

## **Directory of Modules**

**Master's degree programme "Crop Protection"  
- referring to: Prüfungs- und Studienordnung  
für den konsekutiven Master-Studiengang  
"Crop Protection" (Amtliche Mitteilungen  
I 36/2012 p. 1903, last revised through  
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## Modules

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### I. Study programme "Crop Protection"

At least 120 C must be successfully completed within the following regulations.

#### 1. Professional studies

##### a. Compulsory Modules

The following compulsory modules worth overall 18 C must be successfully completed.

M.Cp.0002: Internship (9 C, 6 SWS).....	6145
M.Cp.0017: Scientific presenting, writing and publishing in crop protection (3 C, 2 SWS).....	6159
M.Cp.0018: Journal club on new topics in crop protection (3 C, 2 SWS).....	6160
M.Cp.0019: Basic laboratory techniques (3 C, 2 SWS).....	6161

#### 2. Professional knowledge

##### a. Elective compulsory modules

Elective compulsory modules worth at least 66 C must be successfully completed. Students can earn up to 18 C from elective modules from the other master study programmes of the faculty of agriculture, university of Goettingen. Furthermore maximum one issue-specific module (maximum worth 6 C) from an other faculty can be chosen.

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M.SIA.P08: Pests and diseases of tropical crops (6 C, 6 SWS).....	6169
M.SIA.P12: Crops and production systems in the tropics (6 C, 4 SWS).....	6171
M.SIA.P15M: Methods and advances in plant protection (6 C, 4 SWS).....	6173

### **b. Key competencies**

Out of the following elective compulsory modules one module worth overall at least 6 C must be successfully completed.

M.Cp.0016: Practical statistics and experimental design in agriculture (6 C, 4 SWS).....	6158
M.WIWI-QMW.0004: Econometrics I (6 C, 4 SWS).....	6174

### **3. Master's thesis**

Completion of the Master's thesis is worth 24 Credits.

### **4. Colloquium for the Master's thesis**

Successful completion of the colloquium for the Master's thesis is worth 6 Credits.

## **II. Double/Joint-Degree Programm "PlantHealth"**

At least 120 C must be successfully completed within the following regulations.

## 1. First year of study

At least 60 C must be successfully completed within the following regulations.

### a. Compulsory modules

The following compulsory modules worth overall 27 C must be successfully completed:

M.Cp.0017: Scientific presenting, writing and publishing in crop protection (3 C, 2 SWS).....	6159
M.Cp.0018: Journal club on new topics in crop protection (3 C, 2 SWS).....	6160
M.Cp.0019: Basic laboratory techniques (3 C, 2 SWS).....	6161
M.Cp.0004: Plant diseases and pests in temperate climate zones (6 C, 4 SWS).....	6146
M.Cp.0005: Integrated management of pests and diseases (6 C, 4 SWS).....	6147
M.Cp.0015: Molecular weed science (6 C, 4 SWS).....	6156

### b. Elective compulsory modules

Out of the following elective compulsory modules four modules worth overall at least 27 C must be successfully completed.

M.Agr.0058: Plant herbivore interactions (6 C, 4 SWS).....	6142
M.Cp.0002: Internship (9 C, 6 SWS).....	6145
M.Cp.0006: Pesticides I: Mode of action and application techniques, resistance to pesticides (6 C, 4 SWS).....	6148
M.Cp.0012: Weed biology and weed management (6 C, 4 SWS).....	6153
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M.Cp.0014: Plant Nutrition and Plant Health (3 C, 2 SWS).....	6155
M.Agr.0094: Basics of molecular biology in crop protection (6 C, 4 SWS).....	6144

### c. Key competencies

Licit modules comprising at least 6 C must be passed.

## 2. Second year of study

At least 60 C must be successfully completed within the following regulations.

### a. Compulsory module

The following module comprising 6 C has to be passed.

M.Cp.0007: Pesticides II: Toxicology, Ecotoxicology, Environmental Metabolism, Regulation and Registration (6 C, 4 SWS).....	6149
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### b. Elective compulsory modules

Four of the following modules comprising 24 C have to be passed.

M.Cp.0008: Fungal toxins (6 C, 4 SWS).....	6150
M.Agr.0023: Interactions between plants and pathogens (6 C, 4 SWS).....	6136
M.Agr.0039: Molecular techniques in phytopathology (6 C, 4 SWS).....	6137
M.Agr.0045: Mycology (6 C, 4 SWS).....	6138
M.Agr.0057: Plant Virology (6 C, 6 SWS).....	6141

**c. Master's thesis**

Completion of the Master's thesis is worth 24 Credits.

**d. Colloquium for the Master's thesis**

Successful completion of the colloquium for the Master's thesis is worth 6 Credits.



<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Agr.0003: Agribusiness Sugar Beet- an advanced education for graduate students and junior employees of the sugar supply chain (Englisch)</b>		
<b>Learning outcome, core skills:</b> To acquire profound knowledge in the following fields of the sugar value chain: breeding and other upstream sectors, technology of the sugar and bioethanol industry and biogas production, other downstream sectors, sugar market, agricultural policy. To identify in detail causal relationships in the process management sugar on the basis of recent scientific knowledge. To intensify the knowledge by interpreting scientific figures and tables and their statistics. To gain from the unique opportunity of an advanced education particularly suitable as an on-the-job training program. To take the opportunity of social networking with not only other graduate students but external participants from different professional backgrounds and sugar beet growing countries worldwide, too.	<b>Workload:</b> Attendance time: 54 h Self-study time: 126 h	
<b>Course: Agribusiness Sugar Beet - an advanced education for graduate students and junior employees of the sugar supply chain (Englisch)</b> (Block course, Lecture, Excursion) <i>Contents:</i> In comparison to other cash crops the refining of sugar from sugar beet is characterized by a considerable degree of cooperation between agriculture and food industry. Consequently all specific impacts of the entire production chain of sugar from beet are covered by this module as there are global trade, EU Reform of the Sugar Market Regime, systems for quota and paying, plant breeding, soil cultivation, growing impacts from sowing to harvest including all technical and cultivation aspects, crop yield, extension services, weed control, pathogen and pest management, as well as definition and analysis of the technical quality, processing technology of sugar beets, logistics of harvest and transportation, sugar as food and its marketing. The module consists of lectures by invited speakers and lecturers of the Institute of Sugar Beet Research, study and field trips.		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination prerequisites:</b> It is required to take an examination in one of two modules M.Agr.0003 or M.Agr.0107 only. <b>Examination requirements:</b> M.Sc. after the 2nd semester or junior employees of supply chain.  Knowledge of the sugar value chain and understanding of different influences to the system on the basis of the latest scientific insights.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Bernward Märländer	
<b>Course frequency:</b>	<b>Duration:</b>	

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each summer semester	1 semester[s]
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>
<b>Maximum number of students:</b> 25	

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Agr.0009: Biological control and biodiversity</b>		6 WLH
<b>Learning outcome, core skills:</b> Gain an understanding of what biological control is and how it can be used effectively as part of an IPM system and how biodiversity contributes to control of pest populations and other ecosystem services.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Biological Control and Biodiversity</b> (Lecture, Exercise, Seminar) <i>Contents:</i> <ul style="list-style-type: none"> <li>• Theoretical foundations of biological control</li> <li>• Natural enemy behaviour and biological control success</li> <li>• Biodiversity and ecosystem services in agroecosystems</li> <li>• Practical examples of biological control projects</li> <li>• Plant-herbivore-predator-interactions Principles of population dynamics</li> <li>• Biological weed control</li> </ul>		6 WLH
<b>Examination: Written exam (70%; 45 minutes) and presentation (30%; approx. 20 minutes)</b> <b>Examination prerequisites:</b> regular attendance at seminar and exercise and presentation of a seminar talk <b>Examination requirements:</b> Basic knowledge of the mechanisms of biological control of herbivorous insects; methodological approaches based on case examples; role of biodiversity for ecosystem processes and the population dynamic of herbivorous insects, multitrophic interactions between plants, herbivorous insects and their natural enemies; biodiversity and services of ecosystems.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Vidal	
<b>Course frequency:</b> each winter semester; Göttingen	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 12		
<b>Additional notes and regulations:</b> Lecture based materials; details provided during lectures.		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Agr.0010: Biotechnological applications in plant breeding</b>		
<b>Learning outcome, core skills:</b> Students acquire theoretical and practical knowledge about fundamental plant biotechnological methods and their applications to contribute to solving actual problems in breeding of different crop species. Students learn to critically interpret scientific papers dealing with new biotechnological methods and applications.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Biotechnological Applications in Plant Breeding</b> (Internship, Lecture, Seminar) <i>Contents:</i> Basics and principles of plant biotechnology and molecular genetics are examined and explained in lectures. Biotechnological applications in plant breeding and agriculture are presented and discussed in accompanying seminars given by the students. Topics covered include in vitro-techniques for the mass-propagation of plants, direct and indirect gene transfer in plants, biochemical and molecular characterization of transgenic plants, safety aspects of gene technological applications, haploid production and utilization in plant breeding, sexual and somatic interspecific hybridization, classical mutagenesis (TILLING), site directed mutagenesis, Polymerase chain reaction (PCR), molecular marker types (RAPD, RFLP, AFLP, SSR, SNP) and their genetic characteristics and applications in Plant Breeding. Experiments and Demonstrations underlining the theory will be performed in the greenhouse and in the laboratory.		4 WLH
<b>Examination: Written examination (90 minutes)</b> <b>Examination requirements:</b> Profound and complex theoretical knowledge about fundamental methods and their applications in plant breeding.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Christian Möllers	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 12		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Agr.0023: Interactions between plants and pathogens</b>		
<b>Learning outcome, core skills:</b> Understanding interactions between plants and pathogens from general concepts to selected examples on phenomenological, morphological, physiological and molecular levels. Critical appraisal of technical approaches, supported by own practical experiences from the laboratory.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Interaktionen zwischen Pflanzen und phytopathogenen Organismen sowie Viren (Internship, Lecture)</b> <i>Contents:</i> The course deals with interactions between host plants on one side and plant-pathogenic fungi, bacteria and viruses on the other side. The following topics are covered: Categorization of inter-specific interactions among organisms; general concepts of pathogenicity, virulence and avirulence including gene-for-gene hypothesis and its experimental proof. Example of known resistance genes. Resistance factors (preformed and induced); counteracting mechanisms including detoxification. Induced local and systemic resistance. Infection of plants by <i>Agrobacterium tumefaciens</i> and inter-kingdom gene transfer. Disease cycle of plant pathogenic fungi including host recognition, spore germination, penetration of plant surface, colonization of plant tissue, acquisition of nutrient, building biomass and dissemination of the pathogen.  In the practical part of the course, participants will extract phytoalexins from oilseed rape plants and learn chromatographic techniques for their detection and test their biological activity (HPLC-UV and TLC with bioautography detection).		4 WLH
<b>Examination: Oral examination (approx. 20 minutes)</b> <b>Examination prerequisites:</b> Participation on the laboratory course and approval of the protocol <b>Examination requirements:</b> Understanding theoretical concepts treated in the lecture; knowledge of specific examples of pathosystems illustrating these concepts.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Petr Karlovsky	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 36		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Agr.0039: Molecular techniques in phytopathology</b>		
<b>Learning outcome, core skills:</b> Technical skills in nucleic acid analysis techniques; ability to select adequate methods for a research project. Presentation and interpretation of the results.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Molecular Techniques in Phytopathology</b> (Internship, Lecture) <i>Contents:</i> With the help of laboratory experiments, basic molecular techniques will be taught, including the isolation of plasmids and total DNA as well as DNA fragments from electrophoretic agarose gels, cloning of PCR products (enzymatic modification, ligation), transformation and in vivo amplification of plasmids, DNA blotting, labeling of DNA probes for hybridization with nonradioactive labels (DIG-dUTP), Southern hybridization and detection of hybridized probes by chemiluminescence, ITS-RFLP-analysis of pathogens of oilseed rape, real-time PCR for mycotoxin-producing pathogens of cereals. In accompanying lectures, aspects of nucleic acid and protein chemistry relevant for analytical techniques will be explained. Technical solutions for specific scientific questions will be presented and discussed.		4 WLH
<b>Examination: Oral examination (approx. 20 minutes)</b> <b>Examination prerequisites:</b> Submitted and accepted protocol <b>Examination requirements:</b> Basic knowledge of the structure and properties of nucleic acids, properties and applications of enzymes used in the analysis and manipulation of DNA, understanding of standard techniques (Southern blotting, electrophoresis, DNA sequencing), data analysis, criteria for the selection of a DNA analytical technique for a specific task.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Petr Karlovsky	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 16		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Agr.0045: Mycology</b>		4 WLH
<b>Learning outcome, core skills:</b> <ul style="list-style-type: none"> <li>• Learning methodology for handling of filamentous fungal organisms <i>in vitro</i></li> <li>• Gaining knowledge on the phytopathogenic, mutualistic and ecological roles of filamentous fungi</li> <li>• Acquiring skills in the experimentation with phytopathogenic fungi on plants</li> <li>• Training in the taxonomic determination of fungal organisms</li> </ul>		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Mycology</b> (Internship, Lecture) <b>Contents:</b> <ul style="list-style-type: none"> <li>• Overview on the ecology and taxonomy of phytopathogenic fungi</li> <li>• Exercises for the taxonomic determination of fungi based on morphology and molecular genetic analysis</li> <li>• Isolating of fungi from diverse habitats (soil, water, plants)</li> <li>• Inoculation of plants with phytopathogenic fungi and determination of disease severity</li> <li>• Determination of soil fungistasis</li> <li>• Race determination in powdery mildew</li> <li>• Assessment of fungicide resistance in fungi</li> <li>• in situ studies of infection by biotrophic and necrotrophic pathogens</li> </ul>		4 WLH
<b>Examination: Oral examination (approx. 20 minutes)</b> <b>Examination prerequisites:</b> Preparation of experimental protocols (group work); presentation of results in a final seminar (group work); preparation of taxonomic sheets <b>Examination requirements:</b> Basic knowledge on the biology (life cycles, epidemiology) and ecology of filamentous fungi; specific knowledge on the gaining of fungal isolates from diverse habitats, their handling in the lab and their utilization in phytopathological experiments; basic steps in the taxonomic determination of fungi (conidiogenesis types); methods in fungal phytopathology; fungal diseases of crops (general knowledge)		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Microbiology, plant pathology, crop protection	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Andreas von Tiedemann	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 1	
<b>Maximum number of students:</b> 12		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Agr.0050: Nematology</b>		4 WLH
<b>Learning outcome, core skills:</b> Basic knowledge of the nematode bauplan, their role as pests; basic methods with regard to the quantification and control of nematodes, importance and application of nematodes in biological control programs; their role in regulation processes in ecosystems. Seminar talk on a specific scientific problem related to nematodes.		<b>Workload:</b> Attendance time: 60 h Self-study time: 120 h
<b>Course: Nematologie</b> (Internship, Seminar) <i>Contents:</i> The module deals with the biology of nematodes and their importance in plant protection. The most important taxa of nematodes are presented by preparations and living organisms; the most important morphological characters will be identified. Interactions between plant parasitic nematodes and their host plants will be discussed. The role of nematodes in inundative biological control measures will be discussed as well. During the course students will become familiar with different nematode species and will learn basic principles of their determination. Phytoparasitic nematodes will be prepared. A practical experiment will demonstrate toxicity of different compounds.		
<b>Examination: Term Paper (max. 30 pages)</b> <b>Examination prerequisites:</b> Regular attendance during the course; preparation of a protocol containing own drawings <b>Examination requirements:</b> Basic knowledge in morphological characters of nematodes; ability to discriminate between different feeding types of nematodes; role and function of biological control using nematodes; importance of nematodes for biodiversity; in some circumstances preparation of homework.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Vidal	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 12		



<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Agr.0056: Plant breeding methodology and genetic resources</b>		
<b>Learning outcome, core skills:</b> Students learn the integration of classical and molecular approaches to solve present problems in plant breeding. Social aspects have to be considered.  Students learn, in own presentations, to draw critical conclusions from recent research papers and to communicate these to other students.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Plant breeding methodology and genetic resources (Lecture)</b> <i>Contents:</i> Principles of breeding methodology: Response to selection, breeding methods for clonal, line, hybrid and population cultivars.  Marker assisted selection for monogenic and polygenic traits.  Use of plant genetic resources: wild species, ex-situ and in-situ conservation, on-farm management.  Breeding for marginal environments, demonstrated with examples from temperate and tropical regions.		4 WLH
<b>Examination: Written exam (90 minutes, 80%) and presentation (20 minutes, 20%)</b> <b>Examination requirements:</b> Population Genetics, Application of Markers in Plant Breeding, Concepts of using genetic resources in plant breeding. Good knowledge on: 'Pre-Breeding', categories and methods in Plant Breeding.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge (B.Sc. level) in genetics and plant breeding	
<b>Language:</b> German, English	<b>Person responsible for module:</b> apl. Prof. Dr. Wolfgang Link	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 25		
<b>Additional notes and regulations:</b> <b>Literature:</b> Lecture based material.		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Agr.0057: Plant Virology</b>		6 WLH
<b>Learning outcome, core skills:</b> Knowledge in classical and molecular Plant Virology, Learning of practical plant virus detection methods with electron-optical methods, immunological methods. Deduction of scientific questions and hypotheses and critical review of methods applied based on personal lab experience		<b>Workload:</b> Attendance time: 80 h Self-study time: 100 h
<b>Course: Plant Virology</b> (Internship, Lecture) <i>Contents:</i> Lecture: systematics, vectors, modes of transmission, genome organisation, gene expression strategies, control strategies  Practical course: learning of diagnostic methods, symptom recognition, immunological and molecular detection methods		6 WLH
<b>Examination: Written exam (45 minutes, weighing 50%) and homework (max. 20 pages, weighing 50%)</b> <b>Examination prerequisites:</b> Participation at the practical course following the lecture <b>Examination requirements:</b> Understanding of the imparted detection methods and knowledge about virus biology		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Mark Varrelmann	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 16		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Agr.0058: Plant herbivore interactions</b>		
<b>Learning outcome, core skills:</b> Knowledge of complex interactions between plants and herbivorous insects. Preparation and critical reflection of methods applied in current research findings covering the lecture topics by a seminar presentation.		<b>Workload:</b> Attendance time: 60 h Self-study time: 120 h
<b>Course: Plant herbivore interactions</b> (Lecture, Seminar) <i>Contents:</i> The modul deals with the interactions between plants and herbivorous insects. The diversity of the organisms involved and the biocenoses are discussed. With regard to plants different adaptations to damage by insects are presented and the role of resistance mechanisms is outlined. The sensory organs of herbivorous insects to discriminate between different plant species and the role of volatile and secondary compounds produced by the plants are demonstrated. Multiple Interactions between plants, their herbivores, and natural enemies and application strategies in plant protection are discussed. The interactions between flowering plants and pollinators are outlined and the importance of seed predation will be exemplified. During the seminar part of the module students will present recent research findings which will complement the content of the lectures.		4 WLH
<b>Examination: Written exam (67%, 45 minutes) and presentation (33%, approx. 20 minutes)</b> <b>Examination prerequisites:</b> regular attendance at seminar and preparation of a seminar talk and a handout <b>Examination requirements:</b> Profound knowledge of processes involved in plant selection by herbivorous insects; protection strategies evolved by plants; determinants of herbivorous communities on specific plants, multitrophic interactions between plants; herbivorous insects and their natural enemies; interactions between plants and their pollinators or seed predators.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Vidal	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Module M.Agr.0093: Environmental impact of genetically modified plant</b>	3 C 2 WLH
<b>Learning outcome, core skills:</b> Students should gain an understanding on interactions of genetically modified crops and the environment, learn the fundamentals of risk assessment and general surveillance concepts, should be able to evaluate studies on risks of GMOs to the environment	<b>Workload:</b> Attendance time: 22 h Self-study time: 68 h
<b>Course: Environmental Impact of Genetically Modified Plants</b> (Lecture, Seminar) <i>Contents:</i> Overview on genetically modified crop plants, mode of action of transgenic traits, interactions with non target organisms, national legislation procedures, transgenic crops and sustainable agriculture, concepts of environmental risk assessments, resistance management of transgenic traits; biodiversity and genetically modified crops, global perspectives of transgenic crops	2 WLH
<b>Examination: Written examination (45 minutes)</b> <b>Examination prerequisites:</b> Seminar presentation by students <b>Examination requirements:</b> Concepts of risk assessment of genetically modified crops, mode of action of genetically modified crops, interactions with the environment, case studies	
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Vidal
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>
<b>Maximum number of students:</b> 20	

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Agr.0094: Basics of molecular biology in crop protection</b>		
<b>Learning outcome, core skills:</b> Comprehension about important scientific plant pathogen detection methods like ELISA and PCR used in agriculture, knowledge about biochemical and molecular basics in plant breeding and genetic resistance against plant pathogens.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Basics of molecular biology in crop protection (Lecture)</b> <i>Contents:</i> In agricultural research and diagnostics there is an increasing use of biochemical and molecular methods and techniques. The lecture conveys the scientific basics that are required for the understanding of these methods and prepares students for further practical courses and lectures. Specific contents are: cytology, cell-wall composition of different organisms, structure and function of different macromolecules (proteins, DNA, carbohydrates), function and regulation of enzymes, DNA-replication, transcription and translation, mechanisms of regulation, introduction into principles of molecular detection methods, lipids and membranes, phytohormones and selected secondary metabolites.		4 WLH
<b>Examination: Written examination (90 minutes)</b> <b>Examination requirements:</b> Composition of macromolecules, output materials, typical molecular binding types, function, regulatory mechanisms on protein and nucleic acid level, phytohormones, secondary metabolism.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Mark Varrelmann	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		9 C
<b>Module M.Cp.0002: Internship</b>		6 WLH
<b>Learning outcome, core skills:</b> Specific knowledge of the respective area of work/research will be acquired, social abilities and competences like work organization, teamwork, interdisciplinary work, flexibility will be acquired.		<b>Workload:</b> Attendance time: 240 h Self-study time: 30 h
<b>Course: Internship</b> (Internship) <i>Contents:</i> Students will carry out a practical project in different areas of crop protection, in agrochemical companies, in research or consulting institutions and experience the daily work situation. They will work on other projects and experience the daily working routine outside the university.  Duration minimum 6 weeks.		6 WLH
<b>Examination: Written paper (max. 20 pages, 50%) and Presentation (ca. 20 minutes, 50%)</b> <b>Examination requirements:</b> Practical work in a scientific project in different areas of crop protection, written internship report and seminar presentation.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Andreas von Tiedemann	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 3	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Module M.Cp.0004: Plant diseases and pests in temperate climate zones</b>	6 C 4 WLH
<b>Learning outcome, core skills:</b> Students will be able to recognize and identify the main pests and diseases, understand the origin, distribution and dynamics of diseases and pests in the field as a basis for the development of control methods.	<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Plant Diseases and Pests in Temperate Climate Zones</b> (Lecture, Excursion, Exercise) <i>Contents:</i> The main diseases and pests (fungi, viruses, bacteria, nematodes, mites, and insects) of crops (arable crops, vegetables, fruit crops) in temperate climate zones will be presented. The symptoms, diagnosis, biology and life cycles, economic importance, possible control methods will be studied in lectures, practicals and field trips. The economic damage, prognosis, possible control methods using economic thresholds will be presented.	4 WLH
<b>Examination: Written examination (45 minutes)</b> <b>Examination prerequisites:</b> regular attendance at field practical and excursion <b>Examination requirements:</b> Identification and diagnosis of plant pests and diseases of crops of the temperate climate zones, knowledge of the life cycle, distribution, and population dynamics.	6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Birger Koopmann
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 2
<b>Maximum number of students:</b> 30	

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Cp.0005: Integrated management of pests and diseases</b>		
<b>Learning outcome, core skills:</b> Students will be able to understand and develop plant protection strategies to control plant pathogens and insect pests while observing the sustainability of the whole crop production system.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Integrated Management of Pests and Diseases (Lecture)</b> <i>Contents:</i> The integrated pest management concept and its main components are presented with regard to the management of fungal plant pathogens and insect pests in temperate zones: preventive methods, selective use pesticides, effect of cultural methods ( sowing date, soil preparation, fertilization, crop rotation, varieties) on occurrence, distribution and damage of plant pathogens and insect pests. The diagnostics and quantification of damage symptoms; prognosis systems are discussed.		4 WLH
<b>Examination: Oral examination (approx. 20 minutes)</b> <b>Examination requirements:</b> Knowledge of the relationship between crop production methods and the occurrence of plant diseases and insect pests in temperate zones, concept of integrated pest management.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Andreas von Tiedemann	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 1	
<b>Maximum number of students:</b> 30		



<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Cp.0006: Pesticides I: Mode of action and application techniques, resistance to pesticides</b>		
<b>Learning outcome, core skills:</b> Students will know the pesticide compounds used in agriculture, their mode of action, application techniques and understand the development of resistance and resistance management strategies.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Pesticides I: Mode of Action and Application Techniques, Resistance to Pesticides</b> (Lecture, Excursion) <i>Contents:</i> Mode of action and application techniques of plant protection products (fungicides, insecticides, acaricides, herbicides), the characteristics of active ingredients are presented. Technical and technological possibilities of modern crop protection, requirements and pesticide resistance management is discussed.		4 WLH
<b>Examination: Written examination (90 minutes)</b> <b>Examination requirements:</b> Knowledge of pesticides, their mode of action, targets, side effects, application techniques; important factors for resistance development and possibilities for prevention and reduction.		6 C
<b>Admission requirements:</b> Only for students from the study programme "Crop Protection" and "Sustainable International Agriculture"	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Andreas von Tiedemann	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 1	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b> <b>Module M.Cp.0007: Pesticides II: Toxicology, Ecotoxicology, Environmental Metabolism, Regulation and Registration</b>	6 C 4 WLH
<b>Learning outcome, core skills:</b> Students will understand the basic and applied pesticide toxicology and ecotoxicology, the development of pesticides and risk assessment, and the regulatory framework of pesticide registration and pesticide risks (Germany, EU)	<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Pesticides II: Toxicology, Ecotoxicology, Environmental Metabolism, Regulation and Registration (Lecture)</b> <i>Contents:</i> This unique module gives an overview of all aspects of pesticide science, presented by Several lecturers, being specialists. Basic and applied toxicology of pesticides , ecotoxicology of pesticides, environmental fate and metabolism of compounds in different environments, development of pesticides, regulation of pesticide use and registration.	4 WLH
<b>Examination: Written examination (90 minutes)</b> <b>Examination requirements:</b> Knowledge of the toxicology of pesticides, ecotoxicology, fate and metabolism in the environment, regulation and registration of pesticides in Germany and the EU.	6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Andreas von Tiedemann
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 3
<b>Maximum number of students:</b> 30	

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Cp.0008: Fungal toxins</b>		
<b>Learning outcome, core skills:</b> Students will realize the importance of secondary metabolites produced by fungi in plant production. They will be able to compare and rate the significance of natural toxins and anthropogenic substances and to classify different food contaminations according to their toxicology In the laboratory students will acquire practical knowledge of chemical- analytical methods, so they will be able to select the optimum analytical method.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Fungal Toxins</b> (Lecture, Practical course) <i>Contents:</i> The most important mycotoxins will be presented and described, concepts to determine the toxicity and procedures to develop legal maximum values will be discussed, and the risk for consumers and animals will be judged. The ecological importance of mycotoxins will be discussed, methods of mycotoxin identification will be explained and methods to reduce the mycotoxin contents of plant products will be presented. Selected phytoalexins and phytohormones playing a role as a factor of virulence or pathogenicity in plant diseases will be introduced. In the practical students will process plant material and use different methods for analysis of mycotoxins.		4 WLH
<b>Examination: Written examination (60 minutes)</b> <b>Examination prerequisites:</b> Accepted laboratory protocol <b>Examination requirements:</b> Knowledge of the most important mycotoxins occurring in crop plants, methods to analyse their toxicity, development of legal limit values; ecological importance of mycotoxins; methods to determine mycotoxins, factors responsible for mycotoxin content in plant products, the importance of phytotoxins and phytohormones as factors of virulence and pathogenicity.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Petr Karlovsky	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 12		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module M.Cp.0010: Plant pathology and plant protection seminar</b>		
<b>Learning outcome, core skills:</b> Students will learn, to present, discuss and defend their own individual research project. They will be able to critically discuss scientific results and provide suggestions for improvement.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Plant Pathology and Plant Protection Seminar (Seminar)</b> <i>Contents:</i> In this seminar scientific projects, targets of research and results of research projects will be presented and discussed by the MSc students and members of the research staff. Techniques of presentation and the ability to critically review and discuss research results will be practiced which will suggest and lead to new thoughts for further research projects. <i>Course frequency:</i> jedes Wintersemester		4 WLH
<b>Examination: Presentation (ca. 20 minutes)</b> <b>Examination prerequisites:</b> Participation in 12 seminars <b>Examination requirements:</b> Very good knowledge of own area of research and good ways of presentation of own results. Participation in discussion.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Andreas von Tiedemann	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 2	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Cp.0011: Agricultural entomology seminar</b>		2 WLH
<b>Learning outcome, core skills:</b> Students will learn, to present, discuss and defend their own individual research project. They will be able to critically discuss scientific results and provide suggestions for improvement.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Agricultural Entomology Seminar (Seminar)</b> <i>Contents:</i> In this seminar scientific projects, targets of research and results of research projects in Agricultural Entomology will be presented and discussed by the MSc students. Techniques of presentation and the ability to critically review and discuss research results will be practiced which will suggest and lead to new thoughts for further research projects.		2 WLH
<b>Examination: Presentation (ca. 20 minutes)</b> <b>Examination prerequisites:</b> Participation in 12 seminars <b>Examination requirements:</b> Very good knowledge of own area of research and good ways of presentation of own results. Participation in discussion.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Vidal	
<b>Course frequency:</b> each semester	<b>Duration:</b> 2 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Cp.0012: Weed biology and weed management</b>		
<b>Learning outcome, core skills:</b> Knowledge of the main weed species, their characteristics, ecology, competition and damage.  Students will understand the dynamics and parameters of weed populations.  Knowledge of weed control methods, their possibilities and limitations. Students will be able to formulate criteria for selecting suitable weed management techniques. They will know how to theoretically work on a topic in weed science and understand international aspects of weed dissemination, populations and weed management.		<b>Workload:</b> Attendance time: 60 h Self-study time: 120 h
<b>Course: Weed Biology and Weed Management (Lecture)</b> <i>Contents:</i> The module deals with the biology of weeds and management of weed populations. The botanical weed characteristics and population biology will be presented. Important weeds of Europe and other parts of the world will be presented and the damage caused discussed. Different methods of control are presented: chemical, physical control as well as preventive cultural methods. Actual problems in crop production caused by weeds are discussed. Legal and international aspects of weed dissemination, damage caused and methods of control will be discussed. In the seminar part students will present recent research projects and discuss these in context with the topics presented in the lecture.		4 WLH
<b>Examination: Oral examination (ca. 20 minutes,67%) and Presentation (ca. 20 minutes,33%)</b> <b>Examination prerequisites:</b> Oral presentation <b>Examination requirements:</b> Basic knowledge of weed characteristics, biology and ecology. Knowledge of the main weed control techniques, mode of action and examples. Knowledge of the main weeds worldwide and ways of management. Ability to associate weed populations with present crop production systems and develop control strategies.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Horst-Henning Steinmann	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 1	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Cp.0013: Applied weed science</b>		
<p><b>Learning outcome, core skills:</b>          Knowledge of the main weed species, their characteristics, ecology, competition and damage.          Students will be able to identify the main weed species. Understanding weed population dynamics.          Knowledge of possibilities and limitations of weed control. Knowledge of the mode of action of chemical and non chemical weed control. Students will be able to diagnose and explain weed problems in the field and develop problem solving competences.</p>		<p><b>Workload:</b>          Attendance time:          60 h          Self-study time:          120 h</p>
<p><b>Course: Weeds and Herbicides/Applied Weed Science (Lecture)</b>  <i>Contents:</i>          The module deals with practical aspects of weed biology and weed management strategies. The botanical weed characteristics will be presented in the field and in the greenhouse. The main weeds species of Europe and their characteristics for identification will be studied. Weed management strategies in use today and difficulties in weed control will be shown and discussed on field trips. In the practical students will prepare a herbarium of weeds collected in the field.</p>		4 WLH
<p><b>Examination: Oral examination (ca. 20 minutes, 66%), written paper (max. 10 pages, 34%)</b>  <b>Examination prerequisites:</b>          Participation in the practical and excursions, preparation of a herbarium.  <b>Examination requirements:</b>          Basic knowledge of the main weed species and characteristics for identification. Knowledge of the mode of action of the main control methods including examples. Ability to recognize weed populations of respective crop production systems in the field and to develop control strategies. Preparation of a written paper (excursion or practical protocol) and a herbarium.</p>		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Horst-Henning Steinmann	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 2	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Cp.0014: Plant Nutrition and Plant Health</b>		2 WLH
<b>Learning outcome, core skills:</b> Understanding the relationship between plant nutrition and plant health and its significance in the value-added food chain.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Plant Nutrition and Plant Health</b> (Lecture, Seminar) <i>Contents:</i> Nutrient uptake and transport in the plant; function of different nutrients in the plant especially with respect to plant health ( susceptibility, tolerance, resistance ); mechanisms to increase the efficiency of nutrient availability, uptake and use; characteristics of plant health, effect of nutrient imbalances on plant metabolism and development of plant harvest products, the nutrient concentrations and processing quality.		2 WLH
<b>Examination: Written exam (90 minutes)</b> <b>Examination requirements:</b> Knowledge of and ability to present the presented topics in their context: development of nutritional and processing quality in different crop plants; quality requirements and ways of realization by crop production methods.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Klaus Dittert	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 25		



<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Cp.0015: Molecular weed science</b>		4 WLH
<b>Learning outcome, core skills:</b> Understanding the basic principles of the interactions between herbicides and the target plant and herbicide selectivity. Resistance mechanisms in weeds and mechanisms of tolerance in cultivated plants are understood, can be distinguished and practical consequences be drawn. Students have a fundamental understanding of the development and distribution of herbicide resistance in weeds.		<b>Workload:</b> Attendance time: 60 h Self-study time: 120 h
<b>Course: Molecular Weed Science</b> (Lecture, Practical course) <i>Contents:</i> Lecture: In the lecture the application of molecular methods in weed science and weed management is presented, focusing on the naturally occurring herbicide resistance in weeds. The genetic basis will be taught with regard to transgenic and non transgenic herbicide tolerance in cultivated plants. The possibilities of the use of molecular techniques for the detection of herbicide resistance in weeds will be discussed. New findings by the so called –omics ( genomics, proteomics and metabolomics) on the interaction of weeds with their environment are of importance in the development of new herbicides and will be discussed as well as alternative transgenic approaches in weed management.  Practical: A one week practical will be held after the lecture. In the practical actual resistance problems in weeds are presented. Resistance detection methods will be presented and carried out on the protein level ( target assay) and on the genetic level (SNP-analysis') and the possible use for a sustainable herbicide weed management will be discussed.		4 WLH
<b>Examination: Oral examination (approx. 20 minutes)</b> <b>Examination prerequisites:</b> Participation I the laboratory practical <b>Examination requirements:</b> Knowledge of the interaction between herbicide and target, the selectivity of herbicides, mechanisms of resistance in weeds, mechanisms of development of tolerance in cultivated plants. Basic knowledge of development and distribution of herbicide resistance in weeds		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Jean Wagner	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b>		

20	
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<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Cp.0016: Practical statistics and experimental design in agriculture</b>		
<b>Learning outcome, core skills:</b> The aim of the course is to familiarize students with the basic concepts of statistics and their application in agricultural science. The second goal is to learn the use of software packages like SAS.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Practical Statistics and Experimental Design in Agriculture</b> (Lecture, Exercise) <i>Contents:</i> In the beginning of the course, students are introduced to the basic concepts of statistics like frequency distributions, the normal distribution and hypothesis testing. They are also introduced to software packages like SAS, that are used for the practical exercises.  Regression and correlation analysis are then introduced. Different experimental designs like randomized block, latin square, and split plot are described and analyzed by one-way analysis of variance or as factorial experiments. Generalized Linear Models will be used and multivariate data will be analyzed by cluster and principal component methods.  A large amount of examples and exercises constitute an important aspect of the course, enabling the students to understand and assimilate the theoretical content. Practical analyses of example data sets also provide the students with the required experience and skills for future statistical tasks in the context of Mastertheses.		4 WLH
<b>Examination: Written examination (90 minutes)</b> <b>Examination requirements:</b> Knowledge of the basic concepts of statistics and their application in agricultural science and in the use of software packages like SAS.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Mathematics, statistics	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Heiko C. Becker	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 3	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module M.Cp.0017: Scientific presenting, writing and publishing in crop protection</b>		
<b>Learning outcome, core skills:</b> Students are expected to be able to write scientific papers in English, to design graphics and tables, conduct a literature recherche, to prepare oral and poster presentations, to review manuscripts. Students know the process of paper publication, from writing to submitting and reviewing.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Scientific Presenting, Writing and Publishing in Crop Protection</b> (Lecture, Seminar) <i>Contents:</i> Students will prepare a written paper dealing with selected topics in crop protection. The "Good Scientific Practice", the structure and design of scientific papers, preparation and submission of a manuscript for publication, design of scientific presentations (structure, way of presentation, rhetorics) will be presented.		2 WLH
<b>Examination: Term Paper (max. 10 pages)</b> <b>Examination prerequisites:</b> regular attendance at seminar <b>Examination requirements:</b> Ability to search literature and compile a paper dealing with a scientific topic in crop protection.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Andreas von Tiedemann	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 2	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Cp.0018: Journal club on new topics in crop protection</b>		2 WLH
<b>Learning outcome, core skills:</b> Students learn how to assess and discuss a scientific subject in crop protection: They will be able to give written and oral presentations of a scientific paper and to critically judge the didactic, structure and scientific content and correctness of a scientific paper.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Journal Club on New Topics in Crop Protection</b> (Lecture, Seminar) <i>Contents:</i> Methods will be presented how to collect and read scientific literature dealing with a specific topic. The composition and structure of scientific publications, methods and ways of presentation and proving ideas are studied using specific examples. Criteria for quality assessment are applied.		2 WLH
<b>Examination: Presentation (ca. 15 minutes) and written paper (3 pages)</b> <b>Examination prerequisites:</b> Participation in the seminars <b>Examination requirements:</b> Preparation of written review of a scientific paper, which will be presented and discussed in the seminar.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Andreas von Tiedemann	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 2	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Cp.0019: Basic laboratory techniques</b>		2 WLH
<b>Learning outcome, core skills:</b> Students will get prepared for practical research, including basic chemical and microbiological techniques as well as responsible behaviour in the laboratory and operating of machines.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Basic Laboratory Techniques (Internship)</b> <i>Contents:</i> The practical includes laboratory safety, planning and recording of experiments, chemical calculations (concentrations in media and buffer), sterilization techniques, working in sterile conditions, pH, photometry, ELISA, PCR, preparation of experiments and writing protocols. Students learn to plan and execute safely experiments, to explain and use methods and equipment effectively.		2 WLH
<b>Examination: Written examination (45 minutes)</b> <b>Examination prerequisites:</b> Accepted protocol <b>Examination requirements:</b> Basic knowledge of calculation of concentrations, sterilization techniques, importance and composition of buffers, principles of photometry, centrifugation, ELISA and PCR.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Anke Sirrenberg	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 2	
<b>Maximum number of students:</b> 20		

<p><b>Georg-August-Universität Göttingen</b>  <b>Module M.Forst.1605: Forest Protection and Agroforestry</b></p>	<p>6 C  4 WLH</p>
<p><b>Learning outcome, core skills:</b>  Assessment of forest protection problems and available methods of insect or pathogen control with special emphasis on sustainable methods. Basic understanding of agroforestry systems in the tropics.</p>	<p><b>Workload:</b>  Attendance time:  56 h  Self-study time:  124 h</p>
<p><b>Course: Forest protection and agroforestry (Lecture)</b>  <i>Contents:</i>  Forest protection is aimed at protecting natural, near natural and plantation forests from disease and pests. Diseases do include abiotic diseases (damage from lack and excess of nutrients, fire, drought pollution, etc.) and biotic diseases caused by microorganisms including viruses and protozoa, and parasitic plants. Forest protection deals also with damage from animal pests, meaning arthropods and there specially insects, but also damage from mammalians. The matter is presented in a concept of integrated pest and disease management, here pests and diseases affecting specific tree species (mahogany, teak, Pinus, Dipterocarpaceae, Acacia, Eucalyptus, etc.) are treated together. Beside this core lectures. A prerequisite for the lectures and practical training, is knowledge of basic subjects of phytomedicine. However, if necessary, missing, incomplete and not up to date knowledge may be supplemented in lectures such as: Overview of abiotic diseases, theoretical approach to integrated pest and disease management, biological, bio-technical and chemical control of pests and diseases. The main focus of the module is explanation of specific (and for forest protection important) features of the individual tree species and/or forest types, diagnostic of the disease and pest attack and explanation of strategies for the integrated management of the disease or pest. Possible control strategies include. Experiences of the lecturers are in Germany and abroad (South and Central America, North Africa and South East Asia) and advice can be provided also in Spanish. silvicultural based measures, i. e. displacing the attack of diseases and pests by changing planting distance, managing shadow, managing thinning, establishing mixed stands, change of logging practises. Reducing spread of disease or pest by eradication of individual trees or group of trees or certain areas of the forest (hot spots) or manual collecting of specific insect stages. Genetic based measures i. e. resistant species, subspecies, f. sp., varieties and different provenience, and, if available, genetic engineered plants trimmed for resistance to diseases and pests. Chemical oriented plant protection. Applied according to the principles of integrated pest management, which includes economic threshold, consideration of the residue problems and health of the applying forester. Basic knowledge are required, but may be supplied in a specific lectures. Biological and biotechnical oriented plant protection. In this context experiences and possibilities of applying these measures in the field are being discussed. Specific examples are treated and possible approaches to new problems are discussed. The influence of different factors (including the above listed approaches) on the biological and biotechnical plant protection are considered. Basic knowledge is required, but may be supplied in specific lectures. Agroforestry systems are land-use systems and practises in which woody perennials are deliberately grown</p>	<p>4 WLH</p>

<p>on the same land management unit as crops and/or animal husbandry, either in some form of spatial arrangement or in a time sequence, and in which there is a significant interaction between the woody perennials and the crops or animals. Starting with general considerations in agroforestry systems, a selection of systems in which trees or other woody perennials play an important role are discussed: The classical Taungya System, the tumpangsari system in Java, the Malang and Magelang system, the Juhm system of Nagaland, different home and forest gardens of S-E-Asia. In detail discussed are the role of trees in agroforestry systems and a selection of suitable tree species for agroforestry systems.</p>		
<b>Examination: Written exam (120 minutes)</b>		6 C
<p><b>Examination requirements:</b> Kenntnis der beschriebenen Lehrinhalte, Erreichung der festgelegten Lernziele und Nachweis der angestrebten Kompetenzen.</p>		
<p><b>Admission requirements:</b> none</p>	<p><b>Recommended previous knowledge:</b> none</p>	
<p><b>Language:</b> English</p>	<p><b>Person responsible for module:</b> Prof. Dr. Stefan Schütz</p>	
<p><b>Course frequency:</b> each summer semester</p>	<p><b>Duration:</b> 1 semester[s]</p>	
<p><b>Number of repeat examinations permitted:</b> cf. examination regulations</p>	<p><b>Recommended semester:</b></p>	
<p><b>Maximum number of students:</b> not limited</p>		





<b>Georg-August-Universität Göttingen</b> <b>Universität Kassel/Witzenhausen</b> <b>Module M.SIA.P03: Ecological soil microbiology</b>		6 C 4 WLH
<b>Learning outcome, core skills:</b> Students learn to use microbiological methods and to interpret the obtained data. Students develop a consciousness for the complexity of soil fertility and soil quality and see the difficulties in diagnosing it.		<b>Workload:</b> Attendance time: 60 h Self-study time: 120 h
<b>Course: Ecological soil microbiology</b> (Lecture, Excursion, Seminar) <i>Contents:</i> Introduction to, and application of important up-to-date methods in soil-microbiology to determine the activity, biomass and community structure of soil- microorganisms. The complete operational sequence of a research project is simulated: (1) sampling, (2) sample preparation, (3) measurements and data collection (application of methods), (4) data processing, (5) statistics and (6) drafting a manuscript. Up-to-date literature is presented and discussed by the students.		4 WLH
<b>Examination: Project work (max. 12 pages)</b> <b>Examination prerequisites:</b> 2 presentations (each ca. 20 minutes) <b>Examination requirements:</b> Kenntnisse der zeitgemäßen Methoden der Bodenmikrobiologie zur Bestimmung der Aktivität, der Gemeinschaftsstruktur von Bodenmikroorganismen und deren Biomasse, sowie Wissen über Bodenfruchtbarkeit und Bodenqualität und deren Bestimmung.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge in biology, chemistry, and soil sciences. To do an experimental Master's thesis in soil sciences or plant nutrition this module is compulsory.	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. R.G. Jörgensen	
<b>Course frequency:</b> each winter semester; Witzenhausen	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 12		
<b>Additional notes and regulations:</b> <b>Literature:</b>		

Coyne, M.S. 1999: Soil microbiology: an exploratory approach. Thomson Press; Paul, E.A., Clark, F.E. 1996: Soil microbiology and biochemistry. 2nd ed. New York Academic Press; papers to be presented in the course are provided.

<b>Georg-August-Universität Göttingen</b> <b>Universität Kassel/Witzenhausen</b> <b>Module M.SIA.P07: Soil and plant science</b>	6 C 4 WLH
<b>Learning outcome, core skills:</b> Bridging module for students lacking basic knowledge in some agronomy disciplines. With the help of lectures and reading materials students will be enabled to fill in gaps and get updated on state-of-the art knowledge with a special focus on questions pertinent to organic agriculture. Students, having taken this module, will be able to follow advanced courses in the above fields.	<b>Workload:</b> Attendance time: 60 h Self-study time: 120 h
<b>Course: Soil and plant science</b> (Lecture, Seminar) <i>Contents:</i> Influence of soil formation processes on physical properties (texture, soil water, pore space), chemical properties (buffering, exchange capacity, nutrients), and biological properties (organic matter, edaphon), soil formation and classification. Nutrient availability and and nutrient mobilization under conventional and organic agricultural conditions. Major and minor nutrients and food quality. Plant breeding goals for different agricultural systems. Plant morphology, genetics and breeding: principles of plant domestication and use, characterization and evaluation, use of genetic resources in plant breeding, genetic basis for plant breeding Genetics of host-parasite interactions, epidemiology and plant defence. Insect physiology and ecology. Spezifische allgemeine und wissenschaftliche Artikel, die sich mit dem Zielland der Exkursion befassen werden über eine E-Learning Plattform zur Verfügung gestellt	4 WLH
<b>Examination: Written exam (120 minutes) or oral exam (ca. 20 minutes)</b> <b>Examination requirements:</b> Fundamentals of soil science: Physical properties (texture, soil water, pore space), chemical properties (buffering, exchange capacity, nutrients), biological properties (organic matter, edaphon), soil formation and classification. Plant nutrition: Role of major and minor elements in plants, nutrient availability and nutrient mobilisation, plant nutrients and food quality Plant breeding and genetics: plant morphology, genetics and breeding: principles of plant domestication and use, characterization and evaluation, use of genetic resources in plant breeding, genetic basis for plant breeding. Plant protection: principles of plant pathology and entomology, genetics of plant diseases, epidemiology, plant defence mechanisms; insect physiology and ecology	6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Helmut Saucke
<b>Course frequency:</b>	<b>Duration:</b>

each winter semester; Witzenhausen	1 semester[s]
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>
<b>Maximum number of students:</b> not limited	
<b>Additional notes and regulations:</b> <b>Literature:</b> Brady, N.C. 1990: The nature and properties of soils. 10th edition, Prentice Hall; Marschner, H. 1995: Mineral Nutrition of Higher Plants, Academic Press, New York; Sanchez, P. 1976: Properties and Management of Soils of the Tropics, Wiley, New York; van Wyk, B.E. 2005: Food Plants of the World. Briza Publication, Pretoria; Rehm, S., Espig, G. 1991: The Cultivated Plants of the Tropics and Subtropics. Verlag Josef Margraf, Weikersheim, Germany; Agrios, G.N. 2005: Plant Pathology, 5th edition, Academic Press, New York; Pedigo, L.P. 2002: Entomology and Pest Management, 4th edition, Macmillan Pub Co.	

<b>Georg-August-Universität Göttingen</b> <b>Universität Kassel/Witzenhausen</b> <b>Module M.SIA.P08: Pests and diseases of tropical crops</b>		6 C 6 WLH
<b>Learning outcome, core skills:</b> Students should become familiar with the causes of diseases (abiotic & biotic diseases), with the taxonomy of disease agents (bacteria, fungi, virus) and insect pests, with basics of integrated pest management (approaches, economic threshold, epidemiology), and biological, cultural control (cultivars, crop rotation, planting term, manual control), and chemical control options (toxicology, fungicides, insecticides) of the main crops in subtropical and tropical regions		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Pests and diseases of tropical crops</b> (Lecture, Seminar) <i>Contents:</i> Pests and diseases of selected crops are treated together for each crop including approaches to integrated control. The following crops will be presented: rice, maize, cotton, cocoa, coffee, cassava, phaseolus beans, bananas, and others. For each crop, a short introduction to botanical and agronomic features (as far as they concern disease or pest control) is given, together with an overview of the main diseases world-wide. The economic importance of diseases and pests in different geographical areas is discussed. The most important diseases and pests of die crop are treated in detail and die possibilities for integrated control are discussed. Short introductions (reviews) on basic subjects of plant protection are given, these include: causes of diseases (abiotic & biotic diseases), taxonomy of disease agents (bacteria, fungi, viruses) and insect pests, integrated pest management (approaches, economic threshold), biological control (diseases, pests), cultural control (varieties, crop rotation, planting term, manual control), and chemical control (toxicology, fungicides, insecticides). Students will give seminars on related topics.  Vorlesungsbasierte Literatur		6 WLH
<b>Examination: Written exam (60 minutes, 67%) and presentation (ca. 20 minutes, 33%)</b> <b>Examination prerequisites:</b> Seminar speech <b>Examination requirements:</b> Knowledge on the most important pests and diseases of tropical and subtropical crops; chemical and biological control options, phytosanitary approaches, and sustainable cropping systems for tropical crops.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge (B.Sc. level) in agricultural entomology, plant diseases and plant production	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Vidal	
<b>Course frequency:</b>	<b>Duration:</b>	

each summer semester; Göttingen	1 semester[s]
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>
<b>Maximum number of students:</b> 30	
<b>Additional notes and regulations:</b> <b>Literature:</b> Lecture based materials; details provided during lectures.	

<b>Georg-August-Universität Göttingen</b> <b>Universität Kassel/Witzenhausen</b> <b>Module M.SIA.P12: Crops and production systems in the tropics</b>		6 C 4 WLH
<b>Learning outcome, core skills:</b> Knowledge of botanical, ecological and agronomic facts of presented crops and cropping systems. The students should be able to classify crops and cropping systems in relation to site conditions and undertake system-orientated evaluation of sustainable production.		<b>Workload:</b> Attendance time: 60 h Self-study time: 120 h
<b>Course: Crops and production systems in the tropics (Lecture)</b> <i>Contents:</i> Presentation of the most important crops with respect to: botany, morphology, origin, climatic and ecological requirements, crop production, harvest procedure, significance in local farming systems, utilisation as food, feed, raw materials and as bioenergy source. Discussion of specific cropping systems in the tropics and subtropics and specific management systems for the sustainable improvement of productivity. <b>Literatur</b> Rehm, S., Espig, G. 1991: The Cultivated Plants of the Tropics and Subtropics. Verlag Josef Margraf. Weikersheim, Germany; lecture notes		4 WLH
<b>Examination: Written exam (90 minutes) or oral exam (ca. 30 minutes)</b> <b>Examination requirements:</b> Knowledge of botanical, ecological and agronomic facts of the presented crops and cropping systems. Knowledge of the assignment of crops and cropping systems to different site conditions, as well as system-oriented evaluation of sustainable production at selected sites.		6 C
<b>Admission requirements:</b> Basic knowledge on plant production (BSc-level)	<b>Recommended previous knowledge:</b> Grundlegende Kenntnisse im Pflanzenbau (BSc-Niveau)	
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. sc. agr. Ronald Franz Kühne	
<b>Course frequency:</b> each winter semester; Göttingen	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> 30		
<b>Additional notes and regulations:</b> exam on the first examination, oral exam on the second examination <b>Literature:</b>		



Rehm, S., Espig, G. 1991: The Cultivated Plants of the Tropics and Subtropics. Verlag Josef Margraf. Weikersheim, Germany; lecture notes

<b>Georg-August-Universität Göttingen</b> <b>Universität Kassel/Witzenhausen</b> <b>Module M.SIA.P15M: Methods and advances in plant protection</b>		6 C 4 WLH
<b>Learning outcome, core skills:</b> Students are able to critically evaluate published results and apply this knowledge to actual problems in the field. They are also able to deal with problems in the field: Identification and measurements, design of experimental and analytical approaches to problems.		<b>Workload:</b> Attendance time: 60 h Self-study time: 120 h
<b>Course: Methods and advances in plant protection</b> (Lecture, Excursion, Exercise) <i>Contents:</i> Advanced course in plant pathology and entomology. Methodology and evaluation methods in plant protection. Case studies of specific plant protection issues in organic farming in the form of lectures, seminars and practical courses.		4 WLH
<b>Examination: Written exam (120 minutes) or oral exam (ca. 20 minutes) (70%) and work reports (max. 3 pages) or seminar speech (ca. 10 minutes) (30%)</b> <b>Examination requirements:</b> Advanced knowledge in plant protection (Entomology and Pathology) Methodology and evaluation methods in plant protection based on case studies.		6 C
<b>Admission requirements:</b> Introductory course in plant protection (entomology and pathology, at least 6 ECTS or equivalent) or bridging module M.SIA.P07 Soil and Plant Science	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Maria Renate Finckh	
<b>Course frequency:</b> each winter semester; Witzenhausen	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b>	
<b>Maximum number of students:</b> not limited		
<b>Additional notes and regulations:</b> <b>Literature:</b> Agrios, G.N. 2005: Plant Pathology, 5th edition Academic Press, New York; Pedigo, L.P. 2002: Entomology and Pest Management, 4th edition, Macmillan Pub Co.		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.WIWI-QMW.0004: Econometrics I</b>		
<b>Learning outcome, core skills:</b> This lecture provides a detailed introduction and discussion to the theory of several topics of econometrics. In a practical course the students will apply the methods discussed to real economic data and problems using the statistical software packages Eviews and R.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Courses:</b> <b>1. Econometrics I (Lecture)</b> <i>Contents:</i> Multiple linear regression model: Estimation, Inference and Asymptotics. Maximum likelihood modeling. Generalized least squares. Stochastic regressors. Instrumental variable estimators. Generalized method of moments, likelihood based inference. Dynamic models, weak exogeneity, cointegration, stochastic integration.		2 WLH
<b>2. Econometrics I (Tutorial)</b>		2 WLH
<b>Examination: Written examination (90 minutes)</b> <b>Examination requirements:</b> Linear regression models, generalized linear regression models. OLS, GLS, EGLS estimation. Multiplikative heteroskedasticity, autocorrelation. LM specification testing, Durbin Watson test. Convergence in probability, convergence in distribution. Asymptotics (consistency, asymptotic normality) of OLS estimators. IV estimation, GMM estimation.		6 C
<b>Examination requirements:</b> Linear regression models, generalized linear regression models. OLS, GLS, EGLS estimation. Multiplikative heteroskedasticity, autocorrelation. LM specification testing, Durbin Watson test. Convergence in probability, convergence in distribution. Asymptotics (consistency, asymptotic normality) of OLS estimators. IV estimation, GMM estimation.		
<b>Admission requirements:</b> None	<b>Recommended previous knowledge:</b> Notwendige: Mathematik (lineare Algebra), Statistik. Erwünscht: Einführung in die Ökonometrie (oder vergleichbare Vorlesung)	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Helmut Herwartz	
<b>Course frequency:</b> every semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 2 - 3	
<b>Maximum number of students:</b> not limited		