

## **Supplementary material**

### **Soil degradation of metazachlor and quizalofop-*p*-ethyl herbicides on TLC-plates under natural solar light and dark conditions**

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**Table S1.** F-test fitting criteria for the models used to describe the degradation kinetics of metazachlor under solar light and dark conditions.

Soil type	Treatment	Kinetic model comparison (F-test <sup>a</sup> )	
		SFO vs DFOP <sup>b</sup>	SFO vs FOMC <sup>b</sup>
Loamy	Darkness (days)	6.727 E-6 (1): SFO	5.771 (0.047): SFO
	Sunlight (days) <sup>c</sup>	1.071 E-6 (1): SFO	0.002 (0.961): SFO
	Sunlight (kW/m <sup>2</sup> ) <sup>d</sup>	2.352 E-9 (1): SFO	0.011 (0.920): SFO
Silty loam	Darkness (days)	4.813 E-7 (1): SFO	0.001 (0.970): SFO
	Sunlight (days) <sup>c</sup>	5.438 E-8 (1): SFO	1.567 E-4 (0.990): SFO
	Sunlight (kW/m <sup>2</sup> ) <sup>d</sup>	9.822 (0.013): SFO	7.472 (0.029): SFO
Silty clay loam	Darkness (days)	3.088 E-13 (1): SFO	0.236 (0.642): SFO
	Sunlight (days) <sup>c</sup>	5.223 E-7 (1): SFO	0.002 (0.964): SFO
	Sunlight (kW/m <sup>2</sup> ) <sup>d</sup>	4.369 E-9 (1): SFO	0.063 (0.808): SFO

<sup>a</sup>F-test values at 0.05 significant level; Prob>F values in parenthesis

<sup>b</sup>SFO: Simple First Order – DFOP: Double First Order in Parallel – FOMC: First Order Multi Compartment

<sup>c</sup> Degradation under sunlight in relation to exposure days (one exposure day corresponds to 10 hours of solar light irradiation)

<sup>d</sup> Degradation under sunlight in relation to sunlight irradiation intensity (kW/m<sup>2</sup>)

**Table S2.** F-test fitting criteria for the models used to describe the degradation kinetics of quizalofop-*p*-ethyl under solar light and dark conditions.

Soil type	Treatment	Kinetic model comparison (F-test <sup>a</sup> )		
		SFO vs DFOP <sup>b</sup>	SFO vs FOMC <sup>b</sup>	DFOP vs FOMC <sup>b</sup>
<b>Quizalofop-<i>p</i>-ethyl</b>				
Loamy	Darkness (days)	25.34 (0.001): DFOP		4.695 (0.073): FOMC
	Sunlight (days) <sup>c</sup>	8.829 (0.016): DFOP		1.568 (0.257): FOMC
	Sunlight (kW/m <sup>2</sup> ) <sup>d</sup>	19.24 (0.002): DFOP		1.415 (0.279): FOMC
Silty loam	Darkness (days)	68.25 (7.463 E-5): DFOP		19.07 (0.004): DFOP
	Sunlight (days) <sup>c</sup>	12.19 (0.008): DFOP		1.035 (0.348): FOMC
	Sunlight (kW/m <sup>2</sup> ) <sup>d</sup>	3.460 (0.100): SFO	9.155 (0.019): FOMC	
Silty clay loam	Darkness (days)	36.85 (4.265 E-4): DFOP		6.768 (0.041): DFOP
	Sunlight (days) <sup>c</sup>	1.393 (0.318): SFO	0.093 (0.769): SFO	
	Sunlight (kW/m <sup>2</sup> ) <sup>d</sup>	1.392 E-7 (1): SFO	0.039 (0.849): SFO	

<sup>a</sup>F-test values at 0.05 significant level; Prob>F values in parenthesis

<sup>b</sup> SFO: Simple First Order – DFOP: Double First Order in Parallel – FOMC: First Order Multi Compartment

<sup>c</sup> Degradation under sunlight in relation to exposure days (one exposure day corresponds to 10 hours of solar light irradiation)

<sup>d</sup> Degradation under sunlight in relation to the sunlight irradiation intensity (kW/m<sup>2</sup>)

**Table S3.** Equations, optimized parameters and half-life (DT<sub>50</sub>) for the models used to describe the degradation kinetics of quizalofop-*p*-ethyl under solar light and dark conditions.

Kinetic model	Equations	Parameters	Darkness		Sunlight		
			L <sup>a</sup>	SL <sup>a</sup>	Soil type SCL <sup>a</sup>	L <sup>a</sup>	SL <sup>a</sup>
SFO <sup>b</sup>	$C(t) = C_0 \exp(-kt)$	$C_0^c$ (µg g <sup>-1</sup> )					1.01
	$DT_{50}(\text{days}) = \ln(2)/k$	$k^d$ (days <sup>-1</sup> )					0.705
		$R^2_{adj.}$					0.987
		$DT_{50}$ (days)					1.0
DFOP <sup>b</sup>	iterative procedure	$C(t) = C_1 \exp(-k_1 t) + C_2 \exp(-k_2 t)$		0.45	0.47		
		$C_1^c$ (µg g <sup>-1</sup> )		0.57	0.54		
		$C_2^c$ (µg g <sup>-1</sup> )		-0.005	0.005		
		$k_1^d$ (days <sup>-1</sup> )		0.803	0.732		
		$k_2^d$ (days <sup>-1</sup> )		0.975	0.945		
		$R^2_{adj.}$		3.0	3.5		
FOMC <sup>b</sup>	$C(t) = C_0 / ((t/\beta) + 1)^\alpha$	$C_0^c$ (µg g <sup>-1</sup> )	1.03			1.01	1.00
		$\alpha^e$	0.427			1.147	1.143
		$\beta^e$	0.713			1.023	0.946
		$R^2_{adj.}$	0.943			0.980	0.989
		$DT_{50}$ (days)	2.9			0.6	0.8

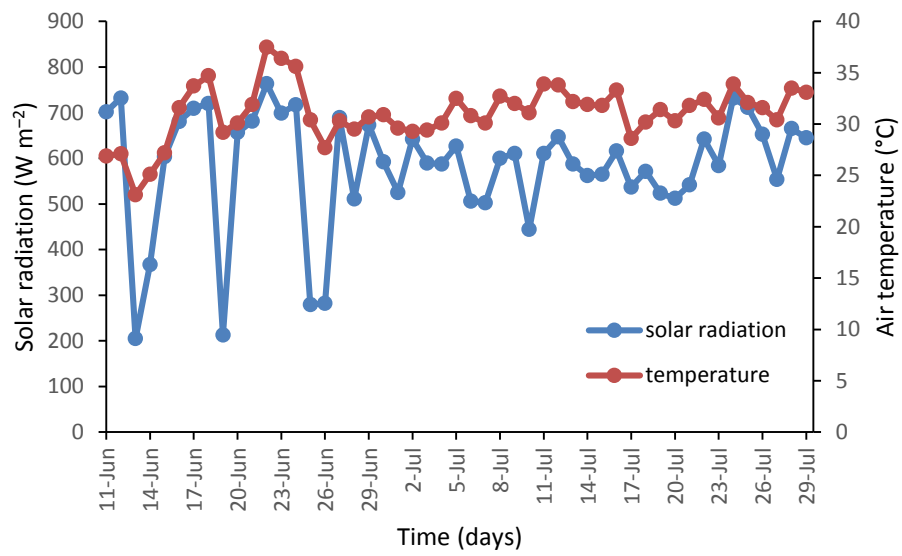
<sup>a</sup>L: Loamy – SL: Silty loam – CL: Clay loam

<sup>b</sup> SFO: Simple First Order; DFOP: Double First Order in Parallel; FOMC: First Order Multi Compartment

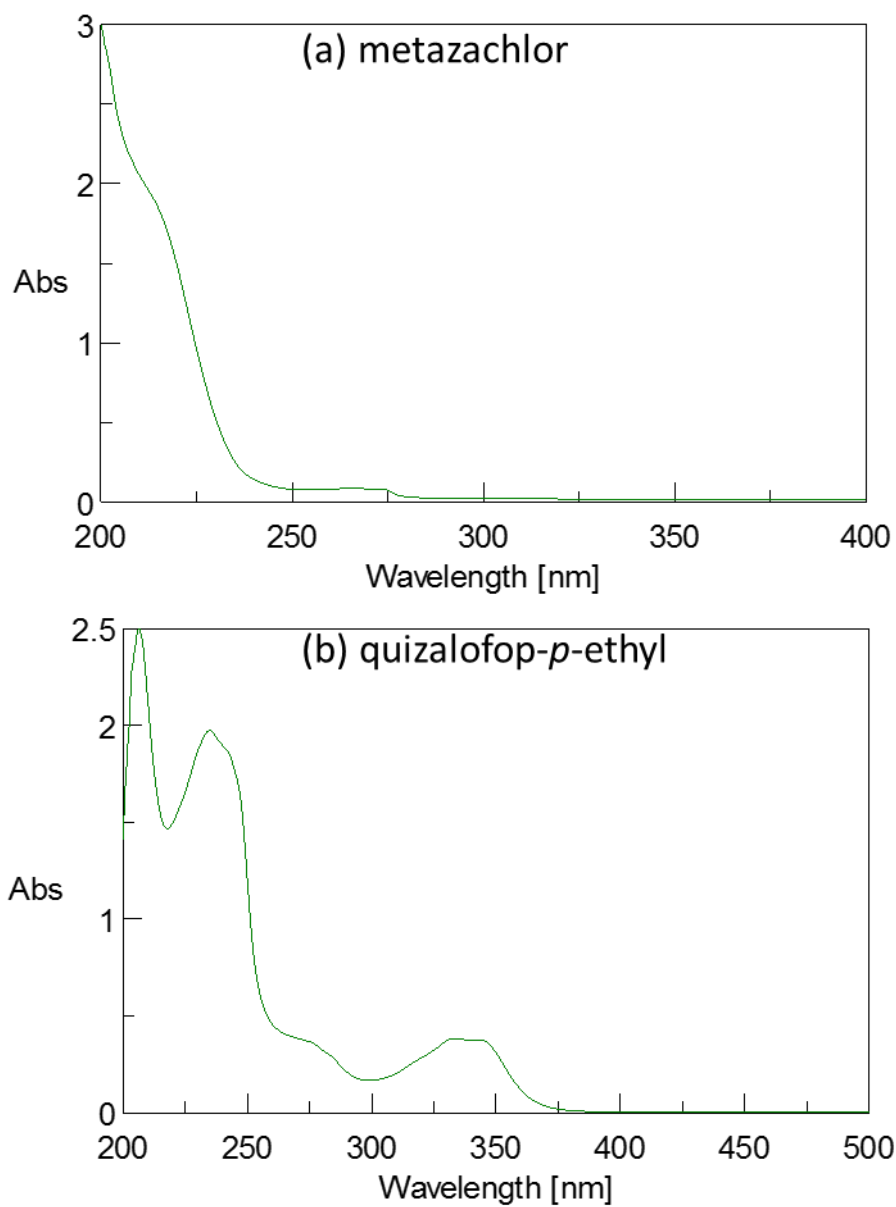
<sup>c</sup> $C_0, C_1, C_2$ : initial concentrations

<sup>d</sup> $k, k_1, k_2$ : rate constants

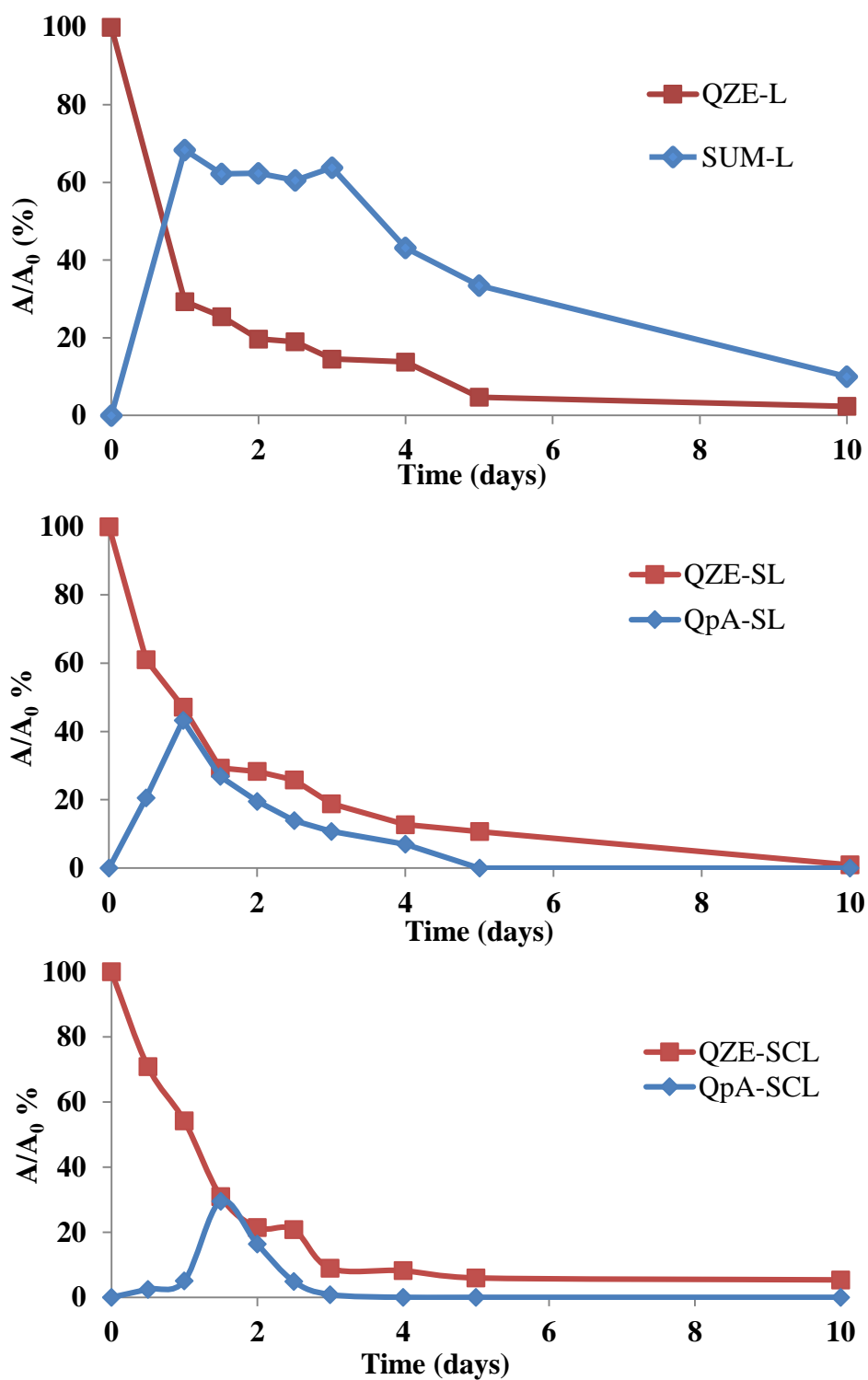
<sup>e</sup> $\alpha, \beta$ : constants



**Fig. S1.** Daily average solar radiation ( $\text{W m}^{-2}$ ) and air temperature ( $^{\circ}\text{C}$ ) during the experimental period.



**Fig. S2.** UV-vis spectra of (a) metazachlor and (b) quizalofop-*p*-ethyl.



**Fig. S3.** Profiles of the degradation of QZE and the formation of QZE degradation products (sum of the identified products by LC-TOF-MS) in the studied soils under sunlight conditions.