Fraction of pesticide reaching the soil.

If a pesticide is sprayed on a crop, only a fraction of the volume of the product will reach the soil. Some of the pesticide will be deposited directly onto the soil. Another part will be intercepted by the plant, some of which can be washed off, due to rain or sprinkler irrigation, and then still reach the soil (see figure).

The fraction intercepted by the crop will depend on the structure of the plant as well as its development stage (e.g. leaf area index). The fraction that is washed off depends mainly on timing and quantity of rainfall and/or overhead irrigation, as well as on the dissipation rate of the pesticide on the plant.
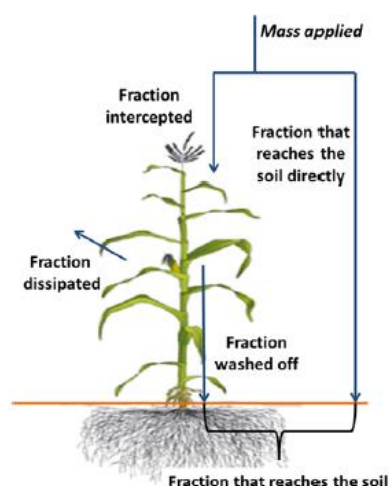

Figure: Schematic overview of the processes occurring at the crop canopy. The fraction of the dose reaching the soil is the sum of wash-off from the canopy and the fraction of the dose that reaches the soil directly (EFSA 2015)

In many soil exposure models, the fraction of pesticide reaching the soil is an input parameter which can be modified by the user of the model. In some cases, the fraction or percentage of crop interception (CI) can be entered (i.e. the fraction of the pesticide NOT reaching the soil); in other models, the fraction reaching the soil (f_{soil}) should be inputted (i.e. the inverse of crop interception). One should be aware of this difference and should **ascertain which parameter** is required in the soil exposure model which is being used!

The two models currently included in the Toolkit (*UK PEC Soil calculator* and *Dutch Ctgb PEC soil calculator*) both require the fraction (or percentage) crop interception (i.e. the fraction of the pesticide NOT reaching the soil).

If such information is not available from the registration dossier or from local research, the default values provided in the table below can be used. These are estimates of "applied pesticide not reaching the soil" provided in guidance published by the European Food Safety Authority (EFSA 2015). The estimates are based on the pesticide intercepted by the plant minus the pesticide washed off the plant. The values in the table refer to pesticides applied as a spray under field conditions and depend on the crop development stage. They are not necessarily representative of protected crops grown in greenhouses or tunnels.

As the estimates in the table have been calculated using European weather conditions, the fraction of pesticide reaching the soil in a tropical or hot semi-arid agroecosystem may well be different. However, currently no information is available about soil exposure to pesticides under such circumstances. Until locally relevant exposure estimates have been generated, it is suggested to use the European data as default. If a local crop for which a soil risk assessment needs to be done is not listed in the table, it is suggested to use the interception value of a crop with a similar structure to the local crop.

Default fractions of pesticides not reaching the soil, equivalent to "crop interception" (CI) fractions, as required in the two models currently provided in the Toolkit (based on EFSA 2015a, b)					
Crop	**Crop development stage (BBCH code)**				
Annual crops (EFSA 2015b)	*00 – 09* *Bare to emergence*	*10 – 19* *Leaf development*	*20 – 39* *Stem elongation*	*40 – 89* *flowering*	*90 – 99* *Senescence and ripening*
Beans (vegetable and field)	0.00	0.15	0.15	0.30	0.50
Cotton	0.00	0.10	0.10	0.45	0.70
Linseed	0.00	0.20	0.30	0.30	0.30
Maize	0.00	0.15	0.20	0.35	0.60
Peas	0.00	0.25	0.30	0.35	0.40
Potatoes *(EFSA 2015b)*	0.00	0.10	0.30	0.30	0.30
Oil seed rape	0.00	0.25	0.35	0.35	0.45
Soybeans	0.00	0.15	0.20	0.25	0.35
Strawberries	0.00	0.20	0.20	0.35	0.55
Sunflower	0.00	0.10	0.20	0.25	0.60
Tobacco	0.00	0.30	0.30	0.30	0.40
Tomatoes	0.00	0.20	0.20	0.30	0.30
Annual crops (EFSA 2015b)	*00 – 09* *Bare to emergence*	*10 – 19* *Leaf development*	*20 – 39* *Stem elongation*	*40 – 49* *flowering*	*50 – 99* *(harvested)*
Cabbage	0.00	0.10	0.15	0.40	0.00
Carrots	0.00	0.15	0.25	0.55	0.00
Onions	0.00	0.05	0.10	0.20	0.00
Sugar beet	0.00	0.10	0.25	0.45	0.00
Cereals (EFSA 2015b)	*00 – 19* *Bare to leaf development*	*20 – 29* *Tillering*	*30 – 39* *Stem elongation*	*40 – 69* *flowering*	*70 – 99* *Senescence and ripening*
Cereals	0.00	0.10	0.30	0.35	0.40
Permanent crops (EFSA 2015a)	*00 – 09* *Sprouting/bud development*	*10 – 69* *Leaf and shoot development, Inflorescence emergence, flowering*	*71 – 75* *Initial fruit development*	*76 – 89* *Maturity of fruit and seed*	
Pome and stone fruit	0.20	0.20	0.25	0.25	
Bush berries	0.20	0.20	0.30	0.30	
Permanent crops (EFSA 2015a)	*00 – 09* *Sprouting*	*10 – 69* *Leaf and shoot development, Inflorescence emergence, flowering*	*71 – 75* *Development of cones*	*76 – 89* *Maturity of cones*	

Default fractions of pesticides not reaching the soil, equivalent to "crop interception" (CI) fractions, as required in the two models currently provided in the Toolkit (based on EFSA 2015a, b)					
Crop	**Crop development stage (BBCH code)**				
Hops	0.20	0.25	0.25	0.25	
Permanent crops (EFSA 2015a)	*00 – 09* *Sprouting/bud development*	*11 – 13* *1st – 3rd leaves unfolded*	*14 – 19* *4th – 9th leaves unfolded*	*53 – 69* *Inflorescence emergence, flowering*	*71 – 89* *Development of fruits, ripening of berries*
Vines	0.20	0.25	0.30	0.25	0.25
Permanent crops (EFSA 2015a)	*Year round (average)*				
Citrus	0.50				
Olives	0.50				
Permanent grass	0.45				
Grass between rows	0.45				

References

EFSA (2015a) Draft EFSA Guidance Document for predicting environmental concentrations of active substances of plant protection products and transformation products of these active substances in soil. European Food Safety Authority. https://www.efsa.europa.eu/sites/default/files/consultation/160715.pdf

EFSA (2015b) EFSA Guidance Document for predicting environmental concentrations of active substances of plant protection products and transformation products of these active substances in soil. European Food Safety Authority. *EFSA Journal* 13(4): 4093. https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2015.4093

> *Note: These EFSA guidance documents provides estimates of the fraction of pesticide reaching the soil (f_{soil}). The values in the table above are the inverse of the EFSA estimates, because this is required in the two models provided in the Toolkit!*