Basic Drift Values

Drift during the application of pesticides is totally unwelcome but nearly not avoidable. In general smaller droplets are more prone to drift through wind movements but they achieve a better coverage on the plants. The nozzles produce the droplets and determine the droplet size. Sprayers are rated concerning their drift compared to the basic drift values. The authorisation procedure for plant protection products refers to these features of sprayers.

New basic drift values in the authorisation procedure for plant protection products

Since 1995 the assessment of plant protection products with regard to their effects on non-target organisms in Germany has taken place on the base of the drift values published in issue no. 305 of the reports of the Federal Research Centre for Agriculture and Forestry (BBA): 'Studies on the spray drift of plant protection products'. These values were based on results of 119 drift trials conducted between 1989 and 1992, forming the base for the calculation of the 95^{th} percentile. The basic drift values were obtained by rounding these 95^{th} percentiles up or down to one decimal place.

Beside the above mentioned drift trials additional tests were conducted from 1996 to 1999 for field crops and orchards. Improved analytical methods were used in these experiments, permitting the determination of reliable readings which fall below the previously measurable values by the factor 10. It thus became possible to measure soil sediment values which are smaller than 0.01 % of the application rate and which can usually be found at greater distances. That is why the measured range in these experiments was extended up to a distance of 100m from the treated area, leading to more reliable conclusions on the shape of the drift curve.

All in all, results achieved in 50 agricultural trials and 72 fruit growing trials are now available for evaluation. In viticulture and hops an adoption of new trials for evaluation purposes was not possible yet.

German authorities involved in the authorisation of plant protection products agreed to use the 90^{th} percentile instead of the 95^{th} percentile in future, in conformity with the proposals made by the FOCUS-Surface Water Group.

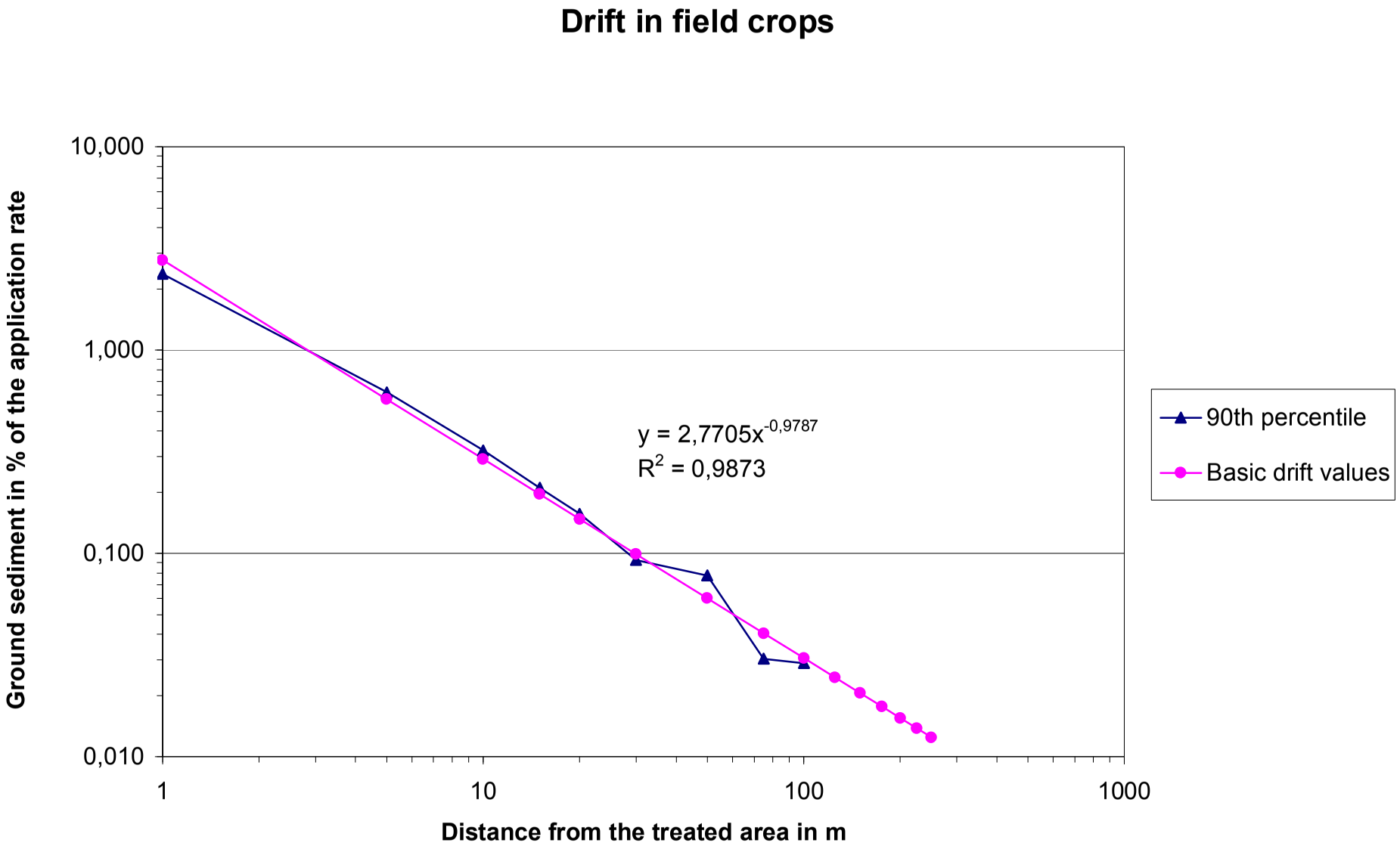
The extension of trials to measured distances up to 100 m permits the calculation of a equation function by means of a regression analysis which also allows extrapolation at greater distances within certain limits. A power function is suitable as equation function, indicating a linear run of the curve when represented with logarithmic scales on both axes. The general functional equation is:

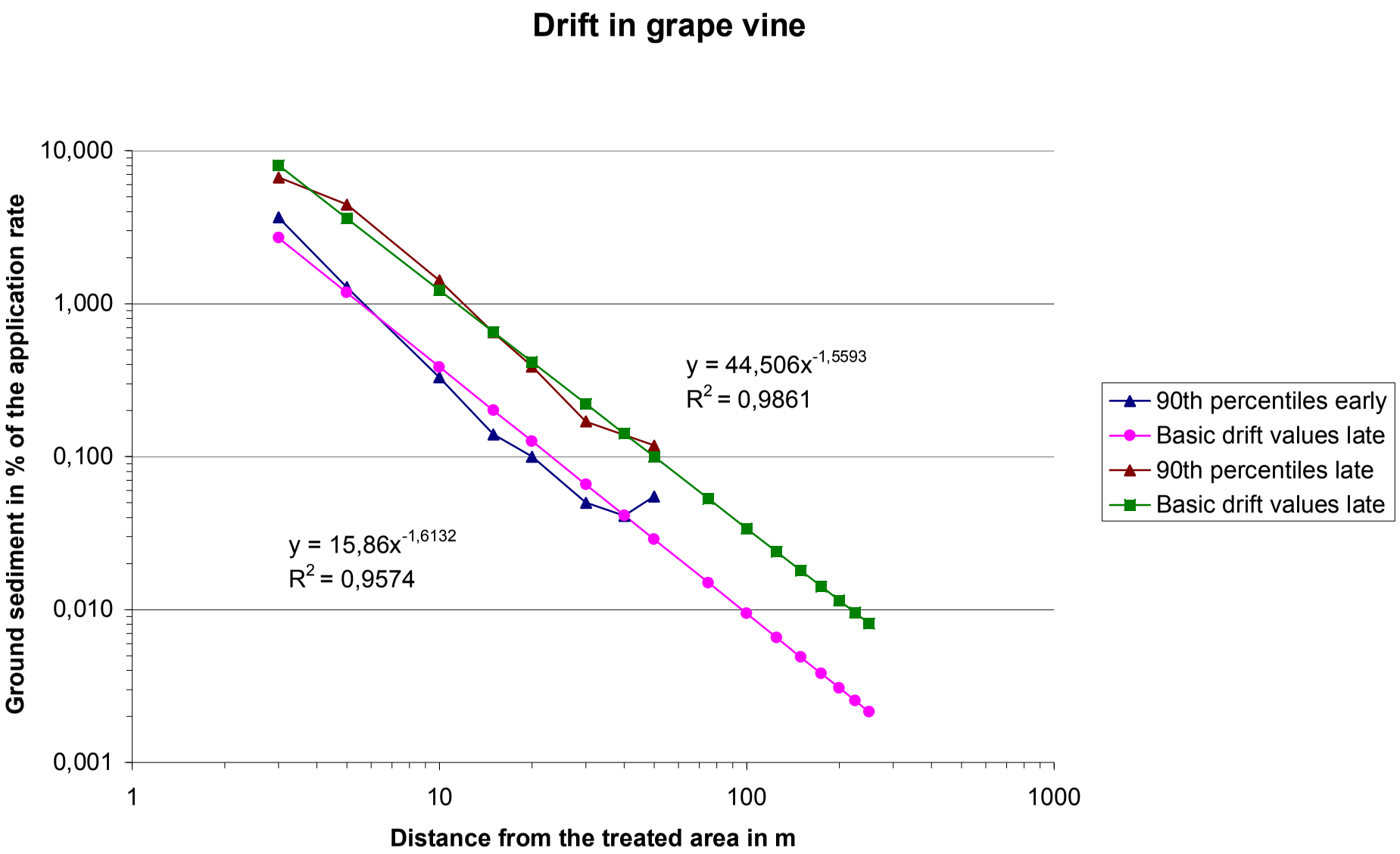
$$y = a*x^b,$$

y is in this case the soil sediment expressed in % of a distance x in m. a and b are parameters, to be calculated from the measured values for each crop individually. In orchards and hops one function does not suffice for an adoption, therefore the distances had to be divided into 3 to 10m and 15 to 250 m. In this case, the height of the plants causes a distinctive lee, leading to a different course of sedimentation as in field crops and viticulture.

In orchards and viticulture a differentiation between early and late growth stages is necessary because of the different drift levels and because there are plant protection products which are only used either in early or in late growth stages.

An extrapolation up to a distance of 250 m was carried through in addition to the distances already measured. Thus, authorisation became possible for some plant protection products so that they may be used in areas which are a long way from surface waters.


Drift in field crops
Ground sediment in % of the application rate
10,000
1,000
0,100
0,010
1
10
100
1000
Distance from the treated area in m
y = 2,7705x-0,9787
R2 = 0,9873
90th percentile
Basic drift values


Drift in grape vine
Ground sediment in % of the application rate
10,000
1,000
0,100
0,010
0,001
1
10
100
1000
Distance from the treated area in m
y = 44,506x-1,5593
R2 = 0,9861
y = 15,86x-1,6132
R2 = 0,9574
90th percentiles early
Basic drift values late
90th percentiles late
Basic drift values late

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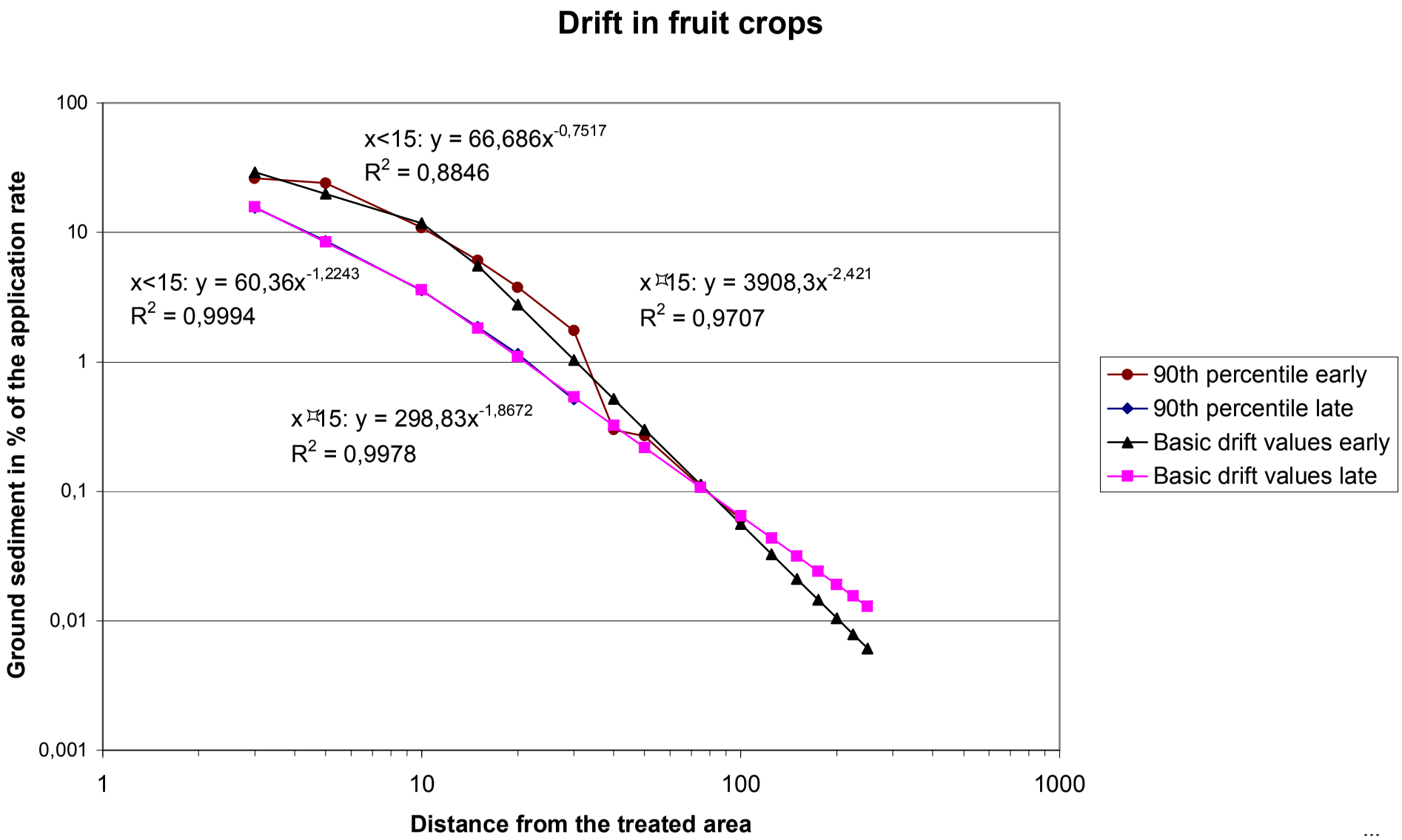
Drift in fruit crops
Ground sediment in % of the application rate
100
10
1
0,1
0,01
0,001
1
10
100
1000
Distance from the treated area
x<15: y = 66,686x-0,7517
R2 = 0,8846
x<15: y = 60,36x-1,2243
R2 = 0,9994
x¤15: y = 3908,3x-2,421
R2 = 0,9707
x¤15: y = 298,83x-1,8672
R2 = 0,9978
90th percentile early
90th percentile late
Basic drift values early
Basic drift values late

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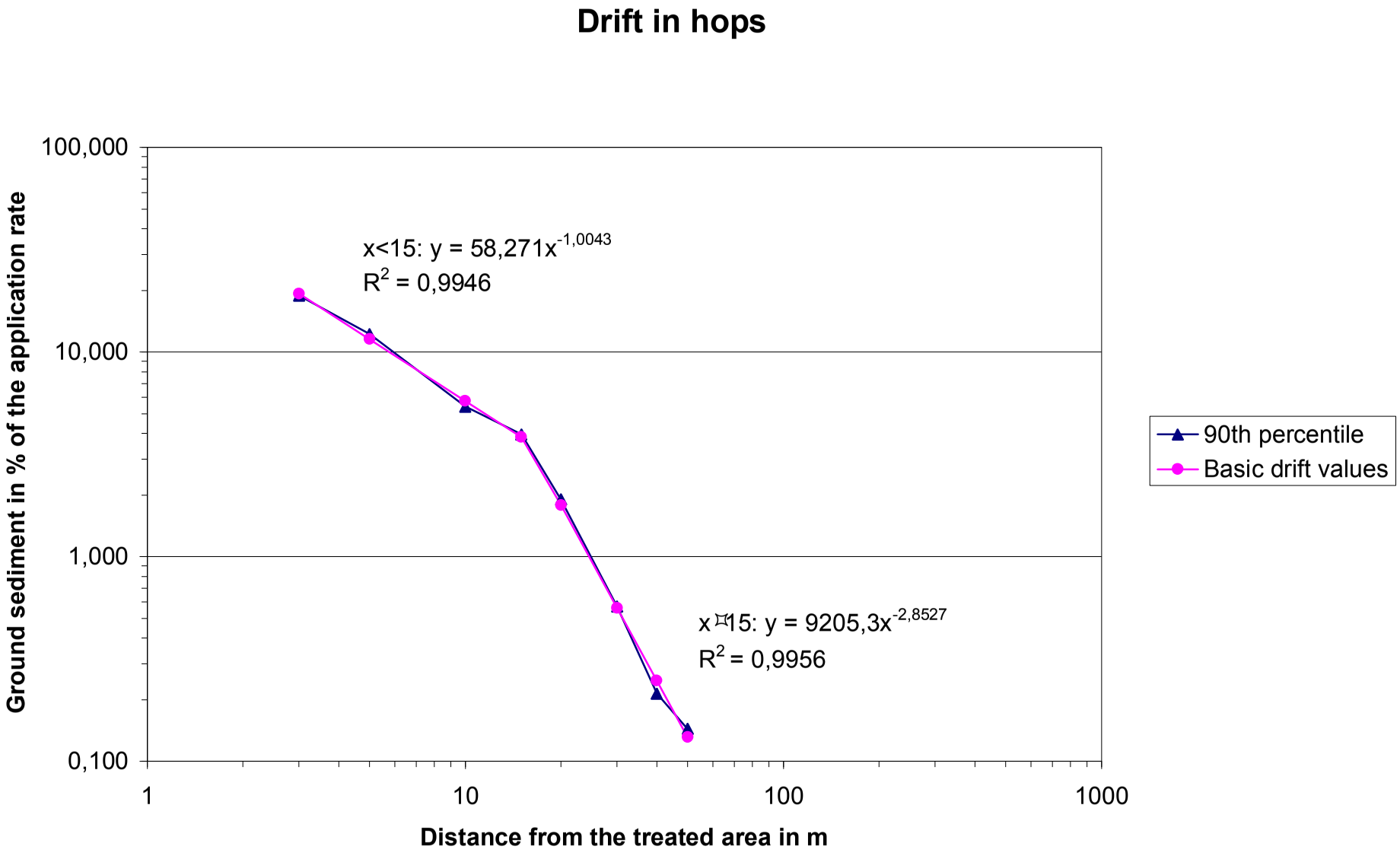
Drift in hops
Ground sediment in % of the application rate
100,000
10,000
1,000
0,100
x<15: y = 58,271x-1,0043
R2 = 0,9946
x¤15: y = 9205,3x-2,8527
R2 = 0,9956
1
10
100
1000
Distance from the treated area in m
90th percentile
Basic drift values

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Table 1: Parameters of the equation function for different crops

	a	b
Field crops	2,7705	-0,9787
Grape vine early	15,86	-1,6132
Grape vine late	44,506	-1,5593
Fruit crops late, x<15	60,36	-1,2243
Fruit crops late, x≥15	298,83	-1,8672
Fruit crops early, x<15	66,686	-0,7517
Fruit crops early, x≥15	3908,3	-2,421
Hops, x<15	58,271	-1,0043
Hops, x≥15	9205,3	-2,8527

At the same time -again in conformity with the FOCUS-group- it was established that a reduced percentile should be used for multiple uses in order not to exceed the 90th percentile cumulatively. The percentiles for multiple applications listed in the table represent the exposure for one of the multiple applications, leaving degradation processes aside. If necessary, they can be taken into account later on. Moreover, it was established that risk assessment for multiple uses should at least amount to the Predicted Environmental Concentration (PEC) required for the calculation of a single use. This regulation ensures in the case of fast degrading active substances that a multiple use does not lead to a lower risk than a single use within the assessment.

The following percentiles are used:

Table 2: Percentiles for multiple applications

Number of applications	percentile used
1	90
2	82
3	77
4	74
5	72
6	70
7	69
8 or more	67

The functional values at a distance of 1, 3, 5, 10, 15, 20, 30, 50, 75, 100, 125, ..., 225 and 250m were rounded up/down to two decimal places or were this was not sufficient for differentiation, to three or more decimal places.

The results are thus the following eight tables with basic drift values corresponding to the number of applications.

Basic drift values for one application Ground sediment in % of the application rate (90th percentiles)								
Distance [m]	Field crops	Fruit crops		Grapevine		Hops	Vegetables Ornamentals Small fruit	
		early	late	early	late		Height < 50 cm	Height ≥ 50 cm
1	**2,77**						**2,77**	
3	**0,95**	**29,20**	**15,73**	**2,70**	**8,02**	**19,33**	**0,95**	**8,02**
5	**0,57**	**19,89**	**8,41**	**1,18**	**3,62**	**11,57**	**0,57**	**3,62**
10	**0,29**	**11,81**	**3,60**	**0,39**	**1,23**	**5,77**	**0,29**	**1,23**
15	**0,20**	**5,55**	**1,81**	**0,20**	**0,65**	**3,84**	**0,20**	**0,65**
20	**0,15**	**2,77**	**1,09**	**0,13**	**0,42**	**1,79**	**0,15**	**0,42**
30	**0,10**	**1,04**	**0,54**	**0,07**	**0,22**	**0,56**	**0,10**	**0,22**
40	**0,07**	**0,52**	**0,32**	**0,04**	**0,14**	**0,25**	**0,07**	**0,14**
50	**0,06**	**0,30**	**0,22**	**0,03**	**0,10**	**0,13**	**0,06**	**0,10**
75	**0,04**	**0,11**	**0,11**	**0,015**	**0,05**	**0,04**	**0,04**	**0,05**
100	**0,03**	**0,06**	**0,06**	**0,009**	**0,03**	**0,02**	**0,03**	**0,03**
125	**0,025**	**0,03**	**0,04**	**0,007**	**0,024**	**0,01**	**0,025**	**0,024**
150	**0,021**	**0,021**	**0,03**	**0,005**	**0,018**	**0,006**	**0,021**	**0,018**
175	**0,018**	**0,015**	**0,024**	**0,004**	**0,014**	**0,004**	**0,018**	**0,014**
200	**0,016**	**0,011**	**0,019**	**0,003**	**0,011**	**0,003**	**0,016**	**0,011**
225	**0,014**	**0,008**	**0,016**	**0,003**	**0,010**	**0,002**	**0,014**	**0,010**
250	**0,012**	**0,006**	**0,013**	**0,002**	**0,008**	**0,001**	**0,012**	**0,008**

Basic drift values for two applications Ground sediment in % of the application rate (82nd percentiles)								
Distance	Field crops	Fruit crops		Grapevine		Hops	Vegetables Ornamentals Small fruit	
[m]		early	late	early	late		Height < 50 cm	Height ≥ 50 cm
1	**2,38**						**2,38**	
3	**0,79**	**25,53**	**12,13**	**2,53**	**7,23**	**17,73**	**0,79**	**7,23**
5	**0,47**	**16,87**	**6,81**	**1,09**	**3,22**	**9,60**	**0,47**	**3,22**
10	**0,24**	**9,61**	**3,11**	**0,35**	**1,07**	**4,18**	**0,24**	**1,07**
15	**0,16**	**5,61**	**1,58**	**0,18**	**0,56**	**2,57**	**0,16**	**0,56**
20	**0,12**	**2,59**	**0,90**	**0,11**	**0,36**	**1,21**	**0,12**	**0,36**
30	**0,08**	**0,87**	**0,40**	**0,06**	**0,19**	**0,38**	**0,08**	**0,19**
40	**0,06**	**0,40**	**0,23**	**0,03**	**0,12**	**0,17**	**0,06**	**0,12**
50	**0,05**	**0,22**	**0,15**	**0,02**	**0,08**	**0,09**	**0,05**	**0,08**
75	**0,03**	**0,07**	**0,07**	**0,01**	**0,04**	**0,03**	**0,03**	**0,04**
100	**0,023**	**0,03**	**0,04**	**0,008**	**0,03**	**0,01**	**0,023**	**0,03**
125	**0,019**	**0,02**	**0,024**	**0,005**	**0,02**	**0,007**	**0,019**	**0,02**
150	**0,015**	**0,011**	**0,017**	**0,004**	**0,015**	**0,004**	**0,015**	**0,015**
175	**0,013**	**0,008**	**0,013**	**0,003**	**0,012**	**0,003**	**0,013**	**0,012**
200	**0,012**	**0,005**	**0,010**	**0,002**	**0,009**	**0,002**	**0,012**	**0,009**
225	**0,010**	**0,004**	**0,008**	**0,002**	**0,008**	**0,001**	**0,010**	**0,008**
250	**0,009**	**0,003**	**0,006**	**0,002**	**0,007**	**0,001**	**0,009**	**0,007**

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Basic drift values for three applications Ground sediment in % of the application rate (77th percentiles)								
Distance [m]	Field crops	Fruit crops		Grapevine		Hops	Vegetables Ornamentals Small fruit	
		early	late	early	late		Height < 50 cm	Height ≥ 50 cm
1	**2,01**						**2,01**	
3	**0,68**	**23,96**	**11,01**	**2,49**	**6,90**	**15,93**	**0,68**	**6,90**
5	**0,41**	**15,79**	**6,04**	**1,04**	**3,07**	**8,57**	**0,41**	**3,07**
10	**0,20**	**8,96**	**2,67**	**0,32**	**1,02**	**3,70**	**0,20**	**1,02**
15	**0,14**	**5,23**	**1,39**	**0,16**	**0,54**	**2,26**	**0,14**	**0,54**
20	**0,10**	**2,36**	**0,80**	**0,10**	**0,34**	**1,05**	**0,10**	**0,34**
30	**0,07**	**0,77**	**0,36**	**0,05**	**0,18**	**0,34**	**0,07**	**0,18**
40	**0,05**	**0,35**	**0,21**	**0,03**	**0,11**	**0,15**	**0,05**	**0,11**
50	**0,04**	**0,19**	**0,13**	**0,02**	**0,08**	**0,08**	**0,04**	**0,08**
75	**0,03**	**0,06**	**0,06**	**0,01**	**0,04**	**0,03**	**0,03**	**0,04**
100	**0,021**	**0,03**	**0,03**	**0,006**	**0,03**	**0,01**	**0,021**	**0,03**
125	**0,017**	**0,015**	**0,022**	**0,004**	**0,02**	**0,007**	**0,017**	**0,02**
150	**0,014**	**0,009**	**0,016**	**0,003**	**0,014**	**0,004**	**0,014**	**0,014**
175	**0,012**	**0,006**	**0,012**	**0,002**	**0,011**	**0,003**	**0,012**	**0,011**
200	**0,010**	**0,004**	**0,009**	**0,002**	**0,009**	**0,002**	**0,010**	**0,009**
225	**0,009**	**0,003**	**0,007**	**0,002**	**0,007**	**0,001**	**0,009**	**0,007**
250	**0,008**	**0,002**	**0,006**	**0,001**	**0,006**	**0,001**	**0,008**	**0,006**

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Basic drift values for four applications Ground sediment in % of the application rate (74th percentiles)								
Distance [m]	Field crops	Fruit crops		Grapevine		Hops	Vegetables Ornamentals Small fruit	
		early	late	early	late		Height < 50 cm	Height ≥ 50 cm
1	**1,85**						**1,85**	
3	**0,62**	**23,61**	**10,12**	**2,44**	**6,71**	**15,38**	**0,62**	**6,71**
5	**0,38**	**15,42**	**5,60**	**1,02**	**2,99**	**8,26**	**0,38**	**2,99**
10	**0,19**	**8,66**	**2,50**	**0,31**	**0,99**	**3,55**	**0,19**	**0,99**
15	**0,13**	**4,91**	**1,28**	**0,16**	**0,52**	**2,17**	**0,13**	**0,52**
20	**0,10**	**2,21**	**0,75**	**0,10**	**0,33**	**0,93**	**0,10**	**0,33**
30	**0,06**	**0,72**	**0,35**	**0,05**	**0,17**	**0,31**	**0,06**	**0,17**
40	**0,05**	**0,32**	**0,20**	**0,03**	**0,11**	**0,14**	**0,05**	**0,11**
50	**0,04**	**0,17**	**0,13**	**0,02**	**0,08**	**0,08**	**0,04**	**0,08**
75	**0,03**	**0,06**	**0,06**	**0,01**	**0,04**	**0,02**	**0,03**	**0,04**
100	**0,019**	**0,03**	**0,04**	**0,006**	**0,03**	**0,01**	**0,019**	**0,03**
125	**0,016**	**0,014**	**0,023**	**0,004**	**0,02**	**0,006**	**0,016**	**0,02**
150	**0,013**	**0,008**	**0,016**	**0,003**	**0,014**	**0,004**	**0,013**	**0,014**
175	**0,011**	**0,005**	**0,012**	**0,002**	**0,011**	**0,002**	**0,011**	**0,011**
200	**0,010**	**0,004**	**0,010**	**0,002**	**0,009**	**0,002**	**0,010**	**0,009**
225	**0,009**	**0,003**	**0,008**	**0,002**	**0,007**	**0,001**	**0,009**	**0,007**
250	**0,008**	**0,002**	**0,006**	**0,001**	**0,006**	**0,001**	**0,008**	**0,006**

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Basic drift values for five applications Ground sediment in % of the application rate (72nd percentiles)								
Distance [m]	Field crops	Fruit crops		Grapevine		Hops	Vegetables Ornamentals Small fruit	
		early	late	early	late		Height < 50 cm	Height ≥ 50 cm
1	**1,75**						**1,75**	
3	**0,59**	**23,12**	**9,74**	**2,37**	**6,59**	**15,12**	**0,59**	**6,59**
5	**0,36**	**15,06**	**5,41**	**1,00**	**2,93**	**7,99**	**0,36**	**2,93**
10	**0,18**	**8,42**	**2,43**	**0,31**	**0,98**	**3,36**	**0,18**	**0,98**
15	**0,12**	**4,61**	**1,24**	**0,15**	**0,51**	**2,03**	**0,12**	**0,51**
20	**0,09**	**2,09**	**0,72**	**0,09**	**0,33**	**0,88**	**0,09**	**0,33**
30	**0,06**	**0,69**	**0,34**	**0,05**	**0,17**	**0,29**	**0,06**	**0,17**
40	**0,05**	**0,31**	**0,20**	**0,03**	**0,11**	**0,14**	**0,05**	**0,11**
50	**0,04**	**0,17**	**0,13**	**0,02**	**0,08**	**0,07**	**0,04**	**0,08**
75	**0,025**	**0,06**	**0,06**	**0,01**	**0,04**	**0,02**	**0,025**	**0,04**
100	**0,018**	**0,03**	**0,03**	**0,006**	**0,03**	**0,01**	**0,018**	**0,03**
125	**0,015**	**0,014**	**0,023**	**0,004**	**0,02**	**0,006**	**0,015**	**0,02**
150	**0,012**	**0,008**	**0,016**	**0,003**	**0,013**	**0,004**	**0,012**	**0,013**
175	**0,011**	**0,005**	**0,012**	**0,002**	**0,010**	**0,003**	**0,011**	**0,010**
200	**0,009**	**0,004**	**0,009**	**0,002**	**0,008**	**0,002**	**0,009**	**0,008**
225	**0,008**	**0,003**	**0,008**	**0,002**	**0,007**	**0,001**	**0,008**	**0,007**
250	**0,007**	**0,002**	**0,006**	**0,001**	**0,006**	**0,001**	**0,007**	**0,006**

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Basic drift values for six applications Ground sediment in % of the application rate (70th percentiles)								
Distance [m]	Field crops	Fruit crops		Grapevine		Hops	Vegetables Ornamentals Small fruit	
		early	late	early	late		Height < 50 cm	Height ≥ 50 cm
1	**1,64**						**1,64**	
3	**0,56**	**22,76**	**9,21**	**2,29**	**6,41**	**14,90**	**0,56**	**6,41**
5	**0,34**	**14,64**	**5,18**	**0,97**	**2,85**	**7,79**	**0,34**	**2,85**
10	**0,17**	**8,04**	**2,38**	**0,30**	**0,95**	**3,23**	**0,17**	**0,95**
15	**0,11**	**4,51**	**1,20**	**0,15**	**0,50**	**1,93**	**0,11**	**0,50**
20	**0,09**	**2,04**	**0,68**	**0,09**	**0,32**	**0,83**	**0,09**	**0,32**
30	**0,06**	**0,66**	**0,31**	**0,05**	**0,17**	**0,28**	**0,06**	**0,17**
40	**0,04**	**0,30**	**0,17**	**0,03**	**0,11**	**0,13**	**0,04**	**0,11**
50	**0,03**	**0,16**	**0,11**	**0,02**	**0,07**	**0,07**	**0,03**	**0,07**
75	**0,023**	**0,05**	**0,05**	**0,01**	**0,04**	**0,02**	**0,023**	**0,04**
100	**0,018**	**0,02**	**0,03**	**0,006**	**0,02**	**0,01**	**0,018**	**0,02**
125	**0,014**	**0,013**	**0,018**	**0,004**	**0,017**	**0,006**	**0,014**	**0,017**
150	**0,012**	**0,008**	**0,013**	**0,003**	**0,013**	**0,003**	**0,012**	**0,013**
175	**0,010**	**0,005**	**0,009**	**0,002**	**0,010**	**0,002**	**0,010**	**0,010**
200	**0,009**	**0,004**	**0,007**	**0,002**	**0,008**	**0,002**	**0,009**	**0,008**
225	**0,008**	**0,003**	**0,006**	**0,002**	**0,007**	**0,001**	**0,008**	**0,007**
250	**0,007**	**0,002**	**0,005**	**0,001**	**0,006**	**0,001**	**0,007**	**0,006**

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Basic drift values for seven applications Ground sediment in % of the application rate (69th percentiles)								
Distance	Field crops	Fruit crops		Grapevine		Hops	Vegetables Ornamentals Small fruit	
[m]		early	late	early	late		Height < 50 cm	Height ≥ 50 cm
1	**1,61**						**1,61**	
3	**0,55**	**22,69**	**9,10**	**2,24**	**6,33**	**14,63**	**0,55**	**6,33**
5	**0,33**	**14,45**	**5,11**	**0,94**	**2,81**	**7,60**	**0,33**	**2,81**
10	**0,17**	**7,83**	**2,33**	**0,29**	**0,94**	**3,13**	**0,17**	**0,94**
15	**0,11**	**4,40**	**1,20**	**0,15**	**0,49**	**1,86**	**0,11**	**0,49**
20	**0,08**	**1,99**	**0,67**	**0,09**	**0,31**	**0,81**	**0,08**	**0,31**
30	**0,06**	**0,65**	**0,30**	**0,05**	**0,16**	**0,26**	**0,06**	**0,16**
40	**0,04**	**0,29**	**0,17**	**0,03**	**0,10**	**0,12**	**0,04**	**0,10**
50	**0,03**	**0,16**	**0,11**	**0,02**	**0,07**	**0,06**	**0,03**	**0,07**
75	**0,023**	**0,05**	**0,05**	**0,01**	**0,04**	**0,02**	**0,023**	**0,04**
100	**0,017**	**0,02**	**0,03**	**0,006**	**0,02**	**0,01**	**0,017**	**0,02**
125	**0,014**	**0,013**	**0,017**	**0,004**	**0,017**	**0,005**	**0,014**	**0,017**
150	**0,012**	**0,008**	**0,012**	**0,003**	**0,013**	**0,003**	**0,012**	**0,013**
175	**0,010**	**0,005**	**0,009**	**0,002**	**0,010**	**0,002**	**0,010**	**0,010**
200	**0,009**	**0,003**	**0,007**	**0,002**	**0,008**	**0,001**	**0,009**	**0,008**
225	**0,008**	**0,003**	**0,005**	**0,002**	**0,007**	**0,001**	**0,008**	**0,007**
250	**0,007**	**0,002**	**0,004**	**0,001**	**0,006**	**0,001**	**0,007**	**0,006**

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Basic drift values for more than seven applications Ground sediment in % of the application rate (67th percentiles)								
Distance [m]	Field crops	Fruit crops		Grapevine		Hops	Vegetables Ornamentals Small fruit	
		early	late	early	late		Height < 50 cm	Height ≥ 50 cm
1	**1,52**						**1,52**	
3	**0,52**	**22,24**	**8,66**	**2,16**	**6,26**	**13,53**	**0,52**	**6,26**
5	**0,31**	**14,09**	**4,92**	**0,91**	**2,78**	**7,15**	**0,31**	**2,78**
10	**0,16**	**7,58**	**2,29**	**0,28**	**0,93**	**3,01**	**0,16**	**0,93**
15	**0,11**	**4,21**	**1,14**	**0,14**	**0,49**	**1,82**	**0,11**	**0,49**
20	**0,08**	**1,91**	**0,65**	**0,09**	**0,31**	**0,78**	**0,08**	**0,31**
30	**0,05**	**0,62**	**0,29**	**0,04**	**0,16**	**0,25**	**0,05**	**0,16**
40	**0,04**	**0,28**	**0,16**	**0,03**	**0,10**	**0,12**	**0,04**	**0,10**
50	**0,03**	**0,15**	**0,11**	**0,02**	**0,07**	**0,06**	**0,03**	**0,07**
75	**0,022**	**0,05**	**0,05**	**0,009**	**0,04**	**0,02**	**0,022**	**0,04**
100	**0,017**	**0,02**	**0,03**	**0,006**	**0,02**	**0,01**	**0,017**	**0,02**
125	**0,013**	**0,012**	**0,017**	**0,004**	**0,017**	**0,005**	**0,013**	**0,017**
150	**0,011**	**0,007**	**0,012**	**0,003**	**0,013**	**0,003**	**0,011**	**0,013**
175	**0,010**	**0,005**	**0,009**	**0,002**	**0,010**	**0,002**	**0,010**	**0,010**
200	**0,008**	**0,003**	**0,007**	**0,002**	**0,008**	**0,001**	**0,008**	**0,008**
225	**0,007**	**0,002**	**0,005**	**0,001**	**0,007**	**0,001**	**0,007**	**0,007**
250	**0,007**	**0,002**	**0,004**	**0,001**	**0,006**	**0,001**	**0,007**	**0,006**

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