Supplementary Material

Estimating Half-Lives for Pesticide Dissipation from Plants

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S-1 Deriving activation energy, Q_{10} temperature coefficient and Arrhenius temperature correction factor from temperature regression estimate

S-1a Temperature regression estimate

We start from the simplified linear model in eq 1 (main text) to estimate from the difference of reported temperatures T (K) and reference temperature $T_{\text{ref}} = 293.16\,\text{K}$ (20 °C) a set of 1030 dissipation half-lives[1] of pesticides in plants, *HL* (day), and yield a fitted temperature estimate of $\beta_T^\circ = -1.995\times10^{-2}\ \text{K}^{-1}$:

$$\log HL_T = \log HL_{T_{\text{ref}}} + \beta_T^\circ \times (T - T_{\text{ref}}) \tag{S-1}$$

S-1b Activation energy and evaluation of non-linearity effect

To evaluate the non-linear effect of temperature, the Arrhenius equation expresses that the ratio of rate constants, k_T and $k_{T_{\text{ref}}}$ (day^{-1}), and corresponding half-lives, HL_T and $HL_{T_{\text{ref}}}$ (day) are proportional to the following function of activation energy, E_a (kJ/mol), and molar gas constant, $R = 8.314\times10^{-3}$ kJ/mol/K:

$$\frac{k_T}{k_{T_{\text{ref}}}} = \frac{HL_{T_{\text{ref}}}}{HL_T} = \frac{\exp\left(\frac{-E_a}{R\times T}\right)}{\exp\left(\frac{-E_a}{R\times T_{\text{ref}}}\right)} = \exp\left[-\frac{E_a}{R}\times\left(\frac{1}{T}-\frac{1}{T_{\text{ref}}}\right)\right] = \exp\left[\frac{E_a}{R}\times\left(\frac{T-T_{\text{ref}}}{T\times T_{\text{ref}}}\right)\right] \tag{S-2}$$

When solving eq S-2 for HL_T in log scale, we obtain the following non-linear equation:

$$\log HL_T = \log HL_{T_{\text{ref}}} + \left[\frac{E_a}{R}\times\left(\frac{1}{T}-\frac{1}{T_{\text{ref}}}\right)\right] \tag{S-3}$$

When plotting the temperature term in eq S-3 as a function of the temperature term in eq S-1 over the range $273.16\,\text{K}\,(0\,°\text{C}) \le T \le 313.16\,\text{K}\,(40\,°\text{C})$, with $T - T_{\text{ref}} = 0\,\text{K}$ for $T_{\text{ref}} = 293.16\,\text{K}$ (20 °C), we can show that the non-linear effect of temperature is negligible in the considered temperature range (Figure S1).

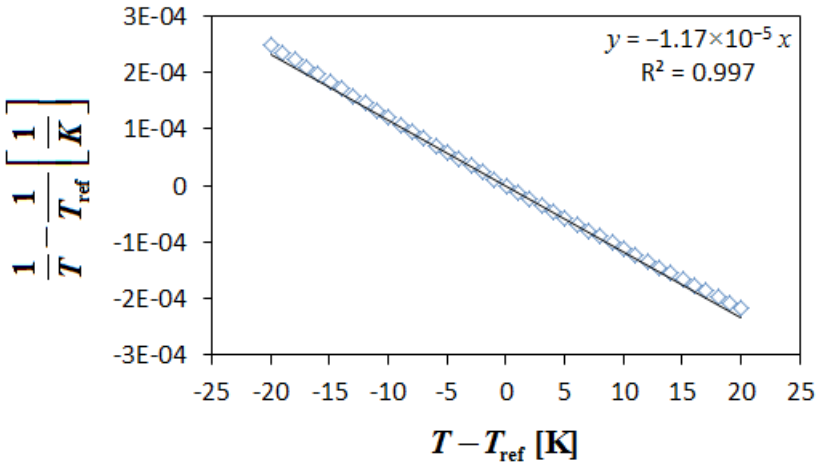

Figure S1. Comparison of temperature terms in linear and non-linear models for estimating dissipation half-lives in plants.

The limits of the temperature range for fitting β_T° (K^{-1}) were chosen according to the fact that most enzymes lose their activity when frozen, i.e. below $0\,°C$ (lower limit), and become denatured at temperatures above $40\,°C$ (upper limit).[2,3]

Comparing eq S-1 with eq S-3, we can relate activation energy E_a to β_T° as:

$$\beta_T^\circ \times (T - T_{\text{ref}}) = \frac{E_a}{R} \times \left(\frac{1}{T} - \frac{1}{T_{\text{ref}}} \right) \tag{S-4}$$

where the left side corrects for the influence of temperature in our linear model and the right side corrects for temperature effects in the non-linear model. We can solve eq S-4 for E_a and obtain the activation energy for dissipation of pesticides in plants as a function of β_T°:

$$\begin{aligned} E_a &= \beta_T^\circ \times R \times \frac{T - T_{\text{ref}}}{\frac{1}{T} - \frac{1}{T_{\text{ref}}}} = \beta_T^\circ \times R \times \frac{T - T_{\text{ref}}}{\frac{T_{\text{ref}}}{T \times T_{\text{ref}}} - \frac{T}{T_{\text{ref}} \times T}} = -\beta_T^\circ \times R \times (T \times T_{\text{ref}}) \\ &= 1.995 \times 10^{-2}\ \text{K}^{-1} \times 8.314 \times 10^{-3}\ \text{kJ/mol/K} \times (293.2\ \text{K} \times 293.2\ \text{K}) = 14.25\ \text{kJ/mol} \end{aligned} \tag{S-5}$$

S-1c Q_{10} temperature coefficient

Next, our parameter estimate for temperature β_T° can be linked through E_a to the often used temperature coefficient for pesticide dissipation, Q_{10}.[4] By definition, Q_{10} is the

multiplicative factor representing the increase in rate constant $k_{T_{\mathrm{ref}}}$ and corresponding decrease in half-life $HL_{T_{\mathrm{ref}}}$ (see eq S-2) for a temperature increase of $\Delta T = T - T_{ref} = 10\,\mathrm{K}$, with what we obtain:

$$Q_{10} = \frac{k_{T_{\mathrm{ref}}+\Delta T}}{k_{T_{\mathrm{ref}}}} = \frac{HL_{T_{\mathrm{ref}}}}{HL_{T_{\mathrm{ref}}+\Delta T}} = \exp\left(\frac{E_a}{R} \times \frac{\Delta T}{T \times T_{\mathrm{ref}}}\right) = \exp\left(\frac{-\beta_T^{\circ} \times R \times (T \times T_{\mathrm{ref}})}{R} \times \frac{\Delta T}{T \times T_{\mathrm{ref}}}\right) \quad \text{(S-6)}$$
$$= \exp(-\beta_T^{\circ} \times \Delta T) = \exp(1.995 \times 10^{-2}\ \mathrm{K}^{-1} \times 10\,\mathrm{K}) = 1.22$$

where E_a is substituted by eq S-5 and Q_{10} is interpreted as a factor of 1.22 by which the pesticide dissipation half-life in plants changes for a change of temperature by 10 K.

S-1d Arrhenius temperature correction factor

Another modified Arrhenius function is commonly found in risk and impact assessment models to relate the difference in dissipation rate constants k_T and $k_{T_{\mathrm{ref}}}$ (see eq S-2) at temperatures T and T_{ref}, respectively:[5,6]

$$\frac{k_T}{k_{T_{\mathrm{ref}}}} = cf_T^{\,(T - T_{\mathrm{ref}})} \quad \text{(S-7)}$$

According to eq S-2, this ratio is also equal to:

$$\frac{k_T}{k_{T_{\mathrm{ref}}}} = \exp\left[\frac{E_a}{R} \times \left(\frac{T - T_{\mathrm{ref}}}{T \times T_{\mathrm{ref}}}\right)\right] = \exp\left(\frac{E_a}{R \times (T \times T_{\mathrm{ref}})}\right)^{(T - T_{\mathrm{ref}})} \quad \text{(S-8)}$$

And, thus, the dimensionless Arrhenius temperature correction factor cf_T is obtained by substituting eq S-8 into eq S-7 and further substituting E_a by eq S-5:

$$cf_T = \exp\left(\frac{E_a}{R \times (T \times T_{\mathrm{ref}})}\right) = \exp\left(\frac{-\beta_T^{\circ} \times R \times (T \times T_{\mathrm{ref}})}{R \times (T \times T_{\mathrm{ref}})}\right) = \exp(-\beta_T^{\circ}) \quad \text{(S-9)}$$
$$= \exp(1.995 \times 10^{-2}\ \mathrm{K}^{-1}) = 1.020$$

All measures, $\beta_T^{\circ}, E_a, Q_{10}$, and cf_T, can finally be used in different models to correct estimated dissipation half-lives of pesticides in plants for the influence of temperature.

S-2 Optimal temperature ranges for plants

To arrive at meaningful estimates of plant-specific temperatures as basis for imputing missing (not reported) temperature data, we first obtained from different sources[7-9] the optimal temperature range for growing each plant and calculated the mean value. The mean optimal temperature per plant is then compared with the mean over all temperatures reported in Fantke and Juraske (2013)[1] for the same plant (Figure S2).

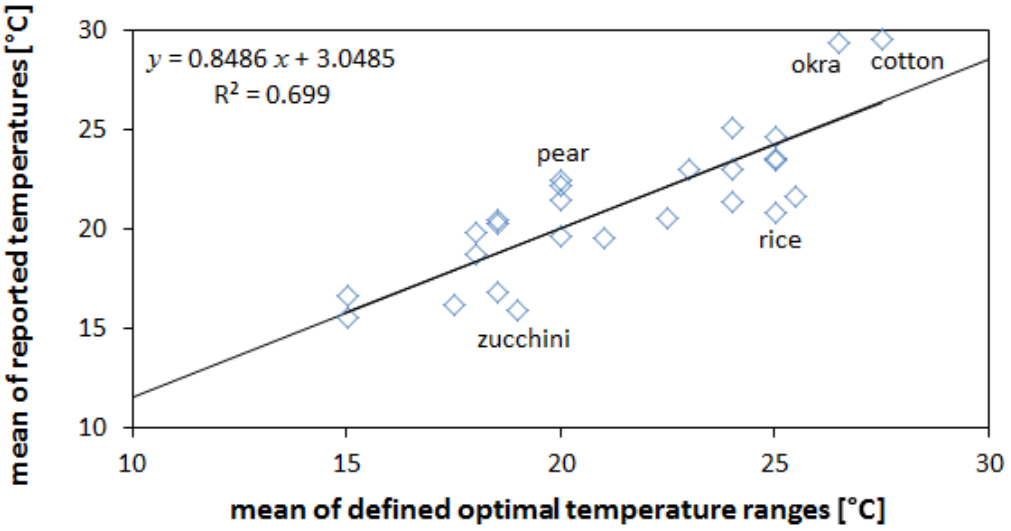

Figure S2. Comparison of means of temperatures as reported in Fantke and Juraske (2013)[1] with means of optimal temperature ranges for plants with $n \geq 20$ reported half-lives and $n \geq 10$ reported temperatures under field conditions.

Means of optimal average air temperature ranges are fitted on means of reported average air temperatures and finally base temperatures are defined for all plants, i.e. temperature estimates that are used as starting point to impute air temperatures for which no reported values are available. Base temperatures for plants with data meeting the criteria of $n \geq 20$ half-lives and $n \geq 10$ average field condition air temperatures at the sampled components (e.g. leaves) per plant are taken from the mean of reported average air temperatures, while base temperatures for plants not meeting the criteria are obtained from the corrected mean of optimal air temperatures. Means of optimal air temperature ranges and of

reported air temperatures, reported data points, and base temperature for each plant are summarized in Table S1.

Table S1. Information for individual plants regarding plant class, optimal air temperature range with minimum, $T_{min}^{optimal}$ (°C), maximum, $T_{max}^{optimal}$ (°C), and calculated arithmetic mean $T_{mean}^{optimal}$ (°C), number of reported data points, n_{HL}, reported average air temperatures, n_T, and different references per total number of reported temperatures, n_{ref_T}, for each plant, mean over reported temperatures per plant $T_{mean}^{reported}$ (°C), and base temperature T_{base} (°C).

plant		optimal air temperature (°C)			reported data				T_{base} (°C)
species	class	$T_{min}^{optimal}$	$T_{max}^{optimal}$	$T_{mean}^{optimal}$	n_{HL}	n_T	n_{ref_T}	$T_{mean}^{reported}$ (°C)	
(A) Plants with $n_{HL} \geq 20$ and $n_T \geq 10$: T_{base} equals mean of reported average air temperatures									
alfalfa	weeds	15	25	20.0	70	19	4	19.7	19.7
apple	fruits	15	25	20.0	173	23	5	21.4	21.4
cabbage	leafy crops	15	22	18.5	113	28	8	20.2	20.2
Chinese cabbage	leafy crops	15	22	18.5	57	31	4	20.4	20.4
cotton	other	25	30	27.5	179	94	1	29.6	29.6
cucumber	vegetables	18	24	21.0	83	10	4	19.6	19.6
eggplant	vegetables	21	27	24.0	130	42	7	21.4	21.4
elm	forest trees	15	20	17.5	32	32	2	16.1	16.1
grape	fruits	20	28	24.0	340	96	19	23.0	23.0
grass	weeds	15	35	25.0	32	10	1	24.6	24.6
green bean	vegetables	15	21	18.0	86	22	4	18.7	18.7
mango	fruits	22	28	25.0	36	10	2	23.4	23.4
okra	vegetables	23	30	26.5	63	12	2	29.3	29.3
olive	fruits	10	20	15.0	26	13	5	15.5	15.5
onion	root crops	12	24	18.0	49	11	2	19.8	19.8
orange	fruits	21	30	25.5	160	32	9	21.6	21.6
peach	fruits	22	28	25.0	126	31	5	23.5	23.5
pear	fruits	15	25	20.0	57	13	4	22.4	22.4
pepper fruit	vegetables	21	24	22.5	96	43	8	20.5	20.5
rice	cereals	20	30	25.0	135	36	10	20.8	20.8
strawberry	fruits	10	27	18.5	83	33	4	16.8	16.8
tea	leafy crops	18	28	23.0	192	26	4	23.0	23.0
tomato	vegetables	21	27	24.0	323	36	11	25.0	25.0
wheat	cereals	15	25	20.0	91	12	5	22.2	22.2
white spruce	forest trees	10	20	15.0	42	27	4	16.6	16.6
zucchini	vegetables	15	23	19.0	22	12	1	15.9	15.9
(B) Plants with $n_{HL} < 20$ and/or $n_T < 10$: T_{base} equals mean of fitted optimal air temperature ranges									
apricot	fruits	18	25	21.5	11	7	2	22.5	21.3
artichoke	vegetables	15	18	16.5	16	11	1	10.7	17.1
balsam poplar	forest trees	10	22	16.0	1	1	1	16.5	16.6
beet	root crops	15	18	16.5	6	4	1	24.3	17.1
beggarweed	ornamentals	20	35	27.5	2	1	1	28.0	26.4
blueberry	fruits	10	25	17.5	5	1	1	19.5	17.9
brown sarson	vegetables	15	18	16.5	1	1	1	13.5	17.1
cauliflower	vegetables	15	18	16.5	59	9	2	19.7	17.1
celery	root crops	15	18	16.5	30	3	1	17.8	17.1
chard	leafy crops	15	18	16.5	6	4	1	18.3	17.1
cherry	fruits	20	28	24.0	11	4	1	21.2	23.4
chickpea	vegetables	15	20	17.5	44	4	2	16.5	17.9
chilli	vegetables	21	29	25.0	78	7	1	25.0	24.3
Chinese broccoli	leafy crops	15	18	16.5	3	3	1	19.5	17.1

plant		optimal air temperature (°C)			reported data				T_{base} (°C)
species	class	$T_{min}^{optimal}$	$T_{max}^{optimal}$	$T_{mean}^{optimal}$	n_{HL}	n_T	n_{ref_T}	$T_{mean}^{reported}$ (°C)	
cleavers	herbs	10	25	17.5	1	1	1	18.0	17.9
clementine	fruits	23	34	28.5	7	7	1	11.0	27.2
cockspur grass	weeds	15	30	22.5	2	2	2	21.5	22.1
collards	leafy crops	15	18	16.5	17	11	1	15.0	17.1
Douglas fir	forest trees	10	22	16.0	4	1	1	12.5	16.6
endive	leafy crops	15	25	20.0	14	1	1	29.8	20.0
grapefruit	fruits	23	34	28.5	32	1	1	18.9	27.2
green ash	forest trees	15	25	20.0	2	2	1	15.8	20.0
green onion	root crops	12	24	18.0	17	4	2	18.0	18.3
guava	fruits	23	34	28.5	15	7	2	26.3	27.2
hemp-nettle	weeds	10	25	17.5	1	1	1	18.0	17.9
kaki fruit	fruits	18	28	23.0	3	2	1	20.3	22.6
lemon	fruits	23	34	28.5	61	9	5	19.5	27.2
lettuce	leafy crops	15	18	16.5	112	7	3	19.0	17.1
lima bean	vegetables	15	21	18.0	9	3	1	22.0	18.3
maize	cereals	15	24	19.5	47	2	1	24.6	19.6
marigold	ornamentals	15	25	20.0	3	3	1	16.5	20.0
mint	herbs	15	25	20.0	8	2	1	19.0	20.0
mustard	herbs	15	18	16.5	54	7	4	17.6	17.1
nectarine	fruits	23	34	28.5	11	7	1	20.8	27.2
Norway maple	forest trees	15	25	20.0	3	3	1	20.6	20.0
orchard grass	weeds	15	25	20.0	3	1	1	23.1	20.0
pangola grass	weeds	15	30	22.5	3	3	1	27.0	22.1
pasture	weeds	15	25	20.0	4	2	2	25.5	20.0
pea	vegetables	15	18	16.5	7	4	1	18.0	17.1
peanut	root crops	23	32	27.5	19	9	2	25.3	26.4
Perilla	herbs	15	30	22.5	3	3	1	28.0	22.1
potato	root crops	15	18	16.5	60	8	3	24.8	17.1
radish	root crops	15	18	16.5	8	4	1	14.9	17.1
redroot pigweed	leafy crops	15	25	20.0	1	1	1	28.0	20.0
roses	ornamentals	20	30	25.0	5	2	1	24.4	24.3
rutabaga	root crops	16	23	19.5	5	5	1	20.0	19.6
sicklepod	vegetables	20	35	27.5	2	1	1	28.0	26.4
smart weed	ornamentals	15	25	20.0	1	1	1	18.0	20.0
snow pea	vegetables	10	20	15.0	3	3	1	16.3	15.8
soybean	vegetables	25	30	27.5	40	1	1	28.0	26.4
spruce	forest trees	10	20	15.0	13	12	1	10.7	15.8
sugar beet	root crops	15	20	17.5	29	7	2	16.3	17.9
sunflower	ornamentals	15	25	20.0	7	2	1	19.0	20.0
tangerine	fruits	23	34	28.5	3	1	1	18.9	27.2
temple	fruits	23	34	28.5	1	1	1	18.9	27.2
timothy grass	weeds	15	30	22.5	1	1	1	23.1	22.1
tobacco	leafy crops	25	30	27.5	41	2	1	26.3	26.4
turfgrass	ornamentals	12	20	16.0	65	3	2	10.8	16.6
turnip	root crops	15	18	16.5	9	6	1	17.6	17.1
watermelon	fruits	21	29	25.0	11	2	1	16.5	24.3
white ash	forest trees	15	25	20.0	1	1	1	15.8	20.0
wolfberry	fruits	15	25	20.0	5	1	1	20.0	20.0
(C) Plants with $n_{HL} \geq 1$, but $n_T = 0$: T_{base} equals mean of fitted optimal air temperature ranges									
African eggplant	vegetables	21	29	25.0	2	–	–	–	24.3
amaranth	cereals	15	24	19.5	1	–	–	–	19.6
asparagus	root crops	15	30	22.5	2	–	–	–	22.1
aspen	forest trees	10	25	17.5	1	–	–	–	17.9
aster scaber	ornamentals	15	25	20.0	4	–	–	–	20.0
azalea	ornamentals	20	30	25.0	1	–	–	–	24.3
balsam fir	forest trees	10	22	16.0	39	–	–	–	16.6
bamboo	forest trees	20	30	25.0	1	–	–	–	24.3
banana	fruits	25	30	27.5	19	–	–	–	26.4

plant		optimal air temperature (°C)			reported data				T_{base} (°C)
species	class	$T_{min}^{optimal}$	$T_{max}^{optimal}$	$T_{mean}^{optimal}$	n_{HL}	n_T	n_{ref_T}	$T_{mean}^{reported}$ (°C)	
barley	cereals	15	20	17.5	6	–	–	–	17.9
ber	fruits	23	34	28.5	8	–	–	–	27.2
betel	herbs	23	34	28.5	4	–	–	–	27.2
birdsfoot trefoil	weeds	15	25	20.0	5	–	–	–	20.0
black grass	weeds	10	20	15.0	3	–	–	–	15.8
black-currant	fruits	10	25	17.5	1	–	–	–	17.9
boysenberry	fruits	15	25	20.0	3	–	–	–	20.0
broccoli	vegetables	15	18	16.5	14	–	–	–	17.1
brussel sprout	vegetables	15	18	16.5	1	–	–	–	17.1
camomile	herbs	10	25	17.5	3	–	–	–	17.9
cardamom	cereals	20	30	25.0	4	–	–	–	24.3
carnation	ornamentals	20	35	27.5	13	–	–	–	26.4
carob	ornamentals	20	35	27.5	2	–	–	–	26.4
carrot	root crops	15	18	16.5	9	–	–	–	17.1
chicory	leafy crops	15	20	17.5	3	–	–	–	17.9
chrysanthemum	ornamentals	15	25	20.0	17	–	–	–	20.0
clover	weeds	10	20	15.0	7	–	–	–	15.8
coastal bermuda grass	weeds	15	30	22.5	17	–	–	–	22.1
cocklebur	weeds	15	30	22.5	1	–	–	–	22.1
corn chamomile	weeds	15	20	17.5	1	–	–	–	17.9
cowpea	vegetables	20	30	25.0	14	–	–	–	24.3
cranberry	fruits	10	25	17.5	4	–	–	–	17.9
curry leaves	leafy crops	23	34	28.5	2	–	–	–	27.2
date	fruits	20	30	25.0	2	–	–	–	24.3
fenugreek	vegetables	20	30	25.0	2	–	–	–	24.3
fig	fruits	20	30	25.0	1	–	–	–	24.3
forest foliage	forest trees	15	25	20.0	7	–	–	–	20.0
garlic chives	vegetables	12	24	18.0	4	–	–	–	18.3
geranium	herbs	10	25	17.5	1	–	–	–	17.9
ginseng	root crops	15	25	20.0	9	–	–	–	20.0
gooseberry	fruits	15	25	20.0	2	–	–	–	20.0
green gram	vegetables	20	30	25.0	4	–	–	–	24.3
green mustard	herbs	15	18	16.5	9	–	–	–	17.1
greengrocery	vegetables	15	25	20.0	1	–	–	–	20.0
groundnut	herbs	25	30	27.5	4	–	–	–	26.4
honeysuckle	fruits	15	25	20.0	2	–	–	–	20.0
hops	other	15	25	20.0	10	–	–	–	20.0
jasmine flower	ornamentals	15	30	22.5	9	–	–	–	22.1
Job's tears	weeds	20	30	25.0	4	–	–	–	24.3
jujube	fruits	20	30	25.0	1	–	–	–	24.3
jute	other	20	35	27.5	6	–	–	–	26.4
kale	leafy crops	15	18	16.5	4	–	–	–	17.1
kiwi	fruits	15	30	22.5	10	–	–	–	22.1
large crabgrass	weeds	15	30	22.5	1	–	–	–	22.1
leaf vegetables	leafy crops	15	20	17.5	2	–	–	–	17.9
leek	vegetables	12	24	18.0	7	–	–	–	18.3
lime	fruits	23	34	28.5	4	–	–	–	27.2
litchi	fruits	22	34	28.0	10	–	–	–	26.8
mandarin	fruits	23	34	28.5	5	–	–	–	27.2
marjoram	herbs	20	30	25.0	2	–	–	–	24.3
mushroom	other	10	25	17.5	2	–	–	–	17.9
muskmelon	fruits	18	24	21.0	3	–	–	–	20.9
oak	forest trees	15	25	20.0	2	–	–	–	20.0
ophiopogon root	root crops	20	30	25.0	7	–	–	–	24.3
pakchoi	leafy crops	15	20	17.5	23	–	–	–	17.9
papaya	fruits	25	30	27.5	2	–	–	–	26.4
parsley	herbs	15	18	16.5	1	–	–	–	17.1
passion fruit	fruits	20	30	25.0	13	–	–	–	24.3
Persian speedwell	ornamentals	15	25	20.0	1	–	–	–	20.0

plant		optimal air temperature (°C)			reported data				T_{base} (°C)
species	class	$T_{min}^{optimal}$	$T_{max}^{optimal}$	$T_{mean}^{optimal}$	n_{HL}	n_T	n_{ref_T}	$T_{mean}^{reported}$ (°C)	
pigeon pea	vegetables	20	30	25.0	14	–	–	–	24.3
pine	forest trees	10	25	17.5	1	–	–	–	17.9
pink knotweed	ornamentals	20	30	25.0	2	–	–	–	24.3
pistachio	fruits	23	34	28.5	2	–	–	–	27.2
plum	fruits	15	25	20.0	2	–	–	–	20.0
pomegranate	fruits	23	30	26.5	48	–	–	–	25.5
ponderosa pine	forest trees	15	25	20.0	8	–	–	–	20.0
quack grass	weeds	10	20	15.0	2	–	–	–	15.8
rapeseed	vegetables	15	18	16.5	42	–	–	–	17.1
red maple	forest trees	15	25	20.0	6	–	–	–	20.0
red oak	forest trees	15	25	20.0	3	–	–	–	20.0
red raspberry	fruits	15	25	20.0	3	–	–	–	20.0
rigid ryegrass	weeds	10	25	17.5	2	–	–	–	17.9
rocket	leafy crops	15	20	17.5	1	–	–	–	17.9
royal palm	forest trees	25	30	27.5	1	–	–	–	26.4
ryegrass	weeds	10	25	17.5	13	–	–	–	17.9
sorghum	weeds	20	30	25.0	5	–	–	–	24.3
spinach	leafy crops	15	18	16.5	19	–	–	–	17.1
squash	vegetables	18	24	21.0	1	–	–	–	20.9
sugar maple	forest trees	15	25	20.0	12	–	–	–	20.0
thyme	herbs	10	25	17.5	2	–	–	–	17.9
turnip rape	vegetables	15	18	16.5	4	–	–	–	17.1
urd	vegetables	20	30	25.0	1	–	–	–	24.3
water milfoil	other	15	30	22.5	2	–	–	–	22.1
white goosefoot	weeds	15	25	20.0	1	–	–	–	20.0
white peony	ornamentals	15	30	22.5	12	–	–	–	22.1
willow	forest trees	10	25	17.5	1	–	–	–	17.9

S-3 Additional tables and figures for Model I, Model II, and Model III

Selection and significance of initial set of predictor variables. Air temperature, substance, plant species, and cold storage conditions are included in Model I to yield temperature estimate β_T° from the subset of 1030 data points with reported average air temperature. Initially, also the harvested and sampled plant components were included, but high auto-correlation was seen between certain plant species-plant component combinations, such as pesticides measured in bark sampled from different tree species. While the R^2 of Model I increased substantially by including plants as predictor variable with 18 out of 30 assessed plant-specific estimates being significant (Table S2), including plant components (e.g. leaves) as predictors did not further increase R^2 substantially and did not affect the value of β_T°. Hence, we excluded plant components from the list of predictor variables in all

models. All predictor variables and parameter estimates, standard errors and associated *p*-values as applied in Model I are listed in Table S2.

Table S2. Predictor variables with associated parameter estimates (intercept: α°, temperature: β_T° (K^{-1}), cold storage conditions: $\beta_{\text{storage}}^{\circ}$, substance: $\beta_{\text{subst},i}^{\circ}$, plant: $\beta_{\text{plant},j}^{\circ}$; in line with eq 1 in main text), standard errors *SE*, and *p*-values (variable significant, if *p*-value < 0.05) as used in the initial regression model to yield temperature estimate β_T° (Model I).

Model variable	estimate	*SE*	*p*-value
intercept	0.98	0.10	<0.0001
temperature	-0.01995	0.003	<0.0001
cold storage conditions	0.61	0.09	<0.0001
substance: 2,4,5-T	-0.09	0.36	0.8487
substance: 2,4-D	-0.28	0.22	0.2475
substance: DDT	0.22	0.16	0.1307
substance: EPN	-0.23	0.12	0.093
substance: abamectin	-0.50	0.31	0.1281
substance: acephate	0.12	0.10	0.1635
substance: acetamiprid	0.06	0.13	0.5164
substance: acrinathrin	-0.27	0.16	0.1207
substance: aldicarb	-0.34	0.35	0.3682
substance: aldrin	-0.41	0.32	0.2358
substance: alpha-endosulfan	-0.25	0.16	0.1682
substance: aminocarb	-0.03	0.17	0.992
substance: azadirachtin	-0.22	0.14	0.1579
substance: azinphos-methyl	-0.04	0.10	0.8742
substance: azoxystrobin	0.22	0.15	0.1077
substance: benomyl	-0.01	0.18	0.9427
substance: bifenthrin	-0.01	0.13	0.9222
substance: bitertanol	0.73	0.31	0.0156
substance: bromoxynil	-0.30	0.19	0.1472
substance: bromoxynil octanoate	-0.33	0.34	0.3724
substance: buprofezin	0.23	0.10	0.0149
substance: captan	-0.20	0.11	0.1052
substance: carbaryl	-0.15	0.14	0.3544
substance: carbendazim	0.35	0.17	0.0251
substance: carbofuran	-0.24	0.17	0.2075
substance: carbosulfan	-0.44	0.16	0.0106
substance: chinomethionat	-0.24	0.24	0.3672
substance: chlordimeform	-0.29	0.23	0.2438
substance: chlorfenapyr	0.42	0.31	0.1612
substance: chlorfluazuron	0.33	0.17	0.0394
substance: chlorobenzilate	0.28	0.15	0.045
substance: chlorothalonil	-0.06	0.13	0.8031
substance: chlorpyrifos	0.13	0.08	0.0685
substance: cinerin I	-0.23	0.24	0.3807
substance: cinerin II	-0.21	0.24	0.4486
substance: cyantraniliprole	0.49	0.20	0.0096
substance: cycloheximide	-0.49	0.16	0.0047
substance: cyfluthrin	-0.59	0.16	0.0003
substance: cyhalofop-butyl	0.48	0.31	0.1062
substance: cyhalothrin	0.12	0.18	0.412
substance: cypermethrin	0.09	0.09	0.1963
substance: cyprodinil	0.23	0.10	0.0149
substance: deltamethrin	-0.28	0.08	0.0021
substance: demeton	0.26	0.13	0.0284
substance: dialifos	0.36	0.31	0.221
substance: diazinon	-0.07	0.11	0.7095
substance: dicamba	-0.06	0.36	0.9182

Model variable	estimate	*SE*	*p*-value
substance: metalaxyl	0.04	0.15	0.6676
substance: metalaxyl-M	0.47	0.22	0.0271
substance: metaldehyde	-0.47	0.20	0.0265
substance: methamidophos	0.05	0.10	0.4261
substance: methidathion	-0.27	0.15	0.113
substance: methiocarb	-0.03	0.12	0.957
substance: methomyl	-0.11	0.09	0.335
substance: methoxychlor	-0.40	0.31	0.2306
substance: metolachlor	0.97	0.20	<0.0001
substance: monocrotophos	0.07	0.15	0.5114
substance: monosodium methylarsonate	-0.07	0.13	0.7427
substance: myclobutanil	0.03	0.14	0.6998
substance: oxamyl	0.01	0.23	0.89
substance: parathion	-0.26	0.08	0.0042
substance: parathion-methyl	-0.26	0.08	0.0042
substance: penconazole	-0.20	0.24	0.451
substance: pencycuron	0.02	0.17	0.8085
substance: penoxsulam	-0.28	0.20	0.1896
substance: permethrin	0.23	0.11	0.0239
substance: phenothrin	-0.24	0.23	0.3663
substance: phenthoate	-0.49	0.24	0.0524
substance: phosalone	0.46	0.31	0.119
substance: picloram	-0.15	0.36	0.7189
substance: piperonyl butoxide	0.52	0.18	0.0022
substance: pirimicarb	0.04	0.17	0.6932
substance: prochloraz	0.63	0.19	0.0005
substance: procymidone	0.77	0.15	<0.0001
substance: profenofos	-0.24	0.19	0.2644
substance: propamocarb hydrochloride	-0.42	0.31	0.2109
substance: propineb	-0.04	0.20	0.9249
substance: pymetrozine	0.00	0.32	0.9483
substance: pyraclostrobin	0.02	0.31	0.8789
substance: pyrazophos	-0.31	0.17	0.0831
substance: pyrethrin I	-0.47	0.18	0.0118
substance: pyrethrin II	-0.15	0.18	0.4658
substance: pyrethrins	-0.41	0.24	0.1099
substance: pyridaben	0.37	0.13	0.0028
substance: pyridafenthion	0.46	0.21	0.0226
substance: pyrimethanil	0.50	0.22	0.0185
substance: pyriproxyfen	1.10	0.17	<0.0001
substance: quinalphos	-0.19	0.33	0.6208
substance: quinoxyfen	0.17	0.31	0.5475
substance: quizalofop-ethyl	-0.46	0.24	0.0672
substance: rotenone	-0.25	0.25	0.3584
substance: spinosad	-0.22	0.18	0.268
substance: spiromesifen	0.41	0.20	0.0334
substance: spiroxamine	0.47	0.17	0.0041
substance: sulfosulfuron	-0.07	0.21	0.8468
substance: sulprofos	-0.35	0.15	0.0316
substance: tau-fluvalinate	-0.34	0.13	0.0201

Model variable	estimate	*SE*	*p*-value
substance: dieldrin	0.33	0.25	0.1447
substance: diethofencarb	-0.13	0.22	0.6221
substance: difenoconazole	-0.30	0.23	0.229
substance: diflubenzuron	0.01	0.16	0.8401
substance: dimethoate	-0.02	0.09	0.9292
substance: dimethomorph	-0.05	0.31	0.9269
substance: dinocap	0.31	0.23	0.1449
substance: dithianon	0.63	0.20	0.001
substance: emamectin benzoate	-0.12	0.19	0.6163
substance: endosulfan	-0.02	0.07	0.4635
substance: endrin	-0.74	0.31	0.0225
substance: epoxiconazole	0.95	0.19	<0.0001
substance: ethametsulfuron-methyl	0.20	0.15	0.1424
substance: ethion	0.26	0.23	0.2259
substance: ethofumesate	-0.41	0.31	0.2139
substance: famoxadone	-0.08	0.17	0.7224
substance: fenamidone	0.38	0.31	0.2016
substance: fenitrothion	0.25	0.10	0.008
substance: fenobucarb	0.47	0.21	0.0194
substance: fenoprop	-0.52	0.42	0.2327
substance: fenpropathrin	-0.32	0.19	0.1302
substance: fenpropimorph	-0.36	0.22	0.1396
substance: fenthion	-0.11	0.16	0.5999
substance: fenthion sulfoxide	0.49	0.20	0.0091
substance: fenvalerate	0.03	0.09	0.5463
substance: florasulam	-0.59	0.17	0.0007
substance: fluazinam	-0.04	0.31	0.9669
substance: flucythrinate	0.38	0.23	0.0734
substance: fludioxonil	0.21	0.11	0.0359
substance: flufenoxuron	0.59	0.25	0.0162
substance: folpet	0.10	0.11	0.2612
substance: forchlorfenuron	-0.41	0.16	0.0198
substance: heptachlor	-0.66	0.32	0.0507
substance: hexaflumuron	-0.13	0.17	0.5218
substance: imazalil	0.01	0.16	0.8439
substance: imazethapyr	0.74	0.15	<0.0001
substance: imidacloprid	0.05	0.10	0.4635
substance: imidaclothiz	0.39	0.25	0.0953
substance: indoxacarb	-0.13	0.17	0.549
substance: iprodione	0.25	0.15	0.0646
substance: jasmolin II	0.05	0.24	0.7558
substance: kresoxim-methyl	0.17	0.31	0.5282
substance: lambda-cyhalothrin	-0.09	0.14	0.6184
substance: lindane	-0.06	0.15	0.834
substance: malathion	-0.16	0.08	0.0946
substance: mancozeb	0.03	0.11	0.6222
substance: mepanipyrim	0.44	0.31	0.1436
substance: meptyldinocap	-0.02	0.22	0.993
substance: tebuconazole	0.51	0.15	0.0006
substance: tebufenozide	0.58	0.09	<0.0001
substance: tebufenpyrad	0.04	0.22	0.7778
substance: teflubenzuron	0.45	0.25	0.06
substance: tetraconazole	0.14	0.13	0.2244
substance: thiacloprid	0.37	0.13	0.0035
substance: tolylfluanid	0.04	0.18	0.7065
substance: toxaphene	0.03	0.15	0.707
substance: tralomethrin	0.59	0.17	0.0003
substance: triadimefon	0.21	0.17	0.1694
substance: triadimenol	0.23	0.24	0.2907
substance: trichlorfon	-0.11	0.23	0.7133
substance: trifloxystrobin	0.10	0.31	0.6988
substance: triflumuron	0.74	0.18	<0.0001
substance: vinclozolin	-0.24	0.09	0.0214
substance: zineb	0.54	0.31	0.0728
substance: ziram	0.48	0.31	0.1081
plant: alfalfa	0.04	0.11	0.197
plant: apple	0.27	0.09	0.319
plant: cabbage	-0.13	0.09	0.0008
plant: cauliflower	-0.07	0.13	0.0579
plant: Chinese cabbage	0.02	0.08	0.0559
plant: cotton	-0.18	0.07	<0.0001
plant: cucumber	0.05	0.12	0.3279
plant: eggplant	0.07	0.08	0.1748
plant: elm	0.05	0.11	0.2667
plant: grape	0.18	0.06	0.0014
plant: grass	0.54	0.29	0.2099
plant: green bean	-0.34	0.11	<0.0001
plant: lemon	0.23	0.11	0.6292
plant: lettuce	-0.42	0.11	<0.0001
plant: mango	-0.08	0.19	0.1724
plant: okra	0.07	0.11	0.3521
plant: olive	0.17	0.12	0.9333
plant: onion	-0.17	0.18	0.0507
plant: orange	0.24	0.10	0.5554
plant: peach	0.24	0.10	0.4926
plant: pear	-0.08	0.12	0.0398
plant: pepper fruit	-0.07	0.08	0.0012
plant: potato	-0.27	0.17	0.0076
plant: rice	-0.21	0.12	0.0013
plant: strawberry	0.15	0.09	0.7689
plant: tea	-0.08	0.13	0.0538
plant: tomato	-0.08	0.08	0.0014
plant: wheat	0.04	0.15	0.3387
plant: white spruce	0.36	0.12	0.1477
plant: zucchini	-0.66	0.12	<0.0001
plant: other plants*	-0.05	0.06	0.0003

*Plants with $n < 8$ reported temperatures.

Model to estimate reference half-lives. Substance, plant species, and cold storage conditions are included in Model II to yield geometric means of half-lives for 333 pesticides applied to an average plant (i.e. average of 30 plant parameter estimates) under reference conditions as recommended for use in risk and impact assessment. Parameter estimates for all predictor variables and associated *p*-values as applied in Model II are listed in Table S3.

Table S3. Predictor variables with associated parameter estimates (intercept: $\alpha^{\bullet}$, cold storage conditions: $\beta^{\bullet}_{\text{storage}}$, substance: $\beta^{\bullet}_{\text{subst},i}$, plant: $\beta^{\bullet}_{\text{plant},j}$; in line with eq 5 in main text), standard errors *SE*, and *p*-values (variable significant, if *p*-value < 0.05) as used in the regression model to estimate recommended dissipation half-lives for 333 reported substances (Model II).

Model variable	estimate	*SE*	*p*-value
intercept	0.595	0.04	<0.0001
cold storage conditions	0.66	0.06	<0.0001
substance: 2,4,5-T	0.40	0.21	0.0457
substance: 2,4-D	-0.13	0.12	0.3187
substance: 2,4-D-dimethylammonium	-0.25	0.18	0.1839
substance: 3-hydroxycarbofuran	0.40	0.14	0.003
substance: abamectin	-0.01	0.06	0.9973
substance: acephate	0.07	0.05	0.1124
substance: acetamiprid	0.16	0.06	0.005
substance: acetochlor	-0.33	0.18	0.0765
substance: acrinathrin	-0.12	0.13	0.4277
substance: aldicarb	0.19	0.09	0.0194
substance: aldoxycarb	0.42	0.12	0.0003
substance: aldrin	-0.30	0.32	0.381
substance: alpha-cypermethrin	0.12	0.11	0.2485
substance: alpha-endosulfan	-0.37	0.10	0.0004
substance: aminocarb	0.04	0.12	0.6423
substance: amitraz	-0.01	0.24	0.9906
substance: anabasine	-0.51	0.16	0.0026
substance: anilofos	-0.20	0.16	0.2282
substance: aramite	-0.22	0.17	0.236
substance: azadirachtin	-0.39	0.06	<0.0001
substance: azimsulfuron	-0.07	0.20	0.7806
substance: azinphos-methyl	0.05	0.06	0.2181
substance: azoxystrobin	-0.05	0.06	0.5862
substance: benalaxyl	-0.24	0.10	0.0275
substance: bendiocarb	0.16	0.11	0.1003
substance: benfuracarb	0.07	0.24	0.7182
substance: benodanil	0.25	0.11	0.0208
substance: benomyl	0.03	0.14	0.7214
substance: beta-cypermethrin	0.11	0.19	0.5216
substance: bifenthrin	-0.07	0.05	0.3314
substance: bitertanol	0.09	0.12	0.346
substance: boscalid	0.23	0.14	0.0794
substance: bromomethane	0.63	0.23	0.0056
substance: bromopropylate	0.01	0.11	0.8393
substance: bromoxynil	-0.30	0.19	0.1277
substance: bromoxynil octanoate	-0.14	0.17	0.4481
substance: buprofezin	0.21	0.07	0.0017
substance: cadusafos	0.77	0.17	<0.0001
substance: captan	0.05	0.07	0.3036
substance: carbaryl	0.01	0.05	0.6053
substance: carbendazim	0.17	0.06	0.0039
substance: carbofuran	0.07	0.07	0.2015
substance: carbophenothion	-0.02	0.09	0.9671
substance: carbosulfan	-0.27	0.08	0.0011
substance: carfentrazone-ethyl	0.20	0.24	0.3542
substance: chinomethionat	-0.04	0.23	0.9068
substance: chlorantraniliprole	-0.07	0.13	0.6893
substance: chlordane	0.16	0.20	0.3699
substance: chlordimeform	-0.64	0.15	<0.0001
substance: chlorfenapyr	-0.07	0.12	0.6649
substance: chlorfenson	-0.15	0.33	0.6743
substance: chlorfenvinphos	0.41	0.17	0.0135
substance: chlorfluazuron	0.13	0.10	0.1617
substance: chlorimuron	0.15	0.20	0.4034
substance: chlormequat	0.19	0.17	0.2375
substance: chlorobenzilate	0.22	0.10	0.0195
substance: chloroneb	0.63	0.15	<0.0001

Model variable	estimate	*SE*	*p*-value
substance: imazethapyr	0.60	0.13	<0.0001
substance: imidacloprid	-0.03	0.04	0.7494
substance: imidaclothiz	0.12	0.19	0.4956
substance: indoxacarb	-0.12	0.10	0.3064
substance: iodosulfuron-methyl-sodium	0.14	0.24	0.5124
substance: iprodione	0.24	0.06	<0.0001
substance: iprovalicarb	0.38	0.14	0.0044
substance: isazofos	0.22	0.12	0.0481
substance: isocarbophos	-0.21	0.10	0.0637
substance: isofenphos	-0.02	0.17	0.9697
substance: isoproturon	0.14	0.20	0.4396
substance: isoxaben	0.18	0.17	0.2583
substance: jasmolin II	-0.05	0.23	0.8802
substance: kresoxim-methyl	0.27	0.10	0.0031
substance: lambda-cyhalothrin	-0.14	0.07	0.0703
substance: leptophos	0.24	0.09	0.0068
substance: lindane	-0.03	0.08	0.8481
substance: lufenuron	0.33	0.12	0.0034
substance: malathion	-0.20	0.04	<0.0001
substance: mancozeb	0.08	0.06	0.1578
substance: mandipropamid	-0.06	0.20	0.8324
substance: maneb	0.06	0.10	0.4472
substance: MCPA	-0.01	0.11	0.9328
substance: mecarbam	-0.07	0.10	0.5819
substance: mecoprop	-0.01	0.17	0.9584
substance: mepanipyrim	0.19	0.19	0.2946
substance: mepronil	-0.18	0.15	0.2826
substance: meptyldinocap	-0.13	0.13	0.3898
substance: mesotrione	-0.54	0.23	0.0244
substance: metalaxyl	0.17	0.08	0.0158
substance: metalaxyl-M	-0.02	0.09	0.9308
substance: metaldehyde	-0.23	0.13	0.0965
substance: methamidophos	0.13	0.05	0.0076
substance: methidathion	-0.14	0.08	0.137
substance: methiocarb	-0.03	0.09	0.8739
substance: methomyl	-0.29	0.04	<0.0001
substance: methoprene	-0.32	0.17	0.0695
substance: methoxychlor	-0.09	0.23	0.7411
substance: methoxyfenozide	0.24	0.23	0.2753
substance: metolachlor	0.70	0.14	<0.0001
substance: metsulfuron-methyl	0.16	0.19	0.3568
substance: mevinphos	-0.59	0.10	<0.0001
substance: mexacarbate	-0.40	0.07	<0.0001
substance: milbemectin	0.49	0.17	0.0033
substance: monocrotophos	-0.06	0.08	0.6064
substance: monosodium methylarsonate	-0.12	0.12	0.3663
substance: myclobutanil	0.04	0.06	0.3297
substance: nicosulfuron	-0.79	0.24	0.0014
substance: nicotine	-0.19	0.11	0.1135
substance: norflurazon	0.30	0.13	0.0126
substance: nornicotine	-0.26	0.19	0.211
substance: novaluron	-0.26	0.10	0.0126
substance: oxadiazon	-0.21	0.17	0.2493
substance: oxamyl	-0.01	0.19	0.9906
substance: oxaziclomefone	0.09	0.24	0.6652
substance: oxydemeton-methyl	0.05	0.33	0.8408
substance: oxyfluorfen	-0.49	0.17	0.0055
substance: paclobutrazol	-0.38	0.11	0.0009
substance: parathion	-0.15	0.05	0.0038

Model variable	estimate	*SE*	*p*-value
substance: chlorothalonil	0.10	0.06	0.0297
substance: chlorphoxim	-0.48	0.33	0.1573
substance: chlorpyrifos	0.01	0.04	0.613
substance: chlorpyrifos-methyl	-0.08	0.08	0.3945
substance: chlorsulfuron	-1.12	0.23	<0.0001
substance: chlozolinate	0.30	0.14	0.0244
substance: cinerin I	-0.33	0.23	0.1662
substance: cinerin II	-0.31	0.23	0.2073
substance: clopyralid	0.02	0.16	0.8214
substance: clothianidin	0.32	0.13	0.0073
substance: cyanazine	-0.07	0.15	0.7229
substance: cyanofenphos	0.65	0.34	0.0495
substance: cyanophos	-0.43	0.33	0.2038
substance: cyantraniliprole	0.44	0.19	0.0161
substance: cyazofamid	0.32	0.20	0.0906
substance: cycloheximide	-0.55	0.16	0.0011
substance: cycloprate	0.32	0.16	0.0327
substance: cyfluthrin	-0.22	0.06	0.0003
substance: cyhalofop-butyl	0.10	0.23	0.6131
substance: cyhalothrin	0.08	0.07	0.1591
substance: cymoxanil	-0.39	0.24	0.1247
substance: cypermethrin	0.03	0.05	0.3307
substance: cyproconazole	0.20	0.15	0.146
substance: cyprodinil	0.16	0.07	0.0076
substance: cyromazine	0.74	0.17	<0.0001
substance: dalapon	0.89	0.24	0.0002
substance: DDT	0.44	0.07	<0.0001
substance: deltamethrin	-0.02	0.05	0.9125
substance: demeton	0.29	0.10	0.0032
substance: desmethylformamide pirimicarb	-0.46	0.24	0.0605
substance: diafenthiuron	-0.04	0.12	0.8134
substance: dialifos	0.58	0.11	<0.0001
substance: diazinon	-0.26	0.07	0.0004
substance: dicamba	0.20	0.17	0.1988
substance: dichlofluanid	0.40	0.14	0.0029
substance: dichlorvos	-0.55	0.11	<0.0001
substance: diclofop-methyl	-0.41	0.24	0.0915
substance: dicloran	0.78	0.14	<0.0001
substance: dicofol	-0.06	0.09	0.6216
substance: dieldrin	0.11	0.10	0.2091
substance: diethofencarb	-0.19	0.23	0.4431
substance: difenoconazole	0.11	0.06	0.0545
substance: diflubenzuron	0.39	0.10	<0.0001
substance: dimefox	0.52	0.13	<0.0001
substance: dimetachlone	0.24	0.17	0.1332
substance: dimethoate	-0.04	0.04	0.6047
substance: dimethomorph	0.12	0.12	0.2817
substance: diniconazole	0.03	0.15	0.7522
substance: dinocap	0.32	0.14	0.0164
substance: dinotefuran	0.41	0.19	0.0268
substance: dioctyldiethylenetriamine	0.39	0.17	0.0174
substance: dioxabenzophos	-0.46	0.23	0.0584
substance: dioxathion	-0.15	0.17	0.4455
substance: dithianon	0.47	0.19	0.0104
substance: dithiopyr	0.11	0.17	0.4635
substance: dodine	-0.07	0.15	0.7015
substance: emamectin benzoate	-0.33	0.13	0.0131
substance: endosulfan	-0.01	0.04	0.7494
substance: endosulfan sulfate	-0.03	0.19	0.9456
substance: endrin	-0.20	0.19	0.3299
substance: EPN	-0.19	0.10	0.0779
substance: epoxiconazole	0.53	0.11	<0.0001
substance: esfenvalerate	-0.39	0.17	0.0246
substance: ethametsulfuron-methyl	0.14	0.15	0.2887
substance: ethion	-0.02	0.08	0.9467
substance: ethirimol	0.10	0.34	0.721
substance: ethofumesate	-0.18	0.23	0.4825

Model variable	estimate	*SE*	*p*-value
substance: parathion-methyl	-0.39	0.06	<0.0001
substance: penconazole	0.31	0.10	0.0006
substance: pencycuron	-0.13	0.14	0.4074
substance: pendimethalin	0.23	0.09	0.0058
substance: penoxsulam	-0.40	0.19	0.0408
substance: pentachloroaniline	0.66	0.15	<0.0001
substance: permethrin	0.17	0.07	0.0097
substance: phenazine-1-carboxylic acid	0.02	0.17	0.8426
substance: phenothrin	0.10	0.15	0.46
substance: phenthoate	0.02	0.11	0.7543
substance: phorate	0.22	0.12	0.0524
substance: phosalone	0.08	0.10	0.3709
substance: phosmet	-0.27	0.10	0.0073
substance: phosphamidon	0.00	0.12	0.8825
substance: phoxim	-0.39	0.13	0.004
substance: picloram	0.25	0.17	0.1287
substance: piperonyl butoxide	0.42	0.15	0.0033
substance: pirimicarb	0.06	0.08	0.3507
substance: pirimiphos-methyl	-0.26	0.08	0.0028
substance: probenazole	-0.22	0.24	0.3985
substance: prochloraz	0.17	0.12	0.1248
substance: procymidone	0.40	0.09	<0.0001
substance: profenofos	-0.24	0.05	<0.0001
substance: propamocarb hydrochloride	-0.56	0.32	0.0922
substance: propargite	-0.02	0.12	0.9722
substance: propiconazole	0.14	0.08	0.0504
substance: propineb	-0.05	0.07	0.5983
substance: propisochlor	-0.13	0.14	0.4321
substance: propoxur	-0.68	0.19	0.0005
substance: pymetrozine	-0.13	0.11	0.2962
substance: pyraclostrobin	0.00	0.17	0.9496
substance: pyrazophos	0.07	0.11	0.4432
substance: pyrethrin I	-0.57	0.15	0.0002
substance: pyrethrin II	-0.25	0.15	0.1099
substance: pyrethrins	-1.27	0.17	<0.0001
substance: pyribenzoxim	0.18	0.20	0.3365
substance: pyridaben	0.09	0.09	0.2426
substance: pyridafenthion	0.31	0.19	0.0892
substance: pyrimethanil	0.13	0.08	0.0656
substance: pyriproxyfen	0.84	0.14	<0.0001
substance: pyroxsulam	-0.58	0.14	<0.0001
substance: quinalphos	-0.20	0.08	0.0144
substance: quinclorac	-0.06	0.15	0.7602
substance: quinoxyfen	0.18	0.32	0.5369
substance: quintozene	0.57	0.10	<0.0001
substance: quizalofop-ethyl	-0.48	0.17	0.0061
substance: quizalofop-P-tefuryl	-0.63	0.17	0.0003
substance: rimsulfuron	-0.72	0.13	<0.0001
substance: rotenone	-0.28	0.14	0.0544
substance: schradan	0.30	0.17	0.0572
substance: s-metolachlor	0.39	0.14	0.0039
substance: spinosad	0.05	0.07	0.3761
substance: spiromesifen	-0.16	0.08	0.0596
substance: spiroxamine	0.41	0.15	0.0039
substance: sulfometuron-methyl	0.20	0.23	0.3675
substance: sulfosulfuron	0.05	0.17	0.7042
substance: sulfotep	-0.37	0.23	0.1273
substance: sulprofos	-0.48	0.14	0.0007
substance: tau-fluvalinate	-0.32	0.13	0.015
substance: tebuconazole	0.29	0.08	0.0003
substance: tebufenozide	0.65	0.07	<0.0001
substance: tebufenpyrad	0.11	0.17	0.4456
substance: teflubenzuron	0.73	0.17	<0.0001
substance: tepraloxydim	-0.06	0.24	0.852
substance: tetraconazole	0.13	0.08	0.0794
substance: tetradifon	0.19	0.17	0.212
substance: thiacloprid	-0.02	0.06	0.9371

Model variable	estimate	*SE*	*p*-value
substance: ethylenethiourea	0.33	0.17	0.0444
substance: ethylicin	-0.19	0.13	0.1702
substance: etofenprox	-0.18	0.14	0.2465
substance: etoxazole	-0.02	0.15	0.9765
substance: famoxadone	0.16	0.11	0.1143
substance: fenamidone	0.26	0.17	0.0988
substance: fenamiphos	0.23	0.17	0.1437
substance: fenarimol	0.16	0.33	0.6022
substance: fenazaquin	-0.02	0.09	0.9289
substance: fenbuconazole	0.29	0.19	0.1054
substance: fenhexamid	0.29	0.13	0.0168
substance: fenitrothion	-0.02	0.06	0.8853
substance: fenobucarb	0.15	0.15	0.2881
substance: fenoprop	0.01	0.25	0.9147
substance: fenoxanil	0.29	0.14	0.0243
substance: fenoxaprop-P-ethyl	-0.25	0.13	0.072
substance: fenoxycarb	0.28	0.19	0.1201
substance: fenpropathrin	-0.06	0.13	0.7427
substance: fenpropidin	0.02	0.24	0.8686
substance: fenpropimorph	-0.39	0.19	0.0438
substance: fenpyroximate	-0.42	0.17	0.0165
substance: fensulfothion	-0.14	0.23	0.5754
substance: fenthion	-0.20	0.08	0.0258
substance: fenthion sulfoxide	0.51	0.15	0.0005
substance: fenvalerate	0.08	0.05	0.0684
substance: fipronil	0.16	0.09	0.0464
substance: florasulam	-0.77	0.15	<0.0001
substance: fluazinam	-0.02	0.32	0.9906
substance: flubendiamide	-0.24	0.07	0.0021
substance: flucythrinate	0.17	0.15	0.2268
substance: fludioxonil	0.12	0.08	0.0808
substance: flufenoxuron	0.59	0.13	<0.0001
substance: fluometuron	0.02	0.14	0.8163
substance: fluopicolide	0.32	0.24	0.1588
substance: fluopyram	0.15	0.24	0.4987
substance: fluroxypyr	0.19	0.17	0.2373
substance: fluroxypyr-meptyl	-0.10	0.20	0.666
substance: flurprimidol	0.47	0.19	0.0129
substance: flusilazole	0.09	0.15	0.4712
substance: fluvalinate	-0.13	0.14	0.3966
substance: folpet	0.12	0.08	0.0987
substance: forchlorfenuron	-0.08	0.11	0.5434
substance: formothion	-0.34	0.24	0.1725
substance: glyphosate	0.00	0.09	0.8271
substance: halofenozide	0.37	0.19	0.0462
substance: halosulfuron-methyl	-0.68	0.23	0.0043
substance: haloxyfop-P-methyl	0.18	0.32	0.5455
substance: HCH	0.24	0.11	0.0169
substance: heptachlor	-0.07	0.11	0.6022
substance: hexachlorobenzene	0.45	0.13	0.0002
substance: hexaconazole	0.00	0.08	0.8195
substance: hexaflumuron	0.02	0.13	0.8103
substance: hexazinone	0.35	0.17	0.0263
substance: hymexazol	-0.04	0.16	0.8599
substance: imazalil	0.16	0.14	0.211
substance: imazapyr	0.78	0.24	0.0009
substance: imazaquin	0.43	0.13	0.0005
substance: thiamethoxam	0.00	0.12	0.8803
substance: thidiazuron	0.03	0.23	0.8643
substance: thifensulfuron-methyl	0.45	0.17	0.0052
substance: thiophanate-methyl	0.36	0.10	0.0001
substance: thiram	0.08	0.13	0.4808
substance: tolclofos-methyl	-0.34	0.08	<0.0001
substance: tolylfluanid	0.24	0.17	0.1283
substance: toxaphene	0.24	0.09	0.0066
substance: tralkoxydim	0.21	0.24	0.3608
substance: tralocythrin	-0.38	0.20	0.0647
substance: tralomethrin	0.13	0.12	0.2258
substance: triadimefon	0.05	0.07	0.3373
substance: triadimenol	0.42	0.23	0.0589
substance: triazophos	0.19	0.08	0.0098
substance: tribufos	0.19	0.13	0.1161
substance: trichlorfon	-0.16	0.08	0.0523
substance: triclopyr	-0.19	0.16	0.2868
substance: tricyclazole	0.43	0.20	0.023
substance: trifloxystrobin	-0.02	0.17	0.9535
substance: triflumuron	0.41	0.12	0.0003
substance: trifluralin	-0.17	0.12	0.1872
substance: triflusulfuron	-0.76	0.15	<0.0001
substance: triforine	0.04	0.15	0.6884
substance: vinclozolin	-0.11	0.07	0.1445
substance: zineb	0.03	0.08	0.5288
substance: ziram	0.42	0.32	0.1736
plant: alfalfa	-0.07	0.05	<0.0001
plant: apple	0.08	0.04	0.0426
plant: cabbage	-0.13	0.04	<0.0001
plant: cauliflower	-0.34	0.05	<0.0001
plant: Chinese cabbage	-0.05	0.05	<0.0001
plant: cotton	-0.09	0.04	<0.0001
plant: cucumber	-0.14	0.05	<0.0001
plant: eggplant	-0.02	0.04	<0.0001
plant: elm	0.11	0.07	0.5496
plant: grape	0.16	0.03	0.0009
plant: grass	0.10	0.09	0.5628
plant: green bean	-0.16	0.05	<0.0001
plant: lemon	0.36	0.05	0.0002
plant: lettuce	-0.19	0.05	<0.0001
plant: mango	0.03	0.07	0.052
plant: okra	-0.12	0.05	<0.0001
plant: olive	0.16	0.07	0.9506
plant: onion	-0.15	0.06	<0.0001
plant: orange	0.25	0.04	0.0174
plant: peach	0.34	0.04	<0.0001
plant: pear	0.13	0.06	0.636
plant: pepper fruit	-0.07	0.04	<0.0001
plant: potato	-0.17	0.06	<0.0001
plant: rice	-0.06	0.05	<0.0001
plant: strawberry	-0.05	0.05	<0.0001
plant: tea	-0.23	0.04	<0.0001
plant: tomato	0.06	0.03	0.0009
plant: wheat	-0.08	0.05	<0.0001
plant: white spruce	0.08	0.07	0.2408
plant: zucchini	-0.70	0.08	<0.0001
plant: other plants*	0.0016	0.03	<0.0001

*Plants with $n < 8$ reported temperatures.

Half-lives estimated without cold storage data. Half-lives obtained with Model II and presented in Table 1 (main text) differ >10% for five pesticides when excluding cold storage data points from the regression model. Half-lives estimated without cold storage data are for those pesticides presented in Table S4.

Table S4. Target Class (TC), CAS Number, Predicted Geometric Mean of Dissipation Half-Life $HL^{\bullet}_{\mathrm{ref},i}$ (day), with Lower and Upper 95% Confidence Interval Limits in Parentheses, Percent Difference to Half-Lives Estimated from All Data (Diff.), Total Number of Reported Data Points n_{HL}, and Number of Data Points with Reported Average Air Temperatures n_T for Five Pesticides where Excluding Cold Storage Data Yields >10% Difference in Estimates.

Pesticide	CAS RN	TC*	$HL^{\bullet}_{\mathrm{ref},i}$ (95% CI) (day)	Diff. (%)	n_{HL}	n_T
buprofezin	69327-76-0	Insecticide	5.60 (3.42 – 9.16)	12.91	22	11
fenthion sulfoxide	3761-41-9	Metabolite	11.35 (2.67 – 48.17)	11.69	3	1
fludioxonil	131341-86-1	Fungicide	6.24 (3.49 – 11.14)	19.09	17	7
pyriproxyfen	95737-68-1	Insecticide	16.54 (5.94 – 46.11)	39.94	4	2
triflumuron	64628-44-0	Insecticide	14.96 (5.72 – 39.12)	48.10	6	3

Comparing standard errors as a function of number of data points. In Model II, data with reported temperature are complemented by data with imputed temperatures into a combined set of 4442 half-lives. With that, we increased the root-mean-squared error by 2%, but strongly reduce the uncertainty on the geometric mean half-life per substance (Figure S3).

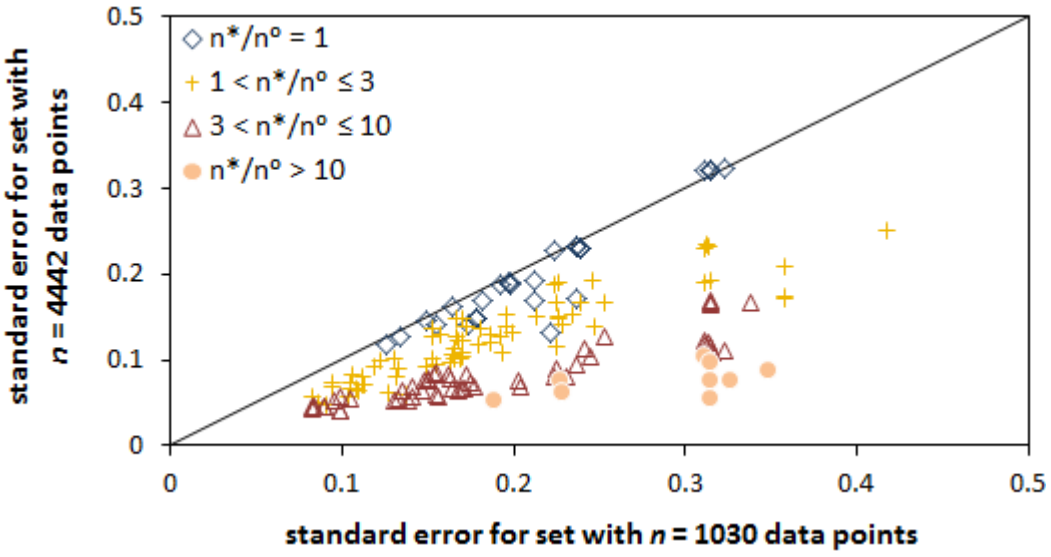

Figure S3. Comparison of standard errors of substance estimates in Model II for the subset of $n^{\circ} = 1030$ data points with reported temperatures and the combined set of $n^{\bullet} = 4442$ data points with reported and imputed temperatures disaggregated according to different ratios of number of data of the combined dataset and the subset with reported temperatures.

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