

Over efficiëntie in de plantaardige productie

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Wageningen University



Resource use efficiency

- kg product per kg input (kg N, kg pesticide, etc.)
- kg product per unit resource (hour labour, hectare, etc.)
- products, inputs and resources can also be expressed in monetary values



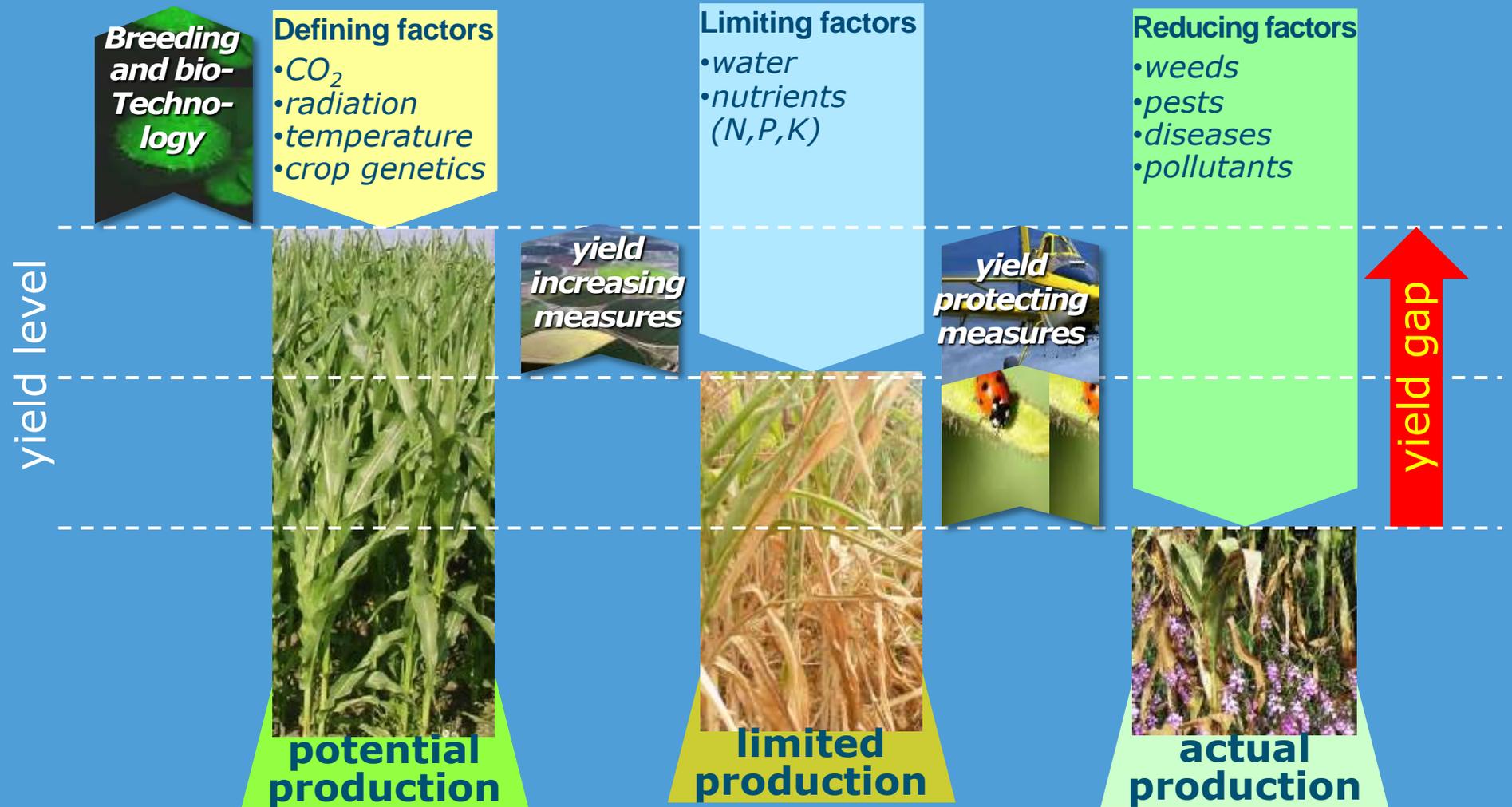
Resource Use Efficiency in Agriculture

C. T. de Wit

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P.O. Box 430, 6700 AK Wageningen, The Netherlands

- *Accordingly, no production resource is used less efficiently and most production resources are used more efficiently with increasing yield level due to further optimizing of growing conditions*
- *Therefore strategic research that is to serve both agriculture and its environment should not be so much directed towards the search for marginal returns of variable resources, as towards the search for the minimum of each production resource that is needed to allow maximum utilization of all other resources*

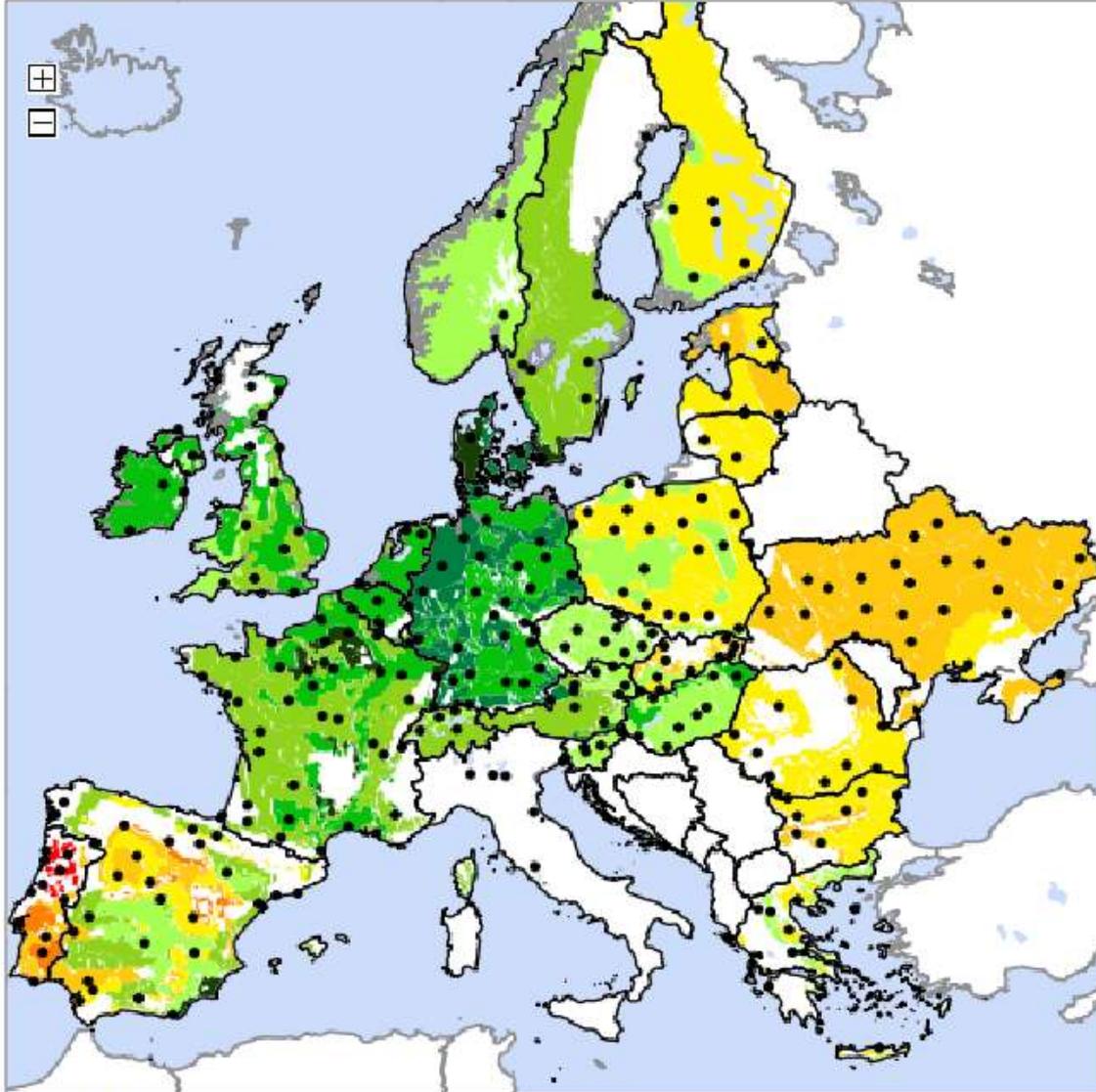
Production-ecological principles & practice





Rainfed wheat

Yields | Map layers



Select crop :

Rainfed wheat

Select aggregation level:

Climate zones

Select yield indicator:

- Relative yield: $Y_a / Y_w \times 100\%$

Select variable:

Mean value

Apply SPAM2005 crop mask: No Yes

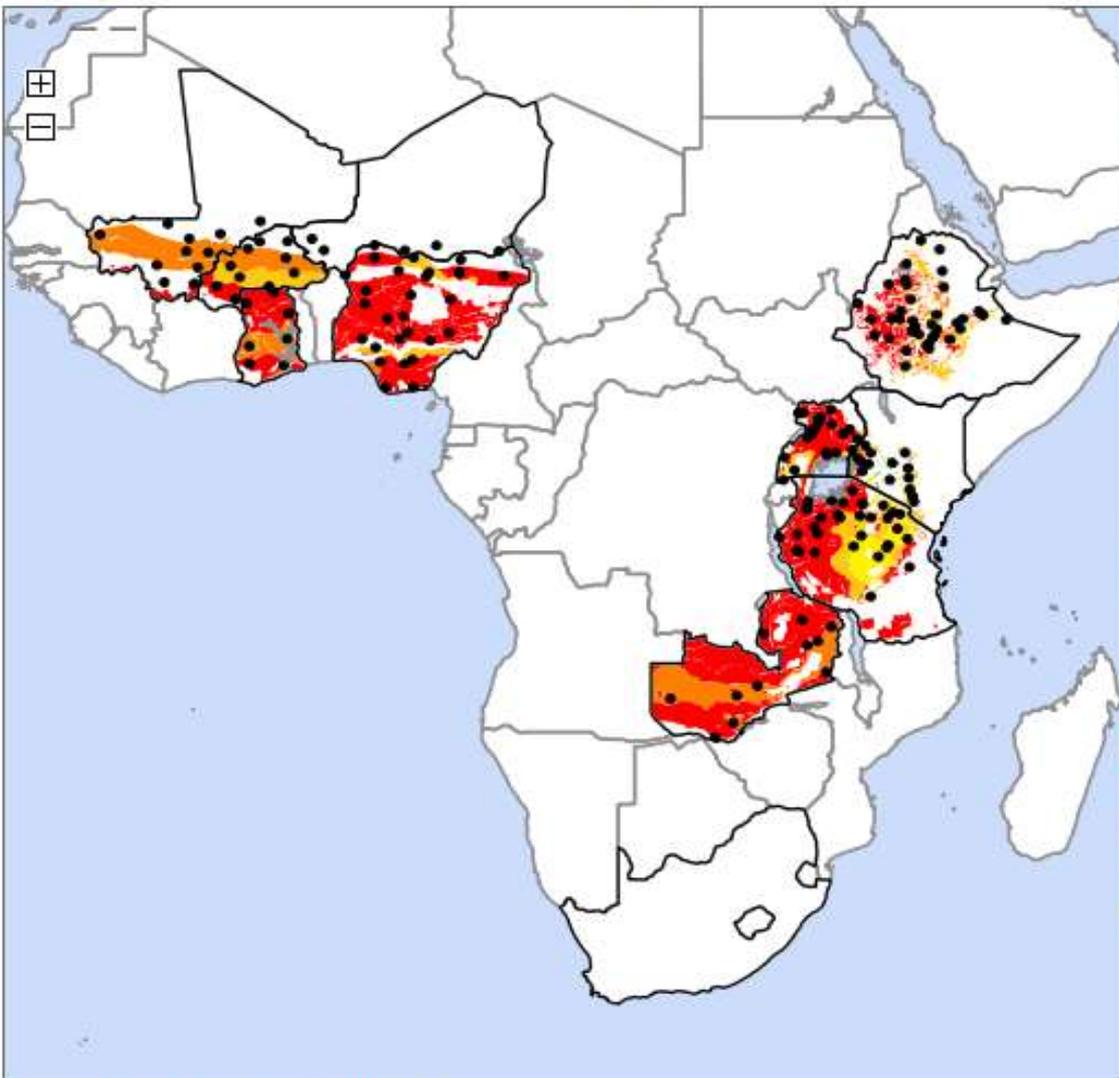
Legend: all classes current classes

%		%	
	up to 10 %		50 % - 60 %
	10 % - 20 %		60 % - 70 %
	20 % - 30 %		70 % - 80 %
	30 % - 40 %		80 % - 90 %
	40 % - 50 %		more than 90 %

To view data details: Click on the map.



Rainfed maize



Yields | Map layers

Select crop :
 Rainfed maize

Select aggregation level:
 Climate zones

Select yield indicator:
 - Relative yield: $Y_a / Y_w \times 100\%$

Select variable:
 Mean value

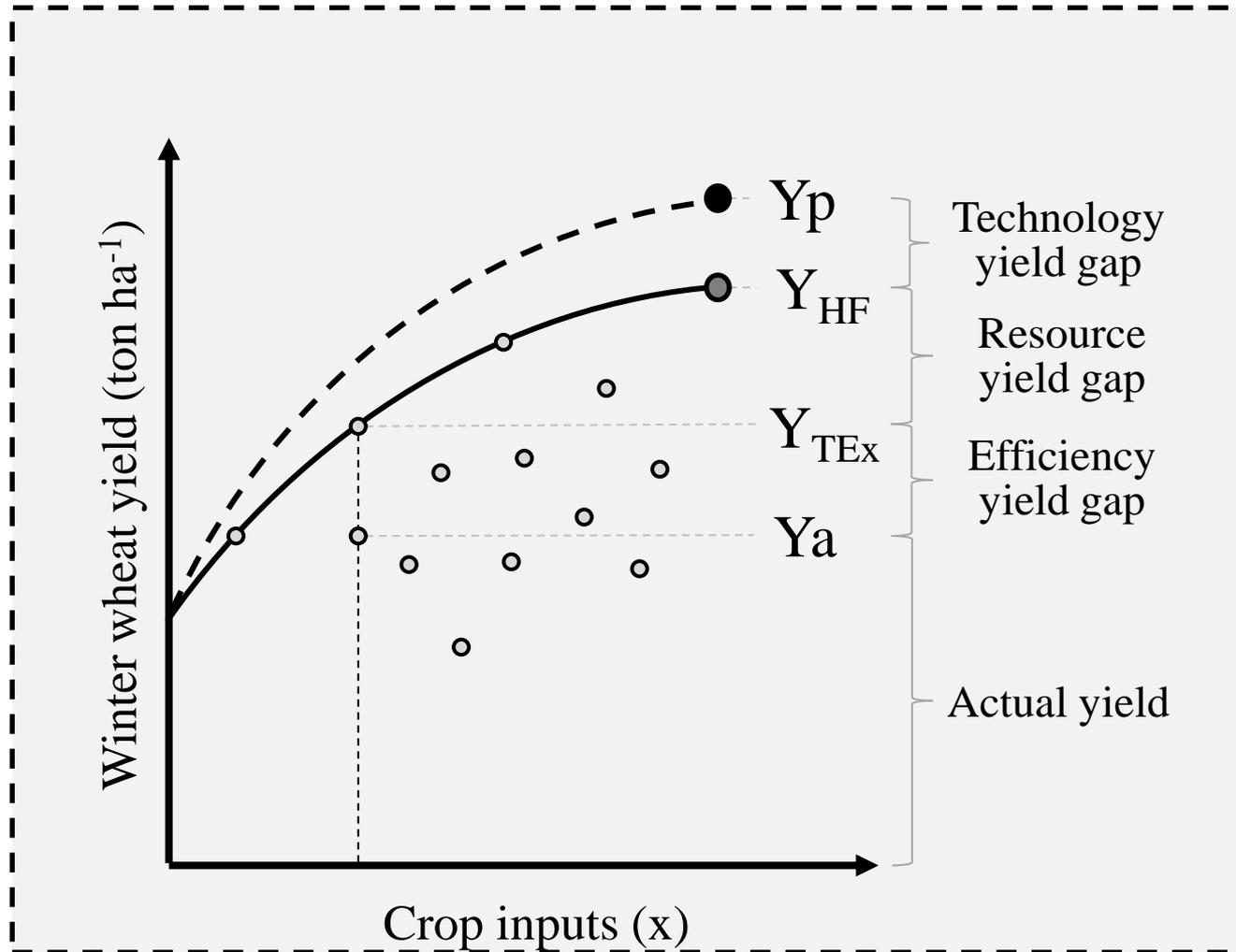
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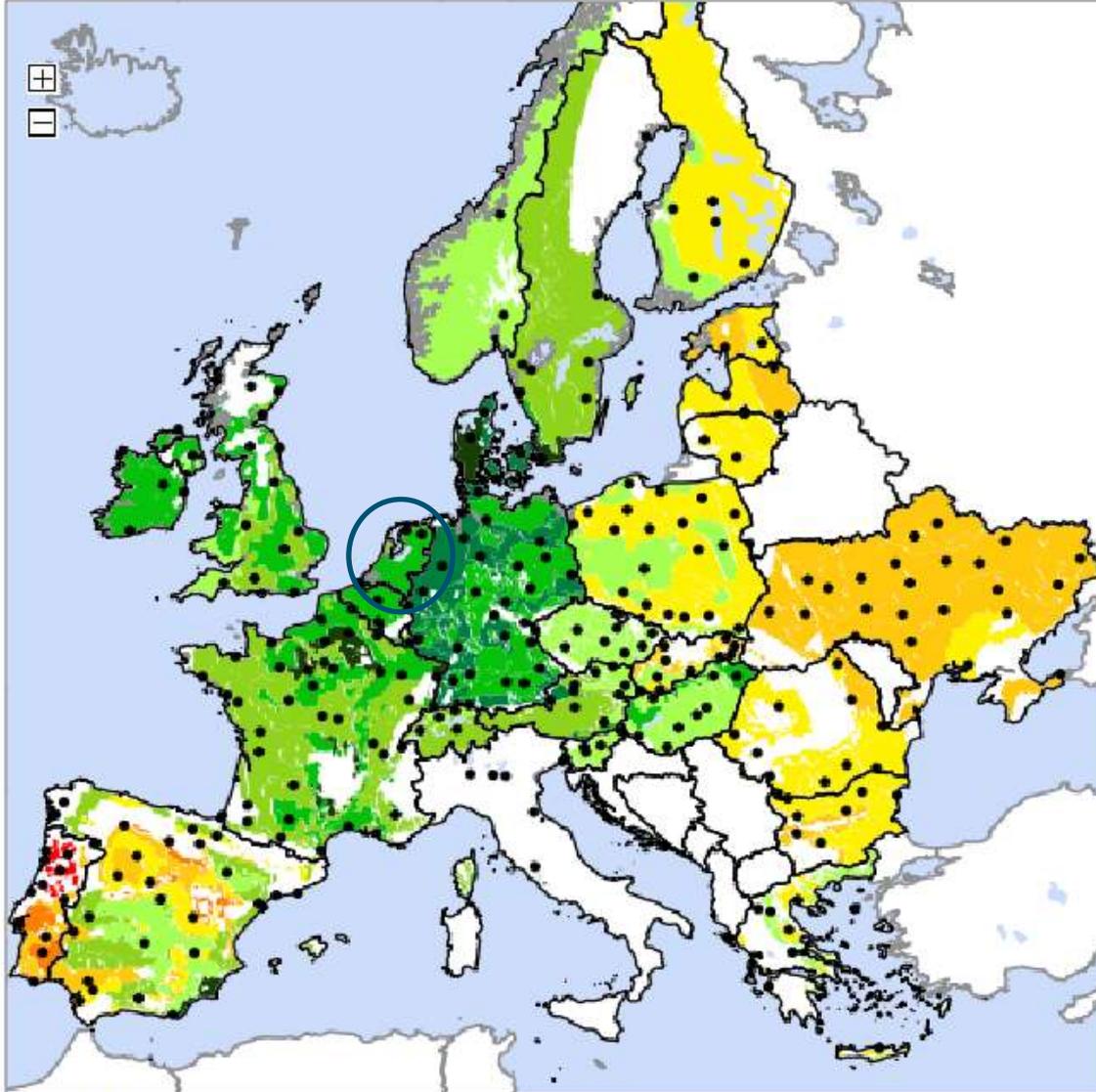
Decomposing the yield gap





Rainfed wheat

Yields | Map layers



Select crop :

Rainfed wheat

Select aggregation level:

Climate zones

Select yield indicator:

- Relative yield: $Y_a / Y_w \times 100\%$

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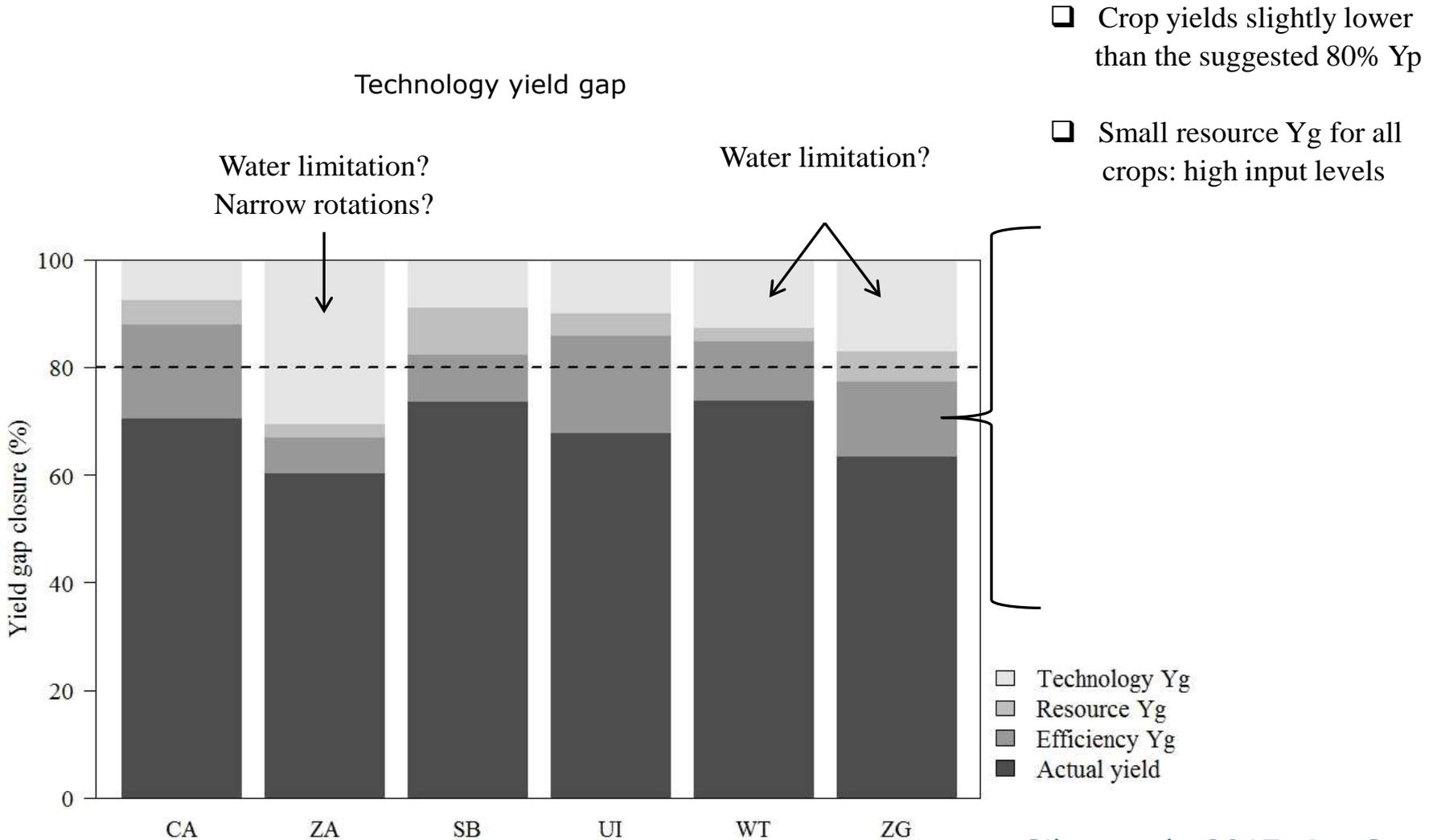
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Legend: all classes current classes

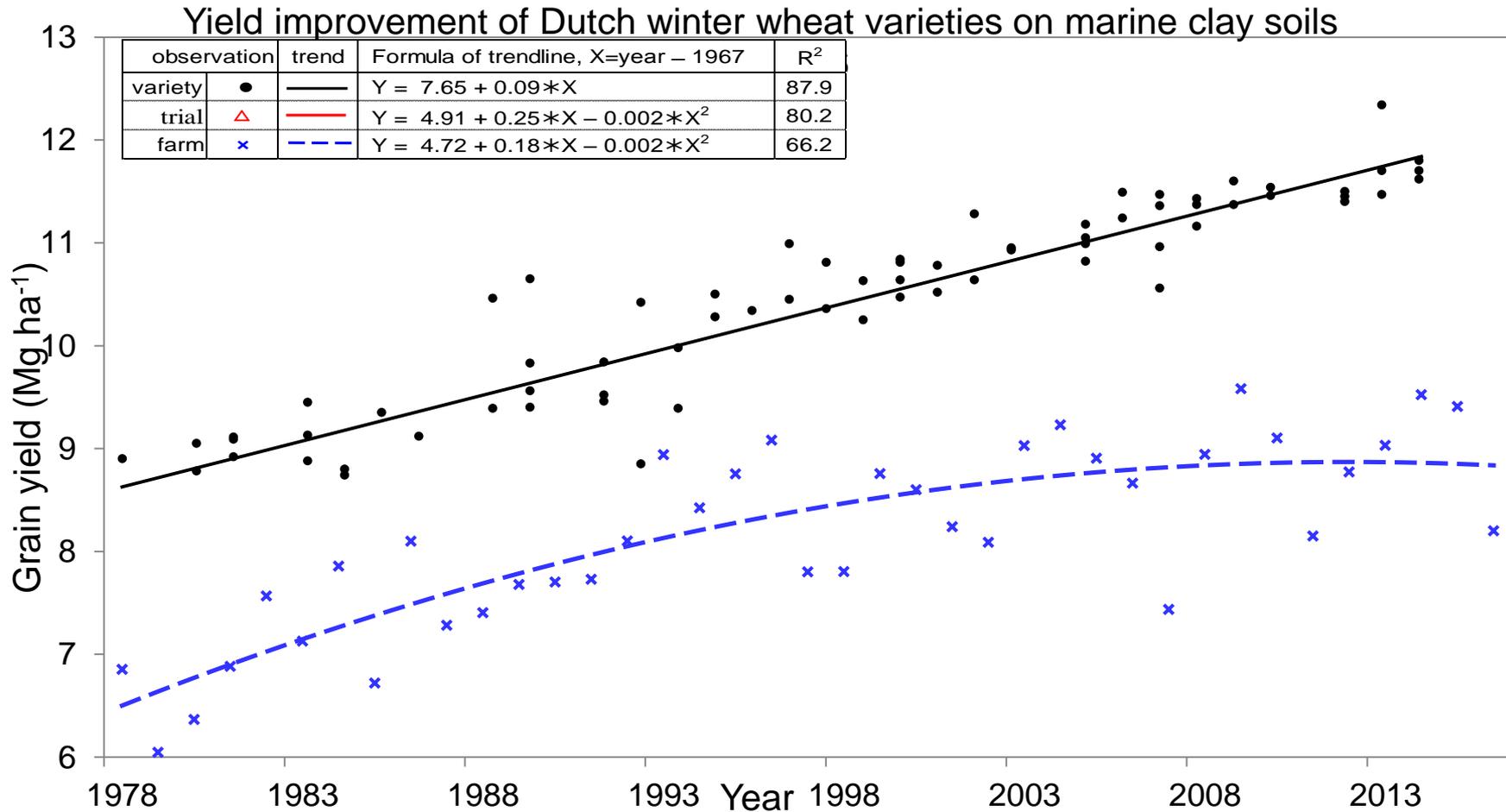
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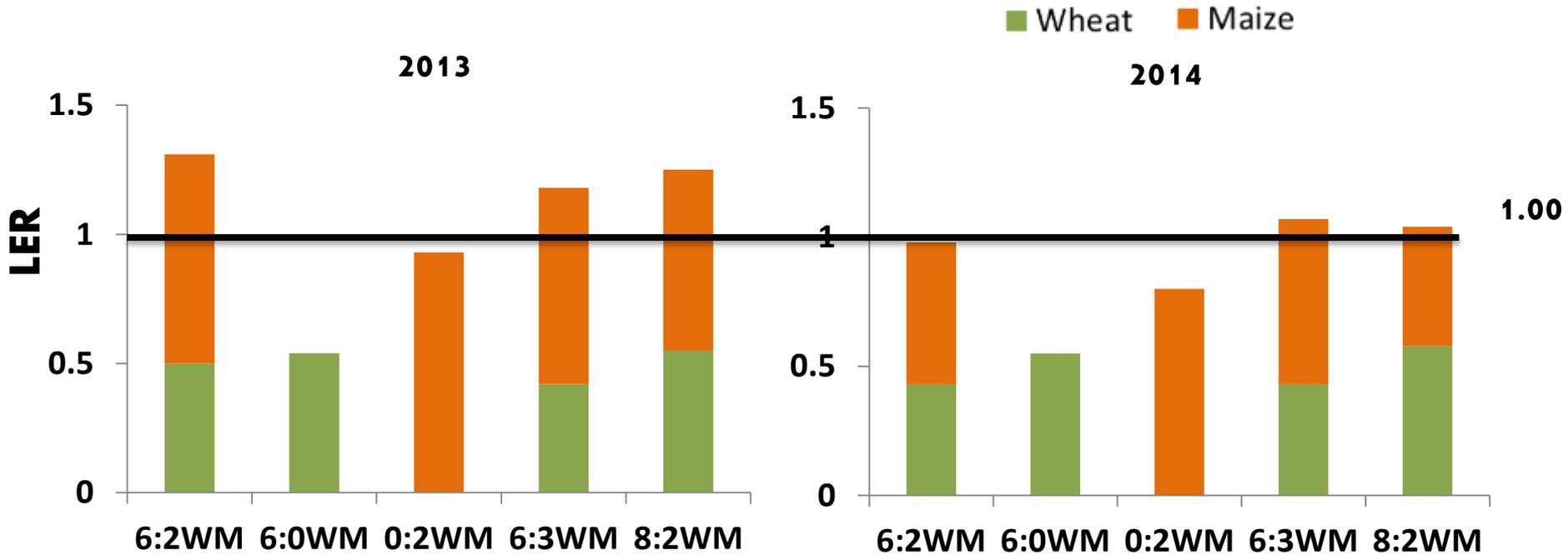
Magnitude of yield gaps for major arable crops in NLs



Genetic progress



Intercropping



Fang et al., Eur. J. Agron., 2016





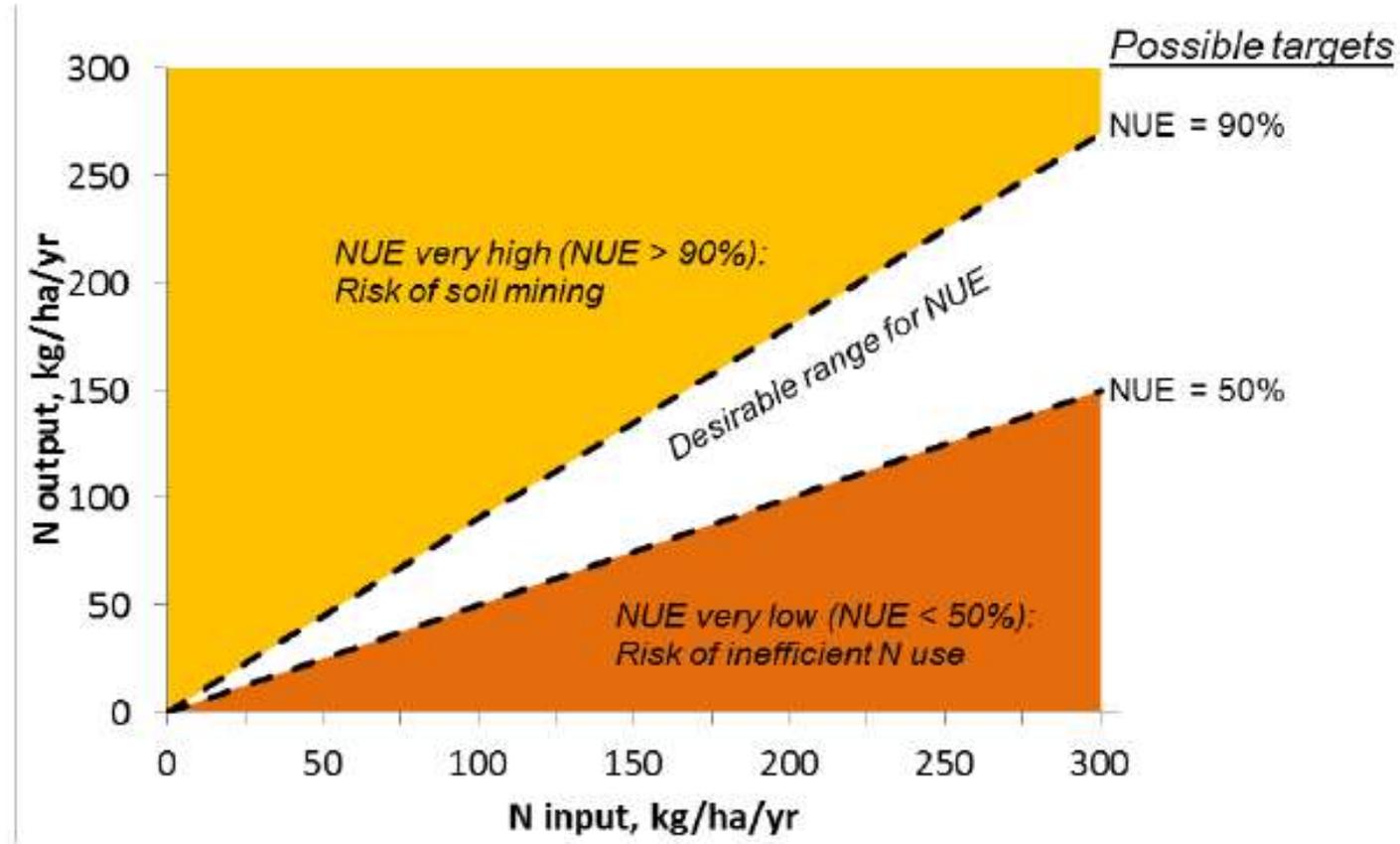
Minimizing the ecological footprint of food: closing yield and efficiency gaps simultaneously?

Meine van Noordwijk^{1,2} and Lijbert Brussaard³

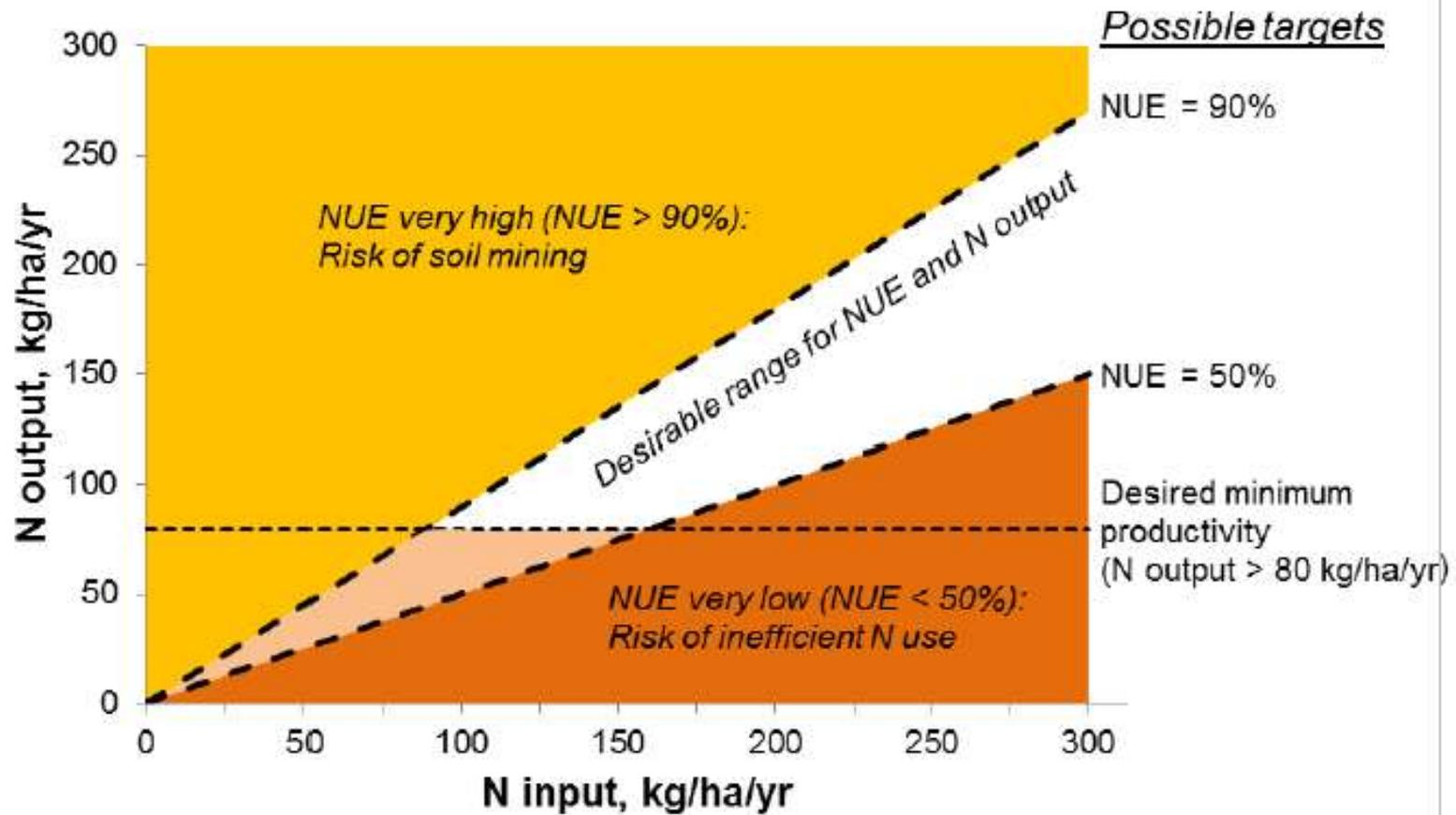


- Efficiencies are scale-dependent (see presentation Imke de Boer)
- Footprint: kg product per unit emission or natural resource
- *"Efficiency gaps, next to yield gaps, result in environmental impacts per unit area that are higher than desirable"*
- Global *and* local focus

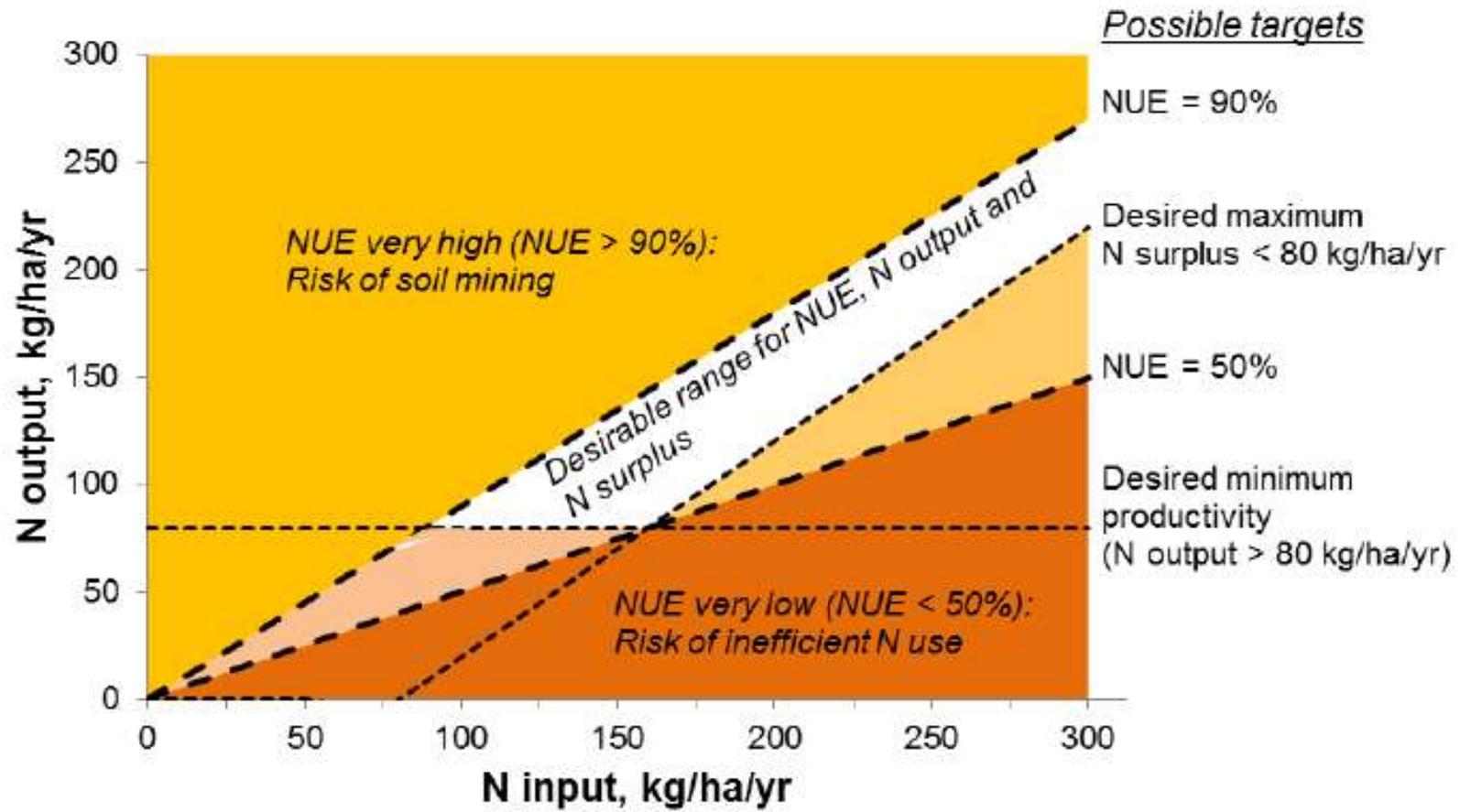
A graphical presentation, in three steps: (i) NUE



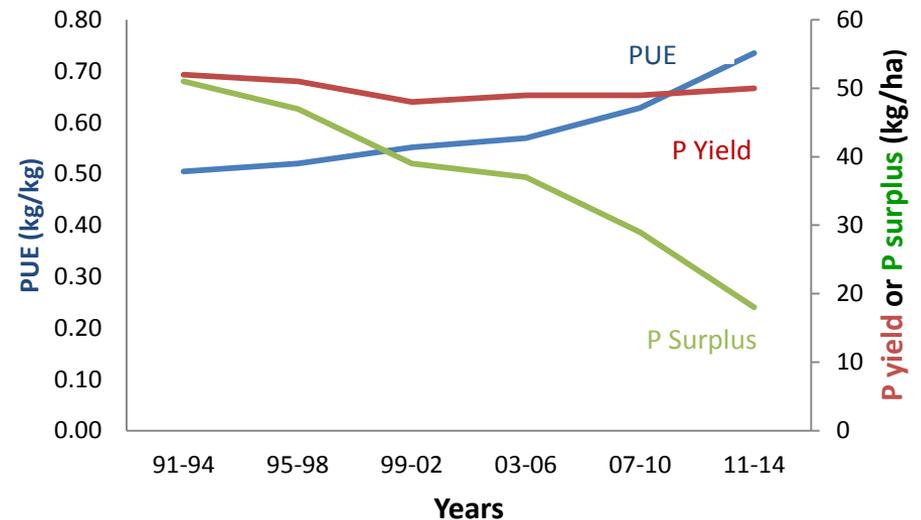
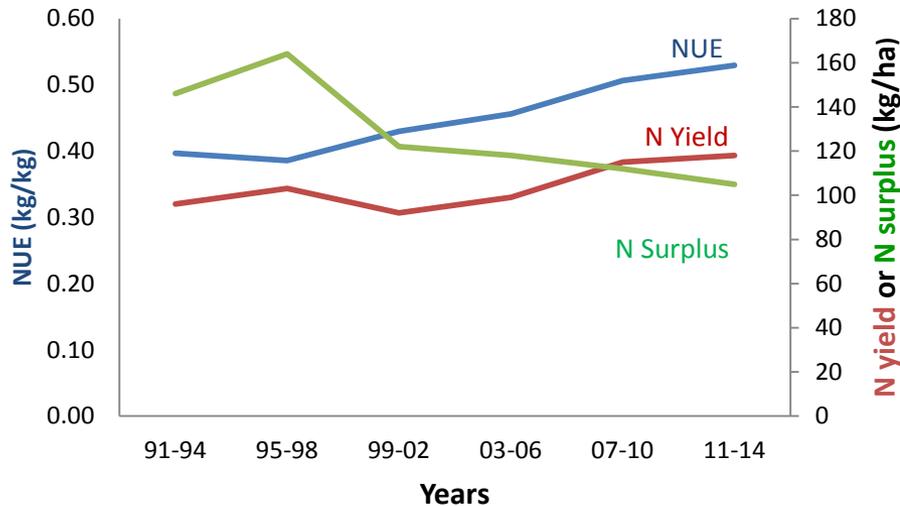
A graphical presentation, in three steps: (ii) N output



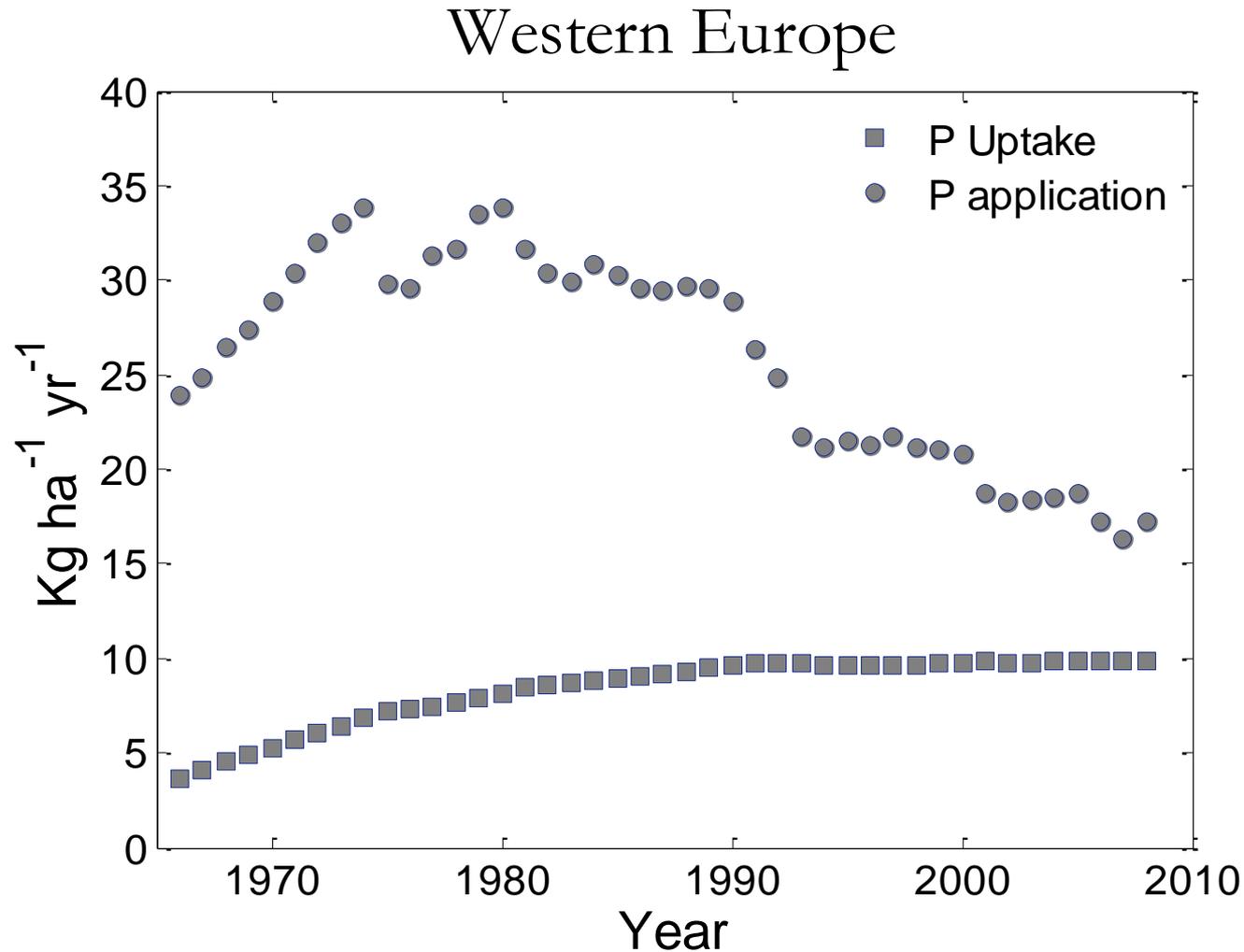
A graphical presentation, in three steps: (iii) N surplus



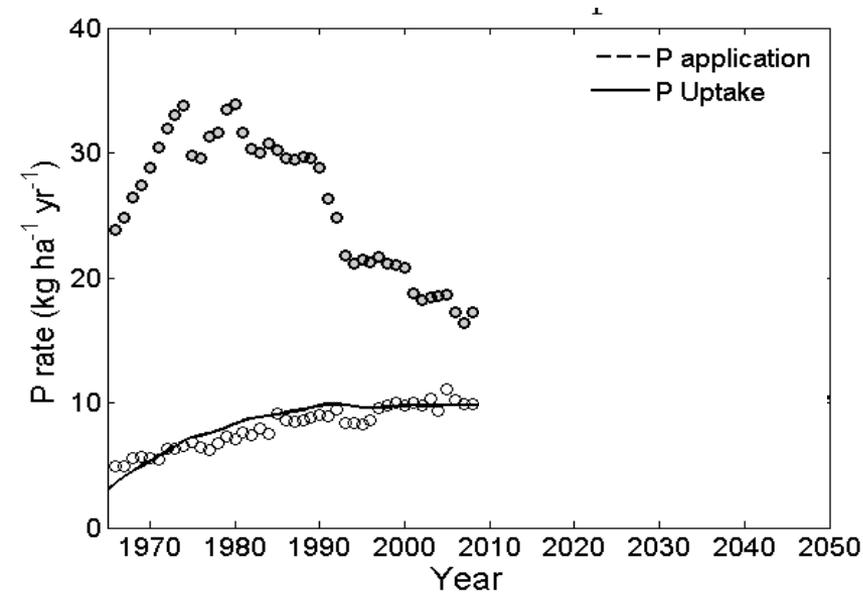
Yield – Use efficiency - Surplus



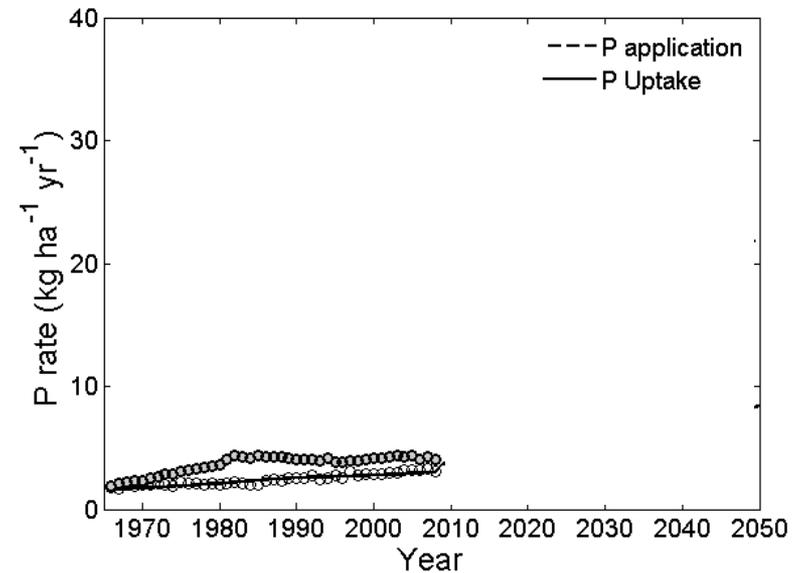
P application and P uptake



Regional differences



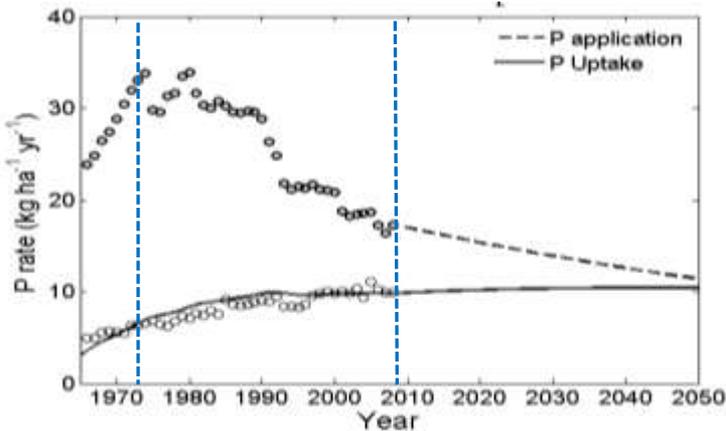
Western Europe



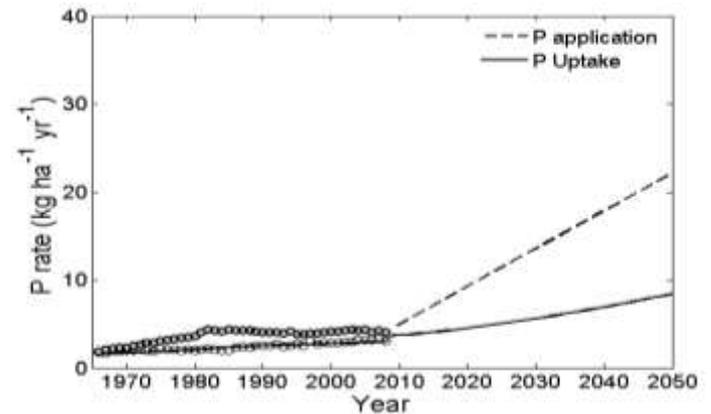
Africa

A learning curve!

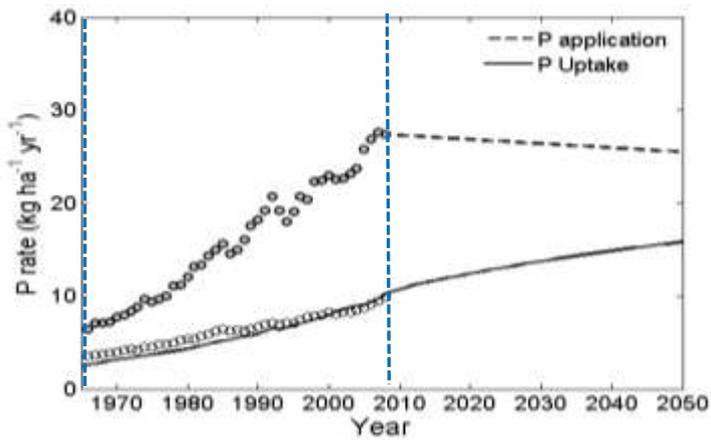
W-Europe



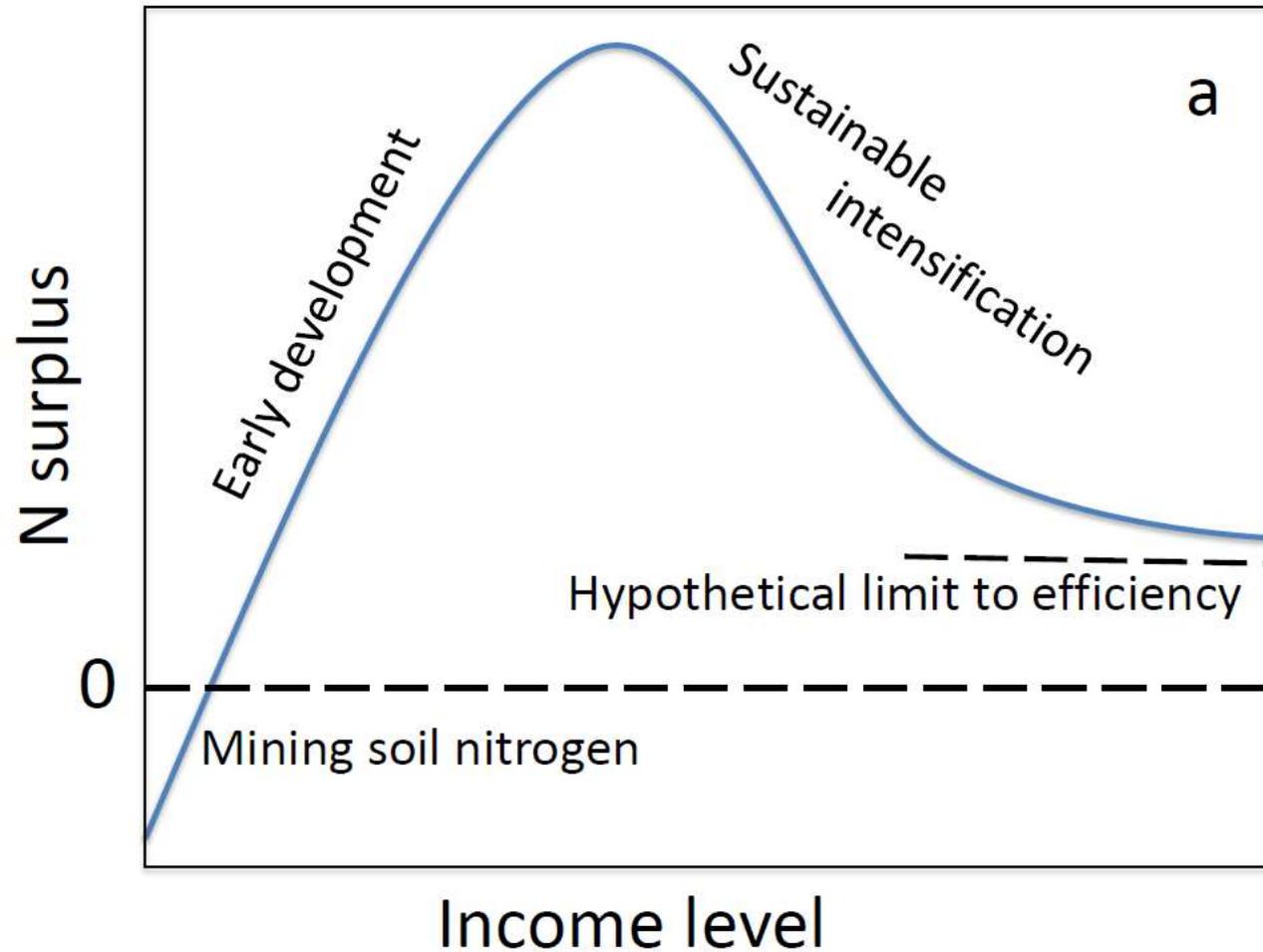
Africa



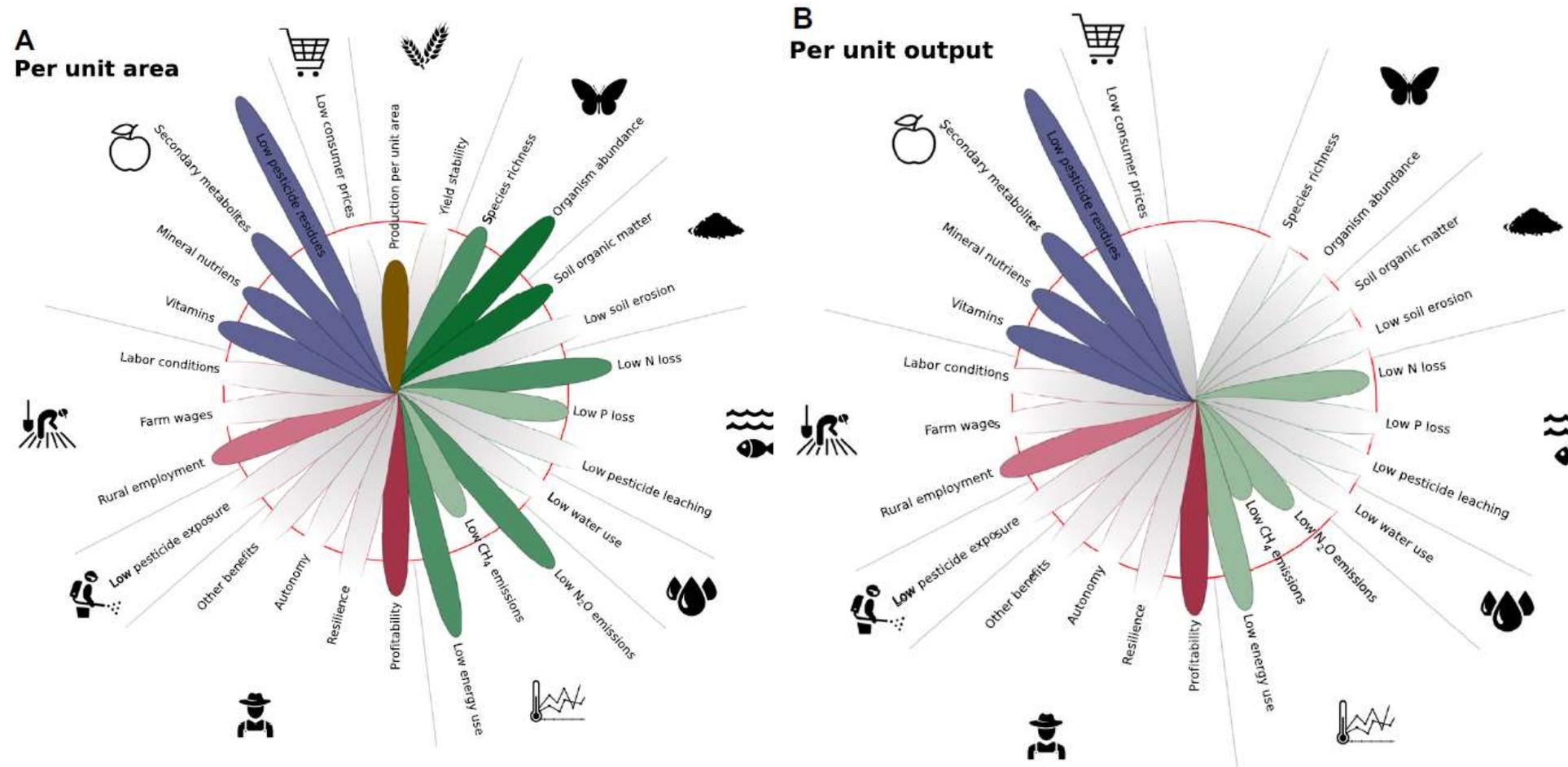
Asia



Intensification or Ecologisation?



Organic vs Mainstream agriculture



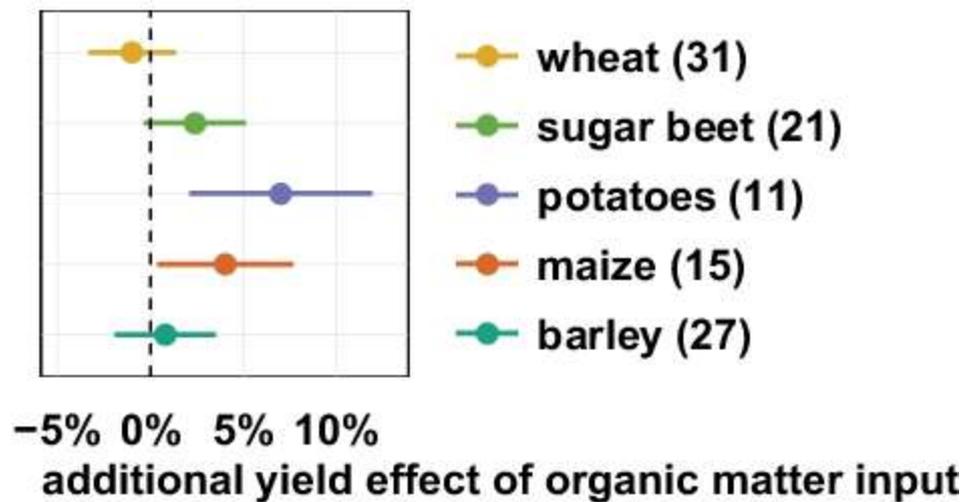
How to ecologise

- Consider objectives, trade-off and re-design at different levels
- Diversify rotations
- Precision management in time and space (e.g. 4 Rs)
- Using organic inputs – organic matter and circularity
- Integrated pest management

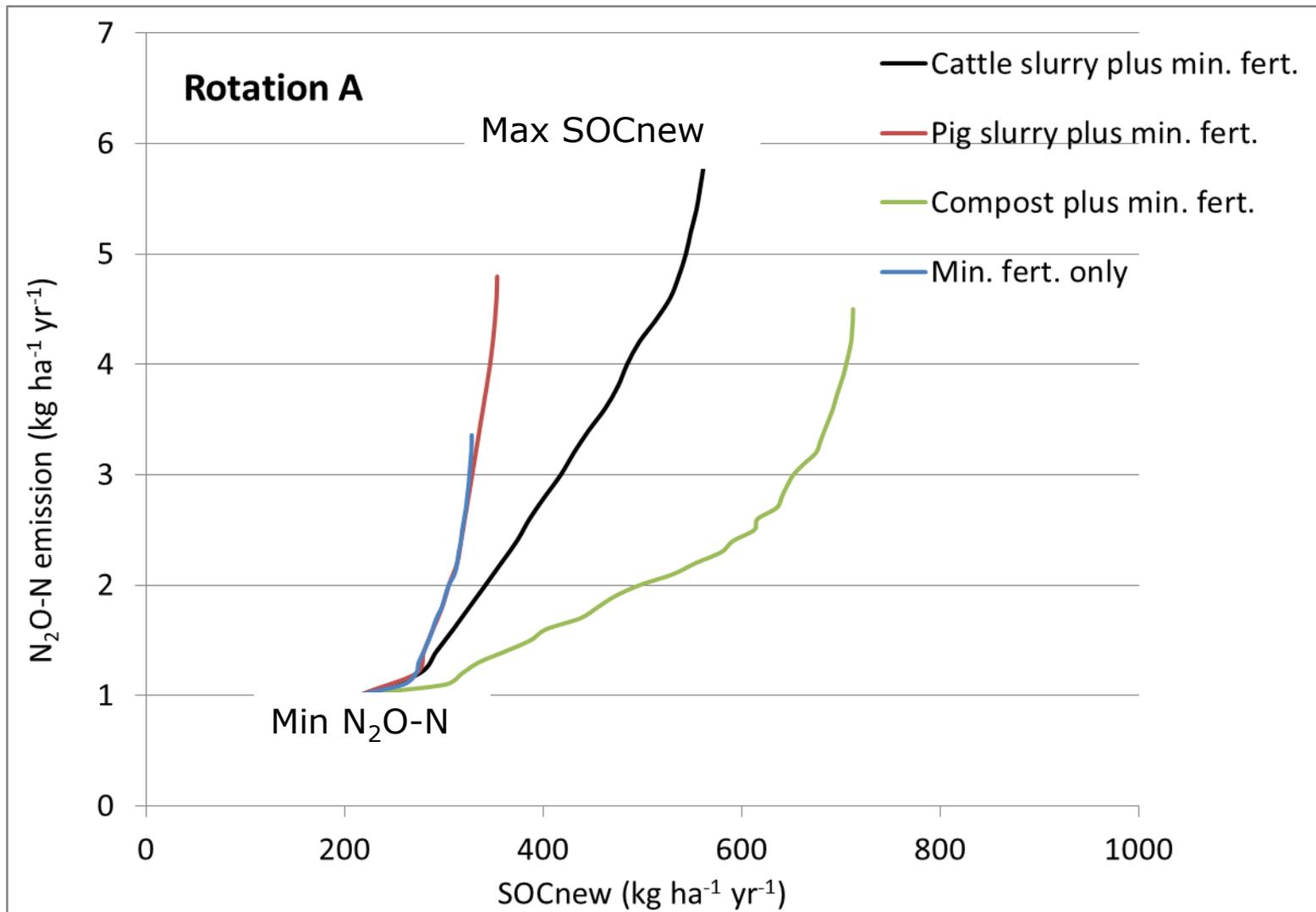
Adding organic (fertilizer) inputs

- Meta-analysis of long-term experiments in Europe:
 - If macro nutrients (NPK) are in ample supply:
 - Mean additional yield effect of organic inputs is not significant ($+1.4\% \pm 1.6$)
- But...

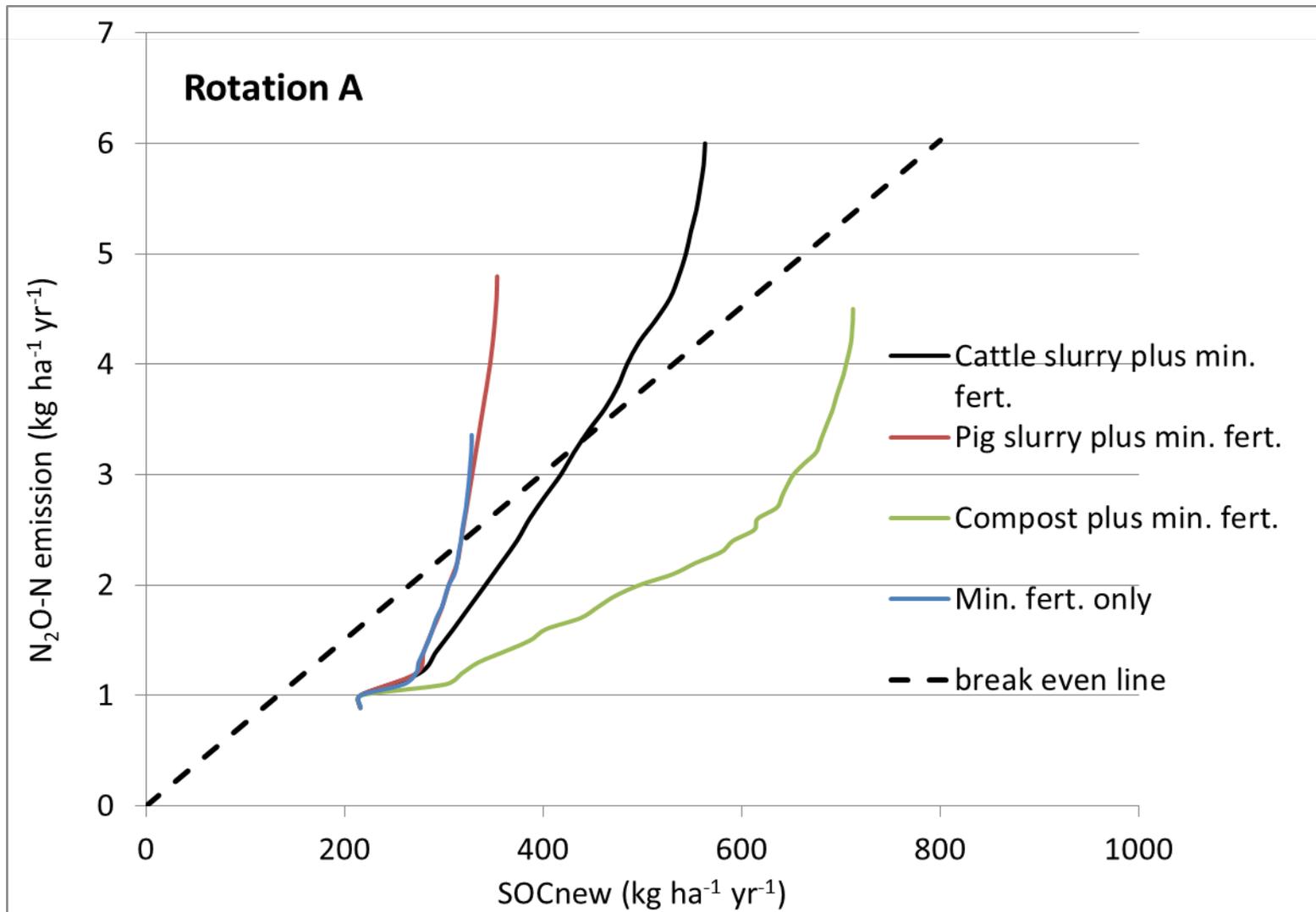
Results – per crop type



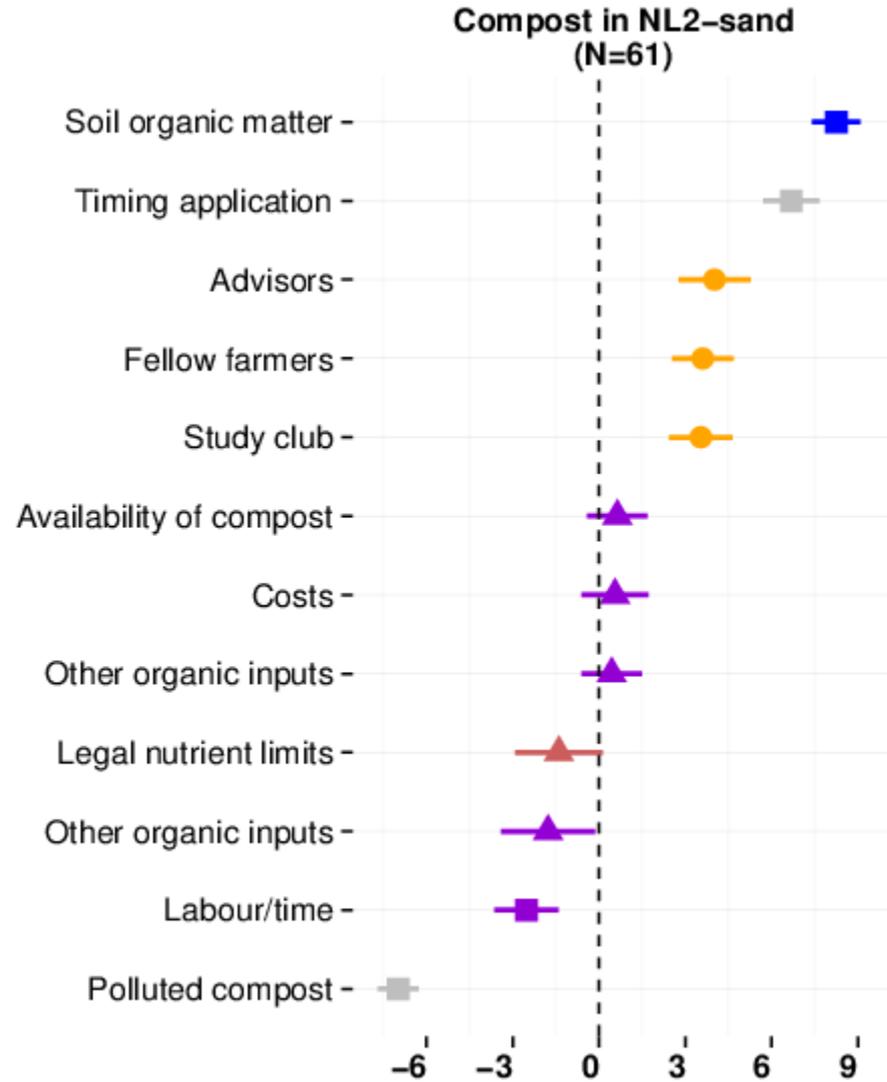
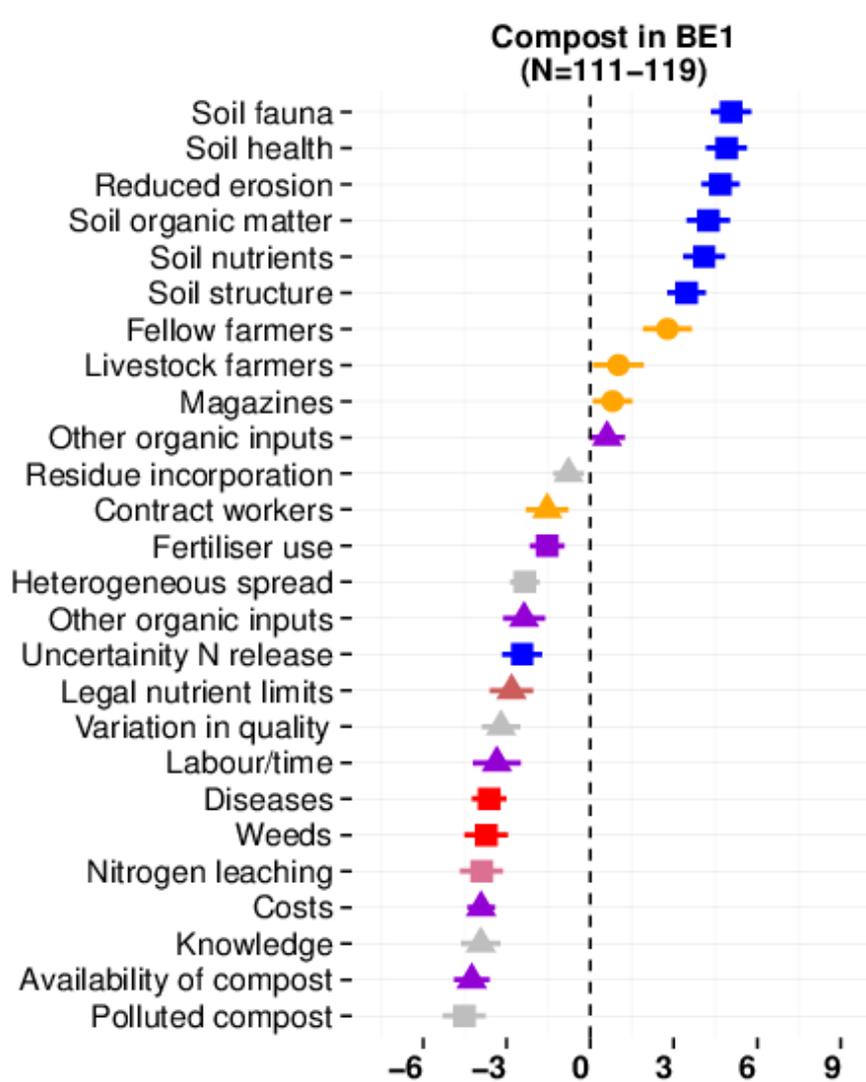
Expect trade-off....



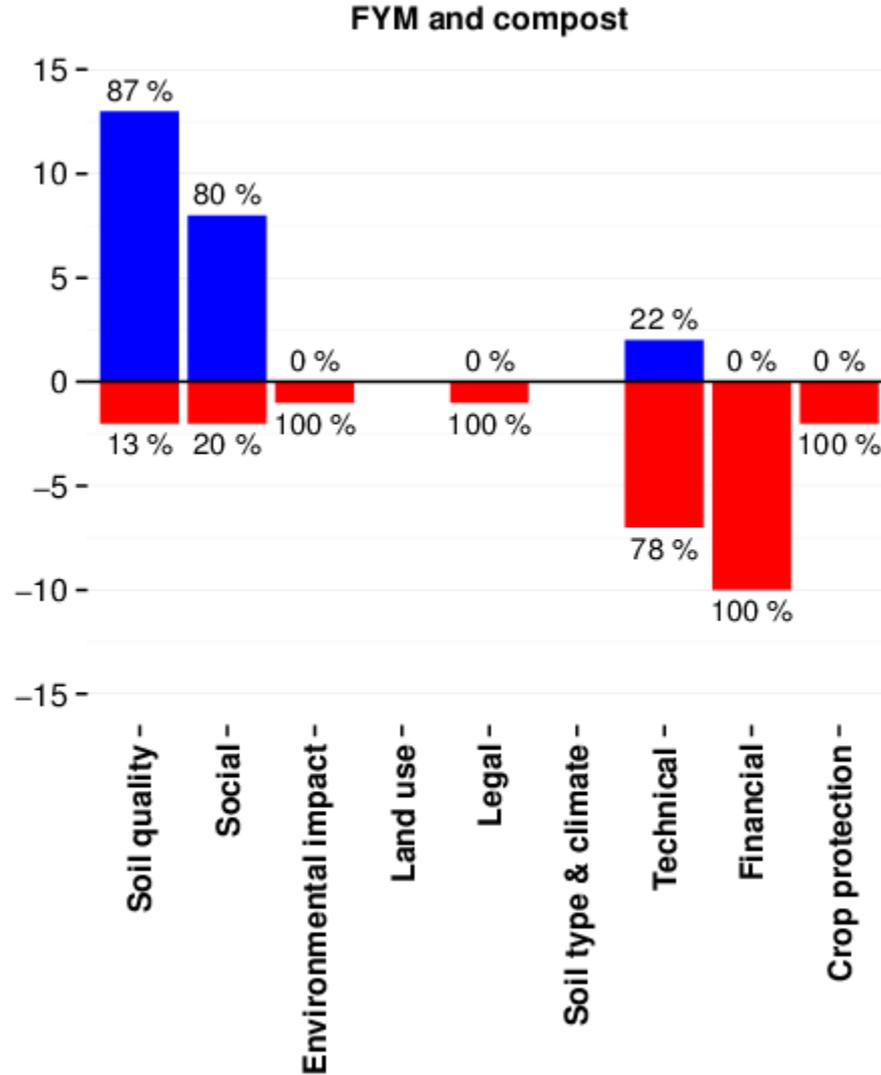
Expect trade-off....



Drivers and barriers - compost



Drivers and barriers - farmyard manure & compost

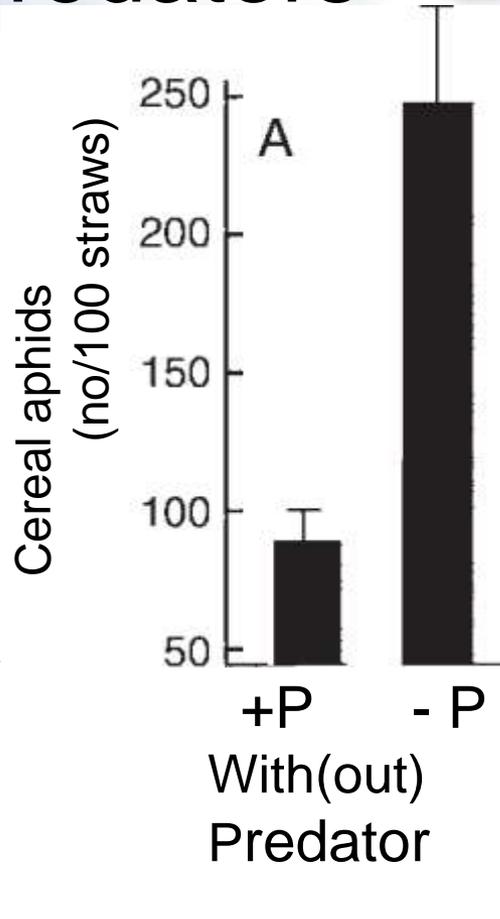


Hijbeek et al., 2017

Plant protection with naturally occurring predators



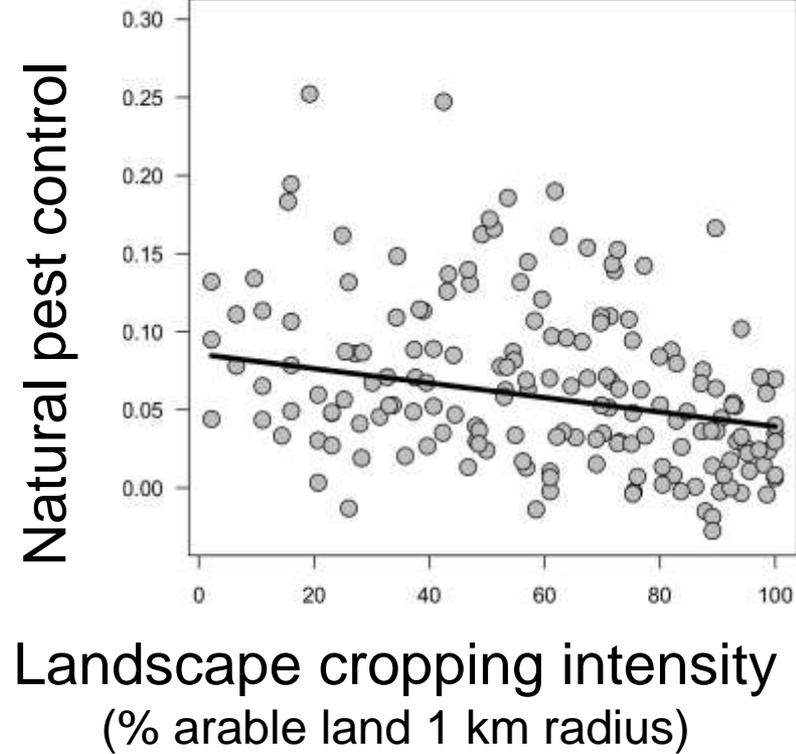
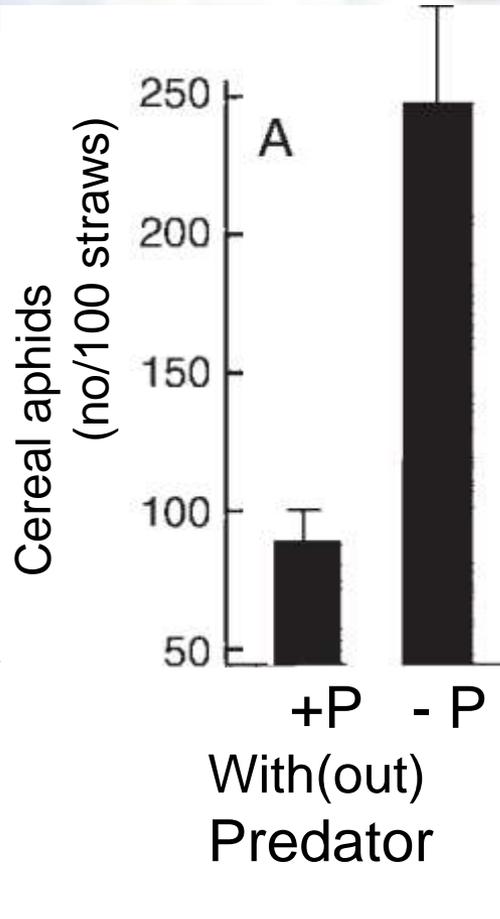
Plant protection with naturally occurring predators



Thies et al 2011 Ecol Appl



Insect communities - pest control



Concluderend

- Hoge opbrengsten en efficiënties kunnen goed samengaan, maar
- De kunst is (ook) goede balans te vinden met emissies per hectare
- We boeken (nog steeds) vooruitgang
- Nadruk op intensiveren of ecologiseren afhankelijk van waar we zijn op de wereld
- Gebruik van organic inputs:
 - Geen wondermiddel
 - Niet zonder trade-off
 - Meer aandacht voor 'drivers & barriers' boeren
- Effect op veerkracht onzeker

Future harvest

Dank voor uw aandacht

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