

Leaching and measures to limit leaching

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Noget at leve af. Noget at leve for.



Reducing leaching has been a key factor in reducing N loss to the environment

- Catch crops (~20 % of agricultural land)
- Early drilling (before September 7th)
- Mandatory fertilization plans and demand for high utilization of nitrogen in manure (65-70% of TN)
- Reduction of nitrogen quotas below economic optimum has previously been used – but has since been abandoned
- How effective are different measures?

Questions

- How effective are catch crops in a low input agriculture?
- How effective is early drilling of winter seed (before September 7th)
- How much can postponed tillage reduce leaching?
- What is the relation between applied nitrogen and leaching?

Marginal leaching

- Agricultural package increased N quota by ~20% (~35-40 kg N pr. ha)
- Increased leaching calculated from marginal leaching, i.e. % of N leached from last kg of applied N
- Marginal leaching is assumed to be ~20% on average in Denmark

Consequence of package if all extra 70.000 tons N were used:

~14.000 tons N of extra leaching (0.2×70000 tons N)

Only 50% of extra N quota was used! So actually ~7000 tons extra leaching

Marginal leaching dramatically can affect the cost effectiveness of reduced N quota compared to other measures.

Why so interested in nitrogen rate and leaching?



Vi har samlet Bank | Forsikring | Pension på ét sted

Professor: Landbrugspakken overvurderede sandsynligvis kvælstofudvaskningen

Søndag 26. november 2017 | 15:25

Skrevet af Filip Knaack Kirkegaard

Udskriv

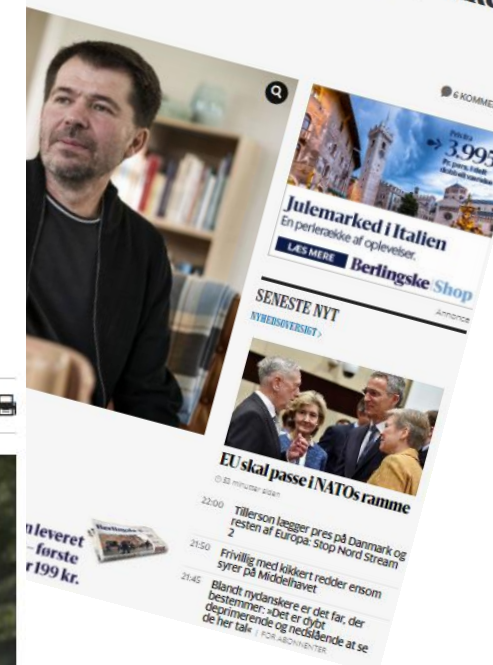


»Det kommer til at få konsekvenser«: Esben Lunde kalder udtalelse fra Ida Auken injurierende i heftig debat om vandmiljø

Selv ordet injurierende blev taget i brug, da miljø- og fødevarerministeren i dag skulle forsvare model bag den omstridte landbrugspakke.

Esben Lunde skal Stor usikkerhed kvælstofudledning i landbruget

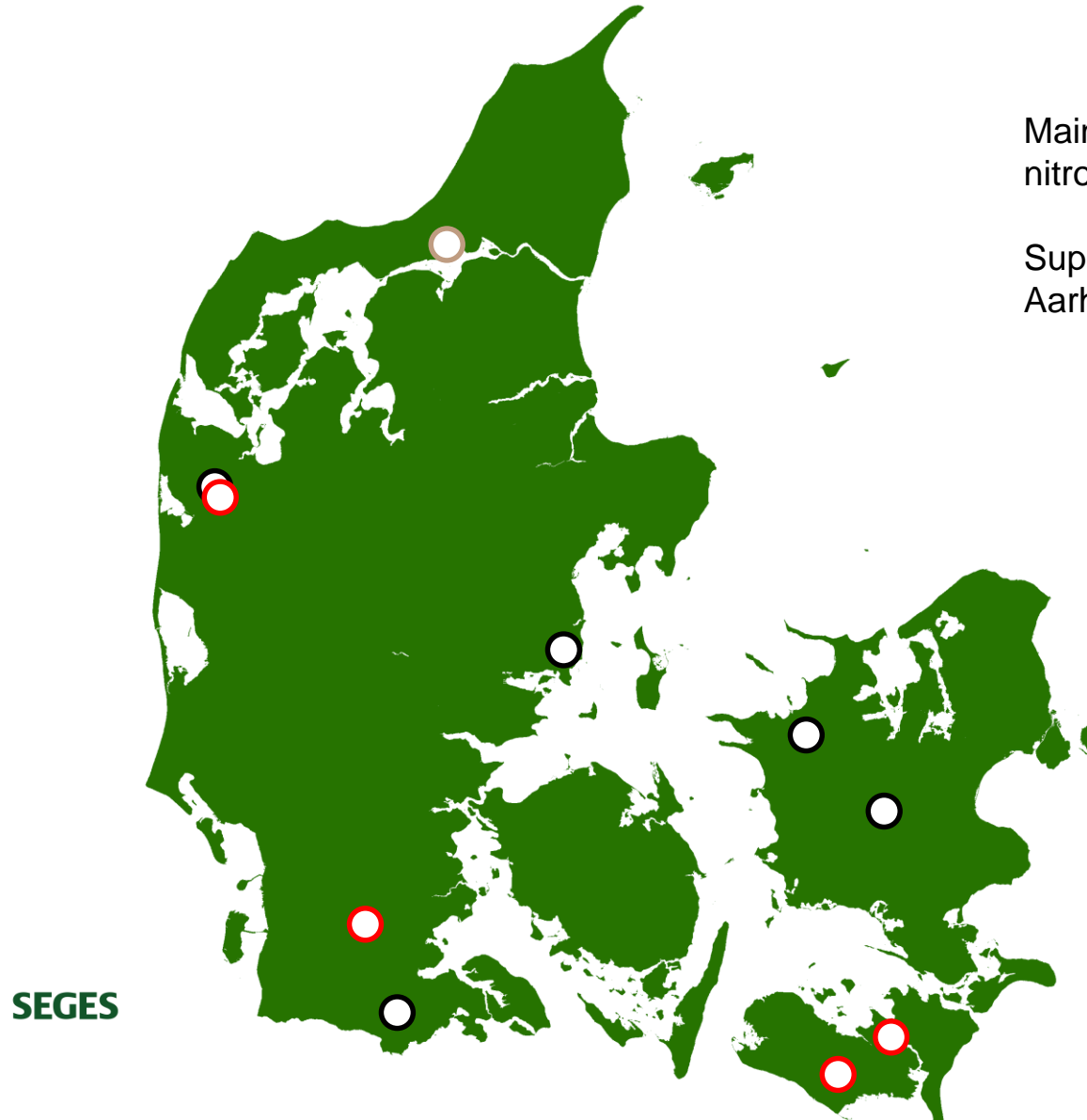
Nye oplysninger rækker ved grundlaget som partierne er ved at forhandle om landbruget.

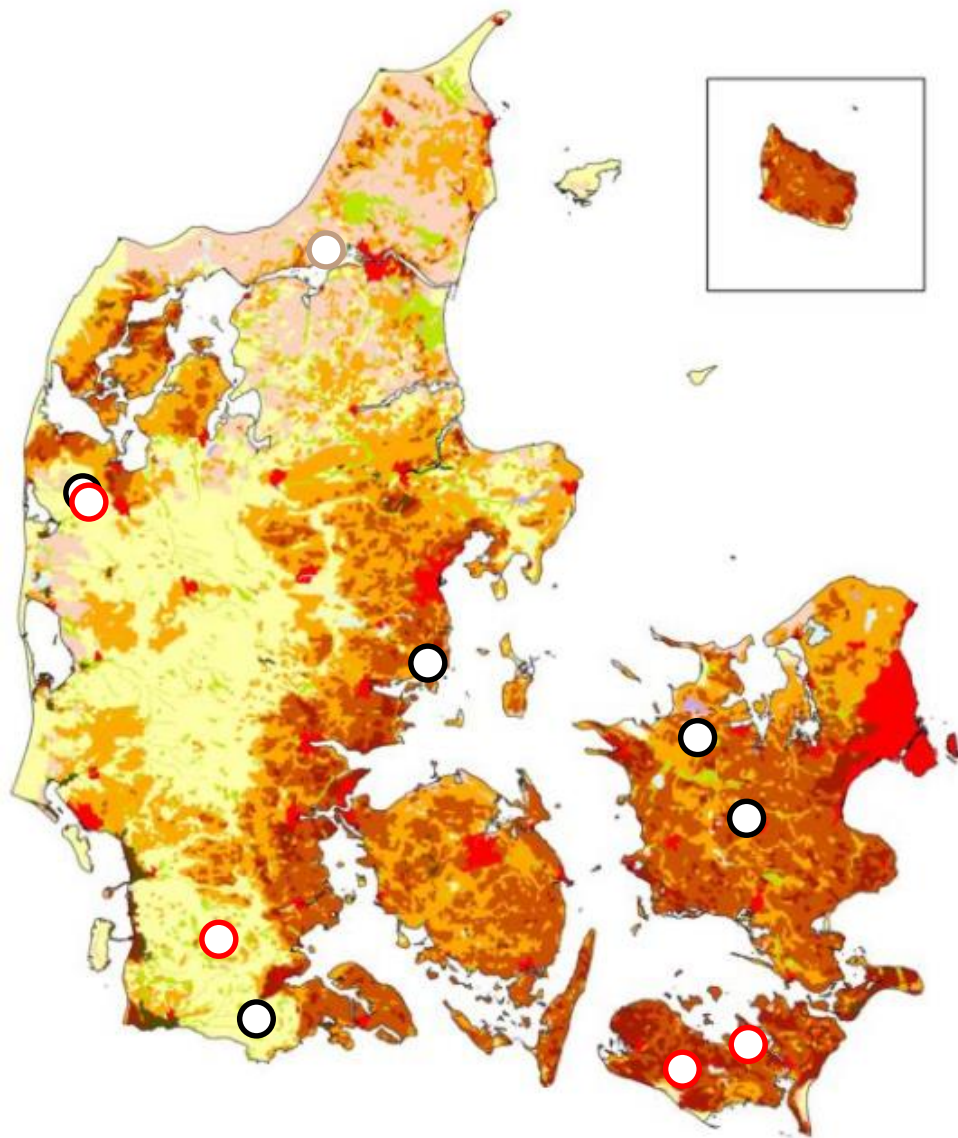


Experiment with leaching estimated from experiments with suction cups at SEGES

Mainly to investigate leaching at different levels of nitrogen fertilisation

Supplement leaching experiments carried out by Aarhus University





- Coarse sandy soil
- Fine sandy soil
- Coarse clayey sand soil
- Fine clayey sand soil
- Coarse sandy clay soil
- fine sandy clay soil
- Clay soil
- Heavy clay soil
- Very heavy clay soil
- Silt soil
- Organic soil

4 sites on sandy soil

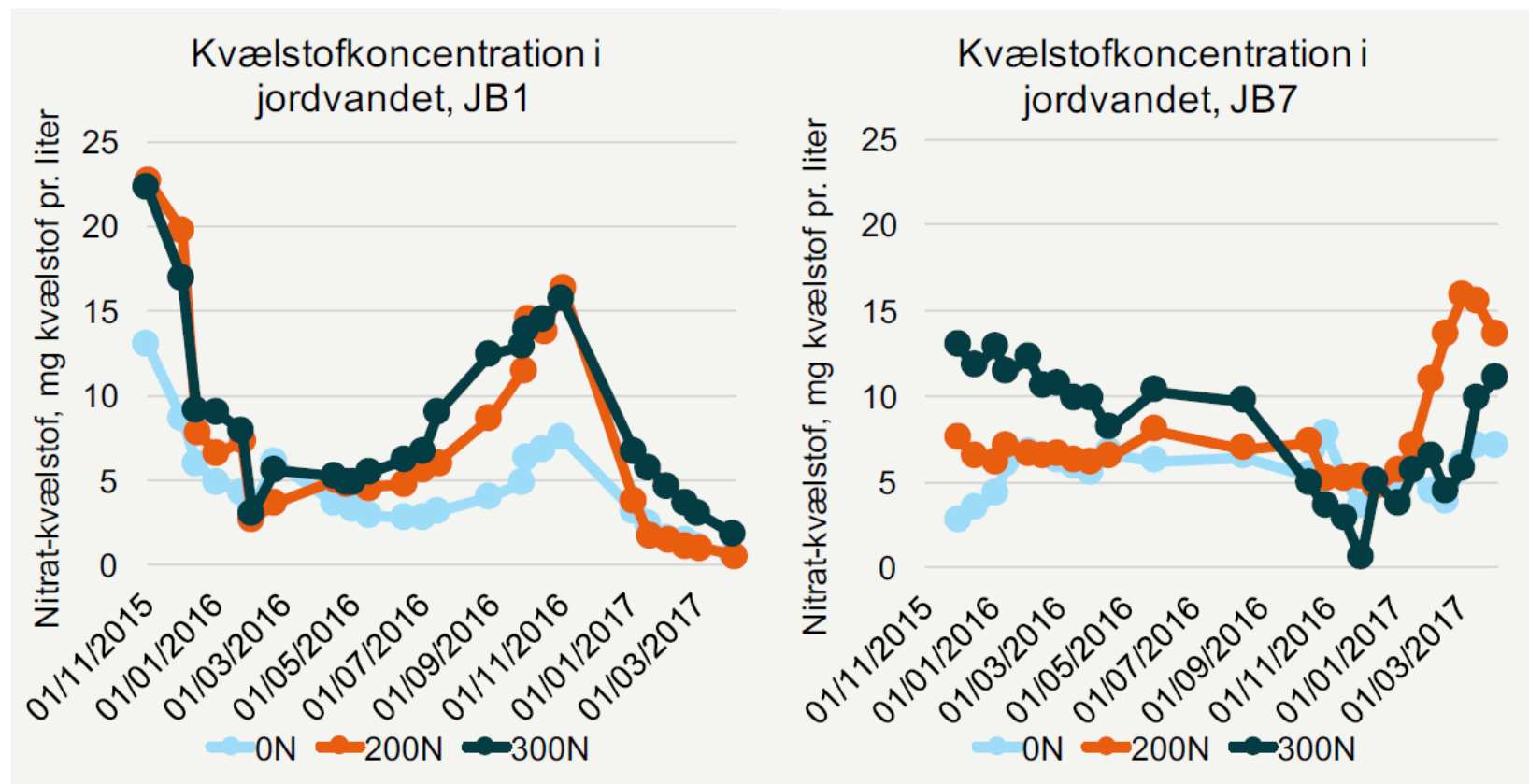
5 sites on loamy sand or sandy loam

Concerns about preferential flow on heavier soil types

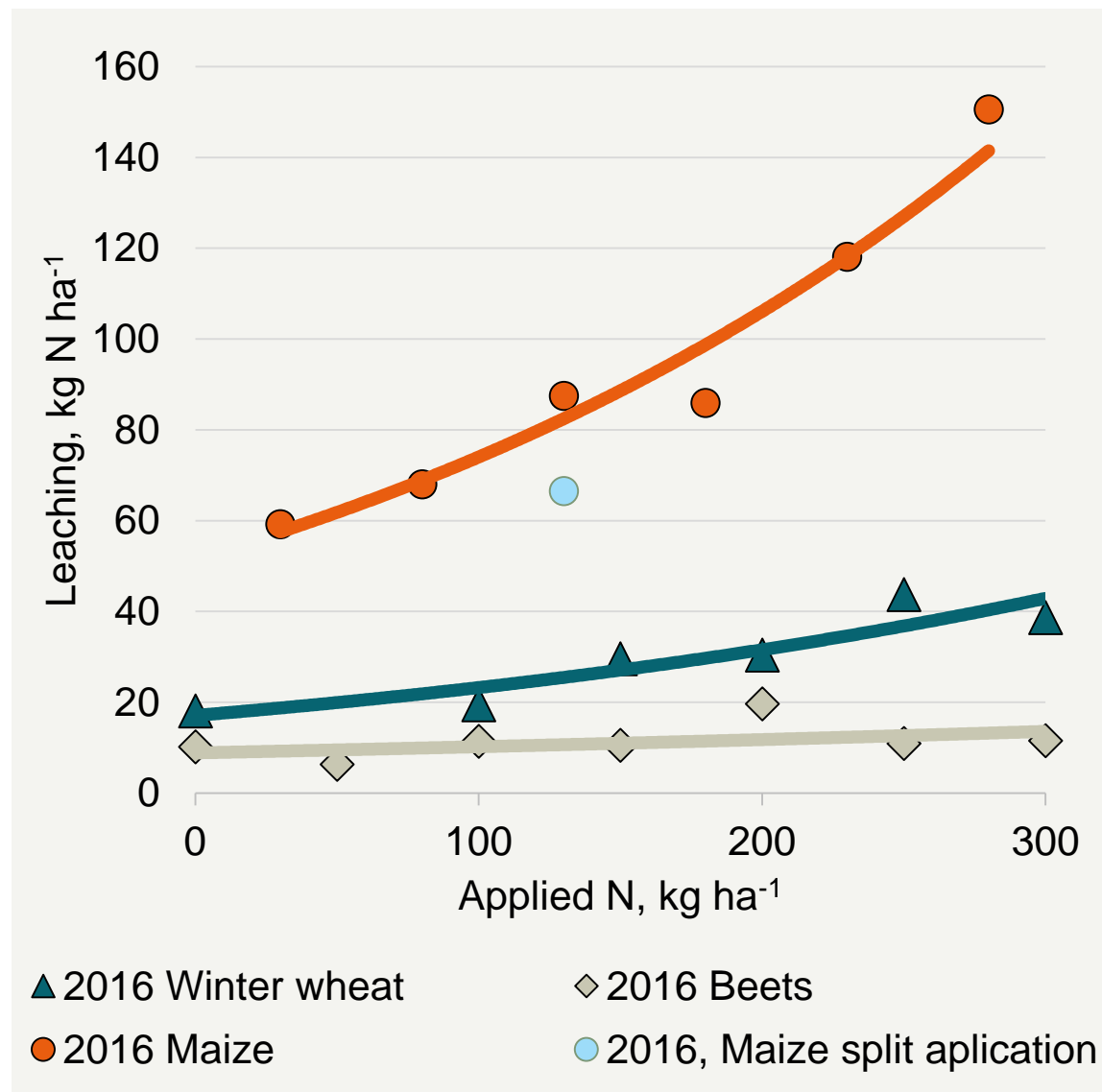
Experimental sites are instrumented with ceramic suction cups



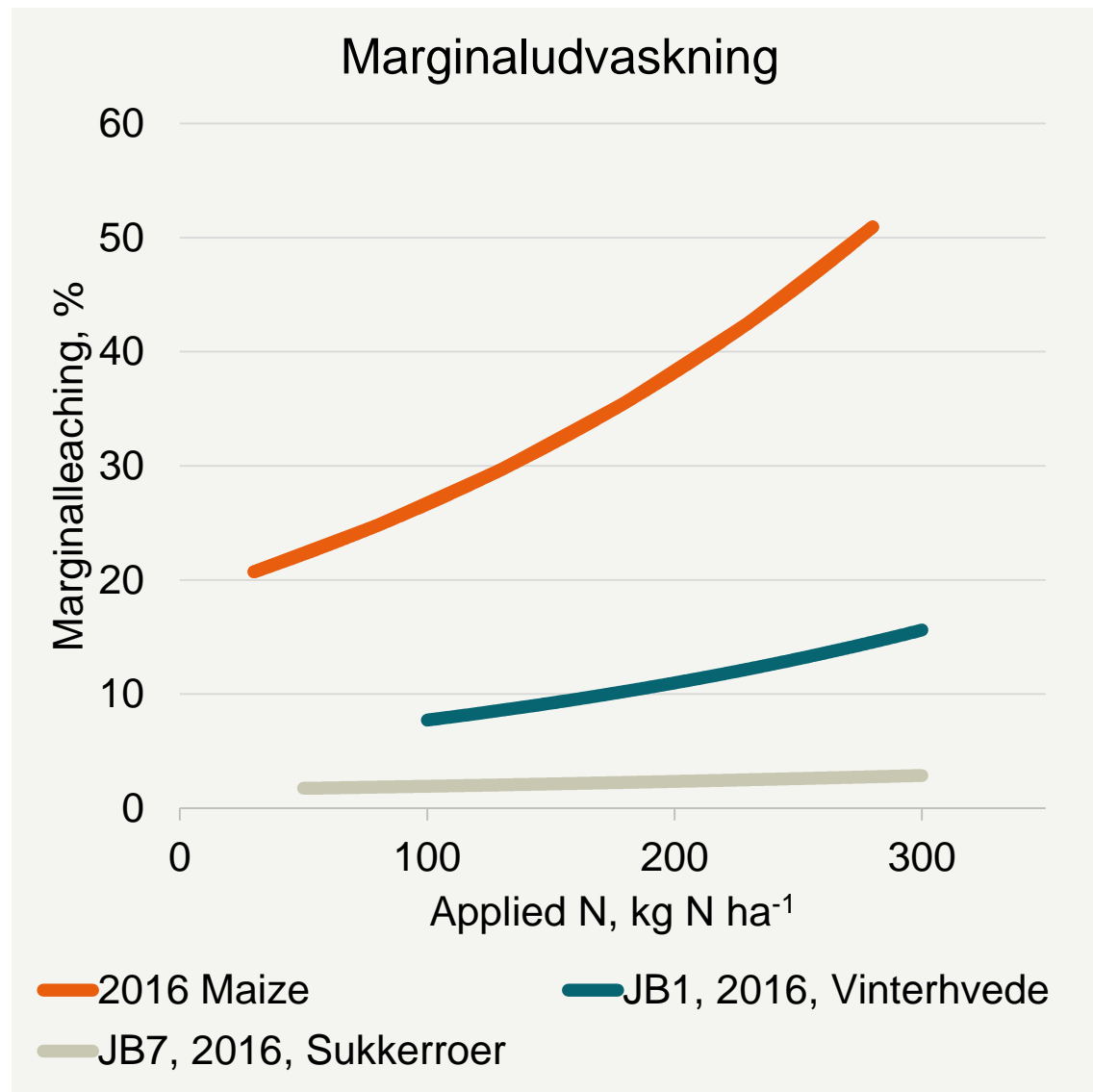
Concentrations in soil water



Results of three leaching experiments



Marginal leaching



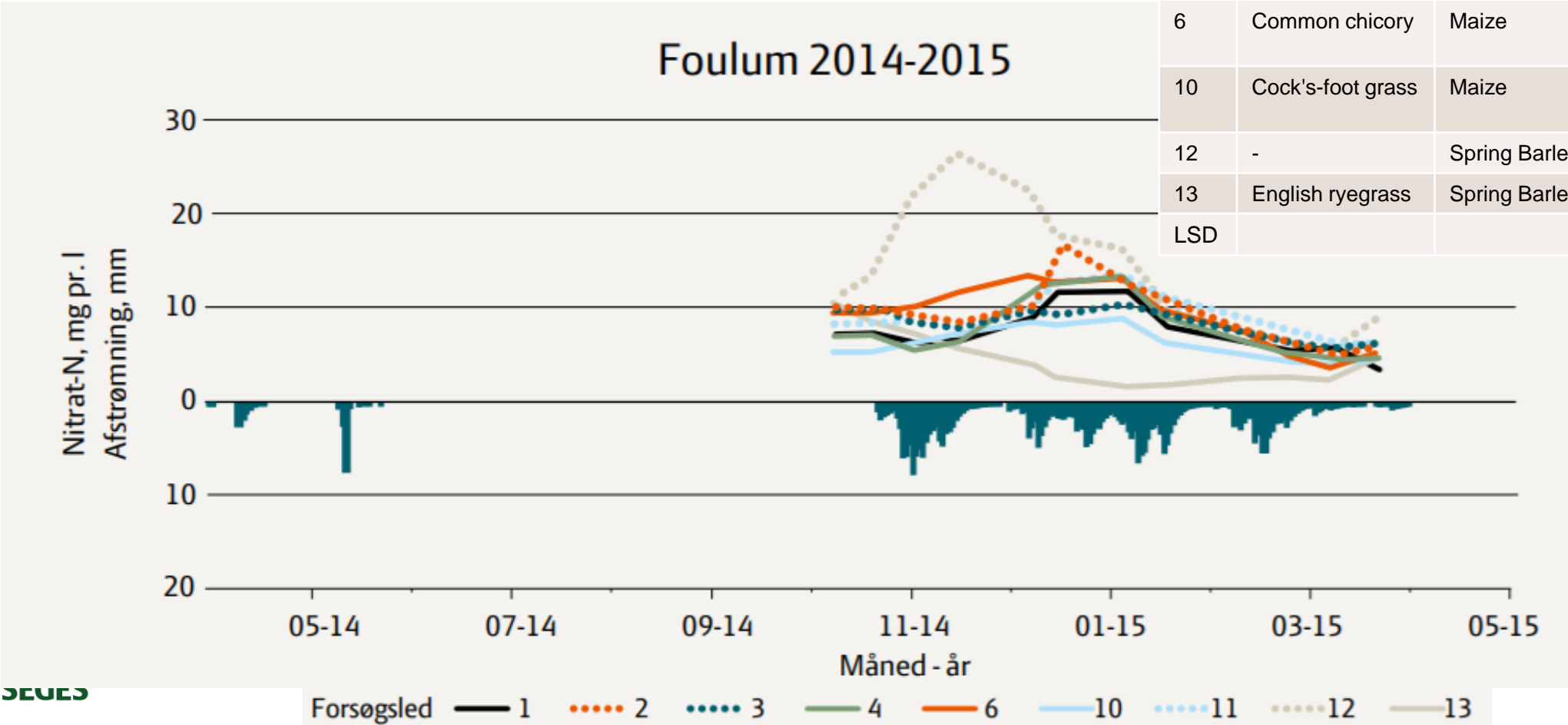
Catch crops

Current estimates of effects of catch crops

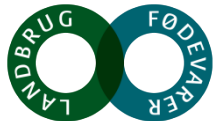
	<80 kg N manure ha ⁻¹		>80 kg N manure ha ⁻¹	
	Clay	Sand	Clay	Sand
	16	34	28	46
Average	25		37	

Are these estimates correct in a low input agricultural system?

Leaching and catch crops



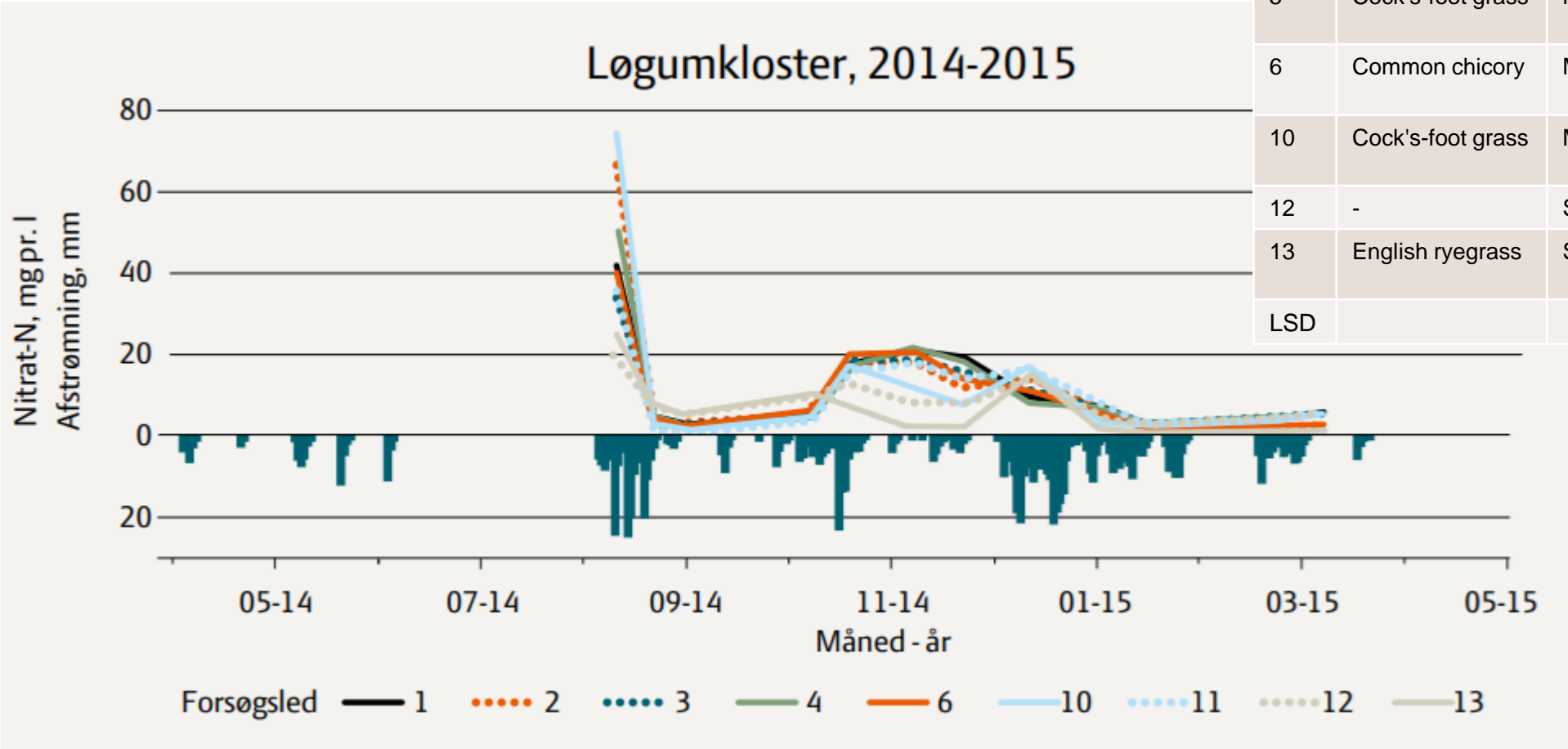
	Catch crop	Crop	Drill time	Leaching, kg N ha ⁻¹
1	-	Maize	-	39
2	English ryegrass	Maize	June 12th	50
3	Cock's-foot grass	Maize	June 12th	41
4	Tall fescue	Maize	June 12th	43
5	Cock's-foot grass	Maize	June 12th	49
6	Common chicory	Maize	June 26th	32
10	Cock's-foot grass	Maize	June 12th	47
12	-	Spring Barley	May 5th	76
13	English ryegrass	Spring Barley	May 5th	18
LSD				-



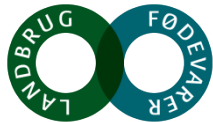
From Hansen and Thomsen 2015

Leaching and catch crops

	Catch crop	Crop	Drill time	Leaching, kg N ha ⁻¹
1	-	Maize	-	84
2	English ryegrass	Maize	June 10th	95
3	Cock's-foot grass	Maize	June 10th	77
4	Tall fescue	Maize	June 10th	85
5	Cock's-foot grass	Maize	June 10th	79
6	Common chicory	Maize	June 20th	100
10	Cock's-foot grass	Maize	June 10th	82
12	-	Spring Barley	April 30th	68
13	English ryegrass	Spring Barley	April 30th	58
LSD				26



From Hansen and Thomsen 2015



Early drilling on sandy loam/loamy sand

Flakkebjerg	Plant uptake	Nitrat leaching	Plant uptake	Nitrat leaching
	Kg N ha ⁻¹			
	Nov. 5th 2015	Nov 24th 2015 – May 17th 2016	31. Okt 2016	18th may 2016 - 26 apr. 2017
Winter wheat, normal drill	3	32	5	22
Winter wheat, early drill	12	20	19	9
Catch crop	25	11	28	3
Spillage grain and weeds	9	23	22	15
Bare soil	-	46	-	31

From Hansen and Thomsen 2017

Early drilling on sandy loam

Foulum, sandy loam	Plant uptake	Nitrat leaching	Plant uptake	Nitrat leaching
	Kg N ha ⁻¹			
	Oct. 28th 2015	Oct. 12th 2015 – May 4th 2016	Nov. 1st 2016	May 5th 2016 – May 11th. 2017
Winter wheat, normal drill	3	39	4	25
Winter wheat, early drill	18	14	13	18
Catch crop	18	15	24	10
Spillage grain and weeds	13	21	23	15
Bare soil	-	45	-	76

From Hansen and Thomsen 2017

Conclusion

- Catch crops work and estimates are along the lines of earlier estimates.
- However, early drilling (before September 7th) is nearly as effective
- Spillage grain and weed does indeed limit leaching, and is more effective than sowing winter wheat at normal time
- Marginal leaching is lower than the average 20% in winter wheat on sandy soil and on beets on clay soil. Only in maize on sandy soil is the marginal leaching higher than 20%