BI1295, Sustainable Plant Production - from Molecular to Field Scale, 15hp, 2024

Lecture room "H" in Uppsala

Lecture room "Plantan" in Alnarp

		Day	Month	Time		most connected ILO	Type		Session	Summary of the content	Reading/Preparation	Teacher	hrs
Week 12	Wed	20	3	09:00 - 10:30	Preparation for group work		I	Compulsory attendance	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
				10:30 - 12:00			I	Compulsory attendance	Group project introduction	Introduction to the group project		AM	1.5
	Thu	21	3	10:30 - 12:00			L/E	Compulsory 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	1.5
				13:00 - 16:00			L/E	Compulsory attendance	Critical thinking			PS	3
	Fri	22	3	13:00 - 14:30	Introduction		L	Compulsory attendance	The concept of sustainability across scales		Clark 2020	AM	1.5
				14:30 - 16:00			L	Compulsory attendance	Sustainable intensification, land sparing vs. land sharing		Finch 2019, *Further reading:* Folberth 2020 and FAO 2011	FS	1.5
Week 13	Mon	25	3						Easter break				
	Tue	26	3										
	Wed	27	3										
	Thu	28	3										
	Fri	29	3										
Week 14	Mon	1	4										
	Tue	2	4	13:00 - 16:00	Basics of plant physiology and modelling		L		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
	Wed	3	4	09:00 - 10:00			L	Compulsory attendance	**"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
				10:00 - 12:00			L		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	2
	Thu	4	4	13:00 - 16:00			L/E		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
	Fri	5	4	13:00 - 16:00			L		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
Wek 15	Mon	8	4	13:00 - 16:00	Breeding and crop domestication		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	3
	Tue	9	4	13:00 - 16:00			L		Where do cultivated plants come from? Summary of plant breeding	continued from 11/04	as for 11/04	PI	3
	Wed	10	4	09:00 - 12:00			L		Basics of genome editing and plant transformation			PH	3
	Thu	11	4	13:00 - 16:00			L		Basics of genome editing and plant transformation			PH	3
	Fri	12	4	13:00 - 16:00			L	Compulsory attendance	**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

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Week 16	Mon	15	4	13:00 - 16:00	Plant-insect & plant-microbe interaction		L		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	3
	Tue	16	4	13:00-15:00			L		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
				15:00 - 16:00			S	Compulsory attendance	***"Meet the auhor"* session:** Intercropping effects on multi-functionality		Boetzl et al. 2023 **(to be read before the seminar, please prepare your questions)**	FBÖ	1
	Wed	17	4	09:00 - 12:00			L		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	3
	Thu	18	4	13:00 - 16:00			L		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	3
	Fri	19	4	09:00 - 12:00			L		Soil microbial nitrogen cycling	Introduction to nitrogen (N) cycle and microbial tarnsformations 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	3
				13:00 - 16:00			S	Compulsory attendance	**Research insights:** Fede Berckx	Nitrogen fixation in legumes		FB	3
Week 17	Mon	22	4	13:00 - 14:30	Nutrient use efficiency		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	MW	1.5
				14:30 - 16:00			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	POL	1.5
	Tue	23	4	13:00 - 16:00	Crop-weed interaction		L		Weed biology and ecology	Functional traits of weeds and their implications for the sustainability of plant production.	Monaco TJ, Weller SC, Ashton FM (2002), Weed Science – Principles and practices, Wiley (Ch 1 and 2)	AM	3
	Wed	24	4	09:00 - 12:00			S	Compulsory attendance	**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	3
	Thu	25	4	13:00 - 15:00			S	Compulsory 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**)	CML	2
	Fri	26	4	13:00 - 16:00			S	Compulsory attendance	**Research insights:** Eirini Daouti	Weed seed predation. Can many little shinny predators help us to sustainably combat weeds?	*Further reading:* Daouti et al. 2020	ED	3
Week 18	Mon	29	4	13:00 - 16:00	Sustainable plant production systems		L		Sustainable plant production systems: Agroecology	Agroecology		GC	3
	Tue	30	4						Valborg				
	Wed	1	5						Public holiday				
	Thu	2	5	09:00 - 12:00			L		Sustainable plant production systems: Intercropping	Intercropping		GC	3
				13:00 - 16:00			L		Grain legume poduction systems		Watson et al. 2017, Zander et al. 2016	FS	3
	Fri	3	5	09:00 - 12:00			S	Compulsory attendance	**Research insights:** James Ajal	Intercropping		JA	3
				13:00 - 16:00			L		Crop rotations and break crop effects		Kirkegaard 2017. Further reading:Reckling 2016	FS	3

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Week 19	Mon	6	5	10:00 - 11:00					Exam Q&A session **via Zoom**			AM	1
	Tue	7	5						Study week				
	Wed	8	5										
	Thu	9	5										
	Fri	10	5										
Week 20	Mon	13	5	13:00 - 16:00					**Exam**			AM	3
	Tue	14	5						Finalising group projects				
	Wed	15	5										
	Thu	16	5										
	Fri	17	5										
Week 21	Mon	20	5						Finalising group projects				
	Tue	21	5										
	Wed	22	5										
	Thu	23	5										
	Fri	24	5	16:00			P		Hand in final project report by 16:00 in Canvas				
Week 22	Mon	27	5	13:00 - 17:00			P	Mandatory attendance	Project presentations + course evaluation			AM	4
	Tue	28	5						Preparation for re-exam if needed				
	Wed	29	5										
	Thu	30	5										
	Fri	31	5	13:00 - 16:00					**Re-exam if needed**			AM	3
													95.5

Type

L	Lecture
E	Exercises
S	Seminars
P	Project

Clarification of teachers' initials		**Emails**
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