credits, which offers comprehensive in-depth competence.
- Reading and keeping updated on literature within his/her field of specialisation.
- The research work.
- Work on the introductory chapter of the thesis, where the candidate has independently written an introduction that provides a theoretical and practical background for the research work, discusses and justifies the choice and use of research methods and puts the results as a whole in an international perspective.

MEANS OF ACQUIRING THE SKILLS

- Participating in planning and shaping the PhD project in detail and, if applicable, participating in the planning of new project applications.
- Supervision and own research, where the PhD student actively benefits from the competence of the supervisory team.
- Developing his/her own international academic network outside the supervisory team.
- Attending courses on research methods and writing, when relevant.
- Working on publications, submissions to journals, handling remarks from referees.
- Working on the thesis.

- Participating in peer review of scientific manuscripts, giving feedback on colleagues' manuscripts, and attending seminars where the ideas and results of other PhD students and researchers are discussed.

MEANS OF ACHIEVING GENERAL COMPETENCE

- Taking a course on research ethics of a scope of at least 5 credits.
- The trial lecture, by familiarising him/herself with a specified topic quickly, time management, searching for / selecting / evaluating / processing information, giving an oral presentation.
- Presenting own research findings at national and international scientific conferences.
- Giving lectures to students and/or being a teaching assistant within his/her area of competence.

REQUIRED COURSEWORK

PhD students shall apply for approval of their PhD education plan as soon as possible after admission, and at the latest within 6 months. Courses that make up the required coursework must total at least 30 credits, including a compulsory course in research ethics of at least 5 credits: [PHI401](#) or the equivalent. The required coursework must be seen in the context of the research plan, so that the PhD study as a whole gives the student adequate academic breadth, depth, and coherent scientific competence. The education plan must be approved by the research committee at IPV in order to ensure that the courses are relevant and as a whole offer a cohesive education at an adequate level.

The required coursework is specific to each subject area, and consists of a combination of different courses in this field. The required coursework will be adapted to the PhD student's individual specialisation in the subject area, based on his/her master's-level competence. Students are free to take the courses in the order that best suits their timeline of activities.

Students are particularly encouraged to incorporate courses from the NOVA Postgraduate School, which are PhD courses offered by the Nordic agricultural universities as a joint venture. We also recommend an advanced course in statistics and methods. Some master's-level courses are permitted, if they fit the overall profile of the plan. The PhD student may carry out supervised self-study in areas in which there are no relevant courses (individual course). All courses that are part of the education plan must have a lecturer/supervisor in charge, and an external examiner must evaluate the courses.

EVALUATION OF LEARNING OUTCOMES

The degree of philosophiae doctor (PhD) is conferred on the basis of:

- Approved completion of the required coursework
- An approved doctoral thesis
- An approved trial lecture on a specified topic
- An approved public defence of the doctoral thesis (disputation)

See section 12.

ACADEMIC CONTENT AND STRUCTURE

The PhD programme in Plant Sciences is based at the Department of Plant Sciences, NMBU. The programme is based on the general description of the *PhD Education at NMBU*, and is regulated by the *Regulations for the Degree of Philosophiae Doctor (PhD) at the Norwegian University of Life Sciences*. You can find information about rules, application forms, and completion of the PhD study at NMBU [here](#).

The Department of Plant Sciences has a broad scientific portfolio in plant sciences that encompasses agroecology, genetics and plant breeding, plant protection, plant physiology, plant biotechnology, plant production and urban horticulture. The doctoral work provides expertise and specialisation in one or more of these areas of research.

The PhD programme in Plant Sciences is a doctoral programme that will educate independent researchers of international calibre in conjunction with national and international research communities. The PhD programme will qualify students for research work and for other work where there are high demands on scientific insight. The PhD programme seeks to fulfil the current and future needs for competence to conduct research, development and dissemination at universities, other public and private institutions, enterprises and organisations. The PhD student will complete an education that offers deeper and broader competence, based on a relevant master's degree. The PhD student will carry out an independent work of research leading to a scientific thesis on a high academic level. The candidate must learn critical thinking skills, dissemination of knowledge and academic collaboration. Each PhD student is assigned a principal supervisor and one or more academic co-supervisors. Supervisors are encouraged to form networks that include highly competent co-supervisors from foreign universities.

The Department of Plant Sciences has its own research committee, with a chair and a secretary, which carries out administrative and advisory functions and performs quality assurance of the admission process, programme description and progress of the doctoral studies.

All PhD students must conduct three regular seminars at their department, in accordance with section 9.1 of NMBU's PhD Regulations: an *introductory seminar* before submitting the application for approval of the education plan, a *midway assessment seminar* about 1.5–2 years into the PhD education, and a *final seminar* about 6 months before submitting the doctoral thesis. The midway assessment seminar must be carried out in accordance with section 9.2 of NMBU's PhD Regulations. The seminars are considered part of the required coursework and the quality assurance of the PhD programme of study, and will give the students useful feedback for the work ahead.

PhD students must submit annual progress reports on a standard [form](#) by 1 November every year. Deviations from the plan must be explained. The requirement of progress reports is set out in section 9.1. PhD students and supervisors share responsibility for progress.

INTERNATIONAL PERSPECTIVE

International collaboration is a main feature of the research groups at the Department of Plant Sciences, which includes participation in international research projects, and the inclusion of international collaborators in our various research projects. Each principal supervisor has a professional network that includes foreign researchers. They are actively brought into PhD projects when relevant, so that PhD students also form an international network during their PhD education. Almost all PhD students at IPV attend international conferences, which helps them expand their professional networks.

RESEARCH COMMUNITY LINKED TO THE PROGRAMME OF STUDY

PhD student's principal supervisors are appointed from among the department's permanent academic staff. Other researchers with relevant expertise can be appointed as co-supervisors, also those who come from other national or international institutions.

Of the department's PhD students in Plant Sciences in January 2015, about half are directly linked to a research community at IPV and are formally employed by NMBU. The rest are employed by collaborating institutions like Bioforsk, Nofima and Graminor. However, it is a requirement that the principal supervisor is an employee of IPV, and an attempt is made to ensure that the PhD candidates in question are linked to research projects in which IPV is an active partner. All supervisors must have a doctoral degree or equivalent academic competence.

RESEARCH WORK IN CONNECTION WITH THE PROGRAMME OF STUDY

The research work shall be an independent, scientific work that fulfils international standards and is of high academic quality (section 10 of the PhD Regulations). The work will be planned and carried out in consultation with the supervisors and any external partners. The research activities encompass planning and conducting of own research, and processing of results, and writing the thesis. This is the most important part of the research process in terms of PhD students acquiring research competence. Active participation in the research

community will give PhD students an understanding of research management, experience with research collaboration, and the opportunity to discuss issues and experiments, and a forum in which to challenge established knowledge and practices, and present their projects.

A realistic milestone plan must be drawn up, so that the work can be completed, and the thesis submitted by the end of the contract period. The principal supervisor has general responsibility for ensuring that the plan is realistic.

The progress of the research work must be reported in the annual [progress report](#).

FORMS OF EVALUATION

The required coursework is evaluated using different forms of evaluation, such as an oral or written examination, submitting assignments or a term paper. The content of the doctoral work and the required coursework shall be approved by the research committee, and the progress is monitored by means of annual progress reports and the compulsory seminars (introductory seminar, midway assessment seminar and final seminar). Other input to learning outcomes does not need to be evaluated, but the principal supervisor is responsible for ensuring that the objectives are met through relevant measures, academic discussions and steps towards dissemination work within the time frame of the doctoral work.

THESIS AND PUBLIC DEFENCE

The thesis shall be an independent, scientific work that fulfils international standards and is of high academic quality in terms of the formulation of research questions, the specification of concepts, the methodological, theoretical and empirical basis, documentation, the use of literature and the form of presentation. The thesis shall contribute to the development of new knowledge in the chosen field and must be of such quality as to qualify for publication as a part of the scientific literature in the field (see section 10).

The doctoral thesis must consist of at least three academic articles that can be published in scientific journals. The articles should ideally be published or accepted for publication before submitting the thesis, but often this is not realistic within a three-year period. However, the articles must at minimum have the same standard as a manuscript that is submitted to a journal for the first time. The PhD candidate must be the lead author of at least two of the articles. An introductory chapter must also be written, in which the PhD candidate displays thorough knowledge of the field, and an ability to synthesise scientific findings and discussions from different articles. The PhD candidate shall write this section on his/her own. The thesis must also be written and submitted in accordance with the rules in sections 10 and 13.1, and [authorship declarations](#) must be enclosed for each scientific article.

The public defence will begin with a trial lecture on a topic that is assigned to the PhD candidate 10 working days in advance. The lecture must last 45 minutes, and be of a standard that corresponds to a lecture for master's degree students in the subject. Two external opponents will then critically review the thesis, and assess the candidate's responses. The evaluation and the work of the evaluation committee must comply with the rules in sections 12 and 15.

SUPPORT FUNCTIONS AND INFRASTRUCTURE

IPV has its own *research committee chair*, who is appointed from among the department's permanent academic staff. This person chairs the research committee, which reviews applications for admission, programme descriptions, proposals for evaluation committees, and monitors the quality and progress of the candidate's PhD education. The department's *research committee secretary/ PhD contact person* carries out the day-to-day administrative and advisory functions in relation to PhD students.

The department will provide the necessary infrastructure for the PhD students, like office space, laboratory space, IT resources, etc.

EXCHANGES

NMBU facilitates national and international exchanges. In order to ensure that PhD students broaden their horizons and gain the necessary expertise, which cannot always be provided by supervisors at the department, we recommend that part of the doctoral work or doctoral courses be taken at other Norwegian or foreign academic institutions, when it can be incorporated into the plans, and funding is secured. Such periods of study/research outside NMBU must be described and explained in each PhD student's education plan.

ACCESSIBILITY

General information about universal design and special arrangements at NMBU: <http://www.nmbu.no/lmu>.

WORDING OF THE DIPLOMA

The PhD programme in Plant Sciences is based at the Department of Plant Sciences at NMBU, and provides expertise and specialisation in one or more of the department's areas of research within plant sciences. This encompasses agroecology, genetics and plant breeding, plant protection, plantphysiology, plant biotechnology, , plant production and urban horticulture. The PhD education shall qualify students for research activity of high international standard and other employment in society in which high requirements are placed on scientific insight and analytical thinking. The PhD student will complete an education that offers deeper and broader competence, based on a relevant master's degree, and will carry out an independent work of research that will lead to a scientific thesis of high academic quality.

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