C2D2: AN OPEN-SOURCE, PAN-EUROPEAN, HARMONISED CROP DEVELOPMENT DATABASE FOR USE IN PESTICIDE EXPOSURE MODELLING AND RISK ASSESSMENT

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BACKGROUND

Exposure assessments conducted as part of regulatory risk assessments for the registration of PPPs are increasingly utilising default/standardised crop development dates in order to remove subjectivity in deciding when the crop development stages mandated on the product GAP occur. While there have been important developments in the crop phenology area in recent years[2] there is currently no comprehensive, readily available, pan-European crop phenology dataset available to undertake an assessment of existing default crop development dates or for use in regulatory risk assessment refinement. Consequently, CropLife Europe have funded a 3-year project (2021 – 2023) to collate a harmonised crop development database for Europe.

METHODOLOGY

Anonymised efficacy trial datasets sourced from seven member companies have been harmonised to create the Crop Life Europe Crop Development Database (C2D2) that meets this need. The compiled database has then been analyzed by comparing the pairs of reported BBCH growth stages and assessment dates versus the application date and BBCH growth stages output by AppDate[1] as well as an independent dataset (PEP725)[2].

RESULTS

C2D2 spans two decades (2000-2020), >250 crops and 30 European countries. Despite the large dataset and the geographical coverage of C2D2, not all FOCUSsw/gw scenarios have sufficient data to facilitate comparison, with smaller scenarios, like FOCUSgw Porto, being under-represented. For those scenarios with sufficient data (e.g., Figure 2), differences between the C2D2 and AppDate crop development dates are often indicated over some/many growth stages suggesting that amendment of the existing representation of crop development within the risk assessment process may be required. While the provenance of the data underpinning AppDate crop development is not documented in the software manual and associated reports, much of the difference is likely a function of C2D2 comprising more recent data describing crop development of modern crop cultivars bred to match current agronomic and weather constraints more closely.

Evaluation of C2D2 against an independent dataset (Figure 1) showed good agreement for equivalent time periods, crop growth stages and geographical regions. This supports the underlying premise that efficacy trials are typically conducted in line with expected agronomic practice and are appropriate for this purpose. In addition, the alignment of the datasets suggests that the data cleaning, processing and harmonisation has not affected the utility of the resulting dataset. C2D2 critically covers a fuller description of crop growth stages across a broader geographical region and is specifically aligned with the risk assessment procedures under 1107/2009/EC having standardised crop and FOCUSsw/gw scenario attribution.

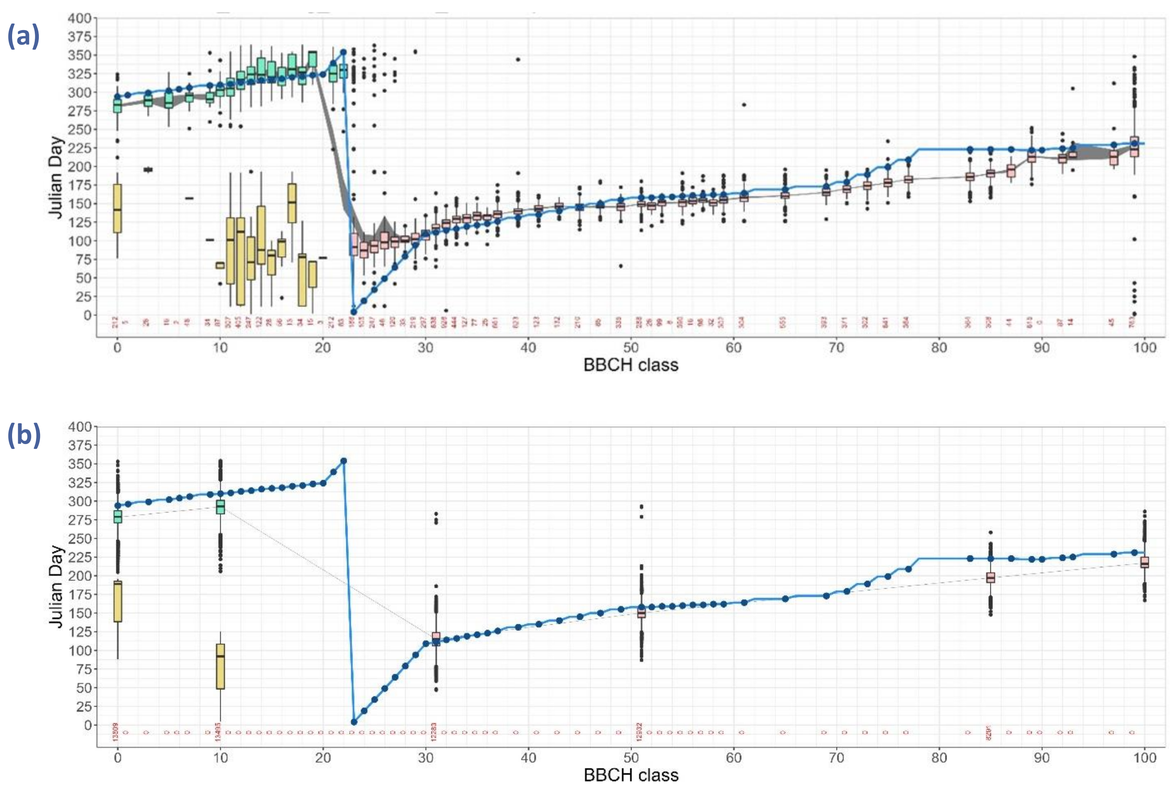

Figure 1: Example plots comparing the AppDate BBCH growth stages (blue dots = recognised growth stages) for Hamburg winter wheat with (a) the data collated within C2D2 and (b) the PEP725 dataset for Germany. For BBCH stages up to 23 the data are split into spring and winter crop ranges using a Jday value of 200. Grey band represents the 90 percent confidence interval of the mean (cross).

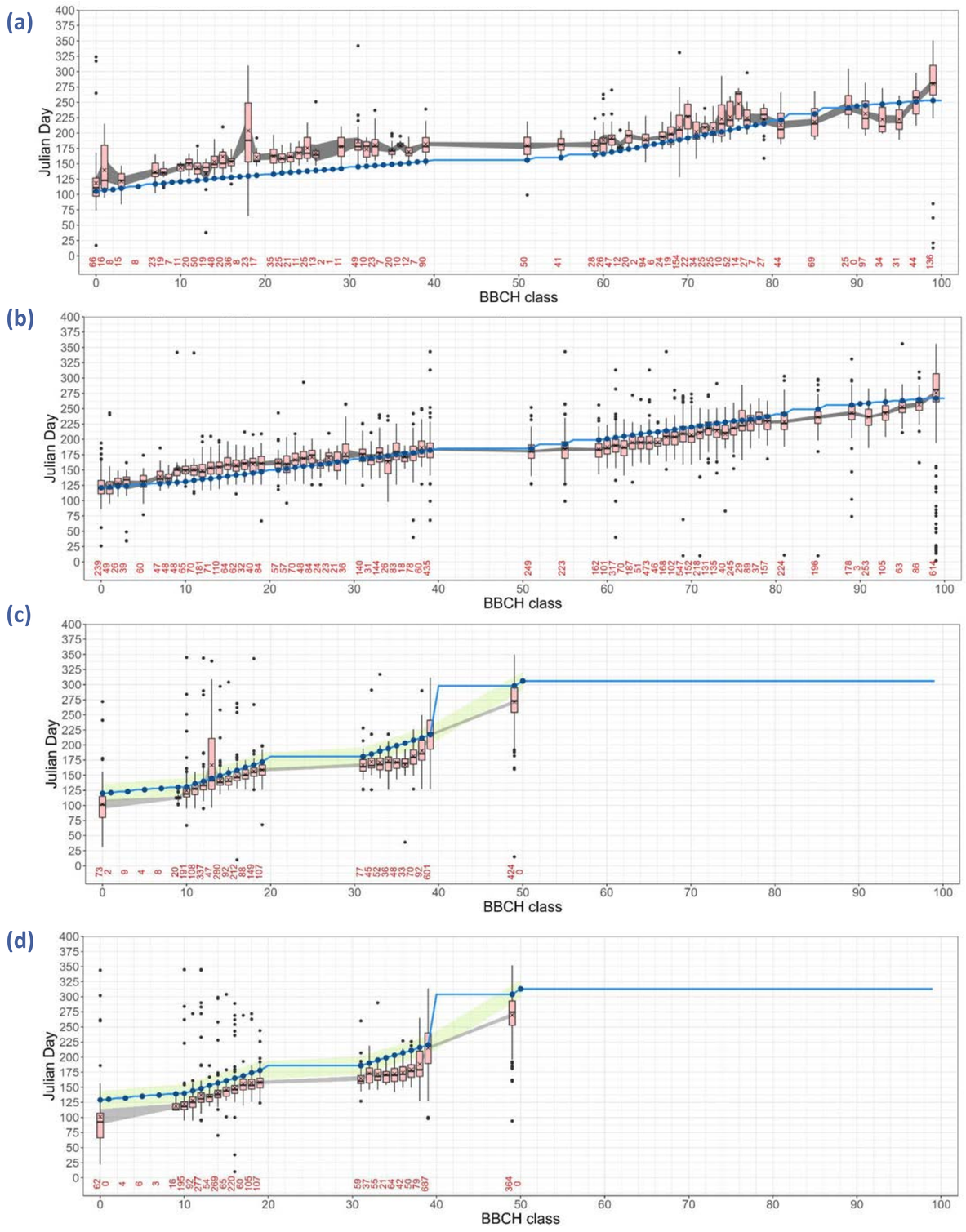

Figure 2: Example plots comparing the AppDate BBCH growth stages (blue dots = recognised growth stages) for potatoes for FOCUSgw (a) Châteaudun and (b) Hamburg scenarios as well as for sugar beet for FOCUSsw (c) D3 and (d) D4 scenarios. Grey band represents the 90 percent confidence interval of the mean (cross).

CONCLUSIONS AND NEXT STEPS

There is a regulatory need for crop development dates to assess current default values used within chemical exposure assessments as well as to justify refinements within risk assessments. The developed C2D2 database is well aligned with this regulatory requirement. A full description of the data harmonisation and results for combinable crops has been submitted for publication, expected later in 2023, at which time C2D2 will be made freely available under a Creative Commons type licence to facilitate innovation in exposure science to allow for more accurate and realistic risk assessment leading to enhanced crop and environmental protection.

References:
1 Klein, M., 2018. Estimation of consistent application dates dependent on BBCH crop development stages for FOCUS models. Fraunhofer IME Schmallenberg. 42pp.
2 Templ, B., Koch, E., Bolmgren, K., Ungersböck, M., Paul, A., Scheifinger, H., et al. (2018). Pan European Phenological database (PEP725): a single point of access for European data. Int. J. Biometeorology. doi: 10.1007/s00484-018-1512-8