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

Lecture room "H" in Uppsala

Lecture room "Plantan" in Alnarp

		Day	Month	Time		ILO	Session	Summary of the content	Reading/Preparation	Teacher
Week 13	Tue	25	3	13:00 - 14:30	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
				14:30 - 16:00			Group project introduction	Introduction to the group project		AM
	Wed	26	3	09:00 - 12:00		4,5	Critical thinking			PS
	Thu	27	3	13:00 - 16:00		3	The concept of sustainability across scales		Clark 2020	AM
	Fri	28	3	13:00 - 16:00						
Week 14	Mon	31	3	13:00 - 16:00	Basics of plant physiology and modelling	2	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
	Tue	1	4	13:00 - 14:00		1	**"Meet the author" session:** Climate change	Paper discussion with the author	Bonosi 2013 (to be read before the seminar, please prepare your questions)	MW
				14:00 - 16:00		2	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; Lavalle 2009; Mäkinen 2018	MW
	Wed	2	4	09:00 - 12:00		2	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
	Thu	3	4	13:00 - 16:00		2	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
	Fri	4	4	13:00 - 16:00						
Week 15	Mon	7	4	13:00 - 16:00	Breeding and crop domestication	1	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
	Tue	8	4	13:00 - 16:00		1	Where do cultivated plants come from? Summary of plant breeding	continued from 7/04	as for 7/04	PI
	Wed	9	4	09:00 - 12:00		1	**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
	Thu	10	4	13:00 - 16:00		1,2	Basics of genome editing and plant transformation			PH
	Fri	11	4	13:00 - 16:00		1,2	Basics of genome editing and plant transformation			PH
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	09:00 - 12:00	Plant-insect & plant-microbe interaction	3	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	MD
				13:00 - 16:00		3	Plant microbe interactions - beneficial interactions	Natural microbiota; microbiome; ecosystem services: single strains or consortia or microbiota as biostimulants, growth promoters, biofertilizers, biocontrol agents, remediatiors; microbes in agriculture - pros-cons (group exercise)	Lugtenberg 2009, Finkel 2017 Supporting reading: Bhattacharyya 2012	MD
	Wed	23	4	09:00 - 12:00		3	Soil microbial nitrogen cycling	Introduction to nitrogen (N) cycle and microbial tamsformations of N compounds, N cycling in rizosphere, 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
	Thu	24	4	09:00 - 12:00		3	**Research insights:** Fede Berckx	Nitrogen fixation in legumes		FB
				13:00 - 16:00		3	Integrated Pest Managment 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
	Fri	25	4	13:00 - 15:00		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
Week 18	Mon	28	4	13:00 - 14:30	Nutrient use efficiency	2	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
				14:30 - 16:00		2	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
	Tue	29	4	09:00 - 12:00	Crop-weed interaction	3	Ecological Weed Management (EWM)	Management of weed comunitoies through use of ecological mechanisms instead of direct control tools like herbicides and/or tillage	MacLaren et al. 2020 (**to be read before the seminar, please prepare your questions**)	AM
				13:00 - 15:00		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
	Wed	30	4				Valborg			
	Thu	1	5				Public holiday			
	Fri	2	5	09:00 - 12:00		3	**Research insights:** Darwin Hickman	What allelopathy is, how it can be explored, and what potential it has for weed management.	*Further reading:* Hickman 2021	DH
				13:00 - 16:00		3	Service crops for weed control	Service crops can be used in used in a variety of ways for supressing weeds. The mechnaisms will be discussed as well as examples for service crop itegration will be provided.		AM
Week 19	Mon	5	5	13:00 - 16:00	Sustainable plant production systems	3	Sustainable plant production systems: Agroecology	Agroecology		GC
	Tue	6	5	13:00 - 16:00		3	Sustainable plant production systems: Intercropping	Intercropping		GC
	Wed	7	5				Re-examination date for courses in periods 2 and 3			
	Thu	8	5	09:00 - 12:00 Online		3	Sustainable plant production systems: Grain legumes		Watson et al. 2017, Zander et al. 2016	FS
	Fri	9	5	09:00 - 12:00 Online		3	Crop rotations and break crop effects		Kirkegaard 2017. Further reading:Reckling 2016	FS

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Week 20	Mon	12	5							
	Tue	13	5							
	Wed	14	5	14:00 - 17:00			**Exam:** **Ultuna -> Tentamenssal 2** **Alnarp -> Malmö University, Kranen**			
	Thu	15	5				Finalising group projects			
	Fri	16	5							
Week 21	Mon	19	5				Finalising group projects			
	Tue	20	5							
	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	09:00 - 15:00			Project presentations + course evaluation			AM
	Tue	3	6	14:00 - 17:00			**Re-exam:** **Ultuna -> Tentamenssal 1** **Alnarp -> Malmö University, Kranen**			
	Wed	4	6							
	Thu	5	6							
	Fri	6	6							

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