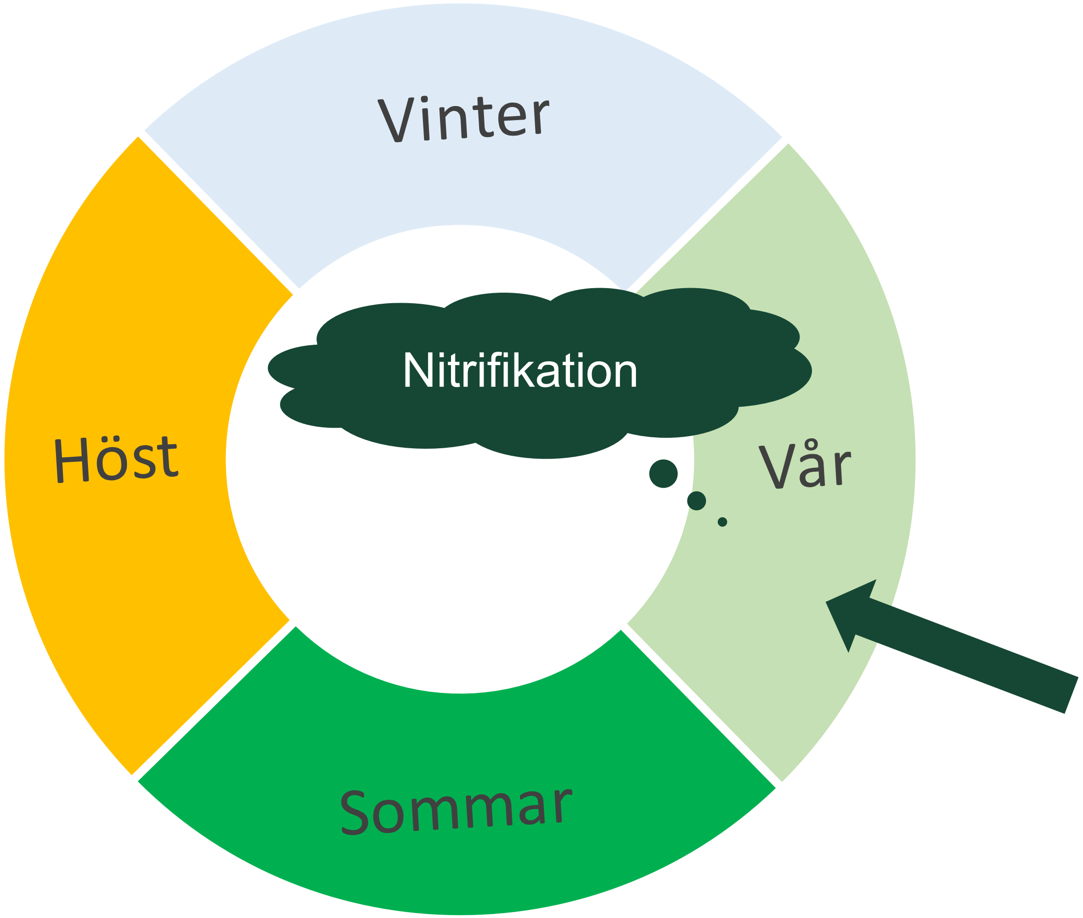
Precisionsgödsling med kväve – effekter på utlakning och klimat?

Sofia Delin och Hanna Karlsson Potter

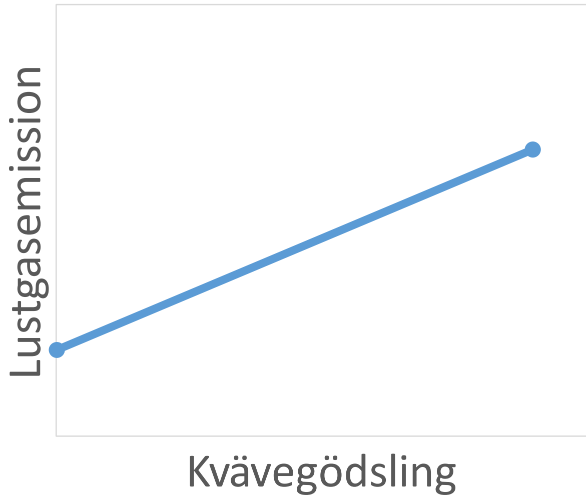
1. Kvävegödsling och lustgasemissioner
2. Kvävegödsling och utlakning
3. Anpassning till det enskilda fältet
4. Anpassning till inomfältsvariationer
5. Klimatpåverkan vid fältanpassad gödsling vs generell rekommendation
6. Klimatpåverkan vid inomfältsvarierad gödsling vs fältanpassad

SD1

Kvävegödsling och lustgasemissioner

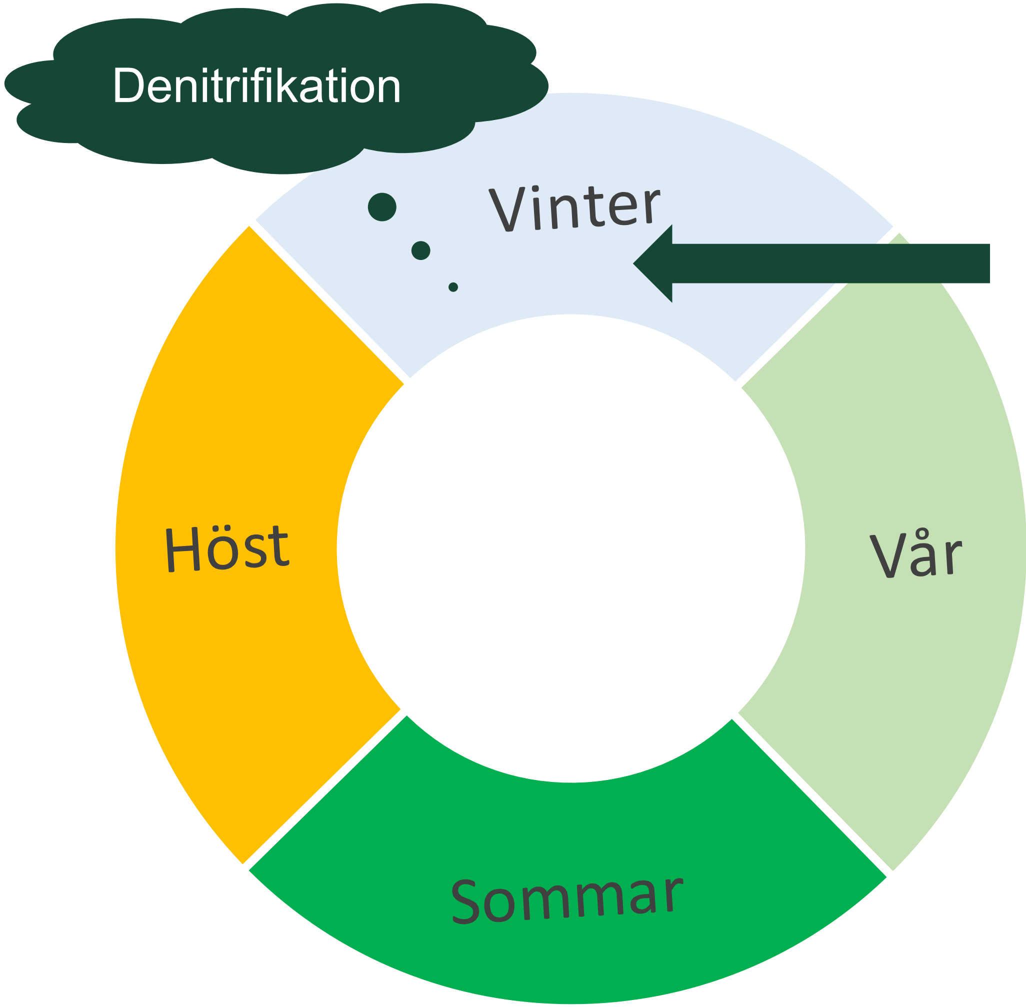


Enligt IPCC:

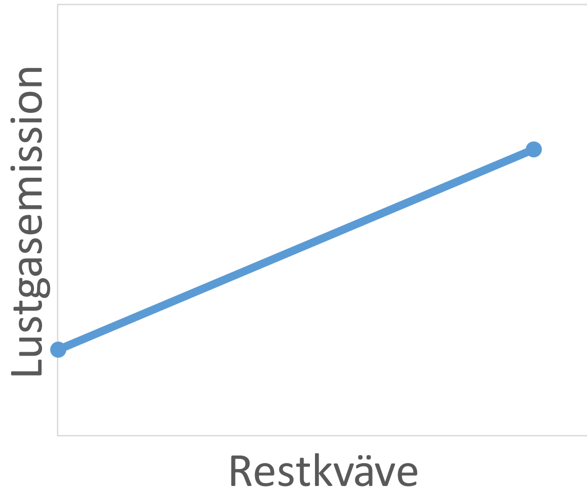


Stämmer om avgången sker innan grödans kväveupptag.

Kvävegödsling och lustgasemissioner



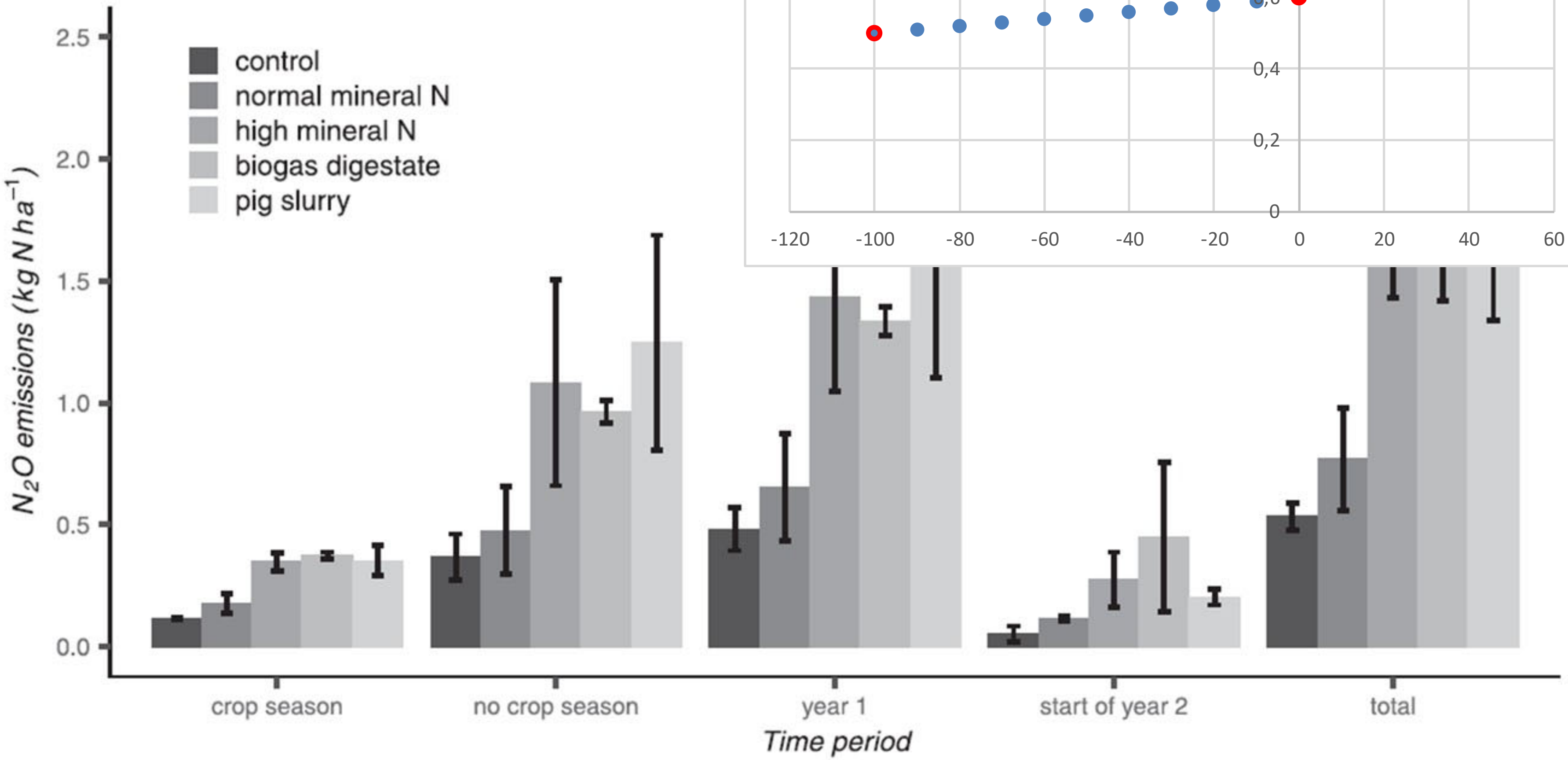
I Sverige kan en betydlig del av emissionerna ske under vintern när marken omväxlande fryser och tinar.

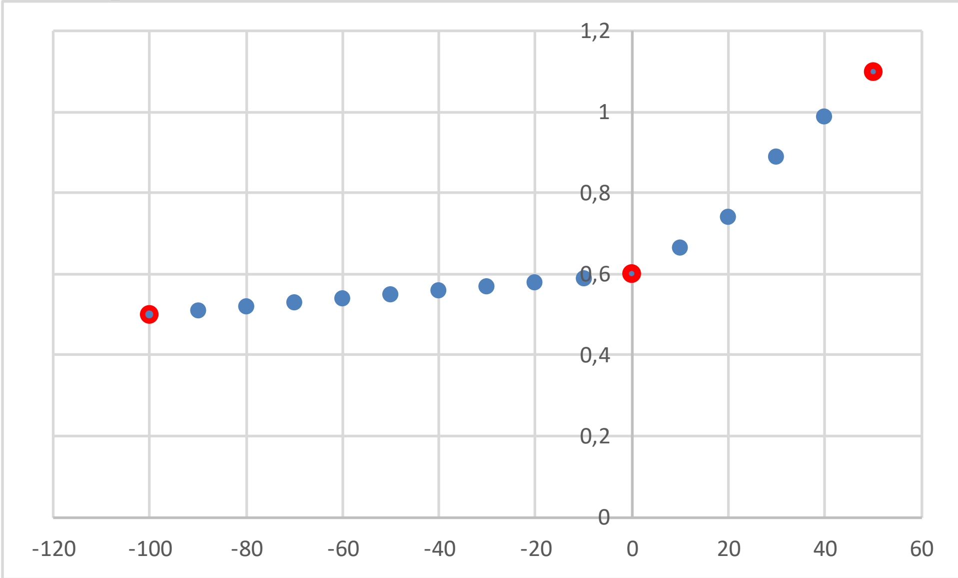


Då är det viktigare om man gödslat efter grödans behov än den absoluta mängden gödsel.

Kvävegödsling och lustgasemissioner

Från Wallman et al, 2022:

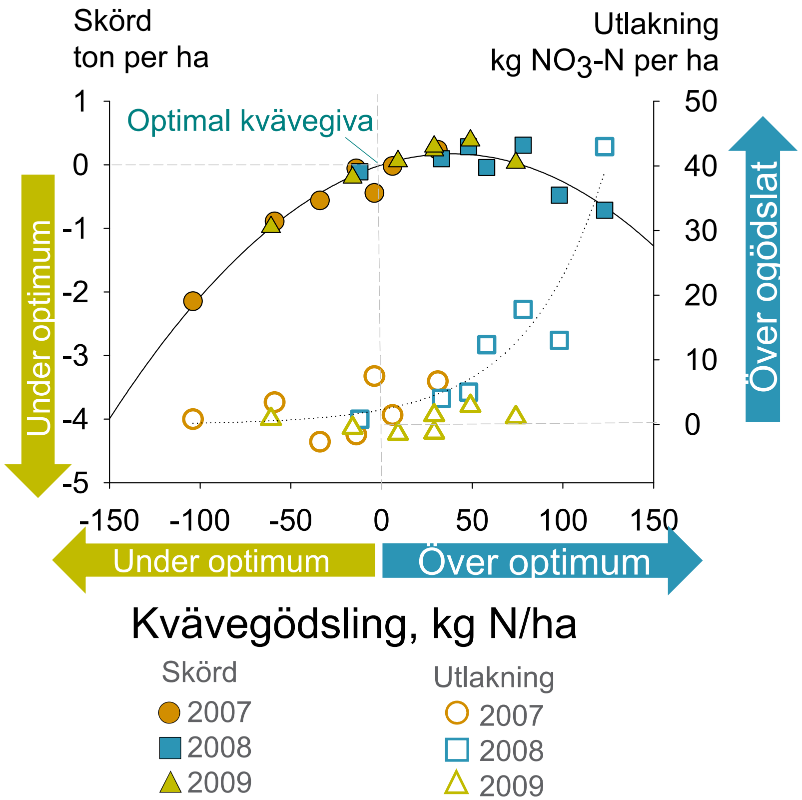




Kvävegödsling och utlakning

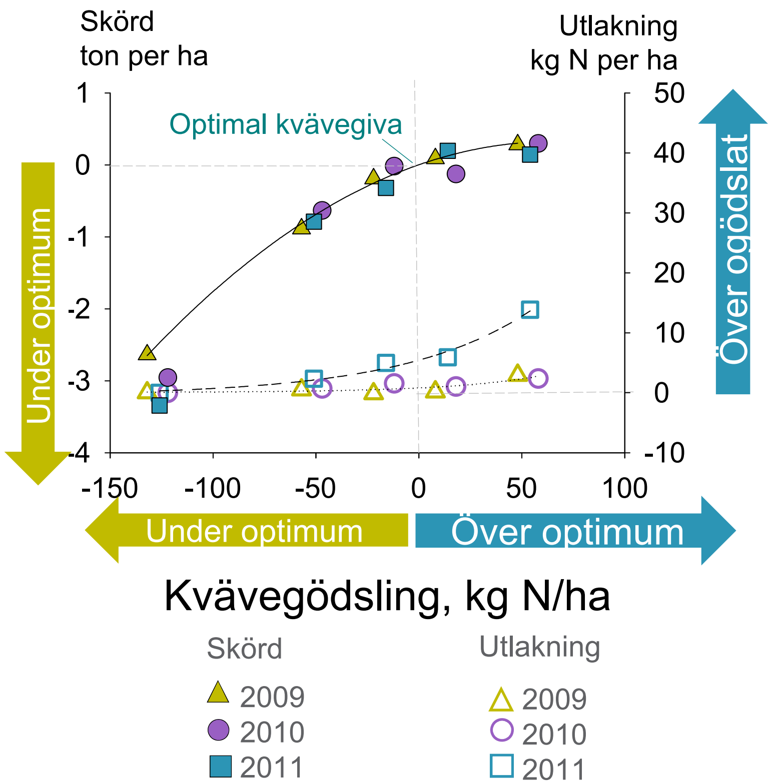
Lättjord (Götala)

Optimala kvävegivor var 104, 12 och 61 kg N ha^{-1} 2007, 2008 respektive 2009.

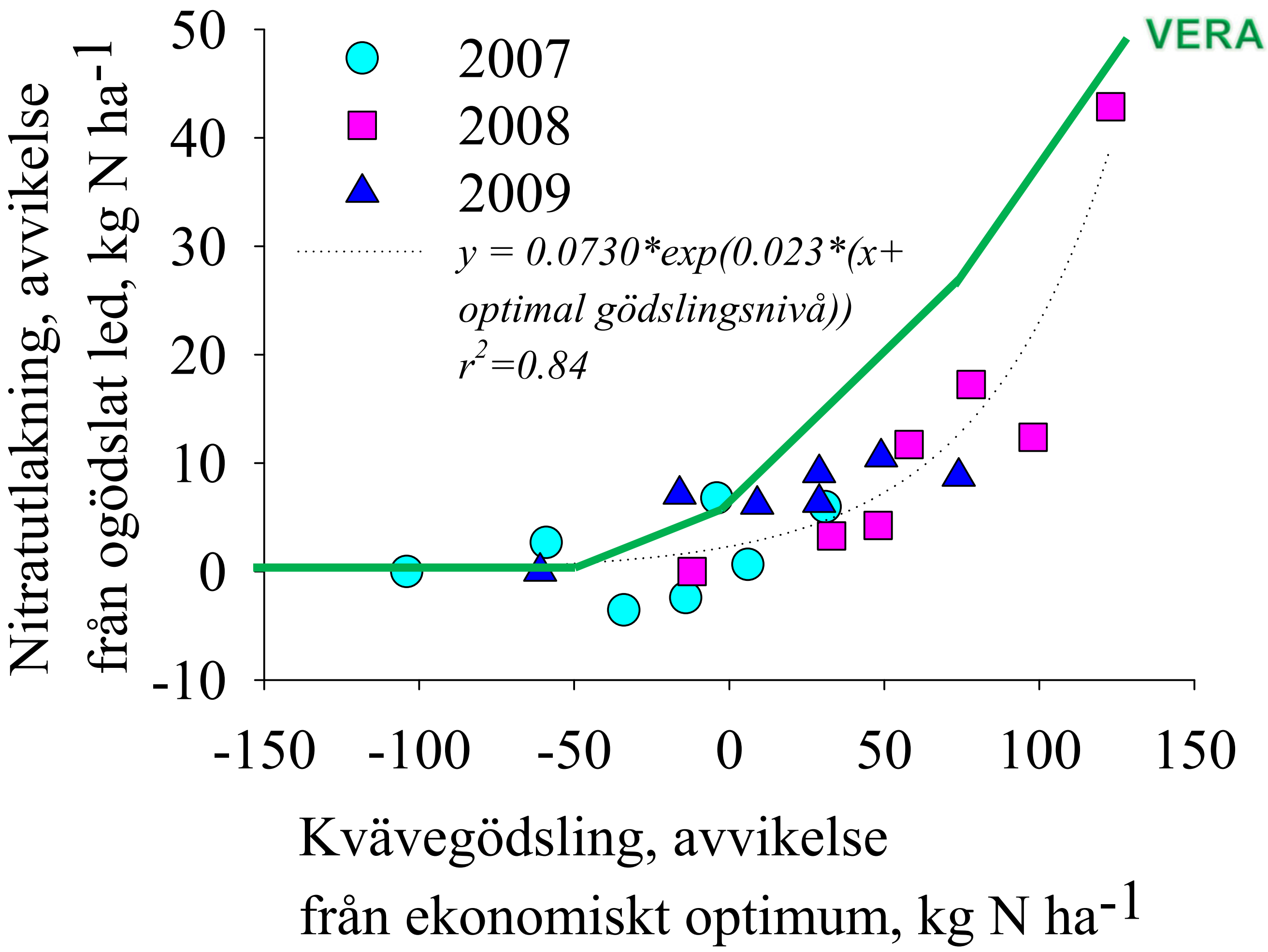


Lerjord (Lanna)

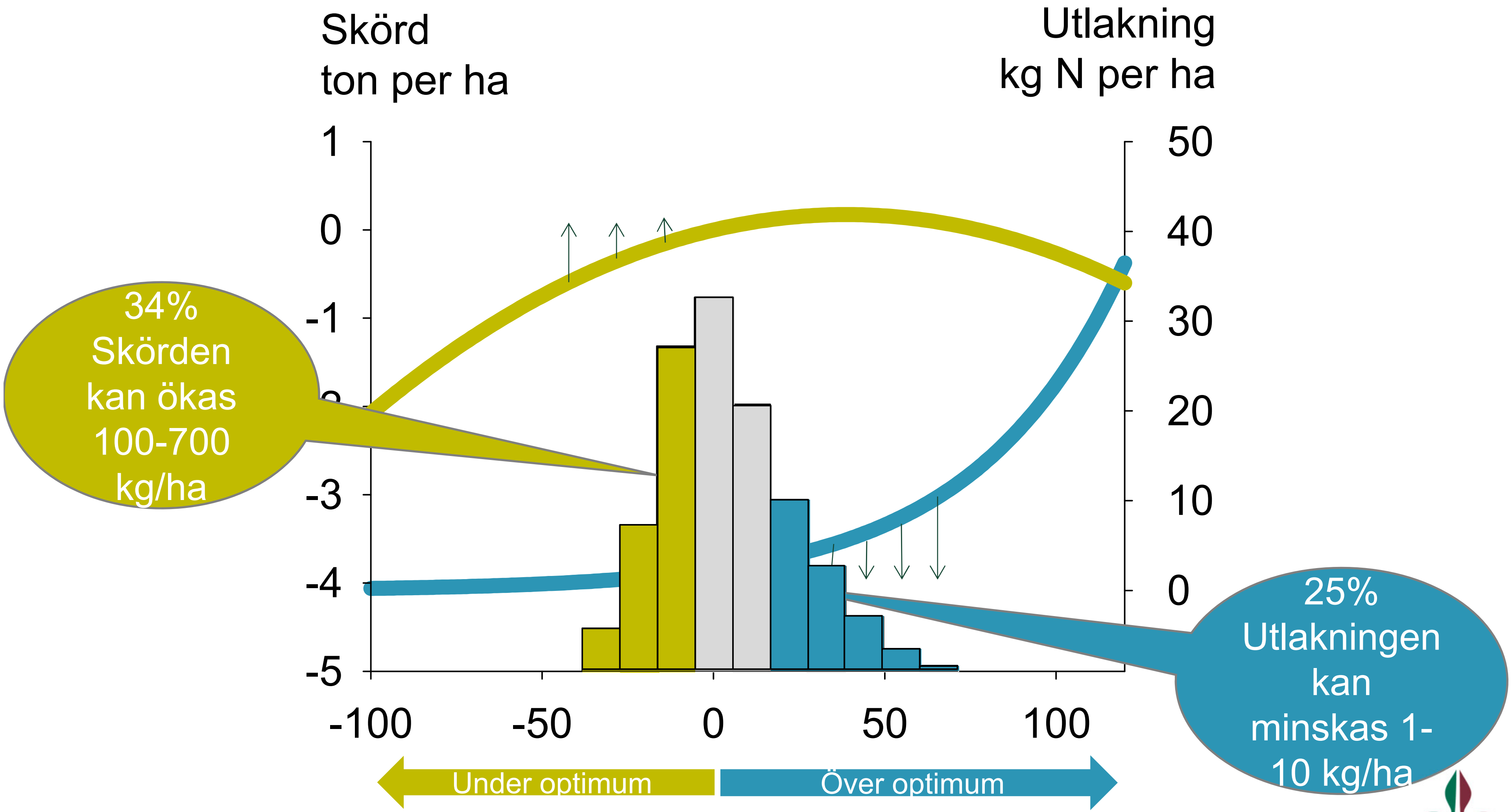
Optimala kvävegivor var 130, 128 och 100 kg N ha^{-1} 2009, 2010 respektive 2011.



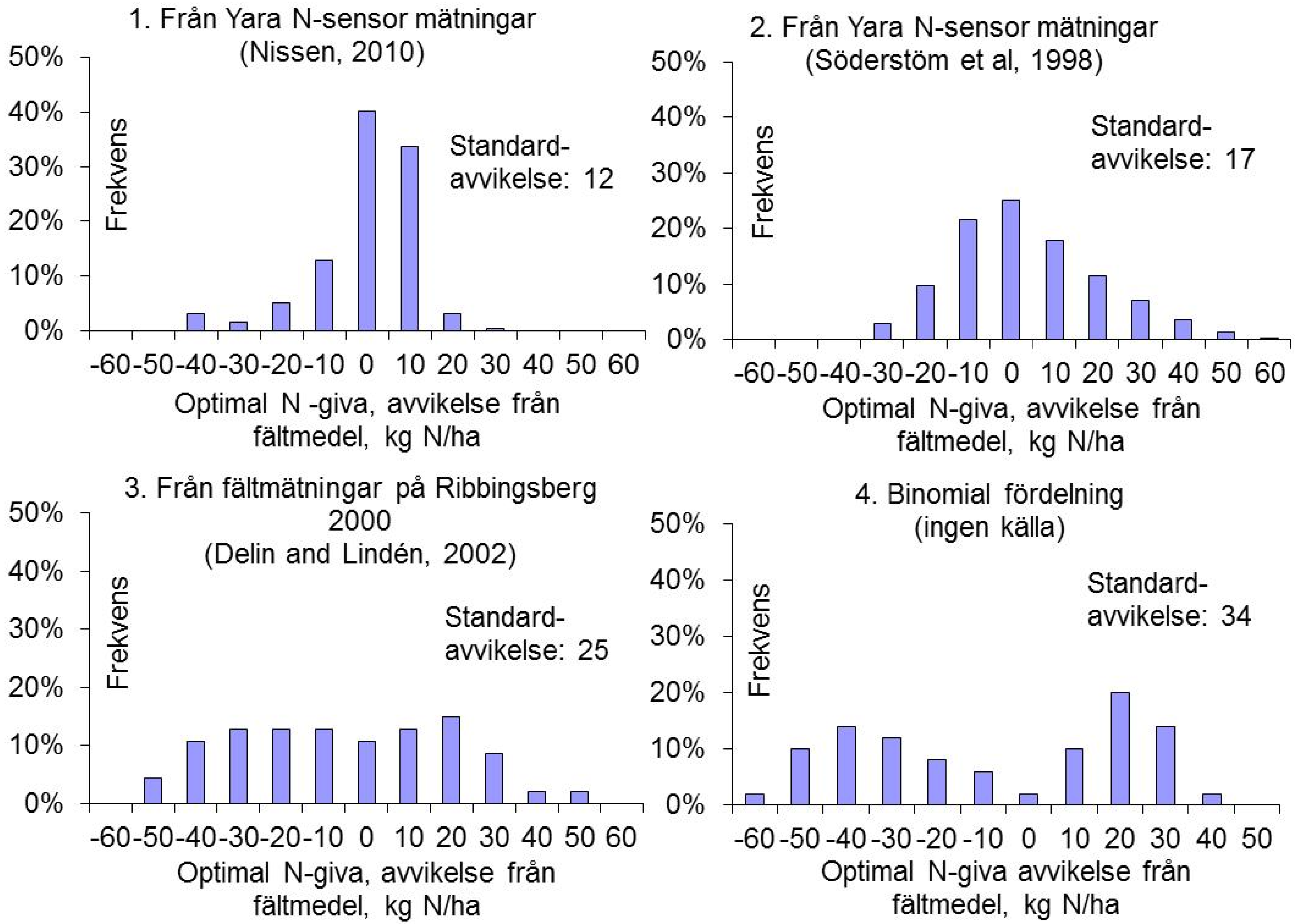
Jämfört med VERA



Minskad utlakning med precisionsgödsling?



Minskad utlakning med precisionsgödsling?



Möjligheter att minska kväveutlakningen genom att anpassa kvävegödslingen till variationer inom stråsädesfält

Examensarbete av Cecilia Nilsson


Sveriges lantbruksuniversitet
Institutionen för mark och miljö

Möjligheter att minska kväveutlakningen genom att anpassa kvävegödslingen till variationer inom stråsädesfält
Possibilities to reduce nitrogen leaching by adjusting nitrogen fertilization to variations within cereal fields

Cecilia Nilsson

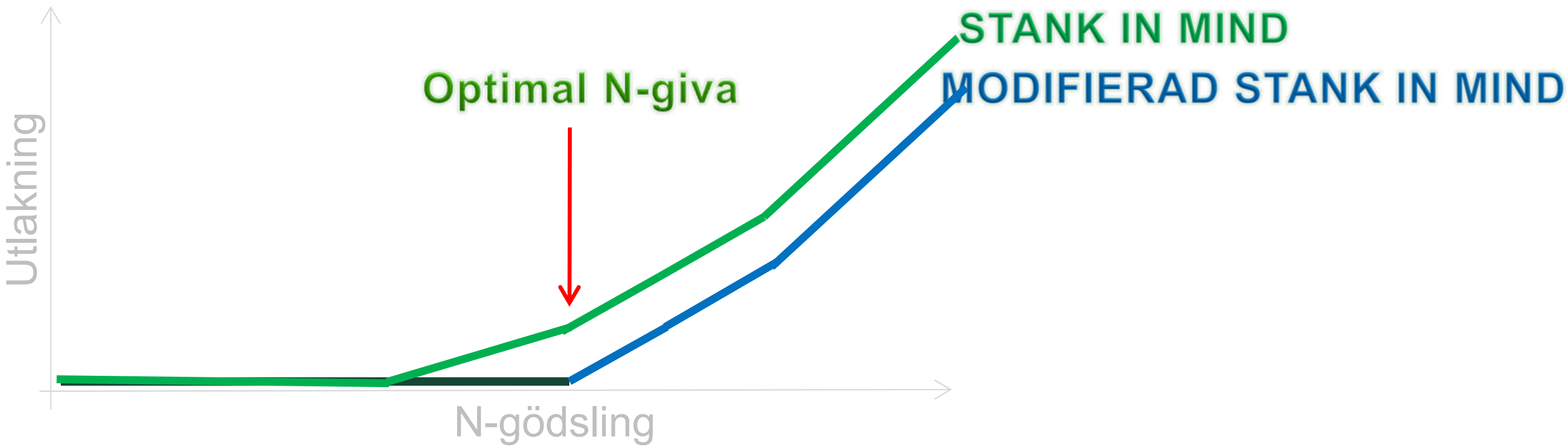
Kandidatuppsats i biologi

Institutionen för mark och miljö, SLU
Examensarbeten 2010:04
Uppsala 2010

Minskningspotential beroende på jordart och inomfältsvariation:

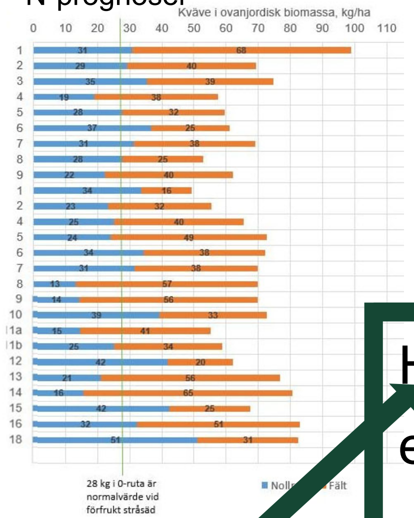
Enligt STANK in MIND:
0,2-3,8 kg N/ha om endast omfördelat
1,4-6,8 kg N/ha om medelgivan dessutom sänkts 10 kg N/ha

Enligt modifierad STANK in MIND:
0,5-6,1 kg N/ha om endast omfördelat
1,5-8,5 kg N/ha om medelgivan dessutom sänkts 10 kg N/ha



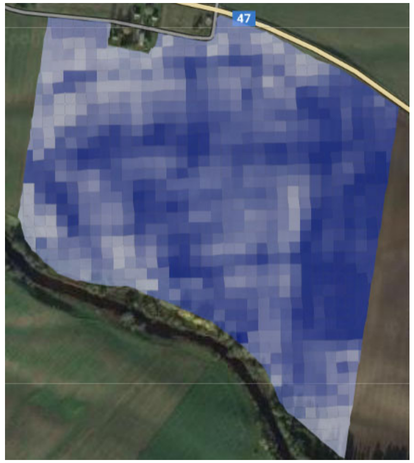
Anpassning till år, fält och inom fält

Yaras eller Jordbruksverkets N-prognoser



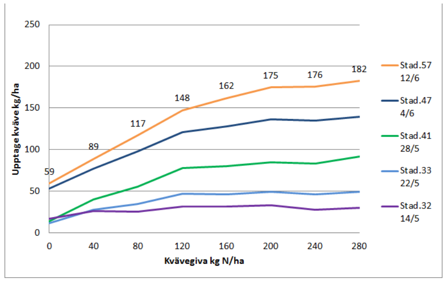
Hänsyn till variationer inom fält

Hänsyn till enskilda fältet



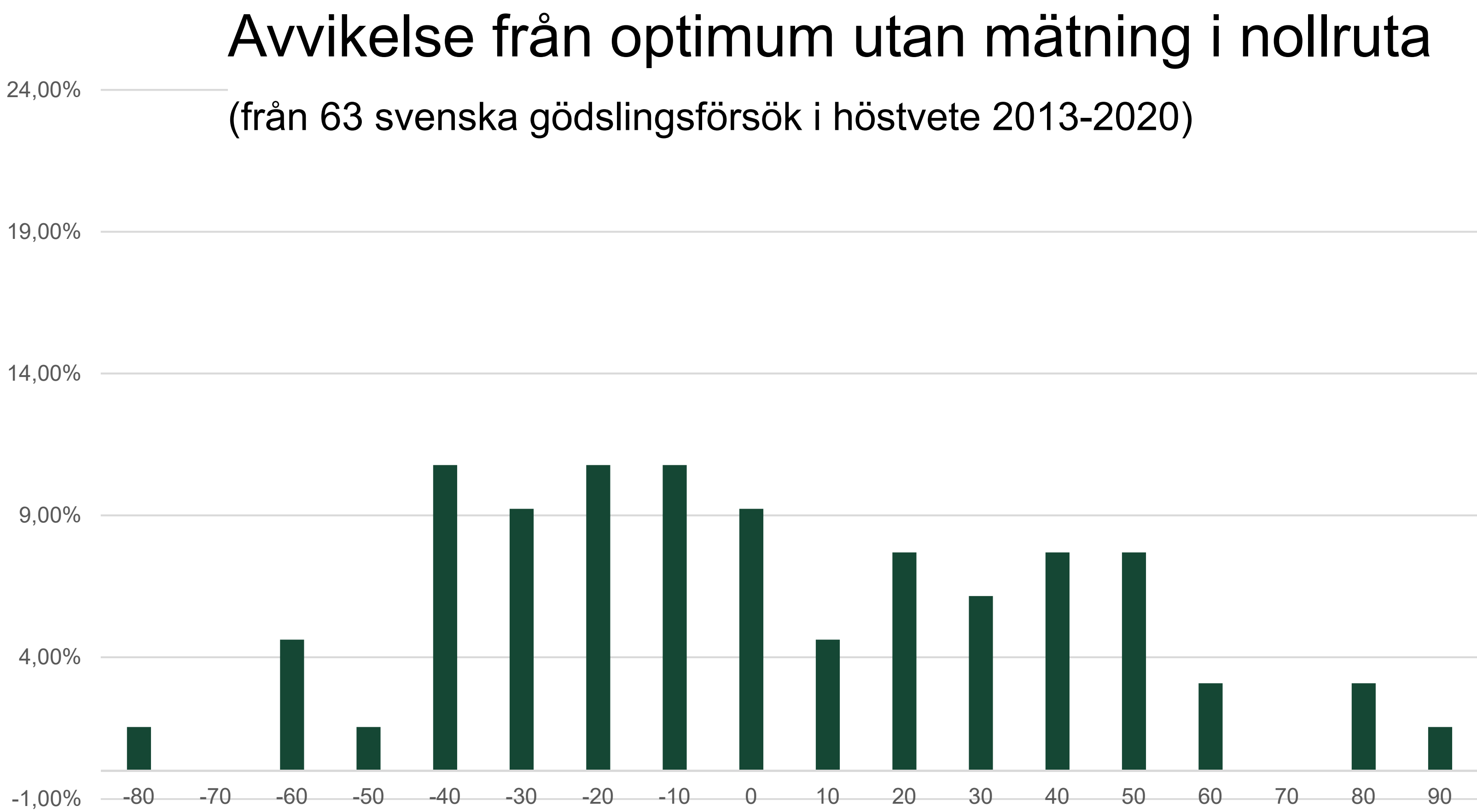
Hänsyn till enskilda året

Allmänna gödslingsråd



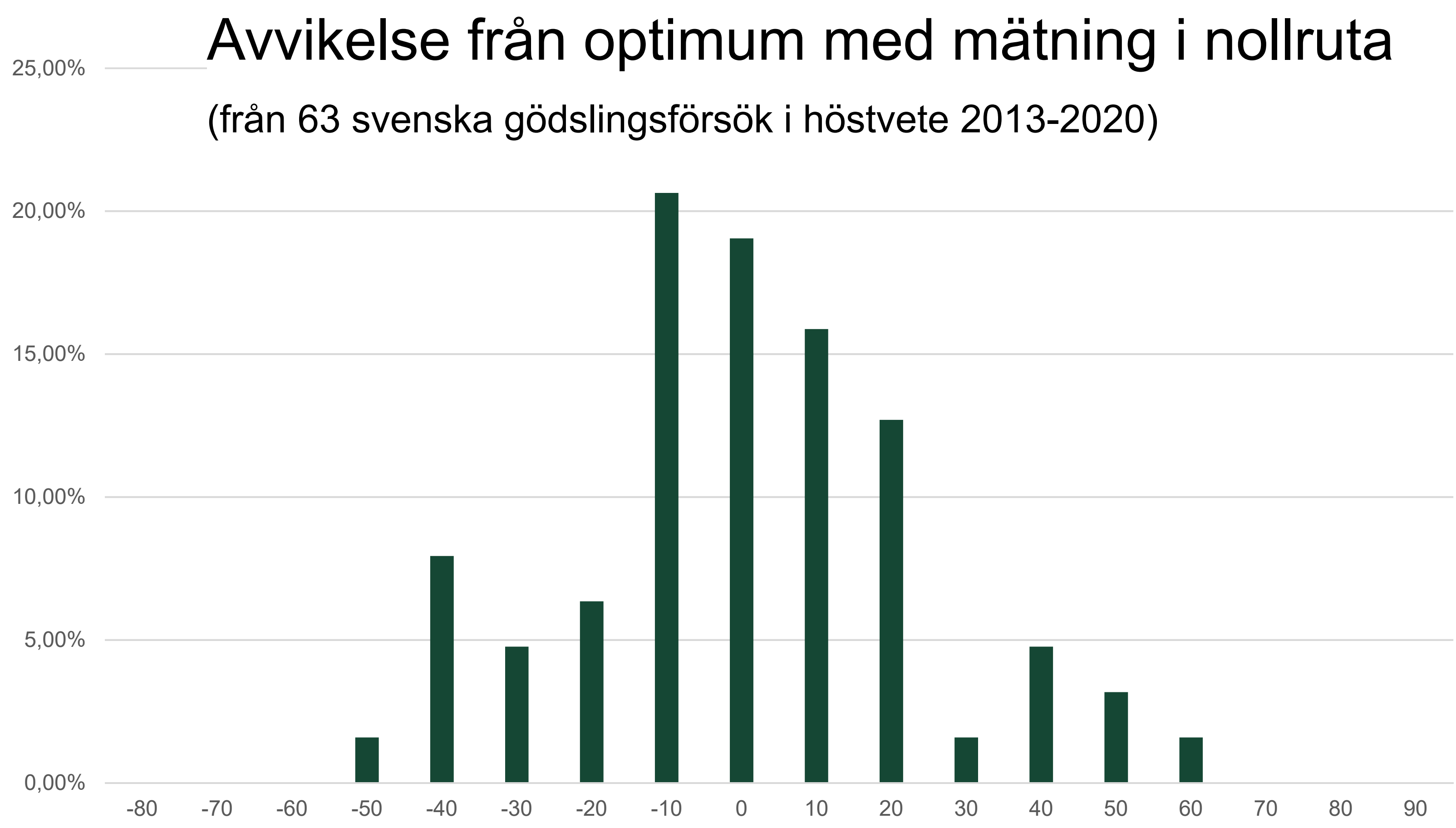
Anpassning till det enskilda fältet

Hur mycket mer rätt blir uppskattningen av optimal kvävegiva om vi har en nollruta på fältet?



Anpassning till det enskilda fältet

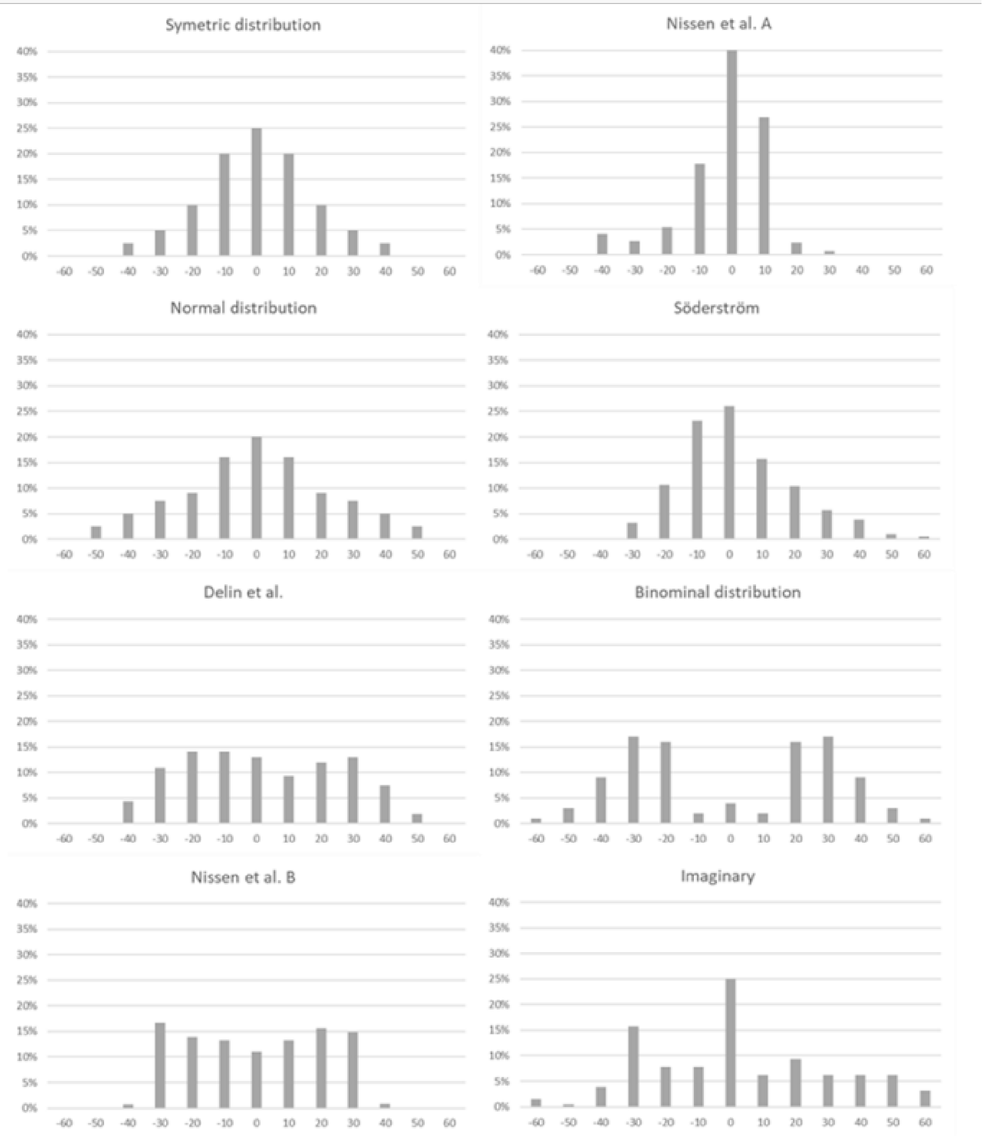
Hur mycket mer rätt blir uppskattningen av optimal kvävegiva om vi har en nollruta på fältet?



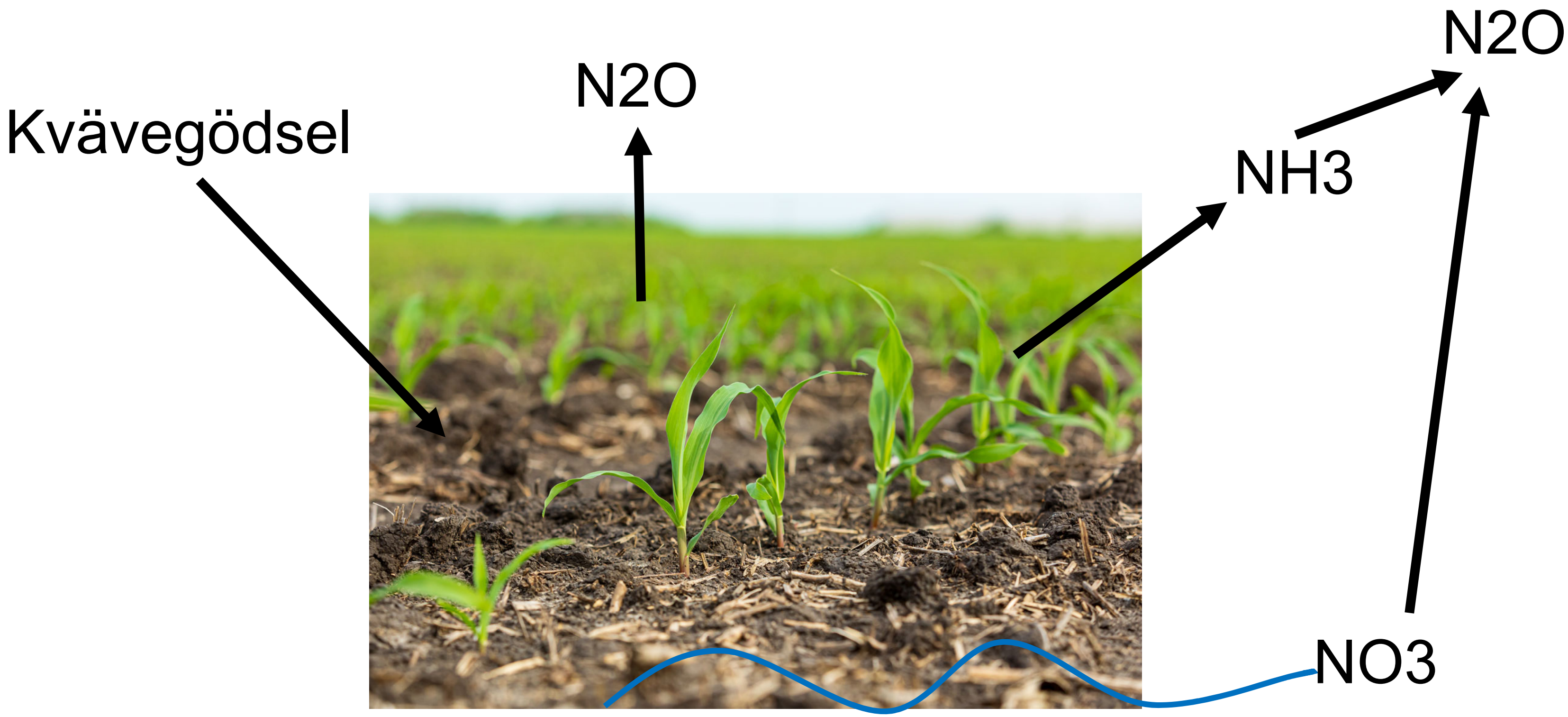
Anpassning till variationer inom fältet

Effekten beror på hur stor variation vi har och om vi kan mäta den.

Mäter vi på hela fältet får vi antaglen ett sannare medelvärde för fältet än om vi bara mäter i en nollruta eller i ett begränsat område..



N2O i ett livscykelperspektiv

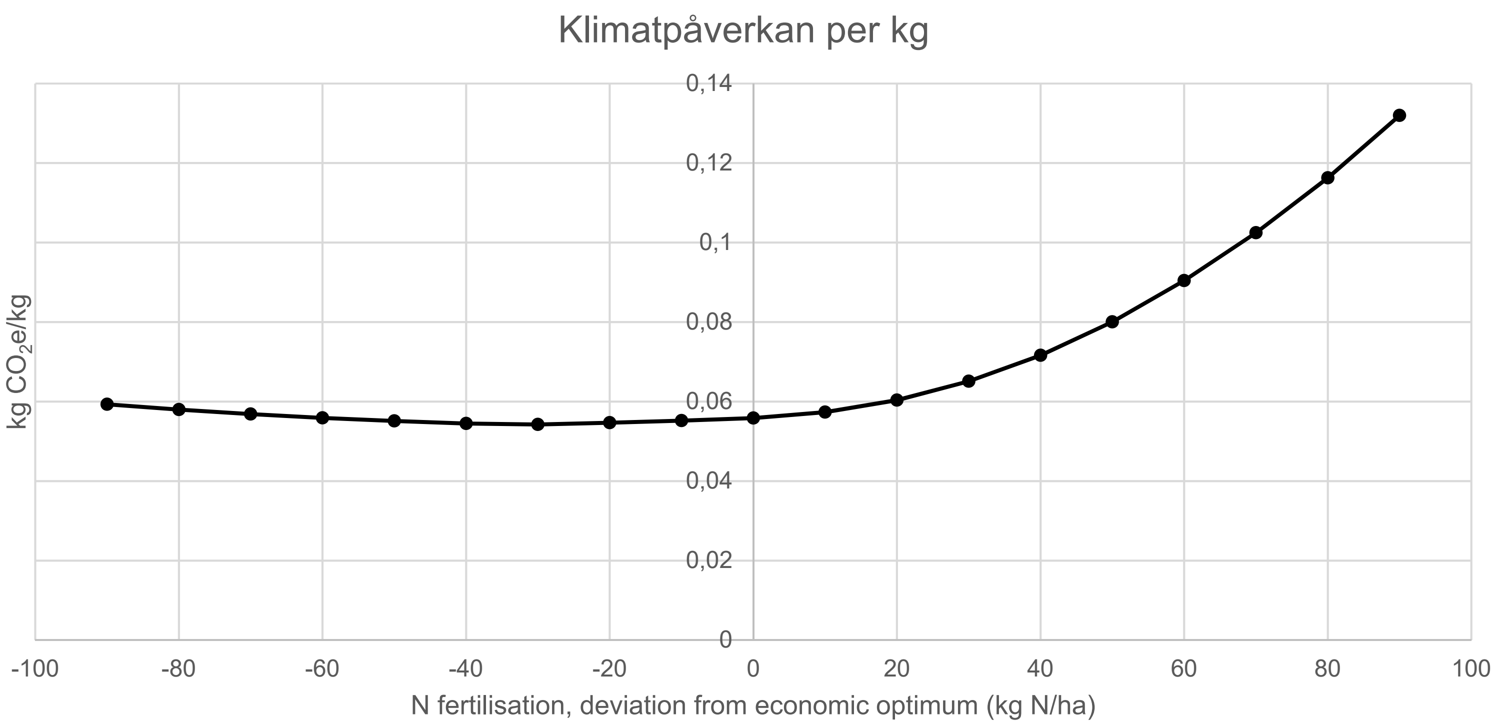


Modeller för att uppskatta N2O från jordbruksmark

IPCC – 1,6% av tillfört kväve (1% general faktor)

PNB (Eagle et al., 2020) - Metod baserad på enkel kvävebalans (N tillfört- N i skörd)

Klimatpåverkan per kg spannmål



Under optimum

Över optimum

Klimatpåverkan vid fältanpassad gödsling

Klimatpåverkan från direkta lustgasemissioner minskade med runt 6% per hektar

	Base case (N2O based on site specific data)					IPCC model for N2O				PNB model for N2O			
	Yield	Field N2O em.		Tot. climate impact		Field N2O em.		Tot. climate impact		Field N2O em.		Tot. climate impact	
		ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1
Field specific N rate	1.0%	-5.5%	-6.4%	-2.2%	-3.2%	0.2%	-0.8%	-0.1%	-1.2%	0%	-1%	-1%	-2%

IPCC's modell- ökning

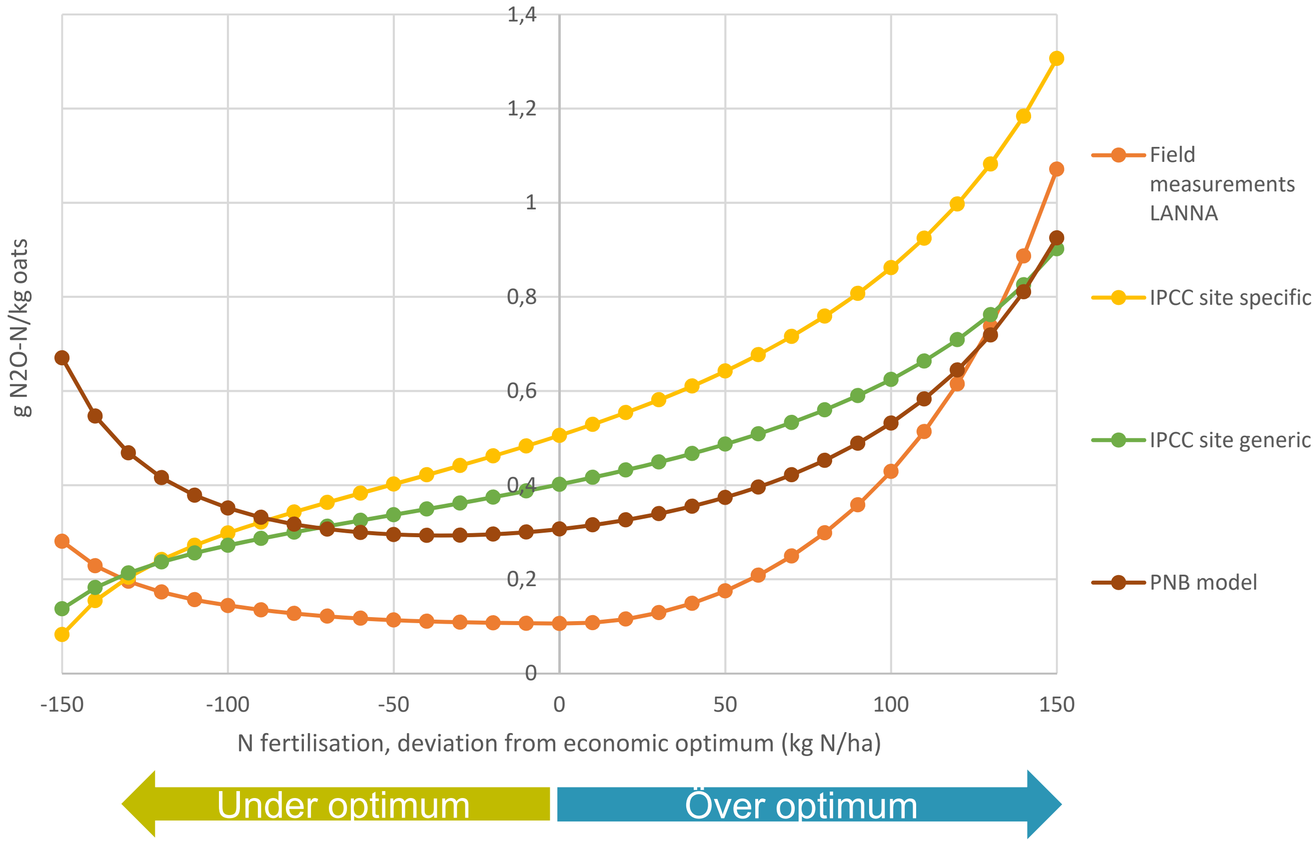
pga mer skörderester

Klimatpåverkan vid inomfältsvarierad gödsling

Klimatpåverkan från direkta lustgasemissioner minskade med 1-10% per hektar

	Base case (N2O based on site specific data)					IPCC model for N2O				PNB model for N2O			
	Yield	Field N2O em.		Tot. climate impact		Field N2O em.		Tot. climate impact		Field N2O em.		Tot. climate impact	
		ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1
Sandjord	Same fertilisation rate												
Symmetric distribution	0.7%	-2.0%	-2.7%	-1.1%	-1.8%	0.1%	-0.5%	-0.1%	-0.8%	-0.2%	-0.9%	-0.4%	-1.0%
Normal distribution	1.3%	-3.9%	-5.1%	-2.1%	-3.3%	0.3%	-1.0%	-0.2%	-1.4%	-0.3%	-1.6%	-0.6%	-1.8%
Nissen et al. A	0.2%	-2.1%	-2.3%	-1.3%	-1.5%	0.0%	-0.2%	-0.2%	-0.4%	0.1%	-0.1%	-0.3%	-0.5%
Söderström	1.0%	-1.0%	-1.9%	-0.5%	-1.4%	0.2%	-0.8%	0.1%	-0.9%	-0.5%	-1.4%	-0.3%	-1.3%
Delin et al	1.6%	-3.2%	-4.7%	-1.7%	-3.2%	0.3%	-1.2%	0.0%	-1.6%	-0.6%	-2.1%	-0.6%	-2.2%
Binomial distribution	2.3%	-6.6%	-8.7%	-3.6%	-5.8%	0.5%	-1.8%	-0.3%	-2.5%	-0.6%	-2.8%	-1.0%	-3.2%
Nissen et al. B	1.1%	-3.3%	-4.3%	-1.8%	-2.8%	0.2%	-0.8%	-0.2%	-1.2%	-0.3%	-1.3%	-0.5%	-1.6%
Imaginary	2.1%	-3.9%	-5.9%	-2.1%	-4.1%	0.4%	-1.6%	-0.1%	-2.1%	0.0%	0.0%	0.0%	0.0%
Lerjord													
Symmetric distribution	0.6%	-3.0%	-3.0%	-1.1%	-1.8%	0.1%	0.1%	0.0%	-0.7%	-0.2%	-0.2%	-0.3%	-1.0%
Normal distribution	1.2%	-5.7%	-6.7%	-2.1%	-3.2%	0.2%	-1.0%	0.0%	-1.2%	-0.4%	-1.6%	-0.4%	-1.6%
Nissen et al. A	0.2%	-3.0%	-3.2%	-1.2%	-1.4%	0.0%	-0.2%	-0.1%	-0.3%	0.1%	-0.1%	-0.2%	-0.4%
Söderström	0.9%	-1.6%	-2.5%	-0.5%	-1.4%	0.1%	-0.7%	0.1%	-0.8%	-0.5%	-1.3%	-0.3%	-1.2%
Delin et al	1.5%	-4.9%	-6.2%	-1.7%	-3.1%	0.2%	-1.2%	0.1%	-1.4%	-0.6%	-2.1%	-0.5%	-1.9%
Binomial distribution	2.1%	-9.9%	-11.7%	-3.7%	-5.7%	0.3%	-1.7%	0.0%	-2.1%	-0.8%	-2.8%	-0.8%	-2.8%
Nissen et al. B	1.0%	-4.9%	-5.8%	-1.8%	-2.8%	0.2%	-0.8%	0.0%	-1.0%	-0.3%	-1.3%	-0.4%	-1.4%
Imaginary	1.9%	-6.4%	-8.1%	-2.3%	-4.1%	0.3%	-1.6%	0.1%	-1.8%	-0.8%	-2.7%	-0.6%	-2.5%

Resultat- olika metoder för att uppskatta N2O



10 kg lägre kvävegiva med bibehållen skörd

	Base case (N2O based on site specific data)					IPCC model for N2O				PNB model for N2O			
	Yield	Field N2O em.		Tot. climate impact		Field N2O em.		Tot. climate impact		Field N2O em.		Tot. climate impact	
		ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1	ha-1	kg-1
Sandjord	Same fertilisation rate												
Symmetric distribution	0.7%	-2.0%	-2.7%	-1.1%	-1.8%	0.1%	-0.5%	-0.1%	-0.8%	-0.2%	-0.9%	-0.4%	-1.0%
Normal distribution	1.3%	-3.9%	-5.1%	-2.1%	-3.3%	0.3%	-1.0%	-0.2%	-1.4%	-0.3%	-1.6%	-0.6%	-1.8%
Nissen et al. A	0.2%	-2.1%	-2.3%	-1.3%	-1.5%	0.0%	-0.2%	-0.2%	-0.4%	0.1%	-0.1%	-0.3%	-0.5%
Söderström	1.0%	-1.0%	-1.9%	-0.5%	-1.4%	0.2%	-0.8%	0.1%	-0.9%	-0.5%	-1.4%	-0.3%	-1.3%
Delin et al	1.6%	-3.2%	-4.7%	-1.7%	-3.2%	0.3%	-1.2%	0.0%	-1.6%	-0.6%	-2.1%	-0.6%	-2.2%
Binomial distribution	2.3%	-6.6%	-8.7%	-3.6%	-5.8%	0.5%	-1.8%	-0.3%	-2.5%	-0.6%	-2.8%	-1.0%	-3.2%
Nissen et al. B	1.1%	-3.3%	-4.3%	-1.8%	-2.8%	0.2%	-0.8%	-0.2%	-1.2%	-0.3%	-1.3%	-0.5%	-1.6%
Imaginary	2.1%	-3.9%	-5.9%	-2.1%	-4.1%	0.4%	-1.6%	-0.1%	-2.1%	0.0%	0.0%	0.0%	0.0%
Lerjord													
Symmetric distribution	0.6%	-3.0%	-3.0%	-1.1%	-1.8%	0.1%	0.1%	0.0%	-0.7%	-0.2%	-0.2%	-0.3%	-1.0%
Normal distribution	1.2%	-5.7%	-6.7%	-2.1%	-3.2%	0.2%	-1.0%	0.0%	-1.2%	-0.4%	-1.6%	-0.4%	-1.6%
Nissen et al. A	0.2%	-3.0%	-3.2%	-1.2%	-1.4%	0.0%	-0.2%	-0.1%	-0.3%	0.1%	-0.1%	-0.2%	-0.4%
Söderström	0.9%	-1.6%	-2.5%	-0.5%	-1.4%	0.1%	-0.7%	0.1%	-0.8%	-0.5%	-1.3%	-0.3%	-1.2%
Delin et al	1.5%	-4.9%	-6.2%	-1.7%	-3.1%	0.2%	-1.2%	0.1%	-1.4%	-0.6%	-2.1%	-0.5%	-1.9%
Binomial distribution	2.1%	-9.9%	-11.7%	-3.7%	-5.7%	0.3%	-1.7%	0.0%	-2.1%	-0.8%	-2.8%	-0.8%	-2.8%
Nissen et al. B	1.0%	-4.9%	-5.8%	-1.8%	-2.8%	0.2%	-0.8%	0.0%	-1.0%	-0.3%	-1.3%	-0.4%	-1.4%
Imaginary	1.9%	-6.4%	-8.1%	-2.3%	-4.1%	0.3%	-1.6%	0.1%	-1.8%	-0.8%	-2.7%	-0.6%	-2.5%
Sandjord	Higher fertilisation rate in reference												
Symmetric distribution	-0.1%	-5.8%	-6.4%	-5.8%	-6.4%	-6.7%	-7.4%	-6.4%	-7.0%	-3.7%	-4.3%	-4.7%	-5.3%
Normal distribution	0.4%	-8.3%	-8.6%	-8.3%	-8.7%	-6.6%	-7.0%	-7.3%	-7.7%	-3.8%	-3.8%	-6.0%	-6.0%
Nissen et al. A	-0.5%	-2.1%	-1.5%	-6.2%	-5.7%	-7.9%	-7.4%	-8.2%	-7.7%	-4.3%	-4.3%	-6.4%	-6.4%
Söderström	0.0%	-4.4%	-4.4%	-5.6%	-3.5%	-5.2%	-5.2%	-5.6%	-4.4%	-2.9%	-2.9%	-4.5%	-2.9%
Delin et al	0.6%	-7.8%	-8.3%	-7.3%	-7.9%	-5.3%	-6.0%	-6.0%	-6.6%	-3.2%	-3.2%	-5.0%	-5.0%
Binomial distribution	1.4%	-12.2%	-13.4%	-10.3%	-11.6%	-6.5%	-7.8%	-7.4%	-8.7%	-4.1%	-4.1%	-6.4%	-6.4%
Nissen et al. B	0.2%	-7.8%	-8.0%	-8.2%	-8.4%	-6.8%	-7.0%	-7.4%	-7.6%	-3.8%	-3.8%	-6.0%	-6.0%
Imaginary	1.1%	-8.3%	-9.3%	-7.6%	-8.7%	-5.1%	-6.2%	-5.9%	-7.0%	-3.2%	-3.2%	-5.1%	-5.1%
Lerjord													
Symmetric distribution	-0.1%	-16.8%	-16.8%	-10.4%	-11.0%	-5.3%	-5.3%	-6.0%	-6.6%	-3.9%	-3.9%	-5.5%	-6.2%
Normal distribution	0.4%	-11.3%	-11.7%	-8.2%	-8.6%	-5.2%	-5.6%	-5.8%	-6.2%	-4.1%	-4.1%	-5.4%	-5.4%
Nissen et al. A	-0.4%	-7.5%	-7.1%	-7.7%	-7.3%	-6.4%	-5.9%	-6.8%	-6.4%	-4.6%	-4.6%	-6.0%	-6.0%
Söderström	0.1%	-6.2%	-6.3%	-5.5%	-3.4%	-4.1%	-4.1%	-4.5%	-3.5%	-3.1%	-3.1%	-4.1%	-2.6%
Delin et al	0.6%	-10.7%	-11.3%	-7.2%	-7.8%	-4.4%	-5.0%	-4.9%	-5.5%	-3.5%	-3.5%	-4.5%	-4.5%
Binomial distribution	1.3%	-16.8%	-17.9%	-10.4%	-11.6%	-5.1%	-6.3%	-5.9%	-7.1%	-4.6%	-4.6%	-5.8%	-5.8%
Nissen et al. B	0.3%	-10.8%	-11.0%	-8.1%	-8.3%	-5.3%	-5.6%	-5.9%	-6.1%	-4.1%	-4.1%	-5.4%	-5.4%
Imaginary	1.0%	-11.9%	-12.9%	-7.8%	-8.8%	-4.0%	-5.0%	-4.7%	-5.7%	-3.7%	-3.7%	-4.8%	-4.8%

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https://mistrafoodfutures.se/sv/reports/


MISTRA FOOD FUTURES

Precision nitrogen application – potential to lower the climate impact of crop production

Hanna Karlsson Potter, Sofia Delin, Lena Engström, Bo Stenberg, Per-Anders Hansson

Mistra Food Futures Report #9
2022