Farming to Protect our Water Resources

Results from UK farm trials: 2011–2018

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Catchment Science Research

Demonstration Test Catchments (**DTCs**)

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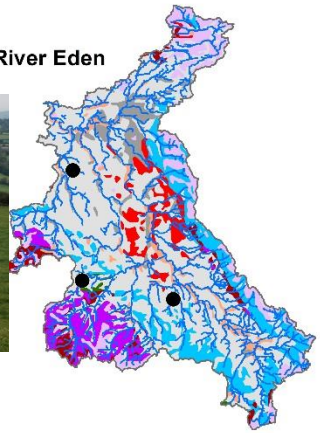

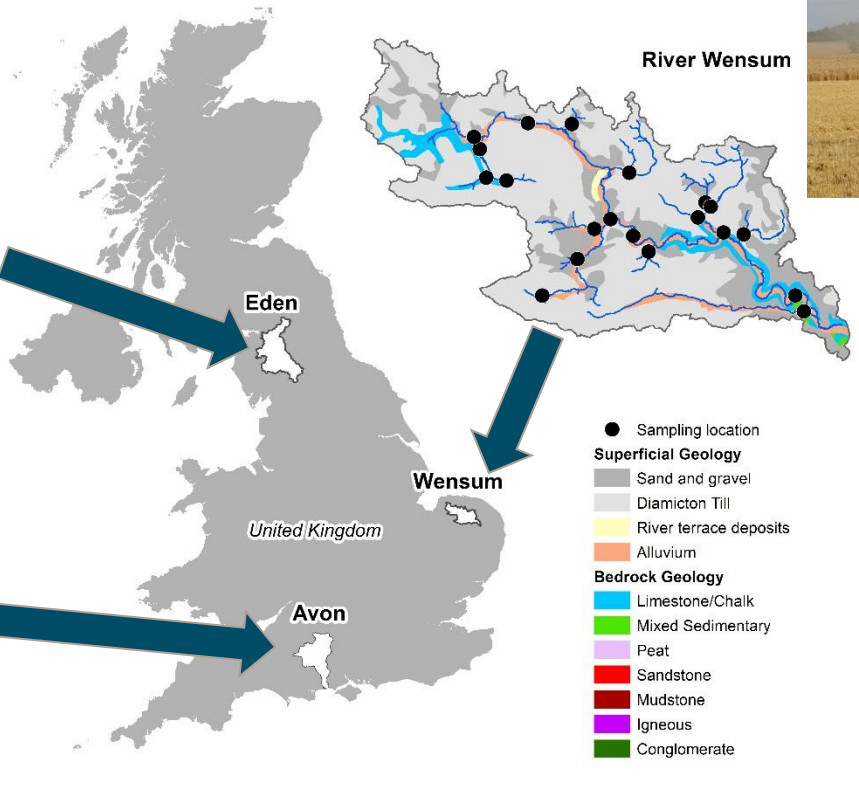

Investment
€8.5 m

Phase 1
2010 – 2014

Phase 2
2014 – 2017

Phase 3
2018 – 2020

The DTC project aims to evaluate the extent to which on-farm mitigation measures can cost-effectively reduce the impacts of water pollution on river ecology while maintaining food production capacity.

Catchment Science Research

River Wensum, Norfolk, UK

University of East Anglia

- 78 km length
- 660 km^2 catchment
- Lowland calcareous system
- EU designated status
- Supplies **53%** drinking water for Norwich (213,000 people)
- Drains into Norfolk Broads National Park

Catchment Science Research

River Wensum, Norfolk, UK

University of East Anglia

Catchment Science Research

Wensum DTC study catchment

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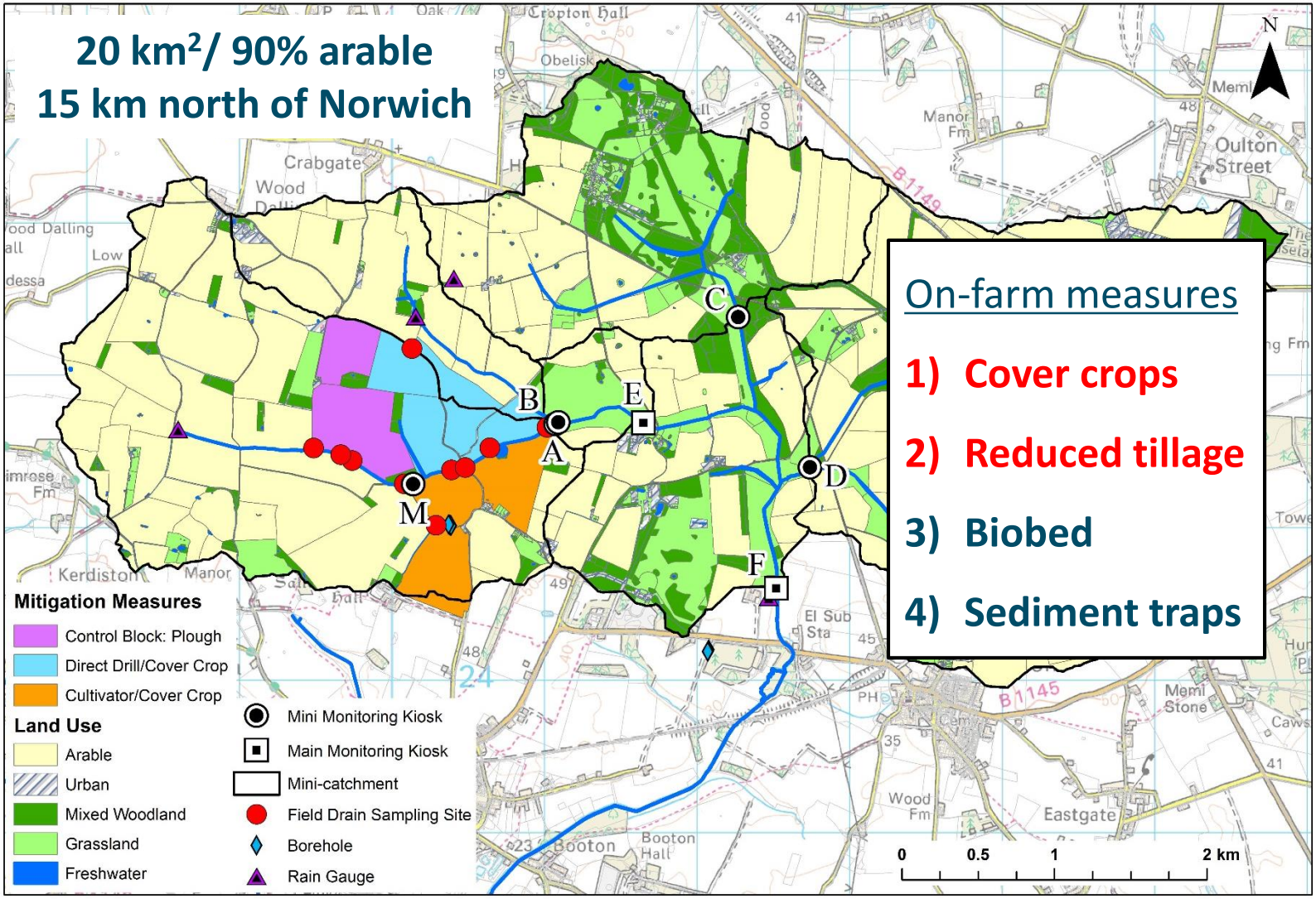


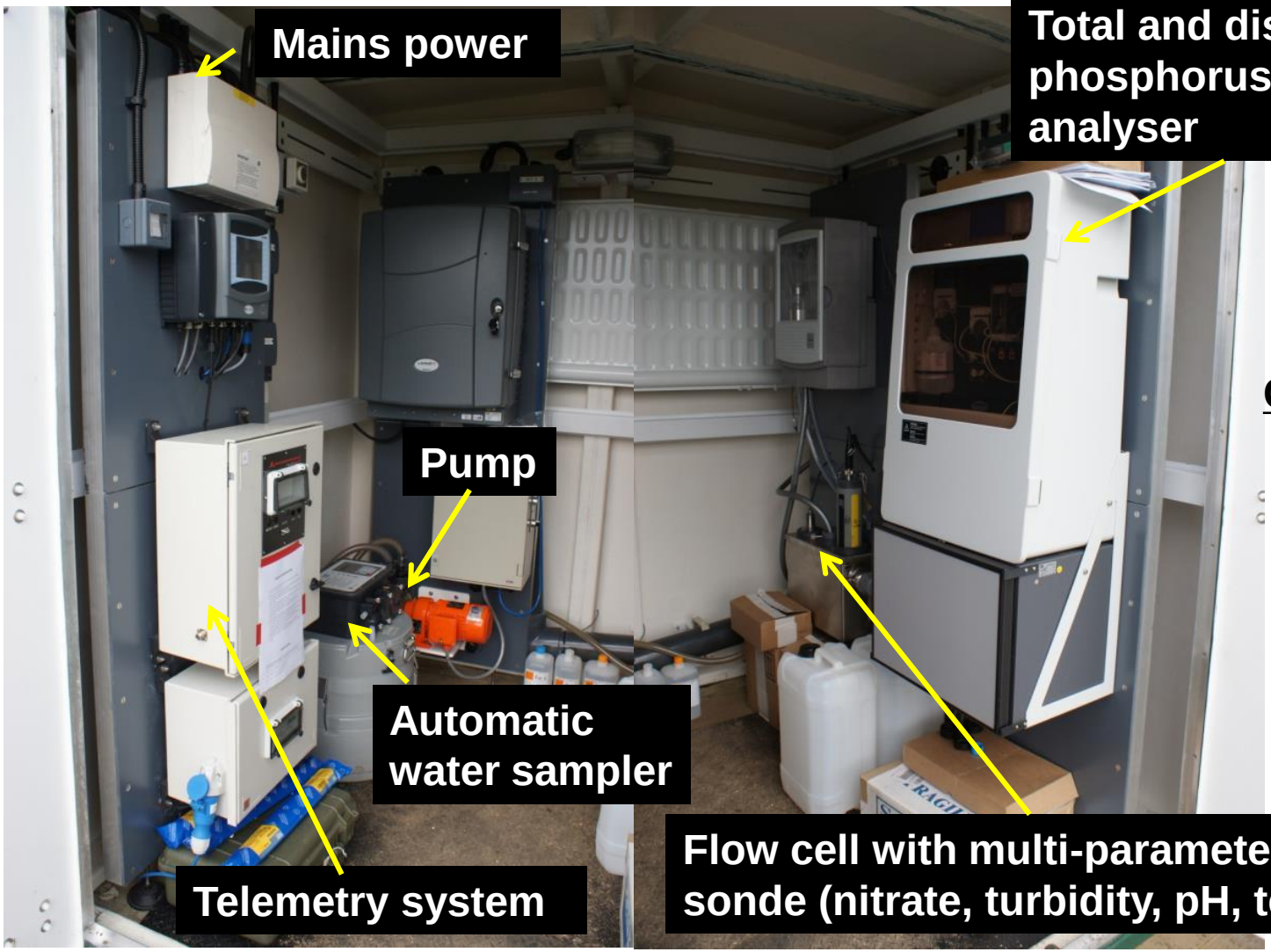
Catchment Monitoring

Riverine monitoring: bankside kiosks

University of East Anglia

Catchment Monitoring

Riverine monitoring: bankside kiosks



Cost per kiosk

€100k

Catchment Monitoring

Riverine monitoring: bankside kiosks

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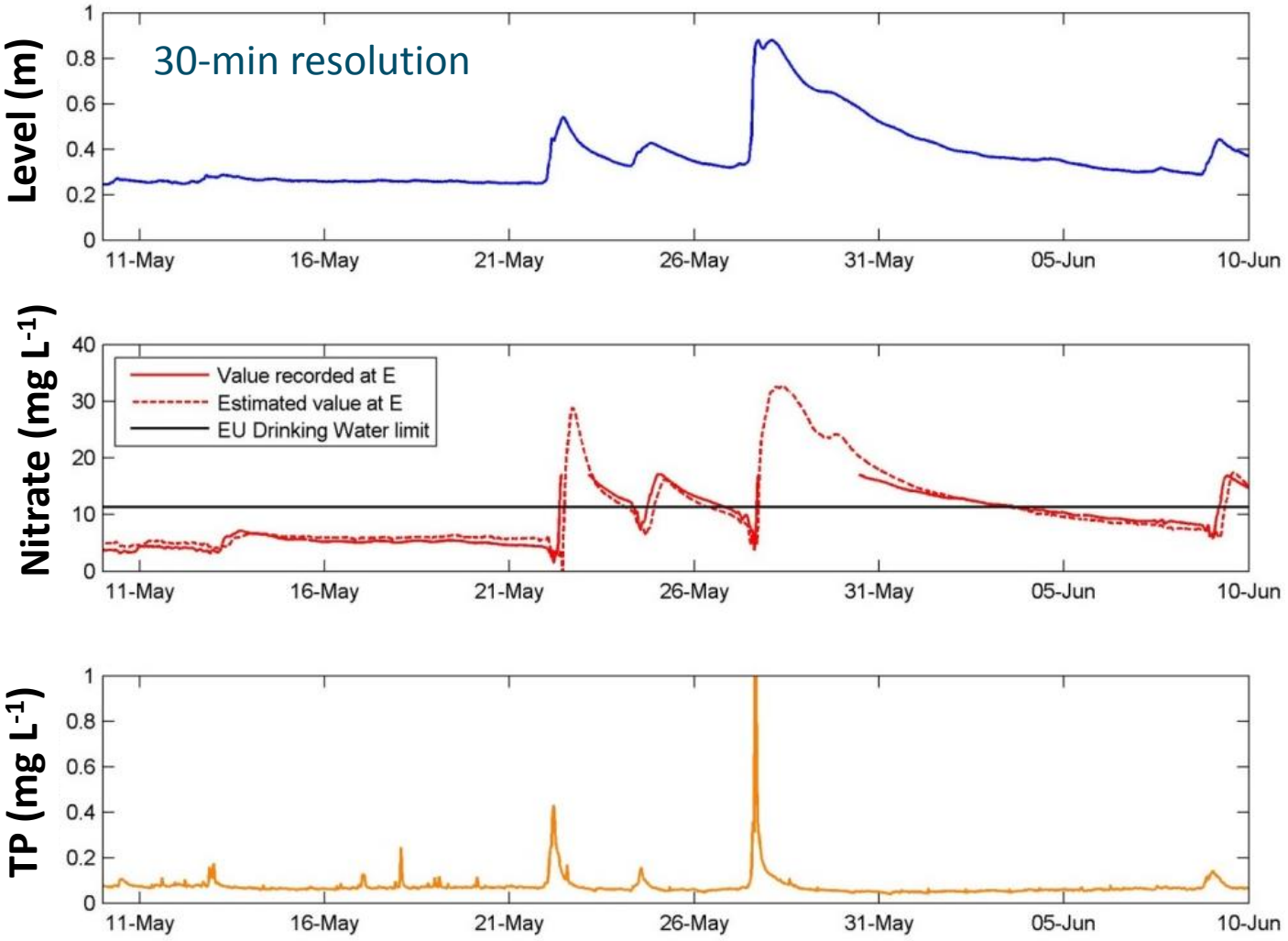
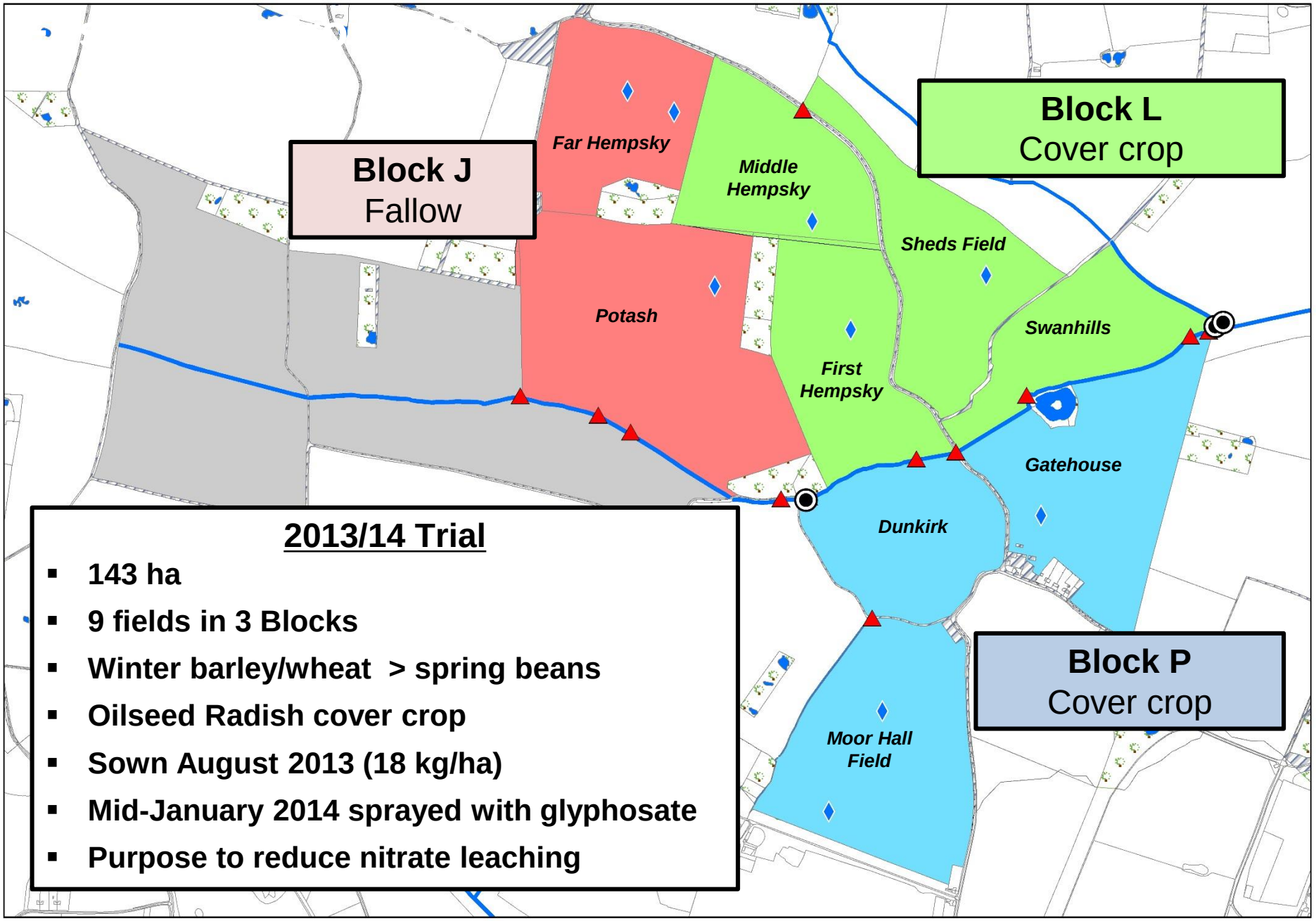


Winter Cover Crops

Trial 1: 2013/14



2013/14 Trial

- 143 ha
- 9 fields in 3 Blocks
- Winter barley/wheat > spring beans
- Oilseed Radish cover crop
- Sown August 2013 (18 kg/ha)
- Mid-January 2014 sprayed with glyphosate
- Purpose to reduce nitrate leaching

Winter cover crops

Trial 1: November 2013

University of East Anglia

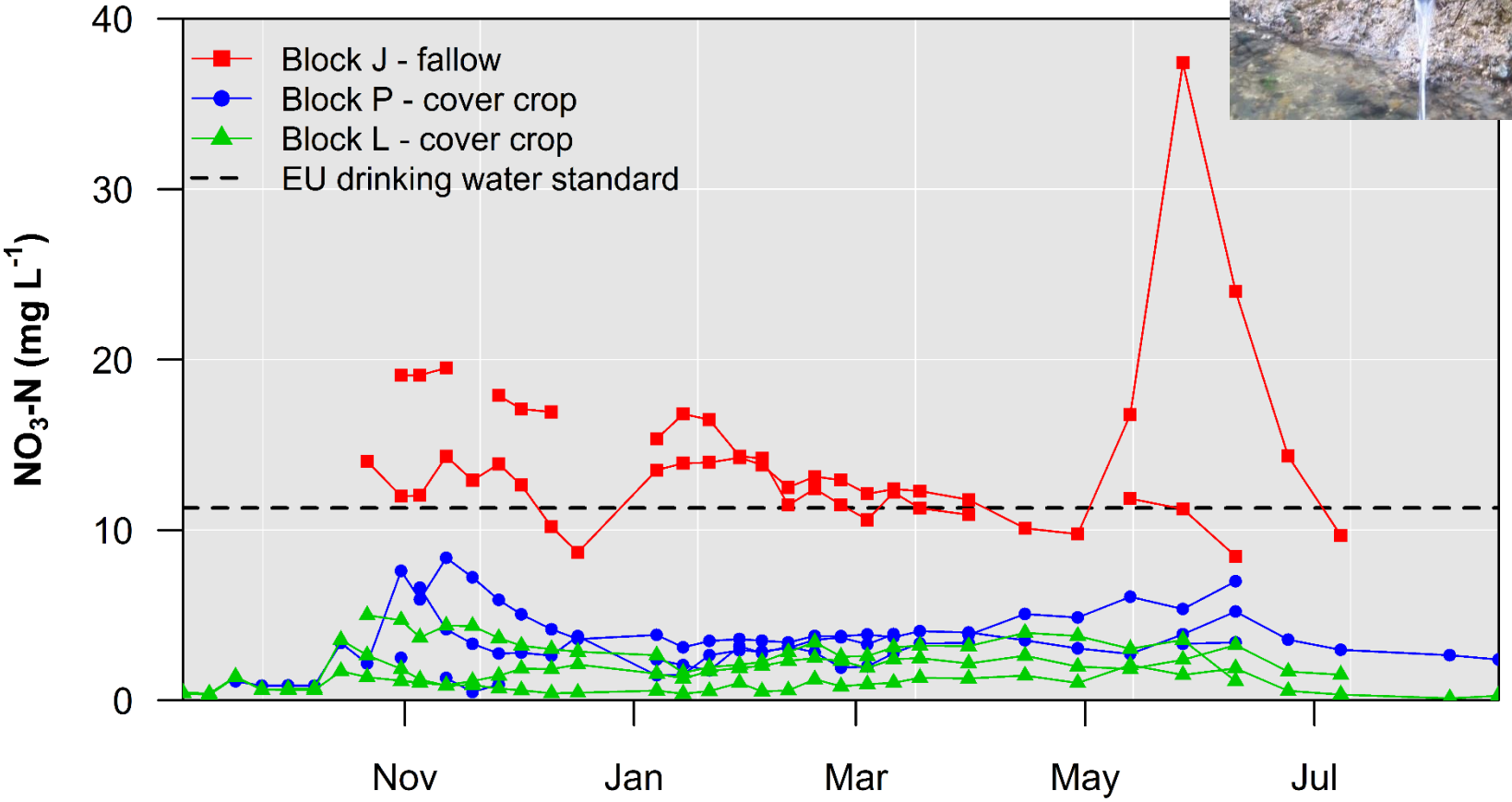
Winter cover crops

Field Drain Monitoring

University of East Anglia

P = **75%** reduction in N losses

L = **88%** reduction in N losses



Winter cover crops

Soil nitrogen monitoring

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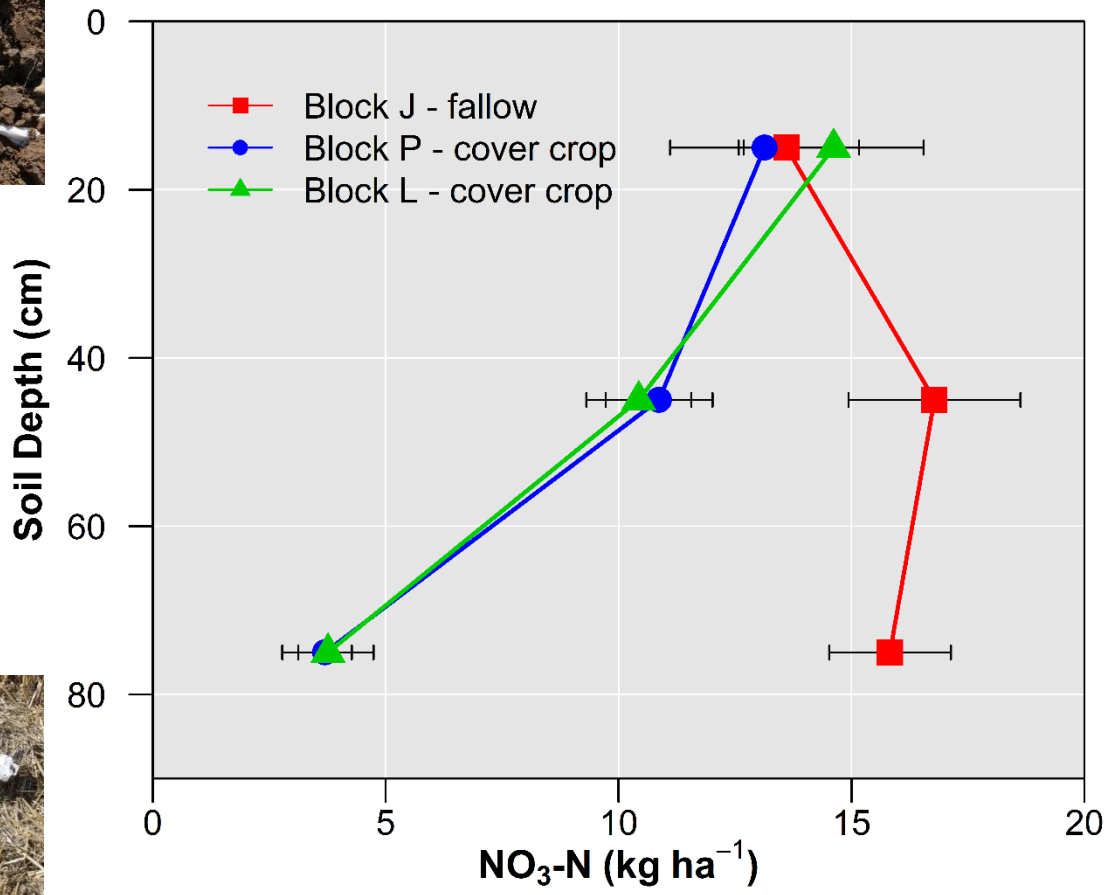
77% reduction in N at 60-90 cm



Winter cover crops

Financial returns: 2013/14

University of East Anglia

	Block J	Block P	Block L
	Fallow	Cover crop	Cover crop
Gross output beans: Yield (t/ha)	5.80	6.55	6.24
Output at €260/t (€/ha)	**1511**	**1706**	**1625**
Costs: Establishment (€/ha)	109	145	76
Applications (€/ha)	102	136	136
Variable costs (€/ha)	360	470	489
Harvesting (€/ha)	96	96	96
Total costs (€/ha)	**667**	**847**	**798**
Margin (€/ha)	**844**	**859**	**828**

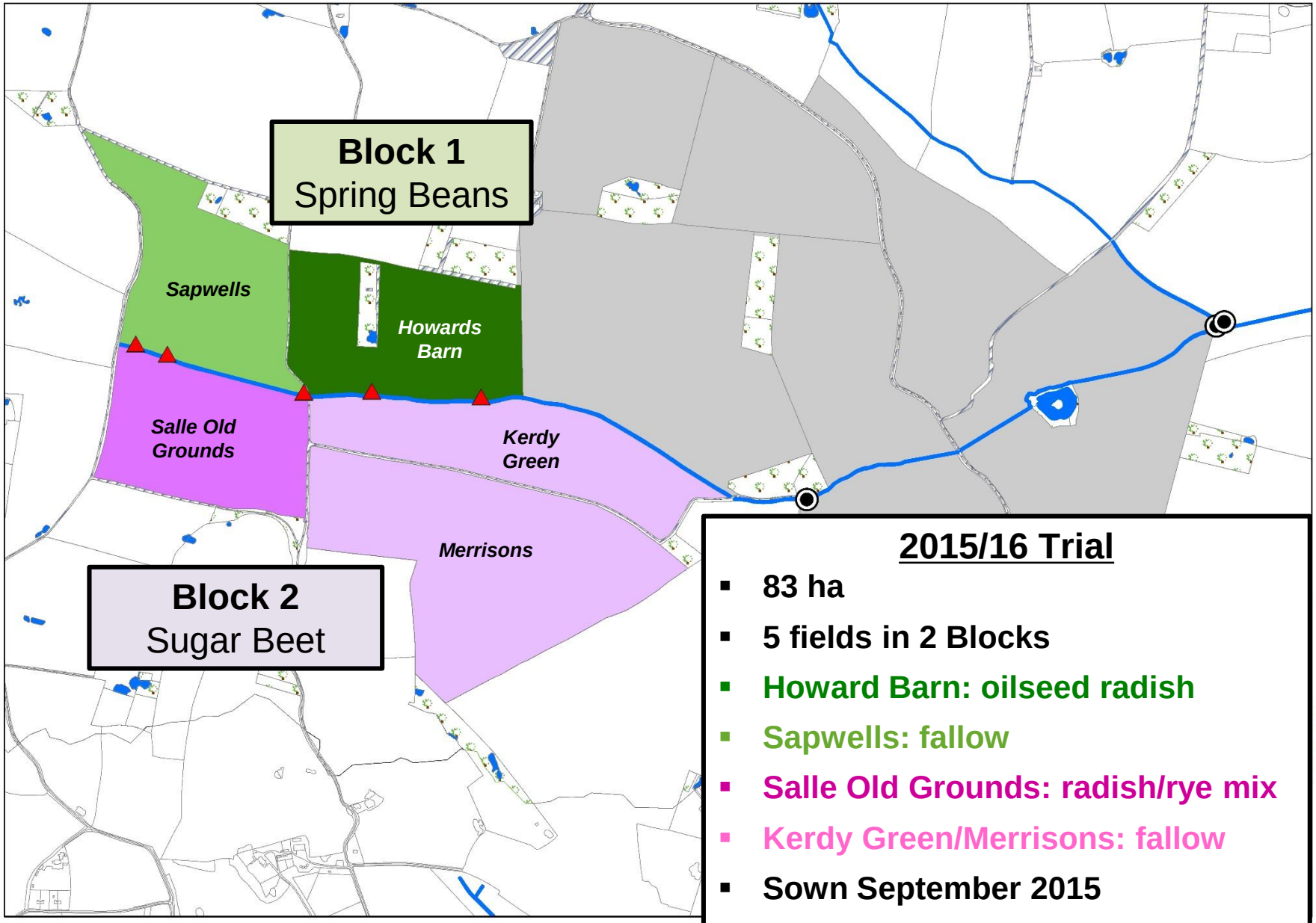
8-12% higher

€130–180/ha higher

Acknowledgement: Data supplied by Salle Farms Co.

Winter Cover Crops

Trial 2: 2015/16



2015/16 Trial

- 83 ha
- 5 fields in 2 Blocks
- Howard Barn: oilseed radish
- Sapwells: fallow
- Salle Old Grounds: radish/rye mix
- Kerdy Green/Merrisons: fallow
- Sown September 2015
- Sprayed off February 2016

Winter cover crops

Trial 2: December 2015

University of East Anglia

Salle Old Grounds

Oilseed radish/rye mix (85 seeds/m^2)

with turkey muck

without turkey muck

Howards Barn

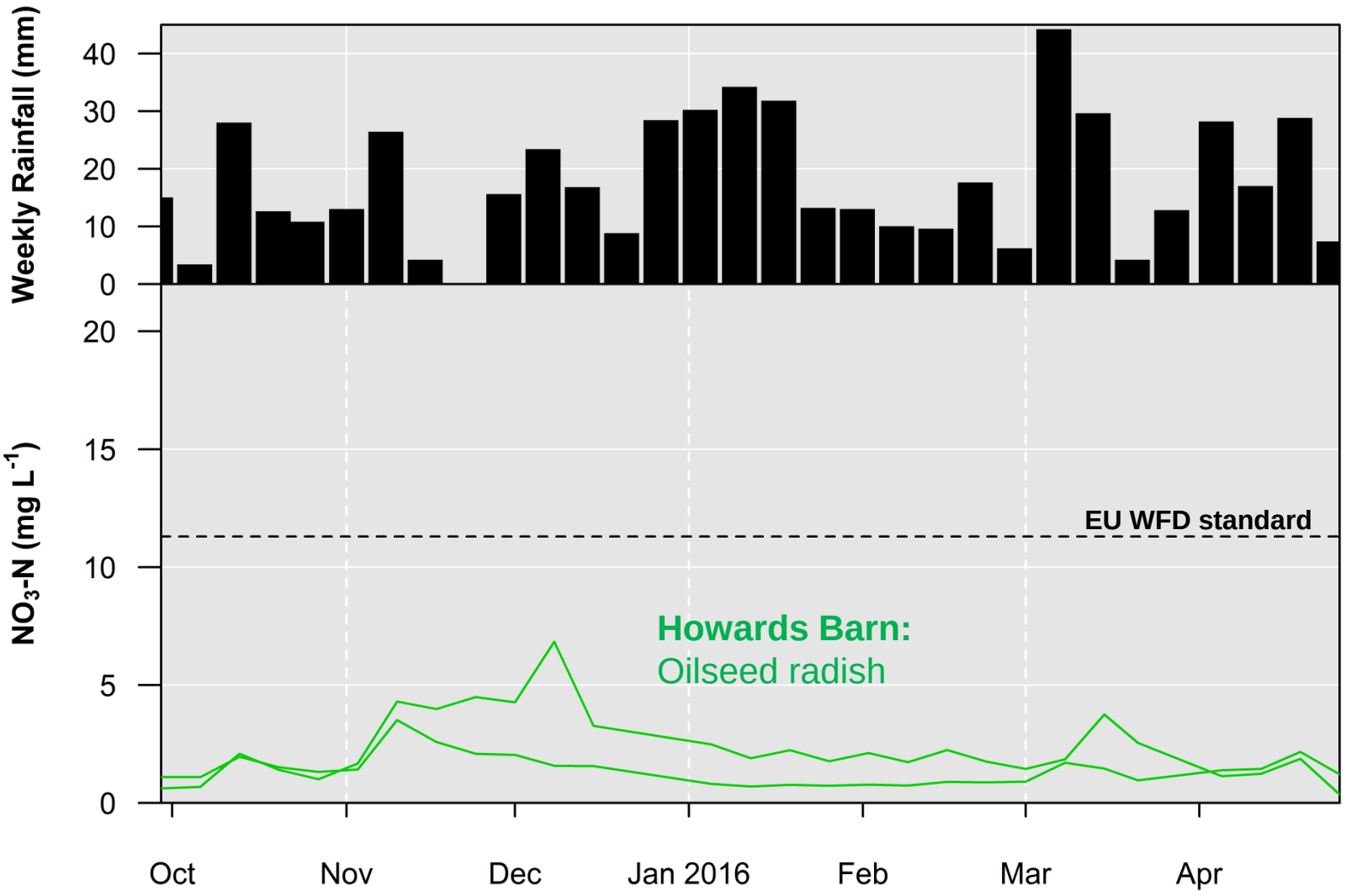
Oilseed radish (165 seeds/m^2)

without turkey muck

Winter cover crops

Trial 2: field drain monitoring

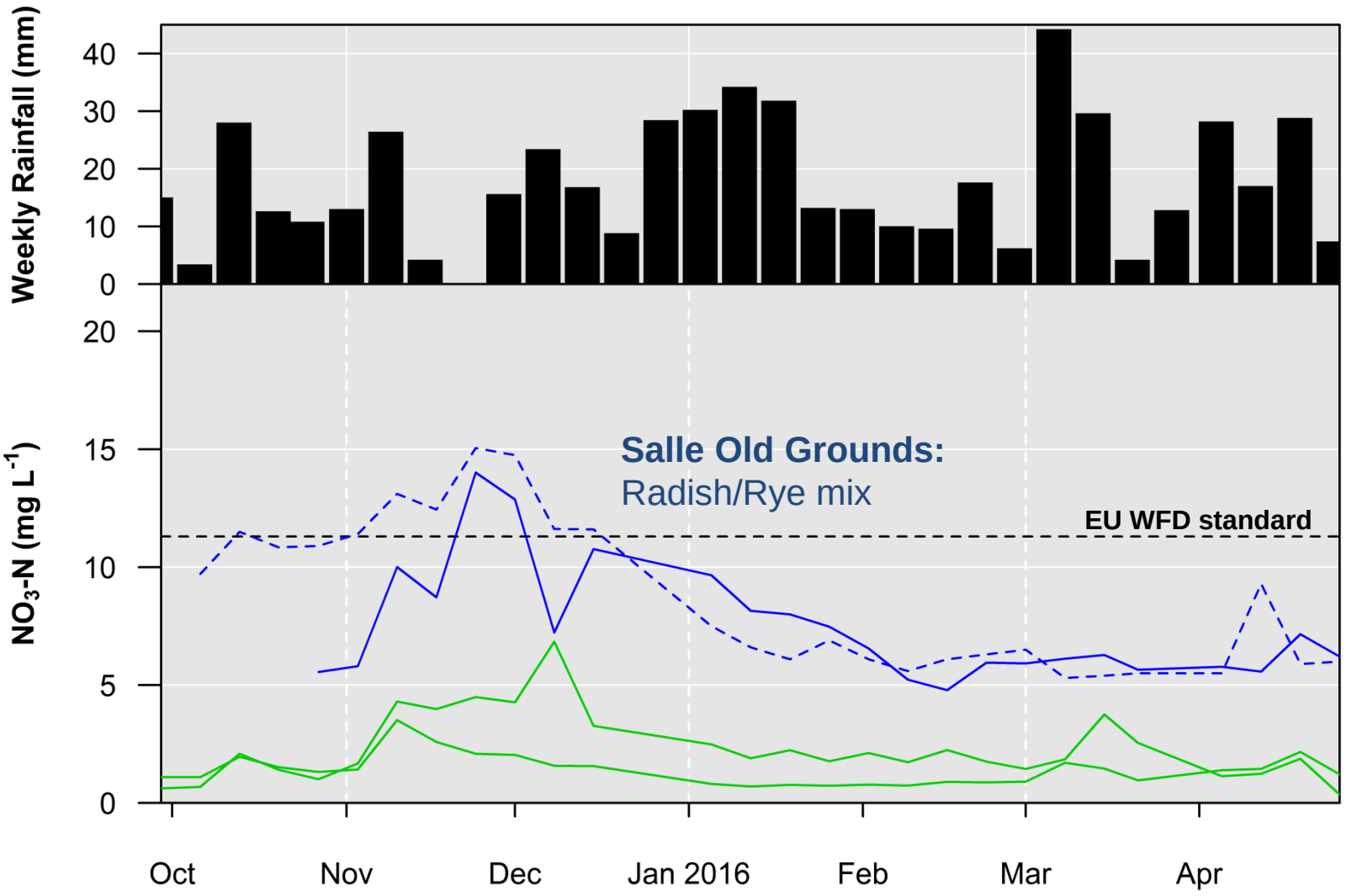
University of East Anglia



Winter cover crops

Trial 2: field drain monitoring

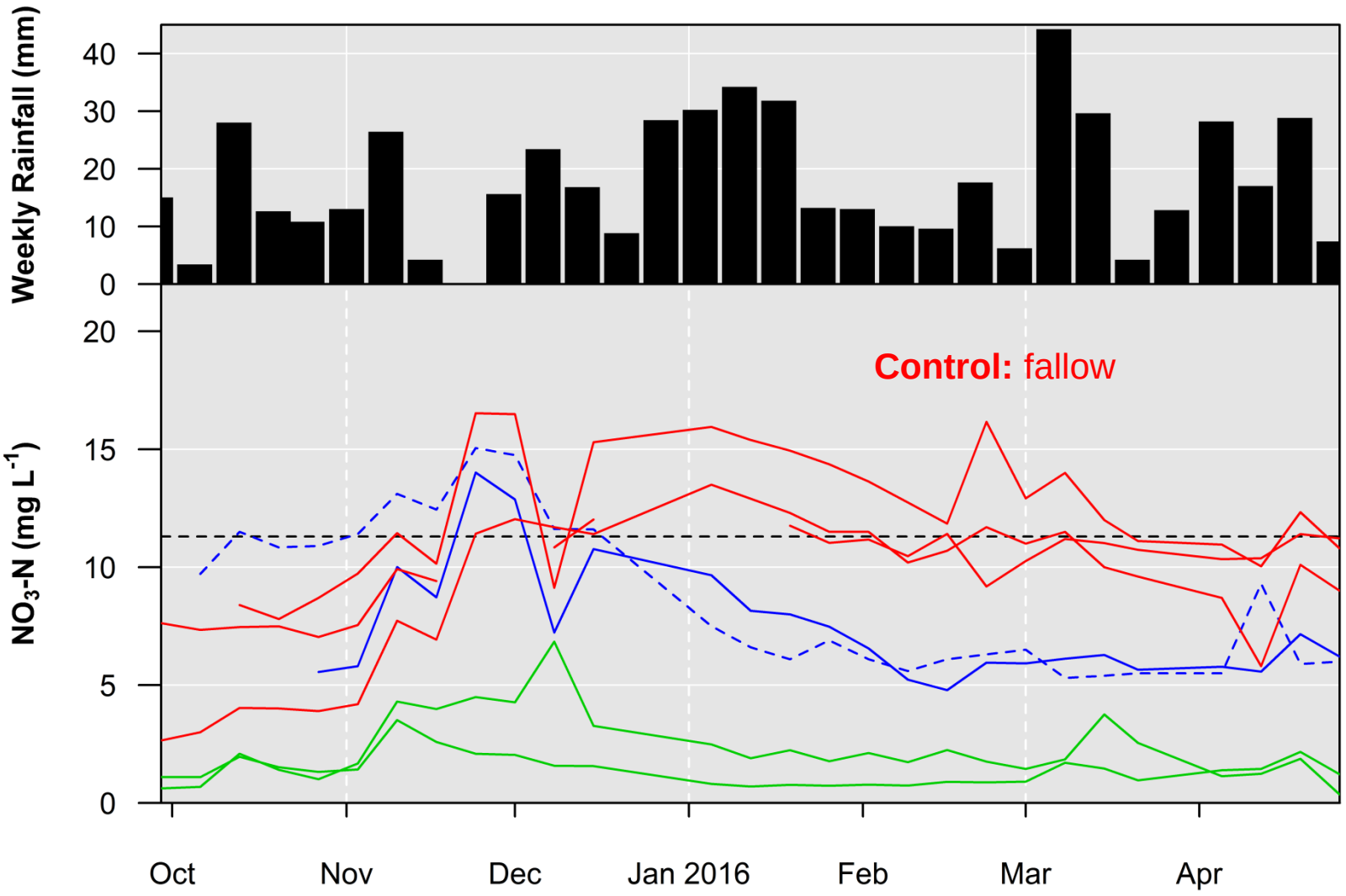
University of East Anglia



Winter cover crops

Trial 2: field drain monitoring

University of East Anglia



Winter cover crops

Trial 2: field drain monitoring

University of East Anglia

	Control Fallow	SOG Radish/rye	SOG Radish/rye + TM	Howards Barn Radish
Nitrate (mg N/L)	10.4	8.6	7.4	1.9
Change (%)	-	-17%	-29%	-82%

Winter cover crops

Trial 2: financial returns 2015/16

University of East Anglia

	Block 1	Block 1	Block 2	Block 2	
	Spring Beans		Sugar Beet		
	Fallow	Cover crop OS Radish	Fallow	Cover crop mixture	
Gross output: Yield (t/ha)	5.9	4.7	64.3	85.6	**33% higher**
Bean output @ €261/t (€/ha)	**1,536**	**1,236**			
Beet Output @ €28/t (€/ha)			**1,821**	**2,427**	
Costs: Establishment (€/ha)	121	162	179	167	
Applications (€/ha)	107	96	119	116	
Variable costs (€/ha)	332	383	637	671	
Harvesting (€/ha)	96	96	227	227	
Total costs (€/ha)	**658**	**737**	**1,162**	**1,180**	**€18 higher**
Margin (€/ha)	**879**	**499**	**295**	**762**	**€467 higher**

Acknowledgement: Data supplied by Salle Farms Co.

Winter cover crops

Trial 1 & 2: agronomic issues

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- **Difficulty destroying and incorporating cover crop**
  - Vigorous growth up to 50 cm in height;
  - Had to be topped; rotary cutter needed on cultivator to mulch residues.

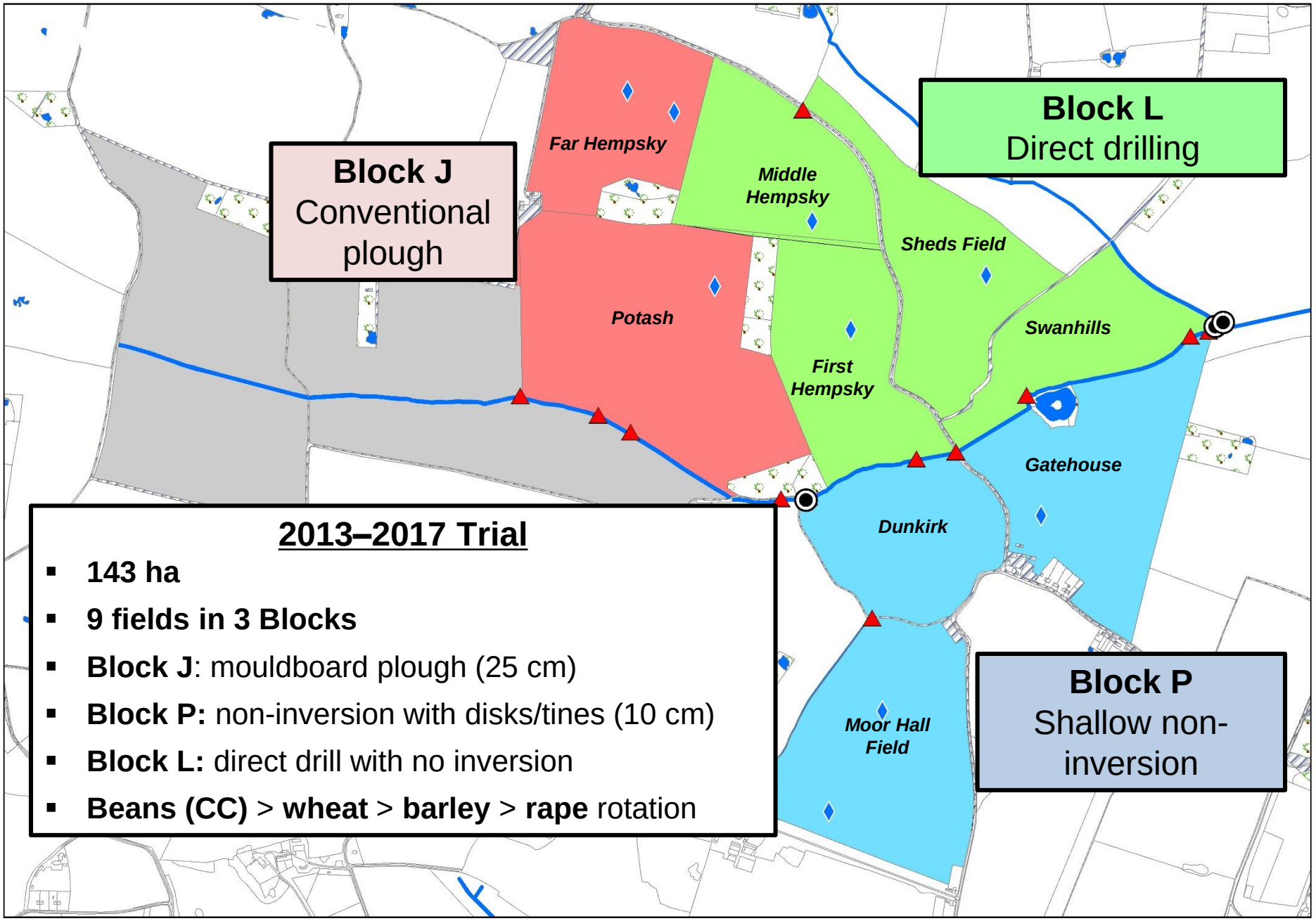
- **Increased slug populations**
  - Accumulations of fresh plant material provided optimum conditions;
  - Necessitated additional metaldehyde applications;
  - Raises issue of pollution swapping.

- **Delayed access onto fields**
  - Wetter soil conditions under decaying cover crop residues;
  - Delayed spring cultivation operations by a few days.

- **Enhanced pea and bean weevil damage**
  - Decaying cover crop residues harboured increased pest populations;
  - Damage inflicted on the following spring bean crop.

Reduced tillage

Trial 2013 – 2017


Block J
Conventional plough
Block L
Direct drilling
Block P
Shallow non-inversion
Far Hempsky
Middle Hempsky
Sheds Field
Potash
First Hempsky
Swanhills
Gatehouse
Dunkirk
Moor Hall Field
2013–2017 Trial
143 ha
9 fields in 3 Blocks
Block J: mouldboard plough (25 cm)
Block P: non-inversion with disks/tines (10 cm)
Block L: direct drill with no inversion
Beans (CC) > wheat > barley > rape rotation

Reduced Tillage

Agricultural equipment

University of East Anglia

Cultivation

Block J: mouldboard plough

Block P: TopDown + Carrier (non-inversion)

Sowing

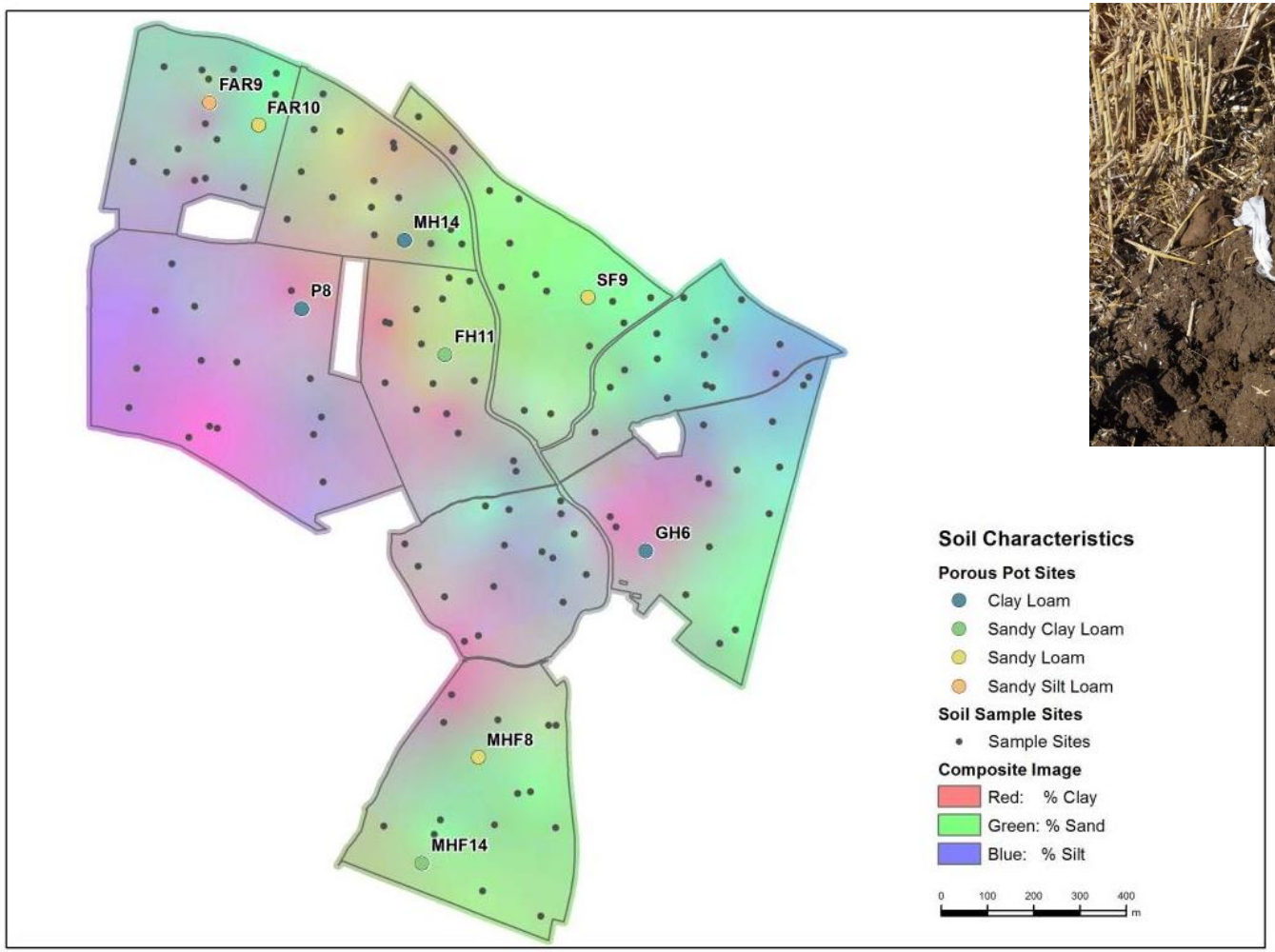
Blocks J + P: Rapid drill

Block L: Seed Hawk direct drill

Reduced Tillage

Agricultural equipment

University of East Anglia



- Soil texture
- Soil structure
- Infiltration rate
- Bulk density
- SMN
- P, K, Mg indices
- OC content
- Soil biology

Aim: to assess the physical, chemical and biological condition of the soils

Reduced Tillage

Soil Structure: bulk density

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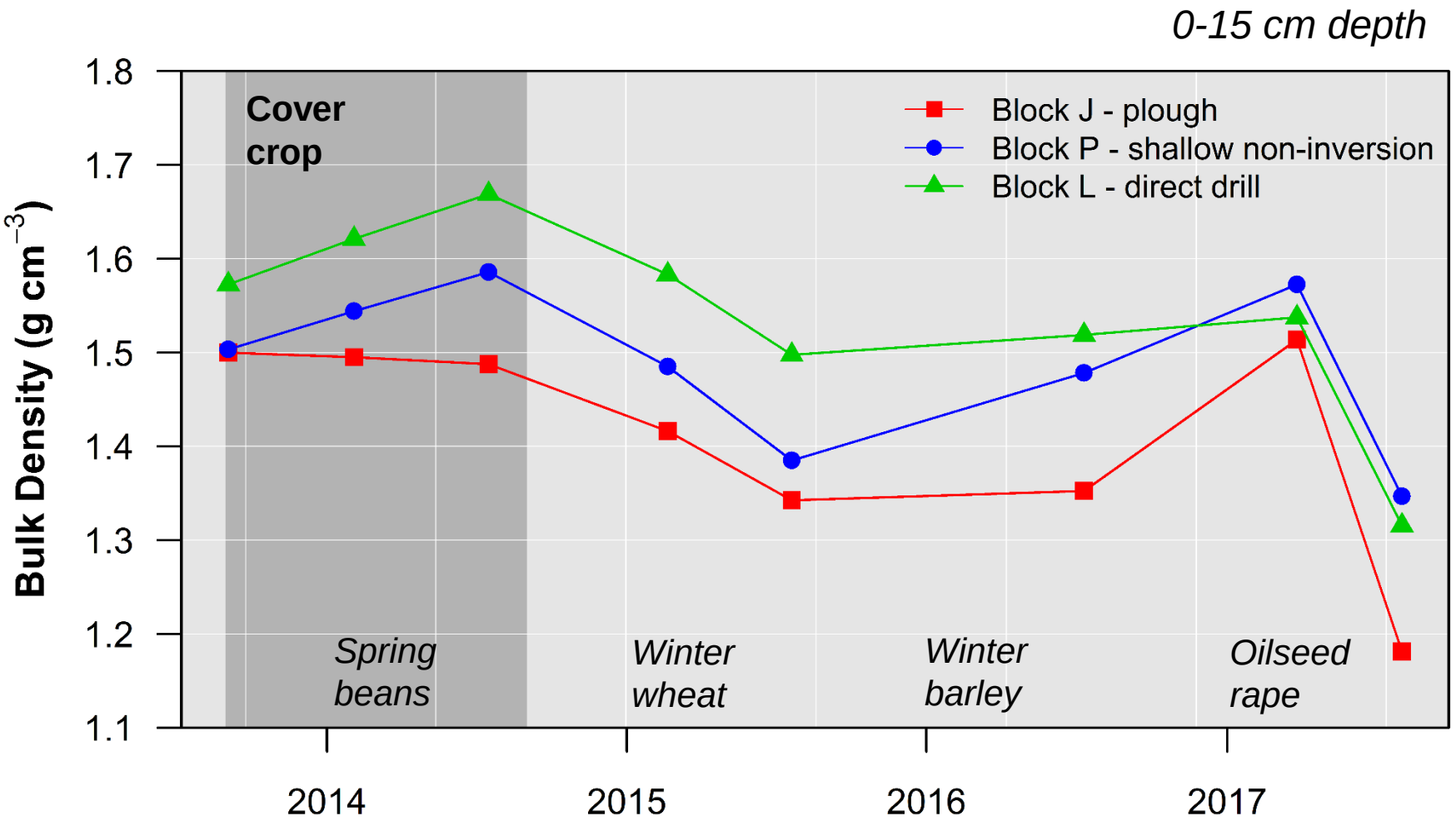

Reduced Tillage

Soil Chemistry: organic carbon

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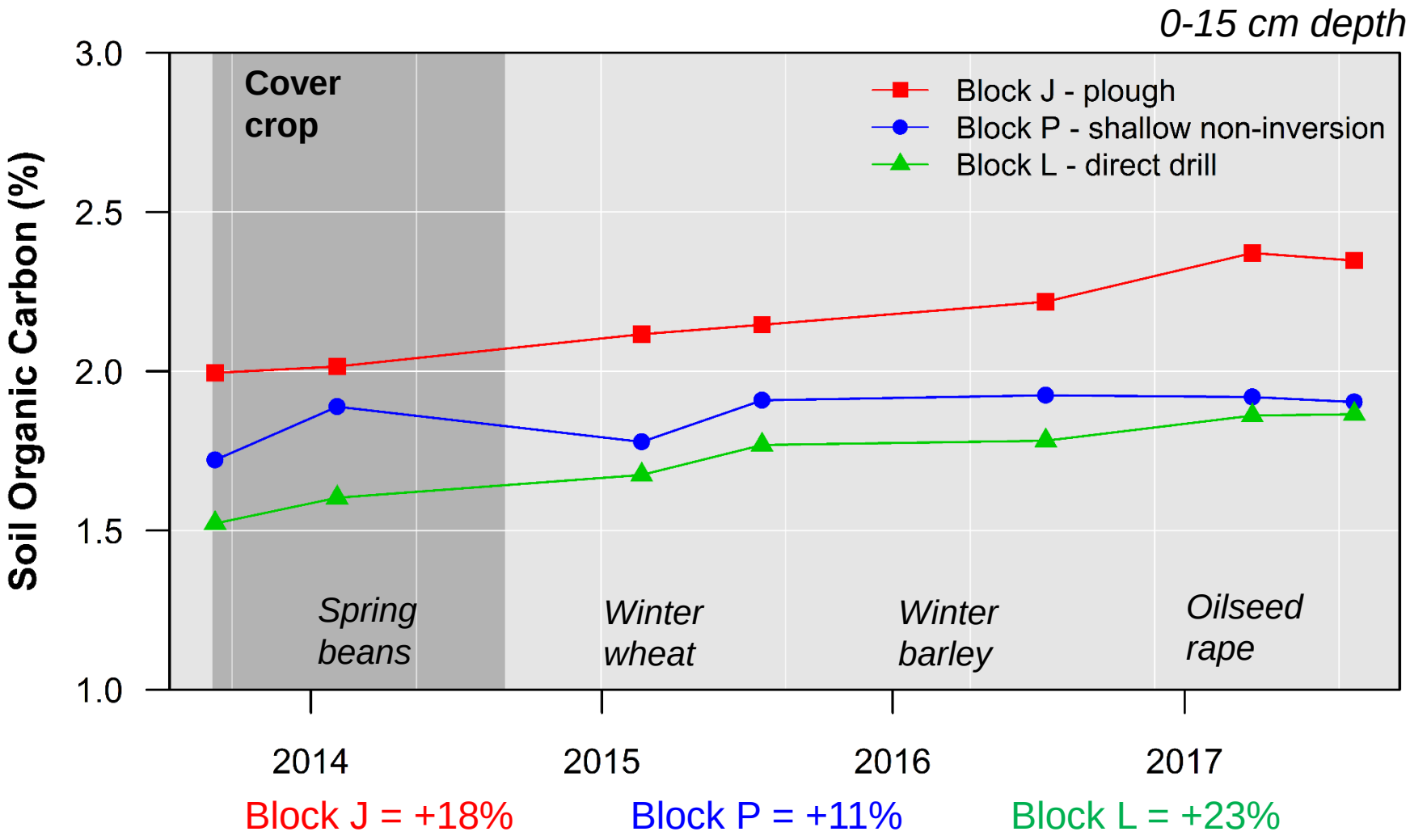

Block J = +18%

Block P = +11%

Block L = +23%

Reduced Tillage

Soil Nutrients: phosphorus

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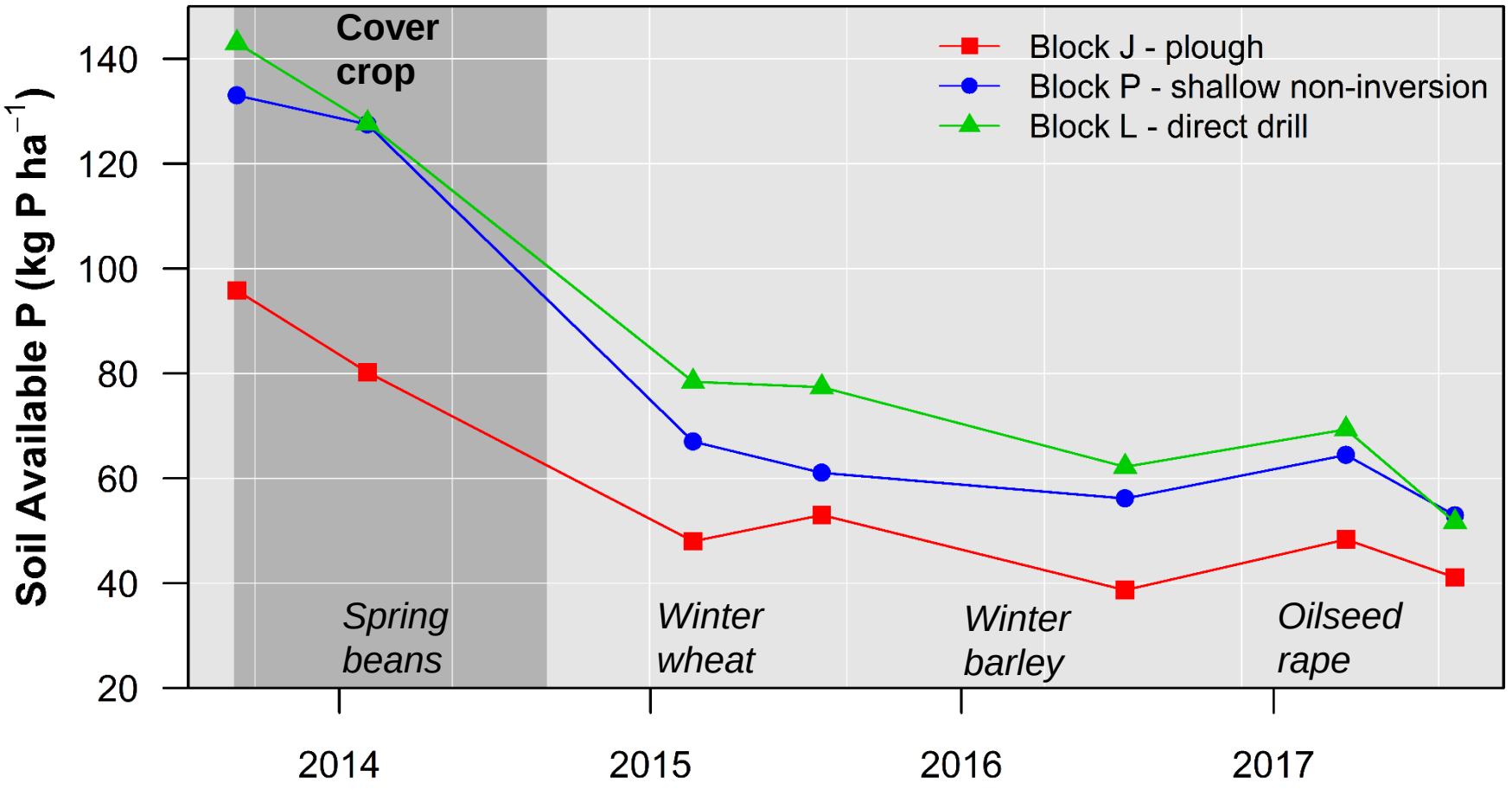
0-15 cm depth



Same trend observed for potassium (K) and magnesium (Mg)

Reduced Tillage

Soil Nutrients: nitrogen

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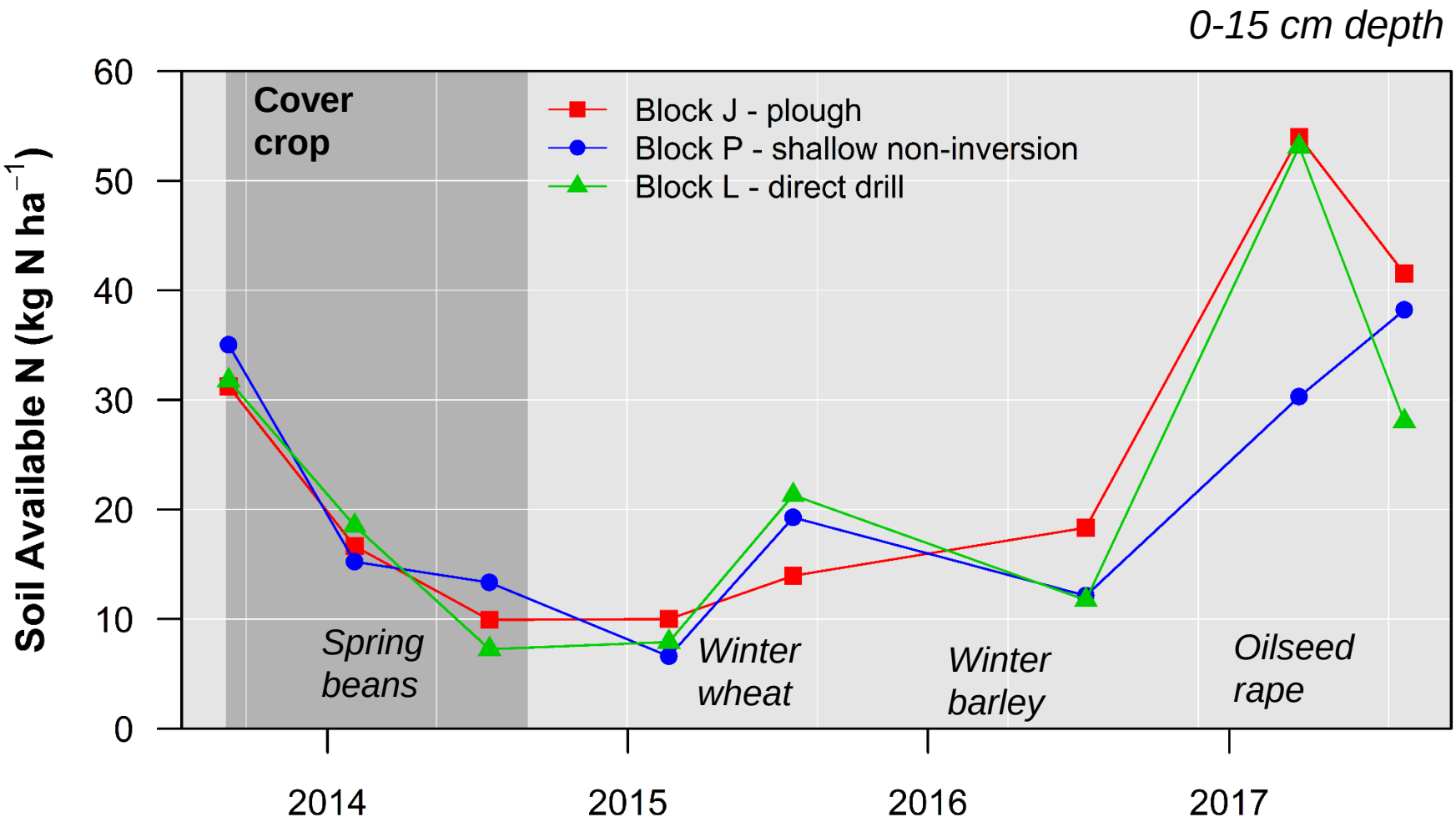

Reduced Tillage

Soil Leaching: nitrogen

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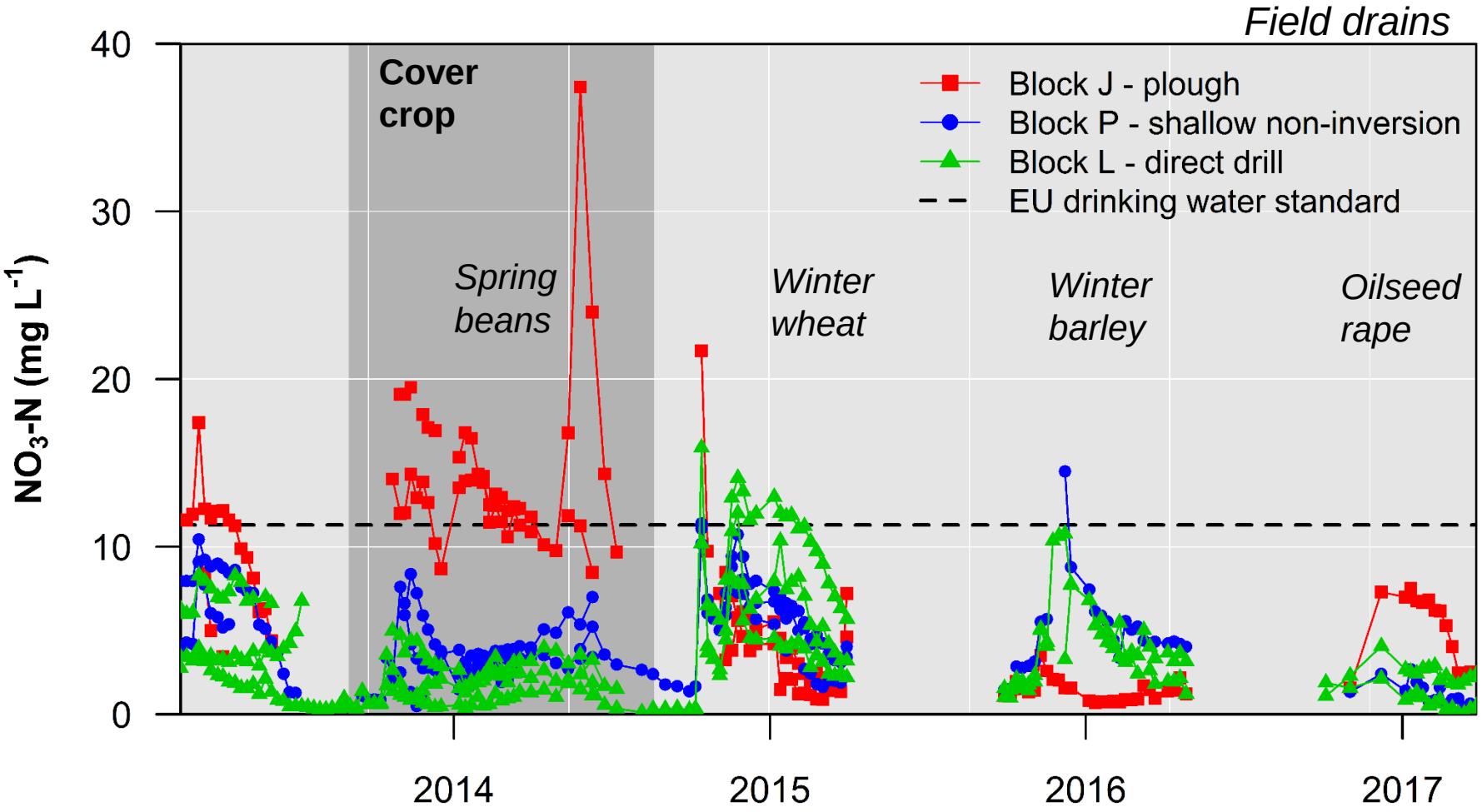

Block J = 3.4 mg/L

Block P = 4.8 mg/L

Block L = 4.5 mg/L

Reduced Tillage

Soil Biology: worm counts

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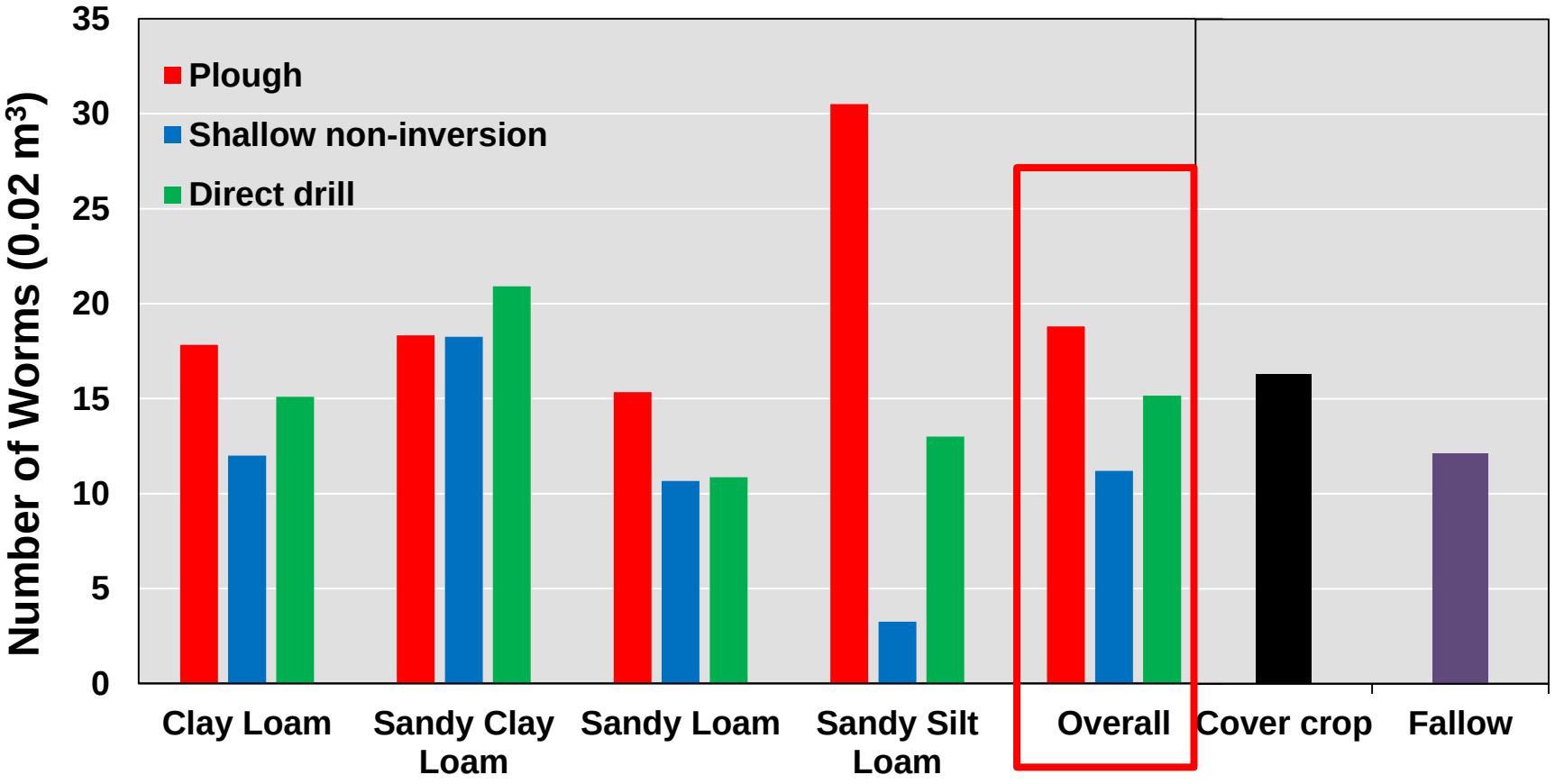

April 2016 | September 2016 | March 2017

Reduced Tillage

Financial Returns: 2013 – 2017

University of East Anglia

		2013/14	2014/15	2015/16	2016/17
		Spring beans + CC	Winter wheat	Winter barley	Oilseed rape
Block J	Total cost (€/ha)	668	889	636	680
Plough	Output (€/ha)	1512	1,921	1,231	1,966
	Margin (€/ha)	**845**	**1,032**	**595**	**1,286**
Block P	Total cost (€/ha)	848	887	659	627
Shallow non-inv.	Output (€/ha)	1,707	1,922	1,246	1,960
	Margin (€/ha)	**859**	**1035**	**587**	**1,333**
Block L	Total cost (€/ha)	798	894	678	624
Direct drill	Output (€/ha)	1,627	1,837	1,231	1,829
	Margin (€/ha)	**829**	**943**	**553**	**1,205**

Block P: yield **0 – 4% higher** | costs **-8% – +4%** | Margins **0 – 4%** above Block J

Block L: **Lowest** fuel/labour costs | **highest** pesticide/fertiliser inputs | **Lower** yields
Margins **4 – 10%** below Block P

Further info: wensumalliance.org.uk

Acknowledgements

Wensum Alliance

UEA University of East Anglia

Department for Environment Food & Rural Affairs

SALLE FARMS Co.