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Experiences with biobeds after several years of use under German climatic conditions

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Content of the presentation

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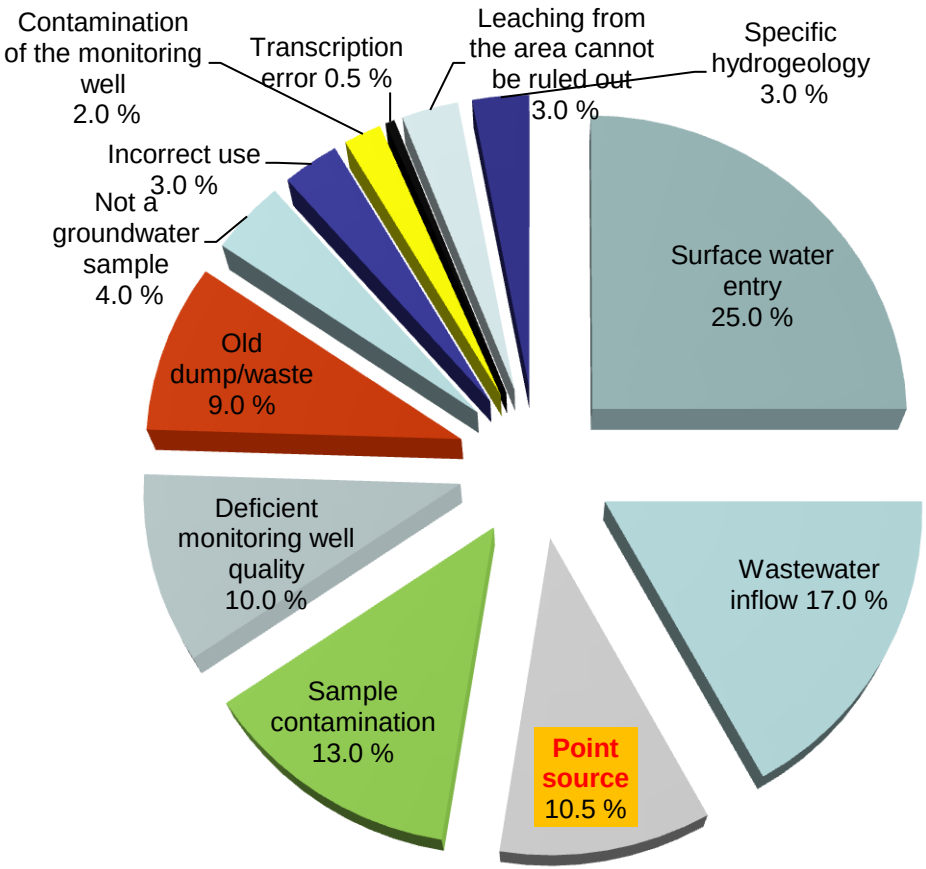
1. Introduction and background

2. Experiments and results
   - 2.1 Test design
   - 2.2 Eluates
   - 2.3 Biomix

3. Conclusions and recommendations

Evaluation of plant protection product findings in groundwater in Germany (concentrations of approximately 0.1 µg/L and higher)

Report of the Federal Environmental Agency (UBA); Schmidt et al. 2005



Point sources (e.g., farm run-off)

Point source entries occur when residual liquids of plant protection products flow either directly into the groundwater or via a surface water passage.

These entries are usually associated with the filling and cleaning of field sprayers or leakages of wastewater tanks.

Accidentally released spray solutions could particularly affect groundwater at sites where the top soil layer was removed for constructing buildings (e.g., sewage tanks, wells, pipes) and no adequate sealing was installed.

Concentration of pesticides in a waste water pit of the research station Dahnsdorf 2004

Active substance	[µg/l]	Active substance	[µg/l]
Azoxystrobin	550	**Fenpropidin**	400
Bentazone	20	**Ioxynil**	430
Carbetamide	900	**Isoproturon**	2000
Cyproconazole	4	**Metalaxyl**	300
Cyprodinil	100	**Metolachlor**	650
Dimefuron	400	**Metribuzin**	70
Epoxiconazole	150	**Tebuconazole**	300

Crop protection equipment
Test methods for the evaluation of cleaning systems

ISO 22368-3:2004

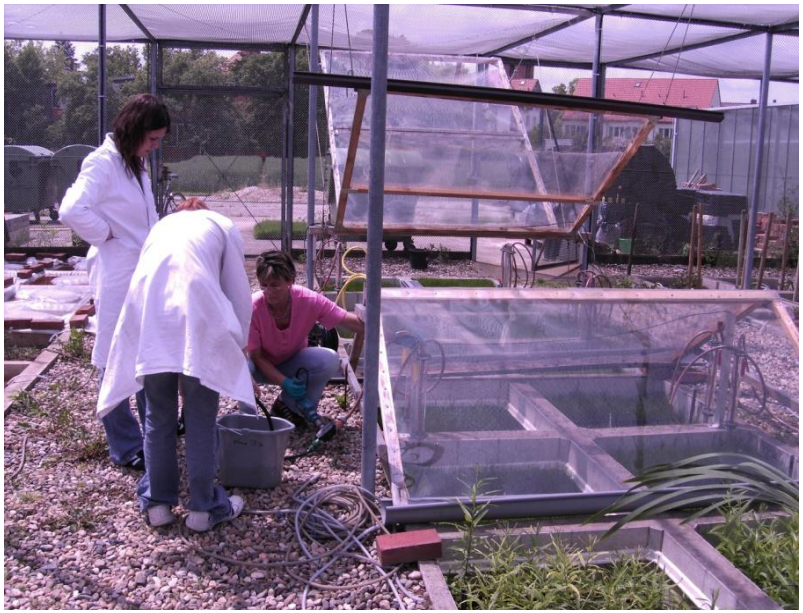
-- Part 1: Internal cleaning of complete sprayers
-- Part 2: External cleaning of sprayers
-- Part 3: Internal cleaning of tank

Residue measurements at different devices revealed that there are between 0.1% and 1.0% of the initial concentration in the equipment and 0.02% to 0.5% of the initial concentration on the equipment.

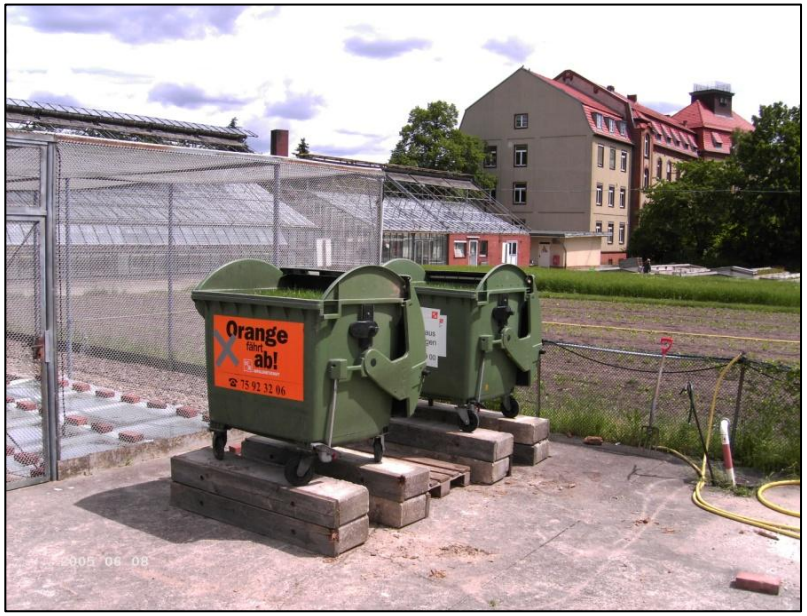
The plant protection act in Germany regulates that the tank container (with technically conditioned eluates) has to be filled with clear water again and the waste water has to be sprayed on a cultural or agricultural area. Fruit and wine farmers as well as greenhouse producers frequently do not possess such „compensation areas “.

Here the biobeds seems to be a good alternative.

Type of biobed



Type of biobed

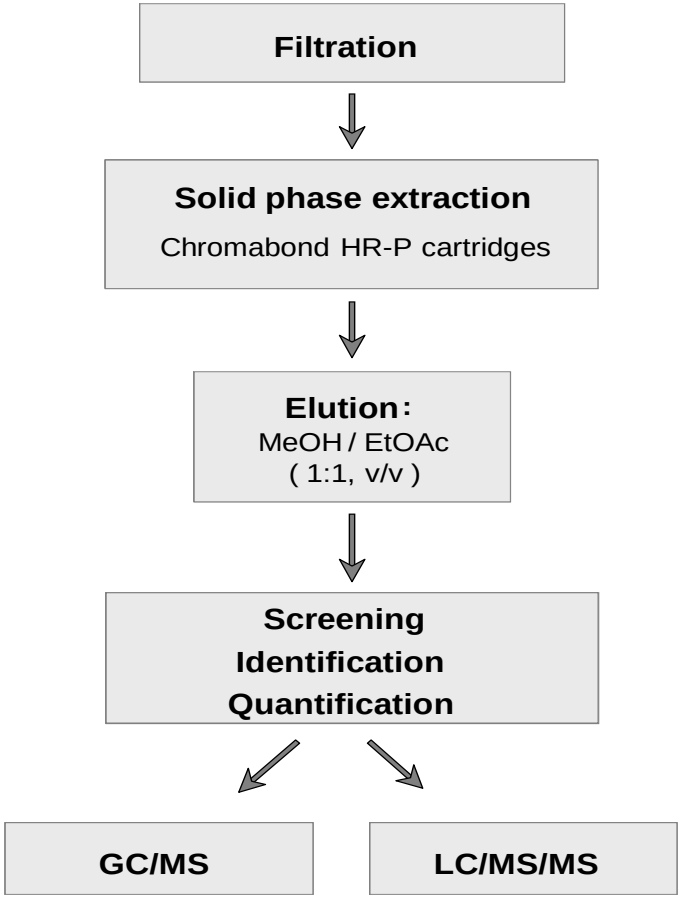


Relative complex pesticide mixtures

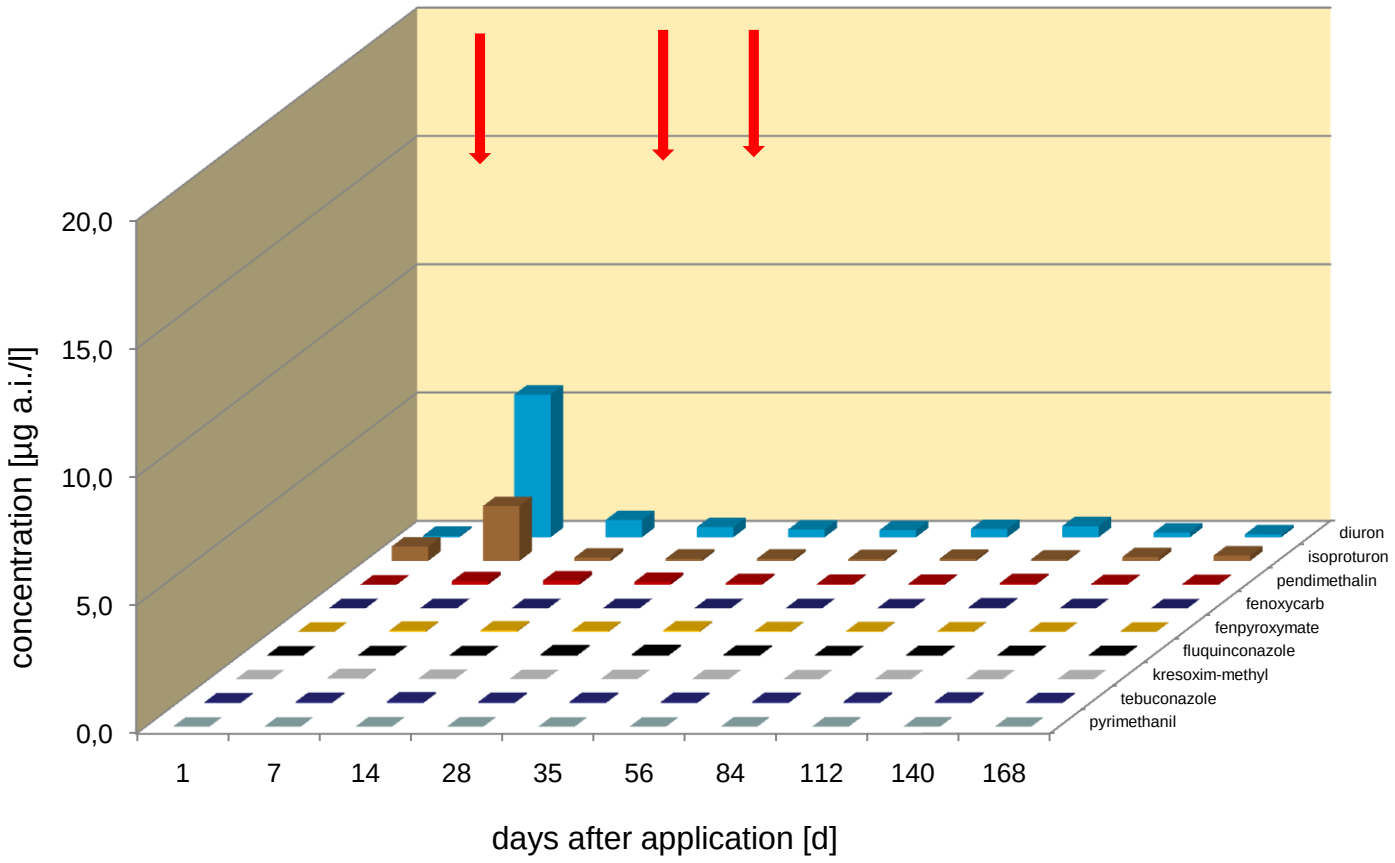
This study was performed to determine whether biobeds can degrade relatively complex pesticide mixtures when applied repeatedly

plant protection product	active ingredient (a.i.)	type	application [mg a.i./m^2]	water solubility [mg/l at 20°C[1)] or 25°C[2)]]	DT_{50} [days]
Arelon	isoproturon	H	150.0	65.0 [1)]	12-33
Discus	kresoxim-methyl	F	75.0	2.0 [1)]	< 1
Folicur	tebuconazole	F	37.5	32.0 [1)]	30-120
Insegar	fenoxycarb	I	16.0	5.7 [2)]	28-107
Kiron	fenpyroximate	A	15.39	0.015 [1)]	25-50
Vision	fluquinconazole	F	2.5	0.9 [1)]	69-250
	pyrimethanil	F	10.0	121.0 [2)]	11-35
Stomp SC	pendimethalin	H	100.0	0.33 [1)]	135
Vorox G	diuron	H	405.0	3.05 [1)]	90-180
	glyphosate	H	648.0	> 12.000	10-360

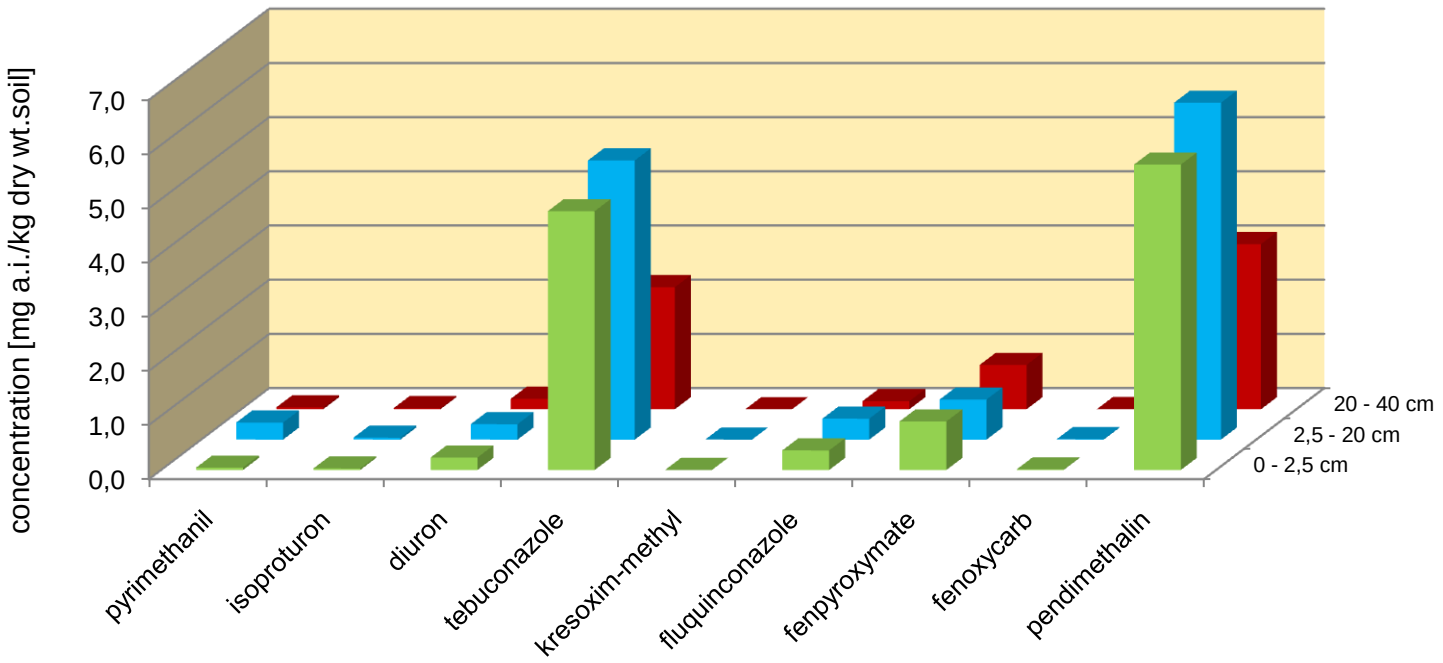
The simplified diagram of a multi-method for the residue analysis of water used at the JKI/Berlin



Pesticide residues in eluates of biobeds 5 – 8 after 5 years (2009)



Pesticide residues in matrix (top soil/peat/bark mulch) of biobeds 5 – 8 after 3 years (2007)



- Studies have shown that biobeds can retain and subsequently degrade high concentrations of relatively complex mixtures of pesticides even when applied repeatedly.

- Within 5 years, accumulation in the eluates from one growing season to the next should not occur except diuron and isoproturon. All other active substances were adsorbed or/and degrades to more than 99.99%.

- After 3 years of use we found ppp residues in the biomix; tebuconazole and pendimethalin were detected with amounts up to 5 mg/kg dry wt. soil.

- The biobeds should get a roof to protect them against water logging or should be located in a barn.
- With plants on the surface of the biobeds an increased evaporation rate can be attained.
- Repeated application of the leachates on the surface improves the degradation rate and reduces the quantity of water in the biobeds.
- If the biobeds are filled up again, the used biomix substrate must be subsequently composted (one year or more?).

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Thank you for your attention