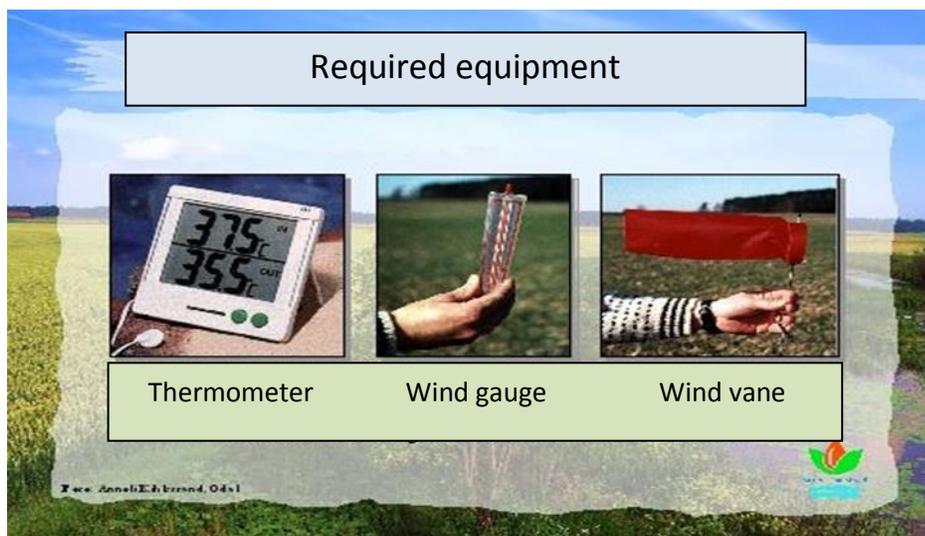


## Mitigating spray drift in Sweden



There is a general requirement in Sweden for all professional users of plant protection products to calculate and observe proper spray drift related safety distances based on local conditions. A particular Helper (Hjälpreda in Swedish) has been developed to facilitate this exercise for farmers at each spraying occasion. The objective is to mitigate spray drift in order to protect vulnerable terrestrial and aquatic compartments outside the field and in particular aquatic organisms, non-target invertebrates and plants. Users first need to measure wind direction, wind speed and temperature and together with data on dose rate, boom height, droplet size (nozzle type) they can calculate the proper safety distances needed taking into account of the sensible off-field objects being present at each spraying occasion.

These requirements are established in a national regulation issued by the Swedish EPA and can also be lay down in the authorization provisions for certain plant protection products. The EPA regulation is from 1997, but will now be revised in order to implement some elements of the Sustainable Use Directive 2009/128/EC. In addition to the general requirement to calculate and take account of spray drift there is also a requirement to use well calibrated equipment to be able to measure the local wind and temperature. For this purpose a thermometer, a wind gauge and a wind vane is required.



## The Helper

The Helper is a pamphlet in pocket size compiled in a tabular format. It is based on the following input parameters.

Input parameters	Options
Temperature	10, 15 or 20 °C
Wind speed at 2 m height	1.5 ,3 or 4.5 m/s
Dose rate	¼, ½ or full dose
Spray boom height	25, 40 or 60 cm
Spray droplet size	Fine, Medium or Coarse
Use of particular spray drift reducing techniques	50, 75 or 90 percent reduction

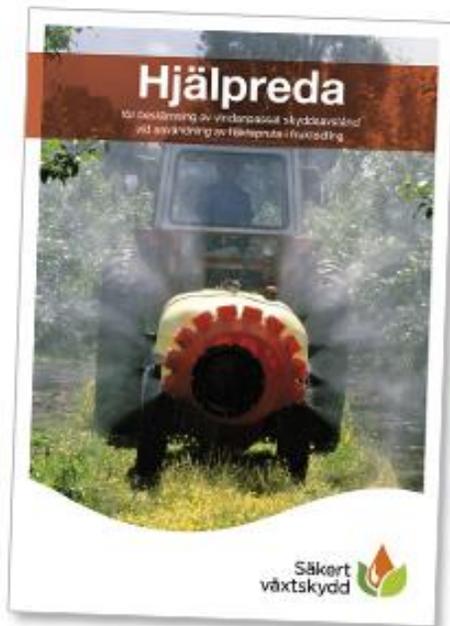
There is also a need to decide whether to apply general or special concern with regard to sensible off-field objects.

	Level of acceptable spray drift	Areas to protect outside the field
General concern	4% fall out drift of highest dose	Biodiversity outside the field, neighbouring crops etcetera in wind direction.
Special concern	1% fall out drift of highest dose	Sensitive areas in wind direction; water courses, areas with vulnerable biodiversity, sensitive crops, organically grown crops, bee-hives, home gardens, playgrounds and other suburban areas.

The Helper was originally developed by the Swedish EPA and the Swedish University of Agricultural Sciences and has been in use since 1997. Although based on a legal requirement, the Helper also forms a

part of a voluntary information campaign between authorities, farmer organisation and industry called Focus on Pesticide Use (Säkert Växtskydd in Swedish). The Helper is intended for field use with tractor mounted boom sprayers. It is limited to spray drift and covers options to mitigate risk for sensitive areas such as surface waters, non-target organisms (e.g. arthropods, plants).

## Orchards



A similar Helper was developed in 2008 for spraying in orchards. It is based on the similar principles for spray drift but does instead pay regard to the specific airblast techniques used in orchards. In this Helper, two different approaches are used, one before and one after flowering. The wind speed is measured at 1 m above the fruit trees, a 20 m spray width is assumed but the air temperature is disregarded. Depending on the equipment used a 25, 50, 75, 90 or 99% drift reduction is possible (Nilsson J, *et al.* 2006)

## Surface run-off

In addition to the spray drift there is also guidance in place for surface run-off with fixed safety distances to drinking water wells, surface water, ditches and drainage wells. However, this paper will focus on the Helper intended for mitigating spray drift using tractor mounted sprayers.

## It started with some field trials

The Helper is based on 132 field trials with different techniques, spray droplet sizes, boom height, wind speed and temperature (Arvidsson, 1997; Arvidsson, Bergström and Kreuger, 2011). The field trials were performed on short cut grass. A model for calculation of fall out drift was made from 52 of these trials. The tractor speed and the relative humidity were fixed at 2 m/s and 70 % respectively.

By using the model a general curve was elaborated where the fall out drift values are used to identify the proper safety distances (2- > 50 m) in wind direction. The use of certain drift reduction technologies (DRT) based on the German approach (JKI, 2003, 2013) was introduced in the Helper in 2003. A list of

DRT is updated two times per year on [www.sakertvaxtskydd.se](http://www.sakertvaxtskydd.se) (new website under construction). A treated width of 96 m is used as a default in order to facilitate the calculation.

Fall out drift % at 5 m distance from field edge. Spray width 96 m, temperature 10°C, wind speed 1.5 m/s and boom height 60 cm.					
Fine	Medium	Coarse	50% DRT	75% DRT	90% DRT
3.86	2.67	1.47	0.45	0.23	0.09

## How to use the Helper

The tabular format covers three different temperatures (10, 15 and 20°C) and three different wind speeds (1.5, 3 and 4.5 m/s). Each combination of temperature and wind speed (nine combinations) constitute a set of two pages, one intended for general and one for special concern. In the table columns there are entries for the different spray droplet sizes and the DRT. The different boom heights can be found in the table rows. Each square block of nine cells refers to the used dose (a quarter, half or full dose).

**Temperatur 15° C Vindstyrka 3,0 m/sek**

**Allmän hänsyn**

Siffrorna i tabellen anger skyddsavstånd i meter till fältgränsen.

Duschkvalitet	Särskilt reducerande utrustning, se sid 32.		
	Fin	Medium	Grov
50 %			
75 %			
90 %			

Kvarts dos				
Bomhöjd, cm	25	2	2	2
	40	2	2	2
	60	2	2	2

Halv dos				
Bomhöjd, cm	25	2	2	2
	40	2	2	2
	60	3	2	2

Hel dos				
Bomhöjd, cm	25	4	2	2
	40	6	3	2
	60	8	6	3

**Temperatur 15° C Vindstyrka 3,0 m/sek**

**Särskild hänsyn**

Siffrorna i tabellen anger skyddsavstånd i meter till det känsliga området.

Duschkvalitet	Särskilt reducerande utrustning, se sid 32.		
	Fin	Medium	Grov
50 %			
75 %			
90 %			

Kvarts dos				
Bomhöjd, cm	25	4	3	3
	40	5	3	3
	60	8	5	3

Halv dos				
Bomhöjd, cm	25	11	6	3
	40	16	9	4
	60	22	16	9

Hel dos				
Bomhöjd, cm	25	30	16	5
	40	40	26	12
	60	>50	38	26

**15°  
3,0  
m/s**

## The calculation exercise

1. Once the temperature and wind speed have been measured, the matching two paged spread of the Helper can be chosen. In the example above the temperature is 15°C and the wind speed is 3.0 m/s.
2. Next step is to decide on the proper level of acceptable spray drift by identifying whether the area in the wind direction requires general (left side) or special (right side) concern to be applied. Guidance is given by the Helper.
3. Continue to identify the proper safety distance by selecting your matching boom height (25, 40 or 60 cm), spray droplet size (Fine, Medium or Coarse) and the used dose (1/1, ½ or ¼ off full dose).
4. If, for example the area in the wind direction requires general concern (left side page), the boom height is 40 cm, the spray droplet size is categorised as medium and the used dose is the recommended dose (1/1), the proper safety distance to the field edge need to be set at 3 m (under condition that no particular DRT is used). However, if instead special concern is needed (right side page), the proper safety distance need to be set at 26 m. If nozzles with e.g. 50% drift reduction are used, a safety distance of 2 or 8 m respectively can be applied.

## The regulatory context

No fixed buffer zones are used in Sweden to mitigate spray drift for plant protection products. Instead a national regulation issued by the Swedish EPA requires all professional users of plant protection products to calculate and observe proper spray drift related safety distances based on local conditions (SNFS 1997:2). In addition to this regulation, authorisation provisions which requires the use of the Helper has been imposed on a number of plant protection products. The purpose is to address specific off-field risks identified during the national review of plant protection products, e.g. risks to surface water, aquatic organisms, non-target arthropods and plants. Effects on non-target plants from some herbicides can for instance in most cases be addressed by applying special concern (max 1% fall out drift).

Risk mitigation with the Helper corresponds very well to the FOCUS spray drift buffer zones up to 15 m for arable crops when using similar conditions as applied in the FOCUS scenario. Products which according to FOCUS simulations require spray drift buffer zones greater than 15 m will not be authorised in Sweden. However, the use of DRT (50%, 75 or 90% reduction for boom sprayers) can be required to further reduce the risk on the condition that the product efficacy can be maintained. A fall-out drift between 0.1 – 4 % can be achieved depending on the type of DRT required. In order to achieve a higher protection level for products with a DRT requirement, it will thus be necessary to disregard this DRT-reduction when the calculation is made.

In addition to the requirement to use the Helper, approximately 5 % of all authorised plant protection products in Sweden also have a provision requiring the use of certain DRT.

## In view of the user

The approach to base the mitigation of environmental risks on local conditions is easier to communicate and easier for users to understand and accept compared to fixed buffer zones where for example weather conditions will be disregarded. The Helper gives the user several options in each spraying situation which is also an important aspect. The user can reduce the dose rate or choose other spraying techniques, eg nozzles which may allow spraying closer to the field edges. If, due to particular weather conditions large safety distances (e.g. >50 m) are required, the user can postpone spraying and come back later when the weather conditions are more suitable for spraying. All professional users of plant protection products in Sweden must be trained and pass exams every five years to receive a licence for spraying. How to use the Helper is an important element in these mandatory training courses and it also forms a part of the written exams. In addition, the voluntary campaign "Focus on Pesticide Use" has had several information activities with regard to the Helper and issues on spray drift during the latest 15 years. One of the more recent activities from this campaign is the production of a video on Youtube giving farmers instructions on how to make best use of the Helper. Link to the video:

<http://www.youtube.com/watch?v=196AN3GzXo4> (Missing the English subtitles? Click on Captions and chose – Translate Captions).

According to a farmer survey, approximately 50 % of all Swedish farmers spraying pesticides report that they use the Helper when to apply safety distances such as buffer zones.

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