

BI1295, Sustainable Plant Production - from Molecular to Field Scale, 15hp, 2021

Unless otherwise noted ('additional' and 'supporting'), the literature is compulsory. Refer to the course literature list and Canvas for details on the literature

	Day	Month	Time	Part	most connected ILO	Type	Session	Summary of the content	Reading/Preparation	Teachers		
Week 12	Wed	24	3	09:00 - 12:00		P	Mandatory attendance Course introduction and arrangements for the group project	General course idea, grading criteria, presentation of the projects, election of the student representative		AM		
	Thu	25	3	09:00 - 10:30	4. Tools	4,5	E	Mandatory attendance The scientific method	The process of scientific investigation from idea to publication is explored with special focus on the role and importance of hypothesis	Grogan 2005	RG	
	Fri	26	3	09:00 - 12:00	4. Tools	4,5	E	Mandatory attendance Bibliometric analysis	Advanced tools for literature search and bibliometric analysis; introduction in bibliometric analysis with R	Aria 2017	AM	
				13:00 - 16:00	4. Tools	4,5	E	Mandatory attendance Bibliometric analysis			AM	
Week 13	Mon	29	3					Easter break				
	Tue	30	3									
	Wed	31	3									
	Thu	1	4									
	Fri	2	4									
Week 14	Mon	5	4									
	Tue	6	4	9-12	4. Tools	4,5	E	Mandatory attendance Critical thinking		PS		
	Wed	7	4	09:00 - 12:00			S	Mandatory attendance Introductory lecture: The concept of sustainability across scales	Clark 2020	AM		
	Thu	8	4	09:00 - 12:00	1. Basics of plant production	2	L		Photosynthesis at single cell scale; effects of external factors on leaf-level and stand-level photosynthesis with focus on the opportunities for crop yield improvements. Opportunities and limitations for sustainable crop production under Northern-European conditions	Lambers 2008 (part of chapter 2); Larcher 2003 (p111-119); Peltonen-Sainio 2009; Xu 2002. Supporting: Open StaxBiology Ch8; Additional: Eisenhut 2019; Weih 2003	MW	
	Fri	9	4	09:00 - 10:00	2. Plant production under disturbance	1	L	Mandatory attendance "Meet the author" session: Climate change	Paper discussion with the authors	Bonosi 2013 (to be read before the seminar, please prepare your questions)	MW	
10:00 - 12:00				2. Plant production under disturbance	2	L		Two case studies: Sensitivity of available germplasm of wheat and biomass willow to extreme weather (i.e. drought). Discussion of major climate change impacts on agriculture and forestry, based on climate effects on crops at field scale	Bonosi 2013; Lavalley 2009; Mäkinen 2018	MW		
Week 15	Mon	12	4	09:00 - 12:00	4. Tools	2	L/E	Mandatory attendance Modelling - the basics	Why do we model? What is (not) a model? Mass and energy balance; Empirical exponential biomass growth model	Ludwig 2010 (to be read before class); Smith 2007 (ch 1 and 2)	GV	
	Tue	13	4	09:00 - 12:00	4. Tools	2	L		Process-based modeling of leaf level C fixation; upscaling to plant level in trees and arable crops; linkage of plant traits to the parameter of the empirical exponential growth. Growing degree days as a simple model for tree and crop phenology.	Revise literature relative to photosynthesis (read for 08/04); additional: Abrahamsen 2000	GV	
	Wed	14	4	09:00 - 12:00	1. Basics of plant production	1	L		Where do cultivated plants come from? Breeding "Dugga" (diagnostic test)	overview on the history of crop domestication, modern tools for breeding and approaches used to adapt both annual and perennial plants for climate resilience and sustainable agriculture	Prepare the "dugga" before class. Readings: compulsory: Doebley 2006; Kole 2015; supporting: selected chapters from Klug (available at SLU libraries)	PI
	Thu	15	4	09:00 - 12:00	1. Basics of plant production	1	L		Where do cultivated plants come from? Summary of plant breeding	continued from	as for 14/04	PI
	Fri	16	4	09:00 - 12:00	2. Crop production under disturbance	3	L		Weed biology	Classification of weeds along their genetic and phenotypic characteristics; Tradeoffs of genetic and phenotypic characteristics;	Monaco TJ, Weller SC, Ashton FM (2002), Weed Science – Principles and practices, Wiley (Ch 1 and 2)	AM
Week 16	Mon	19	4	09:00 - 12:00	2. Crop production under disturbance	3	L		Plant microbe interactions - harmful effects	Introduction to plant pathology with a focus on the ecology of plant pathogens	Raaijmakers 2008, Ritpitakphong 2016 Supporting reading: Guest 2017, Tör 2017	IK
	Tue	20	4	09:00 - 12:00	2. Crop production under disturbance	3	L/E	Mandatory attendance Plant microbe interactions - plant defense	Plant defense and perception of microbes, MAMP-PAMP-DAMP & TLR, PTI-ETI, structural-chemical-cellular barriers, defense signalling, cost of resistance-resource allocation, how to improve crop resistance (group exercise)	Pieterse 2014 Supporting reading: Han 2019	JM	
	Wed	21	4	09:00 - 12:00	2. Crop production under disturbance	3	L/E	Mandatory attendance Plant microbe interactions - beneficial interactions	Natural microbiota; microbiome; ecosystem services: single strains or consortia or microbiota as biostimulants, growth promoters, biofertilizers, biocontrol agents, remediators; microbes in agriculture - pros-cons (group exercise)	Lugtenberg 2009, Finkel 2017 Supporting reading: Bhattacharyya 2012	JM	
	Thu	22	4	09:00 - 12:00	1. Basics of plant production/2. Crop production under disturbance	2	L		Soil microbial nitrogen cycling	Introduction to nitrogen (N) cycle and microbial transformations of N compounds, N cycling in rhizosphere, microbial controls of N loss and retention, plant-microbe interactions in relation to N; competition for N, plant breeding to inhibit microbial N transformations	Coskun 2017; Philippot 2011; Supporting: Robertson 2014; Additional: Kuypers 2018; Philippot 2013	SH
	Fri	23	4	09:00 - 12:00	2. Crop production under disturbance/3. Complexity and multifunctionality across scales	3	L/E	Mandatory attendance Integrated Pest Management and sustainable management of insect pests	Concept of IPM, components of IMP strategies illustrated by examples showing both complexity & multifunctionality. Discuss advantages and disadvantages of strategies. Discussion of sustainability in pest management context	Godfray 2010; additional readings: Khan 2014; Prinsloo 2007	RG	
	Mon	26	4	09:00 - 10:30	3. Complexity and multifunctionality across scales	2	L		Plant nutrient use efficiency across scales - Part 1	Nutrient use efficiency across scales with main focus on nitrogen – assessment of mechanisms determining the efficiency of nutrient use at molecular, tissue, whole-plant and field scales	Lopez-Arredondo 2017; Weih 2017	POL
				10:30 - 12:00	3. Complexity and multifunctionality across scales	2	L		Plant nutrient use efficiency across scales - Part 2	Nutrient use efficiency across scales with main focus on nitrogen – assessment of mechanisms determining the efficiency of nutrient use at molecular, tissue, whole-plant and field scales	Lopez-Arredondo 2017; Weih 2017	MW

Week 17	Tue	27	4	09:00 - 12:00	3. Complexity and multifunctionality across scales	3	L		Weed ecology - field scale implications	Plant-plant interaction; Mechanisms of plant adaptation to new environments in the context of invasive weeds; weed adaptation to climate change		AM	
				13:00 - 15:00	3. Complexity and multifunctionality across scales	3	S	Mandatory attendance	"Meet the author" session: Sustainable weed management	Paper discussion with the authors	MacLaren et al. 2020 (to be read before the seminar, please prepare your questions)	AM/CML	
	Wed	28	4						Free (re-exam date for courses in period 2 och 3 on campus Umeå and Alnarp)				
					09:00 - 12:00	3. Complexity and multifunctionality across scales	3	L		Field scale implications - environmental, genetic and management effects on crop performance - Temperate regions	Discuss implications on field scale and in particular relate environmental and genetic effects on crop performance to management	Slafer 2014; Cassman 2002	GB
					13:00 - 15:00	3. Complexity and multifunctionality across scales	3	S	Mandatory attendance	Field scale implications - The Swedish strategy for reducing the use of pesticides in agriculture.	The Swedish strategy for reducing the risks associated with the use of pesticides in agriculture.	https://jordbruksverket.se/jordbruket-miljon-och-klimatet/giftfri-miljo#h-Riskernamedvaxtskyddsmedelskaminska	AL
Fri	30	4							Free				
Week 18	Mon	3	5	09:00 - 12:00	3. Complexity and multifunctionality across scales	3	L		Field scale implications - environmental, genetic and management effects on crop performance - Tropical and sub-tropical regions	Discuss implications on field scale and in particular relate environmental and genetic effects on crop performance to management	Altieri 2015	ML	
				13:00 - 14:30	3. Complexity and multifunctionality across scales	3	L	Mandatory attendance	"Meet the author" session: Agroecology	Paper discussion with the authors	Altieri 2015 (to be read before the seminar, please prepare your questions)	ML	
	Tue	4	5	09:00 : 10:30			L		Summary session - plant breeding			PI	
	Wed	5	5	09:00 - 10:30			L		Summary session - plant physiology			MW	
	Thu	6	5	09:00 - 11:00			L		Summary session - sustainability from a system perspective, modelling		Springmann 2018 p 1-9 only; Weiner 2017	GV	
	Fri	7	5	09:00 - 10:30			L		Summary session - plant-microbe/insects interactions			JM	
Week 19	Mon	10	5						Study week				
	Tue	11	5						Study week				
	Wed	12	5	09:00 - 10:30				Mandatory attendance	Q&A session for exam preparation + course evaluation			AM	
	Thu	13	5						Study week				
	Fri	14	5						Study week				
Week 20	Mon	17	5	tbd					Exam			AM	
	Tue	18	5						Finalising project work				
	Wed	19	5						Finalising project work				
	Thu	20	5						Finalising project work				
	Fri	21	5						Finalising project work				
Week 21	Mon	24	5						Finalising project work				
	Tue	25	5						Finalising project work				
	Wed	26	5						Finalising project work				
	Thu	27	5						Finalising project work				
	Fri	28	5	09:00 - 12:00 13:00 - 15:00			P	Mandatory attendance	Project presentations - each group gets 15 minutes			AM	
Week 22	Mon	31	5						Finalising project work and preparation for re-exam if needed				
	Tue	1	6						Finalising project work and preparation for re-exam if needed				
	Wed	2	6						Finalising project work and preparation for re-exam if needed				
	Thu	3	6	16:00		4,5	P		Project work - hand in final project report 16:00				
	Fri	4	6	tbd					Re-exam if needed				

Type

- L Lecture.
E Exercise with **obligatory attendance**. An extra assignment is usually given if you miss the class.
S Seminars with **obligatory attendance**.
P Project. Introductory project presentation and the final mini-symposium are **obligatory** sessions. The rest of the scheduled project time is used in agreement between project tutor and group

Clarification of teachers' initials

AM Alexander Menegat
AL Anders Lindgren, Swedish Board of Agriculture
CML Chloe MacLaren, Rothamsted Research
GB Göran Bergkvist
GV Giulia Vico
IK Ida Karlsson
JM Johan Meijer
ML Marcos Lana
MW Martin Weih
PI Pär Ingvarsson
POL Per-Olof Lundquist
PS Per Sandin

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Course segments

Breeding and Crop Domestication
Crop Modelling
Basics of plant physiology and nutrient cycling
General Introduction, Exam, Evaluations etc.
Group work
Scientific work
Weed Biology/Ecology
Examples across scales and summary sessions

Participating teachers

PI, SC, MPA
GV
MW, SH
AM, (project tutors)
(project tutors), Students
AM, MW, RG
AM
MW, PO, GB, GV, PI, AM, JM, ML, PC, VCZ

Colour code

