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NORWEGIAN INSTITUTE OF
BIOECONOMY RESEARCH

Leaching of glyphosate from cereals with different soil management practices

Ole Martin Eklo

Persons contributed

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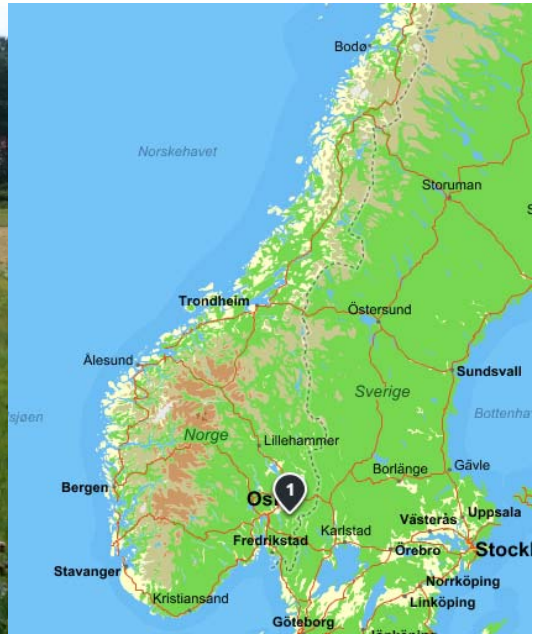
Funded by

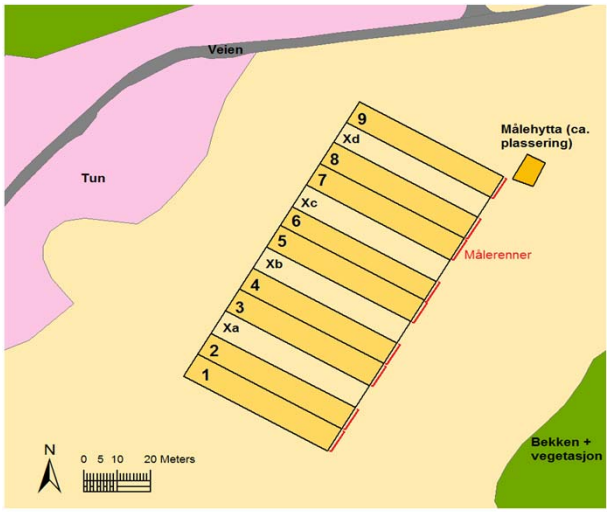
- Landbruksdirektoratet, Halden vannområde and NIBIO

Kjelle, Bjørkelangen



Field specification

- Established autumn 2013
- Regular water sampling from autumn 2014
- 2-4% slope
- Number of plots = 9. Plot size 8x50m
- Number of treatments = 3
- Drained with system for collection of drainage and surface water



Soil management and crops

Soil management (n=3)

- Autumn plowing with spring cereals
- Spring plowing with spring cereals
- Autumn plowing with winter cereals

Crop

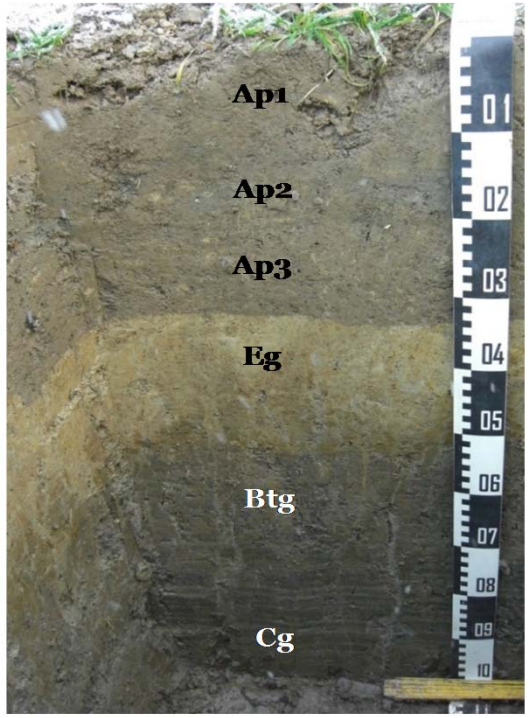
- Oat, barley and wheat

Yield and quality registered

Plots after autumn plowing 2013 (Photo:Geir Tveiti)

Soil profile (p2)

Horizon	Depth	Texture class	Sand	Silt	Clay
Ap1	0-14	Silty clay loam	13,9	62,6	23,6
Ap2	14-19	Silty clay loam	13,4	63,7	22,9
Ap3	19-34	Silty clay loam	14,4	63,0	22,6
Eg	34-52	Silty clay loam	4,4	73,4	22,2
Btg	52-74	Silty clay	2,7	44,7	52,6
Cg	74-100	Silty clay	6,7	48,9	44,4



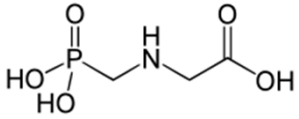
Soil profile Kjelle, Bjørkelangen (Photo: ?)

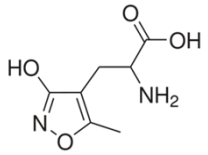
Soil properties (P2)

Sjikt	Depth (cm)	pH	Bulk density (g/cm^3)	C (%)	Water holding capacity θ_s (%)
Ap1	0-14	6,5	1,34	2,3	52
Ap2	14-19	6,1	-	2,2	-
Ap3	19-34	6,2	1,45	2,0	46
Eg	34-52	6,7	1,73	0,2	37
Btg	52-74	7,1	1,61	0,2	42
Cg	74-100	7,4	-	0,2	-

Water sampling

- Separate sampling for discharge of drainage and surface water
- Flow proportional water sampling
- Analyzing nitrogen, phosphorus, suspended solids, glyphosate, AMPA and protioconazol-destio
- Sampling once a month





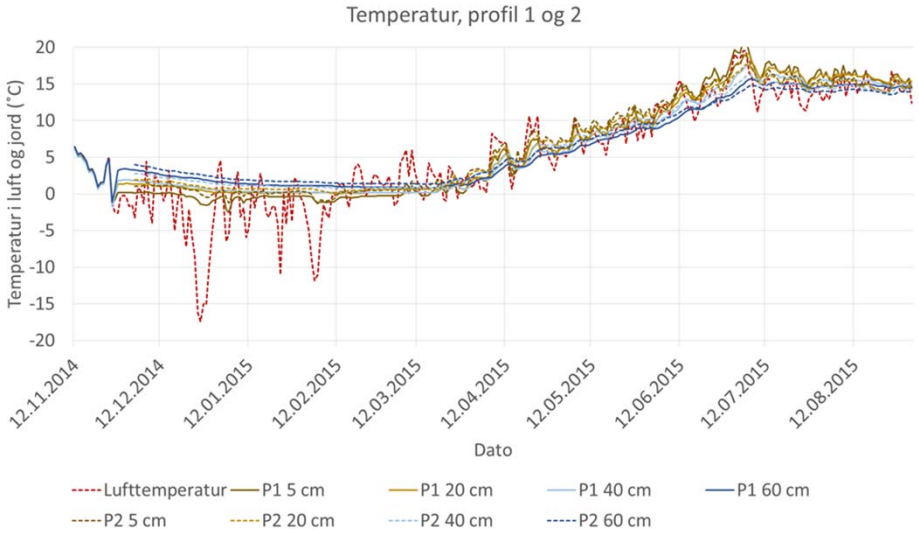
Glyphosate and AMPA (amino-hydroksy-metyl-isoksazolpropionsyre)

Flow proportional water sampling (Photo: Ole Martin Eklo)

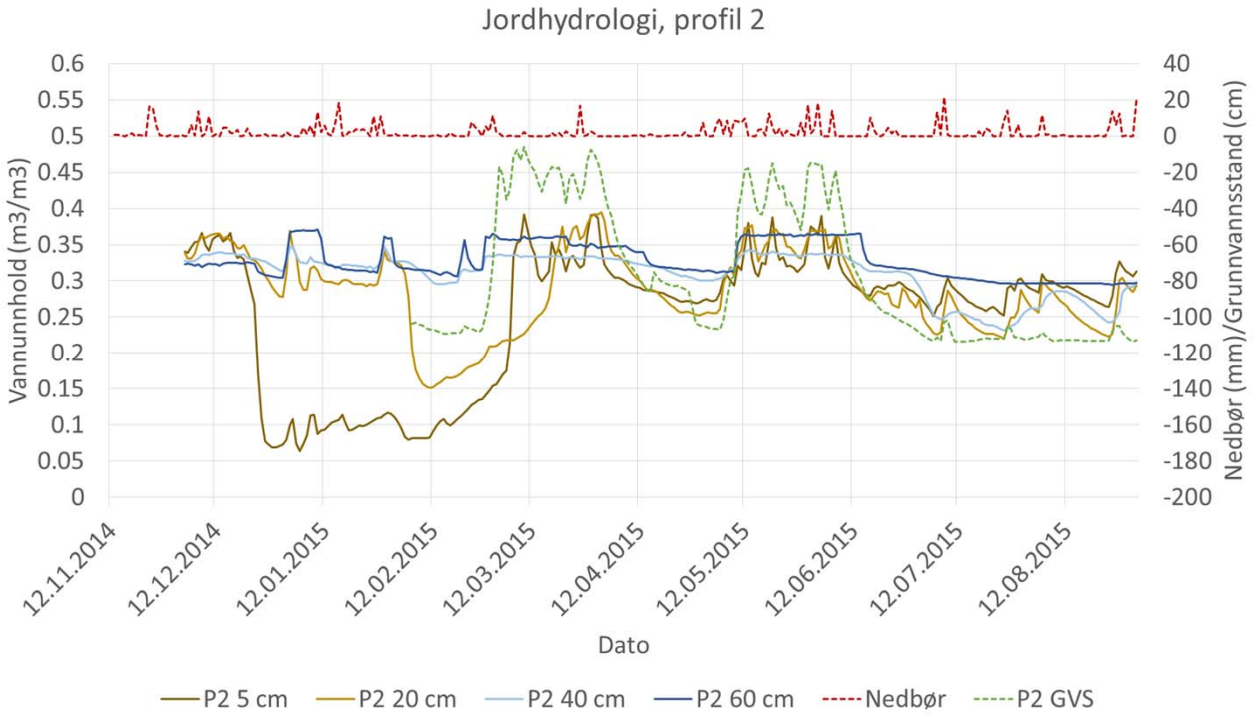
Climate station

- Precipitation
- Temperature
- Radiation
- Wind speed
- Humidity
- Soil temperature (3 depths)
- Web-camera

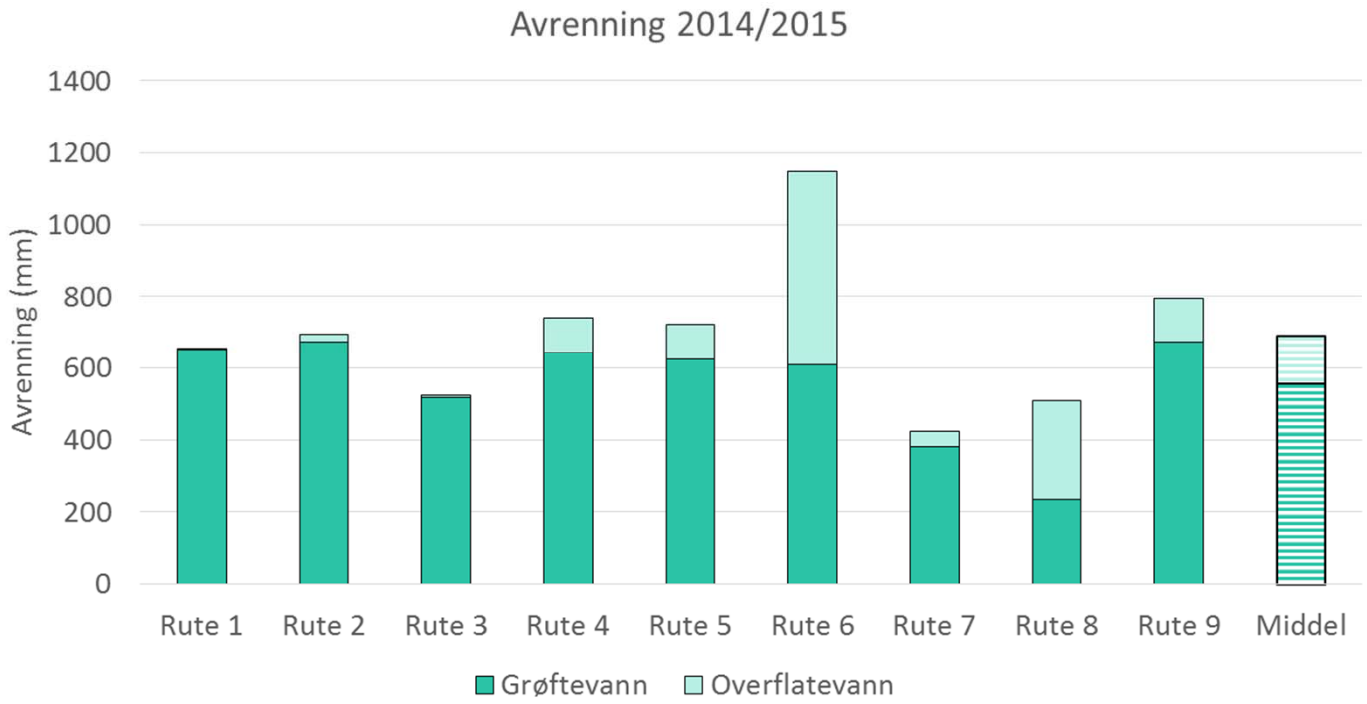
Temperature in air and two soil profiles at Kjelle 2014/2015. (Bechmann et al. 2015)

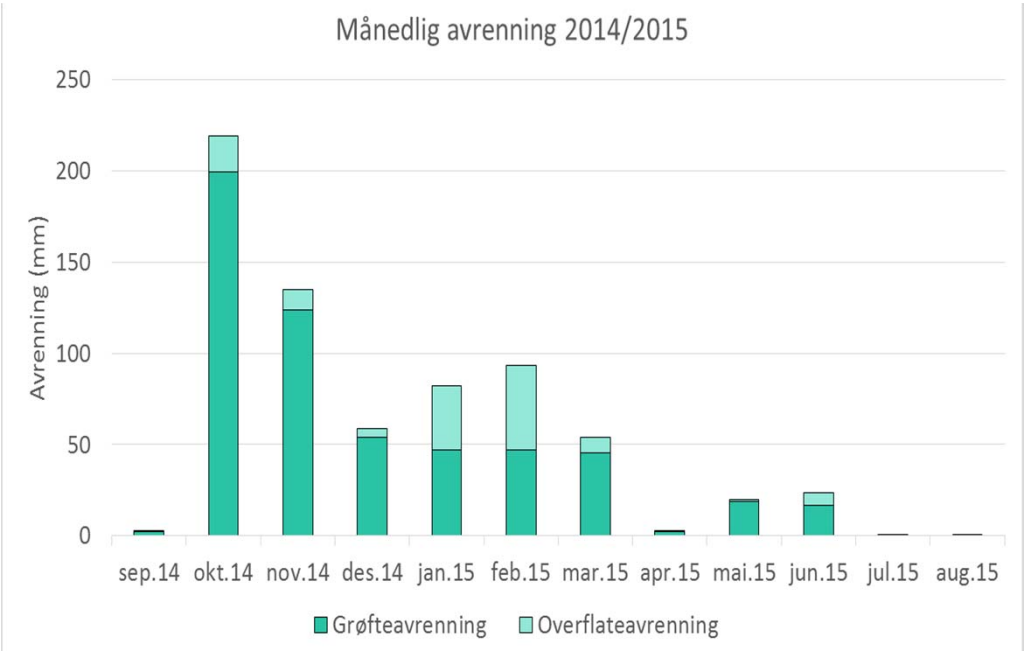


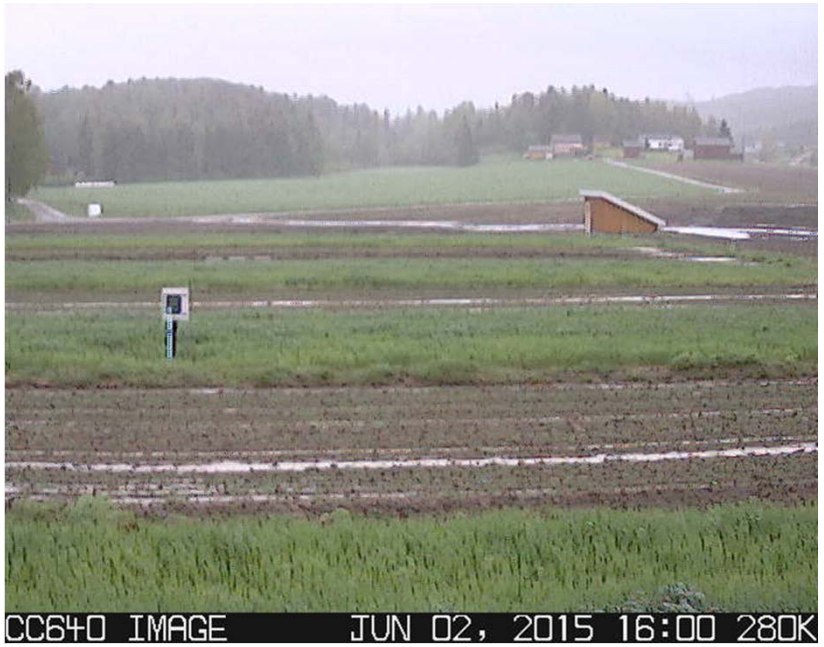
Precipitation, water content, and groundwater level at pofile 2 at Kjelle 2014/2015 (Bechmann et al. 2015)



Runoff of water from different plots at Kjelle 2014/2015 (Bechmann et al. 2015)





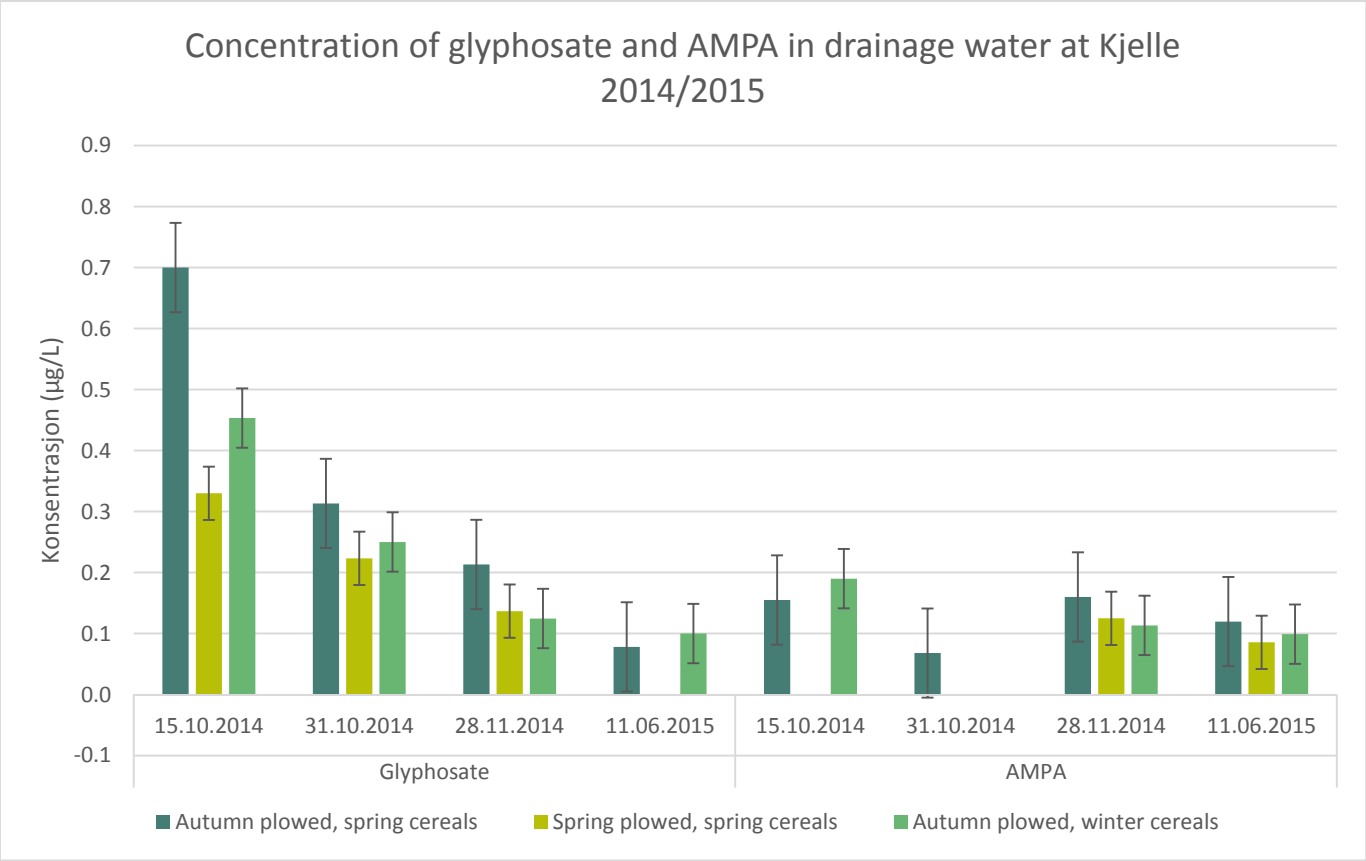


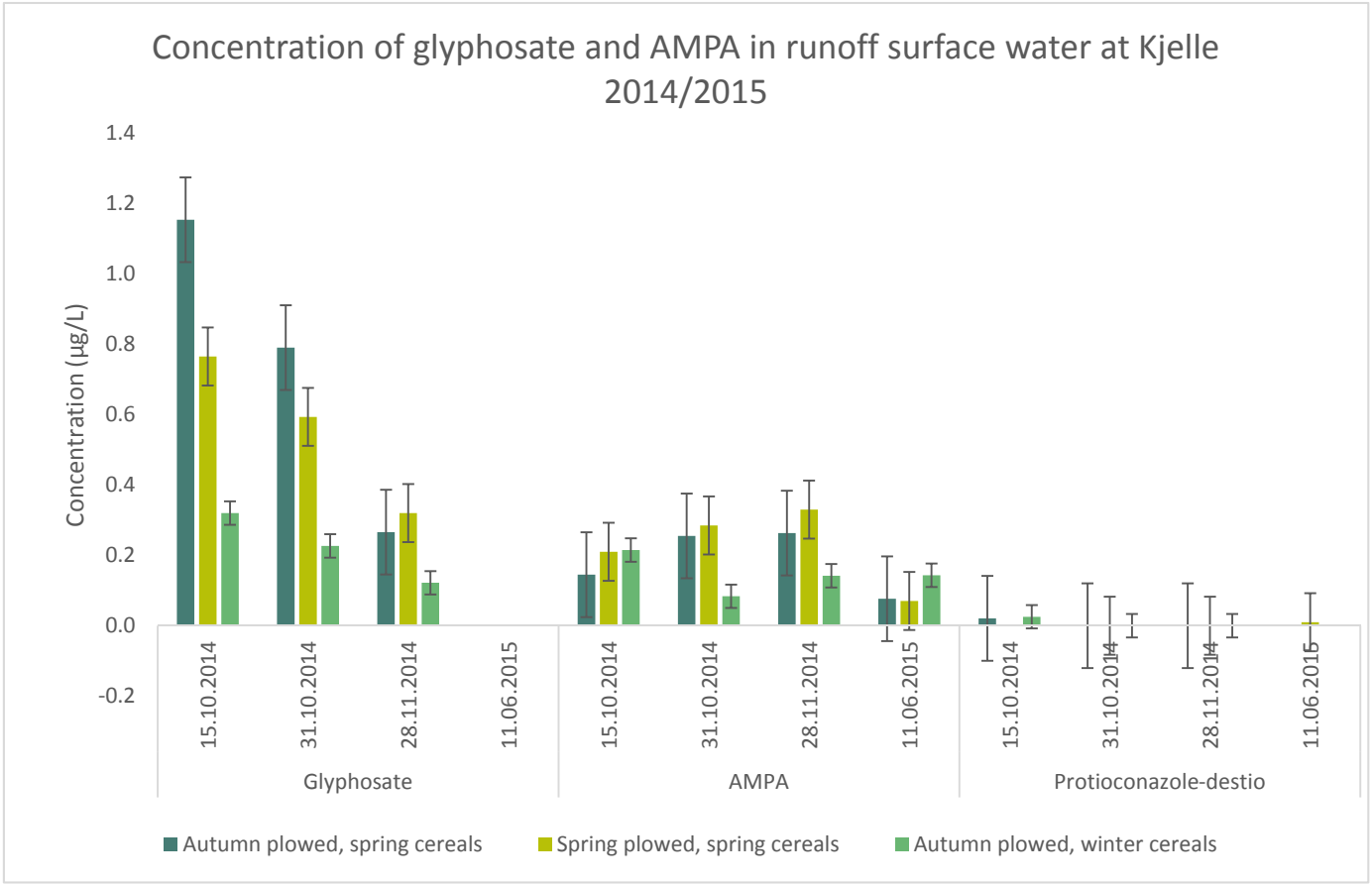
Rainfall event 2nd June 2015 with 18 mm of rain (webcamera).

Monthly runoff from plots at Kjelle (2014/2016) (Bechmann et al. 2015)

Concentration of glyphosate in surface water from plots with different soil management

Sampling periode	Autumn plowed			Spring plowed			Autumn plowed with winter wheat		
	Plot 1	Plot 5	Plot 9	Plot 2	Plot 4	Plot 7	Plot 3	Plot 6	Plot 8
	µg glyphosate/L surface water								
28.8-15.10	0.36	1.4	<0.05	0.43	1.1	0.19	0.24	0.53	1.7
15.10-31.10	<0.05	0.66	0.92	0.25	0.53	1	0.29	0.21	0.18
31.10-28.11	0.058	0.29	0.45	0.14	0.25	0.57	0.17	0.076	0.12
22.1-2.3	0.079	<0.05	0.14	0.12	0.29	1.1	0,065	0.054	0.14
2.3-11.6	<0.05	<0,05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05
11.6-9.9	<0.05	<0,05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05


Concentration of glyphosate and AMPA in drainage water at Kjelle 2014/2015
Konsentrasjon (µg/L)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
15.10.2014
31.10.2014
28.11.2014
11.06.2015
15.10.2014
31.10.2014
28.11.2014
11.06.2015
Glyphosate
AMPA
Autumn plowed, spring cereals
Spring plowed, spring cereals
Autumn plowed, winter cereals


Concentration of glyphosate and AMPA in runoff surface water at Kjelle 2014/2015
Concentration (µg/L)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
15.10.2014
31.10.2014
28.11.2014
11.06.2015
15.10.2014
31.10.2014
28.11.2014
11.06.2015
15.10.2014
31.10.2014
28.11.2014
11.06.2015
Glyphosate
AMPA
Protioconazole-destio
Autumn plowed, spring cereals
Spring plowed, spring cereals
Autumn plowed, winter cereals

Loss of glyphosate and AMPA at Kjelle 2014/2015

Drainage µg/da	Autumn plouging, spring cereals	Spring plowing Spring cereals	Autumn plowing Winter cereals
Glyphosate	141	105	58
AMPA	45	26	19

Surface runoff (µg/da)	Autumn plowing Spring cereals	Spring plowing Spring cereals	Autumn plowing Winter cereals
Glyphosate	28	11	10
AMPA	8	7	5