

Definition of the PRIBEL values in 1991 and 1996

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INTRODUCTION

In this study an evaluation of the risks and impact of pesticides used in Belgian agriculture in 1991 and 1996 will be performed. The Pesticide Risk Indicator for BELgium "PRIBEL" (Vergucht *et al.*, 2006) will be applied in order to calculate the risk and impact values. Some experts will be contacted to gain better insight in the pesticide application patterns from those specific years.

First a lot of input data had to be collected (selection of the crops, fixing reference use doses, update of the (eco)tox database, partition of the active substances over the different crops) before calculation software can start. All the results acquired with PRIBEL will be profoundly evaluated and presented in graphs and tables to make it more visible and clear. In a last part the results are compared to the results of the reference year of the Federal Reduction Plan, 2001, which were already obtained in a former report (Vergucht *et al.*, 2006).

1. Selection of the relevant crops in 1991 and 1996

The objective is not to evaluate all 9 crop groups as was done in 2001, but to select the most important and most relevant crop groups for 1991 and 1996. The representativeness of all crop groups established and applied in the PRIBEL calculations of 2001 will be tested on two issues: area and pesticide usage.

The number of hectares per crop group are shown in Table 1 and Figure 1 (data: NIS). Cereal and maize represent the highest area in Belgium, followed by sugarbeet and potato. Vegetables, industrial crops, fruit, fodder and greenhouse vegetables in particular manifest only a low number of hectares. Trends over the years can also be perceived: the area of cereal and sugarbeet decreased over the 3 considered years, whereas the hectares where maize is cultivated strongly increased.

The contribution of the 5 upper crop groups (potato, sugarbeet, cereal, maize and fruit) amounts to 90% in 1991 and 1996; to 84% in 2001. The researchers decided in consultation with the steering committee that a percentage over 90% could be considered as representative and satisfying.

Table 1: National area of all crop groups in 1991, 1996 and 2001

Crop group	National area (ha)		
	1991	1996	2001
potato	52 106	63 131	62 157
sugarbeet	113 739	107 323	95 553
cereal	305 273	272 632	246 324
maize	153 123	199 588	223 324
fruit	13 605	15 928	17 448
TOTAL of 5	637 846	658 602	644 806
vegetables	31 445	30 693	63 500
Industrial crops	21 168	29 658	39 566
greenhouse vegetables	1 114	976	1 196
fodder	10 229	5 545	12 069
TOTAL of all	701 802	725 474	761 137
% of the 5 crops	90.9 %	90.8%	84.7%

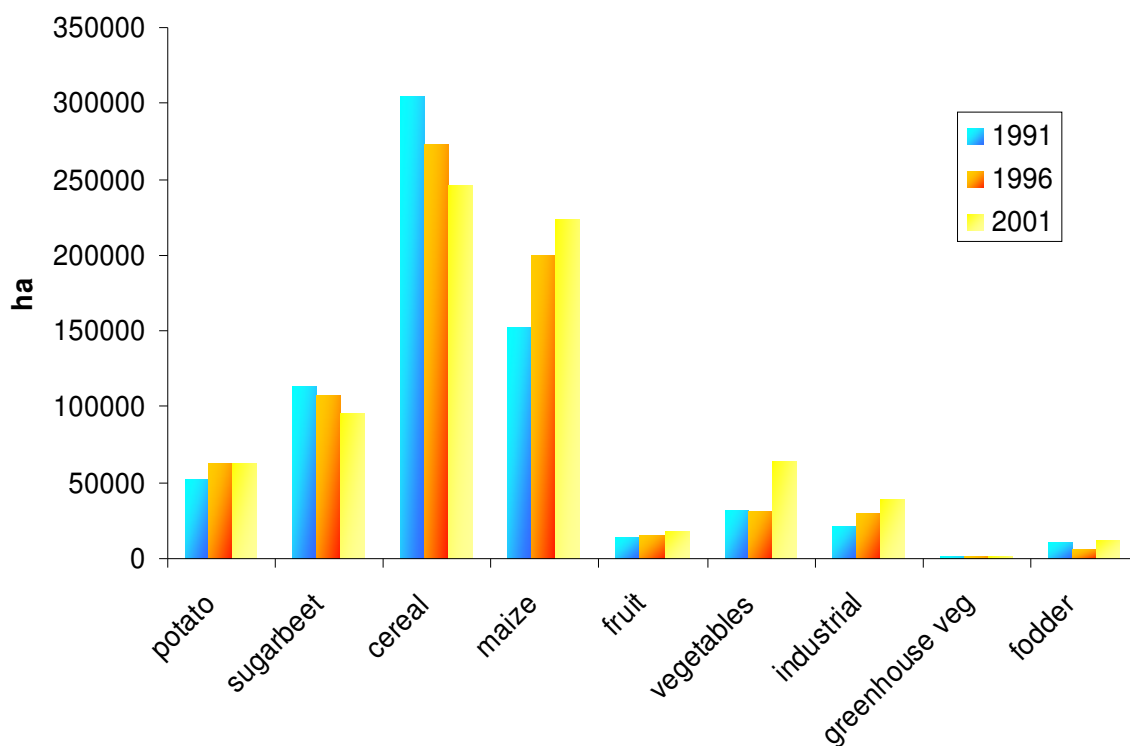


Figure 1: Area representativeness for all crop groups in 1991, 1996 and 2001

The usage representativeness is shown in Table 2 and Figure 2. Those data are based on the top 100 of the national sales (pers. comm. Herman Fontier, FOD VVVL) and the repartition key established by the expert committee and explained in Task 4.

The highest part of pesticides sold in Belgium in 1991 and 1996 was intended for usage in cereal. This can to a large extent be explained by the high area of cereal in Belgium. Potato and sugarbeet are both in the same range concerning area and usage. Maize and fruit show an opposite pattern: although there are many hectares of maize (listed on a second place after cereal, Table 1) the use of pesticides is relatively low (listed on a fifth place, Table 2). The application of pesticides in fruit occurs many times (listed on a third place in 1991 and a second place in 1996, Table 2) whereas the number of hectares is quite small (listed on a fifth place of the 5 considered crops, Table 1).

The use of pesticides in sugarbeet diminished with 30% in 1996 compared to 1991, mainly due to some pesticides sold for a significantly higher amount (e.g. sulphur, lindane, aldicarb) in 1991. It is remarkable that except for fruit (+0.8%) all 5 considered crops show a decrease in pesticide usage in 1996. The cause is twofold: the national sales generally decreased in 1996 (total of all: -5.7%, Table 2) and the partition of the sales over the crops differed in 1996 compared to 1991. The experts often attributed a higher percentage of the sales to the other crops (vegetables, industrial crops, fodder and greenhouse crops) or to the non-agricultural use in 1996.

The contribution of pesticide usage in potato, sugarbeet, cereal, maize and fruit amounts to 79.3% in 1991 and 76.0% in 1996; this was accepted by the steering committee as representative for calculation.

There can be concluded that the 5 proposed crop groups are accepted for further calculations on the basis of a representative area and pesticide usage part and that the evaluation process will be limited to those 5 crops.

Table 2: Kg of active substance (a.s.) used in all crop groups in 1991 and 1996, and decrease or increase in 1996 compared to 1991 in %

Crop group	kg a.s. used		
	1991	1996	% difference in 1996
potato	871 257	792 588	-9.0
sugarbeet	1 021 508	712 329	-30.3
cereal	1 821 735	1 703 124	-6.5
maize	640 904	621 064	-3.0
fruit	990 616	998 336	+0.8
TOTAL of 5	5 346 022	4 827 441	-9.7
other	1 393 688	1 526 015	+9.5
TOTAL of all	6 739 710	6 353 456	-5.7
% of the 5 crops	79.3 %	76.0%	

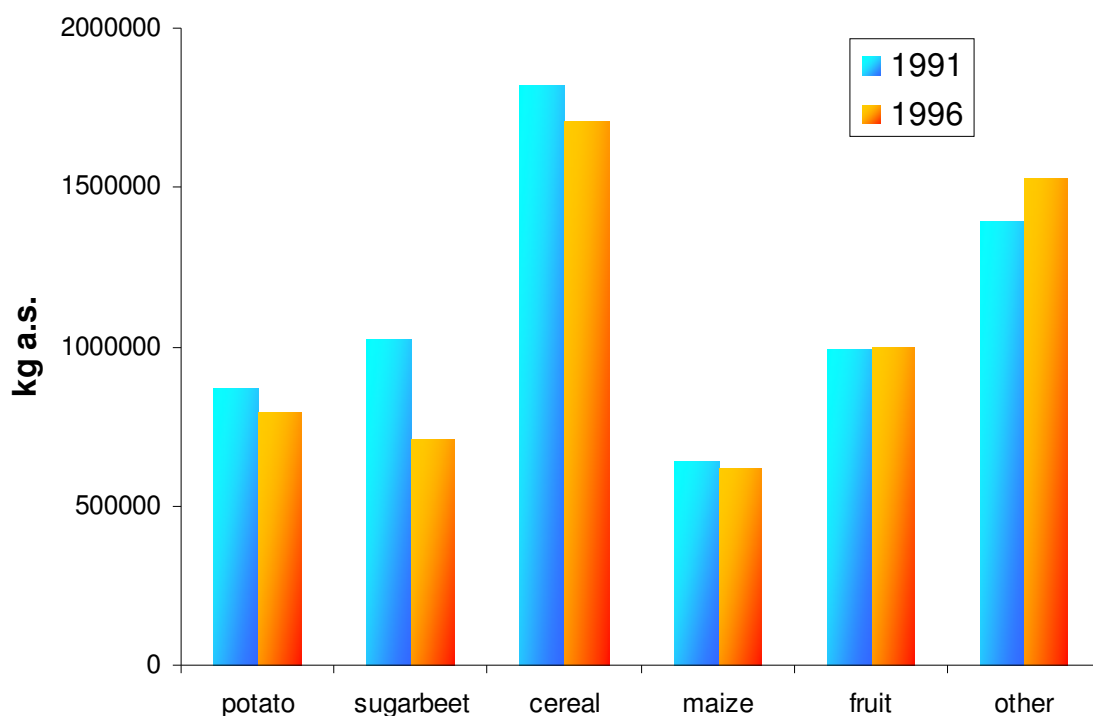


Figure 2: Kg of active substances (a.s.) used in all crop groups in 1991 and 1996

2. Determining the reference use doses of 1991 and 1996

The purpose of task 2 is to fix the usage doses per active substance and per crop group for 1991 and 1996. For PRIBEL calculations in 2001 not the maximum doses as listed on Fytoweb (www.fytoweb.be) were used, but the application doses obtained with enquiries (Van den Bossche & Van Lierde, 2002 and 2003) in order to approach a more *realistic worst case scenario* rather than a worst case scenario. In the evaluations for 1991 and 1996 the “Lijst der erkende gewasbeschermingsmiddelen voor landbouwkundig gebruik”, 1990 and 1996, edited by the Ministry of Agriculture will be used as sources. One could object that the official books contain similar data as Fytoweb and hence that this study will be a worst case scenario evaluation, though pesticide operators (farmers and agricultural contractors) were obliged to spray the mentioned (maximum) dose in 1991 and 1996. So in this point of view it will also be a realistic worst case scenario evaluation.

When doses were given in ml as/l water they had to be converted into l as/ha, consequently the liter of water sprayed per hectare is required. For field crops a default value of 300 liter was implemented; 1500 liter for fruit.

When it concerns a dose interval (e.g. 1-2 kg product) the highest value is taken for implementation in PRIBEL. Formulation types are also copied from the books: liquids (L), wettable powders (WP), granules (GR) and watersoluble granules (WG).

The determined doses for the sales top 100 of 1991 and 1996 is presented in Table 3 in Task 4 (attached to the repartition percentages).

3. Determining the (eco)toxicological data of active substances applied in 1991 and 1996

All physico-chemical and (eco)toxicological data of the active substances are collected in a database that can be linked to the PRIBEL software in order to evaluate the risk and impact. This implies a completion of the database of the Laboratory of Phytopharmacy of Ghent University that was utilized in PRIBEL calculations of 2001. The data are collected from the following sources (in order of importance):

1. European Union dossiers
(http://ec.europa.eu/food/plant/protection/evaluation/index_en.htm)
2. CTB – The Netherlands (<http://www.ctb-wageningen.nl/>)
3. Pandora's Box (Linders et al., 1994)
4. The Pesticide Manual (Tomlin, 2004)
5. Extoxnet (<http://extoxnet.orst.edu/>)
6. Toxnet (<http://toxnet.nlm.nih.gov/>)
7. Other sources

It should be noticed that in the database used for the Pribel calculations, not any confidential value is included. For 101 active substances the ecotoxicological data were provided by the producing company, but as one of the primary goals of Pribel was to be completely transparent, the confidential firm data were replaced by public data originating from the sources listed above. Sometimes big differences were noticed between the original firm data and the new public data.

4. Partition of sales of active substances over the different crops in 1991 and 1996

The national sales per active substance are provided by FOD VVWL (Herman Fontier, pers. comm., 2007). The top 100 is composed for 1991 and 1996 and for reasons of consistency with PRIBEL calculations of 2001, the weighted mean of the sales is taken. Such a weighted mean is used in order to level off peaks in sales due to errors in the sales statistics or to exceptional high sold amounts of certain active substances caused by specific weather conditions. This would obscure overall trends in pesticide use.

$$sales_{1991*} = \frac{sales_{1990} + sales_{1991} + sales_{1992}}{3}$$

$$sales_{1996*} = \frac{sales_{1995} + sales_{1996} + sales_{1997}}{3}$$

With:

- Sales_{1991*} = weighted mean of the 1991 sales
- Sales_{1996*} = weighted mean of the 1996 sales

To make an analysis of the risks per crop group a repartition key is required to divide the sales per active substance over the particular crops. The repartition key developed for the Seq calculations (applied in the MIRA-T reports in Flanders) and used in the PRIBEL evaluation for 2001 cannot be applied for the two former years, for reasons of different active substances placed on the market, different usage in the considered crops (e.g. expired or new authorizations in some crops) and an overestimation of use in fruit. A team of experts was involved to create a repartition key for 1991 and 1996 separately. The repartition key was detailed for the sales top 100 of active substances in 1991 and 1996 for the 5 selected crops. The 5 experts invited were:

- **Laurent De Temmerman:** former engineer at the Ministry of Agriculture, department of Plant Protection (Vlaams-Brabant) until 1994; from 1994 department of Development and Information of Flanders, responsible for the sector industry crops)

- **Annie Demeyere:** engineer at the Ministry of Agriculture, department of Development and Information (Limburg), responsible for all crops and with special affiliation for field crops and fruit (until 2003); from 2003 Flemish Government, department of Sustainable Agricultural Development, responsible for fruit; from 2007 responsible for potatoes, sugarbeets and chicory.

- **Frans Goossens:** engineer at the Ministry of Agriculture, department Plant Protection (West-Vlaanderen), responsible for phytosanitary control and information concerning horticulture (until 1993); department of Research and Development, responsible for crop protection information in horticulture in Flanders (until 2002); from 2003 at the Flemish Public Service, department Agriculture and Fisheries, section Sustainable Development, same task.

- **Jozef Van Melckebeke:** former engineer at the Ministry of Agriculture, department of Development and Information of Flanders, responsible for the sector vegetables)

- **Michel Van Himme:** former scientific employee at the Laboratory of Weed Research at Ghent University

The repartition coefficient RP indicates the distribution of the sold amount between crops and is based on the judgment of the expert panel.

$$Q [kg / yr] = sales [kg / yr] * RP[\%]$$

With:

- Q (kg a.s./crop/year) = total quantity of a.s. used per crop and per year
- Sales (kg a.s./yr) = weighted mean of the national sales per a.s.
- RP (%) = repartition coefficient for a particular a.s. for a specific crop

The basic hypothesis for such a calculation is that the amount of pesticide used per hectare is quite constant over the years while the sales are varying according to the national area of each crop and the number of doses applied per hectare in a given year.

Some active substances are estimated by the expert committee to be used for 100% in non-agricultural applications and are consequently not taken into account in PRIBEL. Table 4 gives an overview for the two studied years.

Tabel 3: overview of the active substances intended for non-agricultural use only in 1991 and 1996

1991	1996
natriumchloraat	natriumchloraat
ijzersulfaat	ijzersulfaat
propionzuur	boortrioxide
TCA	fenol
boortrioxide	ijzerdinatrium-EDTA

For some active substances ecotoxicological data are still scarce and/or not of adequate quality. Those values could be replaced by default values of similar active substances, but as most of the active substances belong to the same category (oils) for which there is a high lack on appropriate ecotox data the authors believe that surrogate values would harm the correctness of the results. Accordingly, these active substances are not implemented in PRIBEL.

Tabel 4: overview of the active substances not implemented in PRIBEL due to missing ecotox data

1991	1996
paraffine olie	paraffine olie
minerale olie	minerale olie
koolzaadolie	koolzaadolie
alkyl-aryl compounds	alkyl-aryl compounds
formaldehyde (smoking tablet)	formaldehyde (smoking tablet)
	active oil

Table 5 reflects all repartition percentages for the sales top 100 of active substances in 1991 and 1996. The applied doses (expressed in g/ha) and the formulation type (liquid L, granule GR, watersoluble granule WG, wettable powder WP or seed treatment ZB) are also added in the table.

Legend of table 5:



Active substances for non-agricultural use only: not implemented in PRIBEL



Active substances with no sufficient ecotox data: not implemented in PRIBEL



Active substance not belonging to the sales top 100 for a specific year: not implemented in PRIBEL

Table 5: Repartition coefficients for all top 100 active substances in 1991 and 1996 in %, applied dose (g/ha) and formulation type (L, WG, WP, GR and ZB)

active substance	crop	% in 1991	dosis (g/ha)	formulation	% in 1996	dosis (g/ha)	formulation
NATRIUMCHLORAAT	graan						
NATRIUMCHLORAAT	mais						
NATRIUMCHLORAAT	biet						
NATRIUMCHLORAAT	aardappelen						
NATRIUMCHLORAAT	fruitteelt						
NATRIUMCHLORAAT	niet landbouw	100			100		
MANCOZEB	graan	40	1600	WP/L/WG	40	1600	WP/L/WG
MANCOZEB	mais						
MANCOZEB	biet						
MANCOZEB	aardappelen	40	3200		30	3200	
MANCOZEB	fruitteelt	10	2400		10	2400	
MANCOZEB	rest	10			20		
MANEB	graan	40	1600	WP/L	40	1600	WP/L
MANEB	mais						
MANEB	biet						
MANEB	aardappelen	40	3200		30	3200	
MANEB	fruitteelt	10	2400		10	2400	
MANEB	rest	10			20		
ZWAVEL	graan	5	4000		2	4000	
ZWAVEL	mais						
ZWAVEL	biet	45	6000	L/WG/WP	10	6000	L/WG/WP
ZWAVEL	aardappelen						
ZWAVEL	fruitteelt	50	7200		88	7200	
ZWAVEL	niet landbouw						
IJZERSULFAAT	graan						
IJZERSULFAAT	mais						
IJZERSULFAAT	biet						

IJZERSULFAAT	aardappelen					
IJZERSULFAAT	fruitteelt					
IJZERSULFAAT	niet landbouw	100			100	
CHLOORMEQUAT	graan	80	1000 L		80	1000 L
CHLOORMEQUAT	mais					
CHLOORMEQUAT	biet					
CHLOORMEQUAT	aardappelen					
CHLOORMEQUAT	fruitteelt	20	1450		20	1450
CHLOORMEQUAT	niet landbouw					
METHYLBROMIDE	graan					
METHYLBROMIDE	mais					
METHYLBROMIDE	biet					
METHYLBROMIDE	aardappelen					
METHYLBROMIDE	fruitteelt	5	900000 L		5	900000 L
METHYLBROMIDE	rest	95			95	
PARAFFINE OLIE	graan					
PARAFFINE OLIE	mais	30			30	
PARAFFINE OLIE	biet	40			40	
PARAFFINE OLIE	aardappelen		12 L			12 L
PARAFFINE OLIE	fruitteelt	30			30	
PARAFFINE OLIE	rest					
ATRAZIN	graan					
ATRAZIN	mais	100	4000 WP/L		100	4000 WP/L
ATRAZIN	biet					
ATRAZIN	aardappelen					
ATRAZIN	fruitteelt					
ATRAZIN	niet landbouw					
METAM-NATRIUM	graan					
METAM-NATRIUM	mais					
METAM-NATRIUM	biet					
METAM-NATRIUM	aardappelen					
METAM-NATRIUM	fruitteelt	5	400000 L		5	400000 L
METAM-NATRIUM	rest	95			95	

ISOPROTURON	graan	100	2250 L	100	2250 L
ISOPROTURON	mais				
ISOPROTURON	biet				
ISOPROTURON	aardappelen				
ISOPROTURON	fruitteelt				
ISOPROTURON	niet landbouw				
DICHLOROPROPEEN CIS 1,3	graan				
DICHLOROPROPEEN CIS 1,3	mais				
DICHLOROPROPEEN CIS 1,3	biet				
DICHLOROPROPEEN CIS 1,3	aardappelen				
DICHLOROPROPEEN CIS 1,3	fruitteelt	5	375000 L	5	375000 L
DICHLOROPROPEEN CIS 1,3	rest	95		95	
THIRAM	graan				
THIRAM	mais				
THIRAM	biet				
THIRAM	aardappelen				
THIRAM	fruitteelt	50	3750 WP	50	3750 WP
THIRAM	rest	50		50	
CHLORIDAZON	graan				
CHLORIDAZON	mais				
CHLORIDAZON	biet	98	3200 WP/L/WG	98	3200 WP/L/WG
CHLORIDAZON	aardappelen				
CHLORIDAZON	fruitteelt				
CHLORIDAZON	rest	2		2	
METAMITRON	graan				
METAMITRON	mais				
METAMITRON	biet	98	3500 WG	98	3500 WG
METAMITRON	aardappelen				
METAMITRON	fruitteelt				
METAMITRON	rest	2		2	
DIURON	graan				
DIURON	mais				
DIURON	biet				

DIURON	aardappelen					
DIURON	fruitteelt	20	4000 WP		20	4000 WP
DIURON	rest	80			80	
PROSULFOCARB	graan	100	4000 L		75	4000 L
PROSULFOCARB	mais					
PROSULFOCARB	biet					
PROSULFOCARB	aardappelen				25	4000
PROSULFOCARB	fruitteelt					
PROSULFOCARB	rest					
GLYFOSAAT	graan	5	2880 L		5	2880 L
GLYFOSAAT	mais					
GLYFOSAAT	biet					
GLYFOSAAT	aardappelen					
GLYFOSAAT	fruitteelt	10	2880		10	2880
GLYFOSAAT	rest	85			85	
MCPA	graan	30	1500 WP/L		30	1500 WP/L
MCPA	mais					
MCPA	biet					
MCPA	aardappelen					
MCPA	fruitteelt	5	1500		5	1500
MCPA	rest	65			65	
CAPTAN	graan					
CAPTAN	mais					
CAPTAN	biet					
CAPTAN	aardappelen					
CAPTAN	fruitteelt	90	6150 WP/L		90	6150 WP/L
CAPTAN	rest	10			10	
AMITROL	graan					
AMITROL	mais					
AMITROL	biet					
AMITROL	aardappelen					
AMITROL	fruitteelt	10	5000 WP/L		10	5000 WP/L
AMITROL	rest	90			90	

CHLOORTHALONIL	graan	60	1250 WP/L	60	1250 WP/L
CHLOORTHALONIL	mais				
CHLOORTHALONIL	biet				
CHLOORTHALONIL	aardappelen	20	1500	20	1500
CHLOORTHALONIL	fruitteelt				
CHLOORTHALONIL	rest	20		20	
FENPROPIMORF	graan	80	750 L	70	750 L
FENPROPIMORF	mais				
FENPROPIMORF	biet	15		15	
FENPROPIMORF	aardappelen				
FENPROPIMORF	fruitteelt				
FENPROPIMORF	rest	5		15	
MECOPROP	graan	50	2000 L		2000 L
MECOPROP	mais				
MECOPROP	biet				
MECOPROP	aardappelen				
MECOPROP	fruitteelt	2	2000		2000
MECOPROP	rest	48			
BENTAZON	graan	5	1440 L	5	1440 L
BENTAZON	mais	90	1440	75	1440
BENTAZON	biet				
BENTAZON	aardappelen			5	
BENTAZON	fruitteelt				
BENTAZON	rest	5		15	
PYRIDAAT	graan	5	2250 WP/L	5	2250 WP/L
PYRIDAAT	mais	95	2250	95	2250
PYRIDAAT	biet				
PYRIDAAT	aardappelen				
PYRIDAAT	fruitteelt				
PYRIDAAT	niet landbouw				
CARBENDAZIM	graan	30	200 WP/L/WG	30	200 WP/L/WG
CARBENDAZIM	mais				
CARBENDAZIM	biet	5	150	5	150

CARBENDAZIM	aardappelen					
CARBENDAZIM	fruitteelt	10	450		10	450
CARBENDAZIM	rest	55			55	
SIMAZIN	graan					
SIMAZIN	mais					
SIMAZIN	biet					
SIMAZIN	aardappelen					
SIMAZIN	fruitteelt	10	1500 WP/GR		10	1500 WP/GR
SIMAZIN	rest	90			90	
LINDAAN	graan					
LINDAAN	mais	20	1500 L		50	1500 L
LINDAAN	biet	50	1500		25	1500
LINDAAN	aardappelen					
LINDAAN	fruitteelt					
LINDAAN	rest	30			25	
ETHOFUMESAAT	graan					
ETHOFUMESAAT	mais					
ETHOFUMESAAT	biet	95	1000 L		95	1000 L
ETHOFUMESAAT	aardappelen					
ETHOFUMESAAT	fruitteelt					
ETHOFUMESAAT	rest	5			5	
2,4-D	graan	60	1250		60	1250 L
2,4-D	mais	5	1250		5	1250
2,4-D	biet					
2,4-D	aardappelen					
2,4-D	fruitteelt	5	1250		5	1250
2,4-D	rest	30			30	
FENTINHYDROXIDE	graan					
FENTINHYDROXIDE	mais					
FENTINHYDROXIDE	biet					
FENTINHYDROXIDE	aardappelen	95	400 WP/L		95	400 WP/L
FENTINHYDROXIDE	fruitteelt					
FENTINHYDROXIDE	rest	5			5	

CHLOORTOLURON	graan	90	2500 WP/L/WG	90	2500 WP/L/WG
CHLOORTOLURON	mais				
CHLOORTOLURON	biet				
CHLOORTOLURON	aardappelen				
CHLOORTOLURON	fruitteelt	5	2500	5	2500
CHLOORTOLURON	rest	5		5	
DAZOMET	graan				
DAZOMET	mais				
DAZOMET	biet				
DAZOMET	aardappelen				
DAZOMET	fruitteelt	1	490000 GR/WP	1	490000 GR/WP
DAZOMET	rest	99		99	
MECOPROP(-P)	graan	50	1440 L	50	1440 L
MECOPROP(-P)	mais				
MECOPROP(-P)	biet				
MECOPROP(-P)	aardappelen				
MECOPROP(-P)	fruitteelt	2	1440	2	1440
MECOPROP(-P)	rest	48		48	
ETHEFON	graan	80	600 L	80	600 L
ETHEFON	mais				
ETHEFON	biet				
ETHEFON	aardappelen				
ETHEFON	fruitteelt	18	750	18	750
ETHEFON	rest	2		2	
KOPEROXYCHLORIDE	graan				
KOPEROXYCHLORIDE	mais				
KOPEROXYCHLORIDE	biet				
KOPEROXYCHLORIDE	aardappelen	10	2500 WP	10	2500 WP
KOPEROXYCHLORIDE	fruitteelt	70	6000	70	6000
KOPEROXYCHLORIDE	rest	20		20	
PROCHLORAZ	graan	80	450 L/WP	80	450 L/WP
PROCHLORAZ	mais				
PROCHLORAZ	biet				

PROCHLORAZ	aardappelen				
PROCHLORAZ	fruitteelt				
PROCHLORAZ	rest	20		20	
CHLOORPROFAM	graan				
CHLOORPROFAM	mais				
CHLOORPROFAM	biet				
CHLOORPROFAM	aardappelen	95	2400 L	95	2400 L
CHLOORPROFAM	fruitteelt				
CHLOORPROFAM	rest	5		5	
FENMEDIFAM	graan				
FENMEDIFAM	mais				
FENMEDIFAM	biet	95	960 L	95	960 L
FENMEDIFAM	aardappelen				
FENMEDIFAM	fruitteelt	2	960	2	960
FENMEDIFAM	rest	3		3	
LENACIL	graan				
LENACIL	mais				
LENACIL	biet	95	800 L/WP	95	800 L/WP
LENACIL	aardappelen				
LENACIL	fruitteelt	1	800	1	800
LENACIL	rest	4		4	
METOLACHLOOR	graan				
METOLACHLOOR	mais	95	2520 L	95	2520 L
METOLACHLOOR	biet				
METOLACHLOOR	aardappelen				
METOLACHLOOR	fruitteelt				
METOLACHLOOR	rest	5		5	
PROPINEB	graan				
PROPINEB	mais				
PROPINEB	biet				
PROPINEB	aardappelen	95	2100 WP		
PROPINEB	fruitteelt				

PROPINEB	rest	5				
PENDIMETHALIN	graan	80	825 L		90	825 L
PENDIMETHALIN	mais	20	825		10	825
PENDIMETHALIN	biet					
PENDIMETHALIN	aardappelen					
PENDIMETHALIN	fruitteelt					
PENDIMETHALIN	niet landbouw					
DIQUAT	graan	10	975 L		10	975 L
DIQUAT	mais					
DIQUAT	biet					
DIQUAT	aardappelen	80	975		80	975
DIQUAT	fruitteelt	5	975		5	975
DIQUAT	rest	5			5	
ZINEB	graan					
ZINEB	mais					
ZINEB	biet					
ZINEB	aardappelen					
ZINEB	fruitteelt	10	4500 WP			
ZINEB	rest	90				
DICHLORPROP	graan	65	2100 L		65	2100 L
DICHLORPROP	mais					
DICHLORPROP	biet					
DICHLORPROP	aardappelen					
DICHLORPROP	fruitteelt	5	2100		5	2100
DICHLORPROP	rest	30			30	
DICHOLOBENIL	graan					
DICHOLOBENIL	mais					
DICHOLOBENIL	biet					
DICHOLOBENIL	aardappelen					
DICHOLOBENIL	fruitteelt	10	6000 WP/GR		10	6000 WP/GR
DICHOLOBENIL	rest	90			90	
MINERALE OLIE	graan		L			L
MINERALE OLIE	mais	30			30	

MINERALE OLIE	biet	40		40	
MINERALE OLIE	aardappelen				
MINERALE OLIE	fruitteelt	30		30	
MINERALE OLIE	niet landbouw				
PARATHION	graan				
PARATHION	mais				
PARATHION	biet	25	250 WP/L	25	250 WP/L
PARATHION	aardappelen				
PARATHION	fruitteelt	25	250	25	250
PARATHION	rest	50		50	
ALDICARB	graan				
ALDICARB	mais				
ALDICARB	biet	90	1000 GR	20	1000 GR
ALDICARB	aardappelen				
ALDICARB	fruitteelt				
ALDICARB	rest	10		80	
CYCLOAAT	graan				
CYCLOAAT	mais				
CYCLOAAT	biet	100	2880 L		
CYCLOAAT	aardappelen				
CYCLOAAT	fruitteelt				
CYCLOAAT	niet landbouw				
TEBUCONAZOOL	graan	100	375 L	100	375 L
TEBUCONAZOOL	mais				
TEBUCONAZOOL	biet				
TEBUCONAZOOL	aardappelen				
TEBUCONAZOOL	fruitteelt				
TEBUCONAZOOL	niet landbouw				
DICHLOORPROP-P	graan	65	1440 L	65	1440 L
DICHLOORPROP-P	mais				
DICHLOORPROP-P	biet				
DICHLOORPROP-P	aardappelen				
DICHLOORPROP-P	fruitteelt	5	1440	5	1440

DICHLORPROP-P	rest	30		30	
DIMETHOAAAT	graan				
DIMETHOAAAT	mais				
DIMETHOAAAT	biet	20	500 L	5	500 L
DIMETHOAAAT	aardappelen	20	500	20	500
DIMETHOAAAT	fruitteelt	20	600	20	600
DIMETHOAAAT	rest	40		55	
ACLONIFEEN	graan				
ACLONIFEEN	mais				
ACLONIFEEN	biet				
ACLONIFEEN	aardappelen	100	2400 L	100	2400 L
ACLONIFEEN	fruitteelt				
ACLONIFEEN	niet landbouw				
TRI-ALLAAT	graan				
TRI-ALLAAT	mais				
TRI-ALLAAT	biet	90	1600 L		
TRI-ALLAAT	aardappelen				
TRI-ALLAAT	fruitteelt				
TRI-ALLAAT	rest	10			
PARAQUAT	graan				
PARAQUAT	mais				
PARAQUAT	biet				
PARAQUAT	aardappelen	10	1000	10	1000
PARAQUAT	fruitteelt	10	800 L	10	800 L
PARAQUAT	rest	80		80	
DNOC	graan	30		0	
DNOC	mais				
DNOC	biet				
DNOC	aardappelen	30	5000 L	30	5000 L
DNOC	fruitteelt	70	5000	70	5000
DNOC	niet landbouw				
METHABENZTHIAZURON	graan	90	3500 WP/WG	90	3500 WP/WG
METHABENZTHIAZURON	mais				

METHABENZTHIAZURON	biet					
METHABENZTHIAZURON	aardappelen					
METHABENZTHIAZURON	fruitteelt					
METHABENZTHIAZURON	rest	10			10	
METOBROMURON	graan					
METOBROMURON	mais					
METOBROMURON	biet					
METOBROMURON	aardappelen	90	2000 L		90	2000 L
METOBROMURON	fruitteelt					
METOBROMURON	rest	10			10	
FORMALDEHYDE	graan					
FORMALDEHYDE	mais					
FORMALDEHYDE	biet					
FORMALDEHYDE	aardappelen					
FORMALDEHYDE	fruitteelt	5	3100 ROOKTABLET		5	3100 ROOKTABLET
FORMALDEHYDE	niet landbouw	95			95	
PIRIMICARB	graan	20	125 WG		20	125 WG
PIRIMICARB	mais					
PIRIMICARB	biet	10	175		10	175
PIRIMICARB	aardappelen	20	175		20	175
PIRIMICARB	fruitteelt	20	375		20	375
PIRIMICARB	rest	30			30	
BIFENOX	graan	100	748 L		100	748 L
BIFENOX	mais					
BIFENOX	biet					
BIFENOX	aardappelen					
BIFENOX	fruitteelt					
BIFENOX	niet landbouw					
ETHIOFENCARB	graan					
ETHIOFENCARB	mais					
ETHIOFENCARB	biet	30	500 L			
ETHIOFENCARB	aardappelen	20	500			
ETHIOFENCARB	fruitteelt	20	500			

ETHIOFENCARB	rest	30				
PROPACHLOOR	graan					
PROPACHLOOR	mais	5	4800 L/WP	5	4800 L/WP	
PROPACHLOOR	biet					
PROPACHLOOR	aardappelen					
PROPACHLOOR	fruitteelt					
PROPACHLOOR	rest	95		95		
IPRODION	graan					
IPRODION	mais					
IPRODION	biet					
IPRODION	aardappelen					
IPRODION	fruitteelt	10	750 WP/L	10	750 WP/L	
IPRODION	rest	90		90		
THIOFANAAT-METHYL	graan	20	700	10	700	
THIOFANAAT-METHYL	mais					
THIOFANAAT-METHYL	biet	20	300	10	300	
THIOFANAAT-METHYL	aardappelen					
THIOFANAAT-METHYL	fruitteelt	10	1275	10	1275	
THIOFANAAT-METHYL	rest	50		70		
METIRAM	graan	10	4000 WG	10	4000 WG	
METIRAM	mais					
METIRAM	biet					
METIRAM	aardappelen	30	4000	30	4000	
METIRAM	fruitteelt	15	4500	15	4500	
METIRAM	rest	55		55		
ENDOSULFAN	graan					
ENDOSULFAN	mais					
ENDOSULFAN	biet					
ENDOSULFAN	aardappelen	50	180 WP/L	50	180 WP/L	
ENDOSULFAN	fruitteelt	20	2700	20	2700	
ENDOSULFAN	rest	30		30		
ALACHLOOR	graan					

ALACHLOOR	mais	100	2400 L		
ALACHLOOR	biet				
ALACHLOOR	aardappelen				
ALACHLOOR	fruitteelt				
ALACHLOOR	rest				
ASULAM	graan				
ASULAM	mais				
ASULAM	biet				
ASULAM	aardapelen				
ASULAM	fruitteelt				
ASULAM	rest	40			
ASULAM	niet landbouw	60		100	
FENTINACETAAT	graan				
FENTINACETAAT	mais				
FENTINACETAAT	biet				
FENTINACETAAT	aardappelen	95	400 WP/L	80	400 WP/L
FENTINACETAAT	fruitteelt				
FENTINACETAAT	rest	5		20	
DINOTERB	graan	90	1250 L		
DINOTERB	mais				
DINOTERB	biet				
DINOTERB	aardappelen				
DINOTERB	fruitteelt				
DINOTERB	rest	10			
FLUROXYPYR	graan	80	200 L	80	200 L
FLUROXYPYR	mais			10	
FLUROXYPYR	biet				
FLUROXYPYR	aardappelen				
FLUROXYPYR	fruitteelt				
FLUROXYPYR	rest	20		10	
TOLYLFLUANIDE	graan				
TOLYLFLUANIDE	mais				
TOLYLFLUANIDE	biet				

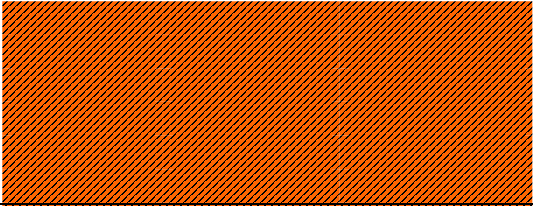
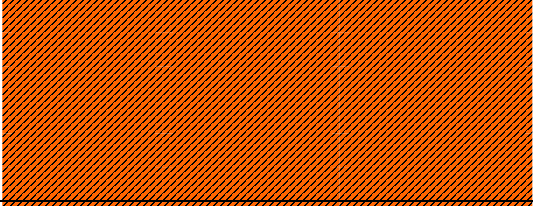
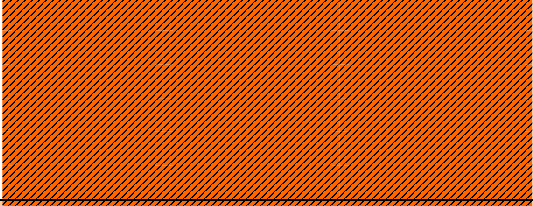
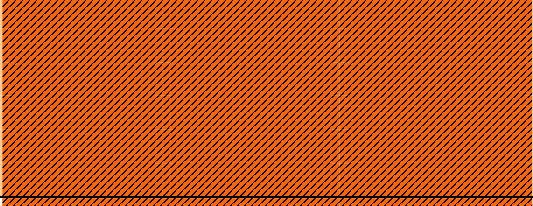
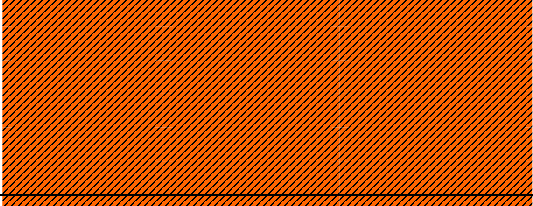

TOLYLFLUANIDE	aardappelen					
TOLYLFLUANIDE	fruitteelt					
TOLYLFLUANIDE	rest	100			100	
PROPIONZUUR	graan					
PROPIONZUUR	mais					
PROPIONZUUR	biet					
PROPIONZUUR	aardappelen					
PROPIONZUUR	fruitteelt					
PROPIONZUUR	niet landbouw	100				
EPTC	graan					
EPTC	mais	90	7200 L/GR			
EPTC	biet	5	1440			
EPTC	aardappelen					
EPTC	fruitteelt					
EPTC	rest	5				
VINCHLOZOLIN	graan					
VINCHLOZOLIN	mais					
VINCHLOZOLIN	biet					
VINCHLOZOLIN	aardappelen					
VINCHLOZOLIN	fruitteelt	10	750 WP/L/WG		10	750 WP/L/WG
VINCHLOZOLIN	rest	90			90	
MCPB	graan	10	2000 L		10	2000 L
MCPB	mais					
MCPB	biet					
MCPB	aardappelen					
MCPB	fruitteelt					
MCPB	rest	90			90	
CARBEETAMIDE	graan					
CARBEETAMIDE	mais					
CARBEETAMIDE	biet					
CARBEETAMIDE	aardappelen					
CARBEETAMIDE	fruitteelt					
CARBEETAMIDE	rest	100			100	

ZIRAM	graan					
ZIRAM	mais					
ZIRAM	biet					
ZIRAM	aardappelen					
ZIRAM	fruitteelt	90	4275 WP/WG	90	4275 WP/WG	
ZIRAM	rest	10		10		
METRIBUZIN	graan					
METRIBUZIN	mais					
METRIBUZIN	biet					
METRIBUZIN	aardappelen	100	525 WG			
METRIBUZIN	fruitteelt					
METRIBUZIN	niet landbouw					
LINURON	graan					
LINURON	mais					
LINURON	biet					
LINURON	aardappelen	50	1000 WP	50	1000 WP	
LINURON	fruitteelt	0	1000	20	1000	
LINURON	rest	50		30		
TCA	graan					
TCA	mais					
TCA	biet					
TCA	aardappelen					
TCA	fruitteelt					
TCA	niet landbouw	100				
DIETHATHYL-ETHYL	graan					
DIETHATHYL-ETHYL	mais					
DIETHATHYL-ETHYL	biet	100	2040 L			
DIETHATHYL-ETHYL	aardappelen					
DIETHATHYL-ETHYL	fruitteelt					
DIETHATHYL-ETHYL	niet landbouw					
KOOLZAADOLIE	graan					
KOOLZAADOLIE	mais	45	266 L			
KOOLZAADOLIE	biet	45	266			

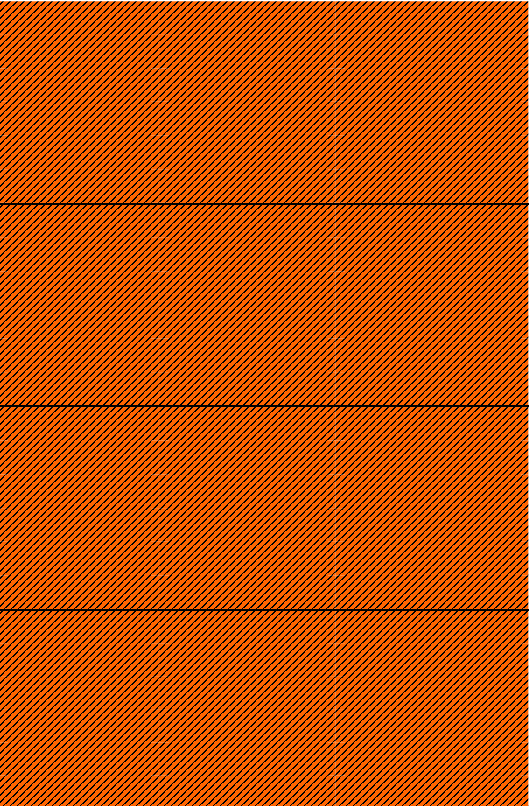
KOOLZAADOLIE	aardappelen						
KOOLZAADOLIE	fruitteelt	10					
KOOLZAADOLIE	niet landbouw						
ALKYL-ARYLVERBINDINGEN	graan	20		L			
ALKYL-ARYLVERBINDINGEN	mais	20					
ALKYL-ARYLVERBINDINGEN	biet	20					
ALKYL-ARYLVERBINDINGEN	aardappelen	20					
ALKYL-ARYLVERBINDINGEN	fruitteelt	10					
ALKYL-ARYLVERBINDINGEN	rest	10					
TRIDEMORF	graan	100		750 L			
TRIDEMORF	mais						
TRIDEMORF	biet						
TRIDEMORF	aardappelen						
TRIDEMORF	fruitteelt						
TRIDEMORF	niet landbouw						
METAZACHLOOR	graan						
METAZACHLOOR	mais						
METAZACHLOOR	biet						
METAZACHLOOR	aardappelen	40		750 L			
METAZACHLOOR	fruitteelt						
METAZACHLOOR	rest	60					
BOORTRIOXIDE	graan						
BOORTRIOXIDE	mais						
BOORTRIOXIDE	biet						
BOORTRIOXIDE	aardappelen						
BOORTRIOXIDE	fruitteelt						
BOORTRIOXIDE	niet landbouw	100					
TRIADIMENOL	graan	90		125 L			
TRIADIMENOL	mais						
TRIADIMENOL	biet						
TRIADIMENOL	aardappelen						
TRIADIMENOL	fruitteelt	8		37.5			
TRIADIMENOL	niet landbouw	2					

METHIOCARB	graan					
METHIOCARB	mais	13	120 GR	13	120 GR	
METHIOCARB	biet	5	120	5	120	
METHIOCARB	aardappelen					
METHIOCARB	fruitteelt	2	120	2	120	
METHIOCARB	rest	80		80		
PROPAMOCARB	graan	10	1100 L	10	1100 L	
PROPAMOCARB	mais	13	1100	13	1100	
PROPAMOCARB	biet	5	1100	5	1100	
PROPAMOCARB	aardappelen					
PROPAMOCARB	fruitteelt	2	1100	2	1100	
PROPAMOCARB	rest	70		70		
IOXYNIL	graan	90	480 L	90	480 L	
IOXYNIL	mais					
IOXYNIL	biet					
IOXYNIL	aardappelen					
IOXYNIL	fruitteelt					
IOXYNIL	niet landbouw	10		10		
FOSETHYL	graan					
FOSETHYL	mais					
FOSETHYL	biet					
FOSETHYL	aardappelen					
FOSETHYL	fruitteelt	10	960 WP	10	960 WP	
FOSETHYL	rest	90		90		
NITROTHAL-ISOPROPYL	graan					
NITROTHAL-ISOPROPYL	mais					
NITROTHAL-ISOPROPYL	biet					
NITROTHAL-ISOPROPYL	aardappelen					
NITROTHAL-ISOPROPYL	fruitteelt	100	450 WP	100		
NITROTHAL-ISOPROPYL	niet landbouw					
IMAZAMETHABENZ	graan					
IMAZAMETHABENZ	mais					
IMAZAMETHABENZ	biet					

IMAZAMETHABENZ	aardappelen							
IMAZAMETHABENZ	fruitteelt							
IMAZAMETHABENZ	niet landbouw							
CARBOFURAN	graan							
CARBOFURAN	mais	30	30g/100 000	ZB		30	30g/100 000	ZB
CARBOFURAN	biet	30	30g/100 000	ZB		30	30g/100 000	ZB
CARBOFURAN	aardappelen							
CARBOFURAN	fruitteelt							
CARBOFURAN	niet landbouw	40				40		
CHLOORPICRINE	graan							
CHLOORPICRINE	mais							
CHLOORPICRINE	biet							
CHLOORPICRINE	aardappelen							
CHLOORPICRINE	fruitteelt							
CHLOORPICRINE	rest	100				100		
AKTIEVE OLIE	graan							
AKTIEVE OLIE	mais							
AKTIEVE OLIE	biet							
AKTIEVE OLIE	aardappelen							
AKTIEVE OLIE	fruitteelt					100		L
AKTIEVE OLIE	niet landbouw							
DIMETENAMIDE	graan							
DIMETENAMIDE	mais					70		1400 L
DIMETENAMIDE	biet					30		1080 L
DIMETENAMIDE	aardappelen							
DIMETENAMIDE	fruitteelt							
DIMETENAMIDE	niet landbouw							
SULCOTRION	graan							
SULCOTRION	mais					100		450 L
SULCOTRION	biet							
SULCOTRION	aardappelen							
SULCOTRION	fruitteelt							
SULCOTRION	niet landbouw							

BENFLURALIN	graan		100		
BENFLURALIN	mais				
BENFLURALIN	biet				
BENFLURALIN	aardappelen				
BENFLURALIN	fruitteelt				
BENFLURALIN	rest				
DODINE	graan		100	600	LWP
DODINE	mais				
DODINE	biet				
DODINE	aardappelen				
DODINE	fruitteelt				
DODINE	niet landbouw				
METOXURON	graan		30	2000	WP
METOXURON	mais				
METOXURON	biet				
METOXURON	aardappelen				
METOXURON	fruitteelt				
METOXURON	rest				
FENOL	graan		100		
FENOL	mais				
FENOL	biet				
FENOL	aardappelen				
FENOL	fruitteelt				
FENOL	niet landbouw				
CHLOORPYRIFOS	graan		5	750	L
CHLOORPYRIFOS	mais				
CHLOORPYRIFOS	biet				
CHLOORPYRIFOS	aardappelen				
CHLOORPYRIFOS	fruitteelt				
CHLOORPYRIFOS	rest				
FLUAZINAM	graan				
FLUAZINAM	mais				
FLUAZINAM	biet				

FLUAZINAM	aardappelen		100	200 L	
FLUAZINAM	fruitteelt				
FLUAZINAM	niet landbouw				
EPOXYCONAZOOL	graan		100	187.5 L	
EPOXYCONAZOOL	mais				
EPOXYCONAZOOL	biet				
EPOXYCONAZOOL	aardappelen				
EPOXYCONAZOOL	fruitteelt				
EPOXYCONAZOOL	niet landbouw				
IMIDACLOPRID	graan		20	80g/50 000	ZB
IMIDACLOPRID	mais		60	90g/100 000	ZB
IMIDACLOPRID	biet				
IMIDACLOPRID	aardappelen				
IMIDACLOPRID	fruitteelt		10	125 L	
IMIDACLOPRID	rest		10		
FENPROPIDIN	graan		100	375 L	
FENPROPIDIN	mais				
FENPROPIDIN	biet				
FENPROPIDIN	aardappelen				
FENPROPIDIN	fruitteelt				
FENPROPIDIN	niet landbouw				
ANTRACHINON	graan		40	60/100 kg	ZB
ANTRACHINON	mais		40	60/100 kg	ZB
ANTRACHINON	biet				
ANTRACHINON	aardappelen				
ANTRACHINON	fruitteelt				
ANTRACHINON	rest		20		
IJZERDINATRIUM-EDTA	graan				
IJZERDINATRIUM-EDTA	mais				
IJZERDINATRIUM-EDTA	biet				
IJZERDINATRIUM-EDTA	aardappelen				
IJZERDINATRIUM-EDTA	fruitteelt				
IJZERDINATRIUM-EDTA	niet landbouw		100		

TRIFLURALIN	graan		60	960 L
TRIFLURALIN	mais			
TRIFLURALIN	biet			
TRIFLURALIN	aardappelen			
TRIFLURALIN	fruitteelt			
TRIFLURALIN	rest		40	
PROPYZAMIDE	graan			
PROPYZAMIDE	mais			
PROPYZAMIDE	biet			
PROPYZAMIDE	aardappelen			
PROPYZAMIDE	fruitteelt		2	1500 WP
PROPYZAMIDE	rest		98	
AMMONIUMTHIOCYANAAT	graan			
AMMONIUMTHIOCYANAAT	mais			
AMMONIUMTHIOCYANAAT	biet			
AMMONIUMTHIOCYANAAT	aardappelen			
AMMONIUMTHIOCYANAAT	fruitteelt		10	4300 L
AMMONIUMTHIOCYANAAT	rest		90	
CARBARYL	graan			
CARBARYL	mais			
CARBARYL	biet			
CARBARYL	aardappelen			
CARBARYL	fruitteelt			
CARBARYL	rest			

5. Evaluation of risk and impact of the pesticides used in the selected crops in 1991 and 1996 by means of PRIBEL

1 DETERMINATION OF ACTIVE SUBSTANCES PER CROP AND PESTICIDE GROUP

Cereal

a.s. name	AR 1991 (g/ha)	pesticide group
2,4-D	1250	HERB
bentazon	1440	HERB
bifenox	748	HERB
carbendazim	200	FUNG
chlormequat	1000	HERB
chlorothalonil	1250	FUNG
chlorotoluron	2500	HERB
dichlorprop	2100	HERB
dichlorprop-p	1440	HERB
dinoterb	1250	HERB
diquat	975	HERB
DNOC	5000	INSE
ethephon	600	HERB
fenpropimorph	750	FUNG
fluroxypyr	200	HERB
glyphosate	2880	HERB
imazamethabenz	750	HERB
ioxynil	480	HERB
isoproturon	2250	HERB
mancozeb	1600	FUNG
maneb	1600	FUNG
mcpa	1500	HERB
mcpb	2000	HERB
mecoprop	2000	HERB
mecoprop-p	1440	HERB
methabenzthiazuron	3500	HERB
metiram	4000	FUNG
pendimethalin	825	HERB
pirimicarb	125	INSE
prochloraz	450	FUNG
propamocarb	1100	FUNG
prosulfocarb	4000	HERB
tebuconazole	375	FUNG
thiophanate-methyl	700	FUNG
triadimenol	125	FUNG
tridemorph	750	FUNG

a.s. name	AR 1996 (g/ha)	pesticide group
2,4-D	1250	HERB
bentazon	1440	HERB
bifenox	748	HERB
carbendazim	200	FUNG
chlormequat	1000	HERB
chlorothalonil	1250	FUNG
chlorotoluron	2500	HERB
dichlorprop	2100	HERB
dichlorprop-p	1440	HERB
diquat	975	HERB
epoxyconazole	187,5	FUNG
ethephon	600	HERB
fenpropidin	375	FUNG
fenpropimorph	750	FUNG
fluroxypyr	200	HERB
glyphosate	2880	HERB
ioxynil	480	HERB
isoproturon	2250	HERB
mancozeb	1600	FUNG
maneb	1600	FUNG
mcpa	1500	HERB
mcpb	2000	HERB
mecoprop	2000	HERB
mecoprop-p	1440	HERB
methabenzthiazuron	3500	HERB
metiram	4000	FUNG
pendimethalin	825	HERB
pirimicarb	125	INSE
prochloraz	450	FUNG
propamocarb	1100	FUNG
prosulfocarb	4000	HERB
tebuconazole	375	FUNG
thiophanate-methyl	700	FUNG
trifluralin	960	HERB

Fruit

a.s. name	AR 1991 (g/ha)	pesticide group
1,3-dichloropropene	375000	SODE
2,4-D	1250	HERB
amitrole	5000	HERB
captan	6150	FUNG
carbendazim	450	FUNG
chlormequat	1450	HERB
chlorotoluron	2500	HERB
copper oxychloride	6000	FUNG

dazomet	490000	SODE
dichlobenil	6000	HERB
dichlorprop	2100	HERB
dichlorprop-p	1440	HERB
dimethoate	600	INSE
diquat	975	HERB
diuron	4000	HERB
DNOC	5000	INSE
endosulfan	2700	INSE
ethephon	750	HERB
ethiofencarb	500	INSE
fosethyl	960	FUNG
glyphosate	2880	HERB
iprodione	750	FUNG
lenacil	800	HERB
mancozeb	2400	FUNG
maneb	2400	FUNG
mcpa	1500	HERB
mecoprop	2000	HERB
mecoprop-p	1440	HERB
metam-natrium	400000	SODE
methiocarb	120	INSE
methyl bromide	900000	SODE
metiram	4500	FUNG
nitrothal isopropyl	450	FUNG
paraquat	800	HERB
parathion	250	INSE
phenmedipham	960	HERB
pirimicarb	375	INSE
propamocarb	1100	FUNG
simazine	1500	HERB
thiophanate-methyl	1275	FUNG
thiram	3750	FUNG
triadimenol	37	FUNG
vinclozolin	750	FUNG
zineb	4500	FUNG
ziram	4275	FUNG
zwavel	7200	FUNG
zwavel	4000	FUNG

a.s. name	AR 1996 (g/ha)	pesticide group
1,3-dichloropropene	375000	SODE
2,4-D	1250	HERB
amitrole	5000	HERB
captan	6150	FUNG
carbaryl	675	INSE
carbendazim	450	FUNG

chloorpyrifos	750	INSE
chlormequat	1450	HERB
chlorotoluron	2500	HERB
copper oxychloride	6000	FUNG
dazomet	490000	SODE
dichlobenil	6000	HERB
dichlorprop	2100	HERB
dichlorprop-p	1440	HERB
dimethoate	600	INSE
diquat	975	HERB
diuron	4000	HERB
DNOC	5000	INSE
dodine	600	FUNG
endosulfan	2700	INSE
ethephon	750	HERB
fosethyl	960	FUNG
glyphosate	2880	HERB
imidacloprid	125	INSE
iprodione	750	FUNG
lenacil	800	HERB
linuron	1000	HERB
mancozeb	2400	FUNG
maneb	2400	FUNG
mcpa	1500	HERB
mecoprop	2000	HERB
mecoprop-p	1440	HERB
metam-natrium	400000	SODE
methiocarb	120	INSE
methyl bromide	900000	SODE
metiram	4500	FUNG
nitrothal isopropyl	450	FUNG
paraquat	800	HERB
parathion	250	INSE
phenmedipham	960	HERB
pirimicarb	375	INSE
propamocarb	1100	FUNG
propizamide	1500	HERB
simazine	1500	HERB
thiophanate-methyl	1275	FUNG
thiram	3750	FUNG
vinclozolin	750	FUNG
ziram	4275	FUNG
zwavel	7200	FUNG
zwavel	4000	FUNG

Maize

a.s. name	AR 1991 (g/ha)	pesticide group
2,4-D	1250	HERB
alachloor	2400	HERB
atrazine	4000	HERB
bentazon	1440	HERB
carbofuran	150	INSE
EPTC	7200	HERB
lindane	1500	INSE
methiocarb	120	INSE
metolachlor	2520	HERB
pendimethalin	825	HERB
propachlor	4800	HERB
propamocarb	1100	FUNG
pyridate	2250	HERB
pyridate	2250	HERB

a.s. name	AR 1996 (g/ha)	pesticide group
2,4-D	1250	HERB
atrazine	4000	HERB
bentazon	1440	HERB
carbofuran	150	INSE
dimethenamide	1400	HERB
fluroxypyr	200	HERB
imidacloprid	400	INSE
lindane	1500	INSE
methiocarb	120	INSE
metolachlor	2520	HERB
pendimethalin	825	HERB
propachlor	4800	HERB
propamocarb	1100	FUNG
pyridate	2250	HERB
pyridate	2250	HERB
sulcotrione	450	HERB

Potato

a.s. name	AR 1991 (g/ha)	pesticide group
aclonifen	2400	HERB
chlorothalonil	1500	FUNG
chlorpropham	2400	HERB
copper oxychloride	2500	FUNG
dimethoate	500	INSE
diquat	975	HERB
endosulfan	180	INSE
ethiofencarb	500	INSE

fentin acetate	400	FUNG
fentin hydroxyde	400	FUNG
linuron	1000	HERB
mancozeb	3200	FUNG
maneb	3200	FUNG
metazachlor	750	HERB
metiram	4000	FUNG
metobromuron	2000	HERB
metribuzin	525	HERB
paraquat	1000	HERB
pirimicarb	175	INSE
propineb	2100	FUNG

a.s. name	AR 1996 (g/ha)	pesticide group
aclonifen	2400	HERB
bentazon	1440	HERB
carbaryl	765	INSE
chlorothalonil	1500	FUNG
chlorpropham	2400	HERB
copper oxychloride	2500	FUNG
dimethoate	500	INSE
diquat	975	HERB
DNOC	5000	INSE
endosulfan	180	INSE
fentin acetate	400	FUNG
fentin hydroxyde	400	FUNG
fluazinam	200	FUNG
linuron	1000	HERB
mancozeb	3200	FUNG
maneb	3200	FUNG
metiram	4000	FUNG
metobromuron	2000	HERB
metoxuron	2000	HERB
paraquat	1000	HERB
pirimicarb	175	INSE
prosulfocarb	4000	HERB

Sugarbeet

a.s. name	AR 1991 (g/ha)	pesticide group
aldicarb	1000	INSE
carbendazim	150	FUNG
carbofuran	150	INSE
chloridazon	3200	HERB
cycloaat	2880	HERB
diethatyl-ethyl	2040	HERB
dimethoate	500	INSE

EPTC	1440	HERB
ethiofencarb	500	INSE
ethofumesate	1000	HERB
fenpropimorph	750	FUNG
lenacil	800	HERB
lindane	1500	INSE
metamitron	3500	HERB
methiocarb	120	INSE
parathion	250	INSE
phenmedipham	960	HERB
pirimicarb	175	INSE
propamocarb	1100	FUNG
thiophanate-methyl	300	FUNG
tri-allate	1600	HERB
zwavel	6000	FUNG

a.s. name	AR 1996 (g/ha)	pesticide group
aldicarb	1000	INSE
carbendazim	150	FUNG
carbofuran	150	INSE
chloridazon	3200	HERB
dimethenamide	1080	HERB
dimethoate	500	INSE
ethofumesate	1000	HERB
fenpropimorph	750	FUNG
imidacloprid	450	INSE
lenacil	800	HERB
lindane	1500	INSE
metamitron	3500	HERB
methiocarb	120	INSE
parathion	250	INSE
phenmedipham	960	HERB
pirimicarb	175	INSE
propamocarb	1100	FUNG
thiophanate-methyl	300	FUNG
zwavel	6000	FUNG

Insecticides

a.s. name	AR 1991 (g/ha)	crop group
aldicarb	1000	sugarbeet
carbofuran	150	maize
carbofuran	150	sugarbeet
dimethoate	600	fruit
dimethoate	500	potato
dimethoate	500	sugarbeet
DNOC	5000	fruit

endosulfan	2700	fruit
endosulfan	180	potato
ethiofencarb	500	fruit
ethiofencarb	500	potato
ethiofencarb	500	sugarbeet
lindane	1500	maize
lindane	1500	sugarbeet
methiocarb	120	fruit
methiocarb	120	maize
methiocarb	120	sugarbeet
parathion	250	fruit
parathion	250	sugarbeet
pirimicarb	125	cereal
pirimicarb	375	fruit
pirimicarb	175	potato
pirimicarb	175	sugarbeet

a.s. name	AR 1996 (g/ha)	crop group
aldicarb	1000	sugarbeet
carbaryl	675	fruit
carbaryl	765	potato
carbofuran	150	maize
carbofuran	150	sugarbeet
chloorpyrifos	750	fruit
dimethoate	600	fruit
dimethoate	500	potato
dimethoate	500	sugarbeet
DNOC	5000	fruit
DNOC	5000	potato
endosulfan	2700	fruit
endosulfan	180	potato
imidacloprid	125	fruit
imidacloprid	400	maize
imidacloprid	450	sugarbeet
lindane	1500	maize
lindane	1500	sugarbeet
methiocarb	120	fruit
methiocarb	120	maize
methiocarb	120	sugarbeet
parathion	250	fruit
parathion	250	sugarbeet
pirimicarb	125	cereal
pirimicarb	375	fruit
pirimicarb	175	potato
pirimicarb	175	sugarbeet

Fungicides

a.s. name	AR 1991 (g/ha)	crop group
captan	6150	fruit
carbendazim	200	cereal
carbendazim	450	fruit
carbendazim	150	sugarbeet
chlorothalonil	1250	cereal
chlorothalonil	1500	potato
copper oxychloride	6000	fruit
copper oxychloride	2500	potato
fenpropimorph	750	cereal
fenpropimorph	750	sugarbeet
fentin acetate	400	potato
fentin hydroxyde	400	potato
fosethyl	960	fruit
iprodione	750	fruit
mancozeb	1600	cereal
mancozeb	2400	fruit
mancozeb	3200	potato
maneb	1600	cereal
maneb	2400	fruit
maneb	3200	potato
metiram	4000	cereal
metiram	4500	fruit
metiram	4000	potato
nitrothal isopropyl	450	fruit
prochloraz	450	cereal
propamocarb	1100	cereal
propamocarb	1100	fruit
propamocarb	1100	maize
propamocarb	1100	sugarbeet
propineb	2100	potato
tebuconazole	375	cereal
thiophanate-methyl	700	cereal
thiophanate-methyl	1275	fruit
thiophanate-methyl	300	sugarbeet
thiram	3750	fruit
triadimenol	125	cereal
triadimenol	37	fruit
tridemorph	750	cereal
vinclozolin	750	fruit
zineb	4500	fruit
ziram	4275	fruit
zwavel	7200	fruit
zwavel	4000	fruit
zwavel	6000	sugarbeet

a.s. name	AR 1996 (g/ha)	crop group
captan	6150	fruit
carbendazim	200	cereal
carbendazim	450	fruit
carbendazim	150	sugarbeet
chlorothalonil	1250	cereal
chlorothalonil	1500	potato
copper oxychloride	6000	fruit
copper oxychloride	2500	potato
dodine	600	fruit
epoxyconazole	187,5	cereal
fenpropidin	375	cereal
fenpropimorph	750	cereal
fenpropimorph	750	sugarbeet
fentin acetate	400	potato
fentin hydroxyde	400	potato
fluazinam	200	potato
fosethyl	960	fruit
iprodione	750	fruit
mancozeb	1600	cereal
mancozeb	2400	fruit
mancozeb	3200	potato
maneb	1600	cereal
maneb	2400	fruit
maneb	3200	potato
metiram	4000	cereal
metiram	4500	fruit
metiram	4000	potato
nitrothal isopropyl	450	fruit
prochloraz	450	cereal
propamocarb	1100	cereal
propamocarb	1100	fruit
propamocarb	1100	maize
propamocarb	1100	sugarbeet
tebuconazole	375	cereal
thiophanate-methyl	700	cereal
thiophanate-methyl	1275	fruit
thiophanate-methyl	300	sugarbeet
thiram	3750	fruit
vinclozolin	750	fruit
ziram	4275	fruit
zwavel	7200	fruit
zwavel	4000	fruit
zwavel	6000	sugarbeet

Herbicides

a.s. name	AR 1991 (g/ha)	crop group
2,4-D	1250	cereal
2,4-D	1250	fruit
2,4-D	1250	maize
aclonifen	2400	potato
alachloor	2400	maize
amitrole	5000	fruit
atrazine	4000	maize
bentazon	1440	cereal
bentazon	1440	maize
bifenox	748	cereal
chloridazon	3200	sugarbeet
chlormequat	1000	cereal
chlormequat	1450	fruit
chlorotoluron	2500	cereal
chlorotoluron	2500	fruit
chlorpropham	2400	potato
cycloaat	2880	sugarbeet
dichlobenil	6000	fruit
dichlorprop	2100	cereal
dichlorprop	2100	fruit
dichlorprop-p	1440	cereal
dichlorprop-p	1440	fruit
diethatyl-ethyl	2040	sugarbeet
dinoterb	1250	cereal
diquat	975	cereal
diquat	975	fruit
diquat	975	potato
diuron	4000	fruit
EPTC	7200	maize
EPTC	1440	sugarbeet
ethephon	600	cereal
ethephon	750	fruit
ethofumesate	1000	sugarbeet
fluroxypyr	200	cereal
glyphosate	2880	cereal
glyphosate	2880	fruit
imazamethabenz	750	cereal
ioxynil	480	cereal
isoproturon	2250	cereal
lenacil	800	fruit
lenacil	800	sugarbeet
linuron	1000	potato
mcpa	1500	cereal
mcpa	1500	fruit
mcpb	2000	cereal
mecoprop	2000	cereal

mecoprop	2000	fruit
mecoprop-p	1440	cereal
mecoprop-p	1440	fruit
metamitron	3500	sugarbeet
metazachlor	750	potato
methabenzthiazuron	3500	cereal
metobromuron	2000	potato
metolachlor	2520	maize
metribuzin	525	potato
paraquat	800	fruit
paraquat	1000	potato
pendimethalin	825	cereal
pendimethalin	825	maize
phenmedipham	960	fruit
phenmedipham	960	sugarbeet
propachlor	4800	maize
prosulfocarb	4000	cereal
pyridate	2250	maize
pyridate	2250	maize
simazine	1500	fruit
tri-allate	1600	sugarbeet

a.s. name	AR 1996 (g/ha)	crop group
2,4-D	1250	cereal
2,4-D	1250	fruit
2,4-D	1250	maize
aclonifen	2400	potato
amitrole	5000	fruit
atrazine	4000	maize
bentazon	1440	cereal
bentazon	1440	maize
bentazon	1440	potato
bifenox	748	cereal
chloridazon	3200	sugarbeet
chlormequat	1000	cereal
chlormequat	1450	fruit
chlorotoluron	2500	cereal
chlorotoluron	2500	fruit
chlorpropham	2400	potato
dichlobenil	6000	fruit
dichlorprop	2100	cereal
dichlorprop	2100	fruit
dichlorprop-p	1440	cereal
dichlorprop-p	1440	fruit
dimethenamide	1400	maize
dimethenamide	1080	sugarbeet
diquat	975	cereal
diquat	975	fruit

diquat	975	potato
diuron	4000	fruit
ethephon	600	cereal
ethephon	750	fruit
ethofumesate	1000	sugarbeet
fluroxypyr	200	cereal
fluroxypyr	200	maize
glyphosate	2880	cereal
glyphosate	2880	fruit
ioxynil	480	cereal
isoproturon	2250	cereal
lenacil	800	fruit
lenacil	800	sugarbeet
linuron	1000	fruit
linuron	1000	potato
mcpa	1500	cereal
mcpa	1500	fruit
mcpb	2000	cereal
mecoprop	2000	cereal
mecoprop	2000	fruit
mecoprop-p	1440	cereal
mecoprop-p	1440	fruit
metamitron	3500	sugarbeet
methabenzthiazuron	3500	cereal
metobromuron	2000	potato
metolachlor	2520	maize
metoxuron	2000	potato
paraquat	800	fruit
paraquat	1000	potato
pendimethalin	825	cereal
pendimethalin	825	maize
phenmedipham	960	fruit
phenmedipham	960	sugarbeet
propachlor	4800	maize
propizamide	1500	fruit
prosulfocarb	4000	cereal
prosulfocarb	4000	potato
pyridate	2250	maize
pyridate	2250	maize
simazine	1500	fruit
sulcotrione	450	maize
trifluralin	960	cereal

Soil disinfectants

a.s. name	AR 1991 (g/ha)	crop group
1,3-dichloropropene	375 000	fruit
dazomet	490 000	fruit

metam-natrium	400 000	fruit
methyl bromide	900 000	fruit

a.s. name	AR 1996 (g/ha)	crop group
1,3-dichloropropene	375 000	fruit
dazomet	490 000	fruit
metam-natrium	400 000	fruit
methyl bromide	900 000	fruit

2 EVALUATION OF IMPACT PER COMPARTMENT

Comparing compartments with each other is not performed in PRIBEL, scientists (risk analysers) cannot equal the importance of one earthworm to one consumer for instance. As this is the task of policy makers (risk managers) they should be entrusted with all possible data to form themselves a picture of the national impact of the use of agricultural pesticides and decide to which compartment(s) priority will be given.

Table x sums up the number of application cases per pesticide group and per crop group. Three trends can be derived: firstly, the gamut of herbicides in the top 100 is the highest, followed by fungicides. Insecticides appear less in the list, and specifically soil disinfectants are seldomly used in the 5 studied crops. Herbicides are used several times per growth season in all crops contrary to the more limited use of fungicides and certainly insecticides. Secondly, most of the application cases occur in fruit and cereal. And third there is few variance between 1991 and 1996 for what concerns the number of application cases.

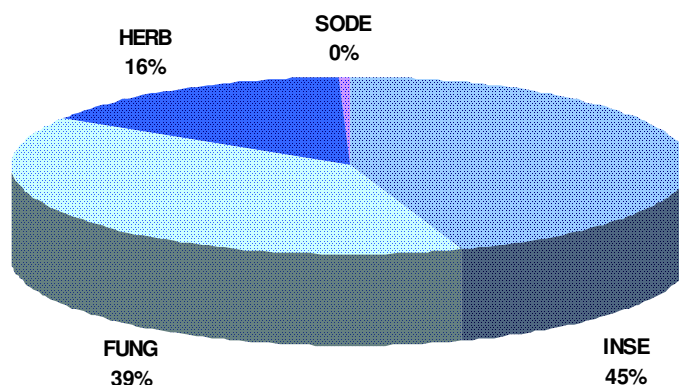
Tabel x: Number of application cases per pesticide group and per crop group in 1991 and 1996

Pesticide or crop group	1991	1996
Insecticides	24	27
Fungicides	44	43
Herbicides	67	67
Soil disinfectants	4	4
TOTAL	139	141
Cereal	36	34
Fruit	47	50
Maize	14	16
Potato	20	22
sugarbeet	22	19
TOTAL	139	141

2.1 Pesticide operator

2.1.1 Operator impact in 1991

The impact RI*F for operator caused by the use of insecticides is the highest (45%), closely followed by fungicides (39%) and then herbicides (16%). Soil disinfectants contribute for a very small part (0.4%). These ratios are shown in a pie chart (Figure x).



Figur 3: Relative contribution (%) of different pesticide groups to the total impact for operator in 1991

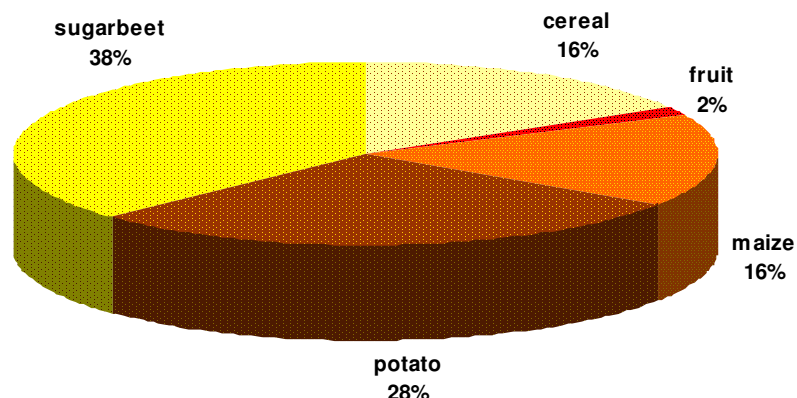
Table X summarizes the 20 active substances contributing the most to the operator impact in 1991. The 5 substances having an impact $> 10E+7$ are nowadays (2008) all banned from the Belgian market. As much as 8 from the 16 active substances in the top 20 are already forbidden for usage in Belgium. Ten application cases in table X are fungicide applications, but as the impact of lindane in sugarbeet dominates the other applications (combination of high toxicity for operator (small AOEL and high dermal absorption), a relatively high application dose (1500 g/ha) and high national sales (31 469 kg in sugarbeet as estimated by the repartition key) the total operator impact of insecticides is higher than the one caused by fungicides. Fentin hydroxide and fentin acetate (both organotin fungicides) are examples of fungicides posing a high risk for the operator; atrazine, isoproturon and alachlor are on top of the herbicides group.

Table 3: Overview of the 20 application cases contributing the most to the operator impact RI*F in 1991 (in orange: substances nowadays banned from the Belgian market)

A. S. Name	AR 1991 (g/ha)	Crop group	Pesticide group	RI*F
lindane	1500	sugarbeet	INSE	
fentin hydroxyde	400	potato	FUNG	
lindane	1500	maize	INSE	
fentin acetate	400	potato	FUNG	
atrazine	4000	maize	HERB	$> 10^{E+7}$
fenpropimorf	750	cereal	FUNG	
isoproturon	2250	cereal	HERB	
zwavel	6000	sugarbeet	FUNG	
maneb	3200	potato	FUNG	

maneb	1600	cereal	FUNG	
parathion	250	sugarbeet	INSE	
alachloor	2400	maize	HERB	
aldicarb	1000	sugarbeet	INSE	
dinoterb	1250	cereal	HERB	
mancozeb	1600	cereal	FUNG	
mancozeb	3200	potato	FUNG	
mcpa	1500	cereal	HERB	
metamitron	3500	sugarbeet	HERB	
fenpropimorf	750	sugarbeet	FUNG	
prochloraz	450	cereal	FUNG	> 10 ^{E+6}

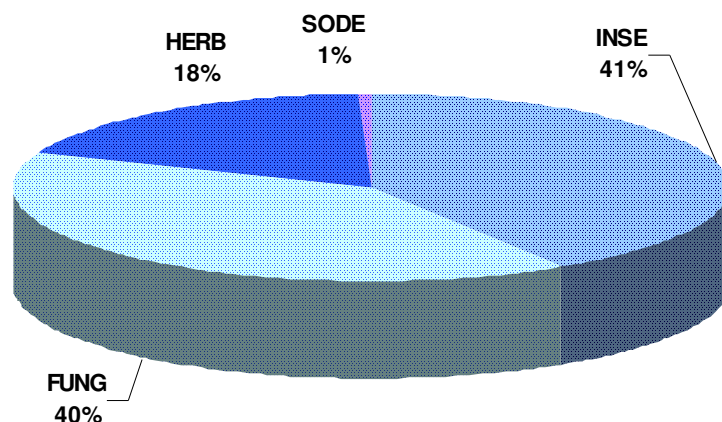
It is particularly interesting to consider an overview of the impact results for the different crop groups. With regard to the operator applications in sugarbeet and potato show the highest total risk (38% and 28% respectively). These findings correspond to the outcomes of Table x, with lindane used in sugarbeet and fentin hydroxide and fentin acetate sprayed in potato. Six of the applications in Table x are used for treatments in sugarbeet; 4 for potato. Fruit constitutes a low impact for the pesticide operator, this complies with table x (not a single application in fruit appears in the top 20). Although many pesticides are used in fruit (see Table x: 47 and 50 application cases in 1991 and 1996 respectively), the most harmful pesticides with regard to the operator are not used in fruit.



Figuur 4: Relative contribution (%) of different crop groups to the total impact for operator in 1991

2.1.2 Operator impact in 1996

The impact $RI \cdot F$ for operator in 1996 does not differ much from the profile in 1991. Insecticides constitute the highest risk (41%), closely followed by fungicides (40%). Herbicides contribute for a smaller part (18%), the impact of soil disinfectants is only marginal. The pie chart below (figure x) encompasses all those results.



Figur 5: Relative contribution (%) of different pesticide groups to the total impact for operator in 1996

Some shifts in the top 20 of highest impact application cases can be perceived between 1991 and 1996 (table x). The highest operator impact in 1996 is due to the use of lindane in maize (instead of sugarbeet in 1991). The use of lindane in sugarbeet stands on a third place. This change can be explained by the repartition key (table x) where the division of the usage of lindane is 50% in sugarbeet and 20% in maize in 1991, whilst in 1996 merely 25% is attributed to sugarbeet and 50% to maize. The national maize area expanded in 1996 (+30% compared to 1991, see Table 1) and moreover an increase of soil insects like wireworms demanded a higher use of insecticides as lindane. The utilization of lindane in sugarbeet decreased in 1996 mainly due to the terminated use of the combination lindane + tri-allaat. Isoproturon rised from a 7th to a 4th place (impact > 10E+7) because of a high increase in sales (+27.5% in 1996).

Disappeared in 1996 arealachlor and dinoterb (banned from the Belgian market in 1991 and 1993 respectively). Aldicarb showed a decrease in sales (-66.5% in 1996) and also a shift in division over the crops (20% was ascribed to sugarbeet in 1996 instead of 90% in 1991) both aspects can be attributed to the rise of sugarbeet seed coating with imidacloprid.

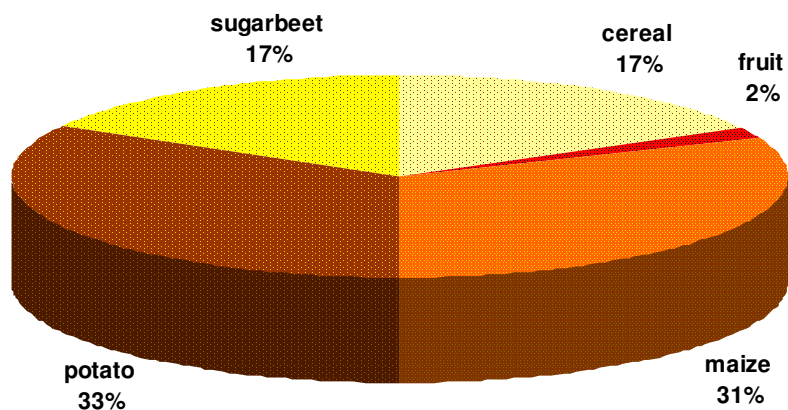
New is fluazinam (on a 9th place), the low-dose fungicide used in potato for the control of phytophthora came on the Belgian market in 1992 and has been steadily growing ever since. The herbicide sulcotrione and fungicide epoxiconazole entered the Belgian pesticide market in 1993 and are nowadays still allowed. The insecticides carbofuran and endosulfan are also new in the impact list of 1996: carbofuran was sold for a very low amount in 1990 and 1991 in comparison with former and later years; the sales of endosulfan increased with as much as 80% in 1996 in relation to 1991.

Tabel 4: Overview of the 20 application cases contributing the most to the operator impact RI*F in 1996 (in orange: substances nowadays banned from the Belgian market)

A. S. Name	AR 1996 (g/ha)	Crop group	Pesticide group	RI*F
lindane	1500	maize	INSE	
fentin hydroxyde	400	potato	FUNG	
lindane	1500	sugarbeet	INSE	
isoproturon	2250	cereal	HERB	> 10 ^E +7
atrazine	4000	maize	HERB	

fentin acetate	400	potato	FUNG	
fenpropimorf	750	cereal	FUNG	
mancozeb	1600	cereal	FUNG	
fluazinam	200	potato	FUNG	
mcpa	1500	cereal	HERB	
parathion	250	sugarbeet	INSE	
mancozeb	3200	potato	FUNG	
maneb	1600	cereal	FUNG	
sulcotrione	450	maize	HERB	
epoxyconazole	187,5	cereal	FUNG	
metamitron	3500	sugarbeet	HERB	
maneb	3200	potato	FUNG	
carbofuran	150	maize	INSE	
endosulfan	180	potato	INSE	
diquat	975	potato	HERB	> 10 ^E +6

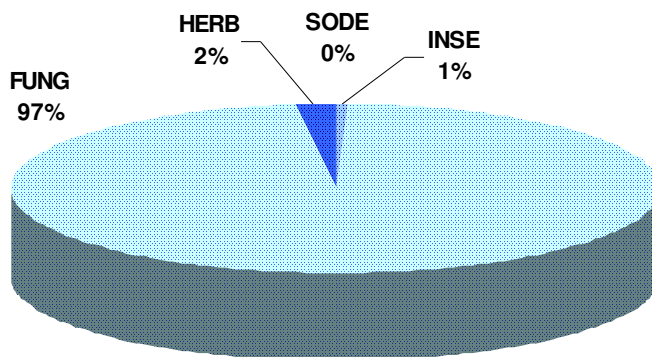
When considering the relative contribution of the different crop groups to the total operator impact in 1996 some remarkable changes catch the eye. The part of sugarbeet strongly diminished (38% in 1991 to 17% in 1996) whereas the maize part almost doubled (16% to 31%). This can to a large extent be attributed to the shift in partition over the crops of lindane (as explained above). The contributions of potato, cereal and fruit are similar to 1991.



Figuur 6: Relative contribution (%) of different crop groups to the total impact for operator in 1996

2.2 Consumer

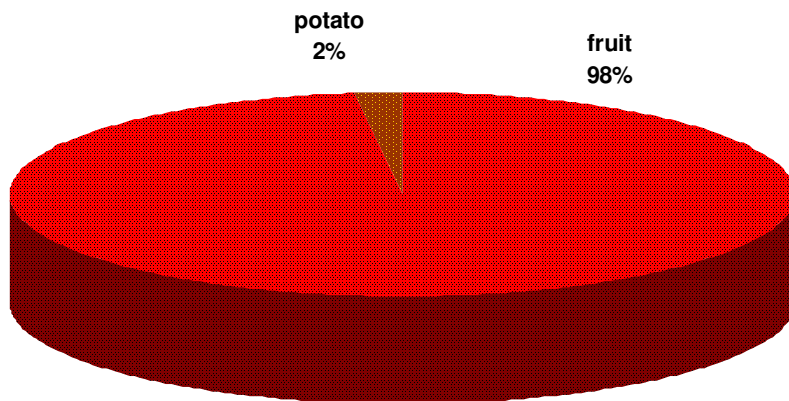
2.2.1 Consumer impact in 1991



Figuur 7: Relative contribution (%) of different pesticide groups to the total impact for consumer in 1991

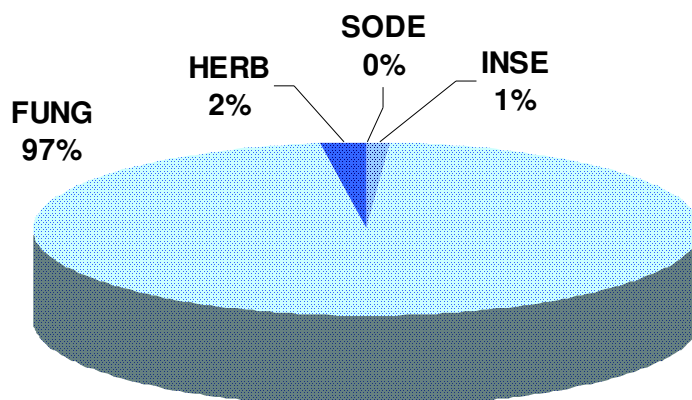
Tabel 5: Overview of the 20 application cases contributing the most to the consumer impact RI*F in 1991

A. S. Name	AR 1991 (g/ha)	Crop group	Pesticide group	RI*F
zwavel	7200	fruit	FUNG	$> 10^E+5$
ziram	4275	fruit	FUNG	
zwavel	4000	fruit	FUNG	
thiram	3750	fruit	FUNG	$> 10^E+4$
ethephon	750	fruit	HERB	
captan	6150	fruit	FUNG	
diquat	975	potato	HERB	
fentin hydroxyde	400	potato	FUNG	
carbendazim	450	fruit	FUNG	$> 10^E+3$
endosulfan	180	potato	INSE	
pirimicarb	375	fruit	INSE	
diuron	4000	fruit	HERB	
maneb	2400	fruit	FUNG	
dichlobenil	6000	fruit	HERB	
fentin acetate	400	potato	FUNG	
mancozeb	2400	fruit	FUNG	
vinclozolin	750	fruit	FUNG	
metribuzin	525	potato	HERB	
dimethoate	500	potato	INSE	
amitrole	5000	fruit	HERB	$> 10^E+2$



Figuur 8: Relative contribution (%) of different crop groups to the total impact for consumer in 1991

2.2.2 Consumer impact in 1996

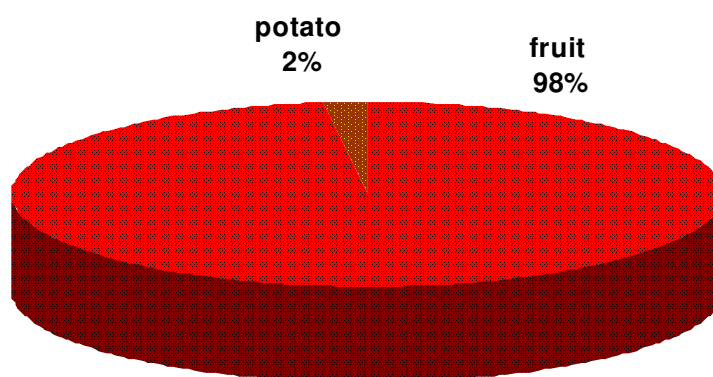


Figuur 9: Relative contribution (%) of different pesticide groups to the total impact for consumer in 1996

Tabel 6: Overview of the 20 application cases contributing the most to the consumer impact RI*F in 1996

A. S. Name	AR 1996 (g/ha)	Crop group	Pesticide group	RI*F
zwavel	7200	fruit	FUNG	$> 10^E+5$
ziram	4275	fruit	FUNG	
thiram	3750	fruit	FUNG	$> 10^E+4$
zwavel	4000	fruit	FUNG	
dodine	600	fruit	FUNG	
ethephon	750	fruit	HERB	
diquat	975	potato	HERB	

captan	6150	fruit	FUNG	
fentin hydroxyde	400	potato	FUNG	
endosulfan	180	potato	INSE	
carbendazim	450	fruit	FUNG	> 10 ^E +3
diuron	4000	fruit	HERB	
metiram	4500	fruit	FUNG	
mancozeb	2400	fruit	FUNG	
imidacloprid	125	fruit	INSE	
linuron	1000	potato	HERB	
vinclozolin	750	fruit	FUNG	
fluazinam	200	potato	FUNG	
dichlobenil	6000	fruit	HERB	
endosulfan	2700	fruit	INSE	> 10 ^E +2



Figuur 10: Relative contribution (%) of different crop groups to the total impact for consumer in 1996

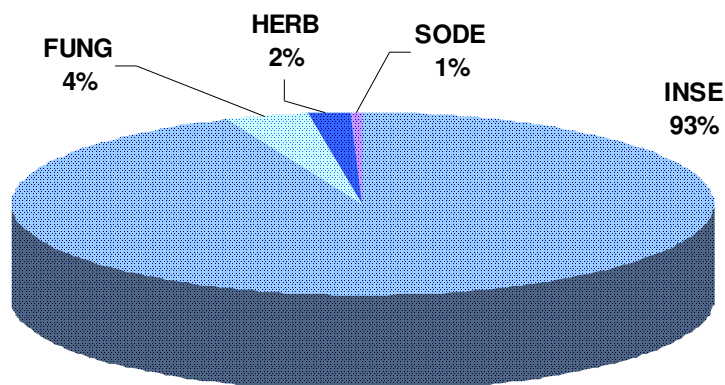
2.3 Birds

2.3.1 Bird impact in 1991

2.3.2 Bird impact in 1996

2.4 Bees

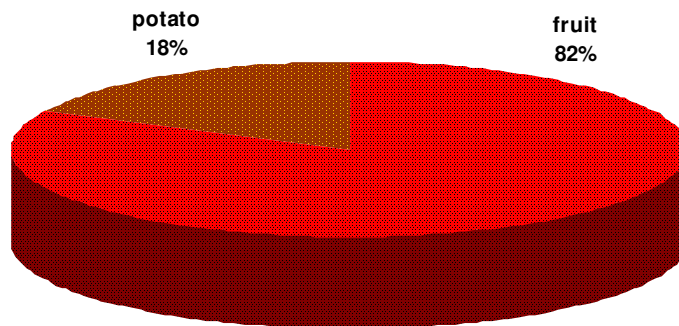
2.4.1 Bee impact in 1991



Figur 11: Relative contribution (%) of different pesticide groups to the total impact for bee in 1991

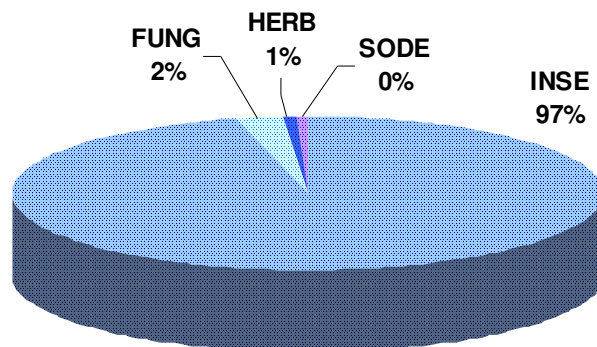
Table 7: Overview of the 20 application cases contributing the most to the bees impact RI*F in 1991

A. S. Name	AR 1991 (g/ha)	Crop group	Pesticide group	RI*F
parathion	250	fruit	INSE	$> 10^E+6$
dimethoate	500	potato	INSE	
dimethoate	600	fruit	INSE	
DNOC	5000	fruit	INSE	$> 10^E+5$
maneb	3200	potato	FUNG	
zwavel	7200	fruit	FUNG	
diquat	975	potato	HERB	
1,3-dichloropropene	375000	fruit	SODE	
mancozeb	3200	potato	FUNG	
pirimicarb	375	fruit	INSE	
pirimicarb	175	potato	INSE	
captan	6150	fruit	FUNG	
copper oxychloride	6000	fruit	FUNG	
ethiofencarb	500	fruit	INSE	
ethiofencarb	500	potato	INSE	
nitrothal isopropyl	450	fruit	FUNG	
maneb	2400	fruit	FUNG	
chlormequat	1450	fruit	HERB	
fentin hydroxyde	400	potato	FUNG	
propineb	2100	potato	FUNG	$>10^E+4$



Figuur 12: Relative contribution (%) of different crop groups to the total impact for bee in 1991

2.4.2 Bee impact in 1996

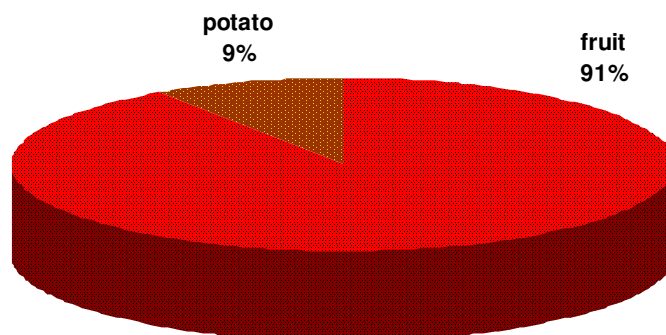


Figuur 13: Relative contribution (%) of different pesticide groups to the total impact for bee in 1996

Tabel 8: Overview of the 20 application cases contributing the most to the bees impact RI*F in 1996

A. S. Name	AR 1996 (g/ha)	Crop group	Pesticide group	RI*F
imidacloprid	125	fruit	INSE	
parathion	250	fruit	INSE	> 10 ^E +6
dimethoate	500	potato	INSE	
dimethoate	600	fruit	INSE	
chloorpyrifos	750	fruit	INSE	
DNOC	5000	fruit	INSE	
carbaryl	675	fruit	INSE	> 10 ^E +5

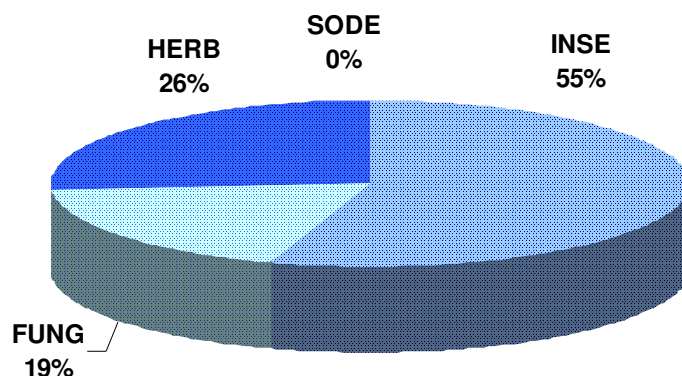
DNOC	5000	potato	INSE	
diquat	975	potato	HERB	
1,3-dichloropropene	375000	fruit	SODE	
zwavel	7200	fruit	FUNG	
dodine	600	fruit	FUNG	
copper oxychloride	6000	fruit	FUNG	
mancozeb	3200	potato	FUNG	
captan	6150	fruit	FUNG	
maneb	3200	potato	FUNG	
carbaryl	765	potato	INSE	
nitrothal isopropyl	450	fruit	FUNG	
chlormequat	1450	fruit	HERB	
fentin hydroxyde	400	potato	FUNG	> 10 ^E +4



Figuur 14: Relative contribution (%) of different crop groups to the total impact for bee in 1996

2.5 Aquatic organisms

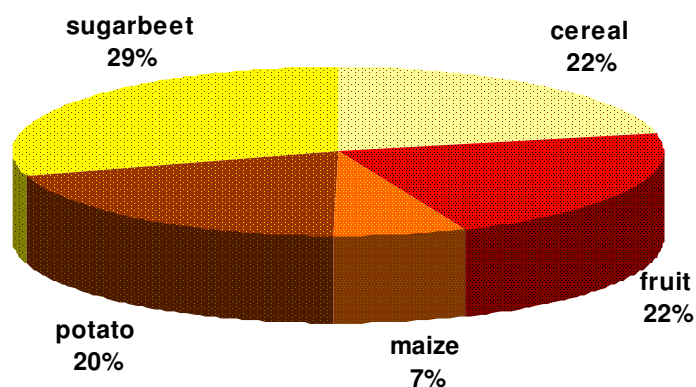
2.5.1 Aquatic organisms impact in 1991



Figuur 15: Relative contribution (%) of different pesticide groups to the total impact for aquatic organisms in 1991

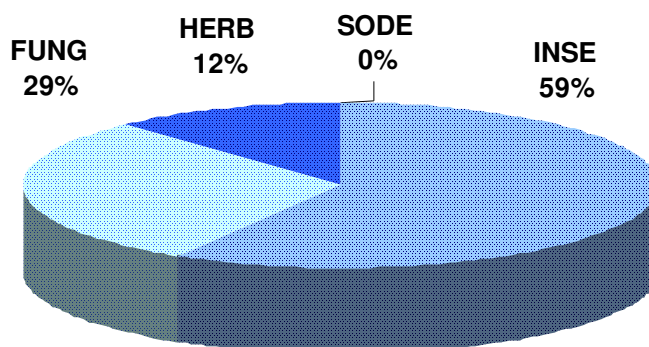
Tabel 9: Overview of the 20 application cases contributing the most to the aquatic organisms impact RI*F in 1991

A. S. Name	AR 1991 (g/ha)	Crop group	Pesticide group	RI*F
lindane	1500	sugarbeet	INSE	
parathion	250	fruit	INSE	
DNOC	5000	fruit	INSE	
fentin acetate	400	potato	FUNG	
dinoterb	1250	cereal	HERB	
endosulfan	180	potato	INSE	
parathion	250	sugarbeet	INSE	
diethatyl-ethyl	2040	sugarbeet	HERB	> 10 ^E +7
DNOC	5000	cereal	INSE	
bifenox	748	cereal	HERB	
carbofuran	150	sugarbeet	INSE	
lenacil	800	sugarbeet	HERB	
lindane	1500	maize	INSE	
aclonifen	2400	potato	HERB	
propamocarb	1100	maize	FUNG	
carbofuran	150	maize	INSE	
propamocarb	1100	cereal	FUNG	
chlorotoluron	2500	cereal	HERB	
mancozeb	1600	cereal	FUNG	
fentin hydroxyde	400	potato	FUNG	> 10 ^E +6



Figuur 16: Relative contribution (%) of different crop groups to the total impact for aquatic organisms in 1991

2.5.2 Aquatic organisms impact in 1991



Figuur 17: Relative contribution (%) of different pesticide groups to the total impact for aquatic organisms in 1996

Tabel 10: Overview of the 20 application cases contributing the most to the aquatic organisms impact RI*F in 1996

A. S. Name	AR 1996 (g/ha)	Crop group	Pesticide group	RI*F
endosulfan	180	potato	INSE	
DNOC	5000	fruit	INSE	
dodine	600	fruit	FUNG	
parathion	250	fruit	INSE	
carbaryl	675	fruit	INSE	
fenpropidin	375	cereal	FUNG	> 10 ^E +7

lindane	1500	maize	INSE	
parathion	250	sugarbeet	INSE	
lindane	1500	sugarbeet	INSE	
fentin acetate	400	potato	FUNG	
DNOC	5000	potato	INSE	
carbofuran	150	sugarbeet	INSE	
propamocarb	1100	maize	FUNG	
lenacil	800	sugarbeet	HERB	
propamocarb	1100	cereal	FUNG	
carbofuran	150	maize	INSE	
bifenox	748	cereal	HERB	
aclonifen	2400	potato	HERB	
mancozeb	1600	cereal	FUNG	
prosulfocarb	4000	cereal	HERB	> 10 ^E +6

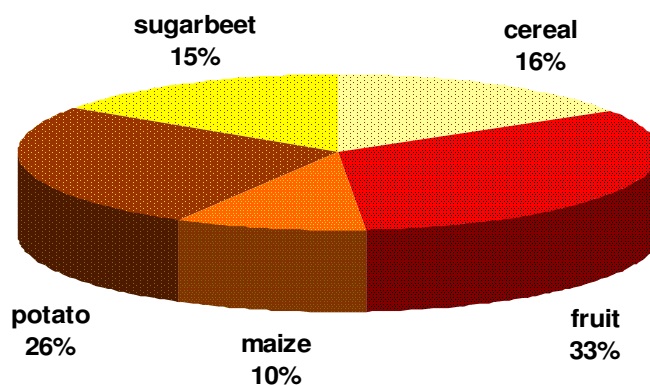
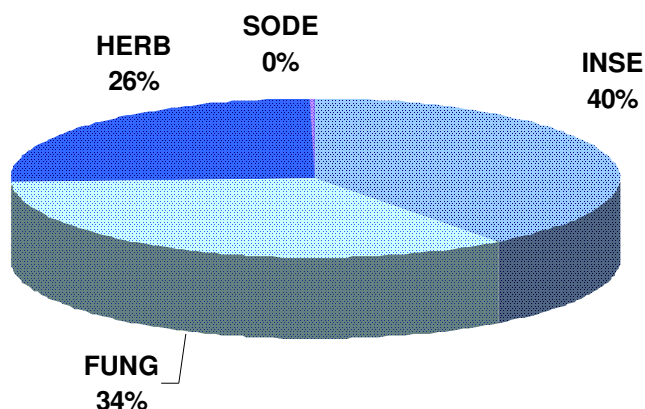


Figure 18: Relative contribution (%) of different crop groups to the total impact for aquatic organisms in 1996

2.6 Earthworms

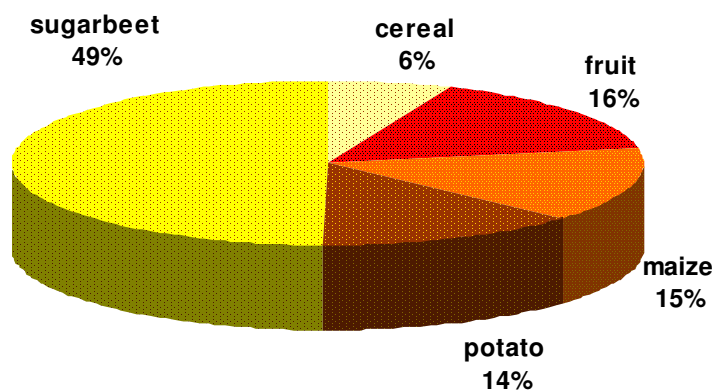
2.6.1 Earthworms impact in 1991



Figur 19: Relative contribution (%) of different pesticide groups to the total impact for earthworms in 1991

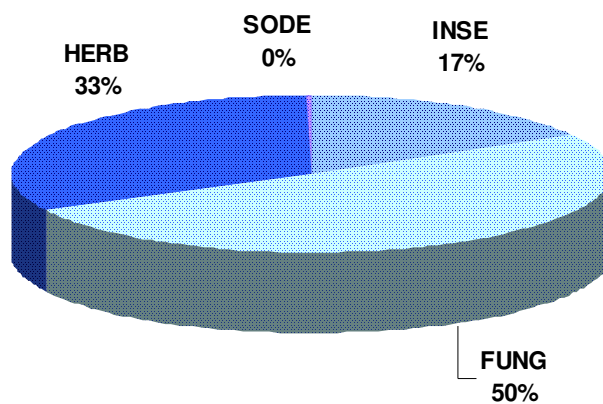
Tabel 11: Overview of the 20 application cases contributing the most to the earthworms impact RI*F in 1991

A. S. Name	AR 1991 (g/ha)	Crop group	Pesticide group	RI*F
aldicarb	1000	sugarbeet	INSE	$> 10^E+5$
atrazine	4000	maize	HERB	
zwavel	6000	sugarbeet	FUNG	
fentin hydroxyde	400	potato	FUNG	
zwavel	7200	fruit	FUNG	
phenmedipham	960	sugarbeet	HERB	
DNOC	5000	fruit	INSE	
carbendazim	450	fruit	FUNG	$> 10^E+4$
carbendazim	200	cereal	FUNG	
fentin acetate	400	potato	FUNG	
carbendazim	150	sugarbeet	FUNG	
mancozeb	3200	potato	FUNG	
lindane	1500	sugarbeet	INSE	
ethofumesate	1000	sugarbeet	HERB	
DNOC	5000	cereal	INSE	
maneb	3200	potato	FUNG	
metolachlor	2520	maize	HERB	
captan	6150	fruit	FUNG	
copper oxychloride	6000	fruit	FUNG	
lindane	1500	maize	INSE	
diquat	975	potato	HERB	$> 10^E+3$



Figuur 20: Relative contribution (%) of different pesticide groups to the total impact for earthworms in 1991

2.6.2 Earthworms impact in 1996

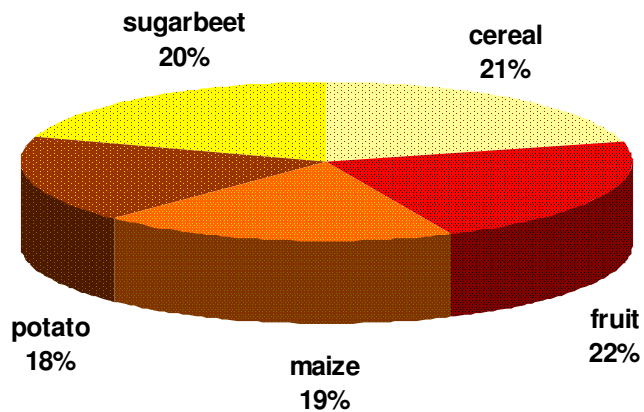


Figuur 21: Relative contribution (%) of different pesticide groups to the total impact for earthworms in 1996

Tabel 12: Overview of the 20 application cases contributing the most to the aquatic organisms impact RI*F in 1996

A. S. Name	AR 1996 (g/ha)	Crop group	Pesticide group	RI*F
fenpropidin	375	cereal	FUNG	
atrazine	4000	maize	HERB	
fentin hydroxyde	400	potato	FUNG	
zwavel	7200	fruit	FUNG	
phenmedipham	960	sugarbeet	HERB	
carbendazim	450	fruit	FUNG	> 10 ^E +4
carbendazim	200	cereal	FUNG	

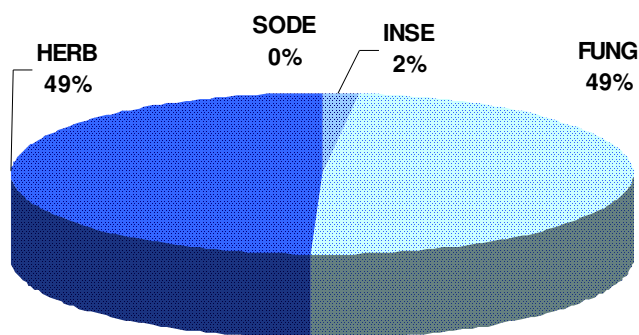
DNOC	5000	fruit	INSE	
carbendazim	150	sugarbeet	FUNG	
aldicarb	1000	sugarbeet	INSE	
metolachlor	2520	maize	HERB	
mancozeb	3200	potato	FUNG	
ethofumesate	1000	sugarbeet	HERB	
lindane	1500	maize	INSE	
copper oxychloride	6000	fruit	FUNG	
DNOC	5000	potato	INSE	
imidacloprid	450	sugarbeet	INSE	
imidacloprid	400	maize	INSE	
imidacloprid	125	fruit	INSE	
prosulfocarb	4000	cereal	HERB	> 10 ^E +3



Figuur 22: Relative contribution (%) of different crop groups to the total impact for earthworms in 1996

2.7 Groundwater

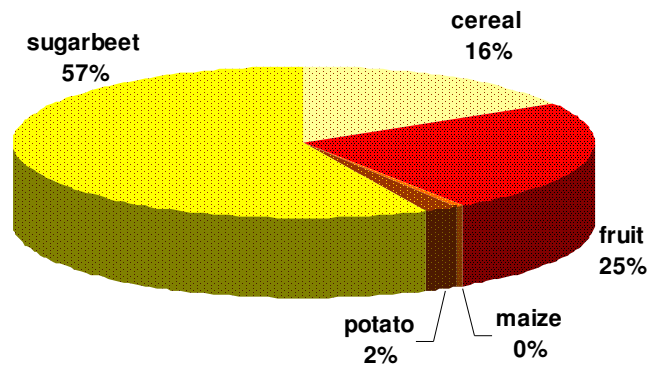
2.7.1 Groundwater impact in 1996



Figuur 23: Relative contribution (%) of different pesticide groups to the total impact for groundwater in 1991

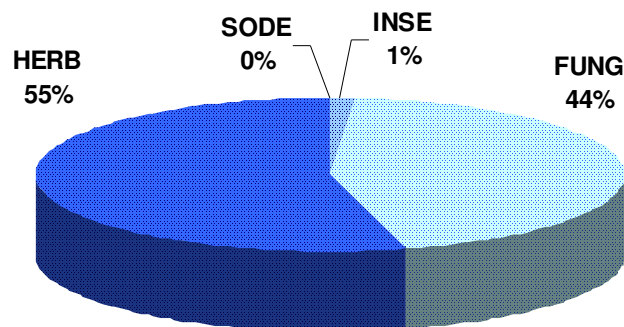
Tabel 13: Overview of the 20 application cases contributing the most to the groundwater impact RI*F in 1991

A. S. Name	AR 1991 (g/ha)	Crop group	Pesticide group	RI*F
lenacil	800	sugarbeet	HERB	
zwavel	6000	sugarbeet	FUNG	
zwavel	7200	fruit	FUNG	
imazamethabenz	750	cereal	HERB	$> 10^{E+7}$
thiophanate-methyl	300	sugarbeet	FUNG	
ethephon	600	cereal	HERB	
copper oxychloride	6000	fruit	FUNG	
cycloaat	2880	sugarbeet	HERB	
ethephon	750	fruit	HERB	
zwavel	4000	fruit	FUNG	
ethofumesate	1000	sugarbeet	HERB	
maneb	3200	potato	FUNG	
thiophanate-methyl	1275	fruit	FUNG	
bentazon	1440	maize	HERB	
chloridazon	3200	sugarbeet	HERB	
ethiofencarb	500	sugarbeet	INSE	
thiophanate-methyl	700	cereal	FUNG	
copper oxychloride	2500	potato	FUNG	
isoproturon	2250	cereal	HERB	
atrazine	4000	maize	HERB	$> 10^{E+6}$



Figuur 24: Relative contribution (%) of different crop groups to the total impact for groundwater in 1991

2.7.2 Groundwater impact in 1996

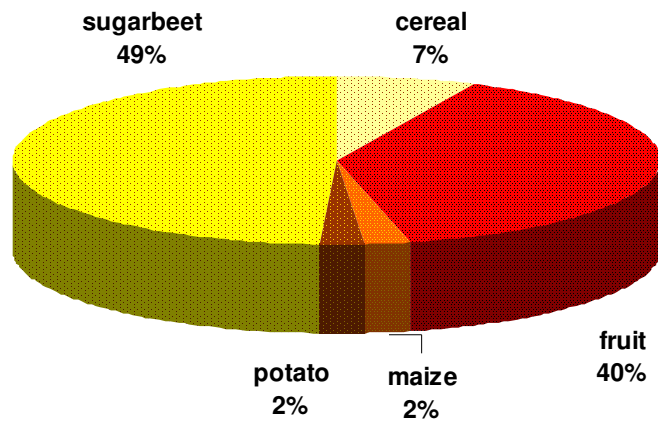


Figuur 25: Relative contribution (%) of different pesticide groups to the total impact for groundwater in 1996

Tabel 14: Overview of the 20 application cases contributing the most to the groundwater impact RI*F in 1996

A. S. Name	AR 1996 (g/ha)	Crop group	Pesticide group	RI*F
lenacil	800	sugarbeet	HERB	
zwavel	7200	fruit	FUNG	
copper oxychloride	6000	fruit	FUNG	> 10 ^E +7
zwavel	6000	sugarbeet	FUNG	
ethephon	600	cereal	HERB	
ethephon	750	fruit	HERB	
ethofumesate	1000	sugarbeet	HERB	
thiophanate-methyl	300	sugarbeet	FUNG	

thiophanate-methyl	1275	fruit	FUNG	
copper oxychloride	2500	potato	FUNG	
chloridazon	3200	sugarbeet	HERB	
isoproturon	2250	cereal	HERB	
bentazon	1440	maize	HERB	
carbofuran	150	sugarbeet	INSE	
carbofuran	150	maize	INSE	
maneb	3200	potato	FUNG	
zwavel	4000	fruit	FUNG	> 10 ^E +6
atrazine	4000	maize	HERB	
thiophanate-methyl	700	cereal	FUNG	
chlormequat	1000	cereal	HERB	



Figuur 26: Relative contribution (%) of different crop groups to the total impact for groundwater in 1996

6. A critical evaluation of the evolution compared to the reference year 2001

In the report “Belgian pesticide risk and use indicators methodology (PRIBEL)”, Vergucht et al., 2006, general and specified impact results are given for the weighted mean of the year 2001. A second important purpose of this study is, besides evaluating the risk for 1991 and 1996, comparing the impact between 1991, 1996 and 2001. In the tables below the absolute results can be perceived per compartment for all active substances (Table x), per pesticide group (table y) and per crop group (table z) respectively. Three reduction percentages are step by step calculated: the impact reduction in 1996 compared to 1991; the reduction in 2001 compared to 1996, and the reduction in 2001 with 1991 as reference year.

Legend:



A positive reduction is realized (i.e. a decrease of the impact)



A negative reduction is realized (i.e. an increase of the impact)



The reduction cannot be calculated because the compartment is not relevant for the specific crop

Tabel 15: Overview of the impact (RI*F) of all active substances (all pesticide groups applied in all crop groups) for the 7 compartments in absolute values and in reduction %

All	applicator	consumer	aquatic organisms	ground water	worms	birds	bees
1991	2,53E+08	4,98E+05	2,35E+08	3,17E+08	4,09E+05	2,19E+08	6,59E+0
1996	2,03E+08	4,41E+05	2,18E+08	1,77E+08	3,12E+05	2,91E+07	1,14E+0
<i>reductie 96 - 91</i>	19,76	11,45	7,23	44,16	23,72	86,71	-72,99
2001	1,49E+08	7,04E+04	1,85E+08	8,50E+07	2,69E+05	5,92E+07	7,52E+0
<i>reductie 01 - 96</i>	26,60	84,04	15,14	51,98	13,78	-103,44	34,04
<i>reductie 01 - 91</i>	41,11	85,86	21,28	73,19	34,23	72,97	-14,11

Tabel 16: Overview of the impact (RI*F) of the 4 pesticide groups for the 7 compartments in absolute values and in reduction %

Pesticide groups	applicator	consumer	aquatic organisms	ground water	worms	birds	bees
INSE 1991	1,12E+08	3,43E+03	1,29E+08	5,92E+06	1,62E+05	2,18E+08	6,17E+0
INSE 1996	8,33E+07	4,34E+03	1,28E+08	2,49E+06	5,19E+04	2,83E+07	1,10E+0
<i>reductie 96 - 91</i>	25,40	-26,38	1,11	57,95	68,02	87,00	-78,36
INSE 2001	4,34E+07	5,29E+03	9,00E+07	1,04E+07	4,00E+04	5,65E+07	7,04E+0

<i>reductie 01 - 96</i>	47,90	-21,89	29,69	-317,67	22,93	-99,65	36,00
<i>reductie 01 - 91</i>	61,13	-54,05	30,47	-75,62	75,35	74,04	-14,15
FUNG 1991	9,82E+07	4,85E+05	4,47E+07	1,54E+07	1,41E+05	4,69E+05	2,64E+0
FUNG 1996	8,11E+07	4,27E+05	6,41E+07	7,84E+07	1,58E+05	3,97E+05	2,58E+0
<i>reductie 96 - 91</i>	17,41	11,91	-43,48	-409,75	-12,19	15,41	2,13
FUNG 2001	7,91E+07	5,76E+04	5,09E+07	2,45E+07	1,52E+05	4,85E+05	2,79E+0
<i>reductie 01 - 96</i>	2,47	86,51	20,59	68,75	3,80	-22,17	-8,14
<i>reductie 01 - 91</i>	19,45	88,12	-13,93	-59,30	-7,93	-3,34	-5,84
HERB 1991	4,21E+07	9,61E+03	6,20E+07	1,75E+08	1,04E+05	3,93E+05	1,20E+0
HERB 1996	3,73E+07	9,70E+03	2,60E+07	9,57E+07	1,02E+05	3,80E+05	1,27E+0
<i>reductie 96 - 91</i>	11,48	-0,98	58,09	45,36	2,04	3,37	-5,95
HERB 2001	2,70E+07	7,49E+03	4,43E+07	4,99E+07	7,72E+04	2,30E+05	1,32E+0
<i>reductie 01 - 96</i>	27,61	22,78	-70,38	47,86	24,31	39,47	-3,94
<i>reductie 01 - 91</i>	35,92	22,03	28,59	71,51	25,86	41,52	-10,12
SODE 1991	1,13E+06	1,10E+01	2,25E+04	1,71E+05	8,62E+02	2,72E+04	3,76E+0
SODE 1996	1,08E+06	1,50E+01	1,52E+04	1,95E+05	6,81E+02	2,34E+04	5,10E+0
<i>reductie 96 - 91</i>	4,03	-36,36	32,42	-14,07	21,00	14,06	-35,48
SODE 2001	7,00E+00	2,00E+00	6,20E-01	1,21E+05	1,23E+02	2,00E+06	0,00E+0
<i>reductie 01 - 96</i>	100,00	86,67	100,00	37,77	81,94	-8438,46	100,00
<i>reductie 01 - 91</i>	100,00	81,82	100,00	29,01	85,73	-7238,30	100,00

Tabel 17: Overview of the impact (RI*F) of the 5 crop groups for the 7 compartments in absolute values and in reduction %

Crop groups	applicator	consumer	aquatic organisms	ground water	worms	birds	bees
Cereal 1991	4,09E+07	NR	5,08E+07	5,10E+07	2,60E+04	3,95E+05	NR
Cereal 1996	3,45E+07	NR	3,52E+07	1,23E+07	6,55E+04	2,55E+05	NR
<i>reductie 96 - 91</i>	15,57	NR	30,76	75,88	-151,56	35,51	NR
Cereal 2001	1,97E+07	NR	3,05E+07	7,38E+06	2,26E+04	1,67E+05	NR
<i>reductie 01 - 96</i>	42,90	NR	13,35	40,00	65,50	34,51	NR
<i>reductie 01 - 91</i>	51,79	NR	40,00	85,53	13,20	57,76	NR
Fruit 1991	4,48E+06	4,89E+05	5,20E+07	7,65E+07	6,41E+04	1,12E+06	5,41E+0
Fruit 1996	4,14E+06	4,32E+05	7,07E+07	7,00E+07	6,98E+04	9,00E+05	1,03E+0
<i>reductie 96 - 91</i>	7,62	11,59	-36,06	8,53	-8,98	19,38	-90,55
Fruit 2001	1,01E+06	5,85E+04	6,03E+07	1,83E+07	3,01E+04	3,05E+05	5,25E+0
<i>reductie 01 - 96</i>	75,60	86,46	14,71	73,86	56,88	66,11	49,03
<i>reductie 01 - 91</i>	77,46	88,03	-16,04	76,09	53,01	72,68	2,87
Maize 1991	4,41E+07	NR	1,53E+07	5,17E+06	5,94E+04	7,02E+06	NR
Maize 1996	6,26E+07	NR	2,14E+07	3,84E+06	5,93E+04	7,90E+06	NR
<i>reductie 96 - 91</i>	-42,10	NR	-39,63	25,75	0,21	-12,59	NR
Maize 2001	2,18E+07	NR	1,30E+07	1,24E+07	3,07E+04	6,69E+06	NR
<i>reductie 01 - 96</i>	65,18	NR	39,25	-222,92	48,23	15,32	NR
<i>reductie 01 - 91</i>	50,51	NR	15,18	-139,75	48,34	4,66	NR
Potato 1991	7,07E+07	9,16E+03	4,73E+07	5,85E+06	5,54E+04	2,81E+05	1,18E+0
Potato 1996	6,80E+07	9,40E+03	5,74E+07	3,59E+06	5,52E+04	3,50E+05	1,06E+0
<i>reductie 96 - 91</i>	3,79	-2,58	-21,38	38,62	0,38	-24,52	10,41
Potato 2001	8,08E+07	1,19E+04	5,15E+07	1,28E+07	8,52E+04	2,48E+06	2,20E+0

reductie 01 - 96	-18,82	-26,60	10,28	-256,55	-54,35	-608,57	-107,55
reductie 01 - 91	-14,32	-29,86	-8,91	-118,84	-53,75	-782,28	-85,94
Sugarbeet 1991	9,30E+07	NR	7,00E+07	1,78E+08	2,03E+05	2,10E+08	NR
Sugarbeet 1996	3,36E+07	NR	3,33E+07	8,72E+07	6,24E+04	1,97E+07	NR
reductie 96 - 91	63,89	NR	52,40	51,14	69,28	90,61	NR
Sugarbeet 2001	2,63E+07	NR	2,99E+07	3,42E+07	1,01E+05	4,96E+07	NR
reductie 01 - 96	21,73	NR	10,21	60,78	-61,86	-151,78	NR
reductie 01 - 91	71,73	NR	57,26	80,84	50,28	76,36	NR

CONCLUSIONS

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