[O23] Crop Modeling: Recent Progress and Applications

Chair: Hiroshi Nakagawa (National Agriculture and Food Research Organization, Japan)
Chair: Xinyou Yin (Wageningen University and Research, Netherlands)
2021年9月9日(木) 17:00 〜 19:00 Room 2 (Oral) (Farming System)

17:00 〜 17:20

[O23-01]Learning from Experiences in Physics to Improve Crop Models for Analysis of Complex Traits

(Invited Speaker)
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Algorithms in many crop models are (semi-)empirical. These models may need improving to face new challenges in crop science, such as how to handle GxE interactions. I argue that to capture these interactions, crop modellers should learn from experiences in physics. Physicists, such as Albert Einstein, used sound theories and solid mathematics in thought experiments, and came up with seemingly simple equations (such as E = mc2) to explain the behaviour of sub-atomic particles and (parts of) the universe. These equations show that there is beauty, simplicity, and regularity, at every level, from the smallest particles to the largest clusters of galaxies.

Likewise, a crop as a system is a masterpiece. Its growth involves many contrasting elements (such as carbon and nitrogen, source and sink, shoot and root, structure and reserves), and each of these contrasts plays a part in forming the regularity of the crop. I will show examples, where biological insights and mathematical analytics are combined to derive simple equations with parameters that have explicit biological meanings.

The advantages of this meta-physically based crop modelling approach are multi-fold: (i) classical crop physiology can still be explored as overarching guidelines; (ii) a clumsy, excessively numerical, modelling approach can be minimised; (iii) models integrating those known equations can be used to generate hypotheses to unravel the unknowns; and (iv) biologically meaningful parameters facilitate the application of models in assisting (genetic) analysis of G× E interactions on complex traits.