Monitoring of pesticide leaching from cultivated fields in Denmark

Walter Brüsch, Annette E. Rosenborn, Nora Badawi and Preben Olsen

The Danish Pesticide Leaching Assessment Programme (PLAP) was initiated in 1998 by the Danish Parliament in order to evaluate whether the use of approved pesticides will result in an unacceptable contamination of the groundwater, if applied under field conditions in accordance with current Danish regulation. In this programme, water samples from variably saturated soil and groundwater collected at five cultivated fields are analysed for selected pesticides and their degradation products. The PLAP results are summarised and evaluated in yearly reports and used by the Danish Environmental Protection Agency in the regulation of pesticides in Denmark (Brüsch *et al.* 2015). In order to represent typical farming scenarios in Denmark, the test fields are situated on meltwater and marine sands, and on tile-drained clayey soils in till areas.

Methods

The five cultivated PLAP fields (1.2–2.4 ha), representing different soils and hydrogeological settings, spread across Denmark (Fig. 1) are located at Silstrup, Estrup and Faardrup with tile-drained clayey soils, and at Tylstrup and Jyndevad with sandy soils (Lindhardt *et al.* 2001). The groundwater table is shallow at all fields, which enables a rapid detection of any pesticide leaching to the groundwater (Table 1). The PLAP fields are farmed according to conventional agricultural practice, and pesticides are applied in the maximum permissible doses and as specified in the regulations.

Water samples are collected weekly from drainage at the clayey till fields, and monthly from standard teflon suction cups in the unsaturated zone at the sandy fields, and from horizontal and vertical groundwater monitoring wells at all fields. The wells are installed in buffer zones surrounding the fields in order to avoid artificial transport pathways for pesticides and their degradation products from the surface to the groundwater. The vertical wells are located downstream from the field (Fig. 2), except for one upstream vertical well, which is used to determine the upstream influx to the groundwater beneath the field. The horizontal wells are installed at the clayey till fields at depths of 2–3.5 m under

the pesticide-treated areas, and at the sandy fields just beneath the fluctuating groundwater table. Detection of pesticides or their degradation products can be directly related to the specific pesticide application to the PLAP fields by monitoring both the variably and fully saturated soil and accounting for potential upstream influx.

In the drainage from the clayey till fields, the weighted average concentration of pesticides is based on flow-proportional sampling. In the two sandy soils, the weighted average pesticide concentration leached to the suction cups at 1 m depth is estimated from the detected concentrations and estimated percolation on a monthly basis (Brüsch *et al.* 2015).

The analytical programme includes relevant pesticides and their degradation products as well as inorganic compounds such as chloride, nitrate, phosphate and bromide,



Fig. 1. Annual net-precipitation in Denmark and the location of the five PLAP fields (*http://www2.mst.dk/Udgiv/publikationer/1992/87-503 -9581-5/pdf/87-503-9581-5.pdf*; Rosenbom *et al.* 2015). Tylstrup and Jyndevad are located in sandy areas with marine sand and glaciofluvial sand, respectively. Silstrup, Estrup and Faardrup are situated in areas dominated by clayey till, and the three fields are drained. The sediments were deposited during and after the last glaciation.

	Tylstrup	Jyndevad	Silstrup	Estrup	Faardrup
Precipitation (mm/y)*	668	858	866	862	558
Potential evapotranspiration (mm/y)*	552	555	564	543	585
Area (ha)	1.1	2.4	1.7	1.3	2.3
Tile drain	No	No	Yes	Yes	Yes
Depth to tile drain (m)			1.1	1.1	1.2
Deposited by	Saltwater	Meltwater	Glacier	Glacier	Glacier
Sediment type	Fine sand	Coarse sand	Clay till	Clay till	Clay till
Topsoil classification	Loamy sand Sand		Sandy clay loam	Sandy Ioam	Sandy Ioam

Table 1. Characteristics of the five pesticide leaching assessment fields

* Based on the period 1961–1990, modified from Lindhardt et al. (2001).

which is used as a tracer. The pesticides are generally analysed for two years following application, but the monitoring continues if significant leaching occurs. To evaluate the pesticide leaching, the water balance, including the percolation



Fig. 2. Overview of the Silstrup field and its technical installations.

through the variably saturated soil, is assessed for all five PLAP fields using the numerical model MACRO (Larsbo *et al.* 2005) based on long-term detailed monitoring of climate, crop-growth, soil water content, groundwater table, and if present, drainage flow (Rosenbom *et al.* 2015).

Monitoring results

According to the legislation of the European Union, the maximum permissible concentration of any pesticide in groundwater is 0.1 μ g/l (Council of the European Union 1994). This limit is not based on health investigations but was the analytical detection limit when the legislation was made in the 1980s, and was chosen to ensure that drinking water did not contain measurable amounts of pesticides. During the latest monitoring period from July 2012 to June 2014, a total of 7378 single analyses of different pesticides or their degradation products were carried out on water samples collected at the five sites. The leaching risk of 22 pesticides and 17 degradation products was evaluated after applying the specific pesticide on specific crops. Of these 39 pesticides and their degradation products, 21 were not detected in any of the water samples.

During the entire monitoring period from May 1999 to June 2014, 51 pesticides and 52 degradation products were analysed. These are listed in the Appendix. The monitoring data showed leaching of 17 of the applied pesticides and their degradation products through the soil to tile drains or suction cups in average concentrations exceeding 0.1 μ g/l. These are marked with asterisks in the Appendix.

The results of the monitoring also showed leaching of an additional 17 pesticides, but in low concentrations, marked by \dagger in the Appendix. Although the concentrations exceeded 0.1 µg/l in several water samples collected from suction cups and tile drains at 1 m depth, the average leaching concentrations did not exceed 0.1 µg/l on an annual basis.

In groundwater samples, twenty-one pesticides or their degradation products were only detected at concentrations

		Fine-grained sand	Coarse-grained sand		Clayey till				
		Tylstrup	Jyndevad	Silstrup	Estrup	Faardrup			
Pesticides	Detections	16	19	39	45	38			
and	Detections >0.1 µg/l	6	9	22	31	21			
metabolites	Detections in %	28.1	32.8	59.1	77.6	66.7			
	>0.1 µg/l in %	10.5	15.5	33.3	53.4	36.8			
Groundwater avg	Nitrate-N	15.5	11.9	3.0	0.4	8.5			
-	Chloride	49.9	15.6	29.5	11.7	27.1			
Drainage avg	Nitrate-N	ns	ns	2.1	3.5	11.2			
	Chloride	ns	ns	30.3	26.6	27.5			

Table 2. Total number of pesticides analysed, detected, and detected below 0.1 µg/l in all sample types

Samples collected from suction cups, drainage and groundwater in the five PLAP fields between 01 January 2000 and July 2012.

Average nitrate and chloride concentrations from groundwater and drainage in the period January 2011 – July 2012.

Avg: average concentration in mg/l.

ns: no samples.

below $0.1 \mu g/l$ or not at all. These are marked by § in the Appendix.

At the three clayey till fields, several pesticides were detected in the drainage, whereas the frequency of detection in the groundwater monitoring screens beneath the tile drain system was lower and varied considerably between the three fields. In the two sandy fields, fewer pesticides and degradation products were generally detected, both in the variably saturated soil and in groundwater (Table 2). The different leaching patterns in the sandy and clayey till fields can be attributed to specific hydrological, geological and geochemical conditions. The subsoil C horizon beneath the tile drains at the Estrup field shows low permeability with few macropores (Kjær et al. 2005; Rosenbom et al. 2015) in contrast to the Faardrup and Silstrup fields, where the clayey till is characterised by fractures and heterogeneity. Hence the fewer records of pesticides and degradation products in the groundwater at Estrup than at Faardrup and Silstrup can be related to the low permeability at the former site.

A comparison between the clayey till fields shows that the number of water samples containing pesticides and degradation products was higher at Silstrup and Estrup (35 and 40%, respectively) than at Faardrup (15%). This can be attributed to different hydro-geochemical conditions and the low net precipitation at Faardrup. The leaching pattern for non-pesticides shows that the average concentration of nitrate-N was much higher in both groundwater and drainage at Faardrup than at the other two fields (Table 2; Ernstsen *et al.* 2015). However, the average chloride content in both drainage and groundwater at Faardrup was higher than at Silstrup (Table 2), due to an up-concentration in the infiltration water caused by the low precipitation at Faardrup. The occurrence of precipitation and subsequent percolation within the first month after application were generally higher at Silstrup and Estrup than at Faardrup (Table 1).

At the clayey till fields, 59-78% of the different applied pesticides and their degradation products were detected in drainage water or groundwater (Table 2), while only 28–33% of them were detected at the sandy fields. High pesticide concentrations dominated at the three clayey till fields, with 33–53% of the detections exceeding 0.1 µg/l, while only 11–16% of the detections at the two sandy fields exceeded the threshold limit. However, the limit of 0.1 µg/l is only relevant for groundwater and not for drainage water.

The average nitrate concentrations were high in the groundwater of the sandy fields and lower at the clayey till fields (Ernstsen *et al.* 2015). However, a high average nitrate concentration was recorded in both the drainage and groundwater from the Faardrup field where the precipitation is low. This is probably because the uppermost part of the till is characterised by high permeability. It is therefore apparent that the pesticide and nitrate concentrations both reflect the geochemical conditions of groundwater and drainage water.

Further details regarding PLAP can be found in Kjær et al. (2002, 2003, 2004, 2005, 2007, 2008, 2009, 2011), Rosenbom et al. (2010), Brüsch et al. (2013a, 2013b, 2015), Ernstsen et al. (2015) and Rosenbom et al. (2015). For further information please visit: http://pesticidvarsling.dk/monitor_uk/index.html.

Conclusions

The results presented here provide an overall picture of the detections of pesticides and their degradation products in soil and groundwater in five monitored cultivated fields representing typical Danish farming activities on clayey and sandy soils in the period from 1999 to 2014. The overall

pesticide leaching detected in the monitoring programme is an outcome of the pesticide selection, hydraulic conditions, type of agriculture and the geochemical conditions such as the redox potential, aerobic conditions and hence the leaching of nitrate-N and potential persistence of individual pesticides. For instance, the leaching of pesticides is more pronounced in fractured clayey soils than in sandy soils due to fast transport in anaerobic fractures in the former soils, in contrast to slower matrix transport in the more aerated sandy soils. This is illustrated by the high number of recorded pesticides in drainage water and groundwater from clayey till soils due to bypassing of the topsoil by rapid leaching through well-connected macropores such as wormholes and fractures (Rosenborn et al. 2015). The occurrence of pesticides in samples from the two sandy soils is probably specifically linked to the application of persistent pesticides such as metalaxyl-M applied to potatoes.

References

- Brüsch, W., Kjær, J., Rosenbom, A.E., Juhler, R.K., Gudmundsson, L., Plauborg, F., Nielsen, C.B. & Olsen, P. 2013a: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2011, 108 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Brüsch, W., Rosenbom, A.E., Juhler, R.K., Gudmundsson, L., Plauborg, F., Nielsen, C.B. & Olsen, P. 2013b: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2012, 106 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Brüsch, W., Rosenbom, A.E., Badawi, N., v. Platten-Hallermund, F., Gudmundsson, L., Plauborg, F., Nielsen, C.B., Laier, T. & Olsen, P. 2015: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2013, 110 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Council of the European Union 1994: Council Directive 94/43/EC establishing Annex VI to Directive 91/414/EEC concerning the placing of plant protection products on the market. Official Journal of the European Union L227, 1.9.1994, 31–55.
- Ernstsen, V., Olsen, P. & Rosenbom, A.E. 2015: Long-term monitoring of nitrate transport to drainage from three agricultural clayey till fields. Hydrology and Earth System Sciences 19, 3475–3488, http:// dx.doi.org/10.5194/hess-19-3475-2015.
- Kjær, J. *et al.* 2002: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2001, 150 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.

- Kjær, J., Ullum, M., Olsen, P., Sjelborg, P., Helweg, A., Mogensen, B., Plauborg, F., Grant, R., Fomsgaard, I. & Brüsch, W. 2003: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2002, 158 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Kjær, J., Olsen, P., Barlebo, H.C., Juhler, R.K., Plauborg, F., Grant, R., Gudmundsson, L. & Brüsch, W. 2004: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2003, 146 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Kjær, J., Olsen, P., Barlebo, H.C., Juhler, R.K., Henriksen, T., Plauborg, F., Grant, R., Nyegaard P. & Gudmundsson, L. 2005: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2004, 86 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Kjær, J., Olsen, P., Barlebo, H.C., Henriksen T., Plauborg, F., Grant, R., Nyegaard, P., Gudmundsson, L. & Rosenbom, A.E. 2007: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2006, 99 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Kjær, J., Rosenbom, A., Olsen, P., Juhler, R.K., Plauborg, F., Grant, R., Nyegaard, P., Gudmundsson, L. & Brüsch, W. 2008: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2007, 91 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Kjær, J., Rosenbom, A., Olsen, P., Ernstsen, V., Plauborg, F., Grant, R., Nyegaard, P, Gudmundsson, L. & Brüsch, W. 2009: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2008, 88 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Kjær, J., Rosenbom, A.E., Olsen, P., Ernstsen, V., Plauborg, F., Grant, R., Gudmundsson, L. & Brüsch, W. 2011: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2010, 110 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Larsbo, M., Roulier, S., Stenemo, F., Kasteel, R. & Jarvis, N. 2005: An improved dual-permeability model of water flow and solute transport in the vadose zone. Vadose Zone Journal **4**, 398–406.
- Lindhardt, B., Abildtrup, C., Vosgerau, H., Olsen, P., Torp, S., Iversen, B.V., Jørgensen, J.O., Plauborg, F., Rasmussen, P. & Gravesen, P. 2001: The Danish Pesticide Leaching Assessment Programme: Site characterization and monitoring design, 73 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Rosenbom, A.E., Brüsch, W., Juhler, R.K., Ernstsen, V., Gudmundsson, L., Plauborg, F., Grant, R. & Olsen, P. 2010: The Danish Pesticide Leaching Assessment Programme: Monitoring results May 1999 – June 2009, 102 pp. Copenhagen, Denmark: Geological Survey of Denmark and Greenland.
- Rosenbom, A.E., Olsen, P., Plauborg, F., Grant, R., Juhler, R.K., Brusch,
 W. & Kjaer, J. 2015: Pesticide leaching through sandy and loamy fields – long-term lessons learnt from the Danish Pesticide Leaching Assessment Programme. Environmental Pollution 201, 75–90.

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Appendix.	PLAP analyses from May 1999 to June 2014. Part A	
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Flamprop-M Flamprop-M-isopropyl 520 38 1 0.109 1204 1 0.024 Flamprop 525 23 1 0.35 1212 121		Fenpropimorph acid		636	2	1	0.25		1435			
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Florasulam florasulam <td></td> <td>Flamprop</td> <td></td> <td>525</td> <td>23</td> <td>1</td> <td>0.35</td> <td></td> <td>1212</td> <td></td> <td></td> <td></td>		Flamprop		525	23	1	0.35		1212			
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Fluazifop-P-buthyl Fluazifop-P-buthyl 128 232 TFMP * 184 53 24 0.64 555 87 16 0.29 Fluazifop-P 451 11 4 3.8 1109 7 1 0.17 Fludioxonil CGA 192155 † 11 4 3.8 1109 7 1 0.17 Fluroxypyr Fluroxypyr K 521 4 3 1.4 1273 2 0.072 Glyphosate Glyphosate * 1091 429 136 31 2216 77 5 0.67 AMPA * 1092 632 142 5.4 2217 37 0.08 lodosulfuron-methyl-natrium Metsulfuron-methyl 332 1 0.054 842		Florasulam-desmethyl		109					130			
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Fluazitop-P 451 11 4 3.8 1109 7 1 0.17 Fludioxonil CGA 192155 † 11 4 3.8 1109 7 1 0.17 Fludioxonil CGA 192155 † 11 4 3.8 1109 7 1 0.17 Fluroxypyr Fluroxypyr Fluroxypyr * 521 4 3 1.4 1273 2 0.072 Glyphosate Glyphosate * 1091 429 136 31 2216 77 5 0.67 AMPA * 1092 632 142 5.4 2217 37 0.08 Iodosulfuron-methyl-natrium Metsulfuron-methyl 332 1 0.054 842 0.01 Linuron Linuron tioxynil 527 24 7 0.25 1128 1 0.01 Linuron Linuron tioxynil 527 24 7 0.038 200 2 0.024 EBIS 7 25 1 0.14		I FMP	*	184	53	24	0.64		555	87	16	0.29
Fludioxonil CGA 192155 † 11 § 48 CGA 339833 11 48 Fluroxypyr Fluroxypyr Fluroxypyr 8 1091 429 136 31 2216 77 5 0.67 Glyphosate Glyphosate * 1091 429 136 31 2216 77 5 0.67 AMPA * 1092 632 142 5.4 2217 37 0.08 lodosulfuron-methyl-natrium Metsulfuron-methyl 332 1 0.054 842 lodosulfuron-methyl 527 24 7 0.25 1128 1 0.01 Linuron Linuron 527 24 7 0.038 200 2 0.024 EBIS 7 25 1128 1 0.019 144 7 0.038 200 2 0.024 MCPA BIS 7 25 1 0.24 912 1 0.019 Mesosulfuron-isopropyl Mesosulfuron-methyl 153 13 0.059 § 411 <td></td> <td>Fluazitop-P</td> <td></td> <td>451</td> <td>11</td> <td>4</td> <td>3.8</td> <td></td> <td>1109</td> <td>/</td> <td>1</td> <td>0.17</td>		Fluazitop-P		451	11	4	3.8		1109	/	1	0.17
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AMPA * 1092 632 142 5.4 2217 37 0.08 Iodosulfuron-methyl-natrium Metsulfuron-methyl 332 1 0.054 842 644 64	Glyphosate	Glyphosate	*	1091	429	136	31		2216	//	5	0.67
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	I de sulfanon as stad a stations	AMPA Mataulfunan mathul	*	1092	632	142	5.4		2217	37		0.08
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Toxynii Toy night and the symbolic and the symbo	L	lodosulfuron-metnyi	Т	60 527	24	7	0.05	8	250	4		0.01
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Picra 334 14 3 3.874 916 1 0.017 2-methyl-4-chlorophenol 354 2 1 0.24 912 Mesosulfuron-isopropyl Mesosulfuron-methyl 153 13 0.059 § 411 Mesosulfuron 119 119 119 Mesotrione Mesotrione † 50 § 156 MNBA 50 156	MCBA			254	11	2	2 001		23 014	1		0.010
Mesosulfuron-isopropylMesosulfuron-methyl153130.059§411Mesosulfuron119119119MesotrioneMesotrione†50§156AMBA50156MNBA50156	MCFA	MCFA		334 254	14	3 1	3.07 4 0.24		710 010	I		0.019
Thesosulturon-isopropyiThesosulturon-interinit153150.057§411Mesosulfuron119119Mesotrione†50§156AMBA50156MNBA50156	Macaculfuran isaaraand	Z-meuryi-a-chiorophenoi Mososulfuron methyl		334 153	∠ 1⊃	I	0.24	ç	71Z			
MesotrioneH 50§ 156AMBA50156MNBA50156	r lesosullui oli-isopropyi	Mosoculfuron		110	13		0.037	8	110			
AMBA 50 156 MNBA 50 156	Mesotrione	Mesotrione	+	50				ç	117			
MNBA 50 156			1	50				3	156			
		MNBA		50					156			

Fifty-one pesticides and 52 degradation products analysed in the PLAP programme in the period May 1999 – June 2014. The columns show the number of water samples analysed, number of detections, and detections in concentrations $\geq 0.1 \mu g/l$ in water samples from the variably-saturated zone (drainage and suction cups), and in groundwater (vertical and horizontal groundwater wells).

Det: number of detections. ≥ 0.1 : number of detections $\geq 0.1 \mu g/l$. Max: maximum concentration in $\mu g/l$.

*: Pesticides and their degradation products leached through soil to tile drains or suction cups in average concentrations above 0.1 µg/l.

†: Pesticides not detected or detected only in a few samples above their threshold concentrations at 1 m depth.

§: Pesticides and their degradation products not detected or only detected in a few samples in groundwater.

	•	Tile drain and suction cup					Groundwater				
Pesticide	Analyte		Samples	Det.	≥0.1	Max.		Samples	Det.	≥0.1	Max.
Metalaxyl-M	metalaxyl-M		207	15		0.037		592	79	23	1.3
	CGA 108906	*	215	175	69	4.8		593	468	128	2.7
	CGA 62826	*	216	100	25	1.2		593	147	8	0.68
Metamitron	Metamitron	*	515	103	31	26.369		1095	53	7	0.63
	Desamino-metamitron	*	518	129	23	5.549		1094	78	16	1.3
Metrafenone	Metrafenone		136	20		0.072		273	1		0.04
Metribuzin	Metribuzin		97	2		0.024		414	1		0.014
	Diketo-metribuzin		340	256	63	0.69		552	479	336	1.372
	Desamino-diketo-metribuzin	*	255	81	51	2.1		551	256	18	1.831
	Desamino-metribuzin	*	91					392			
Pendimethalin	Pendimethalin		694	89	30	32		1811	1		0.052
Phenmedipham	Phenmedipham		288					580	2		0.025
	MHPC		288	2	1	0.19		580	1		0.053
	3-aminophenol		109					245			
Picolinafen	Picolinafen		117	18		0.07		193			
	CL153815	*	117	31	11	0.5		193			
Pirimicarb	Pirimicarb		887	62		0.077		2120	6		0.035
	Pirimicarb-desmethyl-formamido	*	707	29	13	0.379		1638	2		0.076
	Pirimicarb-desmethyl		780	8		0.053		1911	3		0.042
Propiconazol	Propiconazole		899	32	3	0.862		2084	3		0.035
Propyzamid	Propyzamide	*	257	27	8	1.6		754	10	2	0.14
	RH-24644		257	19		0.051		754	2		0.032
	RH-24580		257	2		0.016		754			
	RH-24655		233	1		0.017		690			
Prosulfocarb	Prosulfocarb		199	6	1	0.18		516	5		0.032
Pyridat	Pyridate		39					116			
	PHCP		125	4	4	2.69		373	14	4	0.309
Rimsulfuron	Rimsulfuron		117					367			
	PPU	*	502	388	74	0.29		1519	432	13	0.23
	PPU-desamino		502	186	6	0.18		1519	107		0.089
Tebuconazole	Tebuconazole	*	289	47	17	2		784	8	2	0.12
	1.2.4-triazol	*						16	7	1	0.17
Terbuthylazine	Terbuthylazine	*	513	213	56	11		1324	88	23	1.9
	Desethyl-terbuthylazine	*	612	365	88	8.3		1664	261	33	0.94
	Desisopropylatrazine		414	156	2	0.44		996	92		0.047
	Hydroxy-terbuthylazine	*	384	136	18	0.99		940	34		0.069
	2-hydroxy-desethyl-terbuthylazine	e *	342	128	28	6.3		850	9		0.092
Thiacloprid	Thiacloprid	†	47				§	100			
	Thiacloprid-amide		47	1		0.012		100			
	M34		55					100			
	Thiacloprid sulfonic acid		56					100			
Thiamethoxam	Thiamethoxam	†	132				§	359			
	CGA 322704		132					359			
Triasulfuron	Triasulfuron	†	82				§	301			
	Triazinamin		393					1103	1		0.042
Tribenuron-methyl	Triazinamin-methyl	†	569	2		0.042	§	1523			
Triflusulfuron-methyl	Triflusulfuron-methyl	†	95					288			
	IN-E7710		95	5		0.014		288			
	IN-M7222		95					288	1		0.052
	IN-D8526		95					288			

Appendix. PLAP analyses from May 1999 to June 2014. Part B

Fifty-one pesticides and 52 degradation products analysed in the PLAP programme in the period May 1999 – June 2014. The columns show the number of water samples analysed, number of detections, and detections in concentrations $\geq 0.1 \mu g/l$ in water samples from the variably-saturated zone (drainage and suction cups), and in groundwater (vertical and horizontal groundwater wells).

Det: number of detections. \geq 0.1: number of detections \geq 0.1µg/l. Max: maximum concentration in µg/l.

*: Pesticides and their degradation products leached through soil to tile drains or suction cups in average concentrations above 0.1 µg/l.

†: Pesticides not detected or detected only in a few samples above their threshold concentrations at 1 m depth.

§: Pesticides and their degradation products not detected or only detected in a few samples in groundwater.