

Pesticides in groundwater in Norway. A screening investigation of 28 drinking water wells in agricultural areas, 2010 – 2012

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KNOWLEDGE ABOUT GROUNDWATER IN NORWAY?

- Undisturbed groundwater has normally good quality
- Few investigations of groundwater quality in agricultural areas
- Serious problems with pesticides and nitrate in groundwater in Europa.
- Sufficient control of water quality in norwegian drinking water wells in agricultural areas ?

Project: Pesticides in groundwater in agricultural areas in Norway

- "Action plan to reduce risks using pesticides in agriculture"
 - Start 2007
 - Goal: Screening of pesticides in groundwater aquifer in agricultural areas.
- Presentation 2010 - 2012: 9 field sites – 28 wells
- Investigation reported 05.06.2013

Sampling concentrated on wells with findings or risks for findings of pesticides.

REPORTS AND PRESS RELEASES



NORSK Landbruk

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regjeringen.no | Regjeringen Stoltenberg II | Departementene

LANDBRUKS- OG MATDEPARTEMENTET

Søk hos Landbruks- og matde
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Del/Tips U

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Nyhet, 18.06.2013

Resultater fra prosjekt om plantevernmidler i grunnvannsbrønner i jordbruksområder

Resultater fra prosjektet "Plantevernmidler i grunnvann i jordbruksområder" er nå klare. Fra 2007 til 2012 ble det tatt prøver av grunnvann i 28 brønner i ni jordbruksområder i Norge. I perioden 2010-2012 ble det påvist plantevernmidler i 24 av de 28 grunnvannsbrønnene.

Brønnene ble valgt ut fra at det kunne være risiko for nedvasking av plantevernmidler. Plantevernmidler ble påvist i omkring halvparten av prøvene. Omkring halvparten av totalt 199 vannprøver inneholdt plantevernmidler.

- Prosjektet gir kunnskap om hvordan plantevernmidler oppfører seg i miljøet. Mattilsynet er ansvarlig for godkjenning av plantevernmidler i Norge. Dette er kunnskap som Mattilsynet benytter i sin vurdering av plantevernmidler, sier landbruks- og matminister Trygve Slagsvold Vedum.

- [Les mer om prosjektet hos Bioforsk](#)

Prosjektet er finansiert med midler over Handlingsplan for redusert risiko ved bruk av plantevernmidler og har pågått i seks år.

Handlingsplan for redusert risiko ved bruk av plantevernmidler for 2010-2014 har blant annet som mål å gjøre norsk landbruk mindre avhengig av kjemiske plantevernmidler og redusere risiko for helse- og miljø ved bruk av plantevernmidler. For 2013 går 10 millioner kroner på Landbruks- og matdepartementets budsjett til å følge opp handlingsplanen med ulike tiltak og prosjekter. Mange av prosjektene er viktige for å skaffe ny kunnskap som grunnlag for redusere risikoen ved bruk av plantevernmidler.

- [Les hele handlingsplanen](#)

Plantevernmidler ender opp i
Overstiger grenseverdiene for drikkevann

FIELD SITES/WELLS

	2007	2008	2009 - 2012
Klepp	8	5	4
Kongsberg	3		1
Grue	5	4	4
Ullensaker/ Nannestad	4	4	2
Lærdal	7		
Øyer	3		
Rena	6		
Melhus	5		
Stjørdal/ Meråker	5		
Norddal		5	
Nesodden		6	6* (3)
Larvik		4	2
Råde		9	4
Grimstad		6	3
Overhalla		8	4



METHODS



- Sampling 3 times/year: May, July and October
 - Preferably after rainfall
- Analysis - water samples:
 - GC-Multi M60 (37 pesticide residues)
 - GC/MS Multi M15 (11 residues)
 - LC-MS/MS M91 (66 residues)
 - $\text{NO}_3\text{-N}$ and $\text{NH}_4\text{-N}$
 - pH and conductivity

÷ glyphosate
÷ sulfonylurea herbicides

RESULTS 2010 - 2012

	Wells		Wells with residues		Water samples		Samples with residues		≥0.1 µg/l	
	Number	Number	Percent	Number	Number	Percent	Number	Percent	Number	Percent
Klepp	4	3	75	32	12	34	3	9		
Kongsberg	1	1	100	8	6	75	2	25		
Grue	4	4	100	29	11	38	3	10		
Ullensaker/ Nannestad	2	1	50	16	1	6	0	0		
Nesodden	3	1	33	6	1	17	0	0		
Larvik	2	2	100	14	3	21	1	7		
	Wells		Wells with residues		Water samples		Samples with residues		≥0.1 µg/l	
	Number	Number	Percent	Number	Number	Percent	Number	Percent	Number	Percent
2007 - 2009	30	25	63	186	87	47	15	8		
2010 - 2012	28	24	86	199	89	45	24	12		

PESTICIDE RESIDUES FOUND IN GROUNDWATER

	Pesticide residues found and number of findings 2010 - 2012
Klepp	<u>Simazine</u> (15), <u>bentazone</u> (3), <u>atrazine</u> (2), <u>dicamba</u> (2), <u>metalaxyl</u> (1), <u>BAM</u> (1) og <u>MCPA</u> (1)
Kongsberg	<u>Bentazone</u> (3), <u>trifloksistrobin metabolite</u> (2) and <u>MCPA</u> (1)
Grue	<u>Metalaxyl</u> (5), <u>bentazone</u> (4), <u>imidakloprid</u> (2), <u>cyprodinil</u> (1), <u>oksadixyl</u> (1) og <u>pencykuron</u> (1)
Ullensaker/ Nannestad	<u>Lambda-cyhalothrin</u> (1)
Nesodden	<u>Bentazone</u> (1)
Larvik	<u>Bentazone</u> (2), <u>MCPA</u> (1), <u>2,4-D</u> (1), <u>dicamba</u> (1), <u>phenmedipham</u> (1) og <u>isoproturon</u> (1)
Råde	<u>Bentazone</u> (16), <u>MCPA</u> (8), <u>azoxvstrobin</u> (2), <u>atrazine</u> (1), <u>tiabendazole</u> (1) and <u>mecoprop</u> (1)
Grimstad	<u>Bentazone</u> (5), <u>metalaxyl</u> (5), <u>MCPA</u> (3), <u>BAM</u> (2) and <u>mecoprop</u> (1)
Overhalla	<u>Atrazine</u> (15), <u>BAM</u> (8), <u>pencycuron</u> (5), <u>metalaxyl</u> (2), <u>simazine</u> (1), <u>bentazone</u> (1) and <u>trifloxvstrobin metabolite</u> (1),
Total	19 different pesticides and metabolites

Pesticides $\geq 0,1 \mu\text{g/l}$ (Drinking water limit)

2010 -2012	Pesticide found in concentrations exceeding the drinking water limit ($\geq 0.1 \mu\text{g/l}$)
Klepp	Dicamba (2) and simazine(1)
Kongsberg	Trifloxystrobin metabolite(1) and MCPA(1)
Grue	Metalaxyl(1), imidacloprid(1) og oksadixyl(1)
Ullensaker/ Nannestad	None
Nesodden	None
Larvik	Isoproturon(1)
Råde	Bentazone(3) and MCPA(1)
Grimstad	Bentazone(2) and mecoprop(1)
Overhalla	Pencycuron(4), BAM(1) and atrazine(1)
Total	13 different pesticides and metabolites

PESTICIDE RESIDUES IN GROUNDWATER: TOTAL 2007 – 2012

Pesticide residues found and number of findings 2007 - 2012

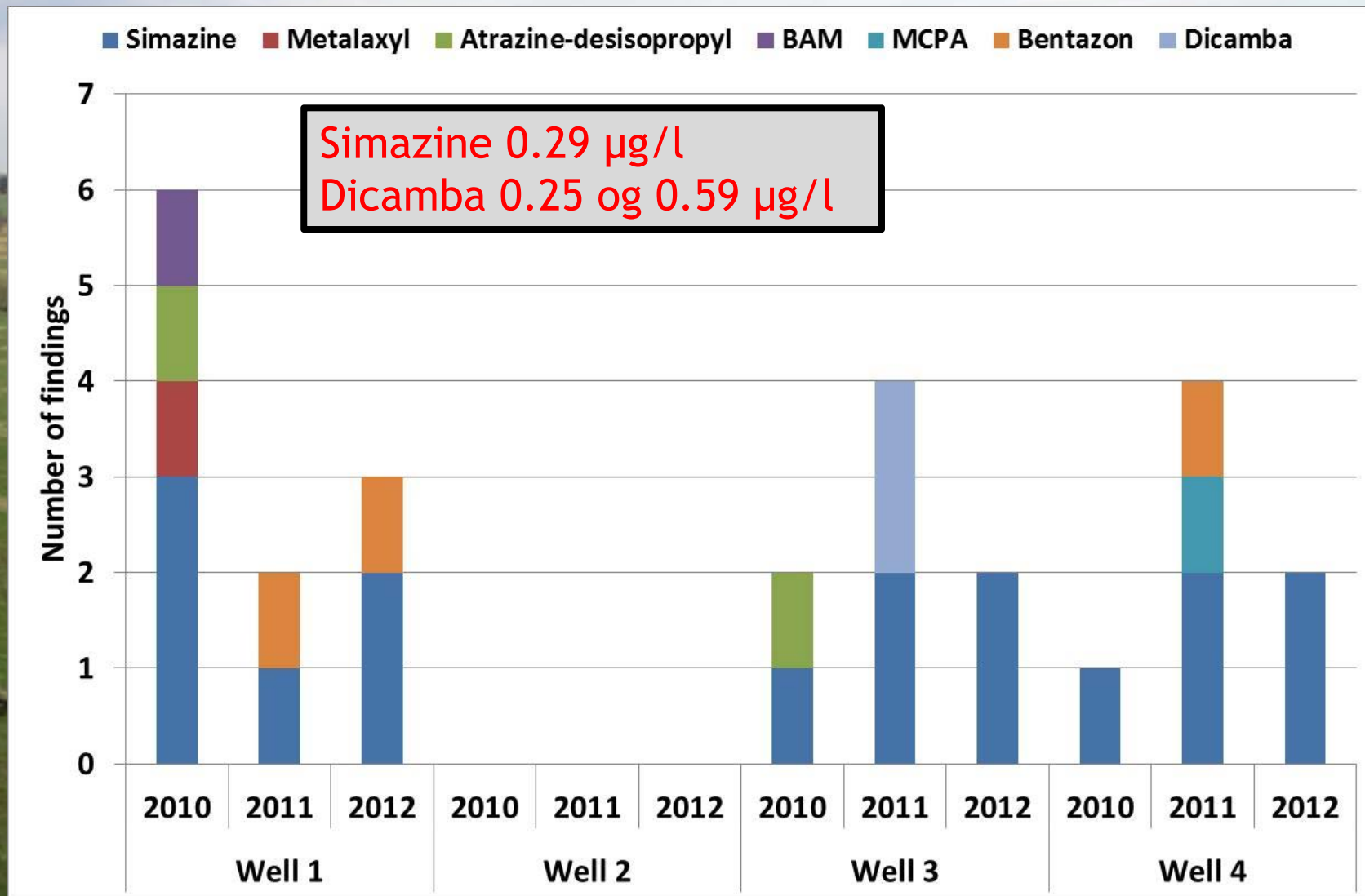
Bentazone(41), simazine(40), BAM(36), metalaxyl(34), atrazine(29), atrazine-desetyl(7), MCPA(20) propikonazole(10), trifloxystrobin metabolite(6), pencycuron(6), fenpropimor(5), iprodion(3), metribuzin(3), azoxystrobin(3), 2,4-D(3), dicamba(3), tiabendazol(2), mecoprop(3), imidacloprid(2), fluroxypyr (1), cyprodinil(1), oxadixyl(1), lambda-cyhalothrin(1), pyrimethanil(1), tebuconazole(1), propachlor(1), aclonifen (1), phenmedipham(1), isoproturon(1), procloraz(1) og kresoxim (1)

31 different pesticides and metabolites

2007 -2012	Pesticides found in concentrations exceeding the drinking water limit ($\geq 0.1 \mu\text{g/l}$)
Klepp	Dicamba(2), aclonifen(1) og simazine(1)
Kongsberg	Fluroxypyr(1), trifloxystrobin metabolite(1) and MCPA(1)
Grue	Metalaxyl(1), imidacloprid(1) og oxadixyl(1)
Ullensaker/ Nannestad	None
Nesodden	None
Larvik	MCPA(1), 2,4-D(1) and isoproturon
Råde	Bentazone(6) and MCPA(2)
Grimstad	Bentazone(2) og mecoprop(1)
Overhalla	BAM(7), pencycuron (4), metalaxyl(2), kresoxim(1) and atrazin(1)
Totalt	17 different pesticides

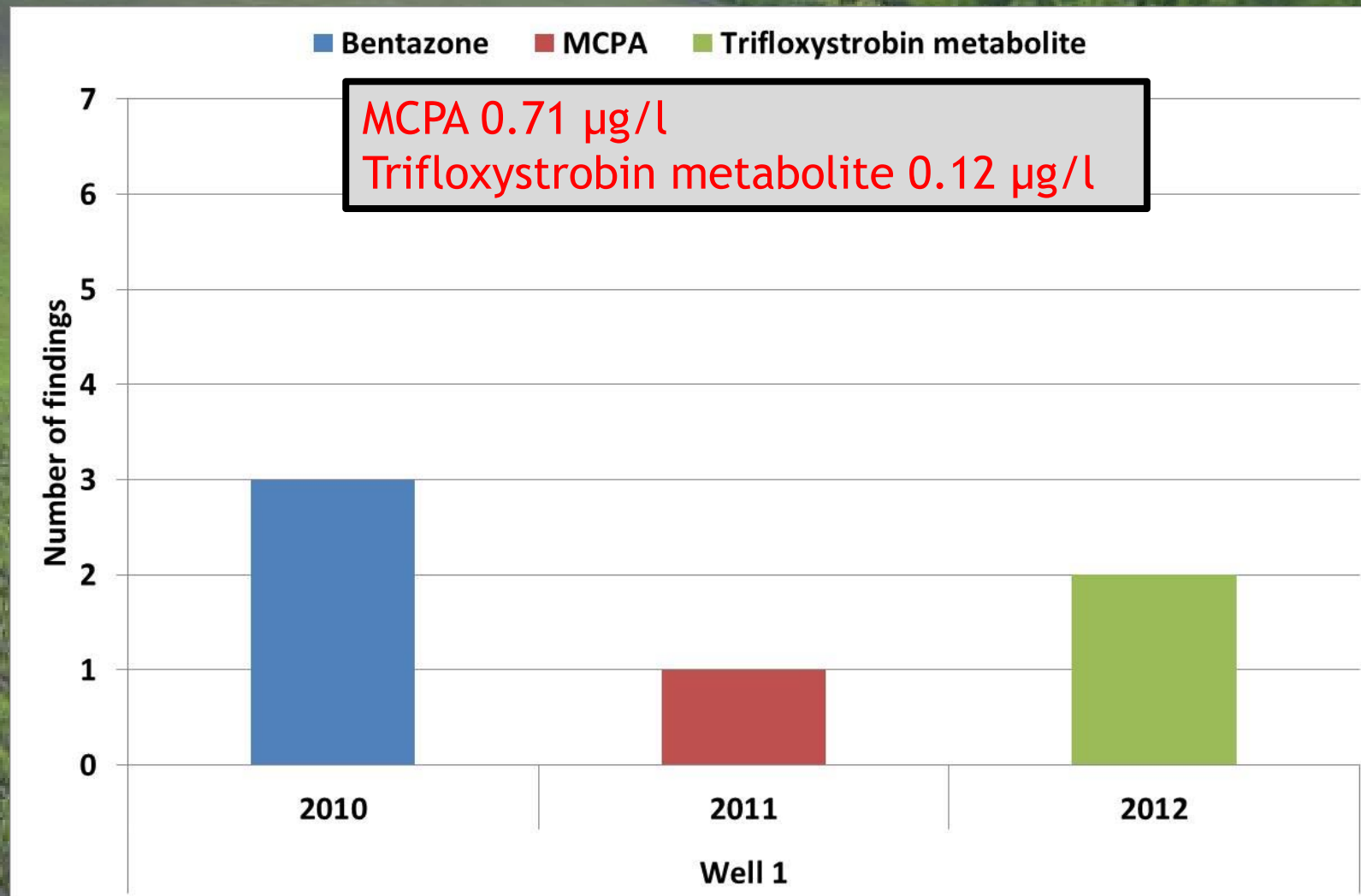
KLEPP

Intensive livestock farming, grass production, grain and potato, glacifluvial deposit



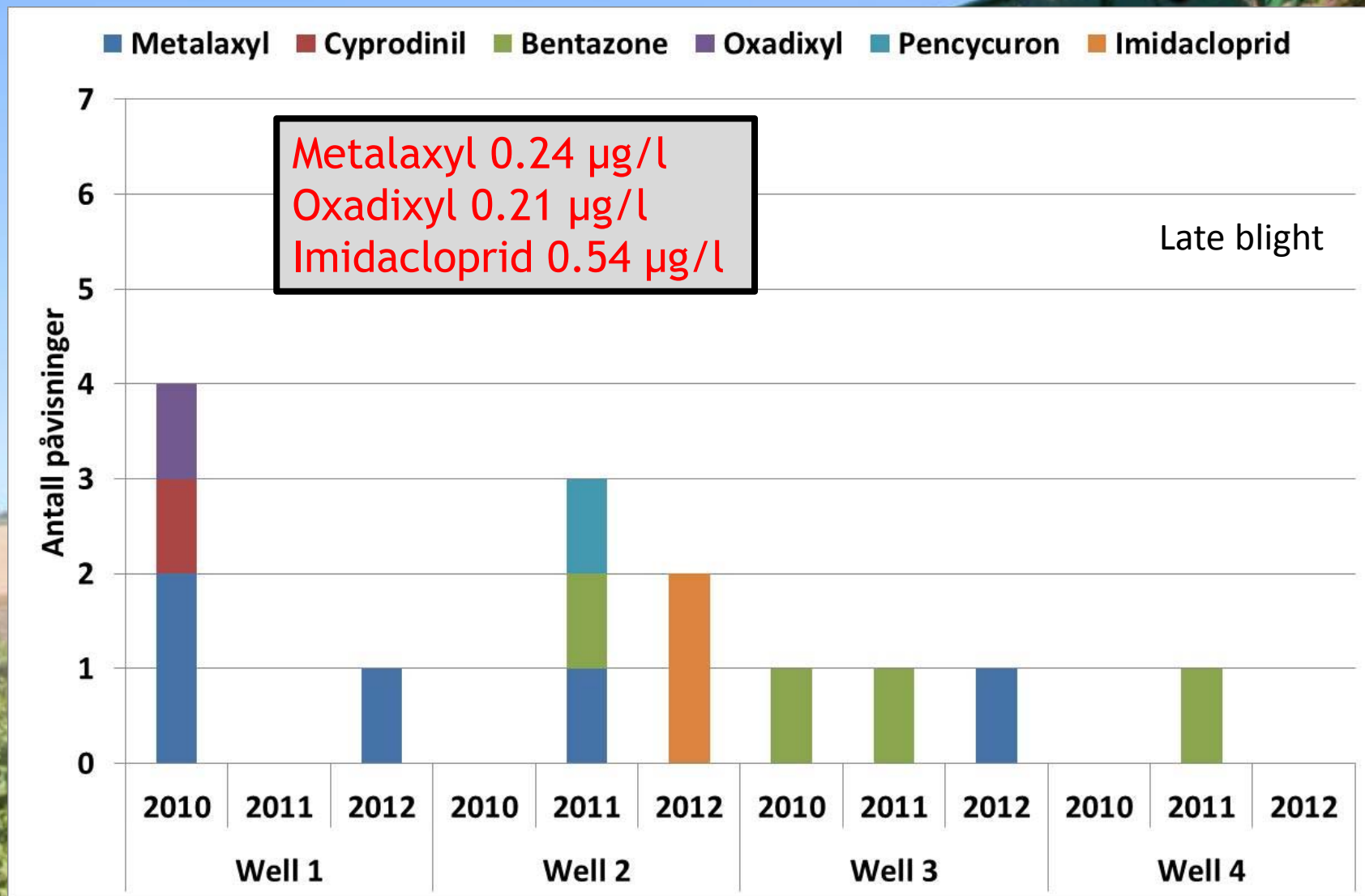
KONGSBERG

Grain produksjon, fluvial deposits Numedalslågen



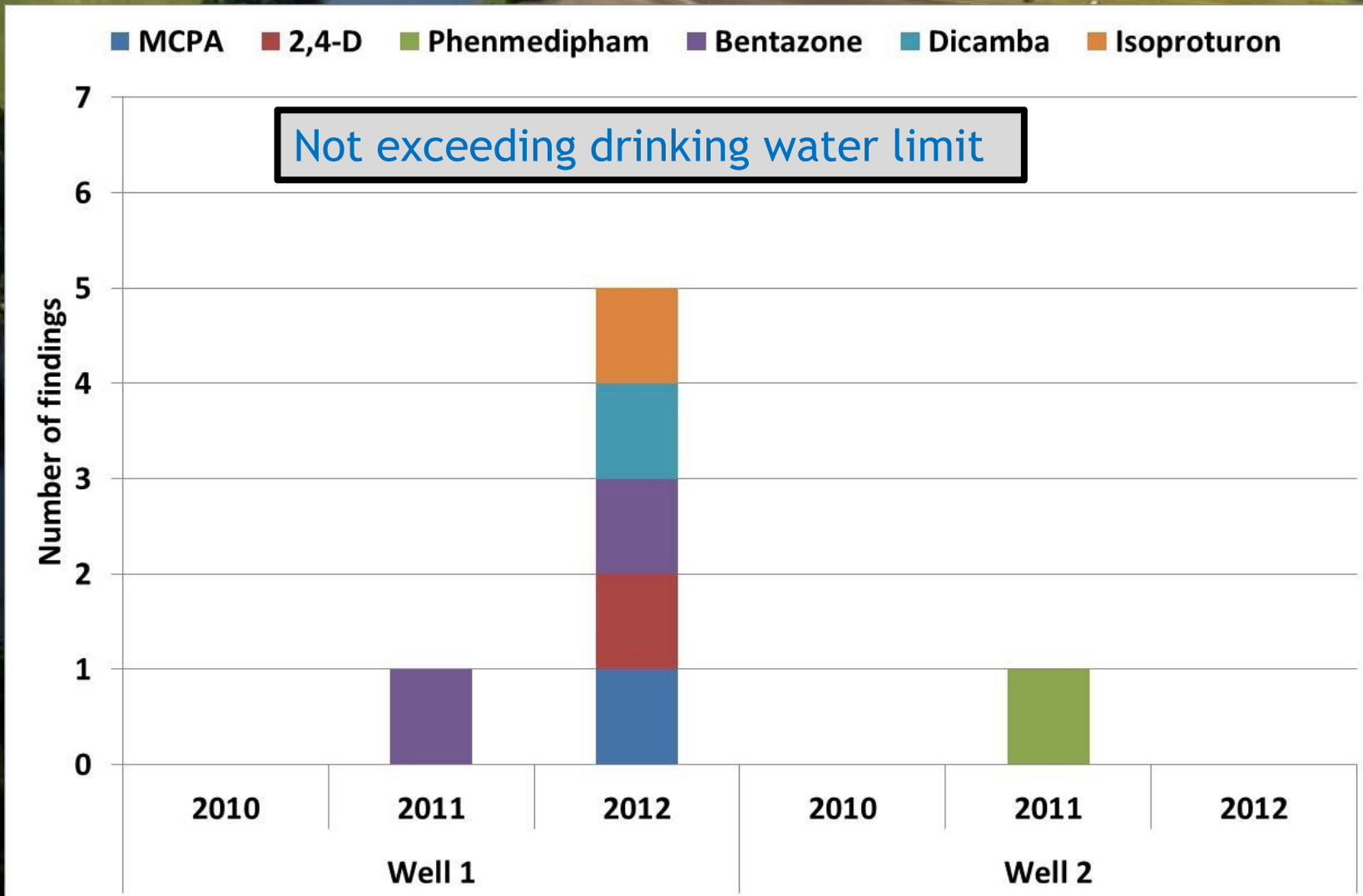
GRUE

Potato and grain, fluvial deposit Glomma



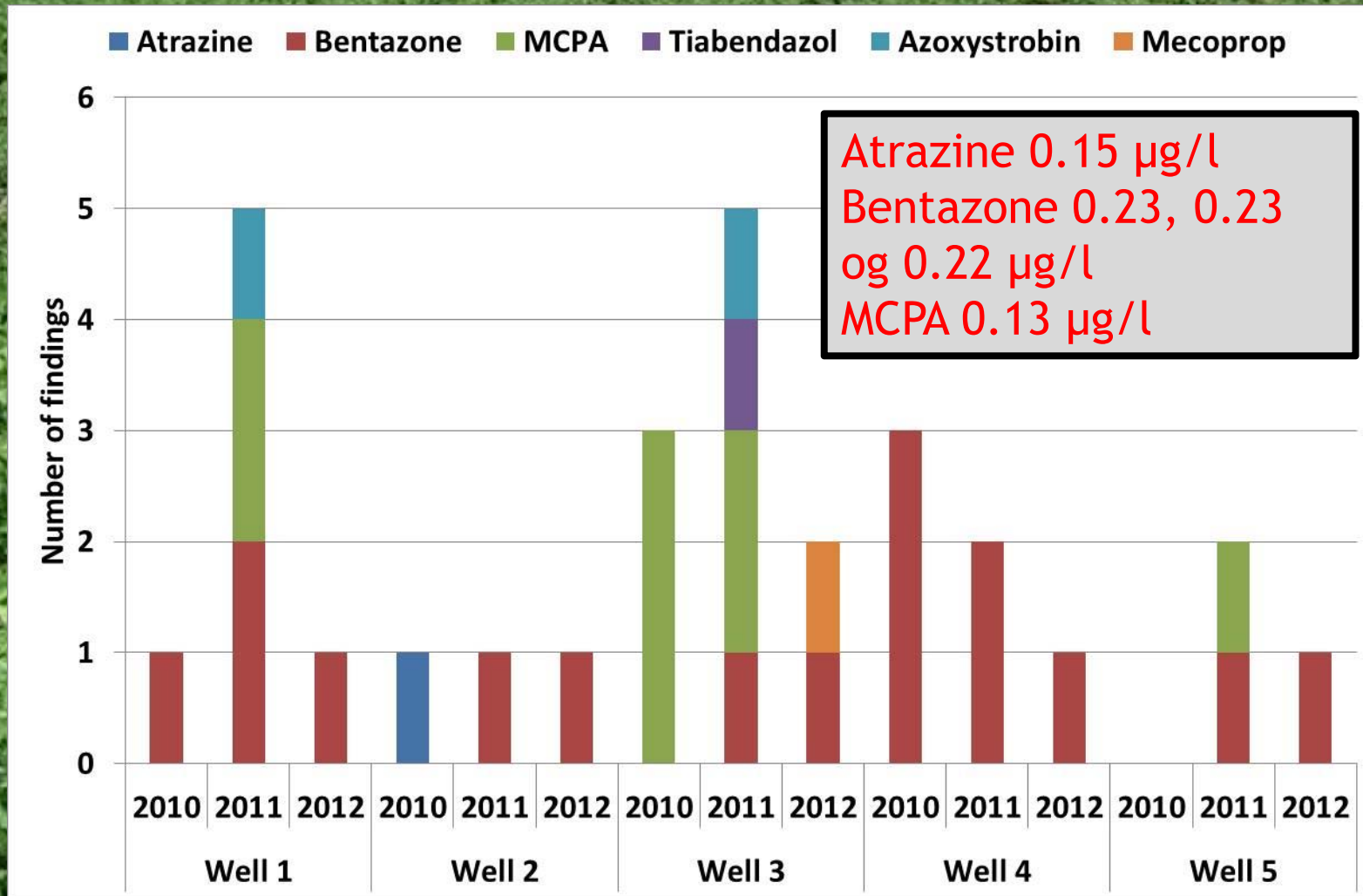
LARVIK

Carrots, onion, potato, fluvial deposit Numedalslågen



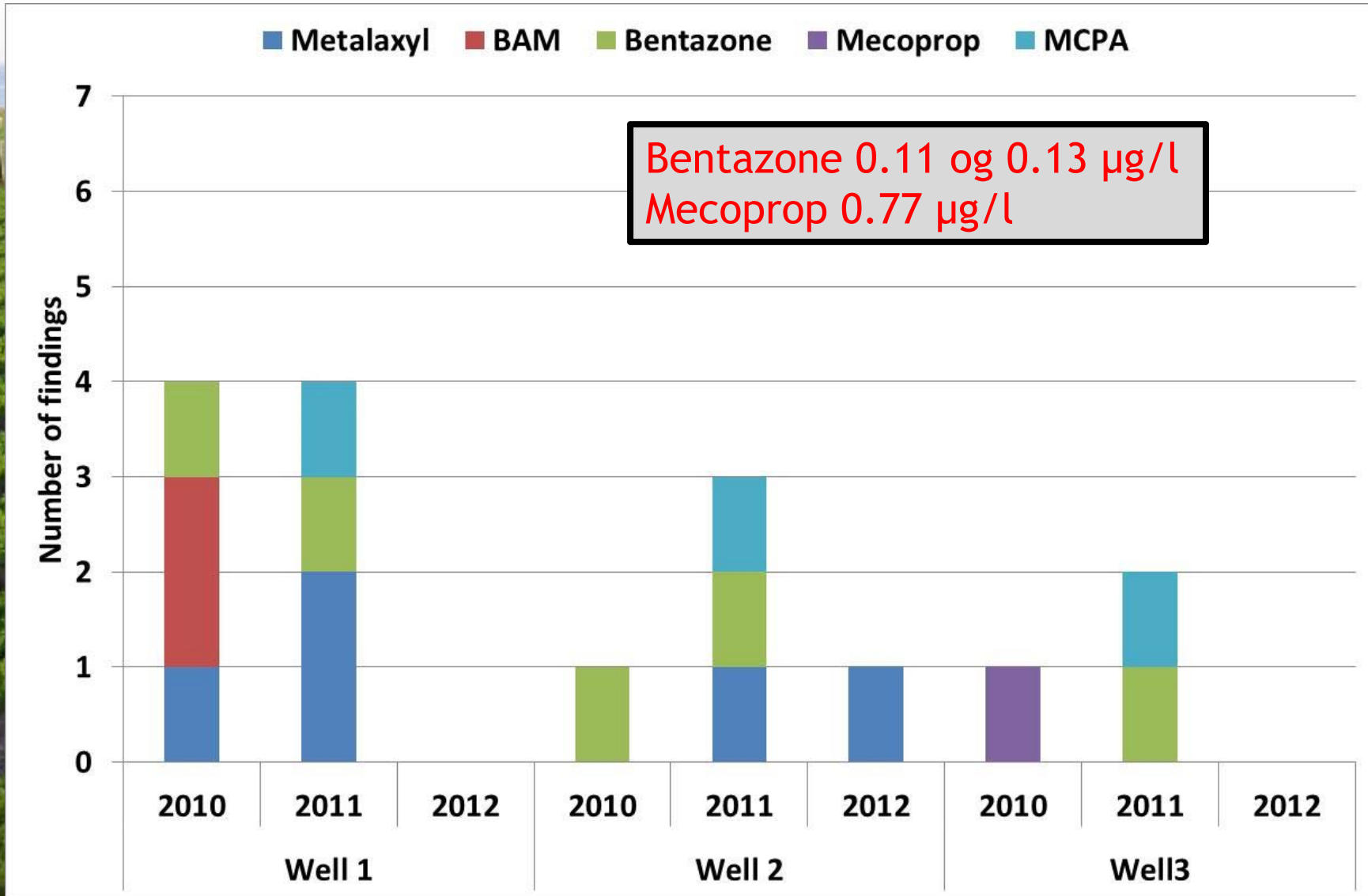
RÅDE

Potato, vegetables and grain, glacifluvial end moraine, sandy soil



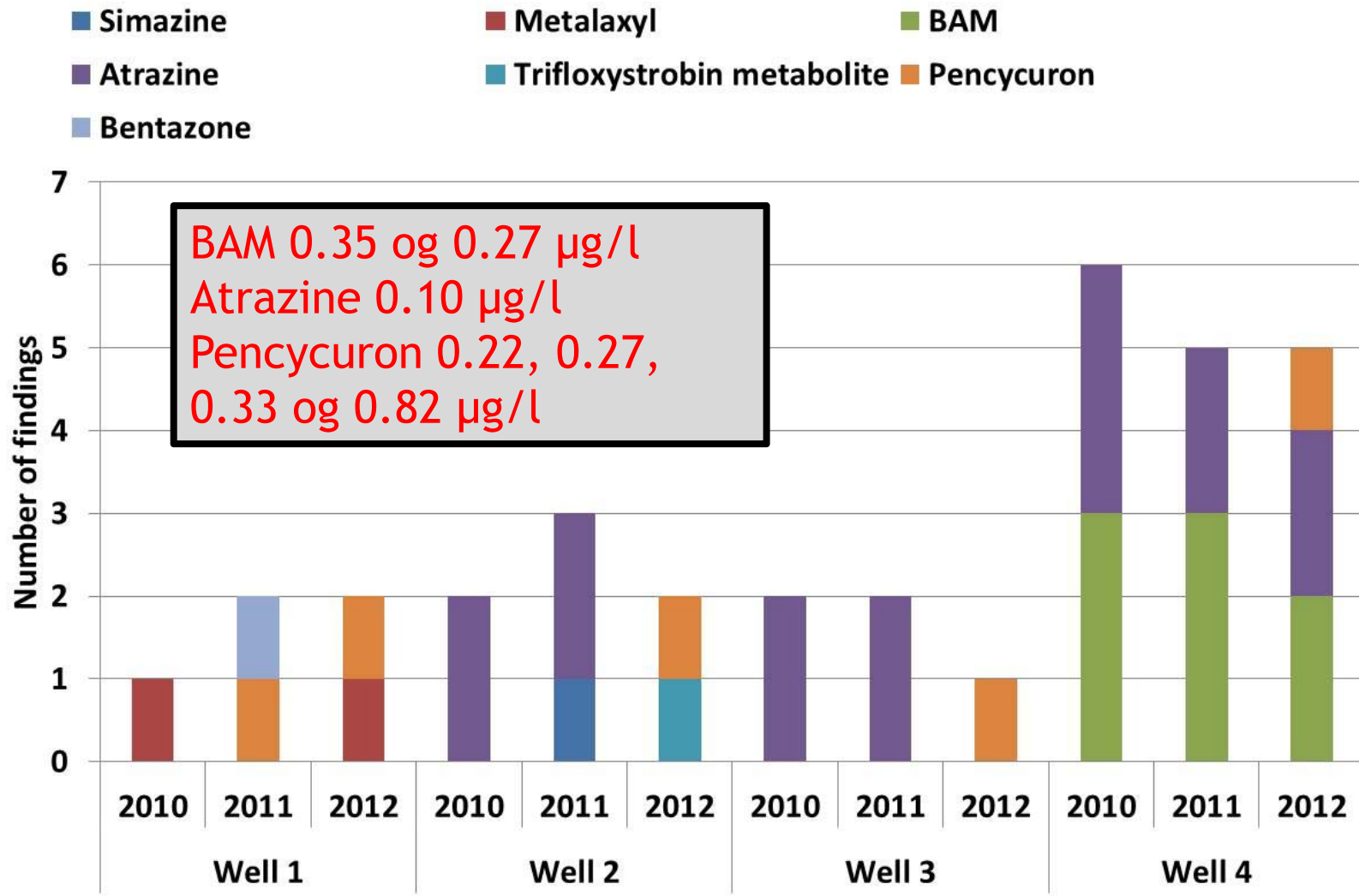
GRIMSTAD

Vegetables, glacialfluvial deposits, sandy soil



OVERHALLA

Potato, fluvial deposit



SUMMING UP – PESTICIDES IN GROUNDWATER

2010 - 2012

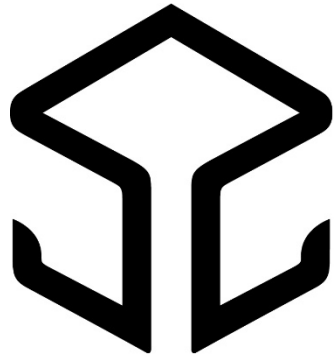
- Analyzed 199 samples from 28 wells. Found pesticides in 89 samples (45 %) and in 24 wells.
- Residues exceeding drinking water limit ($> 0.1 \mu\text{g}/\text{l}$) in 24 samples (12 %).
- Found 19 different pesticides and metabolites (Total 2007-12 = 31 pesticides)
- Most common residues: bentazone, atrazine, simazine, metalaxyl, MCPA and BAM
- Most common residues exceeding $0.1 \mu\text{g}/\text{l}$: bentazone, pencycuron, dicamba and MCPA.
- Pesticides used for coating of seed potato - risk for leaching!
- Variability in occurrence of pesticides in wells - sampling strategy



A new Norwegian monitoring program for groundwater ? Preliminary description

1. National Groundwater Monitoring – agricultural areas, Norwegian Environment Agency (Miljødirektoratet)
2. Report preliminary description - Pesticide monitoring program groundwater («Action plan pesticides»)
 - Established two field sites 2016
 - Sites agricultural areas with groundwater resources, different climate, soil and production (4-6)
 - Well 110 mm stainless steel, well screens and filter pack adapted local conditions. Sampling of springs
 - Auto **Thanks for your attention !** el, temp, EC, Eh, oxygen and pH
 - Include unsaturated zone → AM soil moisture, soil temp and Eh. Sampling pore water.
 - Strategic water sampling groundwater and porewater: Representative/worst case
 - Multimethods pesticides
 - Chemical analysis groundwater and porewater
 - Passive samplers: Sorbisense, TIMFIE, POCIS, Chemcatcher?





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