

BI1295, Sustainable Plant Production - from Molecular to Field Scale, 15hp, 2025

Lecture room "H" in Uppsala

Lecture room "Plantan" in Alnarp

	Day	Month	Time		Session	Summary of the content	Reading/Preparation	Teacher	hrs	
Week 13	Tue	25	3	Introduction & preparation for group work	Course introduction and arrangements for the group project	General course idea, grading criteria, presentation of the projects, election of the student representative		AM	1.5	
					Group project introduction	Introduction to the group project		AM	1.5	
	Wed	26	3		Critical thinking			PS	3	
	Thu	27	3		The concept of sustainability across scales		Clark 2020	AM	1.5	
					Sustainable intensification, land sparing vs. land sharing		Finch 2019, <i>Further reading</i> : Folberth 2020 and FAO 2011	AM/FS	1.5	
	Fri	28	3							
Week 14	Mon	31	3	Basics of plant physiology and modelling	Photosynthesis from scratch to plant production in northern latitudes	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	3	
	Tue	1	4		"Meet the author" session: Climate change	Paper discussion with the author	Bonosi 2013 (to be read before the seminar, please prepare your questions)	MW	1	
					Effects of climate change on plant production	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	2	
	Wed	2	4		09:00 - 12:00	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	3
	Thu	3	4		13:00 - 16:00	Modelling - leaf to plant-level	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 28/03); additional: Abrahamsen 2000	GV	3
	Fri	4	4		13:00 - 16:00					
Week 15	Mon	7	4	Breeding and crop domestication	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	3	
	Tue	8	4		13:00 - 16:00	Where do cultivated plants come from? Summary of plant breeding	continued from 7/04	as for 7/04	PI	3
	Wed	9	4		09:00 - 12:00	Research insights: Jonathan Cope	Overview of the different genepools and how that germplasm can be used in breeding more sustainable crops. This will cover Primary, Secondary, and Tertiary genepools, as well as germplasm resources.		JC	3
	Thu	10	4		13:00 - 16:00	Basics of genome editing and plant transformation			PH	3
	Fri	11	4		13:00 - 16:00	Basics of genome editing and plant transformation			PH	3
Week 16	Mon	14	4	Easter break						
	Tue	15	4							
	Wed	16	4							
	Thu	17	4							
	Fri	18	4							
Mon	21	4								

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Week 17	Tue	22	4	Plant-insect & plant-microbe interaction	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 <i>Supporting reading:</i> Han 2019	MD	3
					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 <i>Supporting reading:</i> Bhattacharyya 2012	MD	3
	Wed	23	4		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; <i>Supporting:</i> Robertson 2014; <i>Additional:</i> Kuypers 2018; Philippot 2013	SH	3
					Research insights: Fede Berckx	Nitrogen fixation in legumes		FB	3
	Thu	24	4		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; <i>additional readings:</i> Khan 2014; Prinsloo 2007	RG	3
					Integrated pest and pollinator management	Integration of pollinators in each level of the IPM pyramid. Concept and case studies.	Lundin et al. 2021	OL	2
Fri	25	4	13:00 - 15:00						
Week 18	Mon	28	4	Nutrient use efficiency	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	MW	1.5
					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	POL	1.5
	Tue	29	4	Crop-weed interaction	Biology & ecology of weeds	Functional traits of weeds and their implications for the sustainability of plant production.	Monaco TJ, Weller SC, Ashton FM (2002), <i>Weed Science – Principles and practices</i> , Wiley (Ch 1 and 2)	AM	3
					"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)	CML	2
	Wed	30	4		Valborg				
	Thu	1	5		Public holiday				
	Fri	2	5		Research insights: Darwin Hickman	What allelopathy is, how it can be explored, and what potential it has for weed management.	<i>Further reading:</i> Hickman 2021	DH	3
					Service crops for weed control	Service crops can be used in used in a variety of ways for suppressing weeds. The mechanisms will be discussed as well as examples for service crop integration will be provided.		AM	3
Week 19	Mon	5	5		Sustainable plant production systems: Agroecology	Agroecology		GC	3
	Tue	6	5		Sustainable plant production systems: Intercropping	Intercropping		GC	3
	Wed	7	5	Re-examination date for courses in periods 2 and 3					
	Thu	8	5	Sustainable plant production systems: Grain legumes		Watson et al. 2017, Zander et al. 2016	AM/FS	3	
	Fri	9	5	Sustainable plant production systems: Agroecosystem re-design			AM	3	

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Week 20	Mon	12	5	10:00 - 11:00	Exam Q&A session via Zoom			AM	1
	Tue	13	5		Study week				
	Wed	14	5						
	Thu	15	5						
	Fri	16	5						
Week 21	Mon	19	5	14:00 - 17:00	Exam			AM	3
	Tue	20	5		Finalising group projects				
	Wed	21	5						
	Thu	22	5						
	Fri	23	5						
Week 22	Mon	26	5		Finalising group projects				
	Tue	27	5						
	Wed	28	5						
	Thu	29	5						
	Fri	30	5	16:00	Hand in final project report by 16:00 in Canvas				
Week 23	Mon	2	6	13:00 - 17:00	Project presentations + course evaluation			AM	4
	Tue	3	6		Preparation for re-exam if needed				
	Wed	4	6						
	Thu	5	6						
	Fri	6	6	08:00 - 11:00		Re-exam if needed			AM

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Type

L Lecture
E Exercises
S Seminars
P Project

Clarification of teachers' initials

AM Alexander Menegat
CML Chloe MacLaren
DH Darwin Hickman
FB Fede Berckx
FS Frederick Stoddard
GC Georg Carlsson
GV Giulia Vico
JC Jonathan Cope
MD Mukesh Dubey
MW Martin Weih
OL Ola Lundin
PH Per Hofvander
PI Pär Ingvarsson
POL Per-Olof Lundquist
PS Per Sandin
RG Robert Glinwood
SH Sara Hallin