



Perennial weeds in a crop rotation perspective

Ilse A. Rasmussen

Dept. of Integrated Crop Protection
Danish Institute of Agricultural Sciences
Research Centre Flakkebjerg



20 cm

40 cm

60 cm

Elymus repens

Sonchus arvensis

Tussilago farfara

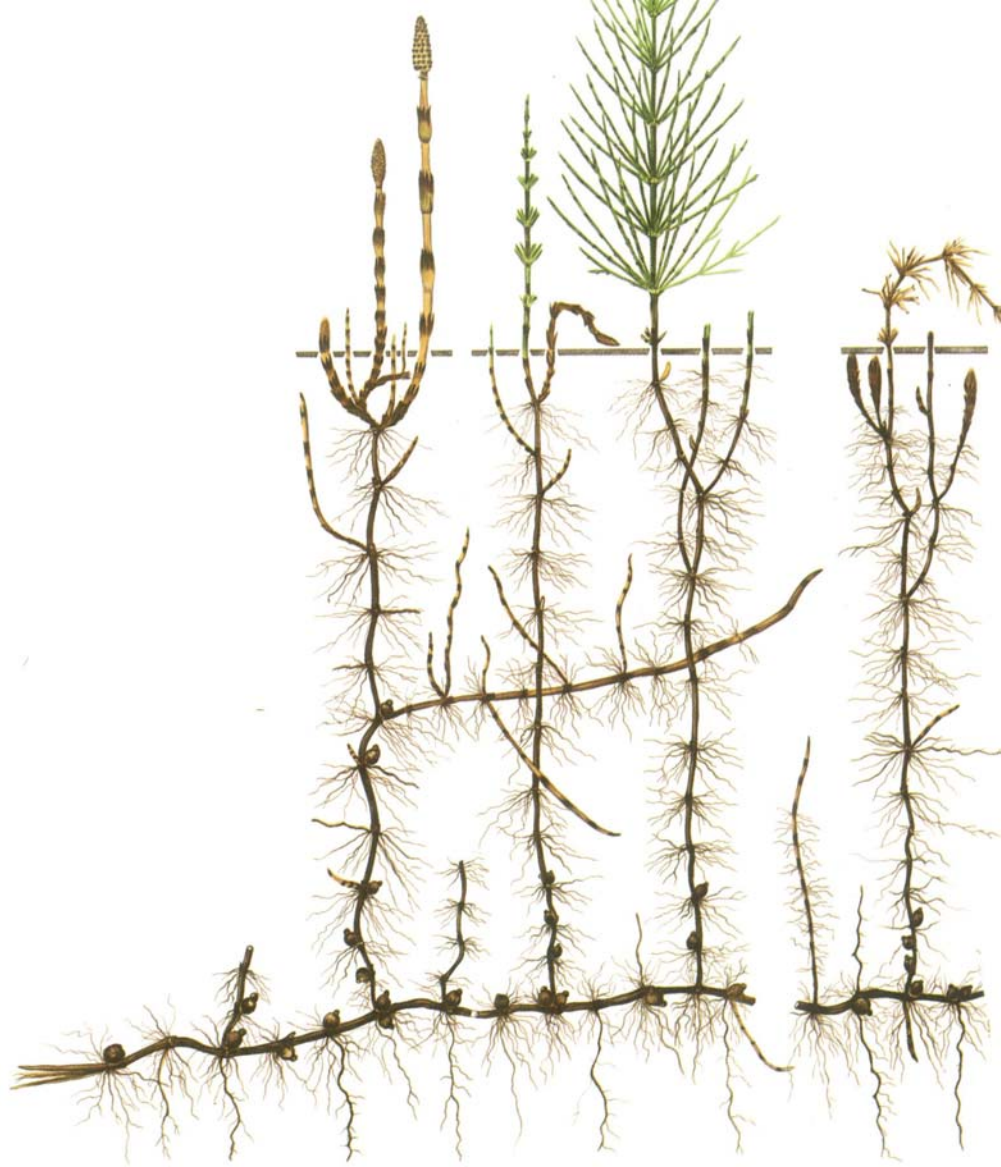
From Korsmo
et al. 1981

50 cm

100 cm

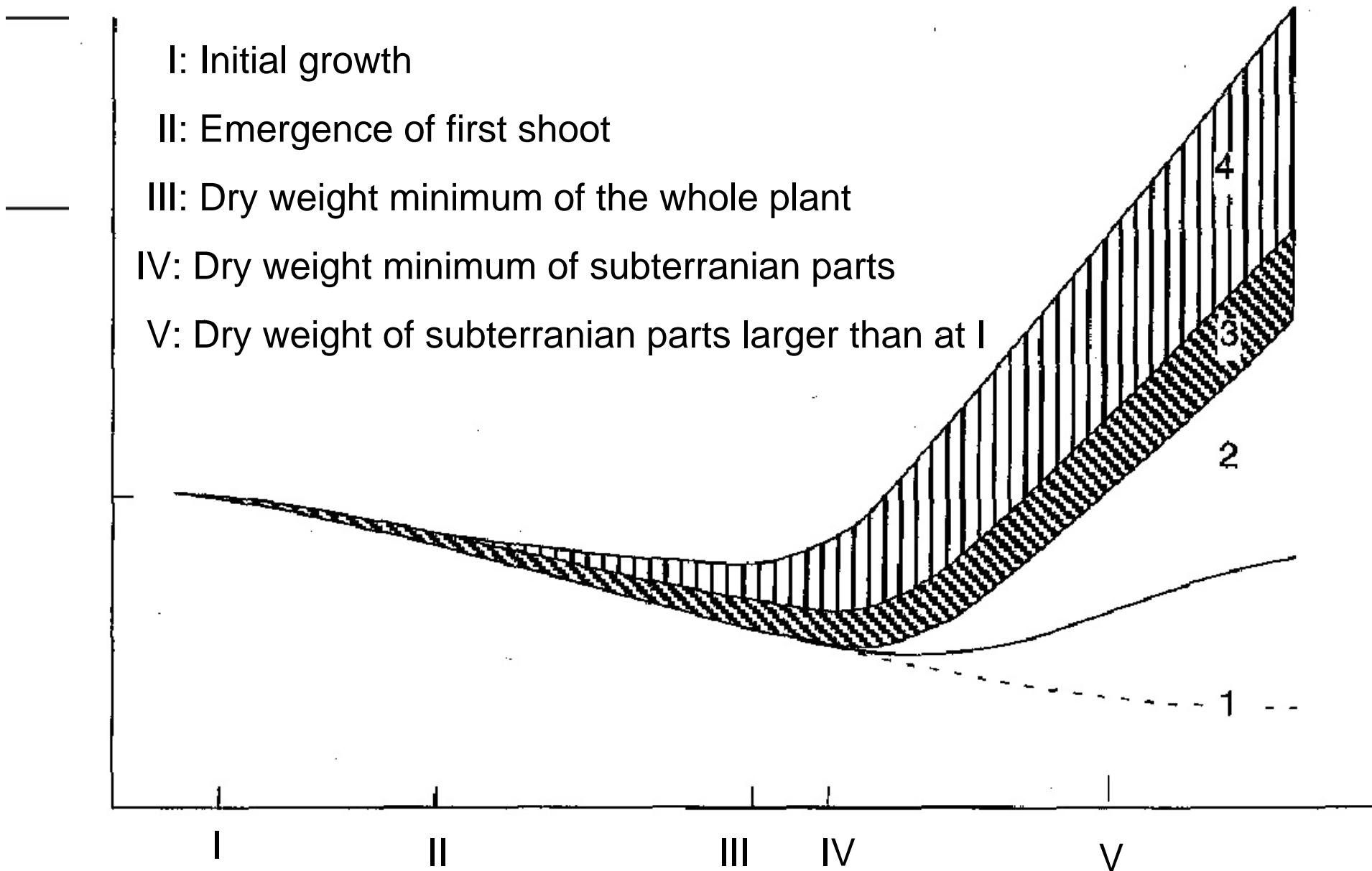


Cirsium arvense



Equisetum arvense

From Korsmo
et al. 1981



1: Original vegetative propagation organs

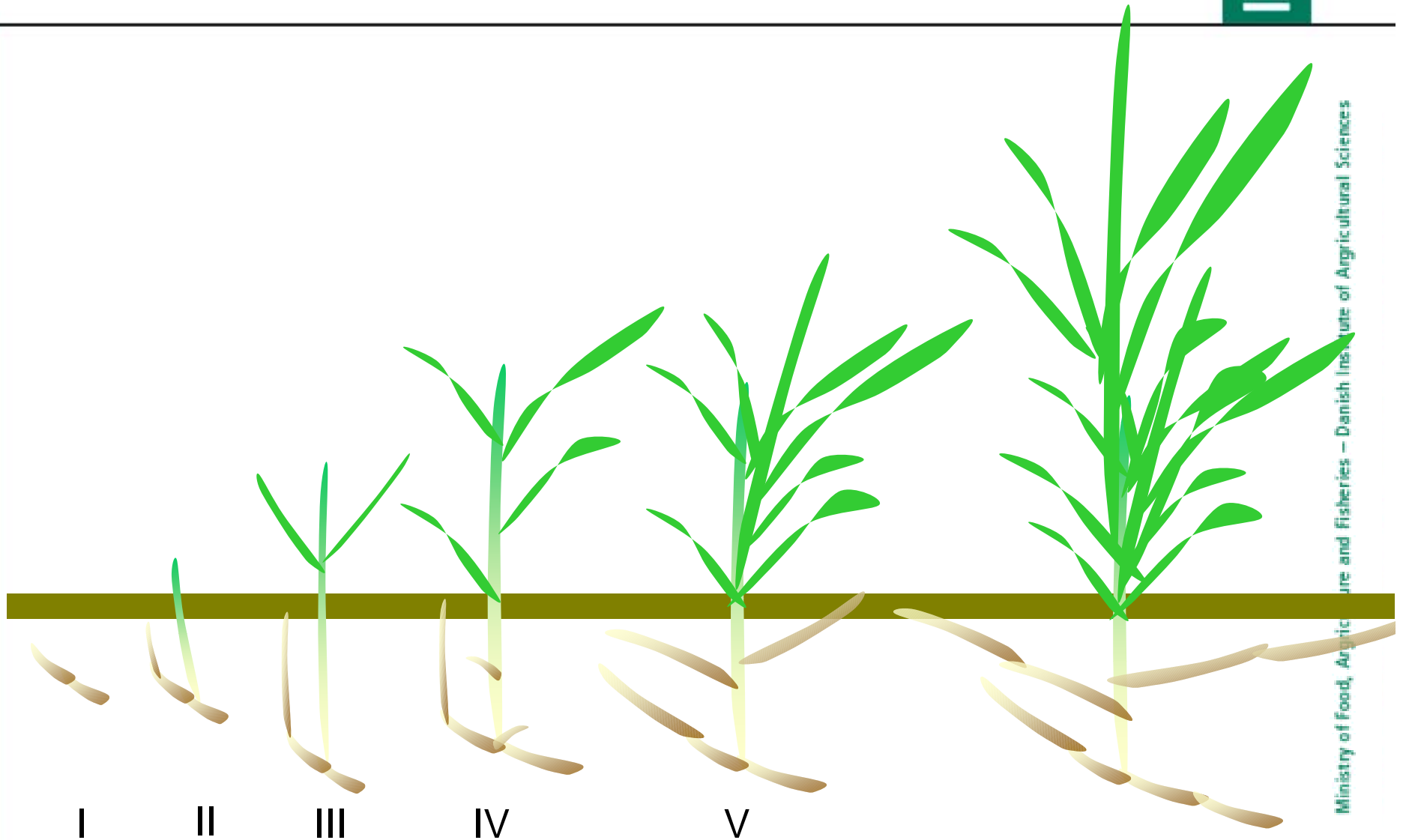
Modified after
 Håkansson 2003

2: New vegetative propagation organs

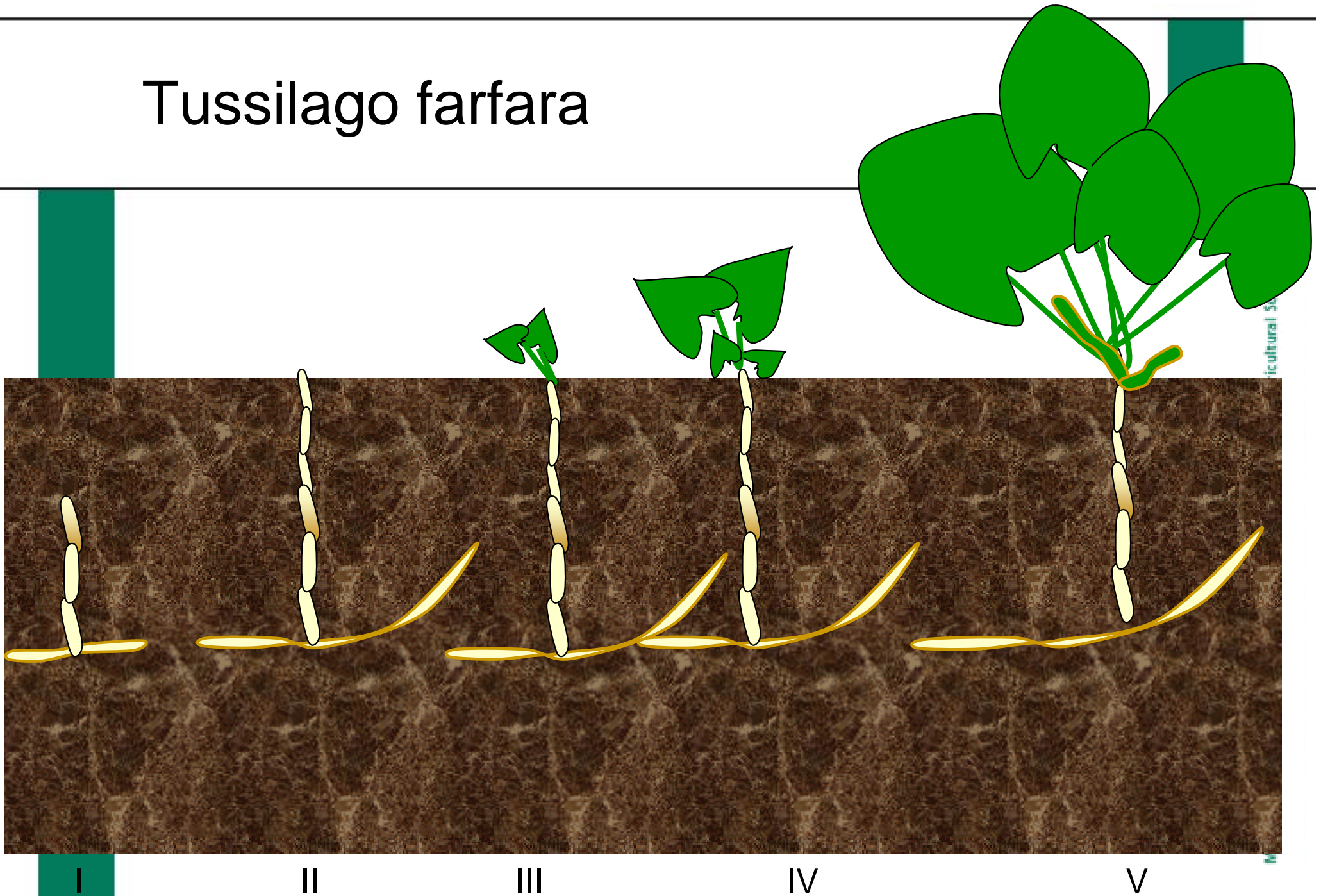
3: New shoots under ground

4: Shoots above ground

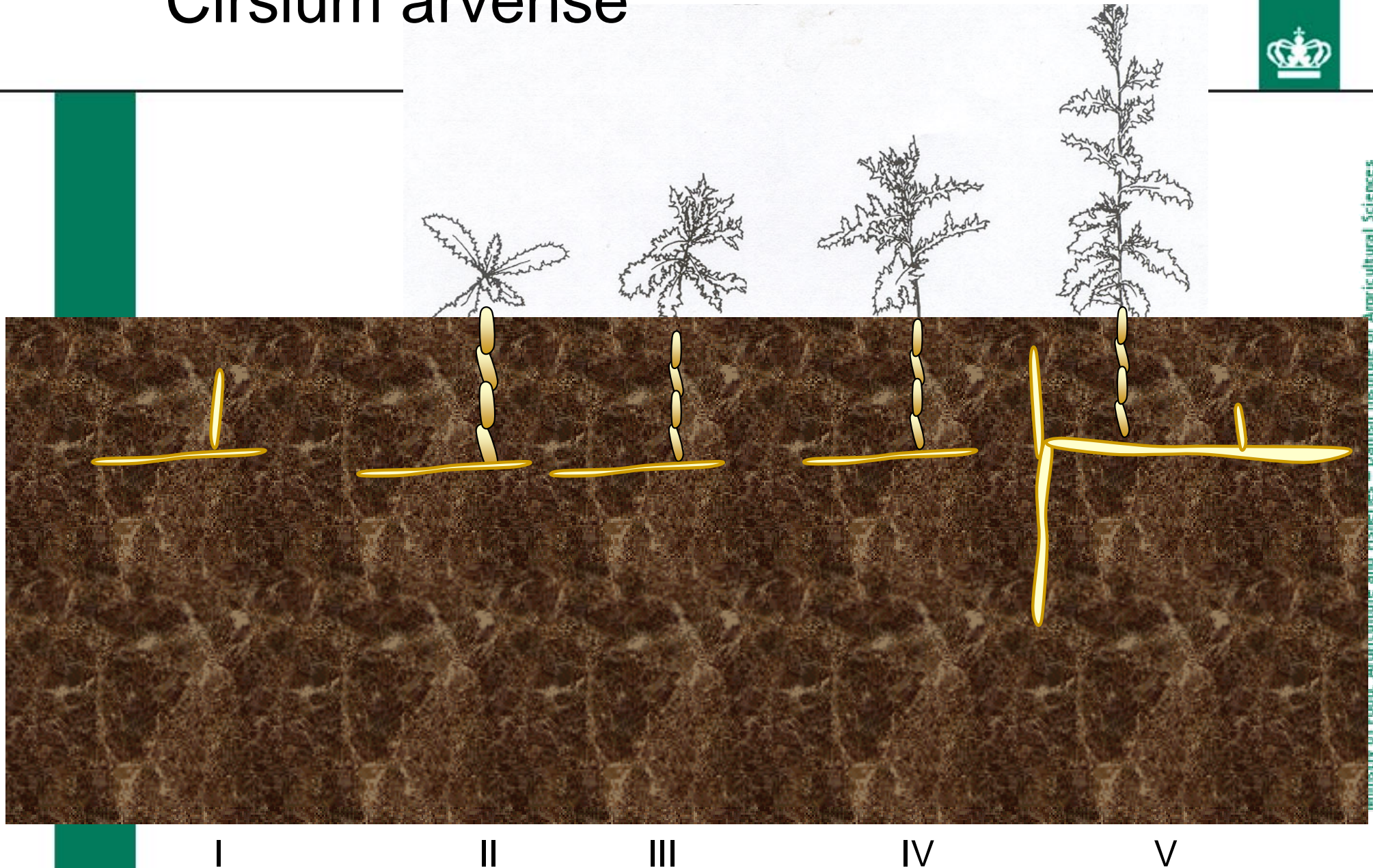
Elymus repens

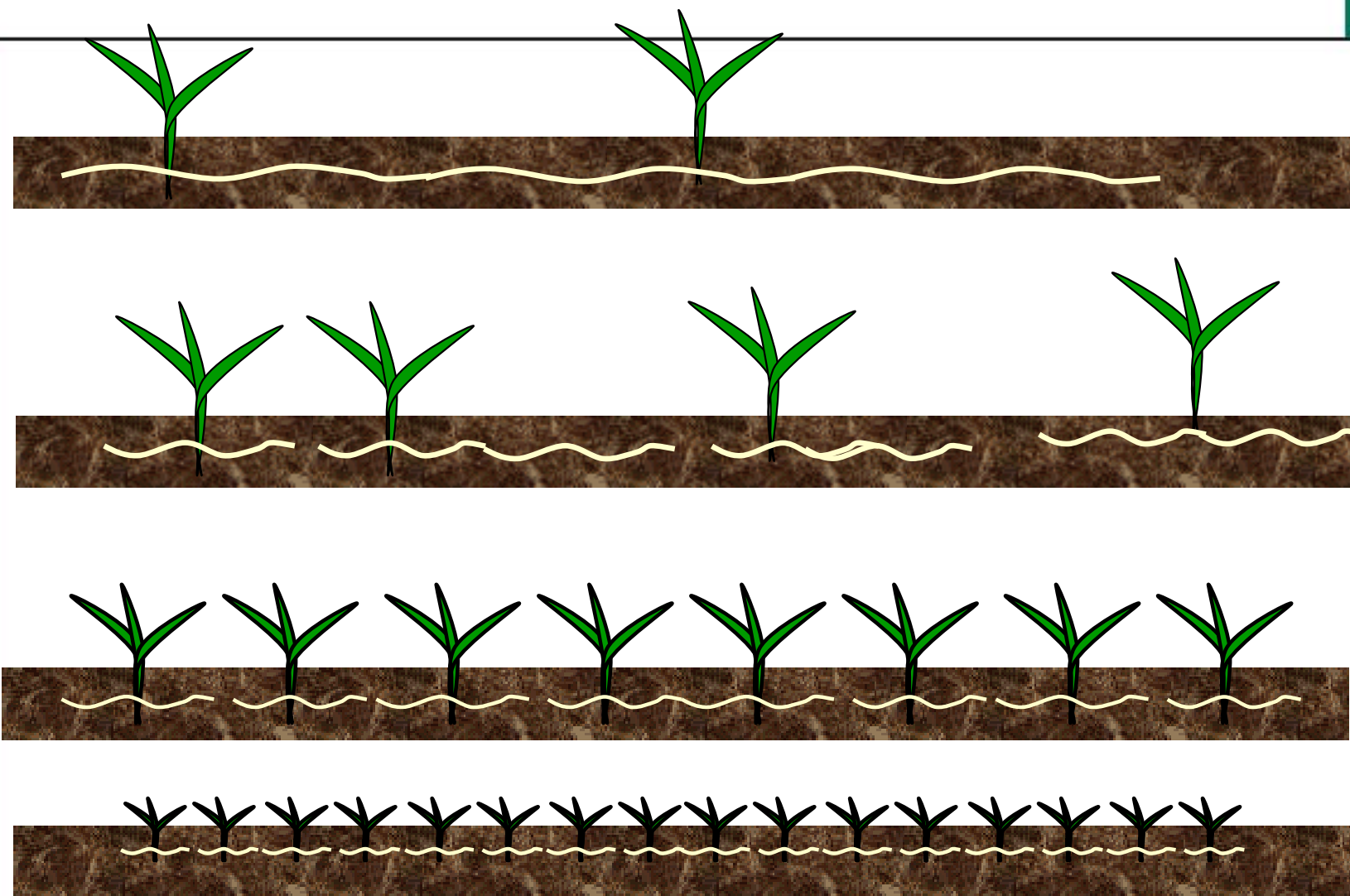


Tussilago farfara



Cirsium arvense





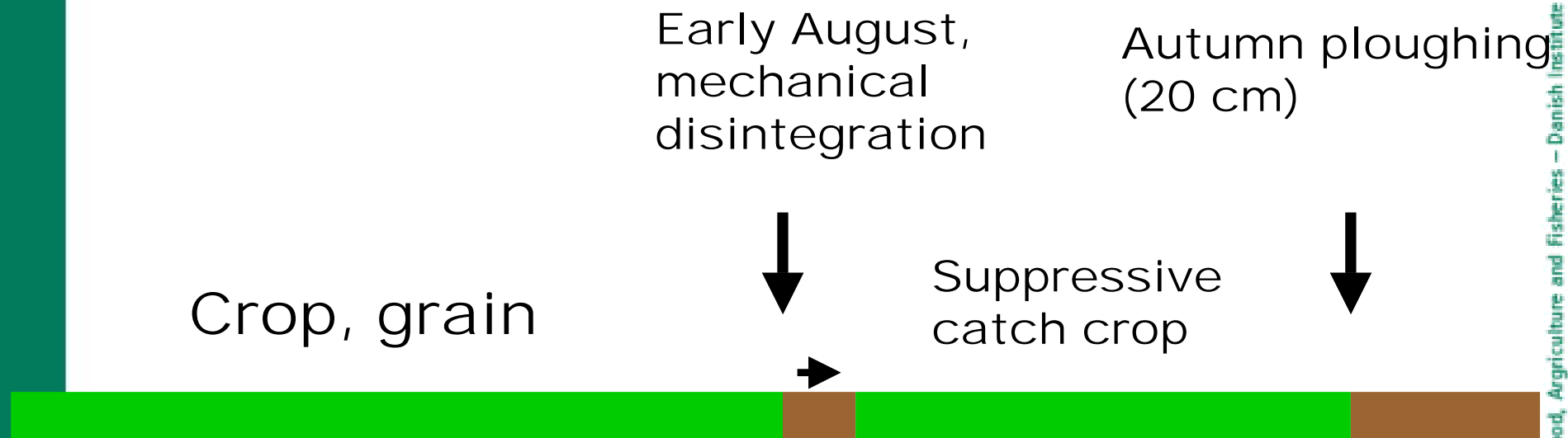
Traditional *E. repens* control



Integrated approach



Strategy I: "Integrated light"



From Melander et al. 2005

Mechanical disintegration



Shallow
ploughing



P.t.o.-driven rotary
cultivation

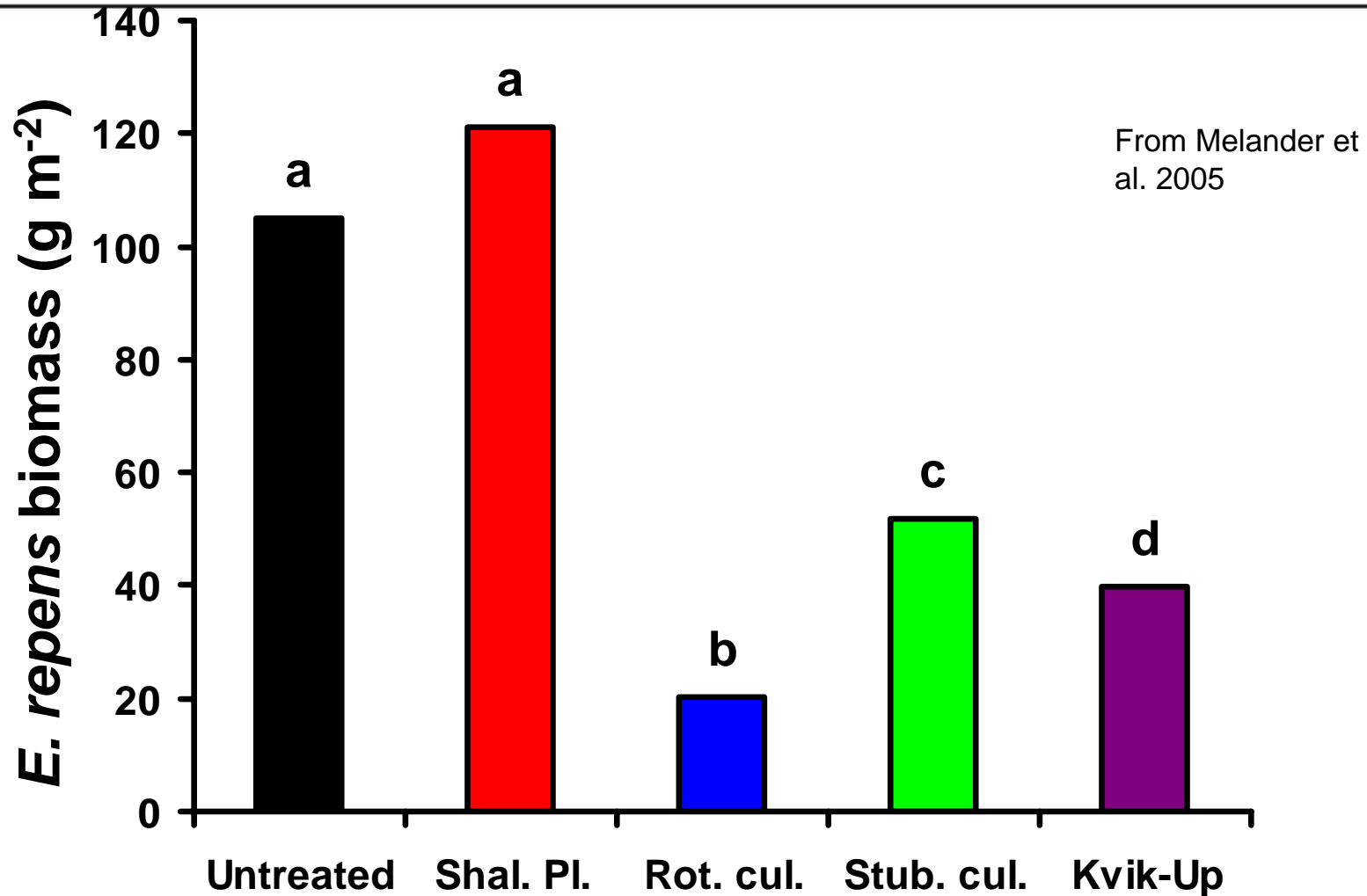


Tine stubble
cultivation



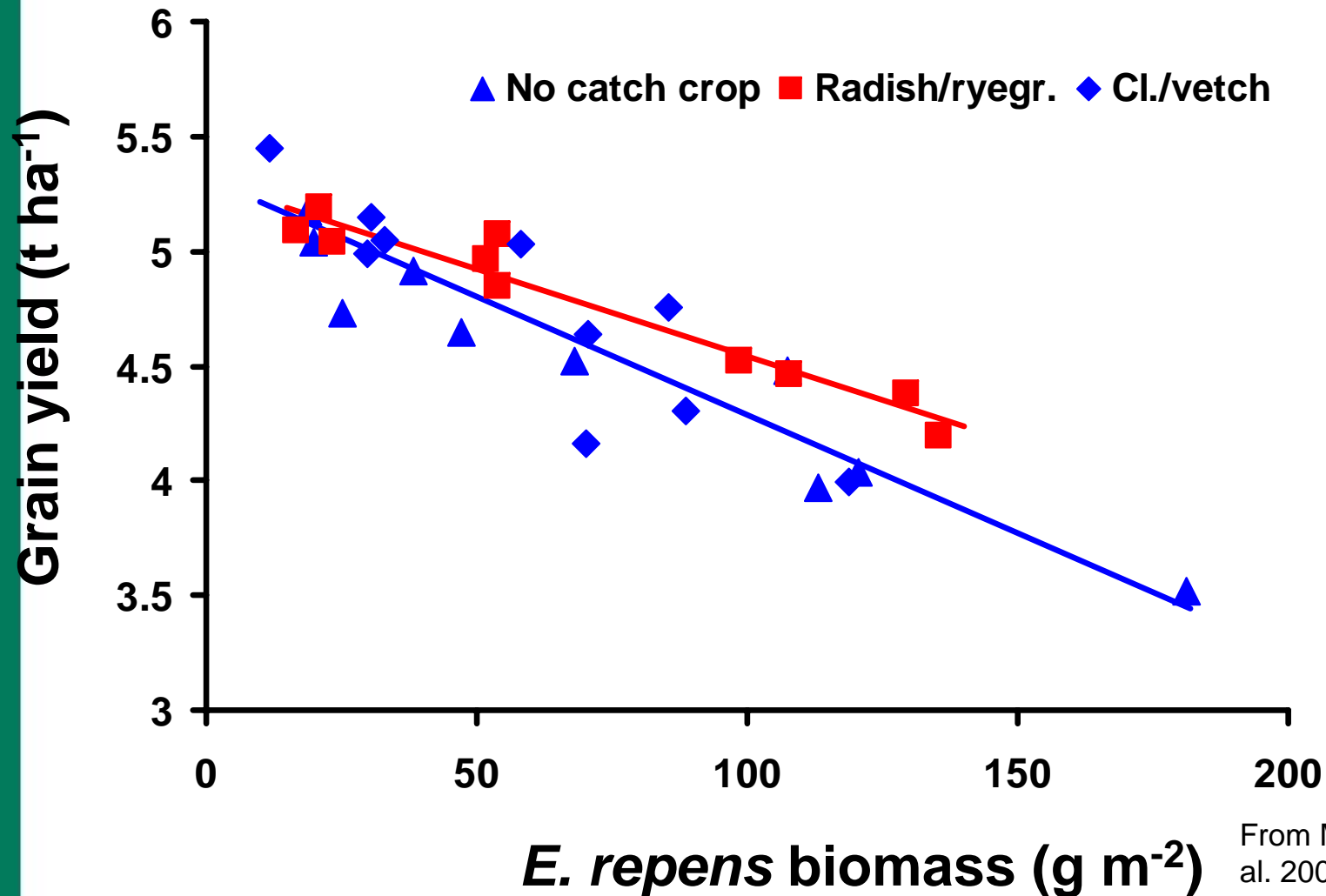
The 'Kvik-Up' harrow

Strategy I: "Integrated light"



Effects recorded close to spring barley harvest the following year

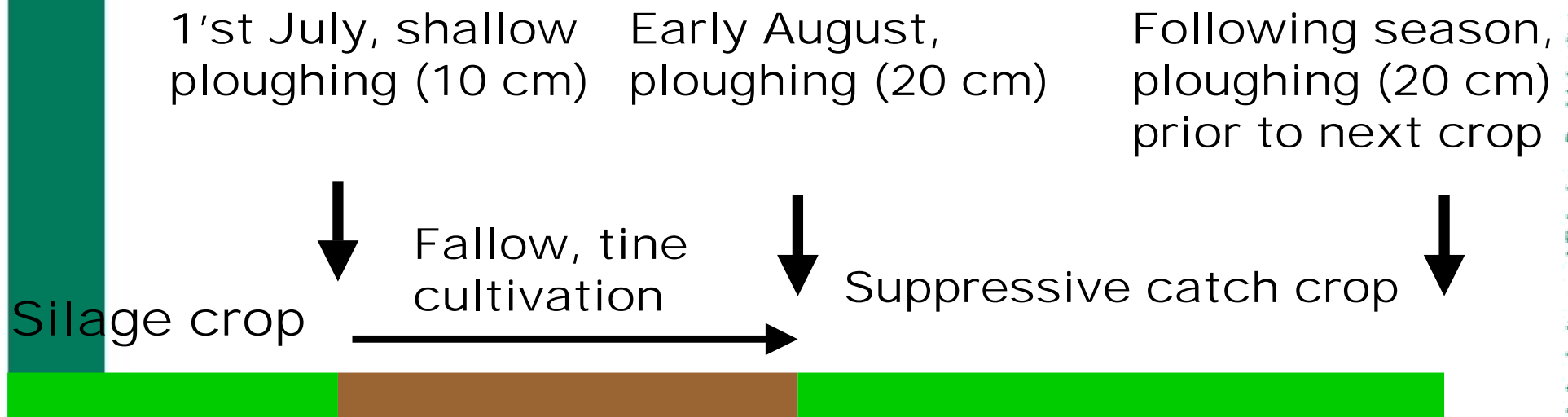
Strategy I: "Integrated light"



Integrated approach



Strategy II: "Integrated intensive"

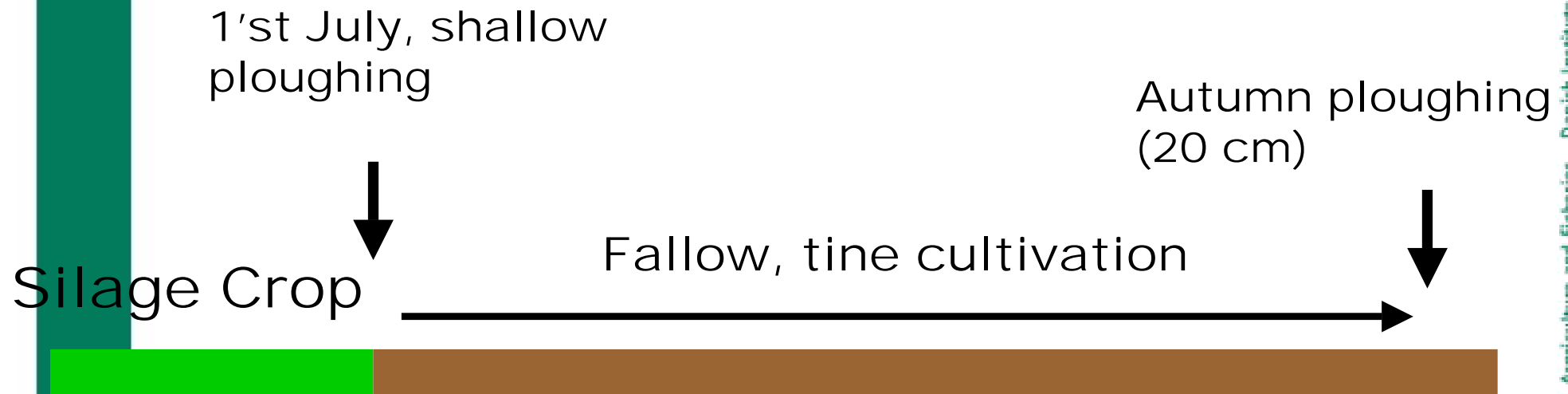


From Melander et al. 2005

Long fallow period



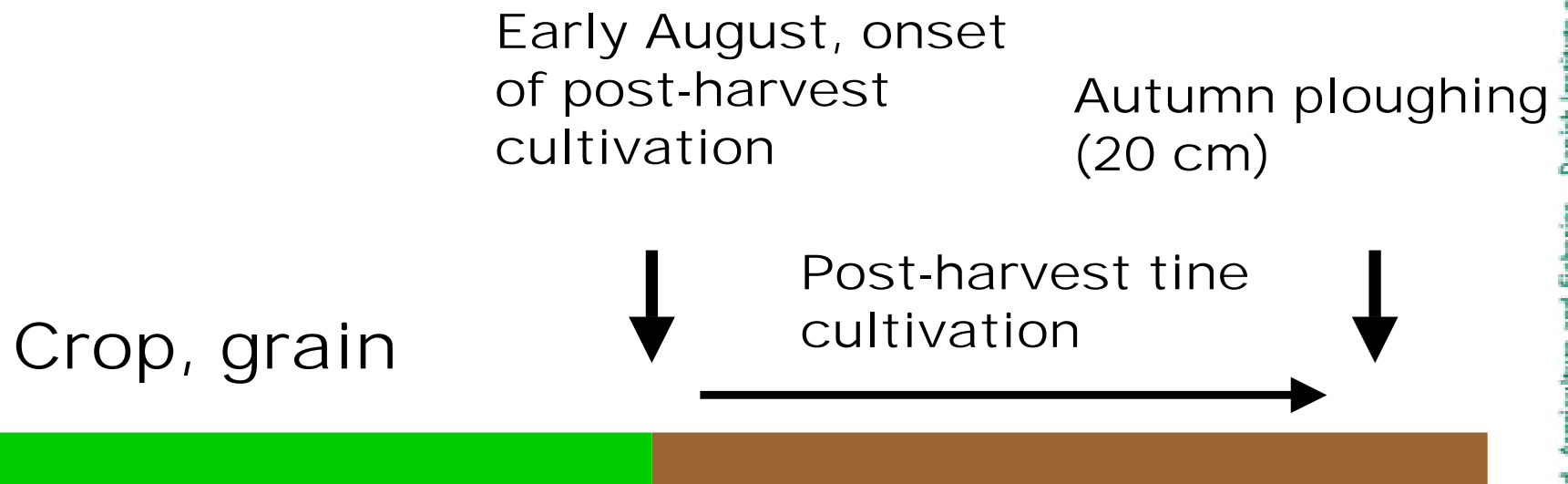
Strategy III: "Half fallow"



From Melander et al. 2005

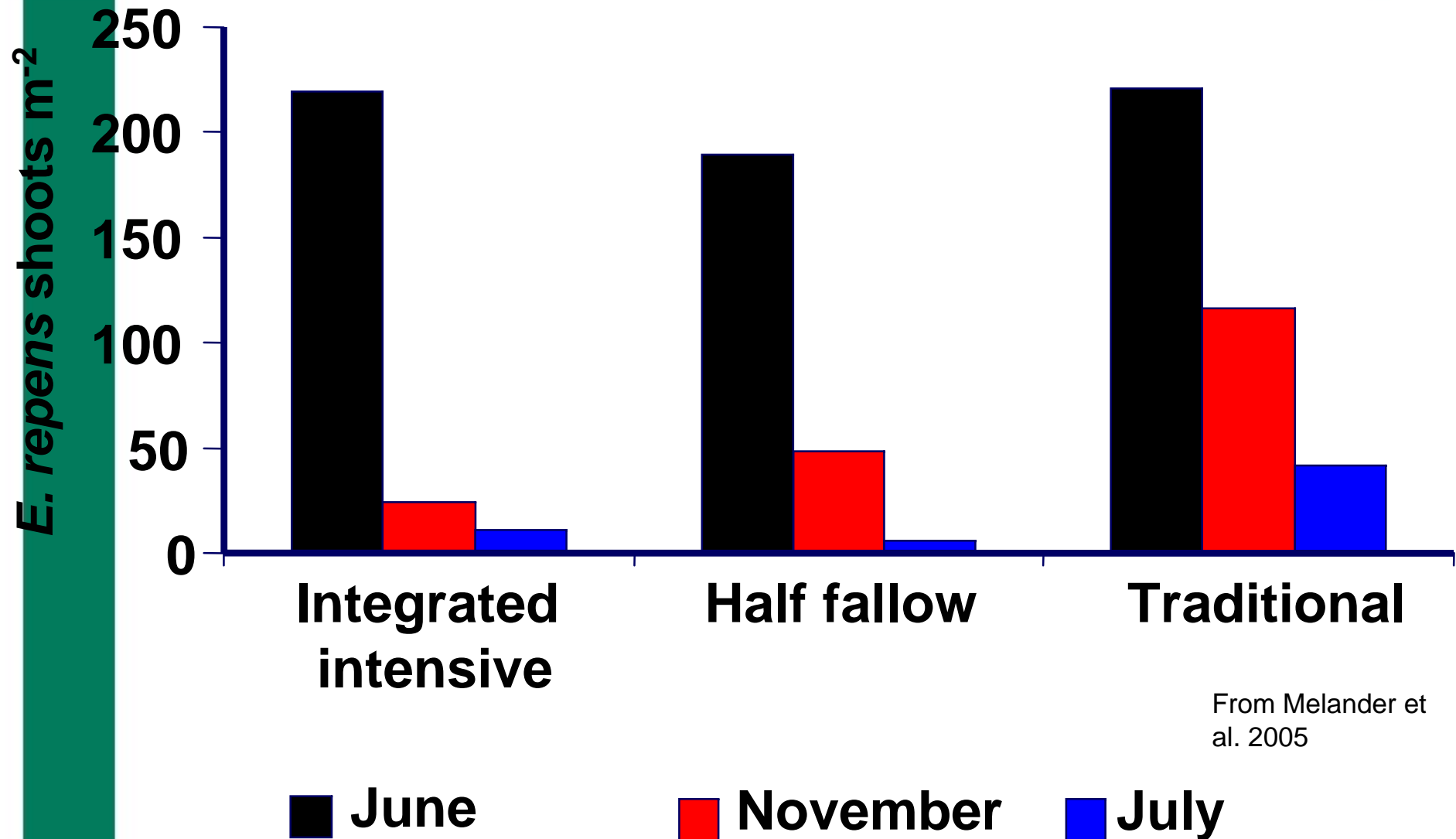


Strategy IV: "Traditional strategy"



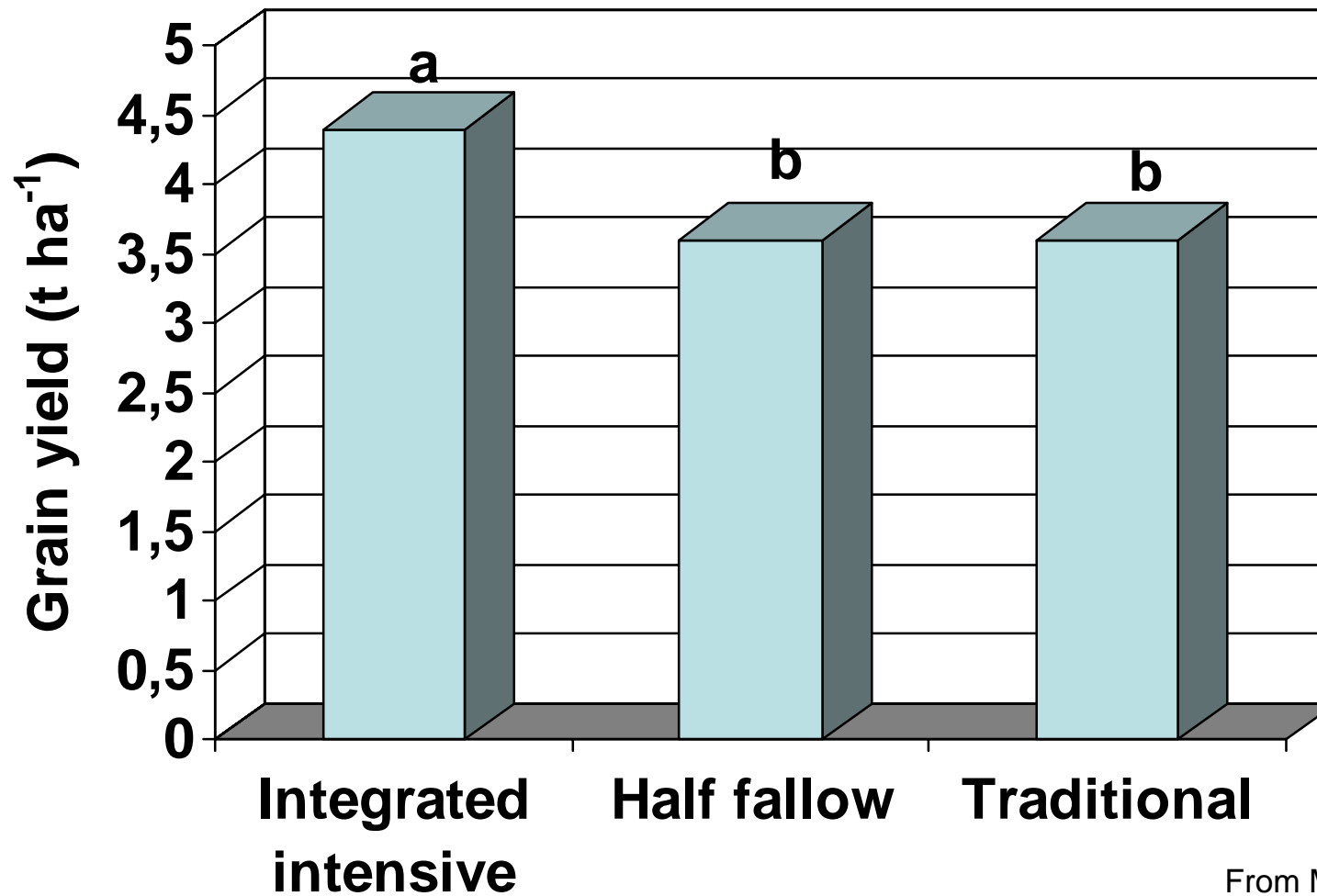
From Melander et al. 2005

Results from 4 experiments



From Melander et al. 2005

Results from 4 experiments



From Melander et al. 2005

Spring barley grain yield the following year

Repeated hoeing in spring barley with undersown clover

Year one: treatments



Hoeing in crop
May - July



Autumn ploughing
(20 cm)

Suppressive
catch crop



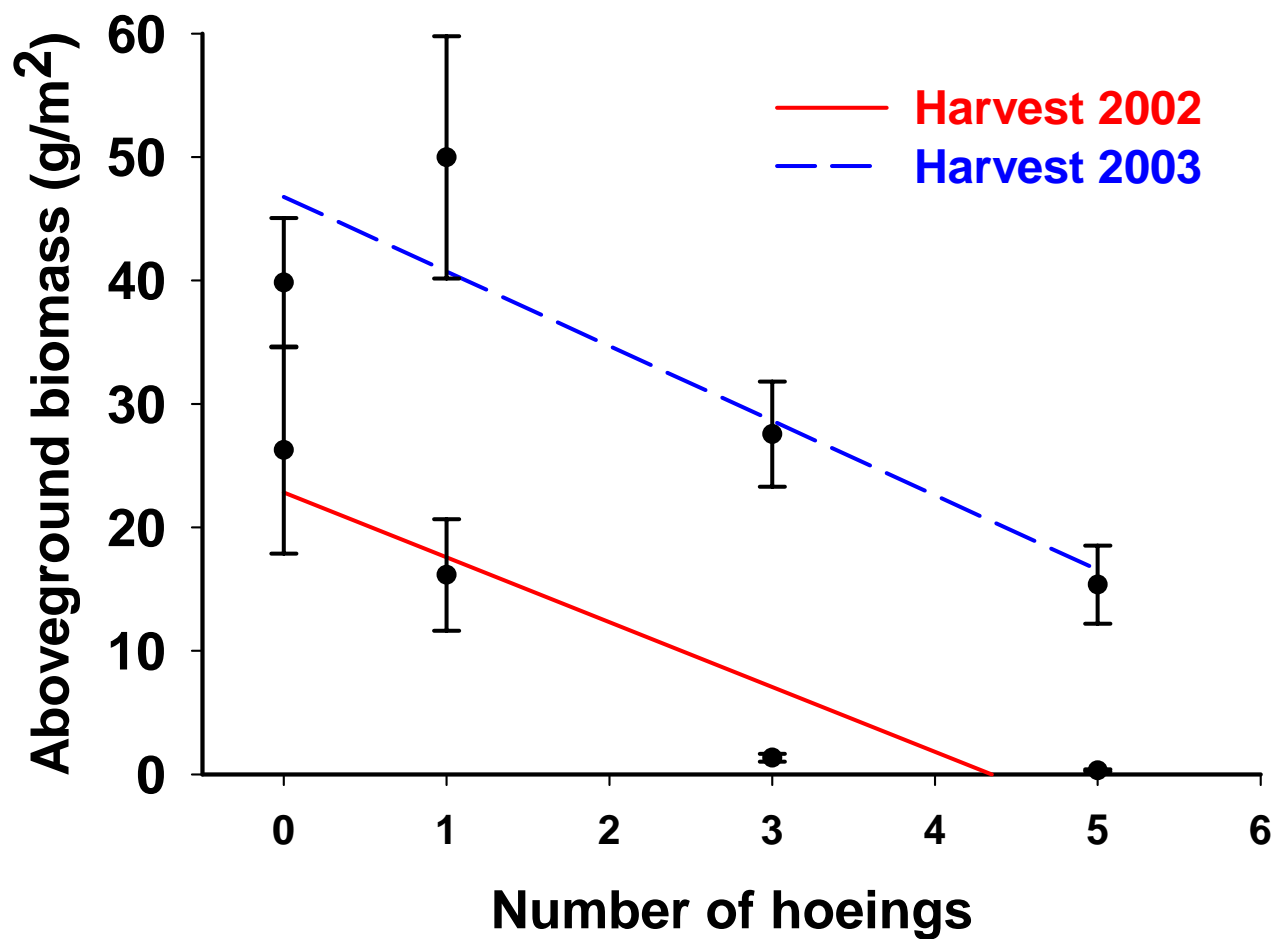
Year two: counts/weights + yield

Crop: spring
barley.



From Graglia et al.
2004

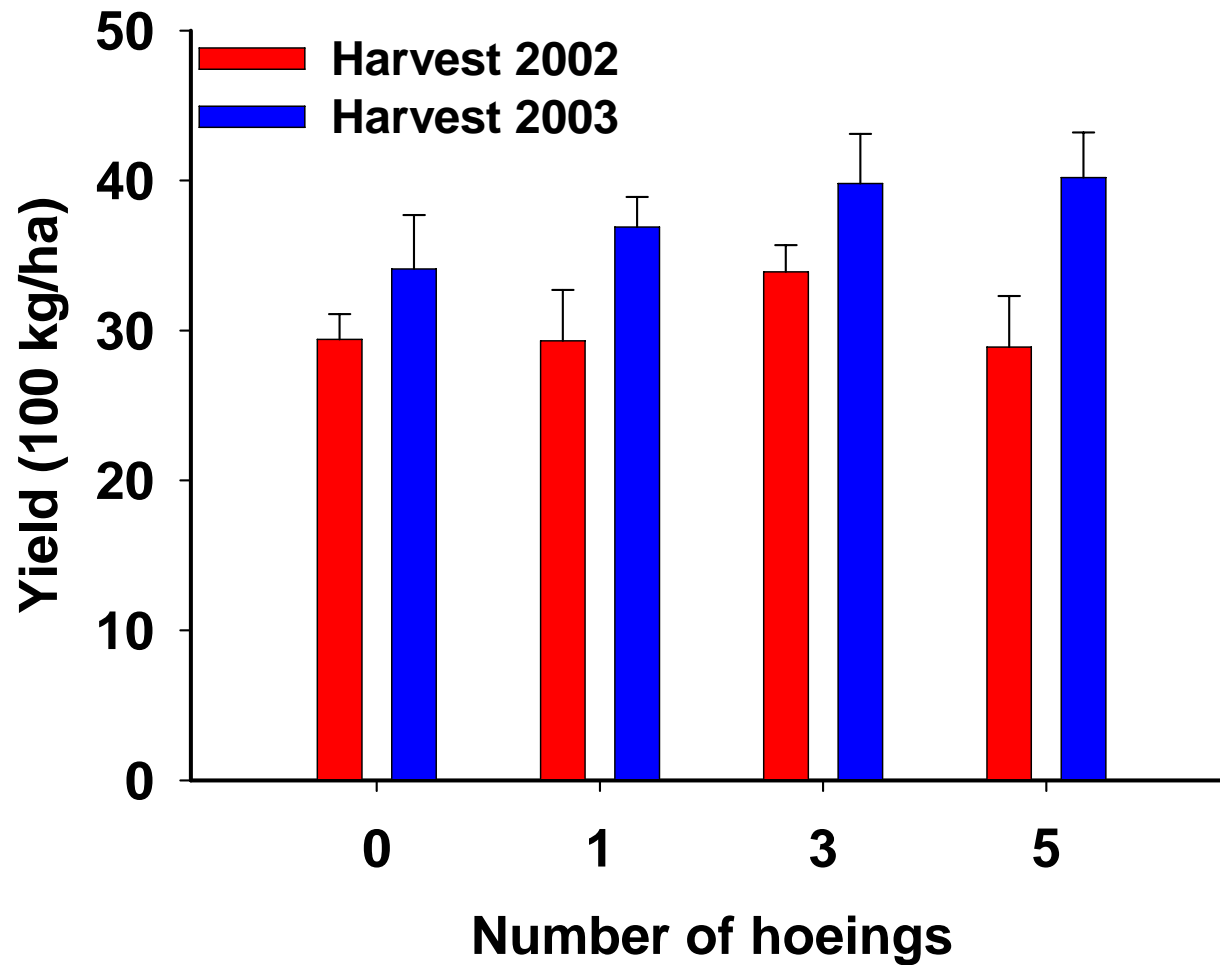
Repeated hoeing



Hoeing: mid-May – mid-July

From Graglia et al.
2004

Repeated hoeing

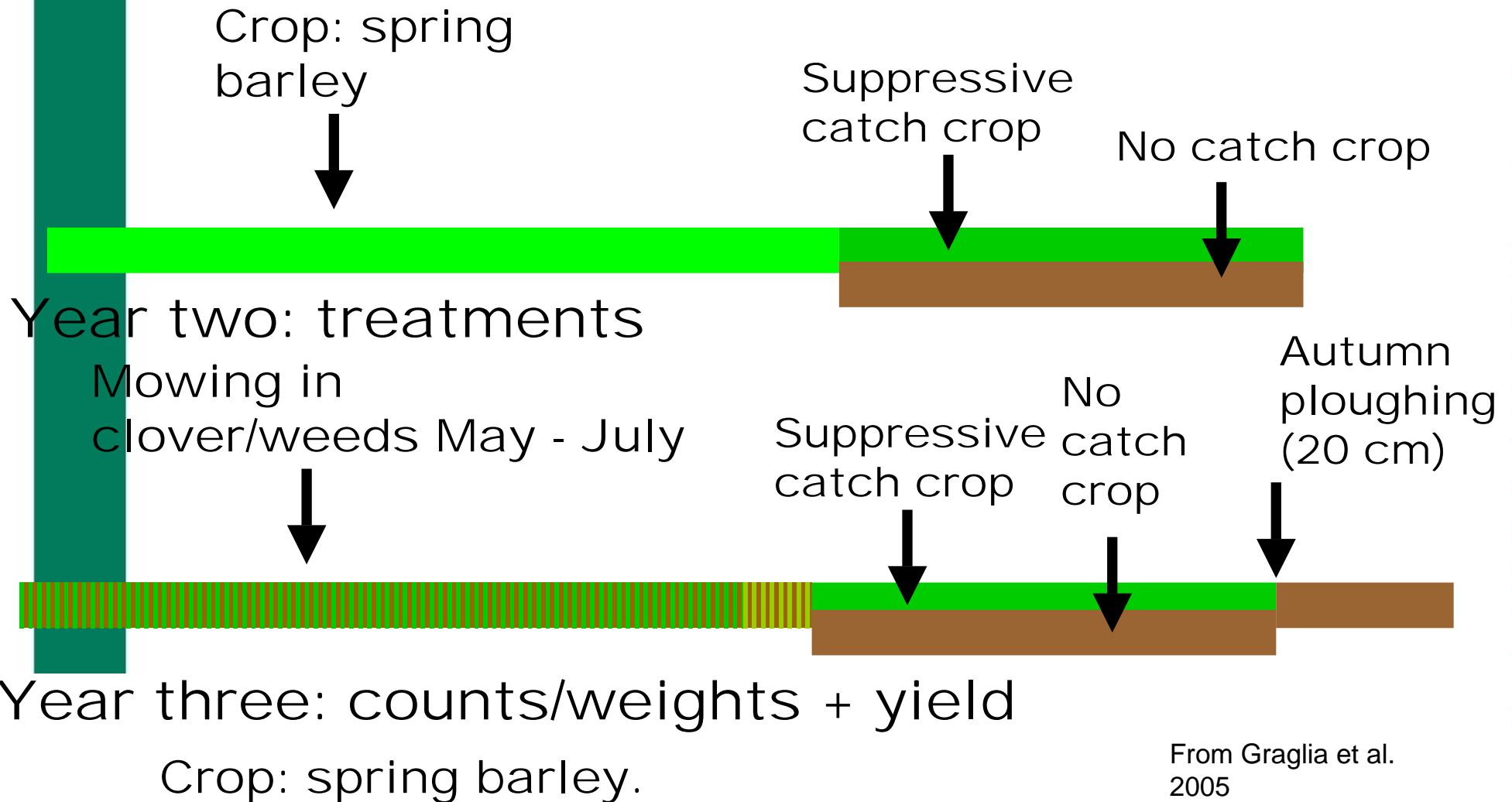


Hoeing: medio May-medio July

From Graglia et al.
2004

Repeated mowing in clover or without crop

Year one: establishment



From Graglia et al. 2005



Ilse A. Rasmussen: Perennial weeds in a crop rotation perspective. 2 March 2006

Mowing weeds without clover



Before



After



Mowing clover



Before

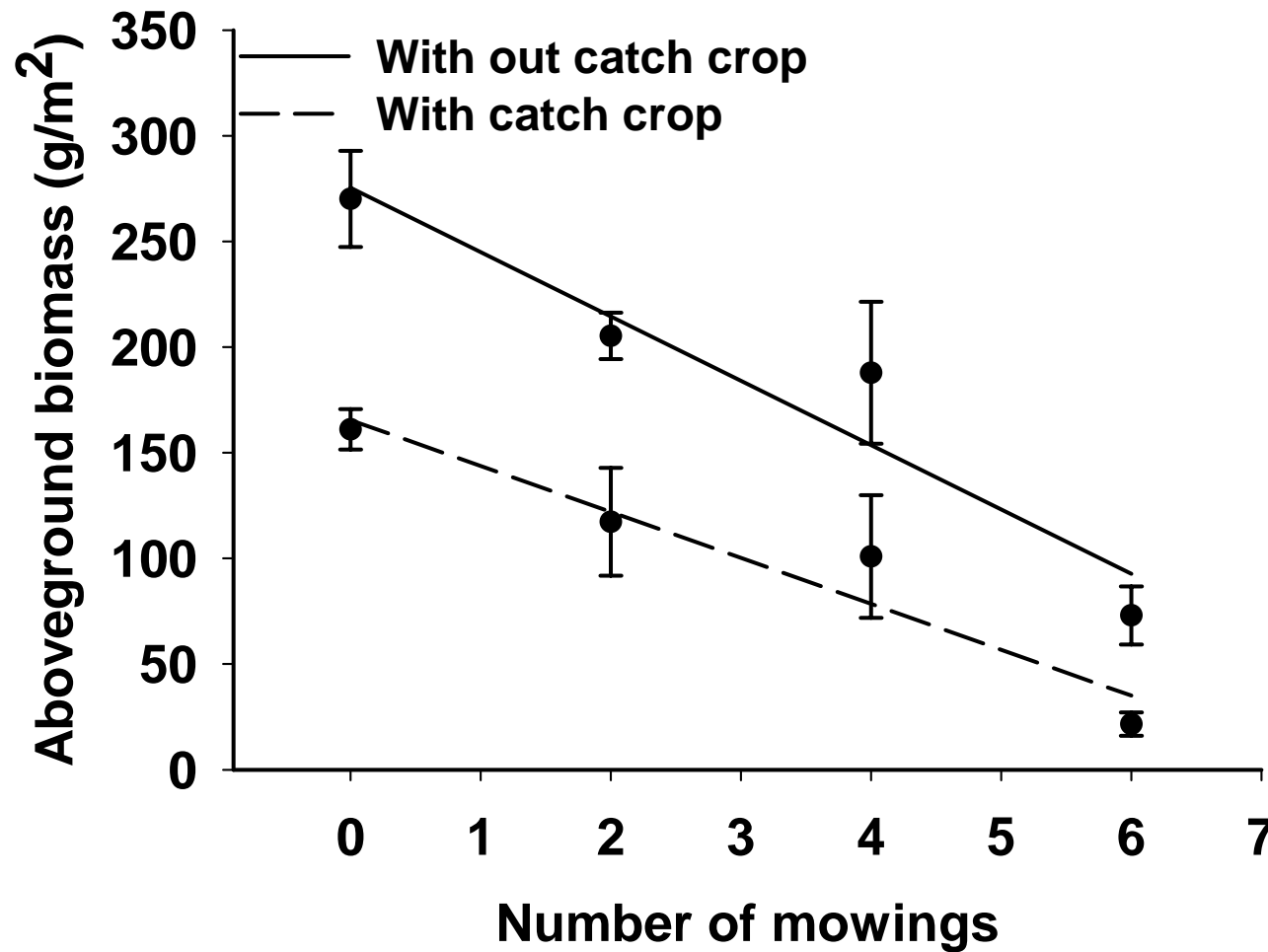


After

Repeated mowing



Harvest 2002



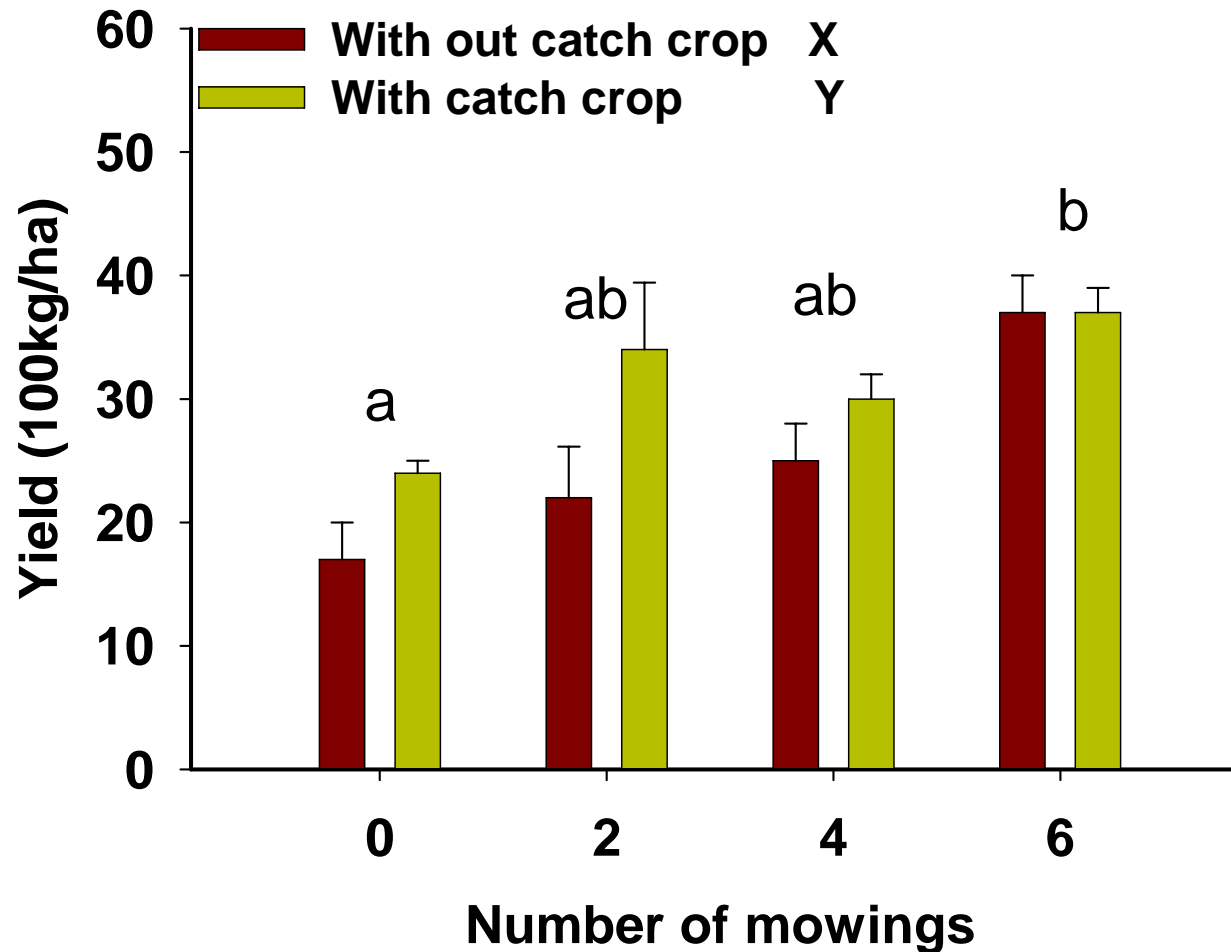
Mowing: mid-May - late July

From Graglia et al.
2005

Repeated mowing



Harvest 2002



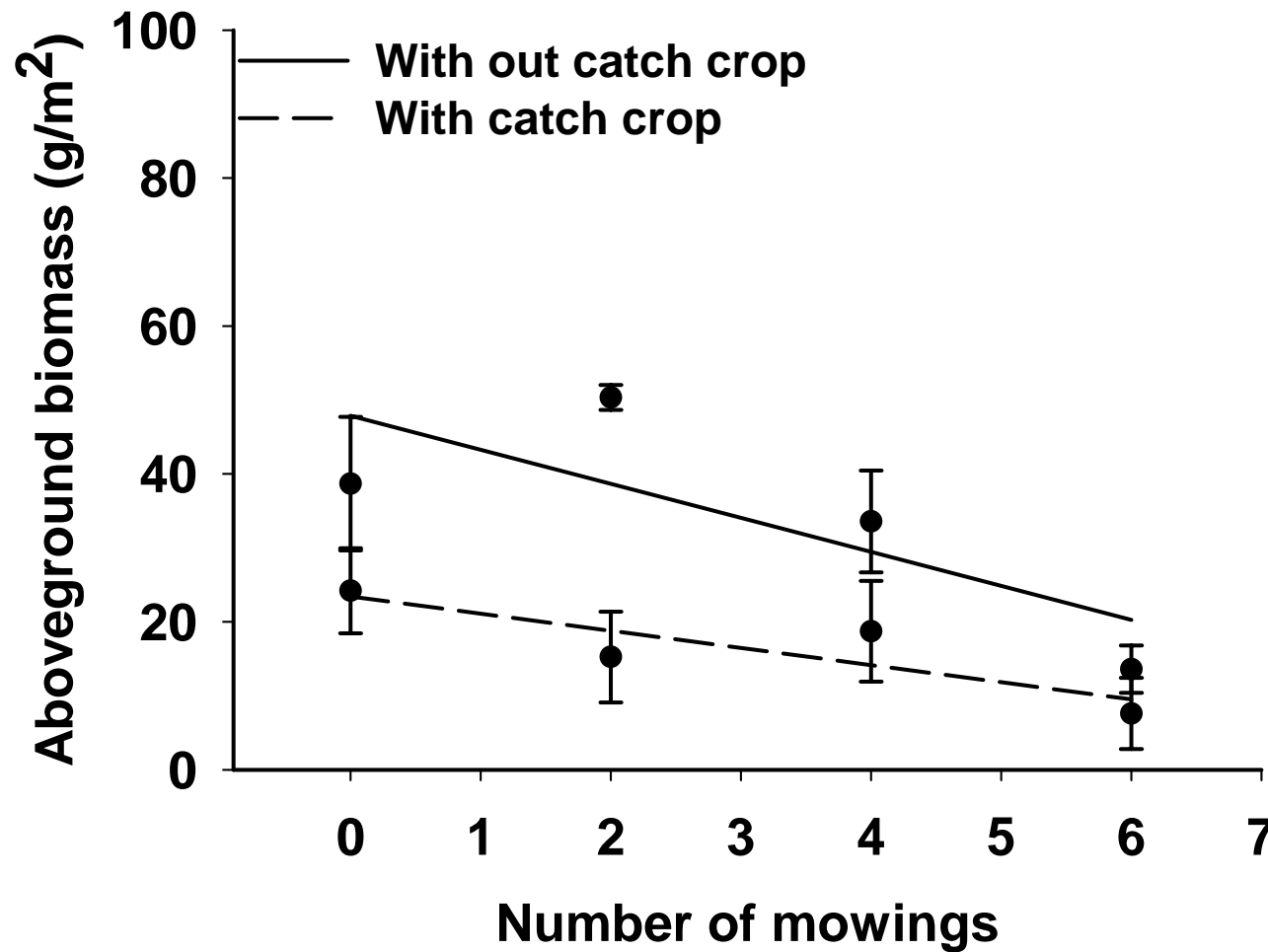
Mowing: mid-May - late July

From Graglia et al. 2005

Repeated mowing



Harvest 2003



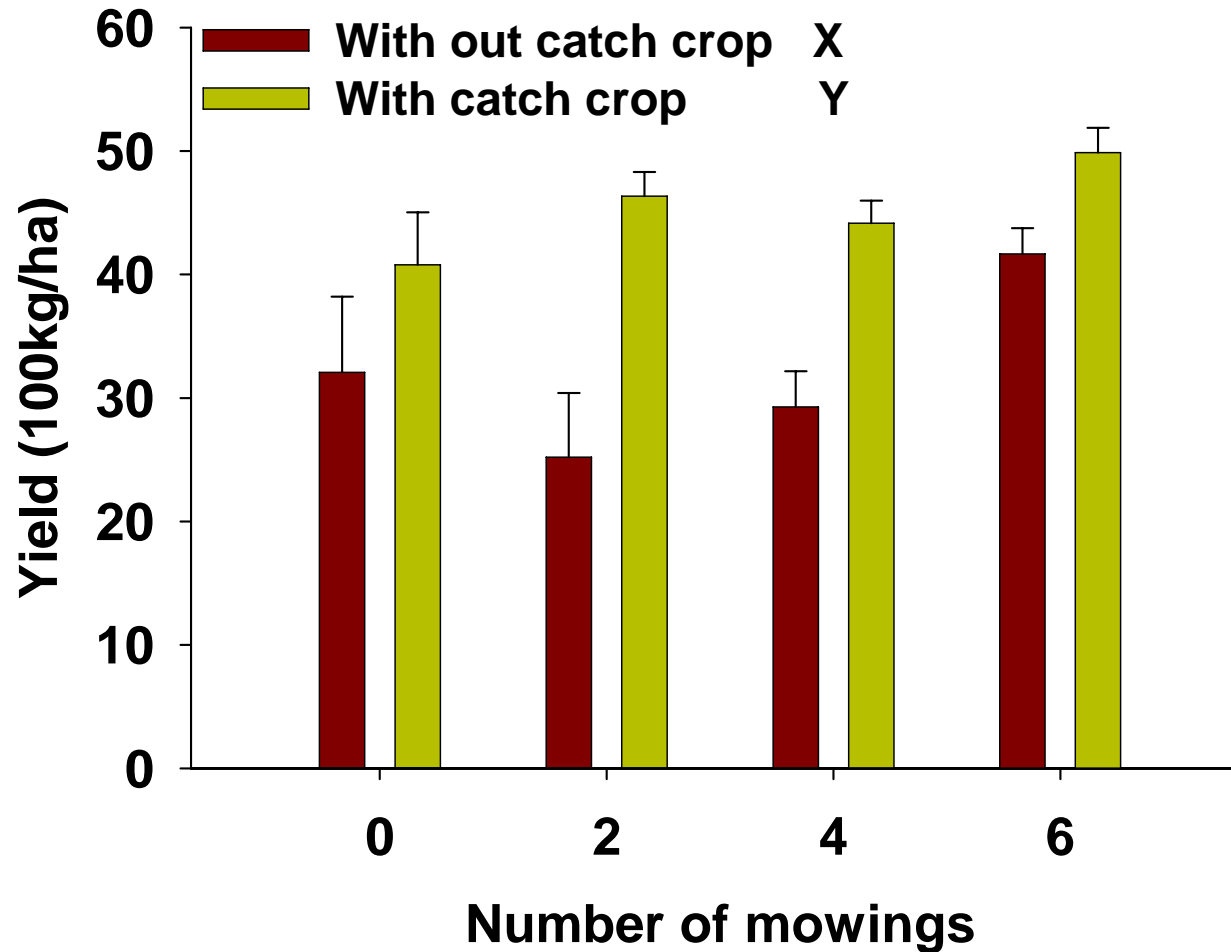
Mowing: mid-May - late July

From Graglia et al. 2005

Repeated mowing



Harvest 2003



Mowing: mid-May - late July

From Graglia et al.
2005

Organic crop rotation experiments



Experimental factors

- Crop rotation (level of cereals)
- Catch crop (without/with catch crop)
- Manure (without/with)

Crop rotations



Four-year crop rotations are used.

The level of cereals and pulses increases from rotation 1 to rotation 4:

1: 1.5 grass-clover + 1 pulse

2: 1 grass-clover + 1 pulse

3: 1 grass-clover

4: 1 pulse

Weed control - perennials



- *Elymus repens* :
 - stubble cultivation:
 - without catch crops > 5 shoots m⁻²
 - with catch crops - none
 - cutting the grass-clover more often at more than 5 shoots m⁻² in the preceding crop

Weed control - perennials



- *Elymus repens* :
 - Rotations with and without catch crops with severe problems:
 - Grass clover plowed early (June)
 - Repeated harrowing
 - Competitive catch crop sown after 6-8 weeks
 - "Summer fallow"

Weed control - perennials



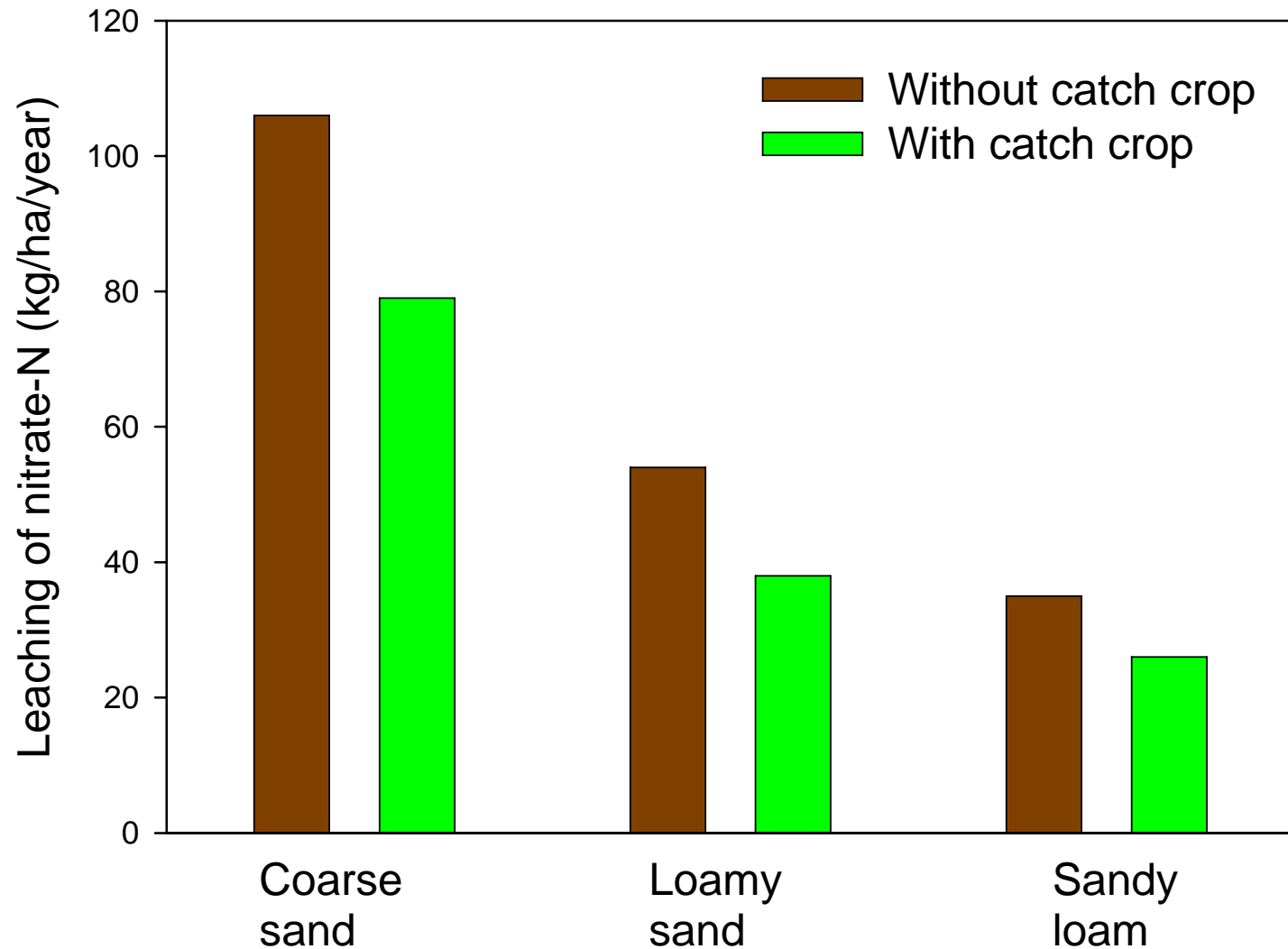
- *Cirsium arvense*:
 - cut below ground and pulled at the anthesis of the cereals
 - stubble cultivation
- Others (*Artemisia vulgaris*, *Rumex crispus* etc.):
 - pulled up at sight
- Stubble cultivation in systems without catch crops

Catch crops



crop rotation perspective. 2 Ma

Nitrate leaching with or without catch crop in rotation with grass-clover

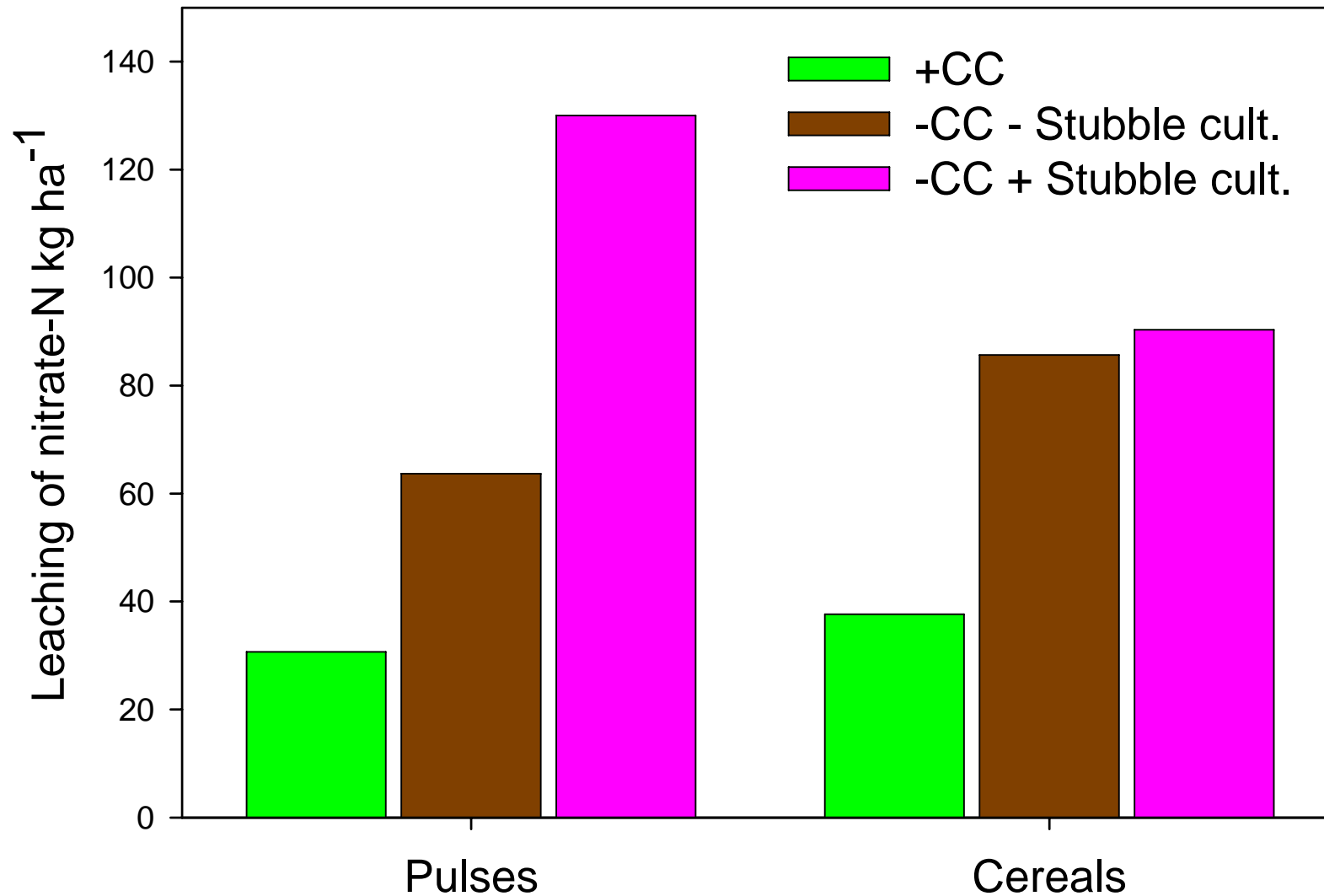


From Rasmussen et al. 2005

Control of perennial weeds in stubble

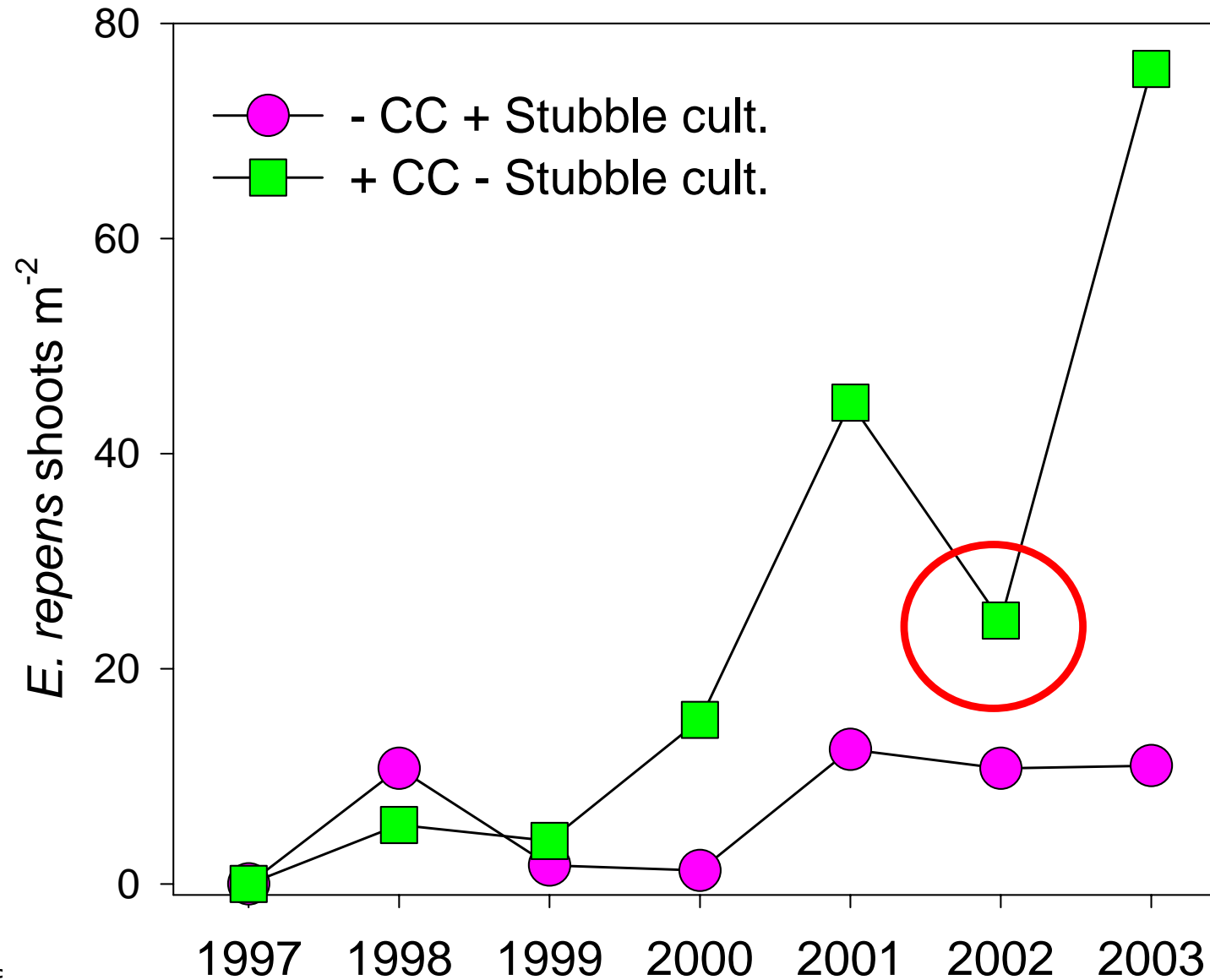


N-leaching on coarse sandy soil with or without catch crops and stubble cultivation



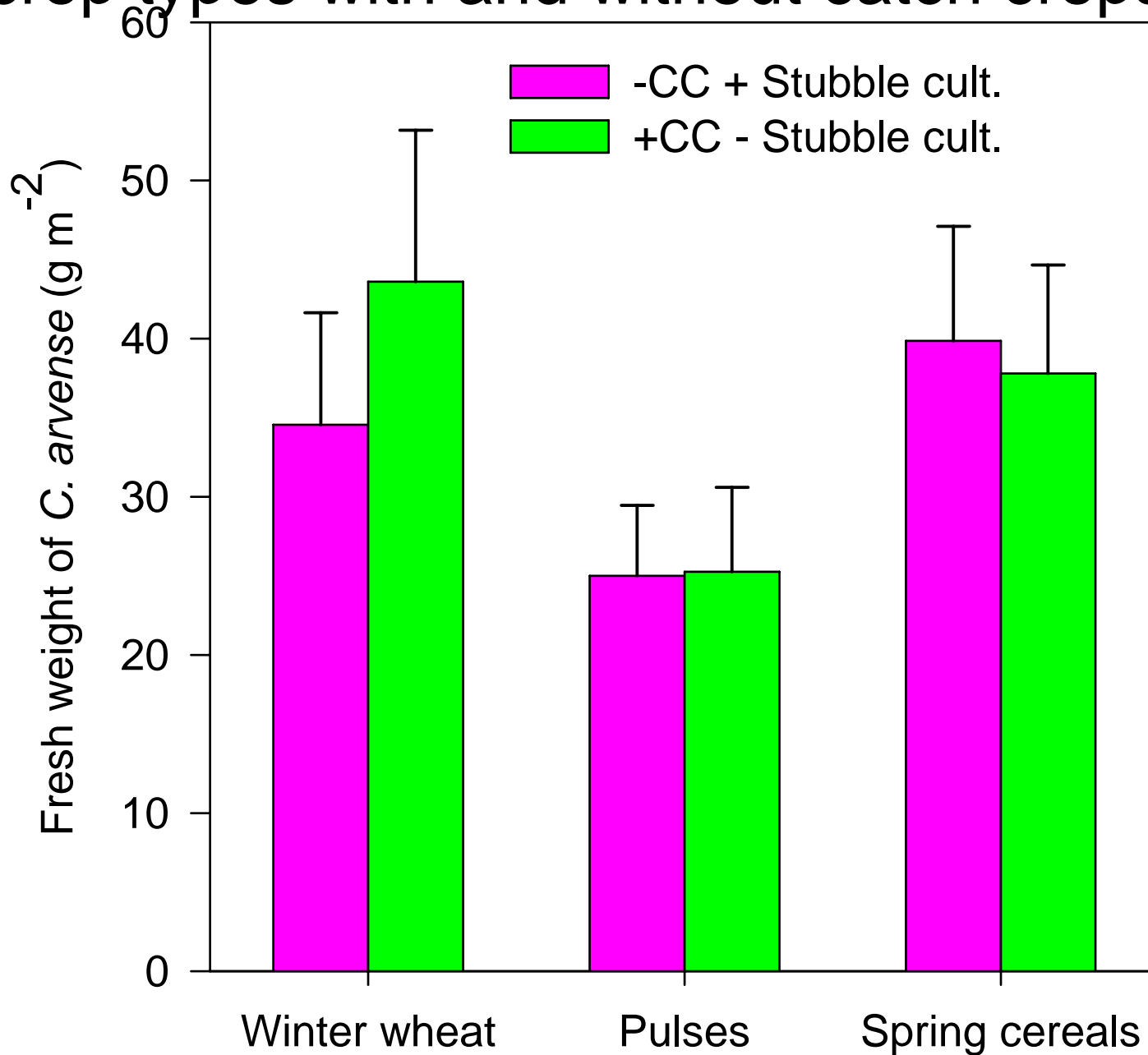
From
Rasmussen *et al.* 2005

E. repens shoots in spring barley on coarse sandy soil with and without catch crops



From Rasmussen et al. 2005

C. arvensis biomass on sandy loam in different crop types with and without catch crops



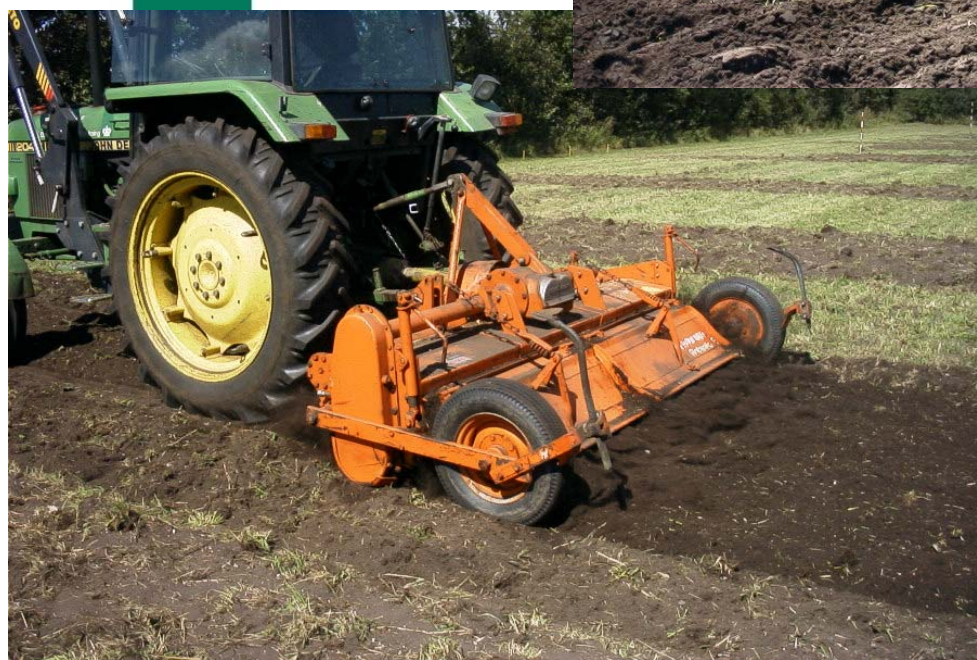
From Rasmussen et al. 2005

Summary



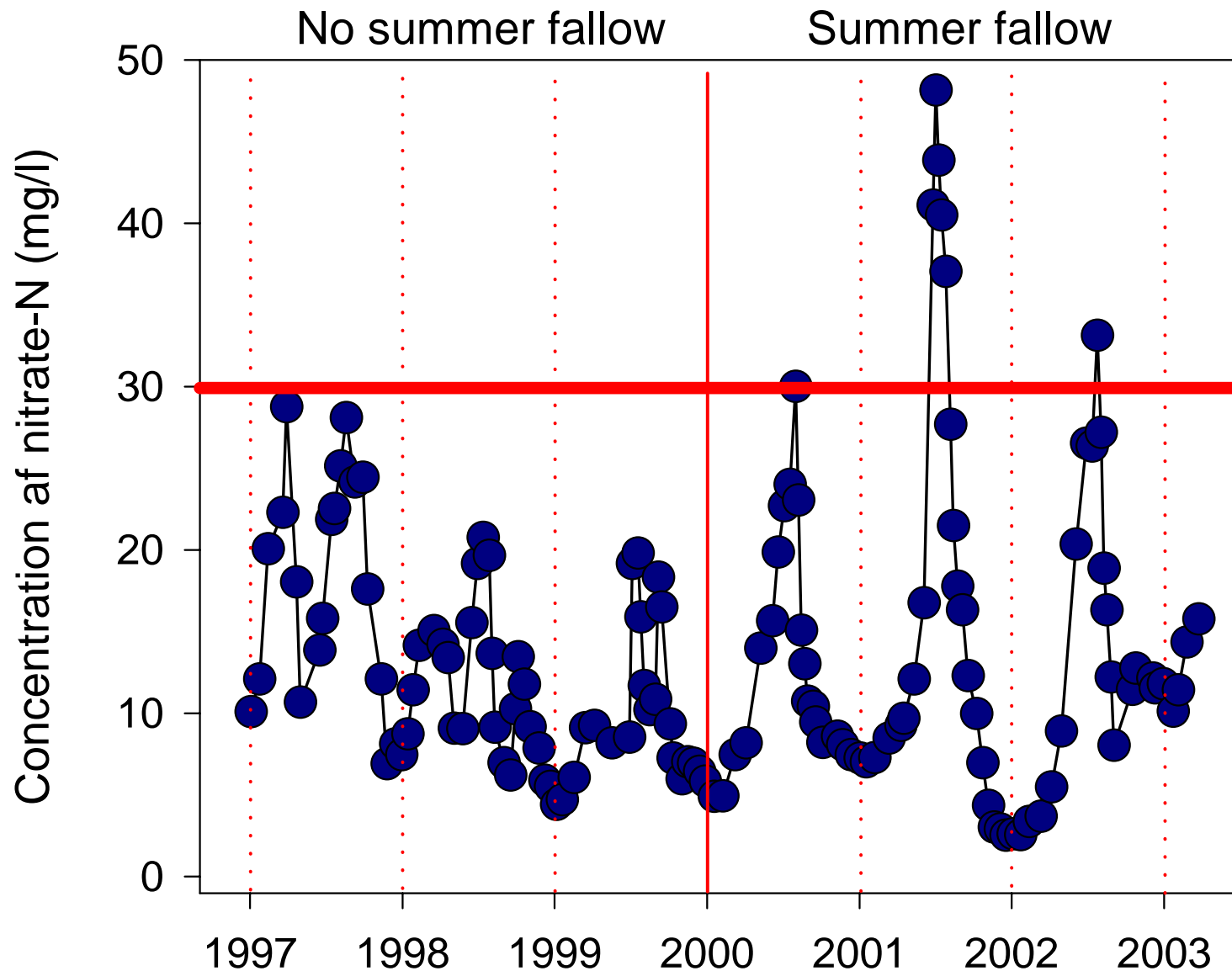
- Catch crops should be included in systems with grass-clover to reduce nitrate leaching when possible, especially on sandy soils
 - but use of catch crops precludes stubble cultivation
- Stubble cultivation should be used to reduce *E. repens* infestations
 - but not after pulses
- Stubble cultivation did not seem to reduce *C. arvensis* biomass in our experiments

Control of perennial weeds in grass-clover: Summer fallow



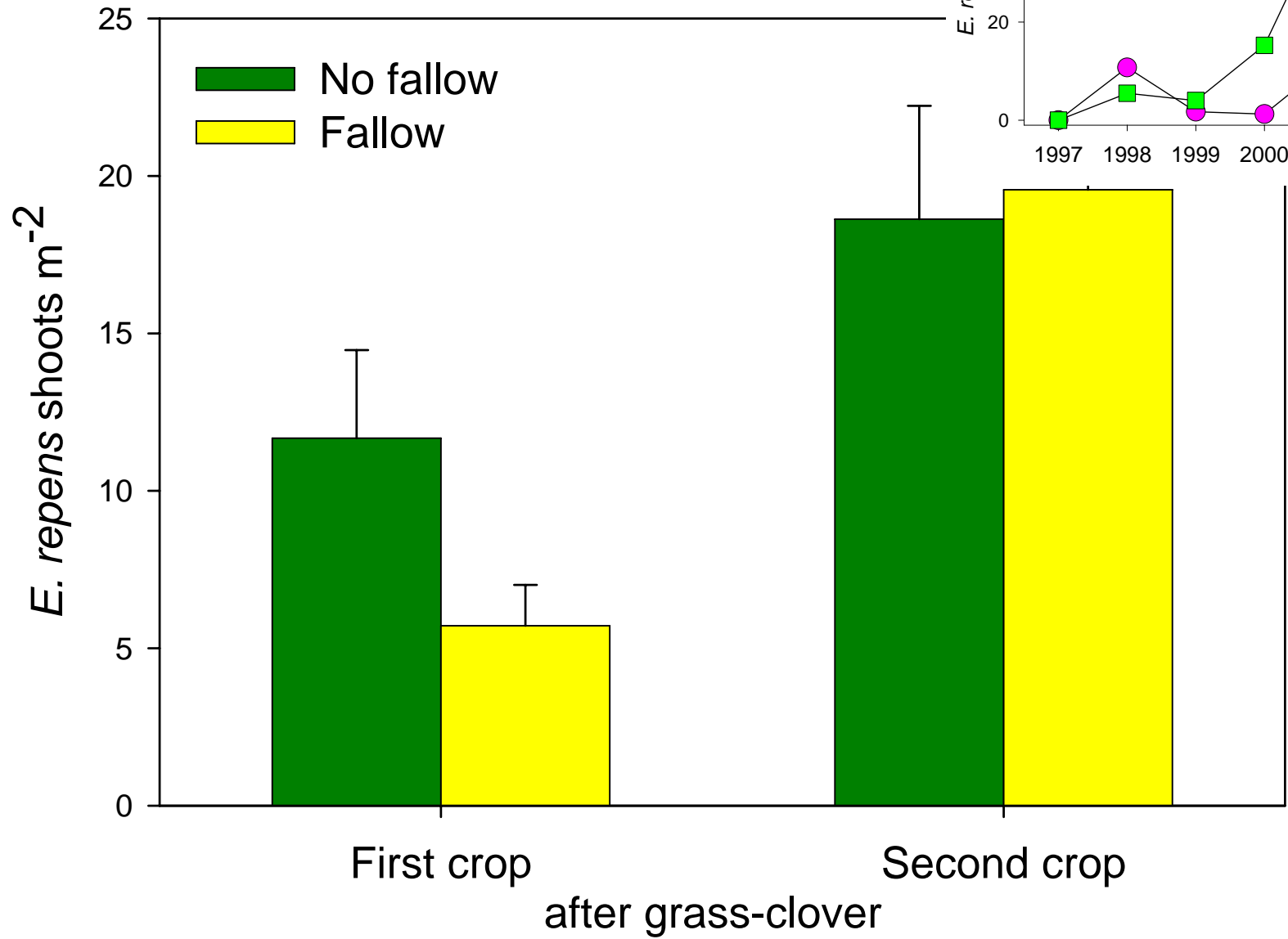
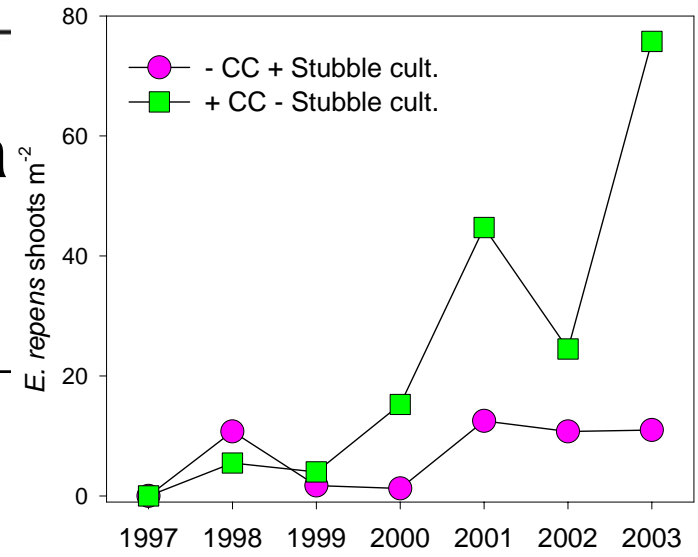
in perspective

Concentrations of nitrate-N on coarse sandy soil. Mean of 4 crops, without catch crop, with manure



From Rasmussen
et al. 2005

E. repens shoots on coarse sandy soil after grass-clover with or without summer fallow



From Rasmussen et al. 2005

Ministry of Food, Agriculture and Fisheries – Danish Institute of Agronomy

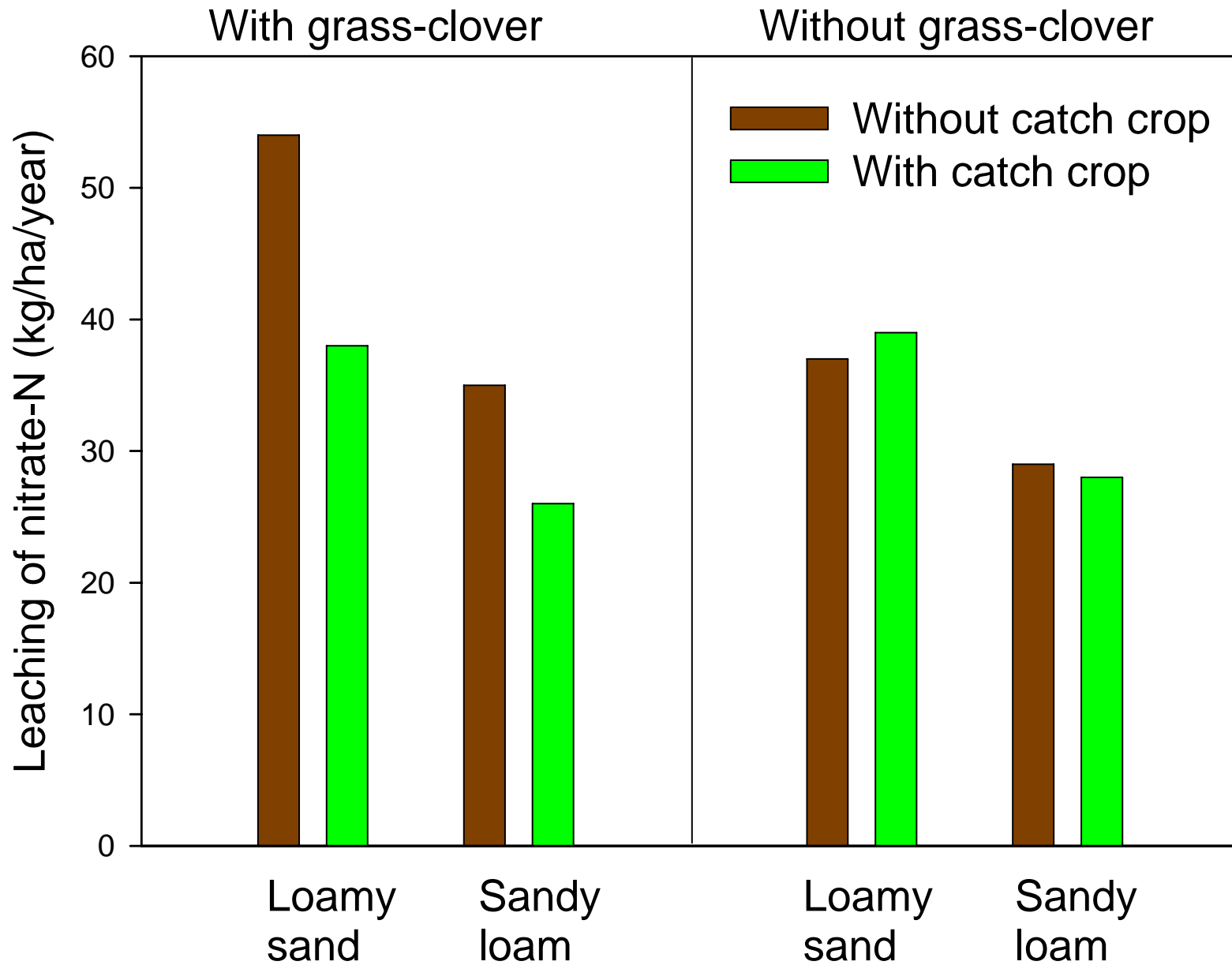
Ilse A

Summary



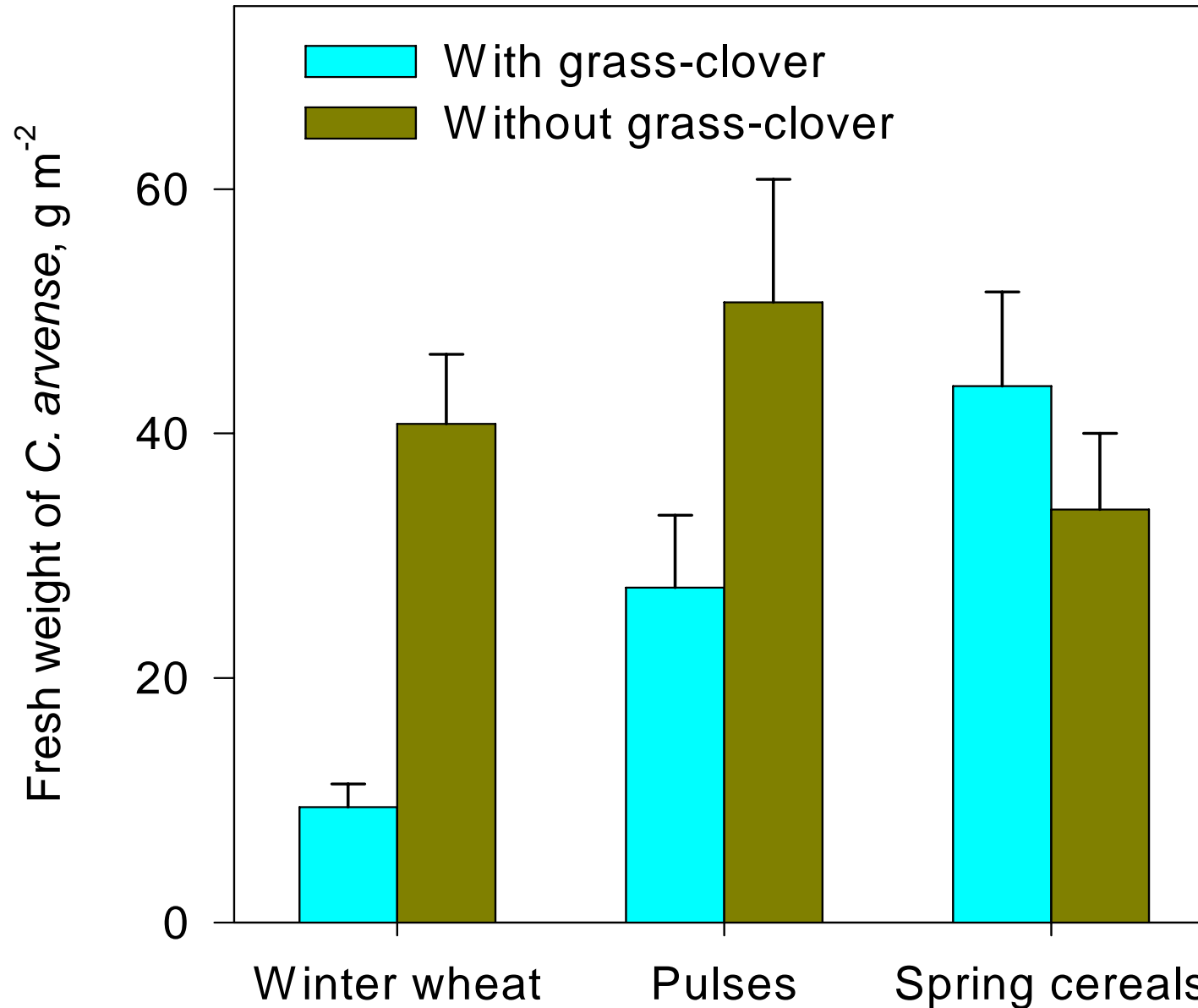
- Summer fallow could be used to reduce *E. repens* infestations
 - mainly the first year after fallow
 - increases risk of nitrate leaching on sandy soil
- Other options should be preferred

Nitrate leaching with or without catch crop in rotations with or without grass-clover



From
Rasmussen et
al. 2005

C. arvensis biomass on sandy loam in different crop types in two rotations



From Rasmussen et al. 2005

Summary



- Grass-clover can be managed to reduce *C. arvensis*
- Catch crops should be included in the rotation to avoid nitrogen leaching

Conclusions



- In organic farming research, it is not sufficient to study effects separately, such as:
 - Perennial weed control
 - Nitrogen leaching
- Unstudied interactions can make the conclusions misleading

References



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- Rasmussen, I.A., Askegaard, M. & Olesen, J.E. (2005): Long-term organic crop rotation experiments for cereal production – perennial weed control and nitrogen leaching. In: Researching sustainable systems – First Scientific Conference of the International Society of Organic Agriculture Research (ISO FAR), Adelaide, South Australia, pp. 227-230.