The Daisy Model Newsletter
Department of Plant and Environmental Sciences
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Daisy Newsletter no. 26

1 The Daisy code, v. 6.09

Version 6.09 is the last version released on all platforms.

2 Courses

Unfortunately, we have had to cancel our planned PhD-course in August 2021 because we could not be guaranteed that we can be allowed on campus. It will still be possible to join the MSc course on "Modelling Soil-Plant-Atmosphere" systems in block 1 (September 2021). We do expect to carry out a PhD course again in 2022.

3 Events

Our on-line monthly lunch meetings (last Wednesday in the month) continue, and we have had presentations by Finn Plauborg on irrigation and fertigation in potato, by Celine Grønning on new parameterisation of oil radish as cash crop and by Efstathios Diamantopoulos on recent advances in agroecological modeling and future perspectives. Keep track on the invitations announced at the Daisy homepage or contact us for a link.

Daniel B.G. Jorgensen will defend his PhD on 22nd June 2021 14.00-17.00 in Auditorium A1.01.01 (Festauditoriet], Bülowsvej 13 at Frederiksberg Campus, University of Copenhagen. The title of the thesis is "Modelling the fate of natural toxins in the environment". Daniel has worked with bracken fern (Pteridium aquilinum L. Kuhn) and its derived carcinogenic toxin, ptaquiloside (PTA). The work includes monitoring of PTA formation and leaching as well as model development and optimisations. Measurements showed concentrations in the soil solution in the order of microgram per liter, three orders of magnitude above maximum tolerable concentrations determined by previous studies. Hence, the presence of bracken might pose a risk towards water quality, both surface and groundwater. The new model allow formation of PTA in the plant and release to the surroundings. The calibrated model DAISY shows a good description of bracken biomass and PTA contents observed in the field. Results from this study shows that the adapted DAISY model represents a flexible and suitable platform for modelling the fate of phytotoxins.

Figure 1. Daniel in the midst of bracken canopy surpassing 2 m height in Vigersted, Denmark.

Look here for the full summary.

4 Recent articles where Daisy has been used

Czajkowski et al (2021) analysed the effect of scale when setting nutrient reduction targets for the Baltic Sea are with particular focus on agriculture. The main result is that there is a large variation in the total cost of the programme depending on the spatial scale of targeting, e.g. for a 40 % reduction in loads, the cost of a Baltic Sea-wide target is nearly three times lower than targets set at the smallest level of spatial scale, because the lowest level does not consider differences in cost-benefit ratios across a larger area. The article builds on Daisy calculations published earlier.

Kostaková et al. (2021) compared the performance of 13 different crop models and even more modelling groups when simulating winter wheat, spring barley, silage maize, and wither oilseed rape. Two groups participated with Daisy. The study clearly showed the importance of the user of a model, but it is also clear that some of the crop models in Daisy requires attention. Spring barley (which we are presently working on) needs attention and oilseed rape does so too. Winter wheat and silage maize were simulated better.

Moharjemi et al. (2021) simulated water and nitrate leaching over 10 years based on comprehensive data from a ten-year monitoring study of a tile-drained loamy field in Denmark under the actual crop rotation of winter wheat, sugar been, spring barley, winter rape and maize. While the overall simulation results were good, there were problems related to frost/thaw-events and to carry-over effects after winter rape. Measured drain water concentrations and even concentrations of nitrate at 2 m depth were most of the time higher than the drinking water criteria.

Pedersen et al. (2021) tries to quantify, on the basis of Daisy simulations, the benefit of having soil information, canopy sensor information, or both when deciding on precision fertilization strategy during the season. Their results show that the gross margin of variable rate application was between 3.88 and 13.30 € ha^{-1} across price and soil variation. This margin approximately doubled with applications based on sensor information and further doubled again with applications based on both soil and canopy sensor information. Thus, it seems to be possible to improve predictions based on canopy sensors considerably by including soil information.

5 Other articles

Liu et al. (2021) investigated light interception models for wheat and found that a model with ellipsoidal leaf angle distribution and canopy clumping outperformed current approaches under most illumination conditions and that the uncertainty in simulated wheat growth and final grain yield due to light models could be as high as 45 %. In Daisy we are presently assuming a spherical distribution, so there may be room for improvement here.

6 References

6.1 Daisy

Czajkowski, M., Andersen, H.E., Blicher-Mathiesen, G., Budziński, W., Elofsson, K., Hagemejer, J., Hasler, B., Humborg, C., Smart, J.C.R., Smedberg, E., Thodsen, H., Wąs, A., Żylicz, T. and Hanley, N. (2021): Increasing the cost-effectiveness of nutrient reduction targets using different spatial scales, Science of the Total Environment, https://doi.org/10.1016/j.scitotenv.2021.147824.

Kostková M et al (2021). Performance of 13 crop simulation models and their ensemble for simulating four field crops in Central Europe. The Journal of Agricultural Science 1–21. https://doi.org/10.1017/S0021859621000216.

Motarjemi, S.K., Rosenbom, A.E., Iversen, B.V., and Plauborg, F. (2021). Important factors when simulating the water and nitrogen balance in a tile-drained agricultural field under long-term monitoring. Science of the Total Environment 787 147610. https://doi.org/10.1016/j.scitotenv.2021.147610.

Pedersen. ;-F-. Gyldengren, J.G., Pedersen, S.M., Diamantopoulos, E., Gislum, R and Styczen, M.E. (2021). A simulation of variable rate nitrogen application in winter wheat with soil and sensor information – An economic feasibility study. Agricultural Systems 192, 103147. https://doi.org/10.1016/j.agsy.2021.103147

6.2 Other articles of general interest

Liu, S., Baret, F., Abichou, M., Manceau, L., Andrieu, B., Weiss, M and Matre, P. (2021): Importance of the description of light interception in crop growth models. Plant Physiology. DOI: 10.1093/plphys/kiab113.