

■ シラバス標準モデル/ Model Syllabus

Course title		Special Lecture on Comparative Agricultural Studies 9				Affiliated department, Job title,Name		Graduate School of Agriculture Associate Professor Ayako Katayama			
Target year	M1 students or above	Number of credits	2	Course offered year/period	2026/Spring Semester	Day/period	Friday 3.00 – 4.30 from 10 April	Class style	Lecture	Language	English
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<p>Traditional vs. Digital Agriculture: Evolution, Technologies, and Sustainability</p> <p>The evolution of agriculture has been marked by significant technological advancements that have shaped farming practices over the centuries. As the need for more efficient and sustainable farming practices has grown, agriculture has transitioned from traditional systems to those incorporating technologies such as Geographic Information System (GIS), automated machinery, and data-driven digital technologies to optimize crop production and resource management from farm to fork. The traditional farming practices and underutilised crops play a vital role in Asian and African farming systems ensuring the food security. This new era in farming utilizes real-time data from sensors, drones, and satellite systems to monitor crop health, optimize irrigation, and predict yields with unprecedented accuracy. This course will develop comprehensive understanding of underutilised crops and traditional crop husbandry, as a comparative study of the theoretical and practical applications of data-driven modelling in modern farming systems.</p>											
[Course objectives]											
<p>At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Explain key characteristics of traditional agricultural systems and the potential of underutilised crops for resilience in farming systems • Evaluate major digital agriculture technologies and tools • Apply data-driven crop models to assess management options • Analyze challenges and opportunities associated with adopting digital agriculture technologies • Critically evaluate case studies from different regions and farming scales 											
[Course Schedule and contents]											
<p>1. How do we obtain a bowl of rice?: Overview of the world agriculture, its foundations, and agricultural evolution</p> <p>2. Overview of underutilised crops and their agronomic and nutritional potentials giving examples from research literature in Asia and Africa Collaborative work with brainstorming session for students</p> <p>3. Traditional agriculture practices, part 1: Emphasizes on local knowledge and ecosystem-friendly practices in cropping systems</p> <p>4. Traditional agriculture practices, part 2: Labour, input, and resource use, with special emphasis on organic fertilisers, pest and disease control</p> <p>5. Strengths, challenges and limitations of traditional agriculture practices: Selected traditional technologies, their advantages, disadvantages, and suitability for integration with modern agriculture Argumentation-based learning::Group presentations and open discussion forum</p> <p>6. Innovative technologies for sustainable farming systems Introduction to digital agriculture: Definition, scope, and drivers of digital transformation in agriculture Information and Communication technology (ICT) and digital tools for enhancing farm productivity The role of digital agriculture in addressing climate change crisis Modeling the impacts of land-use change on environmental sustainability Concept mapping for data and computer application in smart agricultural decision-making</p> <p>7. ICT for data acquisition in agriculture Geospatial Technologies for monitoring crops and soils Computing Technologies in Agriculture</p> <p>8. Introduction to crop modelling Installation and initialization of DSSAT and R software (students register in DSSAT interface)</p> <p>9. Overview of Decision Support System for AgroTechnology Transfer (DSSAT): A widely used crop modelling software for smart agriculture solutions Install DSSAT and R software completed</p> <p>10. Crop model running exercises Group activity: Simulation of maize growth and yield using crop models</p> <p>11. Simulation of potential maize production using DSSAT Group activity: Simulation of potential maize production</p> <p>12. Simulation of water-limited and N-limited yields using DSSAT Group activit: Simulation of water-limited maize growth and yield</p> <p>13. Data-driven systems for digital farming: Early warning system, resilient farming, and assessment of climate change impacts on soil and water balance</p> <p>14. Smart agriculture solutions for soil-crop systems: Integrated water and nitrogen management in closing the yield gap Problem-based learning for cases studies of different countries</p> <p>15. Feedback session via Zoom</p>											
[Course requirements]											

English proficiency suitable for understanding lectures, participating in discussions, and completing assigned readings.

[Evaluation methods and policy]

The course assessment consists of **three** assignments, class discussions, presentations and a final analytical report at the end of the term. Given the considerable importance of discussions between the students and lecturer, all students are expected to prepare themselves well for each topic and contribute to discussions.

Assessment Breakdown

1. Traditional agriculture presentation 30%
2. Problem-based learning case study report – 50%
3. Class discussion and participation 20%

Evaluation policy: Each student's achievement of the course aims will be evaluated in accordance with the grading and evaluation policy of the Graduate School of Agriculture.

[Textbooks]

Azam-Ali, S. N. (2021). The Ninth Revolution. WORLD SCIENTIFIC. <https://doi.org/10.1142/12262>

[References, etc.]

1. Azam-Ali, S.N. and Jahanshiri, E. (2023). Forgotten foods: a manifesto for the future of the food system?. Acta Hortic. 1384, 1–10
DOI: 10.17660/ActaHortic.2023.1384.1

2. Karunaratne, AS, Wimalasiri EM, Esham M, Mabhaudhi T and Jahanshiri E (2024). Editorial: Crop modelling – underutilized crops for climate-smart agrifood systems. Front. Sustain. Food Syst. 8,1305909. <https://doi.org/10.3389/fsufs.2024.1305909>

3. Karunaratne, A.S., Walker, S. & A.C. Ruane (2015). Modelling Bambara groundnut in southern Africa towards climate resilient future, Climate Research, 65: 93–203. <https://doi.org/10.3354/cr01300>

4. Brian A. Keating, Peter J. Thorburn (2018). Modelling crops and cropping systems—Evolving purpose, practice and prospects, European Journal of Agronomy, 100: 2018, 163–176, <https://doi.org/10.1016/j.eja.2018.04.007>.

5. W Jones, G Hoogenboom, C.H Porter, K.J Boote, W.D Batchelor, L.A Hunt, P.W Wilkens, U Singh, A.J Gijssman, J.T Ritchie (2003). The DSSAT cropping system model, European Journal of Agronomy, 18:(3–4), 235–265, [https://doi.org/10.1016/S1161-0301\(02\)00107-7](https://doi.org/10.1016/S1161-0301(02)00107-7).

[Study out of class (preparation and review)]

PowerPoint presentation slides and relevant reference materials will be provided in advance for preparation and review.

(Other information (office hour, etc.))

The lecture is given in English by a visiting research scientist, Prof. Asha S. Karunaratne, Professor, Faculty of Agricultural Sciences, Sabaragamuwa University of Sri Lanka.

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Online meetings by appointment