Toxicophenomic assessment of the combined effect of metsulfuron-methyl exposure and deficit irrigation on *Sinapis arvensis*

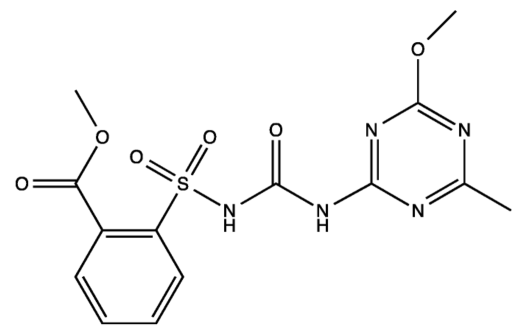
Valentine Guzniczak[1,2], Signe M. Jensen[1]
[1]Copenhagen University
[2]vg@plen.ku.dk

INTRODUCTION

- **Climate change:** increase in frequency and intensity of droughts might affect herbicide performance → adapt risk assessment
- **Toxicophenomics**: acquisition of high-dimensional phenotypic data on an organism-wide scale in ecotoxicological studies → dynamically capture stress response

→ What value does toxicophenomic data add compared to other (omic) data for assessing multiple stressors?

METHODS



- **Wild mustard** (*Sinapis arvensis*)
- 3 levels of **deficit irrigation** (80%, 50% , and 30% of field capacity (FC)) (n=24 per level)
- 8 doses of **metsulfuron methyl**, LAS inhibitor herbicide (n=4 per dose per irrigation deficit level) → drift effect
- Measurements
  - **Non-destructive** through a fully automated high-throughput phenotyping platform over 28 days after spraying → graphs from last day
  - **Destructive** at the end of the 28 days
- Analysis
  - **Dose-response** analysis for all endpoints and measuring times
  - **Benchmark dose** estimation (dashed lines)

Irrigation (%FC)
30%
50%
80%

RESULTS

MULTISPECTRAL MEASUREMENT

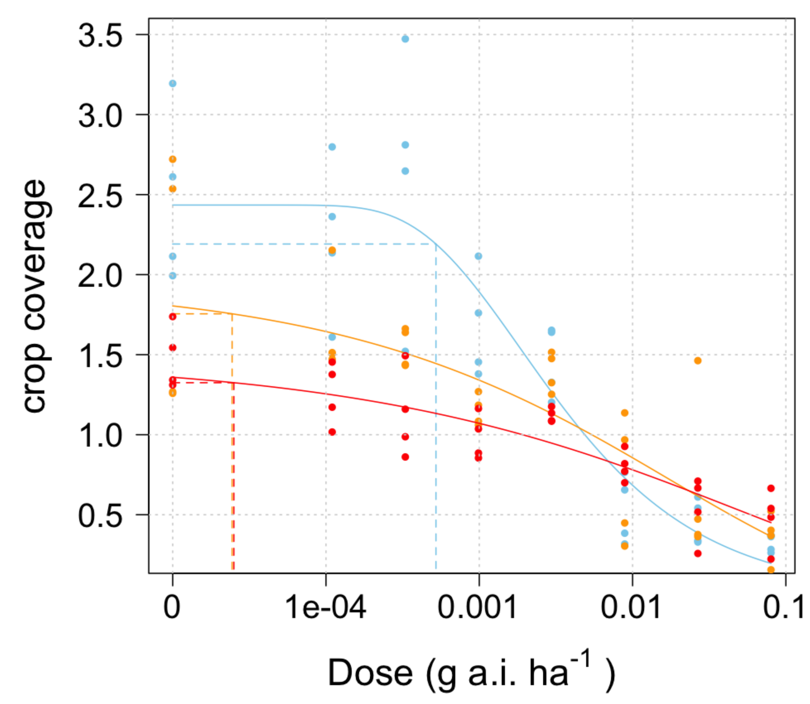


Figure 3: Crop coverage (%) as a function of dose (g a.i. ha^{-1}). W2.3, W1.3, and W1.3 models were fit to the levels 80, 50 and 30%, respectively.

POROMETER

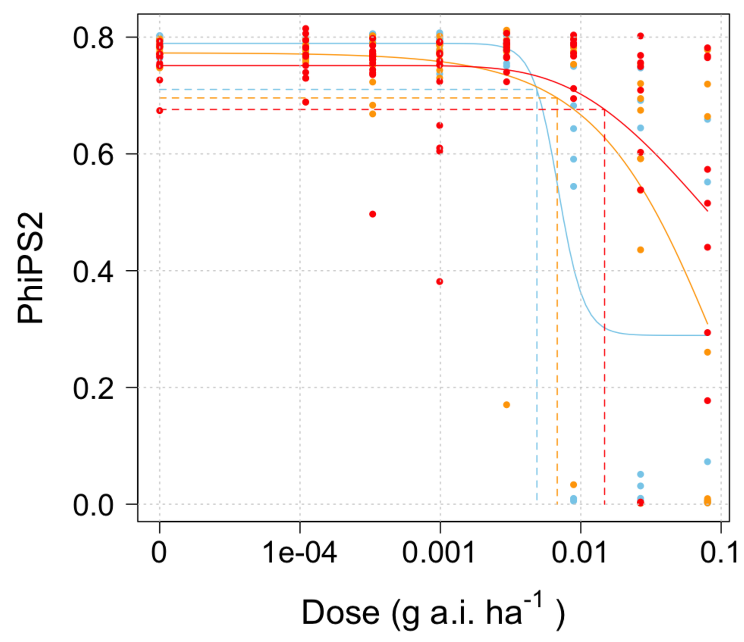


Figure 4: Quantum yield of PSII (PhiPS2) as a function of dose (g a.i. ha^{-1}). LL.4, W1.3, and W2.3 models were fit to the levels 80, 50 and 30%, respectively.

HARVEST

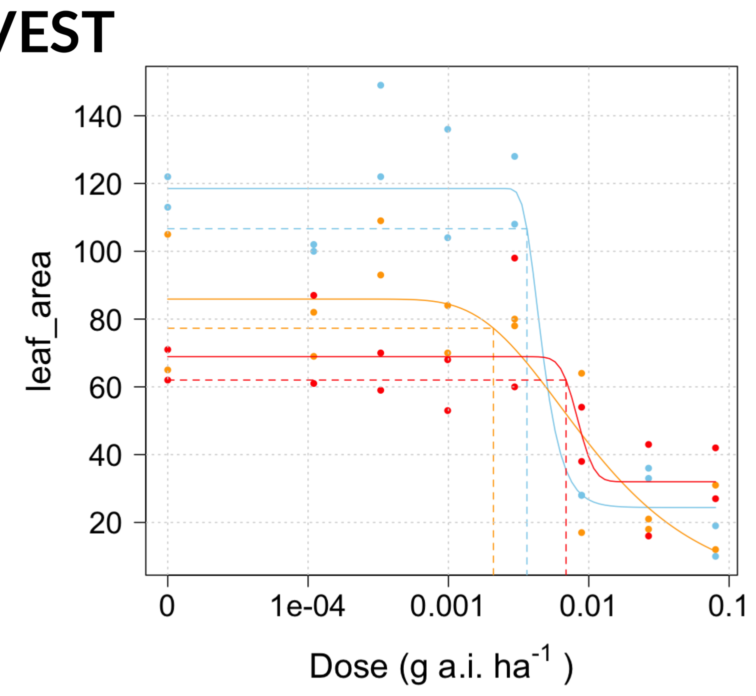


Figure 5: Leaf area (cm^2) as a function of dose (g a.i. ha^{-1}). W2.4, W2.3, and LN.4 models were fit to the levels 80, 50 and 30%, respectively.

BENCHMARK DOSE

The benchmark dose (BMD) is the dose resulting in a small prespecified change (benchmark response, BMR), from the background level.

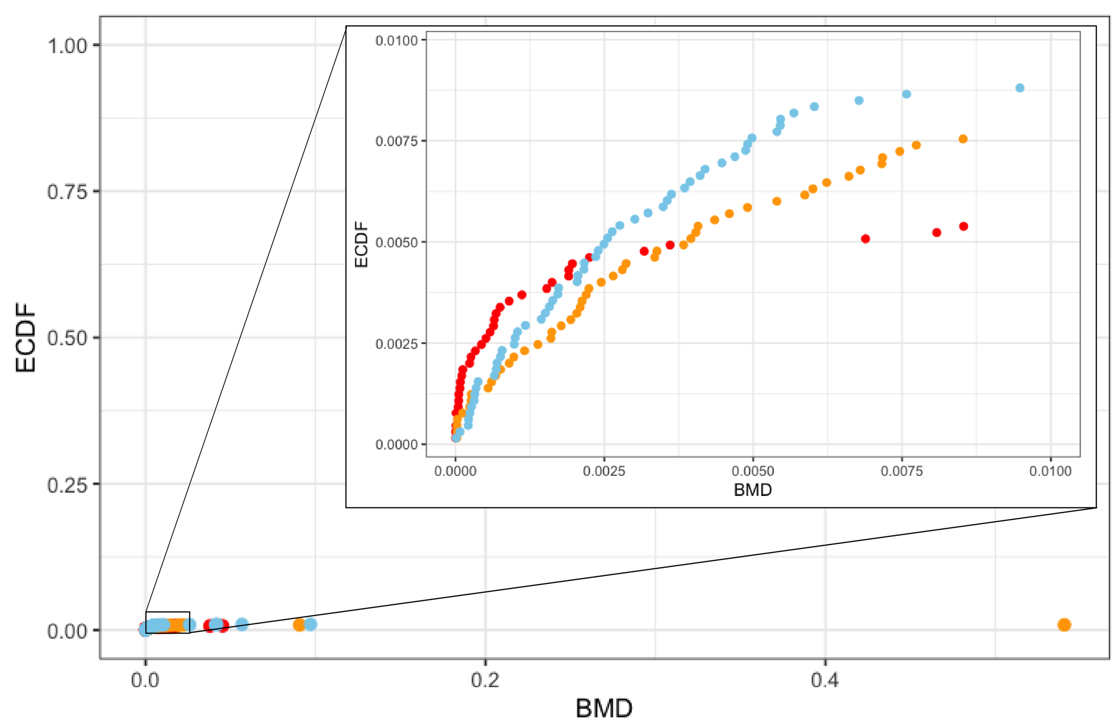


Figure 7: Empirical cumulative distribution function (ECDF) of the benchmark doses (BMD, g a.i. ha^{-1}) for all days combined.

PIGMENT CONTENT *Optical sensor*

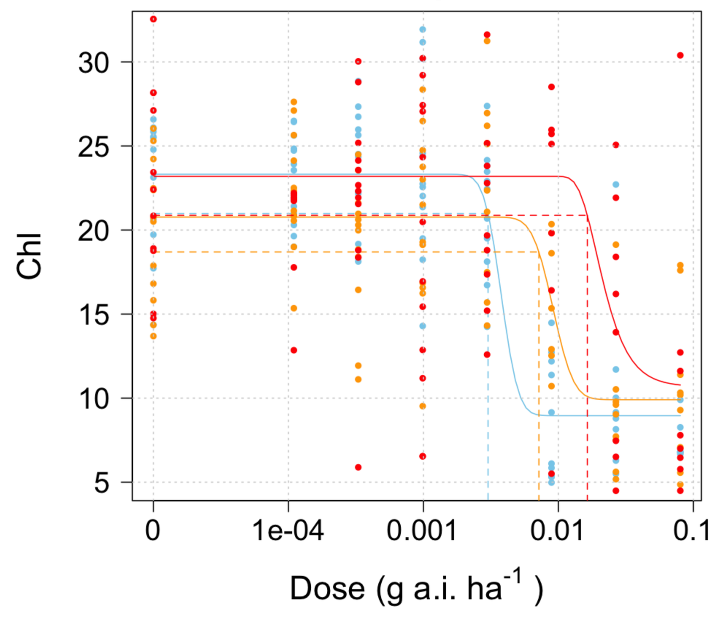


Figure 6: Chlorophyll content (µg/cm²) as a function of dose (g a.i. ha^{-1}). LN.4, LN.4, and W1.4 models were fit to the levels 80, 50 and 30%, respectively.

PIGMENT CONTENT *LC-UV*

- **Next step**: LC with UV detection to analyze pigment content in samples obtained during destructive harvest at the end of the experiment,
- Compare it to other data

→ Multi-omics

UNIVERSITY OF COPENHAGEN
DEPARTMENT OF PLANT AND ENVIRONMENTAL SCIENCES

This work was supported by the Novo Nordisk Foundation

Scan the QR-code to connect with our research group